MODEL PAPER – 2

Time : 3 Hours + 15 Minutes] **[Total Mar ks : 70**

Instructions to the Candidates :

1. Candidates are required to give their answers in their own words as far as practicable.
2. Figures in the right hand margin indicate full marks.
3. 15 minutes of extra time has been allotted for the candidate to read the questions carefully.
4. This question paper is divided into two sections : **Section–A** and **Section–B**.
5. In **Section–A**, there are **70 Objective Type Questions**, out of which only 35 objective questions be answers. Darken the circle with blue/black ball pen against the correct option on OMR Sheet provided to you. Do not use **Whitener/Liquid/Blade/Nail** on OMR Paper, otherwise the result will be invalid.
6. In **Section–B**, there are **20 Short Answer Type Questions** (each carrying 2 marks), out of which any 10 questions are to be answered. Apart from this, there are **6 Long Answer Type Questions** (Each carrying 5 Marks), our of which any 3 of them are to be answered.
7. Use of any electronic device is prohibited.

SECTION – A : Objective Type Questions

Directions : *There are 70 Objective Type Questions, out of which only 35 objective questions to be answered. For each question, mark the correct option on the answer sheet.*

35 × 1 = 35

1. The term 'parthenogenesis' was coined by :
   (A) Boveri (B) Owen
   (C) Sutton (D) Johansson
2. Orthotropous ovule is found in which of the following ?
   (A) Polygonum (B) Pisum sativum
   (C) Solanum nigrum (D) Helianthus annuus
3. Genital warts are due to STD spread by :
   (A) Hepatitis A (B) Herpes virus
   (C) Papilloma virus (D) Trichomonas
4. Autopolyploidy can be induced artificially by :
   (A) Colchine (B) Chloroform
   (C) Colchicine (D) Chloroquine
5. Which form of RNA has a structure resembling clover leaf ?
   (A) *m*RNA (B) *r*RNA
   (C) *hn*RNA (D) *t*RNA
6. The antibodies in the blood are secreted by :
   (A) Monocytes (B) Neutrophils
   (C) Lymphocytes (D) Basophils
7. Fowl pox is caused by :
   (A) Bacteria (B) Ectoparasites
   (C) Virus (D) Endoparasites
8. In genetic engineering the antibiotics are used :
   (A) to select healthy vectors
   (B) as selectable markers
   (C) to keep the cultures free of infection
   (D) Both (A) and (C)
9. Biogeochemical cycling means :
   (A) Cycling of water
   (B) Cycling of energy in a ecosystem
   (C) Cycling of nutrients in an ecosystem
   (D) Cycling of gases between plants and the atmosphere
10. Manas Sancutuary is located in :
    (A) Assam (B) Bihar
    (C) Gujarat (D) Rajasthan
11. Which is always present in photochemical smog ?
    (A) CO_2 (B) O_3
    (C) SO_2 (D) CH_4
12. Among the following which type of fruit Cashewnut is ?
    (A) True (B) Berry
    (C) Nut (D) All
13. Fertilization outiside the body is known as :
    (A) In-vitro (B) In-vivo
    (C) Both 'A' and 'B' (D) None of these
14. Gametes are usually :
    (A) Haploid (B) Diploid
    (C) Polyploid (D) Nulliploid
15. Which of the following is absent in animal cell?
    (A) Chloroplast (B) Mitochondria
    (C) Ribosome (D) Golgibody
16. Entemophily takes place (pollination) by :
    (A) By Bird (B) By Bat
    (C) By Wind (D) By Insect
17. Which one forms endosperm after fusion with male gamete ?
    (A) Oosphere (B) Synergids
    (C) Antipodals (D) Secondary nucleus
18. Central cell of embryo sac is :
    (A) Primary nucleus (B) Secondary nucleus
    (C) Synergid (D) Both 'A' and 'B'
19. Anatropous ovule is :
    (A) Erect (B) Inverted
    (C) Oblique (D) None of these
20. The sperm penetrates through zona pellucida with the help of :
    (A) Secretion from acrosome (B) Hydrolytic enzymes
    (C) Neck with centroids (D) Both 'A' and 'B'
21. Semen is frozen in :
    (A) liquid nitrogen (B) refrigerator
    (C) ice (D) all of these

22. The anterior portion of sperm is covered by a cap like structure known as :
(A) Acrosome (B) Mesosome
(C) Episome (D) Spherosome

