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# +2 ZOOLOGY
## IMPORTANT QUESTIONS WITH ANSWERS
## UNIT II
## (CHAPTERS 4, 5 and 6)

### CHAPTER 4 PRINCIPLES OF INHERITANCE AND VARIATION

**2 MARK QUESTIONS:**

1. **What is Criss cross inheritance? Give example.**
   The inheritance of a trait from the male parent to his grandson through carrier daughter is called Criss cross inheritance. Ex. Colour blindness.
2. **Changing a defective gene to a normal gene in germ plasm is a branch of application of genetic laws to improve human race. Name the branch and define it.**
   Positive eugenics
   Positive eugenics attempts to increase consistently better or desirable germplasm and to preserve the best germplasm of the society.
3. **What does eugenics mean? Who coined the term eugenics.**
   The term eugenics means "well born" and was coined by Francis Galton in 1885.
4. **Define euphenics.**
   The symptomatic treatment of genetic diseases in man like phenylketonuria is called euphenics or medical engineering. In 1960 Joshua Lederberg coined the term Euphenics. It means normal appearing.
5. **Define euthenics.**
   The science of improvement of existing human race by improving the environmental conditions is called euthenics.
6. **What is N - 1 rule?**
   The number of Barr bodies follows N-1 rule (N minus one rule), where N is the total number of X chromosomes present.

**3 MARK QUESTIONS:**

7. **What is haplodiploidy?**
   In this system, the sex of the offspring is determined by the number of sets of chromosomes it receives.
   Fertilized eggs develop into females (Queen or Worker). and unfertilized eggs develop into males (drones) by parthenogenesis.
   It means that the males have half the number of chromosomes (haploid) and the females have double the number (diploid), hence the name haplodiploidy for this system of sex determination.
8. **What is Lyonization?**
   Mary Lyon suggested that Barr bodies represented an inactive

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chromosome, which in females becomes tightly coiled into a heterochromatin, a condensed and visible form of chromatin (Lyon's hypothesis).

The number of Barr bodies observed in a cell is one less than the number of X-Chromosome. XO females have no Barr body, whereas XXY males have one Barr body.

9. Why are sex linked recessive characters more common in the male human beings?

Sex linked inherited traits are more common in males than females because, males are hemizygous (only one member of a chromosome pair rather than the usual two) and therefore express the trait when they inherit one mutant allele.

10. What are holandric genes?

The genes present in the differential region of Y chromosome are called Y- linked or holandric genes. The Y linked genes have no corresponding allele in X chromosome. The Y linked genes inherit alongwith Y chromosome and they are expressed phenotypically only in the male sex.

11. What is Kin selection?

In honey bees only one diploid female becomes a queen and lays the eggs for the colony. All other females which are diploid having developed from fertilized eggs help to raise the queen's eggs and so contribute to the queen's reproductive success and indirectly to their own. This phenomenon is known as Kin Selection.

12. What are multiple alleles and what is multiple allelism?

When three or more alleles of a gene that control a particular trait occupying the same locus on the homologous chromosome of an organism, they are called multiple alleles.

The inheritance of multiple alleles is called multiple allelism. Ex. ABO blood group in man

13. What is a Barr body?

In 1949, Barr and Bertram first observed a condensed body in the nerve cells of female cat which was absent in the male. This condensed body was called sex chromatin by them and was later referred as Barrbody.

14. How is Turner's syndrome produced? Mention the symptoms of Turner's Syndrome.

This genetic disorder is due to the loss of a X chromosome resulting in a karyotype of 45, X.

Persons with this syndrome are sterile females.

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**Low stature, webbed neck, under developed breast, rudimentary gonads and lack of menstrual cycle during puberty are the main symptoms of this syndrome.**

**A fruit fly's body cell contains one X chromosome and three sets of autosomes. Explain its sex determination.**

**Sex in drosophila is determined by the ratio of its X chromosome to that of its autosome sets:**

**Number of X Chromosomes / Number of Sets of Autosomes**

**Sex index = X/ A**

**X=1 and number of autosomes = 3**

**Therefore,**

**1/3 = 0.33**

**The sex of drosophila with this sex index is said to be a meta male/super male.**

**15. How can erythroblastosis fetalis be prevented?**

**If the mother is Rh - and foetus is Rh +, anti D antibodies should be administered to the mother between 28$^{th}$ and 34$^{th}$ week of gestation as a prophylactic measure.**

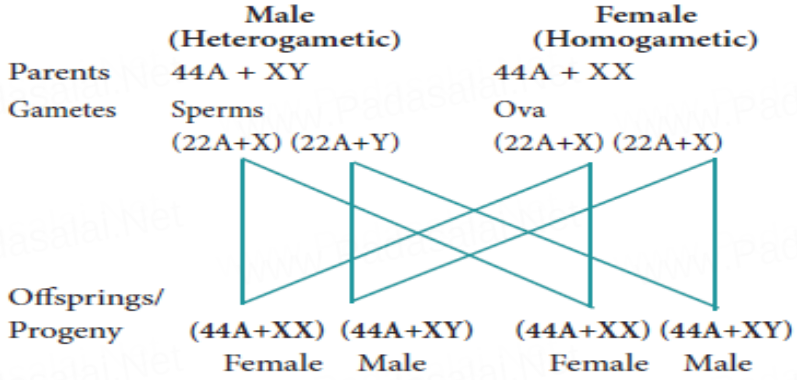
**If the baby is delivered then anti D antibodies should be administered to the mother soon after delivery.**

**5 MARK QUESTIONS:**

**16. How is sex determined in human beings?**

**Genes determining sex in human beings are located on two sex chromosomes, called allosomes.**

**23 pairs of human chromosomes include 22 pairs of autosomes (44A) and one pair of sex chromosomes or allosomes (XX or XY). Females are homogametic producing similar gametes (eggs), each containing one X chromosome while the males are heterogametic producing dissimilar gametes (sperms) with X and Y chromosomes.**




**17. Explain the genetic basis of ABO blood grouping in man.**

**From the phenotypic combinations, it is evident that the alleles IA and**

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**IB are dominant to IO, but co-dominant to each other (IA=IB). Their dominance hierarchy can be given as, IA=IB> IO. A child receives one of three alleles from each parent, giving rise to six possible genotypes and four possible blood types (phenotypes - A, B, AB, and O). The genotypes are IAIA, IAIO, IBIB, IBIO, IAIB and IOIO.**

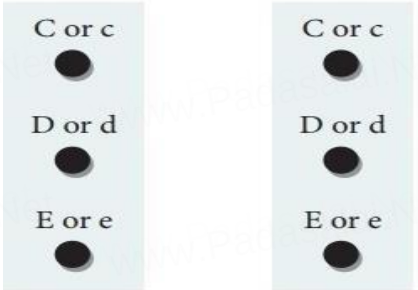
| Genotype | ABO blood group phenotype | Antigens present on red blood cell | Antibodies present in blood plasma |
|---|---|---|---|
| $I^AI^A$ | Type A | A | Anti -B |
| $I^AI^o$ | Type A | A | Anti -B |
| $I^BI^B$ | Type B | B | Anti -A |
| $I^BI^o$ | Type B | B | Anti -A |
| $I^AI^B$ | Type AB | A and B | Neither Anti-A nor Anti-B |
| $I^oI^o$ | Type O | Neither A nor B | Anti -A and anti - B |

**18. Give an account of genetic control of Rh factor.**

**Fisher and Race hypothesis:**

**Rh factor involves three different pairs of alleles located on three different closely linked loci on the chromosome pair. This system is more commonly in use today, and uses the 'Cde' nomenclature.**

**Fischer and Race hypothesis**




**Three pairs of Rh alleles (Cc, Dd and Ee) occur at 3 different loci on homologous chromosome pair. The possible genotypes will be one C or c, one D or d, one E or e from each chromosome. For e.g., CDE/ cde;**

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**CdE/cDe; cde/cde; CDe/CdE etc., All genotypes carrying a dominant 'D' allele will produce Rh positive phenotype and double recessive genotype 'dd' will give rise to Rh negative phenotype.**

