

MOLECULAR BASIS OF INHERITANCE

1. The length of DNA usually depends on

- (A) position of nucleotides
- (B) number of nucleotides
- (C) Both (A) and (B)
- (D) None of the above

2. Find the incorrect match.

- (A) A bacteriophage ($\phi \times 174$) – 5386 nucleotides
- (B) Bacteriophage lamda – 48502 base pairs
- (C) E. coli – 46×10^6 bp
- (D) Haploid content of human DNA – 3.3×10^6 bp

3. Nitrogenous bases are linked to sugar by

- (A) hydrogen bond
- (B) phosphodiester bond
- (C) N-glycosidic bond
- (D) O-glycosidic bond

4. When a phosphate group is linked to ...A... group of nucleoside through ...B... bond, a corresponding ...C... is formed. Choose the correct option for A, B and C.

- (A) A–5' OH, B–phosphodiester bond, C–nucleotide
- (B) A–3'OH, B–phosphodiester bond, C–nucleotide
- (C) A–2' OH, B–phosphodiester bond, C–nucleotide

(D) A–5' OH, B–phosphodiester bond, C–nucleoside

5. Choose the correct option.

- (A) Pyrimidines include adenine and guanine
- (B) Pyrimidines include cytosine, uracil and thymine
- (C) Purines include adenine and thymine
- (D) Purines include guanine and cytosine

6. A polymer or a polynucleotide chain has at one end a freeA..... at 5' end of sugar, similarly at the other end of the polymer the sugar has a freeB..... of 3' group.

- (A) A – Phosphate moiety, B – OH
- (B) A – OH, B – Phosphate moiety
- (C) A – COOH, B – Phosphate moiety
- (D) A – Phosphate moiety, B–COOH

7. Choose the incorrect option.

- (A) Friedrich Miescher in 1869 identified DNA as an acidic substance and named it nuclein
- (B) Erwin Chargaff said, the ratio between A and T and G and C of dsDNA are constant and equals one
- (C) The two strands of dsDNA are complementary to each other
- (D) None of the above

8. Which of the following is not the correct salient feature of double-helix structure of DNA?

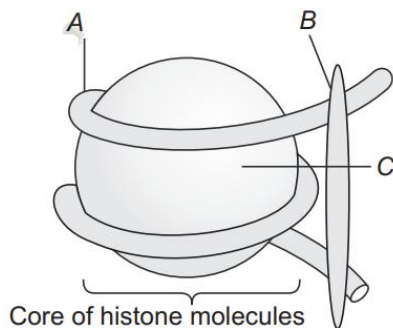
- (A) Two polynucleotide chains have backbone of sugar and phosphate and bases project inside
- (B) Two chains have antiparallel polarity, i.e. one is 5→3' and other is 3→5'

- (C) Adenine forms three hydrogen bonds with thymine and guanine forms two hydrogen bonds with cytosine
- (D) The plane of one base pair stacks over the other in double helix in addition to H-bond to confer extra stability to helical structure

9. In prokaryotes (such as *E. coli*) ...A... nucleus is not present, the DNA is not scattered throughout the cell. DNA is ...B... charged and held by the ...C... charged proteins. This structure in prokaryotes is called ...D... . Choose the correct option for A, B, C and D.

- (A) A—undefined, B—negatively, C—positively, D—nucleoid
- (B) A—undefined, B—negatively, C—positively, D—nucleus
- (C) A—defined, B—negatively, C—positively, D—nucleoid
- (D) A—defined, B—positively, C—negatively, D—nucleoid

10. In the given diagram, identify A, B and C.



- (A) A—DNA, B—H1 histone, C—Histone octamer
- (B) A—RNA, B—H1 histone, C—Histone octamer
- (C) A—DNA, B—H1 histone, C—Histone tetramer
- (D) A—RNA, B—H1 histone, C—Histone tetramer

11. Lightly stained part of chromatin which remains loosely packed and is transcriptionally active named as

- (A) euchromatin
- (B) heterochromatin
- (C) chromatosome
- (D) chromonemata

12. What was unique in Griffith's experiments?

- (A) DNA was found to be the genetic material
- (B) RNA was found to be the genetic material
- (C) Something from dead organisms could change the living cells
- (D) Viruses can live in bacteria