23. Sertoli cells are found in :
(A) Testis (B) Uteres
(C) Ovary (D) Liver

24. 'ABO' blood group in human beings shows :
(A) incomplete dominance (B) multiple allele
(C) co-dominance (D) both 'B' & 'C'

25. Mendel proposed :
(A) law of linkage (B) 10% energy law
(C) laws of inheritance (D) none of these

26. First geneticist/father of genetics was :
(A) de Vries (B) Mendel
(C) Darwin (D) Morgan

27. Chromosome number in human being (male) is :
(A) 44 + xx (B) 44 + xy
(C) 46 + xy (D) 46 + xx

28. Lac operon represent :
(A) Inducible gene system (B) Represssible gene system
(C) Housekeeping gene system (D) All of these

29. Which type of the nitrogenous bases of Purine occur in DNA and RNA ?
(A) Adenine (B) Guranine
(C) Both 'A' and 'B' (D) Cytosine

30. Gene for hypertrichosis (having pinna) is present on :
(A) *X*-chromosome (B) *Y*-chromosome
(C) Sex chromosome (D) Autosome

31. Crossing over takes place in :
(A) Zygotene (B) Leptotene
(C) Pachytene (D) Metaphase

32. Operon model was proposed by :
(A) Watson and crick (B) Nirenberg
(C) Jacob and Monad (D) none of them

33. Amplification of gene for interest may be done by :
(A) MMR (B) PCR
(C) MRI (D) All of these

34. Uracil is related to :
(A) RNA (B) DNA
(C) Both 'A' and 'B' (D) None of these

35. DNA is genetic material of :
(A) T.M.V. (B) Bacteriophage
(C) 'A' and 'B' both (D) None of these

36. Bio reactors provide optimal conditions to produce desired :
(A) Product (B) Organism
(C) Medium (D) All of these

37. Echidna is :
(A) Connecting link (B) Vestigial organ
(C) Extinct link (D) None of these

38. Theory of Inheritane of acquired characters was given by :
(A) Darwin (B) Lamarck
(C) de-Vries (D) Haeckel

39. Which infective stage of plasmodium occurs in man ?
(A) Sporozoite stage (B) Merozoite stage
(C) Criptozoite stage (D) None of these

40. HIV attacks which of the following cells ?
(A) B cell (B) T cell
(C) Epithelial cell (D) T helper cell

41. Increased skin cancer and high mutation rate are due to :
(A) acid rain (B) ozone depletion
(C) CO pollution (D) CO_2 pollution

42. The substances to which an immune response is produced are called :
(A) Allergens (B) Vaccines
(C) Antibodies (D) Antigens

43. What happens, which the regular dose of Alcohol is stopped ?
(A) Expression of withdrawl syndrome
(B) Non functioning of liver
(C) Over all improvement of health in person
(D) All of these

44. Common cold is caused by :
(A) Retro virus (B) Phage virus
(C) Rhino virus (D) Sendai virus

45. HIV that causes AIDS, first starts destroying :
(A) Helper T-lymphocytes (B) B-lymphocytes
(C) Leucocytes (D) Thrombocytes

46. Acita bularia is a type of :
(A) Algae (B) Protozoa
(C) Bacteria (D) Virus

47. Chlorella is an example of :
(A) Single cell Protein (B) Algae
(C) Both 'A' and 'B' (D) Cyanobacteria

48. Which of the following is abundantly present in 'Golden rice' ?
(A) Thymine (B) Folic Acid
(C) B-Carotene (D) Riboflavin

49. Cry IAb controls :
(A) Corn Borer (B) Wheat Rust
(C) Cotton insects (D) Maize height insects

50. Which of the following is not included in animal husbandry?
(A) Bee-keeping (B) Poultry farming
(C) Fish farming (D) Organic farming

51. Which can perform the main role in Biological nitrogen fixation ?
(A) Nostoc (B) Anabaena
(C) Blue-green algae (D) All of these

52. The bacteria found in the root modules of leguminous plants are :
(A) Rhizobium (B) Azotobacter
(C) Staphylococcus (D) Lactobacillus

53. Probiotics are :
(A) New kind of food allergens
(B) Safe antibiotics
(C) Live microbial food supplement
(D) Cancer inducing microbes