**Wiener Hypothesis:**

**Wiener proposed the existence of eight alleles ($R^1$, $R^2$, $R^0$, $R^z$, r, $r^1$, $r^{11}$, $r^y$) at a single Rh locus. All genotypes carrying a dominant 'R allele' ($R^1$,$R^2$, $R^0$, $R^z$) will produce Rh positive phenotype and double recessive genotypes (rr, $r^1r^1$, $r^{11}r^{11}$, $r^yr^y$) will give rise to Rh negative phenotype.**

19. **Explain the mode of sex determination in honeybees.**

**In honeybees, haplodiploidy mechanism of sex determination is common. In this system, the sex of the offspring is determined by the number of sets of chromosomes it receives. Fertilized eggs develop into females (Queen or Worker) and unfertilized eggs develop into males (drones) by parthenogenesis. It means that the males have half the number of chromosomes (haploid) and the females have double the number (diploid), hence the name haplodiploidy for this system of sex determination.**

20. **What are the applications of Karyotyping?**

- **It helps in gender identification.**
- **It is used to detect the chromosomal aberrations like deletion, duplication, translocation, nondisjunction of chromosomes.**
- **It helps to identify the abnormalities of chromosomes like aneuploidy.**
- **It is also used in predicting the evolutionary relationships between species.**
- **Genetic diseases in human beings can be detected by this technique.**

21. **Explain the inheritance of sex - linked characters in human beings with reference to colour blindness.**

**A marriage between a normal visioned woman and a colour blind man will produce normal visioned boys and carrier girls in F1 generation.**

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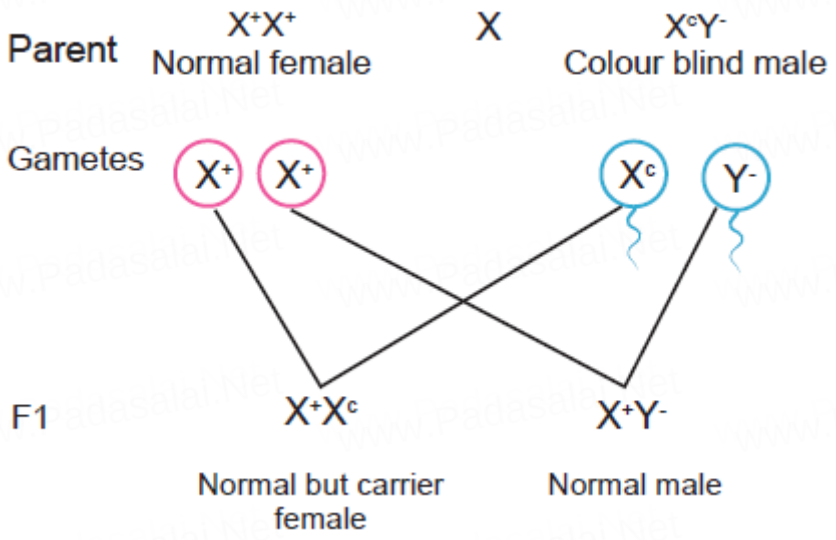
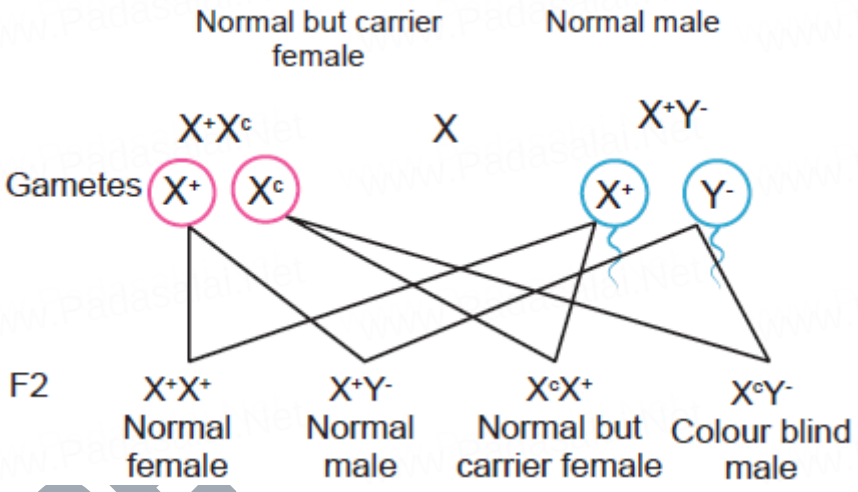
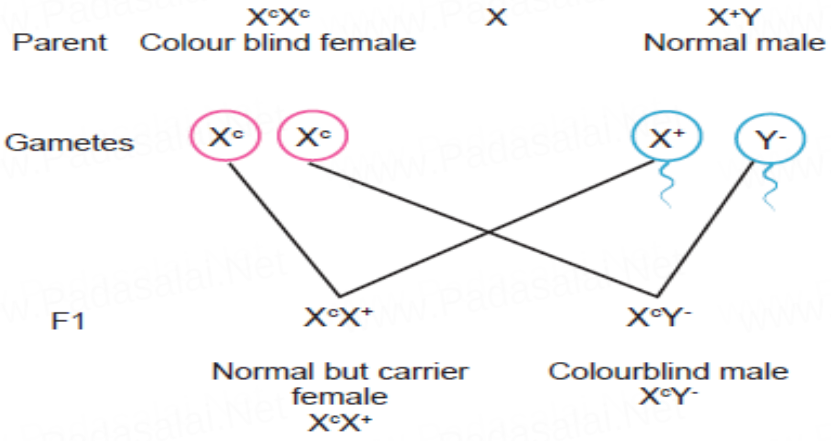



**Marriage between a carrier woman and a normal man will produce a normal visioned girl, a carrier girl, a normal visioned boy and a colour blind boy.**




**Marriage between a colour blind woman and a normal man will produce carrier girls and colour blind boys in 50:50 ratio.**



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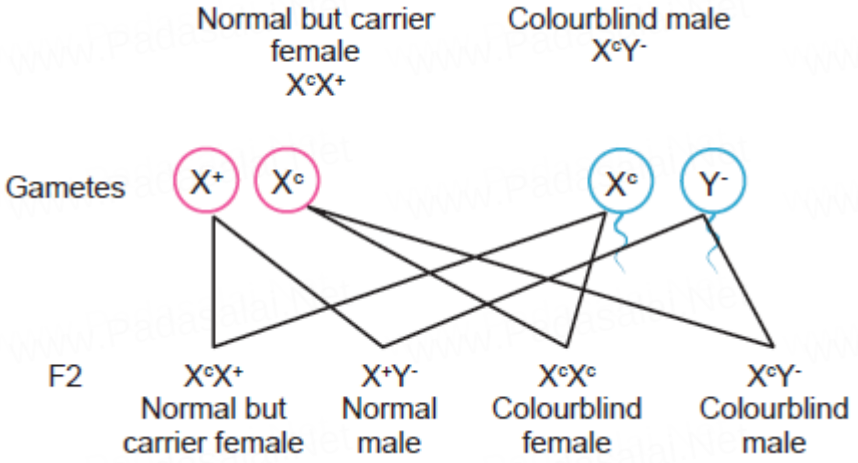
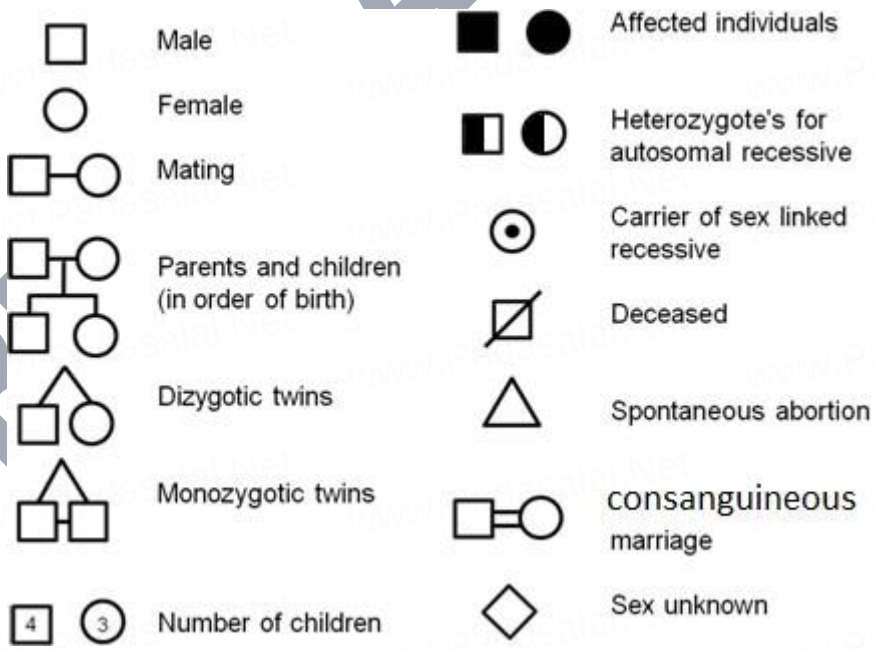
**Marriage between carrier woman and colour blind man will produce carrier girl, colour blind girl, normal visioned boy and a colour blind boy.**




