**Class: XII**
**SESSION : 2022-2023**
**SUBJECT: BIOLOGY (044)**
**SAMPLE QUESTION PAPER - 7**
**with SOLUTION**

**Maximum Marks: 70** **Time: 3 hours**

**General Instructions:**

*(i) All questions are compulsory.*
*(ii) The question paper has five sections and 33 questions. All questions are compulsory.*
*(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.*
*(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.*
*(v) Wherever necessary, neat and properly labeled diagrams should be drawn.*

## Section A

1. The flora and fauna in lakes or ponds are: **[1]**

a) Lotic biota
b) Abiotic biota
c) Lentic biota
d) Field layer

2. Acrosome of spermatozoa is formed from: **[1]**

a) Golgi bodies
b) ER
c) Mitochondria
d) Ribosome

3. What is correct about the test-tube baby? **[1]**

a) Fertilization inside female genital tract and growth in test tube
b) Both fertilization and development are effected outside the female genital tract
c) Fertilization outside and gestation inside the womb of the mother
d) Rearing of prematurely bom baby in incubator

4. New Wild Life Protection Act was passed in: **[1]**

a) 1987
b) 1962
c) 1972
d) 1982

5. Why are flocs important in biological treatment of waste water? **[1]**

a) Microbes present in flocs consume the major part of the organic matter in the effluent
b) Form components of activated sludge

c) Significantly reduces the BOD (Biochemical Oxygen Demand) of the effluent

d) All of these

6. How has the discovery of antibiotics helped mankind in the field of medicine? **[1]**

a) Antibiotics have greatly improved our immunity to fight any diseases

b) Antibiotics have greatly improved our capacity to treat deadly diseases

c) All of these

d) Antibiotics have greatly improved our immunity to fight viral diseases

7. Match List I with List II and select the correct answer using the codes given below the list: **[1]**

| **List I (peculiarity of male determining sperm** | **List II (Organism in which it is seen** |
|---|---|
| (A) No sperm is needed at all | (1) Grasshopper |
| (B) Necessarily with a Y -chromosome | (2) Honeybee |
| (C) With haploid set of autosomes | (3) Birds |
| (D) With W -chromosome | (4) Drosophilia |
| | (5) Human |

a) A-5, B-2, C-4, D-3

b) A-2, B-1, C-3, D-4

c) A-2, B-5, C-1, D-3

d) A-3, B-5, C-1, D-4

8. Hardy-Weinberg principle states that allele frequencies in a population are stable and is: **[1]**

a) Varies from generation to generation

b) Constant up to second generation

c) Constant from generation to generation

d) Constant for the second generation

9. Precisely, the two helices of DNA are held together by: **[1]**

a) Both Hydrophobic interaction and H-bond

b) Phosphodiester bond

c) H-bond only

d) Hydrophobic interaction only

10. To produce copies in billions of a DNA segment, the number of times PCR should be done is: **[1]**

a) 5 times

b) 28-32 times

c) 10 times

d) 15 times

11. A good producer of citric acid is: **[1]**

a) Aspergillus
b) Pseudomonas
c) Saccharomyces
d) Pseudomonas

12. Which of the following cannot be detected in a developing foetus by amniocentesis? **[1]**

a) Klinefelter syndrome
b) Down syndrome
c) Jaundice
d) Sex of the foetus

13. **Assertion (A):** A recessive character that was not expressed in heterozygous condition may be expressed again when it becomes homozygous. **[1]**
**Reason (R):** The characters never blend in heterozygous condition.

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

14. **Assertion (A):** Pollen grains are well preserved as fossils. **[1]**
**Reason (R):** Sporopollenin present in exine of seeds.

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

15. **Assertion:** Micro-organisms such as Lactobacillus and others commonly called Lactic Acid Bacteria (LAB) grow in milk and convert it to curd. **[1]**
**Reason:** During growth, the LAB produces acids that coagulate and partially digest the milk proteins.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
c) Assertion is correct statement but reason is wrong statement.
d) Assertion is wrong statement but reason is correct statement.

