

BIOLOGY SOLUTION

SECTION – A

1. Rosie produced milk with human alpha-lact albumin and was nutritionally a more balanced product for human babies than natural cow-milk.

OR

Neutrophils in blood can phagocytose and destroy the microbes.

2. Cu-T (Copper releasing IUD), suppress sperm motility and fertilizing capacity of sperms.
3. Oogenesis starts in female in their foetal stage while spermatogenesis in males starts at puberty.
4. Monosomy of sex chromosome/XO condition/Absence of one X chromosome (in female).
5. R.C. Punnett.
6. Auto immune disorder or auto-immune disease.
7. C-peptide is an extra stretch of polypeptide. It makes the insulin inactive.
8. Restriction enzymes / polymerase enzymes/ ligase.
9. Its moderate dose produces a sense of euphoria and increased energy while high dose causes hallucination.
10. Tropical latitudes have remained undisturbed for millions of years and had a long evolutionary time for species diversification.
11. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
12. (b) Both assertion (A) and reason (R) are true but reason (B) is not the correct explanation of assertion (A).

OR

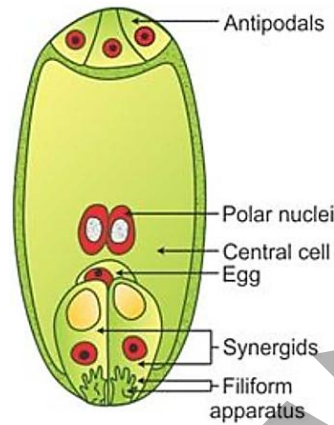
(c) Assertion (A) is true but reason (R) is false

13. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
14. (d) Assertion (A) is false but reason (R) is true.
15. (i) (b) ejaculatory duct
(ii) (b) Ampulla
(iii) (a) 2-2.5°C
(iv) (c) Sertoli cell
(v) (a) a - Sertoli cell, b - interstitial cell
16. (a) Positive terminal-'B' and negative terminal-'A'
(b) He would have loaded the samples near end A, in the wells.
(c) (ii) The smaller the fragment size, farther it moves.
(d) After staining the DNA with ethidium bromide followed by exposure to UV radiations the DNA bands appear coloured.

- (e) By elution separated bands of DNA are cut out from the agarose gel and extracted from the gel piece.

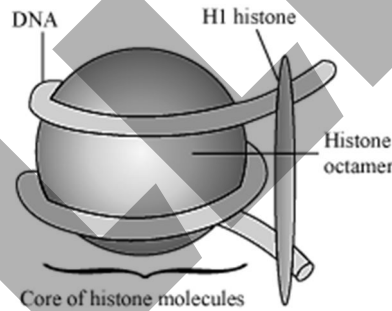
SECTION – B

17.



Mature Embryo Sac

18. A unit of eight molecules of positively charged histones, negatively charged DNA, wrapped around the Histone octamer, contains 200 bp of DNA helix.



DNA is negatively charged, histone is positively charged, 200 bp of DNA helix.

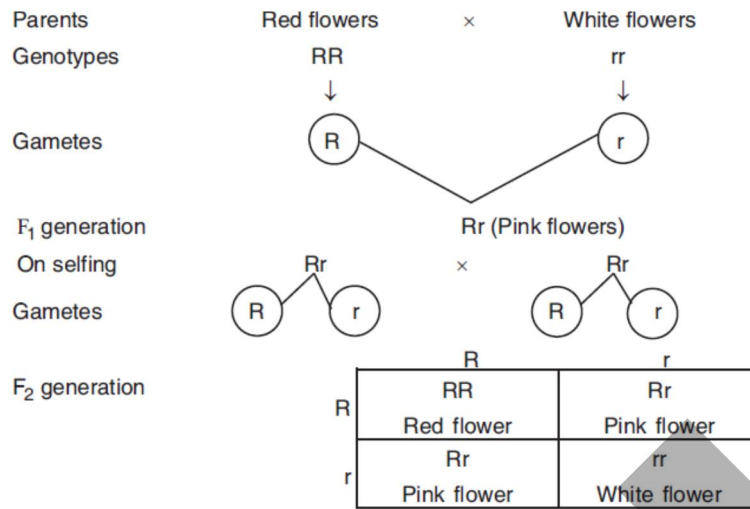
19. Gas - Carbon dioxide
Process - Fermentation
20. **EcoRI** - The first letter of the name comes from the genus and the next two from the name of the species of the bacterium i.e. prokaryotic cell. Thus, Eco stands for the genus and species of the prokaryotic cell from which the enzyme was isolated i.e. E. coli, R stands for strain. I follows order in which enzyme was isolated.