**22. What is pedigree analysis? Give some common symbols used in pedigree chart with explanation.**

**Pedigree is a "family tree", drawn with standard genetic symbols, showing the inheritance pathway for specific phenotypic characters. It is the study of traits as they have appeared in a given family line for several past generations. The common symbols used the pedigree chart is given below.**




**23. Explain how erythroblastosis fetalis occurs in new born babies?**

**If a woman is Rh - and the man is Rh +, the foetus may be Rh+ having inherited the factor from its father.**

**During the first pregnancy, the Rh - mother becomes sensitized by carrying Rh + foetus within her body. Due to damage of blood vessels, during child birth, the mother's immune system recognizes the Rh**

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antigens and produces Rh antibodies. By the time the mother gets sensitized, the child is delivered.

But, the subsequent Rh+ children carried by the same mother, may be exposed to antibodies produced by the mother (during the first pregnancy) are carried across the placenta into the foetal blood circulation.

The antibodies are IgG type which are small and can cross placenta and enter the foetal circulation. This causes haemolysis of foetal RBCs resulting in haemolytic jaundice and anaemia. This condition is known as Erythroblastosis fetalis or Haemolytic disease of the new born (HDN).

## CAHPTER 5 MOLECULAR GENETICS

### 2 MARK QUESTIONS:

24. Give reasons: genetic code is 'universal'.

All living systems use the same triplet codons to direct the synthesis of proteins from amino acids.

25. Mention any two ways in which single nucleotide polymorphism (SNPs) identified in human genome can bring revolutionary change in biological and medical science.

Identification of 'SNIPS' is helpful in finding chromosomal locations for disease associated sequences and tracing human history.

26. Why the human genome project is called a mega project?

The international human genome project was launched in the year 1990. It was a mega project because it took 13 years to complete.

27. Mention the type of sugars present in DNA and RNA.

It is deoxyribose sugar in DNA. In RNA it is ribose sugar. The only difference is one oxygen atom is less in deoxyribose sugar.

28. What is transcription?

The process of copying the genetic information (needed for the synthesis of protein) from one of the strands of DNA into mRNA is called transcription.

29. What is the central dogma of protein synthesis?

Francis Crick proposed the central dogma of protein synthesis. It states that genetic information flows as follows:


30. What is a genetic code?

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It is a sequence of 3 mRNA base that contains information for the synthesis of one of the 20 amino acids that is used in the protein synthesis (translation).

31. What is degenerate code? Give example.
It means more than one triplet codon could code for the same amino acid. GUU, GUC, GUA and GUG code for valine.

32. What do you mean by operons?
The cluster of genes with related functions is called operons.

33. What are SNPs?
Scientists have identified about 1.4 million locations where single base DNA differences (SNPs – Single nucleotide polymorphism - pronounced as 'snips') occur in humans.

<u>3 MARK QUESTIONS</u>:

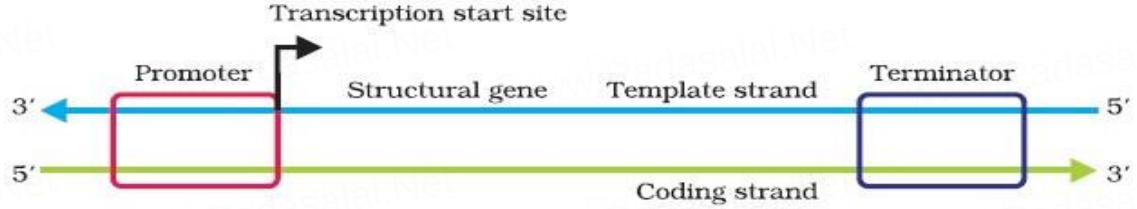
34. Why is tRNA called an adapter molecule?
It acts as a vehicle that picks up the amino acids scattered through the cytoplasm and also reads specific codes of mRNA molecules. Hence it is called an adapter molecule.

35. What is a genetic code?
It is a sequence of 3 mRNA base that contains information for the synthesis of one of the 20 amino acids that is used in the protein synthesis (translation).

36. Why is it so that more than one triplet codons code for a single amino acid?
There are only 20 amino acids involve in the synthesis of protein synthesis. But there are 61 codons available. So, there are more than one triplet codon code for the same amino acid.

37. Differentiate monocistronic and polycistronic structural genes.
A single structural gene that encodes for a single polypeptide chain is called a monocistronic structural gene. Ex. Eukaryotes
Clusters of structural genes encoding for more than one polypeptide chains. Ex. Prokaryotes

38. Draw the schematic structure of a transcription unit.




39. What do you mean by RNA world? Who proposed it?
'RNA world' as the first stage in the evolution of life, refers to the stage when RNA catalyzed all molecules necessary for survival and replication.

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Three molecular biologists in the early 1980's (Leslie Orgel, Francis Brick and Carl Woese) independently proposed it.

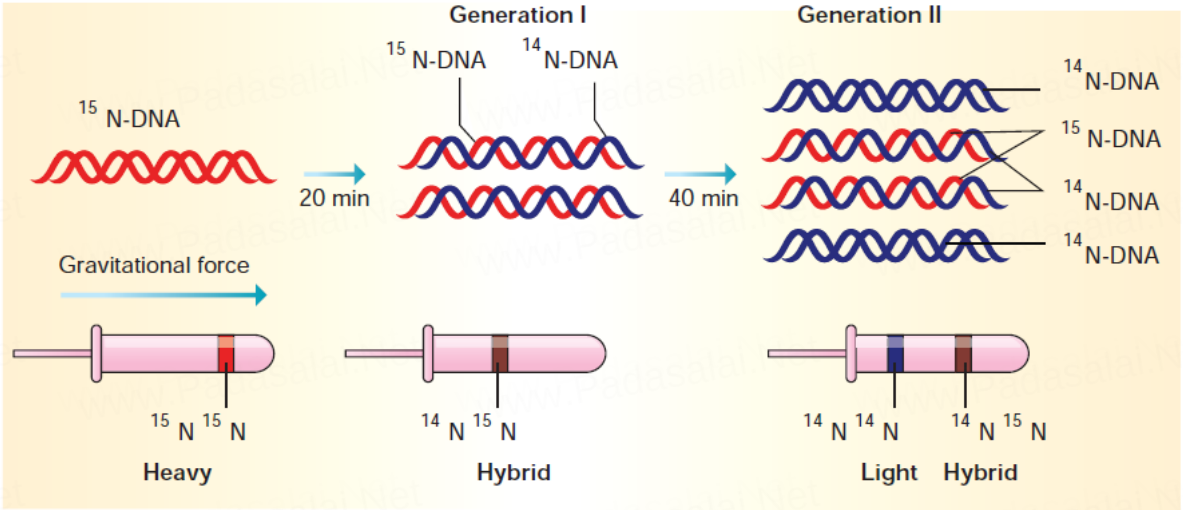
40. If the coding sequence in a transcription unit is written as follows:
5' TGCATGCATGCATGCATGCATGCATGC 3'
Write down the sequence of mRNA.
The coding sequence and the sequence on mRNA will be same, except for uracil instead of thymine.
5' TGCATGCATGCATGCATGCATGCATGC 3'
5' ACGUACGUACGUACGUACGUACGUACG 3'

41. How is the two- stage process of protein synthesis advantageous?
DNA to be transcribed from one of the strands hence the first step, transcription occurs in nucleus.
The second step, translation requires ribosome and tRNAs which are present in cytoplasm. Hence it occurs in cytoplasm.
So, the two - stage process has accuracy and reduces the complexity of the process.