16. **Assertion (A):** Darwin's finches show a variety of beaks suited for eating large seeds, flying insects and cactus seeds. **[1]**
**Reason (R):** Ancestral seed-eating stock of Darwin's finches radiated out from South America mainland to different geographical areas of the Galapagos Islands, where they found competitor-free new habitats.

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

## Section B

17. Name the disorder for which the first clinical gene therapy was conducted. **[2]**

18. List the specific symptoms of pneumonia. Name the causative agent. **[2]**

19. Are the thorns of Bougainvillea and tendrils of cucurbita homologous or analogous? What type of evolution has brought such a similarity in them? **[2]**

20. Name the respective pattern of inheritance where $F_1$ phenotype: **[2]**
(a) does not resemble either of the two parents and is in between the two
(b) resembles only one of the two parents.

21. What are viruses parasitizing bacteria called? Draw a well-labelled diagram of the same. **[2]**

OR

Find out the role of microbes in the following and discuss it with your teacher.

a. Single cell protein (SCP)

b. Soil

## Section C

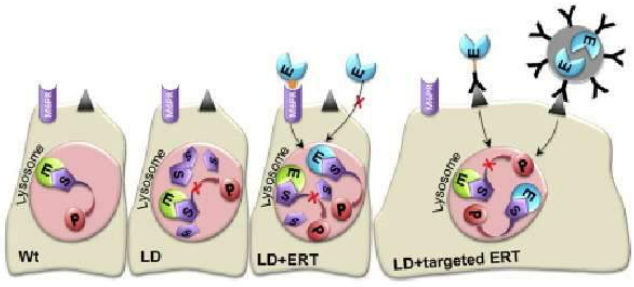
22. Differentiate between intraspecific and inter specific competition. **[3]**

23. Write a short note on function of an ecosystem. **[3]**

24. Differentiate between Dominant gene and Recessive gene. **[3]**

25. What are various oral contraceptive used? How do they function? What is the advantage of Saheli? **[3]**

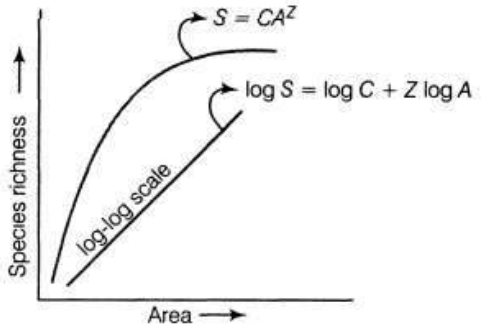
26. The image below eleborates enzyme-replacement therapy. **[3]**




i. Explain enzyme-replacement therapy to treat adenosine deaminase deficiency.

ii. Mention two disadvantages of this procedure.

27. i. Explain the species-area relationship using the graphical representation given below. **[3]**




ii. Explain giving reasons why there is greater biodiversity in tropical regions of the earth.

OR

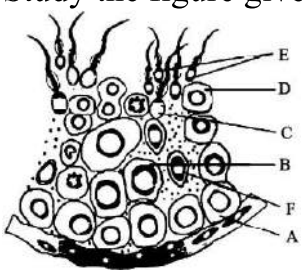
Explain giving three reasons, why tropics show greatest levels of species diversity?

28. Explain convergent and divergent evolution with the help of one example of each. **[3]**

## Section D

29. **Read the text carefully and answer the questions:** **[4]**

Study the figure given:




(i) Pick out the name of cells that undergo spermiogenesis.

(ii) Name A, B, C and F.

