

For BioResire students



NEET Biology Material

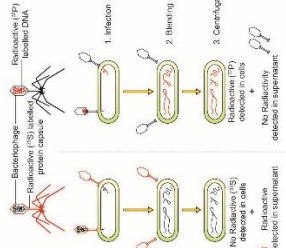
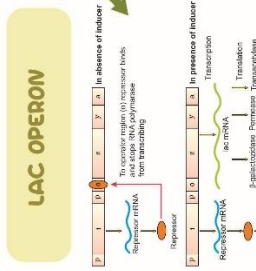
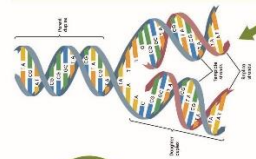
Elite Batch

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SEMI-CONSERVATION MODEL
 Matthew Meselson and Franklin Stahl
 Experimented on bacterium
 Observed - DNA in chromosome
 replicated in a semi-conservative manner

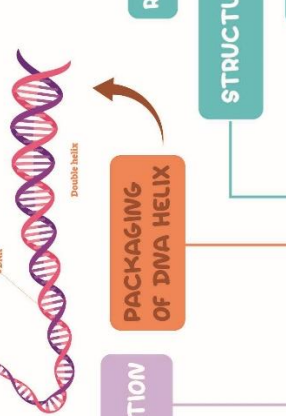
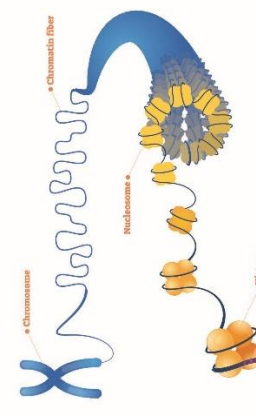
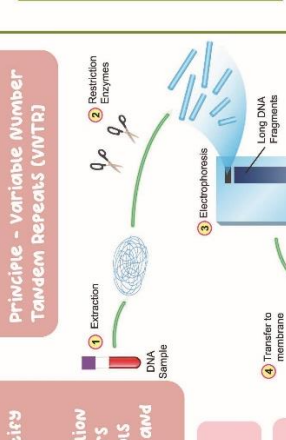
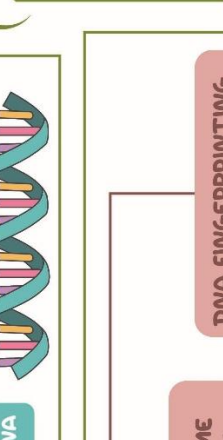
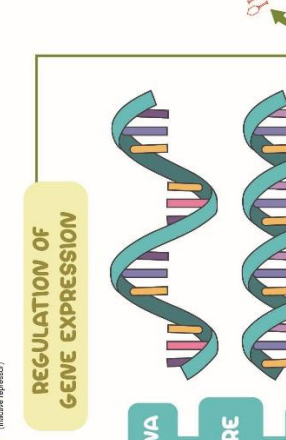


HERSHEY - CHASE EXPERIMENT
 Conducted experiment on Bacteriophage and bacteria
 Observed - DNA is the genetic material

BIOCHEMICAL NATURE OF TRANSFORMING PRINCIPLE
 Oswald Avery, Colin MacLeod and Maclyn McCarty
 Observed that DNA is hereditary material not protein, RNA, etc.

TRANSFORMING PRINCIPLE
 Experimented on mice and Streptococcus pneumoniae

SEARCH FOR GENETIC MATERIAL



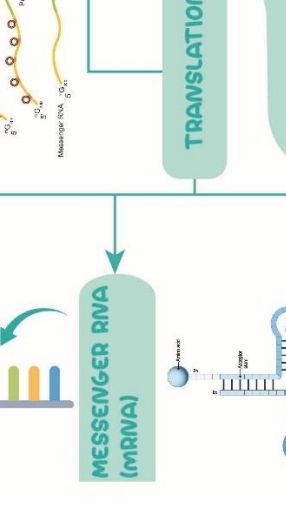
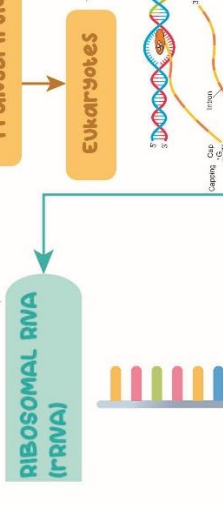
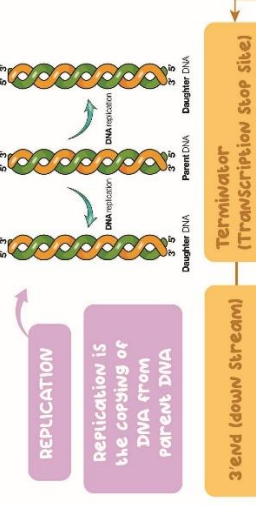
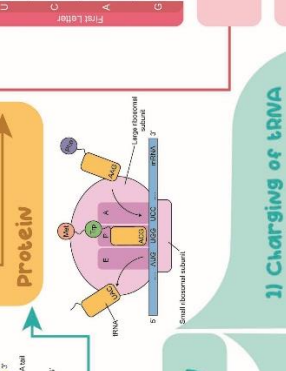
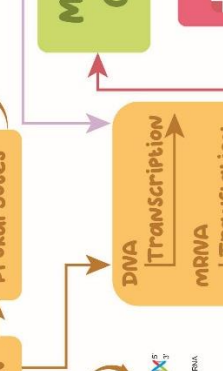
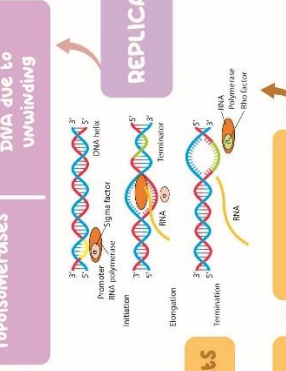
MOLECULAR BASIS OF INHERITANCE

HUMAN GENOME PROJECT (HGP)
 Conducted to identify all the estimated genes in human
 To determine 3 billion chemical base pairs
 Introduction to tools for data analysis and storage

Amino Acid Sequencing Chart		
Second Letter	Third Letter	
U	UUA [Phe]	UUA [Phe]
U	UUC [Phe]	UUC [Phe]
U	UUA [Phe]	UUA [Phe]
U	UUG [Leu]	UUG [Leu]
C	CUU [Leu]	CUU [Leu]
C	CUC [Leu]	CUC [Leu]
C	CUA [Leu]	CUA [Leu]
C	CUG [Leu]	CUG [Leu]
A	AUU [Ile]	AUU [Ile]
A	AUC [Ile]	AUC [Ile]
A	AUA [Met]	AUA [Met]
A	AUG [Met]	AUG [Met]
G	GUU [Val]	GUU [Val]
G	GUC [Val]	GUC [Val]
G	GUA [Val]	GUA [Val]
G	GUG [Val]	GUG [Val]

DNA dependent DNA polymerase
 Primase
 DNA ligase
 Helicase
 Topoisomerases

Initiates DNA Synthesis
 Aids the formation of primers
 Joins fragments of lagging strand
 To unwind DNA helix
 Relieve stress on DNA due to unwinding



GENETIC CODE

Salient features
 Triplet in nature
 Codons degenerate
 Commaless in nature
 Universal. Unambiguous
 Initiator codon (AUG)
 Stop/ Terminator codons (UAA, UAG, UGA)

STRUCTURE OF tRNA
 Anticodon loop
 Acceptor end
 2D - Clover-leaf shaped
 3D - Inverted L shaped

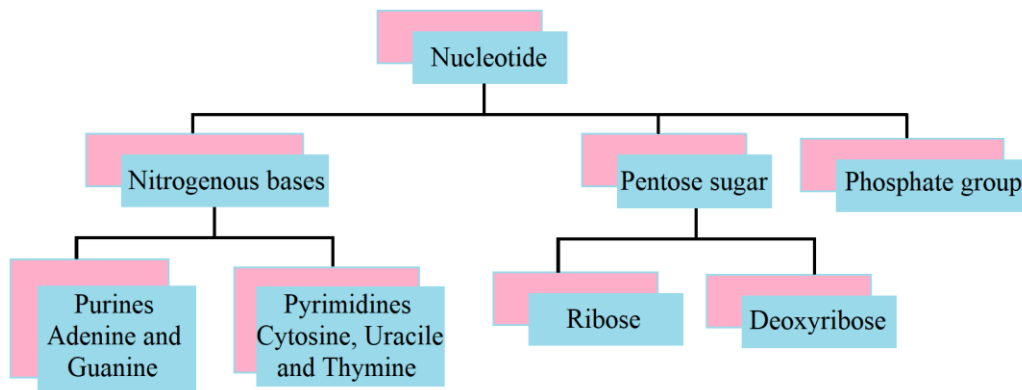
MOLECULAR BASIS OF INHERITANCE

The DNA:

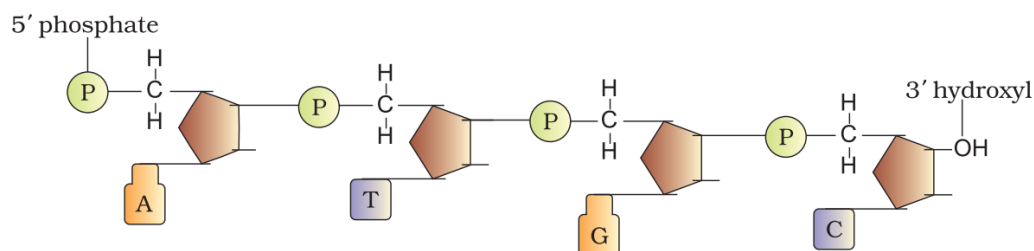
DNA (Deoxyribonucleic Acid) and RNA (Ribonucleic Acid) are two types of nucleic acid found in living organisms. DNA acts as genetic material in most of the organisms. RNA also acts as genetic material in some organisms as in some viruses and acts as messenger. It functions as adapter, structural, and in some cases as a catalytic molecule.

The DNA it is a long polymer of deoxyribonucleotides. A pair of nucleotides is also known as base pairs. Length of DNA is usually defined as number of nucleotides present in it. Escherichia coli have 4.6×10^6 bp and haploid content of human DNA is 3.3×10^9 bp.

Structure of Polynucleotide Chain:



A nucleotide has three components – a nitrogenous base, a pentose sugar (ribose in case of RNA, and deoxyribose for DNA), and a phosphate group. There are two types of nitrogenous bases – Purines (Adenine and Guanine), and Pyrimidines (Cytosine, Uracil and Thymine). Cytosine is common for both DNA and RNA and Thymine is present in DNA. Uracil is present in RNA at the place of Thymine.



A polynucleotide chain:

A nitrogenous base is linked to pentose sugar with N-glycosidic linkage to form a nucleoside. When phosphate group is linked 5'-OH of a nucleoside through phosphoester linkage nucleotide is formed. Two nucleotides are linked through 3'-5' phosphodiester linkage to form dinucleotide. More nucleotide joins together to form polynucleotide. In RNA, nucleotide residue has additional –OH group present at 2'-position in ribose and uracil is found at the place of Thymine.

DNA & RNA

Structure differences:

DNA	RNA
The sugar present in DNA is 2-deoxy-D – (-) - ribose.	The sugar present in RNA is D- (-)- ribose.
DNA contains cytosine and thymine as pyrimidine bases and guanine and adenine as purine bases.	RNA contains cytosine and uracil as pyrimidine bases and guanine and adenine as purine bases.
DNA has a double strand α -helix structure.	RNA has a single stranded α -helix structure.
DNA molecules are very large their molecular mass may vary from $6 \times 10^6 - 16 \times 10^6$ u	RNA molecules are comparatively much smaller with molecular mass ranging from 20,000 – 40,000.

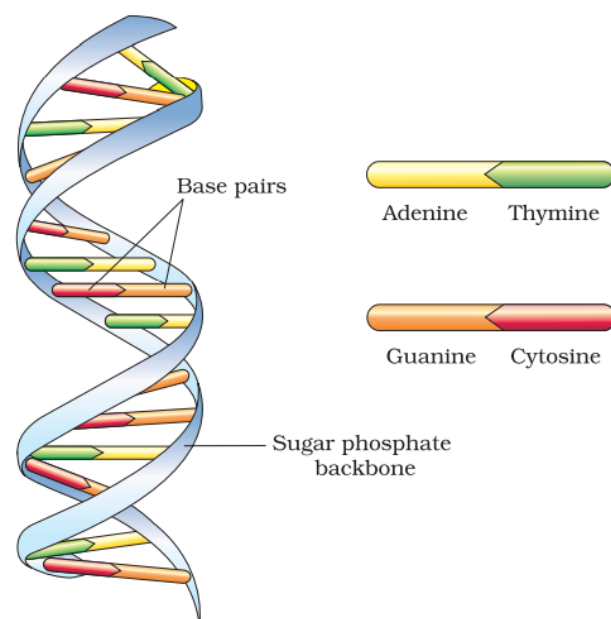
Functional differences:

DNA: DNA has a unique property of replication. DNA controls the transmission of hereditary effects.

RNA: RNA usually does not replicate. RNA controls the synthesis of proteins.

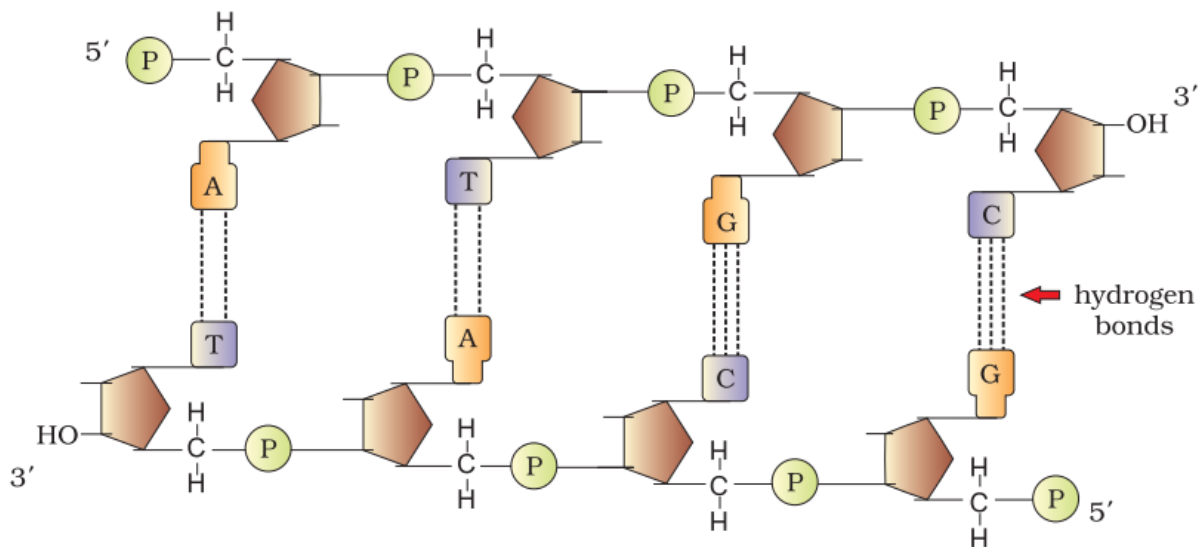
DNA double helix:

In 1953, James Watson and Francis Crick, based on the X-ray diffraction data produced by Maurice Wilkins and Rosalind Franklin, proposed a very simple but famous Double Helix model for the structure of DNA. The ratios between Adenine and Thymine and Guanine and Cytosine are constant and equal to one. The base pairing confers a very unique property to the polynucleotide chains. They are said to be complementary to each other, each strand from a DNA acts as a template for synthesis of a new strand, the two double-stranded DNA molecules produced would be identical to the parental DNA molecule.

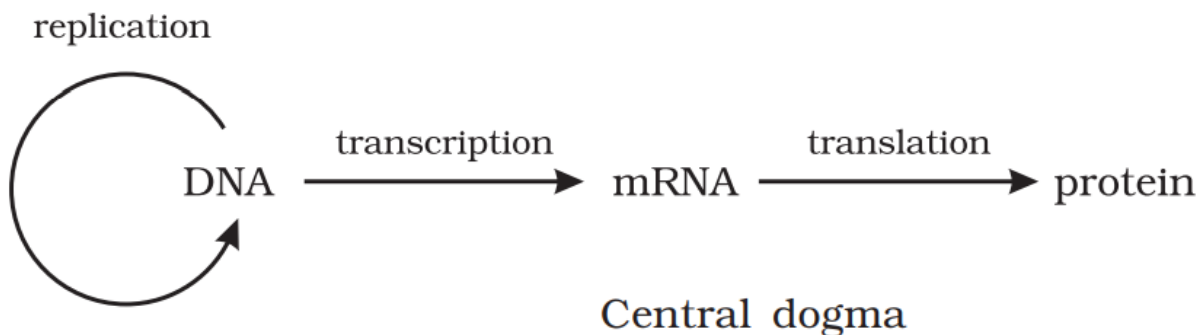


The silent features of this model are:

- DNA is made of two polynucleotide chains in which backbone is made up of sugar-phosphate and bases projected inside it.
- Two chains have anti-parallel polarity. One $5' \rightarrow 3'$ and with $3' \rightarrow 5'$.
- The bases in two strands are paired through H-bonds. Adenine and Thymine forms double hydrogen bond and Guanine and Cytosine forms triple hydrogen bonds.
- Two chains are coiled in right handed fashion. The pitch of helix is 3.4 nm and roughly 10 bp in each turn.
- The plane of one base pair stacks over the other in double helix to confer stability.



Francis Crick proposed the Central dogma in molecular biology, which states that the genetic information flows from DNA \rightarrow RNA \rightarrow Protein.



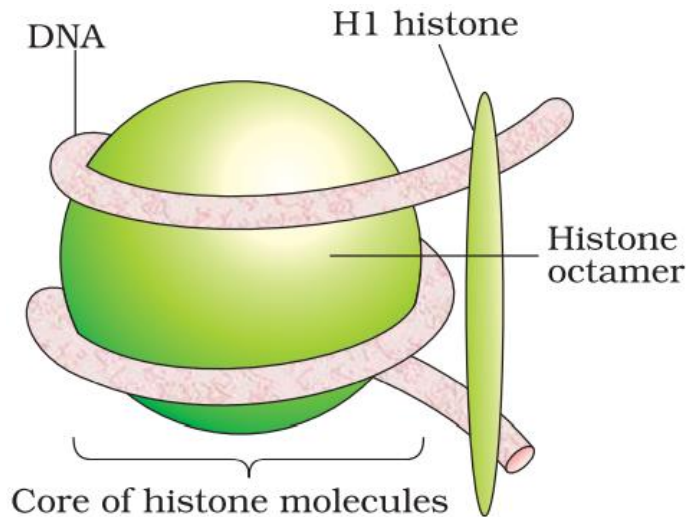
Packing of DNA helix:

In prokaryotes, well defined nucleus is absent and negatively charged DNA is combined with some positively charged proteins called nucleoids.

