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e-mail : info@mtg.in website : www.mtg.in

Regd. Office:

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Editor : Anil Ahlawat

Competition Edge

8 NEET

Practice Paper 2017

17 AIIMS

Practice Paper 2017

23 NEET Foundation

31 High Yield Facts-Botany

Cell: The Unit of Life - II

42 MPP-1

46 Concept Map

48 NEET Essential

Human Female Reproductive System

61 High Yield Facts-Zoology

Human Health and Diseases

78 CBSE Board

Solved Paper 2017

82 MPP-1

Class XI

Class XII



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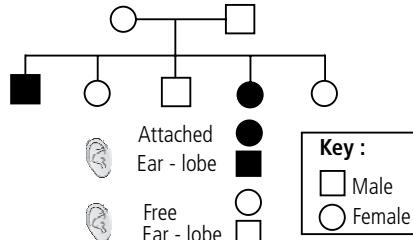
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- (iii) Endosperm represents female gametophyte.

(a) Statements (i) and (ii) are correct

(b) Statements (ii) and (iii) are correct

(c) Statements (i) and (iii) are correct

(d) Statements (i), (ii) and (iii) are correct

12. Excitation of chlorophyll molecule due to light is a

(a) photo-oxidation reaction

(b) endergonic reaction

(c) thermochemical reaction

(d) photochemical reaction.

13. Frameshift mutation occurs when

(a) base is substituted

(b) base is deleted or added

(c) anticodons are absent

(d) none of these.

14. Which one of the following categories of animals, is correctly described with no single exception in it?

(a) All reptiles possess scales, have a three chambered heart and are cold blooded (poikilothermal).

(b) All bony fishes have four pairs of gills and an operculum on each side.

(c) All sponges are marine and have collared cells.

(d) All mammals are viviparous and possess diaphragm for breathing.

15. Mendel was not able to say anything about recombination and crossing over because

(a) he did not have a large and strong microscope

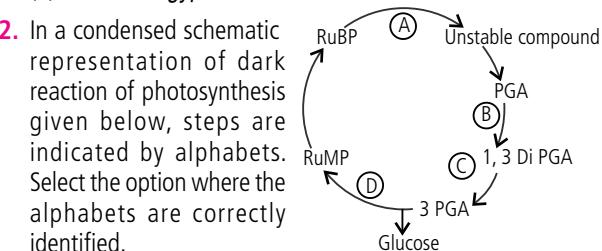
(b) he choose only contrasting characters

(c) traits he choose, were not linked and present on different chromosomes or were far apart

(d) traits he choose had no genes.

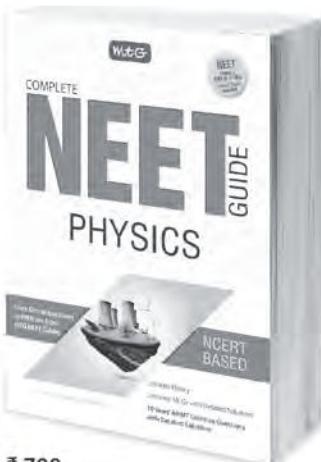
16. Select the mismatched pair out of the following

Matched with its source, target and nature of action?				
	Secretion	Source	Target	Action
(a)	Gastrin	Stomach lining	Oxytic cells	Production of HCl
(b)	Inhibin	Sertoli cells	Hypothalamus	Inhibition of secretion of gonadotropin releasing hormone
(c)	Enterokinase	Duodenum	Gall bladder	Release of bile juice
(d)	Atrial Natriuretic Factor (ANF)	Cardiocytes of atria	Juxta-glomerular apparatus (JGA)	Inhibition of release of renin

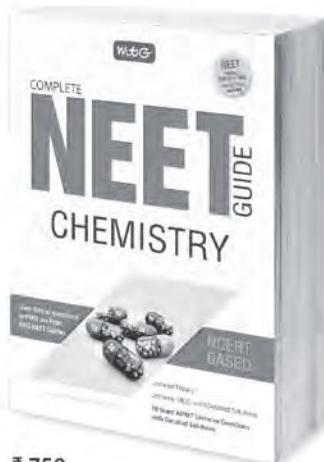


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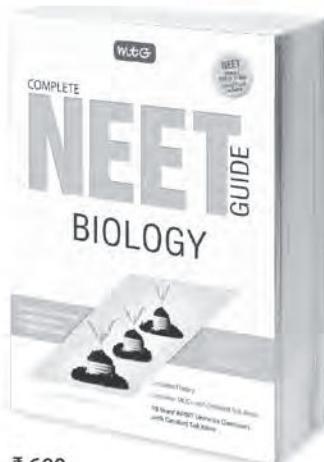
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- (c) archaeabacteria that contain a monolayer of branched chain lipids in the cell membrane.
 (d) archaeabacteria that possess histones resembling those found in eukaryotes but whose DNA is negatively supercoiled.
- 25.** Which one is correct sequence of urine formation?
 (a) Secretion, reabsorption, filtration
 (b) Filtration, reabsorption, secretion
 (c) Reabsorption, filtration, secretion
 (d) Reabsorption, secretion, filtration
- 26.** *Ulothrix* can be described as a
 (a) filamentous alga lacking flagellated reproductive stages
 (b) membranous alga producing zoospores
 (c) filamentous alga with flagellated reproductive stages
 (d) non-motile colonial alga lacking zoospores.
- 27.** Non-cellular layer that connects inner surface of the epithelial tissue to the connective tissue is
 (a) basement membrane (b) epidermis
 (c) dermis (d) either (b) or (c).
- 28.** Antigen binding site in an antibody is found between
 (a) two light chains
 (b) two heavy chains
 (c) one heavy and one light chain
 (d) either between two light chains or between one heavy and one light chain depending upon the nature of antigen.
- 29.** In double fertilisation
 (a) two male gametes fuse with two eggs
 (b) one male gamete fuses with the egg and the other fuses with the secondary nucleus
 (c) one male gamete fuses with the egg and the other fuses with the antipodal
 (d) one male gamete fuses with the antipodal and the other fuses with the diploid nucleus.
- 30.** If in a population, natality is balanced by mortality then there will be
 (a) decrease in population growth
 (b) zero population growth
 (c) increase in population growth
 (d) over population.
- 31.** Which of the following is not an effect of the sympathetic nervous system?
 (a) Dilatation of pupil
 (b) Reduction of peristalsis
 (c) Elevation of blood pressure
 (d) Stimulation for saliva secretion
- 32.** Mammalian lungs have an enormous number of minute alveoli (air sacs). This is to allow
 (a) more surface area for diffusion of gases
 (b) more space for increasing the volume of inspired air
 (c) more nerve supply to keep the lungs working
 (d) more spongy texture for keeping lung in proper shape.
- 33.** Biolistic technique is used in
 (a) tissue culture
 (b) gene transfer
 (c) hybridisation process
 (d) germplasm conservation.
- 34.** Study the given flow chart and identify A and B.
-
- 35.** Populations are said to be sympatric when
 (a) two populations live together and freely interbreed to produce sterile offspring
 (b) two populations are physically isolated by natural barriers
 (c) two populations are isolated but occasionally come together to interbreed
 (d) two populations share the same environment but cannot interbreed.
- 36.** The conidiophores of *Pencillium* are
 (a) uninucleate and colourless
 (b) uninucleate and pigmented
 (c) nucleate and colourless
 (d) anucleate and pigmented.
- 37.** The flower shown in the following diagram is
-
- (a) homochlamydeous, unisexual and hypogynous
 (b) homochlamydeous, bisexual and epigynous
 (c) dichlamydeous, bisexual and hypogynous
 (d) heterochlamydeous, bisexual and epigynous.

- 38.** Based on cellular mechanisms there are two major types of regeneration found in the animals. Which one of the following is the correct example of the type mentioned?
- Morphallaxis – Regeneration of two transversely cut equal pieces of a *Hydra* into two small *Hydra*.
 - Epimorphosis – Replacement of old and dead erythrocytes by the new ones
 - Morphallaxis – Healing up of a wound in the skin
 - Epimorphosis – Regeneration of crushed and filtered out pieces of a *Planaria* into as many new planarians
- 39.** Which of the following statements is correct regarding short day plants (SDPs)?
- They can flower in complete darkness if supplied with exogenous nutrients.
 - They are the same as long day plants.
 - They do not have a critical photoperiod.
 - All of these
- 40.** Severe Acute Respiratory Syndrome (SARS)
- is caused by *Pneumococcus pneumoniae*
 - is caused by a corona virus
 - is an acute form of asthma
 - is characterised by replacement of lung tissue by fibrous connective tissue.
- 41.** Myxomycetes are
- saprobies or parasites, having mycelia, asexual reproduction by fragmentation, sexual reproduction by fusion of gametes
 - slimy mass of multinucleate protoplasm, having pseudopodia-like structures for engulfing food, reproduction through fragmentation or zoospores
 - prokaryotic organisms, cellular or acellular, saprobic or autotrophic, reproduce by binary fission
 - eukaryotic, single-celled or filamentous, saprobic or autotrophic, asexual reproduction by fusion of two cells or their nuclei.
- 42.** Select the correct explanation for the labels A, B, C and D.
-
- (a) A represents the fertilised zygote.
(b) B represents the stage of morula formation.
- 43.** Which one of the following statement pertaining to pollutants is correct?
- DDT is a non-biodegradable pollutant.
 - Excess fluoride in drinking water causes osteoporosis.
 - Excess cadmium in drinking water causes black foot disease.
 - Methylmercury in water may cause itai itai disease.
- 44.** In the prothallus of a vascular cryptogam, the antherozoids and eggs mature at different times. As a result
- there is high degree of sterility
 - one can conclude that the plant is apomictic
 - self fertilisation is prevented
 - there is no change in success rate of fertilisation.
- 45.** Stink gland is found in
- 4th and 5th terga of cockroach
 - 5th and 6th terga of cockroach
 - 5th and 6th sterna of cockroach
 - 4th and 5th sterna of cockroach.
- 46.** A pome fruit is said to be false because
- the pericarp is inconspicuous
 - the endocarp is prominent
 - the fruit is present in fleshy edible thalamus
 - the pericarp is divided into epicarp, mesocarp and endocarp.
- 47.** In India, we find mangoes with different flavours, colours, fibre content, sugar content and even shelf-life. The large variation is on account of
- species diversity
 - induced mutations
 - genetic diversity
 - hybridisation.
- 48.** In which one of the following sets of three items each belong to the category mentioned against them?
- Lysine, glycine, thiamine — amino acids
 - Myosin, oxytocin and gastrin — hormones
 - Rennin, helicase and hyaluronidase — enzymes
 - Optic nerve, oculomotor, vagus — sensory nerves
- 49.** Which one of the following statements pertaining to plant structure is correct?
- Cork lacks stomata, but lenticels carry out transpiration.
 - Passage cells help in transfer of food from cortex to phloem.
 - Sieve tube elements possess cytoplasm but no nuclei.
 - The shoot apical meristem has a quiescent centre.
- 50.** In the development of the human body, the ectoderm is responsible for the formation of
- sweat glands
 - lens of the eye
 - nervous system
 - all of these.

51. Match column I with column II and choose the correct option.

Column I (Scientist)	Column II (Concept)
I. Meselson and Stahl	A. <i>Lac</i> operon
II. Hershey and Chase	B. DNA replicates semi-conservatively
III. Beadle and Tatum	C. One gene one enzyme hypothesis
IV. Jacob and Monod	D. DNA is the genetic material
	E. Transcription

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

52. DNA finger printing technique was first developed by

- (a) Jeffreys, Wilson and Thien
- (b) Boysen and Jensen
- (c) Schleiden and Schwann
- (d) Edward and Steptoe.

53. Choose the correct pair.

- (a) Coconut, Cucurbits - dioecious
- (b) Honey bee, Rotifers - parthenogenesis
- (c) *Ornithorhynchus*, Whale - viviparous
- (d) Frog, Peacock - external fertilisation

54. Which one of the following correctly describes homologous structures?

- (a) Organs with anatomical similarities, but performing different functions
- (b) Organs with anatomical dissimilarities, but perform same function
- (c) Organs that have reduced or do not perform any function
- (d) Organs that appear only in embryonic stage and disappear later in the adult

55. Retting is a process by which bacteria bring about

- (a) curdling of milk
- (b) separation of fibres
- (c) synthesis of various vitamins
- (d) both (a) and (c).

56. Select the group of the three codons which could bring a halt in protein synthesis.

- (a) UGG, UCG, UAU
- (b) UUC, UUA, UAC
- (c) UAG, UGA, UAA
- (d) UUG, UCA, UCG

57. Select the correct pair of microorganism and the product obtained from it.

- (a) *Monascus purpureus* - produces large holes in Swiss cheese
- (b) *Saccharomyces cerevisiae* - used for the distillation of wine and beer

- (c) *Streptococcus* - produces streptokinase which is used to remove clots
- (d) *Aspergillus niger* - produces citric acid and butyric acid

58. Fats absorbed into lacteals as chylomicrons are

- (a) monoglycerides
- (b) fatty acids
- (c) triglycerides
- (d) glycerol.

59. Which of the following disorders are caused due to recessive autosomal mutations?

- (a) Turner's syndrome and sickle cell anaemia
- (b) Edward's syndrome and Down's syndrome
- (c) Cystic fibrosis and phenylketonuria
- (d) Alzheimer's disease and Huntington's chorea

60. Which one of the following has incorrect description?

- (a) Lubb - sharp closure of AV valves at the beginning of ventricular systole
- (b) Dup - sudden opening of semilunar valves at the beginning of ventricular diastole
- (c) Pulsation of the radial artery - valves in the blood vessels
- (d) Initiation of the heart beat - Purkinje fibres

61. An oocyte is released from the ovary under the influence of LH

- (a) before completing meiosis I and before polar bodies are released
- (b) after completing meiosis I
- (c) after completing meiosis II
- (d) before completing meiosis I and after release of polar bodies.

62. In most simple type of canal system of Porifera, water flows through which one of the following ways?

- (a) Ostia → Spongocoel → Osculum → Exterior
- (b) Spongocoel → Ostia → Osculum → Exterior
- (c) Osculum → Spongocoel → Ostia → Exterior
- (d) Osculum → Ostia → Spongocoel → Exterior

63. The quiescent centre in root meristem serves as a

- (a) site for storage of food which is utilised during maturation
- (b) reservoir of growth hormones
- (c) reserve for replenishment of damaged cells of the meristem
- (d) region for absorption of water.

64. Which property among these listed below is not a criteria for a molecule to act as a genetic material?

- (a) Chemically and structurally stable
- (b) Mutate slowly to facilitate evolution
- (c) Express itself in the form of Mendelian characters
- (d) Destroy itself after every cell cycle

65. Which one of the following poultry birds is not an English breed?

- (a) Sussex
- (b) Australorp
- (c) Orpington
- (d) Minorca



66. Match the source gland with its respective hormone and function and select the correct option.

Source	Hormone	Function
(a) Anterior pituitary	Oxytocin	Contraction of uterus muscles during child birth
(b) Posterior pituitary	Vasopressin	Stimulates reabsorption of water in the distal tubules of the nephron
(c) Corpus luteum	Estrogen	Supports pregnancy
(d) Thyroid	Thyroxine	Regulates blood calcium level

67. In photorespiration, glycine moves from

- (a) chloroplast to peroxisome
- (b) peroxisome to mitochondrion
- (c) mitochondrion to peroxisome
- (d) chloroplast to mitochondrion.

68. Standing crops refers to

- (a) all the photosynthetic living forms in an area
- (b) all the living forms in an area
- (c) the amount of living matter present in a unit area of an ecosystem at any time
- (d) all the crop plants in an area.

69. In which population interaction one species is harmed whereas the other is unaffected?

- (a) Amensalism
- (b) Commensalism
- (c) Parasitism
- (d) All of these

70. If a homozygous dominant red-flowered plant is crossed with a homozygous recessive white-flowered plant, the offsprings will be

- (a) 50% white flowers
- (b) 50% red flowers
- (c) 100% white flowers
- (d) 100% red flowers.

71. Read the following statements and select the correct options.

1. Synaptic cleft of neurons secrete adrenaline.
 2. Myelinated nerve fibres have Schwann cells which form a myelin sheath around the axon.
 3. In non-myelinated nerve fibres Schwann cells do not form myelin sheath.
 4. Spinal cord and cranial nerves are made of non-myelinated nerve fibres.
- (a) 1, 2 and 3 are correct while 4 is incorrect
 - (b) 3 and 4 are correct while 1 and 2 are incorrect
 - (c) 1 and 4 are correct while 2 and 3 are incorrect
 - (d) 2 and 3 are correct while 1 and 4 are incorrect.

72. The loss or excretion of water in the form of liquid droplets from the leaves and other parts of an uninjured or intact plant is called

- (a) guttation
- (b) transpiration
- (c) plasmolysis
- (d) translocation.

73. The order of blood flow from right ventricle to left ventricle in mammalian heart is

- (a) Right ventricle → pulmonary arteries → lungs
→ pulmonary veins → left atrium
- (b) Right ventricle → pulmonary veins → lungs
→ pulmonary arteries → left atrium
- (c) Right ventricle → right atrium → lungs → pulmonary veins → left atrium
- (d) Right ventricle → systemic aorta → lungs
→ pulmonary veins → left atrium.

74. Choose the correct statement.

- (a) Oxygen is vital in respiration to drive the process by removal of hydrogen.
- (b) Pyruvate is formed in the mitochondrial matrix.
- (c) There is complete oxidation of glucose in fermentation.
- (d) During the oxidation of succinic acid a molecule of ATP is synthesised.

75. The food chain, in which micro-organisms breakdown the energy rich compounds synthesised by the producers is called

- (a) grazing food chain
- (b) detritus food chain
- (c) parasitic food chain
- (d) predator food chain.

76. Find out the mismatched pair.

- | | |
|--------------------------------------|-----------------|
| (a) Primary CO ₂ fixation | → OAA |
| product of C ₄ plants | |
| (b) Primary CO ₂ acceptor | → RuBP |
| of C ₃ plants | |
| (c) Calvin pathway of | → Bundle sheath |
| C ₄ plants occur in | |
| (d) C ₃ plant | → Maize |

77. Myxoedema occurs due to

- (a) hypersecretion of thyroid hormone
- (b) hyposecretion of thyroid hormone
- (c) hypersecretion of parathormone
- (d) hyposecretion of parathormone.

78. Urea synthesis takes place primarily in liver because

- (a) NH₃ and CO₂ are present in liver only
- (b) hormone ADH is found in liver only
- (c) enzyme arginase is present in liver only
- (d) kidney is smaller than liver.

79. According to Central Pollution Control Board (CPCB), the size of particulate matter that is most harmful is

- (a) 25 µm
- (b) 2.5 µm
- (c) 0.25 mm
- (d) 0.025 mm.

80. Hotspots of biodiversity means

- (a) areas of the earth that contain many endemic species
- (b) species that serve as proxy for entire communities in particular area
- (c) species in particular niche/area
- (d) species diversity at particular area.

- 84.** Match the items of column I with column II and select the correct option.

Column I	Column II
A. Electrostatic precipitator	1. Removes gases like SO ₂
B. Scrubber	2. Reduces automobile emission
C. Catalytic converter	3. Removes particulate matter
(a) A – 2, B – 3, C – 1	(b) A – 3, B – 2, C – 1
(c) A – 1, B – 2, C – 3	(d) A – 3, B – 1, C – 2

- 85.** Match column I with column II and select the correct option from codes given below.

Column I	Column II
A. Phosphoenol pyruvate (PEP)	p. 6-carbon compound
B. Ribulose biphosphate (RuBP)	q. 2-carbon compound
C. Oxaloacetic acid (OAA)	r. 4-carbon compound
D. Acetyl co-enzyme-A	s. 5-carbon compound
(a) A-t, B-s, C-r, D-q	t. 3-carbon compound
(b) A-r, B-s, C-t, D-p	
(c) A-t, B-p, C-q, D-r	
(d) A-q, B-r, C-s, D-t	

ANSWER KEY

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



ANSWERS

WHO AM I...

- | | |
|-------------------|--------|
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| 2. Nuclear matrix | Pg. 39 |
| 3. Typhoid | Pg. 63 |
| 4. Toxoid vaccine | Pg. 72 |

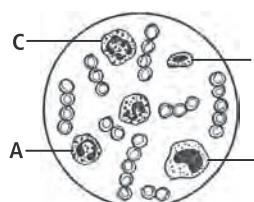
PRACTICE PAPER

AIIMS

Exam on
28th May

1. According to Steward's starch hydrolysis theory, which one of the following is the principle reason for the opening of stomata during daytime?
 - (a) Influx of K⁺ ions into guard cells under the influence of ABA hormone.
 - (b) Conversion of sugar into starch in guard cells.
 - (c) Efflux of K⁺ ions from guard cells under the influence of ABA hormone.
 - (d) Photosynthetic utilisation of CO₂ in guard cells.
2. An insect bite may result in inflammation of that spot. This is triggered by chemicals such as
 - (a) histamine and dopamine
 - (b) histamine and kinins
 - (c) interferon and opsonin
 - (d) interferon and histone.
3. When a stimulus several times greater than the threshold stimulus is provided to a muscle fibre, it will
 - (a) contract with a smaller force
 - (b) contract with a larger force
 - (c) contract with the same force
 - (d) fail to contract.
4. Match column I with column II and choose the correct answer.

Column I	Column II
A. Cleistogamy	m. Insect pollination
B. Geitonogamy	n. Bud pollination
C. Entomophily	o. Pollination between flowers in the same plant
D. Xenogamy	p. Wind pollination
(a) A-o; B-m; C-q; D-n	(b) A-m; B-q; C-n; D-o
(c) A-n; B-o; C-m; D-q	(d) A-q; B-p; C-o; D-n
5. Evolutionary convergence is characterised by
 - (a) development of dissimilar characteristics in closely related groups
 - (b) development of a common set of characteristics in groups of different ancestry
 - (c) development of characteristics by random mating
 - (d) replacement of common characteristics in different groups.
6. Apart from corticotropin releasing hormone (CRH), which other hormone also stimulates the release of adrenocorticotrophic hormone (ACTH)?
 - (a) Epinephrine
 - (b) Aldosterone
 - (c) Insulin
 - (d) Vasopressin
7. The state, during which the respiratory centre is inhibited, is termed as
 - (a) anoxia
 - (b) asphyxia
 - (c) suffocation
 - (d) choking.
8. Which of the following option is incorrect with respect to electron transport system (ETS)?
 - (a) It involves cytochrome-*b*, cytochrome-*c*, cytochrome-*a*, cytochrome-*a₃*.
 - (b) Each NADH₂ gives 3 ATP (through ETS) and each FADH₂ gives 2 ATP (through ETS).
 - (c) There is a progressive increase in energy level of electron through ETS.
 - (d) ETS reaction is a redox reaction.
9. Select the mismatched pair.

(a) PCT	- Absorption of hormones and vitamins
(b) DCT	- Absorption of glucose
(c) Henle's loop	- Concentration of urine
(d) Bowman's capsule	- Glomerular filtration
10. Study the given diagram and identify the cells labelled as A, B, C and D, and choose the correct option.

The diagram shows a cross-section of a blood smear. Labels A, B, C, and D point to specific cells: A points to a large, dark-staining cell (Monocyte); B points to a small, dark-staining cell (Basophil); C points to a medium-sized, dark-staining cell (Eosinophil); and D points to a large, pale-staining cell (Lymphocyte).

 - (a) A-Eosinophil, B-Erythrocyte, C-Neutrophil, D-Basophil
 - (b) A-Eosinophil, B-Lymphocyte, C-Neutrophil, D-Basophil
 - (c) A-Erythrocyte, B-Basophil, C-Neutrophil, D-Lymphocyte
 - (d) A-Eosinophil, B-Monocyte, C-Neutrophil, D-Lymphocyte

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- 11.** Which one of the following is a pair of endangered species?
- Garden lizard and Mexican poppy
 - Rhesus monkey and sal tree
 - Clouded leopard and carrot grass
 - Hornbill and Indian aconite
- 12.** Which one of the following is a correct statement?
- "Bt" in "Bt-cotton" indicates that it is a genetically modified variety produced through biotechnology.
 - Somatic hybridisation involves fusion of two complete plant cells carrying desired genes.
 - The anticoagulant hirudin is being produced from transgenic *Brassica napus* seeds.
 - "Flavr savr" variety of tomato has enhanced the production of ethylene which improves its taste.
- 13.** Select the correct statement given below which mentions the characteristics of monocot stem anatomy.
- Hypodermis is sclerenchymatous, vascular bundles are closed, phloem parenchyma is present.
 - Hypodermis is sclerenchymatous, vascular bundles are closed, phloem parenchyma is absent.
 - Hypodermis is sclerenchymatous, vascular bundles are open, phloem parenchyma is absent.
 - Hypodermis is collenchymatous, vascular bundles are closed, phloem parenchyma is present.
- 14.** The cell organelle involved in the glycosylation of proteins is
- ribosome
 - peroxisome
 - mitochondrion
 - Golgi apparatus.
- 15.** Conditioned reflexes are different than unconditioned reflexes in which of the following ways?
- Conditioned reflexes are limited to brain
 - Conditioned reflexes are inheritable
 - Unconditioned reflexes depend on previous experience
 - Unconditioned reflexes are limited to brain
- 16.** How many NADPH and ATP are required for the production of one molecule of glucose in Calvin cycle?
- 12 NADPH, 18 ATP
 - 18 NADPH, 12 ATP
 - 8 NADPH, 12 ATP
 - 2 NADPH, 3 ATP
- 17.** Which one of the following is the most likely root cause of absence of menstruation in a human female having normal menstrual cycles?
- Maintenance of the hypertrophical endometrial lining
 - Maintenance of high concentration of sex-hormones in the blood stream
 - Degeneration of corpus luteum
 - Low production of luteinising hormone
- 18.** In mature human oocyte, which of the following parts contains acid mucopolysaccharides?
- Cortical granules
 - Zona pellucida
 - Corona radiata
 - Perivitelline space
- 19.** Read the following statements and choose the correct option with respect to DNA.
- Nitrogenous base is linked to the pentose sugar through a N-glycosidic linkage.
 - Phosphate group is linked to 5'-OH of a nucleoside through phosphoester linkage.
 - Two nucleosides are linked through 3' – 5' N-glycosidic linkage.
 - Negatively charged DNA is wrapped around positively charged histone octamer to form nucleosome.
- A, B and C are wrong
 - D alone is wrong
 - C alone is wrong
 - A alone is wrong
- 20.** Tissue culture technique can produce infinite number of new plants from a small parental tissue. The economic importance of the technique is in raising
- genetically uniform population identical to the original parent
 - homozygous diploid plants
 - new species
 - hybrids of sexually reproducing plants.
- 21.** Drinking of mineral water with very low level of pesticides (about 0.02 ppm) over a long period may
- produce immunity against amoebic dysentery
 - cause rheumatoid arthritis in most people
 - cause Wernicke's syndrome
 - lead to accumulation of pesticide residues in body.
- 22.** Quarantine regulation are concerned with
- spraying of diseased plants with insecticide
 - prevention of entry of diseased plants in country
 - growing or entry of diseased plants in country
 - hybrids of sexually reproducing plants.
- 23.** Which one out of A – D given below correctly represents the structural formula of Lysine?
- | A | B | C | D |
|--|--|---|--|
| $\begin{array}{c} \text{NH}_2 \\ \\ \text{H}—\text{C}—\text{COOH} \\ \\ \text{CH}_2 \\ \\ \text{CH}_2 \\ \\ \text{C} \\ \diagup \quad \diagdown \\ \text{O} \quad \text{OH} \end{array}$ | $\begin{array}{c} \text{NH}_2 \\ \\ \text{H}—\text{C}—\text{COOH} \\ \\ \text{CH}_2 \\ \\ \text{OH} \end{array}$ | $\begin{array}{c} \text{CH}_2\text{OH} \\ \\ \text{CH}_2 \\ \\ \text{NH}_2 \end{array}$ | $\begin{array}{c} \text{NH}_2 \\ \\ \text{H}—\text{C}—\text{COOH} \\ \\ \text{CH}_2 \\ \\ \text{CH}_2 \\ \\ \text{CH}_2 \\ \\ \text{NH}_2 \end{array}$ |
- C
 - D
 - A
 - B

- 24.** Which of the following options correctly mentions mustard family and its characteristics?
- Brassicaceae – tetramerous flowers, six stamens, bicarpellary gynoecium, siliqua type fruit
 - Brassicaceae – pentamerous flowers, many stamens, pentacarpellary gynoecium, capsule type fruit
 - Solanaceae - pentamerous flowers, five stamens, bicarpellary gynoecium, berry type fruit
 - Poaceae – trimerous flowers, three stamens, monocarpellary gynoecium, caryopsis type of fruit
- 25.** In spermatogenesis, reduction division of chromosome occurs during conversion of
- spermatogonia to primary spermatocytes
 - primary spermatocytes to secondary spermatocytes
 - secondary spermatocytes to spermatids
 - spermatids to sperms.
- 26.** The major limiting factors of an animal population, food and space operate through which of the following determinants to bring about comparative stability of the population?
- Natality
 - Immigration
 - Emigration and mortality
 - All of these
- 27.** Which one is mismatched?
- Hydra vulgaris* - sea water
 - Hydra gangetica* - fresh water
 - Obelia* - sea water
 - Physalia* - sea water
- 28.** Chiasmata are most appropriately observed in meiosis during
- diakinesis
 - diplotene
 - metaphase-II
 - pachytene.
- 29.** Which of the following synthetic growth regulators is used to promote flowering in pineapple?
- Indolebutyric acid
 - Phenylmercuric acetate
 - Benzyl aminopurine
 - 2-chloroethylphosphonic acid
- 30.** A person saw a snake in his room when he opened the door. Which one of the following is likely to happen in his neuro-hormonal control system?
- Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal medulla.
 - Sympathetic nervous system is activated releasing epinephrine and norepinephrine from adrenal cortex.
 - Hypothalamus activates the parasympathetic division of brain.
 - Neurotransmitters diffuse rapidly across the cleft and transmit a nerve impulse.
- 31.** Keystone species deserve protection because these
- are capable of surviving in harsh environmental conditions
 - indicate presence of certain minerals in the soil
 - have become rare due to overexploitation
 - play an important role in supporting other species.
- 32.** The function of leghaemoglobin, during biological nitrogen fixation in root nodules of legumes, is to
- convert atmospheric N₂ to NH₃
 - convert ammonia to nitrite
 - transport oxygen for activity of nitrogenase
 - protect nitrogenase from oxygen.
- 33.** Red snow is caused by which of the following in alpine vegetation?
- Oscillatoria*
 - Chlamydomonas*
 - Batrachospermum*
 - Sargassum*
- 34.** What will happen if the secretion of parietal cells of gastric glands is inhibited?
- In the absence of HCl secretion, inactive pepsinogen is not converted into the active enzyme pepsin.
 - Gastric juice will be deficient in gastric amylase.
 - Enterokinase will not be released from the duodenal mucosa so, trypsinogen is not converted to trypsin.
 - Gastric juice will be deficient in pepsinogen.
- 35.** A female delivers a baby suffering from stunted growth, mental retardation, low intelligence quotient and reduced metabolic rate. This is the result of
- hyposecretion of growth hormone
 - hypersecretion of pituitrin
 - deficiency of iodine in diet
 - cancer of the adrenal gland.
- 36.** A common characteristic for both bacterial and fungal cell wall structure is
- it is made of cellulose
 - it has mucopeptide
 - it is made up of N-acetylglucosamine
 - it has lipid bilayer.
- 37.** During an injury, nasal septum gets damaged and for its recovery the cartilage preferred is
- elastic cartilage
 - hyaline cartilage
 - calcified cartilage
 - fibrous cartilage.
- 38.** In photorespiration, glycine enters from
- chloroplast to mitochondrion
 - peroxisome to mitochondrion
 - mitochondrion to peroxisome
 - chloroplast to peroxisome.

- 39.** Cleistogamy is advantageous because
 (a) hundreds of pollen grains are transferred by each visit of a pollinator
 (b) more efficient and widespread seed dispersal
 (c) seed set is not dependent on pollinators
 (d) it leads to greater genetic diversity.
- 40.** An amniocentesis test on a pregnant woman shows an extra barr body in the embryo, the syndrome which is likely to be associated with embryo is
 (a) Down's syndrome (b) Edward's syndrome
 (c) Klinefelter's syndrome (d) Cri du chat syndrome.

Directions : In the following questions (41-60), a statement of assertion is followed by a statement of reason. Mark the correct choice as :

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
 (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
 (c) If assertion is true but reason is false.
 (d) If both assertion and reason are false.

41. Assertion : Stomata are found on the surface of leaves in gymnosperms.

Reason : In gymnosperms, cuticle of leaves is thin.

42. Assertion: Generally, a woman does not conceive during the first six weeks of lactation period.

Reason: The hormone 'prolactin' initiates and maintains lactation in a postpartum woman.

43. Assertion: Chromosomal aberrations are caused by a break in the chromosome or its chromatid.

Reason: Duplication, deletion, transversion and translocations are the result of chromosomal aberrations.

44. Assertion: The stem tubers are the swollen ends of specialised underground stem branches, which help in vegetative propagation of the plant.

