DETERMINED TO REVOLUTION

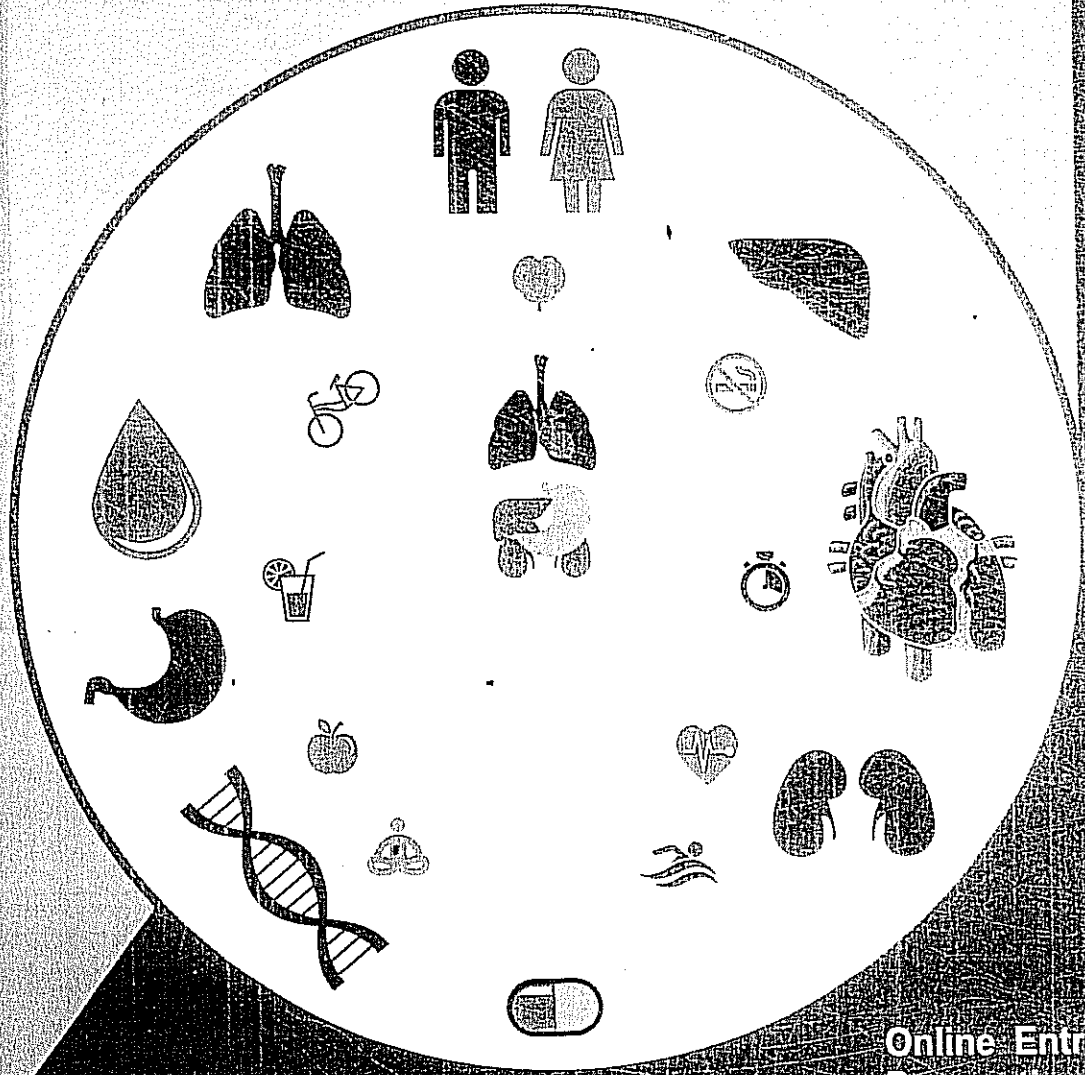
STARS

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BIOLOGY

MDCAT NUMS, UHS, AMC, AJK, AGHA KHAN MEDICAL COLLEGES ADMISSIONS TEST

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Structure of the Question Paper for

Medical and Dental Colleges Admission Test (MDCAT)

Sr. No.	Subject	No. of Questions
1	Biology	80
2	Chemistry	60
3	Physics	40
4	English	20
	Total	**200**

- **Note:**
  - *Time duration to attempt the paper shall be 150 minutes (2hrs 30 minutes).*
  - *Each question shall carry one mark with no negative marking.*

- *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*

BIOLOGY

Table of Contents

1 The Cell
2 Biological Molecules
3 Chromosomes and DNA
4 Cell Division
5 Variety of Life
6 Bioenergetics
7 Gas Exchange
8 Transport in Plants
9 Transport in Human
10 Immunity
11 Homeostasis
12 Muscles and Movement
13 Communication
14 Reproduction
15 Genetics
16 Biotechnology
17 Evolution

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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, Kreb'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 heart, 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 arc / 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, Codominance, Linkage, F_1 & F_2 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 & Dihybrid Crosses
- Gene Linkage and Sex Linkage in 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

CHEMISTRY

TABLE OF CONTENTS

A. Physical Chemistry

1. Fundamental Concepts
2. States of Matter
3. Atomic Structure
4. Chemical Bonding
5. Chemical Energetics
6. Electrochemistry
7. Chemical Equilibrium
8. Reaction Kinetics

B. Inorganic Chemistry

1. Periods
2. Groups
3. Transition Elements
4. Compounds of Nitrogen and Sulphur

C. Organic Chemistry

1. Fundamental Principles
2. Hydrocarbons
3. Alkyl Halides (Haloalkanes)
4. Alcohols and Phenols
5. Aldehydes and Ketones
6. Carboxylic Acids
7. Amino Acids
8. Macromolecules
9. Environmental Chemistry

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PHYSICAL CHEMISTRY

1. FUNDAMENTAL CONCEPTS

COURSE CONTENT

- Relative masses
- Isotopes
- Mole
- Avogadro's number
- Empirical and Molecular formulae
- Stoichiometric Calculations
- Concentration units of solutions
  - i. Percentage composition
  - ii. Molarity
  - iii. Mole fraction

2. STATES OF MATTER

COURSE CONTENT

- Gaseous state
- General Gas Equation (PV=n RT).
- Liquid state:
  - i. Evaporation
  - ii. Vapor pressure
  - iii. Boiling
  - iv. Structure of ice
- Lattice structure of a Crystalline solid

3. ATOMIC STRUCTURE

COURSE CONTENT

- Proton, Neutron and Electron
- Distribution of Mass and charges
- Deduce the number of protons, neutrons and electrons from given proton number and nucleon number

- Shape of s, p and d- Orbitals
- Electronic configuration
- Ionization energy
- Electron affinity

4. CHEMICAL BONDING

COURSE CONTENT

- Ionic (Electrovalent) bond
- Use the "dot and cross" model for:

  i. Covalent bonding

  ii. Co-ordinate (dative covalent) bonding
- Shapes and Bond Angles of molecules
- Covalent Bonding.
- Bond Energy, Bond length and bond Polarity (Electronegativity difference)
- Intermolecular Forces (especially Hydrogen Bonding)
- Interpret and Predict the effect of different types of bonding on physical properties of substances.

5. CHEMICAL ENERGETICS

COURSE CONTENT

- Concept of Energy changes during Chemical reactions
- Use the terms:

  i. Enthalpy change of reaction

  ii. Bond energy
- Numerical Magnitude of Lattice Energy
- Hess's law to construct simple energy cycles.

6. ELECTROCHEMISTRY

COURSE CONTENT

- Redox processes
- Oxidation numbers of Elements.
- Balancing chemical equations by redox method

- Standard electrode (redox) Potential
- Standard Hydrogen Electrode
- Methods used to measure the standard Electrode potentials of metals
- Standard Cell Potential
- Electrode Potential.
- Construct Redox equations
- Advantages of Developing the H_2/O_2 fuel cell

7. CHEMICAL EQUILIBRIUM

COURSE CONTENT

- Rates of forward and reverse Reactions and Dynamic Equilibrium
- Le- Chatelier's Principle.
- Deduce expression for Equilibrium constant
- Calculate the values of Equilibrium constants
- Calculate the equilibrium quantities
- Conditions used in Haber process.
- Qualitatively the differences in behavior of strong/weak acids and bases
- Terms: pH, K_a, pK_a, K_b, pK_b, K_w and K_{sp}.
- $[H^+_{(aq)}]$, $[OH^-_{(aq)}]$, pH and pOH values for strong and weak acids and bases.

8. REACTION KINETICS/ CHEMICAL KINETICS

COURSE CONTENT

- Rate of Reaction, Activation Energy, Catalysis, Rate Equation, Order of Reaction, Rate Constant
- Collisions
- Enzymes as Biological Catalysts
- Construct and use rate equations with special emphasis on
  i. Zero order reaction
  ii. 1st order reaction
  iii. 2nd order reaction
- Half-life of a first order Reaction

- Calculate the order of reaction
- Calculate the rate constant
- Name a Suitable method for studying the rate of a Reaction

INORGANIC CHEMISTRY

1. PERIODS

COURSE CONTENT

- **Variation in the Physical properties of Elements Belonging to period 2 and period 3:**
    a. Atomic Radius
    b. Ionic Radius
    c. Melting Point
    d. Boiling Point
    e. Ionization Energy
    f. Electronegativity
    g. Electron Affinity
    h. Electrical Conductivity
    i. Oxidation States
    j. Hydration Energy
- Periodic Relationship in Binary compounds:
    a. Halides (especially chlorides)
    b. Oxides

2. GROUPS:

COURSE CONTENT

- The variation in the properties of group II and VII Elements:
    a. Reactions of group II elements.
    b. Thermal decomposition and solubility of compounds of group II elements
    c. Properties of Halogens and their compounds
    d. Reaction of Chlorine
    e. Comparison of Oxidizing power of halogens

f. Uses of Halogens and compounds of Halogens

3. TRANSITION ELEMENTS:

COURSE CONTENT

- Chemistry of Transition Elements of 3d series:
  a. Electronic Configuration
  b. Variable Oxidation states
  c. Uses as a Catalyst
  d. Formation of Complexes
  e. Colour of Transition Metal Complexes
  f. Geometry and isomerism of complex ions with coordination number 4 and 6.

4. COMPOUNDS OF NITROGEN AND SULPHUR

COURSE CONTENT

- Nitrogenous fertilizers.
- Presence of Sulphur Dioxide in atmosphere
- Manufacturing of Sulphuric Acid.
- Sulphuric acid as Dehydrating agent and Oxidizing agent.

ORGANIC CHEMISTRY

1. FUNDAMENTAL PRINCIPLES:

COURSE CONTENT

- The Organic compounds.
- Alkanes and Alkenes of lower masses.
- Nucleophiles, electrophiles and free radicals
- Isomerism.
- Functional group and Nomenclature of organic compounds.

2. HYDROCARBON:

COURSE CONTENT

Chemistry of Alkanes with emphasis on:

- Combustion.
- The Mechanism of free radical Substitution reaction.

Chemistry of Alkenes with emphasis on:

- Preparation of Alkenes:
- Reaction of Alkenes:

Chemistry of Benzene

- Benzene.
- Electrophilic substitution reactions and the mechanism
- Hydrogenation of Benzene ring.
- Side chain Oxidation of Methyl Benzene (Toluene) and Ethyl Benzene.
- Benzene ring by 2,4 Directing and 3,5 directing groups

3. ALKYL HALIDES (HALOGENOALKANES)

COURSE CONTENT

- Importance of Halogenoalkanes.
- Reaction of Alkyl Halides:
- Nucleophilic substitution reactions and mechanisms

4. ALCOHOLS AND PHENOLS:

COURSE CONTENT

Alcohols with reference to:

- Alcohols: Primary, Secondary and Tertiary.
- Preparation of Ethanol
- Reactions of Alcohols

Phenols

- Reactions of Phenol
- Acidity of Water, ethanol and phenol

5. ALDEHYDES AND KETONES:

COURSE CONTENT

- Structure of Aldehydes and Ketones.
- Preparation of Aldehydes and Ketones.
- Reactions of Aldehydes and Ketones:
- Nucleophilic addition reaction mechanism

6. CARBOXYLIC ACID:

COURSE CONTENT

- Physical properties of carboxylic acids.
- Reactions of carboxylic acids
- Relative Acidic strength.

7. AMINO ACIDS:

COURSE CONTENT

- General Structure of -Amino Acids found in Proteins.
- Amino Acids on the basis of Nature of R-group.
- Zwitter Ion
- Acid base properties of Amino Acids.
- Peptide bond formation.

8. MACROMOLECULES:

COURSE CONTENT

- Addition polymerization.
- Condensation polymerization.
- Structure of Proteins.
- Structure and function of Nucleic acid (DNA).

9. ENVIRONMENTAL CHEMISTRY:

COURSE CONTENT

- Air Pollutants.
- Chemistry and causes of Acid Rain.
- Ozone and Chlorofluorocarbons (CFCs).

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PHYSICS

Table of Contents

1. Measurement
2. Motion and Force
3. Work, Energy and Power
4. Circular Motion
5. Oscillation
6. Waves
7. Light
8. Heat & Thermodynamics
9. Electrostatics
10. Current Electricity
11. Electromagnetism
12. Electromagnetic Induction
13. Deformation of Solids
14. Electronics
15. Modern Physics
16. Nuclear Physics

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1. MEASUREMENT

COURSE CONTENT

- Physical quantities, numerical magnitude and a proper unit.
- International System of Units, SI base units of physical quantities, and their derived units.
- Prefixes and symbols to indicate decimal, submultiples or multiples of both base and derived units:
- Errors and uncertainties
  - Systematic error and random error.
  - Fractional uncertainty and percentage uncertainty.
  - Assessment of total uncertainty in the final results (Understanding of total assessment about addition and subtraction, multiplication and division & power factor).

2. MOTION AND FORCE

COURSE CONTENT

- Displacement, Distance, Speed, Velocity and Acceleration.
- Velocity–Time Graph.
- Equations of motion.
- Newton's Laws of Motion.
- Momentum and law of conservation of momentum.
- Force and rate of change of momentum.
- Impulse and $I = F \times t = mv_f - mv_i$
- Elastic and in-elastic collisions
- Projectile Motion and its applications.
- Moment of force or torque and use of torque
- Equilibrium.

3. WORK, ENERGY AND POWER

COURSE CONTENT

- Work in terms of the product of a force and displacement in the direction of the force.
- Kinetic energy $K.E = \frac{1}{2}mv^2$
- Potential energy $P.E = mgh$
- Inter-conversion of kinetic energy and potential energy in gravitational field.
- Power in terms of work done per unit time and use power as product of force and

velocity $P = \frac{W}{t}$ and $P = Fv$

4. CIRCULAR MOTION

COURSE CONTENT

- Angular motion, angular displacement & angular velocity
- Centripetal Force and centripetal acceleration
  - $F = mr^2\omega$, $F = \frac{mv^2}{r}$ and $a_c = r\omega^2$ and $a_c = \frac{v^2}{r}$
- Geostationary orbits.
- Radian

5. OSCILLATIONS

COURSE CONTENT

- Simple harmonic motion
- Amplitude, Frequency, Angular Frequency, Phase Difference. Express the time period in terms of both frequency and angular frequency.
- Equations $x=x_o \sin\omega t$, $v = v_0\cos\omega t$, $v = \pm\omega\sqrt{x_o^2 - x^2}$, $a = -\omega^2 x$ and its use
- Motion of simple pendulum and relation.
- Kinetic energy and potential energy during Simple harmonic motion.
- Free, Forced and Damped Oscillations
- Resonance

6. WAVES

COURSE CONTENT

- Progressive waves
- Transverse and longitudinal waves.
- Principle of superposition.
- Stationary waves and wavelength of sound waves in air columns and stretched strings
- Doppler's Effect
- Electromagnetic Spectrum.

7. LIGHT

COURSE CONTENT

- Interference of light waves, constructive and destructive interference.
- Young's Double Slit experiment, fringe spacing, dark and bright fringes.
- Diffraction (basic principle)
- Diffraction grating

8. HEAT & THERMODYNAMICS

COURSE CONTENT

- Basic postulates of kinetic theory of gases
- Pressure exerted by a gas and derive the relation $PV = \frac{Nm}{3} < v^2 >$
- Equation of state for an ideal gas as PV = nRT
- $PV = \frac{Nm}{3} < v^2 >$ and PV = NkT and prove that K.E $\propto$T for a single molecule.
- Internal Energy.
- Specific Heat capacity.

9. ELECTROSTATICS

COURSE CONTENT

- Coulomb's Law
- Electric field strength.
- $E = \frac{\Delta V}{\Delta d}$ to calculate the field strength.
- Electric field lines.
- $E = \frac{Q}{4\pi\varepsilon_o r^2}$ for the field strength
- Gravitational force and electric force.
- Electric potential
- Capacitance of a capacitor
- Energy stored in capacitor

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10. CURRENT ELECTRICITY

COURSE CONTENT

- Current
- Ohm's Law
- Series and parallel Combination of resistors
- Resistance and resistivity
- Potential difference and e.m.f
- Power dissipation in resistors.
- Kirchhoff's First Law as conservation of charge.
- Kirchhoff's Second Law as conservation of energy.
- Potentiometer

11. ELECTROMAGNETISM

COURSE CONTENT

- Magnetic field
- Force on current carrying conductor in uniform magnetic field
- Force on a moving charge in magnetic field
- Motion of charge particle in uniform electric and magnetic field.
- e/m for an electron.

12. ELECTROMAGNETIC INDUCTION

COURSE CONTENT

- Magnetic flux
- Faraday's Law and Lenz's Law.
- Induced e.m.f and factors
- Alternating current and use $V = Vo \sin\omega t$.
- Transformer and uses of $\frac{N_S}{N_P} = \frac{V_S}{V_P} = \frac{I_P}{I_S}$ and practical transformer.
- Period, frequency, peak value and root mean square value of an alternating current or

voltage.

13. DEFORMATION OF SOLIDS

COURSE CONTENT

- Stress, strain and Young's Modulus.
- Tensile stress and strain.
- Hook's Law.
- Elastic and plastic deformation of a material.
- Strain energy.
- Band Theory, valence band, conduction band and forbidden band.

14. ELECTRONICS

COURSE CONTENT

- Half and Full wave rectification
- Single diode for half wave rectification of an alternating current
- Four diodes for full wave rectification of an alternating current
- Operational amplifier and its characteristics

15. MODERN PHYSICS

COURSE CONTENT

- Energy of photon $E = hf$
- Photoelectric Effect, Threshold Frequency and Work Function Energy:
- Maximum photoelectric energy is independent of intensity whereas photoelectric current is proportional to intensity
- Einstein's Photoelectric equation $hf = \phi + \frac{1}{2} mv^2_{max}$
- de Broglie wavelength and use $\lambda = \frac{h}{p}$.
- Discrete energy levels of hydrogen atom and spectral lines.
- Relation $hf = (E_2 - E_1)$

- Production of X-rays and features of X-rays tube.

16. NUCLEAR PHYSICS

COURSE CONTENT

- Nucleus, nucleon number and charge number.
- Radioactivity and emission of radiation.
- Activity, Decay constant and relation Activity = $N\lambda$.
- Half-life of radioactive substance and relation $\lambda = \frac{0.693}{t_{1/2}}$
- Nuclear transmutation and conservation of mass, energy, momentum and charge during nuclear changes.
- Mass-defect, binding energy and relation E = mc2
- Nuclear fission and fusion.
- Hadrons, Leptons and Quarks.

ENGLISH

Aim

The aim of the English section of MDCAT is to measure the applicants' skills in English language and to evaluate how prepared they are for undertaking graduate studies in medicine in English. The test applies a common standard to everyone to be able to evaluate the preparation of the applicants from different sectors, regions and socio-economic backgrounds. The benchmarks for the test have been developed in the light of the curriculum used in HSSC and CIE. Since the students who take the MDCAT come from a wide range of educational contexts, the test comprises items that may be applied to a broadband of language competencies that are not exclusive to one particular type of curriculum.

Objectives

i. To ensure complete alignment between the English curriculum used in various sectors at the HSSC and CIE level and the test items

ii. To create a balance of items from different benchmarks of the English curriculum outlined for MDCAT

iii. To make sure that difficult and ambiguous items beyond the scope of high school education are not included

iv. To design the test specifications

v. To design, select, and arrange test task items

Objective	Benchmark	Contents
Comprehend key vocabulary	Use one or more of the following strategies to determine meaning of key vocabulary: 1.1 contextual clues and illustrations 1.2 background or prior knowledge 1.3 morphology, syntax, phonics, knowledge of word relationships 1.4 knowledge of synonyms, antonyms, homophones	High and low frequency words from the course book or to be selected from similar contexts or the contexts the HSSC and CIE students may be familiar with
2. Demonstrate control of tenses and sentence structure	2.1 Use correct tenses and sentence structure in writing 2.2 Identify mistakes in the use of tenses and sentence structure in written texts	• All the present tenses • All the past tenses • Four types of sentences • Conditionals • Types of clauses • Fragments
3. Demonstrate correct use of subject-verb agreement	3.1 use correct subject-verb agreement in written texts 3.2 Identify mistakes in the use of subject verb-agreement in written texts	Use the texts prescribed/used in HSSC or CIE for selecting test items as well as determining the degree of their complexity
4. Demonstrate correct use of articles and prepositions	4.1 Use appropriate articles and prepositions in different written contexts 4.2 Identify mistakes in the use of articles and prepositions in sentences or short texts 4.3 Select the appropriate article or preposition for a particular context	The test items to be selected from the contexts common to the texts at HSSC and CIE level
5. Demonstrate correct use of writing conventions of spelling, capitalization and punctuation to clarify meaning	5.1 Use capitalization and punctuation such as semi colons, commas in a series, apostrophes in possessives, proper nouns, and abbreviations 5.2 Avoid and identify the following punctuation	The test items to be selected from the type of texts written by HSSC and CIE students and from the contexts common to both the streams

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	mistakes in sentences or short written texts: 5.2.1. Run on sentences 5.2.2. Comma splices 5.2.3. Fragments 5.2.4 Faulty coordination	

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Vocabulary

A	B	C
appalling astounded apparently attached to appraised alas abruptly accentuated anxieties	boon bewilderment briskly bead brimming baffling bashful beckoned	coveted credentials capacious collided with crudely confront compelled crudely coaxed comprehension curious casually confining crammed confirm cautioned captivated condescended compelled criteria
D	**E**	**F**
daintily dispensing dispute distract drummed dilapidated disconsolately delicately dank dilapidated disguise definite	enchanted encouraged fringed exude eccentric excursion elaborate exasperation expansive exaggeration evaluates	fatality flicked flawlessly friction fluttered
G	**H**	**I**
gingerly glistening glared groggy	heap hideous habitat haggard haphazardly harmony haughty havoc hearsay	intended in vain illumination invariably irritable insinuated intently industry intolerable intolerable imperceptibly
J	**K**	**L**
judgment judicial	Kindred Khack	likelihood labyrinth

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junction juvenile jeopardy jealousy jubilant	knickers knickknack	ludicrous limp
M menaced mustered mean mass mounting minimum mayhem miniature mumbled meditated moulded menacing	N nuisance naïve native nauseous negate negligence nemesis neutral niggle	O opted for on the wrong foot occasionally operation
P plopped presume precautions panting purchase persisted pensively prime placidly peered propelling passion promptly practically prone to paraphernalia prerogative path precision pizzazz potential	Q qualitative qualm quantitative quarrel quench query queue quirk quiver quizzical quotation	R rituals reinforce reprimanded riot reluctantly refuge regret rarely reproachful ragged revolving resonant
S swarmed up scenario swathe subsequently struck up string sternly	T tentatively tackle tumultuous tomfoolery tangle troughs tangled	U urge unburdened unprovoked

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solemnly succulent shuffled sailed stunt sauntered splendour sagged off speckled with stable		
V ventured vulnerable	W whipped weighing up writhing waft	Y Yearning Yelp yield
Z zealous zenith zest		

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Unit # 1
CELL BIOLOGY

LEARNING OUTCOMES

A) Compare the structure of typical animal and plant cell
B) Compare and contrast the structure of Prokaryotic cell with Eukaryotic cells
C) Fluid mosaic model of cell membrane and transportation (diffusion, facilitated diffusion, active and passive transport), endocytosis and exocytosis.
D) Outline the structure and function of the following organelles:
Nucleus, Endoplasmic reticulum, Golgi apparatus, Mitochondria, Centrioles, Ribosomes

1. CELL BIOLOGY

Content

Cell structure
Structure and Function of cellular organelles
Cell division

Cell membrane:

- Cell membrane is the outer most boundary of the animal cell while covered by cell wall in the plant cell
- Chemically it is composed of protiens (60-80%) lipids (20-40%) and small amount of carbohydrates
- Lipids are in phospholipid and cholesterol form.

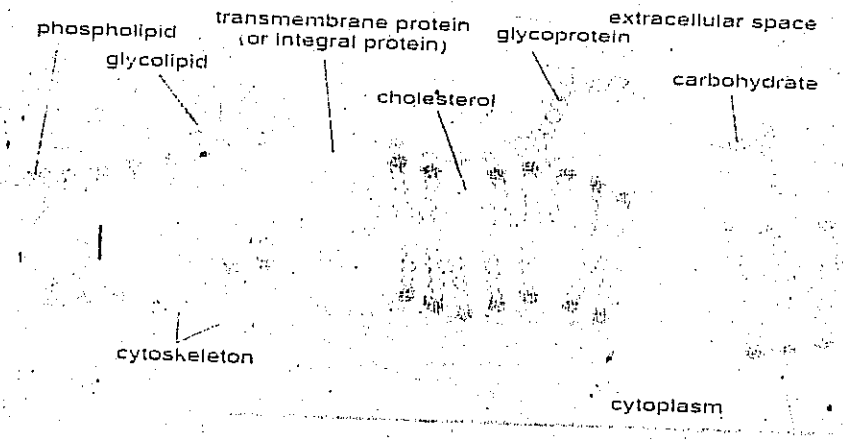
•what do you know the role of following in plasma membrane
•cholesterol
•phospholipid

Unit membrane model:

- It is also called the Danielli-Davson-Robertson model
- The cell membrane is composed of lipid bilayer sandwich between inner and outer layer of protein.
- This structure has hydrophobic components i.e. central non-polar part of phospholipids molecule and a hydrophilic part i.e. outer polar components of phospholipids and globular protein.

Fluid mosaic model:

- This model was devised by SJ Singer and GL Nicolson in 1972; following are the main features of fluid mosaic model.
- According to this model, protein layers are not continuous and are not confined to the surface of the membrane but are embedded in lipid bilayer in a mosaic manner. These protein molecules may function as gateway for the transport of materials.
- This is most accepted model



- what is the difference between carrier and channel proteins?

Functions of cell membrane:

- Cell membrane is a differentially permeable or selectively permeable membrane, allowing only the selective substances to pass through it.
- Lipid soluble substances pass the cell membrane more easily than others.

Small molecules: Small molecules like glucose, water can pass through easily
Ions: Ions being charged particles have some difficulty in crossing
Passive transport: Movement of material which don't require expenditure of metabolic energy is called as passive transport
Active transport: Movement of materials which takes place against the conc. Gradient, it requires energy provided in term of ATP.
Endocytosis: Intake of materials in the form of vacuole is called as endocytosis.
Types:

- Phagocytosis
- Pinocytosis

- what are different types of active transport?
- examples?

Phagocytosis: Intake of solid materials in the form of vacuole is called as phagocytosis
Pinocytosis: Intake of liquid materials in the form of vacuole is called as pinocytosis
Exocytosis: Intake of liquid materials in the form of vacuole is called as pinocytosis.

D) STRUCTURE AND FUNCTION OF ORGANELLES

NUCLEUS

- These are most important organelles of the cell.
- They are visible only in non- dividing cells.
- In animal cells nucleus is present in the center of cell
- In plant cells the nucleus is present at the peripheral part of the cell
- Nucleus is only visible in the non-dividing cells
- They may be irregular or spherical in shape

Mononucleate: A cell containing single nucleus is called as mononucclate

Binucclate: Cell containing two nucleuses is called as binucleate

Composition: It is composed of DNA, RNA and protein including enzymes

Parts: It consists of nuclear membrane, nucleoli, nucleoplasm and chromosomes or chromatin bodies.

- **Give an example of anucleate, uninucleate, binucleate and multinucleate.**

Nuclear membrane:

It separate the nuclear materials form the cytoplasm.

- Outer nuclear membrane is continuous with endoplasmic reticulum and inner one encloses the nuclear contents

Nuclear pores:

They are formed by the fusion of outer and inner membranes. They acts as gateway for the exchange of materials with the cytoplasm.

Nucleolus:

Nucleolus is non-membrane, darkly stained body within the nucleus

- Nucleoli may be one or more
- RNA (rRNA) is synthesized and stored in it

- if rRNA is synthesized in nucleolus then what is the location of mRNA and tRNA synthesis??

Parts:

Nucleolus is composed of two regions

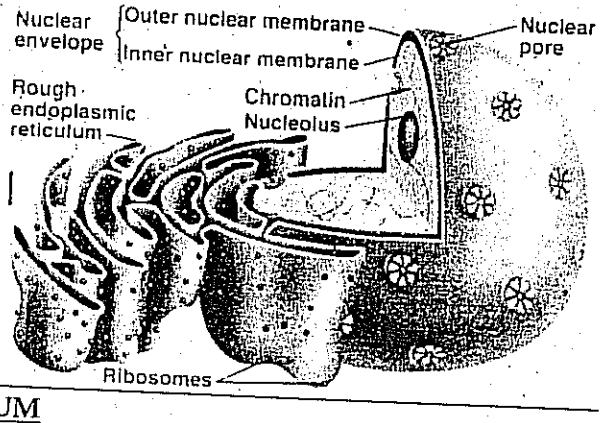
- Peripheral granular area containing precursors for ribosomal subunits
- Central fibril area: it contains RNA and rdna

Chromosomes: Each chromosome is a thread like structure resulting from the organization of chromatin materials during cell division.

- Under compound microscope they appear to be made of arms (chromatids) and a centromere, a place where spindle fibers are attached during cell division.

Centromere: It is the place on the chromosomes and kinetochore is a place on centromere where spindle fibers are attached during cell division

- Chemically chromosomes are composed of DNA and protein



ENDOPLASMIC RETICULUM

It is network of interconnected channels extending and often continuous with the cell membrane to the nuclear membrane is called as endoplasmic reticulum.

- They vary in appearance from cell to cell

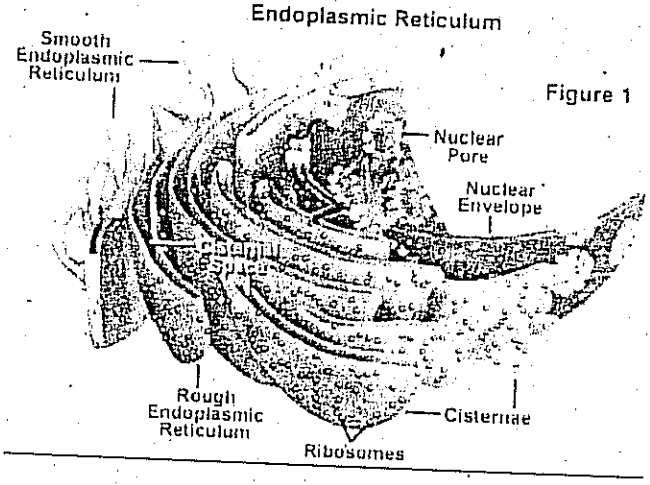


Figure 1

Cisternae:

These are spherical or tubular membranes which separate the materials present in these channels from that of cytoplasmic materials.

Types:

1. Rough E.R.: E.R. attached with ribosomes to its external surface
2. Smooth E.R.: One without ribosomes (In muscle cell it is called as Sarcoplasmic reticulum)

Function:

- They provide the mechanical support to the cell, so that its shape is maintained
- They are also involved in the transport of materials from one part of the cell to another

RER:

- This is involved in the synthesis of proteins. After synthesis, they are either stored in the cytoplasm or transported out of cell through these channels.

SER:

- Store house of catt.
- This helps in the metabolism of various types of molecules particularly lipids
- It also helps in detoxification of harmful drugs
- SER is also involved in the transmission of impulses e.g. in muscles cells and nerve cells

GOLGI APPARATUS

Golgi apparatus was first discovered by Camilio Golgi in 1898

- Golgi apparatus is a stack of flattened, membrane bounded sacs called cisternae
- Golgi complex is a complex system of interconnected tubules around the central stacks

Golgi complex:

The cisternae together with associated vesicles are called golgi complex

- Golgi vesicles are budded off from smooth endoplasmic reticulum are fused together to form cisternae of golgi apparatus

Dictyosomes: In plants golgi apparatus is called as Dictyosome.

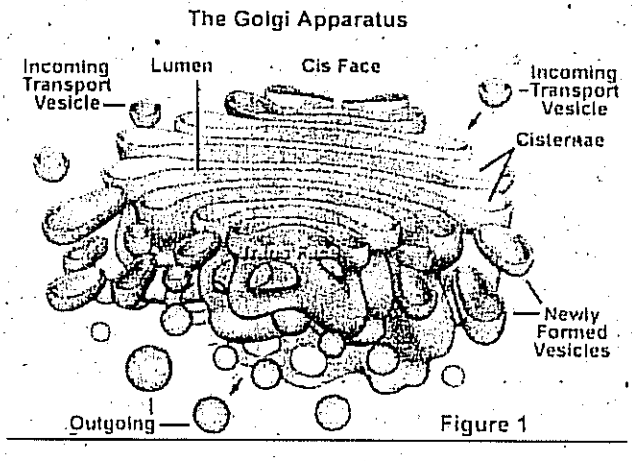


Figure 1

Faces:

Forming face: it is outer convex surface through which any material enters.
Maturing face: it is inner concave surface through which golgi vesicle comes out.

Ribosomes → Endoplasmic reticulum → Transport vesicles → Golgi apparatus

Packed inside a membrane

Lysosomes

Excretory granules

Golgi Vesicles

Modification of proteins and lipids by adding carbohydrates and converting them into glycoproteins and glycolipids.

Roles of Golgi Vesicles:

MITOCHONDRIA: *(power house of the cell)*

- They are self-replicating organelles
- Their size and number varies depending on the physiological activities of the cell
- They contain its own DNA and ribosomes

Under compound microscope:

Under compound microscope they appear as vesicles, rods or filament

Under electron microscope:

Under electron microscope, they are bounded by two membranes

a. Outer smooth membrane
b. Inner forms infolding (cristae)

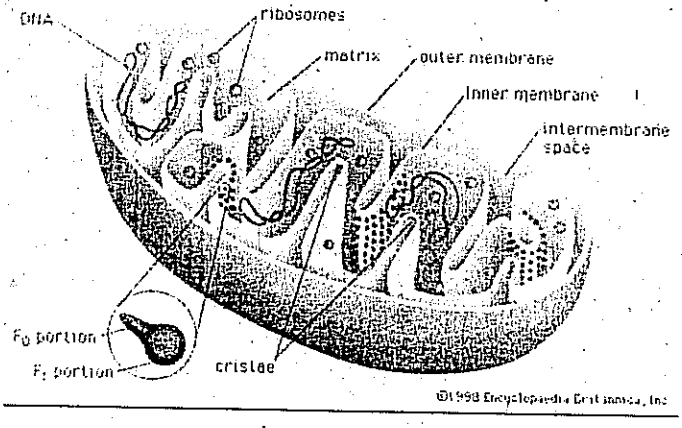
F1 particles:

The inner surface of cristae in the mitochondrial matrix contains small knob like structure like F1 particles.

Mitochondrial matrix: it contains enzymes, coenzymes, organic and inorganic salts

- Enzymes in mitochondrial matrix helps in metabolic processes like Krebs cycle, aerobic respiration and fatty acid metabolism.

Cells with maximum no. of Mitochondria



CENTRIOLES

- They are present in animal cells, in microbes and in lower plants
- They are absent in higher vascular plants
- Cross section shows an array of 9 microtubules, each composed of 3 tubules called triplet of tubules
- Before cell division, they duplicate and none pair move to opposite poles developing spindle fibers
- They decide location of furrowing during cell division
- They also help in the formation of cilia

What is centrosome?

RIBOSOMES

- Ribosomes are assembled in the nucleolus from where
- They are transported to the cytoplasm through nuclear pores

Rough endoplasmic reticulum

Composition:

Ribosomes are composed of ribonucleo-proteins i.e. consists of RNA and proteins

Forms:

i. Freely dispersed in the cytoplasm
ii. Attached to rough endoplasmic reticulum

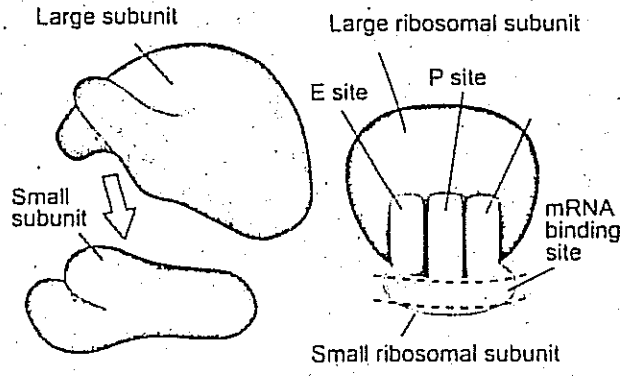
Subunits:

i. Smaller subunits:
In eukaryotes they are 40S

In prokaryotes they are 30S

ii. Larger subunits:
In eukaryotes they are 60S

In prokaryotes they are 50S



Both the small subunits are found in the cytoplasm

Polysomes:

A group of ribosomes attached to mRNA is known as polysomes

A) COMPARE STRUCTURE OF TYPICAL ANIMAL AND PLANT CELL

Features	Animal Cell	Plant Cell
Cell wall	×	√
Plastids	×	√
Glyoxysomes	×	√
Centrosome (centrioles)	√	×
Lysosomes	√	×
Flagella	√	×
Phagocytosis	√	×
Nucleus	Central	Peripheral
Vacuoles	Small	Large

B) COMPARE & CONTRAST STRUCTURE OF PROKARYOTIC & EUKARYOTIC CELL

DIFFERENCE	PROKARYOTIC CELL	EUKARYOTIC CELL
1) Nucleus	Absent	Present
2) DNA	Submerged in cytoplasm	Present in nucleus
	Circular DNA in nucleoid	Linear DNA in nucleus
3) Membrane-Bounded Organelles	Absent	Present
4) Ribosomes	Small, 70S ribosomes (50S+30S)	Large, 80S ribosomes (60S+40S)
5) Cell Wall	Peptidoglycan/ Murein/ Sacculus	Cellulose/ Chitin
6) Cell Membrane	Sterols absent	Sterols present
6) Cell Division	Binary fission.	Mitosis/ Meiosis
7) Histones	Absent	Present
8) Example	Bacteria and blue green algae	e.g. Multicellular animals, plants, fungi and protista.
9. Mesosome Plasmid	Bacteria and blue green algae	

•How flagella of prokaryotic and eukaryotic cell are different from each other?

Exercise

A)

1. A microscope of 10x ocular lense & 40x objective lense would have a magnification power of:

A) 40x B) 10x C) 400x D) 50x

2. All presently living cells have a common origin who said these words?

A) Rudolph Virchow B) Louis Pasteur C) Robert Brown D) August Weismann

3. Lysosome is found in:

A) Plant cell only B) Animal cells only C) Both cells D) Lipid rich seeds

4. Each centriole contains

A) 9 microtubules B) 27 microtubules C) 6 microtubules D) 10 microtubules

5. Digestive enzymes are:

A) Transferases B) Lyases C) Ligases D) Hydrolases

6. Proteins are converted into glycoproteins by:

A) Nucleolus B) Mitochondria C) Golgi bodies D) ER

7. It can break down fatty acid to succinate:

A) Peroxisome B) Glyoxisome C) Lysosome D) Golgi bodies

8. Digestive vacuoles are:

A) Primary lysosome B) Secondary lysosome C) vacuole D) All of these

9. They are involved in internal cell motion:

A) Microtubules B) Microfilaments C) Intermediate filaments D) All of these

10. Plants do not have _____ in their cells:

A) Protien B) Starch C) Glycogen D) All of these

11. Precursors of ribosomal subunits are found in:

A) Nucleus B) Peripheral area of nucleolus C) Central fibril area of nucleolus D) Cytoplasm

12. The soluble part of the cytoplasm is called:

A) Cytosol B) Gel C) Solution D) Colloidal solution

13. Most distinctive feature of prokaryotic cell is:

A) Cilia B) Lack of Ribosomes C) Kind of Cell wall D) Cytoplasm

14. Which cells have highly developed skeleton?
A) RBC. B) Nephron C) WBC D) Muscle cells

15. CO_2 is fixed in
A) Thylakoid B) Grana C) Stroma D) Interganum

16. They are organelles of symbiotic origin :
A) Nucleus & mitochondria B) Golgi & E.R C) Chloroplast & mitochondria D) None of these

17. Which is the site of light capture in a chloroplast
A) Intergranum B) Chloroplast Outer membrane C) Chloroplast Inner membrane D) Granum membranes

18. Absence of enzymes that are involved in the catabolism of lipids cause:
A) Glycogenosis I B) Glycogenosis II C) Tay Sach's disease D) Lipogenosis

19. There are _____ kinds of ribosomes submits found in living things
A) 2 B) 3 C) 4 D) 5

20. Pectin substances are found in
A) Middle lamella B) Primary wall C) Secondary wall D) Both a & c

21. Their membranes vary widely in appearance from cell to cell
A) Golgi bodies B) Mitochondria C) E.R. D) None of these

22. Nuclear outer membrane is continuous with
A) E.R. B) Golgi bodies C) Centrioles D) Both a & b

23. Lysosome eating cell's own parts is:
A) Phagosome B) Secondary lysosome C) Residual body D) Autophagosome

24. Polysome is formed during ------- process
A) Transcription B) Secretion C) Translation D) Division

25. The resolution of electron microscope ranges between:
A) 2 – 4 um B) 2 – 4 nm C) 2 – 4 Å D) 4 – 6 Å

26. Amoeboid movements are done by
A) Microtubules B) Microfilaments C) Intermediate filaments D) All of these

27. Which cell wall has pits

A) Primary B) Secondary C) Tertiary D) Middle lamella

28. A bit of protoplasm bounded by membrane
A) Nucleus B) Mitochondrion C) Protoplast D) Cell

29. The exact replica of chromosome is:
A) Chromatid B) Chromatin C) Centromere D) Plasmid

30. Cell theory is not applicable to:
A) Viruses B) Bacteria C) Prokaryotes D) Cyanobacteria

31. Nucleus is stained with
A) Basic dyes B) Neutral dyes C) Acidic dyes D) None of these

32. Chlorophyll is present in
A) Thylakoid B) Intergrana C) Stroma D) Cytosol

33. Chlorophyll molecule resembles with which part of heamoglobin:
A) Protein B) Haem C) Globulin D) Fats

34. Hypothesis is formed by which reasoning?
A) Inductive B) Deductive C) Both A,B D) Predictive

35. Mitochondria contains:
A) Cristae B) F_1 particles C) Ribosomes D) All of these

36. Short living organelle absent in lipid poor seeds:
A) Lycosome B) Dictyosome C) Glyoxysomes D) Peroxisome

37. In unit membrane model, the part of phospholipids attached to globular protein is:
A) Hydrophilic B) Hydrophobic C) Hydrostatic D) Lipid soluble

38. Single membrane bounded organelle is:
A) Lysosome B) Nucleus C) Ribosome D) Mitochondrion

39. Lysosomes are different from other organelles due to:
A) Anatomy B) Morphology C) Physiology D) Biochemistry

40. Lysosomes are formed from:
A) Golgi bodies B) RER C) SER D) Nucleus

41. The substances which can cross the cell membrane easily:
A) Lipid soluble B) Water soluble C) Inorganic ions D) Organic ions

42. Structure first to be formed between two daughter cell in plants:
A) Primary cell wall B) Secondary cell wall C) Middle lamella D) Not specific

43. Ribosome factory is:

A) RER B) SER C) Nucleus D) Nucleolus

44. The enzyme not concern with peroxisome:

A) Peroxidase B) Catalase C) Glycolic acid oxidase D) d-galactase

45. Ribosomes precursor area of nucleolus is:

A) Central granular B) Peripheral granular C) Central fibrillar D) Peripheral fibrillar

46. Scheilden and Schwaan found that cell consisted of how many parts?

A) 3 B) 4 C) 5 D) 6

47. Human eye can differentiate between two objects which are _____ apart?

A) 2nm B) 1mm C) 1nm D) 2mm

48. According to Robert Hook cell is?

A) An empty space B) Filled with cytoplasm C) Vesicle D) Nucleated

49. Magnification power of a microscope can be determined by ___ the X values of ocular & objective lenses:

A) Adding B) Subtracting C) Dividing D) Multiplying

50. In _____ century very little information was added to concept of cell:

A) 18th B) 20th C) 17th D) 19th

51. How many times the resolution of electron microscope is greater than naked eye?

A) 400 B) 250,000 C) 200 D) 500

52. Schlerenchyma cells are important for?

A) Photosynthesis B) Transport C) Support D) No such roles

53. During cell fractionation various parts of the cells are separated by:

A) Distillation B) Isolation C) Centrifugation D) Filtration

54. Nuclear material is directly submerged in cytoplasm in:

A) Eukaryotic cell B) Plant cell C) Prokaryotic cell D) All cells

55. Lipid bilayer is sand-witched between two protein layers, this is:

A) Cell membrane B) Plasma membrane C) Unit membrane D) Fluid mosaic membrane

56. Which have some difficulty in crossing cell membrane?

A) Steroids B) Gas C) Glucose D) Ions

57. The process of taking in material by enfolding in the form of vacuoles is:

A) Endocytosis B) Phagocytosis C) Pinocytosis D) Cytosis

58. In muscle cells which of these conducts impulses?
A) Nucleus B) Cytoplasm C) Golgi bodies D) Smooth ER

59. Cell wall in plant cells is secreted by which?
A) Nucleus B) Cell membrane C) Protoplasm D) Nucleoplasm

60. In 80 S "S" represents which of the following?
A) Sedimentation rate B) Density C) Mass D) Weight

61. Peroxisomes were isolated from which of these cells?
A) Pancreatic cells B) Skin cells C) Liver cells D) None of these

62. Which is present in peroxisomes?
A) Peroxidase B) Catalase C) Glycolic acid oxidase D) All of these

63. Peroxisomes are present in which of these cells?
A) Plants cells B) Animals cells C) Yeast cells D) All of these

64. Diameter of peroxisome is _____ micrometer:
A) 0.6 B) 0.5 C) 0.4 D) 0.9

65. Which are lipids rich?
A) Soya bean B) Castor bean C) Both a & b D) Pea seeds

66. Plant vacuole is major contributor to which of the following?
A) Waste storage B) Water storage C) Homeostasis D) Turgor

67. The processed enzymes are budded off from Golgi Bodies as Golgi vesicles these are:
A) Primary Lysosome B) Secondary Lysosome C) Peroxisome D) Glyoxisome

68. Which is found to be filled with Glycogen in Glycogenosis type II?
A) Muscle Cells B) Skin cells C) Liver cells D) Both a & c

69. Old mitochondria are digested in which of the process?
A) Autophagy B) Autolysis C) Autophagosomy D) None of these

70. Lyso means:
A) Break down B) Disruption C) Destruction D) Splitting

71. These are stacks of flattened membrane bounded vesicles:
A) Golgi bodies B) Endoplasmic reticulum C) Ribosomes D) Nucleus

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

73. Secretions are products formed within cell on?
A) E.R. B) Golgi bodies C) Ribosome D) Nucleus

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

75. Centrioles play an important role in location of:
A) Ribosome B) Spindle C) Microtubules D) Furrowing

76. Centrioles play important role in the formation of:
A) Pili B) Fimbriae C) Cilia D) Cytoskeleton

77. Mitochondrial matrix supports which of these processes?
A) Krebs cycle B) Anaerobic respiration C) Amino acid metabolism D) All of these

78. Size and number of mitochondria depends upon?
A) Cell shape B) Cell size C) Cell activity D) None of these

79. Mitochondria contain:
A) Ribosome B) DNA C) RNA D) All of these

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

81. Chlorophyll is an:
A) Organic molecule B) Inorganic molecule C) Protein D) Carbohydrate

82. The cell which is metabolically more active ?
A) Eukaryotic B) Prokaryotic C) Skin cells D) Epithelial cell

83. Envelope of chloroplast is:
A) Single membrane B) Double membrane C) Non membranous D) None

84. Haem has a central atom of which of the following elements?
A) Mg B) Na C) Fe D) K

85. Ions involve in translation
A) Zn^{++} B) Ca^{++} C) Mg^{++} D) Mn^{++}

86. On average there are _____ or more thylakoid per granum:
A) 60 B) 50 C) 40 D) 70

87. They are self replicating:
A) Mitochondria B) Choloroplast C) Both a & b D) Ribosomes

88. They are present in ripened fruit:
A) Chromoplast B) Leucoplast C) Choloroplast D) All of these

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

90. Outer nuclear membrane is continuous with inner membrane at:
A) Nuclear Pores B) ER C) Nucleolus D) None of these

91. Eggs have how many nuclear pores:
A) 3 - 4 B) 30,000 C) 40,000 D) 10,000

92. Number of nucleolus per nucleus:
A) Only one B) More than One C) One or more D) Three

93. Each chromosome has how many chromatids at the beginning of cell division:
A) 2 B) 1 C) 6 D) 3

94. Number of chromosomes in potato:
A) 49 B) 48 C) 46 D) 14

95. Entire cell wall of bacterium is a single huge molecule called:
A) Peptidoglycan B) Murein C) Saccule D) Sacculus

96. Peptidoglycan has:
A) Polysaccharide B) Amino acids C) A and B D) Lipids

97. In prokaryotes size of ribosome is _____ is:
A) 70 s B) 80 s C) 40 s D) 60 s

98. Bacterium may have:
A) Pili B) Capsule C) Flagellum D) All of these

99. No. of chromosome in garden pea;
A) 15 B) 16 C) 14 D) 8

100. Cytoskeletal fabrics formed of:
A) Microfilaments
B) Microtubules
C) Intermediate filaments
D) All of these

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

102. Cilia, Flagella and centrioles are composed of:
A) Microtubules
B) Microfilament
C) Intermediate filaments
D) Myofibrils

103. Amoeboid movements and cyclosis are due to:
A) Microfilaments
C) Microtubules

B) Intermediate filaments
D) Fibres

104. Lysosomes and peroxisosmes are first discoved by:
A) Taysach
B) De veries
C) Palad
D) De Duve

105. Lysosome are rich in
A) Acid phosphatase and protolithic enzymes
B) Acid phosphalase and hydrolytic enzymes
C) Acid oxidase and Hydrolytic enzymes
D) None of these

106. A Tay Sach's disease, following enzyme is absent in cell
A) Lipase
B) Glycogenase
C) Glucokinase
D) Proteiase

107. There are found in lipid rich seed
A) Peroxisome
B) Lysosome
C) Ribosome
D) Glyoxisome

108. Glyoxisomes are in the sites for breakdown of fatty acid to:
A) Fats
B) Succinate
C) Proteins
D) Acetic acids

109. Which type of cells would probably be most appropriate to study lysosome?
A) Nerve cell
B) Muscle Cell
C) Liver cell
D) White blood cell

110. The lysosome which eat parts of its own cells are known as:
A) Primary lysosome
B) Secondary lysosome
C) Autophagous lysosome
D) All of these

111. Which substances can cross plasma membrane more easily?
A) Ions
B) Proteins
C) Lipid soluble
D) Starch

112. Which organelle of cell helps to detoxify the harmful drugs?
A) RER
B) SER
C) Golgi Apparatus
D) Ribosomes

113. The ratio between RNA and protein in a ribosome:
A) 1 : 1
B) 2 : 3
C) 4 : 7
D) 3 : 1

114. What is a polysome?
A) Group of mRNAs and one ribosome
B) mRNA + rRNA + tRNA + ribosome
C) Many ribosomes and many mRNAs
D) One mRNA and many ribosomes

115. The vesicles which diffuse to form stack of cisternae sacs are derived from:
A) Golgi Apparatus
B) RER
C) SER
D) Lysosomes

116. The position of the two centrioles with respect to each other:
A) Horizontal
B) Vertical
C) Parallel
D) Right angle

117. Which one is a self-replicating organelle?
A) Ribosome
B) Lysosome
C) Centriole
D) Mitochondrion

118. The size and number of mitochondria depend upon which factor of the cell?
A) Biochemical
B) Physiological
C) Genetic
D) Evolutionary

119. Ribosomes are assembled in:
A) Nucleus
B) Nucleolus
C) Lysosome
D) Nuclear Envelope

120. The exact replica of the chromosome is:
A) Centromere
B) Kinetochore
C) Chromatid
D) Spindle fibres

Answers (A):

1.	C	2.	D	3.	C	4.	B	5.	D	6.	C	7	B	8	B	9	B	10.	C
11.	B	12.	A	13.	C	14.	D	15.	C	16.	C	17.	D	18.	C	19.	A	20.	D
21.	C	22.	A	23.	D	24.	C	25.	C	26.	B	27	B	28.	D	29.	A	30.	A
31.	A	32.	A	33.	B	34.	C	35.	D	36.	C	37.	A	38.	A	39.	B	40.	C
41.	A	42.	C	43.	D	44.	D	45.	B	46.	A	47.	B	48.	A	49.	D	50.	A
51.	B	52.	C	53.	C	54.	C	55.	C	56.	D	57.	A	58.	D	59.	C	60.	A
61.	C	62.	D	63.	D	64.	B	65.	C	66.	D	67.	A	68.	D	69.	A	70.	D
71.	A	72.	A	73.	B	74.	A	75.	D	76.	C	77.	A	78.	C	79.	D	80.	B
81.	A	82.	B	83.	B	84.	C	85.	C	86.	B	87.	C	88.	A	89.	A	90.	A
91.	B	92.	C	93	A	94.	B	95.	D	96.	C	97.	A	98.	D	99.	C	100	D
101	B	102	A	103	A	104	D	105	B	106	A	107	D	108	B	109	D	110	C
111	C	112	C	113	A	114	D	115	C	116	D	117	D	118	B	119	B	120	C

SOLVED EXERCISE

Exercise A-Q24

It is a complex structure formed by group of two or more Ribosomes attached to mRNA. It act to translate mRNA into polypeptide bound thus "c' is the correct answer.

Q 30.

Cell theory is formulated by Schleiden and Rudolf virthow the cell theory states:

1. All living organisms are composed cells. They may be unicellular or multicellular.
2. The cell is the basic unit of life.
3. Cell arise from pre-existing cells.

Bacteria is a single cell.
Prokaryotes are cells without Nucleus and Cyanobacteria is prokaryotes.
The status of virus is below the cellular level.

ANSWERS + DISCUSSION ON MCQS OF EXERCISE IN TEXT BOOK OF BIOLOGY OF STARS ACADEMY LAHORE

Q NO. 30

The cell theory states that all living things are made of cells, cell are basic unit of structure + functions of all living things and all cells come from other living cell, viruses are not made of cells.

Q NO. 24

Aggregations of numerous ribosomes that are in the process actively translating mRNA into protein. They increase efficiency by using mRNA to make many identical polypeptides. Thus translation is the correct answer.

PAGE

Plant vacuole performed all functions to store water, wastes, homeostasis and Turgor. It's major function is to maintain turgidity

Page 15

Cell wall is composed of monomer unit polysaccharide chains covalently bounded to shorter chain of amino acid. The entire cell wall is often regarded as single huge molecule or molecular complexed called sacculus. It is a polymer of peptidoglycan

Q N O. 87

Those organelles which can divided themselves without cell divisions and create copies of themselves. Mitochondria and plastids are best examples. They are of endosymbiotic origin + possess their own DNA.

Q NO. 95

Cell wall of bacteria is composed of polysaccharide chains bound covalently to shorter chains of amino acids or murein forming peptidoglycan. It is monomer molecule. However, entire cell wall of bacteria is polymer of peptidoglycan and is regarded single huge molecule.

Q NO. 56

Transport across the plasma membrane

Lipid Soluble	More easily than others.
Ions	With difficulty
Smaller and neutral molecule	Easily

Q NO. 117

Certain organelles replicate without cell division. There are plastids + mitochondria. They are end symbiotic origin + possess their own DNA + produce their own proteins.

Q NO. 106

Glucokinase is an enzyme responsible for the co n version of glucose into glucose_____6_____.
Glycogenesis is an enzyme that splits glycogen into dextrin and maltose.

LIPASE:

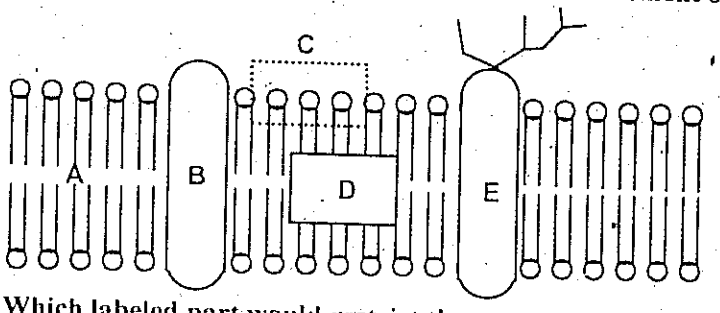
Breakdown facts fatty acid and glycerol. If lipase is absent Lipids will accumulate and cause Tay-Sech's disease.

Exercise (B)

Q .1 Which of the following one single membrane bounded and double membrane-bonded. Connect the correct statement.

	Single membrane		Two membranes	
A)	Vacuole	Lysosome	Nucleus	Chloroplast
B)	Chloroplast	Lysosome	Nucleus	Vacuole
C)	Nucleus	Chloroplast	Lysosome	Vacuole
D)	Nucleus	Lysosome	Chloroplast	Vacuole

Q .2 Which labeled part is this diagram do not allow moment of small lipid-insoluble molecules:



Which labeled part would restrict the movement of small, lipid-insoluble molecules?

Q .3 Which structure is necessary for the cell for proteins?
A) Centrioles
B) Mitochondria
C) Lysosomes
D) Ribosomes

Q .4 Which one is synthesized by free floating ribosomes:
A) Pancreas lipase
B) Insulin
C) Salivary amylase
D) DNA helicase

Q .5 These play vital role in defense activity of macrophages:
A) Mitochondria
B) Lysozymes
C) Lysosomes
D) Ribosomes

Q .6 Which protects the cell from damage whether its prokaryotic or eukaryotic:
A) Mitochondria
B) Cell wall
C) Cell membrane
D) Golgi apparatus

Q .7 Murein donot have:
A) Polysaccharides
B) Amino acid chains
C) Glycans
D) Proteins

Q .8 The movement of Na^+ ion via $Na^+ - K^+$ pump, Na^+ ions move by:
A) Active transport
B) Passive transport
C) Diffusion
D) Osmosis

Q .9 Which one passes from nucleoplasm to cytoplasm:
A) Proteins
B) Enzymes
C) DNA nucleotides
D) RNAs

Q .10 Which of the following donot move during cytoplasmic streaming:
A) Endoplasmic reticulum
B) Mitochondria
C) Lysosomes
D) Glucose and salts

Q .11 Which of the following functions as detoxifier in harful drugs.
A) Ribosomes
B) RER
C) SER
D) Golgi bodies

Q .12 Movement of cisternae in golgi apparatus is from _____ to _____:
A) Inner, outer
B) Concave, convex
C) Medial, lateral
D) Convex, Concave

Q .13 Choose the incorrect one reference to mitochondrial membrane:
A) Outer membrane – smooth
B) Outer membrane – Chemiosmosis
C) Inner membrane – F_1 particles
D) Inner membrane – Increases surface area

Q .14 Synthesis of cell secretions occurs in _____ then transported to outside trhough _____ and _____
A) Ribosome, RER, SER
B) Ribosomes, Golgi apparatus, SER
C) RER, Golgi apparatus, Lysosomes
D) Ribosomes, ER, Golgi apparatus

Q .15 Each of centriole consists of:
A) 3 microtubule triplets
B) 9 microtubule triplets
C) 6 microtubule triplets
D) 12 microtubule triplets

Q .16 Ribosomes found in cytosol and organelles of eukaryotic ell respectively:
A) 60S and 40S
B) 70S and 80S
C) 80S and 70S
D) 80S and 80S

Q .17 Abundance of endoplasmic reticulum and golgi apparatus found in following:
I. Plasma B Cells (produce antibodies)
II. Adipose cells (store fats)
III. Islet of Langerhans cells (secrete insulin)
IV. Red blood cells (transport oxygen)
A) I and II only
B) III and IV only
C) I and III only
D) II and III only

Q .18 Structure responsible for protection in bacterial cells:
A) Cell wall
B) Cellulose
C) Protoplasm
D) Nuclei

Q .19 Structure distinguish plant and animal cells:
A) Mitochondria
B) Ribosomes
C) Endoplasmic reticulum
D) Cell wall

Q .20 Which of the following donot have endoplasmic reticulum:
A) Animal cells
B) Prokaryotic cells
C) Plant cells
D) Protists and Fungal cells

Q .21 Which one has only one cell?
A) Mycoplasma
B) Virus
C) Protists
D) Algae

Q .22 In large particles having polarity transportation occur will be:
A) Osmosis
B) Diffusion
C) Faciliatated diffusion
D) Passive transport

Q .23 Which one present in nucleolus:
A) Ribosomal precursor
B) Protein precursor
C) Polysome
D) Lipid precursor

Q .24 Insulin helps in transportation of glucose within the cell is an example of:
A) Osmosis
B) Active transport
C) Facilitated diffusion
D) Endocytosis

Q .25 Which is the functional unit of Golgi apparatus:
A) Thylakoids
B) Oxysomes
C) Cristae
D) Cisternae

Q .26 Centrioles/ centrosome takes part in:
A) Nucleolus formation
B) Start of cell division
C) Cell plate formation
D) Spindle formation

Q .27 Membranes of mitochondria are:
A) Structurally and functionally similar
B) Structurally and functionally different
C) Structurally similar but functionally different
D) Structurally different but functionally similar

Q .28 Which substances can cross plasma membrane more easily?
A) Ions C) Lipid soluble
B) Proteins D) Starch

Q .29 External and internal part of cell membrane is:
A) Hydrophobic C) Hydrophilic and hydrophobic
B) Hydrophilic D) Neutral

Q .30 Ribosomes have ratio of RNA and protein:
A) 1 : 1 C) 4 : 7
B) 2 : 3 D) 3 : 1

Q .31 Excretory granules bud off from:
A) Golgi bodies C) Vacuoles
B) SER D) Nucleus

Q .32 Composition of polysome is:
A) Group of mRNAs and one ribosome C) Many ribosomes and many mRNAs
B) mRNA +rRNA + tRNA + ribosomes D) One mRNA and many ribosomes

Q .33 Stack of cisternae are formed by fusion of vesicles
A) Golgi apparatus C) SER
B) RER D) Lysosomes

Q .34 Organelles performing self-replication process:
A) Ribosome C) Centriole
B) Lysosome D) Mitochondrion

Q .35 Chromosomes are formed by:
A) Centromere C) Chromatid
B) Kinetochore D) Nucleosomes

Q .36 Autophagy is performed by:
A) Lysosomes C) Glyoxysomes
B) Peroxisomes D) Peroxisomes

Q .37 Organelles having single membranes except:
A) Mitochondria C) Glyoxysomes
B) Lysosomes D) Peroxisomes

Q .38 Which of the following have lysosomes in abundance:
A) Plant cells having phagocytic activity
B) Bacteria with additional DNA plasmids
C) Protozoa
D) Animal cells having phagocytic activity

Q .39 Disease caused by the absence of enzyme involved on lipid catabolism:
A) Tay-Sach's disease C) Glycogenosis type II
B) Glycogenosis type I D) Amyloidosis

Q .40 Which organ is affected by Tay-Sach's disease:
A) Liver C) Kidneys
B) Brain D) Muscles

Q .41 The part of cells and cellular components are eaten up by
A) Primary lysosomes C) Secondary lysosomes
B) Teritary lysosomes D) Autophagosome

Q .42 All of the following enzymes can be present in peroxisomes except:
A) Phosphofructokinase C) Catalase
B) Peroxidase D) Glycolic acid oxidase

Q .43 _____ is decomposed and formed by peroxisomes:
A) Molecular oxygen C) Hydrogen peroxide
B) Reactive oxygen species D) Super oxide radicles

Q .44 Peroxisomes have diameter approximately:
A) 0.5 mm
B) 0.5 nm
C) 0.5 μm
D) 5 μm

Q .45 The conversion of lipids to carbohydrates is the function of:
A) Ribosomes
B) Peroxisomes
C) Lysosomes
D) Glyoxysomes

Q .46 Where did Glyoxysomes are primarily found:
A) Mature plant cell
B) Photosynthetic algae
C) Germinating seedlings
D) Plant stem cells

Q .47 On which factors the size and number of mitochondria dpends upon:
A) Size and shape of the cell
B) Physiological activities
C) Genetic makeup
D) Evolutionary history

Q .48 In which of the seed types of glyoxysomes are absent:
A) Castor beans
B) Peanuts
C) Soya beans
D) Pea

Q .49 Which protiens are involved in assembly and disassembly of spindle fibres during mitosis:
A) Microtubules
B) Intermediate filament
C) Microfilaments
D) All of these

Q .50 Which of the following can maintain the shape of the cell:
A) Microtubules
B) Intermediate filament
C) Microfilaments
D) All of these

Q .51 Which organelle is semiautonomous:
A) Endoplasmic reticulum
B) Chloroplast
C) Peroxisomes
D) Golgi bodies

Q .52 Plant cell do not have:
A) Flagella
B) Central vacuole
C) Cell wall
D) Chloroplast

Q .53 Function of rough endoplasmic reticulum in eukaryotic cell is:
A) Processing and packaging of proteins into transport vesicles
B) Synthesis of new membrane lipids
C) Synthesis of proteins
D) Synthesis of ribosomes

Q .54 Which eukaryotic organelle has symbiotic origin with bacteria:
A) Endoplasmic reticulum
B) Chloroplast
C) Lysosomes
D) Golgi apparatus

Q .55 Choose the correct statement:
A) Prokaryotic cells are bigger than eukaryotic cells
B) Prokaryotic cells came before eukaryotic cell
C) Eukaryotic cells do not have a nucleus, prokaryotic cell do
D) Eukaryotic cells are simple, prokaryotic cells are complex

Q .56 Which organelle donot have ribosomes abundance:
A) Mitochondria
B) Nucleus
C) Golgi apparatus
D) Chloroplast

Q .57 Membrane have large number of proteins:
A) Erythrocytes
B) Inner mitochondrial membrane
C) Outer mitochondrial membrane
D) Myelin sheath

Q .58 Carbohydrates combine with lipids and proteins to form glycolipids and are directed
A) Towards inside
B) Towards outside
C) Towards inside and outside
D) Randomly distributed

Q .59 Which organelle is continuously connected with nuclear membrane:
A) Golgi apparatus
C) RER

B) Lysosomes D) SER

Q .60 Sequence of organelles involve in transport of secretory proteins:
A) RER →SER → Golgi apparatus → Secretory vesicles
B) SER → RER → Golgi apparatus → Secretory vesicles
C) RER → SER → Secretory vesicles → Golgi apparatus
D) RER → Golgi apparatus → Secretory vesicles → SER

Q .61 Glycosylation of protein occurs in:
A) Lumen of mitochondria C) Lumen of smooth endoplasmic reticulum
B) Lumen of rough endoplasmic reticulum D) Lumen of lysosomes

Q .62 Oxidative phosphorylation occurs in structure:
A) Inner mitochondrial membrane C) Outer mitochondrial membrane
B) Mitochondrial matrix D) Thylakoid membrane

Q .63 Which organelle donot have membrane around it:
A) Endoplasmic reticulum C) Nucleus
B) Ribosome D) Chloroplast

Q .64 Plasma membrane have hydrophobic portion in:
A) Toward extracellular matrix C) Inner core of plasma membrane
B) Towards cytoplasm D) Uniformly in plasma membrane

Q .65 Which statement is related to plasma membranes fluid mosaic model:
A) Phospholipid monolayer with embedded proteins
B) Phospholipid bilayer with embedded proteins
C) Triglyceride bilayer with embedded proteins
D) Triglyceride monolayer with embedded proteins

Q .66 Nucleolus is visible in:
A) Interphase C) Metaphase
B) Mitotic phase D) Anaphase

Q .67 Small ribosomal unit 40s is of:
A) E. coli C) Yeast
B) C. botulinum D) T. palladium

Q .68 Which organelle require high light microscope for observation:
A) Endoplasmic reticulum C) Mitochondria
B) Ribosomes D) Golgi apparatus

Q .69 Which proteins is not found in microfilament:
A) Tubulin C) Actin
B) Myosin D) Tropomyosin

Q .70 Plant cells donot have:
A) Ribosomes C) Glyoxysomes
B) Peroxisomes D) Lysosomes

Q .71 Which structure makes difference between prokaryotes and eukaryotes:
A) Prokaryotes cannot undergo cell division C) Prokaryotes do not internal membranes
B) Prokaryotes have no DNA D) Prokaryotes have no cytosol

Q .72 Which of the following is found in both prokaryotes and eukaryotes:
A) A membrane bounded nucleus C) A cell wall made up cellulose
B) Ribosomes D) Linear chromosome made of DNA and Protein

Q .73 Which statement donot belong to endoplasmic reticulum:
A) Plasma cells have RER only C) RER is more than SER in adipose tissue
B) RBCs lack both RER and SER D) Hepatocyte have both RER and SER

Q .74 DNA is not found in:
A) Ribosomes C) Nucleus
B) Chloroplast D) Mitochondria

Q .75 Normal cell membrane of eukaryotes donot have characteristics:
A) Provides mechanical shape
B) Maintain cellular homeostasis
C) Regulate passage molecules
D) Synthesis of ATP

Q .76 In the basic of membranes which one is different:
A) Mitochondria
B) Nucleus
C) Endoplasmic reticulum
D) Chloroplast

Q .77 Microtubules have proteins:
A) Tubulin
B) Myosin
C) Actin
D) Chloroplast

Q .78 Formation of _____ is carried out by golgi complex:
A) Lysosome
B) RER
C) Vacuoles
D) SER

Q .79 Common function of both ER is:
A) Proteins synthesis
B) Mechanical support
C) Muscles contraction
D) Detoxification

Q .80 Identify the free floating organelles:
A) DNA
B) Endoplasmic reticulum
C) Plasma membrane
D) Chloroplast

Q .81 Which structure is not present in animal cell:
A) Chemical nature of DNA
B) Cell wall
C) Ribosomes
D) Cytoplasmic streaming movement

Q .82 In which structure krebs cycle occurs in mitochondria:
A) Matrix
B) F_1 particles
C) Stroma
D) Cristae

Q .83 Plasma membrane's receptor site is:
A) Lipids
B) Cholesterol
C) Intrinsic proteins
D) Glycoprotein

Q .84 Study of mitochondria is more appropriate in:
A) RBC's
B) Muscle cell
C) Mesophyll cell
D) E. coli

Q .85 Which one is correct:
A) DNA replication → Ribosome
B) Protein synthesis → SER
C) Anaerobic respiration → Cristae
D) Modification → Golgi apparatus

Q .86 Cell life is carried out by which structure:
A) Nucleus
B) Chromosome
C) Cell membrane
D) Mitochondria

Q .87 Steroid hormone is produced by:
A) Mitochondria
B) Golgi bodies
C) Smooth endoplasmic reticulum
D) Rought endoplasmic reticulum

Q .88 After completion of G_2 phase and during metaphase of mitosis number of centriles is:
A) 2 and 2
B) 2 and 4
C) 4 and 4
D) 4 and 2

Q .89 Membranes have common molecule:
A) Globular protein
B) Cholesterol
C) Polysaccharides
D) Phospholipid

Q .90 Smooth muscles do not perform:
A) Calcium storage
B) Steroid synthesis
C) Enzyme synthesis
D) Mechanical support

Q .91 Plant cells cell membrane do not perform:
A) Regulation of material
B) Transport of material
C) Active transport
D) Phagocytosis

Q .92 **Which of the organelle is involve in organic molecule synthesis and breakdown respectively:**
A) Mitochondria and ribosomes
B) Chloroplast and ribosomes
C) Chloroplast and mitochondria
D) Mitochondria and chloroplast

Q .93 **Which of the following functionally resembles to mesosomes of prokaryotic cell:**
A) Golgi apparatus
B) Endoplasmic
C) Cell membrane
D) Mitochondria

Q .94 **Molecule that make channels for movement of neutral substances down concentration gradient:**
A) Phospholipids
B) Protein
C) Nucleic acid
D) Molecular sieve

Q .95 **A cell with a predominance of free ribosomes have:**
A) A cell that is secreting proteins
B) A cell producing cytoplasmic enzymes
C) A cell that digesting food particles
D) A cell that enlarging its vacuole

Q .96 **A micro tubular structure similar to basal body posses:**
A) Centriole
B) Lysosome
C) Nucleolus
D) Ribosomes

Q .97 **Mitochondria do not have enzymes for:**
A) Replication of DNA
B) Krebs cycle
C) Fatty acid metabolism
D) Fermentation

Q .98 **Which organelle is present exterior surface of nucleus having array of nine clusters three microtubules is:**
A) Endoplasmic reticulum
B) Golgi bodies
C) Centriole
D) Mitochondria

Q .99 **Which statement is true for plasma membrane:**
A) Only passive transport needs energy
B) Only active transport needs energy
C) Phagocytosis is passive transport
D) Passive and active transport need energy

Q .100 **DNA, ribosomes and protein formation all found in an organelle, that will be referred as:**
A) Self-replicating
B) Self-indicating
C) Self-twisting
D) Self reproducing

Answers (B):

1.	A	2.	D	3.	D	4.	B	5.	C	6.	C	7	D	8	A	9	D	10.	A
11.	C	12.	D	13.	B	14.	D	15.	B	16.	C	17.	C	18.	A	19.	D	20.	B
21.	A	22.	C	23.	A	24.	C	25.	D	26.	D	27	B	28.	C	29.	B	30.	A
31.	A	32.	D	33.	C	34.	D	35.	C	36.	A	37.	A	38.	D	39.	A	40.	B
41.	D	42.	A	43.	C	44.	C	45.	D	46.	C	47.	B	48.	D	49.	A	50.	B
51.	B	52.	A	53.	C	54.	B	55.	B	56.	C	57.	B	58.	B	59.	C	60.	A
61.	B	62.	A	63.	B	64.	C	65.	B	66.	A	67.	C	68.	C	69.	A	70.	D
71.	C	72.	B	73.	C	74.	A	75.	D	76.	B	77.	A	78.	A	79.	B	80.	D
81.	B	82.	A	83.	D	84.	B	85.	D	86.	C	87.	C	88.	C	89.	D	90.	C
91.	D	92.	C	93	D	94.	B	95.	B	96.	A	97.	D	98.	C	99.	B	100	A

SOLVED EXERCISE

Q NO. 21

Which one has only one cell, the option "A" is a bacterial cell without cell wall.