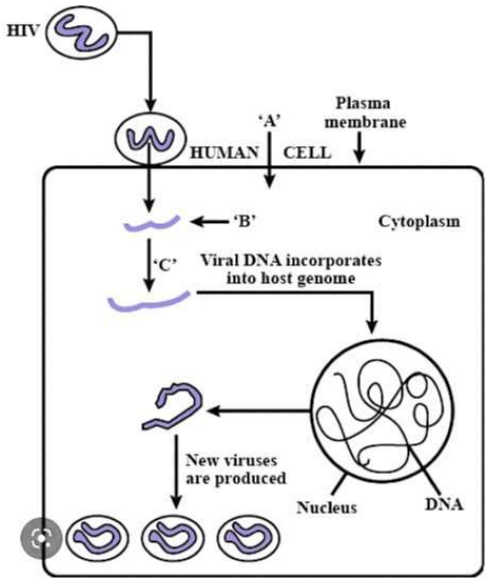
(iii) Give ploidy of B and E.

**OR**

Mention the function of **F** cell.

30. **Read the text carefully and answer the questions:** **[4]**

Study the diagram showing the entry of HIV into the human body and the processes that are followed:




(i) Why macrophages only being infected by HIV at first?

(ii) Mention the genetic material 'B' HIV releases into the cell.

(iii) Identify enzyme 'C'. Suggest preventive measure of the infection.

**OR**

What are the symptoms and how are mild pathogen become virulent in human being?

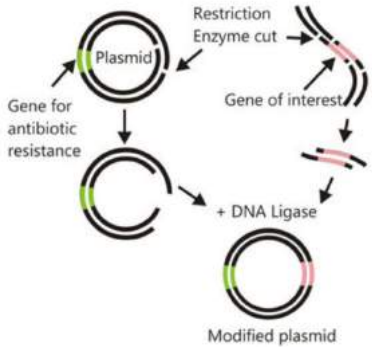
## Section E

31. How did Hershey and Chase differentiate between DNA and protein in their experiment while proving that DNA is the genetic material? **[5]**

OR

Describe Frederick Griffith experiment on Streptococcus pneumoniae. Discuss the conclusion he arrived at.

32. Recombinant DNA molecules are DNA molecules formed by laboratory methods of genetic recombination that bring together genetic material from multiple sources, creating sequences that would not otherwise be found in the genome. **[5]**




A selectable marker is used in the section of recombinants on the basis of their ability to produce colour in presence of chromogenic substrate.

i. Mention the name of the mechanism involved.

ii. Which enzyme is involved in the production of colour?

iii. How is it advantageous over using antibiotic-resistant gene as a selectable marker?

OR

If a desired gene is identified in an organism for some experiments, explain the process of the following:

i. Cutting this desired gene at specific location.

ii. Synthesis of multiple copies of this desired gene.

33. Draw a diagram of a transverse section of an angiospermic anther. Label any six parts. **[5]**

OR

What is geitonogamy? Give an example. How does geitonogamy differ from xenogamy in plants?

# SOLUTION

## Section A

1. **(c)** Lentic biota
   **Explanation:** Lentic biota
2. **(a)** Golgi bodies
   **Explanation:** Golgi bodies
3. **(c)** Fertilization outside and gestation inside the womb of the mother
   **Explanation:** Fertilization outside and gestation inside the womb of the mother
4. **(c)** 1972
   **Explanation:** 1972
5. **(d)** All of these
   **Explanation:** All of these
6. **(b)** Antibiotics have greatly improved our capacity to treat deadly diseases
   **Explanation:** Antibiotics have greatly improved our capacity to treat deadly diseases.
7. **(c)** A-2, B-5, C-1, D-3
   **Explanation:** A-2, B-5, C-1, D-3
8. **(c)** Constant from generation to generation
   **Explanation:** The Hardy–Weinberg principle, also known as the Hardy–Weinberg equilibrium, model, theorem, or law, states that allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences.
9. **(a)** Both Hydrophobic interaction and H-bond
   **Explanation:** Both Hydrophobic interaction and H-bond
10. **(b)** 28-32 times
    **Explanation:** To produce billions of copies of a DNA segment PCR (polymerase chain reaction) is done.
    This is a theoretical consideration, as PCR depends on a number of factors as optimal priming, salt concentration, enzyme activity, available dNTPs, and so on. Ideally, the number of DNA molecules is doubled with every cycle. So the general formula to calculate the number is:
    $n \times 2^{cycles}$ = number of DNA molecules at the end of the PCR
    n is the number of molecules set into the reaction.
    The number of times PCR to get a billion copies should be done is about 28-32 times.
11. **(a)** Aspergillus
    **Explanation:** Aspergillus
12. **(c)** Jaundice
    **Explanation:** Jaundice
13. **(a)** Both A and R are true and R is the correct explanation of A.
    **Explanation:** Both A and R are true and R is the correct explanation of A.
14. **(a)** Both A and R are true and R is the correct explanation of A.
    **Explanation:** Both A and R are true and R is the correct explanation of A.

15. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.
**Explanation:** Assertion and reason both are correct statements and reason is correct explanation for assertion.
16. **(a)** Both A and R are true and R is the correct explanation of A.
**Explanation:** Both A and R are true and R is the correct explanation of A.

**Section B**

17. The first patient to be treated with gene therapy was a four year old girl treated at the NIH Clinical Center in 1990. She had a congenital disease called Severe Combined Immuno Deficiency (SCID), which is caused by Adenosine deaminase (ADA) deficiency, which severely affects immunity and the ability to fight infections.
For the therapy, her white blood cells were taken from her and inserted with the correct genes for making ADA and then reinjected into her. This process was performed by Dr. W. French Anderson from the National Heart, Lung and Blood Institute.
18. **Symptoms of pneumonia:**
(a) Fluid filled alveoli
(b) Fever
(c) Cough and headache
(d) The nails turn gray to bluish in severe cases.
**Causative agent:** Streptococcus pneumoniae
19. The thorn of bougainvillea and tendril in cucurbita are Homologous organs due to the following reasons:
i) Both arise from axillary bud.
ii) They perform different functions. Thorn provides protection and tendril provides support for climbing
iii)They have anatomical similarity but they differ functionally hence they are called Homologous organs.
20. (a) Incomplete dominance
(b) law of dominance
21. The viruses parasitizing are known as bacteriophage. The bacteriophages attack the bacteria and they infect and replicate within the bacteria. They are made up of nucleic acid molecules which is surrounded by protein structure.

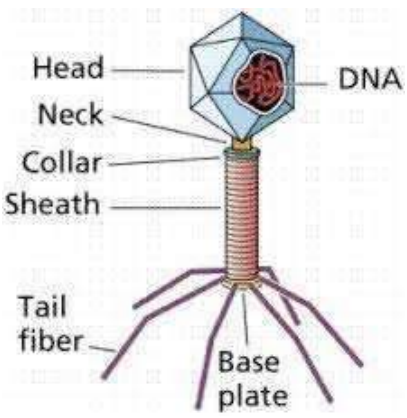



Figure: The structure of a bacteriophage.

OR

a. **SCP:** It is protein rich microbial biomass which can be used as food and feed. It has low fat content. The common SCP are Spirulina, Yeast and Fusarium

graminearum.

b. **Soil:** Microbes play an important role in decomposition of organic matter and thus cause mineralization of the soil. They are used as biofertilizers and biopesticides.

**Section C**

22. Every individual in a population competes with other individuals for food, shelter and mate. Competition can occur between individuals of two different species or between individuals of the same species.

| Intraspecific condition | Interspecific condition |
|---|---|
| Intraspecific condition involves the competition between individuals of the same species. | Interspecific condition involves the competition between the individuals belonging to two different species. |
| Intraspecific competition occurs for all the requirements. | Interspecific competition is for one or more requirements. |
| Intraspecific competition occurs for between individuals which exhibit similar adaptation. | Interspecific competition involves individuals with many types of adaptations. |
| Intraspecific competition is severe. | Interspecific competition is not severe |

23. Both the biotic and abiotic components of an ecosystem function as a unit. Plants absorb biogenetic nutrients from the soil. Their availability is largely dependent upon decomposition and mineralisation of organic matter. Animals found in an ecosystem are delicately balanced by the number of herbivores and the degree of herbivory. Four important functional aspects of the ecosystem are:
    i. Productivity (Primary and Secondary)
    ii. Decomposition,
    iii. Energy flow and
    iv. Nutrient cycling.