Reason: *Solanum tuberosum* is an example of a stem tuber which stores inulin as the main reserve food material.

45. Assertion : The collenchyma is a thick walled living tissue.

Reason : The collenchyma is thickened due to the deposition of pectin and cellulose.

46. Assertion : "Rosie", the first transgenic cow, produced human protein-enriched milk.

Reason : The milk contained the human alpha-(α) lactalbumin and was more balanced product for human babies than natural cow milk.

47. Assertion : Nitrogen-fixing bacteria in legume root nodules survive in oxygen-depleted cells of nodules.

Reason : Leghemoglobin completely removes oxygen from the nodule cells.

48. Assertion : The atmospheric concentration of CO₂ at which photosynthesis just compensates for respiration is referred to as CO₂ compensation point.

Reason : The CO₂ compensation point is reached when the amount of CO₂ uptake is less than that generated through respiration because the level of CO₂ in the atmosphere is more than that required for achieving CO₂ compensation point.

49. Assertion : Mitochondria and chloroplasts are semi-autonomous organelles.

Reason : They are formed by division of pre-existing organelles as well as contain DNA but lack protein synthesising machinery.

50. Assertion : A person who has received a cut and is bleeding needs to be given anti-tetanus injection.

Reason : Anti-tetanus injection provides immunity by producing antibodies against tetanus.

51. Assertion : Natural selection is the outcome of differences in survival and reproduction among individuals that show variation in one or more traits.

Reason : Adaptive forms of a given trait tend to become more common; less adaptive ones become less common or disappear.

52. Assertion: Acetylcholine participates in the nerve impulse transmission across a synapse.

Reason: Acetylcholine is secreted by adrenergic fibres.

53. Assertion : Aschelminthes are called as pseudocoelomates.

Reason : In Aschelminthes, mesoderm is present as scattered pouches in between ectoderm and endoderm.

54. Assertion : Self-incompatibility is a genetic mechanism which prevents self-pollen (from the same flower or other flowers of the same plant) from fertilising the ovules by inhibiting pollen germination or pollen tube growth in the pistil.

Reason : In gametophytic self-incompatibility, the incompatibility reaction is determined by the genotype of the sporophytic tissue of the plant from which the pollen is derived.

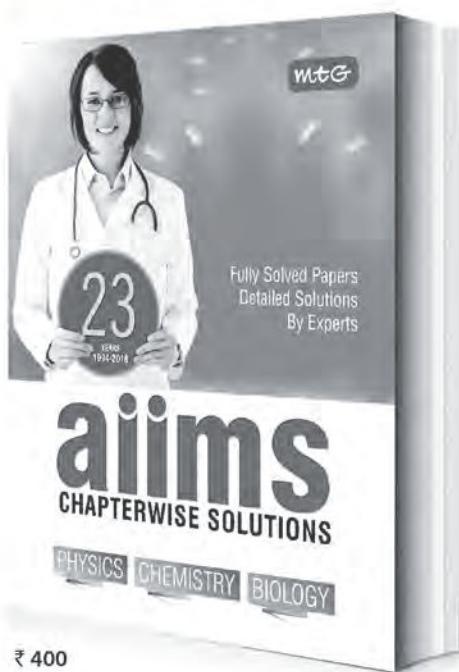
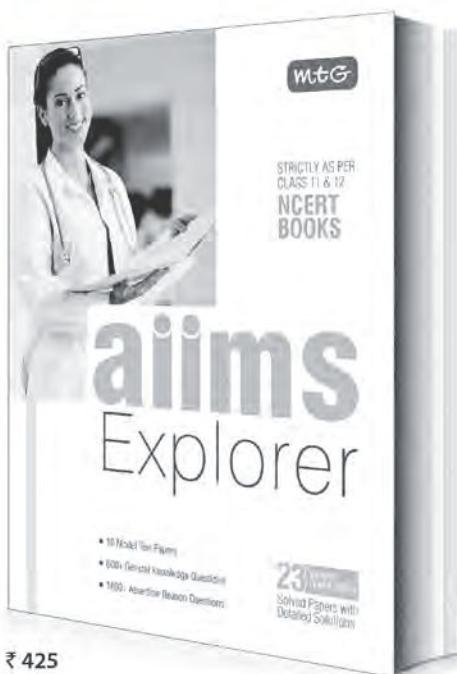
55. Assertion : Offsite collections can be used to restock depleted populations, reintroduce species in the wild and restore degraded habitats.

Reason : Offsite collections have been successful in saving black-footed ferret and californian condor from extinction.

56. Assertion : A population growing in a habitat with limited resources shows initially a lag phase, followed by phases of acceleration and deceleration and finally an asymptote, when the population density reaches the carrying capacity.

Reason : This type of population growth is called Verhulst-Pearl Logistic growth, in which a plot of N (population density) at time (t) results in a sigmoid curve.

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57. Assertion : Anaerobic respiration sometimes occurs in our skeletal muscles during strenuous exercise.

Reason : Pyruvic acid is reduced to lactic acid by lactate dehydrogenase in the absence of oxygen.

58. Assertion : Phenylketonuria is a disease in which excretion of phenylalanine occurs in urine.

Reason : It is due to dietary imbalance.

59. Assertion : Aldosterone is a steroid hormone and is important in the control of sodium and potassium ion concentration in mammals.

Reason : It upgrades sodium ion concentration in the ECF by promoting reabsorption of sodium ions from renal tubules and excretion of potassium ions in urine.

60. Assertion : Digested and semi-digested food is absorbed directly by body surface in tapeworms.

Reason : Digestive organs are absent in tapeworms.

ANSWER KEY

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



RUDOLF VIRCHOW FATHER OF MODERN PATHOLOGY



Rudolf Ludwig Carl Virchow, was a renowned and influential German physician and pathologist of the 19th century. He was a pioneer in veterinary pathology and social medicine. He was also an anthropologist, biologist, writer, editor of several medical journals and a statesman noted for his efforts in advancing public health.

He was born on October 13, 1821. He was the only child of Carl Christian Siegfried Virchow and Johanna Maria in Schivelbein in Pomerania, Prussia (now known as Swidwin in Poland). He did his elementary schooling in Schivelbein.

He graduated from Gymnasium in 1839 and was awarded a military fellowship to study at Berlin's Friedrich-Wilhelms Institute (now Humboldt University of Berlin) from where he got his medical degree in 1843. After his graduation, he worked under Johannes Peter Muller as a subordinate physician and later did his internship at Berlin's Charite Hospital. In 1844, Virchow joined Robert Froriep, a prosector, who was also editor of a journal that dealt specially with international work. He studied microscopy under Froriep and developed an interest in pathology.

Virchow published his first scientific paper in 1845 in which he wrote the earliest known pathological descriptions of leukemia. He qualified the medical licensure examination in 1846, and immediately succeeded Froriep as hospital prosector at the Charité. In 1847, he was appointed to his first academic position with the rank of *privatdozent*.

With colleague, Benno Reinhardt, he started a journal *Archiv für pathologische Anatomie und Physiologie und für klinische Medizini* (now known as Virchow's Archives) in 1847.

To fight political injustice he founded *Die medicinische Reform* (Medical Reform), a weekly newspaper for promoting social medicine, 1848. The newspaper ran under the banners "medicine is a social science" and "the physician is the natural attorney of the poor".

His first major work was a six-volume *Handbuch der speziellen Pathologie und Therapie* (*Handbook on Special Pathology and Therapeutics*) published in 1854. In 1855, he published his famous work describing "*omnis cellula e cellula*" (All cells come from cell).

He contributed to understand cellular pathology and stated that diseases could be characterised and accurately diagnosed by typical anatomical changes.

Among his books, *Cellular Pathology*, published in 1858 is regarded as root of modern pathology and also popularised, the third dictum of cell theory '*Omnis Cellula e cellula*'. He created the field of comparative pathology.

He founded *Zeitschrift für Ethnologie* (Journal of Ethnology). The latter is published by German Anthropological Association and the Berlin Society for Anthropology, Ethnology and Prehistory, the societies of which he was the founder.

Virchow married Ferdinand Rosalie Mayer (Rose Virchow) in 1850. They had three sons and three daughters. Rudolf died of heart failure, on 5 September 1902, in Berlin.

In 1892, he was awarded the British Royal Society's Copley Medal.

His contributions include:

- was first person to identify leukemia in 1847. In 1857, he was the first to describe a type of tumor called chordoma that originated from the clivus.
- He also explained the mechanism of pulmonary thromboembolism for the first time.
- He developed a systematic method of autopsy.
- Virchow was the first to analyse hair in criminal investigation and made the first forensic report in 1861.
- He also described the life cycle of *Trichinella spiralis* (round-worm).

Virchow was an opponent of Darwin's theory of evolution.

Virchow also contributed to anthropology, paleontology and archeology. He believed that the Neanderthal man was a modern *Homo sapiens*, in which deformations were caused by rickets and arthritis.



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- 👉 Application question or question which requires 3 or more concepts - indicated by 3 fingers.

UNIT-II : STRUCTURAL ORGANISATION IN PLANTS AND ANIMALS

CHAPTER-5 : MORPHOLOGY OF FLOWERING PLANTS

Multiple Choice Questions

1. Select the incorrectly matched pair.
(a) Creepers - stems have roots at intervals
(b) Herbs - may have underground stem
(c) Trailers - woody climbers
(d) Twiners - weak stemmed plants
 2. Which of the following statements is correct?
(a) Perennial plants can also be monocarpic.
(b) Psammophytes grow in rocky substrate.
(c) Halophytes are found only in marshy habitats.
(d) Lithophytes are adapted to grow in dry habitats.
 3. In addition to normal roots, *Asparagus* is characterised by presence of
(a) fasciculated roots (b) palmate roots
(c) tuberous roots (d) beaded roots.
 4. Which of the following statements is correct regarding the flattened petiole or rachis of a leaf found in desert plants?
(a) This flattened structure is called phylloclade which performs photosynthesis.
(b) This structure takes part in vegetative reproduction.
(c) It bears nodes and internodes.
(d) They are rarely succulent.
 5. Which of the following inflorescence is a modified spike having bisexual flowers on flattened peduncle?
6. Capsules of *Papaver*, *Gossypium* and lady's finger differ in their mode of dehiscence. Select the option that correctly represents their mode of dehiscence in respective manner.
(a) Pore, longitudinal slit, irregular manner
(b) Pore, longitudinal slit, longitudinal slit
(c) Apical teeth, pore, longitudinal slit
(d) Septicidal slit, pore, irregular manner
 7. Endosperm is fleshy and edible in
(a) litchi (b) cashewnut
(c) banana (d) rice.
 8. Gynandrous condition refers to
(a) attachment of stamens with petals
(b) attachment of stamens with carpel
(c) attachment of stamens with petals as well as carpels
(d) stamens with fused anthers.
 9. Which of the following is an example of parietal placentation?
(a) Tomato (b) Mustard
(c) Sunflower (d) Lemon
 10. Colchicine is used to introduce polyploidy. It is obtained from *Colchicum autumnale* that belongs to Family
(a) Liliaceae (b) Solanaceae
(c) Fabaceae (d) Leguminosae.

Match The Columns

11. Match Column I with Column II.

Column I	Column II
A. Ligule	(i) Broadened hypopodium that completely encloses stem
B. Pulvinus	(ii) Fused stipules that surrounds the stem
C. Amplexicaul	(iii) Outgrowth between leaf base and lamina
D. Ochreate	(iv) Swollen leaf base

12. Match Column I with Column II. (There can be more than one match for items in Column I).

Column I	Column II
A. Hypogynous	(i) Mustard
B. Epigynous	(ii) Racemose
C. Perigynous	(iii) Monoadelphous
D. Stamen	(iv) Guava
E. Inflorescence	(v) China rose
	(vi) Cucumber
	(vii) Diadelphous
	(viii) Rose
	(ix) Cymose
	(x) Peach

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

The monocotyledonous seeds possess a single (i) and are generally (ii). The seed coat is membranous and (iii) with the fruit wall. The main bulk of the grain is (iv), which store (v). Endosperm is separated from the embryo by a distinct layer known as (vi). The embryo is small and occurs in a groove at one end of the endosperm. It consists of one shield-shaped cotyledon known as (vii), an embryonal short axis with (viii) and (ix). A sheath called (x) covers the plumule. Likewise, the radicle is protected by (xi).

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

(a) if both A and R are true and R is the correct explanation of A
 (b) if both A and R are true but R is not the correct explanation of A
 (c) if A is true but R is false
 (d) if both A and R are false.

14. **Assertion :** The leaves of *Mimosa pudica* are bipinnate.

Reason : The pinnules are present on the rachillae, arranged pinnately on primary axis.

15. **Assertion :** Flowers are modified shoot, which perform sexual reproduction.

Reason : Different whorls of flower are arranged successively on internodes.

16. **Assertion :** The mangrove plants possess horizontal cable roots.

Reason : Horizontal roots develop both upright aerial roots and downward absorbing roots.

17. **Assertion :** *Viscum* has non-green stems and leaves.

Reason : *Viscum* sends primary and secondary haustoria into the host for absorbing food only.

18. **Assertion :** Floral organs borne on thalamus are commonly arranged in whorls.

Reason : Sepals protect floral organs while petals attract pollinating insects.

Figure Based Questions

19. Refer to the given floral diagram and answer the following questions.

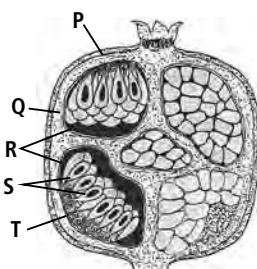


(a) State the characteristics of androecium and gynoecium that can be inferred from the above given floral diagram.

(b) Identify the plant and the family to which the floral diagram belongs.

(c) Give any two economical importance of plants of this family.

20. Refer to the given L.S. of a fruit and answer the following questions.



(a) Identify P, Q, R, S and T.

(b) Which type of fruit is this?

(c) From which parts the outer hard covering and inner papery white covering around the group of seeds are formed in this fruit?



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CHAPTER-6 : ANATOMY OF FLOWERING PLANTS

Multiple Choice Questions

Match The Columns

- 11** Match Column I with Column II

Column I	Column II
A. Mesophyll	(i) Passage cells
B. Periderm	(ii) Isobilateral leaf
C. Endodermis	(iii) Lenticels
D. Subsidiary cells	(iv) Accessory cells
E. Bulliform cells	(v) Palisade cells

- 12.** Match Column I with Column II. (There can be more than one match for items in Column I).

Column I	Column II
A. Exarch xylem	(i) Proxylem towards outer side
B. Endarch xylem	(ii) Centripetal development
C. Prickles	(iii) Epidermal outgrowth with some inner tissues
D. Trichomes	(iv) Strictly epidermal outgrowth (v) Centrifugal development (vi) Proxylem towards centre (vii) Absence of vascular supply (viii) Digestive glands of insectivorous plants

Passage Based Question

13. Complete the given passage with appropriate words or phrases.

Dicot stems produce (i) in outer cortical cells. It divides on the outer side to form (ii), while on the inner side produces (iii). The phellem or cork cells are (iv) and have deposition of (v). Phellem, phellogen and phelloderm collectively form (vi). The function of periderm is protective. Bark includes periderm, (vii), (viii), primary and secondary (ix).

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as :

- (a) if both A and R are true and R is the correct explanation of A
 - (b) if both A and R are true but R is not the correct explanation of A
 - (c) if A is true but R is false
 - (d) if both A and R are false.

- 14. Assertion :** Epidermal cells of cereals have a deposition of silica.

Reason : Silica is abrasive and provides stiffness.

- 15. Assertion :** Root apical meristem appears cup-shaped.

Reason : Quiescent centre is present in the centre of the root apex.

- 16. Assertion :** Epiblema is also called piliferous layer.

Reason : Epiblema bears root hair.

- 17. Assertion :** Leaves of maize gets rolled up to reduce the loss of water in water deficient condition.

Reason : Maize have palisade parenchyma in their mesophyll.

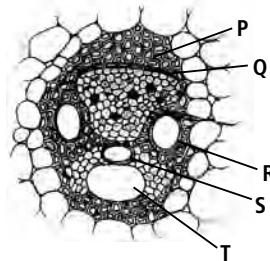
- 18. Assertion :** Lenticels are found in woody trees as well as in climbers.

Reason : Lenticels are produced by phellogen.

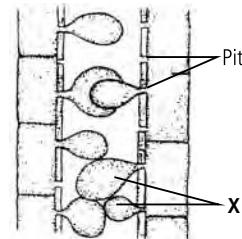
Figure Based Questions

- 19.** Refer to the given diagram and answer the following questions.

- (a)** Identify P, Q, R, S and T.
 - (b)** Identify the type of vascular bundle in the given figure.
 - (c)** Describe the characteristics of xylem present in this type of vascular bundle.



- 20.** Consider the given figure and answer the following questions.



- (a)** Identify the structure X.
 - (b)** Where is X found?
 - (c)** Explain how X is formed.

CHAPTER-7 : STRUCTURAL ORGANISATION IN ANIMALS

Multiple Choice Questions

- 1.** Tendon is made up of

- (a) white fibrous tissue
 - (b) yellow elastic tissue
 - (c) loose connective tissue
 - (d) both (a) and (c).

2. Select the mismatched pair

- Select the mismatched pair.

 - (a) Merocrine gland - Salivary glands
 - (b) Apocrine gland - Mammary glands
 - (c) Holocrine gland - Gonads
 - (d) Heterocrine gland - Pancreas

3. Which of the following statements are incorrect regarding connective tissues?

Match The Columns

- 11.** Match Column I with Column II.

Column I	Column II
A. Tight junctions	(i) Minute projections of membrane that connects adjacent cells
B. Gap junctions	(ii) Helps in anchoring neighbour cells
C. Zonula adherens	(iii) Prevent exchange of chemicals between adjacent cells
D. Intercellular bridges	(iv) Exchange chemicals between adjacent cells

12. Match Column I with Column II. (There can be more than one match for items in Column I)

Column I	Column II
A. Striated muscle	(i) Voluntary
B. Smooth muscle	(ii) Uninucleate fibres
C. Cardiac muscle	(iii) Pavement epithelium
D. Simple squamous epithelium	(iv) Pharynx
	(v) Involuntary
	(vi) Alveoli
	(vii) Intercalated discs
	(viii) Urinary bladder

Passage Based Question

- 13.** Complete the given passage with appropriate words or phrases.

Muscles are made up of highly specialised thin and elongated cells called (i). Muscular tissues are derived from (ii) layer of embryonic germ cells. Muscular cells are also called (iii) or (iv). These develop from (v). Each muscle fibre consists of fine fibrils, present in cytoplasm known as (vi) and the membrane of each fibre is known as (vii). A muscle consists of many muscle fibres arranged in bundles called (viii) which is surrounded by a connective tissue sheath (ix). Each muscle fibre is surrounded by this connective tissue sheath (x). The connective tissue that covers the whole muscle is called (xi).

Assertion & Reason

In each of the following questions, a statement of Assertion (A) is given and a corresponding statement of Reason (R) is given just below it. Of the statements, mark the correct answer as:

- (a) if both A and R are true and R is the correct explanation of A
 - (b) if both A and R are true but R is not the correct explanation of A
 - (c) if A is true but R is false
 - (d) if both A and R are false.

14. Assertion : Endocrine glands do not have ducts.
Reason : Endocrine glands secrete saliva and mucus.

15. Assertion : Calcium is necessary for the contraction of muscles.
Reason : In presence of calcium ions and ATP, actomyosin is formed.

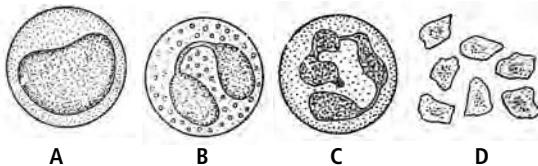
16. Assertion : Blood can prevent its own excessive loss.
Reason : Thrombocytes release platelet factors such as thromboplastin.

17. Assertion : Red bone marrow is present at the epiphyses.
Reason : Red bone marrow is gradually replaced by yellow bone marrow.

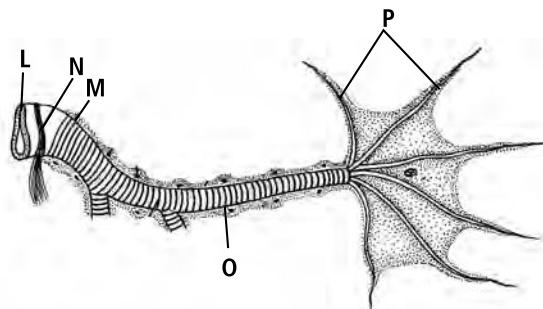
18. Assertion : Ciliated epithelium helps in the movement of secretions from glands, urine and semen.
Reason : Cells of ciliated epithelium are unequal in size and only long cells have cilia at their surface.

Figure Based Questions

19. Refer to the given figure of various human blood corpuscles and answer the following questions.



- (a) Identify the cells A, B, C and D and write their major functions.
 (b) What is the percentage of each of these cells in human blood?
 20. Study the given figure and answer the following questions.



- (a) Identify the structures labelled as L, M, N, O and P in the given figure.
 (b) Which physiological process is performed by these organs?
 (c) State the role of P during the process performed by the given figure.

SOLUTIONS

CHAPTER-5 : MORPHOLOGY OF FLOWERING PLANTS

1. (c) 2. (a) 3. (a) 4. (d) 5. (b)

6. (b) 7. (d) 8. (b) 9. (b) 10. (a)

11. A-(iii); B-(iv); C-(i); D-(ii)

12. A-(i, v); B-(iv, vi); C-(viii, x); D-(iii, vii), E-(ii, ix)

- | | |
|-------------------|---------------------|
| 13. (i) cotyledon | (ii) endospermic |
| (iii) fused | (iv) endosperm |
| (v) food | (vi) aleurone layer |
| (vii) scutellum | (viii) plumule |
| (ix) radicle | (x) coleoptile |
| (xi) coleorhiza | |

14. (a) 15. (c) 16. (b) 17. (d) 18. (b)

19. (a) Androecium of this flower possess five stamens, polyandrous, alternipetalous and epipetalous. Anthers are bithecous, basifix and inferior. Gynoecium is bicarpellary, syncarpous, ovary is superior, placed obliquely and bilocular. Placentation is axile with many ovules in each loculus.

(b) The given floral diagram is of *Solanum nigrum* which belongs to family Solanaceae.

(c) Plants of this family are used as

- (i) Vegetables e.g., Potato, tomato, brinjal, etc.
- (ii) Medicines e.g., *Atropa belladonna* yields belladonna which is used as topical pain reliever for dilation of pupil of the eye. Roots of *Withania somnifera* (Ashwagandha) are used to cure rheumatism and general weakness. Different parts of *Solanum surattense* are useful in treating asthma, bronchitis, leucoderma, etc.

20. (a) P is fused epicarp and thalamus, Q is mesocarp, R is papery endocarp, S are seeds and T represents placenta in fruit.

(b) The given figure is of pomegranate (*Punica granatum*) which is a balausta berry. It is a pseudocarpic berry in which the syncarpous pistil consists of two rows of fused carpels.

(c) The hard rind of pomegranate is made up of exocarp and part of mesocarp while the white papery layer that covers the individual groups of seeds is derived from endocarp.

CHAPTER-6 : ANATOMY OF FLOWERING PLANTS

1. (d) 2. (b) 3. (b) 4. (a) 5. (c)

6. (d) 7. (b) 8. (d) 9. (a) 10. (c)

11. A-(v), B-(iii), C-(i), D-(iv), E-(ii)

12. A-(i, ii), B-(v, vi), C-(iii, vii), D-(iv, viii)

- | | | |
|-------------------|------------------|-----------------|
| 13. (i) phellogen | (ii) phellem | (iii) pheloderm |
| (iv) dead | (v) suberin | (vi) periderm |
| (vii) cortex | (viii) pericycle | (ix) phloem |

14. (b) 15. (a) 16. (a) 17. (c) 18. (d)

19. (a) P-Bundle sheath, Q-Protophloem, R-Metaxylem, S-Protoxylem, T-Protoxylem cavity

(b) The given figure shows the conjoint, collateral and closed type of vascular bundle. These are found in monocot stem where a large number of vascular bundles are scattered in ground tissue i.e., atactostele.

(c) Xylem is endarch and arranged in the form of letter Y. Metaxylem generally consists of two large oval or rounded vessels lying at the upper two angles of xylem. The metaxylem vessels have pitted walls. Protoxylem has a few (2-3) small oval vessels. They lie at lower angle of xylem. The vessels of protoxylem show spiral and annular thickenings. Xylem parenchyma and a few fibres are found just outside them. Some of the protoxylem vessels and xylem parenchyma cells dissolve or separate during the

rapid growth of the stem to form a cavity called protoxylem cavity or lacuna.

20. (a) The balloon like structures 'X' represent tyloses in dicot stem.
(b) Tyloses are found in the heartwood or duramen of older stems.
(c) They are formed when tracheids and vessels of the heartwood get plugged by the ingrowth of the adjacent xylem parenchyma into the lumen of xylem vessels through the pits.

CHAPTER-7 : STRUCTURAL ORGANISATION IN ANIMALS

B is eosinophil that is non-phagocytic but its number increases during allergy and plays important role in immune response.

C is neutrophil which phagocytose germs and dead cells.
D are platelets that help in blood clotting by releasing certain clotting factors.

- (b)** Monocytes - 2-10%
Eosinophils - 1-6%
Neutrophils - 40-70%
Platelets - 2,50,000 per mm³ of blood

20. **(a)** The given figure shows the structure that constitutes the respiratory system of cockroach. Here, L is spiracle, M is tracheal epithelium, N is atrial muscles, O is tracheae and P are tracheoles.

(b) These structures play an important role during breathing or respiration of the insect.

(c) Labelled part 'P' is tracheoles that terminate blindly in the tissues and contain a tissue fluid at the distal end which plays a significant role during the diffusion of the gases. When the air enters the spiracles, tracheae and tracheoles, oxygen from the air is dissolved into the tissue fluid present in the tracheoles from which it is diffused into the body cells.

UNSCRAMBLE ME

Unscramble the words given in column I and match them with their explanations in column II.

Column I	Column II
1. IEPCLOEN	(a) The study of reptiles and amphibians.
2. ARPIMALYNO	(b) A covering of dead spongy tissue over aerial roots.
3. RAARCNGIENE	(c) A false septum that develops between the two parietal placentae in the members of Brassicaceae.
4. REPELOGOYHT	(d) A gelatin like substance that can be obtained by boiling cartilage in water.
5. LAEVNME	(e) Fixed macrophages in bone.
6. PEULMR	(f) Phycocolloid used as a clearing agent in liquors.
7. NOHDCNIR	(g) Specialised complex carbohydrate as reserve food in Euglenoids.
8. SAEOSLTOSTC	(h) Epoch known for the divergent evolution of modern mammals.
9. ONALNLI	(i) The individuals that have exact copies of genetic characteristics of their parent.
10. ESARTM	(j) A wax that forms a protective water insoluble coating on animal fur.

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Winners' names will be published in next issue.

HIGH YIELD FACTS



Class XI

Cell : The Unit of Life - II

- We have already discussed the general organisation of prokaryotic and eukaryotic cells along with the endomembrane system in previous issue. In continuation to that remaining cell organelles are discussed here.
- Cytoplasm contains a variety of organelles. Mitochondria, plastids and peroxisomes are not considered as a part of endomembrane system because their function is not coordinated with the organelles of endomembrane system.

MITOCHONDRIA

- They were first observed by **Kolliker** in 1880 while the name "mitochondrium", was given by **Benda** (1897).
- Mitochondria are organelle of aerobic eukaryotes and are absent in prokaryotes and mature RBCs.
- They are called **power house of cell** because they help in cellular respiration and energy generation.

Structure

- Mitochondria are cylindrical, double membranous structure having length of about 1.0 - 4.1 μm and a diameter of 0.2 - 1.0 μm .
- The outer membrane is smooth and permeable to many metabolites due to presence of protein channels called porins.
- The inner membrane is folded into finger like projections called **cristae**.
- Inner membrane and cristae possess mushroom-like projections called **elementary particles or oxyosomes ($F_0 - F_1$ particles)**.
- These particles are related to ATP synthesis during **oxidative phosphorylation**.
- Mitochondrial matrix contains ribosomes (55S to 70S type), double stranded circular DNA (*m*DNA or *mt* DNA), RNA and enzymes of Krebs cycle.
- Mitochondria are **semi-autonomous** in nature as they have their own DNA which can replicate independently and produce its own mRNA, tRNA and rRNA to synthesize some of their proteins. New mitochondria are produced by pre-existing mitochondria.

	Analysis of various PMTs from 2012-2016				
	2012	2013	2014	2015	2016
AIPMT/NEET	6	3	4	4	8
AIMS	-	1	-	-	2
AMU	4	2	4	3	-
Kerala	3	-	2	3	-
K-CET	1	3	-	1	-
J & K	1	-	-	4	-

Functions

- Synthesise and store ATPs by oxidation of respiratory substrates i.e., carbohydrates, proteins and fats.
- Its matrix is the site of aerobic respiration i.e., Krebs cycle.
- Electron transport system and oxidative phosphorylation takes place in inner mitochondrial membrane.
- Synthesis of fatty acids, many amino acids as well as storage and release of calcium when required.

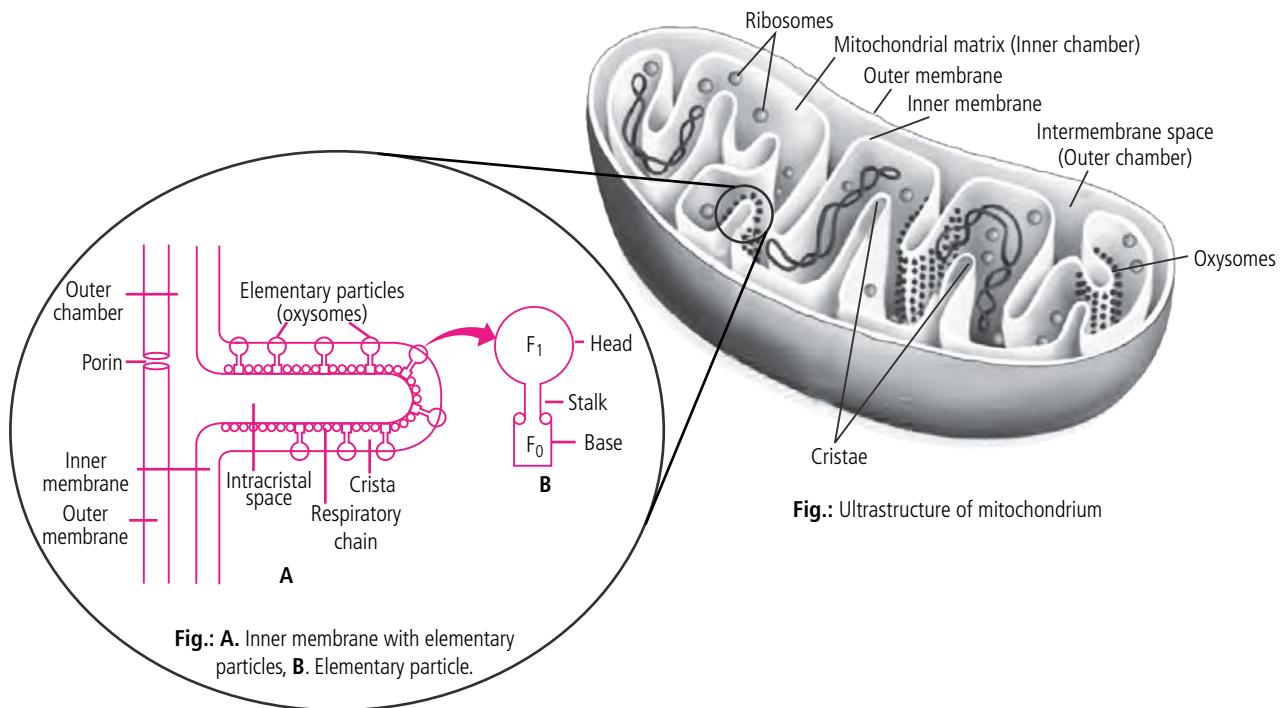
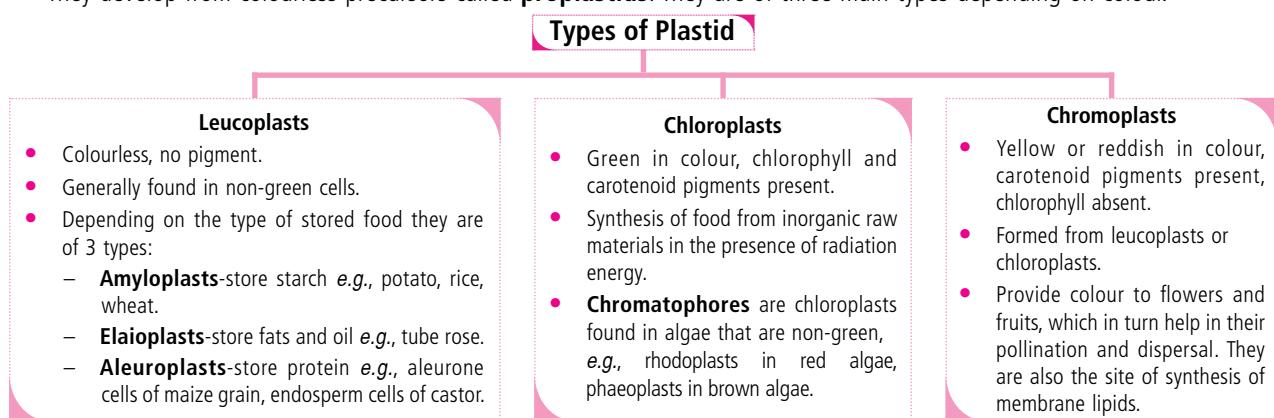


Fig.: Ultrastructure of mitochondrion

PLASTIDS

- The term 'plastid' was introduced by **E. Haeckel** in 1866 but its clear definition was given by **A. Schimper** in 1883.
- Like mitochondria, they are also **semi-autonomous** organelles having DNA, ribosomes and RNA molecules.
- Plastids have double membrane envelope which store or synthesise various types of organic compound. They are restricted only to plant cells, with exception of some protists.
- They develop from colourless precursors called **proplastids**. They are of three main types depending on colour.