The Protista in kingdom includes unicellular protozoans. Similarly algae are unicellular + multicellular. The virus is below the status of a cell. Therefore it is the best answer.

Q NO. 52

Which of the following is not in most in most of the plant cell.
Flagellum
Centriole
Lysosome

Unit # 2

BIOLOGICAL MOLECULES

LEARNING OUTCOMES

A) Discuss carbohydrates: Monosaccharides (Glucose), Oligosaccharides (Cane sugar, sucrose), Polysaccharides (Starches)

B) Describe Proteins: Amino acids, Primary, Secondary, Tertiary and Quaternary structure of proteins.

C) Describe Lipids: Waxes, Phospholipids, Terpenoids

D) Describe the structure along its back bone composition and function of DNA as hereditary material, Give the structure and types of RNA (mRNA, rRNA, and tRNA).

E) What are enzyme and its role in reducing activation energy?

F) Define the following terms:
Enzymes, Coenzyme, Co-factor, Prosthetic group, Apoenzyme and Holoenzyme

G) Explain the mode/mechanism of enzyme action.

H) Describe the effects of temperature, pH, enzyme concentration and substrate concentration on the rate of enzyme catalyzed reaction.

I) Explain the effects of reversible and irreversible, competitive and non-competitive inhibitors on the rate of enzyme activity.

2. BIOLOGICAL MOLECULES

Content

Carbohydrate
Proteins
Lipids
Nucleic acids
Deoxyribonucleic acid (DNA)
Ribonucleic acid (RNA)
Enzymes

A) CARBOHYDRATES

- Carbohydrates literally mean ***"hydrated carbons"***, also called "Saccharides" (derived from Greek word Sakcharon meaning sugar).
- They are composed of C, H and O

Definition:

"Polyhydroxy aldehyde or ketones or complex substances which on hydrolysis yield polyhydroxy aldehyde or ketone subunits"

General formula is $C_x(H_2O)_y$

- Simple carbohydrates are the main source of energy in the cell
- Some carbohydrates are the main constituents of cell walls in plants and microbes

Examples:

- Cellulose of wood
- Cotton and paper
- Starch present in cereals
- Root tubers
- Cane sugars
- Milk sugars

Source:

Main source of carbohydrates are plants

Conjugated molecules:

Carbohydrates combine with protein and lipids to form glycoproteins and glycolipids respectively. Most of secretions are chemically glycoproteins.

Classification of carbohydrates

Feature	Monosaccharides	Oligosaccharides	Polysaccharides
Common Name	Simple sugars	Complex sugars	Most complex sugars
Taste	Sweet	Less sweet	Branched or Tasteless
Solubility in water	Easily soluble in water	Less soluble in water	Sparingly soluble in water or high molecular weight
Hydrolysis	Can't be hydrolyzed into simpler sugar	Can be hydrolyzed	Can be hydrolyzed
General Formula	$(CH_2O)n$	$(CH_2)_nO_{n-1}$ (for disaccharides)	$Cx(H_2O)y$
Classification	On base of number of carbon atoms e.g. trioses (3C), tetroses (4C), pentoses (5C) etc.	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.

Monosaccharides:

Simple sugars

ATOMS	TYPE	FORMULA	EXAMPLES
3 C	Trioses	$C_3H_6O_3$	Glyceraldehyde, Dihydroxyacetone
4 C	Tetroses	$C_4H_8O_4$	Rare, Found in some bacteria
5 C	Pentoses	$C_5H_{10}O_5$	Ribose found in RNA
6 C	Hexoses	$C_6H_{12}O_6$	Glucose, Fructose
7 C	Heptose	$C_7H_{14}O_7$	Heptulose, Sedu heptulose

- Most monosaccharides form a ring structure in solution
- Ribofuranose is five cornered ring
- Glucopyranose is six cornered ring

Glucose:

Naturally produced in green plants which take carbon dioxide from air and H_2O from soil to synthesize glucose

Oligosaccharides:

Those oligosaccharides which yield two monosaccharides on hydrolysis are called as disaccharides and those yielding three are called as trisaccharides

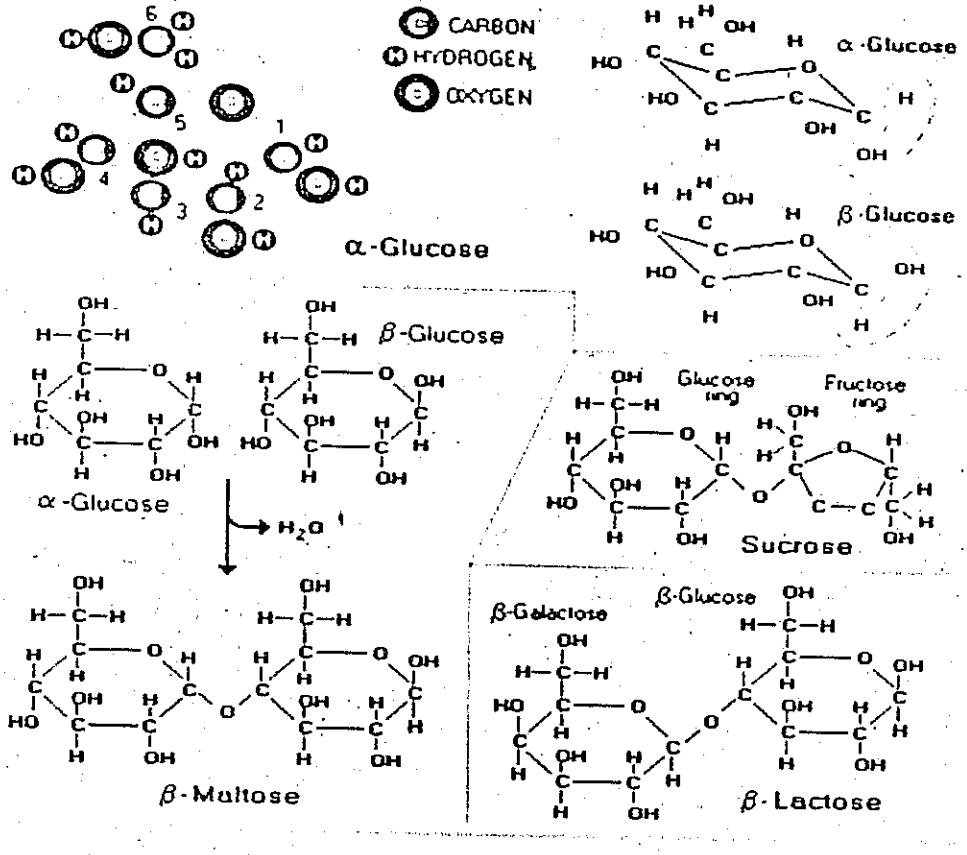
Glycosidic bond:

Covalent bond between two monosaccharides is called glycosidic bond

Examples:

Maltose
Sucrose
Lactose

Glucose + glucose — maltose
Glucose + galactose — lactose
Glucose + fructose — sucrose



- why fructose is reducing sugar while it contain ketone group

Polysaccharides:

- They are formed by several monosaccharide's units linked by glycosidic bonds

Feature	Starch	Glycogen	Cellulose
Organism	Plants	Animal	Plants
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	Yields glucose on hydrolysis.	Glucose molecules
Solubility	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

Starch:

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 linkages

- what are dextrin??

- how chitin is different from other polysaccharides??

Cellulose:

Cotton is a pure form of cellulose
It is not digested in human digestive system

B) PROTEINS

They are the most abundant organic compound 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	Catalyse 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.

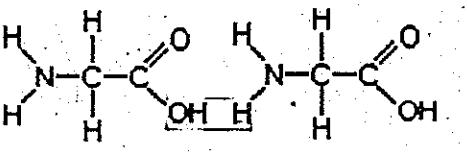
Amino acids:

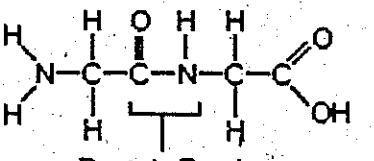
- About 170 amino acids have been found in cells and tissues
- Out of 170 types only 25 are constituents of proteins
- Most of the proteins are however made of 20 types of amino acids

Structure:

Basic structure of amino acid is

Structural formula





A molecule of water is removed from two glycine amino acids to form a peptide bond.

Amino acids are linked together to form a polypeptide molecule

Peptide bond:

Amino acids are linked together by peptide bond

- Two amino acids are linked together by a peptide bond to form a dipeptide e.g. alanine and glycine form glycylalanine

Structure of protein:

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.
Example	Insulin, Hb	Alpha helix (α-helix)	Single chain of Hb	Hb 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

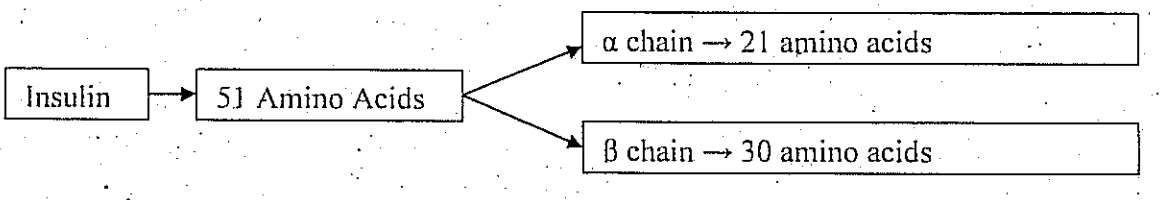
Examples:

1. **Insulin:**

   It consists of 51 amino acids arranged in two chains

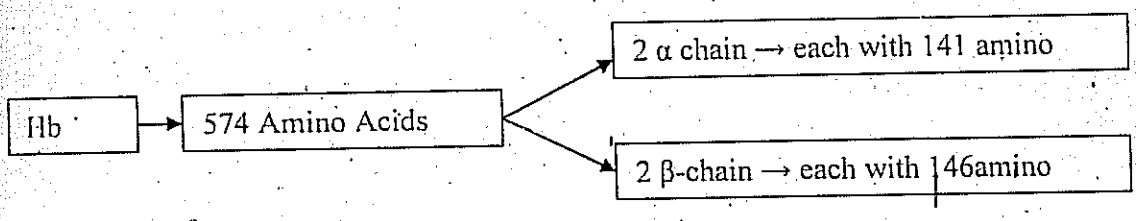
   i. "A" chain consists 21 amino acids

   ii. "B" chain consists of 30 amino acids



2. **Haemoglobin:**
It consists of 574 amino acids

i. 2 Alpha chain: each chain consist of 141 amino acids (2x141=282)
ii. 2 beta chains: each chain consists of 146 amino acids (2x146=292)



Importance of sequence:

Any change in even a single amino acid, results in the failure of that protein that may lead to death. E.g. replacement of single Glutamic acid by Valine in Hb molecule results in the formation of Sickle cell Haemoglobin, which fails to carry oxygen, the characteristic of sickle cell anemia ultimately, leads to death of suffering patient.

- **Which type of bond is alwasys present in all types of protiens?**

Secondary structure:

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

Tertiary structure:

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

Quaternary structure:

- polypeptide tertiary chains are aggregated and held together by hydrophobic interactions

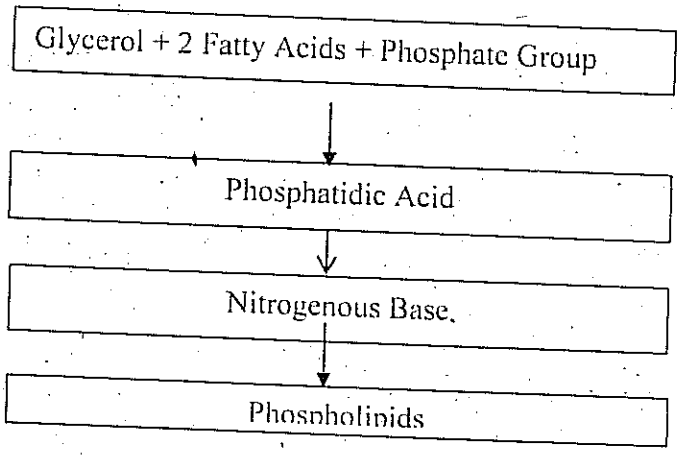
Classification of proteins:

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	Crystallized
Elasticity	Elastic in nature	Inelastic
Role	Structural	Functional
Stability	Stable	Unstable
Examples	Silk fibers, myosin, fibrin, keratin	Enzymes, antibodies, hormones, hemoglobin.

- **Which fibrous protien is alwasy more stable then globular protien while they are at low sturcutral level ?**

Lipids:

- lipids are heterogeneous group of compounds related to fatty acids
- they are insoluble in water but soluble in organic solvents like ether, alcohol etc
- their hydrophobic nature makes them best suited to be a structural component of cell membrane
- lipids store double amount of energy as compared to same amount of carbohydrates because of high proportion of C-H bonds and low proportion of oxygen
- They may act as insulating layer e.g. waxes in exoskeleton of insects and cutin which is an additional protective layer on the cuticle of epidermis of some plant organs like leaves, fruits, and seeds.



Acylglycerols:

- They are composed of glycerol and fatty acids e.g. triacylglycerides or neutral lipids
- Chemically they are defined as esters of fatty acids and alcohol
- Ester is a compound produced as a result of a chemical reaction of an alcohol with an acid and a water molecule is released

$$C_2H_5OH + HOOCCH_3 \longrightarrow C_2H_5COOCH_3 + H_2O$$

- Fatty acids having no double bond are called saturated fatty acids
- Fatty acids having upto 6 double bonds are called unsaturated fatty acids

In animals:

In animals fatty acids are straight chain while in plants they are ringed or branched

Solubility:

Solubility of fatty acids in organic solvents and their melting points increase with the increase in number of C atoms in chain

Oils:

Fats containing unsaturated fatty acids are usually liquid at room temperature and are said to be oils. Most of the plant fats are liquid.

Animal fats:

Fats containing saturated fatty acids are usually solid at room temperature. Animal fats are usually solid at room temperature

Waxes:

Waxes are mixture of long chain fatty acids, glycerol and alkanes

- They form protective coating on the fruits and leaves and thus protect them form water loss and abrasive damage
- They also provide water barrier for insects, birds and animals such as sheep

Phospholipids:

Phospholipids are derivatives of phosphatidic acid

- They are frequently associated with biological membrane
- Phosphatidylcholine is one of its common example also called lecithin

Structure Terpenoids:

Terpenoids are polymers of simple repeating units called isoprenoid units

- Isoprenoid are simple 5C units
- Steroids, terpens are Terpenoids

Nucleic acids:

- Nucleic acid was first isolated by F.Miescher from nuclei of pus cells
- They are so called because of their discovery from nucleus and acidic nature
- ATP is an important nucleotide used as an energy currency by the cell

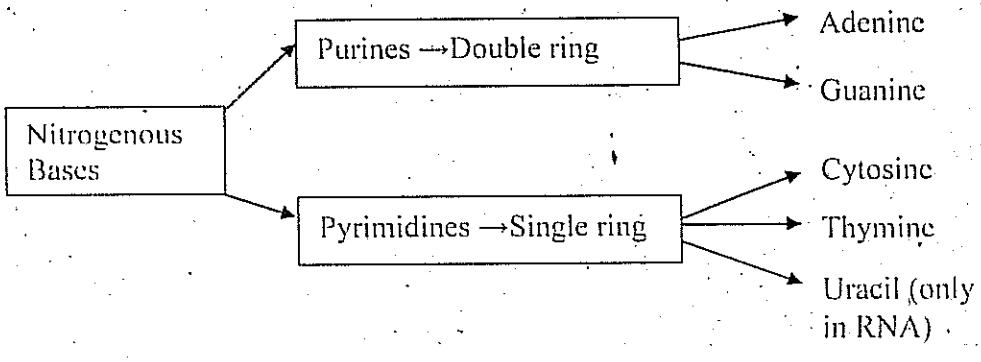
DNA: (deoxyribonucleic acid)

- DNA is made up of repeating units of nucleotides namely
  - i. d-adenosine monophosphate
  - ii. d-guanosine monophosphate
  - iii. d-cytidine monophosphate
  - iv. d-thymidine monophosphate

Nitrogenous bases:

Two types of nitrogenous bases are found

1. **purine (Double ringed)**
   - i. adenine
   - ii. guanine
2. **pyrimidine (ring ringed)**
   - i. thymine
   - ii. cytosine
   - iii. uracil



NAD (nicotinamide adenine dinucleotide):

This is an example of dinucleotide and an important co-enzyme in several oxidation-reduction reactions in cell

- In 1951, Erwin Chargiff provided data about the ratio of different bases present in a DNA molecules
- In each turn of DNA, there are about 10 base pairs of about 34 Angstrom units

- Do you know which vitamin is involved in formation of NAD?

- Basic structure nucleic acid is first determined by P.A Levene in 1920.

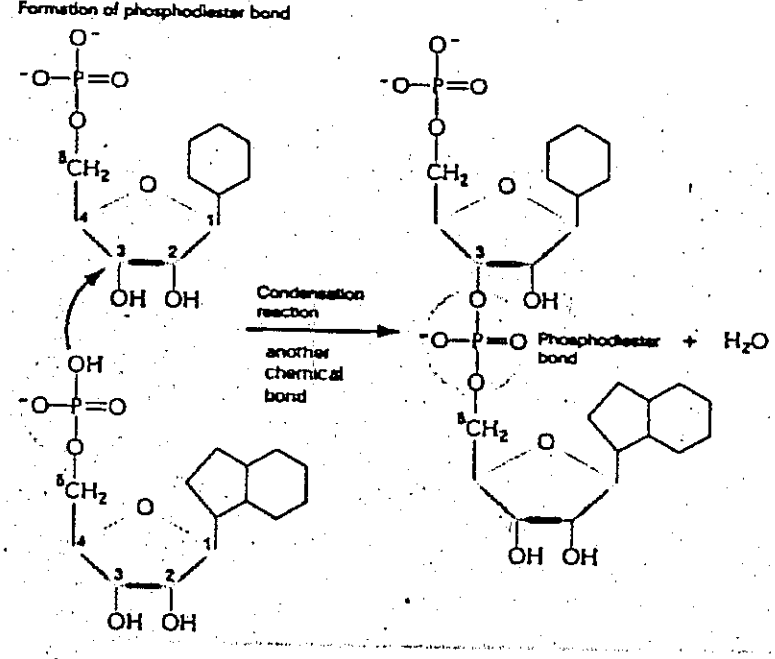
DNA components:

DNA contains three main components

i. Phosphate group
ii. 5 C sugar
iii. Nitrogenous base (purine and pyrimidine)

Phosphodiester linkage:

Linkage between two nucleotides is called as phosphodiester linkage



- Which elements participate in formation of hydrogen bonds in DNA?

Erwin Chargaff:

He showed that amount of adenine is equal to amount of thymine and amount of guanine and cytosine are same.

Adenine=thymine
Guanine ≡ 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:

	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

Maurice Wilkins and Rosalind Franklin:

They describe the X-rays diffraction analysis of DNA
Ratios table

RNA:

Polymer of ribonucleotide

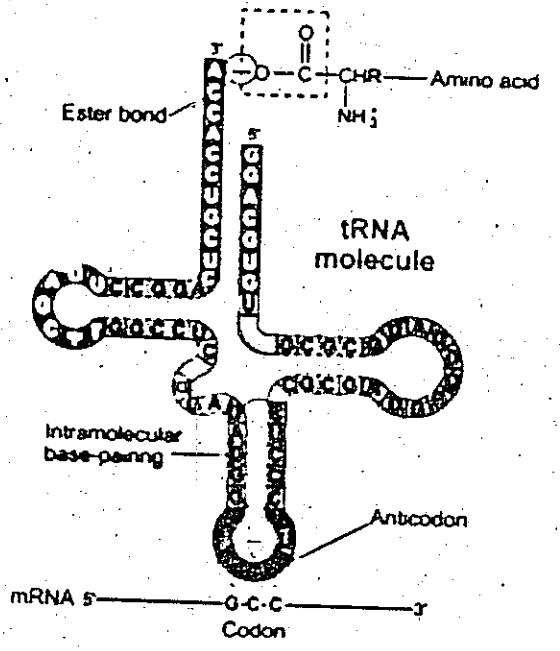
Features	mRNA	tRNA	rRNA
Function	Takes message from DNA	Transfer amino acids	Formation of ribosome
Length	Single strand of variable length	Length of 75-90 nucleotides	Constant length
Percentage	3-4%	10-20%	80%

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

tRNA:

- It transfer amino acids molecules to the site where peptide chains are being synthesized
- There is one specific tRNA for each amino acid. So there are atleast 45 kinds of tRNA molecules and picks amino acids and transfer them to ribosomes
- Human cells contain about 45 different kinds of tRNA molecules



TRNA (Clover Leaf Like Structure)

rRNA:

- It acts as a machinery for the synthesis of protein
- It is strongly associated with the ribosomal proteins where 40-50% of it is present

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	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

Enzyme:

- Enzymes are biological molecules which catalyze a biochemical reaction and remain unchanged after completion of reaction is called enzyme
- All are globular proteins, having a 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
- Are all enzymes are made up of proteins.

Cofactor:

Non-protein part of enzyme that is required for its proper functioning is called as co-factor.

Co-enzyme:

If a cofactor is loosely attached to the protein part is known as coenzyme

Prosthetic group:

If a cofactor or non-protein part is covalently attached to the protein part, it is called prosthetic group

Holoenzyme:

An activated enzyme consisting of polypeptide chain and a cofactor is known as Holoenzyme

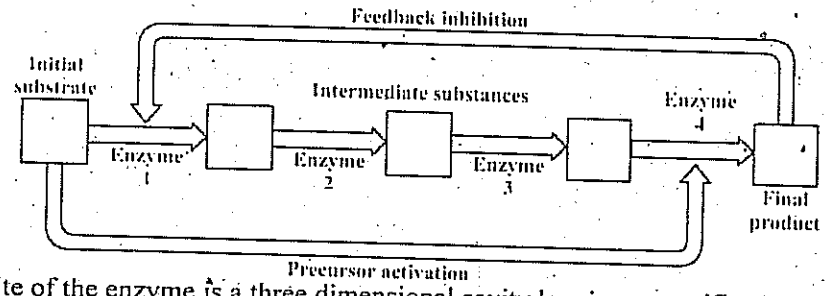
Apoenzyme:

An enzyme with its coenzyme or prosthetic group has been removed is called Apoenzyme

Mechanism of enzyme action:

Enzymes are specific in their action, any enzyme therefore react with its specific substrate and transform it into the product.

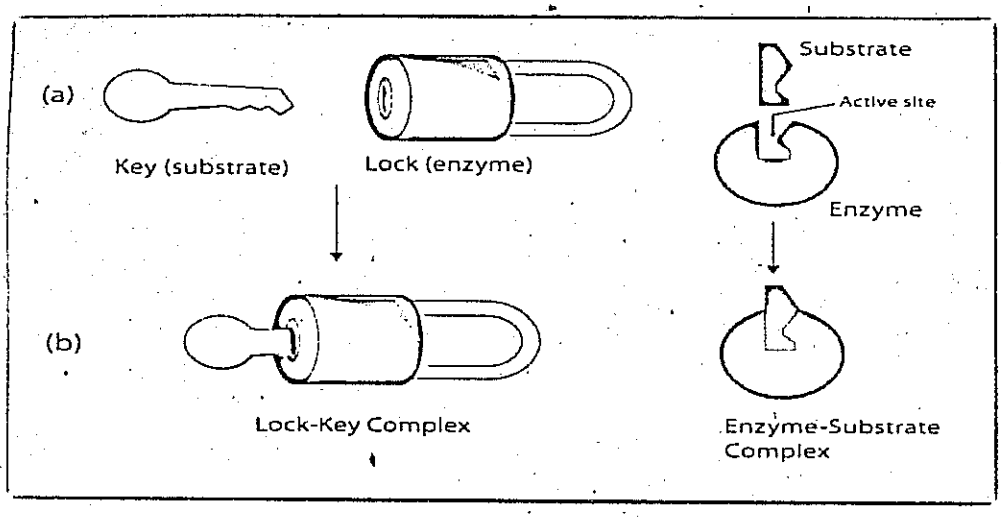
$$\underset{\text{Enzyme}}{E} + \underset{\text{Substrate}}{S} \longrightarrow \underset{\text{(enzyme substrate complex)}}{\textbf{ES complex}} \longrightarrow \underset{\text{Enzyme}}{E} + \underset{\text{Product}}{P}$$



- The active site of the enzyme is a three dimensional cavity bearing a specific charge by which the enzyme reacts with its substrate
- The active site is made of tow definite regions i.e. binding site and catalytic site
- Binding site helps the enzyme in the recognition and binding of the proper substrate to produce an ES complex
- Activate catalytic site catalyzes the transformation of the substrate into product

Models:

- Emil Fischer (1890) proposed lock and key model
- As one specific key can open a specific lock, in the same manner a specific enzyme can transform a specific substrate into product
- 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



Induced fit model:

Koshland (1959) proposed this 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.

Factors affecting rate of enzyme action:

1. Enzyme conc.

- Rate of enzyme action is directly proportional to the amount of enzymes 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 depends upon this increase.

2. Substrate concentration:

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

3. Temperature:

- The rate of the 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 at 37 C is optimum temperature
- Heat provides activation energy

HEAT ↑ violent vibration of enzyme's atom → Loss of Globular structure, enzyme denatured

HEAT → ↑ in K.E of reacting molecules → ↑ rate of reaction.

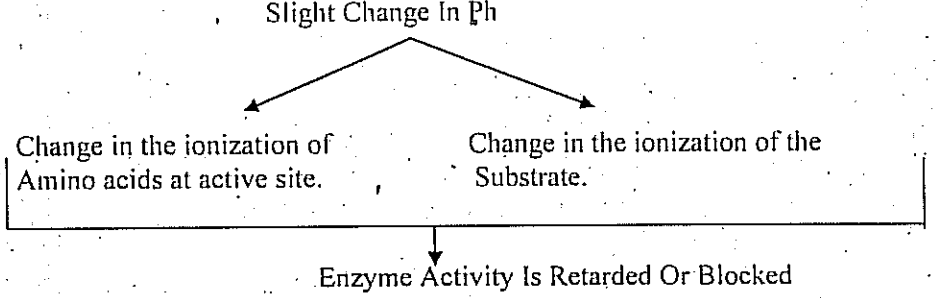
- High heat causes violent vibration of enzymes atoms that lead to loss of globular structure and enzyme will denature

4. pH

- optimum pH is the range of pH at which an enzyme function acts most effectively
- slight change in pH causes change in ionization of the substrate

pH VALUE

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



- it also cause change in the ionization of amino acids at the active site that leads to retardation or blockage of enzymes activity
- extreme change 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
Sucrase	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 argainine into urea	9.70

Inhibitors:

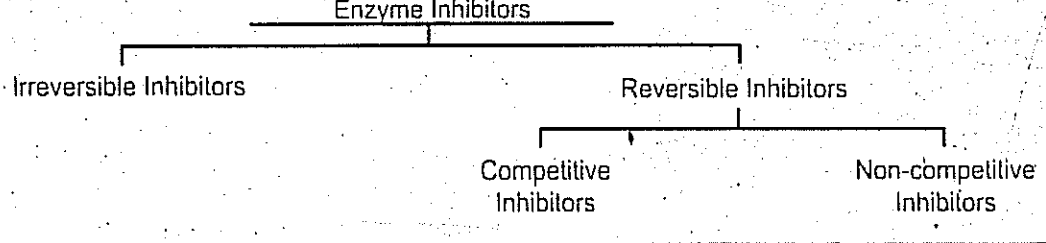
An inhibitor is a chemical substance which can react (in place of substrate) with the enzyme but it is not transformed into product and thus blocks the active site temporarily or permanently

Examples:

- Cyanides
- Antibiotics
- Anti-metabolites
- Drugs

Types:

1. Reversible inhibitors
   a. Competitive inhibitors
   b. Non-competitive inhibitors
2. Irreversible inhibitors

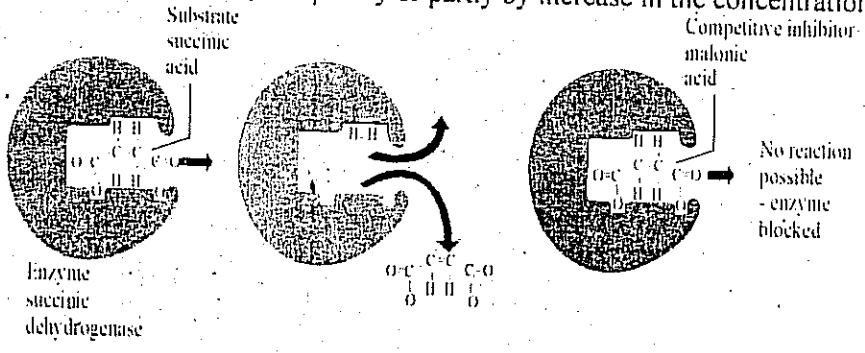


Irreversible inhibitors:

They occupy the active sites by forming covalent bond 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 substrate



Competitive inhibitors:

Competitive inhibitors are structurally similar to the substrate, hence can bind to the active site but can't activate the catalytic site, thus no product are formed

Non-competitive inhibitors:

They bind with the enzyme at the site other than active site. Structure of the enzyme is altered, so that even a genuine substrate binds the active site, catalysis fails to takes place.

Which inhibitor is different from substrate.

PRACTICE EXERCISE

Exercise (A):

1. The term which include rest of others.
   A) Biology C) Chemistry
   B) Philosophy D) Science
2. Living things possess all of the following characteristics except:
   A) Can acquire and use energy C)
   B) Cannot maintain fairly constant internal environment
   C) Contain genetic program of their characteristics
   D) Responding to changes in their environments.
3. Which of the following is not included in biology:
   A) Study of animals C) Study of atoms and molecules
   B) Study of plants D) Study of bacteria and virus
4. Chemical bond provides stability to complex carbohydrate molecules:
   A) Carbon-Hydrogen bond C) Carbon - nitrogen
   B) Carbon – Oxygen bond D) Nitrogen – Hydrogen bodn
5. All of the following are insoluble in water except:
   A) Cellulose C) Fats
   B) Glucose D) Oils
6. Molecules which is unstable and is the immediate source of energy:
   A) Amino acids C) A denosine Triphosphate
   B) Glucose D) Fatty acid
7. Part of our body having 85% water.
   A) Bones C) Muscles
   B) Brain D) Skin
8. When ingram water is heated from 15°C to 16°C heat absorbed is:
   A) 10 Calories C) 2. Calories
   B) 1. Calory D) 5. Calories
9. Monosaccharide have:
   A) Hydroxyl group C) Keto group
   B) Aldehyde group D) All of these
10. The type of monosaccharide rare in living organisms:
    A) Triose C) Pentoses
    B) Tetroses D) Hexoses
11. Monosaccharide formed after the hydrolysis of starch or cellulose
    A) Glucose C) Galactose
    B) Fructose D) All of these
12. One gram of Glucose when burnt will release:
    A) 717.6 K C) 7176 K Cal
    B) 71.76 K Cal D) 7.176 K Cal
13. The covalent bond between two monosac charides:
    A) Glycosidic C) Peptide
    B) Diaster D) Ketonic
14. Cane sugar is a / an:
    A) Polysacharide C) Monosaccharide
    B) Oligosaccharide D) None of these

15. **Polysaccharide which give red colour with iodine:**
A) Cellulose C) Starch
B) Glycogen D) Chitin

16. **Substances which serve as energy storage compound in living bodies:**
A) Proteins C) Lipids
B) Carbohydrates D) DNA

17. **All of the following are performed by Lipids except.**
A) Storage of energy C) Water absorbing material
B) Insulating material D) Protein

18. **Character not found in waxes.**
A) Even No. of carbon atoms C) Protect plants from water loss
B) Have long chains alkanes D) Water barrier substance

19. **Steroids are the members of**
A) waxes C) Phospholipids
B) Acylglycerols D) Terpenoids

20. **Most abundant organic substances of living bodies:**
A) Water C) Proteins
B) Carbohydrate D) Lipids

21. **Kind of amino acids which constitute proteins:**
A) 170 C) 20
B) 25 D) Countless

22. **F. Sanger determined the structure of:**
A) Hemoglobin C) Insulin
B) Fibrin D) Keratin

23. **No. of different types of proteins found in human body:**
A) 1000 C) 100,000
B) 10000 D) 100

24. **Quaternary structure is found in:**
A) Hemoglobin C) Insulin
B) Keratin D) Fibrin

25. **Who isolated nuclic acid in 1870?**
A) F. Sanger C) F. Miescher
B) W. Ingram D) F. Franklin

26. **Substances found in nucleoside**
A) Pentose sugar C) Phosphate
B) Organic base D) A & B

27. **All of the following have unbranched chains of glucose except:**
A) Starch C) Cellulose
B) Glycogen D) Chitin

28. **What is percentage of protein in mammalin cell, per total cell weight?**
A) 12 C) 18
B) 25 D) 25

29. **What is the percentage of lipids in bacterial cell per total cell weight?**
A) 0.5 C) 2
B) 1.0 D) 2.5

30. **What is the most abundant compound in the living cell?**
A) Protein C) Water
B) Lipids D) Carbohydrates

31. What is the proportion of carbohydrates in mammalian cell per total cell weight?
A) 2 C) 4
B) 3 D) 5

32. An amino acid has at least one amino ($-NH_2$) and one carboxyl (COOH) group bonded to carbon atom called:
A) Alpha carbon C) Secondary carbon
B) Beta carbon D) Tertiary Carbon

33. What is the number of amino acids in an insulin molecule?
A) 21 C) 41
B) 30 D) 51

34. Hemoglobin is a protein composed of:
A) Three alpha and one beta chains C) Two alpha and two beta chains
B) Three beta and one alpha chains D) Three alpha and two beta chains

35. What is number of amino acids in alpha chain of hemoglobin.
A) 140 C) 146
B) 141 D) 147

36. The shape of hemoglobin molecule is like a
A) Fiber C) Globe
B) Cigar D) Saucer

37. What is the total number of amino acids in human hemoglobin?
A) 571 C) 574
B) 572 D) 576

38. Basically carbohydrates are made up of:
A) C, H and S C) C, H, O
B) C, H, N D) N, H, O

39. The physical property of monosaccharide is that they are:
A) Less sweet and less soluble in water C) Sweet and easily soluble in water
B) Sweet and less soluble in water D) Less sweet and insoluble in water

40. The ring of Ribofuranose is:
A) 3 cornered C) 5 cornered
B) 4 cornered D) 6 cornered

41. What does sucrose yield on hydrolysis?
A) 2 monosaccharides C) 4 monosaccharides
B) 3 monosaccharides D) 5 monosaccharides

42. What are the reactants for the formation of lactose?
A) Glucose + Glucose C) Glucose + Gluctose
B) Glucose + Fructose D) Fructose + Maltose

43. There are three hydrogen bonds in between different bases found in genetic material.
A) Cytosine and Guanine C) Adenine and Uracil
B) Adenine and Thymine D) Thymine and Uracil

44. Glycogen is chemically
A) Monosaccharide C) Oligosaccharide
B) Disaccharide D) Polysaccharide

45. A suitable example of terpenoids is:
A) Sugar C) Starches
B) Waxes D) Steroids

46. In animal cell polysaccharides are stored in the form of:
A) Starch
B) Glycogen
C) Sugar
D) Oil

47. In plant cell the excess of glucose is converted into
A) Cellulose
B) Galactose
C) Sucrose
D) Starch

48. Cotton fiber is purely
A) Galactose
B) Sucrose
C) Cellulose
D) Glucose

49. In animals fatty acids are in:
A) Branched chain
B) Straight chain
C) Ring
D) None of these

50. Oleic acids is a common example of:
A) Unsaturated fatty acid
B) Saturated fatty acid
C) Super saturated fatty acid
D) None of these

51. What is the total number of carbon atoms in a molecule of palmitic acid.
A) 14
B) 15
C) 16
D) 17

52. Acylglycerols are chemically composed of:
A) Glycerol and nucleic acids
B) Glycerol and inorganic acids
C) Glycerol and fatty acids
D) Glycerol and amino acids

53. Hormone are mostly composed of:
A) Amino acids
B) Fatty acids
C) Inorganic acids
D) Nucleic acid

54. Insulin has 51 amino acids, arranged in how many polypeptide chains
A) One
B) Two
C) Three
D) Four

55. DNA contains all the following nitrogenous base units except
A) Adenine
B) Guanine
C) Cytosine
D) Uracil

56. All of the following are pyrimidine base except
A) Guanine
B) Cytosine
C) Uracil
D) Thymine

57. Which one of the following is not hexose sugar
A) Glucose
B) Galactose
C) Ribose
D) Fructose

58. PGAL is a phosphorylated form of a monosaccharide sugar, it belongs to which group.
A) Trioses
B) Tetroses
C) Pentoses
D) Hexose

59. Nucleic acids are in different forms in the nucleus of a cell. Which of the following forms of nucleic acids controls the synthesis of all these.
A) DNA
B) mRNA
C) tRNA
D) rRNA

60. All of the following are polysaccharides except.
A) Rubber
B) Cotton
C) Wood
D) Paper

61. Biochemistry helps to understand:
A) Anatomy
B) Physiology
C) Ecology
D) Both A & B

62. Tanneries contain which harmful heavy metal
A) Tin
B) Lead
C) Chromium
D) Bromium

Answers (A):

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

Exercise B)

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. 1gm of glucose will yield how much energy:

A) 3800 cal B) 5300 cal C) 717.6 k cal D) 71.76 k cal

3. Most of the starch content is:

A) Amylose B) Amylopectin C) Both are equal D) Dextrose

4. Polysaccharides are:

A) Insoluble in hot Water B) Sparingly soluble in hot water C) Sparingly soluble in cold water D) Insoluble in hot water

5. The length of one turn of DNA double helix is:

A) 34 nm B) 3.4 nm C) 3.4A D) 0.34nm

6. Adenine shows how many oxygen atoms.

A) One B) Two C) Three D) No one

7. NAD is a/an:

A) Nucleotide B) Co-enzyme C) Respiratory protein D) Both a and b

8. Which one is not a fibrous protein?

A) Fibrin B) Actin C) Keratin D) Troponin

9. Fibrous proteins are:

A) In soluble in aqueous medium B) Inelastic C) Crystalline D) None of these

10. The two chains of insulin are held together by:

A) Peptidelinkage B) Sulphide linkage C) Disulphide bridge D) Hydrogen bonding

11. Glycylalanine has how many peptide linkages:

A) One B) Two C) Three D) No one

12. How many types of amino acids are found in cells and tissues:

A) 180 B) 20 C) 45 D) 170

13. Abrassive damage is caused by

A) Gain of water B) Loss of water C) Loss of ions D) Gain of ions

14. Choline contains how many carbon and nitrogen atoms:

A) 4 - 1 B) 3 - 1 C) 5 - 1 D) 4 - 2

15. Phosphatidic acid lacks:

A) Fatty acids B) Phosphate group C) Glycerol D) Choline

16. A mono-unsaturated fatty acids having C = 18, what is the formula:
A) $C_{18}H_{35}COOH$ B) $C_{17}H_{33}COOH$ C) $C_{17}H_{35}COOH$ D) $C_{16}H_{33}COOH$

17. Palmitic acid is more soluble than butyric acid in:
A) Ether B) Water C) Acid solutions D) Salt solution

18. Glycerol donates which group to fatty acid to form triglyceride:
A) OH B) H C) Both a & b D) Phosphate

19. How many possible double bonds may be present in fatty acids:
A) Two B) Three C) Four D) Six

20. Melting point of Palmitic acid is:
A) 60.1 °C B) 63.1 °C C) - 8 °C D) 60.3 °C

21. Specific gravity of fats and oils is:
A) 0.8 B) 1.8 C) 0.6 D) 0.08

22. Glycogen is mainly stored in:
A) Liver B) Spleen C) W.B.C. D) Skin Cells

23. Which chemical compound is more abundant in bacterial cell than mammalian cell:
A) Salts B) RNA C) Lipids D) Carbohydrates

24. How many nucleotides form tRNA:
A) 60 – 75 B) 75 – 90 C) 70 – 80 D) 60 – 80

25. DNA contents in mammalian cells:
A) 1.1% B) 2% C) 0.25% D) 4%

26. Percent amount of carbohydrates in a Bacterial cell:
A) 4 B) 3 C) 2 D) 1

27. Which bond provides stability to complex carbohydrates:
A) N – C B) C – O – C C) P – O – C D) C – O – N

28. Which serves as the storage of smaller molecules:
A) Starch B) Protein C) Cellulose D) All of these

29. Why lipids form layers in membrane:
A) They are insoluble in water B) They are polar
C) They are covalent D) They are organic

30. Due to high specific heat capacity water acts as:
A) Buffer B) Temperature stabilizer C) Lubricant D) Shock absorber

31. Three carbon aldehyde form of sugar:
A) Glyceraldehyde B) Aldehyde C) Dihydroxyacetone D) Formaldehyde

32. What kind of Glycosidic linkage is found in sucrose?
A) 1,6 B) 1,4 C) 2,6 D) 1,2

33. Blood contains _____ percent glucose:
A) 0.8% B) 0.08% C) 0.06% D) 6%

34. What is main source of carbohydrate for animals:
A) Cellulose B) Glycogen C) Starch D) All of these

35. Most common acylglycerols are:
A) Animal fats B) Plant fats C) Monoacylglycerol D) Triacylglycerol

36. Waxes are:
A) Terpenoids B) Glycerides C) Mixture of various compounds D) Phospholipids

37. Carotenoids are:
A) Carbohydrates B) Glycerides C) Lipids D) None of these

38. Glycerol is _____ carbon alcohol:
A) 3 B) 4 C) 5 D) 6

39. The most common phospholipids:
A) Phosphatidic acid B) Lecithin C) Choline D) Isoprenoids

40. Glycylalanine is:
A) A polypeptide B) A dipeptide C) An amino acid D) A tripeptide

41. Primary structure of protein is determined due to:
A) Sequence of amino acids B) Number of amino acids
C) Both a & b D) Size of amino acids

42. Primary structure of protein is maintained by:
A) Ionic bond B) Disulfide linkage C) Hydrogen bonds D) Peptide Bond

43. Which structure is most important in fibrous proteins:
A) Primary B) Secondary C) Tertiary D) Quaternary

44. It is not fibrous:
A) Haemoglobin B) Myosin C) Silk D) Fibrin

45. Which forms a nucleoside:
A) Deoxyribose + nitrogenous base B) Deoxyribose + nitrogenous base + phosphoric acid
C) Ribose + phosphoric acid D) Ribose + nitrogenous base + phosphoric acid

46. There are _____ kinds of nucleotides which are present in DNA:
A) 12 B) 8 C) 4 D) 2

47. Amount of DNA is fixed for a particular:
A) Tertiary structure of DNA B) Secondary structure of DNA
C) Community D) Specie

48. Two polynucleotide chains are held together by hydrogen bonds, this is its:
A) Tertiary structure B) Secondary structure C) Primary structure D) None of these

49. E. coli genome has approximately 5 million:
A) Bases in single DNA B) Bases in DNA duplex
C) Base pairs in a paired strand RNA D) None of these

50. A cukaryotic ribosome contains how many percent of protein:
A) 50% B) 50-60% C) 60-70% D) 20-30%

51. Amylopectin is soluble in:
A) Hot water B) Cold water C) both D) None of these

52. 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

53. How many kinds of rRNA are found in eukaryotic ribosomes?
A) 4 B) 3 C) 2 D) 1

54. Glycosidic bond is a:
A) Covalent B) Covalent coordinate C) Ionic D) metalic Covalent

55. The colour that cellulose gives with iodine is:
A) Blue B) Red C) Violet D) No color

56. The esters of fatty acids and glycerol is:
A) Acylglycerol B) Palmitic acid C) Lecithin D) Phospholipid

57. β – chain of hemoglobin contains_____amino acids:
A) 51 B) 141 C) 144 D) 146

58. The secondary helical structure of protein is kept stable by the formation of:
A) Disulfide bond B) Hydrogen bond
C) Covalent bond D) Hydrophobic Interaction

59. 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

60. The reserved form of carbohydrates in animals is:
A) Starch B) Glucose C) Glycogen D) Amylose

61. Which bond is potential source of chemical energy for cellular activities:
A) C – C B) C – O C) C – N D) C – H

62. Carbohydrate compounds appear in glycolysis contains carbon
A) 5 B) 6 C) 7 D) 9

63. Most abundant protein:
A) Keratin B) Albumin C) Dehydrogenases D) Rubisco

64. Rubber is a:
A) Carbohydrate B) Protein C) Terpenoid D) Acylglycerol

65. Amino acid which gets attached with tRNA, uses its----------group.
A) Amino B) Carboxylic C) R- D) Both R- and amino

66. Spider exoskeleton is?
A) Polysaccharide B) Fibrous protein C) Globular protein D) Lipid

67. Globular proteins are soluble in aqueous solutions of:
A) Salt B) Alcohols C) Acids & bases D) All of these

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

69. Compound formed by combination of base and ribose sugar?
A) Nucleoside B) d-Nucleoside C) d-Nucleotide D) Nucleotide

70. Which has ability to form ester linkage with OH group of pentose sugar?
A) Nucleoside B) Phosphoric acid C) Nitrogenous bases D) Adenine

71. Each nucleotide has _____ components:
A) 3 B) 4 C) 5 D) 6

72. Oxygen is removed from which carbon atom in deoxyribose sugar?
A) 2nd B) 3rd C) 4th D) 5th

73. Number of base pairs in each turn of DNA helix are:
A) 24 B) 10 C) 34 D) 3.6

74. Diameter of DNA duplex is:
A) 0.34 A^0 B) 34 A^0 C) 20 A^0 D) 2 nm

75. Which of these is a germ cell?
A) Egg B) Sperm C) Both D) Embryo

76. All information of structure & function of a cell is stored preciously in:
A) DNA B) Histone C) Nucleus D) Nucleotide

77. *Heamophilus influenzae* is the first microbe whose:
A) Chromosomes were discovered B) Nucleotide was discovered C) Gene order was discovered D) None

78. Nucleic acid has special affinity with what kind of proteins?
A) Basic B) Fibrous C) Globular D) Acidic

79. Nucleohistone is a:
A) Nucleoprotein B) Nucleolipid C) Nucleotide D) All of these

80. Glycoproteins & glycolipids are structural integral component of:
A) Ribosome B) Golgi bodies C) Cell wall D) Plasma membrane

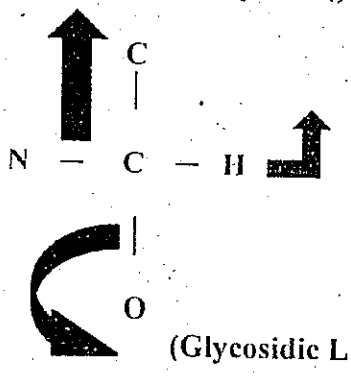
Answers (B):

1.	A	2.	D	3.	A	4.	B	5.	B	6.	D	7.	D	8.	D	9.	A	10.	C
11.	A	12.	D	13.	B	14.	C	15.	D	16.	B	17.	A	18.	B	19.	D	20.	B
21.	A	22.	A	23.	B	24.	B	25.	C	26.	B	27.	B	28.	D	29.	A	30.	B
31.	A	32.	D	33.	B	34.	C	35.	D	36.	C	37	C	38.	A	39.	A	40.	B
41.	C	42.	B	43.	B	44.	A	45.	A	46.	C	47.	D	48.	B	49.	B	50.	A
51.	D	52.	C	53.	D	54.	A	55.	D	56.	A	57.	D	58.	B	59.	D	60.	C
61.	D	62.	B	63.	D	64.	C	65.	B	66.	D	67.	D	68.	A	69.	A	70.	B
71.	A	72.	A	73.	B	74.	D	75.	C	76.	A	77.	C	78.	A	79.	A	80.	D

Q No. 4

SKELETON OF ORGANIC MOLECULE

(Peptide bond in protein)



(Source of energy)

(Glycosidic Linkage)

Q No. 26

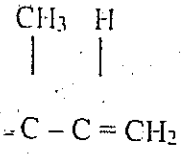
Nucleoside + Nucleotide both are nitrogenous likened with a five carbon sugar, whereas Nucleotide differs from Nucleoside as it is future likened up with one or more phosphate groups.

Nucleotide = Carbon Sugar + Nitrogenous + Phosphate

Nucleoside = Carbon Sugar + Nitrogenous Base

Q NO. 45

Terpenoids are large complex compounds made up of simple repeating un its isoprenoid units



Q NO. 73

Complete the helical turn = 3.4 nm / 34A°

DNA

One turn contain = nitrogen base pair of you have to calculate in (B.P) 3 turn.

3 x10 = 30 NBP

Unit # 3
MICROBIOLOGY

LEARNING OUTCOMES

A) Which are the viral diseases in humans?
B) Retroviruses and Acquired Immunodeficiency diseases
C) Describe the Life cycle of Bacteriophage (in detail with its all steps) including:
   Lytic cycle
   Lysogenic cycle
D) Describe the structure and types of bacteria
E) Discuss in detail:
   Gram +ve bacteria
   Gram -ve bacteria
   Nutrition in bacteria
F) What are the uses and misuses of antibiotics?
G) What are molds (fungi)? How they are useful and harmful to mankind, give examples.
H) Describe the Life cycle of fungus (*Rhizopus*).

3. MICROBIOLOGY

Content

Virus
Bacteria
Fungi

VIRUSES

- These are smallest known infectious entities which are nucleoproteins particles.
- These are obligate intracellular parasites.
- Their protein coat is also called as capside made of capsomeres while genome is either DNA or RNA.
- Envelop is non-essential component found in enveloped viruses and derived from host membrane.

•What is meant by obligate intracellular parasite?

•What do you know about prions & viroids?

•Do viruses contains molecules other than proteins & nucleic acids?

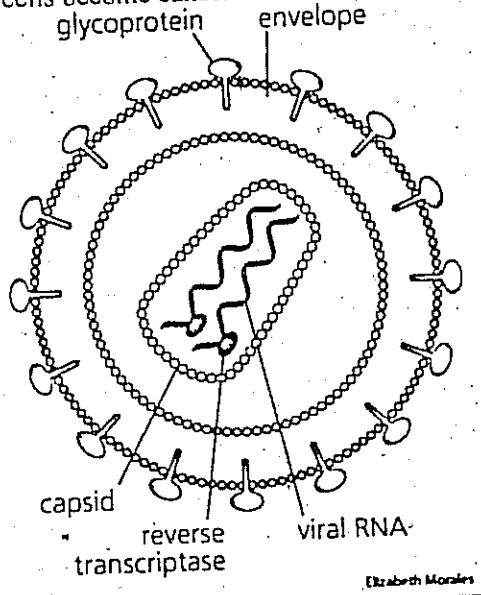
A) VIRAL DISEASES

DISEASE	VIRUS	SYMPTOMS	IMMUNIZATION
Small pox	Pox virus (DNA enveloped virus)	Raised fluid-filled vesicles > Pustules > Pocks (form pitted scars)	Vaccination
Herpes Simplex Oral Herpes Genital	Herpes virus (DNA virus) Type 1 Type 2	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 virus, in spherical capsid). Smallest known virus	Paralysis of limbs	Vaccination
Hepatitis A (Infectious)	RNA non-enveloped virus	Acute infection (Nausea, vomiting, diarrhea, jaundice)	Auto-immunity, Vaccination
Hepatitis B (Serum)	DNA enveloped virus	Acute (vomiting, yellowish skin, tiredness, dark urine, abdominal pain) & chronic (No symptoms, live cirrhosis & liver cancer)	Vaccination
Hepatitis C (Infusion)	RNA enveloped virus	Chronic (ocassionally fever, dark urine, abdominal pain, yellow skin) with cirrohis & liver cancer.	Vaccination NOT available
Hepatitis D	RNA Viroids	Acute (vomiting, yellowish skin, tiredness, dark urine, abdominal pain) & chronic (No symptoms, live cirrhosis & liver cancer)	Vaccination
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

B) RETROVIRUSES & AIDS

RETROVIRUS

- Retroviruses are ***associated with*** tumor production in animals like fowl, rodents and cats.
- Human immunodeficiency virus ***(HIV)*** which causes acquired immunodeficiency syndrome (AIDS) is 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.



Elizabeth Morales

- Does HIV attack on cells other than Helper T lymphocytes?
- Why there are two RNA molecules in HIV?

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.

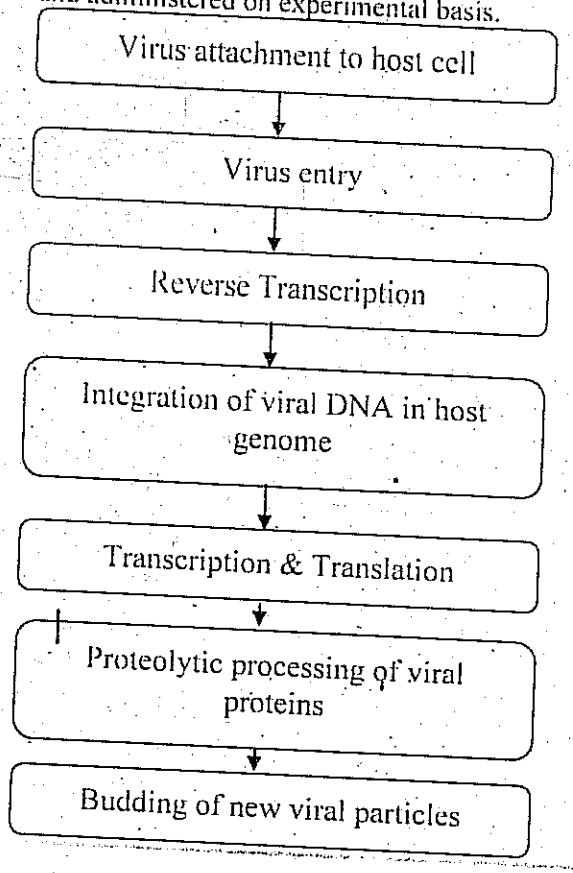
Mode Of Transmission

- 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.
- ***Brest feeding***
- ***Prick*** of an infected needles (problem for health care providers).
- HIV also infects cells of ***C.N.S.***

Prevention

- Avoid sharing syringes, use sterile needles, syringes and utensils.
- Avoid prohibited sexual contacts especially homosexuality.

- Screen the blood and blood products before transfusion.
- Vaccine has been synthesized and administered on experimental basis.



- **Does HIV attack on cells other than Helper T lymphocytes?**

C) LIFE CYCLE OF BACTERIOPHAGE

So far 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.

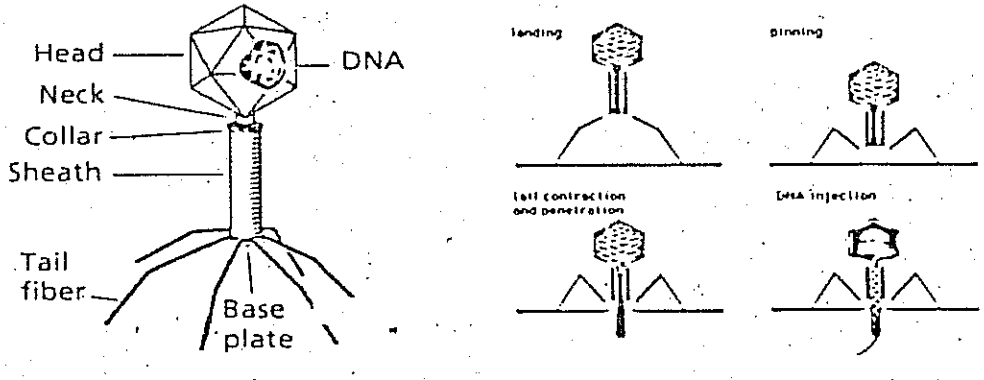
STRUCTURE OF T4

- 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.

- **What is role of tail pins in T4 phages?**

STEPS OF LIFE CYCLE

- Bacteriophage replicates only inside the bacterial cell.
- First step is the attachment (adsorption) to the host cell.
- Next step is penetration, the tail releases the enzyme lysozyme to dissolve a portion of bacterial cell wall.
- Third step is injection of viral DNA in bacterial cell.
- Then two types of cycles are usually seen i.e. lytic and lysogenic cycle.
- Induction involves either a ***spontaneous or environmentally induced***. This results in the initiation of a typical lytic cycle, which ends in the lysis of the bacteria.



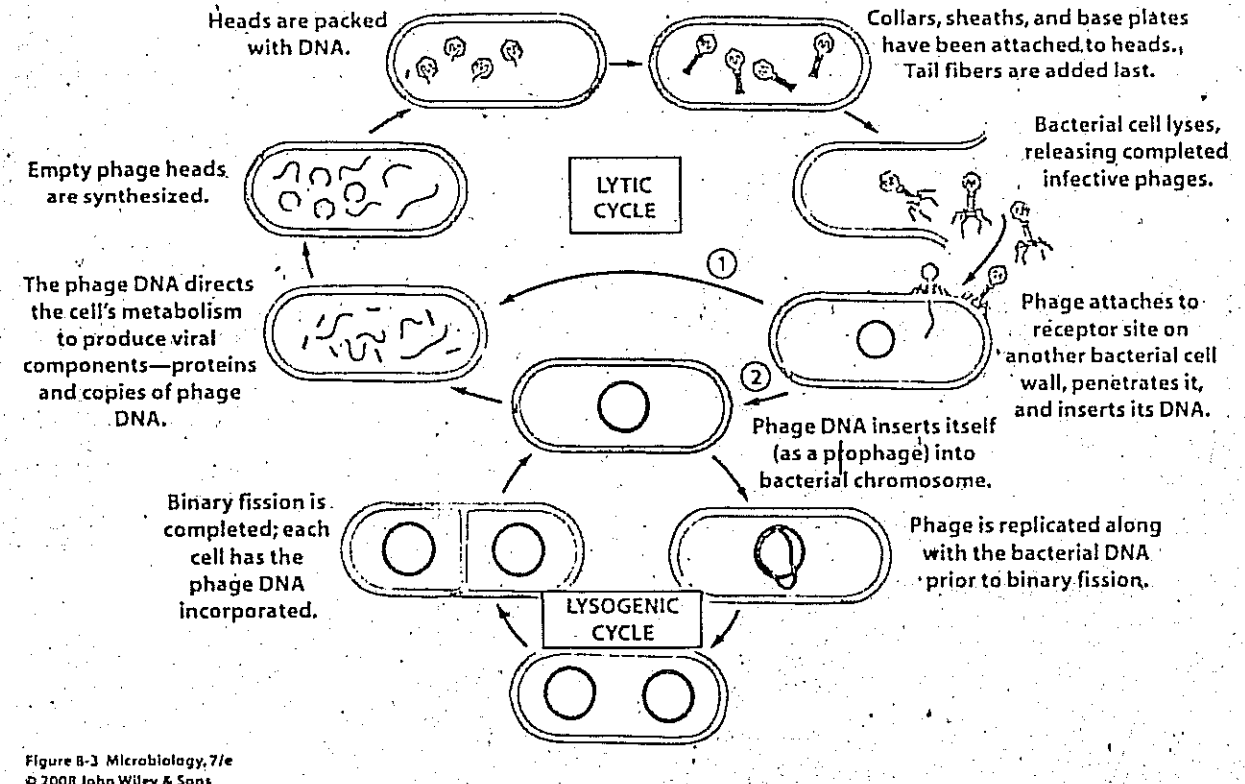
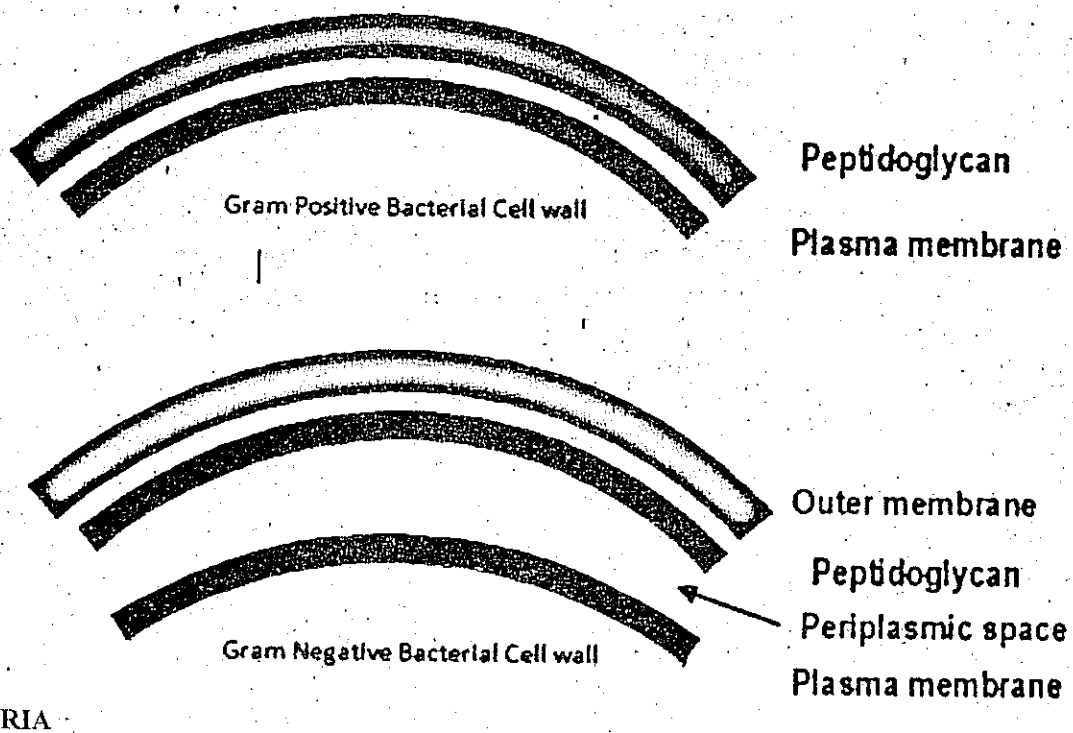


Figure 8-3 Microbiology, 7/e
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Feature	Lytic Cycle	Lysogenic Cycle
Virus	Lytic or virulent phage	Lysogenic or temperate phage
Relationship	Master – Slave relation	Host – Guest relation
Effects	Infectious cycle	Non-infectious cycle
Viral DNA	Takes Control	Integrated
Bacterial DNA	Destroyed	Remains intact

D) STRUCTURE & TYPES OF BACTERIA

- All bacteria cell invariably have a cell membrane, cytoplasm, ribosomes and chromatin bodies.
- The majority have *cell wall*, which gives shape to the bacterial cell.
- *Specific structures* like capsule, slime, flagella, pili, fimbriae and granules are not found in all bacteria.



SIZE OF BACTERIA

TYPE	SIZE
Range	0.1-600 μm
Mycoplasma (smallest)	100-200 nm
Escherichia coli	1.1-1.5 μm (width), 2.0-6.0 μm (length)
Spirochete	500 μm in length
Staphylococci & Streptococci	0.75-1.25 μm in diameter
Epulopiscium fishelsoni	600 μm x 80 μm

SHAPES OF BACTERIA

- Bacteria may be *Cocci* (Spherical or oval in shape), *Bacilli* (Rod shaped) and *Spiral* (Curved/ spring shaped).
- Some have characteristic shapes; others are *pleomorphic* (variable shape).

TYPE	SHAPE	DIVISION
Coccus	Spherical	No
Diplococcus	Two cocci	Single plane of division
Streptococcus	Cocci in chain	Single plane of division
Staphylococcus	Irregular arrangement	Random planes
Tetrad	Group of four	Two planes of division
Sarcina	Group of eight	Three planes of division
Bacillus	Rod shaped	No
Diplobacillus	Two bacilli	Single plane of division
Streptobacillus	Chain of bacilli	Single plane of division
Spirals	Spirally coiled	No
Vibrio	Comma shaped	No
Spirillum	Thick, rigid spiral	No
Spirochete	Thin, flexible spiral	No

FLAGELLA

- *Flagella* are extremely thin hair like structures or appendages.
- They come out through cell wall and originate from *basal bodies*, structures just beneath the cell membrane in the cytoplasm.
- It is made up of protein "*Flagellin*".
- *Cocci* very rarely have flagella.
- They help in *locomotion*.
- With the help of flagella, flagellated bacteria can also detect and move in response to chemical signals which is a type of behaviour called as "*Chemotaxis*".

Does pH act as stimulus for Bacteria?

Classification On Base Of Flagella

TYPE	FLAGELLA
Atrichous	No flagella
Monotrichous	Single flagellum at one end
Lophotrichous	Tuft of flagella at one pole
Amphitrichous	Tuft of flagella at both poles
Peritrichous	Bacterium equally surrounded by flagella

PILI

- These are *hollow, non- helical* filamentous appendages.
- They are *smaller than flagella*.
- True pili are *only present in gram-negative bacteria*.
- They are *not* involved in *locomotion*.
- Pili are primarily involved in a mating process between cells called "*Conjugation process*".
- Some pili function as a *mean of attachment* of bacteria to various surfaces.

• What do you know about fimbriae?

CELL ENVELOPE

Complexes of layers external to the cell protoplasm are collectively called cell envelope and include capsule, slime and cell wall.

Capsule

- A ***thick, gummy*** structure giving sticky character to colonies of encapsulated bacteria.
- It is made up of ***polysaccharide*** units or ***proteins*** or both.

Slime

- ***Loose soluble*** shield of macromolecules called slime capsules.
- Slime provides greater ***pathogenicity*** to bacteria.
- It protects them from ***phagocytosis***.

Cell Wall

- A rigid structure between extracellular substances and cytoplasmic membrane.
- Cell wall is only ***absent in Mycoplasma***.
- It is composed of a macromolecule called ***peptidoglycan*** consisting of long glycan chains cross linked with peptide fragments.
- ***Sugar, teichoic acid, lipoproteins and lipopolysaccharides*** are also present which are linked with peptidoglycans.
- Cell wall of ***archaeobacterial*** does not contain peptidoglycan, rather contain proteins, glycoproteins and polysaccharides.
- It determines the ***shape of bacteria***.
- It ***protects*** the cell ***from osmotic lysis***.
- It provides ***identity to different bacteria***, depending upon their staining characteristics i.e., Gram positive and Gram negative bacteria.

CHARACTERISTICS	GRAM-POSITIVE	GRAM-NEGATIVE
Porins proteisn	Absent	Present
Staining character	Purple. (stained)	Pink. (stained)
Number of major layers	1	2
Chemical make up	Peptidoglycan (50% of dry weight in some bacterial cells), teichoic acid and lipoteichoic acid.	Lipopolysaccharides, lipoproteins, peptidoglycan (10% dry weight of some bacterial cells), lipids. (11-12%)
Lipids	Less	More
Overall thickness	20-80 nm	8-11 nm
Outer membrane	No	Yes
Periplasmic space	Present in some	Present in all
Permeability	More permeable	Less permeable
Resistance	Less	More

CELL MEMBRANE

- It is thin, flexible structure beneath the cell wall, surrounding cytoplasm.
- Bacterial membrane differs from eukaryotic membrane is ***lacking sterols*** such as cholesterol.
- It is involved in ***transport*** of proteins, nutrients, sugar and electron or other metabolites.
- The plasma membrane of bacteria also contains ***enzymes for respiratory metabolism*** **i.e.** site for cellular respiration.

MESOSOMES

- They are formed by ***invagination of cell membrane*** in to the cytoplasm.
- They are involved in DNA replication, cell division, export of exocellular enzymes and also contain respiratory enzymes.

CYTOPLASMIC MATRIX

- A ***gel like*** substance present between the plasma membrane and the nucleoid.

- Plasma membrane and everything present within it is called ***protoplast***.
- Cytoplasmic matrix lack membrane bounded organelles & cytoskeleton however chromatin/ nuclear body, ribosomes, mesosomes, granules and nucleoid are present in it.