42. A low level of expression of lac operon occurs at all the time. Justify the statement.
Lac operon is functional only when glucose is not available. As, most of the time glucose is available in cells as a substrate, there is a low level of Lac operon occurs at all times.

<u>5 MARK QUESTIONS</u>:

43. Explain the experiment by Meselson and Stahl to prove that DNA replicates by semi-conservative method.
Meselson and Stahl grew two cultures of *E. coli* for many generations in separate media. The 'heavy' culture was grown in a medium in which $NH_4Cl$ is the nitrogen source that contained the heavy isotope $^{15}N$. The 'light' culture was grown in a medium in which the nitrogen source contained $^{14}N$.



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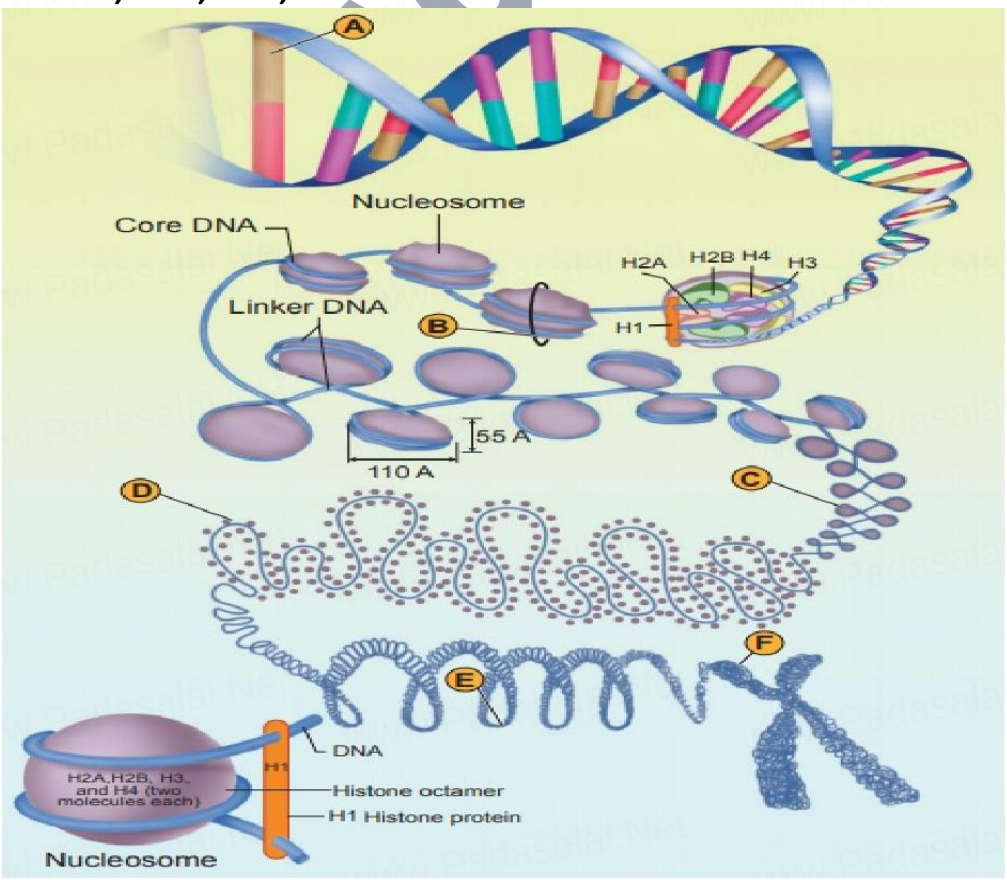
**At the end of growth, they observed that the bacterial DNA in the heavy culture contained only $^{15}N$ and the one in the light culture had only $^{14}N$. They used a technique called Cesium Chloride (CsCl) density gradient centrifugation to distinguish heavy DNA from light DNA ($^{15}N$ from $^{14}N$) The heavy culture ($^{15}N$) was then transferred into a medium that had only $NH_4Cl$, and took samples at various definite time intervals (every 20 minutes). After the first replication, they extracted DNA and subjected it to density gradient centrifugation. The DNA settled into a band that was intermediate in position between the previously determined heavy and light bands. After the second replication (after 40 minutes), they again extracted DNA samples, and this time found the DNA settling into two bands, one at the light band position and one at intermediate position. These results confirm Watson and Crick's semi conservative replication hypothesis.**

**44. Explain the formation of a nucleosome.**

- **Chromatin is formed by a series of repeating units called nucleosomes.**
- **Each nucleosome is composed of 2 molecules of 4 histone proteins, H2A, H2B, H3 and H4.**




- **2 molecules of 4 histone proteins form an octamer.**

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- These 8 molecules are organized to form a unit called histone octamer.
- This positively charged octamer is wrapped around by a negatively charged DNA to form a structure called nucleosome.
- Neighbouring nucleosomes are connected by linker DNA (H1).
- The DNA takes two complete turns around the histone octamer and the two turns are sealed off by linker DNA.
- A typical nucleosome consists of 200 bp in a DNA helix.
- Chromatin lacking H1 has beads on a string appearance in which DNA enters and leaves the nucleosome at random places.
- H1 of one nucleosome can interact with the H1 of the neighbouring nucleosomes resulting in further folding of the fibre.
- 30 nm fibre arising from the folding of nucleosome chains to form solenoid.
- Solenoid is a structure having 6 nucleosomes per turn.
- This structure is stabilized by the interaction between different H1 molecules.
- Hence now the DNA is packed with a solenoid of 40 folds.

45. Explain how did Hershey and Chase prove that DNA is the genetic material.

- They took bacteria phages and allowed them to infect bacteria in culture medium which contained the radioactive isotopes $^{35}S$ or $^{32}P$.
- The bacteriophage that grew in the presence of $^{35}S$ had labelled proteins and bacteriophages grown in the presence of $^{32}P$ had labelled DNA.
- The differential labelling thus enabled them to identify DNA and proteins of the phage.
- Hershey and Chase mixed the labelled phages with unlabelled E. coli and allowed labelled phages to attack and inject their genetic material into unlabelled E. coli.

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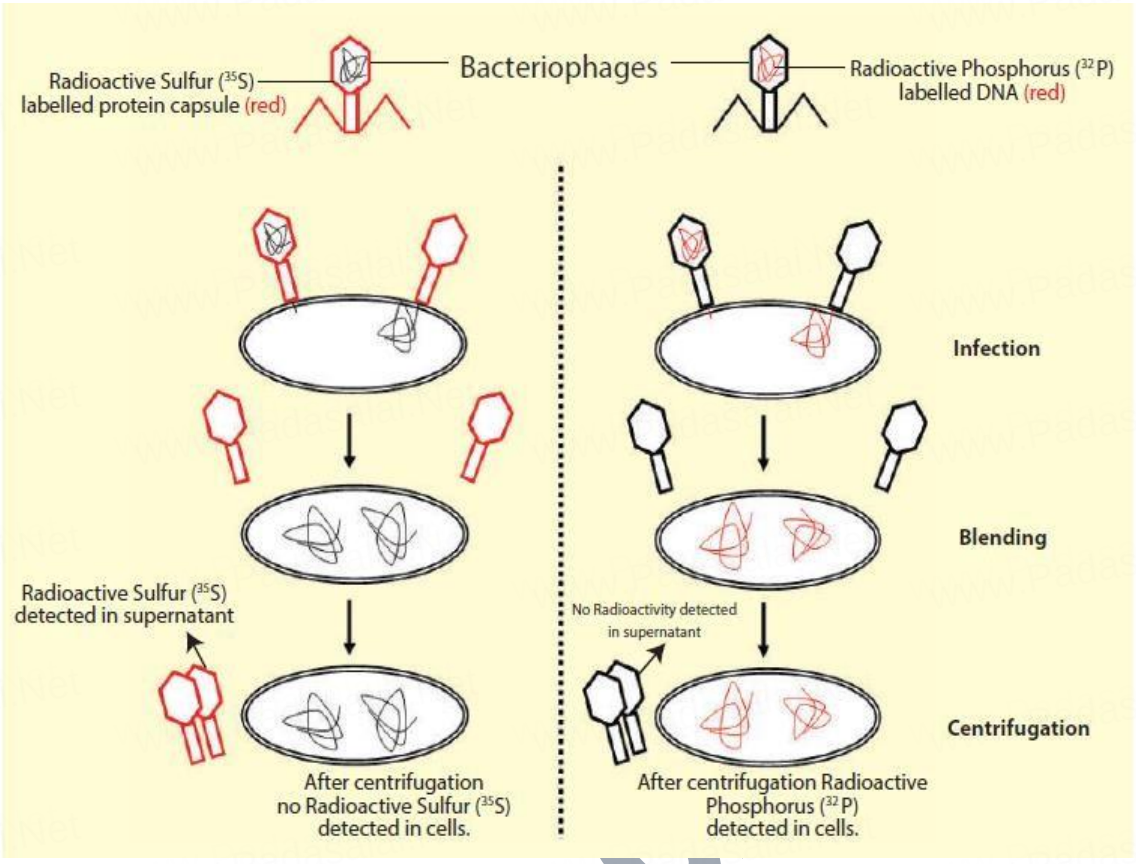