Structure of Chloroplast

- They have various shapes, such as ribbon-like (e.g., *Spirogyra*), cup-shaped (e.g., *Chlamydomonas*) and plate-like (e.g., *Ulothrix*). Chloroplasts of higher plants are generally **disc-shaped**.

- Their size varies in different species. Chloroplasts of higher plants are 4-10 μm in length and 2-4 μm in breadth.
- Chloroplast has three parts: **envelope**, **matrix** and **thylakoids**.
- The chloroplast is covered by two membranes, separated by intermembrane space.
- Matrix or **stroma** consists of circular dsDNA, RNA, ribosomes (70S), starch grains and enzymes of light and dark reactions of photosynthesis.
- Thylakoids are membrane lined flattened structures in the stroma. They are stacked at places to form grana. Each granum has 2-100 thylakoids.
- Thylakoids present between two grana are called **Fret channel** or stroma thylakoids.
- Flat membranous tubules that connect the thylakoids of different grana are called stroma lamellae.
- Thylakoid membrane contains photosynthetic pigments (Chl *a*, Chl *b*, carotenes, xanthophylls) coupling factors (involved in ATP synthesis) and photosystems I and II.

Functions

- It is the site of photosynthesis as it traps solar energy to convert inorganic compounds into organic compounds (carbohydrates).
- It liberates oxygen and utilises CO_2 to keep the balance of gases in the atmosphere.
- It produces ATP and reducing power NADPH for various biochemical reactions.
- It stores starch and lipids.
- It can change into chromoplasts and provide colour to flowers and fruits for attracting various pollinators.

MICROBODIES

- They are small, single membrane bound organelles associated with oxidation reactions (other than those involved in respiration).
- These are of two types:

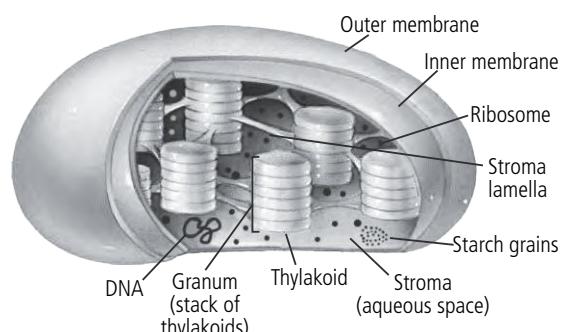


Fig.: Ultrastructure of chloroplast

Microbodies

Peroxisomes

- Discovered by **De Duve et al.** (1965) by fractionation.
- Found in all eukaryotic cells i.e., both plant and animal cells.
- Spherical sac-like structure of size 0.5 - 1.0 μm .
- Contain enzymes for peroxide biosynthesis. E.g., catalase, special docking proteins called peroxins for obtaining materials from cytosol and ER.
- In animal cells, they metabolise number of toxic substances and also detoxify alcohol in liver.
- Breakdown of unusual substances or xenobiotics, which cannot be metabolised by normal enzymes.
- In plants, they perform photorespiration in association with chloroplast and mitochondria.
- In root nodules, they convert fixed nitrogen into **ureids** for transport.

Glyoxysomes

- These are specialised peroxisomes.
- They contain enzymes for β -oxidation and glyoxylate pathway (conversion of fatty acids into carbohydrates).
- Found in plants, germinating oil seeds and some fungi.

Oleosomes (Sphaerosomes) - They are the small, spherical vesicles (0.5 - 1.0 μm in diameter) bound by single membrane. These synthesise and store lipids. They arise from endoplasmic reticulum (ER) and occur abundantly in the endosperm cells of oil seeds. In some tissues, they have hydrolytic enzymes, therefore are considered to have lysosomal activity.

RIBOSOMES

- They were discovered by **Robinson** and **Brown** in 1953 in plant cells and by **Palade** in 1955 in animal cells. Palade also coined the term 'ribosome'.
- They are ribonucleoprotein protoplasmic particles (RNP) without membrane, having length of 200 - 340 \AA and diameter of 170 - 240 \AA .

- Each ribosome consists of one larger and one smaller subunit.
- The smaller subunit fits over larger one and requires Mg^{2+} for binding.
- They are found in all living cells except RBCs.
- They occur in cytoplasm of the cell and in organelles like mitochondria and chloroplast. The cytoplasmic ribosomes may remain free in cytoplasm or attached to ER.
- They are the sites of protein synthesis and are known as **protein factories**.
- Chemically ribosome is made of two parts: proteins and rRNA.
- It has 4 sites for specific attachments: **mRNA binding site, A** or **aminoacyl binding site, P** or **peptidyl site** and **E** or **exit site**.
- The size of ribosome is measured by sedimentation coefficient in the centrifuge and is measured as **Svedberg unit** called **S**. Two subunits of 80S ribosome are 60S and 40S while 70S ribosome has 50S and 30S subunits.

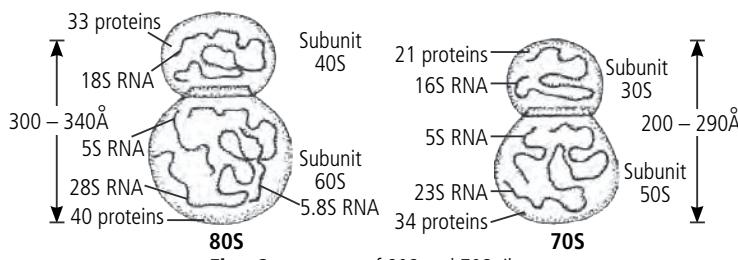
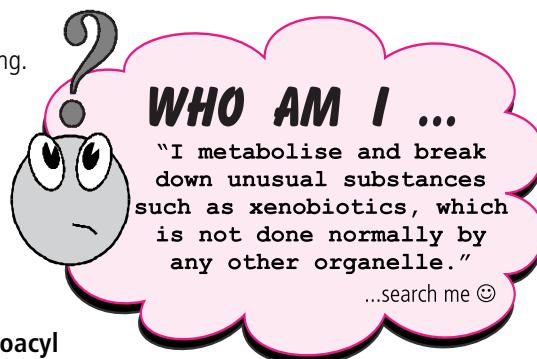
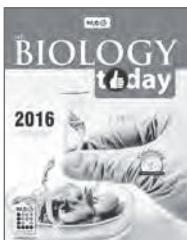
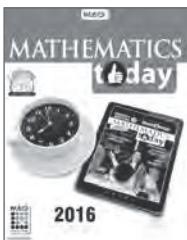
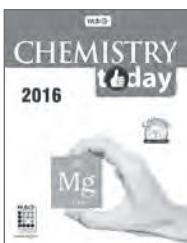
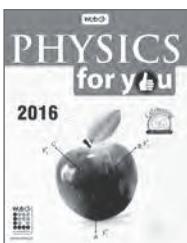


Fig.: Components of 80S and 70S ribosomes.

Functions

- **Protein factories:** Ribosomes are sites for polypeptide or protein synthesis and therefore act as protein factories.
- Free ribosomes synthesise structural and enzymatic proteins for use inside the cell. The attached ribosomes synthesise proteins for transport.
- Ribosomes provide enzymes (e.g., peptidyl transferase) and factors for condensation of amino acids to form polypeptide.
- Ribosome contains rRNAs for providing attaching points to mRNA and tRNAs. Ribosome also has a tunnel for mRNA so that it can be translated properly.
- It also provides protection to newly synthesised polypeptide by enclosing it in groove of larger subunit of ribosome.

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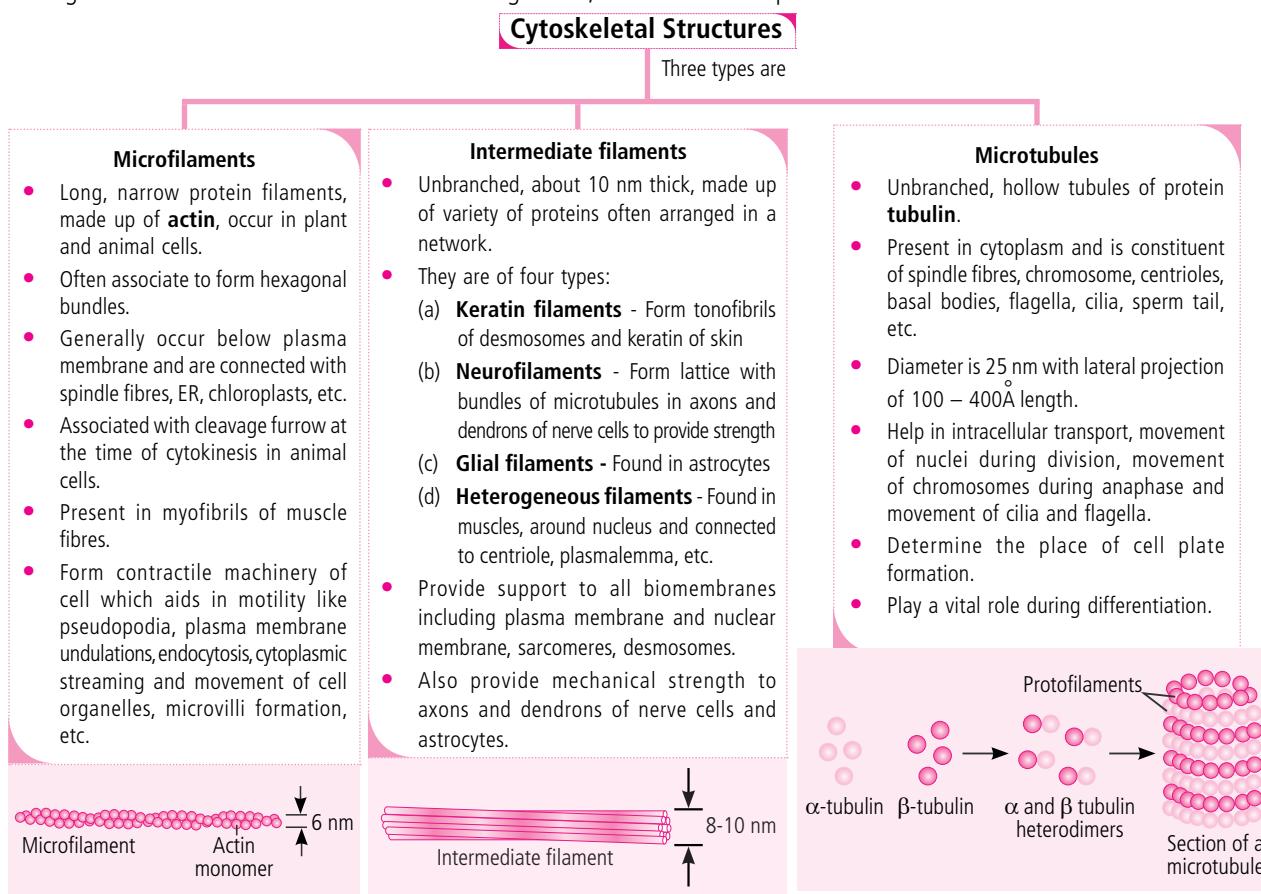
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CYTOSKELETAL STRUCTURES

- They are minute, fibrous and tubular structures that form the structural framework inside the cell and maintain shape of cell, regulate orientation and distribution of cell organelles, intracellular transport and cellular movement.



FLAGELLA AND CILIA

- They are hair-like microscopic locomotory structures.
- Both are structurally similar and have similar parts:
 - Basal body or Kinetosome** - It is also called **basal granule**. Basal body occurs embedded in the outer part of the cytoplasm below the plasma membrane. It has nine triplet fibrils present on the periphery without a central fibril, though a hub of protein is present. Only sub-fibre A is complete (having 13 protofilaments) while sub-fibres B and C are incomplete as they share some of their protofilaments.
 - Rootlets** - They are striated fibrillar outgrowths which develop from the outer lower part of the basal body and are meant for providing support to the basal body. The rootlets are made of bundles of microfilaments.
 - Basal plate** - It is an area of high density which lies above the basal body at the level of plasma membrane. In the region of basal plate, one sub-fibre of each peripheral fibril disappears. The central fibrils develop in this area.
 - Shaft** - It is the hair-like projecting part of flagellum or cilium. The shaft is covered on the outside by a sheath which is the extension of plasma membrane. Internally, it contains a semifluid matrix having **an axoneme** of 9 peripheral doublet fibrils and 2 central singlet fibrils. This arrangement is called 9 + 2 or 11-stranded. The two central singlet fibres are covered by a proteinaceous central sheath. They are connected by a double bridge. Each peripheral fibril consists of two microtubules or sub-fibres B and A. The sub-fibre A bears two bent arms, the outer one having a hook made up of protein **dynein** with ATPase activity. Movement of flagella or cilia occurs due to sliding motion in which dynein arm establishes temporary connection with subtubule B of adjacent doublet fibre. The peripheral doublet fibrils are interconnected by A-B linkers of protein **nexin** between B sub-fibre of one and inner side arm of A sub-fibre of adjacent fibril. Each of their A sub-fibres sends a radial proteinaceous column to the centre which is called **spoke**.

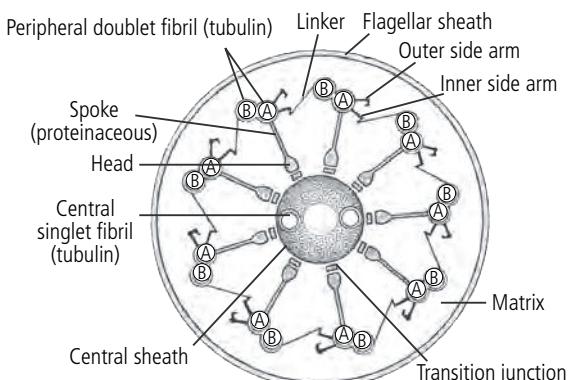


Fig.: Ultrastructure of flagellum

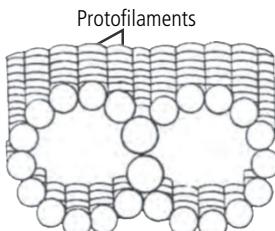


Fig.: Doublet fibril without arms

Table: Differences between cilia and flagella

	Cilia	Flagella
(i)	The number of cilia per cell is usually very large (300-14000).	The number of flagella per cell is usually 1-4.
(ii)	They are smaller (5-20 μm in length), have smooth surfaces and occur throughout or major part of the surface of a cell.	They are longer (100-200 μm in length), may have smooth or possess flimmer surface and are commonly found at one end of the cell.
(iii)	They beat in a coordinated rhythm either simultaneously (isochronic or synchronous rhythm) or one after the other (metachronic rhythm).	The flagella beat independently.
(iv)	Cilia produce a sweeping or pendular stroke.	The flagella produce undulatory motion.
(v)	Cilia help in locomotion, aeration, feeding, circulation, etc.	Flagella help in locomotion.
(vi)	Cilia may fuse to form undulating membrane.	Fusion of flagella is unknown.
(vii)	Flame cells of worms, larval bodies of many invertebrates, epithelium of respiratory tract, renal tubules, oviducal funnel, etc.	Many protists, motile algae, spermatozoa of animals, bryophytes and pteridophytes, choanocytes of sponges, gastrodermal cells of coelenterates, zoospores and gametes of thallophytes.

Functions

- Help in locomotion.
- Create current for obtaining food from aquatic medium.
- Circulate food in the gastrovascular cavity of coelenterates and help in movement of food and egestion in tunicates.
- Help in oxygen supply and quick diffusion of carbon dioxide in aquatic organisms.
- Eliminate dust particles which come with inhaled air in the respiratory tract of land animals.
- Help in passage of eggs in oviduct, excretory substances in kidneys, etc.
- Function as sensory organs and help in fusion of gametes.

CENTRIOLES

- They are non-membranous organelles having (9 + 0) microtubular arrangement.
- They are approximately 0.3 – 0.5 μm in length and 0.15 μm in diameter.
- Usually they are arranged in a group of two at right angles to each other, forming a pair called **diplosome**.
- Diplosome is present in specialised part of cytoplasm called **centrosphere** or **kinoplasm**.
- Centrosome is a complex structure formed of centrioles and centrosphere.
- They are found in almost all eukaryotic animal cells, protozoan protists (except some forms like *Amoeba*), some fungi and the cells of all those eukaryotic plants where flagellate structures are present in the life cycle. They are absent in angiosperms, higher gymnosperms, some algae and fungi.

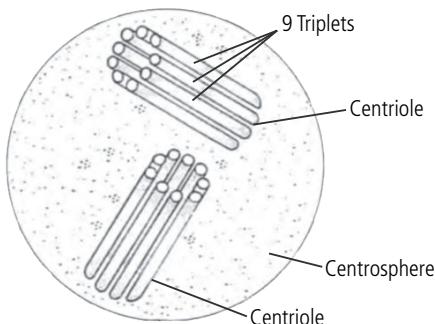


Fig.: Centrosome with pair of centrioles (Diplosome)

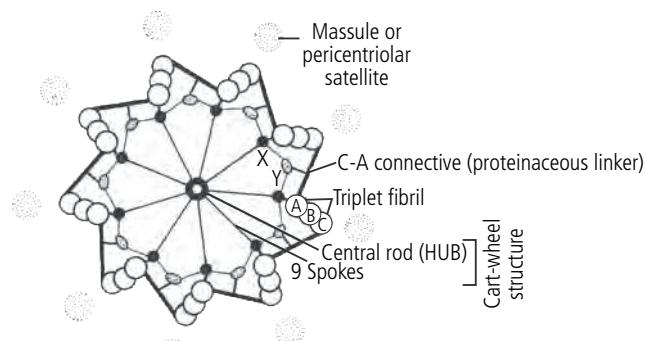


Fig.: Ultrastructure of centriole

- Centrioles replicate with the help of massules in S or G₂ phase to coordinate in animal cell division. Before nuclear division, the two centrosomes separate and move to opposite ends at the place of spindle pole formation.

Functions

- Centrioles help in cell division by forming microtubule-organising centres (MTOCs).
- Out of the two centrioles in a spermatozoan, the distal one forms axial filament or tail.
- Centrioles can be transformed into basal bodies to give rise to cilia and flagella.
- Centrioles are capable of forming new centrioles with the help of massules which function as nucleating centres.

NUCLEUS

- Nucleus was first observed by **Leeuwenhoek** in RBCs and was first studied by **Robert Brown** in orchid root cells.
- It is the largest cell organelle having double membrane and carry all the genetic information.
- Commonly cells are uninucleate, *Paramecium caudatum* is binucleate having (macronucleus for controlling metabolic activities and micronucleus that contains hereditary information). Cells of bone marrow, striated muscles, several fungi and algae are multinucleate.
- A typical interphase nucleus is 5-25 µm in diameter and differentiated into nuclear envelope, nucleoplasm, nuclear matrix, chromatin and nucleolus.

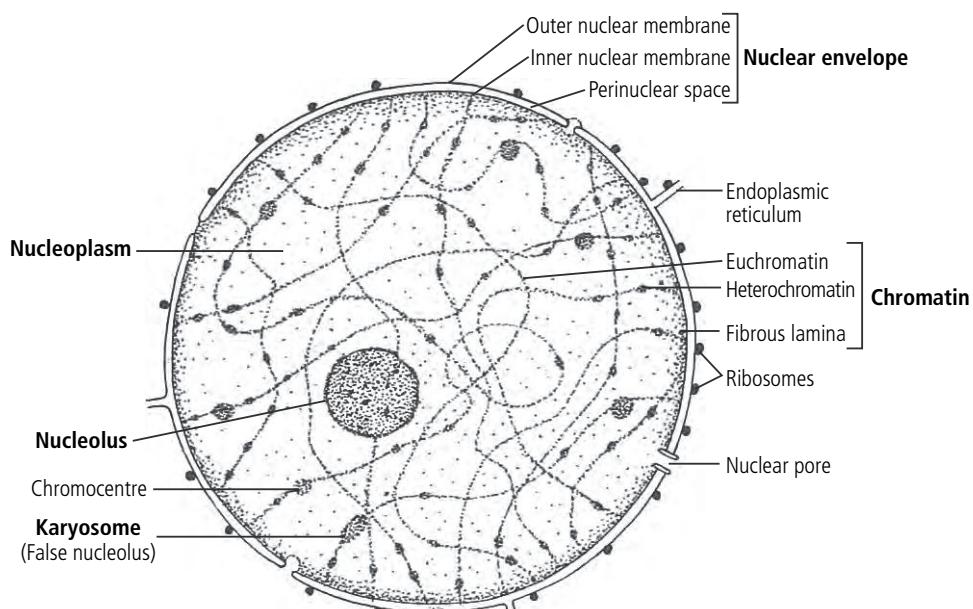


Fig.: Ultrastructure of interphase nucleus

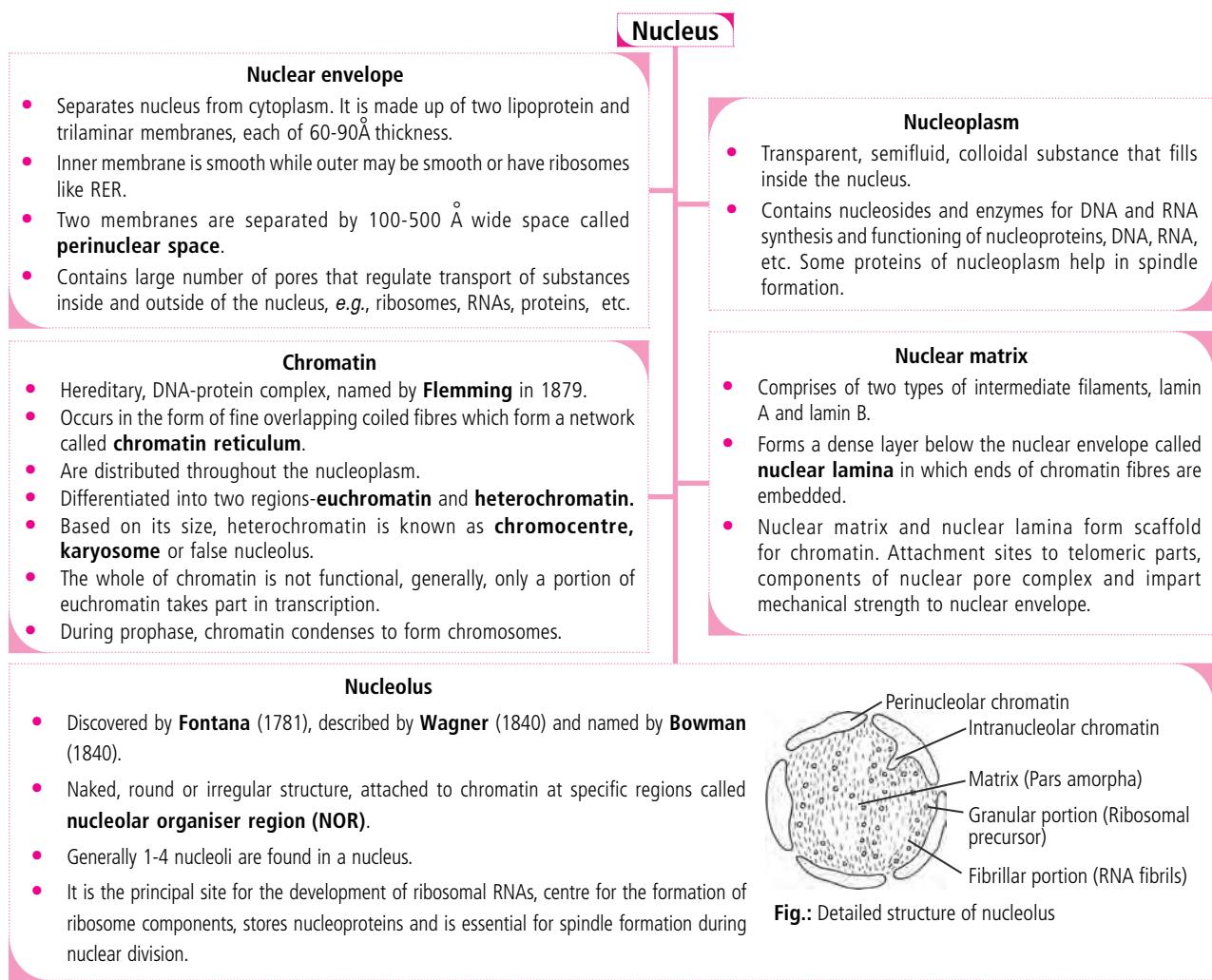


Table: Differences between euchromatin and heterochromatin

	Euchromatin	Heterochromatin
(i)	It is narrower, 10-30 nm in diameter.	It is thicker, 100 nm in diameter.
(ii)	It is somewhat diffused and lightly stained.	It is condensed and darkly stained.
(iii)	It forms the bulk of chromatin.	It is present at certain places in the chromatin.
(iv)	It contains active genes and takes part in transcription.	Heterochromatin does not possess active genes and hence transcription is absent.
(v)	Euchromatin is affected by a number of factors like pH, temperature and hormones.	Heterochromatin is not influenced by these factors.
(vi)	Crossing over is quite common.	Heterochromatin inhibits crossing over.
(vii)	It replicates early.	It replicates late in the S-phase.
(viii)	Nucleosome strand has minimum coiling.	Nucleosome strand has solenoid coiling.

Functions

- It stores genetic information and transmit it to the next generation.
- It controls cellular activities like growth, development, reproduction and metabolism.

- It controls the synthesis of RNAs (*mRNA*, *rRNA*, *tRNA*), enzymes and structural proteins.
- It directs cell differentiation, nucleus replication and cell division.

CHROMOSOMES

- They are rod-shaped or thread-like condensed chromatin fibres which appear only during karyokinesis (late prophase and metaphase).
- Their number is fixed in all individuals of same species.
- Shape and size of chromosomes varies in individuals. The shape is more clearly visible in late prophase and metaphase when primary constriction becomes distinct.
- Two **chromatids** are attached by **centromere** to form a single chromosome.
- Depending upon the position of centromere, chromosomes are of four types:
 - **Telocentric** - Terminal centromere
 - **Acrocentric** - Centromere is situated close to end
 - **Sub-metacentric** - Centromere occurs slightly away from the middle of chromosome
 - **Metacentric** - Centromere present in the middle of chromosome.

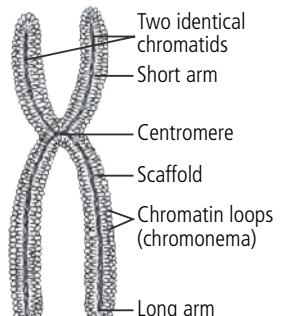


Fig.: Structure of chromosome

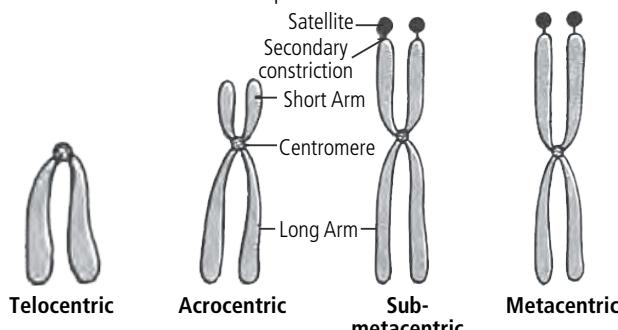
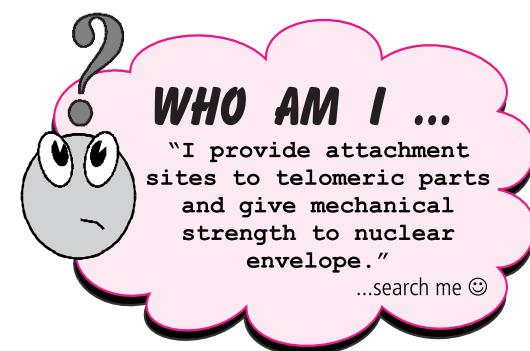


Fig.: Types of chromosome on the basis of position of centromere



Giant Chromosomes

Polytene chromosomes

- First reported by **E.G. Balbiani** in 1881.
- Commonly found in salivary glands of insects and thus, also known as salivary chromosomes. Also present in antipodal cells, endosperm cells, etc.
- Length can be 2000 µm (1000 – 16000 times larger than ordinary somatic chromosomes).
- Formed by somatic pairing between homologous chromosomes and repeated replication of their chromonemata.
- Conspicuous swellings on polytene chromosomes during certain developmental stages are called **puffs**. Larger swellings are called **Balbiani rings**.
- In region of puffs or Balbiani rings, DNA strands uncoil, become active and produce number of copies of messenger or *mRNA*.

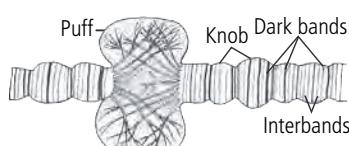


Fig.: Polytene chromosome showing puff

Lampbrush chromosomes

- First seen by **Flemming** (1882) but described by **Ruckert** (1892).
- Highly elongated special kind of diplotene chromosome bivalents.
- Occur in diplotene stage of animal oocytes, spermatocytes, etc.
- Total length may be up to 5900 µm or three times the aggregate length of total polytene chromosomes.
- Occur in pairs, consist of homologous chromosomes.
- Chromomeres give out lateral projections or loops, which provide lampbrush-like appearance to the chromosome pair. Loops are uncoiled parts of chromomere with one to several transcriptional units. **Loops** are region for rapid transcription of *mRNA* meant for synthesis of yolk and other substances required for growth and development of meiocytes.

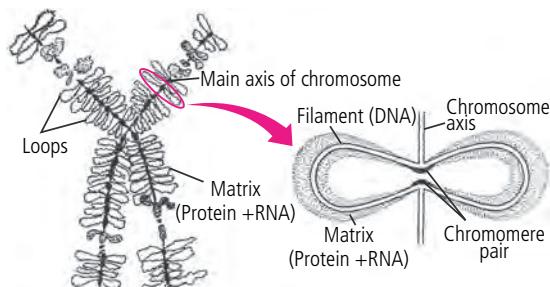


Fig.: Lampbrush chromosome

Functions

- Contain genes hence, transmit genetic information.
- Control synthesis of proteins, enzymes, hence regulate cell division, growth and metabolism.
- Satellite chromosomes produce nucleoli for synthesis of ribosomes.
- Sex chromosomes (e.g., X and Y) determine sex of individuals.
- Introduce variations through crossing over.
- Produce mutations due to change in gene chemistry.

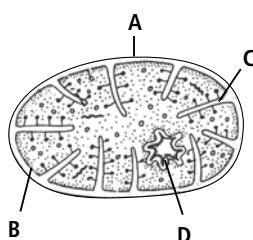
SPEED PRACTICE

- Nucleic acids are not present in
 - ribosomes
 - mitochondria
 - chloroplasts
 - peroxisomes.
- Functional independence of mitochondria and chloroplast from rest of the cellulose machinery is due to
 - presence of double membrane
 - presence of DNA and RNA
 - occurrence of electron transport chain
 - their symbiotic association with prokaryotic cells.
- Microbodies are involved in the process of
 - respiration
 - photorespiration
 - lipid synthesis
 - protein folding.
- Match column I with column II and select the correct option.

Column I	Column II
A. Chromonema	(i) Fine fibres of DNA protein complex
B. Chromatid	(ii) Coiled filament that makes chromosome
C. Chromatin	(iii) Point where chromatids are attached
D. Centromere	(iv) Identical halves of a chromosome

(a) A-(iii), B-(i), C-(ii), D-(iv)
 (b) A-(i), B-(iii), C-(iv), D-(ii)
 (c) A-(iv), B-(ii), C-(iii), D-(i)
 (d) A-(ii), B-(iv), C-(i), D-(iii)

- Refer to the given figure and select the correct option for A, B, C and D.



- (a) A is impermeable to biomolecules.

- (b) Electron transport system is present in B.
 (c) C has the enzymes for the synthesis of fatty acids.
 (d) D is responsible for the paternal inheritance.

- Select the incorrect statement.
 - Different ribosomes of polyribosome are connected by thick strand of mRNA.
 - New chloroplasts arise by the division of proplastids.
 - Microtubules take part in endocytosis and are contractile elements of muscles.
 - Microfilaments are solid structures made of actin proteins.