NUCLEOID

- Bacteria like other prokaryotic cells lack definite membrane bounded nucleus and chromosomes.
- Nucleoid is a single, circular, double stranded DNA molecule, aggregates as an irregular shaped dense area in the centre of bacterial cell.
- Extremely long molecule of DNA that is tightly folded to fit inside the cell component is chromatin body.
- Bacteria have a single chromosome, thus they are ***haploid***.

PLASMID

- Circular, double stranded DNA molecules, ***self-replicating*** but not essential for the bacterial growth and metabolism
- Contain genes of ***drug and insect resistance***.
- Plasmids are important vectors in modern genetic engineering techniques.

RIBOSOMES

- They are composed of ***RNA and proteins***.
- May be loosely attached to the cell membrane or plasma membrane.
- ***Smaller*** than eukaryotic ribosome.

STORAGE BODIES AND GRANULES

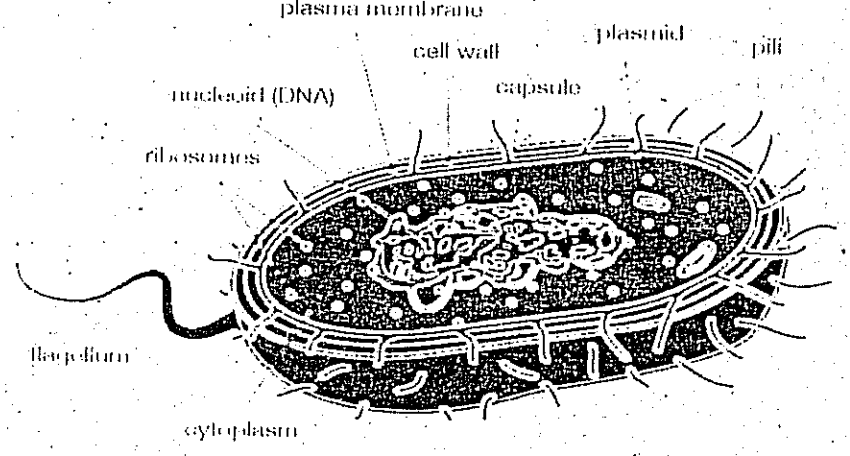
- Store ***extra nutrients*** like glycogen, sulphur, fat and phosphate.
- Also store ***waste material*** like alcohol, lactic acid, and acetic acid.

SPORES

- These are ***metabolically dormant*** bodies, resistant to adverse physical environmental conditions.
- They may be ***exospore*** (external to vegetative cell) or ***endospore*** (inside vegetative cell).
- They ***germinate*** to form vegetative cell under favorable condition.
- They normally develop at ***end stage of growth*** of bacteria.

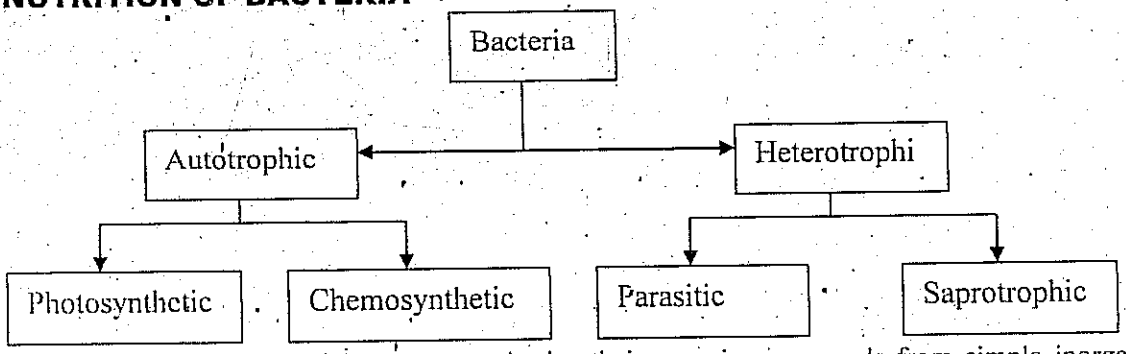
CYSTS

- They are ***dormant, thick walled*** desiccation resistant form but not heat resistant structures.
- They develop during ***differentiation of vegetative cells*** which can germinate under suitable conditions.



E) NUTRITION IN BACTERIA

NUTRITION OF BACTERIA



- Those bacteria which cannot synthesize their organic compounds from simple inorganic substances are called ***heterotrophic bacteria***.
- ***Saprophytic bacteria*** get their food from dead organic matter present in soil in the form of humus (material from partial decay of plants and animals).
- Saprotrophic bacteria have an ***extensive enzyme system*** that break down the complex substances of humus to simple compounds.
- Those bacteria which are fully dependent upon their host for nutrition are ***parasitic bacteria***.
- Those bacteria which can synthesize their organic compounds from simple inorganic substances are called ***autotrophic bacteria***.
- ***Photosynthetic bacteria*** carry out photosynthesis, as they contain chlorophyll which differ from chlorophyll of green plants, dispersed in cytoplasm and thus is different from that of present in cells of green plants.
- ***Examples*** of photosynthetic bacteria are green sulphur bacteria, purple sulphur bacteria, purple non- sulphur bacteria etc.
- ***Chemosynthetic bacteria*** oxidize inorganic compounds like ammonia, nitrates, nitrites, sulphur or ferrous ions and trap the energy thus released for their synthetic reactions e.g. nitrifying bacteria.

- Where we place mutualistic bacteria?

- What is difference between humus & destritus?

- Can you give one example each for?
  - (i) Saprotrophic bacteria
  - (ii) Parasitic bacteria
  - (iii) Photosynthetic bacteria
  - (iv) Chemosynthetic bacteria
  - (v) Mutualistic bacteria

F) USE AND MISUSE OF ANTIBIOTICS

Antibiotics destroy or inhibit the growth of microorganisms in living tissue.
They work with natural defense and stop the growth of bacteria and other microbes.
They may be ***natural*** as synthesized by bacteria, actinomycetes and fungi or ***synthetic as*** prepared in laboratories from living cell.

Misuse Of Antibiotics

Massive quantity of antibiotics when used leads to ***drug resistance***. This cause ineffective antibiotic coverage.

Misuse of antibiotics causes certain side effects.

Penicillin	Allergic reactions
Streptomycin	Effects auditory nerve thus causing deafness.
Tetracyclin	Permanent discoloration of teeth in young children.

Microbicidal effect is one that kills the microbes immediately.

Microbistatic effect inhibits the reproductive capacities of the cells.

Antibiotics work by:

Inhibiting the synthesis of bacterial cell wall e.g., Penicillin.

Inhibiting protein synthesis and nucleic acid.

Inhibiting cytoplasmic enzymes, and cell membrane.

G) 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' latern 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 flavour, aroma and characteristic 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.

Cyclosporin is used in organ transplantation for preventing transplant rejection.

Ergotin is used to relieve migraine (one kind of headache).

Griseofulvin is used to inhibit fungal growth.

Yeats were the first eukaryotes to be used by genetic engineers.

First functional ***artificial chromosome*** was made in saccharomyces cervisiae.

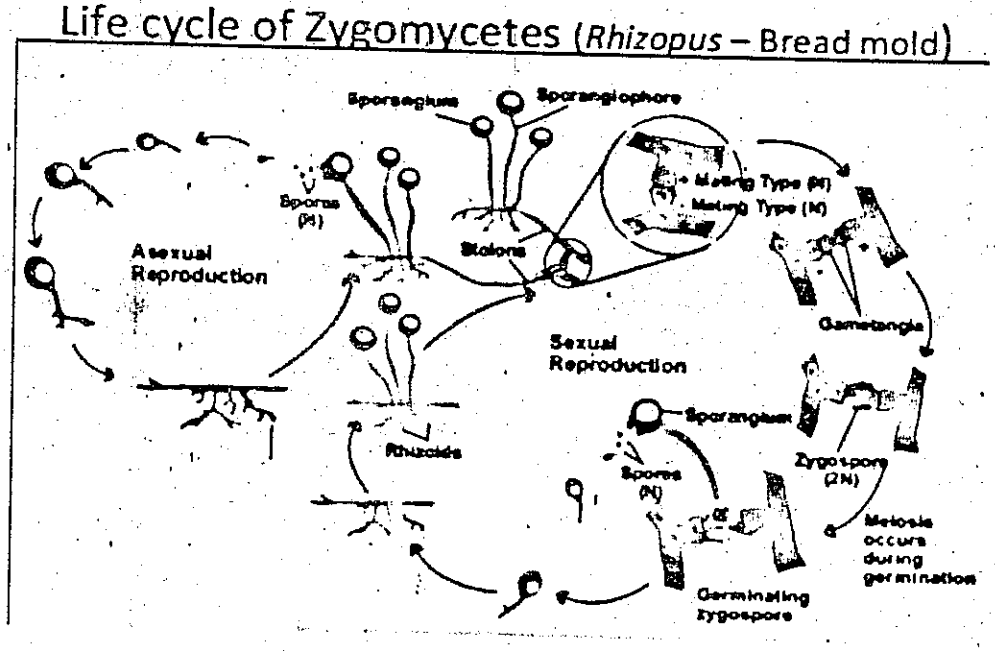
Pink bread mold ***Neurospora*** has been used in genetic research.

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 candidiosis).
- ***Histoplasmosis*** is a serious infection of lungs caused by inhaling spores of a fungus, which is common in soil contaminated with bird's feces.
- *Aspergillus fumigatus* causes ***aspergillosis*** 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.
- A pink yeast *Rhodotorula* grows on shower curtains and other moist surfaces.

H) LIFE CYCLE OF RHIZOPUS



You know fungi without Hyphae.

PRACTICE EXERCISE

Exercise:

A)

1. The major cell infected by HIV is:
A) B-lymphocyte B) T-lymphocyte C) Helper T-Lymphocyte D) Suppressor T lymphocyte

2. Rabies is due to:
A) Fungi B) Bacteria C) Protozoan D) Virus

3. Tobacco mosaic virus was crystallized by:
A) Stanley B) Pasteur C) Ivanowski D) Chamber land

4. Parvoviruses have a size of:
A) 250nm B) 20 nm C) 20 pm D) 25 nm

5. In general appearance which phages are Icosahedral:
A) Cubical B) Helical C) Herpes virus D) Spherical

6. Which viruses consist of head and tail:
A) Adenoviruses B) Virions C) Polioviruses D) Bacteriophages

7. The volume of phage is about how many times less than host:
A) 100 B) 10 C) 100,000 D) 1000

8. The lifecycle of bacteriophage, which results in the increase of infection is:
A) Temperate B) Lytic C) Non-virulent D) Lysogenic

9. In temperate phase, the bacteriophage becomes a:
A) Provirus B) Phage C) Prophage D) None of these

10. "Host guest relationship" results in:
A) Temperate cycle B) Virulent cycle C) Lytic cycle D) All of these

11. The hereditary material of Polio virus is:
A) RNA B) DNA C) Single stranded DNA D) None of these

12. The smallest virus is /is of:
A) Paramyxovirus B) Herpes simplex C) Cow pox D) Poliomyelitis

13. Of the following which one is Retrovirus?
A) HIV B) Influenza C) Mumps D) All Of These

14. The virus which has cancer causing genes:
A) Oncovirus B) Phage C) Provirus D) Retrovirus

15. **Serum hepatitis is also known as:**
A) Hepatitis A B) Hepatitis B C) Hepatitis C D) All of these

16. **Pig could be the source of infection of hepatitis:**
A) E B) B C) A D) D

17. **Who made vaccine for hydrophobia or rabies:**
A) Pasteur B) Edward Jenner C) Robert Koch D) None of these

18. **Chronic liver disease is most frequently caused by:**
A) HAV B) HBV C) HCV D) HIV

19. **Which is referred to as the inflammation of liver:**
A) AIDS B) Hepatitis C) Mumps D) Nephrosis

20. **Collar and end plate are present in Bacteriophages on:**
A) Same side of sheath B) Opposite side of sheath C) In-between the sheath D) Any were

21. **Which of the following can be found in all viruses:**
A) RNA B) Single Stranded DNA C) Protein D) All of these

22. **Which of the following is not DNA virus:**
A) Pox virus B) Polio virus C) Herpes virus D) Both a & c

23. **Capsid of polio virus is:**
A) Spherical B) Helical C) Cylindrical D) None of these

24. **Which of the following is symptom of AIDS:**
A) Swollen lymph nodes B) Weight loss C) Pneumonia D) All of these

25. **Which of the following cannot be grown on artificial media:**
A) Obligate parasite of Bacteria B) Obligate parasite of Fungi C) Viruses D) All of these

26. **Oncoviruses are:**
A) Spherical B) Cubical C) Rod shaped D) Icosahedra

27. **Any virus with cancer causing ability could be called:**
A) Retrovirus B) Paramyxovirus C) Oncovirus D) None of these

28. **The nucleic acid of bacteriophages is mostly:**
A) Single stranded RNA B) Double stranded DNA C) Double stranded RNA D) Single Stranded DNA

29. **Which one of the following has no cellular organization in spite of being living:**
A) Bacteria B) Viruses C) Cyanobacteria D) Algae

30. **It is the 2nd major kind of hepatitis:**

A) B B) C C) D D) A

31. Hepatitis A virus is:
A) DNA enveloped B) DNA non enveloped C) RNA enveloped D) RNA non enveloped

32. Halbur & coworkers revealed fact about hepatitis E in:
A) 2002 B) 2004 C) 2005 D) 2001

33. Recent research on HIV reveals that the virus may multiply in:
A) Insects B) Pigs C) Monkey D) Donkey

34. Rhabdovirus is:
A) Tadpole shaped B) Spherical C) Bullet shaped D) Polyhedral

35. In 1796 Edward Jenner first vaccinated 8 years old boy for:
A) Chicken pox B) Small pox C) Cow pox D) Rabies

36. There are _____ capsomeres in herpes virus:
A) 252 B) 250 C) 150 D) 162

37. In general appearance the helical phages are:
A) Cubical B) Icosahedral C) Polyhedral D) Rod shaped

38. Which is derived from host cell:
A) Nucleic acid B) Capsid C) Envelope D) All of these

39. Which are mainly used in phage study:
A) T_2 phage B) T_4 phages C) Both D) None of these

40. About 60% of adults are immune to it:
A) Measles B) Mumps C) Herpes D) Small pox

41. Which one is false about AIDS:
A) HIV B) Acquired immunodeficiency syndrome C) Host specific D) B-lymphocyte

42. Filterable agents were discovered for yellow fever in:
A) 1898 B) 1915 C) 1917 D) 1901

43. Which enzyme is produced by a phage:
A) Reverse transcriptase B) Lysozome C) Invertase D) Lysozyme

44. First infectious disease against which effective prevention was discovered;
A) Bacterial disease B) Influenza C) Herpes D) None of these

45. Who discovered the process of lysis?
A) Twort B) D'Herelle C) Both of these D) None of these

46. The world virus is derived from a _____ word meaning the poison:

A) Latin B) Greek C) Hebrew D) English

47. For vaccination Edward Jenner removed material from which?
A) Small pox lesion B) Cow pox lesion C) Chicken pox D) All of these

48. He discovered the agent, which caused TMD
A) Stanley B) Chamberland C) Ivanowski D) None of these

49. Bacteria can't pass through these filters:
A) Paper B) Glass C) Whatmann D) Porcelain

50. 250nm is the size of which of the followings?
A) Pox virus B) Adenovirus C) Parvovirus D) Polio virus

51. Viruses are _____ parasites:
A) Intercellular obligate B) Intracellular obligate C) Facultative D) Unicellular

52. RNA retroviruses have a special enzyme which synthesizes the:
A) Proteins B) RNA C) DNA D) DNA & RNA

53. Viroids are plant pathogens consisting of:
A) Protein s only B) Circular single stranded RNA C) DNA without capsid D) None of these

54. Lysozyme damages the bacterial call wall by:
A) Oxidation B) Hydrolysis C) Reduction D) None of these

55. Lysozymes are abundant in:
A) Tears B) Human Milk C) Saliva D) All of these

56. Vaccination for HIV on experimental basis has been started in?
A) 1999 B) 2000 C) 2004 D) 2001

57. Prions were discovered in:
A) 1999 B) 1983 C) 1948 D) 2001

58. Prions may be simply infectious:
A) DNA B) RNA C) Proteins D) Both a & b

59. Viruses are the particles of which?
A) Nucleic acid only B) Proteins only C) Nucleic acid & Protein D) None of these

60. After how many weeks of 1st inoculation boy Phipps was inoculated with small pox pus?
A) 2 B) 19 C) 8 D) 6

61. Ivanowski obtained _____ filtrate from ground up infected plants:
A) Highly B) Virus free C) Bacteria free D) None of these

diluted

62. Which filtrate from a lysed colony can transfer lytic effect to healthy colony:
A) Virus free B) Bacteria free, Concentrated soln. C) Bacteria free, dilute soln. D) Both B&C

63. Viruses are resistant to:
A) Penicillin only B) Streptomycin only C) Broad range of antibiotics D) All of these

64. Which of these has lipids in it?
A) Envelope B) Tail core C) Capsid D) Genome

65. Complete mature and infectious particle is known as:
A) Viroid B) Prions C) Virions D) None of these

66. Bacteriophages occur in _____ structural forms:
A) 1 B) 3 C) 4 D) 2

67. Bacteriophages posses symmetry:
A) Cubical B) Helical C) Both of these D) Spiral

68. In general appearance helical phages posses which shape?
A) Rod B) Spiral C) Cubical D) None of these

69. Prions are responsible for:
A) Cow madness B) Mysterious muscular disorders C) Lung disorders D) Leukemia

70. Early researches on bacteriophages were on those who infect?
A) Pseudomonas B) Rhizobium C) *B. coil* D) *E. coil*

71. The core present inside the tail of the phage is composed of which?
A) DNA B) RNA C) Proteins D) None of these

72. The structure of the phage _____ is relatively more complex:
A) Tail core B) Head C) Genome D) Tail

73. The end of the sheath posses:
A) Collar B) End plate C) Both a & b D) Core

74. Head of the T4 phage is:
A) Pyramidal B) Hexagonal prism C) Both a & b D) Helical

75. First step of life cycle of phage is:
A) Adsorption B) Attachment C) Both a & b D) Penetration

76. Adsorption of phage occurs on a receptor site present on which?
A) Host cell wall B) Host cell membrane C) Phage D) All of these

77. **Tail fibers are meant for:**
A) Penetration B) Replication C) Release D) Attachment

78. **How many tail fibers are there in a phage (T4)?**
A) 4 B) 6 C) 8 D) 10

79. **During attachment weak chemical union is formed between virion and:**
A) Cell membrane B) Receptor site C) Capsule D) Tail

80. **Tail releases an enzyme called:**
A) Lysosome B) Lysozime C) Lysozyme D) Ribozyme

81. Tail core is forced into the cell by contraction of which of the followings?
A) Head B) Tail sheath C) Collar D) None of these

82. **Phage injects which of these into the host cell?**
A) RNA B) DNA C) Tail Core D) Both a&b

83. **Phage DNA takes control of the host biosynthetic machinery in which?**
A) Lytic cycle B) Lysogeny C) Both a & b D) None of these

84. **Lysis occurs after _____ minutes of initial infection by temperate phage:**
A) 25 B) 40 C) 35 D) None of these

85. **If viral DNA gets detached from host chromosome, it is called:**
A) Initiation B) Inspiration C) Induction D) All of these

86. **During_____, the phage directs the cell's metabolism to produce viral components:**
A) Adsorption B) Penetration C) Induction D) Synthesis

87. **Induction occurs:**
A) Spontaneously B) By environmental stimuli C) Both of these D) By light

88. **Viruses can be classified?**
A) Morphology B) Nucleic acid C) Both of these D) Symmetry

89. **Small pox virus is known to have occurred as epidemic in:**
A) Japan B) Russia C) Europe D) China

90. **Small pox was very common until early:**
A) 19th century B) 17th century C) 18th century D) 20th century

91. **The pocks are characteristics of:**
A) Small pox B) Polio C) Herpes D) All of these

92. **By _____ immunization had decreased the danger of small pox:**
A) 1940s B) 1950s C) 1960s D) 1970s

93. Vascular lesions appear on _____ during Herpes:
A) Muscles B) Oral Cavity C) Blood Vessels D) Epithelial layers

94. Influenza viruses are:
A) RNA Naked B) DNA Naked C) RNA enveloped D) DNA enveloped

95. It is one of the commonest diseases of childhood.
A) Mumps B) Measles C) AIDS D) Small Pox

96. It is highly contagious, wide spread, and seldom fatal:
A) Mumps B) Polio C) Influenza D) None of these

97. Retroviruses are associated with tumor formation in which?
A) Fowl B) Rodent C) Cats D) All of these

98. Retroviruses are:
A) Mostly host specific B) Mostly none specific C) Always non specific D) Always host specific

99. AIDS virus can show adsorption in:
A) Helper T lymphocytes B) Monocytes C) Some cells of CNS D) Both A & C

100. A provirus:
A) Can be inherited B) Can't be inherited C) Can't be passed to progeny D) Both of a & c

101. The AIDS was reported in:
A) 1970s B) 1940s C) 1980s D) 1960s

102. AIDS was discovered in young patients which were:
A) Homosexuals B) Heterosexuals C) Both of these D) Weak

103. Cells in _____ can also be infected by HIV in addition to Lymphocytes:
A) Kidney B) CNS C) Lungs D) Spinal Fluid

104. HIV can't be transmitted by:
A) Intimate sexual contact B) Mother to Offspring C) Breathing D) Breast Feeding

105. Experimental administration of vaccination in AIDS patients has started in:
A) North America B) South America C) South Africa D) Hong Kong

106. During 1st step of reverse transcription which is used as template?
A) DNA B) Single stranded RNA C) Both a & b D) Double stranded RNA

107. **The delta hepatitis is:**
A) A B) B C) C D) None of these

108. **It is mild short term and less virulent disease?**
A) Hepatitis A B) Hepatitis B C) Hepatitis C D) All of these

109. **Infected person can be recovered completely from hepatitis:**
A) A B) B C) Both a & b D) C

110. **Hepatitis C is called:**
A) Non A non B B) Infusion hepatitis C) Infectious D) Both a & b

111. **Many _____ viruses enter the host cell as a whole:**
A) Plant B) Polyhedral C) Cubical D) Animal

Answers (A):

1.	C	2.	D	3.	C	4.	D	5.	A	6.	B	7.	D	8.	B	9.	C	10.	A
11.	A	12.	D	13.	A	14.	A	15.	B	16.	A	17.	A	18.	C	19.	B	20.	B
21.	C	22.	B	23.	A	24.	D	25.	C	26.	A	27.	C	28.	B	29.	B	30.	A
31.	D	32.	D	33.	C	34.	C	35.	B	36.	D	37	D	38.	C	39.	C	40.	B
41.	D	42.	D	43.	D	44.	D	45.	A	46.	A	47.	B	48.	C	49.	D	50.	A
51.	B	52.	C	53.	B	54.	B	55.	D	56.	D	57.	B	58.	C	59.	C	60.	D
61.	C	62.	D	63.	D	64.	A	65.	C	66.	D	67.	C	68.	A	69.	A	70.	D
71.	C	72.	D	73.	C	74.	B	75.	C	76.	A	77.	D	78.	B	79.	B	80.	C
81.	B	82.	B	83.	A	84.	A	85.	C	86.	D	87.	C	88.	C	89.	D	90.	D
91.	A	92.	B	93.	D	94.	C	95.	B	96.	A	97.	D	98.	A	99.	D	100.	A
101.	C	102.	A	103.	B	104.	C	105.	C	106.	A	107.	D	108.	A	109.	C	110.	A
111.	D																		

Solved Exercise

Q NO. 48

IN 1884

Chamber land invented porcelain filter paper known as chamber land filter paper. He found that bacteria can not pass through the filter paper while agents for rabies can pass through their filters.

IN 1892

Iwanvosry discovered agent that cause TMV in healthy tobacco plants.

IN 1935

Stanley crystallize TMV from Tobacco leaves infected with TMV and found that virus made of nucleic acid + protein.

Q NO. 45

TWORT + D' Herelle in 1915 discovered bacteriophages virus. TWORT discovered that bacteriophages cause lyses.

While D' Herelle rediscovered phenomenon use the word bacteriophages.

Q NO. 68

The core of contains 8 histone protein. Histone contain positively charged arginine lysine strongly attracted to negatively charged phosphate group of DNA.

Plant virus = SSSRNA

Animals – SSRNA dsRNA

dsDNA

Bacteriophages = ds DDNA

Q NO.44

E.coli is a type of bacteria that lives normally in your intestine. It is facultative anaerobic.

Q No. 113

Attenuated means weakened culture of bacteria. Therefore all of there in the best option

Q NO. 69

Prions cause Madcow infection. Mysterious brain infection. Therefore Mysterious muscular disorders is a false statement.

B)

1. **Anthrax in sheep is caused by:**
A) Cocci B) Bacilli C) Spirilla D) Vibrio

2. **Of the following which one is not found in all bacteria:**
A) Chromatin bodies B) Ribosomes C) Cell membrane D) Cell wall

3. **Poxviruses have a size equal to some members of:**
A) Mycoplasma B) Staphylococci C) Acanthurus nigrofuscus D) Epulopiscium fishelsoni

4. **The bacteria larger than the average eukaryotic cell is:**
A) *Epulopiscium nigrofuscus* B) *Acanthurus nigrofuscus* C) *Epulopiscium fishelsoni* D) *Acanthurus fishelsoni*

5. **A curved or comma shaped rod is known as:**
A) Vibrio B) Diplobacillus C) Streptobacillus D) None of these

6. **Sarcina is made up of how many cocci:**
A) 4 B) 8 C) 12 D) 6

7. **Extremely thin hair like appendages of bacteria are known as:**
A) Cilia B) Flagella C) Fimbrae D) All of these

8. **In eukaryotes flagella originate from:**
A) Basal bodies B) Cell wall C) Cell membrane D) Cytoplasm

9. **The response of chemical signals by flagellated bacteria is known as:**
A) Chemonastic B) Chemotropism C) Chemotaxis D) None of these

10. **True pilli are only present on:**
A) Gram -ve bacteria B) Gram +ve bacteria C) Both D) None of these

11. **Cell envelope does not include:**
A) Cell wall B) Slime C) Capsule D) Cell membrane

12. **The bacteria which retain the primary dye are known as:**
A) Gram-ve bacteria B) Gram+ve bacteria C) Mycoplasma D) All of these

13. **Of the following which one is not the constituent of cell wall in eubacteria:**
A) Proteins B) Teichoic acid C) Lipopolysaccharides D) Peptidoglycan

14. **The cell membrane of bacteria is different from that of eukaryotic, in lacking:**
A) Sterols B) Fats C) Lipids D) None of these

15. **Of the following which one is not characteristics of mesosomes:**
A) They contain B) They are involved in C) They are involved in D) They are involved in the formation of

respiratory enzymes | gene expression | DNA replication | lamellae

16. The structures produced in adverse environment and resistant to heat are known as:
A) Endopores B) Cysts C) Spores D) Mesosomes

17. Green sulfur bacteria and purple non-sulfur bacteria are examples of which bacteria:
A) Chemosynthetic B) Parasitic C) Photo synthetic D) Saprophytic

18. In bacterial 'growth curve' the phase of no growth is:
A) Lag phase B) Log phase C) Stationary phase D) Decline phase

19. What are in general used for sterilization process:
A) Halogens B) Gamma rays C) Potassium permanganate D) Formaldehyde

20. Chemotherapeutic agents which work with natural defense and stop the growth of bacteria:
A) Antiseptics B) Disinfectants C) Electromagnetic radiation D) Antibiotics

21. The medicine which inhibits the reproductive capacities of micro-organisms has which effect?
A) Microbicidal B) Microbistatic C) Antibiotic D) Disinfectant

22. Deafness is caused by misuse of:
A) Penicillin B) Euromycin C) Tetracycline D) Streptomycin

23. The largest and most diverse group of photosynthetic bacteria is:
A) Green algae B) Blue green algae C) Purple sulphur bacteria D) Purple non-sulphur bacteria

24. Bacterial endospores function in:
A) Survival B) Storage C) Reproduction D) Protein synthesis

25. Mesosome helps in:
A) Respiration B) Replication C) Cell division D) All of these

26. Which of the following are used on the surface of living tissues:
A) Antiseptics B) Disinfectants C) Antibiotics D) Both a & c

27. Cluster of spherical bacteria is:
A) Streptococci B) Streptobaccilli C) Staphylococci D) Staphlobacilli

28. *E. coli* are:
A) Cocci B) Bacilli C) Spiral D) None of these

29. Which bacteria are more permeable:
A) Gram positive B) Gram negative C) Equal in Permeability D) Any of these

30. Sticky characters of bacteria is due to:
A) Pilli B) Capsule C) Cell wall D) Cell membrane

31. When tuft of flagella is present at each of two poles of bacteria it is called:
A) Atrichous B) Lophotrichous C) Peritrichous D) Amphitrichous

32. Other name of nucleoid is:
A) Nuclear body B) Chromatin body C) Nuclear region D) All of these

33. Which is used as source of hydrogen during photosynthesis by autotrophic bacteria:
A) CO_2 B) H_2O C) H_2S D) HNO_3

34. About how many species of bacteria are known to cause disease in humans:
A) 100 B) 1000 C) 200 D) 2000

35. Which of following is not heat resistant:
A) Spores B) Cysts C) Both D) None

36. Spirochete bacterium is:
A) Anaerobic B) Aerobic C) Facultative D) Microaerophilic

37. Which of the following is primary function of capsule:
A) Transport B) Support C) Motility D) Adhesion

38. Which one of the following reproduces only in the host cell:
A) Bacteria B) Virus C) Nostoc D) Fungus

39. Primary function of flagella:
A) Hold fast B) Nutrition C) Motility D) None

40. Capsule is composed of:
A) Protein B) Polysaccharide units C) Both D) Lipoproteins

41. How many percent of peptidoglycan is present in gram negative wall:
A) 50% B) 10% C) 8 - 11% D) 20 - 80%

42. Which bacteria only rarely have flagella:
A) Spirilla B) Diplobaccili C) Cocci D) Vibrio

43. Which protects the cell from osmotic lysis:
A) Capsule B) Cell wall C) Cell membrane D) Slime

44. *E. coil* is an:
A) Aerobic B) Anaerobic C) Facultative aerobe D) Facultative anaerobe

45. Which effect kills the microbe immediately:
A) Microbistatic B) Microbicidal C) Cytoplasmic D) None of these

46. Which can be sterilized by membrane filters:
A) Mix products B) Surgical instruments C) Antibiotic D) None of these

47. Attenuated cultures of bacteria used as:
A) Pure cultures B) Artificial cultures C) True culture D) Vaccines

48. **Tetracyline & its related compounds cause:**
A) Allergic reactions B) Deafness C) Both D) Discoloration of teeth

49. **Pasteur made vaccine for:**
A) Cholera B) Hydrophobia C) Anthrax D) All of these

50. **Hyphomicrobium is a----------:**
A) Diplobacillus bacterium B) Spiral bacterium C) Sarcina D) Tetrad

51. **Some members of genus mycoplasma are:**
A) 100-200mm B) 100-200 mu C) 100-200nm D) Both b & c

52. ***B. subtilis*:**
A) Coccus B) Spirllum C) Bacillus D) Vibrio

53. **They do not have peptidoglycan in their cell wall:**
A) Gram positive B) Gram negative C) Archeobacteria D) Eubacteria

54. **In which phase death rate becomes equal to rate of reproduction:**
A) Lag phase B) Log phase C) Stationary phase D) Decline phase

55. **Bacterial cyst & spores help in:**
A) Reproduction B) Storage C) Support D) Survival

56. **Bacterial cells have:**
A) A pair of DNA B) A pair of chromosomes C) Two sets of chromosomes D) Single DNA molecule

57. **Which of these form granules or act as storage bodies in bacteria:**
A) Sulfur B) Minerals C) Starch D) All of these

58. **Facultative bacteria can grow:**
A) In the presence of oxygen B) In the absence of oxygen C) Both a & b D) None of these

59. **Microbiologists place bacteria in _____ major categories:**
A) 2 B) 4 C) 6 D) 8

60. **These are ancient bacteria:**
A) Archeobacteria B) Eubacteria C) Euplectella D) All of these

61. **He was 1st to report microbes:**
A) Robert Koch B) Louis Pasteur C) Leeuwenhoek D) None of these

62. **Leauwenhoek called microbes as:**
A) Bacteria B) Venom C) Animals D) Aminalcules

63. **Leeuwenhoek observed which of these to find out microbes?**
A) Saliva B) Vinegar C) Infusions D) All of these

64. **Pasteur discovered:**
A) Fermentation B) Pasteurization C) Cause of D) All of these

disease

65. These bacteria are smallest and without cell wall:
A) Mycoplasma B) spirochete C) pseudomonas D) E. coli

66. A pure culture will produce disease if inoculated into _____ host:
A) Alternative B) Weak C) Susceptible D) Definitive

67. Bacteria range in size:
A) 0.1-500 nm B) 0.1-400 nm C) 0.1-600 µm D) Both b & c

68. Diameter of *E. coli* is _____ to _____ micrometer:
A) 1.1-1.5 B) 1.1-1.6 C) 2.0-4.0 D) 2.0-6.0

69. Some _____ occasionally reach the length of 500 micrometer:
A) Spirochetes B) Streptococci C) Diplococci D) Cocci

70. Streptococcus and Staphylococcus are ____ to _____ micrometer in diameter:
A) 0.1-600 B) 1.1-1.5 C) 0.75-1.25 D) 2.0-4.0

71. Huge bacterium has been found in which fish?
A) Brown sturgeon B) Brown surgeon C) Brown dipnoi D) Osteolepiform

72. On the basis of general shape bacteria are classified into how many categories?
A) 3 B) 6 C) 4 D) None

73. Those bacteria which can exist in a variety of shapes:
A) Facultative B) Polymorphic C) Pleomorphic D) All of these

74. If a coccus divides only in a single plane it forms:
A) Staphylococci B) Diplococci C) Streptococci D) Both b & c

75. When division of cell occurs in two planes in a coccus:
A) Streptococci B) Sarcina C) Tetrad D) Staphylococcus

76. When plane of division is random what will be produced in cocci?
A) Diplococcus B) Streptococcus C) Sarcina D) None of these

77. A thick rigid spiral is called:
A) Vibrio B) Spirochete C) Spirillum D) None of these

78. Bacteria without any flagella:
A) Atrichous B) Peritrichous C) Amphitrichous D) Monotrichous

79. Which are hollow structures in bacteria?
A) Pilli B) Flagella C) Both a & b D) Cilia

80. Pilli are involved in which process?
A) Mating B) Attachment C) Both a & b D) Movement

81. Collective complexes of layers external to protoplasm are called:
A) Capsule B) Slime capsule C) Cell wall D) Cell envelope

82. Which is characteristic of capsule?
A) It is gummy B) It's tightly held C) It is soluble shield D) Both a & b

83. Which is role of slime?
A) Pathogenicity B) Phagocyte resistance C) Sticky nature D) Both a & b

84. In bacteria beneath extracellular substances and external to cell membrane is present:
A) Cell wall B) Capsule C) Cyst D) Slime

85. During Gram staining positive bacteria are stained:
A) Purple B) Pink C) Blue D) Red

86. Gram-positive bacteria retain primary dye due to formation of which complex?
A) CV-B B) CV-Z C) CV-I D) All of these

87. Which is true for Gram-ppsitive wall?
A) Lipids 10-11% B) 8-11hm thickness C) Lipoproteins D) Peptidoglycan

88. Which is true for Gram negative wall?
A) Less permeable B) No outer membrane C) Has teichoic acid D) 20-80nm thickness

89. Cytoplasm of prokaryotes lacks:
A) Cytoskeleton B) Ribosomes C) Mesosomes D) Storage granules

90. Bacteria are:
A) Haploid B) Diploid C) Triploid D) No relation

91. Chromosome of *E coil* measures about _____ micrometer:
A) 1400 B) 140 C) 14000 D) 14

92. Plasmids are:
A) Circular single stranded DNA C) Circular double stranded DNA
B) Double stranded RNA D) Essential for growth of DNA

93. Plasmids are important _____ in modern genetic engineering:
A) Vectors B) Carriers C) Scissors D) Probes

94. Factory of ribosome synthesis in Bacteria?
A) Nucleolus B) Nucleoid C) Chromosome D) None of these

95. Ribosome of prokaryotes are found:
A) Freely dispersed B) Attached to cell membrane C) Both a & b D) In region of Nucleoid

96. Mesosomes are found in the form of which of the followings?
A) Lamellae B) Vesicle C) Tubules D) All of these

97. Common waste material in the cytoplasm of bacteria:
A) Alcohol B) Lactic acid C) Acetic acid D) All of these

98. They are produced at late stage of cell growth:
A) Capsule B) Cyst C) Spores D) All of these

99. Most of the bacteria are:
A) Parasites B) Heterotrophic C) Autotrophic D) None of these

100. Which of these bacteria have very extensive enzyme system?
A) Saprophytic B) Parasitic C) Chemosynthetic D) Autotrophs

101. Photosynthetic bacteria posses:
A) Chl a B) Chl b C) Chl c D) None of these

102. Which of the following is chemosynthetic?
A) Green sulfur B) Purple non sulfur C) Purple sulfur D) Nitrifying

103. They can live as both aerobic and anaerobic:
A) Microaerophilic B) Obligate aerobes C) Facultative Bacteria D) All of these

104. In Binary fission, parent cell:
A) Shrinks B) Enlarges C) Looses cell wall D) Becomes dormant

105. In bacteria growth refers to which:
A) Individuals growth B) Population growth C) Enlargement D) None of these

106. The interval of time until completion of next division in bacteria is:
A) Interphase B) Division C) Generation time D) Binary fission

107. Which is the sexual process in bacteria?
A) Conjugation B) Transduction C) Transformation D) All of these

108. Process in which physical agents are used to control bacteria:
A) Antisepsis B) Chemotherapy C) Vaccination D) Sterilization

109. Hydrogen peroxide and formaldehyde are used as:
A) Antiseptics B) Vaccine C) Disinfectant D) All of these

110. In 1880's Pasteur isolated the bacterium of:
A) Anthrax B) Chicken cholera C) Rabies D) Whooping cough

111. Electromagnetic radiations with wavelength below _____ nm are effective in killing microbes:
A) 100 B) 600 C) 800 D) 300

112. Attenuated bacteria can stimulate the host to produce:
A) Immunity B) Resistance C) Antibodies D) Infection

113. Which culture of bacteria is called vaccine?

A) Weak B) Attenuated C) Dead D) All of these

114. Milk maids can't be infected by _____ if they are already infected by Cow pox:
A) Small pox B) Anthrax C) Rabies D) Chicken pox

115. Phipps was inoculated with which first?
A) Small pox B) Chicken pox C) Pox D) Cow pox

116. They are beads of cells:
A) Filaments B) Trichomes C) Fragments D) Akinetes

Answers (B):

1.	B	2.	D	3.	A	4.	C	5.	A	6.	B	7.	B	8.	A	9.	C	10.	A
11.	C	12.	B	13.	A	14.	A	15.	B	16.	C	17.	C	18.	A	19.	B	20.	D
21.	B	22.	D	23.	B	24.	A	25.	D	26.	A	27.	C	28.	B	29.	A	30.	B
31.	D	32.	D	33.	C	34.	C	35.	B	36.	A	37	D	38.	B	39.	C	40.	C
41.	B	42.	C	43.	B	44.	D	45.	B	46.	C	47.	D	48.	D	49.	D	50.	B
51.	C	52.	C	53.	C	54.	C	55.	D	56.	D	57.	A	58.	C	59.	A	60.	A
61.	C	62.	D	63.	D	64.	D	65.	A	66.	C	67.	C	68.	A	69.	A	70.	C
71.	A	72.	A	73.	C	74.	D	75.	C	76.	D	77.	C	78.	A	79.	A	80.	C
81.	D	82.	A	83.	D	84.	A	85.	A	86.	C	87.	D	88.	A	89.	A	90.	A
91.	C	92.	C	93.	A	94.	B	95.	C	96.	D	97.	D	98.	C	99.	B	100.	A
101.	D	102.	D	103.	C	104.	B	105.	B	106.	C	107.	A	108.	D	109.	C	110.	B
111.	D	112.	C	113.	D	114.	A	115.	D	116.	B								

Solved Exercise

Q NO.16

Spores

Certain species of bacteria produce spores. Spores are of two types

1. Exospore: outside the vegetative cell
2. Endospore: within the vegetative wall

Formation of spores is not means of asexual reproduction but it is an adaptation to face adverse terrestrial condition.

They are heat resistant cyst. The hard protective covering secrete by protective covering, secreted by bacteria to overcome unfavorable condition is called cyst.
They are not heat resistant.

Q No. 44

E.coli is a type of bacteria that lives normally in your intestine. It is facultative anerobic.

Q NO. 113

Attenuated means weakened culture of bacteria. Therefore all of these are the best option

Q NO.50

Hyphomicrobium is a genus Gram-negative rod shape bacteria. It is usually ovoid with small outgrowth called hypha. Hypha is in the form of coiled stock



Q NO. 50

A	**Infectious Hepatitis**	**Non-evolved RNA Virus**
B	**Serum Hepatitis**	**Evolved DNA Virus**
C	**Non-A, Non-B Hepatitis**	**Evolved RNA Virus**
D	**Delta Hepatitis**	**Evolved RNA Virus**
E		**RNA Non-Envelop**
F	**Yet unidentified**	**Enveloped RNA Virus**
G	**Yet unidentified**	**Enveloped RNA**

Diffusion	infection into vain
Serum	Virus transmitted through infected products
Delta	Triangle
It is	Inflammation
E	No vaccine

C)

1. Digestive enzymes are specifically secreted by which part of rhizopus:
A) Rhizoids B) Sporangium C) Stolon D) Columnella

2. Soredia are:
A) Fungal hyphae B) Spores C) Gametangia D) Antheridia

3. An asymmetrical division of mycelium occurs during is:
A) Fragmentation B) Budding C) Sporulation D) None of these

4. Asexual reproduction in ascomycetes is by:
A) Ascospores B) Ascocarps C) Soredia D) Conidia

5. Zygote of rhizopus directly develops into:
A) Zoospore B) Sporangium C) Zygospore D) Zygocarp

6. Zygospore is:
A) Diploid B) Haploid C) Triploid D) Polyploid

7. Gametangia of the fungus are:
A) Haploid B) Diploid C) Filamentous D) All of these

8. Yeast reproduces a-sexually by forming:
A) Ascospores B) Basidiospores C) Both a & b D) Buds

9. Ovary of wheat is damaged by which hyphae in case of smut:
A) Monokaryotic B) Coenocytic C) Dikaryotic D) None of these

10. Black spores are formed in case of:
A) Smuts B) Rusts C) Fusarium D) Puccinia graminis

11. Red rot is disease of:
A) Potato B) Carrot C) Sugar cane D) Wheat

12. Aspergillus is:
A) Brown mold B) Green mold C) Blue mold D) Red mold

13. Histoplasmosis is disease of:
A) Lungs B) Heart C) Trachea D) Kidney

14. Migraine relief antibiotic is:
A) Griseofulvin B) Ergotine C) Cyclosporine D) Penicillin

15. Septate hyphae are:
A) Monokaryotic B) Dikaryotic C) Both a & b D) Multi karyotic

16. Aseptate hyphae are found in:
A) Rhizopus B) Oomycotes C) Both a & b D) Kelps

17. Rusts and smuts come under:
A) Notorious pathogens B) Delicacies C) Slime molds D) Diatoms

18. Antibiotics affect:
A) Bacteria B) Fungi C) Worms D) All of these

19. Which fungi have extensive enzymes:
A) Saprophyte B) Symbiotic C) Parasite D) Predatory

20. *Pleurotus ostreatus* is:
A) Saprotrophic B) Parasitic C) Predatory D) Symbiotic

21. Fungi can tolerate pH:
A) 2 – 7 B) 2 – 9 C) 4 – 6 D) 6 – 8

22. Spores are dispersed by:
A) Wind B) Water C) Insects D) All of these

23. Spitting fungus is a:
A) Zygomycete B) Sac fungus C) Club fungus D) Imperfect fungus

24. Aspergillus contaminates which of the followings with Aflatoxins?
A) Improperly Stored grains B) Milk C) Eggs and meat D) All of these

25. Degrading and removing environmental pollutants, such a role of fungus could be called:
A) Decomposition B) Biological control C) Bio remediation D) Degradation

26. *Ustilago tritici is* called:
A) Covered smut of wheat B) Covered smut of rice C) Loose smut of rice D) Loose smut of wheat

27. Which spore is diploid:
A) Ascospore B) Basidiospore C) Conidium D) Zygospore

28. The fungi can tolerate temperature:
A) 5^0C ,+50^0C B) 10^0C,+40^0C C) -5^0C ,+50^0C D) 100^0C ,+ 200^0C

29. What attacks immuno suppressed patients:
A) Purple ergot B) Yeast C) *Candida albicans* D) *Aspergillus fumigatus*

30. What causes nervous spasm, psychotic delusion, gangrene:
A) Aspergillosis B) Histoplasmosis C) Migraine D) Ergotism

31. Rhodotorula is a:

A) Pink yeast B) Pink mold C) Mushroom D) None of these

32. Reindeer moss is:
A) Club moss B) Moss C) Lichen D) Fungi

33. Which give blue color to the colony of penicillium:
A) Hyphae B) Rhizoids C) Conidiophores D) Conidia

34. Which of the following is structural component of fungus cell wall?
A) Chitin B) Peptidoglycan C) Cellulose D) Lignin

35. Which is absent in fungi?
A) Chlorophyll B) Hyphae C) Glycogen D) Chitin

36. Citric acid is obtained from which?
A) Agaricus B) Aspergillus C) Yeast D) Penicillium

37. How many species of fungi are known?
A) 10,000 B) 100,000 C) 1 million D) 20,000

38. Which is a delicacy?
A) Rust B) Penicillium C) Truffles D) Yeast

39. Ecological role of fungi as _____ is only paralleled by bacteria:
A) Indicator B) Pathogen C) Autotrophs D) Decomposers

40. Fungi resemble plants in what way?
A) Having chitin B) Possessing cell wall C) Having glycogen D) Having centrioles

41. Many mycologists think that fungi and animals are closely related due to?
A) Starch B) Nuclear mitosis C) Autotroph D) Chitin in both groups

42. Fungi are related to which of these groups according to DNA study?
A) Plants B) Animals C) Slime molds D) Distinct

43. What is special feature of nuclear mitosis?
A) No spindles B) No segregation C) No mitotic apparatus D) No disintegration of nuclear envelope

44. The body of the fungus is called:
A) Hyphae B) Thallus C) Mycelium D) Coenocytic

45. Which is not correct about hyphae?
A) Long B) Slender C) Un branched D) Thread like

46. Multinucleate large cell in which cytoplasm moves effectively is called:
A) Coenocytic B) A septate C) Septate D) Both A and B

47. Which property enables the hyphae to grow rapidly?
A) Septa B) Flow of C) Multiple D) Chitin

materials nuclei

48. Which part of fungus growing through substrate is metabolically active?
A) Young parts B) Only gametangia C) Only vegetative parts D) All parts

49. Which can move from the pore present in septum?
A) Gametes B) Reserve food C) Spores D) Cytoplasm

50. Armillaria is a pathogen of:
A) Angiosperms B) Cereals C) Maize D) Conifers

51. The parasites which can grow only on their host:
A) Facultative B) Obligate C) Ectoparasites D) Intracelluar

52. Which is mostly obligate parasite?
A) Arthrobotrys B) Mushrooms C) Rust D) Basidiomycetes

53. Which is used to lower blood cholesterol?
A) Griseofulvin B) penicillin C) lovastatin D) cyclosporine

54. Fungi store surplus food in the form of:
A) Starch B) Sulfur C) Chitin D) Glycogen or oil

55. Which kind of reproduction is not merely Asexual?
A) Conidia B) Budding C) Spore formation D) Fragmentation

56. Spores are in fungi (mostly):
A) 1n B) 2n C) Both a & b D) Polyploid

57. Conidia can survive for:
A) Weeks B) Centuries C) Years. D) Decades

58. In which plasmogamy is immediately followed by karyogamy?
A) Basidiomycetes B) Ascomycetes C) Zygomycetes D) Deuteromycetes

59. Which could have a long dikaryotic stage?
A) Mildews B) Pilobolus C) Rhizopus D) Aspergillus

60. Visible morel is an example of which?
A) Ascus B) Basidiocrap C) Mushroom D) Ascocarp

61. Saccharomycese cerevisiae is most common:
A) Fungus B) Mold C) Yeast D) Pathogen

62. These are among the most familiar fungi:
A) Sac fungi B) Club fungi C) Spitting fungi D) Morels

63. Which is not a devastating pathogen?
A) Rust B) Smut C) Shelf fungi D) Penicillium

64. Spore masses resemble the soot in which?
A) Smut B) Puccina C) Rust D) Agaricus

65. What is the color of diseased spors of Rust?
A) Red B) Black C) Orange D) Orange Yellow

66. Rust spot appear mostly on which part of plant?
A) Root B) Grain C) Flower & kernels D) Stem and leaves

67. When sexual structures are found for the imperfect fungus, it is placed in :
A) Zygomycota B) Ascomycota C) Appropriate phylum D) No other phylum

68. Which is blue green mold?
A) Penicillium B) Agaricus C) Fasarium D) Helminthosporium

69. Penicillium is a _____ species:
A) Predatory B) Chlorophyllous C) Parasitic D) Saprobic

70. Mycorrhizal association is found in _____ vascular plants
A) 90% B) 95% C) 100% D) 80%

71. Unit of classification between class and family:
A) Genus
B) Species
C) Order
D) Phylum

72. Total different species of plants and animals are over:
A) 1/2 million
B) 1.5 milion
C) 2 million
D) 3 million

73. The class of corn is:
A) Zea
B) Mays
C) Poaceae
D) Monocyotyledonae

74. In Binomial Nomenclature first name refers to:
A) Genus
B) Species
C) Class
D) Family

75. In 1866 Ernst Hackle divided living organisms into:
A) Two kingdoms
B) Three kingdoms
C) Six kingdom
D) Five kingdom

76. Which of the following mode of nutrition was used by Robert Whittekar for the classification:
A) Photosynthesis
B) Absorption
C) Ingestion
D) All of these

77. Which scientist used cytology genetic and organelles of symbiotic origin along with mode of nutrition for classification:
A) Robert Whittaker
B) Margulis and Schwartz
C) Ernst Hackle
D) Carolos Linnaeus

78. One of the following is considered ancestor of all other
A) Plantae
B) Fungi
C) Protista
D) Animilia

79. Mature non enveloped virus is composed of:
A) Genome only
B) Prion only
C) Genome and capsid

D) Nucleic acid + Protein coat + Membrane of the host cell

80. The structure of virus which belongs to the host cell:
A) Envelope
B) The capsid
C) The genome
D) All of these

81. Viral genome is composed of:
A) DNA only
B) RNA only
C) DNA or RNA
D) DNA, RNA and protein

82. Prion is a/an
A) Infectious part of virion
B) Infectious proteins only
C) A piece of RNA
D) A piece of DNA

83. Vacca is a Latin word means:
A) Poison
B) From low
C) Cow
D) Pus from cowpox lesion

84. The first virus to be isolated in crystal form by stanly:
A) Bacteriophage
B) Cowpox
C) Tobaccomosaic virus
D) Polio virs

85. Tail fibers are attached to which one of the folloing component of tail:
A) Sheath
B) Core
C) Coilar
D) Endplate

86. Adsorption means
A) Receptor site
B) Penetration
C) Attachment
D) Lysis

87. The structure of virus injected by bacteriophage during lytic cycle.
A) Tall fibers
B) Tail
C) Protein
D) DNA

88. No. of new bacteriophages released from a bacterial cell after 25 minutes.
A) 100
B) 200
C) 60
D) 500

89. The process of separation of prophage to start Lytic cycle is known as:
A) Adsorption
B) Lysogeny
C) Induction
D) Penetration

90. Pollo virus is:
A) Rod shaped
B) Tadpole like
C) Brick like
D) Spherical

91. Disease caused by the smallest known virus:
A) Herpes simplex
B) Polio
C) Mumps
D) Smallpox

92. All of the following are the characteristics of virus except:
A) Have both DNA and RNA
B) Have no membrane bonded organelle
C) Cannot reproduce out side living cell
D) Have no membrane to exit entry of substance

93. Out side the living cell virus exist in the form known as:
A) Viroid
B) Capsid
C) Virion
D) Pirion

94. The substance not found in virus:
A) DNA
B) RNA
C) Protein
D) Carbohydrate

95. Reverse transcriptase is an enzyme contained by:
A) All viruses
B) Retrovirus
C) Bacteriophage
D) Plant virus

96. Viruses are considered non living because:
A) They produce variations
B) They form crystals
C) Their nucleic acid code for protein synthesis.
D) They can reproduce

97. Which of the following are found in all viruses:
A) Envelop, capsid and nucleic acid
B) DNA, RNA and protein
C) Protein and nucleic acid
D) Protein, nucleic acids carbohydrates and lipids

98. Which part of virus is not produced in multiple copies inside host cells:
A) Virus genome
B) Capsid
C) Envelop
D) All of these

99. Which one of the following is the only infectious protein:
A) Vrioid
B) Virion
C) Prion
D) Envelope

100. Which of the following information transfer is catalyzed by an enzyme reverse transcriptase.
A) RNA → RNA
B) RNA → DNA
C) DNA → RNA
D) DNA→ DNA

101. Which of the following is common in both bacteria and virus:
A) Nucleic acid is genetic material
B) Binary fission
C) Mitosis
D) Ribosomes

102. Which one of the following is not included in the envelop of bacteria.
A) Cell wall
B) Pilli
C) Capsule
D) Slime

103. The structure present in between capsule and cell membrane of bacteria.
A) Slime
B) Flagella
C) Cell wall
D) Basal body

104. Flagelium of bacteria arises from:
A) Pilli
B) Cell membrane
C) Cell wall
D) Basal body

105. All of the followings are true about cysts of bacteria except:
A) Heat resistant
B) Thick walled
C) Desiccation resistant
D) Formed during differentiation of vegetative cells

106. The protoplast of bacterial cell lack which of the following:
A) Nucleus
B) Ribosomes
C) Plasmid
D) Mesosome

107. Substance used to kill microbes in living tissues.
A) Antiseptics
B) Disinfectants
C) Antibiotics
D) All of these

108. Which of the following is sterilized by membrane filters:
A) Sera
B) Antibiotics
C) Hormones
D) All of these

109. One of the following is not used as chemotherapeutic.
A) Alcohol
B) Sulfonamides
C) Tetracycline
D) Penicillin

110. Microaerophilic bacteria can grow in:
A) In the absence of free oxygen
B) In the presence of free oxygen
C) In the absence or presence of free oxygen
D) In the presence of very low concentration of oxygen

111. E. Coli is a/an
A) Aerobic bacteria
B) Anaerobic bacteria
C) Facultative bacteria
D) Microaerophilic

112. Which of the following bacteria can grow in the presence of very low concentration of oxygen:
A) Pseudomonas
B) Spirochete
C) E.Coli
D) Campylobacter

113. Chemo synthetic bacteria are:
A) Autotrophic
B) Heterotrophic
C) Mutualistic
D) Commensalistic

114. Sulphur is produced as a by product during the activity of which type of bacteria:
A) Photosynthetic
B) Chemosynthetic
C) Saprophytic
D) Parasitic

115. During which phase of reproduction death rate becomes equal to new formed bacteria:
A) Lag
B) Log
C) Stationary
D) Decline

116. Rigid spiral bacteria is called:
A) Vibrio
B) Spirillum
C) Spirochete
D) Sarcina

117. Hyphomicrobium is a bacteria shaped like:
A) Spiral
B) Rod
C) Sphere
D) Ladder

118. Gram positive or negative bacteria grouping is on the bases of their:
A) Capsule
B) Cyst
C) Cell wall
D) Cell membrane

119. In which bacteria flagella are surrounding the whole bacterial cell:
A) Atrichous
B) Amphitrichous
C) Peritrichous
D) Lophotrichous

120. The structure which is chemo taxis in bacteria:
A) Capsule
B) Cyst
C) Pilli
D) Flagella

121. Poxvirus sized bacteria is about:
A) 100 to 200 nm
B) 500 nm
C) 75 to 125 u
D) 0.1 to 600 nm

122. Animalcules term was used for micro organism by:
A) Hooke
B) Leeuwenhoek
C) Pasteur
D) Koch

123. Lipid absent in the membrane of bacteria:
A) Wax
B) Sterols
C) Phospholipids
D) Acyl glycerol

124. Nostoc is widely distributed:
A) In alkaline soil
B) On moist rocks
C) Cliffs
D) All of these

125. All of the following are the characteristic of trichome of Nostoc except:
A) Branched
B) Spherical cells
C) Contain Heterocyst
D) Embedded in a jelly like Mass

Answers (C):

1.	A	2.	B	3.	A	4.	D	5.	C	6.	A	7.	A	8.	D	9.	C	10	A
11.	C	12.	A	13.	A	14.	B	15.	A	16.	C	17.	A	18	A	19.	A	20.	C
21.	B	22.	D	23.	A	24.	D	25.	C	26.	D	27.	D	28	C	29.	D	30.	D
31.	D	32.	C	33.	D	34.	A	35.	A	36.	B	37.	B	38	C	39.	D	40.	B
41.	D	42.	D	43.	D	44.	C	45.	C	46.	C	47.	B	48	D	49.	D	50.	D
51.	B	52.	C	53.	C	54.	D	55.	C	56.	C	57.	C	58.	A	59.	D	60.	D
61.	C	62.	B	63.	D	64.	A	65.	D	66.	D	67	C	68.	A	69.	D	70.	B
71.	C	72.	C	73.	D	74.	A	75.	B	76.	D	77.	B	78.	C	79.	C	80.	A
81.	C	82.	B	83.	C	84	C	85.	D	86.	B	87.	D	88.	B	89.	C	90.	D
91.	B	92.	D	93.	C	94.	D	95.	B	96.	B	97.	D	98.	C	99.	C	100	B
101	A	102	b	103	A	104	D	105	A	106	A	107	C	108	D	109	A	110	D
111	C	112	D	113	A	114	A	115	C	116	C	117	B	118	C	119	C	120	D
121	D	122	B	123	B	124	A	125	D										

Solved Exercise

Q NO. 2

Soredia is asexual reproductive structure of lichens . It consists of Fungal hyphae + Algal cell.

Unit # 4
KINGDOM ANIMALIA

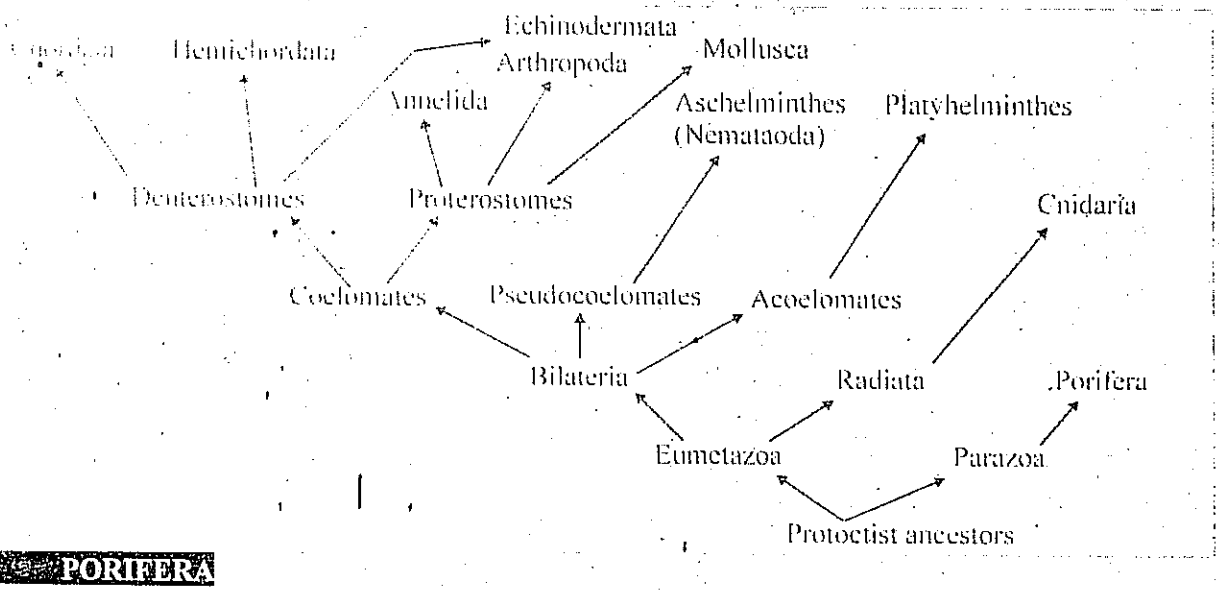
LEARNING OUTCOMES

A) Porifera (with respect to their capacity to regenerate)
B) Coelenterata (coral reefs as habitat for sea animals)
C) Platyhelminthes (Harmful effects on human beings) with examples
D) Aschelminthes (Infection in humans) with examples
E) Arthropoda (Economic importance of Arthropods and harmful impacts on Man)
F) Define the following terms:
Coelomata, Acoelomata, Pseudocoele, Radiata, Bilateria, Diploblastic and Triploblastic organization.

4. KINGDOM ANIMALIA

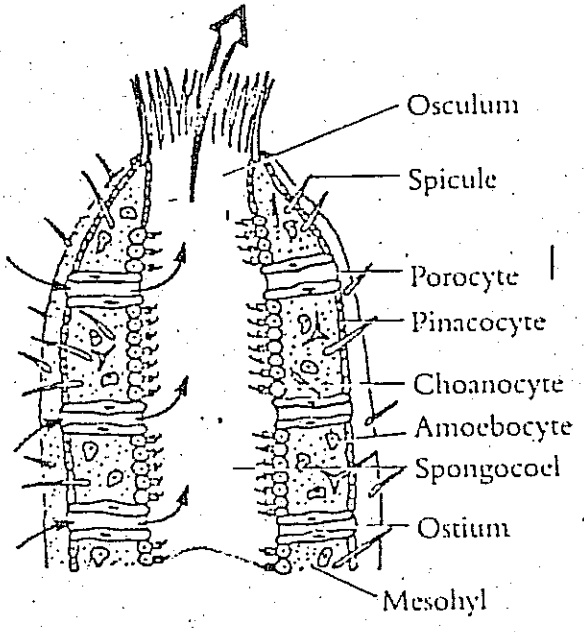
Content

Kingdom Animalia (phyla)



A) PORIFERA

- Phylum porifera is also called ***parazoa, sponges & pore bearing animals.***
- All are ***aquatic***. Out of total ***5000 species*** 150 live in fresh water while all other are marine.
- They ***lack symmetry & tissue organization or have no organs.***
- ***Body wall*** is formed of an outer layer, ***pinacoderm*** (made of pinacocytes) & an inner layer ***choanoderm*** (made of flagellated collar cells or choanocytes). Between these layers, there is gelatinous ***mesenchyme.***
- They range in size from few millimeters wide to more than one meter tall. ***Scolymastra joubini*** is more than a meter tall.
- There is a single cavity inside the body, the ***spongocoel.***



The pores through which water enters the body are called ***ostia*** and pore by which water leaves the body is known as ***osculum***.

20% of their food is zooplankton & phytoplankton & ***80%*** is detrital organic particles.

Adult sponges are ***stationary*** while their larva are able to move (swim).

Skeleton contains needle-like ***spicules*** which are calcareous or siliceous.

Asexual reproduction is by ***budding***. The buds may be external or internal. The internal buds are called ***gemmules***.

Sexually they are ***hermaphrodite*** and ***protandrous***. ***Fertilization*** occurs in mesenchyme and zygote is formed.

Sycon is typical marine sponge, ***Leucoselenia*** consists of erect tubes, ***Euplectella*** (Venous flower basket) has glassy framework & ***Spongilla*** is freshwater sponge.

Their skeleton is ***used for*** washing and bathing. They absorb water, fluids and blood in surgical operations and also for sound absorption in buildings.

Sponges have the highest capacity to regenerate, as they are simplest of all animals.

- **Do you think Poriferans are true animals?**

B) COELENTERATA

Phylum Cnidaria is also called ***coelenterata***.

They have special cells called ***cnidocytes*** which give rise to ***nematocysts***-the stinging cells.

They have ***diploblastic*** organization.

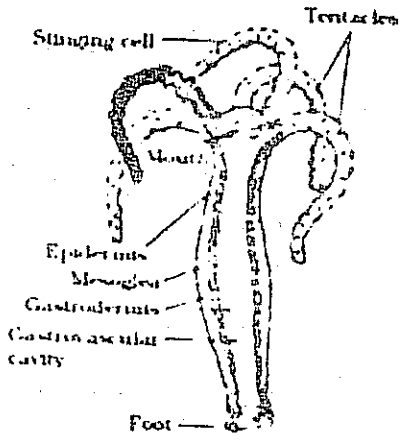
They have gastrovascular cavity or ***enteron*** which serves as digestive as well as body cavity.

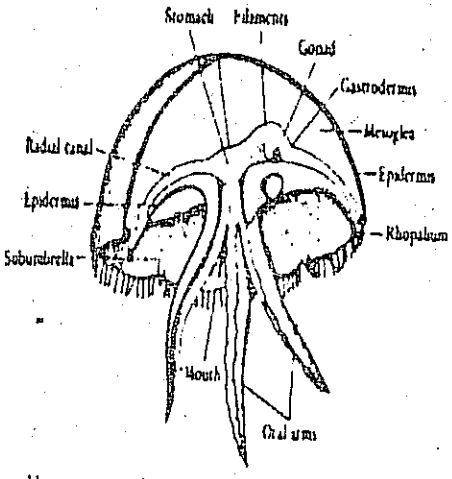
They have ***radial symmetry***.

They are ***aquatic*** living both in marine and freshwater habitats.

They range in size from microscopic *Hydra* to macroscopic ***Branchiocerianthus*** (two meter in length).

They are found in two basic form, the ***polyps and the medusae***.



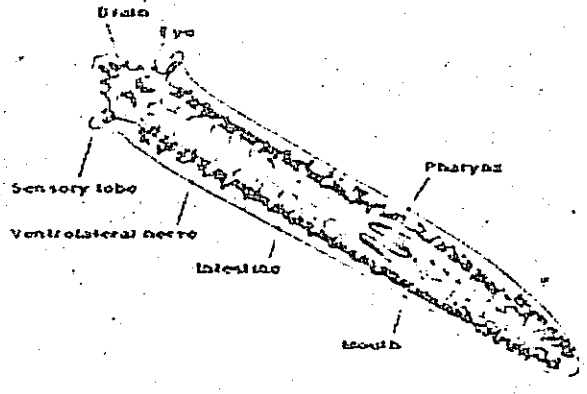


- Polyps are cylindrical, nutritive, and asexually reproducing while medusae are umbrella like, free swimming and sexually reproducing.
- Mouth is surrounded by a series of ***tentacles*** which bear nematocysts or stinging cells.
- They are ***carnivores***.
- They have ***diffused type of nervous system.***
- Their ***exoskeleton*** is formed of calcium carbonate ($CaCo_3$).
- Asexually they reproduce through ***budding*** while sexually they are hermaphrodite.
- ***Obelia*** has three types of zooids, blastostyle or gastrozooids, gonozooids & medusae.
- They show ***alternation of generations***, both generations being diploid.
- The occurrence of structurally and functionally more than two different types of individuals, called zooids within the same organism is called ***polymorphism.***
- ***Hydra*** is freshwater coelenterate that exists only in polyp form.
- ***Obelia*** is marine colonial organism.
- In ***Aurelia*** (Jelly fish), polyp is reduced and medusae is dominant.
- ***Actinia*** (sea anemone) is polyp in which enteron is divided by mesenteries.
- ***Medrepora*** (corals) are important in formation of chalk and lime stone.
- Corals are formed from the secretions produced by specialized polyps that are present in certain coelenterates. The stony network or mass of such coelenterates are called corals. Living polyps are found on the surface layer of corals whereas underneath the mass are dead stony structures only and there are no polyps inside. The stony masses that are formed in this way are called coral reefs. These are mostly formed of calcium carbonates (lime-stone).
- The corals because of their massive structure serve as living place for a variety of sea life.

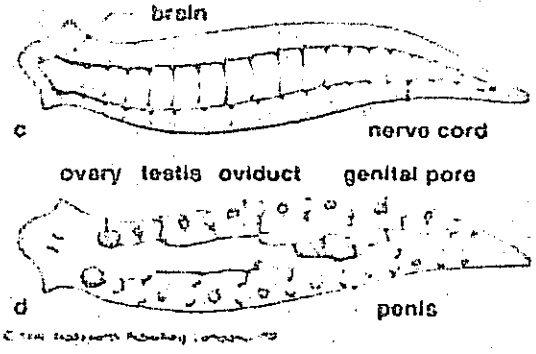
- **Can you elaborate the importance of coral reefs in water ecosystem?**

(C) PLATYHELMINTHES

- Animals of phylum platyhelminthes are called *flatworms*.
- Body is soft and *dorsoventrally compressed*.
- They are *triploblastic acoelomates*.
- They show *bilateral symmetry*.
- They are mostly *endoparasites* and few are free living in their hosts.
- The most common examples are *Taenia solium* (tape worm), *Fasciola hepatica* (liver fluke) and *Schistosoma* (blood fluke).
- Their size ranges from few millimeter (10 mm in case of Planaria to several meters like tape worm).
- They have branching *sac type digestive system*.



- *Excretory system* consists of branching tubes ending in bulb-like cells, the flame cells.
- *Nervous system* contains nerves and ganglia.



- Free living form move by *cilia*.
- They *reproduce* asexually by fission and regeneration and sexually they are hermaphrodite.
- *Dugesia* (Planaria) is a free living flatworm with ciliated outer surface.
- *Liver fluke* is an endoparasite in sheep & humans residing in bile duct. It completes its life cycle in snail, sheep or man.
- *Tape worm* is an endoparasite of humans, cattle and pig. Intermediate host is pig or cattle. Their body is ribbon-like and is divided into segments called *proglottids*.

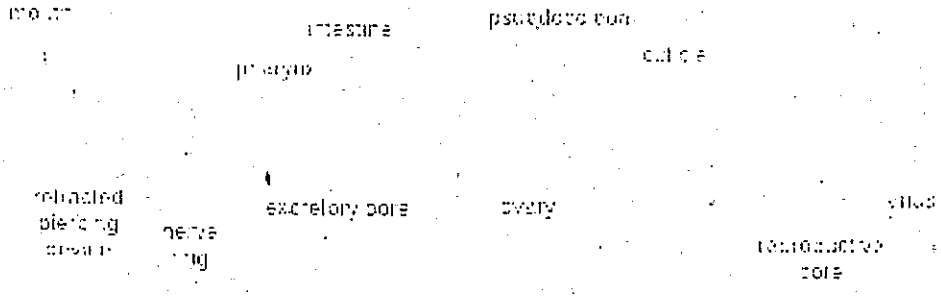
ADAPTATIONS FOR PARASITIC MODE OF LIFE

STRUCTURES PRESENT	STRUCTURES ABSENT/REDUCED
Resistant cuticle	Epidermis
Adhesive organs (Suckers or hooks)	Degenerated muscular & nervous system
Complicated reproduced system	Simplified digestive system
Large number of ova	
Complexity of life cycle (in two host)	

- Why a flatworm produces a large number of ova?