- **Soon after infection the bacterial cells were gently agitated in a blender to loosen the adhering phage particles.**
- **It was observed that only $^{32}$P was found associated with bacterial cells and $^{35}$S was in the surrounding medium and not in the bacterial cells.**
- **When phage progeny was studied for radioactivity, it was found that it carried only $^{32}$P and not $^{35}$S.**
- **Hershey and Chase thus proved that it was DNA, which carries the hereditary information from virus to bacteria and not protein.**

**46. What are the salient features of genetic code?**

- ✓ **It is a triplet codon.**
- ✓ **61 codons code for amino acids. 3 codons do not code for any amino acid and called stop codons.**
- ✓ **It is universal, meaning that all living systems use the same triplet codon to direct the synthesis of proteins from amino acids.**
- ✓ **For example, phenyl alanine in all cells of all organisms is coded by a triplet codon UUU.**
- ✓ **It is non- overlapping, meaning that the same letters are not used for two different codons.**

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- ✓ It is comma less, meaning that the message would be read directly from one end to the other i.e., no punctuation is needed between two codes.
- ✓ It is a degenerating code, meaning that more than one triplet codon could code for a specific amino acid.
- ✓ It is non- ambiguous meaning that one codon codes for one amino acid only.
- ✓ The code is always read in a fixed direction i.e., from 5' -----> 3' direction called polarity.
- ✓ AUG acts as an initiator codon and also codes for the amino acid methionine.
- ✓ UAA, UAG and UGA are termination codons and are also known as non – sense codons.

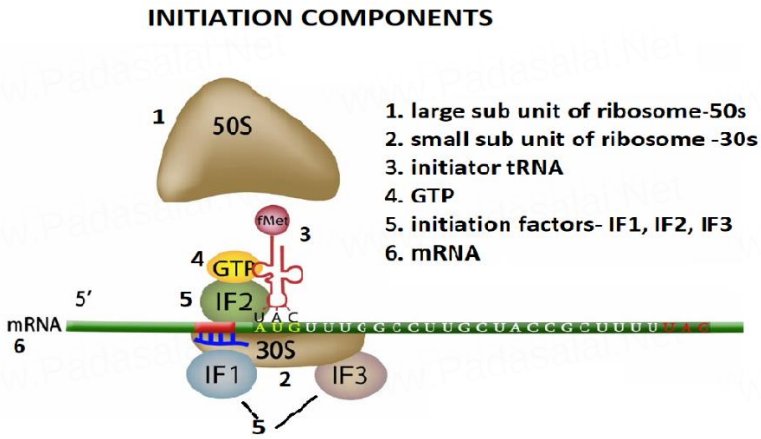
**47. Explain the mechanism of translation.**

Ribosome is the cellular factory of protein synthesis.

Translation process includes three steps i.e., initiation, elongation and termination.

**Initiation:**

**Events that take place during initiation:**




- Initiation starts in E. coli with the formation of an initiation complex.
- The components of initiation complex are ribosomal sub units 30S, sub unit 50S, charged N- formyl methionine tRNA, three initiation factors (IF1, IF2, IF3) GTP (Guanosine Tri Phosphate) and mRNA.

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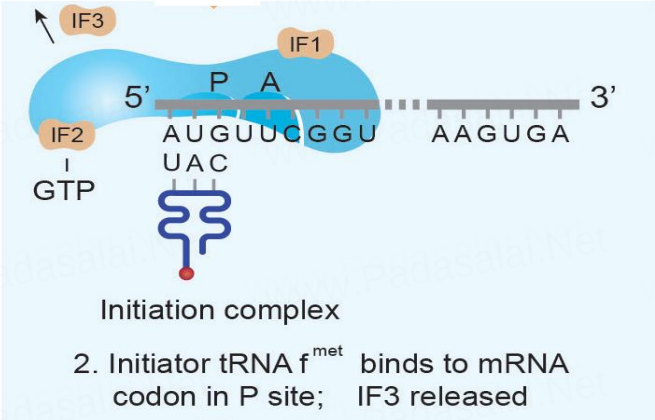
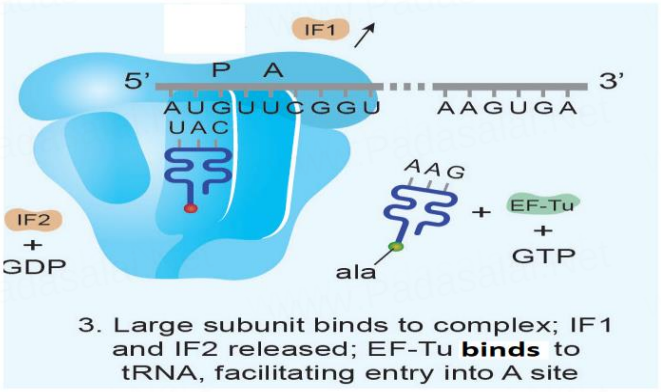



Initiation complex

2. Initiator tRNA $f^{met}$ binds to mRNA codon in P site; IF3 released

- **Once this initiation complex is assembled, IF3 allows the complex to combine with 50S ribosomal unit to form the complete ribosome (70S)**

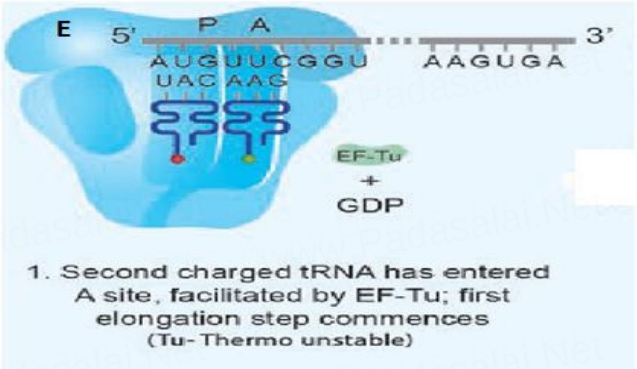



3. Large subunit binds to complex; IF1 and IF2 released; EF-Tu **binds** to tRNA, facilitating entry into A site

- **At the end of the initiation GDP and initiation factors are released from the initiation complex.**

**ELONGATION:**

- **There are three binding sites formed in the ribosome for the tRNAs to bind with ribosome.**
- **They are A site (amino acyl site), P site (peptidyl site) and E site (exit site).**
- **The first tRNA binds with P site.**