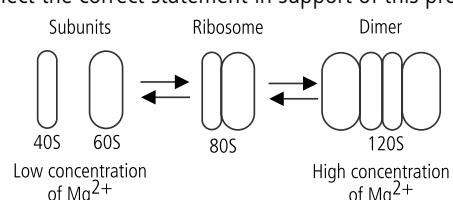
- Select the correctly matched pair.

(a) Nucleolus	- Double membrane
(b) Centriole	- Without membrane
(c) Ribosome	- Single membrane
(d) Glyoxysome	- Without membrane
- Identify the cytoskeletal structure from the following statements.
 - I. It is a solid filament absent in unicellular eukaryotes.
 - II. It is unbranched and have thickness of about 10 nm.
 - III. It provides mechanical strength to axons and dendrons.
 - IV. It protects skin from abrasions.
 - (a) Microtubule
 - (b) Microfilament
 - (c) Intermediate filaments
 - (d) Both (a) and (b)

- Which of the following helps in the formation of new centrioles?
 - Centriolar DNA
 - Nuclear DNA
 - Kinoplasm
 - Pericentriolar satellite

- Given diagram represents the process of formation of ribosomes and its dimer.

Select the correct statement in support of this process.



- (a) At higher concentration of Mg^{2+} , ribosomal subunits get separated.
 (b) Mg^{2+} is required for binding two subunits of ribosome.
 (c) Ribosome may occur as monosomes or polysomes.
 (d) Mg^{2+} do not play any role in the formation of ribosome.
- 11.** More ribosomes would be found in
 (a) meristematic cells of plant
 (b) parenchymatous cells of plant
 (c) lignified cells of plant
 (d) dead cells.
- 12.** Lampbrush chromosomes can be seen during
 (a) diplotene stage (b) metaphase
 (c) anaphase (d) zygotene stage.
- 13.** Specialised microbody that can be extracted from the endosperm of germinating groundnut seed is
 (a) ribosome (b) peroxisome
 (c) lysosome (d) glyoxysome.
- 14.** Study the given table and identify A, B, C and D.
- | Organelle | Function |
|-----------|---|
| Nucleolus | A |
| Centriole | B |
| C | Cytoplasmic streaming, endocytosis and exocytosis |
| D | Provides sites for polypeptide synthesis and protects newly synthesised polypeptide from cytoplasmic enzymes. |
- (a) A - Transcription, B - Cytoskeleton formation, C - Microtubule, D - Peroxisome
 (b) A - Spindle formation, B - Cell plate formation, C - Micro-filament, D - Mitochondria
 (c) A - rRNA synthesis, B - Sensory organ, C - Intermediate filament, D - Nucleus
 (d) A - Stores nucleoproteins, B - Synthesise sperm tail, C - Microfilament, D - Ribosome
- 15.** Which of the following is a characteristic of euchromatin?
 (a) Inhibits crossing over
 (b) Presence of active genes
 (c) Distributed throughout the nucleoplasm
 (d) Does not replicate
- 16.** Puffs or Balbiani rings in polytene chromosomes are sites of
 (a) DNA replication (b) translation
 (c) transcription (d) both (a) and (c).
- 17.** Chloroplast ribosomes are
 (a) 60S (b) 70S
 (c) 55S (d) 80S.

18. Match column I with column II and select the correct option.

Column I	Column II
A. Free ribosome	(i) Endocytosis
B. Bound ribosome	(ii) Synthesis of ribosomal RNAs
C. Chloroplast	(iii) Synthesise proteins to be used inside the cell
D. Peroxisome	(iv) Alcohol detoxification
E. Glyoxysome	(v) Synthesise proteins for transport (vi) β -oxidation of fatty acids (vii) Synthesise fatty acids

(a) A-(ii); B-(i); C-(vi); D-(vii); E-(iv)
 (b) A-(iii); B-(v); C-(i); D-(vi); E-(iv)
 (c) A-(v); B-(iii); C-(i); D-(iv); E-(vii)
 (d) A-(iii); B-(v); C-(vii), D-(iv), E-(vi)

19. Nucleoproteins are synthesised in the

- (a) nucleolus (b) nucleoplasm
 (c) cytoplasm (d) nuclear membrane.

20. Microtubule : Tubulin :: Microfilament : _____.

- (a) Keratin (b) Myosin
 (c) Actin (d) Both (a) and (c)

21. Ribosomes in animal cells were discovered by

- (a) Robinson (b) Brown
 (c) Palade (d) Benda.

22. Chromosome with sub-terminal centromere is called

- (a) telocentric (b) acrocentric
 (c) submetacentric (d) acentric.

23. Oxsomes are present in

- (a) peroxisomes (b) ribosome
 (c) mitochondria (d) rough endoplasmic reticulum.

24. What is the common feature of chloroplast, chromoplast and leucoplast?

- (a) They are bound by double membrane and contain photosynthetic pigments.
 (b) They have thylakoids and grana.
 (c) They store starch, proteins and lipids.
 (d) They have the ability to multiply by binary fission.

25. Which of the following does not belong to cell inclusions?

- (a) Reserve food (b) Secretory product
 (c) Sap vacuole (d) Mineral matter

ANSWER KEY

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (d) | 2. (b) | 3. (b) | 4. (d) | 5. (b) |
| 6. (c) | 7. (b) | 8. (c) | 9. (d) | 10. (b) |
| 11. (a) | 12. (a) | 13. (d) | 14. (d) | 15. (b) |
| 16. (c) | 17. (b) | 18. (d) | 19. (c) | 20. (c) |
| 21. (c) | 22. (b) | 23. (c) | 24. (d) | 25. (c) |



MPP-1

MONTHLY Practice Problems

Class XI

This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

- **The Living World**
- **Biological Classification**

Total Marks : 160

Duration : 40 Min.



1. A system of classifying living and extinct organisms in the historical order in which they have evolved from common ancestors, according to their characters, is called
 - (a) cladistics
 - (b) classical taxonomy
 - (c) phenetics
 - (d) numerical taxonomy.
2. Identify the organisms having following features.
 - (i) They are unicellular, usually marine and photosynthetic.
 - (ii) Cells are usually covered by cellulosic plates called theca.
 - (iii) A toxin produced by them causes paralytic shell fish poisoning in humans.
 - (iv) Some of them cause red tides and some show bioluminescence.
 - (a) Chrysophytes (b) Dinoflagellates
 - (c) Slime moulds (d) Euglenoids
3. The book *Historia Naturalis* was written by
 - (a) Linnaeus (b) John Ray
 - (c) Pliny the Elder (d) Theophrastus.
4. Consider the following statements and select the correct option stating which ones are true (T) and which ones are false (F) regarding binomial nomenclature.
 - (i) The specific epithet can be single or compound and begins with a small letter.
 - (ii) The name of the author is written in Greek script.
 - (iii) The names of families and sub-families should be based on name of genus.

(i) (ii) (iii)

 - (a) T F F
 - (b) T T T
 - (c) F F T
 - (d) T F T

5. Study the given table and identify A, B and C.

	Feature	Bacteria	Cyanobacteria
(i)	Cell wall	1-2 layered	A
(ii)	Flagella	Present	B
(iii)	Carbohydrate reserve food	C	Cyanophycean starch

A	B	C
(a) 2-layered	Present	Glycogen
(b) 3-layered	Absent	Starch
(c) 4-layered	Absent	Glycogen
(d) 1-2 layered	Present	Starch

6. Select the correct option to fill up the blanks in the following statements.
 - (i) _____ has all information about a particular taxon.
 - (ii) A handy book that contains instructions for the collection, identification and occurrence of species in an area is called _____.
 - (iii) _____ contains a list of characters and their alternates to identify various taxa.

(i)	(ii)	(iii)
(a) Catalogue	monograph	Manual
(b) Monograph	manual	Key
(c) Key	catalogue	Manual
(d) Monograph	manual	Catalogue

7. Genus, Family and Class of housefly respectively are
 - (a) *Domestica*, Diptera, Insecta
 - (b) *Musca*, Insecta, Arthropoda
 - (c) *Domestica*, *Musca*, Insecta
 - (d) *Musca*, Muscidae, Insecta.

8. Match the following and select the correct option.

Column I	Column II
-----------------	------------------

- | | |
|------------------------------------|-----------------------|
| A. Red rot of sugarcane (i) | <i>Alternaria</i> |
| B. Soft rot of apple (ii) | <i>Ustilago</i> |
| C. Early blight of potato (iii) | <i>Rhizopus</i> |
| D. Loose smut of wheat (iv) | <i>Colletotrichum</i> |
| (a) A-(i), B-(iii), C-(ii), D-(iv) | |
| (b) A-(ii), B-(i), C-(iii), D-(iv) | |
| (c) A-(iv), B-(i), C-(ii), D-(iii) | |
| (d) A-(iv), B-(iii), C-(i), D-(ii) | |

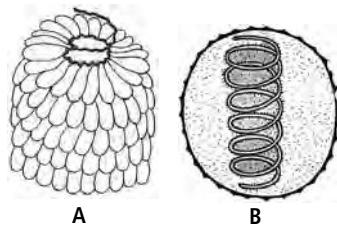
9. Select the incorrect statement regarding mycoplasma.

- (a) Mycoplasmas are the simplest and smallest free living prokaryotes.
- (b) It possesses 70S ribosomes and naked DNA.
- (c) Absence of cell wall makes the organism pleomorphic.
- (d) None of these.

10. The name '*Drosophila*' of plant kingdom' is given to

- (a) *Aspergillus* (b) *Claviceps*
- (c) *Neurospora* (d) *Trichoderma*.

11. Consider the following figures and identify the correct option regarding A and B.



- (a) A is an animal virus with ssRNA and B is a plant virus with dsRNA.
- (b) A is a bacteriophage containing dsDNA and B is a plant virus having dsRNA.
- (c) A is plant virus with dsDNA and B is a bacteriophage with dsDNA.
- (d) A is a plant virus with ssRNA and B is an animal virus with ssRNA.

12. Which of the following is not a useful feature of herbarium?

- (a) It provides information about the ecology of different places.
- (b) It provides living plant material for systemic work.
- (c) It helps in identifying the morphological differences among species.
- (d) It provides information about flowering season of various plants.

13. Sexual reproduction in deuteromycetes

- (a) occurs through planogametic copulation
- (b) occurs through gametangia copulation

- (c) occurs through spermatogamy and somatogamy
- (d) is absent.

14. Identify the organism from the given characteristics.

- (i) They are the smallest self replicating particles discovered by Diener.
- (ii) They are known to cause diseases only in plants.
- (iii) Initiation codon is absent for protein synthesis.
- (a) Prions (b) Viroids
- (c) Virus (d) Mycoplasmas

15. Match column I with column II and select the correct option given below.

Column I	Column II
-----------------	------------------

- | | |
|------------------------------------|--|
| A. John Ray | (i) Father of Botany |
| B. Aristotle | (ii) <i>Historia Generalis Plantarum</i> |
| C. Theophrastus | (iii) New systematics |
| D. Julian Huxley | (iv) Father of Zoology |
| (a) A-(ii), B-(iv), C-(i), D-(iii) | |
| (b) A-(i), B-(iii), C-(ii), D-(iv) | |
| (c) A-(ii), B-(i), C-(iv), D-(iii) | |
| (d) A-(iii), B-(iv), C-(i), D-(ii) | |

16. Which of the following statements is correct regarding cats and leopards?

- (a) Both belong to Genus *Felis*
- (b) Both belong to Family Felidae
- (c) Both have different genus and family
- (d) Cats belong to Family Felidae and leopards belong to Family Canidae

17. Which of the following is not a method of reproduction in lichens?

- (a) Oidia
- (b) Progressive death and decay
- (c) Isidia
- (d) Soredia

18. *Clostridium butylicum* and *Bacillus megatherium* respectively are used for preparing

- (a) chloromycetin, bacitracin
- (b) riboflavin, cobalamin
- (c) terramycin, bacitracin
- (d) cobalamin, ascorbic acid.

19. Which of the following features is not correct for the bacterial cell wall?

- (a) It provides shape and structural support to the cells.
- (b) It is 20-80 nm thick, smooth and single layered in Gram negative bacteria.
- (c) The cell wall contains teichoic acids that form receptor sites and surface antigens in Gram positive bacteria.
- (d) It protects the bacterial cell from bursting in hypotonic solution.

20. Select the mismatched pair.

- (a) Order - Primata
- (b) Genus - *Mangifera*
- (c) Class - Poales
- (d) Family - Canidae

21. Complete the following table by correctly identifying X, Y and Z in context to photosynthetic protists.

	Group	Reserve food	Example
(i)	Dinoflagellates	X	<i>Noctiluca</i>
(ii)	Chrysophytes	Leucosin and oils	Y
(iii)	Euglenoids	Z	<i>Euglena</i>

X Y Z

- | | | |
|----------------------|--------------------|------------------|
| (a) Starch and oils | <i>Cymbella</i> | Glycogen |
| (b) Glycogen | <i>Phacus</i> | Woronin bodies |
| (c) Paramylum bodies | <i>Pleurosigma</i> | Starch and oils |
| (d) Starch and oils | <i>Amphipleura</i> | Paramylum bodies |

22. Identify the incorrect pair.

- (a) Superfamily - Obligate category
- (b) Symbiotic protist - *Trichonympha*
- (c) Simpson - Systematics
- (d) Weed of laboratory - *Aspergillus*

23. Which of the following principles is not used as a criterion for delimiting a species of prokaryotes?

- (a) Morphological differences
- (b) Interbreeding
- (c) Chemotaxonomy
- (d) Cytotaxonomy

24. Select the option which depicts correct taxonomical hierarchy.

- (a) Species → Genus → Family → Class → Order
- (b) Species → Genus → Class → Order → Family
- (c) Genus → Family → Order → Class → Phylum
- (d) Genus → Family → Order → Phylum → Class

25. Which of the following characteristics can be considered as a defining property for a living organism?

- (i) Consciousness (ii) Organisation
- (iii) Growth (iv) Reproduction
- (v) Metabolism
- (a) (i), (ii), (iii) and (v) only
- (b) (i), (ii), (iv) and (v) only
- (c) (ii), (iii) and (iv) only
- (d) (i), (ii) and (v) only

26. Identify the correctly matched pair.

- (a) Symbiotic bacteria - *Frankia*
- (b) Parasitic bacteria - *Pseudomonas*
- (c) Saprotrophic bacteria - *Xanthomonas citri*
- (d) Chemoautotrophic bacteria - *Chlorobium limicola*

27. Which of the following are characteristics of members of Kingdom Protista?

- (i) Nucleus is present and DNA is associated with histone proteins.
- (ii) All organisms are heterotrophic with absorptive type of nutrition.
- (iii) Sap vacuoles are absent.
- (iv) Cytoplasmic ribosomes are 80S while organelle ribosomes are 70S.
- (a) (ii) and (iv) only (b) (i), (iii) and (iv) only
- (c) (i) and (iv) only (d) (i), (ii) and (iii) only

28. _____ created a separate kingdom for organisms on the basis of presence and absence of true nucleus.

- (a) Linnaeus (b) Copeland
- (c) Haeckel (d) R.H. Whittaker

29. Select the correct set of differences among the following types of taxonomy.

	Classical taxonomy	Modern taxonomy
(i)	It deals with biological species.	It deals with morphology of species.
(ii)	It has a typological concept.	It has a biosystematic concept.
(iii)	Species are considered to be dynamic.	Species are considered to be static.
(iv)	It is not based on evolution and inter-relationships of species.	It is based on primitiveness, advancement and inter-relationships of species.

Contributed by : Saurabh Kalra, Chandigarh

SOLUTIONS TO MARCH 2017 CROSSWORD

¹ A	² C	³ T	⁴ A	⁵ B	⁶ U	⁷ L	⁸ U	⁹ M	¹⁰ S	¹¹ M	¹² O	¹³ G	¹⁴ O	¹⁵ G	¹⁶ P
⁷ P	O		E	⁸ S				R	E	P	L	U	M	H	
H	L	¹⁰ N	¹¹ N	E	K	T	O	N	L						Y
A	C	E	D	Y		¹² P	E	L	A	G	I	C			T
E	H	C	O	M			¹³ S	Y	N	A	¹⁴ P	S	¹⁵ E	O	
O	I	R	N	O			¹⁶ V	¹⁷ H	O	¹⁸ T	E	¹⁹ C	L	A	
P	C	O	²⁰ S	U	²¹ C		E	O	C	E	P	A	U	L	
H	I	²² S	Y	R	I	N	X	L	Y	T	T	P	T	E	
Y	N	I	N	I	S		I	A	T	A	O	S	I	X	
T	E	S	G	A	T		L	R	E	N	N	I	O	I	
I	²³ P	E	A	T	R		L	D	S	Y	E	D	N	N	
N		M		O	²⁴ H	U	M	U	S						
	²⁵ K	E	Y		N		M	²⁶ A	T	A	V	I	S	M	
²⁷ A	R	I	S	T	O	I	L	E	²⁸ C	O	R	A	L	S	
²⁹ O	E	D	E	M	A	³⁰ B	I	O	L	I	S	T	I	C	

Key is published in this issue. Search now! ☺

SELF CHECK



Check your score! If your score is

> 90% EXCELLENT WORK ! You are well prepared to take the challenge of final exam.

No. of questions attempted

90-75% GOOD WORK ! You can score good in the final exam.

No. of questions correct

74-60% SATISFACTORY ! You need to score more next time.

Marks scored in percentage

< 60% NOT SATISFACTORY! Revise thoroughly and strengthen your concepts.

CONCEPT MAP

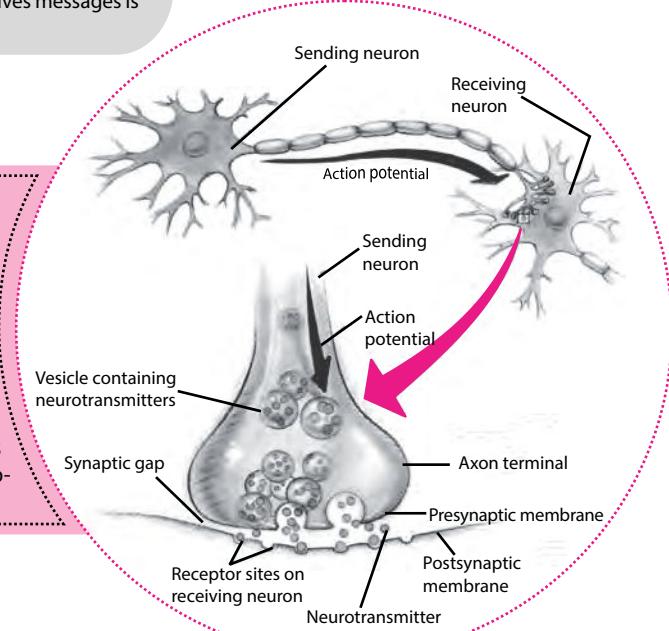
SYNAPSE

Synapse is an anatomically specialised junction between two neurons, where the axon (or some other portion) of one cell (neuron) terminates on the dendrites or some other portion of another cell. The term 'synapse' was first introduced by Charles Sherrington (1924). Transmission of nerve impulse takes place across a synapse between neurons or neurons and an effector. The neuron which sends messages is called presynaptic cell whereas the neuron which receives messages is postsynaptic neuron.

STRUCTURE OF SYNAPSE

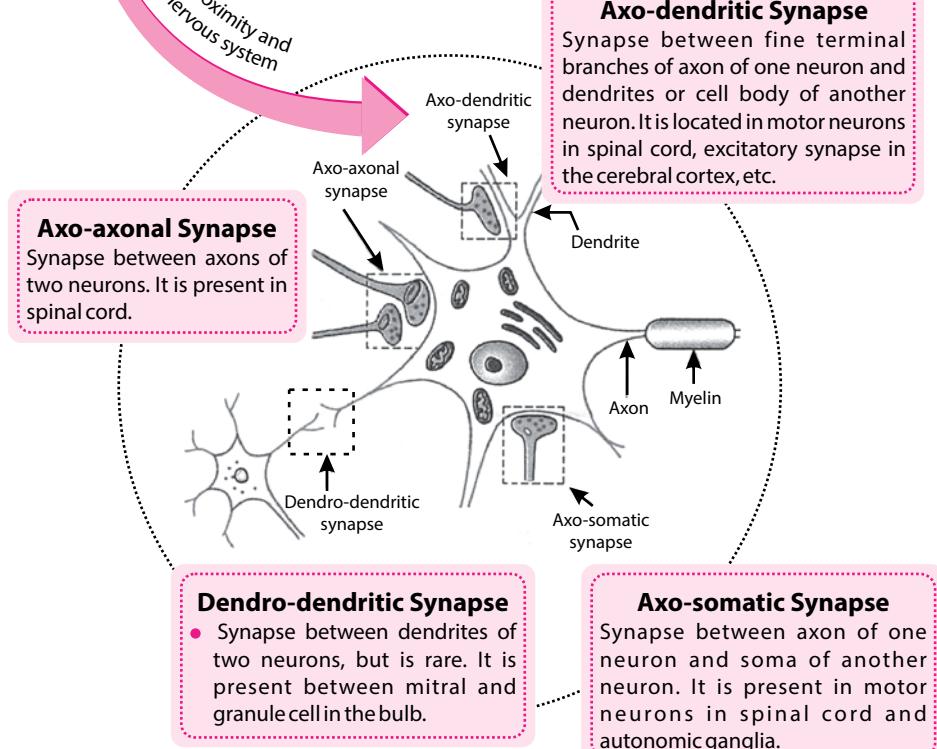
Most of the synapses comprise the following structures:

- (i) **Synaptic knob** – Terminal bulbous ending of presynaptic axon which is devoid of neurofilaments but its cytoplasm contains:
 - (a) **Synaptic vesicles** – Small vesicles present in presynaptic cytoplasm that contain neurotransmitters (for excitation or inhibition), like acetylcholine, GABA, etc.
 - (b) **Mitochondria, ER and microtubules**.
 - (c) **Presynaptic membrane** – Nerve membrane which is in close approximation with membrane of postsynaptic cell.
- (ii) **Sub-synaptic and postsynaptic membrane** – The surface of the cell membrane involved in the synapse is called the sub-synaptic membrane and the remaining of the motor neuron cell membrane is called the postsynaptic membrane. Receptor sites for neurotransmitters are usually located on the sub-synaptic membrane.

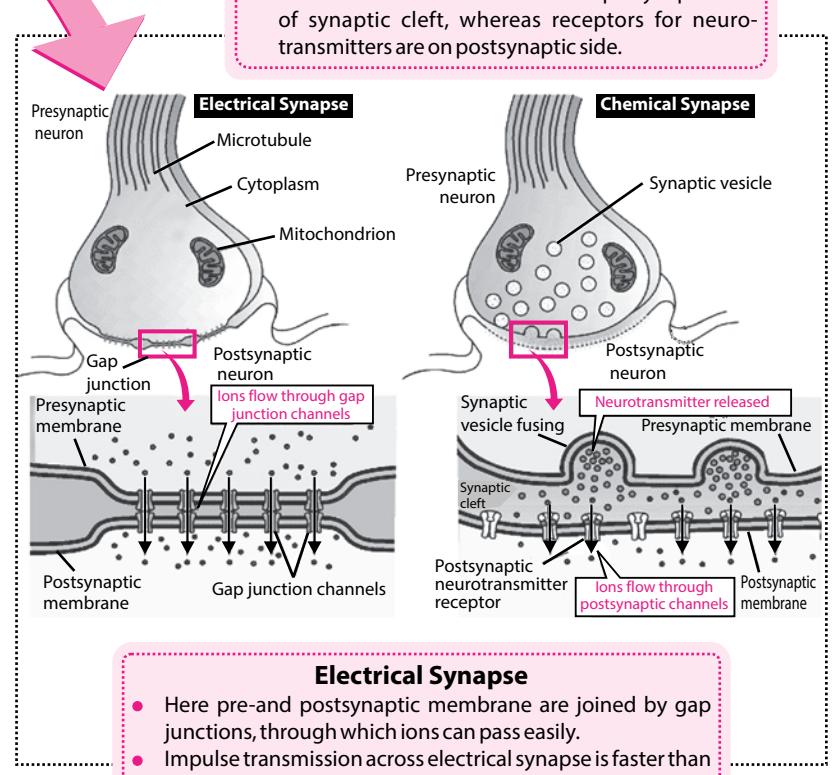


TYPES OF SYNAPSE

On the basis of proximity and location within nervous system



On the basis of physiology



MECHANISM OF IMPULSE CONDUCTION

PROPERTIES OF SYNAPSE

- **Convergence and Divergence** : Many presynaptic neurons converge on any single postsynaptic neuron, e.g., in spinal motor neurons, some inputs come from dorsal root, some from long descending spinal tracts and many from interconnecting neurons. The axons of most presynaptic neurons divide into many branches that diverge to end on many postsynaptic neurons.
- **Fatigue** : Repeated stimulation of presynaptic neuron leads to gradual decrease and finally disappearance of the postsynaptic response. This is due to exhaustion of chemical transmitter, as its synthesis is not as rapid as the release.
- **Synaptic Delay** : When an impulse reaches the presynaptic terminal, there is a gap of about 0.5 msec., before a response is obtained in postsynaptic neuron. This is due to the time taken by synaptic mediator to be released and to act on postsynaptic membrane.
- **Synaptic Plasticity** : Plasticity implies the capability of being easily moulded or changed. Synaptic conduction thus can be increased or decreased on the basis of past experience. These changes can be presynaptic or postsynaptic in location and play an important role in learning and memory.

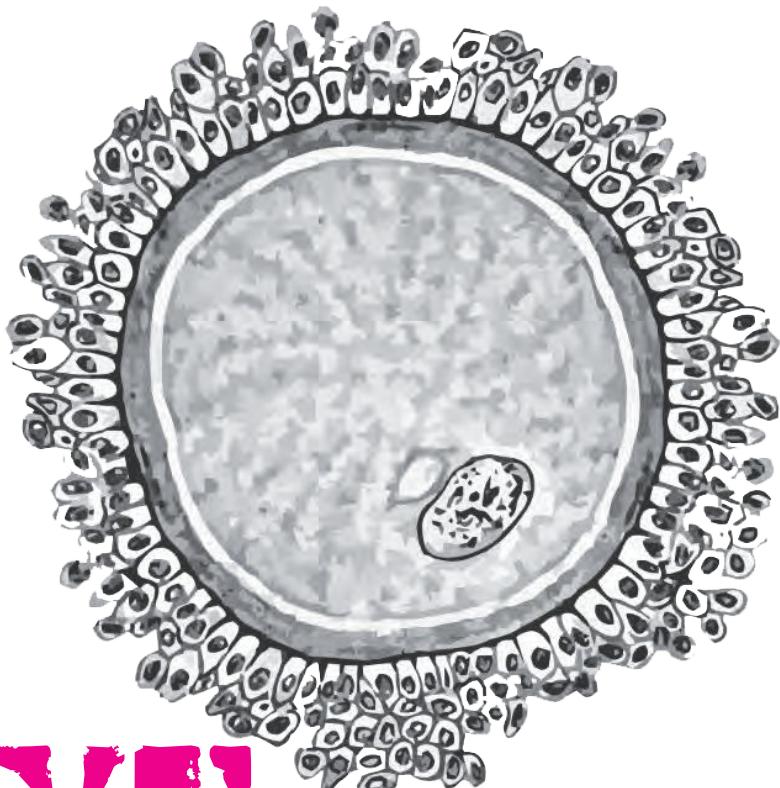
At Chemical Synapse

Mechanism of chemical transmission across a synapse is as follows:

- Action potential arrives at axon terminal
- Voltage gated Ca^{2+} ion channels open and electrochemical gradient favours influx of Ca^{2+} and Ca^{2+} flows into axon terminal
- Ca^{2+} ions cause synaptic vesicles to move to the surface of the knob and fuse with synaptic membrane terminal
- Vesicles release neurotransmitters by exocytosis
- Neurotransmitters diffuse across synaptic cleft and bind to receptors on postsynaptic membrane
- This causes depolarisation and generation of action potential in the postsynaptic membrane.

At Electrical Synapse

- Gap junctions in electrical synapse allow the local currents resulting from arriving action potentials to flow directly across the junction from one neuron to the other.
- This depolarises the membrane of the second neuron to threshold, continuing the propagation of the action potential.



NEET ESSENTIAL

The syllabus for NEET is very vast which impedes students from acquiring indepth knowledge and covering the entire syllabus at the same time. An essential topic for NEET is therefore presented here to enable students grasp the topic, analyse the type of questions and SCORE HIGH.

HUMAN FEMALE REPRODUCTIVE SYSTEM

Human beings exhibit sexual dimorphism, *i.e.*, male and female individuals are differentiated externally. Such characters that distinguish the males and females externally are referred to as secondary sex characters. While anatomically, they show distinct specific set of organs constituting the reproductive system. The male and female reproductive systems have evolved according to their respective functions and contributions in the events of human reproduction.

The reproductive system in general comprises of:

- **Primary sex organs**, *i.e.*, gonads that produce gametes as well as sex hormones.
- **Secondary sex organs** that do not produce gametes or hormones but play an important functions in process of reproduction.
- **External genitalia**
- **Accessory glands**



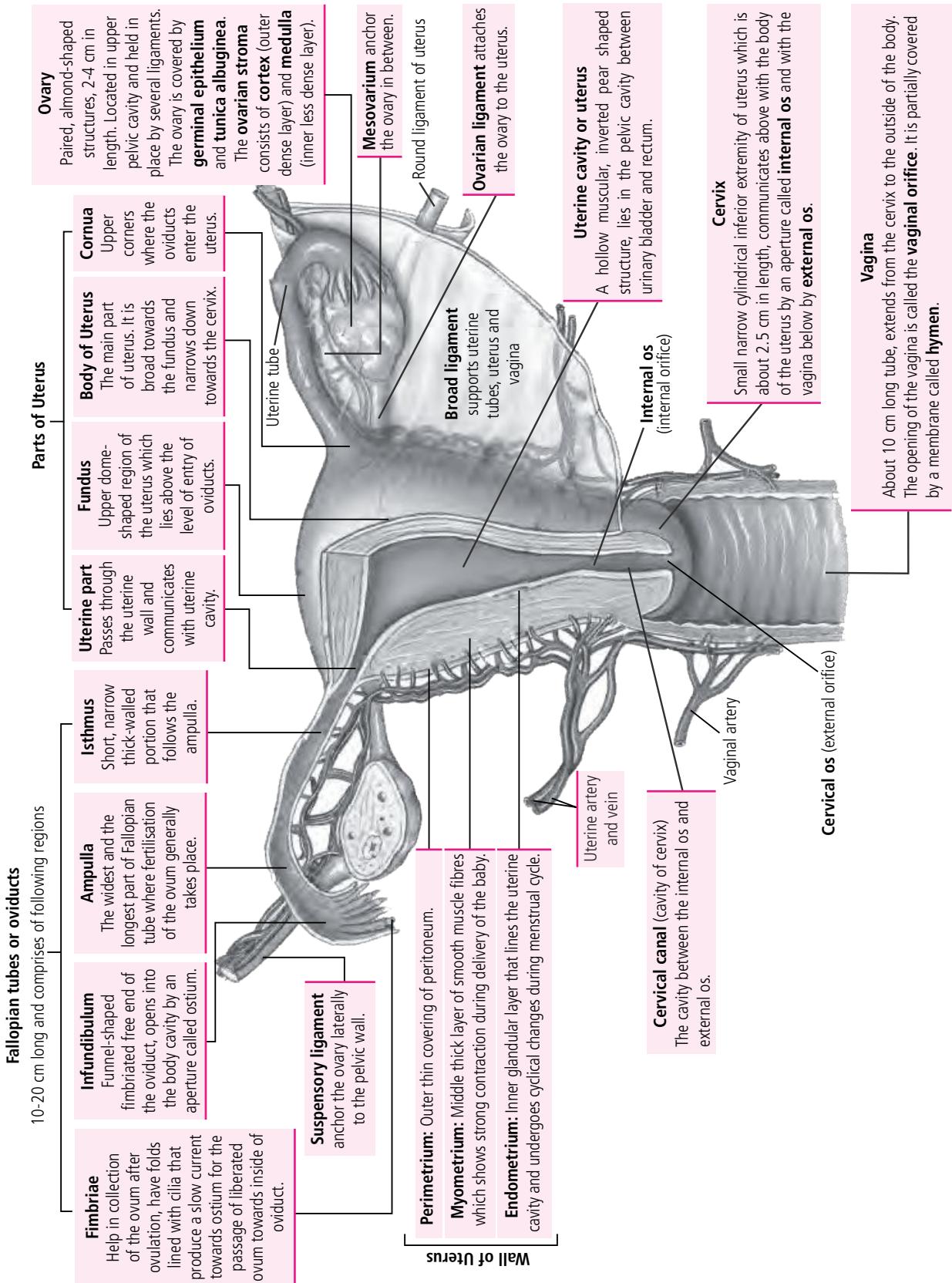


Fig.: Female reproductive system showing primary and secondary sex organs

External Genitalia (Vulva): The external genitalia in human female is collectively called vulva.