D) ASCHELMINTHES (Phylum Nematoda)

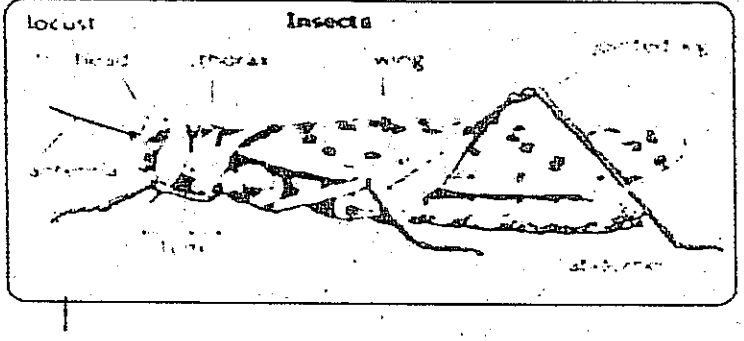
- Animals presents in phylum nematoda are called ***roundworms or aschelminthes***.
- They have pointed ends.
- They are ***triploblastic*** and ***pseudocoelomates***.
- Body is ***unsegmented*** and shows ***bilateral symmetry***.
- ***Digestive system*** is in the form of alimentary canal with two openings.
- ***Excretory system*** consists of two longitudinally running excretory canals that open through an excretory pore at anterior end on ventral side of body.
- ***Nervous system*** has pharyngeal nerve ring with four nerve cords (dorsal, ventral and lateral).



- Sense organs are in form of ***sensory papillae*** present on the lips at the anterior end.
- ***Muscles*** are arranged in four bands, two dorso-lateral and two ventro-lateral.
- ***Sexes*** are separate.
- ***Ascaris lumbricoides***, is an intestinal parasite of man.
- ***Rhabditis*** is free living genus found in soil, organic matter or H_2O.
- ***Enterobius vermicularis*** (pin worm) is a parasite of human caecum, colon and appendix. Its movement causes intense itching of anus, inflammation of mucous membrane of colon and appendix resulting in insomnia and loss of appetite.
- ***Ancylostoma duodenale*** (Hook worm) is a parasite of human small intestine in Asia. It releases an anticoagulant and in children, causes severe anemia & retards physical and mental growth.

E) ARTHROPODA

- Animals of **PHYLUM ARTHROPODA** are called joint-footed animals (arthron=jointed + pods=feet). e.g. insects (cockroaches, grasshoppers etc).
- ***Insects*** are most common arthropods on the earth.
- Their body is ***segmented***.
- They have ***jointed appendages***.



- They are found in all types of ***habitats***.
- They have ***haemocoel***.
- ***Digestive system*** is tube like or is in the form of alimentary canal with the openings.
- ***Developed Excretory system*** consists of malpighian tubules. The nitrogenous wastes are excreted in form of solid uric acid.
- ***Nervous system*** consists of paired ganglia connected to ventral double nerve cord. The sensory organs are usually a pair of compound eyes and antennae etc.
- ***Respiration*** occurs through tracheal system having openings called spiracles. Aquatic arthropods respire through gills and book lungs.
- Their ***blood circulatory system*** is open type. Blood is colourless without haemoglobin.
- They have ***chitinous exoskeleton***.
- They can swim, crawl or fly. The organs of ***locomotion*** are paired appendages or paired wings also.
- Life history of insects is characterized by ***metamorphosis***.
- In ***complete metamorphosis***, egg develops into larva which is converted into motionless pupa that finally develops into adult.
- In some primitive insects, the metamorphosis is ***incomplete***. The larva resembles adult and is called nymph or instar.

ECONOMIC IMPORTANCE

Harmful Insects	Beneficial Insects
Transmit diseases (act as vectors)	Honey, silk & wax
Spoilage of food	Predaceous to other insects
Spoilage of crops	Larvae source of food for fish

- Many arthropods act as vectors to cause many diseases. Female Anopheles mosquito transmits *Plasmodium* that causes malaria in man.
- The tse-tse fly of African countries transmits *Trypanosoma*, the cause of sleeping sickness and skin diseases.
- The common house fly carries disease causing organisms to contaminate food and cause cholera, hepatitis etc.
- Some species of *Trypanosoma* cause disease in cattle, also.

• Differentiate between a scavenger and a decomposer

DEFINITION OF TERMS

RADIATA

- It contains animals with radial symmetry and diploblastic organization.
- Parts of body are arranged around a central axis in such a way that any plane passing through the central axis divides the animal in halves that are almost mirror images of each other e.g. as in cnidarians.
- The cylindrical body of a sea anemone can be cut in two equal halves vertically in any plane.

BILATERIA

- The animal can be divided into two equal parts by an imaginary line only in one plane.
- There are clearly defined right & left sides, anterior and posterior ends and dorsal and ventral surfaces.
- The animals belonging to Phylum Platyhelminthes to Chordata are included in this group.
- Animals belonging to phylum echinodermata have developed bilateral symmetry in their larva forms and adult echinoderms, have secondarily developed radial symmetry, due to their special mode of life.
- All the animals included in grade bilateria are triploblastic.
- They may be acoelomate, pseudocoelomate and coelomate.

DIPLOBLASTIC ORGANIZATION

- Diploblastic animals belong to division radiata.
- The body of these animals consists of two layers of cells, ectoderm and endoderm.
- There is jelly like mesenchyme or mesoglea which in most cases is non-cellular.
- Diploblastic animals show lesser degree of specialization and they do not form specialized organs.
- There is no special transport system in these animals. Most substances are distributed within their body by process of diffusion.
- There is no central nervous system in these animals. A neuron net is present.
- There is only one cavity in the body called gastrovascular cavity which has only mouth which serves for the entry of food and water and also for the removal of wastes alongwith water. This is known as sac like digestive system.
- Diploblastic animals are placed in phylum Cnidaria.

TRIPLOBLASTIC ANIMALS

- These animals have bilateral symmetry.
- The body of these animals is made from three layers ectoderm, mesoderm and endoderm.
- After embryonic development these layers in most triploblastic animals are not distinct as separate layers of cells, but are represented by the structures formed from them.
- The cells of these animals show greater degree of specialization. These have specialized organs organs and organ systems.
- The systems such as integumentary and nervous system develop from ectoderm.
- Mesoderm gives rise to muscular, skeletal and reproductive systems.
- Endoderm forms the lining of digestive tract and glands of digestive system such as liver.
- Triploblastic animals may be acoelomate, pseudocoelomate or coelomate.

ACOELOMATES

- This group includes phylum platyhelminthes.
- There is no body cavity or coelom and forms a loose, cellular tissue mesenchyma or parenchyma which fills the space between the ectoderm and endoderm. It forms a packing around the internal organs of the animals to support and protect them.
- In acoelomate, the gut is sac-type and there is no special transport system.
- Only excretory system is developed for the transport of excretory products.
- This system consists of flame cells, excretory ducts and excretory pores.
- Nervous system is well developed.

PSEUDOCOELOMATES

- This group includes phylum aschelminthes.
- The space between the body wall and the digestive tube is called pseudocoelom (false body cavity).
- Pseudocoelom is not homologous to true coelom because it is not lined by cleomic epithelium.
- It has no relation with the reproductive and excretory organs.
- It develops from the blastocoel of the embryo and it is bound externally by the muscles and internally by the cuticle of intestine.

COELOMATES

- Coelom is cavity present between the body wall and the alimentary canal and is lined by mesoderm.
- The mesoderm splits into outer parietal layer which under lines the body wall and the visceral layer which covers the alimentary canal and the cavity between them is the true coelom. It is filled with fluid called coelomic fluid.
- This group includes animals from annelids to chordates.
- In coelomates, gut includes more complexity and neuro-sensory system is well developed alongwith excretory system, circulatory system, respiratory and reproductive system.

Point to ponder ⇒	• **Can you name the coelomic cavities present in humans?**

CLASSIFICATION OF ARTHROPODA

s	Habitat	Respiration	Body Parts	Coelom	Legs	Wings	Antennae Sense of Tate & Touch	Mandibles (Jaws) Chewing	Maxilla Holding the food	Development
ecan	Aquatic	Gills Body Surface	Cephalothorax and Abdomen	Reduced Hemocoel	5 or More Pair	Absent	2 Pair	One Pair	2 Pairs	Sexes Separate Metamorphosis
ta	Terrestrial Aquatic	Trachea	Head, thorax, abdomen	Reduced hemocoel	3 Pair	Present	# Pairs	One Pair	One Pair	One Sexes separate Oviparous Metamorphosis
ida	Terrestrial	Gills or Book Lungs	Cephalothorax + Abdomen	Reduced Hemocoel	4 Pair	Absent	No	No	One Pair	Separate Oviparous or viviparous No true Metamorphosis
oda	Terrestrial	Trachea	Head, thorax, abdomen	Reduce Hemocoel	One Pair Per Segment	Absent	One Pair	Single Pair	One Pair	Metamorphosis

Grade	Phyla
1. Without true tissues	Porifera
2. With true tissues.	Coelenterate (New name enidaria)
a) Two embryonic tissue layers b) Three embryonic tissue layers	
Acoelomate *No body cavity*	Platyhelminthes
Psudo Coelomate	Nematoda
Biastoceol Persist as body cavity Develo	
Coelomate *Mesodermal body cavity Develops*	Annelida
Haemocoel	Arthropoda
Coelom reduced & blood flows through i	
Haemcoeic Channels	Mollusca
Colcom is divided into haemcoilic channe	
or sinuses	

Exercise (A)

1. The insects damage standing crops and other plants are:
A) Tsetse fly B) Common house fly C) Locusts D) Dragon fly

2. The nitrogen containing complex carbohydrate secreted by epidermis in insects:
A) Cutin B) Tergum C) Chitin D) Wax

3. _____ phyllum contains maximum parasite
A) Echinodermata B) Nematoda C) Annelida D) Arthropoda

4. Which one of the followings is not insect:
A) Wasps B) Moths C) Beetles D) Daphnia

5. Round worms are common name used for
A) Platyhelminthes B) Coelenterate C) Aschelminthes D) Annelids

6. The only invertebrates included in deuterostomes:
A) Annelids B) Arthropods C) Molluscs D) Echinoderms

7. Integumentary system is developed from:
A) Ectoderm B) Endoderm C) Mesoderm D) Hypodermis

8. The term related to the formation of body cavity by splitting of mesoderm:
A) Shizocoelous B) Enterocoelous C) Archenteron D) Pseudocoele

9. Mesenchyma and parenchyma filled in the acoelomate is:
A) Cellular B) Dead C) Amorphous D) All

10. Entrobius vermicularis in the biological name of:
A) Ascaris B) Rhabiditis C) Pinworm D) Roundworm

11. A single rotting apple may contain how many worms:
A) 30,000 B) 60,000 C) 90,000 D) 100,000

12. Schistosoma is!
A) Tapeworm B) Liver fluke C) Pinworm D) Blood fluke

13. Free living freshwater platyhelminthes is:
A) Dugesia B) Taenia C) Fasciola D) All

14. Intermediate host of Fasciola hepatica is:
A) Sheep B) Man C) Snail D) Pig

15. Definitive host of *Taenia solium* is:
A) Man B) Pig C) Sheep D) Cattle

16. Which one is not adaptation for parasitic mode of life of platyhelminthes:
A) Absence of epidermis B) Simplified digestive system C) Developed and complicated reproductive system D) Developed muscular system

17. It is the parasite in the human caecum, colon and appendix causing insomnia and loss of appetie
A) Leech B) Pinworm C) Tapeworm D) Liver

18. In which whole animal is covered in an envelope called mantle
A) Milluscans B) Annelids C) Flatworms D) Round worm

19. Proglottids are:
A) Embryos of taenia B) Uteri of taenia C) Segments of taenia D) Eggs of taenia

20. The main parts of the proglottids of worms are:
A) Excretory organs B) Digestive organs C) Reproductive organs D) Nervous system

21. Nerve ring of nematodes is found around:
A) Head B) Pharynx C) Alimentary Canal D) Ventral cord

22. Nerve ring of aschelminthes givers rise to:
A) Dorsal nerve cord B) Ventral nerve cord C) Lateral nerve cord D) All

23. Pseudcoele is filled with:
A) Protein deficient fluid B) Non-vacuolated cells C) Vacuolated cells D) Carbohydrate rich fluid

24. The systems which are absent in aschelminthes:
A) Nervous system B) Digestive system C) Transport system D) Muscular system

25. The muscles not found in nematodes:
A) Dorso-lateral B) Ventro-lateral C) Longitudinal muscles D) Circular muscles

26. Pseudocoele is the remnant of:
A) Blastocoele B) Archenteron C) Haemocoele D) Mesoderm

27. Which one is not the characteristic feature of ascaris:
A) Pointed ends B) Un-segmented body C) Head is not clearly demarcated D) It is free living

28. *Enterobious vermicularis* is:
A) Hookworm B) Blood worm C) Pinworm D) Round worm

29. Anemia causing nematode parasite is:
A) Hook worm B) Ascaris C) Pin worm D) Tape worm

30. Triploblastic animals are:
A) Eumatazoa B) Bilaterally symmetrical animals C) Radiates D) All

31. Spiral and determinate cleavage is found in:
A) Chordates B) Echinoderms C) Annelids D) Hemichordates

32. Blastopore forms anus in:
A) Molluscs B) Echinoderms C) Annelids D) Nematodes

33. The only system developed in acoelomates is:
A) Nervous system B) Circulatory system C) Integumentary system D) Excretory system

34. What is not true about Pseudocoelom:
A) Is filled by fluid
C) Is bonded externally by cuticle and internally by muscles
B) Has no relation with reproductive and excretory organs
D) Is the space between muscles and the digestive tube.

35. Sac like gut with no special transport system is found in:
A) Coelomates B) Chordates C) Acoelomates D) Pseudocoelomates

36. They have Malpighian tubules for excretion
A) Crustacean, arachnid & myriapods B) Crustacean, insects & myriapods C) Insects & myriapods D) Insects & arachnids

37. Two pairs of maxillae are found in:
A) Crustaceans B) Insects C) Myriapods D) None of these

38. Some _____ make valuable pearls
A) Calms B) Oyster C) Mussel D) Toredo

39. It is a shipworm and damages wooden parts in ship:
A) Mussels B) Oyster C) Mussel D) Toredo

40. Which is mesodermal?
A) Gut B) Skin C) Gonads D) Gonads and muscles

41. _____ are injurious in garden and c ultivation
A) Calms B) Oyster C) Toredo D) Slugs

42. Unio in the name of:
A) Octopus B) Sepia C) Hellix D) Limax

43. Unicellular animals were referred to as:
A) Mesozoa B) Metazoan C) Protozoa D) Eumetazoa

44. Cleavage plane at right angle or symmetrical to polar axis:

A) Determinate B) Indeterminate C) Radial D) Spiral

45. A "tube within tube" is used for:
A) Annelids B) Molluscs C) Nematodes D) Echinoderms

46. Animal involved in causing malaria
A) Tse Tse fly B) Fly C) Plasmodium D) Mosquito

47. Thorax of insects has _____ segments:
A) 4 B) 5 C) 6 D) 3

48. Loligo is the name of:
A) Octopus B) Cuttlefish C) Squid D) Oyster

49. Their mouth cavity may have a tongue like structure called Radula
A) Molluscans B) Roundworms C) Flatworms D) Annelids

50. Enterobius vermicularis is commonly known as?
A) Hook worm B) Pin worm C) Flatworm D) Segmented worm

51. Ancyclostoma duodenale is commonly as?
A) Hook worm B) Pin worm C) Flatworm D) Segmented worm

52. The first group of invertebrates which have developed a closed circulatory system is?
A) Nematoda B) Annelida C) Mollusca D) Arthropda

53. They have closed blood circulatory system
A) Flat worm B) Roundworm C) Insects D) None of these

54. The Tsetse fly of Africa transmits?
A) Plasmodium B) Amoeba proteus C) Trypanosoma D) Trichonymphas

55. How many eyes are usually present in spiders?
A) 8 B) 6 C) 4 D) 2

56. Mites and ticks are included in class?
A) Crustacea B) Insecta C) Arachnida D) Myriapoda

57. The cells absent in sponges are:
A) Chondrocytes
B) Pinacocytes
C) Choanocytes
D) Archeocytes

58. Animals devoid of respiratory, excretory and circulatory organs are:
A) Tapeworms
B) Sponges
C) Earthworm
D) Liver fluke

59. Internal bud in sponges are:
A) Gametes
B) Spores
C) Gemmules
D) Spicules

60. Which is universal for sponges?
A) Marine
B) Calcareous spicules
C) Radial symmetry
D) High regenerative power

61. Important function that suckers perform:
A) Absorption of blood C) Attachment
B) Ingestion of food D) Excretion of waste
62. Complete life cycle of Fasciola hetatica is:
A) 1 C) 3
B) 2 D) 4
63. Cleavage present in spiral and determinate type:
A) Pinworm C) Star fish
B) Cake urchin D) Aphioxus
64. Which one of following has flase coelom is:
A) Ascaris C) Obilia
B) Hookworm D) Planaria
65. Grade radiate have:
A) Diploblastic C) Acoelomate
B) Triploblastic D) Pseudocoelomate
66. Arise reproductive system:
A) Germ layer C) Mesoderm
B) Ectoderm D) Endoderm
67. _____ surrounds endoderm in ceelomates:
A) Coelomic epithelium C) Ectoderm
B) Visceral Mesoderm D) Prietal Mesoderm
68. _____ is not an aschelminthic parasite:
A) *Rhabditis* C) Pinworm
B) *Ascaris lumbricoid* D) Schistosoma
69. Chitinous hooks present in taenia embryo:
A) 3 C) 5
B) 4 D) 6
70. _____ develops Pseudocoelom:
A) Blastostyl C) Blastocoel
B) Blastocyst D) Mesoderm
71. _____ causes inflammation in mucous membrane:
A) Ascaris C) Pin worm
B) Rhabditis D) Hook worm
72. Which one of the following is not a parasite:
A) Schistosoma C) Taenia
B) Planaria D) Fasciola
73. Liver fluke attacks all following hosts except:
A) Pig, C) Cattle
B) Snail D) Human
74. Ancyclostoma duodenale is common name of:
A) Pin worm C) Tape worm
B) Hook worm D) Earth worm
75. These are triploblastic, coelomates but coelom is not present as the main body cavity:
A) Flatworm C) Nematodes
B) Arthropods D) Annelida
76. Which of the following has reduced coelon:
A) Pin worm C) Cockroach

B) Spongilla
D) Tape worm

77. Which one of the following has a body cavity called enteron present in them:
A) Dugesia
C) Hydra
B) Tape worm
D) Round worm

78. Phylum of schiozocoelous animals is:
A) Arthropoda
C) Echinodermata
B) Porifera
D) Chordata

79. Annuli are present in:
A) Earthworm
C) Leech
B) Tapeworm
D) Neries

80. All are the feafures of kingdom Animalia except:
A) Heterotroph
C) Organic synthesis
B) Eukaryotes
D) Multicellular

81. False statement about acoelomates:
A) Sac type digestive system
C) Well developed respiratory system
B) Parenchyma fill the body space
D) Well developed excretory system

82. All the major systems develop from:
A) Ectoderm
C) Endoderm
B) Mesoderm
D) Ectoderm and endoderm

83. For proper removal of tapeworm parasite from the patient body physicians also use:
A) Vaccination
C) Anemia
B) Anima
D) Anema

84. Phylum consisting of "tubule within tube type" structure.
A) Porifera
C) Annelida
B) Nematoda
D) Chordata

85. Severe anemia and mental, physical growth is retarted by:
A) Ascaris lumbricoides
C) Ancyclostoma duodenale
B) Rhabditis
D) Entrerobius

86. _____ consists of sensory papillae:
A) Flatworms
C) Nereis
B) Round worm
D) Stylaria

87. Most of species found in soil, organic matter or water and feces of man or animals _____ is found in:
A) Ascaris
C) Rhabidits
B) Hook worm
D) Pin worm

88. Muscles in which tape worm is embedded in secondary host:
A) Cardiac
C) Smooth
B) Skeletal
D) Involuntary

89. _____ is not true about coelom:
A) Found between body wall and gut
C) Fluid filled
B) Lined by mesoderm
D) Bound internally by cuticle of intestine

90. _____ is not linked by acoelomates:
A) Coelom
C) Mesoderm
B) Mesoderm
D) Coelomic fluid

91. Deuterostomes are characterized by:
A) Indeterminate cleavage
C) Schizocoelous coelom formation
B) Spiral cleavage
D) Mouth formation from blastropore

92. _____ has absence of Rhabditis:
A) Soil
B) Human brain
C) Human / animal faeces
D) Water

93. _____ are breaks down organic matter and are present every where:
A) Roundworm
B) Pinworm
C) Hookworm
D) Segmented worm

94. All of the following are disease vectors for humans except:
A) Honey bee
B) Common housefly
C) Female Anopheles
D) Tse tse fly

95. Which is related to to nematodes.
A) They may cause diseases to pig
B) They may cause diseases to plants
C) cAlso called as roundworms
D) Have a coelom

96. All are true about hook worms excepts:
A) It lives in large intestine
B) Found in Asia, North Africa and Eubrope
C) Sucks the body fluids
D) Hold villi

97. Natural silk is everything except:
A) A protein
B) Obtained from an insect
C) Produced by modified salivary glands
D) Glycolipid in nature

98. _____ is eaten by scavenger insects:
A) Dead matter present on organism
B) Dead plant matter only
C) Dead animals and plants
D) Living animals only

99. Which of the following is an acoelomate is:
A) Liver fluke
B) Pinworm
C) Star fish
D) Earthworm

100. _____ lacks in determinate cleavage:
A) Echinoderms
B) Chordata
C) Mollusca
D) Hemichordata

101. _____ lacks body cavity.
A) Acoelomates
B) Acoelomates and Pseudo Coelomates
C) Pseudo coelomates
D) Coelomates

102. Cause of Malaria is:
A) TseTse fly
B) Female anopheles
C) Plasmodium
D) Trypanosoma

103. A fluid filled cavity which is mesodermal in origin but absent in nematodes is:
A) Coelom
B) Pseudocoelom
C) Gastrocoel
D) Spongocoel

104. Pin worm belongs to _____.
A) Flatworms
B) Ringworms
C) Segmented worms
D) Round worms

105. _____ lives in Bile duct as a parasite.
A) Hook worm
B) Liver fluke
C) Pin worm
D) Planaria

106. Which of the following parasite produces anticoagulant in human body?
A) Ancylostoma duodenale
B) Ascaris lumburicoides
C) Enterobius vermicularis
D) Schistsoma

107. _____ is caused by trypanosome.
A) Yellow fever
C) Sleeping sickness

B) Malaria D) Insomnia.

108. Crops and plants are damaged by _____
A) Flies C) Locusts
B) Lice D) Bugs

109. _____ eats insect leave as food.
A) Man C) Cattle
B) Fish D) sheep

Answers (A):

1.	C	2.	C	3.	D	4.	D	5.	D	6.	D	7	A	8.	A	9.	A	10.	C
11.	C	12.	D	13.	A	14.	D	15.	D	16.	D	17.	B	18.	A	19.	C	20.	C
21.	B	22.	D	23.	B	24.	C	25.	D	26.	A	27.	D	28.	C	29.	A	30.	B
31.	C	32.	B	33.	D	34.	A	35.	C	36.	D	37.	B	38.	B	39.	B	40.	A
41.	D	42.	B	43.	C	44.	D	45.	C	46.	C	47.	D	48.	C	49.	A	50.	B
51.	A	52.	B	53.	B	54.	C	55.	A	56.	C	57.	D	58.	B	59.	C	60.	B
61.	A	62.	A	63.	C	64.	A	65.	A	66.	C	67.	B	68.	D	69.	D	70.	C
71.	C	72.	B	73.	C	74.	A	75.	B	76.	A	77.	C	78.	C	79.	C	80.	C
81.	C	82.	B	83.	D	84.	B	85.	D	86.	B	87.	C	88.	C	89.	C	90.	A
91.	B	92.	B	93.	A	94.	A	95.	C	96.	A	97.	D	98.	C	99.	C	100.	C
101.	B	102.	C	103.	B	104	D	105	B	106.	C	107	C	108	C	109	A		

Solved Exercise

Q NO. 1

STANDING CROPS:

The one kind of plants in a particular area at any given time, mass of organism is also called biomass.

A+B cause disease in animal.

Dragonfly are harmless to people and do not sting or bite.

Q NO. 14

Intermediate Host:

A host which is normally used by parasite in the course of its life cycle in which it may multiply asexually.

Tapeworm

Define Host / Primary Host	Determinate or secondary Host
Man	Pig or Crow
Sexual Stage	Asexual stage

Blood Flukes

Define Host / Primary Host	Secondary Host
	Intermediate Host
Sheep and Cattle	Snail

Unit # 5
HUMAN PHYSIOLOGY

A) **Digestive System:**
Anatomy of digestive system and specify the digestion in:
Oral cavity (role of teeth, tongue, saliva and enzymes)
Stomach (enzymes)
Small intestine
Large intestine

B) **Gas exchange and Transportation:**
Anatomy of respiratory system (nostrils, trachea, lungs)
Explain the term breathing
Discuss lymph, structure of heart, carriage of oxygen and carbon dioxide

C) **Excretion and Osmoregulation:**
Describe the structure of kidney and its functions with respect to homeostasis
What are Kidney problems and cures?
Kidney stones, lithotripsy, kidney transplant, dialysis, renal failure
What do you understand by the term Homeostasis?

D) **Nervous System:**
What is Nervous system and its types?
Explain CNS (Central Nervous System) including forebrain, mid brain, hind brain and spinal cord
Explain PNS (Peripheral Nervous System) and its types (Autonomic and Sympathetic Nervous System)
Neurons (Associative, motor and sensory neuron)
Discuss the Nervous disorders (Parkinson's disease, Epilepsy and Alzheimer's disease)
What do you understand by Biological clock and circadian Rhythms?

E) **Reproduction:**
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)

F) **Support and Movement:**
Explain the role of Human skeleton and skeletal muscles in locomotion
Explain the process of muscle contraction
What is Muscle fatigue, Tetani, Cramps?
Describe the structure and functions of involuntary, voluntary and cardiac muscles

G) **Hormonal control (Endocrine glands):**
What are hormones?
Describe Hypothalamus with its hormones.
Describe Pituitary gland with hormones secreted from its Anterior, Median and Posterior lobe
Describe adrenal gland with its hormones.

What are Islets of Langerhans?
What are the hormones of alimentary canal (Gastrin, secretin)?
The hormones of ovaries and testes

II) **Immunity:**
Immune system and define its components:
Antigen
Antibody (structure of antibody)
Lymphocytes (B and T cells)
What is cell mediated response and humoral immune response?
Types of Immunity:
Active immunity
Passive immunity
What do you mean by vaccination?

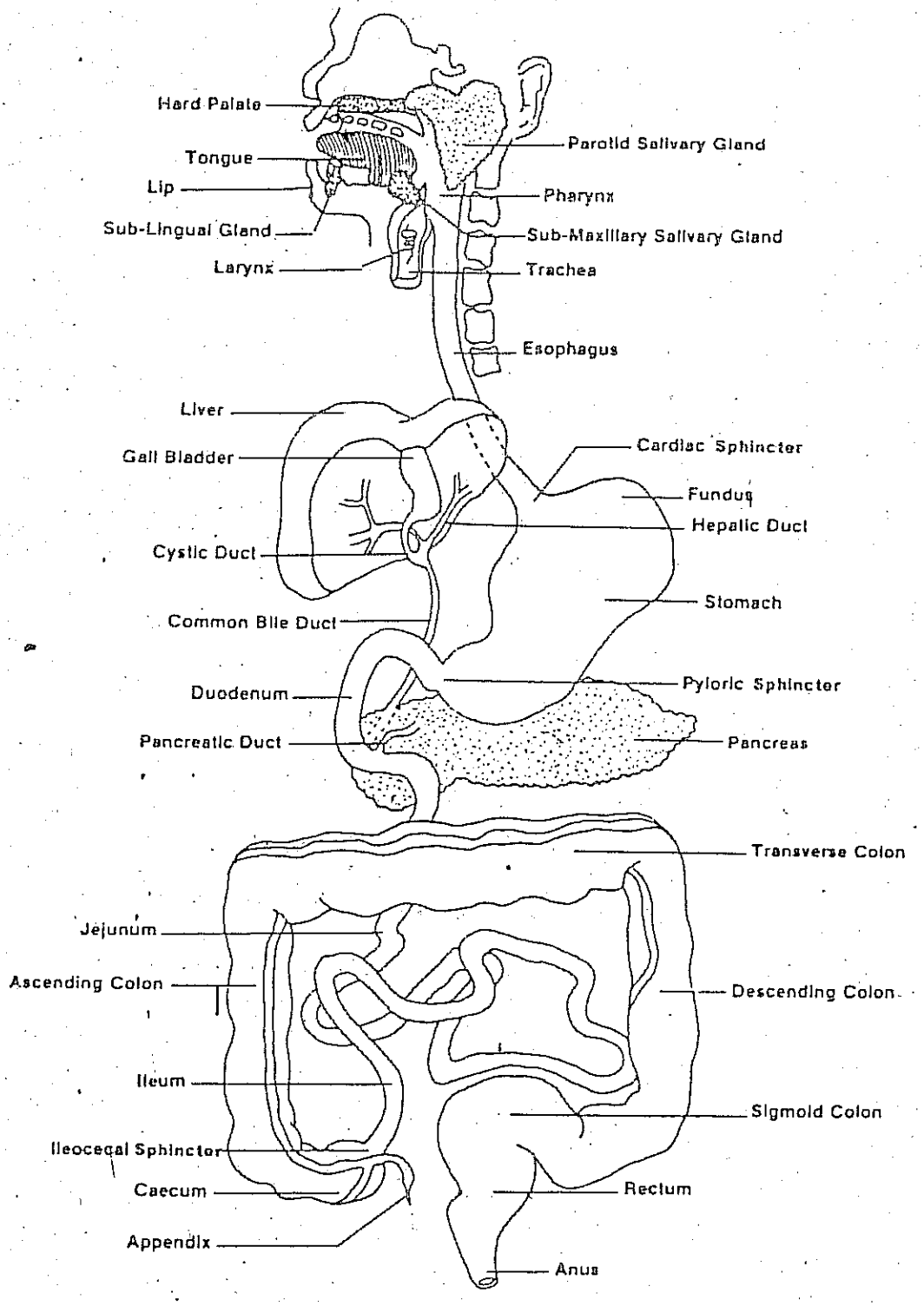
5. HUMAN PHYSIOLOGY

Content

a) Digestive System
b) Gas exchange and Transportation
c) Excretion and Osmoregulation
d) Nervous System
e) Reproduction
f) Support and Movement
g) Hormonal Control (Endocrine Glands)
h) Immunity

A) DIGESTIVE SYSTEM

HUMAN DIGESTIVE SYSTEM



- Digestive system of a man consists of structures extending from oral cavity to anus, including oral cavity, oesophagus, stomach, small intestine (duodenum, jejunum, and ileum) and large intestine (caecum, ascending colon, transverse and descending colon, and rectum).
- Associated glands like salivary glands, liver and pancreas are also components of digestive system.
- Digestion occurs at three sites:
- Oral cavity.
- Stomach
- Small intestine.

DIGESTION IN ORAL CAVITY

It performs four important functions:

- Selection of food.
- Grinding or mastication. (Molars are involved in grinding.)
- Lubrication.
- Digestion.

• How tongue differentiate about different kinds of taste?

Salivary Glands

- There are three pairs of *salivary glands* i.e. sublingual glands (below tongue), submaxillary glands (behind jaws) and parotid glands (in front of ears).
- *Saliva* consists three important components i.e. water & mucous, sodium bicarbonate and amylase (ptyalin).
- **Fresh saliva is alkaline with pH nearly 8, quickly loses carbon dioxide and gets to pH 6.**

Components of Saliva

COMPONENT	ROLE
Water and mucous	Moisten and lubricate food
Sodium bicarbonate	Antiseptic and stabilizes Ph
Ptyalin	Carbohydrate digesting enzyme. It converts starch and glycogen into maltose.

• What is difference between serous and mucus?

- End result of digestion in mouth is small oval lump called **bolus.**
- ***Swallowing*** is transfer of bolus from buccal cavity to oesophagus.
- Beginning of swallowing is voluntary action and then it becomes involuntary.
- ***Peristalsis*** is characteristic movements of digestive tract due to alternate contraction and relaxation of smooth muscles by which food is pushed along the digestive tract.
- ***Antiperistalsis*** are reverse peristaltic movements due to which food is passed from intestine back into stomach and even in mouth. It may lead to vomiting.
- ***Hunger pangs*** are peristaltic contractions caused by low blood glucose level.

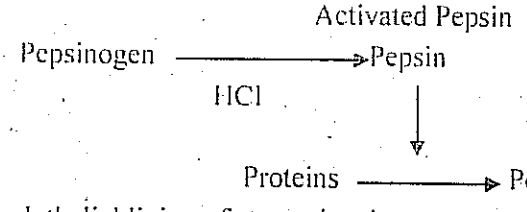
DIGESTION IN STOMACH

- Stomach is an elastic muscular bag involved in digestion of proteins.
- Stomach is situated below the diaphragm on left side of abdominal cavity.
- Point where oesophagus joins stomach is called ***curdiac sphincter***, which is a special closed ring of contracted muscles.
- Point where stomach joins intestine is called ***pyloric sphincter***.
- **Stomach wall** is composed of three principal ***layers*** i.e. outer layer of connective tissue, middle layer of smooth muscles and inner layer (mucosa) of connective tissue with many glands.

Cells of Gastric Glands

CELL	SECRETION	FUNCTION
Mucous cell	Thick Mucous	◦ Covers inside of stomach ◦ Protects stomach wall
Parietal or Oxyntic cells	HCl	◦ Maintains pH from 2-3 ◦ Provide acidic medium for enzyme ◦ Softens food & kills microorganisms ◦ Converts inactive pepsinogen into pepsin
Zymogen (Chief) cells	Pepsinogen	It hydrolyzes proteins into peptones and polypeptides.

- End result of digestion in stomach is formation of semi-fluid mass called ***chyme***.



- From the endothelial lining of stomach, a hormone named gastrin is produced. The stimulus of its secretion is protein content in food. Gastrin stimulates the release of gastric juice.

> ◦ **Smooth muscles are present throughout alimentary canal then why churning occurs only in stomach?**

DIGESTION IN SMALL INTESTINE

- There are three parts of small intestine i.e. duodenum, jejunum and ileum.
- Duodenum is first part of small intestine and is about 20-25 cm long.
- Pancreatic juice is produced by exocrine part of pancreas, which is poured in duodenum by pancreatic duct.

Components of Pancreatic Juice

COMPONENT	ROLE	ACTION
Amylase (amylopsin)	Carbohydrate digesting enzyme	Starch into maltose
Lipase	Fat digesting enzyme	Fats into fatty acids & glycerol
Erypsin	Protein digesting enzyme	Proteins into peptones and polypeptides.
Sodium bicarbonate		Neutralizes chyme, provides alkaline medium

Bile

- Liver secretes ***bile***, which is stored in gall bladder and then transported to duodenum by bile duct.
- ***Bile*** is green, watery fluid containing no enzyme.
- Green colour of bile is due to bile pigments produced due to breakdown of hemoglobin.
- Bile emulsifies fats i.e. converts it into small globules.
- Accumulation of bile pigments in blood causes ***jaundice***.
- ***Secretin*** is hormone produced by action of acidic food on internal mucosa of duodenum. It inhibits production of gastric secretions and promotes production of secretions of liver and pancreas.

◦ How bile is transferred to small intestine?

JEJUNUM AND ILEUM

- Jejunum is about 2.4 meter long and constitutes about 2/5th while ileum 3/5th of small intestine.
- Jejunum and ileum are involved in complete digestion of food.

Enzymes of Intestinal Lining

ENZYMES	SUBSTRATES	PRODUCTS
Amino peptidase	Polypeptides	Dipeptides
Erypsin	Dipeptides	Amino acids
Lipase	Fats	Fatty acids & glycerol
Maltase	Maltose	Glucose
Lactase	Lactose	Glucose & galactose

- Finger-like projections present on inner lining of small intestine are called ***villi*** and they give velvety appearance.
- Each villus has outer covering of epithelial cells, blood capillaries and lacteals.
- ***Microvilli*** are present on villi.
- The digested food products are absorbed into microvilli. The end products of starch and glycogen, which is glucose, and the end product of proteins (Amino acids) are absorbed into blood capillaries of villi. The end products of lipids (which include fatty acids and glycerol) are absorbed into lacteal (a lymphatic vessel).

LARGE INTESTINE

- Large intestine is last part of alimentary canal and divided into caecum, colon and rectum.
- Finger-like appendix arises from caecum. Inflammation of appendix called ***appendicitis***.
- ***Colon*** is longest part of large intestine. It is further divided into ascending, transverse and descending colon.
- Large intestine is involved in absorption of water and salts. Less absorption leads to ***diarrhoea*** and then dehydration. Excessive absorption of water leads to ***constipation***.
- ***Defecation reflex*** is involved in emptying of rectum from faeces. It is consciously inhibited in individuals other than infants.
- Large intestine also harbors a large population of useful bacteria that synthesize some vitamins especially vitamin K, which are absorbed in blood.

◦ What happens if vitamin K is not produced in large intestine?

B) GAS EXCHANGE AND TRANSPORTATION

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, hair, 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 (opening of larynx), lined by mucous membrane	Vocal organ
	Epiglottis: cartilaginous, covering of glottis, muscularly controlled hinge like	Covers glottis during swallowing
	Vocal cords: stretched mucous membrane in two thin edges of fibrous bands	Voice production by vibration through air
Trachea: Tubular, ventral to oesophagus, 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

- What is role of cilia in trachea?

Lungs

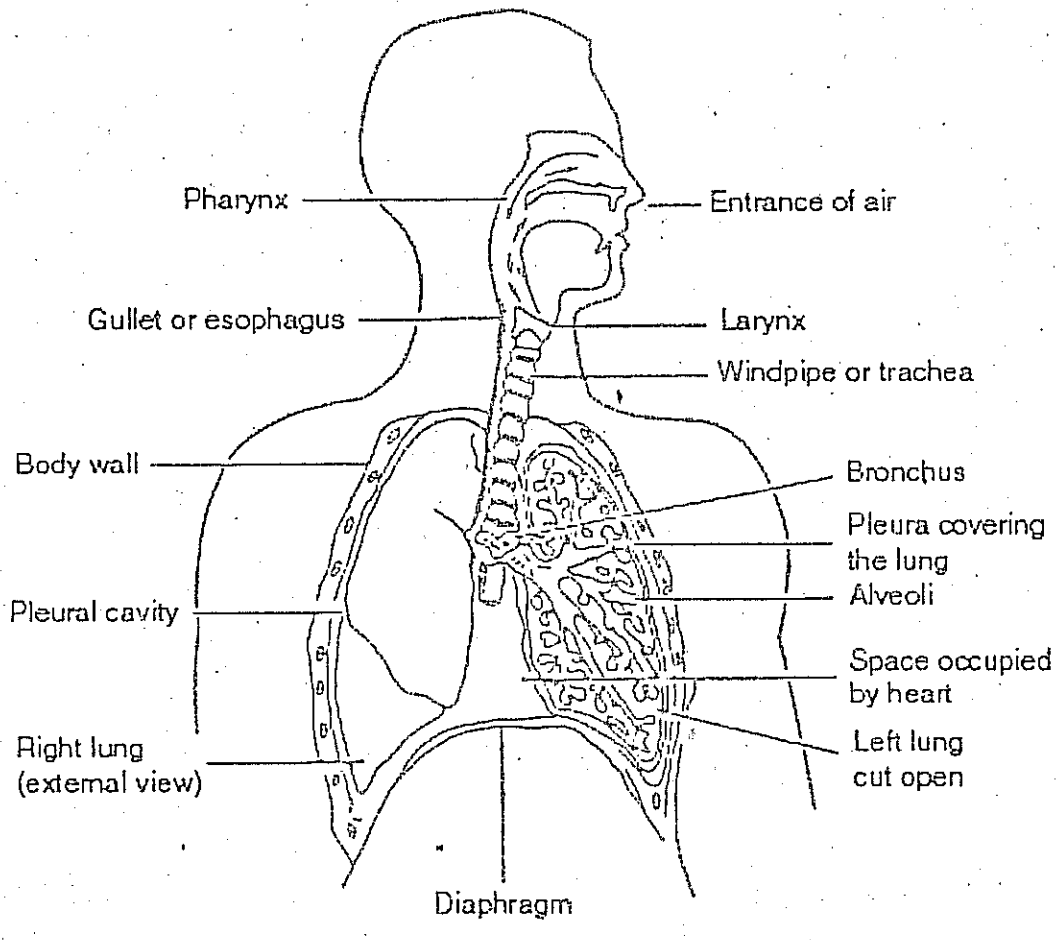
- They are closed sacs that are connected to the outside by the way of trachea and nostrils or mouth.
- *Lungs* are spongy structure and can neither pull the air inside nor expel it outside by themselves.
- Lungs are covered by a double layered thin membranous sacs called *pleura*.

- Is there any difference between right and left lung?

- Floor of chest cavity is called *diaphragm*. It is a sheet of skeletal muscles.
- *Diaphragm* is a doom like muscular structure, when relaxed and is flattened when contracted.
- *Walls* of chest cavity are composed of ribs and intercostal muscles.
- When *intercostal muscles* contract ribs are elevated.
- *Ribs* settle down when intercostals muscle relax.

Surfactant:

- Mixture of lipoproteins secreted by alveolar epithelium
- Forms a layer over the surface of the fluid within the alveoli to reduce surface tension
- In premature infant, respiratory distress syndrome is common due to its deficiency



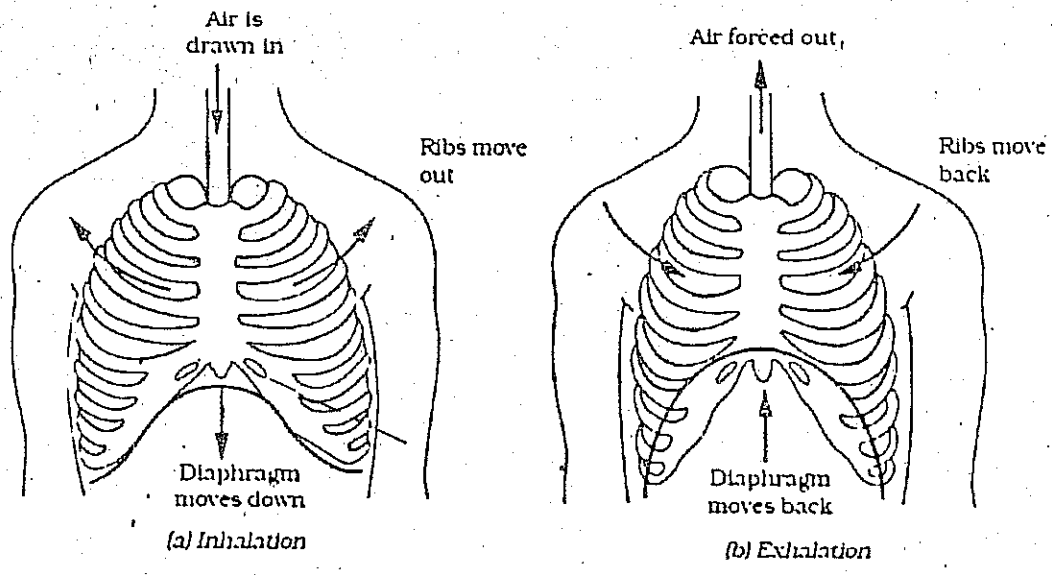
BREATHING

- 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/min during exercise.

PHASES OF BREATHING

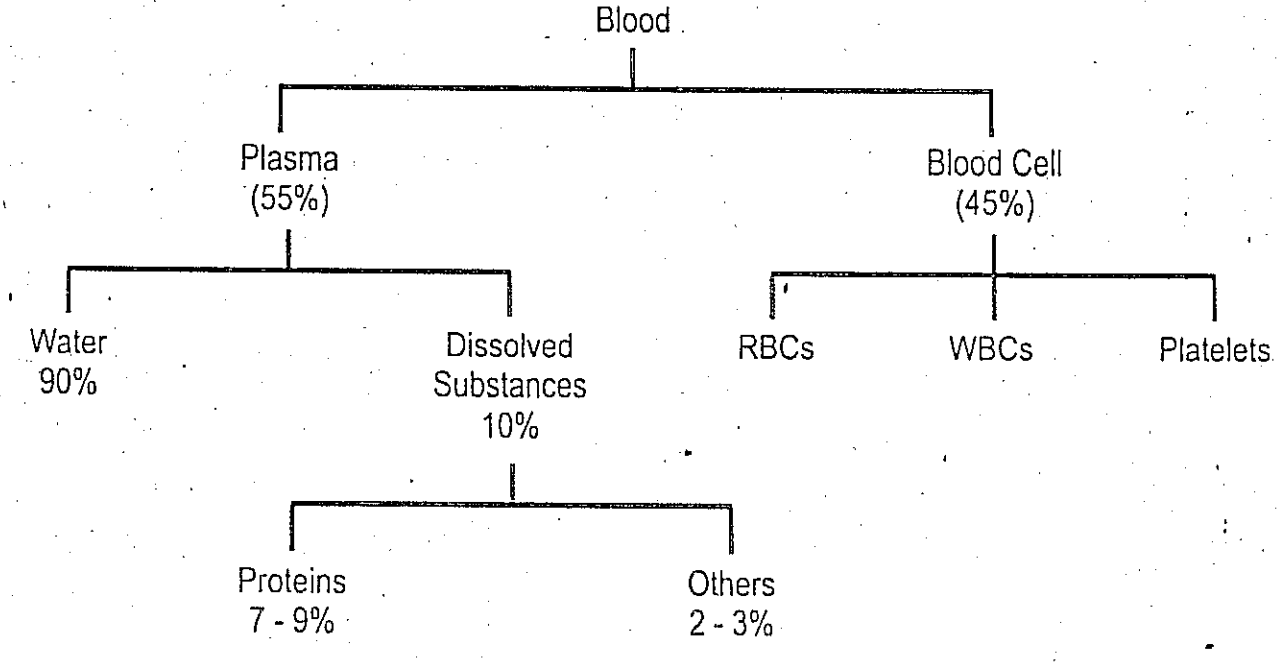
FEATURE	INSPIRATION	EXPIRATION
Other name	Inhalation	Exhalation
Basic Mechanism	Passive expansion of lungs	Passive contraction of lungs
Definition	Taking in of air into the lungs	Removal of air from lungs outside body
Diaphragm	Contracts, moves down, becomes less dome-like	Relaxes, moves up, become more 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

- Why breaking rate is more in children than adults?



BLOOD

- The weight of blood in our body in about $1/12^{th}$ of our body.
- The normal *pH* of blood is 7.4.



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	8μ	Larger than RBC	Small than RBC
Shape	Biconcave	Different	Plate like
Number per mm^3 of blood	5-5.5 million (male), 4-4.5 million (female)	7000-8000	250,000
Structure	Elastic cell membrane, no nucleus, 95% Hb, 5% enzymes, salts, proteins	Nucleus	No nucleus, membrane bounded Cytoplasmic fragments of cells
Life span	4 months (120 days)	Variable	-
Function	Transport of gases	Immunity	Blood clotting

- Enlist organelles present in RBCs

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 phagocyto-sis, form tissue macrophag-es 10-20 hrs after production	Immune response by producing antibodies

LYMPH AND LYMPHATIC SYSTEM

- This system is responsible for the ***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; so 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.
- Masses of connective tissue where lymphocytes are present are called ***lymph nodes***. Lymph nodes are present in neck region, axilla and groin of humans.

- In an average person, about three litres more fluid leaves the blood capillaries than is re-absorbed by them each day.
- After a fatty meal, there fat globules may make up 1% of the lymph.
- *Lacteals* are the branches of lymph capillaries inside villi of intestine.

FUNCTIONS OF LYMPHATIC SYSTEM

- Return of excess extracellular fluid and proteins to the blood.
- Absorption of large fat globules by lacteals of villi.
- Play important role in the defense system of the body. Lymphocytes and macrophages present inside lymph nodes kill bacteria and viruses.

HEART

- The human heart is located in the chest cavity.
- The heart is enclosed in a double membranous sac – the pericardial cavity, which contains the pericardial fluid.
- Pericardium protects the 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.

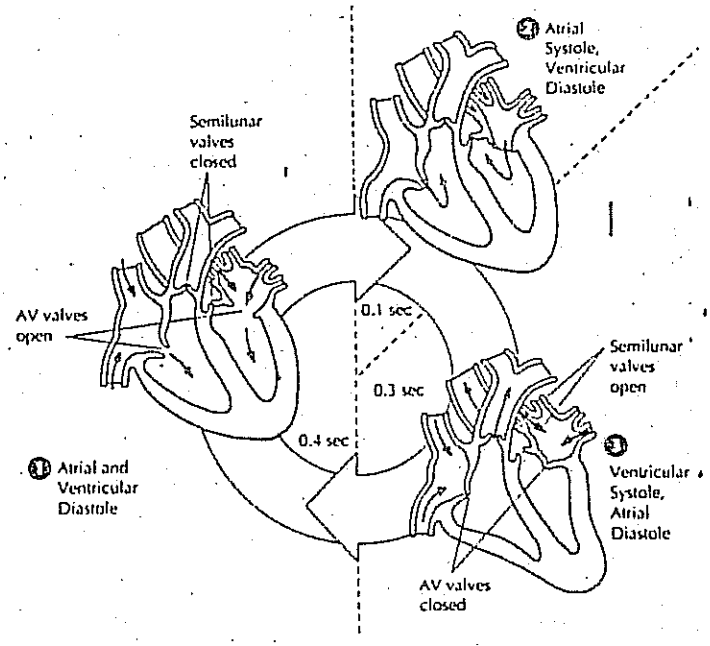
- Why gap junctions are present in heart muscles?

THE CARDIAC CYCLE

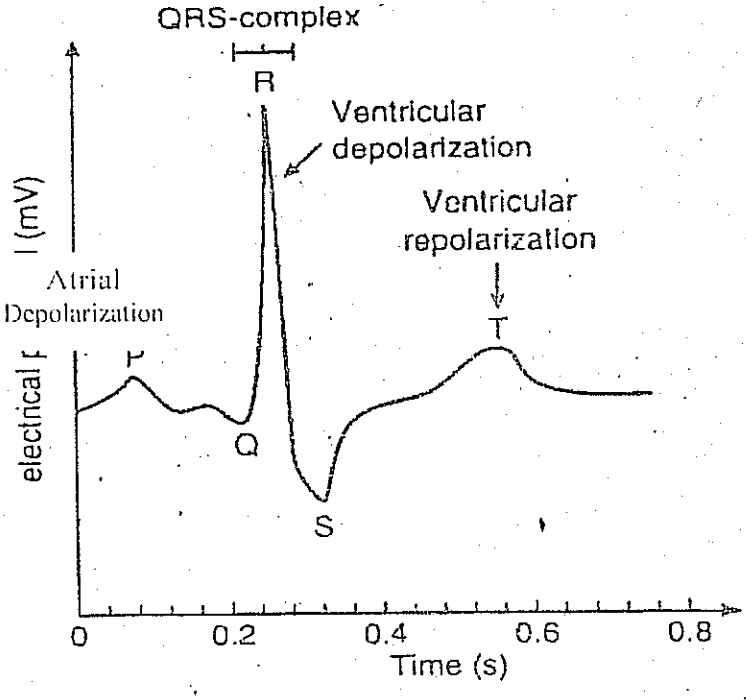
- Heart beat involves three distinct stages i.e. atrial systole, ventricular systole and diastole.
- Relaxed period of heart chambers is called ***diastole***. During this period, atria have more pressure than the ventricles.
- One complete ***heartbeat*** consists of one systole and one diastole and 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-atrial node*** consists of small number of diffusely oriented cardiac fibres, possessing few myofibrils and few nerve endings from the autonomic nervous system.
- 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.



ELECTROCARDIOGRAM



- How ECG can be used as diagnostic test?

TRANSPORT OF OXYGEN

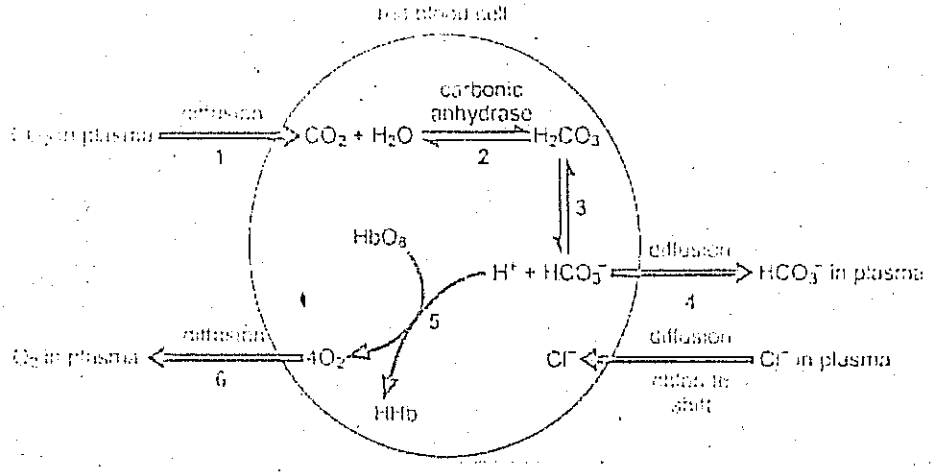
- Most of the oxygen is transported ***through haemoglobin*** while some through plasma in dissolved form.
- ***Maximum capacity*** of haemoglobin to carry oxygen is about 20ml/100ml of blood at sea level.
- ***At 100 mmHg*** oxygen tension, there is 19.6ml/100ml of blood, where it is 98% saturated.
- ***Oxyhaemoglobin*** is unstable at pressure below 60 mmHg.

Factors Affecting O_2 Holding Capacity of Hb

- Increase in temperature decreases capacity.
- Increase in concentration of CO_2 decreases capacity.
- Increase in pH increases capacity.

TRANSPORT OF CARBON DIOXIDE

- Carbon dioxide is more soluble than oxygen.
- *20%* is transported by combining CO_2 with amino group of haemoglobin (***carboxyhaemoglobin***).
- *5%* by ***plasma proteins***
- *70%* as ***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 CO_2/100ml 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.



- With which parts of Hb H^+, O_2, CO_2 & CO combine?

RESPIRATORY PIGMENTS

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

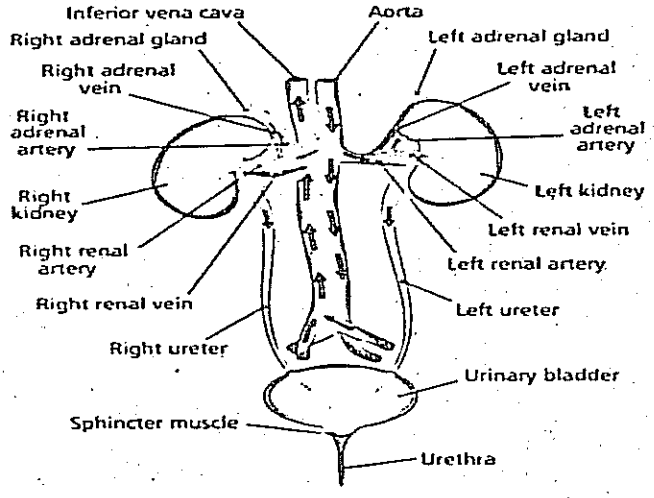
COMPARISON OF HEMOGLOBIN AND MYOGLOBIN

HEMOGLOBIN	MYOGLOBIN
It is found in blood.	It is found in muscles.
It transfers oxygen from lungs to blood and then to tissues.	It transfers oxygen from haemoglobin to aerobic respiring muscle cells.
It cannot store oxygen.	It can store oxygen.
It consists of four polypeptide chains associated with an iron containing ring structure.	It consists of one polypeptide chain associated with an iron containing ring structure.

C) EXCRETION AND OSMOREGULATION

STRUCTURE AND FUNCTIONS OF KIDNEY IN HOMEOSTASIS

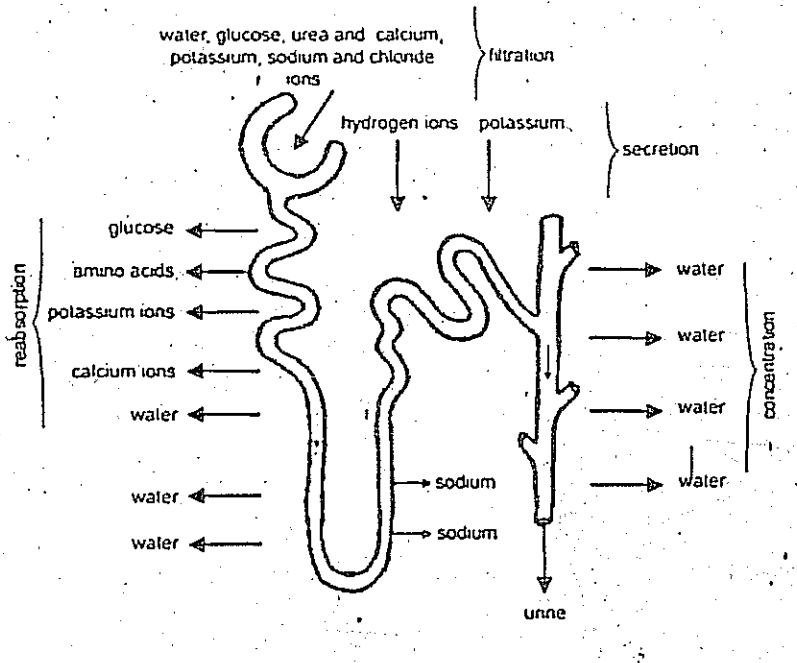
- ***Kidneys*** are not only one of the major excretory organs of humans but also act as an osmoregulator.
- Kidneys account for just *1 %* of the body weight, while they receive 20% of blood supplied with each cardiac output.



- Basic functional unit of a kidney is called ***nephron***.
- Nephrons may be cortical or 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.

Cortical nephron	**Juxtamedullary nephron**
Present in cortex region	Present along the border of cortex and medulla
Having short loop of Henle	Having long loop of Henle
Nearly 80% cortical nephrons present in human kidney	Nearly 20% Juxtamedullary nephrons are present in human kidney
Under normal conditions, they control blood volume	In short supply of water, they retain more water

- Which kidney is slightly lower than other in position & why?



• Which organ in human body receives maximum blood supply?

STRUCTURAL COMPONENTS OF NEPHRON WITH THEIR FUNCTION

Structure	Function
Bowman's capsule	Formation of Bowman's filtrate
Glomerulus	Ball 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.
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, but not to salts.
- 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.
- **Anti diuretic hormone (ADH)** is secreted from posterior pituitary lobe, actively transports water from filtrate in collecting tubule back to kidney.

KIDNEY PROBLEMS AND CURE

• What is literal meaning of ADH?

KIDNEY STONES

- Stone formation in kidney and urinary tract, results in obstruction to flow of urine, increases susceptibility to infection and thus eventually to kidney failure.
- Different types of kidney stones are as follows:

TYPE OF STONE	%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 applied for smaller stones.
- **Lithotripsy** is used for non-surgical removal of kidney stones.
- **Extracorporeal shock wave lithotripsy** is 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.
- **Kidney surgery** is done for larger stones which can't be broken by lithotripsy technique. Direct surgical exposure and removal of stone is done.

- What is meant my extracorporeal?

RENAL FAILURE

- Failure of all the kidney functions i.e., excretory, osmoregulatory, hormonal (secretion of erythropoietin-- 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 urea 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 out side the membrane in another direction.

- Why kidney failure causes Anemia & high blood pressure?

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,

Human Skeleton

1. Axial skeleton
2. Appendicular skeleton

1.AXIAL SKELETON 8

Skull, Sternum, ribs, vertebral column

I. **SKULL** 22

a) Cranium

b) Facial bones

II. **CRNIUM**

Paired		unpaired	
1. Parietal	2	Frontal	1
2. Temporal	2	Occipital	1
		Sphenoid	1
		Ethmoid	1

b) **FACIAL BONES** 14

Paired		Unpaired	
1. Maxilla			2
2. Zygomatic	2		
3. Nasal	2		
4. Lacrimal	2		
5. Palatine	2		
6. Inferior Concha			2

c) **BONES OF THORAX** 25

1. STERNUM	1
2. Ribs	24

I. Pair of Ribs directly attached to sternum 14

II. Pair of Ribs through costal arch 6

III. Pair of Floating Ribs 4

d) **VERTEBRAL COLUMN** 33

Cervical	Thoracic	Lumar	Pelvic
7	12	5	9

2. APPENDICULAR SKELETON 126

PECTORAL GRIDLE

I. Scapula

II. Clavicle

PELVIC GRIDLE

Coxal Bone 1

Ilium

Ischium

Pubis

FORE-LIMB 30

Fore limb consist of

I.	Humerus	2	
II.	Radius and ulna	2	
III.	Carpels	8	
IV.	Metacarpals	5	
V.	Phalanges	14	

HIND LIMB 30

The Hind limb consist of

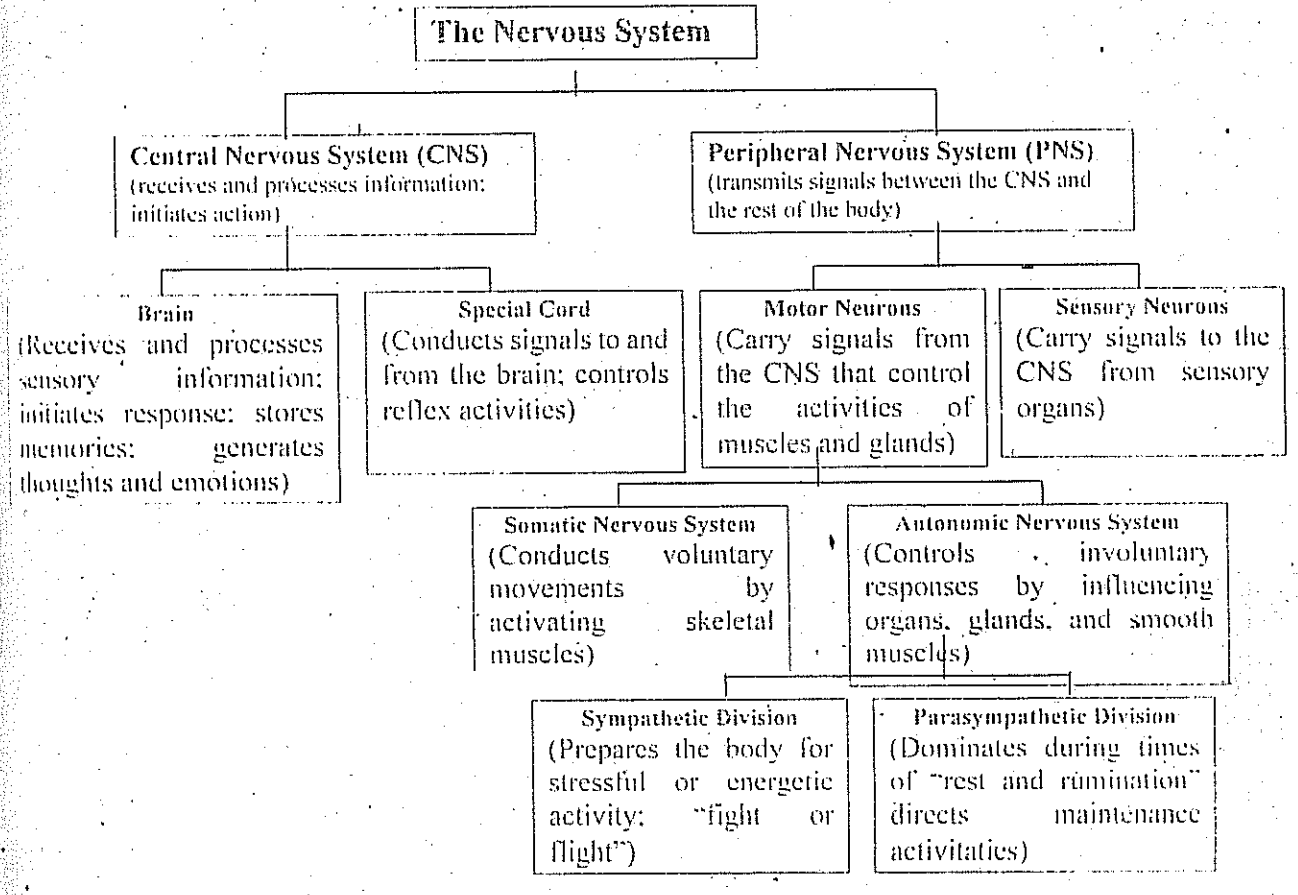
Femur	1	
tibia + Fibula	2	
Tarsals	7	
Metatarsals	5	
phalanges	14	
Patella	1	

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."

D) NERVOUS SYSTEM

NERVOUS SYSTEM AND ITS TYPES



- Write names of 3 layers of meninges and their sequence.

Brain	×	√
Specialized Neurons	×	√
Sense Organs	×	√
Nerves	×	√
Phylum	Cnidaria	Platyhelminthes to Chordata
Example	Hydra	Planaria

CENTRAL NERVOUS SYSTEM

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 surface area)	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 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 form ganglia and the nerves.

- Ganglia are concentrations of cell bodies of neurons.
- The nerves are the bundles of axons 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 heart beat.
- 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.

- **What is difference in length of pre and post-ganglionic fibers in divisions of ANS?**

NEURONS

- It is the basic structural and functional unit of nervous system.
- Neurons can generate and conduct nerve impulses 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.

- **Why neurons are unable to divide?**

Cell Body

- Also called soma, is the chief nutritional part of the cell, synthesizes materials necessary for growth and maintenance of neuron.
- 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 dendrital components.

Axons

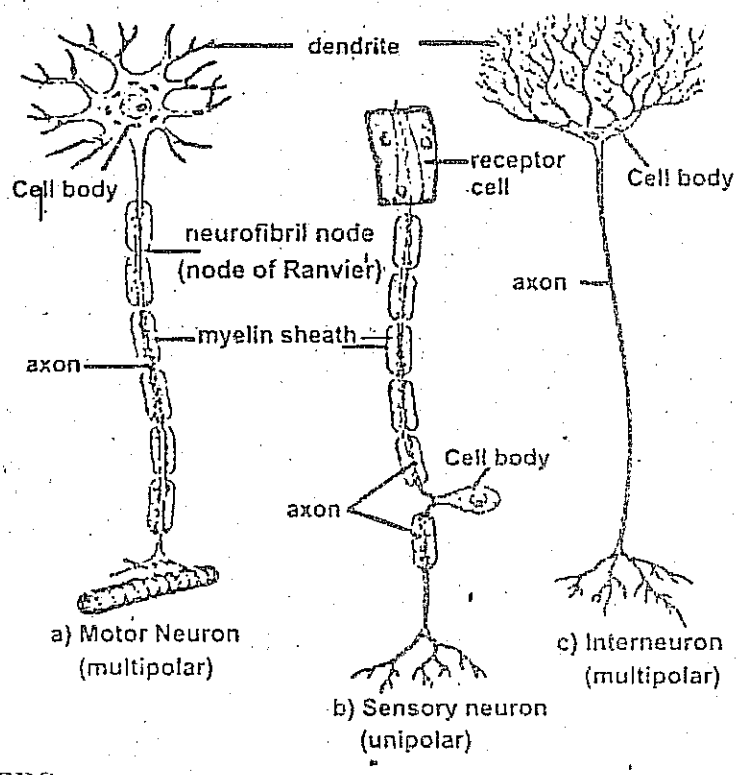
- The processes carrying impulses away from cell body are called axons.
- Cellular organelles like mitochondria, microtubules and neurofibrils, R.E.R. and G.A are present throughout the axoplasm of the neuron.
- Most of the axons are surrounded by protective sheaths called myelin sheath, important for 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

- There are three main types of neurons:
- Sensory neurons carry sensory information from receptors to associative neurons present in CNS.
- Most of them have only one fiber which divides a short distance from cell body into smaller branches.
- Associative (intermediate/ relay) neurons are present in CNS and convey the impulses to motor neurons.
- Motor neurons carry the information from relay neurons to effectors. They have a long axon, which is usually myelinated.



NERVOUS DISORDERS

- ***Parkinson's disease*** is a nervous disorder, characterized by involuntary tremors, diminished motor power and rigidity.
- ***Epilepsy*** is a convulsive disorder of nerves characterized by abrupt transient symptoms of motor, sensory, psychic or autonomic nature, frequently associated with changes in consciousness.
- **Alzheimer's disease** (first described by Alois Alzheimer in 1907) is characterized by decline in brain function.

BIOLOGICAL CLOCK & CIRCADIAN RHYTHMS

- In living things, the behaviour 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.
- 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:

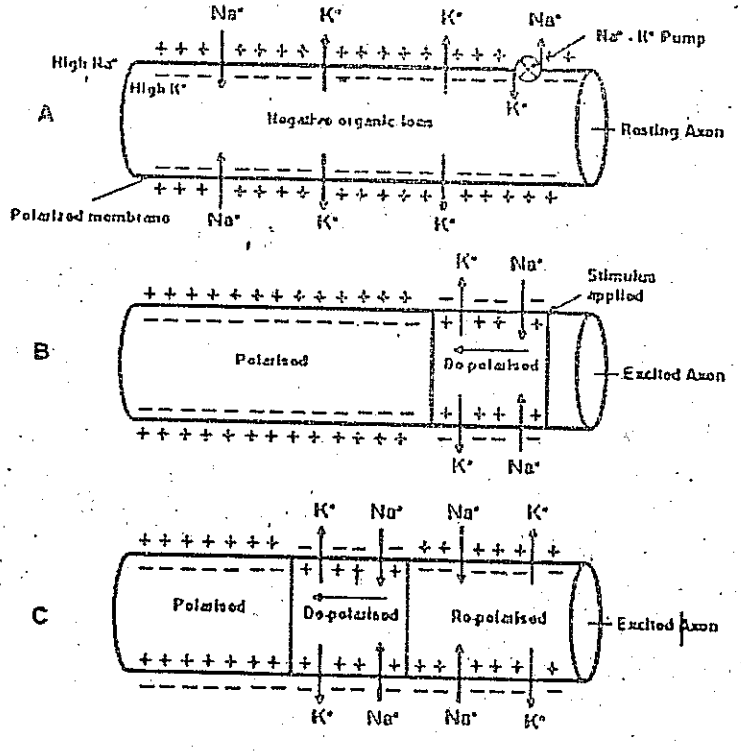
1. There may be direct response to various changes in the external (exogenous) stimuli.
2. There may be an internal (endogenous) rhythm that progresses the organism's behaviour in synchronicity with the exogenous temporal period, particularly a 24 hour or a 365 day period.
3. The synchronization mechanism 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.

- How circadian rhythms are controlled by some Hormone?

NERVE IMPULSE

- Nerve impulse is a wave of electrochemical changes, which travels along the length of neurons involving movement of ions across the membrane.
- The electrical potential that exists across a cell membrane is called membrane potential. This may be a resting membrane potential if recorded across a resting neuronal membrane.



Speed of Nerve Impulse

Normal speed in humans is 100 m/s but can reach upto 120 m/s.