OR

Thermus aquaticus, it remains active during the high temperature, (induced to denature double stranded DNA) and catalyses polymerisation of DNA.

21. (a) Parasitism (b) Mutualism (c) Commensalism (d) Brood parasitism.

22. Inheritance of flower colour in *Antirrhinum majus*.



The above pattern shows law of independent assortment which states that when two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters.

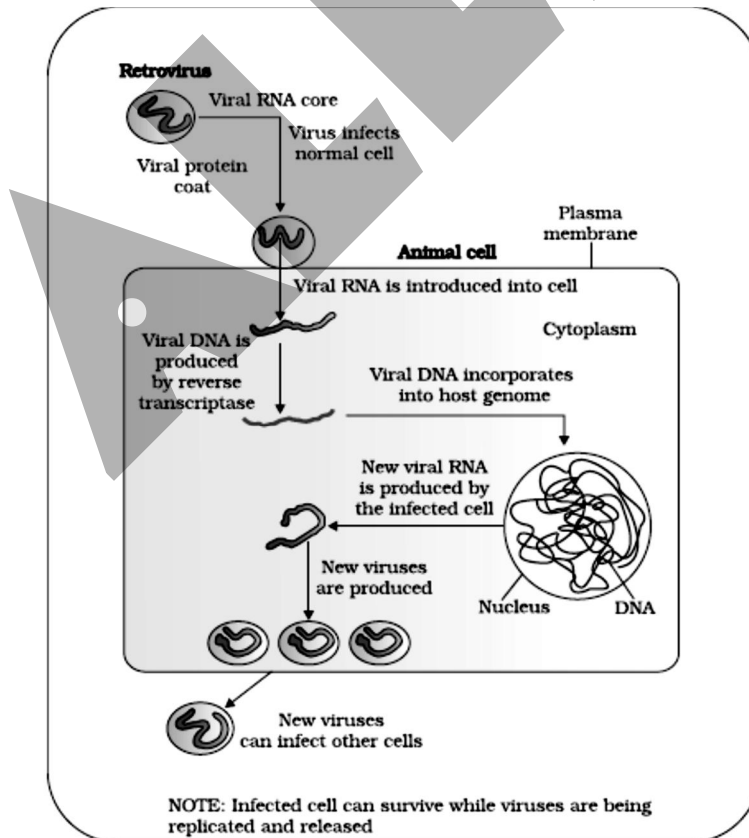
OR

VNTR stands for Variable Number of Tandem Repeats.

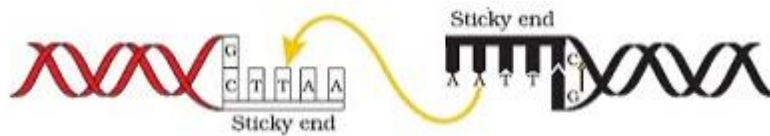
Probe is labelled or radioactive (single stranded polynucleotide that hybridises DNA fragments)

23. Cocaine has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy. Certain sports persons misuse it to enhance their performance.

24.



25. DNA fragments are joined /sealed by them /sticky ends of vector and foreign DNA, joined by them.



26. (a) Difference between spermatogenesis and spermiogenesis :

Spermatogenesis is a process of formation of haploid spermatozoa from germinal cells while spermiogenesis is a process of differentiation of spermatozoa into a spermatid. Here, a spermatid forms a single spermatozoa.

(b) Mitochondria provide energy for the movement of sperm.

27. Transformation

Griffith experiment, Avery, MacLeod and McCarty identified the biochemical nature of transforming principle i.e. DNA (brief explanation).

Transformation is the technique. Avery, MacLeod and McCarty identified the biochemical nature of transforming principle i.e. DNA.

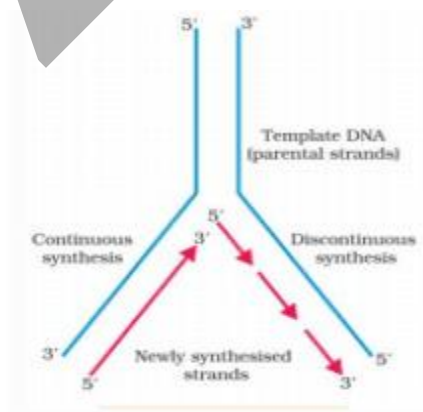
They worked to determine the biochemical nature of transforming principle' in Griffith's experiment. They purified biochemicals (proteins, DNA, RNA etc.) from the heat killed 'S' cells to see which ones could transform live 'R' cells into 'S' cells. They discovered that DNA alone is transformed. Proteases and RNases did not affect transformation. Digestion with DNase inhibited transformation, suggesting that the DNA caused the transformation. Thus, they concluded that DNA is the hereditary material.