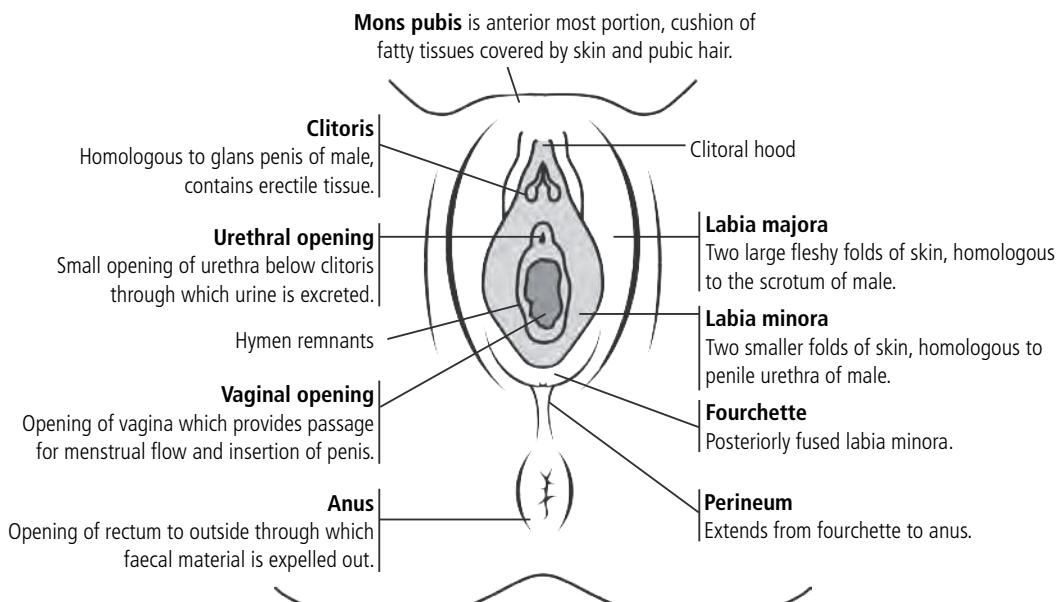


Fig.: External genitalia in human female

Accessory Glands

Vestibular glands

- These are present in external genitalia. They are of two types:

Lesser vestibular glands /Paraurethral glands/ Glands of Skene

- Numerous small glands present on both sides of the urethral opening.
- Homologous to the male prostate and secrete mucus.

Greater vestibular glands/Bartholin's glands

- Paired glands present one on each side of the vaginal opening.
- Homologous to the Cowper's glands of male and secrete viscous fluid for lubrication.

Mammary glands

- Mammary glands or breasts are modified sweat glands comprising of glandular tissues that form mammary glands, connective tissues and adipose tissue.

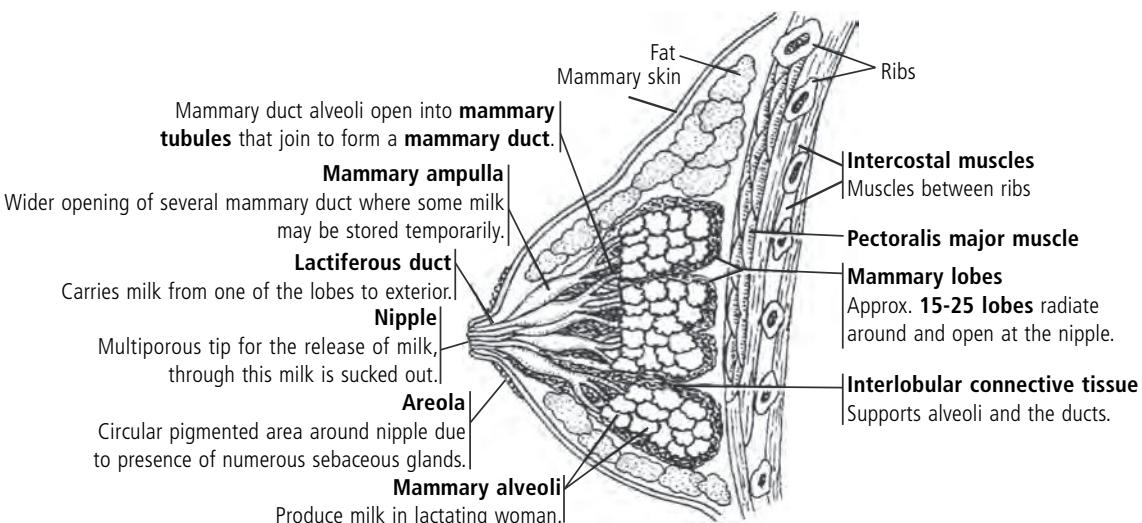
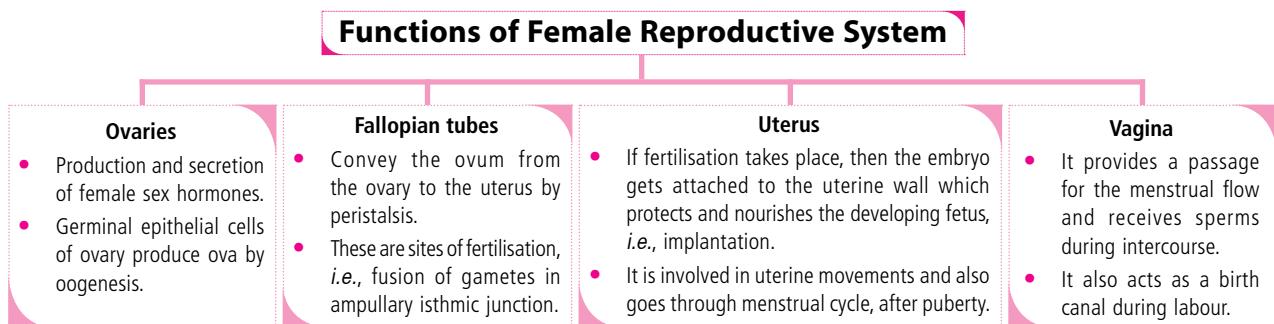


Fig.: Female's breast in sagittal section

- Lactation (milk secretion and ejection) is the main function of mammary glands.
- During pregnancy, mammary glands grow under the influence of hormones estrogen and progesterone. At the time of infant's birth, the hormone **prolactin** stimulates the production of milk and the hormone **oxytocin** causes release of milk as the infant sucks the breast.



Secondary Sexual Characteristics in Female

- | | |
|---|---|
| <ul style="list-style-type: none"> General build up – less muscular Hair growth – shows axillary hair growth and development of pubic hair Mammary glands – well developed Skin – less hairy and coarse Voice – high pitched | <ul style="list-style-type: none"> Breathing – predominantly thoracic Shoulders – are not so broad as compared to men Shape – attains feminine shape, i.e., widening of pelvis, deposition of fat in thighs, buttocks and face |
|---|---|

OOGENESIS

- The process of formation of a mature female gamete (ovum) is called oogenesis. It occurs in ovaries and involves three phases-multiplication, growth and maturation.
- At birth, ovaries contain approx. 2 to 4 million oogonia (egg mother cells). No more oogonia are formed and added after birth.
- During fetal life, all the oogonia develop into primary oocytes. Then they undergo a first meiotic division by replicating their DNA, however, they do not complete the division in the fetus. Accordingly, all the primary oocytes present at birth are said to be in a state of **meiotic arrest** containing 46 chromosomes, each with two sister chromatids.
- The first polar body may divide to form two second polar bodies. They did not play any role in reproduction and soon degenerate due to lack of cytoplasm and food.
- The actual female gamete is ovum. From one oogonium, one ovum and three polar bodies are formed.
- The steps in oogenesis can be illustrated as:-

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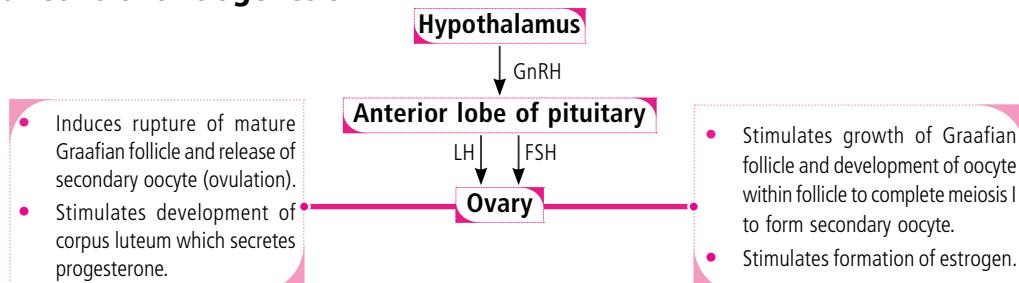
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Stages in Oogenesis		Chromosomes number per cell	Events
(Multiplication phase)	Fetal life		Cells of germinal epithelium divide to produce oogonia which multiply by mitotic divisions forming the primary oocytes.
Birth		46	Meiosis begins in the primary oocytes soon after their formation. However, the oocytes are arrested in the meiotic prophase I. This is the first resting stage . They undergo a round of DNA synthesis, and chromosome pairing takes place. There is accumulation of food materials and other resources for nourishment of the oocyte.
(Growth phase)		46	Primary oocyte
Childhood			1 st meiotic division (begins in utero, completed prior to ovulation)
Puberty			Secondary oocyte
(Maturation phase)			2 nd meiotic division (completed after fertilisation)
Adult reproductive life			Ovum
			First polar body Second polar body

Only those primary oocytes destined for ovulation complete the first meiotic division which occurs just before the mature follicle is ovulated. The second meiotic division occurs in Fallopian tube after ovulation, but only if the secondary oocyte is fertilised, i.e., penetrated by a sperm.

Hormonal Control of Oogenesis



Significance of Oogenesis

- Formation of one ovum and three polar bodies.
- Crossing over in meiosis I brings about variations.
- Maintains half the number of chromosomes in ovum (haploid condition) by forming polar bodies.

UNSCRAMBLED WORDS

MARCH 2017

1-c-PLASMOTOMY	2-i- NYCTINASTY
3-a-PELOTONS	4-f-ELECTROFUSION
5-h-CHAPERONES	6-e-FIBRILLATION
7-j-HISTAMINE	8-d-HOLOGYNIC
9-g-ATAVISM	10-b-VITELLOGENESIS

Winners: Joydeep Saha (West Bengal), Rida Sood (Delhi), Tanmay Kumar (Ranchi), Gaurang Sodani (Gurugram), Aadvik Ahuja (Nainital)

MPP-1 CLASS XI					ANSWER	KEY
1. (a)	2. (b)	3. (c)	4. (d)	5. (c)		
6. (b)	7. (d)	8. (d)	9. (d)	10. (c)		
11. (d)	12. (b)	13. (d)	14. (b)	15. (a)		
16. (b)	17. (a)	18. (b)	19. (b)	20. (c)		
21. (d)	22. (a)	23. (b)	24. (c)	25. (d)		
26. (a)	27. (c)	28. (b)	29. (d)	30. (c)		
31. (c)	32. (d)	33. (d)	34. (d)	35. (d)		
36. (c)	37. (a)	38. (c)	39. (b)	40. (c)		

Follicular Development

- During the course of maturation, the primary oocyte become surrounded by a single layer of squamous follicular cells, to form basal lamina called **primordial follicle**. It remains arrested at the diplotene stage of the first meiotic division till the onset of puberty.
- At puberty, oogenesis is resumed and the basal lamina around the primary oocyte becomes cuboidal to form **primary follicle**.
- As the development proceeds in primary follicle, the follicular cells keep dividing to form several layers around the primary oocyte and are known as **granulosa cells**.
- The primary oocyte secretes an acellular glycoprotein layer around itself, called the **zona pellucida**. The innermost layer of granulosa cells around the zona pellucida consists of columnar cells and is known as the **corona radiata**.
- The granulosa cells are in communication with the growing oocyte by microvilli on their surface which interdigitate with those on the surface oocyte to facilitate the exchange of material between them.
- As the granulosa cells keep on dividing, a small cavity appears between these cells called the **antrum** which is filled with a fluid, **liquor folliculi**, secreted by the granulosa cells. At this stage the follicle is known as an **antral follicle** or the **secondary follicle**.
- Around the granulosa cells, connective tissue of ovarian stroma gets differentiated into two layers: a **vascular theca interna** and a **fibrous theca externa**.
- Blood vessels in the thecal layer cannot transverse the membrane, so the granulosa layer is completely avascular.
- The antrum keeps enlarging with the developing oocyte so that the oocyte is suspended in this fluid-filled cavity by a stalk of granulosa cells surrounding this oocyte. These are known as **cumulus oophorus**.
- The fully formed mature dominant follicle with a large antrum is called **Graafian follicle**. It has a primary oocyte, which is still in meiotic arrest. Just before ovulation this primary oocyte completes its first meiotic division to form a haploid **secondary oocyte** and a **polar body**. Meiosis II is initiated but arrested at the metaphase stage.
- This secondary oocyte, along with its cumulus oophorus, is released in the peritoneal cavity at ovulation from where it is picked up by the fimbriae of the oviduct.
- The ovulated secondary oocyte is carried into the Fallopian tube where fertilisation occurs.
- The remnants of the ovulated follicle in the ovary form the **corpus haemorrhagicum** that has a blood clot in the centre due to rupturing of the blood vessels supplying the thecal layer.
- This clot is dissolved later and the granulosa and thecal cells of the ruptured follicle are transformed and converted into lutein cells having yellow carotene pigment or lutein. These transformed cells form **corpus luteum** which secretes the hormones progesterone and estrogen. The corpus luteum is maintained for about 20 days.
- If fertilisation occurs and a conceptus is formed, then the corpus luteum receives a signal from the conceptus and the corpus luteum is maintained for a long time to support pregnancy.
- In the absence of any such signal from the conceptus, the corpus luteum degenerates. This degenerating corpus luteum is known as the **corpus albicans** and leads to menstruation.

Follicular growth and atresia

- Only one ovarian follicle matures and ovulates in an adult woman in every menstrual cycle, alternatively by the two ovaries. So, only about 450 of the total follicles mature during the entire reproductive span. The rest of them degenerate at different times. The degenerating process is called **follicular atresia**. This is an example of programmed cell death or apoptosis.
- Due to this developmental pattern, eggs ovulated near age 50 are 35 to 40 years older than those ovulated just after puberty. Certain chromosomal defects or abnormalities among children born to older women may be the result of ageing changes in the eggs.

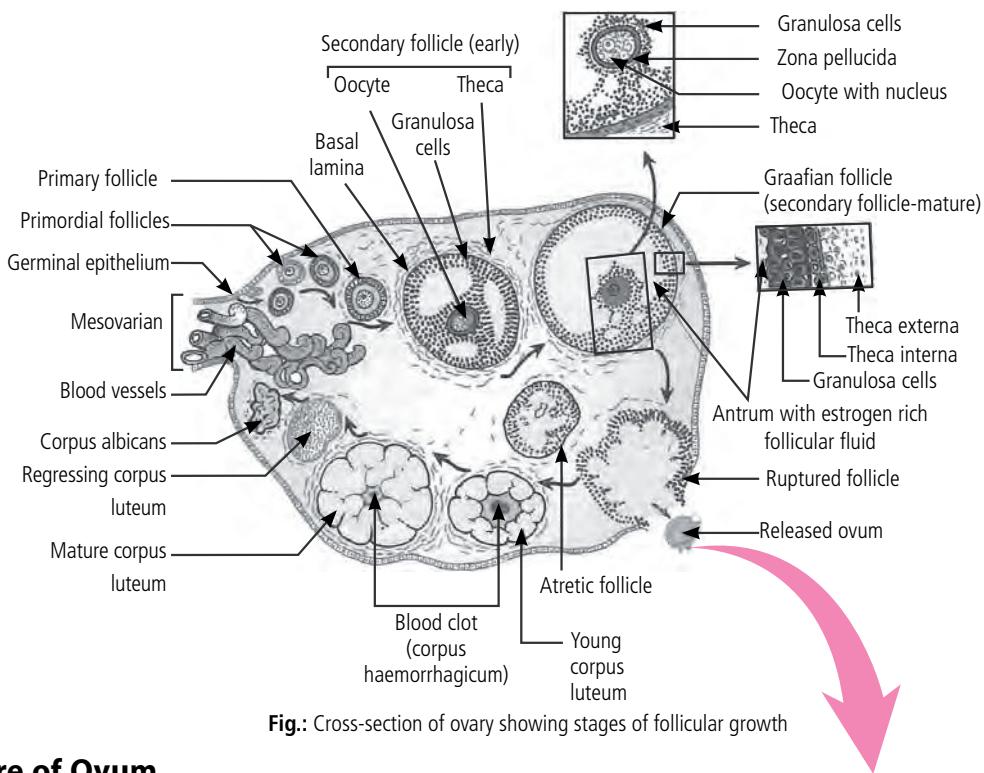


Fig.: Cross-section of ovary showing stages of follicular growth

Structure of Ovum

- Human ovum is spherical in shape.
- It is **alecithal**, i.e., free of yolk.
- Cytoplasm is called ooplasm.
- Nucleus is large with prominent nucleolus, and is called germinal vesicle.
- The cytoplasm is enveloped by plasma membrane, below which are present small cortical granules. To its outsides is present a narrow perivitelline space.
- A thick **noncellular zona pellucida** is present outer to perivitelline space and outer to this a very thick **cellular corona radiata** is present.
- The side of ovum extruding polar bodies is called **animal pole** while the opposite side is called **vegetal pole**.

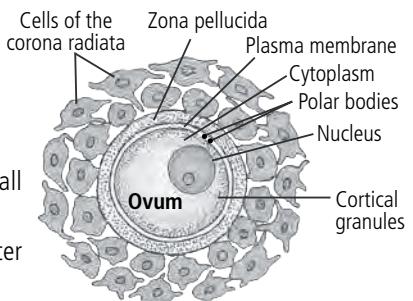


Fig.: Structure of ovum

Differentiation of Oocyte into Ovum

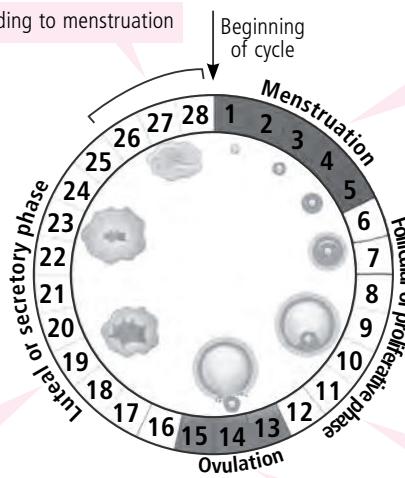
- Oocyte shows certain structural and cellular changes while differentiating into an ovum. Such as:
- **Nuclear changes** – Production of large amount of nuclear sap resulting in enlarged nucleus. Nucleolus also increases in its size.
- **Cytoplasmic changes** – Mitochondria increase in number during growth of the oocyte.
– Golgi bodies either disappear or are converted to some other structures.
– ER are devoid of ribosomes but their membranes remain perforated by pores.
– Formation of cortical granules, these are spherical bodies containing mucopolysaccharides, bound by a simple membrane.

MENSTRUAL CYCLE

- **Menstruation** is the bleeding from the uterus of adult females at an average interval of 28/29 days. The cycle of events starting from one menstruation till the next one is called **menstrual cycle**.
- The first menstruation begins at puberty and is called **menarche**.
- The menstrual cycle comprises of four phases: menstrual, follicular, ovulatory and luteal phase.

The uterine lining detaches leading to menstruation

- Following ovulation, LH stimulates the remnants of ovulated follicle to develop into corpus luteum, which secretes progesterone and some estradiol.
- Both LH and progesterone help in further growth and thickening of endometrium. The major change is that the endometrial glands become secretory.
- The uterine wall becomes ready for nourishing and anchoring blastocyst if fertilisation takes place.
- Progesterone inhibits uterine movements as well as proliferation of new ovarian follicles. The phase lasts for about 10 days.
- If the oocyte is not fertilised, corpus luteum activity declines and it degenerates into **corpus albicans**.
- With decrease in ovarian hormones, release of GnRH, FSH, and LH occurs due to loss of negative feedback suppression by ovarian hormones. This resumes follicular growth.



It continues usually for 3-5 days. Rapid decrease in estradiol and progesterone (secreted by corpus luteum) level induces changes in endometrium. The blood vessels rupture causing bleeding. The uterine tissue and blood, tissue fluid from the endometrial surface pass out through vaginal opening, constituting menstrual flow.

- The rapid rise in plasma LH level, known as the **LH surge** leads to final maturation of Graafian follicle.
- Follicle ruptures and a secondary oocyte is released on about Day 14.
- Shortly after onset of midcycle LH surge, plasma estradiol levels drop and a further rise in plasma progesterone occurs.

Fig.: Schematic representation of menstrual cycle

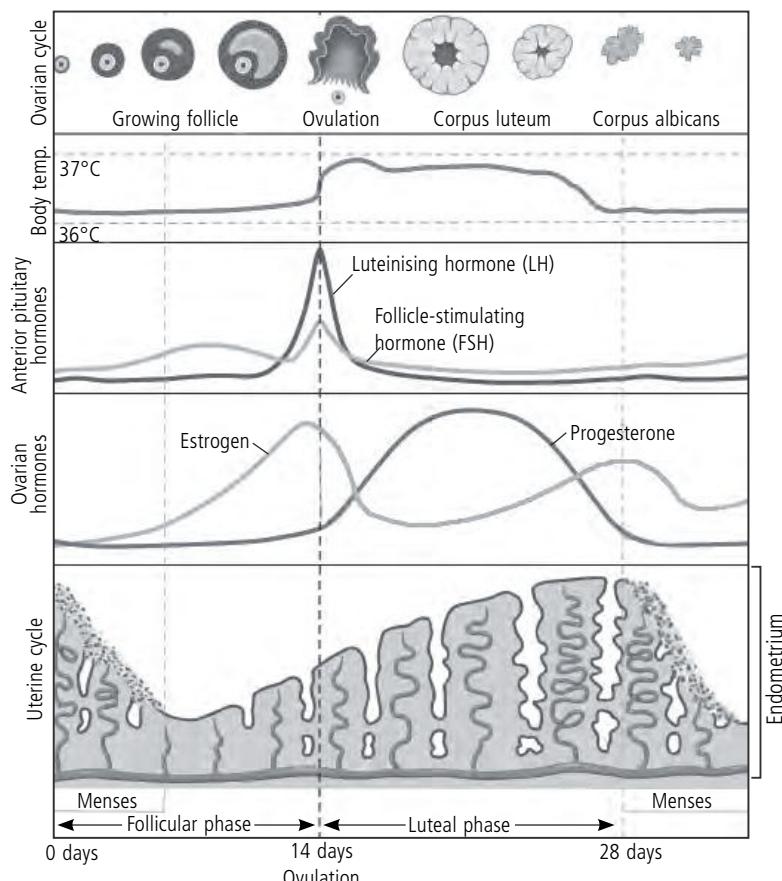


Fig.: Summary of events during a menstrual cycle

Menopause

- It is a phase in woman's life when ovulation and menstruation stop. During this condition, ovaries fail to respond or may become resistant to FSH. In this case FSH levels are very high and the estrogen levels are very low. It occurs between 45 to 55 years of age (in some individuals, it is between 40 to 50 years).
- Since there are no developing follicles, the supply of estrogen and progesterone is reduced. This may lead to temporary depression, hot flushes and other physiological and psychological problems during menopause.

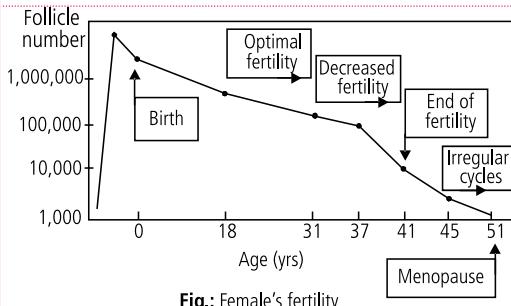
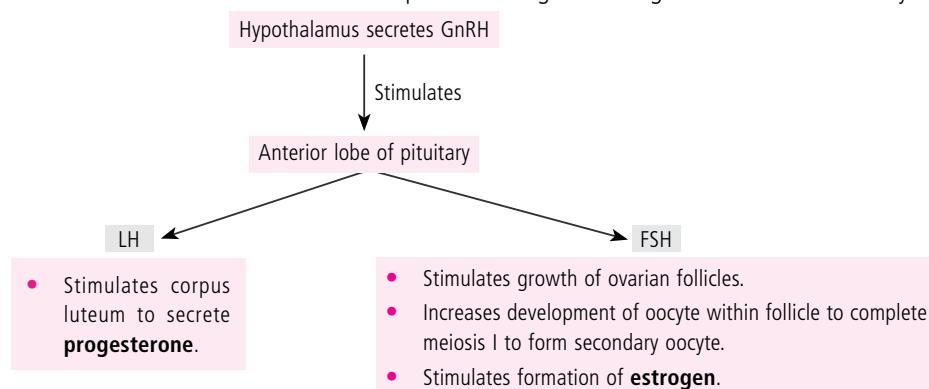


Fig.: Female's fertility

HORMONAL CONTROL OF FEMALE REPRODUCTIVE SYSTEM

- The growth, maintenance and functions of female reproductive organs are regulated and controlled by various hormones.



- Increased levels of progesterone inhibits the release of GnRH, which in turn, inhibits the production of FSH, LH and progesterone.

Disorders of Female Reproductive System

Menstrual disorder

- Dysmenorrhoea** is painful menstruation.
- Menorrhagia** is excessive menstruation.
- Oligomenorrhoea** is sparse or infrequent menstruation.
- Amenorrhoea** is absence of menstruation.

Cervical cancer

It is relatively slow-growing cancer. Its main risk is that it is unnoticed until it has invaded other tissues.

Oophorocytosis (Ovarian cysts)

Ovarian cysts are fluid-filled tumors of the ovary. Such cysts sometimes rupture and regress during pregnancy.

Ectopic pregnancy

It is implantation of embryo at a place other than uterus, generally in the oviduct.

Breast cancer

Breast cancer is rarely seen before the age of thirty. Its incidence increases after menopause.

Infertility

Infertility in women is the inability to become pregnant. It may be due to failure to ovulate or some anatomical factors that prevents the union of egg and sperm.

Endometriosis

It is the growth of endometrial tissue outside the uterus. Its symptoms include premenstrual pain or unusual menstrual pain.

Ophoritis

It is inflammation of ovary, usually caused by an infection.

POWER EXERCISE

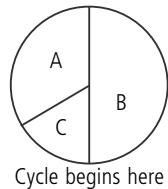
New MCQs

- Select the option which correctly fills the given blanks.
 - Fallopian tubes are attached to the ovaries through _____.
 - _____ cells nourish the developing oocyte and begin to secrete estrogens.
 - Corpus luteum is filled with _____ coloured lutein pigment.
 - Ovarian stroma is covered by a layer of connective tissue called _____.

(i)	(ii)	(iii)	(iv)
(a) isthmus	Follicular	red	cortex
(b) fimbriae	Granulosa	yellow	tunica
(c) fimbriae	Follicular	yellow	albuginea
(d) infundibulum	Granulosa	grey	visceral
			peritoneum
			germinal
			epithelium
- Match column I with column II and select the correct option.

Column I	Column II
1. Prolactin	P. Secretion of estrogen
2. Oxytocin	Q. Milk production
3. FSH	R. Ovulation
4. LH	S. Milk ejection

 - 1 - S ; 2 - Q ; 3 - R ; 4 - P
 - 1 - Q ; 2 - P ; 3 - R ; 4 - S
 - 1 - S ; 2 - Q ; 3 - P ; 4 - R
 - 1 - Q ; 2 - S ; 3 - P ; 4 - R
- Read the given statements and select the correct option
Statement A : Genetic variations occur during oogenesis.
Statement B : Crossing over takes place during meiotic division of primary oocyte.
 - Both statements A and B are correct and B is the correct explanation of A.
 - Both statements A and B are correct but B is not the correct explanation of A.
 - Statement A is correct but statement B is incorrect.
 - Statement A is incorrect but statement B is correct.
- Refer to the given figure and hints. Identify the correct phases of menstrual cycle with their days.



- During C, endometrium breaks down.
- During A, FSH and estrogen secretion increases.
- During B, progesterone is secreted.
 - A - Menstrual phase, 1st - 3rd days
B - Follicular phase, 5th - 18th days
C - Luteal phase, 20th - 28th days
 - A - Luteal phase, 10th - 18th days
B - Follicular phase, 20th - 28th days
C - Menstrual phase, 1st - 10th days
 - A - Follicular phase, 6th - 13th days
B - Luteal phase, 15th - 28th days
C - Menstrual phase, 1st - 5th days
 - A - Ovulatory phase, 1st - 5th days
B - Luteal phase, 6th - 10th days
C - Menstrual phase, 10th - 28th days
- Which of the following events results in the beginning of ovarian cycle?
 - Sudden decrease in level of progesterone
 - Increased level of estrogen
 - Increased secretion of FSH and LH from anterior pituitary
 - Increased secretion of GnRH from hypothalamus
- Which of the following consists of haploid number of chromosomes?
 - Oogonia
 - Primary oocyte
 - Secondary oocyte
 - None of these
- First polar body is formed after
 - mitosis
 - meiosis I
 - meiosis II
 - fertilisation.
- During oogenesis, oogonium produces
 - two functional eggs
 - two functional eggs and three polar bodies
 - one functional egg and three polar bodies
 - one functional egg and one polar body.
- Which one of the following is the widest and longest part of oviduct?
 - Infundibulum
 - Isthmus
 - Ampulla
 - Fimbriae

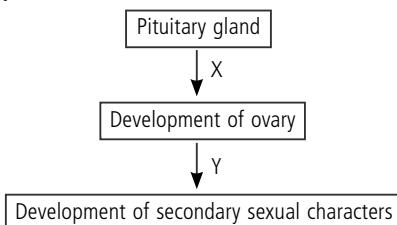
- 10.** Consider the following statements and select the option stating which ones are true (T) and which ones are false (F).
- Cessation of menstrual cycle in women is called menopause.
 - Menstrual cycle is controlled by pituitary as well as ovarian hormones.
 - Oogenesis begins in childhood and gets completed after fertilisation.
 - Oogenesis is controlled by the pituitary hormones only.
- | (i) | (ii) | (iii) | (iv) |
|-------|------|-------|------|
| (a) T | F | T | F |
| (b) T | T | F | T |
| (c) F | F | T | T |
| (d) T | T | F | F |

- 11.** Choose the incorrectly matched pair.

- Bartholin's gland - Either side of urethral opening
- Areola - Pigmented area around the nipple
- Mammary ampullae - May store milk
- Glands of Skene - Homologous to male prostate

- 12.** Given flow chart represents the events occurred at the attainment of puberty in human female.

Identify the hormones X and Y.



- X - Gonadotropin releasing hormone, Y - Progesterone
- X - Growth hormone, Y - Gonadotropic hormone
- X - Follicle stimulating hormone, Y - Luteinising hormone
- X - Follicle stimulating hormone, Y - Estrogen

- 13.** Identify the correct statement.

- Follicular antrum is present in the secondary follicle.
- Corona radiata is formed of modified granulosa cells.
- Degeneration of ovarian follicles is called ovarian atresia.
- The outermost covering of a mature Graafian follicle is cumulus oophorus.

- 14.** The thick layer of uterus wall involved in strong uterine movements during parturition is

- perimetrium
- myometrium
- endometrium
- both (b) and (c).

- 15.** Read the following statements and select the incorrect one.

- Graafian follicle contains granulosa cells which secrete estrogen.
- Corpus luteum is formed by the germinal epithelium of the ovary.

- Endometrium layer of uterus undergoes cyclic changes during menstrual cycle.
- Both (b) and (c).

Exam Section

- Changes in GnRH pulse frequency in females is controlled by circulating levels of
 - progesterone only
 - progesterone and inhibin
 - estrogen and progesterone
 - estrogen and inhibin.

(NEET Phase-I 2016)
- What is the inner lining of the uterus called?
 - Cervix
 - Oviduct
 - Endometrium
 - Fimbriae

(J & K 2015)
- Which of the following events is not associated with ovulation in human female?
 - Release of secondary oocyte
 - LH surge
 - Decrease in estradiol
 - Full development of Graafian follicle

(AIPMT 2015)
- The part of Fallopian tube closest to the ovary is
 - infundibulum
 - isthmus
 - ampulla
 - cervix.

(J & K 2015)
- The main function of mammalian corpus luteum is to produce
 - estrogen only
 - progesterone
 - human chorionic gonadotropin
 - relaxin only.

(AIPMT 2014)
- The figure shows a section of human ovary. Select the option which gives the correct identification of either A or B with function/characteristic.

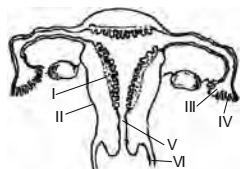
A
B

 - B- Corpus luteum - Secretes progesterone
 - A-Tertiary follicle - Forms Graafian follicle
 - B- Corpus luteum - Secretes estrogen
 - A- Primary oocyte - It is in the prophase-I of the meiotic division

(NEET - Karnataka 2013)
- The secretory phase in the human menstrual cycle is also called
 - luteal phase and lasts for about 6 days
 - follicular phase and lasts for about 6 days
 - luteal phase and lasts for about 13 days
 - follicular phase and lasts for about 13 days.

