Chapter: 20

Chromosomes and DNA

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MCQs

1. The enzyme which joins the two pieces of DNA is:
   (A) endonuclease (B) DNA polymerase (C) Restriction **(D) DNA ligase**

2. Which strand of DNA elongates towards the replication fork?
   (A) Parental strand **(B) Leading strand**
   (C) Lagging strand (D) Sense strand

3. Beadle and Tatum exposed Neurospora spores to:
   (A) Alpha rays **(B) X - rays** (C) Gamma - rays (D) Beta rays

4. RNA polymers I is used for the synthesis of:
   (A) rRNA (B) mRNA (C) tRNA (D) DNA

5. Human cells contain type of rRNA molecules:
   (A) 20 **(B) 45** (C) 195 (D) 204

6. Copying of mRNA from DNA is called :
   (A) Trnaslation (B) Transduction **(C) Transcription** (D) Transformation

7. mRNA is synthesized by:
   (A) DNA polymerase **(B) RNA polymerase**
   (C) RNA ligase (D) Endonuclease

8. In bacteria the newly synthesized mRNA is released in:
   (A) Nulceus **(B) Cytoplasm** (C) Mitochondria (D) Nucleolus

9. Which of the following polymerase synthesize tRNA :
   (A) RNA polymerase - I **(B) RNA polymerase - III**
   (C) RNA polymerase - II (D) RNA polymerase

10. Strand of DNA which is not transcribed is called as :
    (A) Template strand (B) Antisense strand (C) Lagging strand **(D) Coding strand**

11. A gene starts with codon , which encodes the amino acid methionine :
    (A) UAA **(B) AUG** (C) UAG (D) UGG

12. Which of the following is a " Start " codon ?
    (A) UGA (B) UAG **(C) AUG** (D) UAA

13. Which one of the following is initiation codon:
    (A) AUG (B) GUA (C) UGA (D) GAC

14. The following are non- sense condons except that of :
    (A) UAA **(B) AUG** (C) UGA (D) UGA

15. Which one of the given is Non - Sence Codon?
    (A) UCC (B) UCG **(C) UAA** (D) UCU

16. Every gene starts with initiation codon AUG which normally encodes the amino acid :
(A) Arginine (B) Citruline **(C) Methionine** (D) Lysine

17. A combination of three nucleotides of DNA that specifies an amino acid is called :
(A) Cistron **(B) Genetic code** (C) Anticodon (D) Entron

18. When information contained in mRNA is used to direct the synthesis of polypeptide by ribosomes , the process is called :
(A) Transcription **(B) Translation** (C) Transduction (D) Transformation

19. The ultimate source of all charges is :
(A) Evolution **(B) Mutation** (C) Genetic drift (D) Migration

20. This condition appears as a result of point mutation :
(A) Down syndrome **(B) Sickle cell anemia**
(C) Turner syndrome (D) Klinefelter syndrome

21. Each Okazaki fragment is synthesized by :
(A) RNA polymerase I **(B) DNA polymerase III**
(C) DNA polymerase I (D) DNA polymerase II

22. The genetic code for gylcine is :
(A) UAG **(B) GGU** (C) GAU (D) GUA

23. Genetic code for the amino acid methionine is :
(A) AUC (B) UGC (C) CGC **(D) AUG**

24. A Gene with initiation codon , which encodes the Amino Acid methionine is :
(A) UAA **(B) AUG** (C) UAG (D) UGG

25. A full set of genes in an individual is called :
(A) Genome (B) Phenotype **(C) Gene pool** (D) Genotype

26. V - Shaped chromosomes are called :
(A) Acrocentric **(B) Metacentric** (C) Telocentric (D) Submetacentric

27. The particular array of chromosomes that an individual process is called is :
(A) Genotype **(B) Karyotype** (C) Phenotype (D) Epistasis

28. A central role for chromosomes in heredity was first suggested in 1900 by. :
(A) W. Sutton (B) Karl correns (C) T.H. Morgen (D) F. Griffiths

29. In bacteria the newly synthesized mRNA is released in :
(A) Nucleus (B) Mitochondria (C) None of these **(D) Cytoplasm**