Repolarization

- It is the restoration of resting membrane potential, after the wave of depolarization has passed.
- Results from closure of Na+ gates and opening of K+ gates, without flux of K+ ions, causing repolarization
- Na^+/K^+ pump restore the original ionic gradient and thus the resting potential.
- The whole process of depolarization and repolarization takes about 2- 3 millisececond

Saltatory Impulse.

The jumping of nerve impulse from node to node in myelinated nerve ending is called saltatory impulse.

SYNAPSES

- Cytoplasmic gaps between consecutive neurons are called *synapse.*

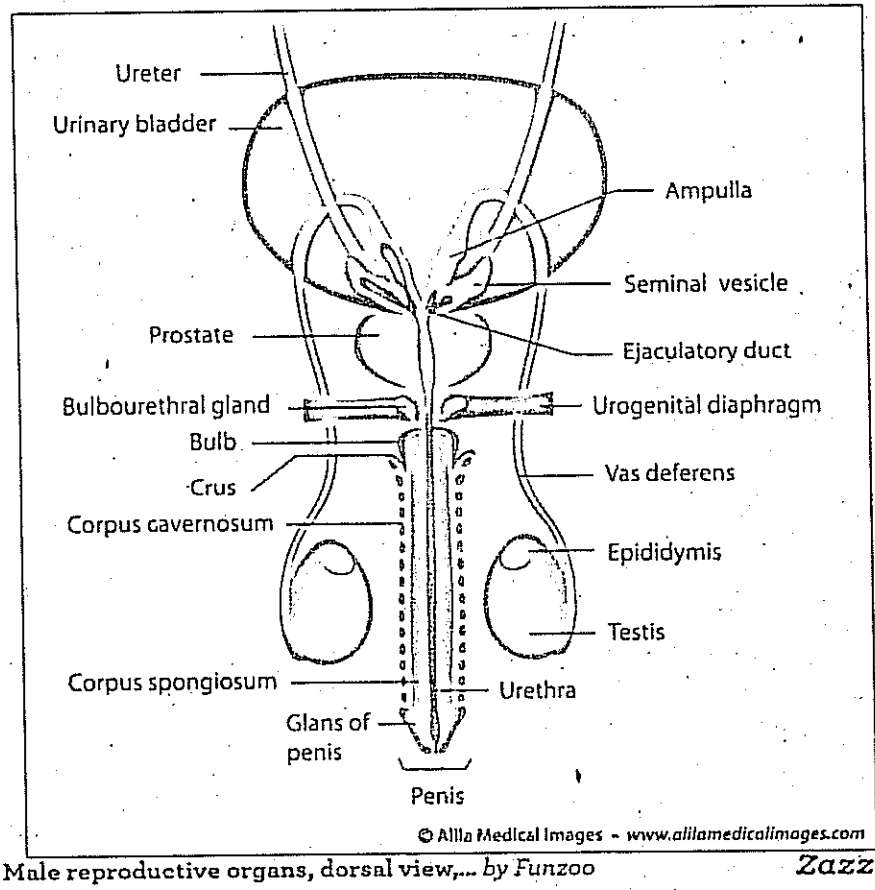
- **Acetycholine** is neurotransmitter for synapse outside CNS while adrenalin, nor-epinephrin, serotonin and dopamine in CNS.

REPRODUCTIVE SYSTEM

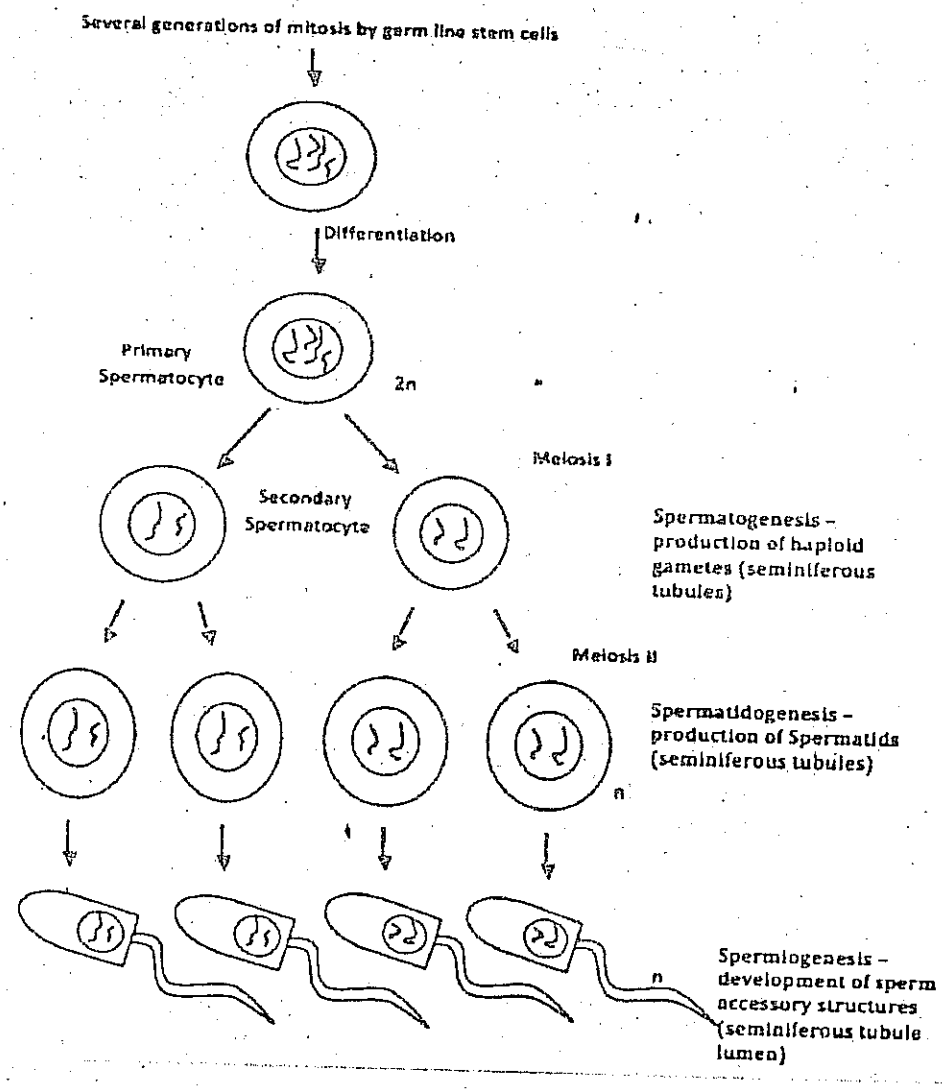
MALE REPRODUCTIVE SYSTEM

- 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.

• What is function of Seminal vesicles and Prostate gland



Male reproductive organs, dorsal view,... by Funzoo Zazzle



- What is average duration of sperm production in Man?

FEMALE REPRODUCTIVE SYSTEM

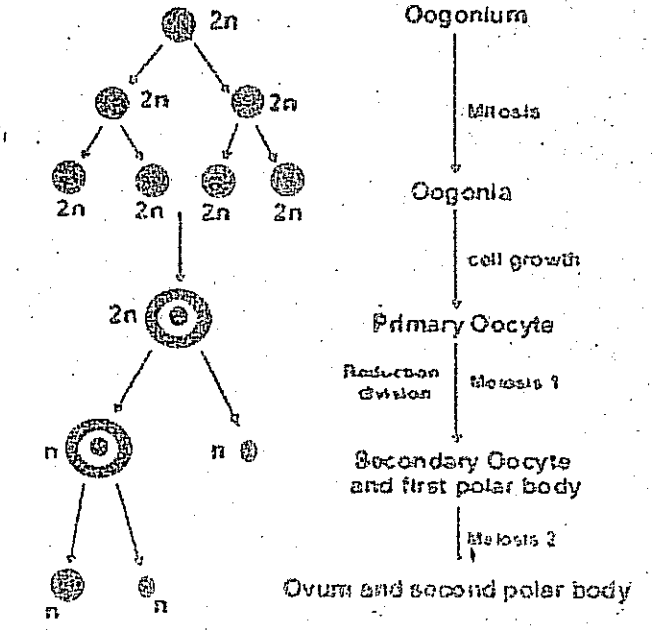
- *Vagina* is external genitalia in female.
- Discharge of ovum from ovary is called ***ovulation.***
- Fertilization of ovum occurs in ***proximal part of oviduct.***
- Oestrous cycle is reproductive cycle in all females' mammals except humans. At this stage female is on heat i.e. exhibits the desire for mating.

- Which hormone Acts on Myometrium?

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.
- ***Leutinizing hormone*** causes ovulation.
- The end or complete stop of menstrual cycle is called ***menupause.***
- ***Menstruation stage*** lasts for 3-7 days

- **What is average life of sperm and egg after release?**



Feature	Male Reproductive System	Female Reproductive System
Gonads	Pair of testes	Pair of ovaries
External Genitilia	Pair of testes & scrotum, copulatory organ	Vagina
Duct system	Seminiferous tubules, epididymis, vas deferens, urethra	Oviduct, uterus, vagina
Gametogenesis	Spermatogonia > Primary spermatocyte > Secondary spermatocyte > Spermatid	Oogonia > Primary oocyte > Secondary oocyte + first polar body > Egg + second polar body

- What are Ulcers? Name some diseases that can cause Ulcers

- How many eggs are produced by a female in her life?

SEXUALLY TRANSMITTED DISEASES

- ***Gonorrhoa*** is caused by gram positive Bacterium *Neisseria gonorrhoeae* and affects mucous membranes of urinogenital tract.
- ***Syphilis*** is caused by spirochaete *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 gonorrhoeae*	*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

F) SUPPORT AND MOVEMENT

HUMAN SKELETON AND ITS ROLE

- Which types of skeletons are present in human?

Major part	Subparts	Bones
Axial Skeleton		
Skull	Cranium (8)	◦ Paired (2): Parietal & Temporal ◦ Unpaired (4): Frontal, Occipital, Sphenoid, Ethmoid.
	Face (14)	◦ Paired (6): Maxilla, Zygomatic, Nasal, Lacrimal, Palatine, Inferior Concha. ◦ Unpaired (2): Mandible, Vomer
Vertebral Column (33 vertebrae)	Cervical	7 vertebrae, neck region, first two atlas and axis
	Thoracic	12 vertebrae
	Lumbar	5 vertebrae
	Pelvic	9 vertebrae, anterior 5 join to form sacrum & posterior 4 join to form coccyx
Rib cage and sternum	12 pairs of ribs	◦ 12 pairs articulate with thoracic vertebrae posteriorly. ◦ Ten pairs connect anteriorly with sternum either directly or through costal cartilages & 2 pairs are of floating ribs (since they don't attach to the sternum).

Appendicular Skeleton	
Pectoral Girdle	Scapula, suprascapula & clavicle (connects scapula with sternum).
Fore limb	1 humerus, A radius & An ulna, 8 carpals, 5 metacarpals & 14 phalanges.
Pelvic Girdle	2 coxal (hip) bones. Each having ilium, ischium & pubis.
Hind limb	1 femur, a tibia & a fibula, 8 tarsals, 5 meta-tarsals & 14 phalanges.

◦ Calculate total number of bones in human Adult

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. Or
- Attachment of muscle on movable bone is called ***insertion***, which thus moves the bone.
- ***Belly*** is the thick part between origin and insertion which contracts.
- ***Ligaments*** are type of a connective tissue that ***attach*** bone to bone and are slightly elastic.
- ***Tendon*** is an example of a connective tissue that anchor the muscle to bone and are non-elastic.

Antagonistics

- At joints, muscles work against each other by contraction. Or
- 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.

Muscles Around Elbow Joint

Muscle	Origin	Insertion	Function
Biceps	By two heads from scapula	Medial surface of radius	Lifts radius (flexion)
Brachialis	Humerus	Ulna	Lifts ulna (flexion)
Brachioradialis	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 ➔ Muscle bundles ➔ Muscle fibers ➔ Myofibrils ➔ Sarcomere (smallest contractile unit of muscle fiber) ➔ Myofilaments (Actin & Myosin)
- Shape: long cylindrical.
- Size: 10 – 100 μm in Diameter.
- Sarcolemma: is the surrounding membrane of muscle fiber.
- Sarcoplasm: is the fluid part of the muscle fiber, is just like cytoplasm except contain large amount of glycogen and O_2 bonding protein called myoglobin that stores O_2
- Nuclei: multinucleated.
- Myofibrills: 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

- These are thick filaments, extending through the entire length of A- band.
- Diameter is 16 nm.
- Each myosin molecule consists of a tail and two globular heads. Tail consists of two long polypeptide chains coiled together. Heads are globular in shape, also called cross bridges, since they link thick 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 filament 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.
- I band → Shorten.
- Z- line → get closer.
- H- zone → disappear.

- **How many steps require energy during muscle contraction and relaxation?**

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.

- **How can you differentiate between perimysium and endomysium?**

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

• How creatine phosphate and ATP correlate during muscle contraction?

MUSCLE FATIGUE, TETANY & CRAMP

Muscle Fatigue

Excess lactic acid accumulation and ionic imbalance causes ***muscle fatigue***, which is a state of physiological inability to contract.

Caused by:

- Relative deficiency of ATP.
- Accumulation of lactic acid ➔ the pH ↓ → muscle to ache.
- Ionic imbalance.

Tetnus

- Infectious disease caused by anaerobic bacterium clostridium tetani.
- Persistent painful spasms of some skeletal muscles.
- Begins with lock jaws.
- Progress to spasm of trunk and limb muscles.
- Usually fatal due to respiratory failure.

Tetany

- It is condition of muscle twitches and convulsions caused by low calcium in blood.
- May be fatal if involves respiratory muscles.

Cramp

- It is tetanic contraction of entire muscle.
- It can last from few seconds to several hours.
- It is caused by:
  - Low blood sugar.
  - Electrolyte depletion
  - Dehydration
  - Irritability of spinal cord and neurons.

Muscles become taut and painful, most common in thigh and hip muscles, usually in night and after exercise.

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-elast collagenous fibers), and thus associated with the movement of bones

G) HORMONAL CONTROL

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 function.
- 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

- How chemical Nature of hormone defines it's mode of action?

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 nerves to the posterior lobe of pituitary to be stored.
- They are released from their storage after receiving nerve impulses from the hypothalamus.

- Elaborate the path way of communication between hypothalamus and pituitary

PITUITARY GLAND & ITS HORMONES

- In man, the pituitary gland or hypophysis cerebri is an ovoid structure about 0.5gm in the adult and is connected to brain through a short stalk (the infundibulum).
- It has three lobes viz, anterior, median and posterior.
- The anterior lobe is often referred to as the master gland, because in addition to producing primary hormones it produces the tropic hormones which control the secretion of hormones in many of the other endocrine glands.

Anterior Lobe

1. **Somatotrophin Hormone (STH)**

- Somatotrophin releasing factor (SRF) is secreted from hypothalamus throughout life.
- When growth has mostly ceased after adolescence, the hormone continues to promote protein synthesis throughout the body.
- If produced in excess during early life, leads to gigantism or if later in life causes the abnormal development of hands, feet, jaws etc (known as acromegaly).
- If there is under secretion, dwarfism results, as well as other symptoms associated with lack of thyroid and adrenal hormone.

2. **Thyroid Stimulating Hormone (TSH)**

- Release of thyrotrophin releasing factor from the hypothalamus is controlled by the levels of thyroxine in the blood.
- In the presence of low levels of thyroxine, there is increasing production of TSH and vice versa.
- It is secreted throughout life but particularly reaches high levels during the periods of rapid growth and development.
- It acts directly on the cells of thyroid gland, increasing both their numbers and secretory activity.

3. **Adrenocorticotrophic Hormone (ACTH)**

- Release of corticotrophin releasing factor from the hypothalamus is controlled by steroid levels in the blood and by direct nervous stimulation of the hypothalamus as a result of stress e.g. cold, heat, pain, fright, infections.
- Excess and deficiency results in disturbance of normal adrenal functions.

4. **Gonadotrophic Hormone (GH)**

- These are follicle stimulating hormone (FSH), luteinising hormone (LH, also called ICSH in male) and prolactin (sometimes inappropriately called luteotrophic hormone, LTH).
- FSH and LH/ICSH share a common hypothalamic releasing factor.
- Prolactin is continuously produced from the pituitary and is inhibited by prolactin inhibiting factor (PIH) from the hypothalamus.
- Prolactin stimulates milk production and acts with LH.
- FSH in females stimulates follicle development and secretion of oestrogens from the ovaries; in males it stimulates development of the germinal epithelium of testis and sperm production.
- LH works with FSH to stimulate oestrogen secretion and rupture of mature follicles to release egg or ovum.
- It also causes the lutenisation of mature follicles and acts synergistically with prolactin to maintain corpus luteum (and hence the progesterone it secretes).
- ICSH in the male stimulates the interstitial cells of the testis to secrete testosterone.

- **Which hormone of Anterior Pituitary is primary?**

Median Lobe

- Median lobe secretes MSH.
- Its inhibition of secretion is controlled by hypothalamus.
- External light governs its secretion.
- More secretion in pregnancy stimulates melanocytes in skin to produce brown pigment, melanin, which darkens the skin.
- Excess MSH is secreted in Addison's disease. One of the symptoms of which is darkening of skin.

- Can you correlate MSH and cortical hormones levels in Addison's disease?

Posterior Lobe

1. **Antidiuretic 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 inspidus, characterized by production of production of large quantities of dilute urine and great thirst.
2. **Oxytocin**
   - Its release is stimulated by distension of cervix, decrease in progesterone level in blood and neural stimuli during parturition and suckling.
   - Primary action is on smooth muscles, particularly in the uterus during child birth and also causes milk ejection from mammary glands.

ADRENAL GLAND & ITS HORMONES

- A pair of adrenal gland is present, one on top of each kidney.
- Its outer layer is called adrenal cortex and inner is adrenal medulla.
- The medulla produces the hormones adrenaline (epinephrine) and noradrenalin (nor-epinephrine).
- The adrenal cortex secretes corticosteroids such as cortisol, corticosterone, aldosterone and androgenic hormones.

Adrenaline & Nor-Adrenaline hormones

- Both adrenaline and nor-adrenaline are secreted in stress situations.
- Essentially adrenaline dilates blood vessels in certain parts of the body such as the skeletal muscles and increases the heart's output.
- Noradrenaline constricts blood vessels but again only in certain areas such as the gut.
- So the effects of the two hormones are synergistic in raising blood pressure.
- Adrenaline and noradrenaline promote the release of glucose from liver glycogen and reinforce the effects of the sympathetic system.
- Rarely found, but in excess, these hormones lead to abnormally high blood pressure.
- In rats whose adrenal medulla has been removed surgically, the ability to withstand any stress situation – such as cold – is markedly diminished.

Cortical Hormones

- The adrenal cortex is active at all times but especially so following shock or stress situation or infections.
- Cortisol is the glucocorticoid and brings about an increase in blood glucose level mainly by its production from protein and antagonizing the action of insulin.
- Corticosterone is both a glucocorticoid and a mineralocorticoid; it increases blood glucose levels and regulate mineral ion balance.
- Aldosterone is the principal mineralo-corticoid and conserves the level of Na^+ in the body by preventing their loss from the kidney tubules.
- The destruction of the adrenal cortex, such as occurs in Addison's disease, will lead to general metabolic disturbance, in particular weakness of muscle action and loss of salts.
- Stress situations, such as cold, which would normally be overcome, lead to collapse and death.
- The reverse of this is found in Cushing's disease where too much cortical hormone is produced. Symptoms are an excessive protein breakdown resulting muscular and bone weakness. The high blood sugar disturbs the metabolism as in diabetes.
- Androgens cause development of the secondary male characteristics.

- Very small amounts of androgens are secreted in both male and female by adrenal glands.
- A tumor on the inner part of the adrenal cortex in a female can cause excess androgens to be produced and thus the development of certain male characteristics. Such cases are very rare.

- **Why both Addison's and Cushing diseases effect muscles?**

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 of 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.
- Failure to produce insulin leads to a condition called diabetes mellitus. 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 seem 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.

HORMONES OF ALIMENTARY CANAL

Gastrin

- It is the hormone produced by mucosa of the pyloric region of the stomach.
- It stimulates the secretion of gastric juice.
- It is produced under the influence of protein food in the stomach after it is partially digested.

Secretin

- It is produced from the duodenum when acid food touches its lining.
- It affects the pancreas to produce and release pancreatic juice and also affects the rate of bile production in the liver.

HORMONES OF OVARIES & TESTES OVARY

Oestrogen

- Oestrogen is secreted by ripening follicles (and in many species by interstitial cells of the ovary) whose development has been initiated by FSH from the pituitary.
- Oestrogen:
  - i) Bring about the development of the secondary sexual characters in the female.
  - ii) Cause thickening of uterine wall.

iii) At a point during the oestrous or menstrual cycle, exert a positive feedback which results in a sharp rise in LH output by the pituitary.
iv) They also aid in healing and repair of uterine wall after menstruation.
v) Under the influence of estrogen, some of the cells of uterine wall become glandular and start secreting proteinaceous secretions which are taken up by the embryo during its early stages of development.

- Deficiency of the sex hormones, for one reason or another, leads in the young of failure to mature sexually and sterility in the adult.

Progesterone

- Produced by the ruptured follicle in response to LH from the pituitary
- **Its functions are:**

i) It inhibits further FSH secretion from the pituitary, thus preventing any more follicles from ripening.
ii) It also affects uterus, causing further thickening and vascularization of its wall and other areas of the female body, preparing it for maintaining the state of pregnancy.
iii) It suppresses ovulation that is why it is a major constituent of birth control pill.

TESTES

- The testes consist of many coiled seminiferous tubules where the spermatozoa develop.
- Between the tubules, regions of interstitial cells produce gonadal hormones called testosterone and 17 β-hydroxytestosterone.
- After the initiation of development, the sex organs in the foetus produce them and their level rises fairly consistently until puberty.
- After puberty the supply of LH (ICSH), and therefore the level of testosterone, remains constant.
- In the foetus, it initiates the development of the sex organs.
- At puberty, it brings about development of the male secondary characteristics and promotes the sex drive.
- The castrated male fails to develop secondary sexual characteristics and his body tends more towards the form of the immature female.

- **How castration will affect an Adult Male?**

H) 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*.

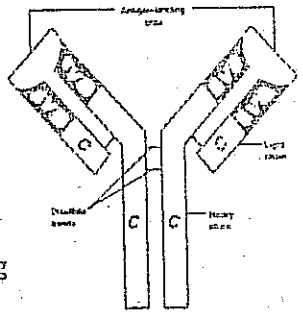
Antigen or immunogen is a foreign substance, often a protein which stimulates the formation of antibodies.

Antibodies are manufactured by B-lymphocytes, then secreted into the lymph and blood where they circulate freely.

- **What is function of constant region of antibody?**

Basic Antibody Structure

- Four amino acid chains linked by disulfide bonds
- Two identical chains are heavy chains
- Two identical chains are light chains
- Arms combine to for unique antigen-binding site for specific antigen



- **if a dog bites a person, what kind of immunization will be preferred to prevent Rabies?**

Types of Immunity

- T-cells recognize antigen and then combat microorganisms and / or effect the rejection of foreign t (in care of tissue transplant). This is called ***cell mediated response***.
- B-cells recognize antigen and form plasma cell clone. These plasma cells synthesize and lit antibodies into the blood plasma and tissue fluid. Here antibodies attach to the surfaces of bacteri speed up there phagocytosis or combine with and neutralize toxins produced by micro-organism producing antitoxins. This is called ***humoral immune response***.
- The use of vaccines, which stimulates the production of antibodies in the body, and making a p immune against the diseases or infection, is called ***active immunity***. But this active immunity has achieved by artificially introducing; antigens in the body, so it is called artificially induced immunity.
- When a person is exposed to an infection (antigen) becomes ill and in most cases survives the immunity, developed against that disease is called ***naturally induced immunity*** or auto immune resp
- In ***passive immunity***, antibodies are injected in the form of antisera to make a person immune aga disease.
- Passive immunity response is immediate, but not long lasting.
- The method of passive immunization is used to combat active infections of tetanus, infectious he rabies, snakebite venom etc.
- In the case of snakebite venom passive immunity is produced by antitoxins so the serum is antivenom serum.

Exercise A) (DIGESTIVE SYSTEM)

1. Cytochromes contain
A) Ca B) Na C) Fe D) Mg

2. Appendix is the extension of which part?
A) Ileum B) Duodenum C) Colon D) Caecum

3. There are ----------sites of digestion in humans:
A) 3 B) 6 C) 8 D) 2

4. The salivary gland found in front of ear:
A) Sublingual B) Submaxillary C) Parotid D) Carotid

5. The glottis is closed by:
A) Contraction of skeletal muscles B) Contraction of a ring of muscles C) Upward movement of larynx D) Both b & c

6. Fresh saliva has a PH of:
A) 8 B) 6 C) 4 D) 2

7. Peristalsis is created by:
A) Contraction of circular muscles
B) Contraction of longitudinal muscles
C) Contraction of both longitudinal & circular muscles
D) None of these

8. Heart burn is associated with:
A) Blockage of coronary arteries
B) A pain of chest muscles
C) Burning sensation in esophagus
D) A respiratory disorder

9. Chief cells are found in:
A) Stomach B) Intestine C) Esophagus D) Caecum

10. Stomach is composed of _____ layers of muscles:
A) 2 B) 3 C) 4 D) 5

11. Duodenum is about _____ in length:
A) 20 – 25 cm B) 30 – 40 cm C) 20 – 30 cm D) 25 – 30 cm

12. Pancreatic amylase is also called:
A) Amylopectin B) Amylopsis C) Amylopsin D) Heparin

13. Pepsin hydrolyzes:
A) Protein polypeptides B) Protein to peptones C) Glycogen to glucose D) Both a & b

14. What secretions are stimulated by secretin:
A) Gastric & hepatic B) Hepatic & pancreatic C) Gastric & pancreatic D) Gastric, hepatic & pancreatic

15. Which contains no enzyme:
A) Saliva B) Gastric juice C) Intestinal Juice D) Bile

16. Action of which enzyme gives amino acids:
A) Erypsin B) Trypsin C) Pepsin D) Ptyalin

17. Proteins combine with fat molecules to form lipoprotein droplet in:
A) Blood capillaries B) Lymph vessels C) Jejunum D) Ileum

18. Goblet cells are present in:
A) Stomach B) Small intestine and large intestine C) Large intestine only D) Pharynx

19. In large intestine bacteria synthesize some vitamins especially:
A) Vitamin A B) Vitamin D C) Vitamin E D) Vitamin K

20. Which is opposite to diarrhea:
A) Vomiting B) Constipation C) Appendicitis D) Food poisoning

21. Improvement of hygiene, use of food softeners & laxatives are measures against:
A) Piles B) Anorexia nervosa C) Obesity D) Dyspepsia

22. It comes with onset of puberty 12-21 years.
A) Anorexia nervosa B) Bulimia Nervosa C) Ulcer D) Both a and b

23. Anus is surrounded by two sphincters:
A) Outer smooth inner striped B) Outer striped inner smooth C) Outer & inner both smooth D) Outer & inner both striped

24. It produces small amount of serous fluid:
A) Pancreas B) Appendix C) Larynx D) Tongue

25. Gastrin is the secretion of:
A) Large intestine B) Gastric endocrine C) ileum D) Duodenum

26. Which animal has large ceacum and appendix?
A) Rabbit B) Mouse C) Cow D) None of these

27. Which animal is not an omnivore:
A) Red fox B) Crow C) Rat D) Tiger

28. In adults Anal sphincters are:
A) Voluntary B) Involuntary C) Both Voluntary & Involuntary D) None

29. Source of gases in GIT is:
A) Swallowed air B) Bacteria C) Blood D) Lipid food

30. Which is not a digestive gland:
A) Liver B) Gastric gland C) Spleen D) Salivary gland

31. Liquid that escapes during defrosting the frozen meat has:
A) Campylobacter B) Clostridium C) Salmonella D) None

32. Decrease in stomach pH is role of:
A) Zymogen cells B) Mucous cells C) Parietal cells D) Endocrine cells

33. Which enzyme covert polypeptides to dipeptides:
A) Trypsin B) Pepsin C) Erypsin D) Amino peptidase

34. Lower _____of small intestine from jejunum is the ileum:
A) Two fourth B) Three fifth C) Three fourth D) Two fifth

35. Trypsinogen is activated by:
A) HCl B) Activated pepsin C) High pH D) Enterokinase

36. Energy is stored in the liver mainly as:
A) Glycogen B) Starch C) Fats D) Cholesterol

37. The utilization of the product of digestion is called:
A) Ingestion B) Digestion C) Absorption D) Assimilation

38. Pepsinogen is activated when it comes into contact with:
A) Already active pepsin B) Pancreatic juice C) Hydrogen D) Base

39. The jejunum is about _____ m in length:
A) 2.4 B) 4.2 C) 4.8 D) 5.2

40. Campylobacter causes:
A) Cardiac paralysis B) Respiratory paralysis C) Food poisoning D) None

41. Digestion of starch takes place in:
A) Stomach and duodenum B) Buccal cavity and duodenum C) Duodenum only D) Buccal cavity and liver

42. The material absorbed in large quantities by the walls of the large intestine is:
A) Glucose B) Alcohol C) Water D) Vitamin C

43. Gall stones are produced by precipitation of:
A) Cholesterol B) Stones C) Tomatoes D) All of above

44. The hardest part of a tooth is:
A) Dentine B) Enamel C) Pulp D) Dental tubules

45. The teeth which are different in shape, size and function are called:
A) Acrodont B) Planrodont C) Homodont D) Heterodont

46. Another term for digestion:
A) Dehydration synthesis B) Hydrolysis C) Absorption D) Assimilation

47. Maximum number of enzymes for digestion are found in:
A) Symbionts B) Carnivores C) Parasites D) Mcrophagous feeders

48. Which of the following enzyme acts efficiently at pH two?
A) Trypsin B) Pepsin C) Ptyalin D) All of above

49. Which is similar to vomiting?
A) Peristalsis B) Antiperistalsis C) Dialysis D) Both a & b

50. Which is an enzyme of saliva?
A) Water B) Mucus C) Sodium bicarbonate D) Amylase

51. Which animalshave large canines?
A) Carnivores B) Detritivores C) Macrophagous feeders D) Omnivores

52. Gastric glands are composed of:
A) Mucous cells B) Oxyntic cells C) Zymogen cells D) All of these

53. Which enzyme acts in small intestine?
A) Lipase B) Amylase C) Trypsin D) All of above

54. Villi and microvilli increase:
A) Absorption B) Assimilation C) Egestion D) Digestion

55. Substrate of lipase is:
A) Fats B) Maltose C) Lactose D) Protein

56. Cause of botulism is:
A) Clostridium B) Salmonella C) Virus D) None

57. Common passage for wind and food is
A) Larynx B) Pharynx C) Oesophagus D) All

58. Oral Cavity Consist Of
A) Teeth B) Tongue C) Palate D) All

59. Human digestive system consists of, except:
A) Liver
B) Salivary glands
C) Spleen
D) Colon

60. All sites of digestion in human digestive system are:
A) Oral cavity, stomach. Small intestine
B) Oral cavity, ileum, stomach
C) Stomach, duodenum, jejunum
D) Stomach, small intestine, colon

61. Cardiac sphincter prevents transfer of food form:
A) Pharynx to trachea
B) Stomach to esophagus
C) Esophagus to stomach
D) Duodenum to stomach

62. Parasympathetic nervous system stimulation increases _____.
A) Peristalsis C) Rate of food flow
B) Heart rate D) Breathing rate

63. Protein digestion is completed in:
A) Stomach C) Rectum
B) Ileum D) Duodenum

64. Inhibition of defecation refence is by:
A) Outer anal sphincter C) Both outer and inner anal sphincters
B) Inner anal sphincter D) Cannot be inhibited

65. The movement of digested products and water across the GI tract epitheluin and into the underlying blood and lymphatic vessels is called:
A) Ingestion C) Assimilation
B) Digestion D) Absorption

66. Maximum absorption of food occurs in:
A) Buccal cavity C) Duodenum
B) Jejunum D) Ileum

67. Chymotrypsin acts on:
A) Proteins in duodenum in alkaline medium C) Proteins in duodenum in acidic medium
B) Starch in duodenum in alkaline medium D) Proteins in stomach in acidic medium

68. Which conversion can be termed as digestion?
A) Soluble food into protoplasm C) Non-diffusible food into diffusible
B) Starch into maltose D) large food particles into smaller ones

69. Food churning in stomac takes place:
A) Inner layer C) Outer layer
B) Middle layer D) Basal layer

70. Which of following is present in respiratory system:
A) Nostrils C) Pharynx
B) Nasal cavities D) Buccal cavity

71. Which is not found in obese patient?
A) Hypercholesterolemia C) Hyperthyrodism
B) Hypertension D) Hyperglycemia

72. Chemical digestion of food begins at:
A) Stomach C) Ileum
B) Oral cavity D) Duodenum

73. Which is not associated with mucus production? Does not involve.
A) Parotid gland C) Sub-mandibular gland
B) Goblet cells D) Sub-lingual gland

74. Direct absorption of food is not helpful in digestion through:
A) Mechanical C) Biochemical
B) Chemical D) Enzymatic

75. Inefficiency of _____ causes heat burning:
A) Cardiac sphincter C) Pyloric sphincter
B) Esophageal sphincter D) Colic sphincter

76. In normal conditions mastication and peristalsis are under:
A) Voluntary control C) Voluntary and involuntary control
B) Involuntary control D) Involuntary and voluntary control

77. **Chymotrysin is present in _____**
A) Bile
B) Pancreatic juice
C) Intestinal juice
D) Gastric juice

78. **Process of digestion shapes in _____.**
A) Buccal cavity
B) Small intestine
C) Stomach
D) Large intestine

79. **An organism which feeds as an active predator would have well developed _____ teeth.**
A) Molars
B) Premolars
C) Incisors
D) Canines

80. **Liver takes part in _____.**
A) Conversion of glucose into glycogen
B) Deamination
C) Conversion of glycogen into glucose
D) All A, B, C

81. **Pancreatic juice have alkaline:**
A) NaCl
B) KOH
C) $NaHCO_3$
D) $NaOH$

82. **Bile and pancreatic juice comes through**
A) A common duct into duodenum
B) Two distinct ducts into duodenum
C) A common duct into ileum
D) Two distinct ducts into ileum

83. **Function of stomach is/are _____.**
A) Breaking food mechanically
B) Partially digesting the food
C) Disinfecting the food
D) All A,B,C

84. **The semi-digested, acidified food that enters duodenum is called:**
A) Chyle
B) Chyme
C) Bile
D) Bolus

85. **Entry of food in stomach mechanically stimulates it to produce a hormone named:**
A) Gastric juiuce
B) Secretin
C) Gastrin
D) Chymotrypsin

86. **_____ is involved in secretion of trypsinogen:**
A) Stomach
B) Intestine
C) Pancreas
D) Liver

87. **Bile secretions are by:**
A) Gall bladder
B) Pancreas
C) Spleen
D) Liver

88. **Intestinal villi _____.**
A) Stimulate peristalsis
B) Prevent antiperistalsis
C) Provide large surface area of absorption
D) Distribute digestive enzymes uniformly

89. **Small intestine _____ secretion further help in digestion.**
A) Bile. Pancreatic juice and intestinal juice .
B) Pancreatic juice, intestinal juice and gastric juice.
C) Bile, pancreatic juice and gastric juice.
D) Bile, gastric juice and saliva.

90. **Protein is digested in _____ by trypsin**
A) Stomach in acidic medium
B) Stomach in alkaline medium
C) Duodenum in acidic medium
D) Duodenum in alkaline medium

91. **Saliva helps to convert**
A) Proteins into amino acids
B) Glycogen into glucose
C) Starch into maltose
D) Fats into vitamins

92. Lacteals are found in _____.
A) Liver C) Villi
B) Pancreas D) Spleen

93. Bile helps in digestion because of presence of _____ in it.
A) Lipase C) Bile pigments
B) Salts D) Necessary enzymes

94. HCl protects epithelial cells in vertebrates because _____
A) HCl is too dilute
B) The epithelial cells are resistant to the action of HCl
C) HCl is neutralized in the stomach
D) The epithelial cells are covered by a mucus layer

95. Conversion of starch into maltose is carried out by:
A) Amylopectin C) Trypsin
B) Amylase D) Both A and B

96. Stoping production _____ and promoting production of _____ is by secretion.
A) Gastric juice, hepatic secretions C) Liver secretions, gastric juice
B) Gastric juice, pepsinogen D) Bile, pepsinogen

97. Oral cavity does not perform:
A) Selection of food C) Lubrication
B) Grinding and mastication D) Digestion of protein

98. Which one of the following is not matching _____.
A) Sublingual – below tongue C) Parotid – in front of ear
B) Sub maxillary – behind jaws D) Lacrimal saliva

99. Enzyme for conversion of polypeptide into dipeptide is:
A) Trypsin C) Maltase
B) Lipase D) Amino peptidase

100. Stomach's inner most layer is:
A) Mucosa C) Muscularis
B) Serosa D) Adventitia

101. Possibility of discontinuous feeding is due to _____.
A) Stomach C) Large intestine of food
B) Small intestine D) Oesophagus

102. Stomach is _____ organ.
A) Endocrine C) Autocrine
B) Exocrine D) Both A and B

103. Area of alimentary canal from where digested food can be picked up by blood:
A) Stomach C) Small intestine
B) Oral cavity D) Large intestine

104. If lactose in milk is not digested in causes _____.
A) Diarrhoea C) Ulcer
B) Constipation D) Vomiting

105. The without any bone part of the body tongue is made of _____.
A) Cartilage and muscles C) Skeletal muscles
B) Muscles and bones D) Smooth muscles

106. Feces does not contain _____.
A) Dead cells C) Lymph
B) Microorganisms D) Cellulose fiber

107. Fearing obesity occurs _____.
A) Anorexia Nervosa C) Piles
B) Bulimia Nervosa D) Ulcer

108. Treatment of Anorexia Nervosa is _____.
A) Anti-inflammatory drugs. C) Vaccines
B) Psychiatric therapy D) Antibiotics

Answers (A):

1.	C	2.	D	3.	A	4.	C	5.	D	6.	A	7	C	8.	B	9.	A	10.	B
11.	A	12.	C	13.	D	14.	B	15.	D	16.	A	17.	B	18.	B	19.	D	20.	B
21.	A	22.	A	23.	B	24.	D	25.	B	26.	C	27.	D	28.	A	29.	B	30.	C
31.	C	32.	C	33.	D	34.	B	35.	D	36.	A	37.	D	38.	A	39.	A	40.	C
41.	B	42.	C	43.	A	44.	B	45.	D	46.	B	47.	B	48.	B	49.	B	50.	D
51.	A	52.	D	53.	D	54.	A	55.	A	56.	A	57.	B	58.	D	59.	C	60.	A
61.	B	62.	A	63.	B	64.	A	65.	D	66.	D	67.	A	68.	C	69.	B	70.	C
71.	C	72.	B	73.	A	74.	A	75.	B	76.	C	77.	B	78.	B	79.	D	80.	D
81.	C	82.	B	83.	D	84.	D	85.	C	86.	D	87.	D	88.	C	89.	A	90.	D
91.	C	92.	C	93	B	94.	D	95.	B	96.	A	97.	D	98.	D	99.	D	100	A
101	A	102	D	103	C	104	A	105	C	106	C	107	A	108	A	109		110	

B) GASEOUS EXCHANGE & TRANSPORTATION

1. What is the functional unit of lungs in mammals:
A) Alveoli B) Air sacs C) Bronchioles D) Parabronchi

2. Carbon dioxide which is carried as Carboxy Haemoglobin:
A) 5% B) 20% C) 85% D) 75%

3. Small amount of carbon dioxide is also carried by corpuscles combined with:
A) Fe B) Mg C) Na D) K

4. Carcinoma is basically a:
A) Benign tumor B) Localized tumor C) Tumor showing metastasis D) Muscle cancer

5. Asthma is allergic reaction to:
A) Cold B) Spores C) Pollutants D) All of these

6. During diving reflex most of the blood goes to:
A) Visceral organs B) Cardiac muscles C) Brain D) Both b & c

7. Which stores oxygen
A) Haemoglobin B) Myglobin C) Biliglobin All Cetaceans

8. This is the process in which oxygen is used to oxidize food to release energy in the form of ATP:
A) Breathing B) Cellular respiration C) Ventilation D) None of these

9. How much air is held by human lungs when they are fully inflated?
A) 3.5litres B) 4.5litres C) 5litres D) 4litres

10. In man which of the following is analogous to spiracles:
A) Trachea B) Bronchus C) Nostrils D) Bronchi

11. Diaphragm is a sheet of:
A) Smooth muscles B) Skeletal C) Cardiac D) Connective tissues

12. Walls of the chest cavity are formed by:
A) Diaphragm B) Ribs C) Intercostal muscles D) Both b & c

13. Amount of CO_2 in arterial blood (pulmonary arteries)
A) 50ml/100ml B) 54 ml/100ml C) 4 ml/100ml D) None of these

14. Affinity of myoglobin to oxygen is _____than/ to haemoglobin:
A) Equal B) Little lower C) Lower D) Higher

15. Haemoglobin increases the oxygen carrying capacity by:
A) 100 times B) 1000times C) 70 times D) 75 times

16. A person suffering from _____ can't oxygenate his blood properly:
A) Asthma B) Pulmonary tuberculosis C) Emphysema D) Lung cancer

17. No. of polypeptides in myoglobin:
A) 2 B) 6 C) 8 D) 1

18. The residual volume of lungs which cannot be expelled:
A) 40% B) 42% C) 30% D) 20%

19. Histamine causes severe contraction of:
A) Bronchi B) Air sacs C) Alveoli D) Bronchioles

20. Carbonic anhydrase is present in:
A) Blood plasma B) R.B.C. C) Lymphocytes D) W.B.C.

21. Respiratory distress syndrome occurs in:
A) Adults B) Childs C) Premature infants D) All of these

22. O_2 affinity of hemoglobin increase when:
A) pH decreases B) Temperature decreases C) CO_2 increases D) None

23. Each nasal cavity is subdivided into passage ways:
A) 3 B) 4 C) 6 D) 2

24. Which is not lined by mucous membrane
A) Glottis B) Pharynx C) Nasal cavity D) None of these

25. Bronchioles are made up of:
A) Longitudinal smooth muscles, B) Circular smooth muscles C) Skeletal muscles D) Striated muscles

26. %age of nitrogen in exhaled air:
A) 21% B) 70% C) 79% D) 4%

27. Extraction & conservation of energy from food molecules during cellular respiration is in the form of:
A) ATP B) ADP C) AMP D) GTP

28. Organismic respiration is also known as:
A) Breathing B) Ventilation C) Both a & b D) None

29. Exchange of gases is carried out only by the process of:
A) Osmosis B) Diffusion C) Active transport D) Cytosis

30. In pulmonary respiration gaseous exchange takes place through:
A) Skin B) Gills C) Lungs D) Both a & b

31. Which of the following plays on important role in swallowing and breathing?
A) Pharynx B) Larynx C) Epiglottis D) All of these

32. Voice box is also known is:
A) Larynx B) Epiglottis C) Pharynx D) Bronchus

33. The floor of the chest is called:
A) Air sac B) Diaphragm C) Larynx D) Peritoneum

34. Respiratory rate in human at rest, is in the range of _____ times per minute:
A) 5 – 10 B) 10 – 15 C) 15 – 20 D) 20 – 25

35. Oxygen absorbed & transported in human at sea level is (100% saturation):
A) 120ml / 15ml B) 100ml / 100ml C) 50ml / 100ml D) 20ml / 100ml

36. Which of following affects oxygen absorption?
A) CO_2 B) Temperature C) pH D) All of these

37. Mycobacterium causes:
A) Asthma B) TB C) Emphysema D) Lung cancer

38. Respiratory pigment present in muscles is:
A) Globin B) Myoglobin C) Haemoglobin D) All of above

39. How much air lungs can hold after expiration:
A) 5 liters B) 4 liters C) 4.5 liters D) 1.5 liters

40. The covering of lungs is called:
A) Pericardium B) Pleural membrane C) Operculum D) Peritoneum

41, The narrowest and most numerous tubes of lungs are termed as:
A) Bronchus B) Alveoli C) Bronchioles D) Hilum

42. The exchange of gases in a mammal takes place at:
A) Trachea B) Bronchioles C) Bronchi D) Alveoli

43. During inspiration, as a result of contraction of muscles attached to it, the diaphragm:
A) Becomes dome-shaped B) Flattens C) Rotates D) Flattens & rotates

44. Oxygen is transported in blood mainly by:
A) Leucocytes B) Erythrocytes C) Thrombocytes D) Blood plasma

45. If the CO_2 concentration in the blood increases, the breathing rate shall:
A) Increase B) Decrease C) Remain constant D) Stop

46. Haemoglobin makes _____ of R.B.C. dry contents:
A): 95% B) 35% C) 50% D) 70%

47. How many Haem groups are present in one molecule of Hb?
A) 4 B) 3 C) 2 D) 1

48. Majority of CO_2 is transported in Blood as:
A) Bicarbonate B) Carboxyhemoglobin C) With myoglobin D) Freely dissolved

49. How many pleural membranes make pleural space?
A) 2 B) 3 C) 4 D) 1

50. Surfactant is mainly composed of:
A) Lipids B) Proteins C) Carbohydrates D) Lipo protein

51. Inorganic ions and salts make up percent of plasma:
A) 55% B) 5 – 7 % C) 45% D) 0.9%

52. Accumulation of excessive fluid is called:
A) Oedema B) Hydration C) Lymphoma D) Anhydrobiosis

53. Which of the followings is involved in protective mechanisms:
A) Lymphocytes B) Monocytes C) Phagocytes D) All of these

54. The thalassaemia is also called:
A) Blood cancer B) Leuceaemia C) Cooley's anemia D) Oedema

55. Which of following is not plasma protein:
A) Albumin B) Globulin C) Prothrombin D) Myosin

56. Histamine is released from:
A) Monocytes B) Lymphocytes C) Basophils D) Neutrophils

57. Monocytes can stay in blood for:
A) 10 – 20 hrs B) 20 – 40 hrs C) 40 – 50 hrs D) 2 – 4 hrs

58. In embryonic life RBCs are produced in:
A) Liver and spleen B) Bone marrow C) Kidney and liver D) Skin

59. Life span of RBCs is:
A) One month B) 2 months C) 3 months D) 4 months

60. Which can serve as precursor of steroid hormone:
A) Lactic acid B) Cholesterol C) Phospholipids D) Glucose

61. All of following are included in granulocytes except:
A) Neutrophills B) Eosinophill C) Basophils D) Monocytes

62. Which of following helps in blood clotting:
A) Platelets B) Fibrinogen C) K^+ D) Both a & b

63. Uncontrolled production of WBCs is called:
A) Thalassaemia B) Leucaemia C) Oedema D) Leucopenia

64. Extracellular oedema may be result of:
A) Renal retention of salt and water B) Leakage of fluid from blood vessels C) Both of these D) Salt stored in cytosol

65. The weight of blood in our body is about _____ of our body:
A) ¼ B) 1/10 C) 1/12 D) 1/16

66. The heart of all amniotes functions as:
A) One chambered B) Two chambered C) Three chambered D) Four chambered

67. Open circulatory system is present in phylum:
A) Arthropods B) Mollusca C) Both a & b D) Chordata

68. Heart receives its nerve supply from which types of nervous system:
A) Sympathetic B) Parasympathetic C) Both of these D) Paratonic

69. The internal lining of blood vessels is called:
A) Endothelium B) Epithelium C) Hypothelium D) Mesothelium

70. Chordae tendinae is present in:
A) Bicuspid valve B) Tricuspid valve C) Both D) Semi- lunar valve

71. Which cell will secret heparin:
A) Neutrophils B) Basophils C) Eosinophils D) All

72. Pulmonary trunk arises from:
A) Right ventricle B) Left ventricle C) Right atrium D) Left atrium

73. Valves are not present in:
A) Arteries B) Veins C) Lymphatic ducts D) All of these

74. Heart's cells receive blood from:
A) Pulmonary artery B) Coronary artery C) Systemic Artery D) Pulmonary Vein bringing blood to left side

75. Highest blood pressure is present in:
A) Vena cava B) Pulmonary vein C) Systemic artery D) Aorta

76. The plug of blood in the vessels that can be dislodged to move some other location is:
A) Blood clot B) Thrombus C) Embolus D) Calculus

77. Damage to the portion of heart muscles may lead to:
A) Necrosis B) Anoxia C) Apoptosis D) Thrombosis

78. Discharge of blood from blood vessels is:
A) Haemorrhage B) Hypertension C) Stroke D) Cardiac infarction

79. Exchange of material b/w tissue and blood takes place at:
A) Arteries B) Veins C) Lymphatics D) Capillaries

80. Echocardio gram is
A) Machine B) Recording C) Process D) All

81. How many phases is involved IN Breathing mechanism:
A) 2 phases
B) 3 phases
C) 4 phases
D) 5 phases

82. Maximum parital pressure of oxygen is in:
A) Inspired air
B) Expired air
C) Alveolar air
D) Oxygenated blood

83. In breathing which play passive role.
A) Lungs
B) Diaphragm
C) Intercoastal muscles
D) Pelura

84. Which is not the facilitate that release O_2 from hemoglobin.
A) High CO_2
B) High temperature
C) High pH
D) High Acidity

85. Pathway of blood that leave the lung
A) Pulmonary Vein – left atrium – Left Ventricle – Aorta
B) Pulmonary artery – Left atrium – Left Ventricle – Aorta
C) Pulmonary Vein – Right atrium – Right ventricle – Aorta
D) Pulmonary artery – Right atrium – Right ventricle – Aorta

86. Which is not occur due to the presence of CO_2 in blood:
A) Increase in rate of breathing
B) Makes blood more acidic
C) Increase respiratory volume
D) Lowers the H^+ concentration in the blood

87. Hemoglobin carries _____ in reduced from:
A) CO_2
B) O_2
C) Hydrogen ion
D) CO

88. Time period for breathing rate during exercise :
A) 15 times per minute
B) 30 times per minute
C) 20 times per minute
D) 25 times per minute

89. Which is in % depending upon external environment is
A) Water vapors
B) Nitrogen
C) Carbon dioxide
D) Oxygen

90. Maximum oxygen carrying capacity found in:
A) Hemoglobin in erythrocyte
B) Myoglobin in sarcoplasm
C) Globulin in blood plasma
D) Bicarbonate ions in RBCs

91. Blood carried most CO_2 in:
A) In red blood cells bound to hemoglobin
B) As dissolved form in the plasma
C) In the plasma as bicarbonate ions
D) Bound to plasma proteins

92. Location of carboxic anhydrase
A) Epithelium of alveoli
B) Endothelium of capillaries
C) RBC's
D) Plasma

93. 100 ml of blood carries _____ oxygen:
A) 20 ml
B) 16 ml
C) 13.4 ml
D) 19.6 ml

94. All are true about hemoglobin expect
A) It is a globular protein
B) Abundantly found in RBC's
C) It contains organic haem group and inorganic Fe^{2+}
D) Each haem in hemoglobin can bind to four O_2 molecules

95. Which one is not bound to hemoglobin in following?
A) HCO_3^-
B) H^+
C) O_2
D) CO_2

96. Form of energy consume in breathing
A) Chemical
B) Potential
C) Physical
D) Mechanical

97. Mark the incorrect statement
A) Inspired air contains more O_2 than exhaled air

B) Amount of N_2 is equal in both inhaled and exhaled air
C) Expired air has 100 times greater CO_2 as inspired air
D) Exhaled air is comparatively dried than inhaled air

98. Cells or tissue have O_2 pressure
A) 158 mmHg
B) 115 mmHg
C) Less than 100 mmHg
D) Less than 60 mmHg

99. Fresh air have oxygen content
A) 200 ml/lit
B) 300 ml/lit
C) 400 ml/lit
D) 500 ml/lit

100. The diaphragm during inspiration.
A) Contracts and relax
B) Relax and rises
C) Contacts and goes downward
D) Relax and goes downward

101. All are functions of lymphatic system except:
A) Transport fat
B) Blood filtration
C) Provide immunity
D) Filtration of urea

102. The most abundant compound in blood plasma is:
A) NaCl
B) Water
C) Albumin
D) Globulin

103. Ventricular systole requires about:
A) 1 sec
B) 0.1 sec
C) 0.8 sec
D) 0.3 sec

104. The heart muscle is nourished by the:
A) Chambers of the heart
B) Right atrium
C) Coronary artery
D) Left atrium

105. Which one is continuation of iliac artery:
A) Renal artery
B) Hepatic artery
C) Femoral artery
D) Intercostal arteries

106. Which one is not related to cardiovascular system:
A) Blood
B) Heart
C) Arteriole
D) Lacteal

107. The waves of ECG shows mainly:
A) Blood pressure
B) Mechanical events
C) Electrical events
D) Chemical events

108. The second heart sound is produced by:
A) Closure of AV valves
B) Opening of AV valves
C) Closure of semilunar valves
D) Opening of semilunar valves

109. The ultimate destination of lymph is:
A) Lymph node
B) Lymph Capillaries
C) Lymphoid organs
D) Subclavian vein

110. More than 70% of colloidal osmotic pressure is due to:
A) Fibrinogen
B) Fibrin
C) Albumin
D) Thrombin

111. After taking too much fat the lymph consist of how much fat globules:
A) 10%
B) 20%
C) 1%
D) 8%

112. Which one filters blood for the purpose other than waste removal:
A) Kidney
B) Spleen
C) Lymph node
D) Liver

113. Correct matching in following is:

		Veins	Capillaries
A)	Blood pressure	Intermediate	Low
B)	Blood flow	Intermediate	Slow
C)	Endothelial cells	No	Yes
D)	Elasticity	No	No

114. Name condition which happens due to H.B.P; when atexy supplied.
A) Hemorrhage
B) Stroke
C) Cerebral infraction
D) Hypertension

115. Which is not the function of blood.
A) Leukemia
B) Wound healing
C) Immunity
D) Buffer action

116. Which blood is carried carotid artery.
A) Deoxygenated blood to brain
B) Oxygenated blood to brain
C) Oxygenated blood to heart
D) Deoxygenated blood to heart

117. Toxic waste broken by liver from hemoglobin called:
A) Bilirubin
B) Cholesterol
C) Ammonia
D) Urea

118. Cause of leukemia which cancer:
A) Excessive formation of red blood corpuscles
B) Excessive growth of a tissue
C) Excessive formation of white blood cells
D) Excessive production of platelets

119. Highest value of voltage in normal person's ECG is:
A) Q
B) R
C) P
D) T

120. Which factor in rich when blood leaving lungs through pulmonary circular
A) Oxygen
B) Carbon dioxide
C) Haemoglobin
D) Number of RBCs

121. Location of tricuspid valve is between in:
A) Sinus venosus and right atrium
B) Right atrium and right ventricle
C) Left ventricle and left atrium
D) Right ventricle and aorta

122. Where blood goes when right ventricle contract:
A) Aorta
B) Pulmonary trunk
C) Pulmonary vein
D) Coronary artery

123. Difference between skeletal muscle and cardiac
A) Control
B) Structure
C) Function
D) All, A, B, C

124. Phagocyte of blood is:
A) Eosinophil
B) Basophil
C) Platelet
D) Neutrophil

125. Name the condition when fatty material deposit inside artery.
A) Arteriosclerosis
B) Atherosclerosis
C) Thrombosis
D) Embolism

126. Which have least blood pressure:
A) Arteries
B) Veins
C) Capillaries
D) Vena cava

127. Which is not characteristic of vein in following:

A) Low blood pressure
B) No pulse detection
C) Valves present
D) Have smaller bore and thin walls

128. Cause of death in western civilization in following
A) Hypertension
B) Thromboembolism
C) Myocardial infarction
D) Cerebral infarction

129. Altered diameter of blood capillary
A) Materials passing through it
B) Greater pressure generating by ventricular systole
C) Direct nervous stimulation or by endogenous chemicals
D) Contraction of muscles

130. Location of baroreceptor is:
A) Wall of aorta
B) Wall of each artery
C) Endothelium capillary
D) At the base of pulmonary vein

131. Which is not correct about cerebral infraction?
A) Symptoms vary depending upon damaged area
B) Thromboembolism is the main cause
C) Neutral tissue death can occur due to accumulation of toxic substances
D) High blood pressure can exaggerate the problem

132. Ventricle construction at short:
A) Cuspid valves are opened
B) Semilunar valves are closed
C) Cuspid valve are opened and semilunar valve are closed
D) Cuspid valve closed and semilunar valve are opened.

133. Location of S.A node
A) Upper and of R.A
B) Inter atrial spectrum
C) Inter ventricle spectrum
D) Atrio-ventricle spectrum

134. Which factor is add for blood clotting:
A) Thrombin
B) Platelets
C) Fibrin
D) Heparin

135. Which is not related to blood clotting
A) Thrombin
B) Platelets
C) Fibrin
D) Heparin

136. Maintain of how lymph is by:
A) Skeletal movements
B) Breathing movements
C) Visceral movements
D) All A, B, C

137. 7% plasma comprises by the group of protein
A) Albumin, keratin, fibrinogen
B) Globulin, keratin, fibrinogen
C) Albumin, globulin, fibrinogen
D) Hemoglobin, keratin, fibrinogen

138. Differentiate between vein and artery
A) Valves to control direction of flow
B) Strong cuticular and muscular valve
C) Narrow lumen
D) Dark pigmented wall

139. Character of myocardium of heart is
A) Smooth and involuntary
B) Striated and involuntary
C) Smooth and voluntary
D) Striated and voluntary

Answer (B):

1.	A	2.	B	3.	D	4.	C	5.	D	6.	D	7.	B	8.	B	9.	C	10.	C
11.	B	12.	D	13.	B	14.	D	15.	D	16.	C	17.	D	18.	C	19.	D	20.	B
21.	C	22.	B	23.	A	24.	B	25.	B	26.	C	27.	A	28.	C	29.	B	30.	C
31.	D	32.	A	33.	B	34.	C	35.	D	36.	D	37	B	38.	B	39.	D	40.	B
41.	C	42.	D	43.	B	44.	D	45.	A	46.	A	47.	D	48.	A	49.	A	50.	D
51.	D	52.	A	53.	C	54.	C	55.	D	56.	C	57.	A	58.	A	59.	D	60.	B
61.	D	62.	D	63.	B	64.	C	65.	C	66.	D	67.	C	68.	C	69.	A	70.	C
71.	B	72.	C	73.	A	74.	B	75.	D	76.	C	77.	A	78.	A	79.	D	80.	B
81.	A	82.	A	83.	A	84.	C	85.	B	86.	C	87.	C	88.	B	89.	A	90.	A
91.	C	92.	C	93.	D	94.	D	95.	A	96.	A	97.	D	98.	D	99.	A	100.	C
101.	C	102.	B	103.	C	104.	B	105.	C	106.	D	107.	C	108.	B	109.	D	110.	C
111.	C	112.	B	113.	B	114.	A	115.	A	116.	B	117.	A	118.	C	119.	B	120	A
121.	B	122.	B	123.	D	124.	D	125.	B	126.	D	127.	D	128.	B	129.	C	130.	A
131.	A	132.	D	133.	A	134.	D	135.	D	136.	D	137.	C	138.	A	139.	B	140.	

C)

Excretion & Osmoregulation

1. The part of kidney through which renal artery, vein and ureter pass into kidney:
A) Renal pelvis B) Hillum C) Hillus D) Medulla

2. The space between renal pyramids is called:
A) Renal space B) Pyramidal interstitium C) Renal column D) Renal pelvis

3. Which has more blood supply:
A) Kidneys B) Liver C) Spleen D) Heart

4. Secretion of which ion occurs in collecting duct:
A) H^+ B) K^+ C) Na^+ D) Cl^-

5. Which process is concerned with pH maintenance of urine and blood:
A) Filtration B) Reabsorption C) Secretion D) All of these

6. Which is not true about diuretics:
A) They increase urine volume B) They are used in hypertension C) They decrease water Reabsorption D) They are used in heart failure

7. The cells which are highly modified for filtration:
A) Podocytes B) Amoebocytes C) Phagocytes D) Thrombocytes

8. Which is the smaller:
A) Right Ureter B) Left Ureter C) Both are same D) Right renal artery

9. If a man drinks two glasses of water there will be immediate:
A) ADH inhibition B) Oxytocin inhibition C) Both D) ADH stimulation

10. Urea requires ———— amount of H_2O as compared to NH_3:
A) $1/5^{th}$ B) $1/10^{th}$ C) $1/100^{th}$ D) Equal

11. Where does the aldosterone act:
A) Proximal tubule B) Distal tubule C) Ascending or thick limb D) Collecting duct

12. All of which are possibly filtered except
A) Glucose B) Ions C) Proteins D) Amino acids

13. Reabsorption of water takes place in all segments except:
A) Proximal convoluted tubule B) Distal convoluted tubule C) Thick limb of loop of Henle D) Descending loop of Henle

14. Which are ancestors of vertebrates:
A) Invertebrates B) Invertebrate chordates C) Enchinoderms D) Protostomes

15. Over _____ of glomerular filtrate is reabsorbed in proximal tubule:
A) 70% B) 40% C) 80% D) 30%

16. Which could be treated as waste in hypotonic environment?
A) Water B) Uric acid C) Ions D) Could be all

17. Which type of kidney stones formation is 15% in occurrence:
A) Ca-oxalates B) Ca-phosphate C) Uric acid D) Cholesterol

18. Which is not true for dialysis:
A) It is for cleaning the blood B) It is used for temporary management C) Hypertonic fluid is used in it D) Dialysis needs to be repeated

19. Most of the homeostasis is maintained by means of:
A) Positive feedback B) Negative feedback C) Precursor activation D) None of these

20. The pH of human urine is:
A) 4 – 4.1 B) 4.2 – 4.5 C) 6 – 7 D) 4.5 – 8.5

21. What kind of kidney is adapted to conserve 99.5% water
A) Human B) Mammalian C) Metanephric D) All of these

22. Incidence of calcium carbonate kind of stones:
A) 70% B) 15% C) 10% D) 0%

23. Anti diuretic hormones act on:
A) Descending loop B) Distal Tubule C) Collecting tubule of vertebrate nephron D) Both B & C

24. This results in decrease in plasma level of urea:
A) Renal failure B) Uremia C) Dialysis D) None of these

25. Amount of diuretic hormone secreted is:
A) Directly proportional to concentration of urine
B) Directly proportional to concentration of solute in urine
C) Inversely proportional to concentration of H_2O in urine
D) All of these

26. Aldosterone addition causes sodium absorption in:
A) Gut B) Kidney C) Bones D) Liver

27. Which dialysis needs to be repeated more frequently?
A) Haemo dialysis B) Peritoneal dialysis C) Both dialysis D) Artificial dialysis

28. In glomerulus blood arrives through:
A) Efferent arteriole B) Afferent arteriole C) Peritubular Capillaries D) None of these

29. Who provides the filtration pressure?
A) Porous wall of glomerulus B) Concentration difference C) Blood pressure D) Blood volume

30. Vasa recta is found in:
A) All nephrons B) Only cortical C) Only medullary D) Juxtamedullary

31. Who assists the kidney in waste disposal:
A) Spleen B) Lymphatic system C) Heart D) Liver

32. What is thick loop of Henle:
A) Ascending B) Descending C) Transverse D) All of these

33. Non surgical removal of kidney stones:
A) Dialysis B) Uremia C) Lithotripsy D) Radiotherapy

34. Elevated levels of nitrogenous waste can cause:
A) Convulsions B) Coma C) Death D) All

35. Metabolism of which produces uric acid:
A) Protein B) Nucleic acid C) Pyrimidine & purine D) All of these

36. Flow of blood would be slow in:
A) Glomerulus B) Renal arteriole C) Peritubular capillaries & vasa Recta D) None of these

37. Nephrons with loop of Henle and glomeruli in outer cortex are:
A) Juxta medullary B) Cortical C) Medullary D) Both a & b

38. 7/8 of all nephrons are:
A) Cortical B) Medullary C) Juxtamedullary D) None of these

39. Flow through single nephron is represented by:
A) 2 capillary beds B) 2 arterioles C) One set of arteriole D) Both b & c

40. Glomerular filtrate has same concentration as that of plasma except:
A) Blood cells B) Glucose C) Amino acids D) Salts

41. 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

42. Substances are reabsorbed in proximal tubule by:
A) Active transport B) Diffusion C) Both D) Osmosis

43. Which is diluting segment of nephron:
A) Distal tubule B) Proximal tubule C) Ascending limb D) Descending limb

44. Which epithelium forms bladder linings
A) Cuboidal B) Columnar always C) Squamous D) Both a and c

45. One kidney receives _____ blood during one circulation
A) 10% B) 20% C) 30% D) 40%

46. Human kidney is
A) Pronephros B) Mesonephros C) Metanephros D) None of these

47. Renal venules:
A) Vasa recta B) Peritubular capillaries C) Both a & b D) Efferent arteriole

48. Dialysis means:
A) Fractionation B) Filtration C) Dissolution D) Centrifugation

49. What can be done in chronic renal failure on permanent basis:
A) Transplant B) Dialysis C) Artificial kidney D) None

50. Kidney as an endocrine gland produces
A) Erythropoietin B) Calcitriol C) Both D) Calcitonin

51. Which acts as semi permeable membrane during peritoneal dialysis:
A) Pleura B) Wall of gut C) Both D) Blood vessels

52. Long tubule of nephridium is for:
A) Filtration and Reabsorption B) Filtration and secretion C) Reabsorption and secretion D) All of these

53. Erythropoietin helps in:
A) Heat production B) R.B.C. Production C) Growth D) W.B.C. formation

54. Calcitriol helps in:
A) Decrease Ca^{2+}ion B) Ca^{2+}elimination via urine C) Removal of $Ca^{2+}$from bone D) Bone formation

55. Which is the sign of renal failure?
A) High blood pressure B) Anemia C) Enzyme denaturation D) All

56. A pair of kidney consists of _____ of functional units:
A) Millions B) Billions C) Thousands D) Trillions

57. Kidney accounts for less than _____ percent of total body weight:
A) 0.5 B) 1 C) 10 D) 20

58. Urethra empties near _____ in females?
A) Ureter B) Vagina C) Uterus D) Clitoris

59. Upper part of ureter where it begins is:
A) Pelvis B) Pyramids C) Hillus D) None of them

60. Kidney stones are formed due to
A) Kidney disorder B) Metabolic disorders C) Cardiac disorders D) None of them

61. Which compels the adaptations in constantly changing external environment?
A) Homeostasis B) Excretion C) Thermoregulation D) None of them

62. Most susceptible component of internal environment is:
A) Water B) Temperature C) Solutes D) All of these

63. Which is central requirement in the maintenance of an organism?
A) Thermoregulation B) Osmoregulation C) Excretion D) Homeostasis

64. Homeostasis means to keep internal environment:
A) At a fixed level B) Within wide range C) Within a narrow range D) All of these

Answers (C):

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

D) Nervous System

1. **Which of these inhibits urination:**
A) Parasympathetic activity B) Sympathetic C) ADH D) Both b & c

2. **Neuron's membrane allows the diffusion of:**
A) Cl^- B) Na^+ C) Large anions D) K^+

3. **Which is concerned with biosynthesis of materials:**
A) Axons B) Dendrites C) Schwan cells D) Soma

4. **Ability to walk is controlled by:**
A) Autonomic nervous system B) Sympathetic N.S. C) Parasympathetic N.S. D) Somatic nervous system

5. **Sensory, motor and associative areas are found in:**
A) Cerebellum B) Medulla C) Cerebrum D) Corpus callosum

6. **Which has thermo receptors:**
A) Hypothalamus B) Skin C) Both A&B D) Thalamus

7. **Bursa of fabricius in bird's cloaca produces secretion which help in maturation of:**
A) Erythrocytes B) Granulocytes C) T – lymphocytes D) B – lymphocytes

8. **Pacinian corpuscles are:**
A) Proprioceptors B) Mechanoreceptors C) Thermoreceptors D) Photoreceptors

9. **Surface area of cerebrum is increased by**
A) carpus callosum B) Cerebral cortex C) Cerebral hemispheres D) All

10. **Pineal gland which controls body rhythms is the part of:**
A) Forebrain B) Mid brain C) Hind brain D) Medulla

11. **Which has center for coordinating reflex responses of visual input:**
A) Cerebral cortex B) Midbrain C) Medulla oblongata D) None of these

12. **Hind brain:**
A) Has three parts B) Is reduced in humans C) Has control over voluntary parts D) Is largest of three parts

13. **Vagus nerve is:**
A) Sensory B) Motor C) Mixed D) Spinal

14. **Which is not important in generating nerve impulse:**
A) Change in membrane permeability B) Change in potential C) Movement of ions D) None of these

15. Which could be called afferent nerves:
A) Autonomic B) Paratonic C) Sympathetic D) Sensory

16. Dementia is sign of:
A) Parkinson B) Epilepsy C) Alzheimer D) All of these

17. The cerebrospinal fluid matches with:
A) Blood B) Coelomic fluid C) Plasma D) Lymph

18. Ganglion is present in
A) CNS B) Outside PNS C) Outside CNS D) Bones

19. The sensations from joints are detected by which receptors:
A) Photoreceptors B) Chemoreceptor C) Thermoreceptors D) Stretch receptors

20. Myelin sheath in central nervous system is formed from cells:
A) Schwann cells B) Soma C) Both D) Dendrites and axons

21. In myelinated nerves fibers, impulse jumps from node to node called:
A) Saltatory conduction B) Ion tropic movement C) Electric impulse D) None

22. Which type of neuron has long dendron:
A) Sensory B) Motor C) Intermediate D) All

23. In dorsal root ganglia, cell bodies of which neurons is present:
A) Motor B) Sensory C) Mixed D) Intermediate

24. Depolarization is caused by:
A) K^+ influx B) Na^+ influx C) Na^+ efflux D) All of these

25. At ATPase Na^+-k^+ pump the no. of binding sites for Na^+
A) 1 B) 2 C) 3 D) 4

26. Under resting condition inner part of cell membrane of neuron is:
A) -vely charged B) +vely charged C) Neutral D) Variable

27. Maximum speed of nerve impulse in humans is:
A) 100 m/sec B) 120 cm/sec C) 100 cm/sec D) 120 m/sec

28. A nerve impulse is passed from one to other neuron by:
A) Jumping movements B) Neurotransmitters C) Hormones D) All

29. Main neurotransmitter for peripheral synapsis is:
A) Acetylcholine B) Dopamine C) Serotonin D) All

30. Differentiation of neurons is present in:
A) Hydra B) Planaria C) Jelly fish D) None of these

31. **Only superficial network of nerves is present in:**
A) Hydra B) Planaria C) Both D) Variable

32. **Two cerebral hemispheres communicate with each other by:**
A) Infundibulum B) Stalk C) Corpus callosum D) Corpus cavernosum

33. **Menstrual cycle in females is under control of:**
A) Limbic system B) Hypothalamus C) Pituitary D) Cerebrum

34. **Reticular formation is the characteristic of:**
A) Midbrain B) Fore brain C) Hind brain D) Pons

35. **Grey matter is composed of:**
A) Cell bodies B) Non-myelinated nerve fibers C) Both D) Myelin

36. **Which is function of cerebral cortex:**
A) Intelligence B) Reasoning C) Judgment D) All

37. **The number of cranial nerves are:**
A) 42 B) 24 C) 36 D) 12

38. **Most ganglionic fibers of sympathetic N.S arise from:**
A) Ends of spinal cord B) mid of spinal cord C) Brain D) All

39. **The size of pupil is decreased by which nervous system part:**
A) Sympathetic B) Parasympathetic C) Paratonic D) Somatic

40. **The symptoms of epilepsy may be of which type:**
A) Sensory B) Motor C) Psychic D) All

41. **Which is characteristic of Parkinson disease:**
A) Tremors B) Rigidity C) Diminished motor activity D) All

42. **In flight and fight situations which is active:**
A) Sympathetic B) Parasympathetic C) Both D) None

43. **Which represents rest and digest:**
A) Parasympathetic B) Sympathetic C) Both D) Somatic nervous system

44. **Which is the sensory relay station (crucial)**
A) Thalamus B) Hypothalamus C) Amygdala D) Cerebrum

45. **Nervous system is provided protection by:**
A) Bones B) Meninges C) CSF D) All

46. Spinal nerves are:
A) 31 pairs B) Mixed C) 62 nerves D) All

47. Centre for the expression of fear and rage is:
A) Amygdala B) Hypothalamus C) Reticular formation D) Medulla

48. Diffused type nervous system is present in:
A) Cockroach B) Planaria C) Hydra D) All of these

49. Activity of GIT is under:
A) Sympathetic N.S. B) Parasympathetic N.S. C) CNS D) Somatic N.S.

50. Cranial nerves are:
A) Sensory B) Motor C) Mixed D) All

51. Outflux of K^+ causes:
A) Depolarization B) Repolarization C) Polarization D) Passive transport

52. The part of nervous system that links the CNS with other body parts:
A) Autonomic nervous system B) Motor system C) Peripheral nervous system D) Sympathetic N.S.