54. Which of the following microbes is a proteinacious infectious agent ?
(A) Fungi (B) Prions
(C) Bacteria (D) Protozoa

55. Which of the following are single cell protein ?
(A) Spirulina (B) Chlorella
(C) Scenadesmus (D) All of these

56. 'GAATTC' is the recognition site for which of the following ?
(A) Eco RI (B) Eco RII
(C) Hind II (D) Bam HI

57. Which Bacterium is used in formation of curd from milk ?
(A) Clostridium (B) Lactobacillus
(C) 'A' and 'B' both (D) Streptococcus

58. Which vitamin is found in golden rice ?
(A) B_{12} (B) A
(C) D (D) C

59. Lac operon represent :
(A) Inducible gene system
(B) Represssible gene system
(C) Housekeeping gene system
(D) All of these

60. 'Cry gene' prevents which crop from bollworms ?
(A) Cotton (B) Mango
(C) Tea (D) Wheat

61. Cry IAb controls :
(A) Corn Borer (B) Wheat Rust
(C) Cotton insects (D) Maize height insects

62. Climax community is present in which area ?
(A) In equilibrium (B) In transition
(C) Bare land (D) None of these

63. Appearance of antibiotic resistance bacteria is an example of :
(A) Adaptive radiation (B) Transduction
(C) Pre existing variation (D) Divergent evolution

64. Water holding capacity is one of the qualities of :
(A) Soil (B) Plants
(C) Water (D) Animals

65. Kaziranga National Park is famous for :
(A) Birds (B) Monkey
(C) Deer (D) Rhinoceros

66. Which one of the following has maximum genetic diversity in India :
(A) Tea (B) Teak
(C) Mango (D) Wheat

67. Rhino sanctuary is located in which state?
(A) Assam (B) West Bengal
(C) Uttar Pradesh (D) Bihar

68. Which of the following is not a green house gas ?
(A) Methane (B) Chlorofluorocarbon
(C) CO_2 (D) Nitrogen

69. Pollution of SO_2 destroys :
(A) Lichen (B) Fungi
(C) Algae (D) Fishes

70. Lichens are the indicators of :
(A) water pollution (B) air (SO_2) pollution
(C) soil pollution (D) all of these

SECTION – B : Non-Objective Type Questions

SHORT ANSWER TYPE QUESTIONS

Directions : *Questions Nos. 1 to 20 are of short answer type. Each question carries 2 marks. Answer any ten questions of them in 50 words.* 10 × 2 = 20

1. **What do you understand by sarcoma ?**
2. **What is addiction ?**
3. **What do you understand by Bt-cotton ?**
4. **Discuss the advantages of GMO.**
5. **What do you mean by Sound pollution ? Write its all effects.**
6. **What is Greenhouse Effect ? Define it.**
7. **What are domestic pollutants ? Describe with examples.**
8. **Define Phosphorus Cycle.**
9. **Distinguish between asexual and sexual reproduction with the help of suitable example.**
10. **Write about false fruit with examples.**
11. **Define monocarpic fruits with examples.**
12. **Describe about the hazards of transgenic animal.**
13. **Describe Protoplast Culture.**
14. **What is parthenogenesis ?**
15. **Name two basic processes involved in sexual reproduction.**
16. **Draw well labelled diagram of male reproductive system.**
17. **What is point mutation ? Give one example.**
18. **What is sterilisation? Explain methods of sterilisation.**
19. **Write the name of any four antibiotics produced by bacteria.**
20. **Define the term disease. Differentiate between infectious and noninfectious diseases.**

LONG ANSWER TYPE QUESTIONS

Directions : *Questions Nos. 21 to 26 are Long Answer Type Questions. Answer any 3 of them in 120 words.* 3 × 5 = 15

21. **What do you understand by vaccination and immunization?**
22. **Define Gene Therapy.**
23. **Explain the effects of climatic factors on population.**
24. **What is Spermatogenesis ? Give a brief account of Spematogenesis.**
25. **Describe the structure of DNA molecules.**
26. **What do you mean by sewage ? Describe the role of microbes in sewage treatment.**

ANSWER WITH EXPLANATION

SECTION – A

OMR ANSWER-SHEET

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

ANSWER

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

SECTION – B

1. Sarcoma is type of cancer that begins in bone or in the soft tissues of the body, including cartilage, fat, muscle, blood vessels, fibrous tissue, or other connective of supportive tissue. Different types of sarcoma are based on where the cancer forms.