In eukaryotes, histones, positively charged protein organized to form 8 molecules unit called histone octamer. Negatively charged DNA is wrapped around the histone octamer to form nucleosome. Histones are rich in the basic amino acid residues lysine's and arginine's. Both the amino acid residues carry positive charges in their side chains. Single nucleosome contains about 200 base pairs. Chromatin is the repeating unit of nucleosome.

In nucleus, some region of chromatin are loosely packed (and stains light) and are

referred to as euchromatin. The chromatin that is more densely packed and stains dark are called as Heterochromatin. Euchromatin is transcriptionally active chromatin, whereas heterochromatin is inactive.



Genetic Material DNA:

DNA acts as a genetic material took long to be discovered and proven. Gregor Mendel, Walter Sutton, Thomas Hunt Morgan and numerous other scientists had narrowed the search to the chromosomes located in the nucleus of most cells. In 1928, Frederick Griffith, in a series of experiments with *Streptococcus pneumoniae* (bacterium responsible for pneumonia), witnessed a miraculous transformation in the bacteria. When *Streptococcus pneumoniae* (pneumococcus) bacteria are grown on a culture plate, some produce smooth shiny colonies (S) while others produce rough colonies (R). This is because the S strain bacteria have a mucous (polysaccharide) coat, while R strain does not. Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia.

S strain → Inject into mice → Mice die

R strain → Inject into mice → Mice live

Griffith was able to kill bacteria by heating them. He observed that heat-killed S strain bacteria injected into mice did not kill them. When he injected a mixture of heat-killed S and live R bacteria, the mice died. Moreover, he recovered living S bacteria from the dead mice.

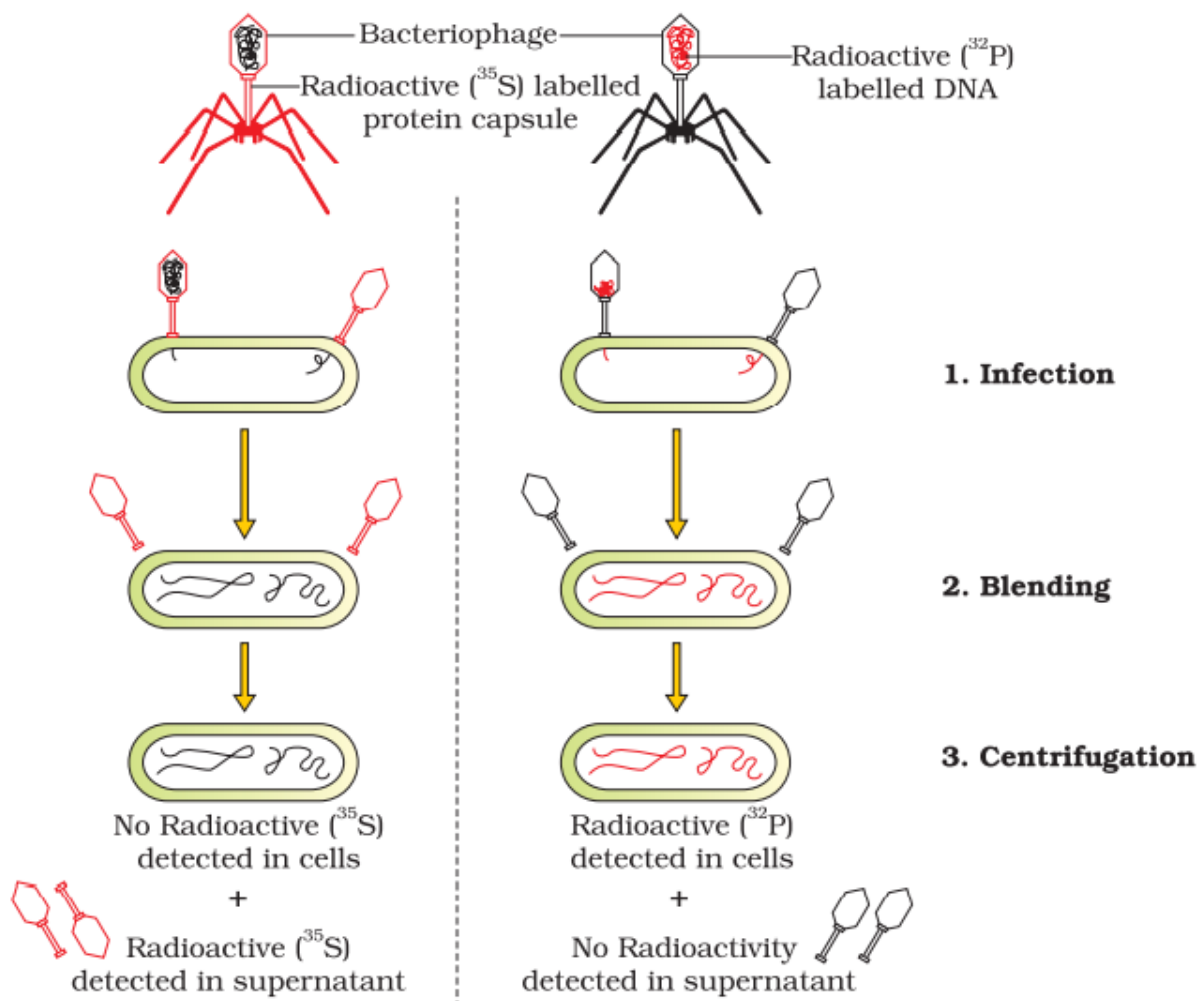
S strain (heat-killed) → Inject into mice → Mice live

S strain (heat-killed) + R strain (live) → Inject into mice → Mice die

He concluded that the R strain bacteria had somehow been transformed by the heat-killed S strain bacteria. transferred from the heat-killed S strain, had enabled the R strain to synthesize a smooth polysaccharide coat and become virulent.

The Hershey-Chase experiment:

Alfred Hershey and Martha Chase (1952). They worked with viruses that infect bacteria called bacteriophages. The bacteriophage attaches to the bacteria and its genetic material then enters the bacterial cell. it was protein or DNA from the viruses that entered the bacteria. They grew some viruses on a medium that contained radioactive phosphorus and some others on medium that contained radioactive sulfur. Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains phosphorus but protein does not. and viruses grown on radioactive sulfur contained radioactive protein but not radioactive DNA because DNA does not contain sulfur. Radioactive phages were allowed to attach to E. coli bacteria. the viral coats were removed from the bacteria by agitating them in a blender. The virus particles were separated from the bacteria by spinning them in a centrifuge. Bacteria which was infected with viruses that had radioactive DNA indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. DNA is therefore the genetic material that is passed from virus to bacteria.

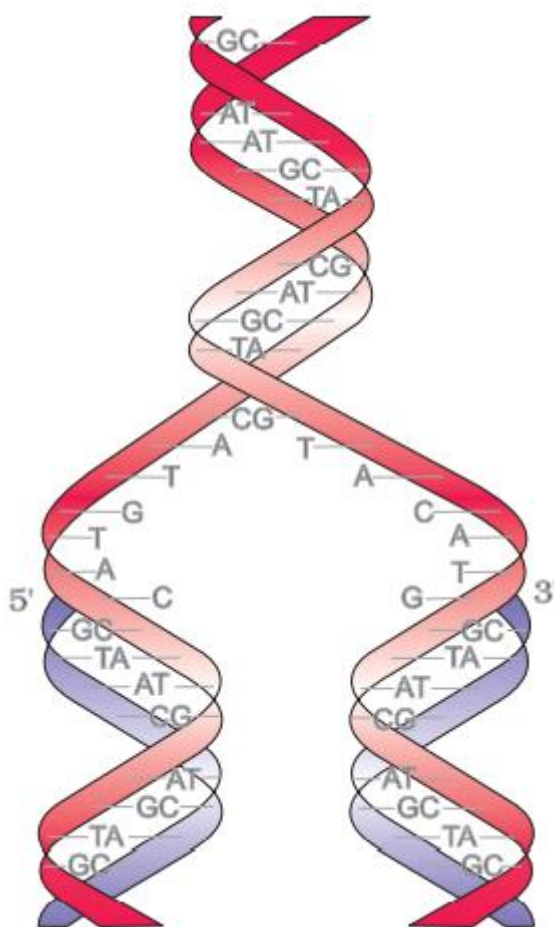


Properties of Genetic Material:

- It should be able to generate its replica (replication).
- It should chemically and structurally be stable.
- It should provide the scope for slow changes (mutation) that are required for evolution.
- It should be able to express itself in the form of 'Mendelian Characters'.
- DNA is chemically less reactive but structurally more stable as compare to RNA. So, DNA is better genetic material.
- RNA used as genetic material as well as catalyst and more reactive so less stable. Therefore, DNA has evolved from RNA.

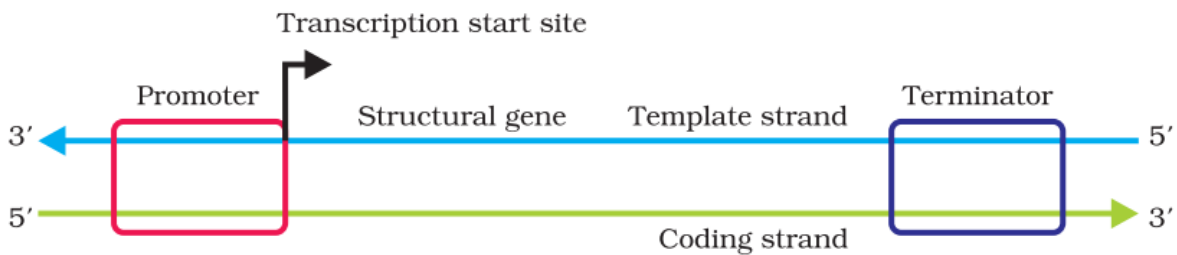
DNA Replication:

The process of producing two identical copies of DNA from a single DNA molecule is called DNA replication. This section describes this whole process in detail, as it is a process of biological inheritance. Students will be familiar with many different terminologies which are associated with the process of DNA replication. You will know about semi-conservative replication, replication fork. This section further explains about leading strand and lagging strand, mentioning the origin of replication at the end of this section.



Transcription:

The process, transcription, where the formation of RNA takes place before the occurrence of gene expression and protein synthesis. You will get an idea about what happens during the transcription process as you read this section. A promoter, structural gene and a terminator are all three different regions in a transcription unit,



Types of RNA and the process of Transcription:

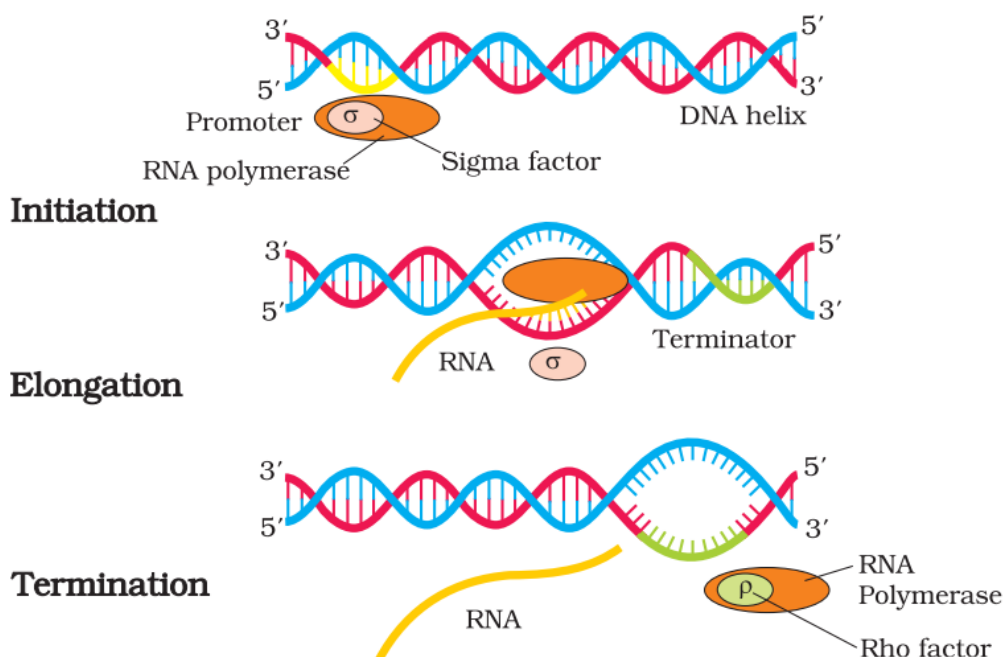
In bacteria, there are three major types of RNAs: mRNA (messenger RNA), tRNA (transfer RNA), and rRNA (ribosomal RNA). All three RNAs are needed to synthesize a protein in a cell. The mRNA provides the template, tRNA brings amino acids and reads the genetic code, and rRNAs play structural and catalytic role during translation.

Transcription in prokaryotes:

Initiation: In this step, RNA polymerase enzyme and initiation factor binds at the promoter of DNA sequence and begin transcription.

Elongation: In this step RNA polymerase, enzyme nucleoside triphosphate behaves as a substrate and polymerases the nucleotides of templates as a complementary strand.

Termination: In this step rho, a terminator factor replaces the initiation factor at the DNA sequence termination point. At this stage RNA and RNA polymerase, an enzyme is separated with rho factor.



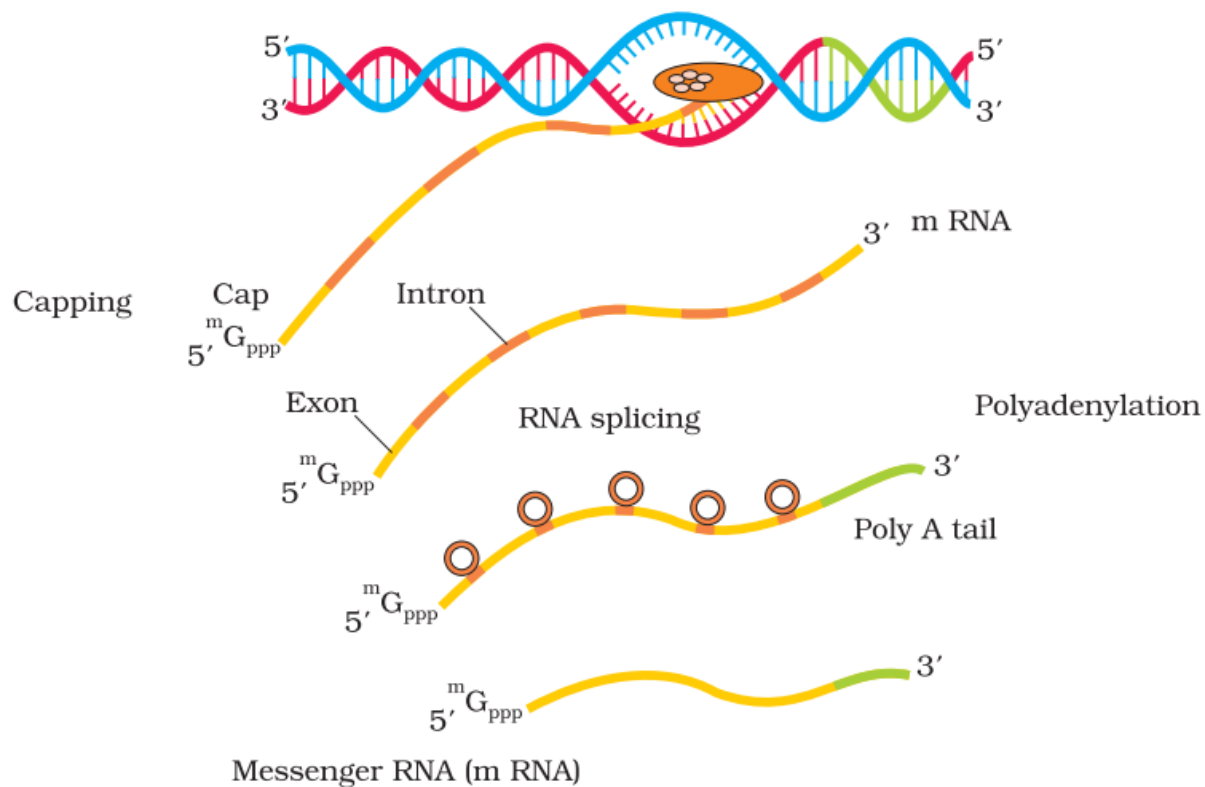
Process of Transcription in Eukaryotes:

Three RNA polymerases in the nucleus (in addition to the RNA polymerase found in the organelles). The RNA polymerase I transcribes rRNAs (28S, 18S, and 5.8S), whereas the RNA polymerase III is responsible for transcription of tRNA, 5srRNA, and snRNAs (small nuclear RNAs). The RNA polymerase II transcribes precursor of mRNA, the heterogeneous nuclear RNA (hnRNA). The primary transcripts contain both the exons and the introns and are non-functional. hnRNA undergo two additional processing called as capping and tailing.

Splicing: where the introns are removed, and exons are joined in a defined order.

Capping: In capping an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of hnRNA.

Tailing: In tailing, adenylate residues (200-300) are added at 3'-end in a template independent manner. It is the fully processed hnRNA, now called mRNA, that is transported out of the nucleus for translation.



Exons: Exons are said to be those sequence that appear in mature or processed RNA.

Introns: Introns or intervening sequences do not appear in mature or processed RNA.