30. Enzyme are responsible for assembly of :
(A) Nucleic acid (B) Protein **(C) All of thse** (D) Carbohydrates

31. Highly condensed portion of the chromation is called :
(A) Heterochromatin (B) Nucleosome (C) Euchromation (D) Polysome

32. Every 200 nucleotides , the DNA duplex is coiled around a core of eight histone proteins

forming a complex , known as :

(A) Polysome (B) Heterochromatin **(C) Neucleosome** (D) Euchromatin

33. How many million nucleotides are in DNA of typical human chromosomes :

(A) 120 **(B) 150** (C) 130 (D) 180

34. Nucleosome occurs every :

(A) 50 nucleotides **(B) 200 nucleotides** (C) 100 nucleotides (D) 150 nucleotides

35. Unlike most proteins , histones are :

(A) Negatively **(B) Positively charged** (C) Neutral (D) Discharged

36. Number of histone protein molecules in a single nucleosome are:

(A) 06 **(B) 08** (C) 09 (D) 10

37. Chromosomal theory of Inheritance was first formulated by:

(A) Karl Correns (B) Carvin Bridges (C) T.H. Morgan **(D) W. Sutton**

38. Transfer of genetic material from one cell to other that can alter the genetic make-up of recipient cell is called:

(A) Transformation (B) Transcription (C) Translation (D) Replication

39 The 5-carbon sugar in DNA is:

(A) Maltose **(B) Deoxyribose** (C) Ribose (D) Lactose

40. DNA was discovered in :

(A) 1864 **(B) 1869** (C) 1861 (D) 1871

41. The basic structure of human nucleic acid was determined by:

(A) Watson (B) Maurice Wilkins (C) Vernon ingram **(D) P.A Levene**

42. X-ray diffraction analysis of DNA was performed by:

(A) Erwin Chargaff **(B) Rosalind Franklin** (C) Watson & Crick (D) Charles Darwin

43. Okazaki fragments are synthesized by :

(A) DNA ligase (B) RNA polymerse **(C) DNA polymrase** (D) Primase

44. In euokaryote , number of nucleotides in Okazaki fragments are about :

(A) 1000 - 2000 **(B) 100 - 200** (C) 300 - 400 (D) 400 - 50

45. Pentose sugar in the molecule of DNA is :

(A) Ribose (B) Lactose **(C) Deoxyribose** (D) Sucrose

46. mRNA is synthesized by :

(A) DNA (B) RNA ligase (C) None of these **(D) RNA polymerase**

47. Which of the following are nonsense codons?

(A) UAA (B) AUG (C) CUA (D) All of these

48. Enzyme are responsible for assembly of :

(A) Nucleic acid (B) Protein **(C) All of thse** (D) Carbohydrates

Fill in the blanks.

1. Particular tRNA molecules become attached to specific amino acids through the action of activating enzymes called…… .

2. ……. is the transfer of genetic material from one cell to another and can alter the genetic makeup of the recipient cell.

3. In a bacteria, a subunit of RNA polymerase called ……. recognizes-10 sequence in the promoter and binds RNA polymerase there.

4. A typical human chromosome contain about ……. Nucleotides in its DNA.

5. Miescher extracted a white substance from the nuclei of human cells and fish sperm and called this substance …… .

Answers

1.	**Amino acyl tRNA synthetase**	**2.**	**Transformation**
3.	**Sigma factor**	**4.**	**140 million**
5.	**Nuclein**		

Chapter : 20 Chromosomes and DNA Short Questions Answers

1. **Who first observe the chromosomes?**

Ans: The German embryologist Walther Fleming first observed them in **1882,** when he was examining the rapidly dividing cells of salamander larvae.

2. **What is euchromatin?**

Ans: The portion of the chromosome except heterochromatin is called euchromatin. It is condensed only during cell division, when compact packaging facilitates the movement of the chromosomes. At all other times, euchromatin is present in an open configuration and its genes can by expressed.

3. **What is transformation?**

Ans: Transformation is the transfer of genetic material from one cell, to another and can alter the genetic up of the recipient cell.

4. **What is nuclein?**

Ans: Miescher extracted a white substance from the nuclei of human cells and fish sperm. He **called** substance **"Nuclein"** because it seemed to be specifically associated with the nucleus.