(AIPMT Mains 2012)

8. The figure given below depicts a diagrammatic sectional view of the human female reproductive system. Which set of three parts out of I-VI have been correctly identified?



- (a) (II) Endometrium, (III) Infundibulum, (IV) Fimbriae
(b) (III) Infundibulum, (IV) Fimbriae, (v) Cervix
(c) (IV) Oviducal funnel, (V) Uterus, (VI) Cervix
(d) (I) Perimetrium, (II) Myometrium, (III) Fallopian tube (I)

(AIPMT Prelims 2011)

9. The second maturation division of the mammalian ovum occurs

 - (a) shortly after ovulation before the ovum makes entry into the Fallopian tube
 - (b) until after the ovum has been penetrated by a sperm
 - (c) until the nucleus of the sperm has fused with that of the ovum
 - (d) in the Graafian follicle following the first maturation division.

(AIPMT Prelims 2010)

(AIPMT Prelims 2010)

10. Which one of the following is the correct matching of the events occurring during menstrual cycle?

 - (a) Proliferative phase : Rapid regeneration of myometrium and maturation of Graafian follicle
 - (b) Secretory phase : Development of corpus luteum and increased secretion of progesterone
 - (c) Menstruation : Breakdown of myometrium and ovum not fertilised
 - (d) Ovulation : LH and FSH attain peak level and sharp fall in the secretion of progesterone (CBSE-PMT 2009)

e (CBSE-PMT 2009)

- 11.** Some important events in the human female reproductive cycle are given below. Arrange the events in a proper sequence. A – Secretion of FSH, B – Growth of corpus luteum, C – Growth of the follicle and oogenesis, D – Ovulation, E – Sudden increase in the levels of LH

(a) A → D → C → E → B (b) B → A → C → D → E
(c) C → A → D → B → E (d) A → C → E → D → B

(Karnataka-PMT 2009)

(Karnataka-PMT 2009)

12. Which hormone level reaches peak during luteal phase of menstrual cycle ?
(a) Luteinising hormone (b) Progesterone
(c) Follicle stimulating hormone
(d) Estrogen (J & K-PMT 2008)

(J & K-PMT 2008)

- 13.** In the human female, menstruation can be deferred by the administration of

- (a) combination of FSH and LH
 - (b) combination of estrogen and progesterone
 - (c) FSH only
 - (d) LH only.

(CBSE-PMT 2007)

- 14.** Withdrawal of which of the following hormone is the immediate cause of menstruation?

- (a) Progesterone (b) Estrogen
(c) FSH (d) FSH-RH (CBSE-PMT 2006)

- 15.** A human female reaches menopause around the age of

(Karnataka-PMT 2000)

Assertion & Reason

The following questions consist of two statements each : assertion (A) and reason (R). To answer these questions, mark the correct alternative as directed below:

- (a) If both A and R are true and R is the correct explanation of A.
 - (b) If both A and R are true but R is not the correct explanation of A.
 - (c) If A is true but R is false.
 - (d) If both A and R are false

- 1. Assertion :** 1st mitotic division in primary oocytes results in the formation of two equal sized cells.

Reason : These cells are equally functional.

- 2. Assertion :** The main function of mammary glands is lactation.

Reason : Mammary glands develop under the influence of prolactin and oxytocin.

- 3. Assertion :** Menstrual cyclical changes occur in oviducts and uterus of female

Reason : Oviducts and uterus are sites of fertilisation

MPP-1 CLASS XII				ANSWER	KEY
1.	(a)	2.	(a)	3.	(a)
6.	(c)	7.	(a)	8.	(b)
11.	(b)	12.	(b)	13.	(a)
16.	(c)	17.	(b)	18.	(c)
21.	(d)	22.	(b)	23.	(b)
26.	(d)	27.	(d)	28.	(d)
31.	(b)	32.	(d)	33.	(a)
36.	(a)	37.	(d)	38.	(c)
				39.	(c)
				40.	(d)

- 4. Assertion :** Germinal epithelial cells of ovary produce oogonia.
Reason : Oogonia are formed during fetal development.
- 5. Assertion :** The uterus and the vagina gradually become atrophic at the age of 45 to 55 in women.
Reason : Decreased level of estrogen and progesterone leads to menopause.

Short Answer Type Questions

- Fill in the blanks.
 - Degenerated corpus luteum is called _____.
 - Formation of polar bodies help in retention of sufficient amount of _____ in the ovum.
 - During ovulation, concentration of _____ reaches its peak in blood.
- In which phase of menstrual cycle, formation of corpus luteum takes place? Also mention the name of its degenerated stage.
- Write a brief note on the hormonal control of female reproductive system.
- Draw a labelled diagram of human female reproductive system.

ANSWER KEY

New MCQs

- (b)
- (d)
- (a)
- (c)
- (a)
- (c)
- (b)
- (c)
- (c)
- (d)
- (a)
- (d)
- (b)
- (b)
- (b)

Exam Section

- (a)
- (c)
- (c)
- (a)
- (b)
- (a)
- (c)
- (b)
- (b)
- (b)
- (d)
- (b)
- (b)
- (a)
- (a)

Assertion & Reason

- (d)
- (c)
- (d)
- (b)
- (a)

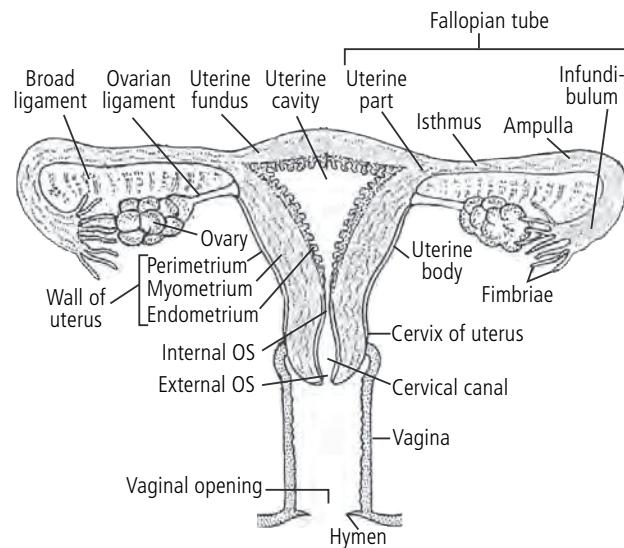
Short Answer Type Questions

- (i) corpus albicans
(ii) cytoplasm
(iii) leutinising hormone
- Corpus luteum is formed during the luteal or secretory phase

of menstrual cycle in females. This phase usually includes cycle days 15 to 28 in a 28 days cycle.

Followed by the ovulation, the remaining cells of ovarian, follicles are developed as corpus luteum under the influence of LH. It secretes progesterone to support pregnancy. However, in the absence of fertilisation, the corpus luteum degenerates. The degenerated part of corpus luteum is called corpus albicans.

- The growth, maintenance and functions of the female reproductive organs are controlled by several hormones. GnRH is secreted by the hypothalamus which stimulates the anterior lobe of pituitary gland to secrete LH and FSH. FSH stimulates the growth of the ovarian follicles and increases the development of oocyte within the follicle to complete the meiosis I to form secondary oocyte. It also stimulates the formation of estrogen. LH stimulates the corpus luteum to secrete progesterone. The rising level of progesterone inhibits the release of GnRH, hence inhibits the production of FSH, LH and progesterone.
- Females attain puberty when pituitary gland starts producing of follicle-stimulating hormone (FSH). It induces the development of ovaries, which in turn produce the hormone estrogen. This hormone is responsible for the development of the female secondary sexual characters, like change in voice, development of external genitalia, breast, body hair, pubic hair, widening of the pelvis and deposits of fat in thighs, buttocks, face, etc.
- Diagrammatic representation of female reproductive system is as follows :



HIGH YIELD FACTS



Class XII

Human Health and Diseases

- Health is a state of optimum physical fitness, mental maturity and social well being.
- A disease is a particular abnormal, pathological condition that affects part or all of an organism. It is often construed as a medical condition associated with specific symptoms and signs.
- In humans, “**disease**” is often used more broadly to refer to any condition that causes pain, dysfunction, distress, social problems, or death to the person afflicted, or similar problems for those in contact with the person.
- The term disease is used to refer specifically to **infectious diseases** that result from the presence of pathogenic microbial agents, such as viruses, bacteria, fungi, protozoa, multicellular organisms and aberrant proteins known as **prions**.
- A **symptom** is a sensation or change in health experienced by a patient e.g., fatigue, pain, nausea, etc.
- Pathogen** (*pathos*-disease, *gen*-causing) refers to an organism that causes certain diseases in animals and plants, e.g., bacteria, virus, fungi, etc.
- Vectors** are the carriers that do not cause disease themselves but transmit the disease causing pathogens from infected person to a healthy person, e.g., female *Anopheles* mosquito is the vector of malarial pathogen, *Plasmodium*.

Pathogens cause diseases in two ways

Tissue damage

The bacteria responsible for tuberculosis, damage cells and cause lesions in the lungs.

The bacteria that cause meningitis attack the protective membranes, called meninges, covering the brain.

Toxin secretion

Many microbes produce powerful poisons, called toxins which cause diseases.

Types of toxins

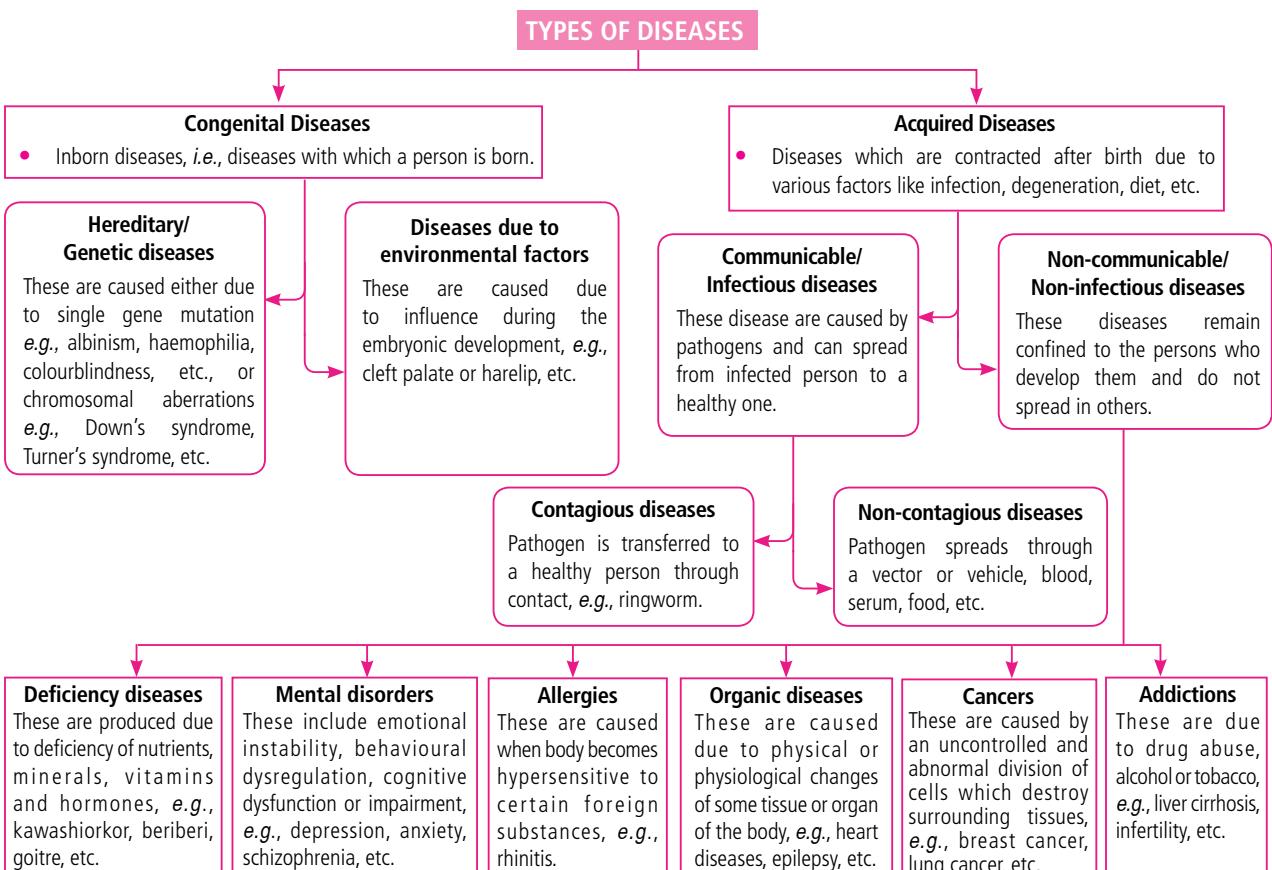
Exotoxins

These are released as soon as they are produced. The diseases brought about by exotoxins include tetanus, diphtheria and botulism (food poisoning).

Endotoxins

These are retained in the bacterial cells and released when bacteria die and disintegrate. The diseases caused by endotoxins include typhoid fever, cholera, bubonic plague and dysentery.

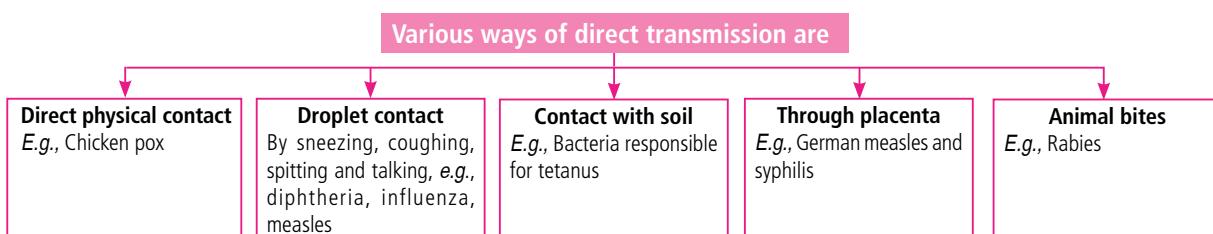
	Analysis of various PMTs from 2012-2016				
	2012	2013	2014	2015	2016
AIPMT/NEET	8	2	2	4	5
AIIMS	–	1	6	3	1
AMU	5	8	12	4	–
Kerala	1	–	–	3	–
K.CET	1	1	5	1	–
J & K	8	–	4	5	–



Flow chart : Classification of Diseases

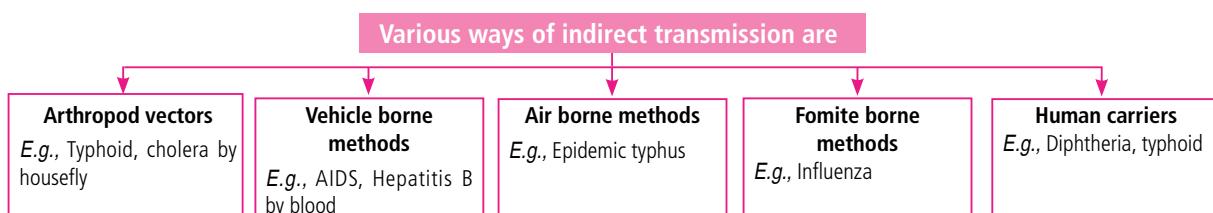
Transmission of Diseases

- There are different ways through which diseases can be transmitted.
 - Two main types of modes of transmission of diseases are :
- (i) Direct transmission :**
- The pathogens are carried directly to the human body without intermediate agents.



(ii) Indirect transmission :

- The pathogens are carried through some intermediate agents.



COMMUNICABLE DISEASES

- These are classified into nine types according to the nature of pathogen, i.e., the disease causing agent.

Viral Diseases

Viral hepatitis

- Viral hepatitis is commonly called **jaundice**.
- In early stage, the liver is enlarged and congested. In later stage, the liver becomes smaller, yellowish or greenish.
- The symptoms in early phase include – fever, anorexia, nausea, vomiting, epigastric discomfort, pain in muscles and joints.
- The urine is dark in colour. Leukopenia (reduction in the number of WBCs) is followed by lymphocytosis (increase in the number of lymphocytes). Splenic enlargement is sometimes present.

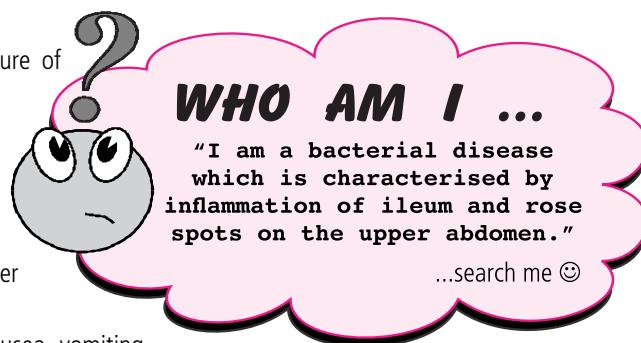


Table: Other viral diseases

	Disease	Pathogen	Mode of transmission/ Incubation period	Symptoms	Prevention
1.	Dengue fever	<i>Flavi-ribo</i> virus	By bite of <i>Aedes aegypti</i> mosquito/3-8 days	Fever, headache, muscles and joint pains, rashes, nausea, vomiting, excessive thirst, bleeding from nose, mouth, gums	Eliminating mosquito breeding places and applying mosquito repellents
2.	Common cold	Rhino virus	Droplet contact/ 3-7 days	Nasal congestion, running nose, sneezing, sore throat, cough, fever, headache	Washing hands frequently and using face masks
3.	Mumps	<i>Paramyxo</i> virus	Droplet contact/ 7-18 days	Fever, painful swelling of parotid glands	Avoiding contact with the sick; MMR vaccine is available
4.	Measles	Rubeola virus	Droplet contact/ 8-15 days	Fever, rash, itching, inflammation of respiratory passage	<i>Same as that of mumps</i>
5.	Chicken pox	<i>Varicella zoster</i> virus	Direct contact and droplet contact/ 14-21 days	Fever, rash which changes into vesicles, pustules and then brown scab which falls off	Scabs should be collected and burnt, soiled articles should be washed and boiled. Vaccine is available
6.	Smallpox (Eradicated from earth)	<i>Variola</i> virus	Direct contact and droplet contact/ 12 days	High fever, chill, headache, vomiting, rash that turn into scabs that fall off	<i>Same as that of chickenpox</i>
7.	Poliomyelitis	Polio virus	Contaminated food and water/ 7-14 days	Stiffness of neck, paralysis of skeletal muscles, fever, headache, pain	Avoiding contaminated food and water. Salk vaccine and OPV vaccine available
8.	Swine flu	Swine influenza (H ₁ N ₁) viruses	Droplet contact	Fever, cough, bodyaches, headache, chills	Avoiding close contact with the sick. Vaccine is available
9.	SARS (Severe Acute Respiratory Syndrome)	Corona virus	Droplet contact/ 2-7 days	Fever, chills, muscleache, cough, dizziness, running nose, vomiting, diarrhoea	Avoiding contact with the sick

Bacterial Diseases

Typhoid

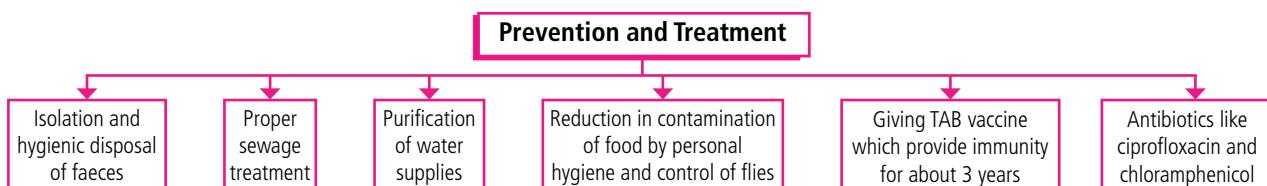
- Typhoid is a common bacterial disease caused by a rod-like bacterium, **Salmonella typhi**, which is commonly found in the intestine of man.

Mode of transmission

- Typhoid spreads via faecal oral route, i.e., through **food** and **water** contaminated with faeces of the patient. **House flies** may carry the pathogens from the faeces to the food, milk and water.
- **Incubation period** varies from 1-3 weeks (average 2 weeks).

Symptoms

- This disease is characterised by the inflammation of ileum and colon, enlargement of liver and spleen, abdominal pain, pea-soup diarrhoea which may become haemorrhagic, constant fever, extreme weakness, vomiting, rash causing **rose spots** on the upper abdomen and sore throat.
- Typhoid is diagnosed by **Widal test**.



Anthrax

- Anthrax is an acute infectious disease caused by air-borne, spore-forming, rod-like, non-motile bacterium, **Bacillus anthracis**.
- Anthrax spores can be produced in a dry form which can be stored as particles that can be used in **biological warfare**.

Mode of transmission

- Infected animals shed a large number of bacilli (bacteria) in the discharges from the mouth, nose and rectum which sporulate in the soil. These spores act as source of infection.
- It requires thousands of spores to cause human infection. Anthrax does not spread from human to human.

Symptoms

- Initial symptoms resemble those of common cold. Later there is difficulty in breathing, cough, fever, fast pulse and cardiovascular collapse.
- If left untreated, anthrax in all forms can lead to **septicemia** and **death**.

Prevention and treatment

- The only known effective prevention against anthrax is the **anthrax vaccine**, which was developed from an attenuated strain of *B. anthracis*.
- A suitable antibiotic like ciprofloxacin is quite effective, particularly if used in the initial stages of disease. But in cattle, ciprofloxacin may be effective only in chronic condition.

Table: Other bacterial diseases

	Disease	Pathogen	Mode of transmission/ Incubation period	Symptoms	Control measures/ Treatment
1.	Cholera	<i>Vibrio cholerae</i>	Contaminated food and drinks / 2 - 3 days	Vomiting, dehydration, muscular cramps	Proper sanitation/ORS, tetracycline
2.	Diarrhoeal diseases	<i>E.coli, Shigella, Campylobacter, Salmonella, Clostridium</i>	Contaminated food and drinks/variable period	Frequent stools with blood, dehydration, low blood pressure	Proper sanitation /ORS

3.	Pneumonia	<i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i>	Direct contact / 1 - 3 days	Cough, fever, pain in the lungs	PCV13 vaccine / Erythromycin, tetracycline
4.	Diphtheria	<i>Corynebacterium diphtheriae</i>	Droplet infection/ 2-5 days	Fever, sore throat	DPT vaccine / Erythromycin
5.	Whooping cough or pertussis	<i>Bordetella pertussis</i>	Direct contact / 10 - 16 days	Cough, breathlessness and vomiting	DPT vaccine/Erythromycin
6.	Tuberculosis	<i>Mycobacterium tuberculosis</i>	Droplet infection and contaminated food and drinks / 3 - 6 weeks	Constant cough, pain in chest, loss of weight and appetite	BCG/Streptomycin, PAS rifampicin
7.	Tetanus (Lock jaw)	<i>Clostridium tetani</i>	Spores enter the wounds / 3 - 25 days	Painful muscular spasms, fever, lock jaw	DPT / Antitetanus serum (ATS), tetanus toxoid
8.	Plague (Black death)	<i>Pasteurella/Yersinia pestis</i>	Bite of infected rat flea <i>Xenopsylla cheopis</i> / 2 - 6 days	Painful buboes, fever, haemorrhages	Streptomycin, oral tetracycline, antiplague vaccine
9.	Leprosy (Hansen's disease)	<i>Mycobacterium leprae</i>	Prolonged direct contact / 2 - 5 years	Infection of skin, wasting of body parts, deformities of fingers, toes, hypopigmentation	Rifampicin, dapson, clofazimine

Protozoan Diseases

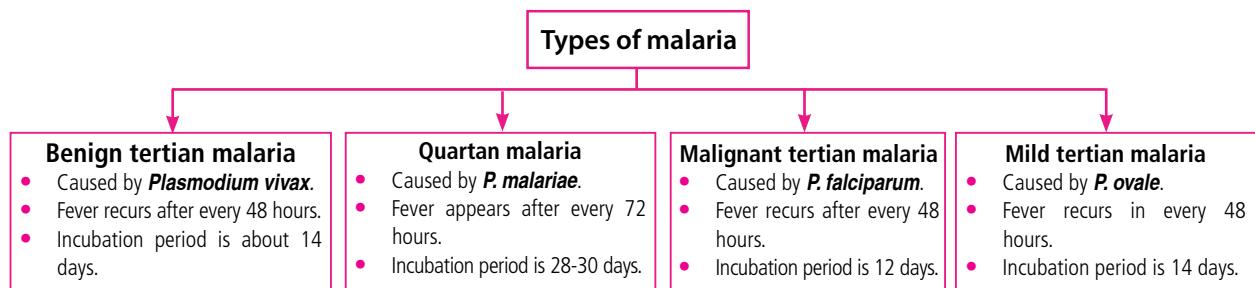
- Protozoans are diverse group of eukaryotic, unicellular organisms.
- Human diseases caused by protozoa are relatively few, but are individually of devastating consequences.

Malaria

- Malaria is caused by a digenetic (have two hosts to complete its life cycle) protozoan parasite known as ***Plasmodium***.
- The primary host is female *Anopheles* mosquito and secondary host is man.
- Sir Ronald Ross** established that malarial parasite is transmitted by the bite of a female *Anopheles* mosquito for which he got Nobel Prize in 1902.

Mode of transmission

- The malarial parasite, *Plasmodium* enters the human body as **sporozoites** (infective stage) through the bite of infected female *Anopheles* mosquito.
- There are four species of *Plasmodium* which causes four main types of malaria in human.



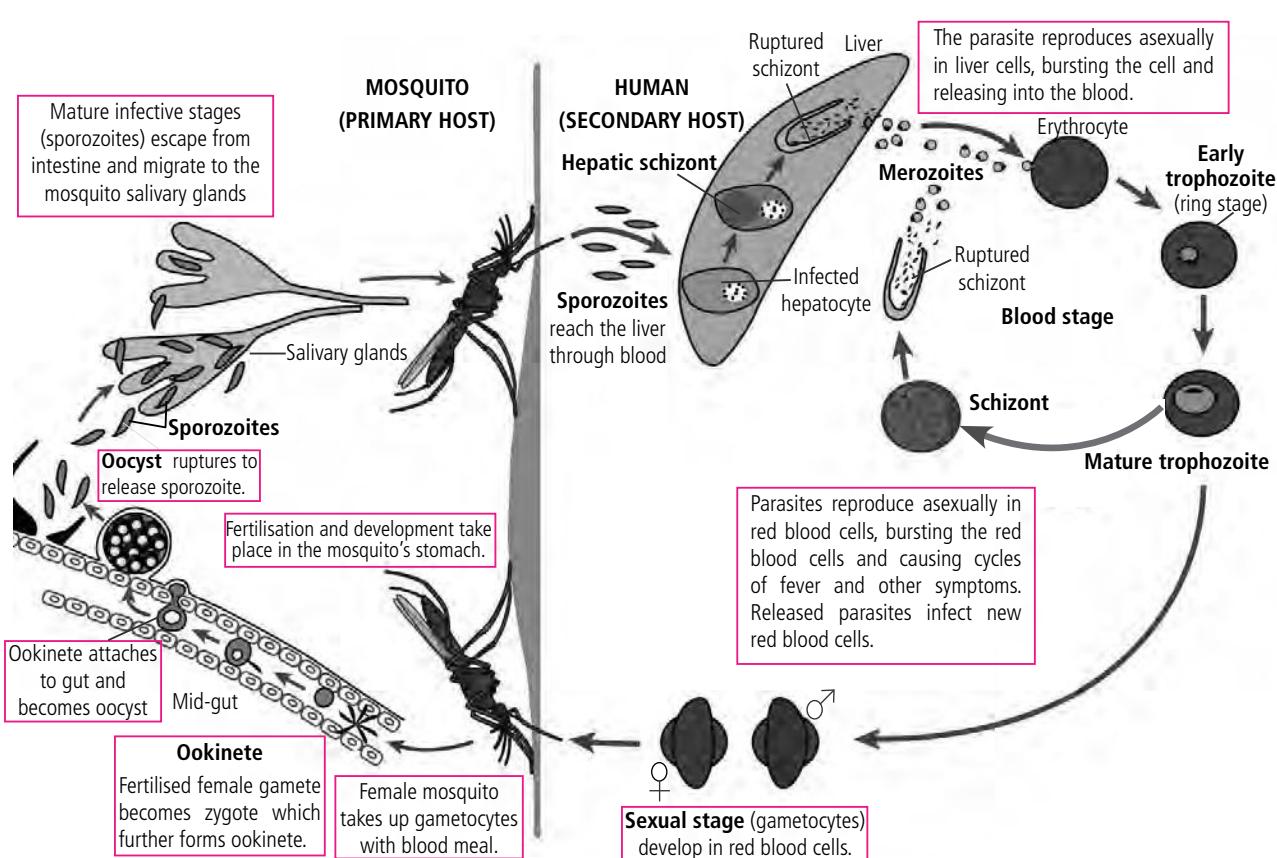


Fig.: Life cycle of *Plasmodium*

Symptoms

- Malaria is characterised by fever at intervals, each attack of malaria fever shows three successive stages:
 - Cold stage** - At the onset of fever, patient suffers a severe shaking chill and needs to be covered with huge pile of blankets. It lasts for 20 minutes to one hour.
 - Hot stage** - As chill subsides, the body temperature rises as high as 41-106°F. It lasts for 1-4 hours.
 - Sweating stage** - As the temperature drops, patients sweat profusely. Finally the fever comes down and temperature becomes normal.
- Malaria is also accompanied by nausea, headache, laziness and muscular pain. It also results in anaemia and splenomegaly.

Prevention and Treatment

- ↓ Spraying DDT, BHC and other insecticides
- ↓ Fitting doors and windows with wire nets
- ↓ Using mosquito nets and repellants
- ↓ Use of drugs like chloroquine, quinine, primaquine, etc.

Table: Other protozoan diseases

	Disease	Pathogen	Mode of transmission/ Incubation period	Symptoms	Control measures / Treatment
1.	Amoebiasis	<i>Entamoeba histolytica</i>	Faecal - oral route, sexual contact, vectors, e.g., flies. / 2-4 weeks	Abdominal pain, diarrhoea, blood in faeces, passing out of mucus	Sanitation, protection of food from flies. Emetine, stremetine and metronidazole
2.	Giardiasis	<i>Giardia intestinalis</i>	Contaminated food and water / 1-3 weeks	Epigastric pain, headache, diarrhoea	Clean food and water/ Metronidazole, tinidazole

3.	Trypanosomiasis or African sleeping sickness	<i>Trypanosoma gambiense</i>	Biting of tse tse fly (<i>Glossina</i> sp.)/ Weeks or months	Swelling of lymphatic glands, recurrent fever, anaemia, patient falls asleep	Pentamidine, atoxyl, tryparsamide, germanin
4.	Kala-azar or Dum-dum fever	<i>Leishmania donovani</i>	Bite of sandfly <i>Phlebotomus argentipes</i> / 3-6 months	High fever, spleen enlargement, anaemia, darkening of skin	Sodium antimony tartrate, glyconate, urea stebamine, neostibosan

Helminthic Diseases

- Helminths are animals that belong to the Phylum **Platyhelminthes** (flatworms) and **Nematoda** (roundworms).
- Many parasitic forms of this group, popularly known as **parasitic worms** are endoparasites of gut and blood in human body and cause various diseases called as **helminthiasis**.

Table: Helminthic diseases

	Disease	Pathogen	Mode of transmission	Symptoms	Prevention / Treatment
1.	Taeniasis	<i>Taenia solium</i> (Pork tapeworm), <i>Taenia saginata</i> (Beef tapeworm)	Raw or under-cooked pork or beef	Abdominal pain, nausea, anaemia, indigestion, epilepsy	Pork or beef to be cooked properly before eating / Camoquin and atabrin
2.	Ascariasis	<i>Ascaris lumbricoides</i>	Contaminated fruits, vegetables, food or water, etc., containing <i>Ascaris</i> eggs	Muscular pain, fever, anaemia, blockage of intestinal passage	Preventing exposure to unhygienic conditions/ Chenopodium oil, tetrachloroethylene
3.	Filariasis (Elephantiasis)	<i>Wuchereria bancrofti</i> , <i>W. malayi</i>	Bite of <i>Culex</i> mosquito	Swelling of feet, legs, thighs, scrotal sacs, breast	Take precautions against mosquito bites/ Albendazole, hetrazan, diethyl carbamazine (DEC)
4.	Ancylostomiasis	<i>Ancylostoma duodenale</i>	Juveniles penetrate through skin of hands and feet	Gastrointestinal disturbances, anaemia, nervous disorders.	Proper sanitation and hygiene/ Tetrachloroethylene and carbon tetrachloride

Fungal Diseases

- The fungal diseases of man are either **mycoses** (caused by infection of fungi) or **toxicoses** (caused by toxic fungal metabolites).