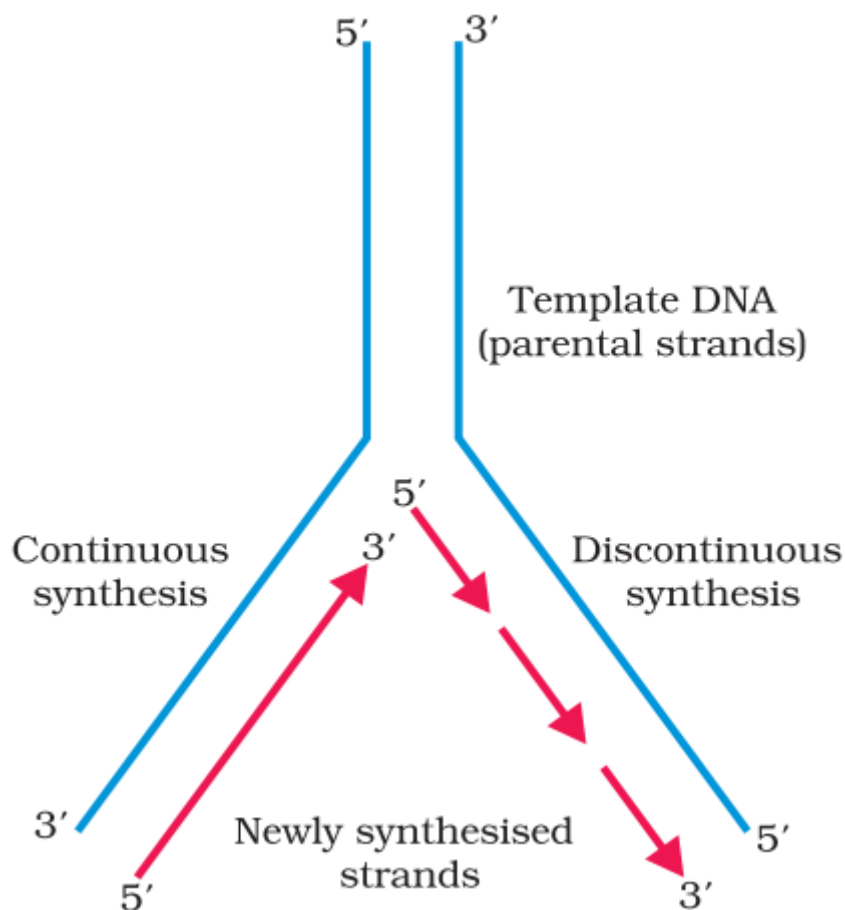
The Machinery and the Enzymes:

In living cells, such as *E. coli*, the process of replication requires a set of catalysts (enzymes). The main enzyme is referred to as DNA-dependent DNA polymerase. These enzymes are highly efficient enzymes as they have to catalyse polymerization. *E. coli* that has only 4.6×10^6 bp (compare it with human whose diploid content is

6.6 × 10⁹ bp) Any mistake during replication would result into mutations. energetically replication is a very expensive process.

Replicating Fork:

For long DNA molecules, since the two strands of DNA cannot be separated in its entire length (due to very high energy requirement), the replication occur within a small opening of the DNA helix, referred to as replication fork. The DNA-dependent DNA polymerases catalyse polymerisation only in one direction, that is 5' → 3'. on one strand (the template with polarity 3' → 5'), the replication is continuous, while on the other (the template with polarity 5' → 3'), it is discontinuous. The discontinuously synthesized fragments are later joined by the enzyme DNA ligase. The DNA polymerases on their own cannot initiate the process of replication. Also the replication does not initiate randomly at any place in DNA. There is a definite region in E. coli DNA where the replication originates. Such regions are termed as origin of replication. It is because of the requirement of the origin of replication that a piece of DNA if needed to be propagated during recombinant DNA procedures, requires a vector. The vectors provide the origin of replication.



Genetic Code:

- Genetic Code is the relationship of amino acids sequence in a polypeptide and nucleotide/ base sequence in mRNA. It directs the sequence of amino acids during synthesis of proteins.
- George Gamow suggested that genetic code should be combination of 3 nucleotides to code 20 amino acids.
- H.G. Khorana developed chemical method to synthesizing RNA molecules with

defined combination of bases.

- Marshall Nirenberg's cell free system for protein synthesis finally helped the code to be deciphered.

	First position		Second position				Third position	
	U	C	U	C	A	G	U	C
U	UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys
	UUC	Phe	UCC	Ser	UAC	Tyr	UGC	Cys
	UUA	Leu	UCA	Ser	UAA	Stop	UGA	Stop
	UUG	Leu	UCG	Ser	UAG	Stop	UGG	Trp
C	CUU	Leu	CCU	Pro	CAU	His	CGU	Arg
	CUC	Leu	CCC	Pro	CAC	His	CGC	Arg
	CUA	Leu	CCA	Pro	CAA	Gin	CGA	Arg
	CUG	Leu	CCG	Pro	CAG	Gin	CGG	Arg
A	AUU	Ile	ACU	Thr	AAU	Asn	AGU	Ser
	AUC	Ile	ACC	Thr	AAC	Asn	AGC	Ser
	AUA	Ile	ACA	Thr	AAA	Lys	AGA	Arg
	AUG	Met	ACG	Thr	AAG	Lys	AGG	Arg
G	GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly
	GUC	Val	GCC	Ala	GAC	Asp	GGC	Gly
	GUA	Val	GCA	Ala	GAA	Glu	GGA	Gly
	GUG	Val	GCG	Ala	GAG	Glu	GGG	Gly

The Codons for the Various Amino Acids

Salient features of Genetic Code are:

- The code is triplet. 61 codons code for amino acids and 3 codons do not code for any amino acids called stop codon (UAG, UGA and UAA).
- Codon is unambiguous and specific, code for one amino acid.
- The code is degenerate. Some amino acids are coded by more than one codon.
- The codon is read in mRNA in a contiguous fashion without any punctuation.
- The codon is nearly universal. AUG has dual functions. It codes for methionine and also act as initiator codon.

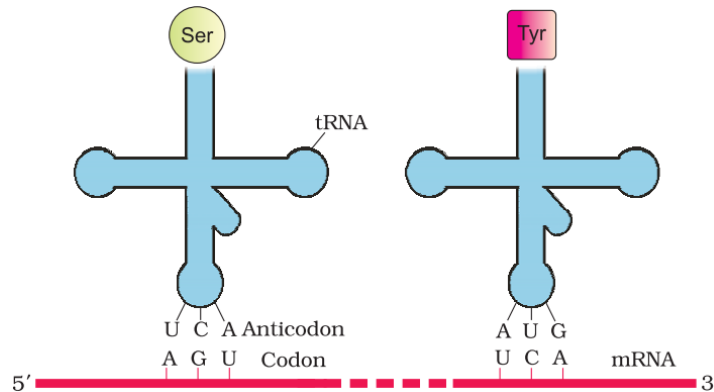
Mutations and Genetic code:

A change of single base pair (point mutation) in the 6th position of Beta globin chain of Hemoglobin results due to the change of amino acid residue glutamate to valine. These results into diseased condition called sickle cell anemia. Insertion and deletion of three or its multiple bases insert or delete one or multiple codons hence one or more amino acids and reading frame remain unaltered from that point onwards. Such mutations are called frame-shift insertion or deletion mutations.

tRNA– the Adapter Molecule:

The t-RNA called as adaptor molecules. It has an anticodon loop that has bases complementary to code present on mRNA and also has an amino acid acceptor to which amino acid binds. t-RNA is specific for each amino acids.

The secondary structure of t-RNA is depicted as clover-leaf. In actual structure, the t-RNA is a compact molecule which look like inverted L.



Translation process:

Translation is the process of polymerization of amino acids to form a polypeptide. The order and sequence of amino acids are defined by the sequence of bases in the mRNA. Amino acids are joined by peptide bonds.

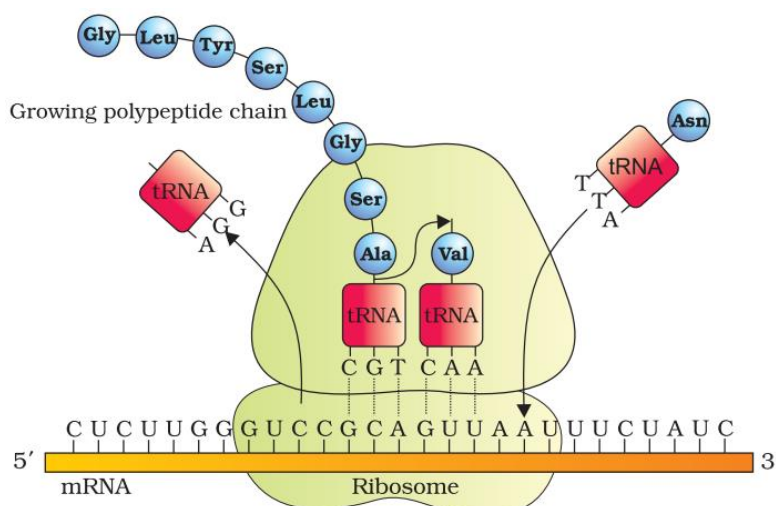
It involved following steps:

Charging of t-RNA.

Formation of peptide bonds between two charged tRNA.

The start codon is AUG. An mRNA has some additional sequence that are not translated called untranslated region (UTR).

For initiation ribosome binds to mRNA at the start codon. Ribosomes moves from codon to codon along mRNA for elongation of protein chain. At the end release factors binds to the stop codon, terminating the translation and release of polypeptide form ribosome.



Regulation of Gene Expression:

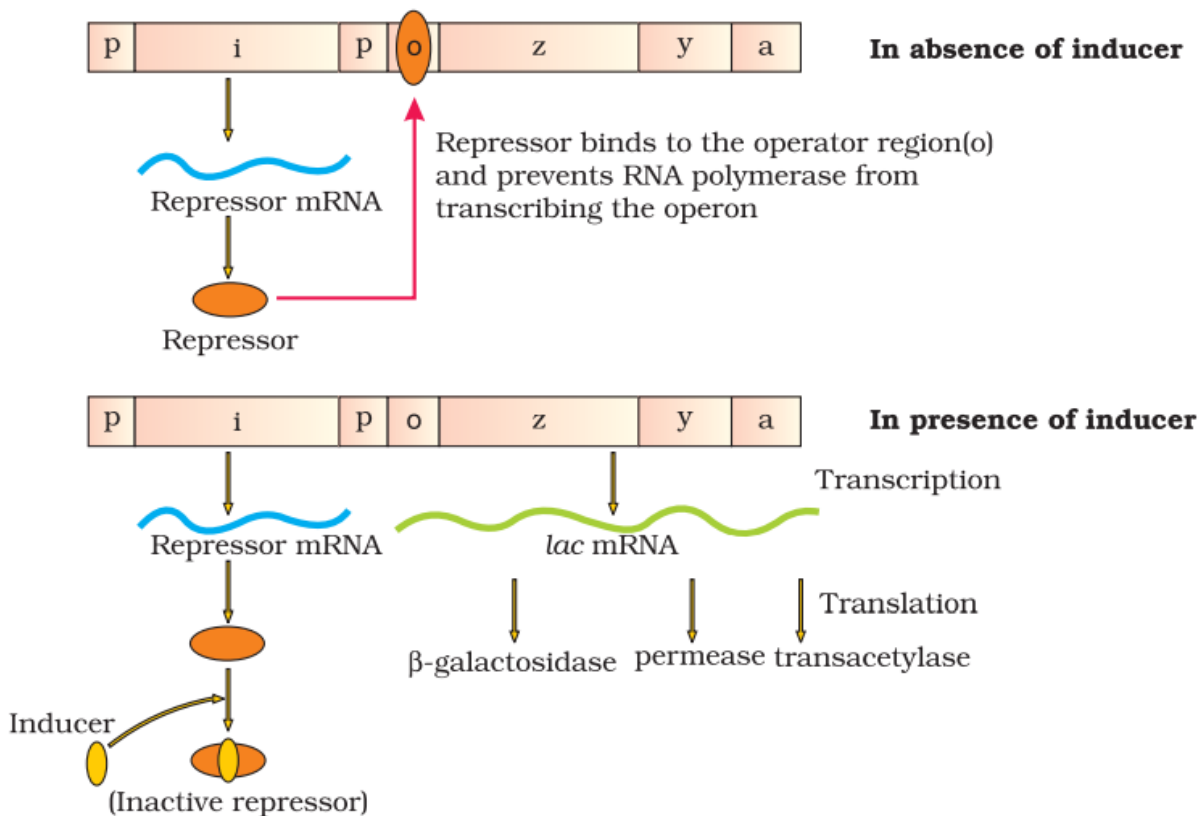
All the genes are not needed constantly. The genes needed only sometimes are called regulatory genes and are made to function only when required and remain non-functional at other times. Such regulated genes, therefore required to be switched 'on' or 'off' when a particular function is to begin or stop.

The Lac Operon:

Lac operon consists of one regulatory gene (i) and three structural genes (y, z and a). Gene i code for the repressor of the lac operon. The z gene code for beta-galactosidase, that is responsible for hydrolysis of disaccharide, lactose into monomeric units, galactose and glucose. Gene y code for permease, which increases permeability of the cell. Gene a encode for transacetylase.

Lactose is the substrate for enzyme beta-galactosidase and it regulates switching on and off of the operon, so it is called inducer.

Regulation of Lac operon by repressor is referred as negative regulation. Operation of Lac operon is also under the control of positive regulation.



Human Genome Project (HGP):

Human Genome Project was launched in 1990 to find out the complete DNA sequence of human genome using genetic engineering technique and bioinformatics to isolate and clone the DNA segment for determining DNA sequence.

The project was coordinated by the US Department of Energy and the National Institute of health.

The method involved the two major approaches- first identifying all the genes that

express as RNA called Express sequence tags (EST).The second is the sequencing the all set of genome that contained the all the coding and non-coding sequence called sequence Annotation.

Goal of HGP:

- Identify all the genes (20,000 to 25,000) in human DNA.
- Determine the sequence of the 3 billion chemical base pairs that make up human DNA.
- Store this information in data base.
- Improve tools for data analysis.
- Transfer related information to other sectors.
- To address the legal, ethical and social issues that may arise due to project.

Salient features of Human Genome:

- The human genome contains 3164.7 million nucleotide bases.
- The average gene consists of 3000 bases, but sizes vary greatly, with the largest known human gene being dystrophin at 2.4 million bases.
- Less than 2 per cent of the genome codes for proteins.
- Repeated sequences make up very large portion of the human genome.
- Repetitive sequences are stretches of DNA sequences that are repeated many times, sometimes hundred to thousand times.
- Chromosome 1 has most genes (2968), and the Y has the fewest (231).
- Scientists have identified about 1.4 million locations where single base DNA differences (SNPs – single nucleotide polymorphism) occur in humans.

DNA Fingerprinting:

Satellite DNA regions are stretches of repetitive DNA which do not code for any specific protein. These non-coding sequences form a major chunk of the DNA profile of humans. They depict a high level of polymorphism and are the basis of DNA fingerprinting. These genes show a high level of polymorphism in all kind of tissues as a result of which they prove to be very useful in forensic studies.

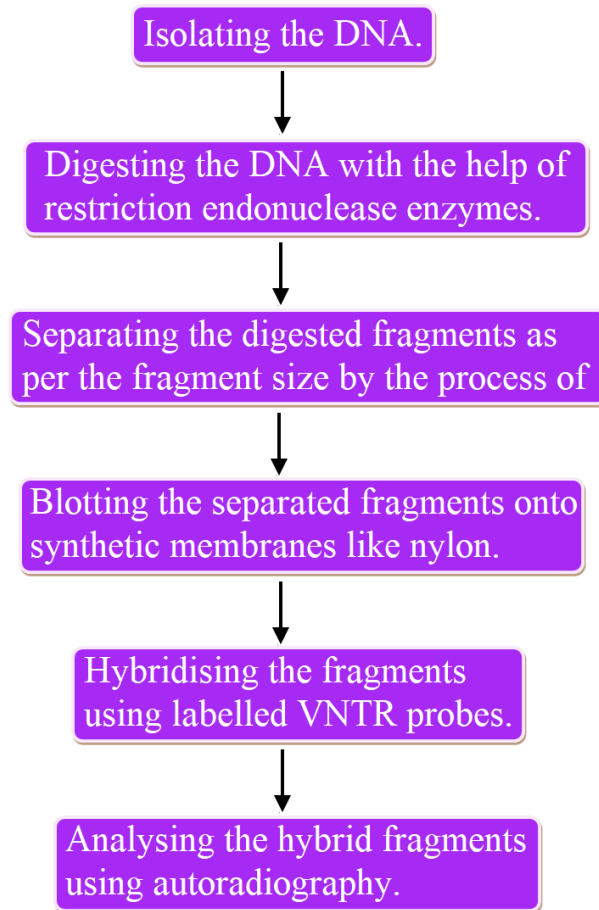
Any piece of DNA sample found at a crime scene can be analyzed for the level of polymorphism in the non-coding repetitive sequences. After the DNA profile is traced, it becomes easier to find the criminal by performing the DNA fingerprinting for the suspects.

Apart from crime scenes, Fingerprinting applications also prove useful in finding the parents of an unclaimed baby by conducting a paternity test on a DNA sample from the baby.

DNA Fingerprinting Steps:

Alec Jeffreys developed this technique in which he used satellite DNAs also called VNTRs (Variable Number of Tandem Repeats) as a probe because it showed the high level of polymorphism.

Following are the steps involved in DNA fingerprinting:



DNA Fingerprinting Applications:

As discussed earlier the technique of fingerprinting is used for DNA analysis in forensic tests and paternity tests. Apart from these two fields, it is also used in determining the frequency of a particular gene in a population which gives rise to diversity. In case of the change in gene frequency or genetic drift, Fingerprinting can be used to trace the role of this change in evolution.