OR

Blood related autosomal Mendelian disorder is sickle cell anaemia. It is called Mendelian disorder due to alteration or mutation in a single gene.

The defective haemoglobin undergoes polymerization under low oxygen tension and changes the shape of RBC from biconcave cells to sickle-shaped elongated cells. The disease is controlled by a single pair of alleles, Hb^A and Hb^S . Of the three possible genotypes, only individual homozygous for Hb^S show the disease. Heterozygous individuals ($Hb^A Hb^S$) are carriers.

28. (a)



(b) 2 strands are anti parallel. DNA polymerase acts only in one direction i.e. $5' \rightarrow 3'$

29. Habitat loss and fragmentation - Habitat loss from tropical rainforest / The Amazon rain forest is being cut and cleared / for raising cattle / for conversion to grasslands / for cultivating soyabeans / large habitats are broken up into small fragments due to human activities / mammals and birds requiring large territories are badly affected leading to decline in population.

Over exploitation - when 'need' turns 'greed' lead to over exploitation of natural resources / Steller's sea cow /passenger pigeon were over exploited /marine fish populations around the world are over exploited/endangering existence of commercially important species.

Alien species invasions - when introduced unintentionally or deliberately for any purpose some of them turn invasive and decline indigenous species/carrot grass/ Parthenium / African cat fish/*Clarias gariepinus* poses threat to indigenous cat fishes of our river.

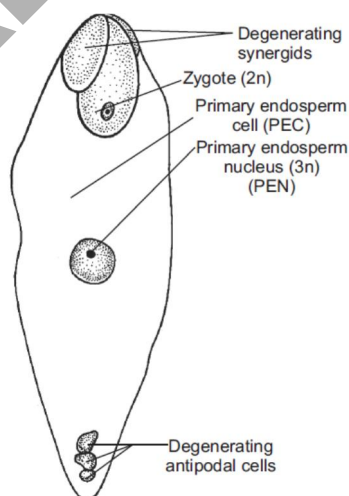
Co-extinctions - when a species becomes extinct the plant or animal species associated with it (an obligate way) become extinct / when a host species becomes extinct (its unique assemblage of) parasites meets the same fate / extinction of any member in plant pollinator mutualism leads to extinction of other.

30.

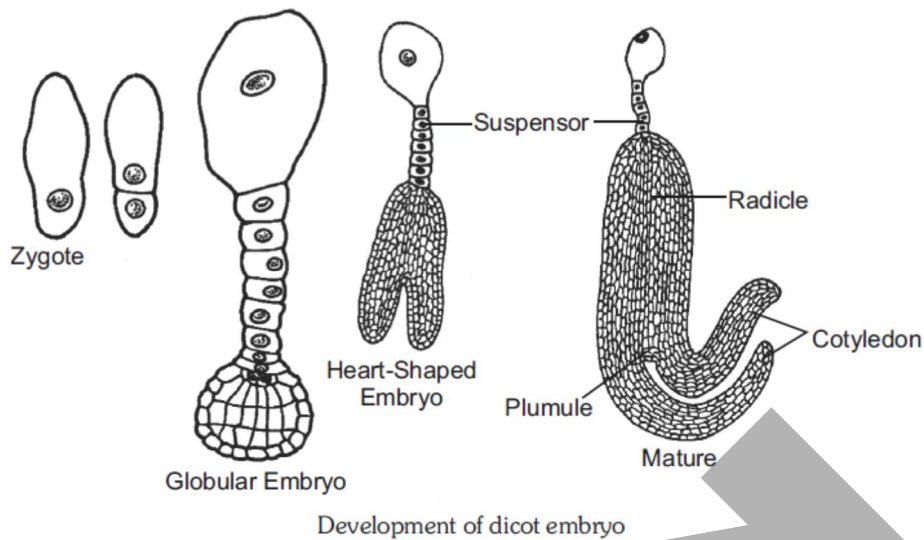
	Competition	Predation	Commensalism
Differences	Both species lose in their interaction.	Only one species benefits in their interaction.	One species is benefitted and the other is neither benefitted nor harmed in their interaction.
Similarity	Both the interacting species live together.	Both the interacting species live together.	Both the interacting species live together.