Table : Fungal disease

Disease	Pathogen	Mode of transmission/ Incubation period	Symptoms	Control measure/ Treatment
Ringworm (Tinea)	<i>Microsporum</i>	Direct contact or by soil	Infect skin, hair and nails	Drugs like griseofulvin and miconazole inhibit infection

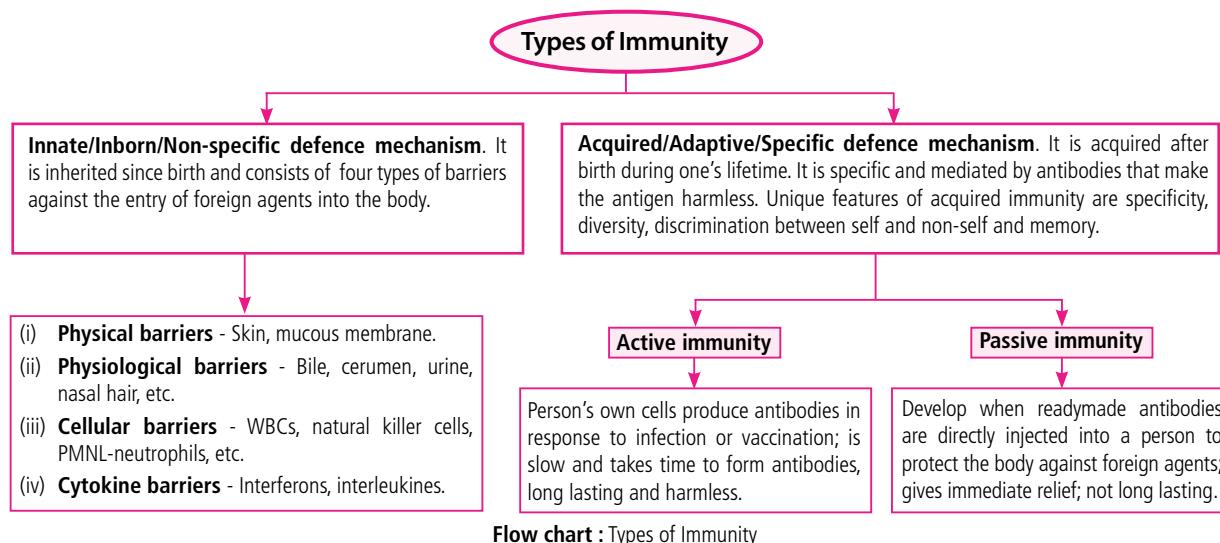
NON-COMMUNICABLE DISEASES

- These diseases are not transmitted from infected persons to healthy persons.
- Some of the non-communicable diseases are discussed below:
 - **Diabetes mellitus** or **hyperglycemia** is the most common endocrine disorder of the pancreas which is caused when either insulin is produced insufficiently (**insulin dependent diabetes mellitus**) or becomes non functional (**non-insulin dependent diabetes mellitus**). In both disorders, the blood glucose concentration is elevated above the normal range. Glucose is excreted in urine, resulting in excessive urination and dehydration of body tissues.

- **Cardiovascular diseases** are those diseases that affect the blood vessels and heart, for e.g.,
 - (i) **Arteriosclerosis** - Hardening and loss of elasticity of the arteries, causes high blood pressure.
 - (ii) **Atherosclerosis** - Lumpy thickness develops on the inner walls of arteries that prevent dilation of arteries.
 - (iii) **Hypertension or high blood pressure** - Arterial pressure exceeding 120/80 mmHg; can result in heart failure, kidney damage, etc.
 - (iv) **Myocardial infarction** - Clot formation in the lumen of coronary artery, results in “**heart attack**”.
- **Cerebrovascular accident (CVA)** or **stroke** is the sudden interruption of blood flow to a portion of the brain due to a blockage or rupture of a cerebral blood vessel. Thus, the brain cells do not get sufficient oxygen and glucose. This can cause paralysis, loss of speech, etc.

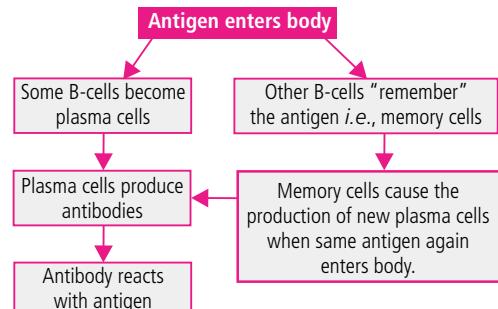
IMMUNITY

- Immunity is the ability of the body to protect against all types of foreign bodies like bacteria, virus, toxic substances, etc., which enter the body. It is also called disease resistance. The lack of immunity is known as **susceptibility**.
- The study of body's defence mechanism against pathogens is called **immunology**.
- **Edward Jenner** (1749 - 1823) is known as the Father of Immunology.
- **Antigens** are substances which when introduced into the body, stimulate the production of antibodies.



Components of Acquired Immunity

- It has two components:
- 1. **Antibody mediated immune system (AMIS) or humoral immunity**
 - It consists of antibodies that circulate in the body fluids like blood plasma and lymph.
 - **B-lymphocytes or B-cells** produce **antibodies** that regulate antibody mediated or humoral immunity.
 - T-lymphocytes do not secrete antibodies but help B lymphocytes to produce them.
 - **B-cells give rise to:**
 - **Plasma cells (Effector B-cells)** : The antigen specific T-cells stimulate specific B-lymphocytes to multiply rapidly, forming clone of plasma cells.
 - **Memory B-cells** : Some of the activated B cells do not differentiate into plasma cells but rather remain dormant as **memory B-cells** until activated once again by a renewed attack of the same antigen.

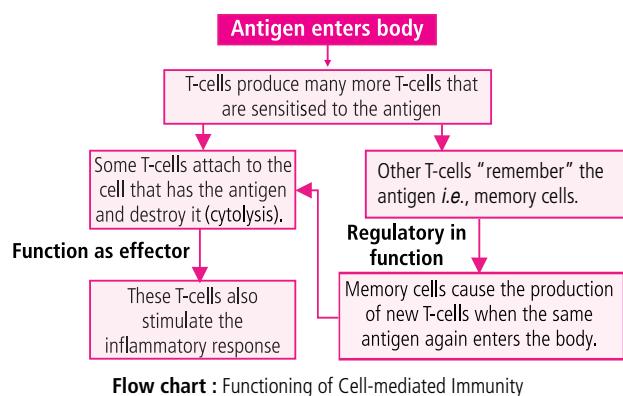


2. Cellular immunity or cell-mediated immune system or T-cell immunity (CMIS)

- T lymphocytes or T-cells are produced in the bone marrow and mature in thymus.

Types of T-cells

- Cytotoxic or killer T-cells** : Directly attack and destroy antigens by secreting a protein **perforin**.
- Suppressor T-cells** : Keep a check on entire immune system from attacking the body's own cells.
- Helper T-cells** : Stimulate the B-cells to produce antibodies. They form protein mediators called **lymphokines**.
- Memory cells** : Sensitised T-cells retain memory of antigen specificity for future, sometimes lifelong. They proliferate and differentiate into all types of T-cells.



Immune Response

- The specific reactivity induced in a host by an antigenic stimulus is known as the immune response.

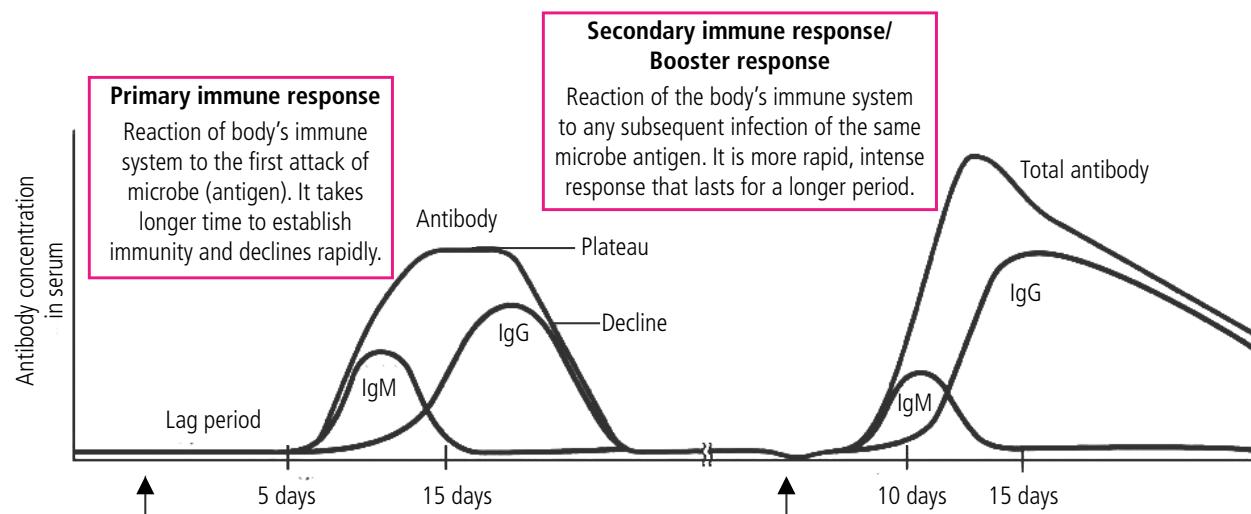


Fig.: Primary vs Secondary immune responses

Immune System

- The human immune system comprises of **lymphoid organs**, **tissue cells** and soluble molecules such as **antibodies**.
- Lymphoid organs are of two types : **Primary lymphoid organs** where B-and T-lymphocytes mature and acquire antigen-specific receptors such as bone marrow and thymus and **secondary lymphoid organs** where mature lymphocytes undergo proliferation and differentiation such as spleen, lymph nodes, tonsils, etc.
- Antigen Presenting Cells (APCs)** - APCs are the cells that engulf antigens and present fragments to T-cells. *E.g.*, marophages, dendritic cells and B cells.

Antibodies

- Antibodies** are immunoglobulins (Igs) which are produced in response to antigenic stimulation.
- All antibodies are immunoglobulins but all immunoglobulins are not antibodies.
- Antibodies are produced by B-lymphocytes and plasma cells. The mature plasma cells produce antibodies which direct antibody mediated immunity.

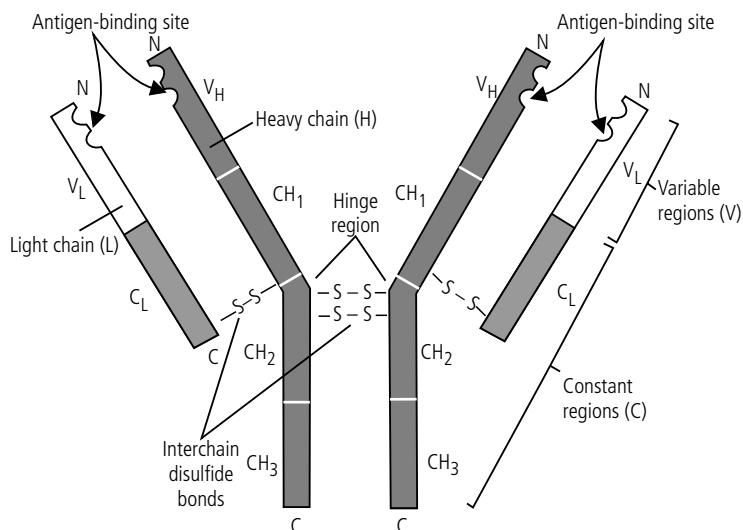


Fig.: Structure of antibody molecule

Types of Immunoglobulins

IgG

- **Most abundant**, found in blood, lymph and intestine.
- Predominant antibody in the secondary response.
- **Only antibody to cross the placenta.**
- **Opsonizes** i.e., enhance phagocytosis, neutralises toxins, fixes complement.

IgA

- **Second most abundant** antibody.
- Found in body secretions including saliva and tears.
- Available in colostrum (first milk secreted by a mother).
- Localised protection in external secretions.

IgM

- **Largest antibody.**
- Produced early in the primary response.
- Most efficient in agglutination, complement fixation.

IgD

- Functions as antigen receptor on surface of B cells.
- Present on surface of B-cells and in blood and lymph.

IgE

- **Least abundant.**
- Bound to mast cells and basophils throughout the body.
- Mediate immediate hypersensitivity reactions.
- Involved in allergic reactions.

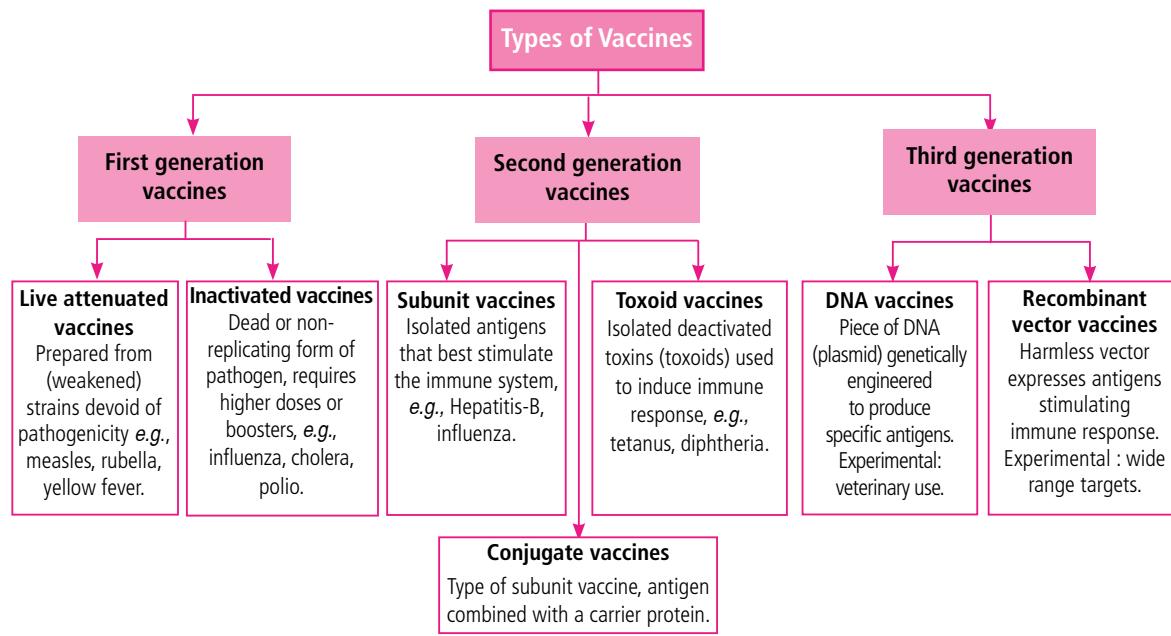
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VACCINATION AND IMMUNISATION

- Vaccine (*L. vacca* = cow) is a preparation/suspension or extract of dead/attenuated (weakened) germs of a disease which on inoculation (injection) into a healthy person provides temporary/permanent active/passive immunity by inducing antibodies formation.
- The process of introducing a vaccine into an individual to provide protection against a disease is called **vaccination**.

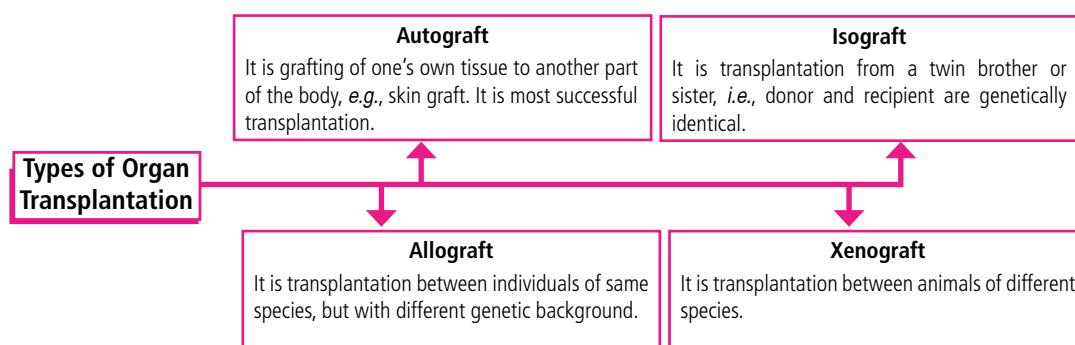


Flow chart : Types of Vaccines

- Immunisation** is the process by which the body produces antibodies against the vaccine preventable diseases through administration of specific vaccines.

ORGAN TRANSPLANT

- Transplantation involves the removal of damaged/injured tissues or organs from the body of a person and their substitution by similar tissues/organs from a donor.
- Tissue matching and blood group matching are essential before undertaking any graft/transplant. Sometimes, the immune system may reject the transplanted organ by recognising its protein as foreign. Therefore, patient has to take **immuno-suppressants** (drugs) to prevent organ rejection throughout the life.
- The success of tissue and organ transplants depends on the donor's and recipient's **human leucocyte antigens (HLA)** encoded by the HLA genes. The genes for the HLA proteins are clustered in the **major histocompatibility complex (MHC)**, located on the short arm of chromosome 6.



DISORDERS OF IMMUNE SYSTEM

Hypersensitivity (Allergy)

- Hypersensitivity or allergy is an exaggerated immune response to common antigens, called allergens.
- Allergy is due to the release of chemicals like histamine and serotonin from the mast cells.
- Common examples of allergens are mites in dust, pollens, animal dander, etc.
- Symptoms of allergic reactions include sneezing, watery eyes, running nose and difficulty in breathing.
- The use of drugs such as antihistamines, adrenaline and steroids quickly reduce the symptoms of allergy.
- Common examples of allergy are **hay fever** and **asthma**.

Autoimmunity

- Autoimmunity refers to abnormal immune responses in which the immune system fails to properly distinguish between self and non-self and attacks self body proteins.
- When the cells act as antigens in the same body, they are called **autoantigens**.
- Some of the examples of autoimmune disorders are Grave's disease, Rheumatic fever, Myasthenia gravis, Pernicious anaemia, etc.

Immunodeficiency Diseases

- Immunodeficiencies occur when one or more of the components of the immune system are inactive due to gene mutations, infections, malnutrition or accident.
- A person suffering from an immunodeficiency disease is liable to suffer from diseases which normally would not occur (**opportunistic diseases**).
- SCID and AIDS are two common immunodeficiency diseases.

Severe Combined Immuno Deficiency or SCID

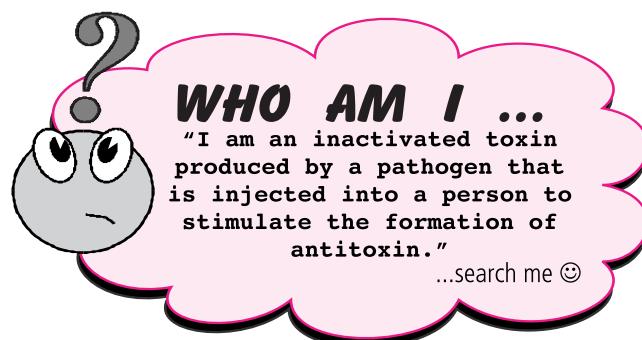
- It occurs due to defect in the specialised white blood cells (B and T-cells) that represents a group of rare, sometimes fatal, **congenital disorders** characterised by little or no immune response.

Acquired Immuno Deficiency Syndrome or AIDS

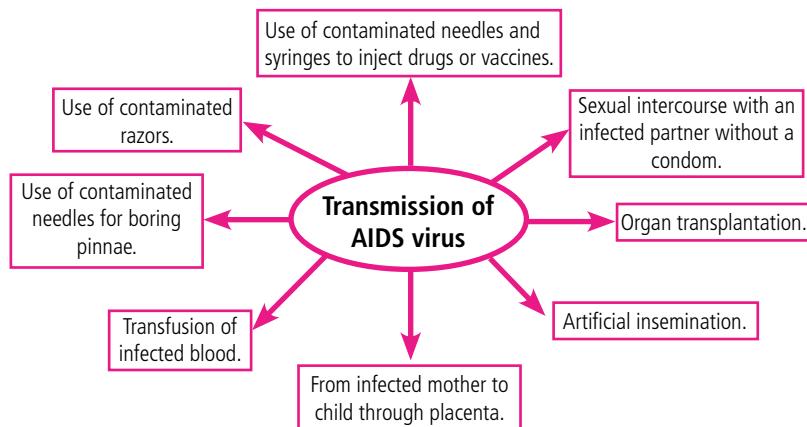
- AIDS is a disorder of cell-mediated immune system of the body. There is a reduction in the number of helper T cells which stimulate antibody production by B-cells.
- This results in the loss of natural defence against viral infections.
- The infection by **human immuno-deficiency virus** (HIV) causes AIDS.
- The **incubation period** of AIDS ranges between 6 months to 10 years.

Infection by HIV

- (i) **Infection** : Virus enters the body of a person and reaches macrophages (cells of immune system).
- (ii) **Reverse transcription** : The viral RNA is converted to viral DNA with the help of reverse transcriptase enzyme.
- (iii) **Integration** : Viral DNA is incorporated into the host cell's DNA and gets replicated.
- (iv) **Multiplication** : The viral DNA replicates along with infected host cell. Thus, the infected macrophages act as HIV factory.
- (v) **Assembly of virus** : The viral proteins formed are assembled to form new viral particles which are released from the infected cell. They mature and target T-cells of body (destroy them).
- (vi) Since the number of helper T lymphocytes decrease in the body, the person becomes susceptible to infections of bacteria, viruses, fungi and even parasites like *Toxoplasma*.
- (vii) The patient gets immune deficient and he/she is unable to protect himself/herself against these infections.



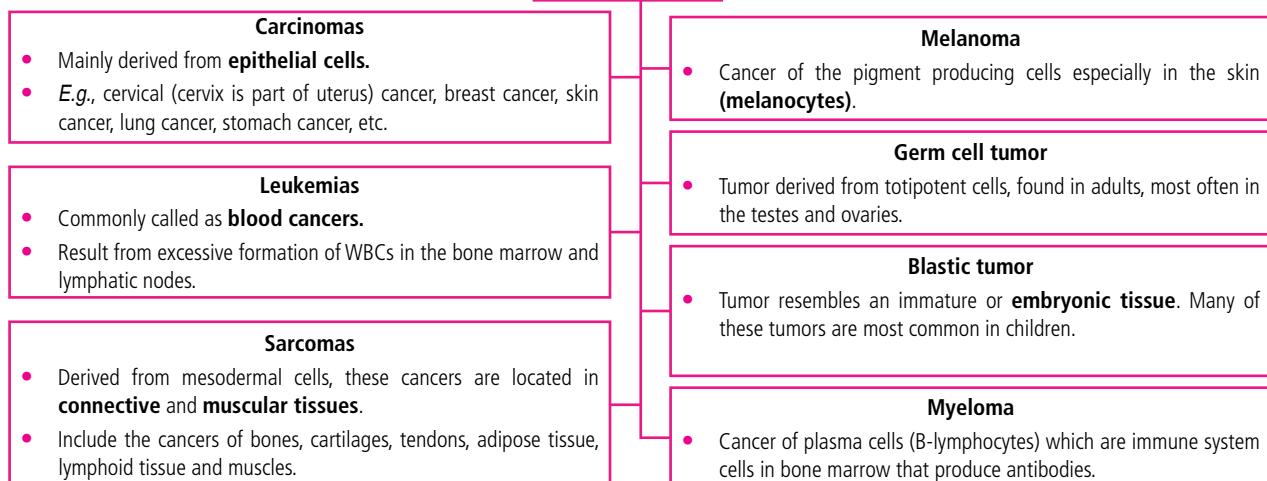
- **Symptoms** of HIV infection include fever, lethargy, pharyngitis, nausea, headache, rashes, etc.
- For **prevention**, one should avoid sharing needles, syringes and should have safe sex.
- Although there is no cure for AIDS, use of certain drugs can prolong the life of AIDS patient.



Cancer

- Cancer is an abnormal and uncontrolled proliferation of cells without any differentiation.
- Due to uncontrolled divisions, an abnormal growth called **tumor** occurs.
- **Tumor or neoplasm** is any abnormal swelling, lump or mass in the body. Tumor is of two types : Benign and malignant. Benign tumor remains confined to the site of origin and does not spread to other body parts. Malignant tumors spread to distant sites through body fluids to develop secondary tumor, by the process called **metastasis**.

Types of Cancer



Causes of cancer

- Chemical and physical agents that can cause cancer are called **carcinogens**. Carcinogens fall into three basic categories:
 - (i) **Oncogenic transformations:** They are carcinogens which bring about changes in genetic material, e.g., radiations (X-rays, cosmic rays, UV rays etc.) and chemicals.
 - (ii) **Tumor promoters:** They promote proliferation of cells which have undergone oncogenic transformation, e.g., some growth factors, hormones etc.

Table : Carcinogens and organs affected

	Carcinogens	Organs affected
(i)	Soot	Skin, lungs
(ii)	Coal tar (3, 4-benzopyrene)	Skin, lungs
(iii)	Cigarette smoke (N-nitrosodimethylene)	Lungs
(iv)	Cadmium oxide	Prostate gland

(iii) **Tumor viruses:** Some viruses are known to be involved in oncogenic transformations.

Possible symptoms of cancer

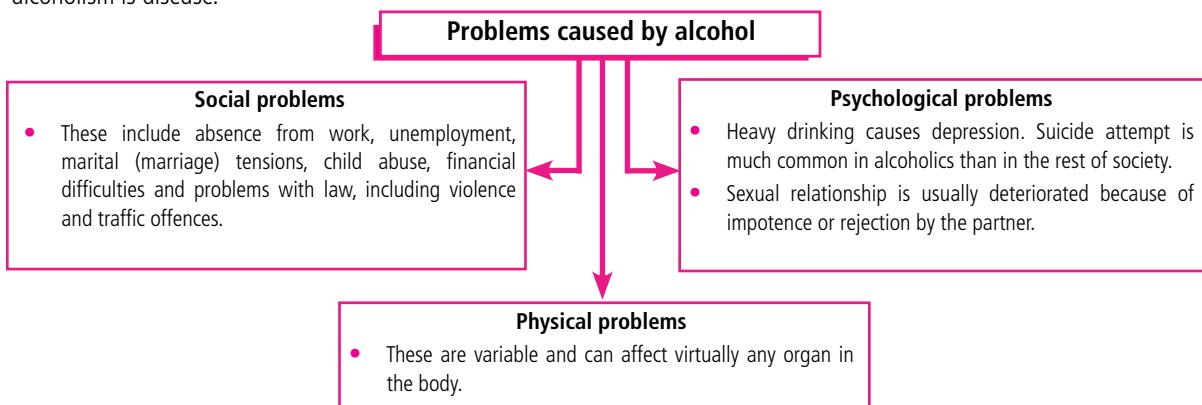
- (i) A lump or hard area in the breast.
- (ii) Unexplained low-grade fever.
- (iii) Unexplained loss of weight.
- (iv) Non-injury bleeding from the surface of the skin, mouth or any other opening of the body.
- (v) Bleeding in vagina at times other than the menstruation.

Treatment

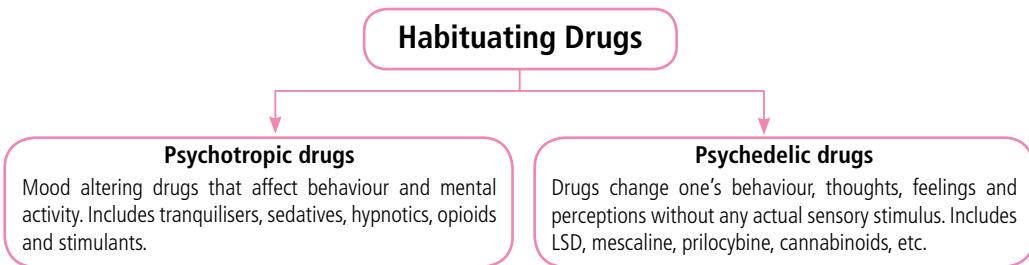
- The common approaches for treatment of cancer are surgery, radiation therapy, chemotherapy and immunotherapy.

ALCOHOL AND DRUG ADDICTION

- Alcohol refers to ethyl alcohol or ethanol (C_2H_5OH) manufactured by fermentation of sugars.
- Drinking of excessive alcohol that impairs one's physical, physiological and psychological functions, refers to alcohol abuse. The dependence or addiction of alcohol is called alcoholism and the addict is termed as alcoholic. WHO declared in 1964 that alcoholism is disease.



- **Drug addiction or abuse** can be defined as intake of drugs for purpose other than clinical use, in amount, concentration or frequency that impairs physical, physiological and psychological functions of the body. The drugs, which are commonly abused are **opioids, coca alkaloids and cannabinoids**.



- **Opiate narcotics/Opioids** are the drugs derived from dried latex of unripe fruits of poppy plant (*Papaver somniferum*). They are also called pain killers and have narcotic, analgesic, astringent (that causes contraction of body parts) and sedative effect, e.g., opium (afeem), heroin, smack, etc.
- **Cocaine** is natural coca alkaloid obtained from leaves of coca (or cocca) plant (*Erythroxylum coca*). Cocaine has **vasoconstrictor properties** and acts as a good local anaesthetic. It is a powerful CNS stimulant. Its overdose causes **hallucinations**.
- **Hemp or cannabis compounds** (hallucinogenic chemicals) are obtained from leaves, resin and flowering tips (inflorescence) of hemp plant that naturally have sedative effects, e.g., bhang, charas, ganja, marijuana, etc.
- **Tobacco** has volatile poisonous alkaloid called **nicotine** which causes addiction. High concentration of nicotine paralyses nerve cells and may also lead to heart diseases.

Addiction and Dependence

- **Addiction** is a psychological attachment to certain effects such as euphoria and a temporary feeling of well-being that is associated with drugs and alcohol.
 - **Dependence** is an adaptive state that develops from repeated drug administration. It can result in withdrawal syndrome (anxiety, nausea, shivering), if the drug is abruptly discontinued.
 - Effects/symptoms of drug abuse include reckless behaviour, vandalism, violence, socially inactive, lack of concentration, etc.

Prevention and Control

- Psychologists, psychiatrists, deaddiction and rehabilitation specialists are available to help individuals who fall in the trap of drug, tobacco or alcohol abuse.
 - Teachers and parents should always be careful to look for and identify danger signs that can indicate tendency to go in for addiction.
 - Avoid undue pressure on child.



- 1.** Read the following statements regarding dengue and choose the correct option given below.

 - It is caused by *Flavi-ribo* virus.
 - The virus is transmitted by *Anopheles* mosquito.
 - Incubation period is 7-14 days.
 - This disease is also known as break bone fever.

(a) I, III and IV (b) I and IV
 (c) II, III and IV (d) I and III

2. Read the following statements.

 - Antibody consists of 6 peptide chains, four small and two long.
 - Active immunity provides immediate relief.
 - Primed cells remain dormant until activated once again by a new quantity of same antigen.
 - Dendritic cells are non-phagocytic in nature.

Of the above statements,

(a) A and B are correct (b) A, B and D are correct
 (c) C and D are correct (d) B and C are correct.

3. A drug addict showing symptoms of drowsiness, lethargy, decreased weight and loss of interest in work. He is most probably addicted to

(a) amphetamines (b) marijuana
 (c) cocaine (d) heroin.

4. Read the given statements and select the correct option.

Statement A : A person, who has undergone an organ transplant, is given immunosuppressive drugs.

Statement B : Immunosuppressive drugs suppress the immune system from rejecting the transplanted organ.

(a) Both statements A and B are correct and statement B is the correct explanation of statement A.
 (b) Both statements A and B are correct but statement B is not the correct explanation of statement A.

5. Statement A is correct but statement B is incorrect.
 (d) Both statements A and B are incorrect.

6. The cancers that are located in connective and muscular tissues derived from mesoderm are called

(a) myomas (b) melanomas
 (c) sarcomas (d) lipomas.

7. Nicotine is a component in tobacco products that stimulates the release of

(a) dopamine (b) adrenaline
 (c) histamine (d) serotonin.

8. Chagas disease is caused by A and it is transmitted by B.

(a) *Trypanosoma gambiense*, *Glossima palpalis*
 (b) *Trypanosoma gambiense*, triatomids
 (c) *Trypanosoma rhodesiense*, *Glossima morsitans*
 (d) *Trypanosoma cruzi*, triatomids

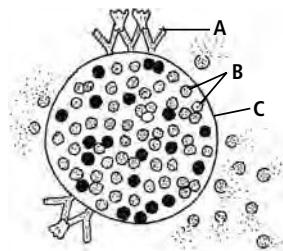
9. Identify the mismatched pair.

(a) Tetanus toxoid - Active immunisation
 (b) Antivenom serum - Passive immunisation
 (c) Vaccine - Passive immunisation
 (d) Salk's polio vaccine - Active immunisation

10. Kala-azar disease is transmitted by

(a) *Dracunculus* (b) *Phlebotomus*
 (c) *Trypanoma* (d) *Balantidium*.

11. Study the given figure showing interactions between antigens, antibodies and cell involved in an allergic reaction. Identify A, B and C and choose the correct option.