NCERT LINE BY LINE QUESTIONS

1. Monomer of nucleic acids are –(Pg. 95, E)
 A) Peptides B) Nucleosides C) Ribonucleosides D) None of these
2. DNA and RNA are types of – (Pg. 95, E)
 A) Nucleotides B) Nucleosides C) Nucleic acids D) Nucleamides

Paragraph 6.1 The DNA

3. Length of DNA is usually defined as- (Pg. 96, E)
 A) Number of nucleotides present in it
 B) Number of pair of nucleotides present in it
 C) Number of base pairs present in it
 D) All of these
4. Match the length of DNA with the correct organisms – (Pg. 96, M)

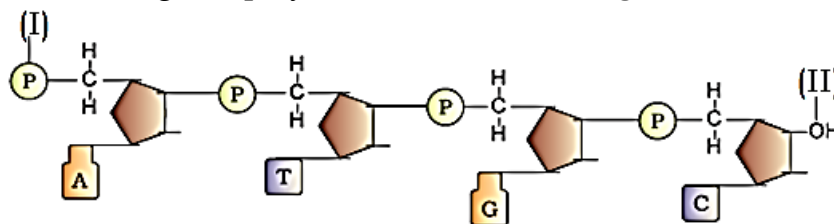
A	B
I) $\Phi \times 174$	1) 4.6×10^6 bp (base pairs)
II) Bacteriophage γ	2) 3.3×10^9 bp
III) E. coli	3) 48502 bp
IV) Human DNA (haploid)	4) 5386 nucleotides

I	II	III	IV
A) 4	3	1	2
B) 3	4	2	1
C) 4	3	2	1
D) 3	4	1	2

Paragraph 6.1.1 Structure of polynucleotides chain

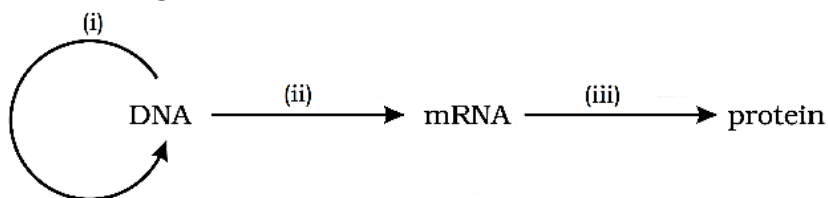
5. A nucleotides contains – (Pg. 96, E)
 A) Hexose sugar + nitrogenous base + phosphate group
 B) Pentose sugar + nitrogenous base + phosphate group
 C) Hexose sugar + nitrogenous base + sulphate group
 D) Pentose sugar + nitrogenous base + sulphate group
6. Which of these is a purine – (Pg. 96, E)
 A) Cytosine
 B) Adenine
 C) Thiamine
 D) More than one is correct
7. Which of these is a pyrimidine – (Pg. 96, E)
 A) Adenine B) Thymine C) Guanine D) None of these
8. Which of these is a correct combination for a DNA nucleotides (Pg. 96, E)
 A) Oxyribose + Phosphate + Uracil
 B) Oxyribose + Phosphate + Thymine
 C) Deoxyribose + Phosphate + Uracil
 D) Deoxyribose + Phosphate + Thymine
9. All the given nucleotides exists, except (Pg. 96, E)
 A) Deoxy uridine B) Thymine C) Both A & B D) None of these
10. Nitrogenous base is linked to which carbon of pentose sugar (Pg. 96, E)
 A) 1'C B) 2'C C) 3'C D) 5'C

11. Nitrogenous base is linked to pentose sugar by which bond - (Pg. 96, E)
 A) N - Glycosidic bond B) Phosphoester bond
 C) Phosphodiester bond D) Peptide bond
12. Phosphate group is linked to which carbon of pentose sugar (Pg. 96, E)
 A) 1'C B) 2'C C) 3'C D) 5'C
13. Identify the free ends of given polynucleotides chain - (Pg. 96, E)



- | | |
|-----------------|--------------|
| I | II |
| A) 3' phosphate | 5' hydroxyl |
| B) 5' hydroxyl | 3' phosphate |
| C) 5' phosphate | 3' hydroxyl |
| D) 3' hydroxyl | 5' phosphate |
14. Backbone of polynucleotide chain is formed due to -(Pg. 97, E)
 A) Sugar and N-base
 B) Sugar and phosphate
 C) Phosphate and N - Base
 D) All of these
15. Which is correct about thymine & uracil - (Pg. 97, E)
 A) Uracil is 5-methyl thymine
 B) Thymine is 5-methyl uracil
 C) Uracil is 5-ethyl thymine
 D) Thymine in 5-ethyl uracil
16. DNA is -(Pg. 97, E)
 A) Acidic and positively charged
 B) Basic and positively charged
 C) Acidic and negatively charged
 D) Basic and negatively charged
17. Name of DNA as 'Nuclein' was given by - (Pg. 97, E)
 A) Francis crick B) Erwin Chargaff
 C) Friedrich Meischer D) Rosalind Franklin
18. Double Helix for structure of DNA model was proposed by - (Pg. 97, E)
 A) Wilkins and Franklin based on their Xray diffraction date
 B) Watson and Crick based on their X-ray diffraction date
 C) Chargaff based on their X-ray diffraction data
 D) None of these
19. The proposition of base pairing between the two stands of polynucleotide chain in double Helix model of DNA was based on observation of - (Pg. 97, E)
 A) Maurice Wilkins B) Rosalind Franklin
 C) Erwin Chargaff D) Both A & B
20. The two chains of double Helix DNA have - (Pg. 97, E)
 A) Parallel polarity B) Anti-parallel polarity
 C) No polarity D) Depends on organism
21. The bases in two stands of DNA are paired through (Pg. 97, E)
 A) Hydrogen bond B) Peptide bond
 C) Glycosidic bond D) Sulfide bond

22. Which of the following is true about base pairing in DNA - (Pg. 97, E)
 A) Adenine forms two hydrogen bond with Guanine
 B) Adenine forms three hydrogen bond with Guanine
 C) Adenine forms two hydrogen bond with Thymine
 D) Adenine forms three hydrogen bond with Thymine
23. Which of the following is true about base pairing in DNA -(Pg. 97, E)
 A) Guanine forms two H-bond with Cytosine
 B) Guanine forms three H-bond with Cytosine
 C) Guanine forms two H-bond with Adenine
 D) Guanine forms three H-bond with Adenine
24. Uniform distance between two stands of Helix is due to -(Pg. 97, E)
 A) Double and triple bond formed between base pairs
 B) Sugar - phosphate backbone
 C) Purine - pyrimidine base pairing
 D) None of these
25. How many of the following statements about Double - helix structure of DNA is correct -(Pg. 97, E)
 i) Two chains are coiled in right - handed fashion
 ii) Pitch of helix is 3.6 nm
 iii) There are roughly 10 bp in each turn
 iv) Plane of one base pair stacks over the other
 A) 1 B) 2 C) 3 D) 4
26. Pitch of helix in double helix DNA is -(Pg. 98, E)
 A) 3.6 nm B) 3.4 nm C) 3.2 nm D) 3.8 nm
27. Central dogma in molecular biology was proposed by --(Pg. 98, E)
 A) Crick B) Watson C) F. Meischar D) Chragaff
28. Identify correct labels --(Pg. 98, E)

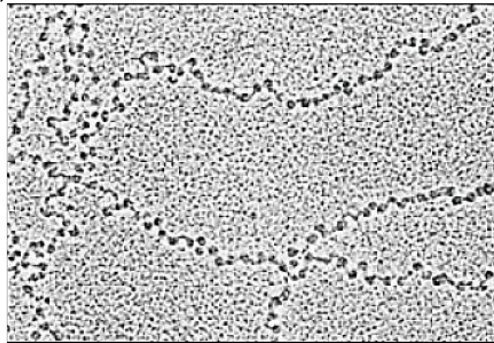


- | (i) | (ii) | (iii) |
|------------------|---------------|---------------|
| A) Replication | Translation | Transcription |
| B) Replication | Transcription | Translation |
| C) Transcription | Replication | Translation |
| D) Translation | Replication | Transcription |

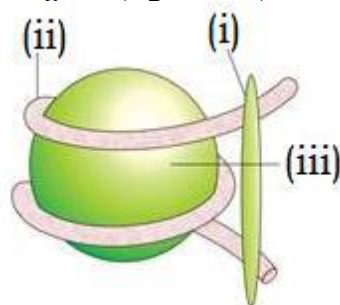
Paragraph 6.1.2 Packaging of DNA Helix

29. If length of E. coli DNA is 1.36 mm, calculate number of base pair in E. coli? Given - distance between consecutive base pairs is 0.34×10^{-9} m. - (Pg. 99, E)
 A) 4×10^6 B) 4×10^9 C) 4×10^{-6} D) 4×10^{12}
30. **Assertion** : In E. coli, DNA is scattered throughout the cell
Reason : In E. coli, there is no defined nucleus (Pg. 99, M)
 A) Both Assertion & Reason are correct & Reason is correct explanation for Assertion
 B) Both Assertion & Reason are correct but Reason is not correct explanation for Assertion
 C) Assertion is correct and Reason is incorrect
 D) Reason is correct and Assertion is incorrect
31. Histones are - (Pg. 99, E)

- A) Positive and acidic in eukaryotes
 B) Positive and acidic in prokaryotes
 C) Positive and basic in eukaryotes
 D) Positive and basic in prokaryotes
32. Assertion – Histones are positively charged Reason – Histones are rich in basic amino acid residues lysine and arginine **(Pg. 99, M)**
 A) Assertion & Reason are correct and Reason is correct explanation for Assertion
 B) Assertion & Reason are correct and Reason is not the correct explanation for Assertion
 C) Assertion is correct and Reason is wrong
 D) Both Assertion and Reason are wrong
33. Histones are organized into **-(Pg. 99, E)**
 A) Hexamer B) Octamer C) Tetramer D) Dimer
34. A typical nucleosome contain _____ bp of DNA has **(Pg. 99, E)**
 A) 200 B) 400 C) 600 D) 800
35. Repeating unit of chromatin **-(Pg. 99, E)**
 A) Are nucleosomes
 B) Are seen as 'beads-on-string' under electron microscope
 C) Are packed to form fibres
 D) All of these
36. The figure show **-(Pg. 99, E)**



- A) Beads-on-string
 B) A nucleosome
 C) Chromatin
 D) More than one option is correct
37. Identify the correct label for given figure **(Pg. 99, M)**



- | | | | |
|----|------------|-----------------|-----------------|
| | (i) | (ii) | (iii) |
| A) | H2 histone | DNA | Histone octamer |
| B) | H1 histone | Histone octamer | DNA |
| C) | H2 histone | Histon octamer | DNA |
| D) | H1 histone | DNA | Histone octamer |
38. Chromosomes are connected chromatin fibres present **-(Pg. 99, E)**
 A) At all times in cell
 B) Only during cell division – formed at prophase
 C) Only during cell division – formed at metaphase

- D) Only during cell division – formed at Interphase
39. In a typical nucleus, euchromatin & heterochromatin are present. Choose the correct set of characters for heterochromatin – (Pg. 99, E)
- i) Loosely packed ii) Densely packed
 iii) Light stain iv) Dark stain
 v) Inactive chromatin vi) Active chromatin
- A) i, iii, v B) ii, iv, vi C) i, iii, vi D) ii, iv, v

40. Choose correct set of characters for euchromatin (Pg. 99, E)
- i) Loosely packed ii) Densely packed
 iii) Light stain iv) Dark stain
 v) Inactive chromatin vi) Active chromatin
- A) i, iii, v B) ii, iv, vi C) i, iii, vi D) ii, iv, v

6.2 The Search for Genetic Material Transforming Principle

41. Griffith's experiments were conducted in- (Pg. 100, E)
- A) 1928 B) 1958 C) 1978 D) 1968
42. The experiment of Griffith was performed in- Pg. 100, E)
- A) Diplococcus pneumoniae, bacteria B) Haemophilus influenzae, fungi
 C) Streptococcus pneumoniae, fungi D) None of these
43. Match the given columns- Pg. 100, M)
- | I | II | III |
|----------------|--------------------|--|
| i. R-strain | (a) Smooth | (1) Mucous coat |
| ii. S-strain | (b) Rough colonies | (2) No mucous coat |
| A) (i)-(a)-(1) | B) (i)-(b)-(1) | C) (ii)-(a)-(1) D) (ii)-(a)-(2) |
44. Which strain of the microbe used Griffith is virulent- Pg. 100, E)
- A) S-strain B) R-strain C) Both D) None
45. Griffith observed that the mice died surprisingly the following combination of strains was used, which was unusual- Pg. 100, E)
- A) S-strain heat killed B) Heat killed S-strain
 C) Heat killed R-strain + Live S-strain D) Heat killed S-strain + Live R-strain
46. In Griffith experiment (Pg. 100, E)
- A) R-strain transformed to S-strain and became virulent
 B) R-strain transformed to S-strain and lost virulence
 C) S-strain transformed to R-strain and became virulent
 D) S-strain transformed to R-strain and lost virulence
47. Griffith claimed that- (Pg. 100, E)
- A) Some protein was transferred among bacteria
 B) Some DNA was transferred among bacteria
 C) Some carbohydrates were transferred among bacteria
 D) None of these

Biochemical Characterization of Transforming Principle

48. Prior to work of Avery, Macleod and McCarty, genetic material was thought to be- (Pg. 100, E)
- A) Protein B) DNA C) RNA D) None
49. Avery, Macleod & McCarty discovered that- (Pg. 100, E)
- A) DNA caused transformation
 B) RNA caused transformation
 C) Protein caused transformation
 D) Lipid caused transformation
50. Which enzyme inhibited the transformation- (Pg. 101, E)
- A) Protease B) RNase C) DNase D) All

- | | | |
|-------------------|----------------|----------------|
| A) Blending | Infection | Centrifugation |
| B) Infection | Blending | Centrifugation |
| C) Centrifugation | Infection | Blending |
| D) Blending | Centrifugation | Infection |

6.2.2 Properties of Genetic Material (DNA vs RNA)

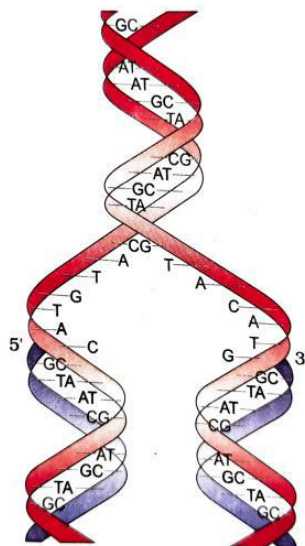
59. RNA is genetic material in- (Pg. 102, E)
 A) TMV B) QB Bacteriophage C) Both A and B D) None of these
60. Properties of genetic material include- (Pg.103, E)
 A) Stable B) Mutable C) Replicable D) All of these
61. A - Stability as a property of genetic material was very evident in Griffith's transforming principle.
 R-Heat can kill the bacteria and completely destroy the properties of genetic material(Pg.103,M)
 A) Both A and R are true and R is correct explanation for A
 B) Both A and R are true but R is not correct explanation for R
 C) A is true but R is false D) Both A and R are false
62. Which is more structurally and chemically stable? (Pg. 103, E)
 A) DNA B) RNA C) Protein D) All
63. RNA viruses show- (Pg. 103, E)
 A) Less mutation B) Faster evolution
 C) Slower evolution D) More than one option is correct
64. DNA is preferred by nature over RNA for- (Pg. 103, E)
 A) Storage of genetic information B) Transmission of genetic information
 C) Expression of genetic information D) More than one

6.3 RNA World

65. Choose incorrect statement RNA- (Pg.104, E)
 A) was first genetic material B) acts as catalyst too
 C) is more stable than DNA D) has protein synthesizing mechanism built around it

6.4 Replication

66. Scheme for replication of DNA was proposed by-(Pg. 104, E)
 A) Watson & Crick B) Meselson & Stahl
 C) Taylor D) Hershey & Chase
67. The replication of DNA is-(Pg. 104, E)
 A) Conservative B) Non-conservative
 C) Semi-conservative D) All of these depending on organism
68. (Pg. 104, E)

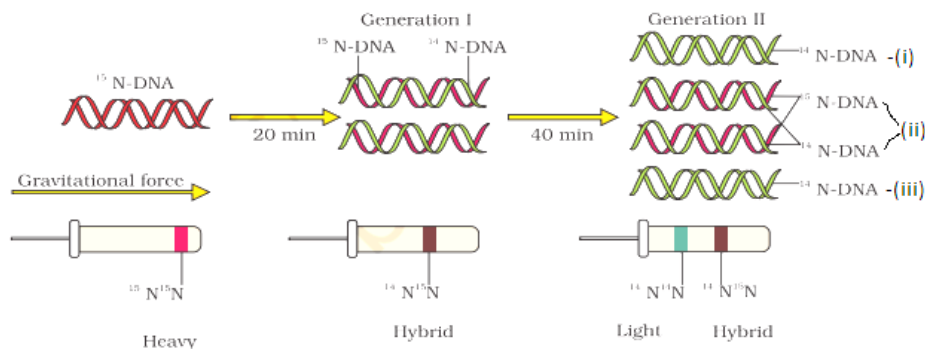


The figure shows-

- A) Conservative DNA replication model
- B) Semi-conservative DNA replication model
- C) Non-conservative DNA replication model
- D) Can't say

6.4.1 The Experimental Proof

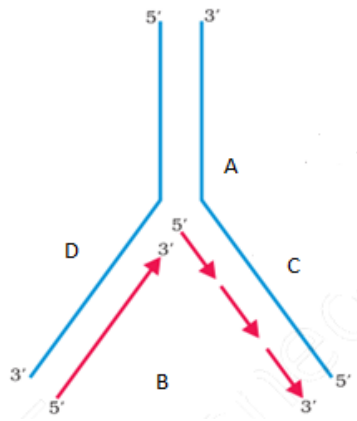
69. The DNA replication model experimental proof was first shown in- (Pg. 104, E)
 A) Human cells B) E. coli C) Plant cell D) Vicia faba
70. Meselson and Stahl performed experiment for proving DNA replication scheme in-(Pg. 105, E)
 A) 1952 B) 1953 C) 1958 D) 1961
71. The bacteria were grown in medium containing-(Pg. 105, E)
 A) $^{15}\text{NH}_4\text{Cl}$ - ^{15}N is heavy isotope of nitrogen
 B) $^{14}\text{NH}_4\text{Cl}$ - ^{14}N is heavy isotope of nitrogen
 C) $^{15}\text{NH}_4\text{Cl}$ - ^{15}N is normal isotope of nitrogen
 D) $^{14}\text{NH}_4\text{Cl}$ - ^{14}N is normal isotope of nitrogen
72. The heavy DNA molecule containing heavy isotope of N is distinguished from normal DNA by- (Pg. 105, E)
 A) UV rays B) Ethidium bromide solution
 C) Centrifugation in CsCl density gradient D) PCR technique
73. In Meselson & Stahl experiment, first they- (Pg. 105, E)
 A) grew bacteria on heavy isotope of N medium followed by normal one
 B) grew bacteria on normal isotope of N medium followed by heavy one
 C) grew bacteria on radioactive N followed by heavy one
 D) grew bacteria on heavy isotope of N followed by radioactive one
74. Identify the correct label (Pg. 105, E)



- (i) (ii) (iii)
- A) Light Heavy Hybrid
 B) Heavy Hybrid Light
 C) Light Hybrid Light
 D) Heavy Hybrid Heavy
75. In Meselson & Stahl expt a bacteria after dividing in 20 minutes had a hybrid DNA. What will be the ratio of Hybrid to Light after 80 minutes? (Pg. 105, E)
 A) 2 : 14 B) 14 : 2 C) 16 : 2 D) 2 : 16
76. Similar experiment on Vicia faba was conducted by ____ to detect distribution of newly synthesized DNA in chromosomes. (Pg. 106, E)
 A) Taylor B) Stahl C) Gamow D) Nirenberg
77. Experiment on Vicia faba involved use of- (Pg. 106, E)
 A) Radioactive uridine B) Radioactive thymidine
 C) Radioactive adenosine D) Radioactive cytidine

