# Chapter 6 MOLECULAR BASIS OF INHERITANCE

## **ONE MARK QUESTIONS:**

- 1. Name the pentose sugar present in DNA. (K)
- 2. Name the pentose sugar present in RNA. (K)
- 3. Mention an example for purine. (K)
- 4. Mention an example for pyrimidine. (K)
- 5. Name the bond present between pentose sugar and nitrobase in a nucleoside. (K)
- 6. Name the bond present between a nucleoside and the phosphate group. (K)
- 7. Name the bonds present between the two strands of a DNA molecule. (K)
- 8. Name the bond formed between sugar and phosphate back bone of single stranded DNA. (K)
- 9. What is the alternative chemical name of thymine? (K)
- 10. Name the nitrogenous base present in DNA but not in RNA. (K)
- 11. Name the nitrogenous base present in RNA but not in DNA. (K)
- 12. Name the nucleoside present only in DNA. (K)
- 13. Name the nucleoside present only in RNA. (K)
- 14. What was the observation of Erwin Chargaff for a double stranded DNA? (U)
- 15. The two strands in a DNA molecule are said to be antiparallel. Why? (A)
- 16. Which nitrogenous base provides additional stability to DNA? (K)
- 17. State the central dogma of molecular biology. (U)
- 18. What is reverse dogma of molecular biology? (U)
- 19. What is nucleosome? (K)
- 20. Name the proteins which form the core of nucleosomes. (K)
- 21. Mention any one basic amino acid present in large quantities in the histone proteins of nucleosomes. (K)
- 22. How many base pairs (bp) of a DNA helix are found in a typical nucleosome? (K)
- 23. What is chromatin? (K)
- 24. What is euchromatin? (K).
- 25. Define heterochromatin. (K)
- 26. What is the loosely coiled and lightly stained region of chromatin called? (K)
- 27. What is the densely packed and darkly stained region of chromatin called? (K)
- 28. Replication in the region of euchromatin would be faster. Justify. (A)
- 29. Replication in the region of heterochromatin would be slow. Justify. (A)
- 30. Heterochromatin is transcriptionally inactive when compared to euchromatin. Give reason. (A)
- 31. Name the scientific name of bacteria used by Griffith in his experiment. (K)
- 32. Why the mouse dies when the mixture of heat killed 'S' strain and live 'R' strain of *Streptococcus pneumoniae* is injected? (A)
- 33. DNA is a better genetic material than RNA. Justify with one reason. (A)
- 34. Define replication. (K)
- 35. Why replication in DNA is referred to as semi-conservative replication? (A)
- 36. Name the enzyme involved in the polymerization of nucleotides during DNA replication. (K)
- 37. What is the function of DNA polymerase during replication? (K)
- 38. Mention the template polarity on which replication occurs continuously. (U)

- 39. Mention the template polarity on which replication occurs discontinuously. (U)
- 40. Name the enzyme which joins discontinuously synthesized fragments of DNA during DNA replication. (K)
- 41. What is the function of DNA ligase during replication? (K)
- 42. What is origin of replication? (K)
- 43. In which phase of the cell cycle DNA replication occurs? (K)
- 44. Define transcription. (K)
- 45. "Both the strands of DNA do not act as templates during transcription". Justify with a reason. (A)
- 46. Name the enzyme involved in polymerization of nucleotides during transcription. (K)
- 47. What is a 'coding strand' with respect to transcription? (K)
- 48. What is 'template strand' with respect to transcription? (K)
- 49. What is the significance of promoter site on a transcription unit? (U)
- 50. What is a cistron? (K)
- 51. What do you mean by monocistronic transcriptional unit? (U)
- 52. What is polycistronic transcriptional unit? (U)
- 53. What are exons? (K)
- 54. What are introns? (K)
- 55. What are split genes? (U)
- 56. Why eukaryotic genes are called split genes? (A)
- 57. Mention the function of mRNA. (K)
- 58. Mention the function of tRNA. (K)
- 59. Mention the function of rRNA. (K)
- 60. Why tRNA is called an adaptor molecule? (A)
- 61. Mention the factors that temporarily associate with RNA polymerase during initiation of transcription in prokaryotes. (K)
- 62. Mention the factors that temporarily associate with RNA polymerase during termination of transcription in prokaryotes. (K)
- 63. Mention the enzyme that transcribes mRNA in prokaryotes. (K)
- 64. In bacteria, translation can begin much before mRNA is fully transcribed. Give one reason. (A)
- 65. Mention the enzyme that transcribes hnRNA in eukaryotes. (K)
- 66. Which enzyme is involved in transcription of tRNA in eukaryotes? (K)
- 67. Which enzyme is involved in transcription of 28SrRNA in eukaryotes? (K)
- 68. Mention the function of RNA polymerase I.
- 69. Mention the function of RNA polymerase II.
- 70. Mention the function of RNA polymerase III.
- 71. What is hnRNA?
- 72. What is 'capping' with reference to post-transcriptional stage in eukaryotes ?
- 73. What is 'tailing' with reference to post-transcriptional stage in eukaryotes ?
- 74. Define 'splicing' with respect to post-transcriptional stage in eukaryotes.
- 75. Define genetic code. (K)
- 76. What is triplet code? (K)
- 77. Name the Severo Ochoa enzyme. (K)
- 78. What is the special property of Severo Ochoa enzyme (polynucleotide phosphorylase)? (U)
- 79. Name the enzyme which is helpful in polymerizing RNA with defined sequences in a template independent manner. (A)