2. It is the physical and mental dependence of the body on the certain substances like drugs. Initially, people use to take these substances to get mental relaxation and to escape from the realities of life. Generally, they become dependent upon them and they cannot live without their daily use. Thus, addiction to smoking, drinking and drugs has been found in these persons who are unable to adjust themselves to the stresses and strains of life. However, addiction ultimately leads to several complicacies like tobacco addiction causes lung and mouth cancer, bronchitis, emphysema and ulcers. Similarly, drug addiction leads to mental and moral deterioration, convulsions, paralysis and even death. Any how, addiction can be overcome under medical supervision and by the support of the society.

3. **BT-cotton**—BT-cotton is type of cotton. Bt gene was isolated and transferred from a bacterium bacillus thurigiensis to American cotton. The Bt-cotton variety contains a foreign gene obtained from bacillus thuringiensis. This bacterial gene, introduced genetically into the cotton seeds. Protects the plant from bolloworm (A lepid optora), a major pest of cotton. The worm feeding on the leaves of a BT cotton plant becomes lethargic and sleepy thereby causing less damage to plant.

4. **Advantages of GMO :**
   (i) GMO food crops have shorter growing cycles, greater resistance to both insects and disease, higher yields and higher nutritional value.
   (ii) GMO animals have increased production and with high nutritive value as well. For example, dairy cows may produce more milk.
   (iii) The World Health Organisation or WHO, claims that GMO plants and animals may allow food prices to drop while food sources become more abundant.

5. **Sound Pollution**—The unwanted sound which is released into the environment. It disturbs the human being and cause an adverse effect on the mental and psychological well being. It is measured in the unit of decibels and is denoted by dB.
   Effects of Sound Pollution :
   (i) Exposure to the harm full noise can cause damages to our most important organs of our bodies ear.
   (ii) It is main sources of cardiovascular disease.

6. Certain gases in the atmosphere play an important role in maintaining an average temperature conducive for life, near the surface of the Earth. This is called greenhouse effect. The gases like CO_2, NO_2, CH_4, O_3, chlorofluorocarbons (CFCs)

and water vapour act like a glass sheet in a green house, hence these are called **greenhouse gases.** The solar radiation that falls on Earth's surface heats it up. Earth's surface re-emits heat in the form of infrared radiation but part of this does not escape into space, as atmospheric gases (carbon dioxide, methane, etc.) absorb a major fraction of it. The molecules of these gases radiate heat energy, directing a major part of it again towards Earth's face, thus heating it up once again.

7. Domestic or household pollutant are contaminates that are released during the use of varies products in daily life. Many household products like detergents, furniture polish, deodorizers etc. release chemicals that may be harmful to human health.

   Domestic pollution is the pollution caused to the earth by domestic use sewage originating primarily from kitchen, bathroom and laundry sources. Waste from food preparation, dishwashing, garbage, toilets, baths, showers and sinks etc.

8. **Phosphorus Cycle**—Phosphorus is a major constituent of biological membranes, nucleic acids, cellular energy transfer systems (ATP) and also of shells, bones and teeth. The natural reservoir of phosphorus is rock, which contains phosphorus in the form of phosphates. When rocks are weathered, minute amount of these phosphates dissolve in soil solution and are absorbed by the roots of the plants. Herbivores and other animals obtain this element from plants. The waste products and the dead organisms are decomposed by phosphate solubilising bacteria releasing phosphorus.

9. **Difference between Asexual and Sexual reproduction :**

Asexual Reproduction	Sexual Reproduction
(i) It occurs in lower invertebrates.	(i) It occurs almost in all types of animals and mostly in higher plants.
(ii) It is always uniparental.	(ii) It is usually biparental.
(iii) Gametes are not formed.	(iii) Gametes are always formed.
(iv) There is no fertilization.	(iv) Fertilization take places.
(v) It involves only mitosis.	(v) It involves both meiosis and mitosis.
(vi) Young ones are genetically identical to the parent.	(vi) Young one differ genetically from the parents.
(vii) Multiplication occurs rapidly. Since there is no variation, so it does not contribute to evolution of the species.	(vii) Multiplication is not so rapid as an asexual reproduction. Since there are variations, so it contributes to evolution of the new species.
(viii) Eg. Bacteria, Fungi, Protozoa etc.	(viii) Eg. Human being, Angiospermic plants etc.