5. **What is semi-conservative replication?**

Ans: In this form of DNA replication, the daughters DNAs have one of the original strands and the other strand is newly synthesized from complementary nucleotides.

6. **How DNA polymerase III can initiate synthesis of DNA?**

Ans: DNA polymerase can initiate synthesis of DNA only if another enzyme, primase, constructs an RNA primer. DNA polymerase III recognizes the primer and adds DNA nucleotides to it to construct the DNA strands. The RNA nucleotides in the primers are

then replaced by DNA nucleotides.

7. **What are Okazaki frangments?**

Ans: The lagging strand, which elongates away from the replication fork, in synthesized discontinuously as a series of short segments that are later connected. These segments are **called** Okazaki frangments.

8. **What is the length of Okazaki frangments?**

Ans: They are about 100-200 nucleotides long in eukaryotes and 1000-2000 nucleotides long in prokaryotes.

9. **What "one gene or one polypeptide"?**

Ans: Many enzymes contain multiple protein or polypeptide subunits, each encoded by a separate gene; this relationship is referred to as "one gene or one polypeptide".

10. **What is transcription?**

Ans: The first step of central dogma is the transfer of information from DNA to RNA, which occurs when an mRNA copy of gene is produced. The process is **called** transcription.

11. **Which codons are called stop codons and nonsense condon and why?**

Ans: Out of 64 codons, three codons UAA, UAG and UGA do not code for any amino acid and hence are known as nonsense condon. These codons are usually present at the end of the gene and hence are also called stop codons.

12. **What is initiation condon?**

Ans: Every gene starts with initiation condon AUG, which encodes the amino acid methionine.

13. **How long DNA would stretch, if the DNA all of the cells of an adult human were lined up end to end?**

Ans: If the DNA in all of the cells of an adult human were lined up end to end, it would stretch nearly 100 billion kilometer - 60 times the distance from Earth to Jupiter.

14. **What is primer?**

Ans: The primer is a sequence of about 10 RNA nucleotides complementary to the parent DNA template. It is synthesized by enzyme primase.

15. **What are the three major classes of RNA?**

Ans: mRNA, tRNA and rRNA.

16. **What is the function of RNA polymerase in transcription?**

Ans: Transcription is initiated when the enzyme RNA polymerase binds to a particular binding site **called** a promoter located at the beginning of the gene.

17. **What is triplet code?**

Ans: The genetic code for specifying amino acids does consist of 3 bases. This is **called** triplet code.

18. **What is anticondon?**

Ans: A sequence of three nucleotides in tRNA that is complementary to mRNA is **called** anticondon.

19. **What are chromosomes?**

Ans: Chromosomes are thread like structures that appear inside the nucleus at the time of cell division. They were first observed by Walther Fleming in **1882,** when he was examining the rapidly' dividing cells of salamander larvae.

20. **What is the number of chromosomes in Penicillium and ferns?**

Ans: Penicillium, a fungus, has only one pair of chromosomes, while some ferns have more than 500 pairs.

21. **What a typical chromosome is made up of?**

Ans: Typically a chromosome is made of chromatids, centromere (primary constriction) and a secondary constriction.

22. **What is Karyotype?**

Ans: The particular array of chromosomes that an individual possesses is **called** its Karyotype.

They vary in size, staining properties, the location of centromere, he relative length of the two arms on either side of centromere, and the position of constricted regions along the arms.

23. **What are different types of Chromosomes depending upon location of centromere?**

Ans: The Chromosomes are **called** Telocentric, acrocentric sub metacentric and metaccentric depending upon the location of centromere between the middle and tip of the chromosomes.

24. **What are different shapes of chromosomes?**

Ans: The usual shapes of chromosomes are i, j and v.

25. **What is the composition of chromosomes?**

Ans: Chromosomes are composed of DNA and protein. Most are about 40% DNA and 60% Protein.

26. **How many nucleotides are contained in a typical human chromosome?**

Ans: A typical human chromosome contains about 140 million (14 * 10(8)) nucleotides in its DNA.

27. **How much information is contained in one chromosome?**

Ans: The amount of information one chromosome contains would fill about 280 printed books of 1000 pages each, if each nucleotide corresponds to a word and each page had about 500 words on it.