- 80. Name the initiator codon. (K)
- 81. Why AUG is considered as initiator codon? (A)
- 82. What other function the initiator codon performs in addition to initiating translation? (U)
- 83. Name the amino acid coded by initiator codon. (U)
- 84. Mention terminator codon. (K)
- 85. Why UAA is considered as terminator or stop codon? (A)
- 86. Why UAG is considered as terminator or stop codon? (A)
- 87. Why UGA is considered as terminator or stop codon? (A)
- 88. Why genetic code is referred to as degenerate? (A)
- 89. Why genetic code is said to be universal? (A)
- 90. Why genetic code is said to be unambiguous or specific? (A)
- 91. What is point mutation? (K)
- 92. What is frame shift insertion mutation? (K)
- 93. What is frame shift deletion mutation?
- 94. Mention an example for a genetic disorder which is a result of point mutation. (K)
- 95. Define translation. (K)
- 96. Name the cellular factory responsible for synthesizing proteins. (K)
- 97. What do you mean by charging of tRNA with respect to translation? (U)
- 98. What do you mean by aminoacylation of tRNA with respect to translation? (U)
- 99. Mention the enzyme involved in peptide bond formation during protein synthesis. (K)
- 100. What is the function of ribosome during chain elongation of translation? (K)
- 101. Which type of rRNA acts as ribozyme for the formation of peptide bonds during translation in bacteria? (K)
- 102. Mention the type of RNA that has anticodon? (K)
- 103. Expand UTR with reference to mRNA. (K)
- 104. What is an operon? (K)
- 105. What is lac operon? (K)
- 106. Name the protein produced by lac 'i' gene. (K)
- 107. What is the function of regulatory gene of Lac-operon? (K)
- 108. Why transcription in E.coli does not occur in the absence of lactose in the medium? (A)
- 109. How does repressor protein prevent the transcription of structural genes? (U)
- 110. What is the function of repressor in an operon? (K)
- 111. Name the enzyme encoded by the lac 'z' gene. (K)
- 112. Name the enzyme encoded by the lac 'y' gene. (K)
- 113. Name the enzyme encoded by the lac 'a' gene. (K)
- 114. What is the function of  $\beta$  galactosidase in *E.coli*? (K)
- 115. Mention the function of permease in E.coli. (K)
- 116. What is the importance of operator in Lac-operon? (K)
- 117. Mention the inducer that inactivates Lac repressor protein. (K)
- 118. Why lactose is termed as inducer with reference to Lac-operon? (A)
- 119. What is negative regulation? (K)
- 120. What are expressed sequence tags? (K)
- 121. Define sequence annotation. (K)
- 122. Mention a common vector used for the amplification of DNA fragments during the sequencing of human genome. (K)

- 123. Which is the largest known human gene? (K)
- 124. Which chromosome in humans has the largest number of genes? (K)
- 125. Which chromosome in humans has the least number of genes? (K)
- 126. With reference to Human Genome Project, what do SNPs refer to? (K)
- 127. What is single nucleotide polymorphism? (K)
- 128. What is repetitive DNA? (K)
- 129. What is satellite DNA? (K)
- 130. Define DNA polymorphism. (K)
- 131. Expand VNTR. (K)
- 132. What is a VNTR probe or DNA probe? (U)
- 133. 'Restriction endonucleases are important tools in DNA finger printing technique'. Justify. (A)
- 134. Why gel electrophoresis is an important step in DNA fingerprinting? (A)
- 135. Mention one application of DNA fingerprinting. (K)