1. Second charged tRNA has entered A site, facilitated by EF-Tu; first elongation step commences
(Tu- Thermo unstable)

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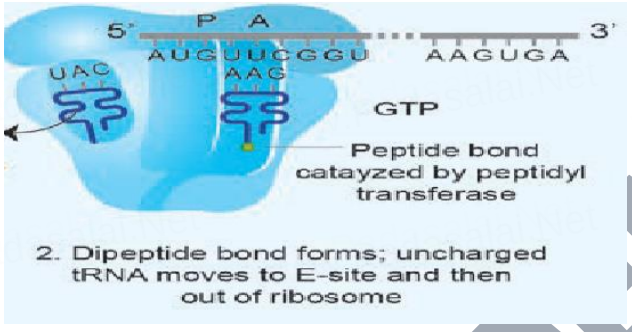
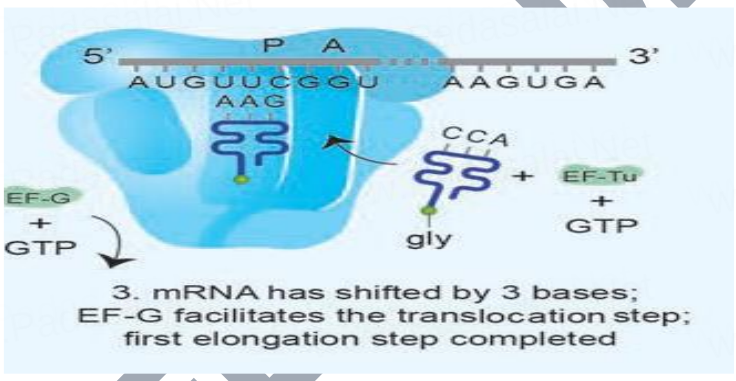
- The second tRNA carrying next amino acid as per the codon present on mRNA moves in to the complex to position itself at A site.
- The bond between the first tRNA (occupying the P site) and its amino acid is broken.
- Hence the uncharged tRNA is released through E site, leaving behind the amino acid it was carrying.

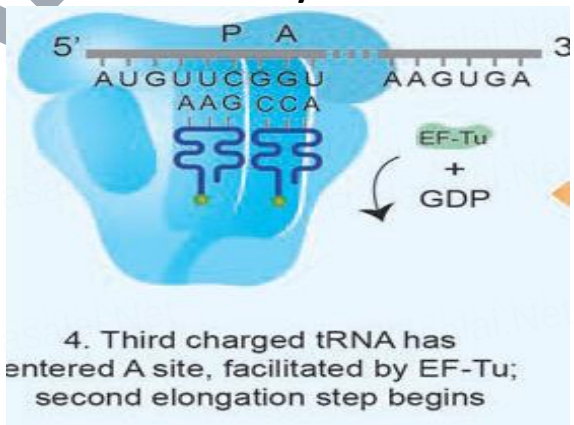


2. Dipeptide bond forms; uncharged tRNA moves to E-site and then out of ribosome



3. mRNA has shifted by 3 bases; EF-G facilitates the translocation step; first elongation step completed

- The ribosome moves along the mRNA in the direction of 5' to 3'.
- Hence the entire mRNA – tRNA – aa 1- aa 2 complex is shifted in the direction of the P site by a distance of three nucleotides.



4. Third charged tRNA has entered A site, facilitated by EF-Tu; second elongation step begins

- Now the third triplet codon on the mRNA is ready to accept another charged tRNA in the A site.

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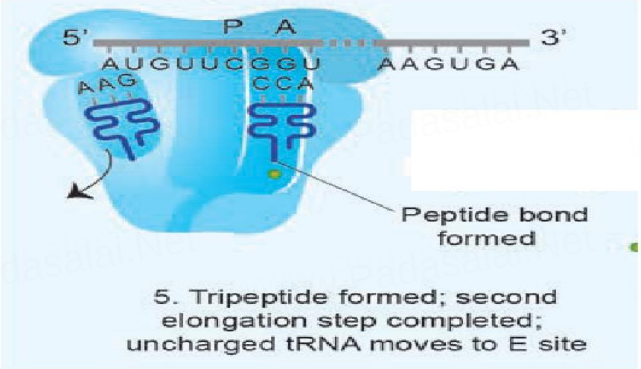
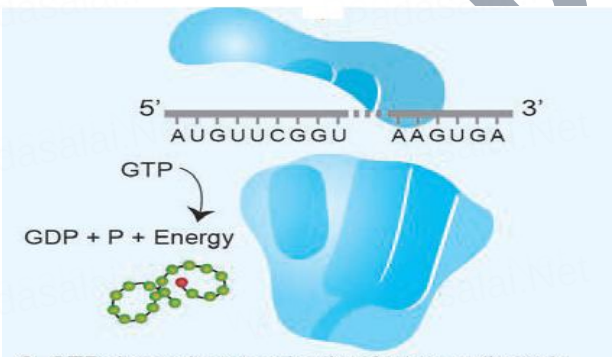


5. Tripeptide formed; second elongation step completed; uncharged tRNA moves to E site

- Thus, the sequence of elongation is repeated over and over.

**TERMINATION:**

- Termination occurs when one of the three stop codons appear in the A site of ribosome.
- The terminal codon signals the action of GTP dependent release factors which cleave the polypeptide chain from the terminal mRNA.



2. GTP-dependent termination factors activated; components separate; polypeptide folds into protein

- The tRNA is released from the ribosomal complex and the ribosome thereafter dissociates into sub units.

48. Enumerate the steps involved in DNA finger printing.

The Steps in DNA Fingerprinting technique:

1. **Extraction of DNA:**
   The process of DNA fingerprinting starts with obtaining a sample of DNA from blood, semen, vaginal fluids, hair roots, teeth, bones, etc.
2. **Polymerase chain reaction (PCR):**
   In many situations, there is only a small amount of DNA available for DNA fingerprinting. If needed many copies of the DNA can be produced by PCR (DNA amplification).
3. **Fragmenting DNA:**
   DNA is treated with restriction enzymes which cut the DNA into smaller fragments at specific sites.
4. **Separation of DNA by electrophoresis:**

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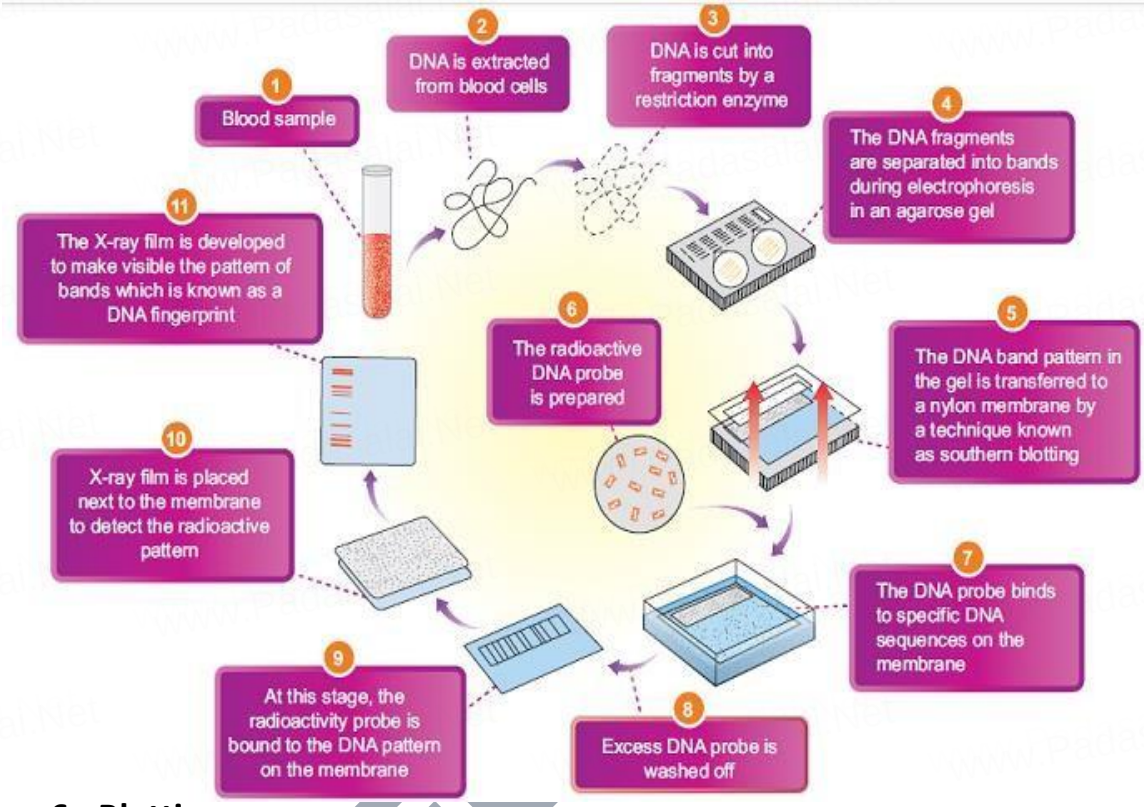
**During electrophoresis in an agarose gel, the DNA fragments are separated into bands of different sizes. The bands of separated DNA are sieved out of the gel using a nylon membrane.**