10. **False fruit**—A false fruit is that which is not formed from the ovary of a flower. Apple is a false fruit. The hard core inside the ovary, but the stuff that we usually eat is the Fleshy Thalamus. It is derived from an inferior ovary. Sometime it is also called pseudo fruit.

11. **Monocarpic fruits**—Monocarpic fruit is that fruit which is produced only once carpic plant. After that plant dies. **Examples**—Banana, Fruit of Banana etc.

12. **The hazards of transgenic animals :** Transgenetical animals contain certain risks. Some of them are as follows :
   (i) Genetic contamination.
   (ii) Increased selection pressure on target and new target organism.
   (iii) Ecosystem impacts.
   (iv) Horizontal transfer of recombinant genes to other micro-organisms.

13. **Protoplast Culture :** Protoplast are the naked plant cells whose cell wall is dissolved by enzymes cellulose and pectinase. Protoplasts can be isolated from leaves, callus, suspension cultures and from pollen grains. These can be grown on agar containing nutrients.

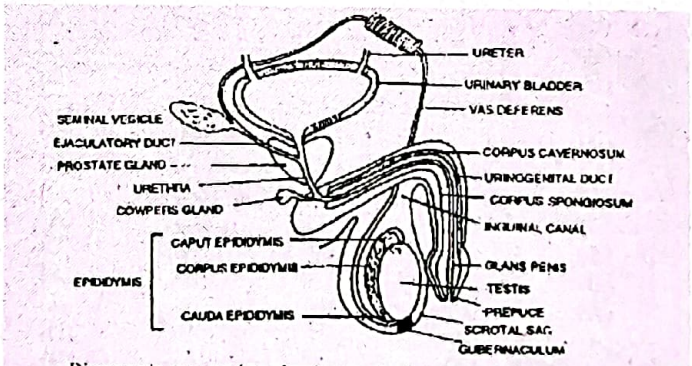
   The protoplast culture is used by the following purposes:

   Somatic cell Hydridisation : A hybrid produced by the fusion of somatic cells of two varieties or species is called somatic hybrid. The process of producing somatic hybrids is called somatic hybridization. In plants, this is achieved by protoplast fusion.
   (i) Production of hybrids between species that cannot be produced by sexual hybridization.
   (ii) Gene transfer and formation of transgenic plants.
   (iii) Transfer of cytoplasm.
   (iv) Production of allotertraploids.

14. Parthenogenesis is the development of an unfertilized ovum into a fully formed haploid organism. It is monoparental i.e. honey bees, wasps, aphids. The offsprings thus produced are exactly similar to the parents. It permits triploid and aneuploid chromosomal combination. At the same time it stops the chances of new combinations of genes.

15. Two basic processes involved in sexual reproduction are :
   (i) **Gametogenesis :** It involves the formation of haploid gametes (sperms and ova) in the primary sex-organs called gonads.
   (ii) **Syngamy :** Syngamy (fertilization) involves the complete and permanent fusion of two haploid gametes to form a diploid zygote.

16.



Diagramatic presentation of male reproductive system (side view)

17. It is the abrupt change in gene structure due to change in a single base pair of DNA due to inversion and substitution, without changing the reading of subsequent bases. A classical example of such mutation is sickle cell anaemia. In this there is a single base change at the chain of haemoglobin where glutamic amino acid is changed to *y* valine.

18. Surgical methods are called sterilisation. Sterilisation are generally advised for the male/female partner as a terminal method to prevent any more pregnencies. Surgical intervantion blocks gamete transport and thereby prevent conception. Sterilisation procedure in the male is called 'vasectomy' and that in the female 'tubectomy'.

19. Name of antibiotics obtained from bacteria :

Antibiotics	Sources
(i) Tetracycline	S. qureofaciens
(ii) Chloromycetin	Streptomyces Venuzulae
(iii) Fry thromycin	S. erytheracos
(iv) Streptomycin	S. griseus

20. **Disease**—It is the condition where malfunctioning of body organs occurs leading to uneasiness and discomfort.

Infectious diseases are those which are easily transmitted from one person to another. These diseases are very common and every one suffers from these one time or the other examples are AIDS, common cold, typhoid etc.