A	B	C
(a) IgM	Granules of hapten	Mast cell
(b) IgG	Granules of serotonin	Basophil
(c) IgE	Granules of histamine	Mast cell
(d) IgA	Granules of opsonin	Histiocytes

11. Match column I with column II and select the correct option from the codes given below.

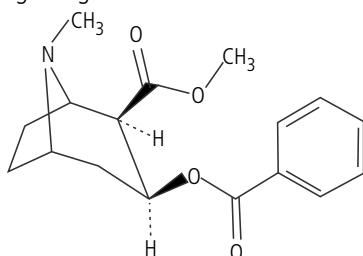
Column I	Column II
A. <i>Microsporum canis</i>	(i) Measles
B. <i>Bordetella pertussis</i>	(ii) Syphilis
C. <i>Treponema pallidum</i>	(iii) Bubonic plague
D. <i>Rubeola virus</i>	(iv) Whooping cough
E. <i>Yersinia pestis</i>	(v) Ringworm
(a) A-(iii), B-(i), C-(v), D-(ii), E-(iv)	
(b) A-(ii), B-(iv), C-(iii), D-(v), E-(i)	
(c) A-(iv), B-(iii), C-(i), D-(v), E-(ii)	
(d) A-(v), B-(iv), C-(ii), D-(i), E-(iii)	

12. Read the following statements and select the correct option stating which ones include true (T) and which ones are false (F).

- I. Hepatitis B is transmitted by parenteral route.
- II. Symptoms of hepatitis include light coloured urine and dark stools.
- III. Hepatitis A virus has RNA as the genetic material.
- IV. Incubation period for Hepatitis A is 6-8 weeks.

I	II	III	IV
(a) T	T	T	F
(b) F	T	T	T
(c) T	F	T	F
(d) F	T	F	T

13. Study the chemical structure below and select the correct option regarding it.



- (a) It is a crystalline powder obtained from plant *Erythroxylon coca*.
- (b) It has hallucinogenic properties obtained from hemp plant.
- (c) It is a psychedelic drug causing horrible dreams.
- (d) It is a type of opium derivative, strong analgesic with sedative and calming effects.

14. Rohan suffered from chicken pox when he was five years old. His body has developed life time resistance to the infection, due to
 (a) natural passive immunity

- (b) artificial active immunity
- (c) natural active immunity
- (d) artificial passive immunity.

15. Study the table and identify A, B, C and D.

Disease	Site of infection	Effect
Taeniasis	A	Anaemia
B	Caecum and appendix	Bloody stools
Enterobiasis	C	Appendicitis
Giardiasis	Small intestine	D

- (a) A-Large intestine, B-Ancylostomiasis, C-Colon and appendix, D-Epigastric pain and fever
- (b) A-Small intestine, B-Trichuriasis, C-Caecum and colon, D-Epigastric pain and headache
- (c) A-Subcutaneous tissue, B-Ascariasis, C-Small intestine, D-Enlargement of spleen and fever
- (d) A-Caecum and appendix, B-Ascariasis, C-Large intestine, D-Enlargement of spleen and fever

16. Which of the following statements regarding antigen-antibody complex is incorrect?

- (a) Neutralisation occurs when antibody-antigen reaction blocks bacterial toxins, viruses, etc., from affecting the body cells.
- (b) Clumping of blood cells or microorganisms due to antigen-antibody reaction is called agglutination.
- (c) Some antibodies can attack and rupture the plasma membrane of a cell causing precipitation.
- (d) Neighbouring cells aggregate when a single antibody binds with the epitopes of two or more different antigens at the same time.

17. Consider the following statements and select the correct option that fills the blanks.

- I. The lymphoid organ that is responsible for producing phagocytic macrophages is _____.
- II. _____ is pentamer in structure and cannot cross the placental barrier.
- III. _____ can induce antibody formation only when they combine with larger protein molecules serving as carriers.

I	II	III
(a) Peyer's patches	IgA	Epitope
(b) Thymus	IgM	Opsonins
(c) Spleen	IgM	Haptens
(d) Tonsils	IgA	Partial antigen

18. One difference between a cancer cell and a normal cell is that

- (a) the cancer cell is unable to synthesise DNA
- (b) the cell cycle of the cancer cell is arrested at the S-phase
- (c) cancer cells continue to divide in a regulated manner even when they are tightly packed

- (d) cancer cells cannot function properly because they suffer from density-dependent inhibition.
- 19.** Live vaccine is a
- low dose of the infectious bacteria administered as prophylactic
 - dose of modified bacterial strain devoid of its pathogenicity but retains immunogenicity
 - low dose of toxin that is produced by the bacterium
 - sample of cells from a patient who recently recovered from the disease.
- 20.** Match the terms given in column I with their description in column II and select the correct codes.
- | Column I | Column II |
|------------------------------------|---|
| A. Helper T-cells | (i) Cells that are active in production of antibodies |
| B. Plasma cells | (ii) Enhance activity of cytotoxic T-cells |
| C. Killer T-cells | (iii) Inhibit function of cytotoxic T-cells |
| D. Suppressor T-cells | (iv) Secrete perforins |
| (a) A-(iv), B-(i), C-(ii), D-(iii) | |
| (b) A-(iii), B-(ii), C-(i), D-(iv) | |
| (c) A-(i), B-(iii), C-(iv), D-(ii) | |
| (d) A-(ii), B-(i), C-(iv), D-(iii) | |
- 21.** Malignant malaria is caused by
- Plasmodium malariae*
 - Plasmodium ovale*
 - Plasmodium falciparum*
 - Plasmodium vivax*.
- 22.** Which of the following is not a symptom of typhoid?
- Low pulse rate with high fever
 - Abdominal pain with high pulse rate
 - Low pulse rate and frequent stools
 - Both (a) and (b)
- 23.** An autoimmune disease in which the body destroys the functioning of thyroid gland is
- Simmond's disease
 - Grave's disease
 - Hashimoto's disease
 - Addison's disease.
- 24.** Match column I which lists the components of body defense with column II that lists the corresponding description and choose the correct option.
- | Column I | Column II |
|-----------------------------|--|
| A. Active natural immunity | p. Injection of gamma globulins |
| B. First line of defense | q. Complement proteins and interferons |
| C. Passive natural immunity | r. Direct contact with the pathogens that have entered inside body |
| D. Second line of defense | s. Lysozyme and skin |
| | t. Antibodies transferred through the placenta |
- 25.** The transplantation between the individuals of same species of different genetic background is
- autograft
 - allograft
 - isograft
 - xenograft.
- 26.** HIV decreases natural immunity of body by
- attacking T-lymphocytes
 - attacking B-lymphocytes
 - destroying antibodies
 - destroying erythrocytes.
- 27.** Which of the following is correct option for bacterial diseases?
- | | |
|-----------------------|-------------------|
| I. Hansen's disease | II. Measles |
| III. Yellow fever | IV. Lock jaw |
| V. Whooping cough | VI. Flu |
| (a) II, III, V and VI | (b) I, III and VI |
| (c) I, IV and V | (d) IV, V and VI |
- 28.** Elephantiasis is caused by
- aschelminthes
 - platyhelminthes
 - viruses
 - protozoans.
- 29.** Match column I with column II and select the correct option.
- | Column I | Column II |
|------------------------------------|---------------------------|
| 1. LSD | (i) <i>Erythroxylon</i> |
| 2. Caffeine | (ii) <i>Thea sinensis</i> |
| 3. Cocaine | (iii) <i>Cannabis</i> |
| 4. Hashish | (iv) Ergot alkaloid |
| (a) 1-(iv), 2-(iii), 3-(i), 4-(ii) | |
| (b) 1-(i), 2-(ii), 3-(iii), 4-(iv) | |
| (c) 1-(iv), 2-(iii), 3-(ii), 4-(i) | |
| (d) 1-(iv), 2-(ii), 3-(i), 4-(iii) | |

- 30.** Which of the following statements is incorrect?
- An alcoholic may suffer from cholestasis.
 - Mallory-Weiss syndrome is characterised by oesophagitis and gastritis.
 - Alcohol consumption can effect the haemopoietic system by decreasing the RBC size.
 - Cerebrum is the first part of brain affected after alcohol consumption.

ANSWER KEY

1. (b)	2. (c)	3. (d)	4. (a)	5. (c)
6. (b)	7. (d)	8. (c)	9. (b)	10. (c)
11. (d)	12. (c)	13. (d)	14. (c)	15. (b)
16. (c)	17. (c)	18. (c)	19. (b)	20. (d)
21. (c)	22. (b)	23. (c)	24. (c)	25. (b)
26. (a)	27. (c)	28. (a)	29. (d)	30. (c)



CBSE BOARD SOLVED PAPER

2017

CLASS XII

Time Allowed : 3 hours

Maximum Marks : 70

GENERAL INSTRUCTIONS

- (i) There are total 26 questions in five sections in the question paper. All questions are compulsory.
- (ii) Section A contains questions number 1 to 5. Very Short Answer type questions of one mark each.
- (iii) Section B contains questions number 6 to 10. Short Answer type-I questions of two marks each.
- (iv) Section C contains questions number 11 to 22. Short Answer type-II questions of three marks each.
- (v) Section D contains question number 23. Value Based Question of four marks.
- (vi) Section E contains questions number 24 to 26. Long Answer type questions of five marks each.
- (vii) There is no overall choice in the question paper, however, an internal choice is provided in one question of two marks, one question of three marks and all three questions of five marks. An examinee is to attempt any one question out of the two given in the question paper with the same question number.

SECTION - A

1. Our government has intentionally imposed strict conditions for MTP in our country. Justify giving a reason.
2. State the fate of a pair of autosomes during gamete formation.
3. What role does an individual organism play as per Darwin's theory of natural selection?
4. Suggest a method to ensure an anamnestic response in humans.
5. What is biopiracy?

Recommend the varieties of crops the farmers should grow to get rid of the existing problem and thus improve the crop yield.

9. How does the application of the fungal genus, *Glomus*, to the agricultural farm increase the farm output?
10. Plenty of algal bloom is observed in a pond in your locality.
 - (a) Write what has caused this bloom and how does it affect the quality of water.
 - (b) Suggest a preventive measure.

SECTION - C

6. A mature embryo sac in flowering plant may possess 7-cells, but 8-nuclei. Explain with the help of diagram only.
7. Describe the structure of a nucleosome.

OR

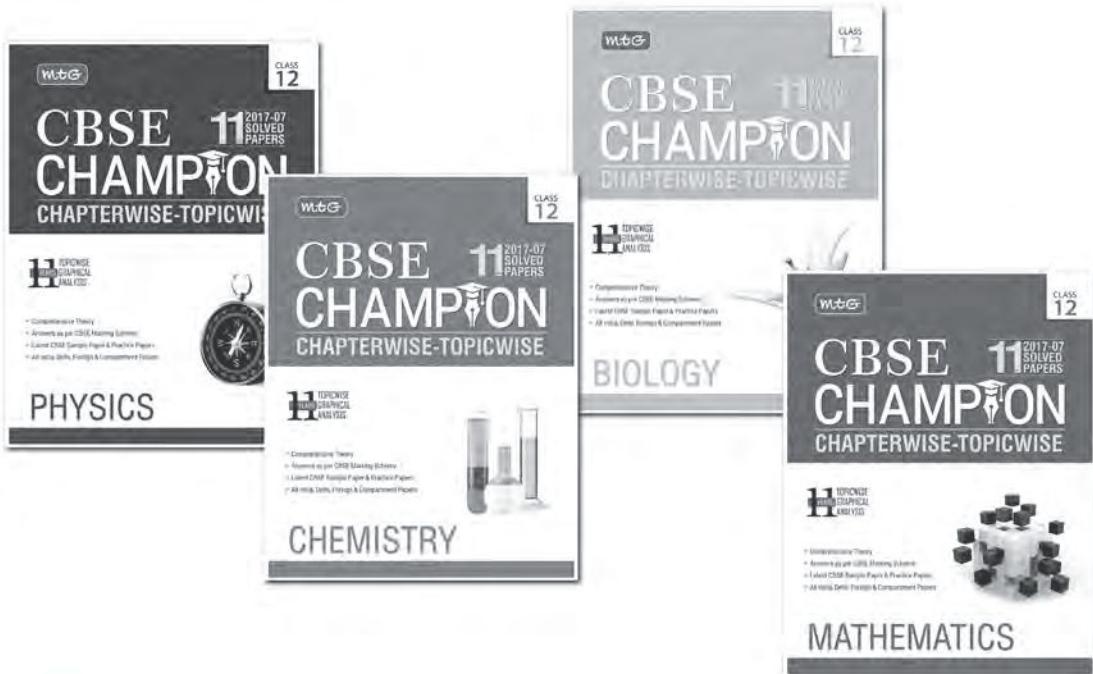
Mention the evolutionary significance of the following organisms.

- | | |
|-------------------------|-------------------------|
| (a) Shrews | (b) Lobefins |
| (c) <i>Homo habilis</i> | (d) <i>Homo erectus</i> |
8. In an agricultural field there is a prevalence of the following organisms and crop diseases which are affecting the crop yield badly
 - (a) White rust
 - (b) Leaf and stripe rust
 - (c) Black rot
 - (d) Jassids

11. (a) List the three stages the annuals and biennial angiosperms have to pass through during their life cycle.
- (b) List and describe any two vegetative propagules in flowering plants.
12. Draw a labelled diagrammatic sectional view of a human seminiferous tubule.
13. During a medical investigation, an infant was found to possess an extra chromosome 21. Describe the symptoms the child is likely to develop later in the life.
14. A number of passengers were severely burnt beyond recognition during a train accident. Name and describe a modern technique that can help in handing over the dead to their relatives.



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CBSE Chapterwise-Topicwise Solved Papers Series

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15. $p^2 + 2pq + q^2 = 1$. Explain the algebraic equation on the basis of Hardy Weinberg's principle.

16. (a) What precaution(s) would you recommend to a patient requiring repeated blood transfusion?

(b) If the advise is not followed by the patient, there is an apprehension that the patient might contract a disease that would destroy the immune system of his/her body. Explain with the help of schematic diagram only how the immune system would get affected and destroyed.

17. (a) What is inbreeding depression?

(b) Explain the importance of "selection" during inbreeding in cattle.

18. Describe how do 'flocs' and 'activated sludge' help in sewage treatment.

19. Explain the role(s) of the following in Biotechnology :

- (a) Restriction endonuclease
- (b) Gel-electrophoresis
- (c) Selectable markers in pBR322.

20. Write the steps you would suggest to be undertaken to obtain a foreign-gene-product.

21. Why do lepidopterans die when they feed on Bt cotton plant? Explain how does it happen.

22. (a) 'in-situ' conservation can help endangered/threatened species. Justify the statement.

OR

(b) Name and describe any three causes of biodiversity losses.

SECTION - D

23. Public all over India is very much concerned about the deteriorating air quality in large parts of North India. Alarmed by this situation the Resident's Welfare Association of your locality organised an awareness programme entitled "Bury not burn". They invited you, being a biology student to participate.

(a) How would you justify your arguments that promote burying and discourage burning? (Give two reasons)

(b) With the help of flow charts, one for each practice depict the chain of events that follow.

SECTION - E

24. Read the following statement and answer the questions that follow : "A guava fruit has 200 viable seeds."

(a) What are viable seeds?

(b) Write the total number of :

- (i) Pollen grains
 - (ii) Gametes
- in producing 200 viable guava seeds.

(c) Prepare a flow-chart to depict the post-pollination events leading to viable-seed production in a flowering plant.

OR

(a) Arrange the following hormones in sequence of their secretion in a pregnant woman.

(b) Mention their source and the function they perform.
hCG; LH; FSH; Relaxin

25. State and explain the "law of independent assortment" in a typical Mendelian dihybrid cross.

OR

(a) How do the observations made during moth collection in pre- and post-industrialised era in England support evolution by Natural Selection?

(b) Explain the phenomenon that is well represented by Darwin's finches other than natural selection.

26. (a) What is an age-pyramid?

(b) Name three representative kinds of age-pyramids for human population and list the characteristics for each one of them.

OR

Discuss the role of healthy ecosystem services as a pre-requisite for a wide range of economic, environmental and aesthetic goods and services.

SOLUTIONS

1. Government of India imposed strict conditions for MTP because it is being misused for sex determination and illegal abortions of female fetuses. It may lead to the death of many women.

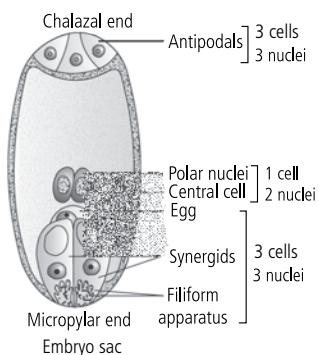
2. A pair of autosomes get segregated by means of meiotic division and produce haploid gametes during gametogenesis.

3. According to the Darwin's theory of natural selection, an individual organism would lead to evolution of new species as it adds variations by random mating and nature selects the fittest organism, resulting in inheritance of useful variations and evolution of new species.

4. To ensure anamnestic or secondary immune response, dead or attenuated pathogens of a disease can be injected into a healthy person that can produce memory cells i.e., vaccination.

5. Biopiracy is the commercial exploitation or patenting of biological resources of a nation by some other organisation or company without proper authorisation from concerned country.

6. A mature embryo sac in a flowering plant possesses 7 cells but have 8 nuclei.



7. DNA packing of eukaryotes is carried out with help of lysine and arginine rich basic proteins called histones. The unit of compaction is nucleosome. There are five types of histone proteins - H₁, H_{2A}, H_{2B}, H₃ and H₄. Four of them (H_{2A}, H_{2B}, H₃ and H₄) occur in pairs to produce histone octamer, called nu body or core of nucleosome. Their positively charged ends are towards the outside. They attract negatively charged strands of DNA. DNA over nu body forms $1\frac{3}{4}$ turns to form nucleosome core. A typical nucleosome contains 200 bp of DNA helix. DNA connecting two adjacent nucleosomes is called interbead or linker DNA. It bears H₁ histone protein. Nucleosome chain gives a bead on string appearance.

OR

- (a) Shrews-The first mammals evolved in the earth were like shrews, who existed 2,00,000 years ago. Their fossils show that they were small sized. They were viviparous, more intelligent and avoided dangers because of better senses.
- (b) Lobefins-Lobefins are fishes which were considered to be extinct 65 million years ago, until one was captured in 1938 in South Africa. They are considered living fossils as they were the first amphibians that lived both on land and water. They were ancestors of modern day frog and salamander.
- (c) *Homo habilis* - *Homo habilis* (able or skillful man, the tool maker or handyman) was the transition man, who evolved from *Australopithecus*. He lived in Africa about 2 million years ago. The teeth and bipedal locomotion were like that of modern man. *Homo erectus* evolved from them.
- (d) *Homo erectus* - *Homo erectus* appeared about 1.7 million years ago in middle pleistocene in central Java (1891). *H. erectus* evolved from *Homo habilis*. His skull was flatter than that of modern man. Also some primitive type of speech had developed and use of fire may be known.
8. Following resistant varieties of crop should be grown by the farmers to get rid of the problem of crop diseases and yield.

- (a) White rust – *Pusa Swarnim* variety of *Brassica*
- (b) Leaf and stripe – Himgiri variety of wheat
- (c) Black rot – *Pusa Shubhra*, *Pusa Snowball K-1* varieties of Cauliflower
- (d) Jassids – *Pusa Sem-3* or *Pusa Sem-2* varieties of flat beans

9. Many members of the genus *Glomus* form symbiotic associations with plants to form mycorrhiza. The fungal symbiont in these associations absorbs phosphorus from soil and passes it to the plant. Plants having such associations show other benefits also, such as resistance to root-borne pathogens, tolerance to salinity and drought, and an overall increase in plant growth and development. Therefore, *Glomus* increases the farm yield.
10. (a) Algal bloom is the excess growth of planktonic algae that causes colouration of water. It is caused due to passage of sewage and run off from fertilised fields into ponds, lakes and other water bodies. Nutrients present in sewage and fertilisers cause nutrient enrichment or eutrophication particularly with nitrogen and phosphorus. Algal blooms cut off light and oxygen for submerged plants and aquatic life causing their death. They cause deterioration of the water quality and fish mortality.
- (b) Farmers should find the alternates for fertilisers like manures and compost. Domestic or industrial wastes with organic nutrients must be treated before passing into water bodies.
11. (a) The three stages that angiosperms have to pass through are:
 - (i) Vegetative phase
 - (ii) Reproductive phase
 - (iii) Senescence phase
- (b) (i) Roots : Modified tuberous roots of sweet-potato, tapioca, yam, *Dahlia* and *Asparagus* can be propagated vegetatively when planted in soil. The buds present on the roots grow into leafy shoots above ground and adventitious roots at their bases. Adventitious buds develop on the ordinary roots of *Dalbergia sisso*, *Populus*, Guava, etc., and grow to form new plants.
- (ii) Rhizomes : Rhizomes are underground modified stem that serve as means of vegetative propagation by perennating under unfavourable conditions. They produce new aerial shoots during the favourable season. *Typha*, *Canna*, ginger, turmeric, lotus, *Saccharum*, water hyacinth and many other plants propagate vegetatively with the help of rhizomes.

For more solutions refer to **Mtg CBSE Chapterwise topicwise**.

This specially designed column enables students to self analyse their extent of understanding of specified chapters. Give yourself four marks for correct answer and deduct one mark for wrong answer. Self check table given at the end will help you to check your readiness.

- **Reproduction in Organisms**
- **Sexual Reproduction in Flowering Plants**

Total Marks : 160

Duration : 40 Min.

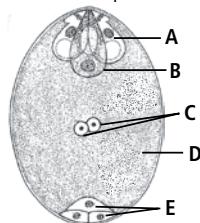


1. The type of vegetative propagation used by horticulturists to multiply trees like litchi and pomegranate is
 - (a) air layering
 - (b) trench layering
 - (c) serpentine layering
 - (d) mound layering.

2. Match the following and select the correct option.

Column I	Column II
A. Homogametes	(i) <i>Cladophora</i>
B. Dioecious	(ii) <i>Fucus</i>
C. Heterogametes	(iii) Papaya
D. Monoecious	(iv) <i>Chlamydomonas</i>
E. Zygotic meiosis	(v) Maize
(a) A-(i); B-(iii); C-(ii); D-(v); E-(iv)	
(b) A-(ii); B-(iv); C-(i); D-(v); E-(iii)	
(c) A-(iii); B-(i); C-(ii); D-(iv); E-(v)	
(d) A-(v); B-(i); C-(iv); D-(iii); E-(ii)	

3. Study the given figure of an embryo sac and select the correct option for the labelled parts A-E.



	A	B	C	D	E
(a)	Synergids	Oosphere	Polar nuclei	Central cell	Antipodal cells
(b)	Oosphere	Polar nuclei	Antipodal cells	Central cell	Synergids
(c)	Polar nuclei	Oosphere	Synergids	Nucellus	Central cell
(d)	Antipodal cells	Oosphere	Polar nuclei	Central cell	Synergids

4. Select the correctly matched pair.
 - (a) Rhizomes - *Colocasia*
 - (b) Bulbs - Garlic
 - (c) Corms - Artichoke
 - (d) Tuber - *Adiantum*
5. Which of the following is not a function of tapetum?
 - (a) It secretes enzymes like callase for degradation of callose wall around pollen tetrad.
 - (b) It produces Ubisch granules containing sporopollenin for exine formation.
 - (c) It secretes pectinase enzyme for dehiscence in the ripe anther.
 - (d) It provides nourishment for pollen grains and microspore mother cells.
6. Read the given statements.
 - (i) The division of multinucleate parent into many multinucleate daughter individuals without nuclear division is called plasmotomy.
 - (ii) Exogenous budding is observed in *Spongilla*.
 - (iii) Broken tail of lizard is replaced by epimorphosis.
 - (iv) Ephyra larvae of *Aurelia* are formed by fragmentation.

Of the above statements, the incorrect ones are

 - (a) (i), (ii) and (iv)
 - (b) (i) and (iii)
 - (c) (ii) and (iv)
 - (d) (iii) and (iv).
7. Self pollination helps in
 - (a) ensuring seed production without producing large number of pollen grains
 - (b) introducing variations and genetic recombination in the progeny
 - (c) increasing hybrid vigour
 - (d) making plants resistant to diseases.
8. In *Cucurbita*, the pollen tube enters the ovule through the _____ and is known as _____.

- (a) micropyle, mesogamy (b) integuments, mesogamy
 (c) funicle, mesogamy (d) chalaza, chalazogamy
- 9.** In ovoviparous animals
 (a) the egg remains inside the mother's body after fertilisation and placenta develops for nourishment
 (b) the mother gives birth to the young one
 (c) the mother lays unfertilised calcareous eggs
 (d) the development of the embryo takes place outside the mother's body.
- 10.** Identify the technique of grafting from the given statements.
 I. Numerous scions are selected and cut at the base to form wedges.
 II. Many slits are formed on stock.
 III. Stock has larger diameter than scions.
 IV. Scions are inserted in the slits and held by bandages.
 (a) Approach grafting (b) Crown grafting
 (c) Side grafting (d) Wedge grafting
- 11.** The type of ovule that is half inverted and at right angle to the funiculus is called
 (a) anatropous ovule (b) hemitropous ovule
 (c) circinotropous ovule (d) amphitropous ovule.
- 12.** Read the following statements and select the correct option.
Statement 1 : There is no genetic variability in vegetatively propagated plants.
Statement 2 : The plants obtained vegetatively degenerate easily as they show less adaptability to the changes in environment.
 (a) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
 (b) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
 (c) Statement 1 is true but statement 2 is false.
 (d) Both statements 1 and 2 are false.
- 13.** Match column I with column II and column III and select the correct option.
- | Column I | Column II | Column III |
|-----------------|---|-----------------------|
| A. Offset | (i) One internode long runners | p. <i>Vallisneria</i> |
| B. Runners | (ii) Slender underground branches at base of aerial stem | q. <i>Oxalis</i> |
| C. Suckers | (iii) Narrow, green, horizontal branches at the base of a crown | r. <i>Pistia</i> |
| D. Stolons | (iv) Arched horizontal branches at the base of a crown | s. Mint |
- (a) A-(i)-r; B-(iii)-q; C-(ii)-s; D-(iv)-p
 (b) A-(ii)-q; B-(i)-r; C-(iv)-p; D-(iii)-s
- 14.** Select the wrongly matched pair.
 (a) Exine - Sporopollenin
 (b) Intine - Pecto-cellulosic
 (c) Pollen mother cells - Callose
 (d) Pollenkitt - Proteins
- 15.** Read the following statements about a dicot embryo and select the option that correctly fills the blanks.
 (i) The part of embryonal axis that is present above the level of cotyledons is called _____.
 (ii) _____ is the part of embryonal axis present below the level of cotyledons.
 (iii) The root tip is called _____.
 (i) hypocotyl (ii) Epiblast (iii) calyptra
 (b) epicotyl Hypocotyl radicle
 (c) plumule Coleoptile epiblast
 (d) epiblast Epiblast calyptra
- 16.** The spores that are produced exogenously, either singly or in chains, by constriction at the tip of special hyphal branches are called
 (a) oidia (b) sporangiospores
 (c) conidia (d) chlamydospores.
- 17.** Identify the type of pollination from the given floral characteristics.
 I. Pollen grains are light, smooth, non-sticky and dry.
 II. Anthers and stigma are protruding.
 III. Flowers are small, colourless and nectarless.
 IV. Stigma is hairy and feathery.
 (a) Hydrophily (b) Anemophily
 (c) Zoophily (d) Entomophily

Spellathon

1. Make as many biological terms as possible using the given letters. Each word should contain the letter given in circle.
2. Minimum 4 letter word should be made.
3. In making a word, a letter can be used as many times as it appears in the box.
4. Make at least 1 seven letter word.



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- 18.** Which of the following is false regarding fertilisation?
- In algae and fishes, fusion of gametes occurs outside the body.
 - In internal fertilisation, mobile male gamete travels to female gamete to fuse with it.
 - Internal fertilisation occurs in gymnosperms, amphibians, birds, mammals, etc.
 - Offsprings are not protected from the predators in external fertilisation.
- 19.** Consider the given statements and select the correct option stating which statements are true (T) and which are false (F).
- Strobilation is observed in the neck of *Taenia*.
 - Estrous cycle is present in mammals like dog, cats, monkeys, etc.
 - Parthenium* is the major contributor to pollen allergy.
 - Viability of seeds can be tested by immersing the seed in 0.1% solution of triphenyl formazan.
- (i) (ii) (iii) (iv)
- | | |
|-------------|-------------|
| (a) T F T F | (b) F F T F |
| (c) T T F T | (d) F F T T |
- 20.** Pollination which involves transfer of pollen from anther of one flower to stigma of genetically different flower is called
- geitonogamy
 - cleistogamy
 - anisogamy
 - xenogamy.
- 21.** When pollen grains from another flower germinate faster than the pollen grains of the same flower over the stigma, it is called
- dichogamy
 - herkogamy
 - diincliny
 - prepotency.
- 22.** Given figures represents sporulation in various organisms.
-
- Select the option which correctly identifies A, B and C.
- | A | B | C |
|---------------------|----------------|-----------------|
| (a) Conidia | Chlamydospores | Sporangium |
| (b) Chlamydospores | Oidia | Sporangiospores |
| (c) Sporangiospores | Chlamydospores | Oidia |
| (d) Conidia | Oidia | Chlamydospores |
- 23.** Identify the type of parthenogenesis in which only females are produced.
- Arrhenotoky in mites
 - Thelytoky in lizards
 - Amphitoky in aphids
 - Arrhenotoky in honey bees
- 24.** Study the given statements and select the incorrect one.
- Testa is outer, one layered, thick covering of seed.
 - Coleorhiza protects the plumule during its emergence from soil.
 - Pericarp is unused nucellus in the seed.
 - Coleorhiza does not come out of soil and remains non-green.
- (i), (ii) and (iii) only
 - (ii) and (iv) only
 - (i), (iii) and (iv) only
 - (ii) and (iii) only
- 25.** Double fertilisation was discovered by
- Strasburger
 - Dickson
 - Charles Bonnet
 - Nawaschin.
- 26.** Identify the mismatched pair.
- Obligatory parthenogenesis - *Typhlina brahma*
 - Cyclic parthenogenesis - Turkeys
 - Artificial parthenogenesis - Star fish
 - Paedogenetic parthenogenesis - Wasps
- 27.** Which of the following statements is incorrect?
- In *Bryophyllum*, uninjured fallen leaves develops into new plants from marginal buds.
 - Turion in *Utricularia* remains dormant under unfavourable conditions and in the favourable conditions forms a new plant.
 - In *Agave*, floral buds show vegetative propagation through bulbils.
 - Stolons are arched horizontal branches that cause vegetative propagation in *Eichhornia*.
- 28.** Adventive embryony occurs when
- an embryo is haploid and formed without meiosis and syngamy
 - all embryo-sac cells including egg are diploid and can form normal embryos
 - an embryo is formed directly from diploid egg without fertilisation
 - an embryo is formed directly from a diploid cell other than egg, like integument or nucellus.
- 29.** Which of the following statements is correct about chasmogamous flowers?
- The flowers are open, exposing anthers and stigmas.
 - Flowers do not undergo self pollination.
 - The flowers remain closed and are self pollinated.
 - The anthers dehisce inside the closed flower.
- 30.** Root cuttings are used to artificially propagate
- Bougainvillea*
 - Saintpaulia*
 - blackberry
 - grapes.

- (c) bright, secrete abundant nectar and strongly scented
(d) dull coloured, odourless and secrete abundant nectar.

37. Which of the following pairs are monocarpic plants?

(a) *Strobilanthes*, Grape vine
(b) Rice, China rose
(c) *Bambusa*, Orange
(d) Carrot, Wheat

38. Read the given statements and select the correct option.

Statement 1 : In *Salvia*, a lever-mechanism promotes cross pollination.

Statement 2 : *Salvia* has protandrous and anemophilous flowers.

(a) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
(b) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
(c) Statement 1 is true but statement 2 is false.
(d) Both statements 1 and 2 are false.

39. Refer to the given table about transformation of flower parts and select the option that correctly fills the blanks in it.

39. Refer to the given table about transformation of flower parts and select the option that correctly fills the blanks in it.

Pre-fertilisation	Post-fertilisation
Micropyle of ovule	A
B	Pericarp
Outer integument	C
Nucellus	D

	A	B	C	D
(a)	Perisperm	Ovary wall	Perisperm	Tegmen
(b)	Micropyle of seed	Ovule	Perisperm	Disappear
(c)	Micropyle of seed	Ovary wall	Testa	Perisperm
(d)	Thalamus	Ovule	Testa	Disappear

40. If the numbers of chromosomes in the aleurone layer of a seed is 60, what must have been the number of chromosomes present in megasporangium?

 - (a) 30
 - (b) 20
 - (c) 10
 - (d) 40

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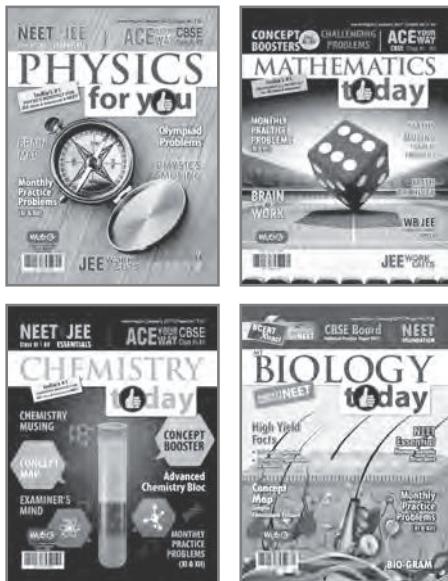
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