6.4.2 The Machinery and the Enzymes

78. The main enzyme of replication is-(Pg.106, E)
 A) RNA dependent RNA polymerase
 B) RNA dependent DNA polymerase
 C) DNA dependent DNA polymerase
 D) DNA dependent RNA polymerase
79. Choose correct statement with regard with efficiency of DNA polymerase. (Pg. 106, E)
 A) 4.6×10^6 bp of E. coli replicate within 46 minutes
 B) The average rate of polymerization of DNA polymerase has to be approximately 2000 bp/minute
 C) The polymerization accuracy is very high and very fast
 D) All of these
80. What is function of deoxyribonucleoside triphosphate-(Pg. 106, E)
 A) It act as substrate
 B) Provide energy for polymerization
 C) A and B both
 D) It is product formed after polymerization
81. Assertion : The two strands of DNA cannot be separated in their length.
 Reason : Separation required very high energy. (Pg. 106, E)
 A) Both Assertion & Reason are correct and reason is correct explanation of assertion
 B) Both Assertion & Reason are correct and reason is not correct explanation of assertion
 C) Assertion is correct, Reason is false
 D) Assertion & Reason are false
82. Polymerization by DNA polymerase is in- (Pg. 106, E)
 A) $3' \rightarrow 5'$ direction only
 B) $5' \rightarrow 3'$ direction only
 C) A and B both
 D) Random
83. The template of replication fork with polarity $5' \rightarrow 3'$ is ____ while $3' \rightarrow 5'$ is ____.(Pg. 106, E)
 A) continuous, continuous
 B) continuous, discontinuous
 C) discontinuous, continuous
 D) discontinuous, discontinuous
84. DNA ligase act on-(Pg. 106, E)
 A) $5' \rightarrow 3'$ template strand
 B) $3' \rightarrow 5'$ template strand
 C) Both A and B
 D) Ligate RNA with vector of $3' \rightarrow 5'$ polarity
85. The replication in eukaryotes take place in- (Pg. 106, E)
 A) M-phase B) G1 phase C) S-phase D) G2 phase
86. Polyploidy resulted by-(Pg. 106, E)
 A) A failure in cell division after DNA replication
 B) A failure in DNA replication after cell division
 C) A failure in cell division before DNA replication
 D) A and C both
87. Correct label of A, B, C, D is- (Pg. 107, E)



- (i) A = Template parental strand
- (ii) B = Newly synthesized strand
- (iii) D = Continuous strand
- (iv) C = Discontinuous strand

A) i, ii only B) iii, iv only C) i, ii, iii, iv D) None of these

6.5 Transcription

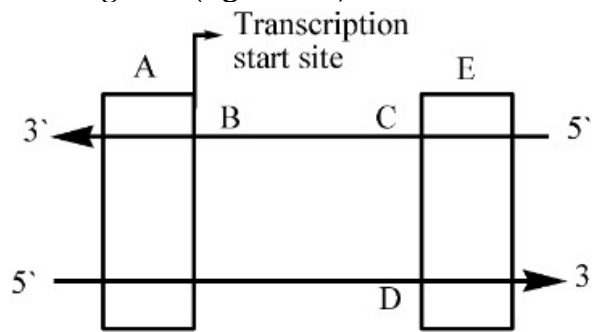
88. Transcription is-(Pg. 107, E)
 A) The process of copying genetic information from both strand of DNA into RNA
 B) The process of copying genetic information from one strand of DNA into RNA
 C) The process of copying genetic information from RNA into DNA
 D) A and B both
89. In transcription, adenosine bind with (Pg.107, E)
 A) Thymine B) Uracil C) Cytosine D) A and B both
90. Why both the strand of DNA are not copied during transcription-(Pg. 107, E)
 A) If both strands act a template, they would code for RNA molecules with same sequence
 B) RNA formed by transcription of both strand, when code for protein, the sequence of amino acid in protein are same
 C) The two RNA molecules if produced simultaneously would be complementary to each other
 D) All of these
91. Translation of RNA would be prevented if- (Pg. 107, E)
 A) RNA is single strand
 B) RNA is double-stranded
 C) RNA is produced by both strand of DNA
 D) B and C both

6.5.1 Transcription Unit

92. Transcription unit primarily consist of-(Pg. 107, E)
 A) 1 region B) 2 regions C) 3 regions D) None of these
93. Transcription primarily required-(Pg. 107, E)
 A) RNA dependent RNA polymerase
 B) DNA dependent RNA polymerase
 C) DNA dependent DNA polymerase
 D) RNA dependents DNA polymerase
94. Template strand of transcription unit is/are-(Pg. 108, E)
 A) 5' → 3' strand of DNA
 B) 3' → 5' strand of DNA
 C) Site of catalysis of enzyme required for transcription
 D) B and C both
95. What is coding strand of given template strand 3' - AGCATGCA - 5' (Pg. 108, E)
 A) 5' - TACGTACGT - 3'

- B) 5' - UACGUACGU - 3'
 C) 3' - UACGUACGU - 5'
 D) 3' - TACGTACGT - 5'

96. Label A, B, C, D, E of given diagram. (Pg. 108, E)



	a	b	c	d	e
A	Promoter	Structural Gene	Template strand	Coding strand	Terminator
B	Terminator	Structural Gene	Coding strand	Template strand	Promoter
C	Promoter	Template strand	Coding strand	Structural Gene	Terminator
D	None of these				

97. Promoter is located-(Pg. 108, E)

- (i) 3' end
 (ii) 5' end
 (iii) upstream of structural gene
 (iv) downstream of structural gene

A) i, iii B) ii, iii C) i, iv D) ii, iv

98. Terminator is located at (Pg. 108, E)

- (i) 3' end
 (ii) 5' end
 (iii) upstream of structural gene
 (iv) downstream of structural gene

A) i, iii B) ii, iii C) i, iv D) ii, iv

6.5.2 Transcription unit and the gene

99. A gene is defined as- (Pg. 108, E)

- A) Functional unit of inheritance
 B) Non-functional region of DNA that haven't any information
 C) A and B both
 D) None of these

100. Cistron is- (Pg. 109, E)

- A) Segment of DNA coding for a polypeptide
 B) Segment of RNA coding for a polypeptide
 C) Segment of DNA that are non-coding sequence
 D) Segment of RNA have not any coding sequence

101. Choose the correct statement. (Pg. 109, E)

- A) Monocistronic eukaryotic structural gene have interrupted coding sequence.
 B) Polycistronic prokaryotic structural gene have interrupted coding sequence.

- C) Monocistronic prokaryotic structural gene have interrupted coding sequence.
 D) A and B both
102. Exons are- **(Pg. 109, E)**
 A) Coding sequence
 B) Non-coding sequence
 C) Expressed sequence
 D) A and C both
103. Intron- **(Pg. 109, E)**
 A) appear in mature or processed RNA
 B) do not appear in mature or processed RNA
 C) appear in prokaryotes
 D) B and C both

6.5.3 Types of RNA & Process of Transcription

104. Which of following play role in protein synthesis of prokaryote? **(Pg. 109, E)**
 A) r-RNA B) t-RNA
 C) m-RNA D) All of these
105. The function of some RNA are given below choose the incorrect one. **(Pg. 109, E)**
 A) mRNA provide template strand
 B) mRNA provide non-template strand
 C) tRNA bring amino acid
 D) rRNA play structural & catalytic role
106. How many polymerase required in bacteria for transcription of all type of RNA? **(Pg. 109, E)**
 A) One B) Two C) Three D) Five
107. Choose incorrect step about transcription. **(Pg. 109, E)**
 A) RNA polymerase binds to promoter and initiate transcription.
 B) Nucleotide triphosphate act as substrate and polymerization in a template.
 C) A short stretch of RNA remains bound to enzyme.
 D) Last step is termination.
108. Initiation factor and termination factor are- **(Pg. 110, E)**
 A) Sigma and Rho factor respectively.
 B) Rho and Sigma factor respectively.
 C) Rho and Rho factor respectively.
 D) Sigma and Sigma factor respectively.
109. Translation & transcription in eukaryote occur in **(Pg. 110, E)**
 A) Cytoplasm & nucleus respectively
 B) Nucleus & cytoplasm respectively
 C) Cytosol
 D) Nucleus
110. Which of following can be coupled in bacteria? **(Pg. 110, E)**
 A) Replication & transcription
 B) Transcription & translation
 C) Replication & translation
 D) None of these
111. Transcription of 18 s rRNA is done by ____ in eukaryote. **(Pg. 111, E)**
 A) RNA pol. I B) RNA pol. II C) RNA pol. III D) All of these
112. Choose incorrect statement. **(Pg. 111, E)**
 A) 5.8 s r-RNA and 5 s-RNA transcribes by same RNA polymerase in eukaryote.
 B) hnRNA & mRNA transcribe by same RNA polymerase in eukaryote.
 C) tRNA & snRNA transcribes by same RNA polymerase in eukaryote.
 D) None of these

113. Splicing is required to- **(Pg. 111, E)**
 A) remove intron in eukaryote
 B) remove exon in eukaryote
 C) remove exon in prokaryote
 D) remove intron in prokaryote
114. Capping is- **(Pg. 111, E)**
 A) Addition of methyl guanosine triphosphate at 5' end
 B) addition of adenylate residue at 3' end
 C) addition of methyl guanosine triphosphate at 3' end
 D) addition of adenylate residue at 5' end
115. The fully processed hnRNA is- **(Pg. 111, E)**
 A) tRNA B) mRNA C) rRNA D) None of these

6.6 Genetic Code

116. George Gamow argued- **(Pg. 111, E)**
 A) There are only 5 bases and if they have code for 20 amino acid the code should constitute a combination of bases
 B) There are only 4 bases and if they have code for 20 amino acid the code should constitute a combination of bases
 C) Genetic code is triplet
 D) B and C
117. Which of following have maximum codon in genetic code-**(Pg. 112, E)**
 A) Leu B) Met C) Cal D) Phe
118. Which of following is/are showing dual function-**(Pg. 112, E)**
 A) UUU B) AUG C) UGA D) GUA
119. Least number of codon is for- **(Pg. 112, E)**
 A) Met B) Phe C) Glu D) Gly

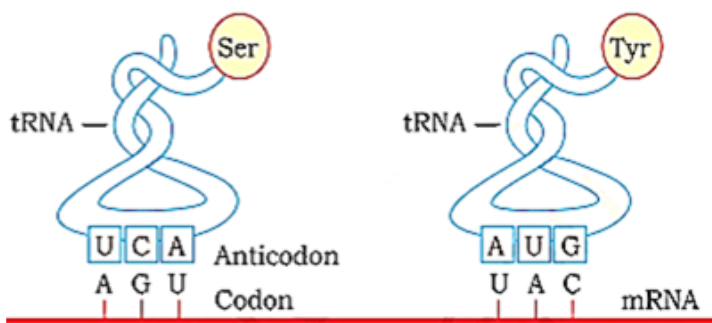
6.6.1 Mutations and Genetic Code

120. Sickle cell anaemia is classical example of-**(Pg. 113, E)**
 A) point mutation
 B) frameshift mutation
 C) deletion mutation
 D) addition mutation
121. In sickle cell anaemia, there are changes in gene for- **(Pg. 113, E)**
 A) alpha globin chain
 B) beta globin chain
 C) gamma globin chain
 D) delta globin chain
122. In sickle cell anaemia, resultant effect of mutation is change of amino acid residue-**(Pg. 113, E)**
 A) Valine to alanine
 B) Valine to glutamic acid
 C) Alanine to valine
 D) Glutamic acid to valine
123. The following is an example of- BIG RED CAP \Rightarrow BIG REM DCA P **(Pg. 113, E)**
 A) Deletion mutation
 B) Point mutation
 C) Addition mutation
 D) More than one option
124. RAM HAS CAP \Rightarrow RAM HAS BIG CAP **(Pg. 113, E)**
 The given example shows-
 A) Addition mutation

- B) Deletion mutation
- C) Substitution mutation
- D) More than one option

6.6.2 tRNA – the Adapter Molecule

125. tRNA has- (Pg. 114, E)
 A) Codon loop B) Anticodon loop C) Both D) Neither
126. The presence of adapter molecule to read the code on DNA and bind to amino acids was postulated by- (Pg. 114, E)
 A) James Watson B) Francis Crick C) Friedrich Meisher D) Both A and B
127. tRNA was also called- (Pg. 114, E)
 A) s RNA (soluble RNA) B) s RNA (single RNA)
 C) s RNA (smart RNA) D) s RNA (simple RNA)
128. The amino acid acceptor end of tRNA is-(Pg. 114, E)
 A) 5' B) 3' C) Can be any of these D) Free end
129. For initiation translation, (Pg. 114, E)
 A) Only tRNA carries initiator amino acid to the site.
 B) Specific rRNA carries initiator amino acid to the site.
 C) Any rRNA carries initiator amino acid to the site.
 D) Specific tRNA carries initiator amino acid to the site.
130. For stop codon- (Pg. 114, E)
 A) There are specific tRNAs with amino acids.
 B) There are specific tRNAs which do not bind to any amino acids.
 C) There are no tRNA.
 D) There are tRNAs which may or may not bind to amino acids.
131. The given figure shows- (Pg. 114, E)



- A) Secondary structure of tRNA – Cloverleaf
 - B) Primary structure of tRNA – clover-leaf
 - C) Secondary structure of tRNA –inverted-L
 - D) Primary structure of tRNA – inverted-L
- ### 6.7 TRANSLATION
132. Translation refers to process of- (Pg. 114,E)
 A) Making RNA from DNA
 B) Making DNA from RNA
 C) Polymerization of nucleotide to form a DNA
 D) Polymerization of amino acid to form a polypeptide
133. The order and sequence of amino acid during translation are defined by- (Pg.114, E)
 A) The sequences of bases in r-RNA
 B) The sequences of bases in t-RNA
 C) The sequences of bases in m-RNA
 D) All of these
134. Which of following bond is formed during translation? (Pg. 115, E)

- A) Glycosidic bond
 B) Phosphodiester bond
 C) Peptide bond
 D) All of these
135. First phase of translation does not involve-(Pg. 115, E)
 A) Charging of RNA
 B) Amino acids are activated in presence of ATP
 C) Activated amino acid are linked to their cognate tRNA
 D) None of these
136. Initiation or first phase of translation is-(Pg. 115, E)
 A) Amino acylation of tRNA
 B) Amino acylation of mRNA
 C) Both A and B
 D) Deamino acylation of mRNA
137. The cellular factory responsible for synthesizing protein is- (Pg. 115, E)
 A) Ribosome B) Lysosome C) Peroxisome D) None of these
138. In inactive state, protein factory of cell exist in (Pg. 115, E)
 A) Two state B) 4 state in prokaryote
 C) 6 state in eukaryote D) B and C both
139. Which of following is sign as beginning of translation? (Pg. 115, E)
 A) When the large subunit of protein factory of cell encounters an mRNA.
 B) When the small subunit of protein factory of cell encounters an mRNA.
 C) When the small subunit of protein factory of cell encounter a tRNA.
 D) When the large subunit of protein factory of cell encounters a tRNA.
140. The bond formation (peptide) between charged tRNA is accomplished due to- (Pg.115, E)
 A) Presence of ATP and catalyst
 B) Two such charged tRNA are brought close by two site in large subunit of ribosome
 C) Two charged tRNA are brought close by two site in small subunit of ribosome & presence of ATP along with catalyst
 D) A and B both
141. The ribosome act as catalyst during bond formation (peptide) as in- (Pg. 115, E)
 A) 28 s rRNA in bacteria B) 23 s rRNA in bacteria
 C) 23 s rRNA in eukaryote D) 28 s tRNA in bacteria
142. Choose the correct statement- (Pg. 115, E)
 A) A translational unit in mRNA is sequence of RNA that is flanked by start codon and stop codon and codes for polypeptide.
 B) A translational unit is sequence of DNA that is flanked by start codon & codes for polypeptide.
 C) A transcriptional unit in tRNA is the sequence of RNA that is flanked by start codon and stop codon and codes for polypeptide.
 D) A transcriptional unit in rRNA is the sequence of RNA that is flanked by start codon (AUG) and stop codon and codes for polypeptide.
143. UTR is/are-(Pg. 115, E)
 (i) Untranslated region of mRNA
 (ii) It present at both 5' end (start codon) and 3' end (before stop codon)
 (iii) They are required for efficient translation process
 (iv) It present at both 3' end (before start codon) and 3' end (after stop codon)
 A) i, ii, iii are correct B) i, ii, iii and iv are correct
 C) i, iii, iv are correct D) i, iii are correct
144. Initiator tRNA binds with (Pg. 115, E)

- A) AUG codon of mRNA
 - B) at initiation of protein synthesis
 - C) ATG codon of dsDNA
 - D) A and B both
145. Choose the correct about elongation of translation- (Pg. 115, E)
- A) Complexes composed of an amino acid linked to tRNA, sequentially bind to appropriate codon in mRNA by forming complementary base pairs with the tRNA anticodon
 - B) The ribosome moves from codon to codon along the mRNA in (3' → 5').
 - C) Complexes composed of an amino acid linked to tRNA, sequentially bind to appropriate anticodon in mRNA by forming complementary base pair with tRNA codon.
 - D) A and B both
146. Termination of translation complex is done when- (Pg. 115, E)
- A) Release factor binds with stop codon (AUG)
 - B) Release factor binds with UGA like codon
 - C) Complete translation of DNA including UTR occurs in eukaryotes
 - D) B and C both