53. The part of brain that controls sexual arousal:
A) Amygdala B) Hippocampus C) Hypothalamus D) Corpus callosum

54. Corpus callosum is:
A) Bundle of neurons B) Bundle of dendrites C) Bundle of axons D) All

55. Co-ordination among movements is controlled by:
A) Amygdala B) Midbrain C) Pons D) Cerebellum

56. Which disease is related with Al^{+3}
A) Parkinson's disease B) Epilepsy C) Alzheimer's disease D) All

57. Brain is covered by how may meningeal layers?
A) 2 B) 3 C) 4 D) 5

58. Dementia is loss of:
A) Appetite B) Memory C) Both A&B D) None

59. Long term memory formation takes place in:
A) Amygdala B) Thalamus C) Hippocampus D) Cerebrum

60. The smallest part of the Brain:
A) Fore brain B) Mid brain C) Hind brain D) Cerebrum

61. Which of following act as effectors:
A) Muscles B) Glands C) Both A&B D) None

62. Nissl's granules are found in:
A) Sensory neurons B) Motor neurons C) Asspciative neurons D) All

63. Measurement of capacity to do electrical work is:
A) Depolarization B) Repolarization C) Electrical polarization D) Electrical potential

64. Inside of the neuronal membrane is -vely charged because of:
A) Proteins B) Organic acids C) Cl- D) All

65. Which branch of motor neuron is more lengthy:
A) Dendrite B) Axon C) Dendron D) Central branch

66. The neurons not involved in reflex actions:
A) Sensory B) Motor C) Associative D) None

67. Active transport occurs in
A) Na+/ K+ gates B) Ribosomes C) Na+/ K+ pump D) all

Answers (D):

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

E) Reproduction

1. Fraternal twins are always:
A) Genetically different B) Sexually different C) Developmentally different D) All of these

2. Egg is enriched with food in:
A) Oviparous B) Viviparous C) Ovoviviparous D) Both a & c

3. Semen is stored in:
A) Seminiferous tubules B) Epdidymis C) Seminal vesicles D) Vas deferens

4. ICSH acts on:
A) Sertoli cells B) Epididymis C) Seminiferous tubules D) Interstitial cells

5. In spermatogenesis primary spermatogonium undergoes:
A) Meiosis I B) Meiosis II C) Mitosis D) Any of these

6. Spermatogenesis in humans involves:
A) Mitosis B) Meiosis C) Post operative modifications D) All of these

7. Rich source of energy in semen is:
A) Glucose B) Fructose C) Lactose D) Sucrose

8. Sertoli cells provide:
A) Protection to sperms B) Liquid medium to sperms C) Nourishment to sperms D) All of these

9. Sperms reach to proximal part of fallopian tube by:
A) Tail movement C) Ciliary movement of oviduct
B) Reverse contractile movement of vaginal and uterine tissues D) All of these

10. Oogenesis in humans is completed:
A) Prior to fertilization B) After fertilization C) Not specific D) None of these

11. In female reproductive cycle at which stage progesterone level is maximum:
A) 1-7 days B) 8-14 days C) 15-27 days D) 22-28 days

12. Fertilization in mammals occurs in the:
A) Ovary B) Fallopian tubes C) Uterus D) Vagina

13. Corpus luteum is responsible for the production of:
A) Progesterone B) FSH C) LH D) Lactogenic hormone

14. Amnion is an extra embryonic membrane around the embryos of:
A) Reptiles, birds and mammals B) Fish & amphibians C) Amphibians & reptiles D) Amphibians & mammals

15. The process of embryonic development which most closely follows after fertilization is:
A) Cleavage B) Metamorphosis C) Blastulation D) Gastrulation

16. Placenta in human is derived from the:
A) Maternal tissues B) Foetal tissues C) Both a & b D) None of these

17. Release of ovum from the ovary:
A) Fertilization B) Ovulation C) Implantation D) Birth

18. The oviducts:
A) Lead from the ovary to uterus C) Surrounds the uterus
B) Lead from uterus to exterior D) Lie outside the abdomen

19. Which of the following tubes are not found in females:
A) Epididymis B) Fallopian tubes C) Vas deferens D) Both A & C

20. *Neisseria gonorrhoeae* causes:
A) Genital herpes B) Syphilis C) AIDS D) Gonorrhoea

21. Human menstrual cycle repeats after:
A) 3 - 7 days B) 3 - 32 days C) 28 days D) 280 days

22. From beginning of 3rd month of pregnancy the human embryo referred to as:
A) Foetus B) Neonate C) Placenta D) Young one

23. Which one of following hormones induces labour pains:
A) Lactogen B) LTH C) LH D) Oxytocin

24. The fetus is protected from the mechanical damage by:
A) Placenta B) Amniotic fluid C) Clitoris D) None

25. A reproductive cycle found in female mammals except in human:
A) Oestrous cycle B) Menstrual cycle C) Ovarian cycle D) Uterine cycle

26. All of the following may be concerned as secondary sex characteristics of the male except:
A) Increase in sex drive
B) External genitalia
C) Pattern of hair and beard growth
D) Development of a deeper voice

27. During gamete production in human female, the cell which under goes reduction divisions (meiosis) eventually produces ----------functional egg(s):
A) 4 B) 8 C) 1 D) Around 100

28. Common method of sexual reproduction is:
A) Tissue culturing B) Identical twins C) Cloning D) None of these

29. The 1st day of menstrual cycle is the one on which:
A) Bleeding starts B) Bleeding stops C) Ovulation occurs D) None of these

30. The main duct of male reproductive tract is:
A) Seminiferous tubules B) Vas deferens C) Epididymis D) Urethra

31. All of the following hormones are produced by placenta except:
A) Gonadotropins B) Progesterone C) Chorionic gonadotropin D) Estrogen

32. Reproduction is a means through which:
A) Species tend to maintain themselves
B) May be source of genetic variations
C) Is essential for population to survive
D) All of these

33. During the process of meiosis in the human male, four functional sperms are produced while in the female one functional egg and 3 ..... are the end result.
A) Zygotes B) Follicles C) Polar bodies (polocytes) D) Blastocysts

34. Ovulation occurs due to which hormone:
A) FSH B) Prolactin C) Progesterone D) LH

35. Uterus opens into vagina through:
A) Urethra B) Fallopian tubes C) Cervix D) Ovaries

36. The menstruation lasts for usually:
A) 2-5 days B) 2-4 days C) 3 – 5 days D) 3 – 7 days

37. Most major organs are formed by _____ week of pregnancy:
A) 8th B) 10th C) 12th D) 20th

38. After birth, bleeding is controlled by:

A) Clotting B) Smooth muscles C) Feotal corticosteroids D) Balloon

39. During birth which is stimulus for progesterone inhibition:

A) Maternal ACTH B) Foetal ACTH C) Foetal corticosteroids D) FSH + LH

40. Total gestation period in humans is:

A) 28 days B) 28 weeks C) 280 weeks D) 280 days

41. Genital soreness and ulcers are caused by:

A) Neisseria gonorthoea B) Treponema pallidum C) Herpes simplex type II D) HIV

42. Syphilis caused by:

A) Treponema pallidum B) Neisseria gonorthoea C) Herpes virus type II D) None of these

43. Human are:

A) Craniates B) Amniotes C) Tetrapods D) All of these

44. Menstrual cycle begins:

A) At the end of menstruation B) At the beginning of menstruation C) At the mid of menstruations D) At proliferation

45. Which are gonadotrophins:

A) FSH and LH B) Progesterone and oestrogen C) Androgens and testosterone D) Inhibin and androgen

46. What is meant by 'fertilized egg getting conceived':

A) Aborted B) Removed C) Moved to uterus D) Implanted

47. Secondary oocyte is:

A) Diploid B) Haploid C) Product of meiosis II D) Both a & c

48. FSH is produced:

A) Only in males B) Only in females C) In both males and females D) Helps only in spermatogenesis

49. Which can affect female reproductive cycle:

A) Malnutrition B) Emotional stresses C) Hormones D) All of these

50. Which provide more protection to their young ones:

A) Amphibians B) Birds C) Oviparous animals D) Mammals

51. Which duct is urogenital:
A) Vas deferens B) Ureter C) Ejaculatory D) Urethra

52. Vagina:
A) Has a single opening B) Two openings C) 3 openings D) None of these

53. Which acts as birth canal:
A) Uterus B) Oviduct C) Vagina D) Ovary

54. Top skin of penis is called:
A) Didymis B) Prepuce C) Erectile part D) Scrotum

55. Number of sperm ducts in males:
A) 1 B) 2 C) 3 D) 4

56. Which helps in secretion of LH:
A) Ovulation B) Decrease in FSH C) Increase in oestrogen D) Both b & c

57. Desire to mate in mammal females at the time of ovulation is referred to as:
A) Estrus B) Menstruation C) Heat D) Both a & c

58. Internal linings of uterus are called:
A) Myometrium B) Perimetrium C) Endometrium D) None of these

59. Secretary phase lasts from _____ to _____ days of menstrual cycle:
A) 13 , 27 B) 4, 13 C) 1 , 3 D) 14 ,16

60. Triplet means:
A) Identical twins B) Three twins C) Parental twins D) Fraternal twins

61. Process of birth is initiated by
A) Foetus B) Mother C) Environment D) All of these

62. Sperm is kept neutralized by ____ gland?
A) Cowper's B) seminal vesicle C) prostate D) all of these

63. **Which one of the following is a haploid except:**
A) Secondary spermatocyte
B) Primary spermatocyte
C) Spermatid
D) Spermatozoa

64. **Layer of uterus that is Estrogen acts on:**
A) Myometrium
B) Myometrium
C) Endometrium
D) Perimetrium

65. **Which one of the following causes growth and development of germinal epithelium of the testes?**
A) Inhibin
B) Testosterone
C) LH
D) FSH

66. **Placental hormone that prepares mammary glands for lactation is:**
A) Estrogen
B) Lactogen
C) LTH
D) Progesterone

67. **During estrous cycle, estrogen production:**
A) Prepares the uterus for conception
B) Does not prepares uterus for conception either partly or fully
C) Prepares uterus for conception partly
D) Gest stopped permanently before conception

68. **Immune system is destroyed in:**
A) AIDS
B) Gonorrhea
C) Herpes simplex
D) Syphilis

69. **Enlargement of mammary glands at the onset of puberty is under the control of:**
A) Estrogen
B) Oxytocin
C) Prolactin
D) Placental lactogen

70. **Syphilis is caused by:**
A) Bacillus
B) Coccus
C) Coccobacillus
D) Spirochete

71. **During _____ estrogen action is maximum:**
A) Secretary phase
B) Proliferative phase
C) Luteal phase
D) Menstrual phase

72. **Which –ve feedback stimulates LH production:**
A) Decrease in FSH
B) Increase in estrogen
C) Both A & B
D) Increase in progesterone

73. **Hormone repaired from couupus interm**
A) Estrogen
B) Progesterone
C) Inhibin
D) Oxytocin

74. **Acidic nature of semen is due to?**
A) Bulbourethral gland
B) Seminal vesicles
C) Prostate gland
D) Cowper's gland

75. **Structure that undergoes meiosis I is:**
A) Primary spermatocyte
B) Secondary spermatocyte
C) Spermatid
D) Spermatogonium

76. **Fertilization occurs in:**
A) Proximal part of cervix
B) Proximal part of uterine tube
C) Distal part of oviduct
D) Distal part of cervix

77. **Spermatozoa is formed by:**
A) Mitosis
B) Mitosis I
C) Differentiation
D) Meiosis 2

78. **Storage house of sperm is:**
A) Urethra
B) Epididymis
C) Seminal vesicles
D) Prostate gland

79. **Food is provides by _____ to sperm:**
A) Bulbourethral gland
B) Seminal vesicles
C) Prostate gland
D) Seminiferous tubules

80. **Human sperm and ova show similarities in following respect:**
A) Both are haploid
B) Both having approximately same size
C) Both carry identical genetic makeup
D) Both possess good mobility

81. **All of the following contributes to the formation of semen except:**
A) Seminal vesicles
B) Prostate gland
C) Cowper's gland
D) Vas deferens

82. **Start of oogenesis is _____.**
A) At puberty
B) Before puberty
C) Before birth
D) After puberty

83. **Progesterone is produced in _____.**
A) Menstruation phase
B) Prolifereative phase
C) Luteal phase
D) Both A and B

84. **Individual can survive without _____.**
A) Excretion
B) Reproduction
C) Respiration
D) Metabolism

85. **Corpus luteum is actually _____.**
A) Primary follicle
B) Graffian follicle
C) Ruptured follicle
D) Corpus albican

86. **Spermatogenesis occurs in _____.**
A) Leydig cells
B) Sertoli cells
C) Granulosa cells
D) Seminiferous tubules

87. **Which one of the following structure is least differentiated?**
A) Spermatid
B) Spermatogonium
C) Spermatocyte
D) Spermatozoa

88. **Which causes debris of blood, during menses?**
A) Mesometrium
B) Myometrrium
C) Endometrium
D) Perimetrium

89. **Correct sequence of events in spermatogenesis is/are:**
A) Spermatogonia > Spermatids > Spermatocytes > Spermatozoa
B) Primary spermatocytes > Secondary spermatocytes > Spermatozoa
C) Spermatogonia > Primary spermatocyte > Secondary spermatocytes > Spermatid
D) Secondary spermatocyte > Spermatozoa > Spermatogonia > Spermatids

90. **Ovulation is due to _____.**
A) Peak level of FSH
B) Peak level of progesterone
C) Peak level of LH
D) Peak level of Oxytocin

91. **Days of ovulation are in between**
A) 11^{th} to 14^{th} day
B) 14^{th} to 16^{th} day
C) Immediately after menstruation
D) 6^{th} to 9^{th} day

92. **Embryo is implanted in _____.**
A) Endometrium
B) Mesometrium
C) Myometrium
D) Perimetrium

93. **Ovulation day of a 45 day menstrual cycle is _____.**
A) 14^{th}
B) 40^{th}
C) 31^{st}
D) 20^{th}

94. **Uterus opens into vagina through a narrow entrance that is:**
A) Cervix
B) Fallopian tube
C) Birth canal
D) Uterine body

95. **Endometrium shows maximum thickness during**
A) Start of proliferative phase
B) End of proliferative phase
C) Secretary phase
D) Menstruation

96. **First polar body is formed as a result of:**
A) Differentiation of oocyte
B) Mitotic cell division in spermatocytes
C) 1^{st} meiotic division in oocyte
D) 2^{nd} meiotic division in oocyte

97. **Define menstruation as a discharge of _____.**
A) Blood. Water and cellular debris
B) Lymph. Mucous and solid debris
C) Blood; mucous and cellular debris
D) Lymph. Blood and cellular debris

98. **Egg of mammal's releases in _____.**
A) Body cavity
B) Uterus
C) Fallopian tube
D) Graffian follicle

99. **Select the odd one _____.**
A) Testes
B) Bulbourethral gland
C) Seminal vesicles
D) Prostate gland

100. **High level of estrogen favour _____.**
A) Ovulation has occurred
B) Ovulation is occurring
C) Ovulation is about to occur
D) Ovulation cannot occur

101. **Parasitic STD is _____.**
A) Gonorrhea and syphilis
B) AIDS and Syphilis
C) Genital herpes and Herpes simplex
D) AIDS and Genital herpes

102. **Which is the iluction of buliodfkdsf gland.**
A) Sperm maturation
B) Sperm production
C) Neutralization of urethra
D) Semen formation

103. **How many spermatozoa and ova are produced from 50 primary spermatocytes and 50 primary oocytes?**
A) 200 spermatozoa and 100 ova
B) 100 spermatozoa and 50 ova
C) 200 spermatozoa and 50 ova
D) 100 spermatozoa and 100 ova

104. **Motile and completely mature cell with flagellum is:**
A) Spermatid
B) Spermatogonium
C) Spermatocyte
D) Spermatozoa

105. **Which two hormones exhibit positive feedback during normal menstrual cycle.**
A) FSH and Inhibin
B) Estrogen and progesterone
C) Estrogen and LH
D) Progesterone and GnRH

106. **Complete oogenis occurs in _____.**
A) Uterine tube
B) Uterus
C) Ovary
D) Graffian follicle

107. **Transmission of Neisseria gonorrhea is best described by which one of the following method.?**
A) Oro-fecal route
B) Unsafe sex
C) Vector borne
D) Droplet infection

108. **What will be the effect on the duration of menstrual cycle if one of the ovaries is removed?**
A) Duration will be more than 28 days
B) Duration will be less than 28 days
C) Menstrual cycle stops completely
D) Menstrual cycle remains unaffected

109. **Causes of multiple births are _____.**
A) There is an excess of sperms
B) Menstruation occurs
C) Over activity of pituitary occurs
D) Multiple ovulations occurs

110. **Periods lasts for _____.**
A) 3 – 7 days
B) 1 – 3 days
C) 20 - 22 days
D) 15 – 17 days

111. **Which one of the following stops ovulation during pregnancy?**
A) Estrogen
B) Thyroxin
C) Progesterone
D) LTH

112. **In young females, ovulation occur at _____ day of reproductive cycle.**
A) 18
B) 28
C) 14
D) 24

113. **Sertoli cells are under control of:**
A) LH
B) ICSH
C) FSH
D) Testosterone

114. **In a menstrual cycle of 24 days, which of the following will be day of ovulation?**
A) 14th day
B) 10th day
C) 7th day
D) 6th day

115. **FSH is produced?**

A) Only in males
B) Only females
C) In both sexes
D) Promote ovulation

116. **Spermatogenesis is a:**
A) Periodic process
B) Cyclic process
C) Continuous process
D) Discontinuous process

117. **It is the correct passage of sperms from testes to outside.**
A) Seminiferous tubules → Sperm duct → Epididymis → Urethra
B) Sperm duct → Seminiferous tubule → Epididymis → Urethra
C) Epididymis → Seminiferous tubule → Sperm duct → Urethra
D) Seminiferous tubules → Epididymis → Sperm duct → Urethra

118. **Epididymis is:**
A) Distal part of vas deferens
B) Proximal part of vas deferens
C) Proximal part of oviduct
D) Distal part of oviduct

119. **Primary spermatocytes are produced after _____.**
A) Meiosis I
B) Mitosis
C) Meiosis II
D) Differentiation

120. **Select the odd ones in males.**
A) Epididymis – sperms storage
B) Urethra – carries urine only
C) Scrotum – thermoregulation
D) Testes – testosterone production

121. **Oviduct in females opens into:**
A) Fallopian tube
B) Ovary
C) Uterus
D) Cervix

122. **Egg is released during.**
A) Anaphase I
B) Prophase I
C) Metaphase I
D) Metaphase II

123. **Excess LH favors:**
A) oogenesis
B) Ovulation
C) Fertilization
D) Menstruation

124. **The end or complete stop of the menstrual cycle is called:**
A) Oestrous
B) Menstruation
C) Menopause
D) Menarche

125. **Release of FSH and development of primary follicles starts:**
A) During foetal development
B) Before birth
C) Right after birth
D) At puberty

126. **Follicular atresia is the degeneration of:**
A) Primary oocyte
B) Primary follicles
C) 1st polar body
D) 2nd polar body

127. **First step of female reproductive cycle is:**
A) Proliferative phase
B) Menstrual phase
C) Ovulatory phase
D) Secretory phase

128. **FSH in males acts on:**
A) Germinal epithelium
B) Interstitial cells
C) Simple epithelium
D) Germinal endothelium

129. **Process of spermatogenesis in males continuously occurs from:**
A) Birth to death
B) Birth to puberty
C) Puberty to adulthood
D) Puberty to death

130. **Distal part of seminferon tubules are _____.**
A) Epididymis
B) Vas deferens
C) Urinary bladder
D) Urethra

131. **All are female glands except _____.**
A) Prostate and seminal vesicle
C) Seminal vesicles and corpus luteum

B) Prostate and corpus luteum
D) Prostate and placenta

132. **Menstrual cycle is generally of:**
A) 21 days
B) 28 days
C) 30 days
D) 40 days

133. **Secondary oocyte is released at _____ in menstrual cycle**
A) Beginning
B) Midway
C) End
D) Any time

134. **Sperm and egg fuses at:**
A) Uterus
B) Vagina
C) Fallopian tube
D) Urethra

135. **Primary oocyte is:**
A) Diploid
B) Haploid
C) Polyploid
D) Monoploid

136. **Number of sperm produced by 1 spermatocyte _____.**
A) 4
B) 8
C) 2
D) 1

137. **Select the odd one regarding level of progesterone.**
A) Gestation
B) Pregnancy
C) Luteal phase
D) Menstruation

138. **Phase of ovulation is:**
A) Luteal
B) Menstrual
C) Proliferative
D) Secretory

139. **Main feature of spermatogenesis**
A) Mitosis
B) Meiosis
C) Metamorphosis
D) Both A & B

140. **Which of the following does not occur between 15-28 days of menstrual cycle?**
A) Proliferative phase
B) Luteal phase
C) Secretory phase
D) Menstrual phase

141. **Withdrawal of which hormone is the immediate cause of menstruation?**
A) Lastrogen
B) FSH
C) FSH–LH
D) Progesterone

142. **Sperm duct is:**
A) Epididymis
B) Vas deferens
C) Seminiferous tubules
D) Vasa efferentia

143. **Division in germinal epithelium directly produces:**
A) Spermatids
B) Spermatocytes
C) Sperms
D) Spermatogonia

144. **Which of the following lightly convoluted duct:**
A) Vas deferens
B) Epididymis
C) Sperm duct
D) Urinogenital duct

145. **Which of the following is a nourishing cell?**
A) Prostate gland
B) Bulbo-urethral gland
C) Sertoli cells
D) Epididymis

146. **Hormones are important for:**
A) Production of sperms
B) Ejaculation of sperms
C) Transfer of sperms to female body
D) Nutrition sperms

147. **Primary oocyte is converted into _____ polar bodies.**
A) 1
B) 3
C) 2
D) 4

148. **LH in males mainly acts on:**
A) Epididymis
C) Sertoli cells

B) Interstitial cells D) Germinal epithelium

149. **Zygote is implanted in:**
A) Oviduct C) Uterine tube
B) Uterus D) Cervix

150. **The ovulation occurs after day _____ in average human menstrual cycle.**
A) 8 C) 13
B) 25 D) 17

151. **Which of the following is released from ovaries and acts on endometrium?**
A) FSH C) Estrogen
B) LH D) All, A,B,C

152. **Select odd regarding eye infection.**
A) Syphilis C) Genital herpes
B) AIDS D) Gonorrhea

153. **The bacteria that infect the mucous membranes of urinogenital tract is:**
A) Clostridium tetani C) Treponema pallidum
B) Neisseria gonorrhea D) Staphylococcus aureus

154. **Ulcers in reproductive tracts are formed in:**
A) Gonorrhea C) Syphilis
B) AIDS D) Genital herpes

155. **Genital herpes is caused by Herpes simplex type:**
A) 1 C) 2
B) 3 D) 4

156. **All STDs can be. Which cannot be cured?**
A) Gonorrhea C) Syphilis
B) Genital Herpes D) AIDS

157. **Constant phase of menstrual cycle is:**
A) Proliferative C) Luteal
B) Menstrual D) All A,B,C

158. **Sertoli cells are found:**
A) Outside of seminiferous tubules C) Inside seminiferous tubules
B) In Vas deferens D) in interstitium

159. **All are female parts excepts:**
A) Urethra C) Vagina
B) Cervix D) Uterus

160. **Structure that is formed at the site of ovulation.**
A) Placenta C) Graafian follicle
B) Corpus luteum D) Primary Oocyte

Answers (E) :

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

Solved Exercise

Q NO. 140

Urine cycle is a series of cyclic change in the endometrium of the uterus. It consist of three phases:

1) **Menstrual Phase**,
In this phase the endometrium break causing discharge of blood. It extends from 1-3 days.

2) **Proliferative Phase**
In this phase endometrium rebuilt itself. It extends from 4-13 days.

3) **Secretary Phase**
In this phase the endometrium prepare for implantation of embryo. It extends from 14-28 days.

F) Support & 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) Striated 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. Which is true for movement of hinge joint:
A) Axis is parallel to movement direction C) Axis is antiparallel to movement direction
B) Axis is perpendicular to movement direction D) Both are at an angle of 120^0

6. Which one is strongest bone of face:
A) Sphenoid B) Palatine C) Mandible D) Maxilla

7. Which is called beauty bone in woman:
A) Sternum B) Clavicle C) Pelvis D) Maxilla

8. In adults, the no. of vertebrae are:
A) 26 B) 25 C) 30 D) 33

9. Elbow joint is of what variety:
A) Synovial B) Ball and socket C) Pivot D) Condylar

10. The joints of skull bones are called:
A) Skull joints B) Cranial joints C) Sutures D) Synovials

11. Number of cranial bones:
A) 11 B) 12 C) 8 D) 6

12. Which one of following contains tropomyosin:
A) Myosin Filaments B) Actin filaments C) Z-lines D) H-line

13. In man no. of facial bones is:
A) 10 B) 12 C) 14 D) 16

14. For antagonism which is true:
A) Both muscles move bone in same direction
B) When one relaxes, other contracts
C) One contracts when other's contraction ends
D) Both may be present one above the other

15. In tetany which is responsible for twitching:
A) Hypoglycemia B) Hypercalcemia C) Hypocalcemia D) Hyperoxaluria

16. Attachment of myosin head and actin in rigor mortis occurs due to:
A) Stored ATP in body B) Hypercalcemia C) Deficiency of ATP D) Hyperactivity of mitochondria

17. The type of muscles which have many nuclei per cell:
A) Skeletal muscles B) Cardiac muscles C) Smooth muscles D) Both a & b

18. Biceps and triceps are:
A) Antagonists B) Synergists C) Antiparallel D) None of these

19. Muscle fatigue is caused by:
A) Aerobic condition B) Lock of Myoglobin C) Lactic acid accumulation D) All of these

20. Which pair of vertebrae are equal in no:
A) Cervical & lumbar B) Coccyx and sacral C) Sacral and lumbar D) Cervical and coccyx

21. Which are mature bone cells?
A) Ostrogenic cell B) Osteoblasts C) Osteoclasts D) Osteocytes

22. The cells which are involved in bone resorption:
A) Osteocytes B) Osteogenic cells C) Osteoclasts D) Osteoblasts

23. The lower two pairs of ribs are called:
A) Free ribs B) Floating ribs C) False ribs D) All of these

24. The sacrum is formed by fusion of:
A) Anterior five vertebrate B) Posterior four vertebrate C) Medial body of vertebrate D) Spinal arch

25. The joints between vertebrae is of which type:
A) Hyaline cartilaginous B) Fibrous cartilaginous C) Synovial joint D) None of these

26. Which is true for spondylosis:
A) It is caused by fusion of vertebrae C) It results in enlargement of vertebrae
B) It is due to disc slip D) All of these

27. Which is supplied by somatic nervous system:
A) Skeletal muscles B) Cardiac muscles C) Smooth muscles D) Non-Striated muscles

28. The biceps uplifts by exerting force on:
A) Radius B) Ulna C) Humerus D) Scapula

29. Aspiration pneumonia occurs in which condition:
A) Microcephaly B) Arthritis C) Cleft palate D) Spondylosis

30. Complete bone healing time is about:
A) One months B) 2-3 months C) 3-4 months D) 4-5 months

31. Each myosin filament is surrounded by how many actin filaments:
A) 2 B) 4 C) 6 D) 8

32. During muscle contraction, which band is not affected:
A) A B) I C) H – zone D) Z

33. Sarcoplasmic reticulum is different from endoplasmic reticulum due to:
A) Devoid of ribosome B) Specialized repeating pattern C) Both of these D) Large vesicles

34. Lock Jaw is the symptom of:
A) Tetany B) Tetanus C) Cramp D) Fatigue

35. Tendons attach muscle to:
A) Muscle B) Bones C) Ligament D) Cartilage

36. Which is not the character of skeletal muscle:
A) Somatic control B) Regular Stripes C) One nucleus per cell D) Slow to rapid movement

37. Vertebral column includes:
A) Cervical vertebrae B) Thoracic vertebra C) Lumbar vertebrae D) All of these

38. Chondrocytes are the living cells of:
A) Bone B) Cartilage C) Muscles D) Tendon

39. Which of following is multinucleated cell:
A) Stem cell B) Osteoblast C) Osteocyte D) Osteoclast

40. **Pivot type joint is present between:**
A) Radius, ulna& humerus B) Ulna & carpals C) Radius & carpals D) Carpals and phalanges

41. **Gouty arthritis is due to accumulation of:**
A) Pathogens B) Urea C) Uric acid D) All of these

42. **In thin filament there are _____ actin chains:**
A) 2 B) 4 C) 8 D) 6

43. **How many bones are found in forelimb beyond elbow:**
A) 27 B) 28 C) 29 D) 30

44. **Ligament & tendon:**
A) Both are inelastic B) Both are elastic C) Elastic, inelastic respectively D) Inelastic, elastic respectively

45. **Sarcoplasmic reticulum releases calcium to cytosol which binds to:**
A) Tropomyocin B) Myosin C) Troponin D) Actin

46. **Cross bridges are unable to detach due to ATP deficiency:**
A) Rigor mortis B) Muscle fatigue C) Both D) Tetany

47. **Their speed of contraction is intermediate:**
A) Smooth B) Cardiac C) Skeletal D) All of these

48. **It is a chronic arthritis:**
A) Gouty arthritis B) Osteoarthritis C) Rheumatoid arthritis D) All of these

49. **Which provides energy for explosive activity such as sudden short sprints:**
A) ATP B) Glycolysis C) Fermentation D) Phospocreatine

50. **It is auto immune disorder:**
A) Gouty arthritis B) Osteoarthritis C) Osteoporosis D) Rheumatoid arthritis

51. **Ilium, ischium and pubis fuse to form:**
A) Coxal bone B) Beauty bone C) Breast bone D) Boath a & b

52. **Appendages are beneath the body:**
A) Amphibians B) Reptiles C) Mammals D) All of these

53. **No blood vessels are found in:**
A) Cartilage B) Chondrocytes C) Osteoclast D) Both a & b

54. Myofibrils are about _____ in diameter:
A) 1 – 2 μm B) 1 μm C) 0.1 –,0.01 mm D) 2 μm

55. Which muscles evolved 1st:
A) Cardiac B) Smooth C) Skeletal D) None

56. Which are mesodermal in origin:
A) Tooth B) Muscles C) Bones D) All

57. Chief component of thin filament is:
A) Actin C) Myoglobin
B) Myosin D) Actin

58. Immediate source of energy for muscle contraction is:
A) Glucose C) Creatine phosphate
B) Glycogen D) ATP

59. The sliding protein of muscle:
A) Tubulin C) Myoglobin
B) Myosin D) Actin

60. Which one yields ATP required for muscle contraction:
A) Myoglobin C) Creatinine
B) Creatine D) Phosphate

61. Vertebrae are name according to:
A) Structure C) Formation
B) Functions D) Location

62. The number of ribs that are attached with sternum:
A) 20 C) 12
B) 24 D) 12 Pairs

63. The total number of vertebrae in lumber and pelvic regions are:
A) 9 C) 16
B) 14 D) 13

64. Which of the following band allows most of the light to pass through it:
A) A-band C) Muscle bundle
B) I-Band D) Muscle fiber

65. A protein that is complex of three polypeptide chains is:
A) Actin C) Tropmyosin
B) Myosin D) Troponin

66. How many bones are present in human skull?
A) 22 C) 28
B) 12 D) 42

67. Human vertebral formula is:
A) $C_7T_9L_5S_4Cd_1$ C) $C_7T_{12}L_5S_5Cd_4$
B) $C_7T_{12}L_4S_1Cd_1$ D) $C_7T_{12}L_4S_4Cd_1$

68. Which one of the following is paired cranium bone:
A) Frontal C) Parietal
B) Occipital D) Sphenoid

69. How many bones present in our arms?
A) 32 C) 60
B) 25 D) 45

70. Total number of tarsals is:

A) 16
B) 7
C) 14
D) 8

Answers (F):

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

G) Hormonal Control

1. It increases glucose conversion to fatty acids:
A) Cortisol B) Corticosteron C) Insulin D) Glucagon

2. Which increases heart rate:
A) Hypothyroidism B) ADH C) Adrenaline D) Both b & c

3. Puffiness of skin is caused in:
A) Cretinism B) Addison C) Cushing D) Myxoedema

4. High Ca^{2+} level gives negative feed-back to:
A) Calcitonin B) Para-thormone C) Insulin D) Both a & b

5. Somatotrophin is:
A) Produced by hypothalamus B) A growth hormone C) Produced by anterior pituitary D) Both b & c

6. Which inhibits menstruation
A) LH B) Progesterone C) Prolactin D) All

7. A female if developing a beard she could has an excessive secretion of:
A) Thyroid hormones B) Cortical hormones C) Pancreatic hormones D) Medullary hormones

8. Androgens produce sex derive in:
A) Males only B) Females only C) Both males & females D) It does not produce sex derive

9. What you suggest for thyrotrophin of thyroid stimulating hormone?
A) Produced by thyroid gland B) Produced by Adrenals. C) Produced by neurohypophysis D) Produced by anterior pituitary

10. Which is called as master gland:
A) Pituitary B) Anterior lobe of pituitary C) Posterior lobe of pituitary D) Median lobe of pituitary

11. Which is also called interstitial cell stimulating hormone:
A) FSH B) LH C) Prolactin D) Dopamine

12. Lack of ADH secretion leads to:
A) Diabetes mellitus B) Diabetes inspidus C) Low urine volume D) All

13. The Tetany is caused by _____ of parathyroid glands:
A) Under activity B) Over activity C) Both D) No effect

14. The condition in which excess cortisol is produced:
A) Addison's disease B) Cushing disease C) Grave's disease D) Insulinoma

15. The major component of birth control pills is:
A) Progesterone B) Estrogens C) LH D) FSH

16. Corticosterone is a:
A) Mineralocorticoid B) Glucocorticoid C) Both A & B D) Neuropeptide

17. In which condition pigmentation occurs:
A) Addison's disease B) Cushing disease C) Grave's disease D) All

18. If STH secretion occurs in excess later in life, it's called:
A) Hyperthyroidism B) Acromegaly C) Dwarfism D) Cushing disease

19. Antagonist to parathyroid hormone is:
A) Insulin B) Calcitonin C) ADH D) Thyroxine

20. All are related except:
A) Pancreas B) β-cells C) Diabetes D) Epinephrine

21. Which hormone is used as spray to keep the flowers fresh:
A) Auxins B) Cytokinins C) Ethene D) Abscisic acid

22. Which of followings are steroid hormones:
A) Estrogen B) Testosterone C) Cortisol D) All of these

23. Any detectable change in the environment:
A) Behavior B) Stimulus C) Response D) Learning

24. Which one of the following glands lies above the kidneys of frog:

A) Pituitary B) Bowman's capsule C) Adrenal D) None

25. Which one of the hormones is not steroid:
A) Testosterone B) Progesterone C) Carticosterone D) Oxytocin

26. Oxytocin is produced in:
A) Posterior hypophysis B) Anterior hypophysis C) Pars media D) Hypothalamus

27. Estrogen is secreted by:
A) Ovary B) Placenta C) Kidneys D) Both a & b

28. Duodenum secretes:
A) Gastrin B) Secretin C) Pancreatic juice D) All

29. Conversion of non-carbohydrates into carbohydrates is known as:
A) Glycolysis B) Glycogenosis C) Gluconeogenesis D) Glycogenolysis

30. Which is not the function of thyroxine:
A) Metabolism B) Brain cell differentiation C) Ca^{++} regulation D) Metamorphosis

31. ADH is produced in:
A) Anterior pituitary B) Posterior pituitary C) Median pituitary D) None of these

32. Dwarfism results due to deficiency of:
A) FSH B) ACTH C) STH D) LH

33. Glucagon tends to :
A) Help excrete glucose through urine
B) Decrease the level of blood glucose
C) Slow down the conversion of glucose to glycogen
D) Promotes the conversion of glycogen to glucose

34. True statement about hormone?
A) Exocrine and endocrine secretion
B) Chemically of any inorganic nature
C) Start chemical reactions
D) Produced in very small amount

35. Hormone effect on an organ known as:
A) Effector
B) Target
C) Initiator
D) Terminator

36. Primary target of the hormone of Hypothalamus.
A) Pineal gland
B) Thymus
C) Pituitary gland
D) Testis

37. Which organ produce the releasing hormone.
A) Testis
B) Pancreas
C) Pituitary
D) Hypothalamus

38. Posterior pituitary receive hormone from hypothalamus through:
A) Duct
C) Neurons

B) Blood D) CSF

39. **Why diabetes mellitus occur.**
A) Under secretion of insulin C) Under secretion of estrogen
B) Under secretion of thyroxin D) Under secretion of vasopressin

40. **Name the male sex hormone:**
A) ICSH C) FSH
B) Conadotropic hormone D) Testosterone

41. **Which hormone reduces sodium loss:**
A) Calcitonin C) Parathormone
B) Aldosterone D) Vasopressin

42. **Why Dwarfism occur.**
A) Deficiency of thyroxin C) Deficiency of STH
B) Excess of thyroxin D) Deficiency of insulin

43. **Special character of a hormone is:**
A) Organic nature C) Proteins
B) Transportation by duct D) Production throughout life

44. **ACTH perform following function.**
A) Stimulate pituitary C) Stimulate adrenal medulla
B) Stimulate the adrenal cortex D) Stimulate thyroid

45. **Reproductive process in human are controlled by hormone.**
A) Hypothalamums C) Pituitary gland
B) Medulla D) Adrenal gland

46. **Effect of high amount of water on ADH.**
A) Increase C) First increase then decrease
B) Decrease D) Will remain unchanged

47. **Hormone produce by corpus luteum**
A) Progesterone C) Estrogen
B) Cortisol D) Testosterone

48. **Activity reduce to the deficient of adrenal cortex.**
A) Cushing's disease C) Addison's disease
B) Grave's disease D) Cretinism

49. **Increase production of hormone induced acromegaly.**
A) Hypersecretion of GH in children C) Hyposecretion of GH
B) Hypersecretion of STH in adults D) Deficiency of vitamin D

50. **Pregnancy is maintained by which hormone.**
A) Estrogen C) FSH
B) LH D) Progesterone

51. **Hormones can control/regulate other homrones through:**
A) Competition C) Feedback
B) Inhibition D) Antagonizing

52. **A patient consist of large amount of Na in urine has:**
A) Diseased adrenal medulla C) Diseased pancreas
B) Diseased adrenal cortex D) Diseased thymus

53. **Organ secreted chronic gonadotropic hormone:**
A) Ovary C) Uterus
B) Pituitary D) Placenta

54. _____ **also produces androgens, besides testis.**
A) Thyroid C) Adrenal medulla

B) Thymus. D) Adrenal cortex

55. **Which one is not produced from pituitary gland.**
A) ADH C) STH
B) ACTH D) LTH

56. **Glucagon is secreted from which cells of islet of Langerhans>**
A) α-cells C) γ-cells
B) β-cells D) Both α-cells and β-cells

57. **All are ductless gland except _____:**
A) Testis C) Sub-maxillary
B) Ovary D) Pituitary

58. **Secretion of estrogen is under the control of:**
A) FSH C) LH
B) Progesterone D) STH

59. **Gland for flight, fight and fright/ life saving/emergency:**
A) Thyroid gland C) Pituitary gland
B) Thymus D) Adrenal gland

60. **It simulates the secretion of gastric juice.**
A) Secretin C) Gastrin
B) Adrenaline D) Corticosterone

61. **_____ controls ovulation in human females.**
A) FSH C) LTH
B) TSH D) LH

62. **It is secreted as a result of distension of cervix:**
A) ADH C) Oxytocin
B) Thyroxin D) MSH

63. **The interstitial cells of testes are stimulated by _____ to secrete testosterone.**
A) FSH C) LH
B) LTH D) ICSH

64. **Diabetes insipidus is due to less secretion of:**
A) Vasopressin C) Thyroxin
B) Estrogen D) Progesterone

65. **Secondary male characteristics are developed by:**
A) Androgens C) Adrenaline
B) Epinephrine D) Aldosterone

66. **Chemical nature of LH and ICSH is:**
A) Steroids C) Tyrosine derivatives
B) Polypeptides D) Amino acids

67. **What is/are possible site of hormone action.**
A) Cell membrane C) Nucleus
B) Cytoplasm D) All, A, B, C

68. **Enzymes and hormone are related to each other by:**
A) Mode of action C) Chemical nature
B) Transportation D) Site of action

69. **_____ doesn't affect the secretion of oxytocin.**
A) Progesterone C) Uterus contractions
B) Breast feeding D) Hyperglycemia

70. **Addison's disease can be due to all reasons except:**
A) Hypothalamus C) Pituitary

B) Adrenal cortex D) Addison disease

71. Pancreatic exocrine section is caused by:
A) Glucose C) Secretin
B) Gastrin D) Bile

72. _____ is the main store house of testosterone.
A) Germinal epithelium C) Interstitial cells
B) Sertoli cells D) G cells

73. Vasodilation is muscle is due to:
A) Nor epinephrine C) Cortisol
B) Epinephrine D) Glucagon

74. Over secretion of cortisol can be due to excess of:
A) Adrenalin C) STH
B) ADH D) ACTH

75. Pick the gland that have both exocrine as well as endocrine cells:
A) Pituitary C) Pancreas
B) Hypothalamus D) Adrenal

76. Deficiency of ADH can causes.
A) Diabetes Mellitus C) Myxedema
B) Addison's disease D) Diabetes insipidus

77. _____ hormone is involved in milk production.
A) Oxytocin C) Prolactin
B) ADH D) LH

78. Parturition and suckling is under the secretion of:
A) ADH C) FSH
B) Oxytocin D) LH

79. _____ is the steroid hormone.
A) Vasopressin C) Cortisol
B) ADH D) Glucagon

80. All hormones are lipid in nature except:
A) Testosterone C) Estrogen
B) Cortisol D) ADH

81. Adrenal cortex is stimulated by low blood pressure.
A) ADH C) Aldosterone
B) Epinephine D) Nor-epinephrine

82. Which gland doesn't produce hormone:
A) Pituitary C) Sweat gland
B) Adrenal D) Thyroid

83. Neuro-secretory hormones are _____ in nature.
A) Protein C) Polypeptide
B) Steroid D) Amino acid derivative

Answers (G):

1.	C	2.	C	3.	D	4.	B	5.	D	6.	B	7.	B	8.	C	9.	D	10.	B
11.	B	12.	B	13.	A	14.	B	15.	A	16.	C	17.	A	18.	B	19.	B	20.	D
21.	B	22.	D	23.	B	24.	C	25.	D	26.	D	27.	A	28.	B	29.	C	30.	B
31.	D	32.	C	33.	D	34.	D	35.	B	36.	C	37.	D	38.	C	39.	A	40.	D
41.	B	42.	C	43.	A	44.	B	45.	C	46.	B	47.	A	48.	C	49.	B	50.	D
51.	C	52.	B	53.	D	54.	D	55.	A	56.	A	57.	D	58.	A	59.	D	60.	C
61.	D	62.	C	63.	D	64.	A	65.	A	66.	B	67.	D	68.	C	69.	D	70.	D
71.	C	72.	C	73.	B	74.	D	75.	C	76.	D	77.	C	78.	B	79.	C	80.	D
81.	C	82.	C	83.	C	84.		85.		86.		87.		88.		89.		90.	

Solves Exercise

Q NO. 6

There are three defense lines

Physical barrier including

a) Skin
b) Mucus

2nd defense line

The cells which eat foreign material & destroy there include Neutrophil Eosinophil Macrophages

3rd defense line

B-Lymphocyte
T-Lymphocyte

H) 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 B) Mucous membrane C) Both of these D) None of these

7. The serum containing antibodies is called:
A) Immune serum B) Antiserum C) Hypersensitive serum 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 B) Antibodies C) Antigen antibody complex D) All of these

11. The normal alveolar ventilation is regulated by:
A) Hemoglobin
B) Oxygen
C) Iron
D) Carbon dioxide

12. Platelets are fragments of large cells called
A) Microkaryocytes
B) Megakaryocytes
C) Erythrocytes
D) Leucocytes

13. Which cells are produced in bone marrow and matures in the thymus gland?
A) T-Cells
B) B-Cells
C) Plasma cells
D) Memory cells

14. T-cells don't produce:

A) Antigens C) Cytokines
B) Antibodies D) All of these

15. **Production of RBCs is called:**
A) Haematopoiesis C) Haemorphosis
B) Metamorphosis D) Hetermorphosis

16. **They show antihistamine properties:**
A) Neutrophils C) Eosinophils
B) Basophils D) Monocytes

17. **Least abundant leucocytes are:**
A) Lymphocytes C) Eosinophils
B) Neutrophils D) Basophils

18. **The mammalian red blood cells are:**
A) Biconcave C) Concave
B) Biconvex D) Convex

19. **Which is found in interstitial fulid?**
A) Large proteins C) Red blood cells
B) White bloods cells D) Platelets

20. **Disorder in which hemoglobin molecule have F. Chain instead of B-chain is known as:**
A) Thalassemia C) Oedema
B) Leucaemia D) Emphysema

21. **Cerebral infraction is also known as:**
A) Stroke C) Hemorrhage
B) Heart attack D) Hypertension

22. **A substance produce by basophil that inhibits blood clotting is:**
A) Fibrinogen C) Histamine
B) Heparin D) Globulin

23. **The uncontrolled production of white blood cells result in:**
A) Leukemia C) Thalassemia
B) Oedema D) Asthma

24. **In the embryonic life the red blood cells are formed in:**
A) Red bone marrow C) In bone marrow of sternum and ribs
B) Liver and spleen D) Bone marrow of vertebrate

25. **62% of white blood cells are:**
A) Neutrophils C) Basophils
B) Eosinophils D) Lymphocytes

26. **Coronary arteries supply blood to the:**
A) Head C) Heart
B) Shoulders D) Kidneys

27. **The plasma proteins constitute percent by weight of plasma:**
A) 7-9 % C) 11-13 %
B) 9-11 % D) 13-15 %

28. **The bone which provides attachment for muscles:**
A) Compact bone C) Spongy bone
B) Cartilage D) All of them

29. **Bone dissolving cells is called:**
A) Osteoblast C) Osteocyte
B) Osteoclast D) Chontroblast

30. Inside of a resting neutron is more _____ than outside:
A) Positive C) Neutral
B) Negative D) None

31. Resting membrane potential of neutron is:
A) -70 mV C) -70V
B) -07 V D) 07V

32. Active membrane potential of neuron is:
A) + .05 V C) 50 V
B) – .05 V D) - 50 V

33. Platelets are fragments of large cells called
A) Microkaryocytes C) Erythrocytes
B) Megakaryocytes D) Leucocytes

34. The normal alveolar ventilation is regulated by:
A) Hemoglobin C) Iron
B) Oxygen D) Carbon dioxide

35. Incomplete or imperfect digestion is called:
A) Dyspepsia C) Obesity
B) Food poisoning D) Ulcer

36. When inner Mucus layer of diffusive tract break down, the digestive enzymes begin to eat away the walls of stomach and Duodenum. This result in a sore called _____.
A) Food poisoning C) Ulcer
B) Dyspepsia D) Obesity

37. It is Neurotic disorder in older girl:
A) Bulimia Nervosa C) Obesity
B) Anorexia nervosa D) Dyspepsia

38. _____ are masses of dilated tortuous veins in the an rectal mucous
A) Bulimia nervosa C) Botulism
B) Piles D) Obesity

39. Psychiatric therapy is required for the treatment of:
A) Piles C) Anorexia Nervosa
B) Obesity D) Bulimia Nervosa

40. Which is the common feature of cell humoral response and cell mediated response are:
A) Recognition of antigen C) Tissue rejection
B) Production of antibodies D) Plasma clone formation

41. Which type of response show the function tissue rejection:
A) Cell mediated C) Cell hormonal
B) Cell signaling D) Cell to cell

42. Alike tetanus vaccination against specific disease us is an example of:
A) Artificial active immunity C) Natural active immunity
B) Artificial passive immunity D) Natural passive immunity

43. Which immunity antiobides are injected in:
A) Artificial active immunity C) Natural active immunity
B) Artificial passive immunity D) Natrual passive immunity

44. Antibodies has:
A) One heavy chain only C) Tow heavy chains only
B) Two heavy and two light chain only D) Two light chains only

45. Antibodies are an example of which protein:
A) Fibrous C) Globular

B) Catalytic D) Regulatory

46. **Antigen binding sites are present:**
A) Constant region of heavy chain only C) Variable region of both heavy and light chains
B) Constant region of light chain only D) Constant region of both heavy and light chains

47. **Immune system that may activated by any foreign body is:**
A) Antigen C) Immunoglobulin
B) Antbodies D) Plasmogen

48. **Between blood and lymph the fluid that is transition is:**
A) Lymph C) Interstitial fluid
B) Serum D) Blood

49. **All are the component of lymphatic system except which:**
A) Lacteal C) Lymphatic duct
B) Left thoracic lymphatic duct D) Left sub-calvin vein

50. **In ileum the lymphatic capillaries presents are:**
A) Lacteal C) Lymphatic duct
B) Left thoracic lymphatic duct D) Left sub-calvian vein

51. **Except which flow of lymph is maintained:**
A) Skeletal movements C) Visceral movements
B) Breathing movements D) Reflex movements

52. **Lymph drain into lymph nodes:**
A) Single afferent vessel C) Single efferent vessel
B) Many afferent vessels D) Many efferent vessels

53. **After snake bite the injection of anti-venom serum is an example of:**
A) Active artificial immunization C) Passive natural immunization
B) Active natural immunization D) Passive artificial immunization

54. **When phagocytes generally come into action:**
A) 1st defense line is breached C) Infection is over
B) Parasites enter the body D) Lymphocytes fail

55. **Lymph nodes are drained by:**
A) Single afferent vessel C) Single efferent vessel
B) Many afferent vessels D) Many efferent vessels

56. **Largest lymphoid mass is:**
A) Thymus C) Spleen
B) Adenoid D) Tonsils

57. **Immunity study is called:**
A) Immunology C) Teratology
B) Cardiology D) Physiology

58. **Ain immunity which one is not involved:**
A) T-lymphocytes C) B-lymphocytes
B) Antibodies D) Myoglobin

59. **Except which condition immunity is mostly lost:**
A) SCID C) Cystic fibrosis
B) AIDS D) Leukemia

60. **Immune system is an example of:**
A) 1st line of defense C) 3rd line of defense
B) 2nd line of defense D) 4th line of defense

61. **Skin and mucous are an example of:**
A) 1st line of defense C) 3rd line of defense
B) 2nd line of defense D) 4th line of defense

62. **In which line of defense antibodies are involved:**
A) 1st line of defense C) 3rd line of defense
B) 2nd line of defense D) 4th line of defense

63. **Except which as they of immune system:**
A) T – lymphocytes C) Antibodies
B) B – lymphocytes D) Monocytes

Answer (H):

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

Unit # 6
BIOENERGETICS

A) Photosynthetic pigments and their absorption spectrum
B) Light dependent stage
C) Light independent stage
D) Describe the respiration at cellular level including:
Glycolysis, Krebs cycle, Electron Transport Chain

6. BIOENERGETICS

Content

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 wavelengths of light.
- ***Absorption Spectrum is*** a graph showing absorption of light of different wavelengths by a pigment.

PHOTSYNTHETIC PIGMENTS

Chlorophyll.....Main photosynthetic pigment

Carotene.... Orange to red pigments

Xanthophylls..... Yellow

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.
- ***Bacteriochlorophylls*** are found in photosynthetic bacteria.
- They mainly ***absorb violet- blue and orange – red wavelengths.*** Green, yellow and indigo wavelengths are least 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 tetrapyrrole ring structure containing magnesium as central metal ion, which is coordinated with nitrogen.
- ***Hydrophobic hydrocarbon tail*** is long, anchoring phytol ($C_{20}H_{39}O$).

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
Colour	Blue – green	Yellow- Green

• Why chlorophyll a is blue 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

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.

Photosystem

Photosynthetic pigments are organized into clusters called ***photosystems***.

- ***Antenna complex*** has many chlorophyll a, b and carotenoids, which channelize energy to reaction centre.
- ***Reaction centre*** is constituted by chlorophyll a along with primary electron acceptor and associated electron carriers of electron transport system.
- ***Primary electron acceptor*** traps the high energy electron from the reaction centre 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

- It is more common than cyclic photophosphorylation.
- Non-cyclic phosphorylation 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.

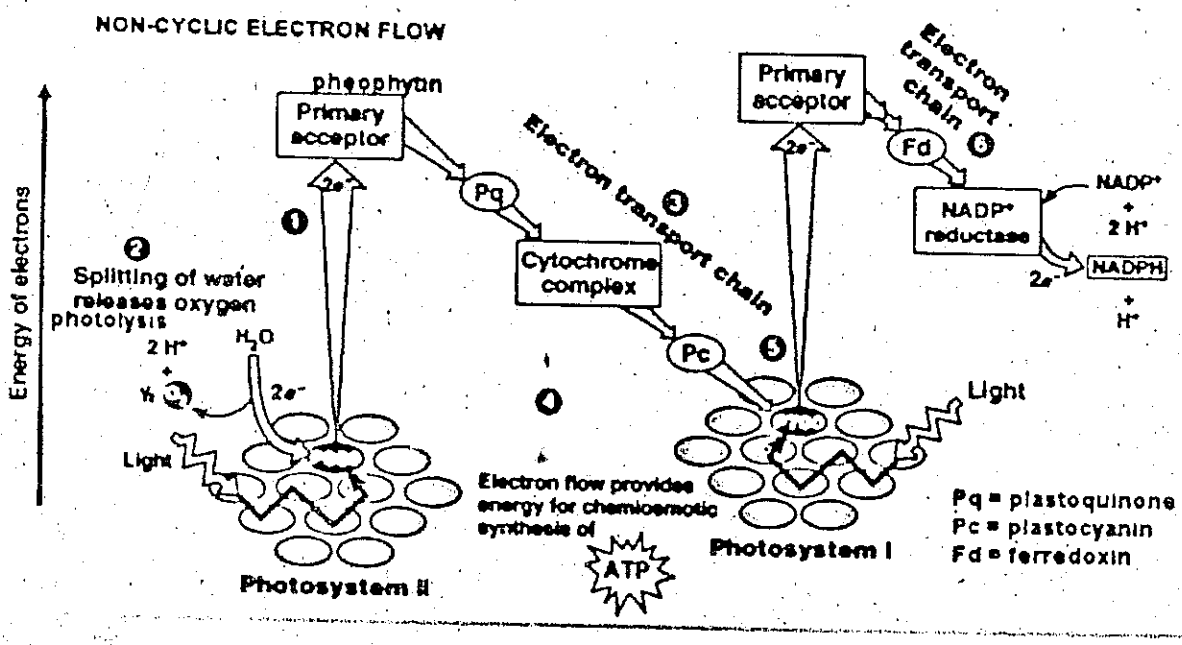
Passage Of Electrons

PS II ⟶ Primary Electron Acceptor ⟶ Pq ⟶ Cytochrome Complex ⟶ Pc ⟶ PS I

Primary Electron Acceptor ⟶ Fd ⟶ NADP+

End Products Of Light Reaction

- NADPH/ $NADPH_2$
- ATP



• Which part of chloroplast catalyzes photolysis?

CYCLIC PHOTOPHOSPHORYLATION

• Occurs at that time when ATP become less and NADPH more for Calvin cycle.

COMPARISON OF CYCLIC AND NON-CYCLIC PHOSPHORYLATION

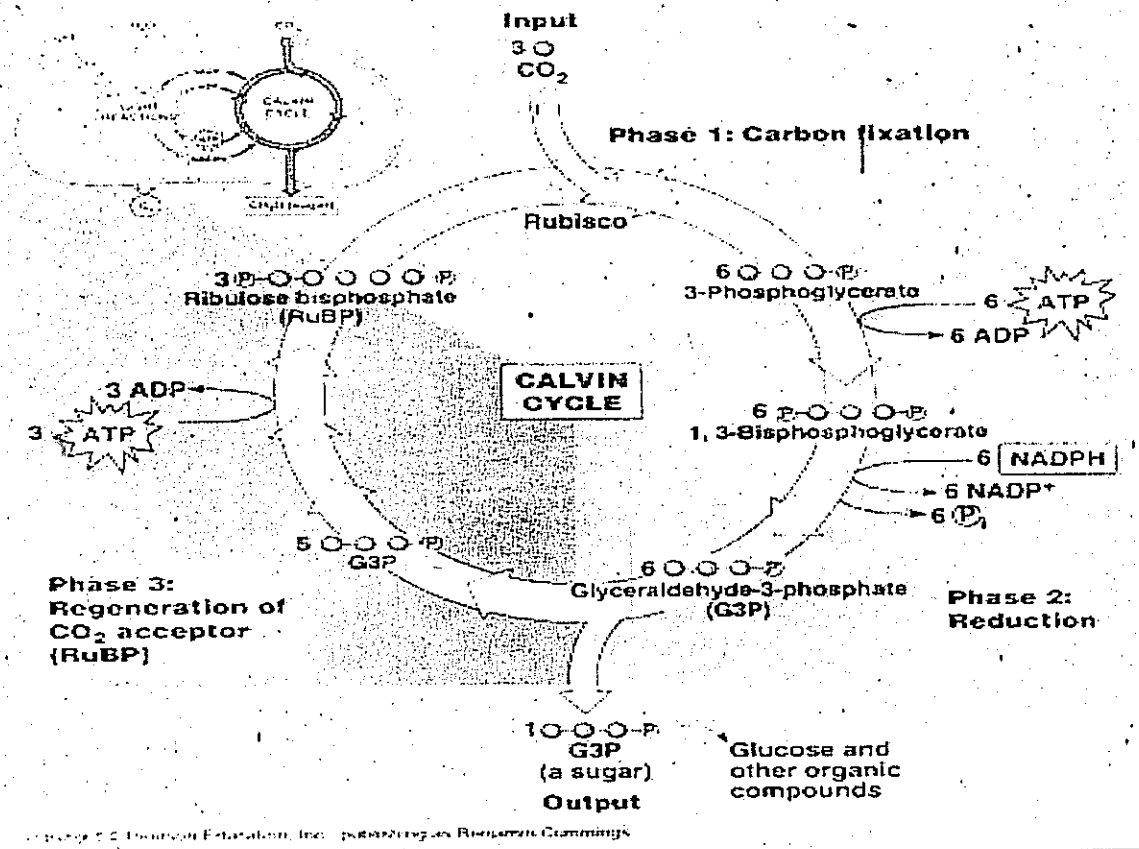
NON-CYCLIC	CYCLIC
Electrons are not reused.	Electrons are reused.
It involves both PS I and II.	It involves only PS I.
It is long pathway.	It is short circuit.
It is normal process.	It occurs when ATP are less and NADPH more.
It generates both ATP and NADPH.	It generates only ATP.
Oxygen is released.	Oxygen is not released.

C) LIGHT INDEPENDENT STAGE

- 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 respective enzymes, by which the carbon is fixed and reduced, resulting in the synthesis of sugar during the dark reaction, is called **Calvin Cycle.**

• Does Rubisco involve in respiration?

- It is divided into three steps:
  - **Carbon fixation**
  - **Reduction**
  - **Regeneration of CO_2 acceptor.**
- CO_2 fixation is dependent on ribulose biphosphate carboxylase (***Rubisco***).
- Rubisco is most abundant protein in chloroplast and on earth.



COMPARISON OF LIGHT AND DARK REACTIONS

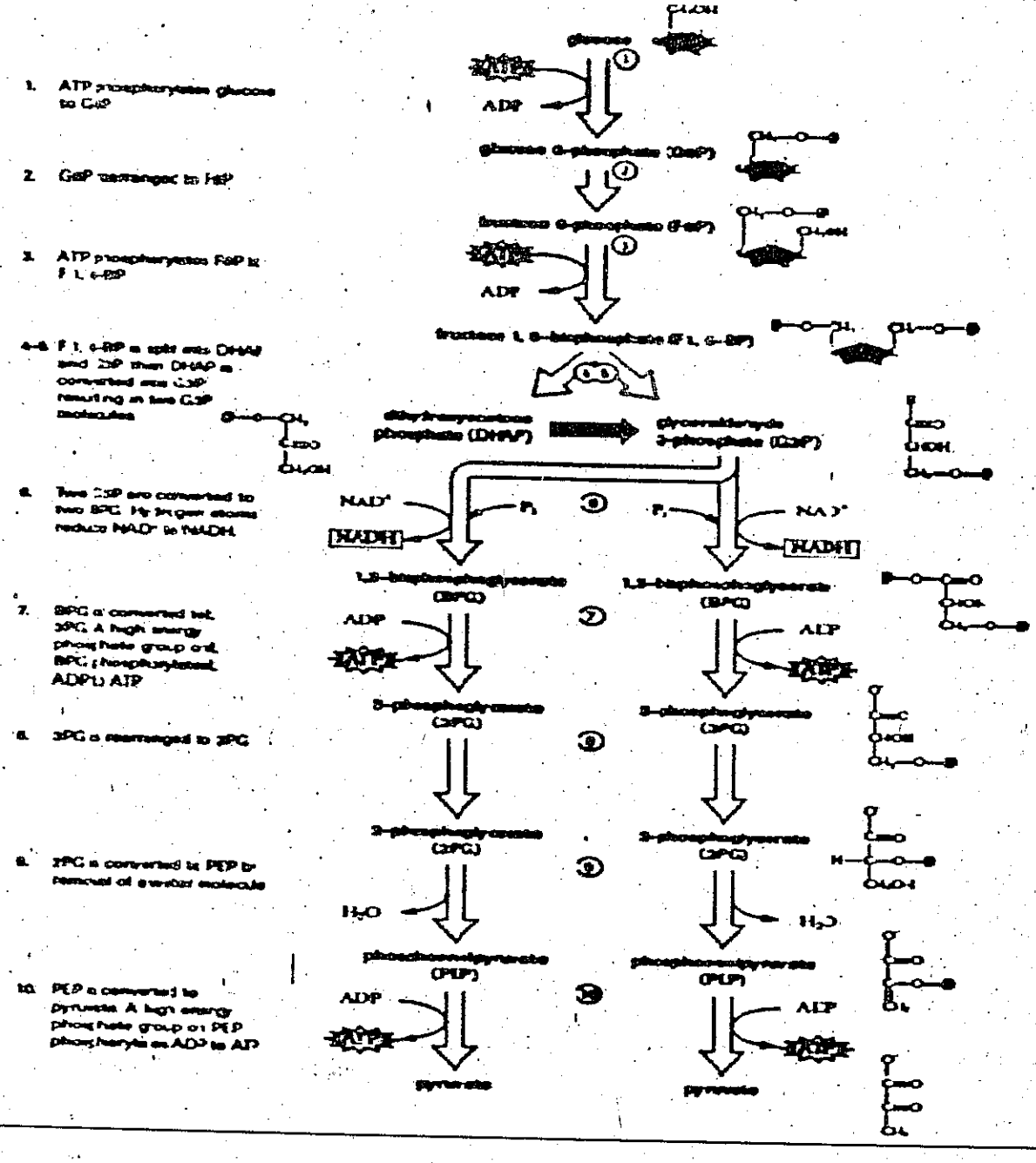
Light Reaction	Dark Reaction
Occur in grana of chloroplast.	Occurs in stroma of chloroplast.
Light is required	Light is not required.
O_2 ATP and $NADPH_2$ are the end products.	In Calvin cycle, ATP and $NADPH_2$ are used to prepare carbohydrates.

D) CELLULAR RESPIRATION

- A process by which energy is made available to cells in a step by step breakdown of C- chain molecules in the cell is called ***cellular respiration***.
- Cellular respiration is an ***oxidation process***.

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 Coenzyme 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.

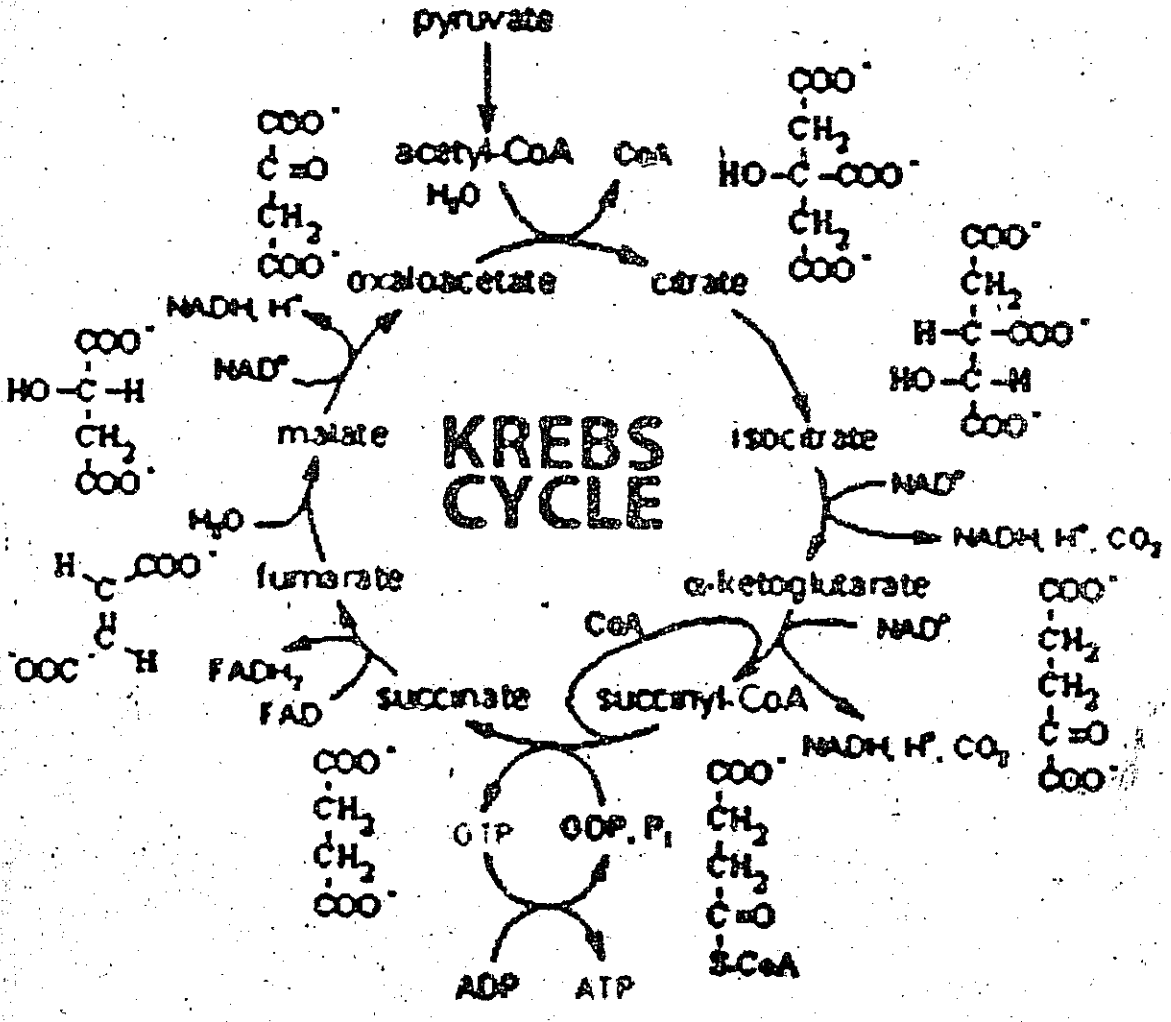


KREB'S CYCLE

- It is also called *citric acid cycle.*
- Pyruvate enters in Kreb's cycle in form of acetyl co-A.
- ***Sequence of reactions*** is as

Acetyl CoA + Oxaloacetate → Citrate → Isocitrate → α-ketogluterate → succinate → Fumarate → Malate → Oxaloacetate

- One Kreb's cycle yields 1ATP, 3NADH and 1$FADH_2$.