5. **Denaturing DNA:**
   **The DNA on gels is denatured by using alkaline chemicals or by heating.**




6. **Blotting:**
   **The DNA band pattern in the gel is transferred to a thin nylon membrane placed over the 'size fractionated DNA strand' by Southern blotting.**
7. **Using probes to identify specific DNA:**
   **A radioactive probe added to the DNA bands. The probe attaches by base pairing to those restriction fragments that are complementary to its sequence. The probes can also be prepared by using either '' fluorescent substance'' or ''radioactive isotopes''.**
8. **Hybridization with probe:**
   **After the probe hybridizes and the excess probe washed off, a photographic film is placed on the membrane containing 'DNA hybrids'**
9. **Exposure on film to make a genetic/DNA Fingerprint:**
   **The radioactive label exposes the film to form an image of bands corresponding to specific DNA bands. The thick and thin dark bands form a pattern of bars which constitutes a genetic fingerprint.**

**49. List out the applications of DNA finger printing.**

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1. **Forensic analysis:** It can be used in the identification of a person involved in criminal activities, for settling paternity or maternity disputes, and in determining relationships for immigration purposes.
2. **Pedigree analysis:** inheritance pattern of genes through generations and for detecting inherited diseases.
3. **Conservation of wild life:** protection of endangered species. By maintaining DNA records for identification of tissues of the dead endangered organisms.
4. **Anthropological studies:** It is useful in determining the origin and migration of human populations and genetic diversities.

**50. Write the salient features of Human Genome Project?**

- ✓ The human genome contains 3 billion nucleotide bases.
- ✓ An average gene consists of 3000 bases, the largest known human gene (dystrophin) has 2.4 million bases.
- ✓ Genes are distributed over 24 chromosomes. Chromosome 19 has the highest gene density.
- ✓ Chromosome 13 and Y chromosome have lowest gene densities.
- ✓ 99.9 nucleotide bases are exactly the same in all people.
- ✓ Less than 2 percent of the genome codes for proteins.
- ✓ Chromosome 1 has 2968 genes whereas chromosome 'Y' has 231 genes.
- ✓ Scientists have identified about 1.4 million locations where single base DNA differences (SNPs – Single nucleotide polymorphism – pronounce as 'snips') occur in humans.
- ✓ Identification of 'SNIPS' is helpful in finding chromosomal locations for disease associated sequences and tracing human history.

**51. Explain Lac-Operon model.**

- Lac operon, also called lactose operon refers to the transcriptional unit in E. coli.
- It consists of genes that code for enzymes which involve in the metabolism of lactose.
- Lac operon becomes functional only when glucose is not available as a substrate and lactose is present.

**When glucose is available:**

- The operator gene is switched off, so that lactose metabolism does not occur.
- The 'i' gene in the promotor region transcribes a repressor mRNA, which is translated into a repressor protein.

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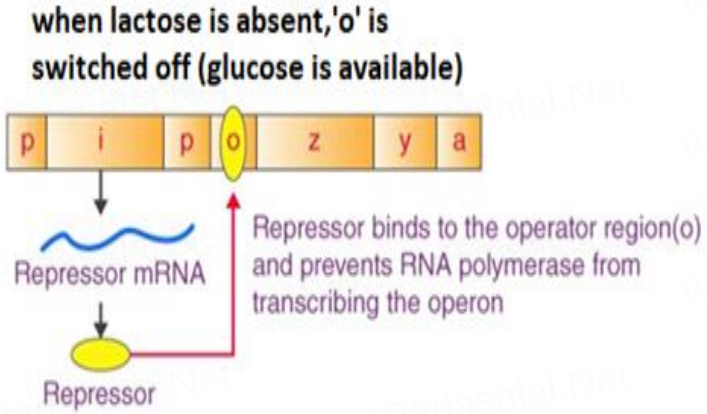
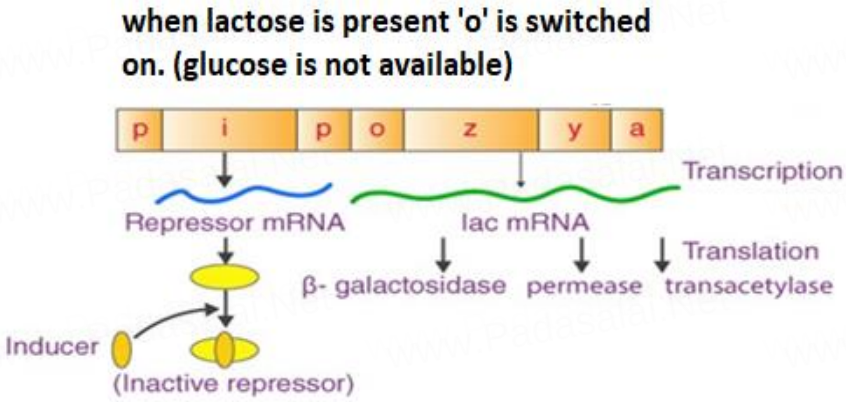
- This repressor protein when binds with operator gene, switching it off, that RNA polymerase is prevented from binding with promotor gene.




Now operator gene cannot transcribe lac mRNA and the structural genes z, y, a are not translated into three enzymes necessary for lactose metabolism.

When glucose is not available:

- The operator gene is switched on, so that lactose metabolism occurs.
- The inducer allolactose binds with repressor protein.
- So, the repressor protein becomes inactive.
- The operator gene is switched on and the RNA polymerase binds with promotor site.




- The genetic information in the structural genes z, y and a is transcribed into lac mRNA.
- The transcribed lac mRNA is now translated into three enzymes, ß- galactosidase, permease and transacetylase, which involve in lactose metabolism.

## CHAPTER 6 EVOLUTION

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**TWO MARK QUESTIONS:**

**52. What is K-T extinction?**

The mass extinction of species is referred as K-T extinction.

**53. List out the major gases seems to be found in the primitive earth.**

Ammonia, methane, hydrogen and water vapour

**54. What factors disturb Hardy- Weinberg equilibrium?**

Mutation, preferred mating, gene flow and natural selection are the factors that will disturb Hardy- Weinberg's equilibrium.

**55. Rearrange the descent in human evolution**

Australopithecus → Homo erect → Homo sapiens → Ramapithecus → Homo habilis.

Ramapithecus → Australopithecus → Homo habilis → Homo erect → Homo sapiens

**56. How does Neanderthal man differ from the modern man in appearance?**

Neanderthal man differs from modern man by having semierect posture, flat cranium, sloping forehead, thin large orbits, heavy brow ridges, protruding jaws and no chin.

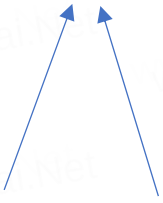
**3 MARK QUESTIONS:**

**57. 'Darwin denoted struggle for existence in 3 ways'- Explain.**

Darwin denoted struggle for existence in three ways – Intra specific struggle between the same species for food, space and mate. Inter specific struggle with different species for food and space. Struggle with the environment to cope with the climatic variations, flood, earthquakes, drought, etc.,

**58. Define convergent evolution.**

One or more different species evolve similarities in their characteristics and functions due to adaptations in an environment. This type of evolution is called Convergent evolution. They evolve from the different species but develop similar characteristics, like wings of birds and insects.

