UNIT -IV : MOLECULAR BIOLOGY

10. MOLECULAR BASIS OF INHERITANCE

(2 x 2) + (1 x 4) = 8 Marks

ROOT POINTS

1. **Molecular biology** deals with study of Macro molecules and their mechanisms in living organisms such as gene replication, mutation and expression.
2. **Molecular basis of inheritance** for most of the organisms is due to 2 nucleic acids **DNA , RNA**.
3. **Nucleic acids** are long polymers of nucleotides.
4. **DNA stores** the genetic information where as RNA helps in expression of information.
5. **DNA** is chemically and structurally **more stable** and it is better genetic material than RNA.
6. DNA has double stranded helical structure and RNA has single stranded helix structure.
7. DNA undergoes **self-replication** but RNA does not undergo self-replication.
8. DNA is written in 3 letter words. Each of such '3 letter word' is called a codon.
9. Each codon encodes for one of the 20 amino acids used in the synthesis of proteins.
10. Genetic code is a set of instructions that direct the translation of DNA into 20 amino acids.
11. **Components of nucleotide**: Nitrogenbase, pentose sugar and phosphate molecule. *[IPE]*
12. **Components of transcription unit**: (i) A promoter (ii) The structural gene (iii) A Terminator
13. **Exons:** These are coding sequences . They appear in mature or processed RNA. *[IPE]*
14. **Introns:** These are non-coding sequences. They do not appear in mature or processed RNA.
15. **Capping:** Adding of an unusual nucleotide (methyl guanosine triphosphate) to the 5'-end of hnRNA is called Capping. *[IPE]*
16. **Tailing:** Adding of adenylate residues (200-300) to the 3'-end in a template is called tailing.
17. **Nucleosome** is a bead like structure of chromosomes. *[IPE]*

FRUITY Qs OF IPE

(2 x 2) + (1 x 4) = 8 Marks

1. Distinguish between heterochromatin and euchromatin. Which of the two is transcriptionally active?
2. Who proved that DNA is genetic material? What is the organism they worked on?
3. What is the difference between exons and introns?
4. What is meant by capping and tailing?
5. What is the function of the codon-AUG.
6. Define stop codon. Write the codons.
7. In a typical DNA molecule, the proportion of Thymine is 30% of the N bases. Find out the percentages of other N bases.
8. How many types of RNA polymerases exist in cells? Write their names and functions.
9. Draw the schematic/ diagrammatic presentation of the lac operon.
10. What are the differences between DNA and RNA
11. Write the important features of Genetic code?
12. Write briefly on nucleosomes

SCENT BOXES- MEMORY HINTS

FOR SELECTIVE QUESTIONS

39. Define transformation in Griffith's experiment. Discuss how it helps in the identification of DNA as genetic material.

A: **1) Transformation:** It is the genetic alteration of a cell resulting from the direct uptake and incorporation of genetic material from its surroundings through the cell membranes.

2) In 1928, Fredrick Griffith conducted a series of experiments on a bacterium called streptococcus pneumoniae, which is responsible for pneumonia.

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Sr & Rnv enjoyed at
Streba's Party.
S-Died,
R-Safe
HKS-Safe
HKSR- Died

3) During his experiment he found that the bacteria can change its physical form. He has grown the bacteria on a culture medium.

4) He observed two strains of this bacterium, one forming smooth colonies with capsule (S-type) and the other forming rough colonies without capsule (R-type)

5) The S-type cells are virulent while R-type cells are non-virulent.

6) When live S-type cells are injected into mice, they suffered from pneumonia and died.

7) When live R-type cells are injected into mice, the disease didnot appear and the mice survived.

8) When heat killed S-type cells were injected, the disease did not appear.

9) When heat killed S-type were mixed with live R-type and injected into mice, the mice died of pneumonia and live S-type cells were isolated from the body of dead mice.

10) He concluded that two R-strain cells have been transformed by the heat killed S-strain bacteria.

11) This must be due to the transfer of genetic material by the transforming principle.

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40. How many types of RNA polymerases exist in cells? Write their names and functions.

A: **Three types of RNA polymerases in the nucleus:** **[TS 17, 23]**

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Do You Know?
RP Transcribe RNA
Molecule using
DNA as a Template

1) RNA Polymerase I : It transcribes rRNAs (28S, 18S and 5.8S)

2) RNA Polymerase II : It transcribes the precursor of mRNA, the heterogeneous nuclear RNA (hnRNA).