13. Isotopes used by Hershey and Chase were

- (A) ^{32}P and ^{35}S
- (B) ^{35}P and ^{32}S
- (C) ^{34}P and ^{31}S
- (D) ^{30}P and ^{32}S

14. Hershey and Chase concluded that viral infecting agent in their experiment was

- (A) Protein
- (B) DNA
- (C) RNA
- (D) Both (B) and (c)

15. RNA is the genetic material in

- (A) All bacteria
- (B) Tobacco Mosaic Viruses (TMV)

- (C) QB bacteriophage
- (D) Both (B) and (C)

16. Who experimentally proved the semiconservative mode of DNA replication?

- (A) Mathew Meselson
- (B) Franklin Stahl
- (C) Both (A) and (B)
- (D) Watson and Crick

17. In Meselson and Stahl's experiment (1958), DNA extracted from the culture one generation after the transfer from ^{15}N to ^{14}N medium had a hybrid (or intermediate) density. Why?

- (A) Because the generation time of *E. coli* (culture) was about 20 minutes
- (B) Because it would take 20 minutes for RNA replication
- (C) Because it would take 20 minutes for replication of DNA to RNA (transcription)
- (D) Because it would take 20 minutes for translation RNA to protein

18. Similar experiments like Meselson and Stahl was performed by Taylor in 1958. The experimental organism of Taylor was

- (A) *Vicia faba*
- (B) Fungi
- (C) *E. coli*
- (D) Protista

19. For long DNA molecules, the two strands of DNA cannot be separated in its entire length due to the requirement of

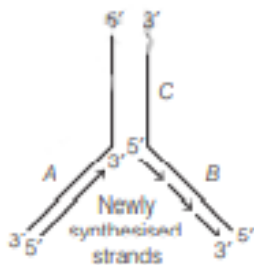
- (A) enzymes
- (B) high energy

- (C) RNA
- (D) phosphate and nucleotide

20. DNA-dependent DNA polymerases catalyses polymerisation in which direction?

- (A) $3' \rightarrow 5'$
- (B) $5 \rightarrow 2'$
- (C) $5' \rightarrow 3'$
- (D) $2' \rightarrow 5'$

21. Identify A, B and C strands.



- (A) A—Continuous strand, B—Discontinuous strand, C—Template strand
- (B) A—Leading strand, B—Lagging strand, C—Parental strand
- (C) A— $5' \rightarrow 3'$ strand, B— $3' \rightarrow 5'$ strand, C—Parental strand
- (D) All of the above

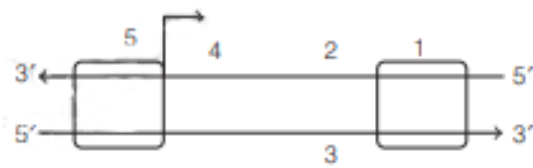
22. Deoxyribonucleoside triphosphate serve dual purposes. The purposes are

- (A) act as substrate and decrease reaction rate
- (B) provide energy for polymerisation and act as substrate
- (C) decrease reaction rate and provide energy for polymerisation
- (D) Synthesise RNA primer and decrease reaction rate

23. Why both the strands of DNA are not copied during transcription?

- (A) Because RNA molecule with different sequences will be formed
- (B) Because RNA molecule with same sequences will be formed
- (C) Because RNA molecule with identical sequences will be formed
- (D) Because DNA molecule with different sequences will be formed

24. In given diagram find out



- A. Promoter site
- B. Structural gene
- C. Terminator site
- D. Template strand
- E. Coding strand

Codes

	A	B	C	D	E
(A)	5	1	4	2	3
(B)	5	1	4	3	2
(C)	5	4	1	2	3
(D)	5	4	1	3	2

25. In bacteria, which enzyme catalyses the transcription of all types of RNA (mRNA, tRNA and rRNA)?

- (A) DNA-dependent RNA polymerase
- (B) DNA-dependent DNA polymerase
- (C) RNA-dependent RNA polymerase
- (D) RNA-dependent DNA polymerase