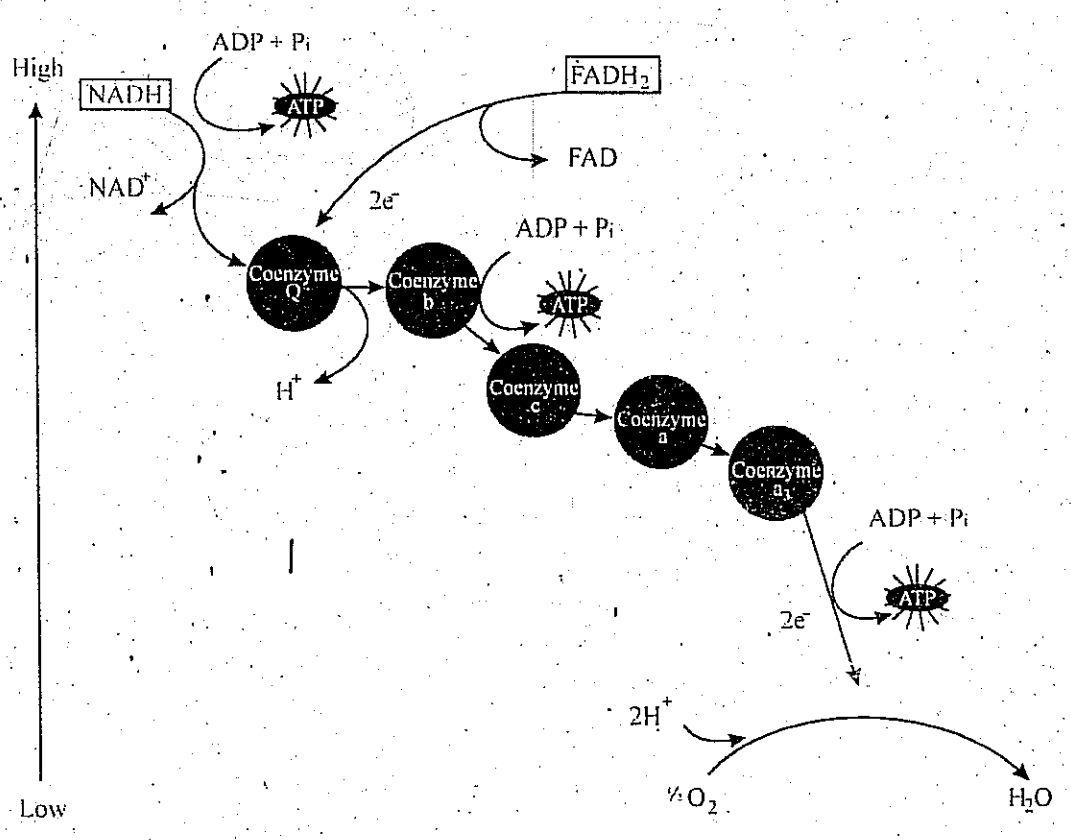
ELECTRON TRANSPORT CHAIN

- 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_3

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 $FADH_2$



- **Is there any difference between number of ATPs produced by aerobic respiration of glucose in eukaryotes & prokaryotes?**

Exercise

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. Haem portion of the Haemoglobin is:
A) Phytol B) Porphyrin C) Acetyl D) Ketone compound

3. Chl exists in how many forms:
A) 2 B) 3 C) Single D) Several

4. Chl-a is:
A) Yellow green B) Bluish green C) Light green D) Red green

5. Chlorophyll a shows absorption peak at:
A) 430nm, 670nm B) 400nm, 700nm C) 350nm, 600nm D) None of these

6. Chlorophylls absorb mainly:
A) Violet-blue B) Organ-Red C) Both a & b D) Yellow – Green

7. Carotenoids are also present in:
A) Skin B) Eye C) Hairs D) All of these

8. Engelmann used which of these to estimate amount of O_2 evolved?
A) Pigments B) Photo spectrometer C) Indicators D) Bacteria

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. How many $NADH_2$ are utilized during fermentation per glucose molecule?
A) 2 B) 3 C) 4 D) 6

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

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

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

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

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

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

18. How many CO_2 molecules are inserted into one Calvin cycle per RUBP:
A) 1 B) 2 C) 3 D) 4

19. There are _____ forms of chlorophylls in eukaryotes:
A) 3 B) 4 C) 2 D) None of these

20. 1st product of dark reaction is:
A) 3PGA B) 3PGAL C) 2,3-DPGA D) RUBP

21. Which of the following describes condition in a photosynthesizing cell, exposed to high light intensity and low carbon dioxide concentration?

	Concentration of CO_2 acceptor	Concentration of ATP	Concentration of GP (PGA)
A)	High	High	Low
B)	High	Low	Low
C)	Low	High	High
D)	Low	Low	High

22. The another name used for z-scheme is:
A) Cyclic photophosphorylation C) Calvin cycle
B) Non-cyclic photophosphorylation D) Oxidative phosphorylation

23. Reaction center of photosystem II has:
A) P_{680} C) P_{730}
B) P_{700} D) P_{660}

24. Which molecule formed in metabolic pathway by the equal splitting of a phosphorylated hexose into two halves?
A) Acetyl coenzyme A C) Fructose 1,6-bisphosphate
B) Ribulose bisphosphate D) Triose phosphate

25. In cellular respiration the ffunction of molecular oxygen?
A) To cause the breakdown of citric acid
B) To combine with glucose to produce carbon dioxide
C) To combine with carbon from organic molecues to produce carbon dioxide
D) To combine with hydrogen from organic molecules to produce water

26. Complete oxidation of 1 mole of pyruvate produced how many moles of carbon dioxide
A) 1 C) 4
B) 3 D) 6

27. In thylakoid interior space which reaction occurs:
A) Photolysis C) ATP synthesis
B) Transport of electrons D) Dark reaction

28. Which of the following might be absent in photosynthetic prokaryotes?
A) Grana C) Thylakoid like membranes
B) Chlorophyll D) ATP synthase

29. Carotenes absorbed least wavelength are:
A) Blue to green C) Yellow to orange
B) Red to orange D) Yellow to red

30. Number of carbon and hydrogen atoms respectively in the tail of chlorophyll b molecule are:

A) 20, 39
B) 20, 40
C) 55, 72
D) 55, 70

31. **When a plant shifts from cyclic to non-cyclic flow of electron:**
A) It has low reducing power
B) It runs low on assimilating power
C) Assimilating power is restored
D) It has sufficient reducing power

32. **On the basis of which photosystem I and II are differentiated:**
A) Chlorophyll a
B) Chlorophyll b
C) Primary electron acceptor
D) Carotenoids

33. **NADH is formed without decarboxylation in which step?**
A) Isocitrate → α-ketoglutarate
B) α-ketoglutarate → succinate
C) Pyruvate → Acetyl CoA
D) Malate → Oxaloacetate

34. **$FADH_2$ produce by the oxidation of:**
A) Malate
B) FAD
C) Fumarate
D) Succinate

35. **Light energy is converted into chemical energy through the formation of:**
A) $NADPH_2$
B) ATP
C) ATP and $NADPH_2$
D) RuBP

36. **Photo synthesis photophosphorylation consists of:**
A) Cyclic and non-cyclic phosphorylation
B) Oxidative phosphorylation
C) Substrate level phosphorylation
D) respiratory chain

37. **In photosynthesis the by product is:**
A) Organic compound
B) Oxygen
C) $NADPH_2$
D) Energy

38. **The ground matrix of stroma is:**
A) Lysosomes
B) Oxysomes
C) Ribosomes
D) Chloroplast

39. **Wavelength that consist of light photosynthesis maximum are:**
A) Red light
B) Green light
C) Blue light
D) Ultra-violet light

40. **Within the chloroplasts the source of protons is:**
A) Water
B) Carbon dioxide
C) Excited chlorophyll molecule
D) Rubisco

41. **In carbon assimilation dark reaction occur in:**
A) Cytoplasmic matrix
B) Mitochondria
C) Leucoplasts
D) Chloroplasts

42. **In photosynthesis $NADPH_2$ is produced during:**
A) Dark reaction
B) Pseudocyclic photophosphorylation
C) Non-cyclic photophosphorylation
D) Cyclic photophosphorylation

43. **Chlorophyll consists of:**
A) A head of phytol and tail of four pyrrole rings
B) A head of linked carbons and tail of four pyrrole rings
C) A head of four pyrrole rings and tail of lined nitrogens
D) A head of four pyrrole rings and a phytol tail.

44. **In ribulose the no. of carbon atom present are:**
A) 6
B) 5
C) 4
D) 3

45. **In calvin Benson circle ATP molecules required for synthesis of a glucose molecule.**
A) 36
C) 12

B) 38 D) 18

46. **Synthesis of photophosphorylation is:**
A) ADP from ATP C) Glucose 6-phosphate from glucose
B) ATP from ADP D) $NADP^+$ from NAD^+

47. **What is needed for fixing 3 molecules of CO_2 in Calvin cycle,**
A) $9ATP + 6NADPH_2$ C) $18ATP + 12NADPH_2$
B) $6ATP + 9NADPH_2$ D) $3ATP + 3NADPH_2$

48. **De-phosphorylation is represented by which one?**
A) Fructose 1-phosphate → Fructose 1,6-biphosphate
B) Fructose 1,6-biphosphate → Fructose 1-phosphate
C) Fructose 1-phosphate → Fructose 6-phosphate
D) Glucose 6-phosphate → Fructose 1-phosphate

49. **Product formed as a result of release of energy in cellular respiration is:**
A) ATP C) Oxygen
B) NADH D) Glucose

50. **The difference between respiration and combustion is related to respiration being:**
A) Multistep reactions C) Intracellular
B) Enzyme controlled D) All A,B,C

51. **In anaroibic respiration when a molecule of pyruvic acid is subjected to and form lactic acid then:**
A) 2 ATP are formed C) No ATP is formed
B) 4 ATP are formed D) 6 ATP are formed

52. **In the conversion of pyruvate to acetyl CoA. Which process is used?**
A) Decarboxylation C) Dehydration
B) Dehydrogenation D) Both A & B

53. **During aerobic respiration in the net gain of energy from one molecule of glucose.**
A) 2 ATP C) 38 ATP
B) 4 ATP D) 40 ATP

54. **In plants during which process the energy is released?**
A) Photosynthesis C) Respiration
B) Transpiration D) Water absorption

55. **In aerobic respiration incomplete breakdown of sugar forms:**
A) Fructose and water C) Glucose and CO_2
B) Alcohol and CO_2 D) Water and CO_2

56. **Which is the correct sequence of energy transfer between photosynthetic pigmetns:**
A) Chl.a → Chl.b → Carotenoids C) Carotenoids → Chl.b → Chl.a
B) Chl.b → Carotenoids → Chl.a D) In any direction

57. **Which show the function of enery:**
A) Mitochondria C) Cytoplasm
B) Stroma of chloroplast D) Grana

58. **All of following are differences between chl.a and b except:**
A) Chl.a has different types while Chl.b has single type
B) Chl.a have functional group $-CH_3$ but b have $-CHO$
C) Chl.a is necessary pigment but b is a accessory pigments
D) Chl.a is present in antenna complex while Chl.b is in reaction center

59. **Which is obtained during cyclic photophosphorylation:**
A) ATP C) $NADPH_2$
B) O_2 D) All A,B,C

60. In the process of lactic acid fermentation:
A) CO_2 is produced
B) Ethanol is produced
C) NADH is oxidized
D) ATP are produced

61. During calvin cycle of ATP are required to convert a molecule of RuP into RuBP:
A) 1
B) 2
C) 3
D) 6

62. All of the following processes of aerobic respiration occur except:
A) Krebs cycle
B) Respiratory chain
C) Pyruvic acid oxidation
D) Glycolysis

63. During krebs cycle to α-ketonglutarate is:
A) Decarboxylation
B) Oxidation
C) Both A and B
D) Isomerism

64. In aerobic respiration except which step ATP production occurs.
A) Glycolysis
B) Pyruvic acid oxidation
C) Krebs cycle
D) Electron transport chain

65. On which of the following enzyme cycle exert an inhibitory effect:
A) Phosphofructokinase
B) Succinic dehydrogenase
C) Pyruvate decarboxylase
D) Cytochrome oxidase

66. During glycolysis gross production of ATP molecules is:
A) 2
B) 6
C) 4
D) 8

67. In 1833 action spectrum of photosynthesis was described by:
A) Robert Hill
B) T.W. Englemann
C) M. Calvin
D) Hatch and Slack

68. The molecule regenerated by fermentation:
A) O_2
B) NAD^+
C) ATP
D) Pyruvate

69. Some photosynthetic organism contain chloroplasts that lack photosystem II, yet as able to survive. Which the next way lack of photosystem II in these organisms:
A) To determine if they have thylakoids in the chloroplasts
B) To test for liberation of O_2 in the light
C) To test for CO_2 fixation in the dark
D) To do experiments to generate an action spectrum

70. NAD^+ into NADH require:
A) 2 Electrons 1 proton
B) 1 Electron 2 protons
C) 2 Electrons 2 protons
D) 1 Electrons 1 proton

71. The products of photosynthesis in plants:
A) $C_6H_{12}O_6 + 6O_2$
B) $(CH_2O)_n + H_2O + 2S$
C) $(CH_2O)_n + H_2O + 2S$
D) $C_6H_{12}O_6 + 6O_2 + 6H_2O$

72. The source of oxygen produced during photosynthesis is:
A) Water
B) Glucose
C) CO_2
D) Oxidation of chlorophyll

73. Pick out wrong statement about photosynthesis:
A) It occurs during day time
B) It requires chlorophyll
C) It uses water with CO_2
D) It uses oxygen

74. Which is incorrect for calvin cycle.
A) It does not require light directly
B) It is also called carbon cycle
C) It uses ATP from oxidative phosphorylation
D) Glyceraldehyde is produced in dark reaction

75. Light reaction occurs in plants in:

A) Stroma
B) Chloroplast
C) Thylakoid membrane
D) Leucoplast

76. **Spectrophotometer is used to measure:**
A) Absorption of CO_2
B) Reflection of pigments
C) Absorption of O_2
D) Absorption of different wavelengths

77. **Magnesium is central part of:**
A) Porphyrin ring
B) Pyrrole ring
C) Phytol tail
D) Hydrophobic part

78. **Which shows the effectiveness of wavelengths of light driving photosynthesis?**
A) Absorption spectrum
B) Broad spectrum
C) Action spectrum
D) Engelman spectrum

79. **Photon of light excites electrons?**
A) 01
B) 02
C) 04
D) 06

80. **During cyclic phosphorylation, electron passes from all except:**
A) Photosystem I
B) Photosystem II
C) Ferridoxin
D) Cytochrome complex

81. **Light is absorbed by carotenoids.**
A) Red to orange
B) Yellow red
C) Yellow green
D) Blue violet

82. **Formation of ATP is termed as:**
A) Light reaction
B) Chemiosmosis
C) Dark reaction
D) Fermentation

83. **NADP reductase transfers electron from:**
A) $NADP^+$ to ferridoxin
B) ADP to ATP
C) Ferridoxin to $NADP^+$
D) Cytochrome complex to $NADP^+$

84. **In yeast, Glucose is ultimately broken into:**
A) Ethyl alcohol
B) Acetic acid
C) lactic acid
D) Fumaric acid

85. **Terminal phosphate group of ATP?**
A) 4.3 kCal
B) 6.3 Kcal
C) 5.3 KCal
D) 7.3 Kcal

86. **When fructose 1,6-bisphosphate is converted into two 3 carbon compound? How many ATP & NADH are used in glycolysis?**
A) ATP is used
B) NADH is used
C) No ATP and NADH used
D) Both ATP and NADH produce

87. **Which of following produces water?**
A) 2-phosphoglycerate → PEP
B) 3-phosphoglycerate → 2-phosphoglycerate
C) 1,3 bisphosphoglycerate → 3-phosphoglycerate
D) G3P → 1,3 bisphosphogylcerate

88. **Photolysis of H_2O**
A) Interior space of thalakoid
B) Into the stroma
C) Within the thylakoid membrane
D) At ATP synthase complex

89. **Which is incorrect z-scheme.**
A) It absorbs photons into PS-I
B) It produces ATP
C) It is a long pathway
D) Carbon dioxide production

90. **Which is part of calvin cycle.**
A) ATP production
B) Carbon dioxide fixation
C) Oxygen production
D) Carbon dioxide production

91. **In dark reaction _____ is produced.**
A) ATP
B) G3P
C) RuBP
D) PEP

92. **The final acceptor of electron during the z-scheme:**
A) Photosystem I
B) Photosystem II
C) Photosystem II
D) $NADP^+$

93. **If 12 NADPH are used in Calvin cycle, then how many glucose molecule will formed?**
A) One
B) Two
C) Six
D) Twelve

94. **About 2% energy of chemical bonds of glucose is converted into ATP by:**
A) Glycolysis
B) Fermentation
C) Chemosmosis
D) Calvin cycle

95. **This process in which CO_2 is produced.**
A) Glycolysis
B) Fermentation
C) Chemiosmosis
D) Calvin cycle

96. **The process in which CO_2 is used to produce:**
A) Glycolysis
B) Krebs cycle
C) Calvin cycle
D) Light dependent reaction

97. **Succinate dehydrogenase produces organic compound:**
A) NADH
B) Malate
C) $FADH_2$
D) ATP

98. **During NADH and $FADH_2$ are formed:**
A) Glycolysis
B) The electron transport system
C) The Krebs cycle
D) Fermentation

99. **$C_3G_6O_3$ formation occurs in:**
A) Glycolysis
B) The Krebs cycle
C) The electron transport system
D) Fermentation

100. **When products of glycolysis passes through Krebs cycle, it will produce?**
A) 2NADH, $2FADH_2$, 2ATP
B) 1NADH, $3FADH_2$, 2ATP
C) 3NADH, $1FADH_2$, 1ATP
D) 6NADH, $2FADH_2$, 2ATP

101. **Acetyl-CoA is formed from:**
A) Pyruvate and coenzyme
B) ATP and pyruvate
C) Citric acid and a coenzyme
D) Carbon dioxide and pyruvate

102. **Which of following more ATP in ETC?**
A) NADH
B) Pyruvate
C) $FADH_2$
D) Glucose

103. **Biological oxidation involves removal of hydrogen, linked with specific coenzymes and is catalyzed by:**
A) Carboxylase
B) Hydrogenases
C) Dehydrogenases
D) Catalases

104. **Cellular respiration is essentially a/an _____ process.**
A) Oxidation
B) Reduction
C) Redox
D) Hydrogenation

105. **The final acceptor of electron in electron transport chain is:**
A) Cytochrome a
B) Oxygen
C) Cytochrome b
D) Hydrogen

106. **Before pyruvate enters the citric acid cycle, it is decarboxylated, oxidized, and combined with coenzyme A, forming acetyl CoA, carbon dioxide, and one molecule of:**
A) NADH
B) $FADH_2$
C) ATP
D) ADP

107. **Phytol tail of chlorophyll b is located in:**
A) Stroma
B) Thylakoid surface
C) Thylakoid membrane
D) Thylakoid lumen

108. **PS-I is named as it:**

A) Absorb wavelength of 680 nm
B) Absorb wavelength of 700 nm
C) Discover earlier than PS-II
D) Slightly located upward than PS-II

109. The Mammalian cell that does not carry out oxidative phosphorylation?
A) Erythrocytes
B) Oxyntic cell
C) Neuron
D) Cardiac muscle cell

110. Electron transport chain in mitochondria is used to:
A) Synthesis of $NADP^+$
B) Create electron gradient
C) Produce ATP
D) Create proton gradient

111. The most abundant protein in Plants is:
A) Rubisco
B) Ribulose bisophosphatase
C) RUBP
D) Ribulose bisphosphate hydrogenase

112. The precursor of fumarate during Krebs cycle require _____ for fumarate synthesis.
A) Succinate
B) Succinate dehydrogenase
C) Fumarate dehydrogenase
D) FAD^+ Oxidase

113. Calvin cycle is also known as C_3 pathway due to:
A) Initial incorporation of 3 CO_2 molecules
B) Production of 3 carbon 3PGA
C) Production of 3 carbon G3P
D) Cycle has 3 steps

114. A pyruvic acid produces _____ molecules of CO_2 :
A) 2
B) 6
C) 12
D) 3

115. In ETC $FADH_2$ reduces:
A) Coenzyme Q
B) Cytochrome c
C) Cytochrome a
D) Cytochrome b

116. _____ Is not function of carotenoids
A) Convert light energy into chemical energy
B) Transfer energy
C) Protect chlorophyll
D) Protect human eye

117. Pick out correct sequence for the movement of electrons during non-cyclic photophosphorylation?
A) $P680 \rightarrow P700 \rightarrow water \rightarrow NADP^+$
B) $Water \rightarrow P680 \rightarrow P700 \rightarrow NADP^+$
C) $Water \rightarrow P700 \rightarrow P680 \rightarrow NADP^+$
D) $P680 \rightarrow P700 \rightarrow NADP^+ \rightarrow Water$

118. The stage of cellular respiration producing maximum ATP.
A) Glycolysis
B) Krebs cycle
C) Oxidation of pyruvate
D) ETC

119. Main regulatory enzyme during carbohydrate metabolism at early stages is:
A) Hexokinase
B) Decaroxylase
C) Phosphofructokinase
D) Isomerase

120. Formation of ATP form ADP during glycolysis occurs via formation of ATP from ADP:
A) Photophosphorylation
B) Chemiosomosis
C) Oxidative phosphorylation
D) Substrate level phosphorylation

Answers:

1.	A	2.	B	3.	D	4.	B	5.	A	6.	C	7.	D	8.	D	9.	A	10.	C
11.	A	12.	B	13.	B	14.	C	15.	C	16.	C	17.	B	18.	C	19.	B	20.	B
21.	A	22.	B	23.	A	24.	D	25.	D	26.	B	27.	B	28.	A	29.	A	30.	A
31.	C	32.	A	33.	D	34.	D	35.	C	36.	A	37	B	38.	D	39.	A	40.	A
41.	D	42.	B	43.	D	44.	B	45.	D	46.	C	47.	A	48.	B	49.	A	50.	D
51.	C	52.	D	53.	C	54.	C	55.	C	56.	C	57.	D	58.	D	59.	D	60.	C
61.	A	62.	D	63.	C	64.	B	65.	C	66.	C	67.	B	68.	B	69.	B	70.	A
71.	D	72.	A	73.	D	74.	B	75.	C	76.	D	77.	A	78.	C	79.	A	80.	B
81.	D	82.	B	83.	C	84.	A	85.	D	86.	B	87.	A	88.	A	89.	D	90.	B
91.	B	92.	D	93.	A	94.	B	95.	B	96.	C	97.	C	98.	B	99.	D	100.	D
101.	A	102.	A	103.	B	104.	A	105.	B	106.	A	107.	C	108.	C	109.	A	110.	D
111.	A	112.	B	113.	B	114.	B	115.	A	116.	A	117.	B	118.	D	119.	B	120.	D

Unit # 7
BIOTECHNOLOGY

LEARNING OUTCOMES

A) Explain Recombinant DNA Technology
B) Discuss Polymerase Chain Reaction (detailed procedure)
C) What do you understand by the following terms:
Gene therapy
Transgenic animals

7. BIOTECHNOLOGY

Content

DNA technology

A) 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.*** The DNA molecule is called ***complementary DNA. (cDNA)***

Molecular Scissors: Restriction Endonucleases

- First ***restriction enzyme*** was isolated by Hamilton O. Smith in 1970.
- They are called so because they restrict the growth of viruses.
- ***Palindromic sequences*** are sequences of four or six nucleotides arranged symmetrically in the reverse order produced by restriction enzymes, which cut the DNA at specific sites.
- ***EcoR1*** is a commonly used restriction enzyme.
- The single stranded but complementary ends of the two DNA molecules are called ***sticky ends***

• Why Restriction endonuclease does not act on bacterial DNA?

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

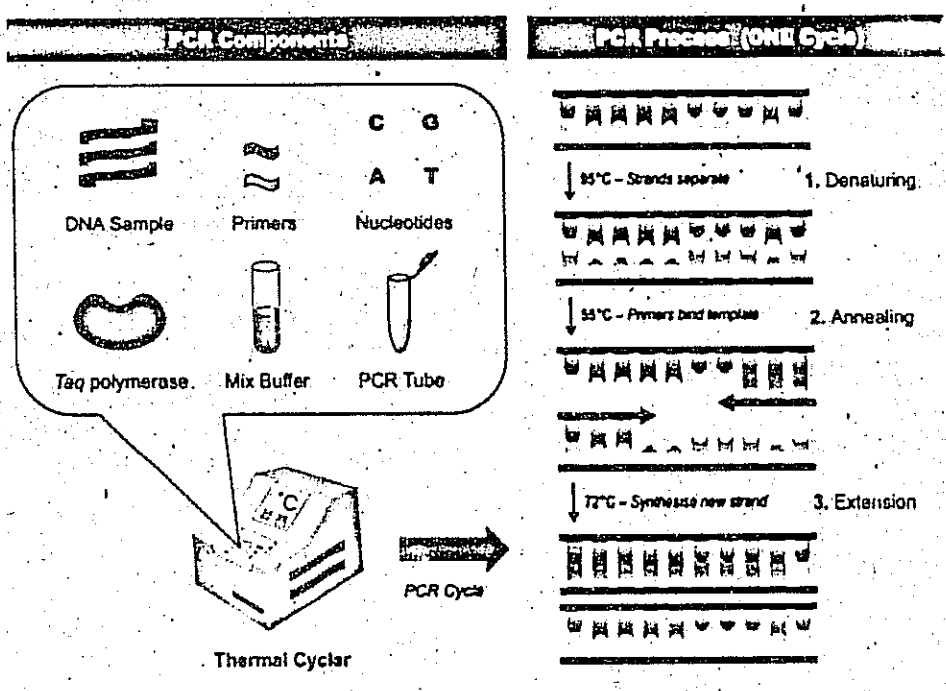
- Bacterial cells take up recombinant plasmid if they are treated with calcium chloride to make them more permeable
- ***Lambda phage*** (DNA of bacterial viruses) can also be used as a vector

B) 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 is ***temperature–insensitive*** (thermostable) enzyme extracted from the bacterium ***Thermus aquaticus***. This enzyme is also known as ***Taq polymerase***.

Point to ponder

- Why Restriction endonuclease does not act on bacterial DNA?



C) UNDERSTANDING OF TERMS

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.
- ***SCID*** is due to deficiency of enzyme called adenosine deaminase (ADA).
- Familial hypercholesterolemia is a condition that develops when liver cells lack a receptor for removing cholesterol from blood.
- Cystic fibrosis patients lack a gene that codes for trans-membrane carrier of the chloride ion.

Point to ponder

- What may be other options to treat coronary artery blockage?

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 inserting 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 produce pharmaceuticals.
- ***Urine is a preferable vehicle*** for a biotechnology products than milk because;
  - All animals in herd urinate while only females produce milk.
  - Animals start to urinate at birth while female do not produce milk until maturity.
  - It is easier to extract proteins from urine than from milk.

Exercise

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 B) Restriction enzymes C) Polymerases D) None

3. **Restriction enzymes were isolated by:**
A) Beadle B) T.H. Morgan C) G. Haberlandt D) Hamilton O. Smiths

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. **Enzyme used in PCR is:**
A) Ligase B) *Taq* polymerase C) DNA polymerase D) Both b & c

7. ***Thermus aquaticus* is important in relation to:**
A) *Taq* polymerase B) Ligase C) Helicase D) Primase

8. **Thermocycler is:**
A) PCR process B) PCR machine C) Primers D) Both b and c

9. **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

10. **The important application of DNA finger printing is in:**
A) Cytology B) Forensic science C) Genetic engineering D) None

11. 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

12. During DNA sequencing, separation of different pieces of DNA is made on:
A) Agarose gel B) Agar C) Dextrin D) Carrageenan

13. How many base pairs are present in human genome:
A) 6 billions B) 2 billions C) 3 billions D) 5 billions

14. The organisms having foreign genes inserted into the genome are called:
A) Mutated organisms B) Transgenic organisms C) Both a and b D) None

15. Which one of the following mutations is not heritable?
A) Gametic B) Inversions C) Somatic D) Point

16. The cells most likely to be used for cloning of transgenic animals:
A) Sperm cells B) Somatic cells C) Cumulus cells D) Egg cells

17. Which one is artificial organ used:
A) Organoid B) Organ C) Both a & b D) Synthoid

18. Which one is used to prevent clotting during surgery:
A) Anti thrombin III B) Thrombin C) Fibrinogen D) None

19. The machine that is made for achieving the bio-product:
A) Biofilter B) Analyzer C) Bioreactor D) All of them

20. Cloning of a gene can be done by:
A) Recombinant DNA technology B) PCR C) Both D) Gene therapy

21. pBR-322 has antibiotic resistant gene for:
A) Tetracycline B) Ampicillin C) Both of them D) Streptomycin

22. A genomic library can be searched by:
A) Probe B) Promoter C) Primer D) Reverse transcriptase

23. Which would you not expect to be a biotechnology product:
A) Vaccine B) Glycogen C) Protein hormone D) Enzyme

24. Which is incorrectly matched:
A) Protoplast- plant cell engineering C) DNA polymerase – PCR
B) RFLPs – DNA analysis D) DNA ligase – mapping human chromosome

25. **Gene therapy is effective against:**
A) Cystic fibrosis B) Parkinson's disease C) Hemophilia D) Not yet feasible

26. **The science of studying the DNA sequence and properties and entire genome:**
A) Genetics B) Genomics C) Histogram D) None of these

27. **NutraSweet has amino acids:**
A) One B) Two C) Three D) Four

28. **Plaindromit sequence for EcoR1restriction enzymes is:**
A) GAATTC B) CTTAAG C) TTAA D) AATT

29. **Antibodies are synthesized by:**
A) The liver B) Granulocytes C) Platelets D) B Lymphocytes (plasma cells)

30. **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

31. **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

32. **Non-Hodgkin's Lymphoma is:**
A) Degeneration of lymph nodes C) Swelling of lymph nodes
B) Cancer of lymphocytes D) Development of lymph nodes

33. **Which of followings can be used as a vector:**
A) Plasmid B) Virus C) Bacterium D) Both a and b

34. **Which can act to terminate polynucleotide chain:**
A) Ribose containing nucleotide C) Dideoxyribose containing nucleotide
B) Deoxyribose containing nucleotide D) None of these

35. **Human genome is _____ times larger than any other genome studied:**
A) 50 B) 25 C) 20 D) 60

36. **Which of these can be used as vector:**
A) TMV B) Gold particles C) Liposomes D) All of these

37. **Why not restriction enzymes cut the DNA of bacterial cells in which they are present?**
A) Bacteria lack palindromes C) Bacterial cells have modified their DNA at restriction sites.

B) Restriction enzymes are prevented to reach palindromes D) Reason is unknown

38. **This disease causes progressive deterioration of brain cells and gradual loss of motor control:**

A) Cystic fibrosis B) SCID C) Huntington D) Spastic paraplegia

39. **Which will survive in medium having ampicillin and tetra cycline**

A) PBR 322 B) PSC 101 C) BOM × Erythrocine D) None of these

40. ***E. coli* is found in:**

A) CSF B) Tissue fluids C) Human intestine D) Plasma

41. **Since _____ biotechnology has produced drugs and vaccines:**

A) 1980s B) 1970s C) 1960s D) 1950s

42. **Reverse transcriptase is obtained from:**

A) Bacteria B) Cells C) DNA viruses D) Retroviruses

43. **The number of nucleotides in sticky ends:**

A) 4 B) 6 C) 4 to 6 D) 4 to 8

44. **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

45. **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

46. **After separating restriction fragments on agarose gel by electrophoresis DNA is:**

A) Blotted to film B) Blotted to gel C) Denatured and blotted to membrane D) All of these could be possible

47. **Dopamine producing cells can be grafted into the brain of man to cure:**

A) Epilepsy B) Alzheimer' disease C) Parkinson's disease D) SCID

48. **How many primers are used in PCR**

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

49. **Probe is ____**

A) Single stranded nucleoside
B) Single stranded nucleotide
C) Double stranded DNA
D) Double stranded RNA

50. The children with SCID lack an enzyme
A) ADA
B) AMA
C) Adenosine deaminase
D) Both a & c

51. Soyabeans have been made resistant to common:
A) Herbicide
B) Insecticide
C) Pesticide
D) Fungicide

52. Arabidopsis is
A) Salt – tolerant
B) Water – tolerant
C) Heat resistant
D) Sugar – resistant

53. Coconut milk contains
A) Auxins
B) Gibberellins
C) Cytokinins
D) Abscisic acid

54. The cell containing full genetic potential called:
A) Genome
B) Protoplast
C) Both a & b
D) Totipotent

55. Oil spills at the beaches can be cleaned by using
A) Transgenic plants
B) Transgenic bacteria
C) Transgenic animals
D) All of these

56. Luciferase enzyme works with
A) Luciferin
B) Nutra – Sweet
C) Digitoxin
D) None

57. A complete carrot plant can be made by piece of
A) Xylem
B) Cortex
C) Phloem
D) Pith

58. An example of biodegradable plastic is
A) Polythene
B) PVC
C) Polyhydroxy butyrate
D) All

59. Cell suspension cultures of cinchona leadgeriana produce
A) Digitoxin
B) Quinone
C) Anti-toxin
D) Polludrin

60. The cells which cling to an egg are called
A) Callus
B) Cumulus
C) Forensic
D) Digitoxin

61. In 1999, transgenic crops were planted world wide on more than
A) 70 million acre
B) 20 million acre
C) 60 million acre
D) 30 million acre

62. Silicon carbide meedles are used in vortex method to made
A) Transgenic bacteria
B) Transgenic animal
C) Transgenic virus
D) Transgenic plants

63. The transgenic animals used for
A) Higher growth rate of animals
B) Gene pharming
C) Gene cloning
D) All of these

Answers:

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

Unit # 8

ECOSYSTEM

LEARNING OUTCOMES

A) Abiotic and biotic components of ecosystem
B) What is succession, give various stages of succession on land.
C) Explain the following terms:
Predation, parasitism, symbiosis, mutualism, commensalism, grazing
D) Describe the flow of energy in an ecosystem
Food chain
Food web
E) What is the significance of Human activity on ecosystem as population, deforestation, ozone depletion, atmospheric pollution, Green house effect, industrial effluents (insecticides and herbicides).

8. ECOSYSTEM

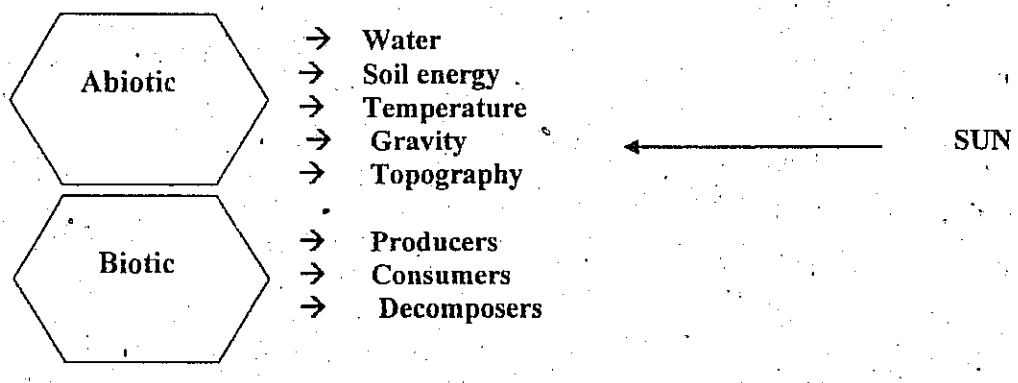
Content

Components of Ecosystem
Biological succession
Energy flow in ecosystem
Impacts of Human activity on ecosystem

A. ABIOTIC & BIOTIC COMPONENTS OF ECOSYSTEM

- ***Biotic components*** include all living organisms (animals and plants) supported by biosphere
- ***Abiotic components*** include non-living components i.e. atmosphere, Hydrosphere, lithosphere. (air, water and soil)

• How can you compare ecosystem & biome?



• What is topography?

A) SUCCESSION & ITS STAGES

- ***Succession*** is a change in community and its non -living environment over a period of time. Or
- ***Succession*** is a sequence of events in community structure of ecosystem over period of time.
- Succession begins by a few hardy invaders called ***pioneers***.
- Diverse and stable community at the end is called ***climax community***.
- Succession in an ecosystem from bare rock sand or clear glacial pool where there is no trace of previous life is called ***primary succession***.
- During ***secondary succession***, a new ecosystem develops after an existing ecosystem is disturbed by forced fire or an abandoned farm field.
- Primary succession starting in a pond is called ***hydrosere*** and that on a dry soil or habitat is called ***xerosere***. Plants growing in xeric conditions are called ***xerophytes***, which are able to withstand prolonged periods of water storage. Succulent plants like cacti have water stored in large parenchyma tissue

XEROSERE STAGE	DESCRIPTION
Crustose lichen stage	Crustose means crust on the substratum. Special types of lichens get impregnated in the form of crust. They are dormant
Foliage lichen stage	In it lichens are just like crumpled leaves attached at one point. Produces shade to the crustose lichens as a result of which their growth is reduced or decreased. Area becomes rough with more fissure and depressions develop. e.g. *Dermatocarpon, permellia*
Moss stage	Mosses like *polytrichum, tortula* etc. They compete with lichens for water and penetrate deeper into the soil add more humus to the soil.
Herbaceous stage	They establish due to more availability of moisture, humus, soil for anchorage.
Shrub stage	Shrubby plants start growing and shadowing herbaceous plants which die and add more humus to the soil.
Climax forests	Woody plants develop due to improved soil. They dominate and this stage in succession remains essentially same if nothing changes in the environment to upset the balance

C) EXPLANATION OF TERMS

PREDATION

- An animal that preys on other animals is a ***predator*** while an animal which is caught and eaten is the ***prey***.
- Relation between predator and prey is called ***predation***.

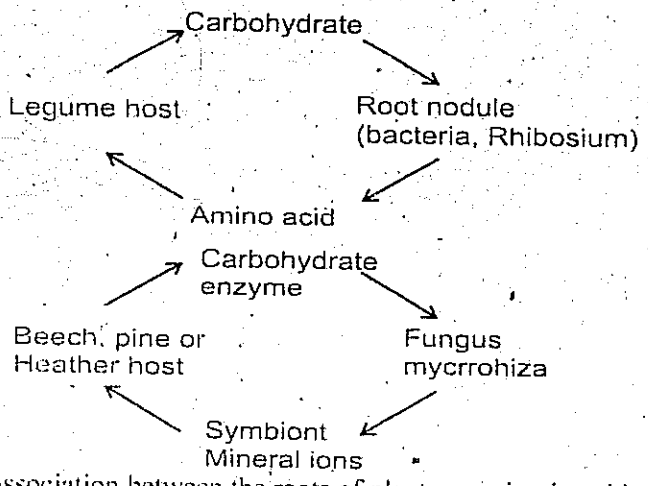
PARASITISM

- ***Parasitism*** is an association between a host and a parasite.
- Diseases in living organism which caused by parasites are called ***infestations***.
- Parasites may be ***ectoparasites*** (living outside the body of the host) and ***endoparasites*** (living inside the body of the host).

SYMBIOSIS

- ***Symbiosis*** is an association between two organisms which brings benefit to both organisms.

• Legume plants, pea plants and beans are the hosts to symbiont bacteria which inhabit the roots forming ***root nodules***

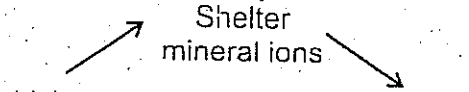


• ***Mycorrhiza*** is an association between the roots of plants growing in acid soil and certain fungi. Host is pine, beech or heather

• **Enlist different types of symbiosis.**

MUTUALISM

• ***Mutualism*** is a symbiotic association in which both partners are benefited.



• ***Lichens*** is a dual organism composed of symbiotic association of an alga living within a fungus mycelium

• The relationship between insects and flowering plants is another example of mutualism. The insect gets nectar from the flower; the flowers are able to reproduce because the insects carry pollen from flower to flower.

COMMENSALISM

• Such type of symbiotic relation in which only one organism is benefited is called ***commensalism***.

• ***Sharks*** may have small fish called ***remoras*** attached to them.

GRAZING

• Feeding on grasses is called ***grazing*** and such animals are called ***grazers***.

• Grasses are more resistant than herbaceous plants.

• Final result of ***over-grazing*** is totally barren land.

D) FLOW OF ENERGY IN AN ECOSYSTEM

• The total amount of energy fixed by pants is ***gross primary production***.

• Gross primary production minus respiratory loss is gross or net primary production. It is plant ***biomass***.

• About 1% of the total energy from sun is trapped by the producers in an ecosystem.

FOOD CHAIN

• All animals depend on plants for their food constituting *food chain*

Simple food chain:

Grass → Caterpillar → Blue bird → Eagle

FOOD WEB

• Combination of many food chains is called *food web*.

• Food webs consist of *3-5 trophic levels* e.g. T1 is producers, T2---primary consumers, T3---secondary consumers, T4—tertiary consumers

E) SIGNIFICANCE OF HUMAN ACTIVITY ON ECOSYSTEM

POPULATION

• *Demography* is the study of human populations and things that affect them.

• *Population of Pakistan* was 32.5 million in 1947. it has now increased to around 150-160 million in year 2000.

• About 20 years ago, human population was increasing at rate of 2% and was doubling every 35 years.

DEFORESTATION

• Clearance of vast areas of forest for procuring lumber, planting subsistence crops or grazing cattle is called *deforestation*.

• The destruction of forests leaves the soil barren and it is called deforestation leading to *desertification*.

• *Reforestation* is replantation of plants in the areas where they were present earlier.

• In reforestation coniferous species are important which often require bare soil to establish.

• *Aforestation* is establishment of new forests where no forests existed previously.

• Forests are called as *environmental buffers* because they break speed of wind, rain and floods.

• About half of the rain, which falls, in tropical forests comes from transpiration of these plants

• *Biodiversity* is total number of different species within an ecosystem and the resulting complexity of interactions among them.

ATMOSPHERIC POLLUTION

• "The befouling of the air by anything that may be harmful to living organisms is air pollution"

AIR POLLUTANT	SOURCES	HARMFUL EFFECTS
Chlorofluorocarbons	Aerosal spray foams, air conditioning system, refrigerants	Thinning of ozone layer, green house effect, global warming
Sulphur dioxide	Power station, fossil fuel	Acid rains, breathing disorders, lung cancer
Lead compounds	Combustion of leaded petrol or oils	Lead poisoning, brain damage, forest decline
Oxides of nitrogen	Burning of fossil fuels	Global warming, green house effect, acid rain, headache, cough
Carbon monoxide	Incomplete burning of carbonate & carbon compounds, cigarette smoke	Headache, brain damage, death

OZONE LAYER DEPLETION

• Ozone is layer of atmosphere extending from *10-50 km* above earth, which filters and protects us from UV rays.

• In pure form ozone is bluish, explosive and highly poisonous gas. Ozone molecule is made up of 3 oxygen atoms O_3.

• Decline in thickness of ozone layer is called *ozone depletion*.

• Ozone depletion is caused by increasing *chlorofluorocarbons* (CFCs), which contains chlorine, flourine and carbon. These are produced from air conditioners and refrigerators.

- A single chlorine atom can react with ultraviolet rays and destroys as many as one million ozone molecules.
- The level of ozone in the ozone layer over the *Antarctica* has fallen drastically and has led to a hole.
- UV rays cause skin cancers and cataracts in human.

GREENHOUSE EFFECT

- *Green house gases* are those, which prevent heat to escape out from them e.g. CO_2.

Sun rays penetrate green house → absorbed by plants and soil → reradiate as longer wave infra-red radiations(heat) → these rays cant escape out from the glass → so heat remains within the green house

- Increase in earth's atmosphere due to CO_2 and retention of heat rays is called ***green house effect.***
- Causes of green house effect are:
- Over urbanization
- Deforestation
- industrialization
- Heating of earth is called ***global warming.***



• Why ozone layer depleted in Antractica?

INDUSTRIAL EFFLUENTS

- The chemical wastes from industry are called ***effluents.***
- Agents that kill insects are called ***insecticides.***
- Agents that destroy herbs are called ***herbicides.***

PRACTICE EXERCISE

1. **A group of several species living together with mutual tolerance or adjustment and beneficial interactions is a natural areas is known as**
   A) Species
   B) Community
   C) Populations
   D) Family
2. **Interaction between the two organisms in which one organism kills and feeds on the second organism is known as**
   A) Scavenging
   B) Parasitism
   C) Predation
   D) Mutualism
3. **The relationship between the two organisms or species in which both the partners derive benefit from each other is known as**
   A) Parasitism
   B) Commensalisms
   C) Symbiosis
   D) Predation
4. **Succession is**
   A) Series of physical changes that occur in an area
   B) Series of changes in community structure
   C) Development of biotic communities on a bare area
   D) Series of changes in community structure and physical environment in an area
5. **What is true of commensalisms?**
   A) One organism is harmed while the other is unaffected
   B) One is benefited while the other is harmed
   C) One organism is benefited while the other is unaffected
   D) Both are benefited
6. **Mycorrhiza is a symbiotic association between**
   A) Algae and fungi
   B) Fungi and roots of plants
   C) Algae and roots of plants
   D) Viruses and Bacteria
7. ***Rhizobium* and root nodules of Pea have an association called**
   A) Predation
   C) Parasitism

B) Symbiosis D) Commensalisms

8. **Total organic matter present in an ecosystem is called**
A) Biomass C) Biome
B) Litter D) Food

9. **A food chain is**
A) Group of organisms which eat the same type of food
B) Series of plants/animals which are interrelated in the form of organism being eaten as food by the other
C) Animals eating the plants
D) Producers and consumers

10. **A food chain always starts with**
A) Consumers B) Producers C) Decomposers D) Detritivores

Exercise

A)

1. **Group of interbreeding organisms residing together in space & time are:**
A) Community B) Population C) Genus D) Family

2. **Regional ecological community of plants & animals primarily determined by climate:**
A) Biome B) Niche C) Habitat D) Both b & c

3. **Layer of earth where life is present is called:**
A) Hydrosphere B) Lithosphere C) Biosphere D) Topography

4. **The relationship of a single population towards its environment is called:**
A) Ecology B) Synecology C) Autoecology D) All of foregoing

5. **"Litho" means:**
A) Air B) Earth / soil C) Water D) All of these

6. **Fungi as well as bacteria are generally known as:**
A) Producers B) Consumers C) Decomposers D) None

7. **Food chains combine to form:**
A) Large food chain B) Large organisms C) Trophic levels D) Food web

8. **The major components of ecosystem are:**
A) 2 B) 3 C) 4 D) 6

9. **The change in structure of community of an ecosystem during a time period is called:**
A) Succession B) Evolution C) Mutation D) Regression

10. **The succession which occurs in dry soil or rock is:**
A) Hydrosere B) Xerosere C) Derosere D) All of these

11. **Climax in xerosere is the establishment of:**
A) Woody forest B) Grasses C) Herbs D) Shrubs

12. Which include seral stages of a primary succession are:
A) Lichen & algae B) Mosses and ferns C) Grasses & shrubs D) All of these

13. Consumers that prey other animals are known as:
A) Predators B) Preys C) Parasites D) Competitors

14. A symbiotic relationship that benefits one species & neither helps nor harms the other is called:
A) Mycorrhiza B) Symbiosis C) Commensalism D) Mutualism

15. Which of these stages appears as a pioneer during succession on barren land?
A) Foliage lichens B) Mosses C) Crustose lichens D) Fruiticose lichens

16. Moss stage is represented by:
A) Polytrichum B) Tortula C) Adiantum D) Both a & b

17. Infestations are the diseases which are caused by _____ in living organisms:
A) Parasites B) Saprophytes C) Bacteria D) Viruses

18. Grazers feed mainly on which kind of plants:
A) Tree leaves B) Shrubs C) Grasses D) Cereals

19. Elements required in large amounts are called:
A) Micronutrient B) Macronutrient C) Organic elements D) Inorganic elements

20. The Study of relationship of an organism to their environment is known is:
A) Biology B) Ecology C) Zoology D) Mycology

21. A community is:
A) A collection of plants and animals C) Autotrophs and heterotrophs
B) Population of different species living together in the same area D) Food chain

22. Producers are:
A) Heterotrophs B) Green plants C) Carnivores D) Herbivores

23. The biotic components of the ecosystem are the:
A) Producers B) Consumers C) Producers, consumers and the decomposers D) Decomposers

24. The examples of decomposers of the ecosystem are the:
A) Fungi B) Fungi and bacteria C) Bacteria D) Viruses

25. Which one of the following is true:

A) Population is a larger unit than a community
C) Biome and community are equal units
B) Biosphere is a smaller unit than a biome
D) Biome is a larger unit than population

26. A lichen is the symbiotic association between a:
A) Fungus and a bryophyte
C) Fungus and an alga
B) Roots of higher plants and an alga
D) Roots of higher plants and a fungus

27. An animal which captures and readily kills living animals for its food is known as:
A) Parasite B) Predator C) Scavenger D) Consumer

28. In an ecosystem sheep and rabbits are examples of:
A) Producers B) Predators C) Grazers D) Saprophytes

29. Which of the following is always an intracellular parasite:
A) Zooparasite B) Viral parasite C) Phyto parasite D) Microbial parasite

30. Which one of the following does not refer to mutualism:
A) Mycorrhiza B) Parasitism C) Lichen D) Bacteria in the gut of cow

31. The correct sequence in a food chain is:
A) Mice – green plants – snake – hawk
C) Green plants – mice – snake – hawk
B) Mice – snake – green plants – hawk
D) Green plants – hawk – snake – mice

32. A symbiotic association between a fungus and the roots of higher plants is known as:
A) Lichen B) Parasitism C) Mycorrhiza D) Commensalism

33. Which one of the following is an example of commensalism:
A) Nodulated roots B) Remoras attached to sharks C) Mycorrhiza D) Plasmodium in the blood

34. The organisms found in the gut of the termites which help it digest wood are the:
A) Bacteria B) Fungi C) Flagellates D) Viruses

35. The oxygen concentration in the air is maintained by the green plants which release it during:
A) Fermentation B) Respiration C) Photosynthesis D) Chemosynthesis

36. The gross production of an ecosystem is its total:
A) Photosynthesis B) Net production C) Photosynthate D) Biomass

37. **A relationship that harms one of the partners is called:**
A) Parasitism B) Symbiosis C) Commensalism D) None

38. **Infestations are the diseases which are caused by _____ in living organisms:**
A) Worms B) Saprophytes C) Bacteria D) Virus

39. **The ecosystem present on land or soil is called:**
A) Terrestrial ecosystem B) Lithospheric ecosystem C) A and B D) None

40. **Which are pioneers of terrestrial ecosystem:**
A) Dermatocarpons B) Parmelia C) Polytrichum D) None of these

41. **Ornithology is the study of:**
A) Mammals B) Reptiles C) Insects D) Birds

42. **What is trampling:**
A) Eating grasses to roots B) Nipping leaves C) Overgrazing D) Putting pressure on soil to make it compact

43. **Overgrazing:**
A) Promotes salinity B) Promotes erosion C) Promotes grasses D) Inhibits dicot competitors

44. **The oxidation of ammonia is:**
A) Ammonification B) Nitrogen fixation C) Nitrification D) Denitrification

45. **Which is not a seral stage:**
A) Climax forest B) Moss C) Shrub D) None

46. **Leech is preferably a:**
A) Host B) Parasite C) Predator D) Mutualist

47. **Omnivores are described by how many trophic levels:**
A) Any 2 B) Any 3 C) Any 1 D) Primary & any higher

48. **Which eat consumers:**
A) Predators B) Carnivores C) Omnivores D) All

49. **Which can't increase their weight in inorganic medium:**
A) Producer B) Consumer C) Decomposer D) Both b & c

50. **It is community relay:**
A) Niche B) Evolution C) Speciation D) Succession

51. **Nutrient elements become the part of protoplasm during:**
A) Photosynthesis B) Decomposition C) Fixation D) Assimilation

52. Pyramid always starts at:
A) T_1 B) T_2 C) T_3 D) T_4

Answers (A):

1.	B	2.	A	3.	C	4.	C	5.	B	6.	C	7	D	8.	B	9.	A	10.	B
11.	A	12.	D	13.	A	14.	C	15.	C	16.	D	17.	A	18.	C	19.	B	20.	B
21.	B	22.	B	23.	C	24.	B	25.	D	26.	C	27.	B	28.	C	29.	B	30.	B
31.	C	32.	C	33.	B	34.	C	35.	C	36.	C	37.	A	38.	A	39.	C	40.	D
41.	D	42.	D	43.	B	44.	C	45.	D	46.	B	47.	D	48.	D	49.	D	50.	D
51.	D	52.	A																

B)

1. Global warming is due to:
A) CFC's B) SO_2 C) O_3depletion D) CO_2

2. Acid rain is mainly due to:
A) SO_2 B) NO_2 C) Lead components D) Both a and b

3. Ozone is present at about _____ km above earth:
A) 5 – 10 B) 10 – 20 C) 10 – 40 D) 10 – 50

4. The purest form of ozone is of _____ colour.
A) Greenish B) Bluish C) Yellowish D) Reddish

5. The major effect of global warming is in the shape of:
A) Disease B) Flood C) Acid rain D) All of these

6. Taj Mahal's marble has been affected by:
A) CFC's B) Lead pollution C) Acid rain D) None

7. Enrichment of water bodies by organic nutrients is called:
A) Organic pollution B) Eutrophication C) Sewage pollution D) Detergents pollution

8. Which disease is due to nutritional deficiency:
A) Scurvy B) Diabetes C) Herpes D) Diphtheria

9. Establishment of new forest at places where no forests existed previously is called:
A) Reforestation B) Afforestration C) Deforestration D) Both a and b

10. What are the environmental buffers?

A) Trees B) Animals C) Factories D) Microbes

11. Cloud cover is reduced due to:
A) Reforestation B) Afforestration C) Deforestration D) Air pollution

12. Monoculture is:
A) One organism B) A lab culture C) A pure culture D) Both b and c

13. Hemophilia is a _____ disease:
A) Heritable B) Genetic C) Nutritional deficiency D) Both a and b

14. The study of human population and factor affecting it is called:
A) Population census B) Population dynamics C) Demography D) Etymology

15. About 20 years ago what was the rate at which human population was increasing:-
A) 1% B) 2% C) 3% D) 5%

16. Excessive ploughing of lands in arid regions results in the development of:
A) Forest B) Deserts C) Grasslands D) Fields

17. Dams and canal networks developed for irrigation purposes in Pakistan and many other countriescreate the problems of:
A) Salinity and soil erosion C) Salinity and water logging
B) Soil depletion and water logging D) Soil erosion and depletion

18. Man depends directly or indirectly on his environment for:
A) Fuel B) Food C) Shelter D) All

19. Aerosol spray foams are potential sources of :
A) Carbon monoxide B) Sulphur dioxide C) Chlorofluorocarbons (CFCs) D) Lead compounds

20. The deficiency of which one of the following is cause of goiter:
A) Iodine B) Calcium C) Potassium D) Iron

21. Topography is study of?
A) Population B) Individual C) Earth D) birds

22. Population of Pakistan was _____ in 1947:
A) 23.5 million B) 30 million C) 32.5 million D) 40 million

23. Oxides of nitrogen are produced by burning of:
A) Carbonate B) Leaded patrol C) Fossil fuels D) All of above

24. Global warming is the result of:
A) Ozone layer B) Acid rain C) Green D) All of them

depletion house gases

25. **Which element is the most potent source for the depletion of ozone layer:**
A) Chlorine B) Fluorine C) Carbon D) All of them

26. **Air conditioners are the source of:**
A) Effluents B) SO_2, NO_2 C) Heavy metals D) CFCs

27. Which of these diseases is not infectious?
A) Measles B) Influenza C) Pneumonia D) Tetany

28. **One atom of chlorine can destroy up to---------- ozone molecules?**
A) One million B) One billion C) One thousand D) Two million

29. **Some _____ years ago human population and conversion of land to agricultural production began**
A) 10,000 B) 40,000 C) 5000 D) None

30. **Green house effect, acid rain headaches and coughs are related to which of the followings?**
A) Oxides of nitrogen B) Oxides of sulphur C) CO D) CFCs

31. **What is cause of Eutrophication:**
A) Excreta B) Phosphate C) Nitrates D) All

32. **How plants are deprived of nutrients by acid rain:**
A) Due to leaching B) Due to fall in pH C) Acid creates a barrier to absorption D) Unknown cause

33. **Which oxide causes headache and brain damage:**
A) Nitrogen B) Lead C) CO_2 D) CO

34. **Chlorofluorocarbons are:**
A) Organic B) Inorganic C) Intermediate D) Solid

35. **We are reducing natural 'carbon dioxide's':**
A) Sources B) Sinks C) Both D) None

36. **Modern man has been on this planet for about:**
A) 4000 years B) 400,000 year C) 40,000 years D) 50,000 years

37. **Lichens forms**
A) Climax community
B) Pioneer community
C) Hardy invaders
D) Both b and c

38. **Succession starting on dry soil is**
A) Hydrosere
B) Hygrosere
C) Xerosere
D) Both b and c

39. **Dermatocarpon is an example of**
A) Foliose lichen
B) Crustose lichen
C) Fruiticose lichen
D) All of these

40. **Replantation of trees is**

A) Deforestation
B) Reforesaton
C) Aforestation
D) Preforestation

41. Which is environmental buffer?
A) Trees
B) Herbs
C) Lichens
D) Mycorrhiza

42. Ozone is
A) Bluish
B) Explosive
C) 10 - 50 km
D) O_2

43. CFCs causes
A) Ozone depletion
B) Acid rain
C) Greenhouse effect
D) Pollution

44. Through which of the following energy enters in an ecosystem?
A) Producers
B) Primary consumers
C) Secondary consumers
D) Decomposers

45. When does the energy flow starts in an ecosystem?
A) When material cycle starts
B) When sun rises
C) When solar energy is convereted to chemical energy
D) When any living organism gains food

46. At each trophic level, energy is lost in the form of:
A) Heat energy
B) Light energy
C) Chemical energy
D) Mechanical energy

47. Which one is not a necessary component for the survival of producers?
A) Light
B) Optimum temperature
C) Organic food
D) Carbon dioxide

48. In _____ competition for light nutrients and space is much sevrere:
A) Population
B) Biome
C) Community
D) Forest

49. Study of an individual in relation to various environmental factors refer to:
A) Synecology
B) Autecology
C) Population ecology
D) Human biology

50. Competition, parasitism, predation are all:
A) Positive interaction
B) Interaction between plants only
C) Negative interactions
D) Interaction between plants and animals

51. Ozone saves the biosphere by absorbing the radiations called:
A) IR rays
B) X-rays
C) UV rays
D) Gamma rays

52. Ecosystem show all characters except:
A) Homeostasis
B) Self-recognition
C) flow of energy
D) Consist of biotic factors only

53. Branch of biology that deals with human population and things that affect them:
A) Enivronmental biology
B) Human biology
C) Population genetics
D) Demography

54. Ice caps and are melting rapidly due to:
A) Green house effect
B) Ozone layer depletion
C) Acid rain
D) Algal blooms

55. Large amount of _____ in lakes encourages the growth of algae called eutrophication.

A) Minerals
B) Organic food
C) Oxygen
D) Humum

56. Every one can become a prey except.
A) Producers
B) Primary consumers
C) Secondary consumers
D) Carnivores

57. Population is a group of interbreeding organisms sharing.
A) Same time
B) Same space
C) Same resources
D) Same place

58. All the populations with in an ecosystem are known as:
A) Environment
B) Grand population
C) Community
D) Biosphere

59. Major types of ecosystems, those that occupies broad geographical region form.
A) Biomes
B) Biosphere
C) Community
D) Desert

60. Nitrogen fixing bacteria are those which
A) Inhabit the roots of leguminous plants
B) Are decomposers
C) Are saporotrophic
D) Present every where

61. _____ is the driving force of an ecosystem.
A) Biomass
B) Solar energy
C) Producers
D) Carnivores

62. All of the following can be reason of disastrous floods except:
A) Deforestation
B) Global warming
C) Greenhouse effect
D) Acid rain

63. The establishment of new forests where no forests existed previously.
A) Deforestation
B) Afforestation
C) Reforestation
D) Environmental buffer

64. A single chlorine atom can react with ultraviolet rays and destroy ozone molecules up to:
A) One hundred
B) One thousand
C) One million
D) One trillion

65. Which of the following is not a symbiotic relationship?
A) Parasitism
B) Predation
C) Commensalism
D) Mutualism

66. Which of the following factor enhances soil eroision.
A) Afforestation
B) Deforestation
C) Reforestation
D) Eutorphication

67. Carnivores that eats herbivores are
A) Primary consumers
B) Secondary consumers
C) Tertiary consumbers
D) Decomposers

68. An ecosystem is made up of _____ necessary feeding components.
A) 3
B) 4
C) 5
D) 6

69. Biosphere is spread out over the surface of the planet earth extending about.
A) 8-10 m
B) 8-10 Km
C) 80 – 100 Km
D) 8-12 Km

70. _____ is much more rapid – then others
A) Primary succession
B) Secondary succession
C) Xerosere Succession
D) Hydrosere Succession

71. _____ is the first stage of xerosere

A) Crustose lichen stage
B) Foliage lichen stage
C) Moss stage
D) Herbaceous stage

72. _____ is the most toxic oxide.
A) NO_2
B) SO_2
C) CO_2
D) CO

73. Disease caused by parasites in their hosts is called as:
A) Infection
B) Infestation
C) Contamination
D) Inflammation

74. Thin layer of earth in which all living organisms exists.
A) Habitat
B) Niche
C) Biosphere
D) Atmosphere

75. Basic role of an organisms in the community is sescribed as
A) Habitat
B) Niche
C) Predator
D) Autotroph

76. Which one can't directly feed on producer
A) Cuscuta
B) Rabbit
C) Insect larvae
D) Eagle

77. Which of the following process act to remove CO_2 from atmosphere?
A) Burning fossil fuels
B) Photosynthesis
C) Deforestation
D) Lighting

78. _____ exactly describe biotic component of ecosystem
A) Flora, fauna and climate
B) Microbes, animals and plants
C) Climate, soil, water and atmosphere
D) Climate, animals and humans

79. Succession begin by
A) Natives
B) Descendants
C) Pioneers
D) Immigrants

80. Mycorrhizal asocation usually found growing in.
A) Acidic soil
B) Sodic soil
C) Saline soil
D) Sand

81. Which of the following has inverse relationship with population increase.
A) Solid waste
B) Buildings
C) Industry
D) Forest

82. _____ is not concerened with ozone layer depletion
A) CFCS
B) Ultraviolet rays
C) Foams
D) Leaded petrol

83. Humans affect the environment in the following ways
A) Harvesting of marine algae
B) Combustion of fossil fuets
C) Felling of tropical rain forest
D) Afforestation

84. _____ limits the no of trophic levels in food chain
A) Primary productivity
B) Efficient energy conversations
C) Net productivity
D) Species diversity

85. An omnivores lives at _____ trophic levels.
A) One
B) Two
C) More than one
D) Depends upon energy of trophic level

86. The niche of the man in an ecosystem
A) Decomposer
B) Producer
C) Consumer
D) Organiser

87. The flow of energy in food chain is

A) Straight
B) Cyclic
C) Zigzag
D) Scattered

88. Harmful effect of overgrazing are:
A) Good pastured lands
B) Rocky areas
C) Totally barren lands
D) Salinity

89. Total solar energy trapped by the producers in an ecosystem is:
A) 95%
B) 99%
C) 78%
D) 1%

90. The colour of ozone in its pure form is:
A) Greenish
B) Bluish
C) Yellowish
D) Reddish

91. Energy flow in an ecosystem is:
A) Unidirectional
B) Multidirectional
C) Bidirectional
D) Non directional

92. Which of the following term best describe the food web?
A) Species
B) Community
C) Biome
D) Niche

93. Diverse and stable community at the end of succession is:
A) Stable community
B) Top community
C) Climax community
D) Pioneers community

Answers (B):

1.	D	2.	D	3.	D	4.	B	5.	B	6.	C	7	B	8.	A	9.	B	10.	A
11.	C	12.	C	13.	D	14.	C	15.	B	16.	B	17.	C	18.	D	19.	C	20.	A
21.	C	22.	C	23.	C	24.	C	25.	A	26.	D	27.	D	28.	A	29.	A	30.	A
31.	D	32.	A	33.	D	34.	A	35.	B	36.	C	37	D	38	C	39	A	40	B
41	A	42	A	43	A	44.	A	45.	C	46.	A	47.	C	48.	A	49.	B	50	C
51.	C	52.	D	53.	D	54.	A	55.	A	56.	A	57.	C	58.	C	59.	A	60.	A
61.	B	62.	D	63.	B	64.	C	65.	B	66.	B	67.	B	68.	A	69.	B	70.	B
71.	A	72.	D	73.	B	74.	C	75.	B	76.	D	77.	B	78.	B	79.	C	80.	A
81.	D	82.	D	83.	B	84.	B	85.	C	86.	C	87.	A	88.	C	89.	D	90.	B
91.	A	92.	B	93.	C	94.		95.		96.		97.		98.		99.		100.	

Solved Exercise

Q NO. 30

The greenhouse effect in the warming that happens when certain gases in the earth atmosphere trap heat. The greenhouse gases H_2O water vapors, CO_2, methane CH_4, nitrous oxide + Ozone O_3let in light but keep heat from escaping like glass wall of green house, hence the name.

Unit # 9
EVOLUTION

LEARNING OUTCOMES

A) Theory of Darwin and Lamarck, also discuss the merits and demerits
B) Evidences of evolution from paleontology and comparative embryology
C) Sex determination and sex linkage in humans
D) Define the following terms:
Mutations, Epistasis, Gene, Allele, Multiple allele, Pleiotropy

10. EVOLUTION & GENETICS

Content

Darwin's theory
Lamarck's theory
Evidences of evolution
Genetics

A) 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.
- According to Lamarck, inheritance of acquired characters means that the modifications an organism acquires during its lifetime can be passed along to its offspring.

• Can you give example of any trait evolving in humans?

DARWIN'S THEORY OF NATURAL SELECTION

- Darwin 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

B) EVIDENCES OF EVOLUTION

• What are putrified fossils?

PALAEONTOLOGY

- ***Fossils*** are either the actual remains or traces of organisms that lived in ancient geological times.
- Most fossils are found in ***sedimentary rocks.***
- Fossils provide visual record in a complete series showing the evolution of an organism.
- The oldest known fossils are of prokaryotes.
- They show chronological appearance of the different classes of organisms.

COMPARITIVE EMBRYOLOGY

- Evolution is a ***remodeling process*** in which ancestral structures that functioned in one capacity become modified as they take on new functions.
- Closely related organisms go through similar stages in their embryonic development
- Gills have modified into ***Eustachian tubes*** that connect the middle ear with the throat in humans.

• Write any five example of vestigial structures in human.

MOLECULAR BIOLOGY

- Evolutionary relationships among species can be found in their DNA, proteins in their genes and gene products.
- Sometimes, the genes and proteins of two species have similar sequences of monomers. It means that they have a common ancestor.

Example:

For example, a common genetic code is evidence in support of evolution and is a basis for the unity and diversity of life.

Example:

Similarly, humans and bacteria are taxonomically remote organisms. But still they have some common proteins. For example, cytochrome c is a are respiratory protein. It is found in all aerobic species.

BIOGEOGRAPHY

- The geographical distribution of species is called biogeography. It was biogeography that first suggested the idea of evolution to Darwin. The islands have many endemic species of plants and animals. These species are closely related to species of the nearest mainland or neighboring island.
- **For example**, armadillos (the armored mammals) live only in the America. The evolutionary view of biogeography predicts that contemporary armadillos are modified descendants of earlier specie. These species occupied these continents. The fossil record confirms that such ancestors existed.

HARDY WEINBERG THEOREM:

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. The Hardy Weinberg theorem describes the frequencies of genotypes of non-evolving population. So shuffling of alleles due to meiosis and random fertilization has no effect on the overall genetic structure of a population. Hardy Weinberg theorem is named for the two scientists, Hardy and Weinberg. They derived this principle independently in 1908.

- The genic structure of a noevolving population remains constant over the generation.

- Sexual recombination alone will not alter the relative frequencies of alleles of alleles of genotypes. (p = frequency of A; q = frequency of a.)

Application of Hardy Weinberg theorem:

The Hardy Weinberg equation is used for calculation the frequencies of alleles and genotypes in populations at equilibrium. For example, a gene locus has only two alleles in a population.

1. **Measurement of allelic frequency:** Population geneticists use the letter p to represent the frequency of one allele and the letter q to represent the frequency of the other allele. A wildflower population has

$$p = 0.8$$
$$q = 0.2$$

Note that p + q = 1, the combined frequencies of all possible allele must be equal to 1005 of the genes for that locus in the population. It there are only two alleles and we know the frequency of one, the frequency of other can be calculated.

2. **Measurement of gene frequency:**

In the wildflower population the frequency of dominant allele is;	P = 0.8
The frequency of recessive allele:	q = 0.2
The gametes combine their alleles to from zygotes. The probability of producing AA genotype. Then probability of an A sperm fertilizing A ovum to produce. AA zygote is:	P^2 = 0.64
The frequency of individual homozygous for the other allele (aa) population is:	q^2 = 0.2x0.2=0.04
There are two ways in which an Aa genotype can arise. It depends on which parent contributes the dominant allele. Therefore, the frequency heterozygous individuals in the population is:	2pq 2x0.5x0.2=0.32
We have calculated the frequencies of all possible genotypes correctly, they should add to give.	1

p^2 + 2pq + q^2 = 1
(Frequency of AA) (Frequency of Aa + AA) + (Frequency of aa) =1
0.064 + 0.32 + 0.04 =1

In fact, the Hardy Weinberg equation is a binomial expansion:

$(p + q)^2 = p2 + 2pq + q^2$

Factors affecting gene frequency

1. **Mutation**
   A spontaneous change in part of DNA is called mutation. Mutation is the ultimate source of all changes.
2. **Migrations**
   The movement of an organism from on population to the other is called migration. Emigration and immigration of members of a population cause disturbance in the gene pool.
3. **Genetic drift**
   The change in frequency of alleles (in a small population) at a locus by chance is called genetic drift.
4. **Non Random Mating**
   Individuals with certain genotypes mate with one another more commonly than expected random mating. This is called random mating.
5. **Selection**
   Some individuals leave behind more progeny than others due to their well-adapted inherited characteristics. This is called selection. Selection can be artificial selection of natural selection: the environment plays this role. Thus selection affects the proportions of gene in a population.