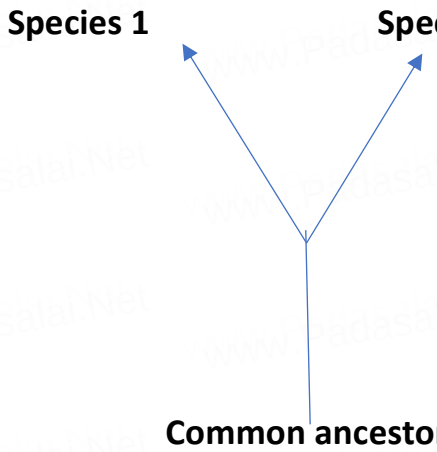


Species 1 Species 2

**59. Define divergent evolution.**

When one ancestral species diverges into multiple different species, ultimately giving rise to new species, then it is said to be Divergent evolution. They evolve from same species and gradually give rise to new

species like Darwin's finches, which have evolved into around 80 new species.




60. Give examples for fossilization by actual remains method.
Woolly Mammoth that lived 22 thousand years ago were preserved in the frozen coast of Siberia as such.
Several human beings and animals living in the ancient city of Pompeii were preserved intact by volcanic ash which gushed out from Mount Vesuvius.

61. On what conditions a population will be in Hardy Weinberg equilibrium?
A population will be in Hardy Weinberg equilibrium, when in that population there is,
No mutation
No Random mating
No gene flow
Very large size population

62. What is Hardy Weinberg Equilibrium?
Hardy of UK and Weinberg of Germany stated that the allele frequencies in a population are stable and are constant from generation to generation in the absence of gene flow, genetic drift, mutation, recombination and natural selection.

63. Who disproved Lamarck's Theory of acquired characters? How?
August Weismann disproved Lamarck's theory.
He conducted experiments on mice for twenty generations by cutting their tails and breeding them. All mice born, were with tail. Weismann proved his germplasm theory that change in the somatoplasm will not be transferred to the next generation but changes in the germplasm will be inherited.

64. What is biogenetic law?
Ernst Von Haeckel, propounded the "biogenetic law or theory of recapitulation" which states that the life history of an individual

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(ontogeny) briefly repeats or recapitulates the evolutionary history of the race (phylogeny). In other words, "Ontogeny recapitulates Phylogeny".

**5 MARK QUESTIONS:**

65. Darwin's finches and Australian marsupials are suitable examples of adaptive radiation – Justify the statement.

The common ancestor of Darwin's finches arrived on the Galapagos about 2 million years ago. During that time, Darwin's finches have evolved into 14 recognized species differing in body size, beak shape and feeding behaviour.

Changes in the size and form of the beak have enabled different species to utilize different food resources such as insects, seeds, nectar from cactus flowers and blood from iguanas.

Australian marsupials and north American placental mammals also had come from the same ancestor. Which later, occupied different habitats and produced varieties of species and adapted to particular food resource, locomotory skills or climate.

Hence Darwin's finches and Australian marsupials are the suitable examples of adaptive radiation.

66. Explain the three level of impact of extinction of species.

1. Species extinction:
   This eliminates an entire species, by an environmental event (flood etc.,) or by biological event (disease or non -availability of food resource half or more).
2. Mass extinction:
   This eliminates half or more species in a region or ecosystem, as might occur following a volcanic eruption.
   Five major mass extinction that occurred since the Cambrian period.
   This mass extinction is often referred to as K-T extinction.
3. Global extinction:
   This eliminates most of the species on a large scale or larger taxonomic groups in the continent or the Earth. Snow ball Earth and extinction following elevation in $CO_2$ levels are examples. Extinction events open up new habitats and so can facilitate the radiation of organisms that survived the mass extinction.

67. Explain Urey and Miller experiment with a diagram.

- In their experiment, a mixture of gases was allowed to circulate over electric discharge from a tungsten electrode.
- A small flask of water was kept boiling and the steam emanating from it was made to mix with the mixture of gases (ammonia,

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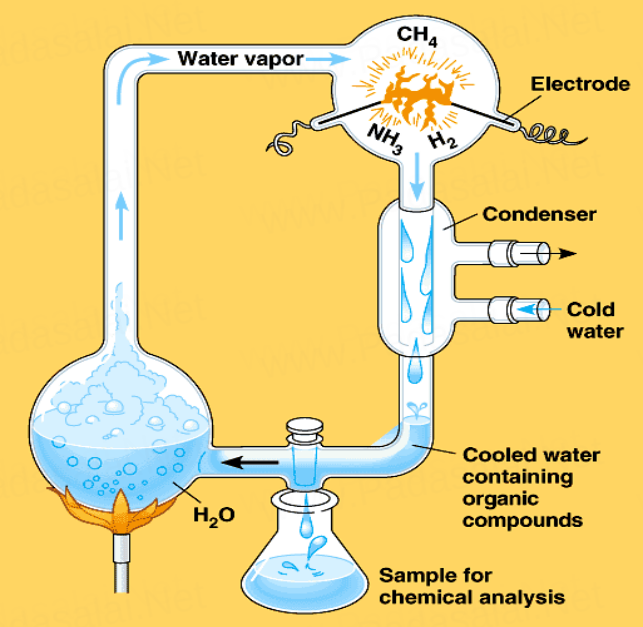
methane and hydrogen) in the large chamber that was connected to the boiling water.

- The steam condensed to form water which ran down the 'U' tube. Experiment was conducted continuously for a week and the liquid was analyzed.




- Glycine, alanine, beta alanine and aspartic acid were identified.
- Thus, Miller's experiments had an insight as to the possibility of a biogenetic synthesis of large amount of variety of organic compounds in nature from a mixture of sample gases in which the only source of carbon was methane.

68. Explain Big Bang theory.

The primitive earth had no proper atmosphere, but consisted of ammonia, methane, hydrogen and water vapour. The temperature of the earth was extremely high. UV rays from the sun split up water molecules into hydrogen and oxygen.

Gradually the temperature cooled and the water vapour condensed to form rain. Rain water filled all the depressions to form water bodies. Ammonia and methane in the atmosphere combined with oxygen to form carbon dioxide and other gases.

69. Taking the example of Peppered moth, explain the action of natural selection.

The peppered moth, Biston betularia, were available in England. They were in two colours, viz. white and black. They were common in England before industrialization.

Pre-industrialization witnessed white coloured background on the wall of the buildings. Due to white background, the white-coloured moths had

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escaped from their predators and the black coloured became victims to predators.

But during the time of Post industrialization, the tree trunks became dark due to smoke and soot let out from the industries. While the black moths could camouflage on the dark bark of the trees, the white moths were easily identified by their predators. Hence the dark- coloured moth population was selected and their number increased.

This shows that in a population, organisms that can adapt will survive and produce more progenies resulting in increase in population through natural selection.

This phenomenon is called Industrial melanism.

70. How does Hardy-Weinberg's expression ($p^2+2pq+q^2=1$) explain that genetic equilibrium is maintained in a population? List any four factors that can disturb the genetic equilibrium.

Suppose in a large population of beetles, (infinitely large) appear in two colours dark grey (black) and light grey, and their colour is determined by 'A' gene. 'AA' and 'Aa' beetles are dark grey and 'aa' beetles are light grey.

In a population let's say that 'A' allele has frequency (p) of 0.3 and 'a' allele has a frequency (q) of 0.7. Then p + q = 1.

If a population is in Hardy Weinberg equilibrium, the genotype frequency can be estimated by Hardy Weinberg equation.

$(p + q)^2 = p^2 + 2pq + q^2$

$p^2$ = frequency of AA

2pq = frequency of Aa

$q^2$= frequency of aa

p = 0.3, q = 0.7 then,

$p^2 = (0.3)^2 = 0.09 = 9$ % AA

$2pq = 2(0.3)(0.7) = 0.42 = 42$ % Aa

$q^2 = (0.7)^2$ 0.49 = 49 % aa

Hence, when the beetles in Hardy- Weinberg equilibrium reproduce, the allele and genotype frequency in the next generation would be the same.

Mutation, preferred mating, gene flow and natural selection are the factors that will disturb Hardy- Weinberg's equilibrium.

71. Mention the main objections to Darwinism.

- ✓ Darwin failed to explain the mechanism of variation.
- ✓ Darwinism explains the survival of the fittest but not the arrival of the fittest.
- ✓ He focused on small fluctuating variations that are mostly non-heritable.

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- ✓ **He did not distinguish between somatic and germinal variations. He could not explain the occurrence of vestigial organs, over specialization of some organs like large tusks in extinct mammoths, oversized antlers in the extinct Irish deer etc.,**

**ALL THE BEST!**

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