SECTION-D

31. (a) Fertilised embryo sac showing zygote and Primary Endosperm Nucleus (PEN)



(b)

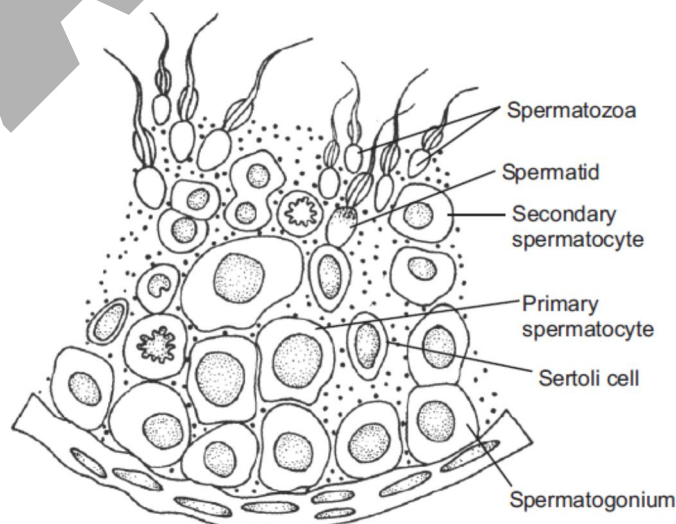


Stages in dicot embryo development:

- The zygote undergoes transverse division forming a large basal cell and a small apical or terminal cell.
- The large basal cell enlarges and undergoes transverse division to form a group of 6–10 cells called **suspensor**.
- The first cell of the suspensor towards the micropylar end is called **haustorium**, whereas the last cell of the suspensor toward the chalazal end is called **hypophysis** that later develops into radicle.
- The smaller terminal or apical cell undergoes one vertical division. The two cells formed from terminal cell divide by a transverse division thus forming four embryonal cell (**quadrant stage**).
- Finally these four cells divide vertically forming 8-celled proembryo (**octate stage**). Four cells at the apex give rise to plumule and another four give rise to hypocotyl except its tip.

OR

(a) Diagrammatic sectional view of a seminiferous tubule (enlarged)



(b)

S. No.	Process of gametogenesis	Males	Females
(i)	Time of initiation of the process	At puberty	At puberty
(ii)	Products formed at the end of the process	Four spermatozoa are produced from one primary spermatocyte.	One ovum and two polar bodies are produced from one primary oocyte.