26. Name the nucleotide added to 5' end of hnRNA in capping.

- (A) Ethyl cytosine triphosphate
- (B) b) Ethyl guanosine triphosphate
- (C) Methyl guanosine triphosphate
- (D) Methyl cytosine triphosphate

27. Choose the correct option.

- (A) Splicing represent the dominance of RNA world
- (B) The presence of introns is reminiscent of antiquity
- (C) Split gene arrangements represent an ancient feature of the genome
- (D) All of the above

28. Codons are non-ambiguous, which means that one codon codes for

- (A) more than one amino acid
- (B) two amino acids
- (C) Only one amino acid
- (D) non-sense amino acid

29. Degeneracy refers to

- (A) one amino acid has more than one code triplet
- (B) one amino acid has only one code triplet
- (C) codons which specify the same amino acids differ only in the third base of the triplet
- (D) Both (A) and (C)

30. Choose the incorrect option for tRNA molecule.

- (A) It has an anticodon loop that has bases complementary to the code
- (B) It has an amino acid acceptor end to which it binds to amino acids

- (C) tRNA are not specific for each amino acid
- (D) tRNA looks like a clover leaf

31. The process of polymerisation of amino acids to form a polypeptide is

- (A) transcription
- (B) replication
- (C) translation
- (D) polymerisation

32. Which among the following process occur(s) during charging or aminoacylation of tRNA?

- (A) Activation of amino acids in the presence of ATP
- (B) Linking of amino acids to their cognate tRNA
- (C) Both (A) and (B)
- (D) None of the above

33. UTRs present on mRNA refer to

- (A) Untranscribed regions at both 5' end and 3' end
- (B) Untranslated regions at 5' end
- (C) Untranslated regions at both 5' end and 3' end
- (D) Untranslated regions at 3' end

34. Termination of protein synthesis or translation requires

- (A) Both stop signal and starting codon
- (B) Both starting codon and release factor
- (C) Both release factor and stop codon

(D) GUG and AUG codon

35. In prokaryotes, control of the rate of ...A... is the pre-dominant site for the control of gene expression. In a transcription unit, the activity of ...B... at a given promoter is in turn regulated by interaction with ...C... proteins, which affects its ability to recognise the start sites. Complete the statement filling the correct options in given blanks.

- (A) A–RNA replication, B–DNA polymerase, C–accessory
- (B) A–transcriptional initiation, B–RNA polymerase, C–accessory
- (C) A–translational initiation, B–RNA polymerase, C–accessory
- (D) A–DNA replication, B–RNA polymerase, C–accessory

36. Positively regulatory proteins are called

- (A) activator
- (B) repressors
- (C) necessary proteins
- (D) accessory proteins

37. Lactose is a substrate for

- (A) galactosidase
- (B) α -galactosidase
- (C) β -galactosidase
- (D) γ -galactosidase

38. Lactose is transported into cells through

- (A) β -galactosidase
- (B) permease

- (C) transacetylase
- (D) transferase

39. Why glucose and galactose cannot act as an inducer for lac operon?

- (A) Because they cannot bind with the repressor
- (B) Because they can bind with the repressor
- (C) Because they can bind with the operator
- (D) Because they can bind with the regulator

40. Which of the following option is true for Human Genome Project (HGP)?

- (A) It was launched in the year 1990 and was called mega project
- (B) Total estimated cost of the project would be 9 billion US dollars
- (C) It aims to identify all 20000-25000 genes in human DNA
- (D) All of the above

41. Identify the incorrect pair.

- (A) Expressed sequence tags — Genes that are express as RNA
- (B) Sequence annotation — Sequencing genome with coding sequences
- (C) Automated DNA sequences — Work on the principle developed by Frederick Sanger
- (D) None of the above

42. DNA fingerprinting involves identifying the differences in some specific regions in DNA sequence called

- (A) non-repetitive DNA
- (B) coding DNA
- (C) non-coding DNA
- (D) repetitive DNA