# **TWO MARK QUESTIONS:**

- 1. Mention the four nitrobases present in DNA. (K)
- 2. Mention the four nitrobases present in RNA. (K)
- 3. List the nucleosides of DNA. (K)
- 4. Mention the nucleosides of RNA. (K)
- 5. If a double stranded DNA has 20% of cytosine, calculate the percent of adenine in the DNA. (A)
- 6. Explain the central dogma of molecular biology with a schematic representation. (U)
- 7. Draw a labeled diagram of nucleosome. (S)
- 8. Mention two differences between euchromatin and heterochromatin. (U)
- 9. How many base pairs of DNA are present in a typical nucleosome? Mention the types of proteins present in a nucleosome. (K)
- 10. Write the conclusion that can be drawn from Griffith's experiment. (K)
- 11. Mention any two criteria that a molecule must fulfill to act as genetic material. (K)
- 12. DNA is a better genetic material than RNA. Justify with two reasons. (A)
- 13. Mention the functions of DNA polymerase and DNA ligase during replication. (K)
- 14. Draw a labeled diagram of replication fork. (S)
- 15. "Both the strands of DNA molecule do not act as templates during transcription". Justify with two reasons. (A)
- 16. Write the schematic structure of a transcriptional unit. (S)
- 17. Write any two differences between prokaryotic and eukaryotic transcription unit. (U)
- 18. Differentiate monocistronic transcriptional unit from polycistronic transcriptional. (U)
- 19. Differentiate introns and exons. (U)
- 20. Differentiate template strand from a coding strand in DNA. (U)
- 21. Write the coding strand and the sequence of base on mRNA synthesized by DNA template with the sequence 3'-ATGCATAGCAT-5'. (A)
- 22. Write a note on the role of sigma factor and the rho factor in transcription in prokaruotes. (K)
- 23. What is heterogeneous nuclear RNA (hnRNA)? How is it converted into functional mRNA? (K)
- 24. Mention the functions of mRNA and rRNA. (K)
- 25. Mention the functions of mRNA and tRNA. (K)
- 26. Mention the functions of rRNA and tRNA. (K)

- 27. In bacteria, translation can begin much before the mRNA is fully transcribed. Justify with two reasons. (A)
- 28. Mention the functions of RNA polymerase I and RNA polymerase II in eukaryotes. (K)
- 29. Mention the functions of RNA polymerase I and RNA polymerase III in eukaryotes. (K)
- 30. Mention the functions of RNA polymerase II and RNA polymerase III in eukaryotes. (K)
- 31. With reference to transcription, define splicing and capping. (K)
- 32. Mention any two differences with reference to transcription in prokaryotes and eukaryotes. (U)
- 33. Define the terms transcription and translation. (U)
- 34. Name Severo Ochoa enzyme. Mention its function. (K)
- 35. Explain any two properties of genetic code. (U)
- 36. Mention the initiator and terminator codons. (K)
- 37. Name the initiator codon and the amino acid coded by it. (K)
- 38. "Codon AUG has dual function". Justify the statement. (A)
- 39. List the essential roles of ribosome during translation. (U)
- 40. Differentiate point mutation and frame-shift mutation. (U)
- 41. What is point mutation? Give an example for a genetic disorder in human beings caused by point mutaion. (K)
- 42. Mention the four levels at which regulation of gene expression can be exerted in eukaryotes. (K)
- 43. Mention the enzymes encoded by lac 'z', lac 'y' with their function. (K)
- 44. Mention the role of repressor and inducer in regulation of gene expression. (U)
- 45. Mention the functions of β-galactosidase and permease in lactose metabolism in *E. coli*. (K)
- 46. How does the Lac-operon function in the absence of inducer (lactose) in the medium? (U)
- 47. How does the Lac-operon function in the presence of inducer (lactose) in the medium? (U)
- 48. Mention the role of repressor and inducer in regulation of gene expression. (U)
- 49. Mention the function of repressor protein. What change occurs when lactose is added to the medium containing *E. coli*? (U)
- 50. In the medium where *E.coli* was growing, lactose was added, which induced the Lac-operon. Then, why does Lac-operon shut down some time after addition of lactose into the medium. (U)
- 51. Mention any two goals of Human Genome Project (HGP). (K)
- 52. Mention the two approaches with respect to the methodology of sequencing DNA in Human Genome Project. (K)
- 53. Mention two salient features of human genome. (K)
- 54. With reference to human genome, what is single nucleotide polymorphism (SNP)? Mention its significance. (K)
- 55. Mention two applications of Human Genome Project. (K)
- 56. Mention two common vectors used for the amplification of DNA fragments during the sequening of human genome. (K)