24.

| **Dominant gene** | **Recessive gene** |
|---|---|
| A dominant gene is able to express itself even in the presence of its recessive allele. | A recessive gene is unable to express itself in the presence of its dominant allele. |
| It expresses both in homozygous and heterozygous form. | It expresses only in homozygous form when both the genes are similar. |
| It expresses because it forms complete enzyme for expressing the effect e.g., Red flower colour in Pea. | Recessive gene forms an incomplete enzyme, this fails to express its effect e.g., White flower colour in Pea. |

25. Oral administration of small doses of either progestagens or progestogen-estrogen combinations is another contraceptive method used by the females. They are used in the form of tablets and hence are popularly called the 'pills'. They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms in the vagina. Pills are very effective with lesser side effects and are well accepted by the females.

**Advantages of Saheli:** 'Saheli', the new oral contraceptive for the female contains a non-steroidal preparation called 'centchroman'. It is a 'once a week' pill with very

few side effects and high contraceptive value.
Recently a new pill i-pill has been introduced by Cipla pharmaceuticals to be used within 72 hours of unprotected sex to avoid unwanted and undesired pregnancy.

26. In enzyme replacement therapy, the patient is given functional ADA (Adenosine Deaminase) by injection.
Hereditary disease can be corrected by gene therapy. It is a collection of methods that allows correction or replacement of defective genes. The first gene therapy was given in 1990 to a 4 years old girl with Adenosine Deaminase (ADA) deficiency. It is caused due to the deletion of gene for adenosine deaminase.
**Disadvantages**
i. The patient does not completely recover from the disease.
ii. It needs periodic injections of the enzyme to the patients.

27. i. Alexander von Humboldt studied species-area relationship. He observed that within a region, the species richness increased with increasing the area up to a certain limit.
ii. Ecologists have discovered that the value of Z lies in the range of 0.1-0.2 regardless of taxonomic group or region. When species-area the relationship is considered for a large area like a whole continent, regression coefficient Z or slope of the line becomes steeper with Z-values in the range of 0.6-1.2. For example, for fruit-eating birds and mammals in tropical forests of a different continent, the slope is found to be 1.15.

OR

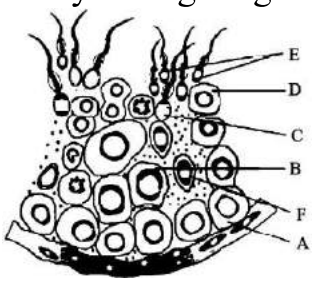
Biodiversity is more in tropical latitudes than in temperate or in polar regions.The reasons are:
i. Speciation is a function of time. The temperate regions were subjected to frequent glaciation in the past, while the tropics have remained undisturbed and so had a long time to evolve more species diversity.
ii. More solar radiation is available in the tropical region. This leads directly to more productivity and indirectly to greater species diversity.
iii. The environment of tropics is less seasonal and relatively more constant and predictable, which encourages niche specialisation and species diversity.

28. **Convergent evolution:** Different structures evolving for the same function but are different in their structural details and origin. The analogous structures are the result of convergent evolution.
e.g. Flippers of Dolphins and Penguins
**Divergent evolution:** Different structures evolving for the different functions but are similar in anatomical structure. The homology indicates divergent evolution.
e.g. The forelimbs of whales, Bats, cheetah and Human.