28. **What is the length of a strand of DNA from a single chromosome?**

Ans: If the strand of DNA from a single chromosome were laid out in a straight line, it would be about 5 centimeter long.

29. **What are nucleosomes?**

Ans: Every 200 nucleotides, the DNA duplex is coiled around a core of eight histone proteins forming a complex known as a nucleosome.

30. **Why histones are positively charged?**

Ans: Histones are positively charged due to an abundance of the basic amino acids, arginine and lysine. They are thus strongly attracted to the negatively charged phosphate groups of the DNA.

31. **What are supercoils of DNA?**

Ans: The histone cores act as magnetic forms that promote and guide the coiling of the DNA. Further coiling occurs when the string of nucleosomes wraps up into higher order coils **called** supercoils.

32. **What are heterochromatin?**

Ans: Highly condensed portions of the chromatin are **called** hetero-chromatin. Their DNA is never exposed.

33. **Define the chromosome theory of inheritance?**

Ans: According to this theory, the genes are physical units located on the chromosome. It means that one member of gene pair is located on one homologous chromosome and the other member of a gene pair is located on the other homologous chromosome.

34. **What is a sex linked trait?**

Ans: A trait determined by a gene on the X chromosome is said to be sex linked.

35. **Who repeated the experiments of Griffith?**

Ans: In **1944,** in a classic series of experiments Oswald Avery along with Colin Macleod and Maclyn McCarty repeated Griffith's experiments and characterized what they referred to as the Transforming principle.

36. **Why Hershey and Chase are famous for?**

Ans: In **1952** by Alfred Hershey and Martha Chase experimented with bacteriophages T2 and provided additional evidence supporting Avery's conclusion.

37. **What are the main components of DNA?**

Ans: **Main components of DNA:**

- Phosphate (PO4) groups
- Five carbon sugars
- nitrogen containing bases called purines (adenine, A, and guanine, G) and pyrimidines (thymine, T and cytosine, C, RNA contains uracil, U instead of T)

38. **What is the structure of a typical nucleotide?**

Ans: In a typical nucleotide, nitrogen base is attached to carbon number 1 of a pentose sugar and phosphate group is attached to carbon number 5 of the sugar. In addition a free hydroxyl (- OH) group is attached to the 3 carbon atom.

39. **What is phosphodiester bond or linkage?**

Ans: In a polynucleotides chain the linkage between two groups is **called** a phosphodiester bond because the phosphate group is now linked to the two sugars by means of a pair of ester (P-O-C) bonds.

40. **What is the work of Chargaff?**

Ans: Erwin Chargaff showed that the amount of adenine in DNA always equals the amount of thymine, and the amount of guanine always equals the amount of Cytosine.

41. **What is X-ray diffraction?**

Ans: In this analysis a molecule is bombarded with a beam of X-rays. When individual rays encounter atoms their path is bent or diffracted and the diffraction pattern is recorded on the photographic film. When carefully analyzed this pattern gives three dimensional structure of a molecule.

42. **Who prepared the X-ray diffraction of DNA?**

Ans: Rosalind Franklin prepared this X-ray diffraction pattern of DNA in the laboratory of British Biochemist Maurice Wilkins, who prepared DNA fibres.

43. **What does X-ray diffraction of DNA suggest?**

Ans: The diffraction pattern prepared suggested that the DNA molecule had a shape of a helix with a diameter of 2nm and a complete helical turn every 3.4 nm.

44. **Who proposed the double helical structure of DNA?**

Ans: In **1953,** James Watson and Francis Crick, proposed structure of the DNA molecule.

45. **Define replication?**

Ans: The process by which DNA of a living organism gives rise to a copy of itself is **called** DNA replication.

46. **What is Semi-conservative replication of DNA?**

Ans: In semi conservative replication, the two strands of the duplex separate out each acting as a model or mold, along which new nucleotides are, arranged thus giving rise to two new duplexes.

47. **Define Conservative Replication of DNA?**

Ans: The conservative model stated that the parental double helix would remain intact and generate DNA copies consisting of entirely new molecules.