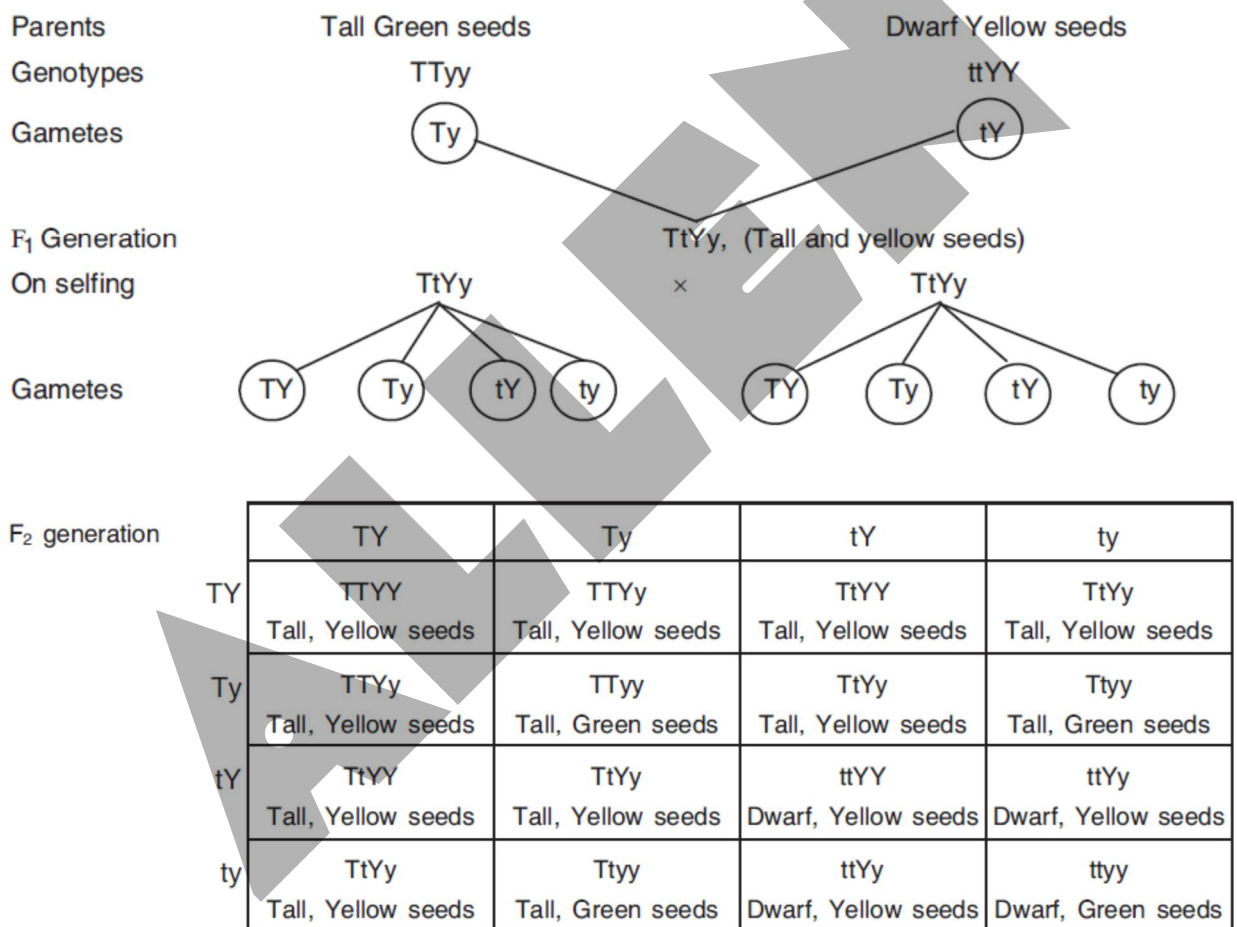
32. **Genetically engineered insulin:** Production of insulin by *rDNA* techniques was achieved by an American company, Eli Lilly, in 1983. It prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *E.coli* for production. The A and B chains produced were separated, extracted and combined by creating disulfide bonds to form human insulin.

OR

- (a) Nematode *Meloidegryne incognitia* infects the roots of tobacco plant.
- (b) Transgenic tobacco plants are produced in following way:
- (i) To prevent the roots of tobacco plants from infections a strategy was adopted based on the process of RNA interference (RNAi).
- (ii) Nematode-specific genes were introduced into the host plants using *Agrobacterium* vectors.
- (iii) The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells.
- (iv) These two RNAs being complementary to each other formed a double stranded RNA (*dsRNA*) that initiated RNAi and thus, silenced the specific *mRNA* of the nematode.
- (v) The parasite could not survive in a transgenic host expressing specific interfering RNA, thus plant got itself protected from the parasite.
33. **Watson and Crick** in 1953 proposed a scheme that DNA replication was **semi-conservative**. According to the scheme, the two parental strands separate and each strand acts as a template for synthesising a complementary strand over it. After completion of replication, each DNA had one parental strand and one newly synthesised strand.
- Experimental Proof for semi-conservative mode of DNA replication:
- **Matthew Meselson** and **Franklin Stahl** in 1958 performed experiments on *E. coli* to prove that DNA replication is semi-conservative.
 - They grew *E. coli* in a medium containing $^{15}\text{NH}_4\text{Cl}$ (in which ^{15}N is the heavy isotope of nitrogen) for many generations.
 - As a result, ^{15}N got incorporated into newly synthesised DNA.

- This heavy DNA can be differentiated from normal DNA by centrifugation in Caesium chloride (CsCl) density gradient.
- Then they transferred the cells into a medium with normal $^{14}\text{NH}_4\text{Cl}$ and took the samples at various definite time intervals as the cells multiplied.
- The extracted DNAs were centrifuged and measured to get their densities.
- The DNA extracted from the culture after one generation of transfer from the ^{15}N medium to ^{14}N medium (i.e., after 20 minutes) showed an intermediate hybrid density.
- The DNA extracted from culture after two generations (i.e., after 40 minutes) showed equal amount of light DNA and hybrid DNA.

OR



(i) Phenotype of F₁—Tall plants with yellow seeds.
 Genotype of F₁— TtYy .

(ii) Phenotypic ratio of F₂ generation:

Tall plants, yellow seeds : Tall plants, green seeds : Dwarf plants, yellow seeds : Dwarf plants, green seeds
 9 : 3 : 3 : 1