43. Alec Jeffreys used a satellite DNA as probe that shows very high degree of polymorphism. It was called as

- (A) Short Number of Tandem Repeats (SNTRs)
- (B) Large Number of Tandem Repeats (LNTRs)
- (C) Variable Number of Tandem Repeats (VNTRs)
- (D) All of the above

Answer Key

1	(B)	2	(D)	3	(C)	4	(A)	5	(B)
6	(A)	7	(D)	8	(C)	9	(C)	10	(A)
11	(A)	12	(C)	13	(A)	14	(B)	15	(D)
16	(C)	17	(A)	18	(A)	19	(B)	20	(C)
21	(A)	22	(B)	23	(A)	24	(C)	25	(A)
26	(C)	27	(D)	28	(C)	29	(D)	30	(C)
31	(C)	32	(C)	33	(C)	34	(C)	35	(B)
36	(A)	37	(C)	38	(B)	39	(A)	40	(D)
41	(B)	42	(D)	43	(C)				

HINTS & EXPLANATIONS

1. (B) Length of DNA is directly proportional to the number of nucleotides. As the number of nucleotides increases, the length of DNA also increases.
2. (D) Option (D) is the incorrect match and can be corrected as Haploid content of human DNA is 3.3×10^9 bp. Rest of the matches are correct.
8. (C) Option (C) is incorrect and can be corrected as Adenine forms two hydrogen bonds with thymine of the opposite strand and vice-versa. On the other hand, guanine is bounded with cytosine with three H-bonds. Rest of the options are correct.
12. (C) In Griffith's experiment, he found out that something from dead organism could change the living cells. From his experiment he showed that dead S-bacteria (virulent) are changing (transforming) the R-bacteria (non-virulent) into S-type, i.e. the virulent strain.
13. (A) Hershey and Chase grew cultures of Escherichia coli. One culture was supplied with radioactive sulphur (S^{35}) and the another with radioactive phosphorus (P^{32}).
17. (A) In Meselson and Stahl's experiment, the generation time (replication time) of E. coli culture is about 20 minutes. Therefore, the DNA extracted after the interval of 20 minutes in the experiment had heavy ^{15}N incorporated in its genetic material and had a hybrid density.
18. (A) An experiment similar to Meselson and Stahl experiment was performed on Vicia faba (faba beans) by Taylor and colleagues in 1958. The experiments proved that the DNA in chromosomes also replicate semiconservatively.
19. (B) Separation of the entire length of DNA helix needs a large amount of energy. Hence, only up to certain extent separation of DNA helix can take place.
22. (B) Option (B) is correct. The phosphorylated nucleotides are dATP (deoxy Adenosine Triphosphate), dCTP (deoxyCytidine Triphosphate), dTTP (deoxy Thymidine Triphosphate). These triphosphates serve dual purpose. These act as substrate as well as provide energy for polymerisation of nucleotides by releasing energy after dissociating the phosphate group.

23. (A) The strands in the DNA are complementary to each other, not identical. If the two RNAs are formed from both strands then RNAs with different sequences would be formed.
29. (D) Degeneracy refers to the fact that one amino acid has more than one code triplet and the codons which specify the same amino acids differ only in the third base of the triplet, e.g. both CAC and CAU code for the amino acid histidine.
33. (C) UTRs present on mRNA refer to Untranslated Regions present at both 5'-end (before start codon) and 3'-end (after stop codon). These are the additional sequences that are not translated. These are required for efficient translation process.
36. (A) Positively regulatory proteins are called activators. These activator proteins bind to regulatory sites on DNA near to the promoter regions which act as on / off switches. This binding facilitates RNA polymerase activity and transcription of nearby genes.
37. (C) Lactose is the substrate for the enzyme beta (B) galactosidase and it regulates the switching on and off of the lac operon. Hence, it is termed as inducer.
39. (A) An inducer binds with the repressor protein and prevents the repressor protein from binding to the operator. Glucose and galactose cannot act as an inducer because these do not have the binding sites for attaching the repressor protein.
41. (B) Option (B) is the incorrect match and can be corrected as Sequence annotation is simply sequencing the whole set of genome that contained all the coding and non-coding sequence and later assigning different regions in the sequence with functions. Rest of the matches are correct.