6.8 REGULATION OF GENE EXPRESSION

BOTANY

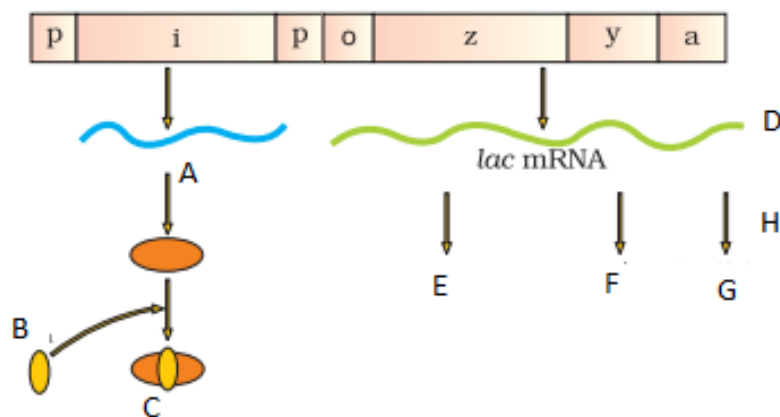
147. Gene regulation in eukaryotes is exerted at- (Pg. 115, E)
- A) Formation of primary transcript
 - B) Transport of mRNA from nucleus to cytoplasm
 - C) A and B both
 - D) Regulation of splicing of tRNA
148. β -galactosidase is used to catalyze the hydrolysis of (Pg. 116, E)
- A) Lactose into galactose and glucose
 - B) Lactose into fructose & glucose
 - C) Lactose into fructose & fructose
 - D) None of these
149. E. coli do not have lactose around them to utilize for energy source, they would- (Pg. 116, E)
- A) No longer require the synthesis of enzyme α -galactosidase
 - B) Synthesize enzyme β -galactosidase
 - C) Die due to lack of carbon source and energy source
 - D) None of these
150. In prokaryotes, the predominant site for control of gene expression is- (Pg. 116, E)
- A) Control of rate of transcriptional initiation
 - B) Control of rate of translation
 - C) Control of rate of transcriptional elongation
 - D) B and C both
151. Given below are statements. Choose the incorrect statement. (Pg. 116, M)
- A) The development and differentiation of embryo into adult organisms are the result of coordinated regulation of expression of several sets of genes.
 - B) Regulatory proteins act positively in activation.
 - C) In a transcriptional unit the activity of RNA polymerase at a given promoter is in turn regulated by interaction with accessory protein.
 - D) None of these
152. Operator- (Pg. 116, E)
- A) Region adjacent to sequence by which repressor mRNA is formed
 - B) Binds with repressor protein
 - C) Binds with inducer
 - D) A and B both

153. Each operon has-(Pg. 116, E)
 A) Same operator and same repressor
 B) Same operator but specific repressor
 C) Specific operator but same repressor
 D) Specific operator and specific repressor

6.8.1 THE LAC OPERON

154. Lac operon was studied first by-(Pg. 116,E)
 A) Francois Jacob
 B) Jacque Monod
 C) Geneticist and Biochemist
 D) None of these
155. Lac operon is/are-(Pg. 116, E)
 A) Monocistronic structural gene is regulated by a common promoter & regulators genes.
 B) Polycistronic structural gene is regulated by a common promoter & regulatory genes.
 C) Consist of one regulatory gene, monocistronic structural gene having five gene along with promoter & operator.
 D) A and C both
156. Regulatory gene of lac-operon is- (Pg. 116,E)
 A) p-gene B) i-gene C) o-gene D) z-gene
157. i in i-gene stand for-(Pg. 116, E)
 A) inducer B) inhibitor C) A and B both D) Inactive repressor
158. Match Column-I & Column-II. (Pg. 116, E)
- | Column-I(Gene) | | | | Column-II(Product) |
|----------------|--|--|--|---------------------|
| (a) Z-gene | | | | (i) Repressor mRNA |
| (b) a-gene | | | | (ii) β -gal |
| (c) Y-gene | | | | (iii) Permease |
| (d) i-gene | | | | (iv) Transacetylase |
- | a | b | c | d |
|----------|-------|-------|-------|
| A) (iii) | (ii) | (iv) | (i) |
| B) (iv) | (iii) | (ii) | (i) |
| C) (i) | (ii) | (iv) | (iii) |
| D) ii) | (iv) | (iii) | (i) |
159. The monomeric product of lactose is chiefly hydrolyzed by-(Pg. 116, E)
 A) i-gene B) z-gene C) a-gene D) y-gene.
160. Lac in lac-operon is for(Pg. 116, E)
 A) Monosaccharide B) Disaccharide
 C) Polysaccharide D) Insect
161. In absence of preferred carbon source, if lactose is provided in growth medium of bacteria, the lactose is transported into cell through by action of product formed by- (Pg. 117, E)
 A) i-gene B) z-gene C) a-gene D) y-gene
162. Allolactose is-(Pg. 117, E)
 A) Inducer of lac-operon
 B) Inductive repressor
 C) Form of lactose that bind with product of repressor mRNA and inhibit transcription of structural gene
 D) All of these
163. Lac operon is-(Pg. 117, E)
 A) Negative regulation operon
 B) Positive regulation operon
 C) A and B both

- D) None of these
164. Inducer of lac-operon is-(Pg. 117, E)
 A) Glucose B) Galactose C) Lactose D) Fructose
165. (Pg. 117, M)



- A) The given diagram is in presence of lactose
 B) The given diagram is in absence of lactose
 C) The given diagram is of gene off
 D) D and H is same process
- 6.9 HUMAN GENOME PROJECT (HGP)**
166. HGP was launched in- (Pg. 118, E)
 A) 1980 B) 1970 C) 1990 D) 2000
167. HGP was called a- (Pg. 118, E)
 A) Minor project B) Hexagonal project
 C) Mega project D) None of these
168. Human genome has approx. _____ bp.(Pg. 118, E)
 A) 3×10^9 B) 3×10^6 C) 6×10^9 D) 6×10^6
169. If cost of sequencing required is US \$ 3 per bp, then total cost of sequencing human genome as per 8-3 will be: (Pg. 118, E)
 A) US \$ 18 billion B) US \$ 9 billion C) US \$ 18 million D) US \$ 9 million

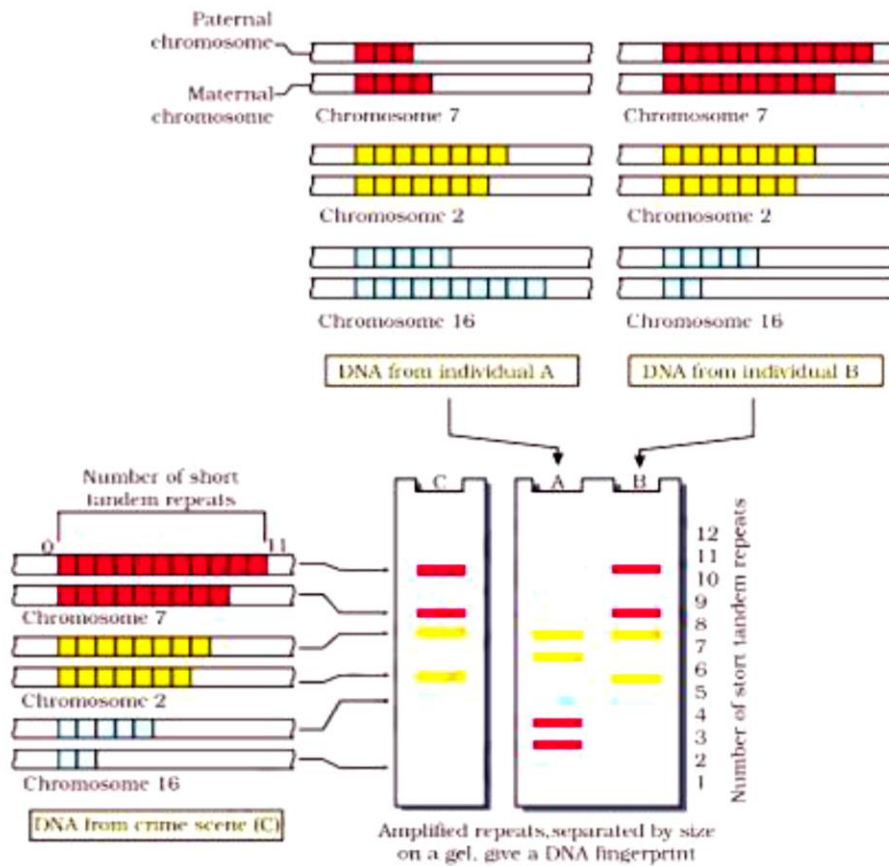
GOALS OF HGP

170. There were approx. _____ genes in human DNA, as per the goals of HGP (Pg. 118, E)
 A) 20,000 - 25,000 B) 40,000 - 45,000 C) 10,000 - 15,000 D) 50,000 - 60,000
171. HGP was a _____ year project (Pg. 118, E)
 A) 15 B) 12 C) 13 D) 14
172. HGP was coordination by- (Pg. 118, E)
 A) US department of engineering & national institute of health
 B) US department of engineering and national institute of biotechnology
 C) US department of energy and national institute of biotechnology
 D) US department energy and National Institute of Health
173. The _____ of U.K was a major partner of HGP (Pg. 118, E)
 A) Wellcome trust B) Health trust
 C) Social trust D) Welcome trust
174. Project was completed in- (Pg. 118, E)
 A) 2005 B) 2004 C) 2003 D) 2002
175. Additional contributes to HGP was- (Pg.118, E)
 A) Japan B) China C) Germany D) All of these
176. Caenorhabditis elegans is a- (Pg. 119, E)
 A) Fungi B) Nematode C) Bacteria D) Virus
177. Caenorhabditis elegans is-(Pg. 119, E)

- C) ~ 9000 million bp D) ~ 1000 million bp
189. Dystrophin was found to be-
- A) Largest known human gene with 2.4 million bases
 B) Smallest known human gene with 2.4 million bases
 C) Largest known human gene with 4.8 million bases
 D) Smallest known human gene with 4.8 million bases
190. Which chromosome was found to have most genes- **(Pg. 120, E)**
- A) Chr 22 B) Chr 1 C) Chr 5 D) Chr Y
191. Which chromosome was found to have fewest genes-**(Pg. 120, E)**
- A) Chr X B) Chr Y C) Chr 1 D) Chr 5

6.10 DNA FINGER PRINTING

192. The DNA sequence in which small stretch of DNA is repeated many times is called-**(Pg. 121, E)**
- A) SNP B) Repetitive DNA
 C) Polymorphic DNA D) More than one option
193. Satellite DNA classified into different categories like micro - satellite , mini -satellite , etc based on- **(Pg. 121, E)**
- A) Length of segment B) Number of repetitive
 C) Base composition D) All of these
194. Polymorphism arises due to-**(Pg. 121, E)**
- A) Mutation - inheritable B) Stability of genetic material
 C) Mutation - non-heritable D) All of these
195. DNA polymorphism is observed more in- **(Pg. 122, E)**
- A) non-coding DNA sequence as its mutation affects reproduction
 B) coding DNA sequence as its mutation affects reproduction
 C) non-coding DNA sequence as its mutation may not affect reproduction ability
 D) Coding DNA sequence as its mutation may not affect reproduction ability
196. Technique of DNA fingerprinting was initially developed by-**(Pg. 122, E)**
- A) James Watson B) Jansley
 C) Alec Jeffreys D) Maheshwari
197. VNTR stands for-**(Pg. 122, E)**
- A) Various number of Tendon Repeats
 B) Variable Number of Tendon Repeats
 C) Various Number of Tandem Repeats
 D) Variable Number of Tandem Repeats
198. VNTR belongs to- **Pg. 122, E)**
- A) Micro-satellite B) Macro-satellite
 C) Mini-satellite D) All of these
199. **Pg. 123, E)**

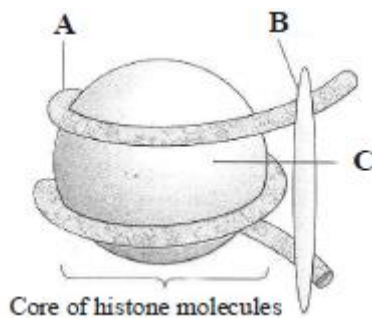


In the given figure if 'C' is the DNA collected from crime site and 'A' & 'B' are samples from suspects, then who is the criminal?

- A) B B) A C) Both A and B D) None of these

NEET PREVIOUS YEARS QUESTIONS

- The experimental proof for semi-conservative replication of DNA was first shown in a : [2018]
 (a) Fungus (b) Bacterium (c) Virus (d) Plant
- Select the correct match [2018]
 (a) Alec Jeffreys - *Streptococcus pneumoniae*
 (b) Alfred Hershey and Martha Chase - TMV
 (c) Francois Jacob and Jacques Monod - Lac operon
 (d) Matthew Meselson and F. Stahl - *Pisum sativum*
- Many ribosomes may associate with a single mRNA to form multiple copies of a polypeptide simultaneously. Such strings of ribosomes are termed as : [2018]
 (a) Polysome (b) Polyhedral bodies (c) Nucleosome (d) Plastidome
- AGGTATCGCAT is a sequence from the coding strand of a gene. What will be the corresponding sequence of the transcribed mRNA? [2018]
 (a) AGGUAUCGCAU (b) UGGTUTCGCAT (c) UCCAUAAGCGUA (d) ACCUAUGCGAU
- All of the following are part of an operon except : [2018]
 (a) An operator (b) Structural genes (c) A promoter (d) An enhancer
- The given figure shows the structure of nucleosome with their parts labelled as A, B & C. Identify A, B and C. [2017]



- (a) A – DNA; B – H1 histone; C – Histone octamer (b) A – H1 histone; B – DNA; C – Histone octamer
 (c) A – Histone octamer; B – RNA; C – H1 histone (d) A – RNA; B – H1 histone; C – Histone octamer

7. Match the codons given in column I with their respective amino acids given in column II and choose the correct answer. [2017]

Column -I (Codons)		Column -II (Amino acids)	
A	UUU	I.	Serine
B	GGG	II.	Methionine
C	UCU	III.	Phenylalanine
D	CCC	IV.	Glycine
E	AUG	V.	Proline

- (a) A – III; B – IV; C – I; D – V; E – II (b) A – III; B – I; C – IV; D – V; E – II
 (c) A – III; B – IV; C – V; D – I; E – II (d) A – II; B – IV; C – I; D – V; E – III

8. The final proof for DNA as the genetic material came from the experiments of : [2017]

- (a) Hershey and Chase (b) Avery, Mcleod and McCarty
 (c) Hargobind Khorana (d) Griffith

9. DNA fragments are : [2017]

- (a) Negatively charged (b) Neutral
 (c) Either positively or negatively charged depending on their size
 (d) Positively charged

10. Which of the following RNAs should be most abundant in animal cell? [2017]

- (a) t-RNA (b) m-RNA (c) mi-RNA (d) r-RNA

11. The association of histone H₁ with a nucleosome indicates [2017]

- (a) DNA replication is occurring. (b) the DNA is condensed into a chromatin fibre.
 (c) the DNA double helix is exposed. (d) transcription is occurring.

12. If there are 999 bases in an RNA that codes for a protein with 333 amino acids, and the base at position 901 is deleted such that the length of the RNA becomes 998 bases, how many codons will be altered? [2017]

- (a) 11 (b) 33 (c) 333 (d) 1

13. During DNA replication, Okazaki fragments are used to elongate [2017]

- (a) the lagging strand towards replication fork. (b) the leading strand away from replication fork.
 (c) the lagging strand away from the replication fork. (d) the leading strand towards replication fork.

14. Spliceosomes are not found in cells of : [2017]

- (a) Fungi (b) Animals (c) Bacteria (d) Plants

15. Which of the following is required as inducer(s) for the expression of Lac operon? [2016]

- (a) Glucose (b) Galactose (c) Lactose (d) Lactose and galactose

16. Which of the following is not required for any of the techniques of DNA fingerprinting available at present? [2016]

- (a) Polymerase chain reaction (b) Zinc finger analysis
 (c) Restriction enzymes (d) DNA-DNA hybridisation

17. Which one of the following is the starter codon? [2016]

- (a) AUG (b) UGA (c) UAA (d) UAG

18. A complex of ribosomes attached to a single strand of RNA is known as : [2016]
 (a) Polysome (b) Polymer (c) Polypeptide (d) Okazaki fragment
19. There are three genes a, b, c. Percentage of crossing over between a and b is 20%, b and c is 28% and a and c is 8%. What is the sequence of genes on chromosome? [2015]
 (a) b, a, c (b) a, b, c (c) a, c, b (d) None of these
20. Which one of the following is not applicable to RNA? [2015]
 (a) 5' phosphoryl and 3' hydroxyl ends (b) Heterocyclic nitrogenous bases
 (c) Chargaff's rule (d) Watson and Crick
21. In sea urchin DNA, which is double stranded, 17% of the bases were shown to be cytosine. The percentages of the other three bases expected to be present in this DNA are: [2015]
 (a) G-17%, A-16.5%, T-32.5% (b) G-17%, A-33%, T-33%
 (c) G-8.5%, A-50%, T-24.5% (d) G-34%, A-24.5%, T-24.5%
22. The movement of a gene from one linkage group to another is called _____. [2015]
 (a) duplication (b) translocation (c) crossing over (d) inversion
23. Gene regulation governing lactose operon of *E.coli* that involves the lac I gene product is : [2015]
 (a) negative and inducible because repressor protein prevents transcription.
 (b) negative and repressible because repressor protein prevents transcription.
 (c) feedback inhibition because excess of β -galactosidase can switch off transcription.
 (d) positive and inducible because it can be induced by lactose.
24. Satellite DNA is important because it : [2015]
 (a) shows high degree of polymorphism in population and also the same degree of polymorphism in an individual, which is heritable from parents to children.
 (b) does not code for proteins and is same in all members of the population.
 (c) codes for enzymes needed for DNA replication.
 (d) codes for proteins needed in cell cycle.
25. Select the correct option. [2014]

	Direction of RNA synthesis	Direction of reading of the template DNA strand
(a)	5'—3'	3'—5'
(b)	3'—5'	5'—3'
(c)	5'—3'	5'—3'
(d)	3'—5'	3'—5'

- (a) 5'—3' 3'—5' (b) 3'—5' 5'—3' (c) 5'—3' 5'—3' (d) 3'—5' 3'—5'
26. Which one of the following represents a palindromic sequence in DNA? [2014]
 (a) 5' - GAATTC - 3'
 3' - CTTAAG - 5'
 (b) 5' - CCAATG - 3'
 3' - GAATCC - 5'
 (c) 5' - CATTAG - 3'
 3' - GATAAC - 5'
 (d) 5' - GATACC - 3'
27. Transformation was discovered by : [2014]
 (a) Meselson and Stahl (b) Hershey and Chase (c) Griffith (d) Watson and Crick
28. Which one of the following is wrongly matched? [2014]
 (a) Transcription – Writing information from DNA to tRNA.
 (b) Translation – Using information in mRNA to make protein.
 (c) Repressor protein – Binds to operator to stop enzyme synthesis.
 (d) Operon – Structural genes, operator and promoter.
29. Commonly used vectors for human genome sequencing are: [2014]
 (a) T-DNA (b) BAC and YAC (c) Expression vectors (d) T/A cloning vectors
30. Purines found both in DNA and RNA are :- [NEET-2019]
 (1) Adenine and thymine (2) Adenine and guanine
 (3) Guanine and cytosine (4) Cytosine and thymine
31. Under which of the following conditions will there be no change in the reading frame of following mRNA ? [NEET-2019]
 5'AACAGCGGUGCUAUU3'