Non-infectious diseases remain restricted to the person who are suffering from these and are not easily transmitted from one person to the another person to another e.g. cancer.

21. Vaccination and immunisation both are same. Our body have a natural defence against infection. This is called immunity when we get an infection, our bodies produce chemicals called antibodies to fight it. In same way, vaccination works by exposing our body to an infection so that we develop immunity to it. Some vaccination are given orally, other by injection an we get immunised. There are three type of vaccination; Primary immunisation, Booster immunisation and Mass immunisation. Immunisation develops due to formation of memory cells by the immune system. When a vaccinated person receives an injected dose of the pathogen, the existing memory T or B cells recognises the antigen and induce massive formation of antibodies for elimination of invadens.

22. Gene Therapy :

(i) It is a replacement of a defective or absent gene with normal healthy ones to correct a genetic disorder.

(ii) The first clinical gene therapy was given in 1990 to a 4 years old girl with adenosine deaminase (ADA) deficiency, caused due to the deletion of the gene coding for this enzyme. This causes inability to break down adenosine resulting in accumulation of a reaction product which is toxic to lymphocytes. Without functional lymphocytes immune system cannot fight infections and results in Serve Combined Immune Deficiencies (SCID).

(iii) Gene therapy is used to correct ADA deficiency as follows :

(a) Lymphocytes are isolated from the blood or bone marrow of the patient and grown in a culture outside the body.

(b) A normal ADA gene is isolated from normal cells.

(c) This normal functional ADA gene is then introduced into the cultured lymphocytes, which are subsequently returned to the patient.

(iv) These cells have a limited life, so the patient requires repeated infusion of such genetically engineered lymphocytes.

However, if the gene isolate from marrow cells producing ADA is introduced into the cells at early embryonic stages, it could be a permanent cure.

23. Climate change has brought effect on population as :

(a) Effect on man : It is detrimental to human health causing major respirary disorders. Fever, asthma and bronchitis are caused due to air pollution.

(b) Effects on animals : The crops are sometimes contained with metallic pollutants, such as lead arsenic and molybdenum and thermal power plants area due to air pollution. The domestic animal fleeding on contaminated fodder suffer from different diseases.

(c) Effects of plants : Plants are affected by various air pollutant excessive sulphur dioxides make the cell inactive and finally are killed.

(d) Effect on material and atmosphere sulphur dioxide with water produces sulphurous and sulphuric acid that are extremely corrosive. Increase in carbon dioxide concentrain, increases the temperature of the earth. Depletion of ozone layer due to fluoro carbon of aerosol causes the exposure of ultra violet radiation which is lethal.

24. Spermatogenesis—The process of formation of spermatogoa from the spermatogonia in the male gonad, testis is called spermatogenesis. In it the geminal cell (spermatogonial cell) of testis form spermatogonia (2N). Some of these remain as stem cell (spermatogonia A-type). Some other differentiate into

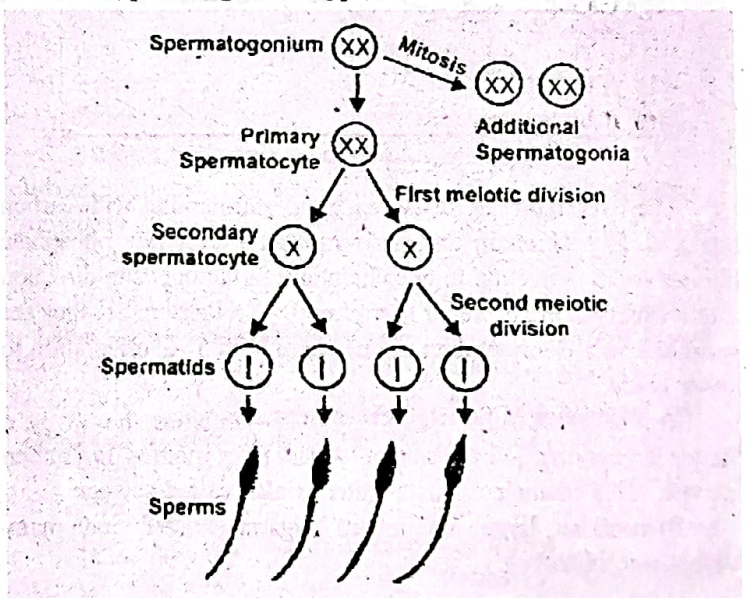


Fig. Spermatogenesis

progenitor cells (spermatogonia B-type) after maturation into primary spermatocytes (2N). The primary spermatocytes undergo meiosis to form four spermiotids which are transformed into sperma-tozoa by spermiogenesis. There are three stages of spermatogenesis followed by spermiogenesis.