#### THREE MARK QUESTIONS:

- 1. The base sequence in one of the DNA strands is TAGCATGAT. Based on this answer the following: (U)
  - (a) Give the base sequences of its complementary strand.
  - (b) How are these base pairs held together in a DNA molecule?
  - (c) What was the observation of Chargaff on the base ratio in double stranded DNA?
- 2. Explain packaging of DNA in prokaryotes. (U)

- The length of a DNA molecule in a typical mammalian cell is calculated to be approximately 2.2 meters. How is the packaging of this long molecule done to accommodate it within the nucleus having a size of approximately 6μ. (A)
- 4. List any three criteria that a molecule has to fulfill to act as a genetic material. (K)
- 5. Why is DNA molecule a more stable genetic material than RNA? Explain. (U)
- 6. Explain how Avery, MacLeod and McCarty did determine, the biochemical nature of the molecule responsible for transforming R strain into S strain bacteria. (U)
- 7. Draw a labeled schematic sketch of replication fork of DNA. Explain the role of enzymes involved in DNA replication. (U)
- 8. Describe the structure of a transcriptional unit. (U)
- 9. "RNA polymerases in eukaryotes show a clear cut division of labour". Substantiate.
- 10. Explain the function of the following: (K)(a) Promoter (b) tRNA (c) Exons
- 11. Explain the stages of post-transcriptional modification of hnRNA in eukaryotes.
- 12. With reference to post-transcriptional modifications in eukaryotes, explain splicing, capping and tailing. (U)
- 13. Given below is a part of the template strand of a structural gene TAC CAT TAG GAT. Based on this, answer the following: (U)
  - (a) Write its transcribed mRNA strand with its polarity
  - (b) Explain the mechanism involved in initiation of transcription on this strand.
- 14. Draw a schematic representation which shows the structure of a transcription unit and show the following in it: (U)
  - (a) Direction in which transcription occurs (b) Polarity of the two strands involved (c) Template strand (d) Terminator
- 15. Explain non-overlapping nature, unambiguity and degeneracy of genetic code. (U)
- 16. Explain three features of genetic code. (U)
- 17. Define the terms point mutation, frame shift insertion mutation and frame shift deletion mutation. (K)
- 18. Define translation. Mention the initiator codon and three stop codons. (U)
- 19. Mention the role of ATP and ribosomes in protein synthesis. (K)
- 20. Why tRNA is called an adapter molecule? Draw the structure of the tRNA adapter molecule which can bind with initiator codon. (A)
- 21. Mention the anticodon of AUG. Justify the statement that AUG has dual role in translation. (A)
- 22. Mention the structural genes of Lac-operon and the ezymes produced by each of them. (K)
- 23. Draw a diagrammatic sketch of the Lac-operon when lactose is absent in the medium. (S)
- 24. Draw a diagrammatic sketch of the Lac-operon when lactose is present in the medium. (S)
- 25. (a) In human genome, which one of the chromosomes has the most genes and which one has the least? (K)

(b) What is single nucleotide polymorphism? Mention the significance SNPs. (K)

- 26. Mention the three goals of HGP. (K)
- 27. Mention any three salient features of HGP. (K)
- 28. Mention three applications of Human Genome Project. (K)
- 29. List out three applications of DNA fingerprinting. (K)
- 30. What is DNA fingerprinting? Mention two of its applications. (K)
- 31. List the steps of DNA finger printing technique. (K)

## **FIVE MARK QUESTIONS:**

- 1. Explain the structure of double helical DNA as proposed by Watson and Crick. (U)
- 2. Draw the diagram of a nucleosome and explain the packaging of DNA in eukaryotes. (U)
- 3. Explain Griffith's transformation experiment which proved that DNA is the genetic material. (U)
- 4. Describe the experiment of Hershey Chase which proves that DNA is the genetic material. (U)
- 5. Explain semi-conservative replication of DNA with a diagram. (U)
- 6. Describe the experiment of Messelson and Stahl that proves that replication of DNA is semiconservative. (U)
- 7. Explain the structure of transcription unit with a labeled diagram. (U)
- 8. Describe the process of transcription in bacteria with a labeled diagram. (U)
- 9. Describe the process of transcription in eukaryotes with a labeled diagram. (U)
- 10. What is genetic code? Explain any four salient features of genetic code. (U)
- 11. Explain the different steps involved in translation. (U)
- 12. Explain Lac-operon concept with diagrams. (U)
- 13. Mention any five salient features of HGP. (K)
- 14. What is DNA finger printing? Write the sequential steps involved in DNA fingerprinting. Mention two applications of this technique. (K)

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