48. **What is Dispersive Replication of DNA?**

Ans: The dispersive model predicted that parental DNA would become dispersed throughout the new copy so that each strand of all the daughter molecules would a mixture of old and new DNA.

49. **What was work of Meselson - Stahl?**

Ans: The three hypothesis of DNA replication were evaluated by Mathew Meselson and Franklin Stahl of the California Institute of Technology in **1958.**

50. **What is the role of DNA polymerase I?**

Ans: DNA polymerase I is a relatively small enzyme that plays a supporting role in DNA replication.

51. **What is the role of DNA polymerase II?**

Ans: DNA polymerase II plays a role in DNA repair.

52. **What is the role of DNA polymerase III?**

Ans: This enzyme is a dimmer and catalyzes replication of one DNA strand. Polymerase III progressively threads the DNA through the enzyme complex moving it at a rapid rate of some 1000 nucleotides / second.

53. **Hat is the direction of replication on growing DNA strand?**

Ans: Replication always proceeds 5 -> 3 direction on a growing DNA strand because DNA polymerase III can add nucleotides only to the 3 end of a DNA strand.

54. **What is the role of DNA ligase?**

Ans: DNA ligase, attaches the repaired fragments of the lagging strand.

55. **What is Alkaptonuria?**

Ans: It is disorder in which the patients produced urine that contained homogentisic acid. This substance oxidized rapidly when exposed to air, turning the urine black. In normal individuals, homogentisic acid is broken down into simpler substances.

56. **Why Beadle and Tatum are famous for?**

Ans: Beadle and Tatum performed experiment on Neurospora, fungus, and concluded that each gene encodes the structure of one enzyme. This is also **called** one gene one enzyme hypothesis.

57. **Why Sanger was famous for?**

Ans: In **1953,** Frederick Sanger, described the complete sequence of amino acids of insulin. Sanger's achievement was significant, as it was demonstrated for the first time that proteins consisted of definable sequences of amino acids.

58. **Why Vernon Ingram is famous for?**

Ans: Vernon Ingram in **1956** discovered the molecular basis of sickle cell anaemia. He showed that sickle cell anaemia is caused by a change from glautamic acid to valine at position 6 in one chain of haemoglobin.

59. **What is Promotor?**

Ans: Transcription is initiated when the enzyme RNA polymerase binds to a particular binding site **called** a promoter located at the beginning of the gene.

60. **What is translation?**

Ans: The process by which the nucleotide sequence of the mRNA is translated into an amino acid sequence in the polypeptide is **called** translation.

61. **What is codon?**

Ans: A sequence of 3 nucleotides along strand of mRNA is **called** codon.

62. **What are template and coding strands of DNA?**

Ans: Only one of the two strands of DNA are transcribed. This strand is called template strand or the anti-sense strand. The opposite strand is **called** coding or the sense strand.

63. **What is the role of RNA polymerase?**

Ans: The RNA polymerase enzymes synthesize RNA from 5 - 3 direction.

64. **What is core enzyme?**

Ans: When sigma subunit is detached from other subunits of RNA polymerase then enzyme is called core enzyme.

65. **How many binding sites are found in in promoter of prokaryote and eukaryote?**

Ans: In prokaryote within promoter there are two binding sites TTGACA also **called** -35 sequence and TATAAT also **called** -10 sequences, which have affinity for the RNA polymerase. In Eukaryotes these sites are at -25 and -70 sites.

66. **What is the stop signal for transcription?**

Ans: The simplest stop signal is a series of GC base pair followed by a series of AT base pairs. The RNA forms a GC hairpin followed by four or more U ribonuleotides. The hairpin causes RNA polymerase to stop synthesis.

67. **Why a cap and a tail is added to mRNA?**

Ans: A cap and a tail is added to mRNA so that the molecule may remain stable during long journey to ribosome.

68. **What is genetic code?**

Ans: Genetic code is a combination of 3 nulceotides in DNA, which specify a particular amino acid.

69. **What is Chromosomal aberrations?**

Ans: The change in number or structure of chromosomes is **called** chromosomal abberation.

70. **What are Point mutations?**

Ans: Point mutations are mutational changes which affect the message itself, producing alterations in the sequence of DNA molecule. If alterations involve only one or a few base pairs in the coding sequence they are **called** point mutation.