- (1) Insertion of G at 5th position (2) Deletion of G from 5th position
 (3) Insertion of A and G at 4th and 5th positions respectively
 (4) Deletion of GGU from 7th, 8th and 9th positions
32. Which of the following features of genetic code does allow bacteria to produce human insulin by recombinant DNA technology? [NEET-2019]
 (1) Genetic code is not ambiguous (2) Genetic code is redundant
 (3) Genetic code is nearly universal (4) Genetic code is specific
33. Expressed Sequence Tags (ESTs) refers to :- [NEET-2019]
 (1) Genes expressed as RNA (2) Polypeptide expression
 (3) DNA polymorphism (4) Novel DNA sequences
34. Match the following genes of the Lac operon with their respective products :- [NEET-2019]
 (a) i gene (i) β -galactosidase (b) z gene (ii) Permease
 (c) a gene (iii) Repressor (d) y gene (iv) Transacetylase
 Select the correct option.
 (a) (b) (c) (d) (a) (b) (c) (d) (a) (b) (c) (d) (a) (b) (c) (d)
 (1) (i) (iii) (ii) (iv) (2) (iii) (i) (ii) (iv) (3) (iii) (i) (iv) (ii) (4) (iii) (iv) (i) (ii)
35. What will be the sequence of mRNA produced by the following stretch of DNA? [NEET-2019 ODISSA]
 3'ATGCATGCATGCATG5' TEMPLATE STRAND
 5' TACGTACGTACGTAC3' CODING STRAND
 (1) 3'AUGCAUGCAUGCAUG5' (2) 5'UACGUACGUACGUAC 3'
 (3) 3' UACGUACGUACGUAC 5' (4) 5' AUGCAUGCAUGCAUG 3'
36. Match the following RNA polymerase with their transcribed products : [NEET-2019 ODISSA]
 (a) RNA polymerase I (i) tRNA
 (b) RNA polymerase II (ii) rRNA
 (c) RNA polymerase III (iii) hnRNA
 Select the correct option from the following :
 (1) a-i, b-iii, c-ii (2) a-i, b-ii, c-iii (3) a-ii, b-iii, c-i (4) a-iii, b-ii, c-i
37. From the following, identify the correct combination of salient features of Genetic Code :- [NEET-2019 ODISSA]
 (1) Universal, Non-ambiguous, Overlapping (2) Degenerate, Overlapping, Commaless
 (3) Universal, Ambiguous, Degenerate (4) Degenerate, Non-overlapping, Non-ambiguous
38. Which scientist experimentally proved that DNA is the sole genetic material in bacteriophage ? [NEET-2019 ODISSA]
 (1) Beadle and Tatum (2) Messelson and Stahl (3) Hershey and Chase (4) Jacob and Monod
39. In the process of transcription in Eukaryotes, the RNA polymerase I transcribes [NEET-2019 ODISSA]
 (1) mRNA with additional processing, capping and tailing (2) tRNA, 5 S rRNA and snRNAs
 (3) rRNAs. 28 S, 18 S and 5.8 S (4) Precursor of mRNA, hnRNA
40. What initiation and termination factors are involved in transcription in Eukaryotes? [NEET-2019 ODISSA]
 (1) s and r, respectively (2) a and b, respectively
 (3) b and g, respectively (4) a and s, respectively
41. The term 'Nuclein' for the genetic material was used by : [NEET-2020 COVID]
 (1) Franklin (2) Meischer (3) Chargaff (4) Mendel
42. In the polynucleotide chain of DNA, a nitrogenous base is linked to the -OH of: [NEET-2020 COVID]
 (1) 2'C pentose sugar (2) 3'C pentose sugar (3) 5'C pentose sugar (4) 1'C pentose sugar
43. E.coli has only 4.6×10^6 base pairs and completes the process of replication within 18 minutes; then the average rate of polymerisation is approximately- [NEET-2020 COVID]
 (1) 2000 base pairs/second (2) 3000 base pairs/second
 (3) 4000 base pairs/second (4) 1000 base pairs/second
44. Which is the basis of genetic mapping of human genome as well as DNA fingerprinting? [NEET-2020 COVID]
 (1) Polymorphism in DNA sequence (2) Single nucleotide polymorphism
 (3) Polymorphism in hnRNA sequence (4) Polymorphism in RNA sequence

45. Name the enzyme that facilitates opening of DNA helix during transcription [NEET-2020]
 1) RNA polymerase 2) DNA ligase 3) DNA helicase 4) DNA polymerase
46. The first phase of translation is: [NEET-2020]
 1) Recognition of an anti-codon 2) Binding of mRNA to ribosome
 3) Recognition of DNA molecule 4) Aminoacylation of tRNA
47. If the distance between two consecutive base pairs is 0.34 nm and the total number of base pairs of a DNA double helix in a typical mammalian cell is 6.6×10^9 bp, then the length of the DNA is approximately [NEET-2020]
 1) 2.7 meters 2) 2.0 meters 3) 2.5 meters 4) 2.2 meters
48. Complete the flow chart on central dogma [NEET-2021]
 (a) $\text{DNA} \xrightarrow{(b)} \text{mRNA} \xrightarrow{(c)} (d)$
 1) (a)-Translation; (b)-Replication; (c)-Transcription;(d)-Transduction
 2) (a)- Replication;(b)- Transcription;(c)- Translation;(d)-Protein
 3) (a)-Transduction; (b)-Transcription (c)-Transduction;(D) –Protein
 4) a) Replication, b) Transcription, c) Transduction; D)-protein
49. Identify the correct statement [NEET-2021]
 1) RNA polymerase binds with Rho factor to terminate the process of transcription in bacteria.
 2) The coding strand in a transcription unit is copied to an mRNA
 3) Split gene arrangement is characteristic of prokaryotes
 4) In capping, methyl guanosine triphosphate is added to the 3' end of hnRNA
50. What is the role of RNA polymerase III in the process of transcription in eukaryotes? [NEET2021]
 1) Transcribes tRNA, 5s rRNA and snRNA 2) Transcribes precursor of mRNA
 3) Transcribes only snRNAs 4) Transcribes rRNAs (28S, 18S and 5.8S)
51. Which is the "Only enzyme" that has "capability" to catalyse initiation, Elongation and Termination in the process of transcription in prokaryotes ? [NEET-2021]
 1. DNA dependent RNA polymerase 2. DNA Ligase
 3. DNase 4. DNA dependent DNA polymerase
52. A specific recognition sequence identified by endonucleases to make cuts at specific positions within the DNA is [NEET-2021]
 1) Okazaki sequences 2) Palindromic Nucleotide sequences
 3) Poly(A) tail sequences 4) Degenerate primer sequence
53. Which of the following RNAs is not required for the synthesis of protein? [NEET-2021]
 1) tRNA 2) rRNA 3) siRNA 4) mRNA
54. Statement-I: The codon 'AUG codes for methionine and phenylalanine. [NEET-2021]
 Statement-II: AAA' and 'AAG" both codons code for the amino acid lysine.
 In the light of the above statements, choose the correct answer from the options given below
 1) Both Statement I and Statement II are false
 2) Statement I is correct but Statement II is false
 3) Statement I is incorrect but Statement II is true
 4) Both Statement I and Statement II are true
55. Which one of the following statements about Histones is wrong? [NEET-2020]
 1) The pH of histones is slightly acidic.
 2) Histones are rich in amino acids – Lysine and Arginine.
 3) Histones carry positive charge in the side chain
 4) Histone are organized to form a unit of 8 molecules.
56. DNA fingerprinting involves identifying differences in some specific regions in DNA sequence, called as: [NEET-2021]
 1) Repetitive DNA 2) Single nucleotides 3) Polymorphic DNA 4) Satellite DNA
57. In an *E.coli* strain *i* gene gets mutated and its product cannot bind the inducer molecule. If growth medium is provided with lactose, what will be the outcome? [NEET-2022]
 1) Only *z* gene will get transcribed

- 2) z, y, a genes will be transcribed
 3) z, y, a genes will not be translated
 4) RNA polymerase will bind the promoter region
58. If the length of a DNA molecule is 1.1 metres, what will be the approximate number of base pairs? [NEET-2022]
 1) 3.3×10^9 bp 2) 6.6×10^9 bp 3) 3.3×10^6 bp 4) 6.6×10^6 bp
59. Ten *E.coli* cells with ^{15}N - dsDNA are incubated in medium containing ^{14}N nucleotide. After 60 minutes, how many *E.coli* cells will have DNA totally free from ^{15}N ? [NEET-2022]
 1) 20 cells 2) 40 cells 3) 60 cells 4) 80 cells

60. Match List I with List II

List I

- A. Frederick Griffith
 B. Francois Jacob & Jacque Monod
 C. Har Gobind Khorana
 D. Meselson & Stahl

List II

- I. Genetic code
 II. Semi-conservative mode of DNA replication
 III. Transformation
 IV. Lac operon

Choose the correct answer from the options given below:

- (a) A-III, B-II, C-I, D-IV
 (b) A-III, B-IV, C-I, D-II
 (c) A-II, B-III, C-IV, D-I
 (d) A-IV, B-I, C-II, D-III

[NEET 2024]

61. Which of the following statement is correct regarding the process of replication in *E.coli*?

- (a) The DNA dependent DNA polymerase catalyses polymerization in one direction that is $3' \rightarrow 5'$
 (b) The DNA dependent RNA polymerase catalyses polymerization in one direction, that is $5' \rightarrow 3'$
 (c) The DNA dependent DNA polymerase catalyses polymerization in $5' \rightarrow 3'$ as well as $3' \rightarrow 5'$ direction
 (d) The DNA dependent DNA polymerase catalyses polymerization in $5' \rightarrow 3'$ direction

[NEET 2024]

62. Which one is the correct product of DNA dependent RNA polymerase to the given template?
 3'TACATGGCAAATATCCATTCA5'

- (a) 5'AUGUACCGUUUAUAGGUAAGU3'
 (b) 5'AUGUAAAGUUUAUAGGUAAGU3'
 (c) 5'AUGUACCGUUUAUAGGGAAGU3'
 (d) 5'ATGTACCGTTTATAGGTAAGT3'

[NEET 2024]

63. Match List I with List II:

	List I		List II
A.	RNA polymerase III	I.	snRNPs
B.	Termination of transcription	II.	Promotor
C.	Splicing of Exons	III.	Rho factor
D.	TATA box	IV.	SnRNAs, tRNA

Choose the correct answer from the options given below :

- (a) A-II, B-IV, C-I, D-III
 (b) A-III, B-II, C-IV, D-I
 (c) A-III, B-IV, C-I, D-II
 (d) A-IV, B-III, C-I, D-II

[NEET 2024]

64. Name the component that binds to the operator region of an operon and prevents RNA polymerase from transcribing the operon.

- (a) Promotor
 (b) Regulator protein
 (c) Repressor protein
 (d) Inducer

[NEET 2023 Manipur]

65. Given below are two statements :

Statement I : The process of copying genetic information from one strand of the DNA into RNA is termed as transcription.

Statement II : A transcription unit in DNA is defined primarily by the three regions in the DNA i.e., a promotor, the structural gene and a terminator. In the light of the above statements, choose the correct answer from the options given below:

- (a) Statement I is correct but Statement II is false
 (b) Statement I is incorrect but Statement II is true
 (c) Both Statement I and Statement II are true
 (d) Both Statement I and Statement II are false

66. Given below are two statements :

Statement I : RNA being unstable, mutate at a faster rate.

Statement II : RNA can directly code for synthesis of proteins hence can easily express the characters.

In the light of the above statements, choose the correct answer from the options given below :

- (a) Statement I is correct but Statement II is false
- (b) Statement I is incorrect but Statement II is true
- (c) Both Statement I and Statement II are true
- (d) Both Statement I and Statement II are false

[NEET 2023 Manipur]

67. Which one of the following acts as an inducer for lac operon?

- (a) Sucrose
- (b) Lactose
- (c) Glucose
- (d) Galactose

[NEET 2023 Manipur]

68. With reference to Hershey and Chase experiments. Select the correct statements.

- (A) Viruses grown in the presence of radioactive phosphorus contained radioactive DNA.
- (B) Viruses grown on radioactive sulphur contained radioactive proteins.
- (C) Viruses grown on radioactive phosphorus contained radioactive protein.
- (D) Viruses grown on radioactive sulphur contained radioactive DNA.
- (E) Viruses grown on radioactive protein contained radioactive DNA.

Choose the most appropriate answer from the options given below :

- (a) (D) and (E) only
- (b) (A) and (B) only
- (c) (A) and (C) only
- (d) (B) and (D) only

[NEET 2023 Manipur]

69. Unequivocal proof that DNA is the genetic material was first proposed by

- (a) Alfred Hershey and Martha Chase
- (b) Avery, Macleoid and McCarthy
- (c) Wilkins and Franklin
- (d) Frederick Griffith

[NEET 2023]

70. What is the role of RNA polymerase III in the process of transcription in Eukaryotes?

- (a) Transcription of tRNA, 5S rRNA and snRNA
- (b) Transcription of precursor of mRNA
- (c) Transcription of only snRNAs
- (d) Transcription of rRNAs (28 S, 18 S and 5.8 S)

[NEET 2023]

71. Expressed Sequence Tags (ESTs) refers to

- (a) All genes that are expressed as proteins.
- (b) All genes whether expressed or unexpressed.
- (c) Certain important expressed genes.
- (d) All genes that are expressed as RNA.

[NEET 2023]

72. Upon exposure to UV radiation, DNA stained with ethidium bromide will show

- (a) Bright blue colour
- (b) Bright yellow colour
- (c) Bright orange colour
- (d) Bright red colour

[NEET 2023]

73. Match List I with List II.

	List I		List 2
(A)	Gene 'a'	(I)	β -galactosidase II
(B)	Gene 'y'	(II)	Transacetylase
(C)	Gene 'i'	(III)	Permease
(D)	Gene 'z'	(IV)	Repressor protein

Choose the correct answer from the options given below :

- (a) A-II, B-III, C-IV, D-I
- (b) A-III, B-IV, C-I, D-II
- (c) A-III, B-I, C-IV, D-II
- (d) A-II, B-I, C-IV, D-III

[NEET 2023]

74. Given below are two statements:

Statement I: In prokaryotes, the positively charged DNA is held with some negatively charged proteins in a region called nucleoid.

Statement II: In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form nucleosome.

In the light of the above statements, choose the correct answer from the options given below:

- (a) Both Statement I and Statement II are false.
- (b) Statement I is correct but Statement II is false.
- (c) Statement I is incorrect but Statement II is true.
- (d) Both Statement I and Statement II are true.

[NEET 2023]

75. Which one of the following is the sequence on corresponding coding strand, if the sequence on mRNA formed is as follows 5'AUCGAUCGAUCGAUCGAUCGAUCG AUCG 3'?

- (a) 3' UAGCUAGCUAGCUAGCUAGCUAGCUAGC 5'
- (b) 5' ATCGATCGATCGATCGATCGATCGATCG 3'
- (c) 3' ATCGATCGATCGATCGATCGATCGATCG 5'
- (d) 5' UAGCUAGCUAGCUAGCUAGCUAGCUAGCUAGC 3'

[NEET 2023]

76. A transcription unit in DNA is defined primarily by the three regions in DNA and these are with respect to upstream and down stream end;

- (a) Repressor, Operator gene, Structural gene
- (b) Structural gene, Transposons, Operator gene
- (c) Inducer, Repressor, Structural gene
- (d) Promotor, Structural gene, Terminator

[NEET 2024]

77. The lactose present in the growth medium of bacteria is transported to the cell by the action of

- (a) Beta-galactosidase
- (b) Acetylase
- (c) Permease
- (d) Polymerase

[NEET 2023]

78. Given below are two statements:

Statement I: In the RNA world, RNA is considered the first genetic material evolved to carry out essential life processes. RNA acts as a genetic material and also as a catalyst for some important biochemical reactions in

living systems. Being reactive, RNA is unstable.

Statement II: DNA evolved from RNA and is a more stable genetic material. Its double helical strands being complementary, resist changes by evolving repairing mechanism.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (a) Both statement I and statement II are correct
- (b) Both statement I and statement II are incorrect
- (c) Statement I is correct but statement II is incorrect
- (d) Statement I is incorrect but statement II is correct

[NEET 2025]

79. Which chromosome in the human genome has the highest number of genes?

- (a) Chromosome X
- (b) Chromosome Y
- (c) Chromosome 1
- (d) Chromosome 10

[NEET 2025]

80. Which of the following are the post-transcriptional events in an eukaryotic cell?

- A. Transport of pre-mRNA to cytoplasm prior to splicing.
- B. Removal of introns and joining of exons.
- C. Addition of methyl group at 5' end of hnRNA.
- D. Addition of adenine residues at 3' end of hnRNA.
- E. Base pairing of two complementary RNAs.

Choose the correct answer from the options given below:

- (a) A, B, C only
- (b) B, C, D only
- (c) B, C, E only
- (d) C, D, E only

[NEET 2025]

81 . Match List-I with List-II.