PRACTICE EXERCISE

1. **The use and disuse principle of evolution or theory of "inheritance of acquired characters" was proposed by:**
   A) Hugo de Vries
   B) Weismann
   C) Lamarck
   D) Darwin
2. **The present giraffe has a long neck as compared to its ancestors. Lamarck believed it could be due to:**
   A) Natural selection
   B) Inheritance of acquired characters
   C) Isolation
   D) Speciation
3. **For evolutionary success, mutations must occur in:**
   A) Somatic RNA
   B) Germ cell DNA
   C) Somatic DNA
   D) Germplasm RNA
4. **Which of the following concept is attributed to Charles Darwin?**
   A) Use and disuse of organs is of great importance in evolution
   B) Every cell must come from a preexisting cell
   C) In the struggle for existence, the fittest would survive
   D) The gametes will carry only one of a pair of contrasting characters.
5. **Key point of Lamarck's view about organic evolution is that every offspring:**
   A) Is similar to its parents
   B) Inherits characters acquired by the parental generation
   C) Shows struggle for existence
   D) Repeats phylogeny in its ontogeny
6. **The initial theory that environment can bring about changes in individuals was proposed by:**
   A) Mendel
   B) Lamarck
   C) Darwin
   D) Lyell
7. **The animal species on the Galapagos resemble species living on the:**
   A) North American mainland
   B) South American mainland
   C) Great Britian
   D) Northern Europe
8. **Darwin worked out the major features of his theory of natural selection as the mechanism of:**
   A) Adaptation
   B) Modification
   C) Reproduction
   D) Evolution
9. **Production of more individuals than the environment can lead to:**
   A) Struggle for existence
   B) Survival of the fittest
   C) Natural selection
   D) Evolution

Exercise

A)

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. Study of distribution of living things on earth is called:
A) Comparative anatomy B) Biogeography C) Comparative embryology D) Zoogeography

6. Number of Individuals of an area belonging to same species are:
A) Population B) Gene Pool C) Species D) Both a and b

7. C. Darwin died in the year:
A) 1866 B) 1881 C) 1882 D) 1902

8. Penguin is a bird that lost the use of its wings by not flying. Such statement would express the viewsof:
A) Darwin B) Wallace C) Lamarck D) Huxley

9. The fossil remains of archaeopteryx were found from:
A) Jurassic rocks B) Triassic rocks C) Cretaceous rocks D) Cenozoic rocks

10. The fossil remains of archaeopteryx shows characteristics of:
A) Amphibians B) Reptiles and Birds C) Fish and amphibians D) Reptiles and mammals

11. Remote homologies can be found in:
A) Homologous organs B) Analogous organs C) Vestigial organs D) All of these

12. Existence of coal can be explained by:
A) Ecology B) Botany C) Paleontology D) Bacteriology

13. Frequency of a character increases when it is:
A) Recessive B) Dominant C) Mutated D) Adaptable

14. **Sum total of genes in a population is:**

A) Genotype B) Karyotype C) Genetic constitution D) Gene Pool

15. **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

16. **Darwin's theory, as presented in the Origin of Species, is mainly concerned with:**

A) How new species arise B) The origin of life C) How adaptations are inherited D) How extinctions occur

17. **An important vestigial organ of man is:**

A) Ear muscles B) Nasal membrane C) Colon D) Rectum

18. **Which type of struggle for existence is more challenging:**

A) Intra-specific B) Inter-specific C) Among communities D) None of these

19. **In human body all the following organs are vestigial, except:**

A) Nictitating membrane B) Muscles C) Appendix D) Coccyx

20. **Galapagos Islands visited by Darwin are near:**

A) South America B) Australia C) South Africa D) Europe

21. **_____ refers to the processes that have transformed life on earth from its earliest forms to the vastdiversity that we observe today:**

A) Evolution B) Catastrophism C) Random mating D) New-Drawinism

22. **The organ which become reduced or non-functional in an organism but is functional and welldeveloped in alike form is called:**

A) Homologous organ B) Vestigial organ C) Primordial organ D) Analogous organ

23. **The presence of notochord, gill slits and dorsal hollow central nerve tube are the characteristicfactures of:**

A) Fishes B) Chordates C) Invertebrate D) All the animals

24. **Similarities in the nature of protein, DNA and RNA have confirmed that:**

A) All living things were specially created C) They form a food chain

B) All living things are related to each other D) They have undergone mutation

25. The ocean between Europe and North America;
A) Atlantic B) Pacific C) Indian D) North Pacific

26. Which is Island:
A) Australia B) New Zealand C) West Indies D) All

27. Charles Darwin was:
A) Evolutionist B) Naturalist C) Creationist D) Both a & b

28. Which of these represent the tip of evolutionary tree which Darwin explained in "Descent withmodification":
A) Man B) Cow C) Angiosperms D) All

29. Neo Darwinism was developed in early:
A) 1920s B) 1930s C) 1940s D) None

30. Forelimbs of bat and armadillo would be:
A) Analogous B) Homologous C) Vestigial D) None

31. The pterodactyls were:
A) Primitive reptiles B) Flying birds C) Primitive birds D) Mammals

32. They are historical remnants of structures that had important function in ancestors but no longeressential:
A) Homologous B) Analogous C) Accessory D) Vestigial

33. Whales retain which of these as vestigial:
A) Pectoral girdle B) Forelimbs C) Pelvic bones D) Tail

34. Two similar organisms have similarity in:
A) DNA B) RNA C) Proteins D) All of these

35. Most slowly changing molecule which could be used to estimate very distant relations:
A) rRNA B) Ribosome C) mRNA D) tRNA

36. Cytochrome C is found in:
A) Bacteria B) All eukaryotes C) Both of these D) None of these

37. Which is largest ocean:
A) Pacific B) Indian C) Atlantic D) Arctic

38. Endosymbiont hypothesis was first proposed by
A) Lynn Margulis
B) Lynn Malthus
C) Lynn Wallace
D) Lyell

39. Tissues of the fossils can be replaced petrified by
A) Calcium oxalate
B) Silica
C) Calcium carbonate
D) Both b & c

40. Archaeobacteria can tolerate temperature upto
A) 120 °C
B) 220 °C
C) 500 °C
D) 320 °C

41. Evolution is in contrast to:
A) Homology
B) Special creation
C) Mutation
D) Migration

42. Our atmosphere was considered, initially as
A) Catalytic
B) Reducing
C) Oxidizing
D) Analytic

43. _____ believed in perceived unity in life
A) Malthus
B) Lamarck
C) Lyell
D) Darwin

44. Similarity in characteristics resulting from common ancestory is known as
A) Analogy
B) Homology
C) Progression
D) Retrogression

45. The organ which are structurally different but work alike are called
A) Homologous organs
B) Vestigial organs
C) Analogous organs
D) Vegetative organs

46. Which can not alter allelic frequency at once?
A) Selection
B) Inbreeding
C) Mutation
D) All of these

47. _____ may lead to the loss of particular alleles in small populations.
A) Genetic drift
B) Genetic frequency
C) Genetic stability
D) Genetic consistency

48. In a population, gene frequencies can be alter by:
A) Migration
B) Natural selection
C) Mutation
D) All of these

49. The smallest biological unit that can changes/evolve over the time is:
A) Species
B) Population
C) Individual
D) Community

50. An acquired character is that
A) Is inherited by an organism
B) Can pass from parents to offspring
C) Provide material for evolution
D) None of these

51. In terrestrial animals gill pouches develop into
A) Gills
B) Lungs
C) Eustachian tube
D) Pharynx

52. Oldest known fossils are
A) Eukaryotes
B) Prokaryotes
C) Protista
D) Viruses

53. Descent with modification means
A) All organisms show resemblance
B) The organisms do not show resemblance
C) Ancestor shows resemblance with descendent but later changes
D) Both b and c

54. Most fossils are found in
A) Soil
B) Ice
C) Sedimentary rocks
D) Volcano's

55. In humans gill pouches are modified in
A) Nose
B) Ear
C) Eustachian tube
D) Middle ear

56. Inheritance of acquired characters concept was given by
A) Lamarck
B) Darwin
C) Lyell
D) Cuvier

57. Eustachian rube connect middle ear to
A) Neck
B) Larynx
C) Brain
D) Throat

58. Who explained the principles of "survival of fittest"?
A) Wallace
B) Fischer
C) Darwin
D) Lamarck

59. The finches found in Galapagos Islands are best example of
A) Adaptive radiation
B) Convergent evolution
C) Homology
D) None

60. Which one is earliest vertebrate fossil?
A) Fish
B) Amphibians
C) Mammals
D) Reptiles

Answers (A):

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

Unit # 10

GENETICS

LEARNING OUTCOMES

a) Law of segregation
b) Law of independent assortment
c) Sex determination and sex linkage in humans and drosophila
d) Define the following terms:
Mutations, Epistasis, Gene, Allele, Multiple allele, Pleiotropy.
e) Replication, Role of triplet codons, Transcription, Translation synthesis: role of ribosomes, mRNA, tRNA
f) Explain Mitosis, what is its significance?
g) What is Meiosis? Describe it in detail.
h) Describe Meiotic errors (Down's syndrome, Klinefelter's syndrome, Turner's syndrome)
i) Discuss the terms Karyokinesis and Cytokinesis;
j) Discuss and explain:
Uncontrolled cell division (cancer)
Programmed cell death (Apoptosis)
Necrosis

TERMINOLOGIES

GENE:

"Gene is the basic unit of biological information. (A part of DAN with specific base sequence which controls specific character is called gene"

LOCUS:

The position of a gene on the chromosome is called its locus.

ALLELE:

Partner of a gene pair is called allele.

PHENOTYPE:

The form of appearance of a trait is called phenotype.

GENOTYPE:

The genetic complement of an individual is called genotype i.e. the genes in an individual for a particular trait

DOMINANT AND RECESSIVE:

The trait that appears in F_1 is called dominant trait. The trait which is masked in F_1 is called recessive trait.

HOMOZYGOUS:

When both the alleles of a gene pair in an organism are same, it is called homozygous
For example RR

HETEROZYGOUS:

When both the alleles of a gene pair in an organism are different, it is called heterozygous. An individual with a heterozygous genotype is a heterozygote. For example Rr

CODOMINANCE:

Different alleles of a gene that are both expressed in a heterozygous condition are called codominant.

In this case, the heterozygote shows different phenotype then the two homozygotes. It is not an intermediate quantitative expression like incomplete dominance. Each allele of the gene produces different substance, e.g.

$$\text{Allele } A_1 \xrightarrow{\text{Produces}} \text{Substance X}$$
$$\text{Allele } A_2 \xrightarrow{\text{Produces}} \text{Substance Y}$$

MULTIPLE ALLELES:

The genes with more than two altered alternative alleles are celled multiple alleles. Gene mutations produce many different alleles of a gene. Some genes may have as many as 300 cells

EPISTASIS:

When a gene or gene peir 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.

Example:

Bombay Phenotype

LAW OF SEGREGATION:

According to law of segregation, the two coexisting alleles for each trait in an individual segregate from each other during meiosis, so that each gamete receives only one of the two alleles. Alleles unite again at random fertilization of gametes when zygote in formed

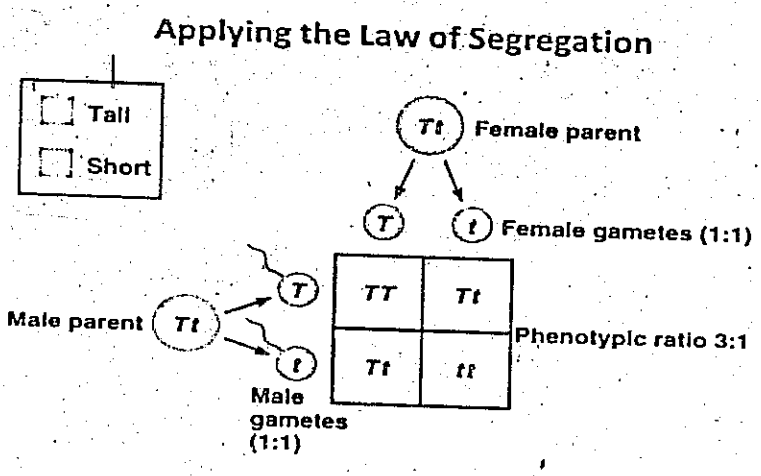
Proof of law of segregation by monohybrid cross

Mandrel carried out following crosses to prove this law.

1. **F_1 Cross:** Mendel crossed the two P_1 generations. One was dominant with round seeds and the other was recessive with wrinkle seeds. All the offsprings in F_1 were round seed.
2. **F_2 Cross:** Then Mendel allowed self-fertilization among F_1 monohybrids. It produces F_2 progeny. As a result of monohybrid cross 1/3 of F_2 were round and 1/4 wrinkled. Mendel got the same 3:1 ratio in offspring of monohybrid crosses for all the seven contrasting pairs of traits.
3. **F_3 Cross:** Then Mendel self-fertilized F_2 plants and he got F_3 generation. He noted that 1/3 of F_2 round produced only round. While 2/3 of F_2 round produced both round and wrinkled in single trait inheritance in 3:1 ratio. But F_2 wrinkled produced only wrinkled. He concluded that 1/3 of F_2 round were true breeding like P_1 round, and 2/3 of F_2 rounds were monohybrids like F round.

Mendel's Interpretations

Concept of Hereditary factor: Mendel proposed that each contrasting form of a trait was determined by particulate hereditary factors. He called these hereditary factors as elementen'.



For example roundness or wrinkledness of seed, these factors carry hereditary information.

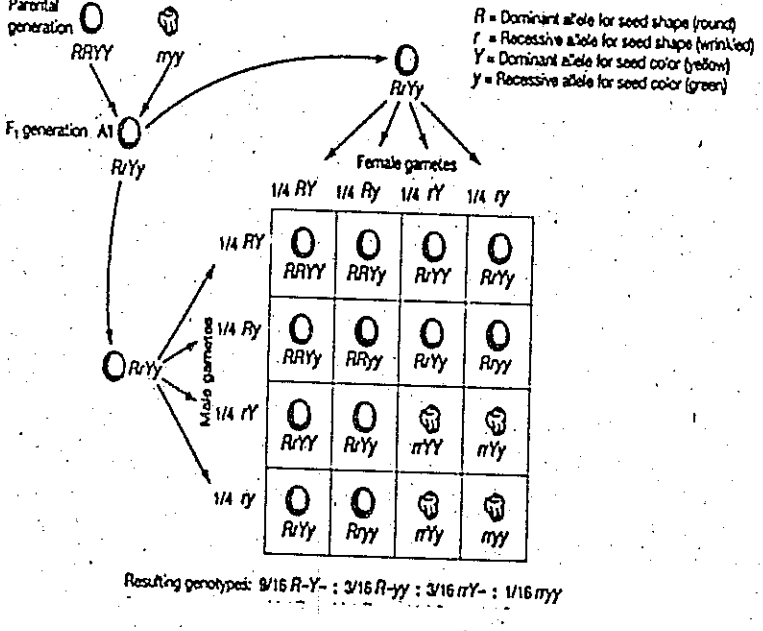
LAW OF INDEPENDENT ASSORTMENT:

It states that, "when two contrasting pairs of traits are followed in the same cross, their alleles assort independently into the two gametes". Alleles of one pair inherit independently of alleles of the other pair. The distribution of alleles of one trait into gametes has no influence on the distribution of alleles of independent of its chance of being yellow or green.

Proof of law of independent assortment by dihybrid cross

Mendel thoroughly studied each trait separately. He then decided to study the inheritance of two traits simultaneously. He used seed shape and seed colour. Seed shape could be round or wrinkled. Seed colour could be yellow or green. He crossed true breeding round and yellow seed plants with true breeding wrinkled and green seed plants. All the F_1 dihybrids were round yellow seeded. So round yellow is dominant over wrinkled green. Then he self-fertilized the F_1 dihybrids. The result was quite surprising. Seeds produced two types of F_2 progeny.

- The two parental combinations, i.e., round yellow and wrinkled green.
- Two new phenotypic combinations, i.e., round green and wrinkled yellow. The F_2 progeny gives 9:3:3:1 phenotypic ratio.



SEX DETERMINATION:

- Chromosomes having genes for determination of sex are called ***sex chromosomes***.
- All chromosomes other than sex chromosomes are called ***autosomes***.

SEX DETERMINATION IN HUMAN:

- 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 ***zigzag 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 which are present both on X and Y chromosome are called X-and-Y linked genes.

HAEMOPHILIA:

- ***Haemophilia***c's blood fails to clot properly after an injury, because it has either reduction or malfunction or complete absence of blood clotting factors.
- ***Haemophilia A and B*** are non-allelic recessive sex-linked but ***haemophilia C*** is an autosomal recessive trait.
- ***80%*** haemophiliacs suffer from haemophilia A due to abnormality of factor VIII, about ***20%*** suffer from haemophilia B due to disturbance in factor IX but less ***1%*** suffer from haemophilia C due to reduction in factor factor XI.

> • Do you know how many factors are required for blood clothing? Name those which are not present in Haemophilics.

COLOUR BLINDNESS

- Normal trichromatic colour vision is based on three different kinds of cone cells in the retina.
- The genes for red and green opsins are on X chromosome while the gene for blue opsin is present on autosome 7.
- A ***dichromat*** can perceive two primary colours but is unable to perceive one whose opsins are missing due to mutation.
- ***Protanopia*** is red blindness, ***deuteranopia*** is green blindness while ***tritanopia*** is blue blindness.
- 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.

> • Can color blindness and haemophilia be autosomal?

OTHERS

- ***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 one 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.

TRAITS AND EXAMPLES

TRAIT	EXAMPLE
X-linked recessive	Hemophilia, colourblindness, testicular feminization syndrome
X-linked dominant	Hypophosphatemic or vitamin D resistant rickets
Y- linked trait	Maleness
Pseudoautosomal trait	Bobbing in insects
Sex limited trait	Milk yield in cow, beard in man
Sex influenced trait	Baldness

DNA AS HEREDITORY MATERIAL:

- first evidence of hereditary nature of DNA was provided by a British microbiologist Frederick Griffth
- He worked on streptococcus pneumoniae
- Streptococcus pneumoniae is of two types
- S-form (smooth) it is virulent strain
- R-form (rough) it is mutant stains which is not virulent

TRANSFORMATION

Transformation is the transfer of genetic material from one cell to another and can alter the genetic makeup of the receipient cell.

Ostwald Avery, Collin Mcleaod and Mclin McCarty:

- They experimentally explained that DNA is hereditary material
- They use different enzyme to cut the protein, RNA and DNA
- DNAase enzyme breaks the DNA which is then not transferred to the receipient cell

Harshy and Chase experiment:

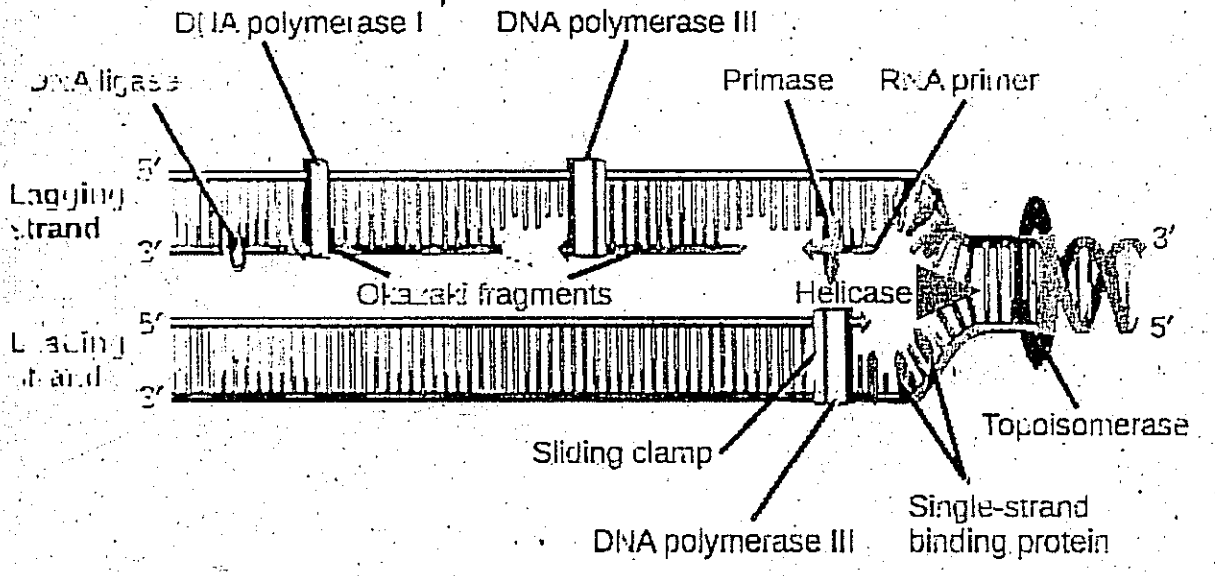
- They provided the final experimental proof about the DNA as hereditary material by using radioisotopes P32 and S35 for DNA and protein respectively
- The radioactively labeled DNA is transferred to the bacteria by bacteriophage which shows that DNA is hereditary material.

REPLICATION OF DNA:

According to Franklin and Wilkin, DNA has a simple double helix shape with a diameter of 2nm and a complete helical turn of 3.4nm.

- 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
- Semi-conservative method 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 method, parental double helix would remain intact and generate DNA copies consisting of entirely new molecule
- According to dispersive model, parental DNA would become completely dispersed and each strand of all daughter molecules would be the mixture of old and new DNA
- DNA polymerase catalyze addition of nucleotides to the complementary strand of DNA
- There are three types of DNA polymerase I, II, III in bacteria

- The true E.coli replicating enzyme is DNA polymerase III which is 10 times larger
- Rate of replication is 1000 nucleotides/second
- Primase constructs primer which is a sequence of about 10 RNA nucleotides complementary to the parent DNA template
- Replication always proceeds from 5' to 3' direction on a growing DNA strand
- Leading strand elongates towards the replication fork
- Lagging strand elongates away from replication fork
- Okazaki fragments are 100-200 nucleotides long in eukaryotes and 1000-2000 nucleotides long in prokaryotes



Role of triplet codons

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 Har Goind Khorana** tested all 64 codons by making artificial mRNA 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 donot code for any for any amino acid and so known as nonsense codons
- 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

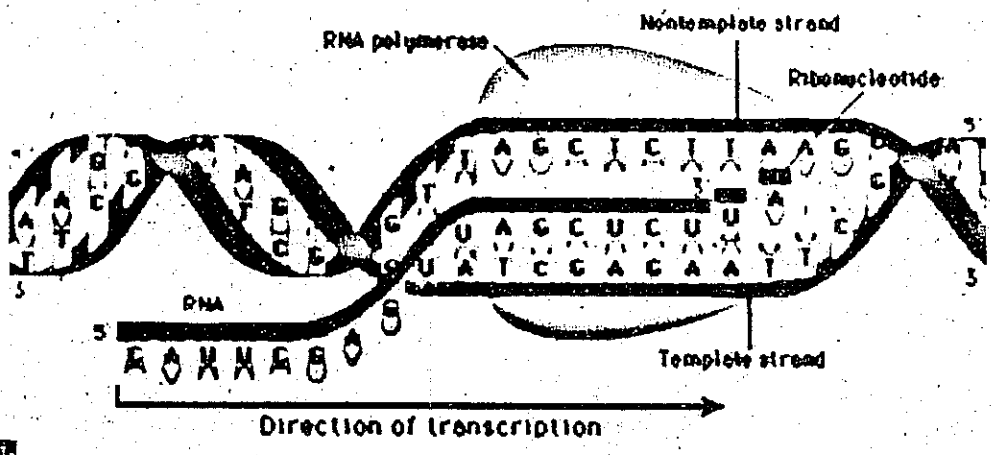
TRANSCRIPTION:

The process in which RNA copy of DNA sequence encoding the genes is produced with the help of an enzyme RNA polymerase

Process:

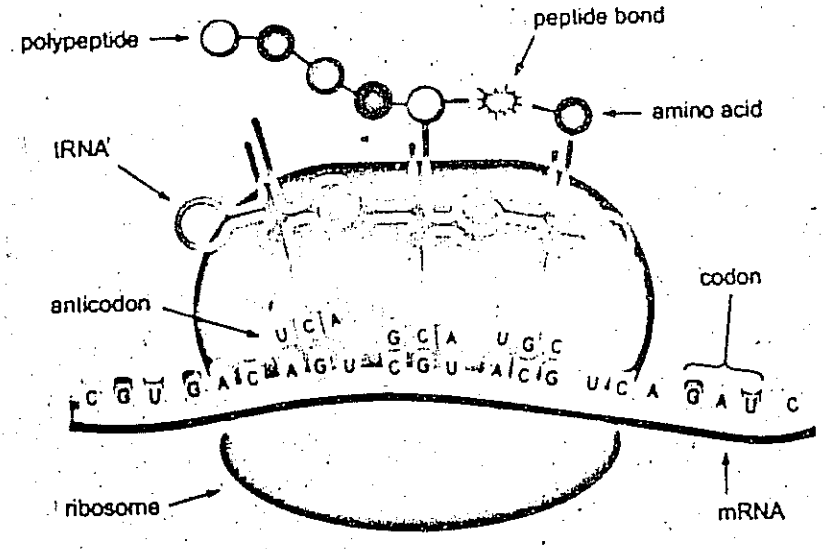
- RNA polymerase transcribes only one strand of DNA, which is called template or antisense strand. Other strand is called coding strand or sense strand or opposite strand
- RNA polymerase enzyme synthesize RNA from 5' to 3' direction

- there is only one type of RNA in prokaryotes which is responsible for the synthesis of all three types of RNAs
- in prokaryotes only one type of RNA polymerase synthesize all 3 types of RNA
- in eukaryotes, RNA polymerase I synthesize rRNA, RNA polymerase II mRNA, and RNA polymerase III synthesize tRNA.
- Transcription starts from promoter on DNA template strand
- In prokaryotes within promoter there are two binding sites TTGACA also called -35 sequence and TATAAT sequence also called -10 sequence. In eukaryotes these are -75 and -25 sites
- In bacteria newly synthesized mRNA is directly released into the cytoplasm when it is converted into polypeptide chain, while in eukaryotes in 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 the addition of 7-methtyl GTP is linked 5 to 5' with first nucleotide while poly A tail linked to 3' end of the RNA



TRANSLATOIN:

- three nucleotide sequence on tRNA is called anticodon
- ribosome and aminoacyl-tRNA is called initiation complex
- particular tRNA molecule becomes attached to specific amino acids through the action of activating enzymes called aminoacyl-tRNA synthetase
- P (Peptidyl site) is involved in peptide bond formation,
- A (aminoacyl site) for the successive aminoacyl-tRNA and
- E (exit site) to eject hollow tRNA
- Initiation factors, elongation factors and termination factors are the main components involved in process of translation
- Translation starts at start codon (AUG) and ends at stop codon (UAA, UAG, UGA)



SEX DETERMINATINO PATTERN:

1. **XO – XX type:**

This pattern of sex determination is found in grasshopper and protenor bug.

- **Male:** Male has only one X chromosome. So it is XO. The other sex chromosome is missing entirely. Thus male is heterogametic and it forms two types of sperm. Half of the sperms have X chromosome, while the other half are without any sex chromosome. A gamete without any sex chromosomes is called nullo gamete.
- **Female:** Female grasshopper has two X chromosomes. Thus it is XX. It forms only one of eggs. So it is homogametic. Every egg carries an X chromosome.

Sex of the offspring depends on the kind of sperm that fertilizes the egg. If and X-carrying sperm fertilized the egg, an XX female offspring is produced. If the nullo sperm fertilizes the egg, on XO male offspring is produced. Sex ratio between male and female offspring is 1:1

2. **XY – XX type:**

This pattern of sex determination is found in drosophila, man and many other organisms.

- **Male:** Male is XY. Male is heterogametic. It produces two types of sex determining sperms. Half the sperm carry X-chromosome and the other half carry Y-chromosome. Chances for both types of sperms are equal.
- **Female:** Female is XX. Female is homogametic. So it produces only one type of eggs. Each egg has an X chromosome. The type of sperm determines sex of the offspring. If an X-carrying sperm fertilizes the egg, the zygote will be XX. Thus a female offspring is produced. If a Y-carrying sperm fertilizes the egg, the zygote will be XY. Thus a male offspring will be produced. The sex ratio between male and female offspring is 1:1. Sex ratio indicates chances of the sex in the offspring. Chances for a son or daughter in human birth are equal.

3. **ZZ – ZW type:**

This type of sex determination pattern is common in birds, butterflies and moths. It was discovered by J. Seiler in 1914 in moth. It is reverse of XY – XX system.

- **Female:** Female is heterogametic ZW. Female produces two kinds of eggs Z and W in equal proportions.
- **Male:** The male is homogametic ZZ. Each sperm is carrying a Z – chromosome. So all the sperm are alike. The kind of egg determines the sex of the offspring. When a Z – carrying egg is fertilized by the sperm, a male offspring is produced. When a W – carrying egg is fertilized by the sperm a female offspring is produced. Sex ratio is 1:1.

CELL CYCLE:

The cell undergoes a sequence of changes, which involve period of growth, replication of DNA, followed by cell division. This sequence of changes is called cell cycle. It consists of two phases which are interphase and mitotic phase. Interphase is that period of non-apparent division while the mitotic phase is the period of division. Each phase is further sub dividable into different sub-phases.

1. **Interphase**

The peiod of life cycle of cell (cell cycle) between two consecutive divisions is termed as the interphase or misleadingly called resting phase.

Phases

(i) G1-Phase

G_1 (Gap 1) is the period of extensive metabolic activiey, in which cell normally grown in size, specific enzymes are synthesized and DNA base units are accumulated for the DNA synthesis.

(ii) S-Phase

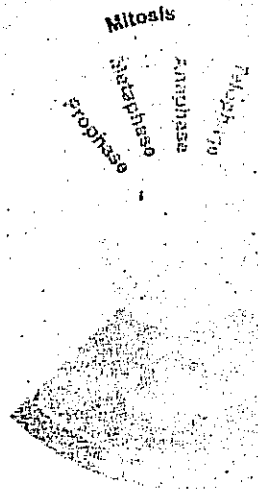
Following the G_1 is the S-phase (synthesis phase), during which the DNA is synthesized and chromosome number is doubled, which initiates G_2 phase (pre-mitotic phase).

(iii) G_2-Phase

This phase prepares the cell for division e.g. energy storage for chromosome movements, mitosis specific proteins, RNA and microtubule subunits (for spindle fibers) synthesize. Cells then proceed to next phase which is the period of division. At each stage there are specific check points, which determine the fate of new phase according to cell's internal makeup.

(iv) G_0-Phase

Post mitotic cell can exit the cell cycle during G_1 entering a phase called G_0, and remain for days, weeks, or in some cased (e.g. nerve cells and cells of the eye lens) even the life time of the organism without proliferating further.



MITOSIS:

It is the type of cell division, which ensures the same number of chromosomes in the daughter cells as that in the parent cell.

Major phases of mitosis

Mitosis is a continuous process, but conventionally it may divided into two phases which are Karyokinesis and Cytokinesis.

KARYOKINESIS:

Karyokinesis is the division of nucleus

At the beginning of the process in an animal cell. the partition of the centriole takes place, which have been duplicated during interphase but present in the same centrosome. Early in the mitosis the two pairs of centrioles separate and migrate to opposite sides of the nucleus. establishing the bipolarity of dividing cells.

There sets of microtubules (fibres) originate from each pair of centrioles.

(i) One set the astral microtubules, radiate outward and form aster. The other two sets of micortublues compose the spindle.

(ii) The kinetochore microtubules attach to chromosomes at kinetochores.

(iii) Polar microtubules do not interact the chromosomes but instead form interdigitate with polar microtubules from the opposite pole. These microtubules are composed of a protein tubulin and traces of RNA. This specialized microtubule structure including aster and spindle is called mitotic apparatus.

PROPHASE:

During interphase (non-dividing) of the cell cycle, the chromosomes are not visible even with the electron microscopy. However, by using histologic stains for DNA, a network of very fine threads can be observed. This network is called as chromatin.

- The chromatin material gets condensed by folding and the chromosome appear s thin threads (0.25 $\mu m - 50\ \mu m$ 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 the prophase, the nuclear envelope disappears. The nuclear material is released in the cytoplasm, the nucleoli disappear. Mitotic apparatus is organized and the Cytoplasm becomes more viscous.

METAPHASE:

Each metaphase chromosome is a duplicated structure which consists of two sister chromatids, attached at a points called centromere or primary constriction.

- The centromere has special area the kinetochore, with specific base arrangement and special proteins where kinetochore fibers of mitotic apparatus attach.
- The kinetochore fibers of spindle attach to the kinetochore region (specialized are in centromere) of chromosome, and align them at the equator of the spindle forming equatorial plate or metaphase plate.
- **The array of chromosomes on the equator of spindle is called equatorial plate.**

ANAPHASE:

It is the most critical phase of the mitosis which ensures the equal distribution of chromatids in the daughter cells.

- The kinetochore fibers of spindle contract towards their respective poles, exert force and sister chromatids are separated from centromere. As a result, half-sister chromatid travel towards each pole. At the same time polar microtubules elongates.

TELOPHASE:

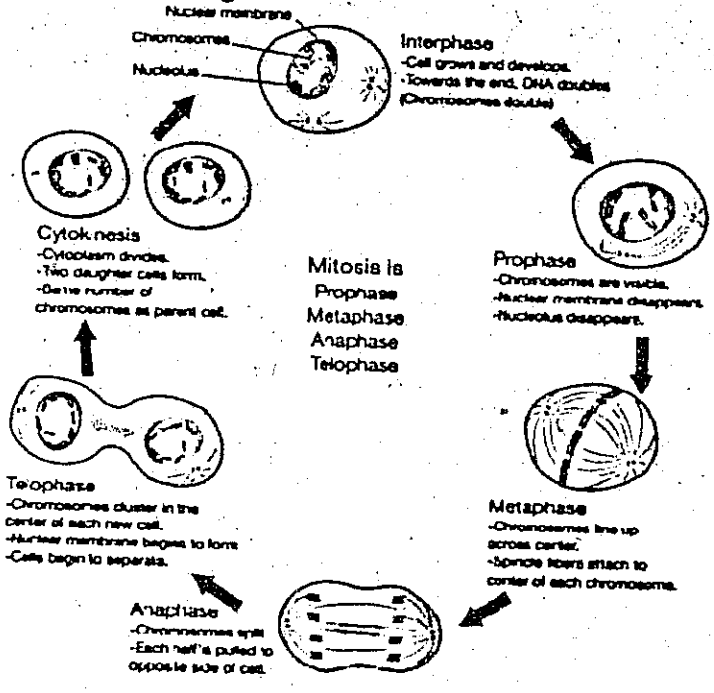
Reaching of the chromosomes at opposite poles terminates anaphase and start telophase.

- The chromosomes decondense due to unfolding and finally disappear as chromatin.
- Mitotic apparatus disorganize while the nuclear membrane and nucleoli recognize. As a result two nuclei are formed at two poles of the cell.

CYTOKINESIS:

Cytokinesis is the division of the whole cell

- During late telophase, the astral microtubules send signals to the equatorial region of the cell, when actin and myosin are activated which form contractile ring, followed by cleavage furrow.
- The cleavage furrow deepens towards the centre of the cells. As a result the parent cell is divided into two daughter cells.



MEIOSIS:

Meiosis is the special type of cell division in which the number of chromosomes in daughter cells is reduced to half, as compared to the parent cell. Meiosis takes place in diploid cells only,

- in animals at the time of gamete formation,
- in plants when spores are produced.

PROPHASE I:

- This is very prolonged phase. It differs from the prophase of mitosis, because in Prophase I of meiosis, the chromosomes behave as homologous pairs.
- Each diploid cell has two chromosomes of each type, one member from each parent, because of fusion of male and female gametes.
- These similar but not necessarily identical chromosomes are called as homologous chromosomes.

- Each chromosome has two chromatids, because chromosomes have been replicated during interphase. The interphase of meiosis lack G_2 stage.

Prophase 1 consists of the followings stages:

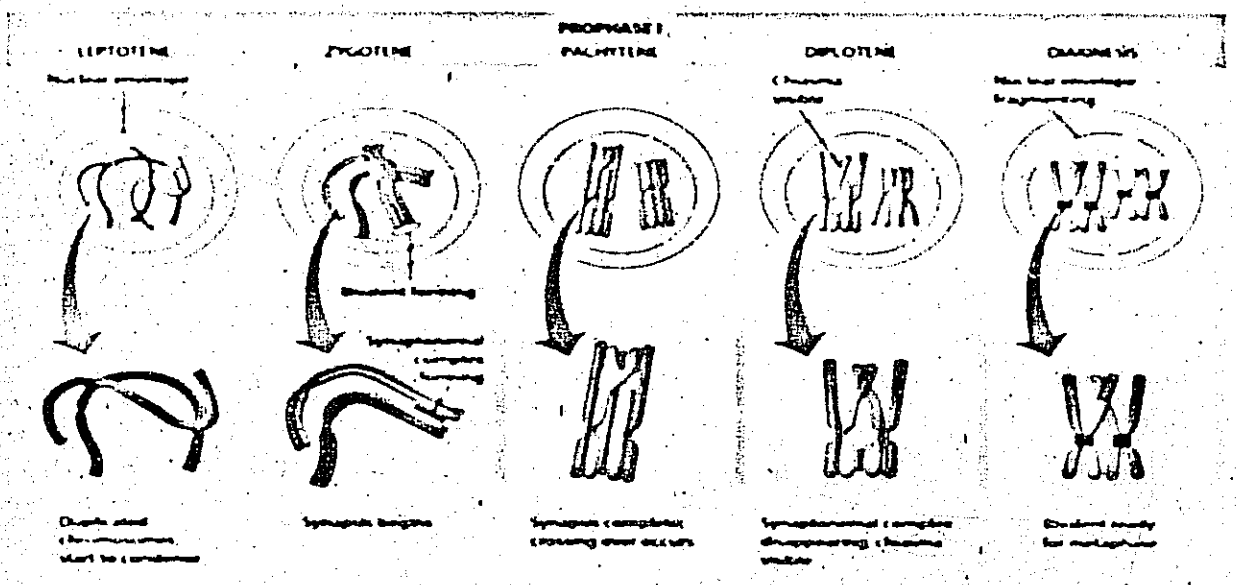
I. **Leptotene:** The chromosomes become visible, shorten and thick. The size of the nucleus increases and homologous chromosomes start getting closer the each other.

II. **Zygotene:** First essential phenomenon of meiosis i.e. pairing of homologous chromosomes called synapsis starts. The pairing is highly specific and exact point for point, but with no definite starting point(s). Each paired but not fuse, complex structure is called as bivalent or tetrad.

III. **Pachytene:** The pairing of homologous chromosomes is completed. Each bivalent has four chromatids, which wrap around each other. **Non-sister chromatids of homologous chromosomes exchange their segments due to chiasmata formation, during the process called crossing over.** In this way reshuffling of genetic material occurs which produce recombination's. **Pachytene may last for day, weeks or even, years whereas leptotene and zygotene can last only for few hours.**

IV. **Diplotene:** the paired chromosomes repel each other and begin to separate. Separation however, is not complete, because homologous chromosomes remain unite by their point of interchange (chiasmata). Each bivalent has at least one such point, the chromatids otherwise are separated (fig 21.5)

V. **Diakinesis:** During this phase the condensation of chromosomes reaches to its maximum. At the same time separation of the homologous chromosomes (started during diplotene) is completed. But still they are united at one point, more oftenly at ends. **Nucleoli disappear.**



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METAPHASE I:

- Nuclear membrane disorganize at the beginning of this phase.
- Spindle fibers originate and the kinetochore fibers attach to the kinetochore of the homologous chromosome form each pole and arrange bivalents at the equator.
- The sister chromatids of individual chromosomes in bivalent behaves as a unit.

ANAPHASE I:

- The kinetochore fibers contract and the spindle or pole fibers elongate, which pull the individual chromosome (each having two chromatids) towards their respective poles.
- In contrast to anaphase of mitosis, sister chromatids are not separated. This is actually reduction phase because each pole receives half of the total number of chromosomes.

TELOPHASE I:

- Nuclear membrane reorganized around each set at two poles.
- Nucleoli reappear and two nuclei each with half number of chromosomes are formed. The cytoplasm also divides and the first meiotic division terminates.
- The chromosomes may decondense during this state.

MEIOSIS II:

- Meisosis II is just like mitosis

MEIOTIC ERROR

DOWN'S SYNDROME (MONGOLISM):

- It is none of the consequences of autosomal non-disjunction man, during which 21st chromosome fails to segregate, resulting gamete with 24 chromosomes.
- This gamete fertilizes normal gamete. The new individual will have 47 (2n + 1) chromosomes.
- Non-disjunction occurs in the ova and related to the age of mother.

Occurrence:

- The chances of teenage mother having down's syndrome child is one in many thousands, forty years old mother has one in hundred chance and by forty- five the risk is three times greater.

Symptoms:

- The affected individuals have flat, broad face,
- squint eyes with the skin fold in the inner corner, and
- Protruding tongue, mental retardation (defective development of central nervous system).

Non-disjunction in the sex chromosome

KLINEFILTER'S SYNDROME:

- These individuals have additional sex chromosome e.g., 47 chromosomes (44 autosome + YXY).

Symptoms:

- They are phenotypically male but have frequently enlarged breasts.
- Tendency to tallness,
- obesity,
- small testes with no sperms at ejaculation and

- Under development of secondary sex characters. Males with 48 chromosomes (44 autosomes + XXXY), whit 49 chromosomes (44 autosomes + XXXXY) and male with 47 chromosomes (44 autosomes + XYY) are also observed (Fig 21.6)

TURNOR'S SYNDROME:

- These affected individuals have one missing X chromosome with only 45 chromosomes (44 autosomes + Y).

Symptoms:

- Individuals with this condition often do not survive pregnancy and are aborted.
- Those which survive have female appearance with
- short stature,
- webbed neck.
- broad chest.
- without ovaries and
- complete absence of germ cells.

EXERCISE:

A)

1. When one gene does not allow the expression of other non-allelic gene, it is referred to as:

A) Dominance B) Mutation C) Epistasis D) Pleiotropy

2. Which of the following processes can reduce variations?

A) Inbreeding B) Out breeding C) Cross pollination D) Hybridization

3. The phenomenon of staying together of all the genes of chromosomes is called:

A) Linkage B) Mutation C) Homozygous D) Histogram

4. An organism with two identical alleles of a gene in a cell is called:

A) Homozygous B) Dominant C) Heterozygous D) Hybrid

5. When an allele fails to express itself in F1 generation in the presence of other allele, the former is saidto be:

A) Recessive B) Co-dominant C) Complementary D) Epistatic

6. Alleles are:

A) Homologous chromosomes C) Alternate forms of a gene

B) Chromosomes that have crossed over D) Linked genes

7. When an individual is having both the alleles of contrasting characters it is said to be:

A) Heterozygous B) Dioecious C) Monoecious D) Hermaphrodite

8. Inheritance of 'ABO' blood group shows:

A) Polyploidy B) Overdominance C) Incomplete dominance D) Multiple allelism

9. Which of following minimizes the chance of genetic recombination:

A) Crossing over B) Epistasis C) Gene linkage D) Pleiotropy

10. Baldness in humans is---------- trait:

A) Sex-limited B) Sex influenced C) Pseudoautosomal D) Polygenic

11. A single gene with multiple phenotypic effects represents:

A) Co-dominance B) Pleiotropy C) Epistasis D) Crossing over

12. If your blood group is AB, you can receive blood from donor with blood group:

A) A B) B C) AB D) All of these

13. To prevent erythroblastosis foetalis mother is given Rh-antiserum:

A) During early pregnancy B) After birth C) At both times D) Not given

14. Secretors have dominant secretor gene "Se" on chromosome:
A) 9 B) 11 C) 21 D) 19

15. Most gametes have parental combination of linked genes but some are different as a result of:
A) Segregation B) Independence C) Non-disjunction D) Crossing over

16. Haemophilia is a serious genetic diseases in which:
A) Blood clots very fast
B) Blood fails to clot or clots very slowly after an injury
C) Formation of red blood cells increased
D) Haemoglobin fails to absorb oxygen

17. A person with blood type AB can donate blood to another one having blood type:
A) O, A, B, AB B) AB C) B and AB D) A and AB

18. Colour blindness is more common in men than women because:
A) Its allele is situated on the 'X' chromosome only
B) Its allele is recessive
C) Its allele is recessive and is situated on the 'X' chromosome only
D) Its allele is dominant and is situated on the 'X' chromosome only

19. A person having blood type O is universal donor because of:
A) Absence of antibodies in blood
B) Presence of antigen A only
C) Absence of antigens on RBCs
D) Presence of antigens B only

20. Inheritance of colour of kernel in wheat is an example of:
A) Monogenic inheritance B) Polygenic inheritance C) Pleiotropic inheritance D) None of these

21. All the following characters are sex related except:
A) Baldness B) Haemophilia C) Albinism D) Colour blindness

22. Protanopia are those who can / are:
A) See red B) Green blind C) Red blind D) Blue blind

23. Insulin dependent diabetes mellitus is due to:
A) Obesity B) Auto immunity C) Aging D) Cancer

24. Genes which don't settle at one place:
A) Walking genes B) Running genes C) Jumping genes D) All of these

25. Which one is an example of co-dominance:
A) MN B) AB C) O D) Both a & b

26. Which one is universal recipient:
A) O^{+ve} B) O^{-ve} C) AB^{+ve} D) AB^{-ve}

27. Who gave the word of genes:
A) Fleming B) Correns C) Johannsen D) Avery

28. Secretors have antigens in their:
A) Kidneys B) Secretions C) Interstitium D) Body cells

29. Which blood group has no antigen:
A) O B) A C) B D) AB

30. Which blood group has no antibodies of ABO system?
A) A B) B C) AB D) AB-

31. Bombay phenotype has _____ blood group phenotype:
A) A B) B C) AB D) O

32. If husband and wife have 'O' blood groups they will have no child of:
A) A B) B C) AB D) All

33. XO syndrome in drosophila is a:
A) Sterile male B) Fertile male C) Sterile female D) Fertile female

34. Universal donors are:
A) Recessive B) Rare C) Both D) Dominant

35. Which type of hemophilia is due to disturbance in factor XI:
A) A B) B C) C D) Both a & b

36. Deuteranopia is _____ colour blindness:
A) Green B) Red C) Blue D) All

37. Which colour blindness is not sex linked:
A) Green B) Red C) Blue D) None

38. X-linked recessive traits are:
A) More in females B) More in males C) Less in male D) Less in female

39. The chances of which hemophilia is equal in male & females:
A) A B) B C) C D) All

40. Man has _____ linkage group:
A) 23 B) 21 C) 25 D) 46

41. The two linked genes A and B with a 30% recombination frequency must be:
A) 15 units apart B) 30 units apart C) 60 units apart D) 90 units apart

42. SRY is located at the tip of:
A) Short arm of X-chromosome B) Short arm of Y-chromosome C) Long arm of Y-chromosome D) Long arm of X-chromosome

43. Pseudo-autosomal genes are present on:
A) X-chromosome B) Y-chromosome C) Both a & b D) Autosomes

44. Diabetes is the leading cause of:
A) Kidney failure B) Adult blindness C) Heart disease D) All of these

45. Blood pressure is also an example of _____ trait:
A) Multifactorial B) Qualitative C) Single genic D) Both a & b

46. A carrier mother for colour blindness does not have:
A) A normal boy B) A carrier boy C) A colour blind boy D) A normal daughter

47. How many kinds of rhodopsins, a blue cone monochromate will have:
A) 3 B) 2 C) 1 D) No rhodopsins

48. Degenerated testes are present in abdomen in which of these cases:
A) Down's syndrome B) Klinefelter's syndrome C) Turner's syndrome D) Testicular feminization

49. Insulin receptors are present in:
A) Cytoplasm of muscle cells B) Cell membrane of liver cells C) Cell membrane of muscle and liver cells D) Cell membrane of all body cells

50. A blue cone monochormate:
A) Can perceive two colours B) Can't perceive any colour C) Can perceive only blue colour D) Can perceive only red colour

51. Which can convert glucose to glucose 6 phosphate:
A) Hexokinase B) Glucokinase C) Phospho fructokinase D) Both a & b

52. What will be the risk of heamophila in sons if father is haemophilic and mother is normal:
A) 0% B) 20% C) 25% D) 50%

53. Queen Victoria was having which kind of haemophilia:
A) A B) B C) C D) None

54. Genes can be mapped on chromosomes on the basis of:
A) Sex linkage B) Assortment C) Recombination frequency D) Gene sequencing

55. If six cells out of 10, do crossing over what will be percentage of cross over gametes:
A) 60% B) 30% C) 40% D) 50%

56. If the distance of 20 map units is found among two linked loci what would be the percentage of crossover gametes:
A) 40% B) 60% C) 20% D) 10%

57. Color blindness, haemophilia and gout form linkage group on:
A) Chromosome 9 B) Chromosome 19 C) x-chromosome D) y- chromosome

58. Anti-Rh antibodies appear in plasma:
A) During first few months B) During last months C) Only when stimulated D) If Rh^+ individual mistakenly receives Rh- blood

59. When father is AB and mother is B, they can't have a baby of blood group:
A) A B) B C) AB D) O

60. There are _____ total possible genotypes of blood group ABO system:
A) 3 B) 4 C) 6 D) 7

61. Bilirubin:
A) Turns skin Yellow B) Damages brain cells C) Causes jaundice D) All of these

62. What are chances for having Rh-ve baby if one parent is Rh+ve and (homozygous) and other is Rh-ve:

A) 25% B) 50% C) 100% D) 0%

63. Rh factor is encoded by:
A) 2 genes which occupy 3 loci C) 2 genes which occupy 2 loci

B) 3 genes which occupy 2 loci D) 3 genes which occupy 3 loci

64. What is the probability of having albino child if father and mother both are carrier(Aa):
A) 25% B) 30% C) 50% D) 75%

65. Two parents of blood group A had a child of blood group O, what will be percentage chances ofhaving such child again:
A) 25% B) 50% C) 75% D) None

66. Interaction of two loci:
A) Pleiotropy B) Epistasis C) Dominance D) Differentiation

67. A phenotype which can't be expressed in heterozygous state but can only be expressed either inhomo or hemi form, would be:
A) Dominant B) Bombay C) Recessive D) Ordinary

68. Which is due to point mutation?
A) Cystic fibrosis B) Sickle cell anemia C) Tay Sach's disease D) All of these

69. Who did describe the complete sequence of amino acids of insulin:
A) F.Miescher B) F.Sanger C) Avery D) Mc Carty

70. Vernon Ingram (1956) discovered the molecular basis of:
A) Sickle cell anemia B) Phenylketonuria C) Alkaptonuria D) Schizophrenia

71. In case of sickle cell anemia, in place of glutamic acid, _____ is found:
A) Histidine B) Valine C) Proline D) Leucine

72. Mutations are inherited only if they occur in the:
A) Gland cells B) Gametes C) Muscle cells D) Somatic cells

73. A change in one or more bases of DNA, which results in the formation of an abnormal protein iscalled:
A) Moulting B) Transformation C) Mutation D) Fission

74. Homogenetisic acid is oxidized rapidly when exposed to air, turning the urine:
A) White B) Purple C) Blue D) Black

75. Point mutation occurs in:
A) Sickle cell anemia B) Phenylketonuria C) Alkaptonuria D) All

76. Which enzyme deficiency leads to phenylketonuria:
A) Phenylalanine oxidase B) Phenylalanine hydroxylase C) Phenylalanine synthase D) Phenylalanine carboxylase

77. Mutation of one or two N-bases is:
A) Inversion B) Point mutation C) Deletion D) Chromosomal aberrations

78. Mutation may be caused by:
A) Chemicals B) Radiations C) Mutagens D) All of these

79. Sickle cell mutation affects:
A) One beta chain B) Both beta chains C) Only alpha chain D) None of the alpha or beta chains

80. Genes for alpha and beta chains of hemoglobin are found on which chromosomes?
A) Chromosome 16 alpha; chromosome 11 beta C) Chromosome 11
B) Chromosome 11 alpha; chromosome 16 beta D) Chromosome 16

81. In sickle cell beta chain glutamic acid is replaced by valine which is sixth amino acid from:
A) N-terminal B) C-terminal C) R-terminal D) H-terminal

82. What is the 5th amino acid in sickle cell beta chain:

A) Histidine B) Proline C) Leucine D) Valine

Answers (A):

1.	A	2.	A	3.	A	4.	A	5.	A	6.	C	7	A	8.	D	9.	C	10.	B
11.	B	12.	D	13.	C	14.	D	15.	D	16.	B	17.	B	18.	C	19.	C	20.	B
21.	C	22.	C	23.	B	24.	C	25.	D	26.	C	27.	C	28.	B	29.	A	30.	C
31.	D	32.	D	33.	C	34.	C	35.	C	36.	A	37.	C	38.	B	39.	C	40.	A
41.	B	42.	B	43.	C	44.	D	45.	A	46.	B	47.	C	48.	D	49.	D	50.	C
51.	D	52.	A	53.	A	54.	C	55.	B	56.	C	57.	C	58.	C	59.	D	60.	C
61.	D	62.	D	63.	B	64.	A	65.	A	66.	B	67.	C	68	D	69	B	70	A
71	B	72	B	73	C	74	D	75	D	76	B	77	B	78	D	79	B	80	A
81	A	82	B																

B)

1. Genotype means:
A) Genetic Composition of the individual C) Appearance of an individual
B) Genetic composition of the germ cell D) Gene sequence of an organism

2. Chromosomal theory of the heredity was postulated by:
A) Charles Darwin B) Gregor Mendel C) Sutton D) Hargovind Khorana

3. Sex determination can be studied in:
A) Unisexual plants B) Bisexual plants C) Monoecious plants D) Intersex plants

4. Genetic information of DNA is coded in the:
A) Sequences of nucleotides B) Base pairing C) Proportion of each base D) None Coding sequence

5. Hydrolysis of nucleic acid yields:
A) Sugar only B) Phosphoric acid only C) Nitrogenous base only D) All the above

6. The distance between two base pairs of DNA is:
A) 3.4 ^{0}A B) 34 ^{0}A C) 340 ^{0}A D) 3400 ^{0}A

7. A short length of DNA double stranded molecule contains 120 adenine and 120 cytosine bases. The total number of nucleotides in this DNA fragment is:
A) 480 B) 120 C) 60 D) 240

8. Exact replication of DNA is possible due to:
A) Genetic code B) Mitosis C) Base pairing rule D) DNA is enclosed in a membrane

9. DNA generally acts as template for the synthesis of:
A) Only protein B) Only RNA C) Both DNA & RNA D) Only DNA

10. In DNA replication, the Okazaki fragments on the lagging strand are joined together by:
A) DNA polymerase B) Primase C) Helicase D) DNA ligase

11. One gene, one enzyme hypothesis was proposed by:
A) Beadle and Tatum B) Jacob and Monod C) Watson and Crick D) Jersey and Luria

12. If number of amino acids in a polypeptide chain is 150. The number of mRNA bases required is:
A) 150 B) 450 C) 100 D) 50

13. In protein synthesis the codon used as a start signal is:
A) UAA B) AUG C) AGU D) GCA

14. In bacteria, genes for antibiotic resistance are usually located in:
A) Genomic DNA B) Cytoplasm C) Mitochondria D) Plasmids

15. mRNA is synthesized by:
A) DNA polymerase B) RNA polymerase C) RNA ligase D) None of these

16. Which of the following is nonsense codon?
A) AUG B) UAA C) CUA D) All of these

17. Enzymes are responsible for assembly of:
A) Nucleic acid B) Protein C) Carbohydrates D) All of these

18. In bacteria the newly synthesized mRNA is released in:
A) Nucleus B) Cytoplasm C) Mitochondria D) Both a & b

19. TATAAT box of prokaryotes is _____ sequence
A) -10 B) -35 C) -25 D) -70

20. The central dogma states that biological information flows in which of these patterns?
A) DNA→RNA→Protein B) RNA→DNA→Protein C) DNA→Protein→RNA D) RNA→Protein

21. Genes are made of:
A) Ribonucleotides B) Deoxyribonucleotides C) Polypeptides D) Polysaccharides

22. The nucleotide unit is composed of
A) Fatty acids and glycerol B) Amino acids C) Pentose sugar and a nitrogenous base D) Nucleoside and phosphate group

23. Which of the following is not an amino acid?
A) Arginine B) Aspartic acid C) Methionine D) Tubulin

24. Which of the following is not a part of RNA molecule?
A) Phosphate B) Adenine C) Thymine D) Pentose sugar

25. De-oxyribonucleoside contains:
A) Five carbon sugar B) Three carbon sugar C) No sugar D) Four carbon sugar

26. Who worked out the structure of DNA?
A) Watson & Crick B) Hershey and Chase C) Griffith D) Miescher

27. The organic acid which is mostly confined to the nucleus of cell is:
A) Deoxyribonucleic acid B) Oxalic acid C) Acetic acid D) Ribonucleic acid

28. Which paring is not found in DNA
A) A-G B) G-T C) T-U D) All of these

29. Who was the first person to show by X-rays photograph of the helix structure of DNA molecule?
A) Hershey and Chase B) Miescher C) J-Wilson and Crick D) Rosalind and Franklin

30. How many chemical compounds make a nucleotide?
A) Two B) Three C) Four D) Five

31. DNA dictates a coded message for protein synthesis directly to:
A) m RNA B) r RNA C) ATP D) tRNA

32. The word chromosome comes from the Greek 'chroma' which means:
A) Genetic material B) DNA C) Body D) Colored

33. Which is due to point mutation?
A) Cystic fibrosis B) Sickle cell anemia C) Tay Sach's disease D) All of these

34. Which consists of active DNA:
A) Heterochromatin B) Euchromatin C) Chromatin D) All of these

35. Drosophila has only:
A) Two pairs of chromosomes B) Four pairs of chromosomes C) Six pairs of chromosomes D) Eight pairs of chromosomes

36. Dark thread like structures visible during cell division inside nucleus:
A) Chromatin B) Chromosomes C) Microtubules D) Spindles

37. Interphase nucleus contains:
A) Chromatin B) Chromosomes C) Microtubules D) Spindles

38. More than 500 pairs of chromosomes are found in some:
A) Mosquitoes B) Honey bees C) Ferns D) Sugar cane species

39. The particular array of chromosomes that an individual possesses is called its:
A) Karyotype B) Primary constriction C) Kinetochore D) Secondary constriction

40. The two sister chromatids are attached at their:
A) Karyotype B) Primary constriction C) Kinetochore D) Secondary construction

41. Centromere is located in the middle of chromatid in which kind of chromosome?
A) Metacentric B) Submetacentric C) Acrocentric D) Telocentric

42. The shape of Acrocentric chromosome during anaphase is:
A) V B) L C) J D) I

43. Who did describe the complete sequence of amino acids of insulin:
A) F. Miescher B) F. Sanger C) Avery D) Mc Carty

44. Vernon Ingram (1956) discovered the molecular basis of:
A) Sickle cell anemia B) Phenylketonuria C) Alkaptonuria D) Schizophrenia

45. The second step of central dogma is:
A) Transcription B) Translation C) Replication D) Mutation

46. Genetic code is a combination of _____ nucleotides:
A) 2 B) 3 C) 4 D) 5

47. It is site where peptide bond will form:
A) A site B) P site C) E site D) Active site

48. It is the site where empty tRNA will exit the ribosome:
A) A site B) P site C) E site D) Active site

49. In Drosophila the autosomal sets are:
A) 5 B) 3 C) 2 D) 6

50. The 1st evidence that the DNA is the genetic material came from:
A) The fact that chromosomes are made of DNA
B) The knowledge that DNA is present in the nucleus.
C) The studies on the transformation of bacterial cell.
D) That the DNA does not have the power to duplicate itself

51. Since there are four bases in DNA and sequence of three bases in the mRNA molecule (triplet) contains coded information (codon) for the various amino acids, the number of triplet codons possible is:
A) 12 B) 48 C) 16 D) 64

52. The two strands of DNA:
A) Are similar in nature and complementary
B) Are basically different in nature
C) Are antiparallel and non complementary
D) Are antiparallel and complementary

53. Gene controls:
A) Heredity, but not protein synthesis
B) Protein synthesis but not heredity
C) Protein synthesis and heredity
D) Biochemical reaction of some enzymes

54. Nucleic acid was extracted for the first time from:
A) Fish sperms B) Human cell C) Drosophila D) Bacteria

& fish
sperms

55. Centromere is located at tip of chromosomes:
A) Metacentric B) Submetacentric C) Acrocentric D) Telocentric

56. Histone proteins combine with DNA to form a complex:
A) Nucleosome B) Kinetochore C) Chromatin D) Centromere

57. A trait determined by a gene on the X-chromosomes is said to be:
A) Sex limited B) Sex influenced C) Sex linked D) Non-sense trait

58. The transfer of genetic material from one cell to another which can alter the genetic makeup of the recipient cell is called:
A) Conjugation B) Mutation C) Transformation D) Transudation

59. Formation of DNA from DNA is :
A) Transcription B) Translation C) Replication D) Cell division

60. Hershey and Chase labeled the DNA with radio isotope:
A) P^{32} B) S^{35} C) S^{32} D) P^{35}

61. Which one is not correct for semi-conservative model:
A) Primary structure of DNA is conserved
B) Each daughter DNA has 1 parental strand
C) Secondary structure is conserved
D) Proposed by Watson and crick

62. Meselson and Stahl grew bacteria in a medium containing heavy isotope of:
A) Sulphur B) Nitrogen C) Phosphorus D) Oxygen

63. Each Okazaki fragment is synthesized by DNA polymerase ..... in 5′ → 3′ direction:
A) I B) II C) III D) IV

64. Homogenetisic acid is oxidized rapidly when exposed to air, turning the urine:
A) White B) Purple C) Blue D) Black

65. About 15% of the total RNA is:
A) iRNA B) rRNA C) mRNA D) tRNA

66. The copy of genetic code in the molecule of mRNA is called:
A) Codon B) Anti Codon C) Triad D) Code

67. The percentage of DNA in composition of chromosomes is:
A) 20% B) 40% C) 60% D) 50%

68. The number of base pairs in each nucleosome is:
A) 100 B) 2000 C) 300 D) 200

69. In nucleosomes, _____acts a magnetic force:
A) Histone core B) DNA strand C) Both D) Lipids & proteins

70. Which is a phosphodiester bond
A) C-O-C B) P-O-C C) P-O-P D) P-C-O

71. In typical nucleotide, nitrogen base is attached to which carbon of sugar:
A) C_1 B) C_2 C) C_5 D) C_6

72. Phosphodiester bond is present between two:
A) Monosaccharides B) Amino acids C) Nucleotides D) Terpenoids

73. In Meselon & Stahl experiment, they dissolved DNA into:
A) NaCl B) KCl C) CsOH D) Cscl

74. In process of replication, which of following has supporting role:
A) Polymerase I B) Polymerase II C) Polymerase III D) DNA ligase

75. The initiation of replication is carried out by which enzyme :
A) Polymerase III B) Primase C) Polymerase I D) Helicase

76. No. of nucleotides in Okazaki fragments in prokaryotes is:
A) 100 – 200 B) 200 – 1000 C) 2000 – 4000 D) 1000 – 2000

77. Polymerase III adds nucleotide to _____ end of DNA stand:
A) 3' B) 5 C) Primers D) Variable

78. The newly synthesized DNA strand that moves towards replication fork is:
A) Leading strand B) Lagging strand C) Okazaki fragments D) Discontinuous strand

79. Gene expression involves:
A) Transcription B) Translation C) Replication D) Both a & b

80. Human cell contain _____ types of tRNAs:
A) 20 B) 34 C) 45 D) 50

81. The strand of DNA that is transcribed is:
A) Template strand B) Antisense C) Non coding D) All of these

82. In prokaryotes RNA polymerase III synthesizes:
A) mRNA B) tRNA C) rRNA D) rDNA

83. Amino acid is attached to _____ end of aminoacyl tRNA.
A) 5' end B) 3' end C) Anticodon D) D loop

84. Post transcription modifications takes place in:
A) Eukaryotes B) Prokaryotes C) Both D) Bacteria

only only

85. Mitochondrial genetic code AUA is for:
A) Isolcueine B) Methionine C) Initiating code D) Terminating code

86. Initiation complex in prokaryotes, N-formyl methionine-tRNA binds to:
A) Larger subunit of Ribsomes B) Small subunit of Ribsomes C) mRNA D) rRNA

87. During translation peptide bond formation b/w two amino acids is done in:
A) Elongation B) Small subunit C) Large subunit D) Transpeptidase

88. Which is a sexual process in the bacteria?
A) Conjugation B) Translation C) Transduction D) All of these

89. Free hydroxyl group is present at which carbon of a DNA nucleotide:
A) 2 B) 3 C) Both D) 5

90. Enzyme involved in peptide bond formation during translation?
A) Transpeptidase B) Aminoacylg transfera se C) Peptidyl transfera se D) All of these

91. DNA completes a helical turn every _____ nm and has _____base pairs.
A) 0.34, 12 B) 2, 12 C) 3.4, 10 D) 3.4, 12

92. The primary structure is disrupted in which of these hypothesis:
A) Conservation B) Semi conservation C) Dispersive conservation D) All

93. RNA primers are constructed repeatedly in which strand:
A) Leading B) Lagging C) Both D) None of these

94. Ribosome moves by _____ nucleotides during translation:
A) 4 B) 3 C) 2 D) 5

95. An animo acid is attached to tRNA by which of its group:
A) Amino B) R-group C) OH D) Carboxylic group

96. Which is not the part of initiation complex:
A) N-formyl methionin e B) Aminoacyl tRNA C) Small ribosomal subunit D) Peptidyl transferase

97. Why ATP is not required during peptide bond formation during translation:
A) Because it is energetically less costly C) Because its detachment from tRNA provides energy

1. The cell cycle includes:
A) Period of growth B) Replication of DNA C) Division of cell D) All

2. Cells that are locked of divisions are said to be in state of:
A) G_1 B) G_2 C) G_0 D) S

3. Cell cycle of human cell completes in about:
A) 24 hours B) 30 minutes C) 9 hours D) 90 minutes

4. Mitosis was first studied by Walther Fleming in:
A) Animals B) Plants C) Fungi D) Monera

5. Which of the following is not a function of mitosis in humans:
A) Growth B) Production of gametes C) Embryonic development D) Wound repair

6. In function, the plant cell structure that is analogous to an animal's cell cleavage furrow is the:
A) Centrosome B) Phragmoplast C) Nucleus D) Chromosome

7. Synthesis of new DNA occurs during:
A) Prophase B) Interphase C) Mitosis D) Cytokinesis

8. At which stage of mitosis are chromosomes arranged along a plane at the midline of the cell:
A) Metaphase B) Anaphase C) Inter phase D) Telohase

9. Cytokinesis is the division of:
A) Centrosome B) Cytoplasm C) Nucleus D) Cell wall

10. Equatorial or metaphase plate indicates:
A) Prophase B) Metaphase C) Anaphase D) Telophase

11. Reverse of prophase is:
A) Telophase B) Anaphase C) Metaphase D) Interphase

12. Which one of following is not function of mitosis:
A) Sexual reproduction B) Regeneration C) Healing of wounds D) Replacement of older cells

13. The spread of tumor cells and establishment of secondary areas of growth is called:
A) Tissue culture B) Cloning C) Malignancy D) Metastasis

14. The presence of invading cells in normal tissue is indication of:
A) Immunity B) Malignancy C) Health D) Infection

15. Cancer is mainly caused by mutations in:
A) Somatic cells B) Liver cells C) Intestinal cells D) All of these

16. Cancer is a failure in:
A) Cell division B) DNA synthesis C) Genetic control on cell division D) Nuclear division

17. Ultraviolet radiation is leading cause of:
A) Lung cancer B) Liver cancer C) Heart attack D) Skin cancer

18. Synapsis takes place during:
A) Leptotene B) Zygotene C) Pachytene D) Diakinesis

19. Crossing over occurs during:
A) Zygotene B) Diplotene C) Pachytene D) Meiosis II

20. XYY condition is called:
A) Patau's syndrome B) Edward's syndrome C) Turner's syndrome D) Jacob's syndrome

21. Mitosis is divided into:
A) Karyokinesis B) Cytokinesis C) Interphase D) Both a & b

22. Mitosis is a division that produces:
A) Two cells B) Four cells C) Two nuclei D) Four nuclei

23. The phase of mitosis with two daughter nuclei in parent cell is:
A) Anaphase B) Prophase C) Metaphase D) Telophase

24. Cells that are _____ are said to be in state of G_0
A) Dividing B) Enlarged C) Locked D) Embryonic

25. Cancer is a _____ in genetic control:
A) Improvement B) Failure C) Success D) Disease

26. Un-separated replica of chromosome is called:
A) Chromatin B) Kinetochore C) Chromatid D) Centromere

27. Exchange of chromosomal segments is called:
A) Linkage B) Crossing over C) Chiasmata D) Synapsis

28. Spindle fibres are mainly composed of a protein called:
A) Histone B) Histamine C) Tubulin D) Insulin

29. Mitosis in animals cells was first studied by;
A) Morgan B) Strassburger C) Mendel D) Fleming

30. In Klinefilter's syndrome:

A) One X chromosome missing C) Sex chromosomes fail to segregate

B) Additional sex chromosome is present D) None of these

31. The S phase during human cell cycle is:
A) 30 minutes B) 10 hours C) 9 hours D) 4.5 hours

32. Duplication of Nuclear material in the cell occurs in the phase:
A) G_1 B) G_0 C) S D) G_2

33. DNA base units are accumulated for replication in which of these phases?
A) G1 B) S C) G2 D) Anaphase

34. The sequence in the cell cycle is:
A) G1, S, G2, M B) S, M, G1, G2 C) S, G2, M, G1 D) G2, S, M, G2

35. The process involved in inflammation of liver:
A) Apoptosis B) Necrosis C) Both a & b D) Non disjunction

36. Mongolism is also called as:
A) Down's syndrome B) Turner's syndrome C) Klinefelter's syndrome D) Jacob's syndrome

37. Squint eyes and broad face are feature of:
A) Down's syndrome B) Turner's syndrome C) Klinefelter's syndrome D) Edward's syndrome

38. Which of following is trisomy syndrome:
A) Down's B) Patau's C) Edward's D) All of these

39. Which is the most lengthy phase of human cell cycle:
A) G_1 phase B) S-phase C) G_2 phase D) All equal of time

40. Mitotic apparatus is organized in:
A) Prophase B) Anaphase C) Metaphase D) Telophase

41. Which set of microtubules radiates outwards:
A) Kinetochore B) Astral C) Polar D) All

42. Webbed neck and absence of ovaries is feature of _____ syndrome:
A) Down's B) Klinefelter's C) Tuner's D) Edward's

43. Trisomy '18' is _____ syndrome:
A) Edward's B) Turner's C) Metafemale D) Jacob's

44. Spindle fibers which run from pole to pole:
A) Chromosomal B) polar C) kinetochore D) None of these

45. Spore mother cells of plants show which kind of division for spore formation?

A) Mitosis B) Meiosis C) Both of these D) None of these

46. Which is a modified centriole:
A) Centrosome B) Flagella or cilia C) Basal body D) Kinetochore

47. Which wall is 1st to be formed among daughter cells in plants:
A) Secondary wall B) Tertiary wall C) Middle lamella D) Cell membrane

48. The contents of the vesicles appearing in center of dividing cell contribute to the formation of:
A) Middle lamella B) Primary wall C) Both D) Secondary wall

49. In which stage a diploid cell actually becomes 4n:
A) G_1 B) S C) G_0 D) None of these

50. Crossing over occurs at which stage:
A) Two strand stage C) Could occur in both two and four strand
B) Four strand stage D) Can never occur in two strand stage

51. What you suggest for number of chiasma formed at pachytene per pair:
A) 1 B) 2 C) 3 D) Variable

52. During meiosis at which stage a cell can have four nuclei:
A) Telophase I B) Telophase II C) Anaphase D) Telophase

53. Independent assortment of chromosomes takes place in:
A) Mitosis B) Meiosis I C) Meiosis II D) None of these

54. When the genes controlling cell division become abnormal due to mutation or abnormal activation they are called:
A) Retrogenes B) Oncogenes C) Mitogenes D) None

55. The most common carcinogenic radiations are:
A) Ionizing radiations B) X-rays C) U.V. rays D) Gamma rays

56. Which viruses can be the cause of tumors:
A) DNA Viruses B) H Viruses C) Retroviruses D) None of these

57. The Golgi vesicles which divide the daughter cells during Cytokinesis of plant cells originate actually in:
A) Metaphase B) Anaphase C) Telophase D) Prophase

58. Highest mortality rate is in which cancer?

A) Lungs B) Breast C) Prostrate D) Skin

59. Incidence of which kind of cancer is most common in males?
A) Prostrate B) Lungs C) Mouth D) Skin

60. Incidence of which kind of cancer is most common in females?
A) Lungs B) Skin C) Breast D) Stomach

61. Blebs are formed during:
A) Cell Division B) Meiosis C) Apoptosis D) Necrosis

62. Meiosis was discovered and described for the first time in:
A) Sea urchin eggs B) Frog embryo C) Human cells D) Fish cells

63. One set of chromosomes in human cell has:
A) 23 homologues B) 23 non homologues C) 46 chromosomes D) Both a and c

64. The zygotene stage, also known as zygonema, from Greek word meaning:
A) Thin threads B) Paired threads C) Homologous D) None of them

65. Synapsis occurs by the help of synaptonemal complex with is made of:
A) Proteins B) Carbohydrate and proteins C) DNA D) DNA and proteins

66. Which is un-programmed death of cells and tissues:
A) Apoptosis B) Necrosis C) Both D) None of these

67. What makes a cell to commit suicide:
A) Presence of -ve signals B) Absence of positive signals C) Both of these D) Suicide is spontaneous

Answers (C):

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