**Section D**

29. **Read the text carefully and answer the questions:**

Study the figure given:




(i) D - Sperm atids

(ii) A - Sperm atogonium

B - Primary spermatocyte

C - Secondary spermatocyte

F - Sertoli cells

(iii) B - Diploid

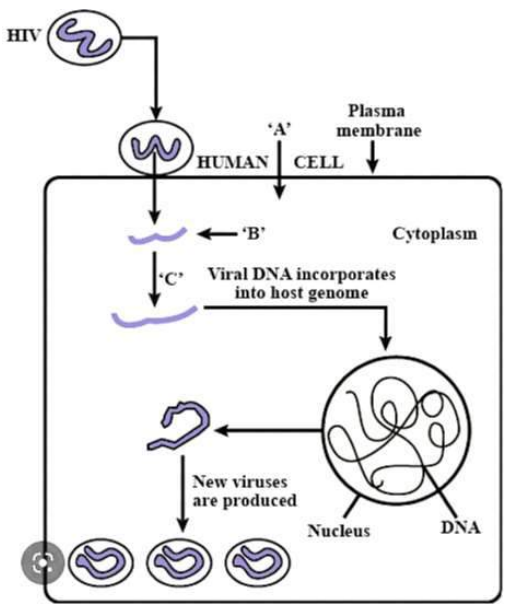
E - Haploid

OR

Provide nourishment to germ cells.

30. **Read the text carefully and answer the questions:**

Study the diagram showing the entry of HIV into the human body and the processes that are followed:




(i) For host cell specificity purpose.

(ii) Viral RNA

(iii) Reverse transcriptase. Avoid sexual act with unknown partners, avoid used syringes and salon tools and check the blood before transfusion, early diagnosis of HIV in pregnant women.

OR

Immune system greatly weakens the body, fever, fatigues etc. and mild pathogen become virulent in humans through their ability to multiply within host.

## Section E

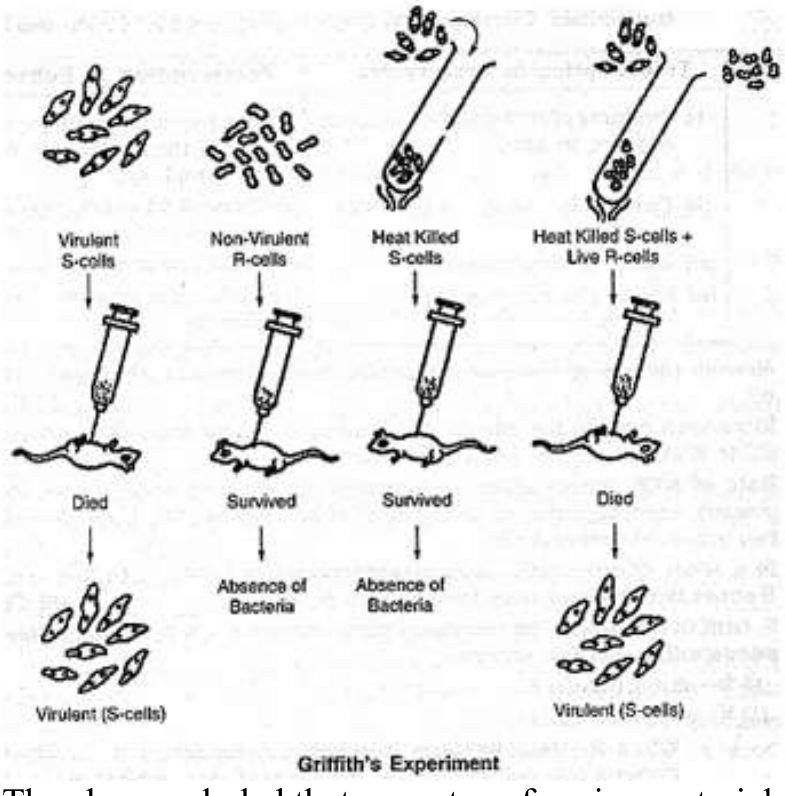
31. To confirm the constituent of genetic material, Harshey and Chase conducted the bacteriophage experiment. Normally $T_2$ bacteriophage joins the walls of E. coli by means of its tail fibre which releases lysozyme to rupture the bacterial cell wall.