	List-I		List-II
A.	Alfred Hershey and Martha Chase	I.	Streptococcus Pneumoniae
B.	Euchromatin	II.	Densely packed and dark-stained
C.	Frederick Griffith	III.	Loosely packed and light-stained
D.	Heterochromatin	IV.	DNA as genetic material confirmation

Choose the correct answer from the options given below:

- (a) A-II, B-IV, C-I, D-III
- (b) A-IV, B-II, C-I, D-III
- (c) A-IV, B-III, C-I, D-II
- (d) A-III, B-II, C-IV, D-I

[NEET 2025]

82. Silencing of specific mRNA is possible via RNAi because of -

- (a) Complementary dsRNA
- (b) Inhibitory ssRNA
- (c) Complementary tRNA
- (d) Non-complementary ssRNA

[NEET 2025]

83. Histones are enriched with -

- (a) Lysine & Arginine
- (b) Leucine & Lysine
- (c) Phenylalanine & Leucine
- (d) Phenylalanine & Arginine

[NEET 2025]

84. Who proposed that the genetic code for amino acids should be made up of three nucleotides?

- (a) George Gamow
- (b) Francis Crick
- (c) Jacques Monod
- (d) Franklin Stahl

[NEET 2025]

85. Which factor is important for termination of transcription?

- (a) α (alpha)
- (b) σ (sigma)
- (c) ρ (rho)
- (d) γ (gamma)

[NEET 2025]

NCERT LINE BY LINE QUESTIONS – ANSWERS

1) D	2) C	3) D	4) A	5) B	6) B	7) B	8) D	9) D	10) A
11) A	12) D	13) C	14) B	15) B	16) C	17) C	18) A	19) C	20) B
21) A	22) C	23) B	24) C	25) C	26) B	27) A	28) B	29) A	30) D
31) C	32) A	33) B	34) A	35) D	36) D	37) D	38) C	39) D	40) C
41) A	42) D	43) C	44) A	45) D	46) A	47) D	48) A	49) A	50) C
51) B	52) A	53) D	54) A	55) D	56) B	57) C	58) B	59) C	60) D
61) C	62) A	63) B	64) A	65) C	66) A	67) C	68) B	69) B	70) C
71) A	72) C	73) A	74) C	75) A	76) A	77) B	78) C	79) C	80) C
81) A	82) B	83) C	84) A	85) C	86) A	87) C	88) B	89) B	90) C
91) D	92) C	93) B	94) D	95) A	96) A	97) B	98) C	99) A	100) A
101) C	102) D	103) B	104) D	105) B	106) A	107) B	108) A	109) A	110) B
111) A	112) A	113) A	114) A	115) B	116) B	117) A	118) B	119) A	120) A
121) B	122) D	123) D	124) A	125) B	126) B	127) A	128) B	129) D	130) C
131) A	132) D	133) C	134) C	135) D	136) A	137) A	138) A	139) B	140) D

141) B	142) A	143) D	144) D	145) A	146) B	147) C	148) A	149) D	150) A
151) D	152) B	153) D	154) C	155) B	156) B	157) B	158) D	159) B	160) B
161) D	162) A	163) C	164) C	165) A	166) C	167) C	168) A	169) B	170) A
171) C	172) D	173) A	174) C	175) D	176) B	177) A	178) B	179) B	180) B
181) C	182) D	183) A	184) C	185) C	186) C	187) A	188) A	189) A	190) B
191) B	192) B	193) D	194) A	195) C	196) C	197) D	198) C	199) A	

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

- 1 (b) 2 (c) 3 (a) 4 (a) 5 (d) 6 (a) 7 (a) 8 (a) 9 (a) 10 (d)
 11 (b) 12 (b) 13 (c) 14 (c) 15 (c) 16 (b) 17 (a) 18 (a) 19 (a) 20 (c)
 21 (b) 22 (b) 23 (a) 24 (a) 25 (a) 26 (a) 27 (c) 28 (a) 29 (b) 30 (2)
 31 (4) 32 (3) 33 (1) 34 (3) 35 (2) 36 (3) 37 (4) 38 (3) 39 (3) 40 (1)
 41 (2) 42 (4) 43 (1) 44 (1) 45 (1) 46 (2) 47 (4) 48 (2) 49 (1) 50 (1)
 51 (1) 52 (2) 53 (3) 54 (3) 55 (1) 56 (1) 57 (4) 58 (2) 59 (1) 60(b) 61(d) 62(a) 63(d) 64(c) 65(c)
 66(c) 67(b) 68(b) 69(a) 70(a) 71(d) 72(c) 73(a) 74(c) 75(b) 76(d) 77(c) 78(a)
 79(c) 80(b) 81(c) 82(a) 83(a) 84(a) 85(c)

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

- (b) Semi-conservative DNA replication was first shown in bacterium *Escherichia coli* by Matthew Meselson and Franklin Stahl.
- (c)
- (a) A polyribosome (or polysome) is a complex of an mRNA molecule and two or more ribosomes that act to translate mRNA instructions into polypeptides.
- (a) Coding strand and mRNA have the similar nucleotide sequence except, Thymine (T) is replaced by Uracil (U) in mRNA.
- (d) Unlike eukaryotes, in prokaryotes the genes are organised into operon. Operon is a co-ordinated group of genes which are all transcribed together & regulate a metabolic pathway as a unit.
- (a) 7. (a)
- (a) Hershey and Chase proved that DNA is genetic material. They used bacteriophage for their experiment.
- (a) DNA fragments are negatively charged because of presence of phosphate group.
- (d) Ribosomal RNA (rRNA) is most abundant in animal cell. It constitutes about 80% of total RNA of the cell.
- (b) The association of H1 protein indicates the complete formation of nucleosome which requires DNA condensation. Therefore DNA is in condensed form.
- (b) If deletion happens at 901st position than the remaining 98 bases specifying for 33 codons of amino acids will be altered.
- (c)
- (c) In eukaryotes spliceosomes are used in removal of introns during post-transcriptional processing of hnRNA. They are absent in prokaryotes.
- (c)
- (b) Zinc-finger analysis is used for protein analysis. The zinc finger proteins are a super family of proteins involved in numerous activities of plant growth and development.
- (a) The start codon is the first codon of a messenger RNA (mRNA) transcript translated by a ribosome. The start codon always codes for methionine in eukaryotes and a modified Met (fMet) in prokaryotes. The most common start codon is AUG.
- (a) A polysome or polyribosome is a complex of an mRNA molecule and two or more ribosomes, which is formed during the active translation process. They were initially named as ergosomes in 1963. However, further research by Jonathan Warner and Alex Rich characterised polysome.
- (a)
- (c) Chargaff's rule is not applicable to RNA.
- (b) 22. (b)
- (a) Lac operon under control of repressor shows a negative regulation. Operon has inducible nature.
- (a)
- (a) Synthesis of RNA exhibits several features that are synonymous with DNA replication. RNA synthesis requires accurate and efficient initiation, elongation proceeds in the 5'-3' direction (*i.e.* the polymerase

moves along the template strand of DNA in the 3'–5' direction), and RNA synthesis requires distinct and accurate termination. Transcription exhibits several features that are distinct from replication.

26. (a) 27. (c) 28. (a)

29. (b) Human genome sequencing is a process that determines the complete DNA sequence of an organism's genome at a single time. This requires sequencing of an organism's chromosomal DNA as well as DNA contained in the mitochondria and, for plants, in the chloroplast. Commonly used vectors for human genome sequencing are BAC (Bacterial artificial chromosomes) and YAC (Yeast artificial chromosomes).
45. Opening of DNA helix is facilitated by RNA polymerase. Opening of DNA is performed by DNA helicase
46. In the first step of RNA translation mRNA binds to ribosomes
47. $6.6 \times 10^9 \text{ bp} \times 0.34 \text{ nm} = 2.2 \text{ meters}$
48. DNA—DNA-----Replication
DNA---RNA---- Transcription
RNA—Protein ---- Translation
d—protein
49. • Split gene arrangement is characteristic of eukaryotes.
- In capping 5-methyl guanosine triphosphate is added at 5' end of hnRNA.
 - At 3' end poly-A tail is added.
 - The non coding or template strand is copied to an mRNA. RNA polymerase associate with ρ factor (Rho factor) and it alters the specificity of the RNA polymerase to terminate the processes.
50. • RNA polymerase III transcribes tRNA, ScRNA, 5S rRNA and SnRNA.
• RNA polymerase I transcribes 5.8S, 18S and 28S rRNA.
• RNA polymerase II transcribes hnRNA which is precursor of mRNA
51. The enzyme capable of Initiation , elongation and termination in the process of transcription in prokaryotes
DNA dependent RNA polymerase
52. Palindromic Nucleotide sequences are specific recognition sequence
53. Short interfering RNA or silencing RNA is not involved in protein synthesis.
54. The codon 'AUG' codes for methionine and 'UUU' codes for phenylalanine.
55. * Histones are rich in basic amino acids residue lysine and arginine with charged side chain.
* There are five types of histone proteins i.e., H1, H2A, H2B, H3 and H4. Four of them occur in pairs to produce a unit of 8 molecules (histone octamer)
* The pH of histones is basic.
56. Repetitive DNA
57. z, y, a genes will be transcribed normally as i gene gets mutated and its product cannot bind the inducer molecule
58. Length of DNA is 2.2m i.e., $6.6 \times 10^9 \text{ bp}$
Therefore 1.1m is $3.3 \times 10^9 \text{ bp}$
59. 3 cycles of division occurs in 60 minutes forming a total of 80 *E.coli* cells. 20/80 cells contains medium DNA and 60/80 cells contain light DNA

60. Ans. (b)

Explanation

Frederick Griffith series of experiment witness miraculous transformation in the bacteria.

The elucidation of Lac operon was a result of a close association between geneticist, Francois Jacob and a biochemist, Jacques Monod.

Meselson and Stahl gave semi-conservative mode of DNA replication.

Har Gobind Khorana developed chemical method to define combination of bases in genetic code.

61.Ans.(d)**Explanation**

In Prokaryotes, like E.coli during replication, the DNA dependent DNA polymerase catalyse polymerization only in one direction, that is $5' \rightarrow 3'$

62.Ans. (a)**Explanation**

Template DNA is :

3'TACATGGCAAATATCCATTCA5'

5'AUGUACCGUUUAUAGGUAAGU3' m-RNA

63.Ans. (d)**Explanation**

In eukaryotes, RNA polymerase III codes for snRNAs, tRNA and 5s rRNA.

- Splicing of exons is performed by snRNPs.
- TATA box is present in promoter
- region of transcription unit.

Rho factor is responsible for termination of transcription

64.Ans.(c)**Explanation**

The component that binds to the operator region of an operon and prevents RNA polymerase from transcribing the operon is the Repressor protein. Repressor proteins are produced by a regulator gene and can bind to an operator site to block transcription of downstream structural genes.

Therefore, the correct answer is Option c : Repressor protein.

65.Ans. (c)**Explanation**

Option c : Both Statement I and Statement II are true

Statement I is correct. Transcription is the process of copying genetic information from one strand of the DNA into RNA. The resulting RNA molecule is complementary to the DNA strand from which it was transcribed.

Statement II is also correct. A transcription unit in DNA is indeed defined by three main regions: the promoter, the structural gene, and a terminator.

1. The promoter is a DNA sequence that defines where transcription of a gene by RNA polymerase begins.
2. The structural gene contains the actual genetic information that is being transcribed.
3. The terminator is a sequence of nucleotides that signals the end of transcription.

So, both the statements are true.

66.Ans. (c)**Explanation**

The correct answer is :

Option c: Both Statement I and Statement II are true

Here's why :

Statement I : RNA is indeed generally less stable than DNA and mutates at a faster rate. This is due to the presence of a hydroxyl group on the 2' carbon of RNA, which makes it more susceptible to hydrolysis and other chemical reactions. This increased rate of mutation can be beneficial for RNA viruses, for example, as it allows them to rapidly adapt to new environments or hosts.

Statement II : RNA, particularly mRNA (messenger RNA), can directly code for the synthesis of proteins. In

the process of gene expression, DNA is first transcribed into RNA, which is then translated into protein. Hence, changes in the RNA sequence can directly affect the resultant protein and thus easily express different characters.

67.Ans.(b)

Explanation

The correct answer is :

Option b : Lactose

Explanation :

In bacterial genetics, the lac operon is an operon (a functioning unit of genomic DNA containing a cluster of genes under the control of a single regulatory signal or promoter) required for the transport and metabolism of lactose in *E. coli* and some other enteric bacteria.

When lactose is present, it acts as an inducer for the lac operon. This means that lactose, when present, triggers the activation of the lac operon, allowing the bacteria to produce the necessary enzymes (beta-galactosidase, lactose permease, and thiogalactoside transacetylase) to metabolize lactose. The lac operon is a classic example of a gene system subject to both positive and negative control.

68.Ans.(b)

Explanation

Option b : (A) and (B) only

Explanation : In the Hershey and Chase experiments, they used bacteriophages (viruses that infect bacteria) and grew one batch in the presence of radioactive phosphorus (P32) and another batch in the presence of radioactive sulfur (S35).

Phosphorus is a component of DNA but not of protein. Therefore, any virus particles grown in the presence of radioactive phosphorus would have radioactive *DNA*, which is statement (A).

Sulfur is found in proteins (in the amino acids methionine and cysteine) but not in DNA. Therefore, any virus particles grown in the presence of radioactive sulfur would have radioactive protein, which is statement (B). Statements (C), (D), and (E) are incorrect because they do not align with the components of DNA and proteins, and where sulfur and phosphorus are found in these molecules.

The Hershey and Chase experiments were key in establishing that DNA, not protein, is the genetic material.

When these radioactive viruses infected bacteria, they found that the radioactive DNA (from phosphorus) was transferred to the bacteria, not the radioactive protein (from sulfur).

69.Ans.(a)

Explanation

The first unequivocal proof that DNA is the genetic material came from the experiments conducted by Alfred Hershey and Martha Chase in 1952. They

used bacteriophages (viruses that infect bacteria) and radioactively labeled the protein and DNA of the phage separately in two different sets of experiments. They found that it was the DNA, not the protein, of the phage that was injected into the bacteria and carried the genetic information necessary for the production of new phage particles.

Avery, Macleoid and McCarty gave the biochemical characterisation of Transforming Principle.

The transformation experiments by using *Pneumococcus* was conducted by Frederick Griffith.

Wilkins and Franklin produced X-ray diffraction data of DNA.

So, the correct answer is :

Option a : Alfred Hershey and Martha Chase.

70.Ans. (a)

Explanation

In eukaryotes there are three major types of RNA polymerases.

RNA polymerase I transcribes : 5.8S, 18S, 28S rRNAs

RNA polymerase II transcribes : hnRNAs (precursor of mRNA)

RNA polymerase III transcribes : tRNAs, ScRNA, 5S rRNA and snRNA

71.Ans. (d)

Explanation

Expressed Sequence Tags (ESTs) are short sub-sequences of a cDNA sequence. They may identify expressed genes, so they are derived from mRNA which is transcribed from expressed genes. They serve as a kind of "tag" or marker for identifying the gene from which it was transcribed. Therefore, ESTs represent genes that are expressed as RNA. The other options listed do not accurately describe what ESTs are

72.Ans. (c)

Explanation

Option (c) is the correct answer because in recombinant DNA technology the separated DNA fragments can be visualised only after staining the DNA with a substance known as ethidium bromide followed by exposure to U.V. radiation. You can see bright orange coloured bands of DNA in an ethidium bromide stained gel exposed to U.V. light.

73.Ans. (a)

Explanation

The question relates to the lac operon model in *E. coli*, which is a well-studied example of gene regulation. In this model :

- Gene 'z' codes for beta-galactosidase (breaks down lactose into glucose and galactose)
- Gene 'y' codes for permease (transports lactose into the cell)
- Gene 'a' codes for transacetylase (may help in lactose metabolism, but its exact role is unclear)
- Gene 'i' codes for the repressor protein (binds to the operator to prevent transcription)

So, matching the List I (genes) with List II (proteins they code for) :

- A (Gene 'a') matches with II (Transacetylase)
- B (Gene 'y') matches with III (Permease)
- C (Gene 'i') matches with IV (Repressor protein)
- D (Gene 'z') matches with I (Beta-galactosidase)

Therefore, the correct option is :

Option a : A-II, B-III, C-IV, D-I

74.Ans. (c)

Explanation

In prokaryotes, the negatively charged DNA is held with some positively charged proteins in a region termed as nucleoid.

In eukaryotes, the negatively charged DNA is wrapped around the positively charged histone octamer to form a structure called nucleosome.

75.Ans. (b)

Explanation

The sequence on the mRNA is 5'AUCGAUCGAUCGAUCGAUCGAUCG AUCG 3'. The mRNA is synthesized from the template strand of DNA by complementary base pairing, following these rules: A pairs with U, U pairs with A, C pairs with G, and G pairs with C. The coding strand of DNA has the same sequence as the mRNA, except with T instead of U.

To find the sequence on the corresponding coding strand, we can use these rules to convert the mRNA sequence back to DNA:

5' AUCGAUCGAUCGAUCGAUCGAUCG AUCG 3' (mRNA)

76.Ans.(d)

Explanation

A transcription unit of DNA is defined primarily by the three regions in the DNA:

(i) A promoter

(ii) The structural gene

(iii) A terminator

The promoter is said to be located towards 5'-end (upstream) of the structural gene (the reference is made with respect to the polarity of coding strand)

The terminator is located towards 3'-end (downstream) of the coding strand

77.Ans. (c)

Explanation

The *y* gene lac operon codes for permease enzyme, which increase the permeability of cell to β -galactosides.

So, the lactose present in the growth medium of bacteria is transported into the cell by the action of permease

78.Ans. (a)

Explanation

RNA was the first genetic material. RNA used to act as a genetic material as well as a catalyst (there are some important biochemical reactions in living systems that are catalysed by RNA catalysts and not by protein enzymes). But, RNA being a catalyst was reactive and hence unstable. DNA has evolved from RNA with chemical

modifications that make it more stable. DNA being double stranded and having complementary strand further resists changes by evolving a process of repair

79.Ans. (c)

Explanation

Chromosome 1 has most genes (2968), and the Y has the fewest (231).

80.Ans. (b)

Explanation

The post-transcriptional events in a eukaryotic cell include:

- B. Removal of introns and joining of exons (splicing)
- C. Addition of a methyl guanosine cap at the 5' end of hnRNA (capping)
- D. Addition of adenine residues at the 3' end (poly-A tailing)

A is incorrect because transport to cytoplasm occurs after splicing, and E (base pairing of two complementary RNAs) is not a typical posttranscriptional modification

81.Ans. (c)

Explanation

A	Alfred Hershey and Martha Chase	IV.	DNA as genetic material confirmation
B.	Euchromatin	III.	Loosely packed and light-stained
C.	Frederick Griffith	I.	Streptococcus pneumoniae
D.	Heterochromatin	II.	Densely packed and dark-stained

82.Ans. (a)

Explanation

- RNA interference (RNAi) takes place in all eukaryotic organisms as a method of cellular defense.
- This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA and thereby silencing the specific mRNA.

83.Ans. (a)

Explanation

Histones are rich in lysine and arginine.

84.Ans. (a)

Explanation

It was George Gamow, a physicist, who argued that since there are only 4 bases and if they have to code for 20 amino acids, the code should constitute a combination of bases. He suggested that in order to code for all the 20 amino acids, the code should be made up of three nucleotides. This was a very bold proposition, because a permutation combination of 4³ (4 × 4 × 4) would generate 64 codons; generating many more codons than required.

85.Ans. (c)

Explanation

The rho (ρ) factor is essential for the termination of transcription in prokaryotes. It binds to the RNA and causes the RNA polymerase to dissociate from the DNA template, ending transcription.

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