3) RNA Polymerase III: It is responsible for transcription of tRNA, 5srRNA and snRNAs

42. What are the differences between DNA and RNA [AP 20] [TS 17,20,22]

A:

DNA	RNA
1) DNA stands for Deoxyribo Nucleic Acid.	1) RNA stands for Ribo Nucleic Acid.
2) DNA is double stranded Helix.	2) RNA is single stranded Helix.
3) DNA is stable under alkaline condition.	3) RNA is unstable under alkaline condition.
4) DNA contains the sugar Deoxyribose	4) RNA contains the sugar Ribose.
5) DNA is made up of more than 4 million nucleotides.	5) RNA is made up of 75-2000 nucleotides.
6) DNA undergoes self replication.	6) RNA does not undergo self replication.
7) DNA is genetic material.	7) RNA is non-genetic material.
8) DNA does not participate directly in protein synthesis.	8) RNA participates directly in protein synthesis.
9) DNA is of one type (metabolically).	9) RNA is of three types(metabolically).
10) The base pairing is A=T and G≡C	10) The base pairing is A=U and G≡C

☺ SCENT BOX ☺

Hurray! DNA

So excited to know about
my Genetic Material DNA (or)
Wow! I have much
advantageous Genetic Material
i.e., DNA
than that of a
Viral Cell i.e., RNA

44. Write briefly on nucleosomes. **[AP 17, 19][TS 22]**

A: 1) Nucleosome is a bead like structure of chromosomes.

2) It consists of eight histone molecules (histone octamer) and a DNA segment of about 150 base pairs.

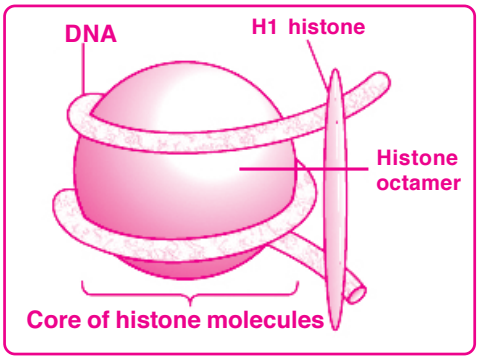
3) The negatively charged DNA is wrapped around the positively charged histone octamer to form the structure of nucleosome.

4) Nucleosome helps to fold DNA into a compact form.

5) DNA and basic histone proteins constitute chromatin.

6) Nucleosomes constitute the repeating unit of a structure in nucleus called chromatin.

7) The nucleosomes in chromatin are seen as 'beads-on-string' when viewed under electron microscope.



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Nucleosomes conserves/ saves space by binding out the DNA of 150bp into a compact form.

90. Distinguish between heterochromatin and euchromatin. Which of the two is transcriptionally active? [TS 22]S[AP 20]

A:

Heterochromatin	Euchromatin
1) The chromatin that is more densely packed and stains dark is called Heterochromatin.	1) The chromatin that is loosely packed and stains light is called Euchromatin.
2) It is transcriptionally inactive.	2) It is transcriptionally active.

SCENT BOX

Inactive dpsd is heterochromatin

Active lpsl is Euchromatin

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97. What is the difference between exons and introns? [TS 15,18,22]

A: **1) Exons:** These are coding sequences .

They appear in mature or processed RNA.

2) Introns: These are non-coding sequences.

They do not appear in mature or processed RNA.

SCENT BOX

Exon is a positive thinker while Intron is a negative thinker

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98. What is meant by capping and tailing? [TS 16,23][AP 17,23]

A: 1) **Capping:** Adding of an unusual nucleotide (methyl guanosine triphosphate) to the 5'-end of hnRNA is called Capping.

2) **Tailing:** Adding of adenylate residues (200-300) to the 3'-end in a template is called tailing.

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They have 5 Head caps & 3 Temporary Tails

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99. What is meant by point mutation? Given an example. [AP 18] [TS 19,19]

A: 1) **Point Mutation:** It is the mutation that occurs in a single base pair of DNA fragment

2) **Ex:** Sickle cell anemia.

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Sickle Cell Anemia is PM

103. Write any two differences between DNA and RNA. **[AP 17, 19]**

A: 1) DNA has deoxyribose sugar.

DNA undergoes self replication.

2) RNA has ribose sugar.

RNA doesnot undergoes self replication.

SCENT BOX

DNA ds is a Sr

But RNA rs is not a Sr