(i) Multiplication phase

(ii) Growth phase

(iii) Maturation phase

Spermatogenesis occurs in the seminiferous tubules of testis.

25. DNA is a double stranded structure and one strand coils around the other and gives it a helical structure. DNA is formed of number of nucleotides units. Each nucleotide has a base, a pentose sugar (deoxyribose) and inorganic phosphate. There are two double ring purine bases called adenine (A) and guanine (G) and two single ring pyrimidine, cytosine (C) and the thymine (T) Adenine of one strand of DNA always pairs with thymine of another strand by two hydrogen bonds; guanine pairs with cytosine by three hydrogen bonds. Each nitrogeneous base is linked to the pentose sugar through a N-glycosidic linkage to form a corresponding nucleoside. When a phosphate group is linked to 5'—OH of a nucleoside through phosphoester linkage, a corresponding nucleotide (depending upon the type of sugar present) is formed.

The nucleotides are linked together through 3'-5' phosphodiester linkage between the phosphate group of one nucleotide and the sugar of the next to form a long polynucleotide chain. The sugar and phosphate form a backbone from which the bases project.

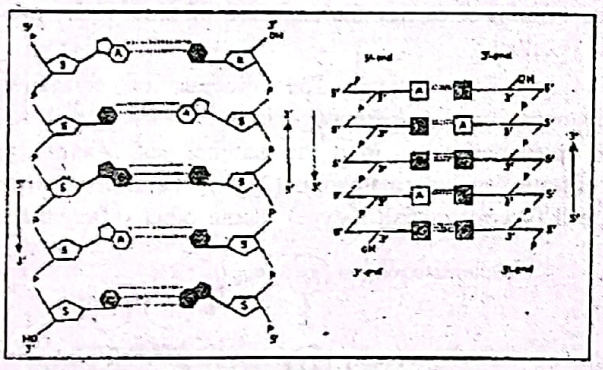


Fig : Molecular structure of DNA

The two chains of DNA run in an anti-parallel with carbon atom at 5' position in the sugar molecule with free phosphate moiety in one direction in one chain and in the opposite direction in the other chain i.e., sugar has a free 3'—OH group. So, they are assigned as 5'-3' orientation in one chain with 3'–5' orientation in other chain.

26. Microbes in Sewage Treatment—In cities and towns, a major component of the waste water from homes is human excreta. This municipal waste-water is also called sewage.

It contains large amount of organic matter and many pathogenic microbes.

That is why before disposal, it needs to be treated in Sewage treatment Plants (STPs) to make it less polluting.

Treatment of waste water is done by the heterotrophic microbes (bacteria, fungi, Protozoa, rotifers, etc.) naturally present in the sewage. This treatment is carried out in two stages.

(i) Primary treatment—It involves physical removal of particles, large and small-from the sewage through filtration and sedimentation.

All solids that settle down, form the primary sludge and the supernatant forms the effluent.

The effluent from the primary settling tank is taken for secondary treatment.

(ii) Secondary treatment or Biological treatment—The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it.

This allows vigorous growth of naturally present useful aerobic microbes into flocks (big clumps of bacteria associated with fungal filaments to form mesh like structures).

While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD (Biochemical Oxygen Demand) of the effluent (BOD refers to the amount of the oxygen that would be consumed, if all the organic matter in one litre of water were oxidised by bacteria).

The BOD test measures the rate of uptake of oxygen by microorganisms in a sample of water. BOD is a measure of the organic matter present in the water. The greater the BOD of waste water. More is its polluting potential.

The sewage water is treated till the BOD is reduced significantly.

The effluent is then passed into a settling tank where the bacterial 'flocks' sediment. This sediment is called activated sludge as it contains active microbes.

From here :

(a) A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum.

(b) The effluent from the secondary treatment plant is generally released into natural water bodies like rivers and streams.

(c) The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here lack of oxygen kills the aerobic bacteria and they are digested along with the other biomass by anaerobic bacteria and fungi.

During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas which is inflammable and therefore can be used as fuel.

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