Some bacteriophase were grown in medium that contained radioactive phosphorus $(32_P)$ and others were grown in medium that contained radioactive sulphur $(32_S)$. The bacteriophages grown in the presence of $(32_P)$ contained radioactive DNA, because DNA contains phosphorus and not the protein. Similarly the bacteriophages grown on $(32_S)$ contained radioactive protein but not radioactive DNA because sulphur is a constituent of amino acids. These two types of cells (phages) were made to infect normal bacterial cells in two samples. It was found that phages grown in radioactive phosphorus passed there radioactivity to daughter cells, while the phages containing radioactive sulphur did not transfer their radioactivity to daughter phages.

OR

Bacterial Transformation

- It was performed by Frederick Griffith (1928) on the bacteria Streptococcus pneumoniae (bacteria responsible for causing pneumonia)
- This bacteria has two strains -
  S - type (Smooth, virulent and mucus coat with) - can cause pneumonia.
  R - type (rough, avirulent, without mucus coat) cannot cause pneumonia.
- Mice infected with S-type of cells die from pneumonia.
- Mice infected with R-type of cells do not develop pneumonia.
- Griffith observed that heat killed S-cells didn't kill the mice.
- When a mixture of heat heat-killed and live R-cells was injected then mice died. Moreover, he recovered living S bacteria from the dead mice.



Griffith's Experiment

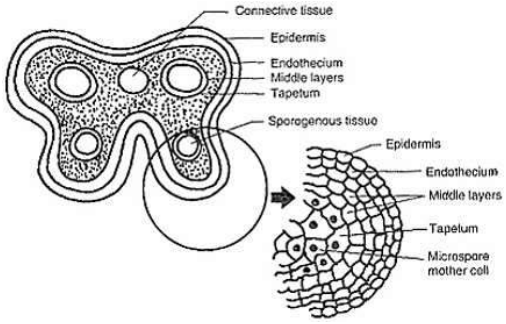
- Thus he concluded that some transforming material transferred from the heat killed S-type cells had enabled the R-type cells to synthesise mucus coat and become virulent and this must be due to the transfer of genetic material
- Oswald Avery, Colin Mac Leod and Maclyn Mc Carty (1933-44) later discovered that DNA from the heat killed S-cells had transformed the R-strain of Bacteria.

- They conducted biochemical characterization of transforming principle by using proteases, RNases and DNases.
- They observed that proteases and RNases did not affect transformation, but DNase inhibited the transformation. They concluded that DNA is the genetic material.

32. i. Insertional inactivation.
ii. $\beta$-galactosidase.
iii. Selection of recombinants due to inactivation of antibiotics requires simultaneous plating on two plates having different antibiotics.

OR

i. Cutting of the desired gene at a specific location is done by incubating the DNA with specific restriction endonuclease. Restriction enzymes recognise a particular palindromic nucleotide sequence and cut the DNA at that site.
ii. Synthesis of multiple copies of the desired gene is carried out by Polymerase Chain Reaction (PCR)
Amplification of recombinant DNA gene is done using Polymerase Chain Reaction (PCR). It is carried out in the following steps:
a. **Denaturation** -The double-stranded DNA is denatured by applying high temperature of 95°C for 15 seconds. Each separated strand acts as a template.
b. **Annealing -** Two sets of primers are added, which anneal to the 3'end of each separated strand.
c. **Extension -** DNA polymerase extends the primers by adding nucleotides complementary to the template provided in the reaction. Taq polymerase is used in the reaction, which can tolerate heat. All these steps are repeated many times to get several copies of the desired DNA.

33. 


OR

Geitonogamy is a type of self pollination in which the pollen grains from the anthers of one flower are transferred to the stigma of another flower borne on the same plant. However they require a pollinating agent. Example: Cucurbits

| | **Geitonogamy** | | **Xenogamy** |
|---|---|---|---|
| 1 | It refers to the transfer of pollen grains from the anthers of one flower to the stigma of another flower on the same plant. | 1 | It refers to transfer of pollen grains from the anthers of one flower to the stigma of another flower on a differ plant. |
| 2 | It is a type of self pollination. | 2 | It is cross pollination. |