

Molecular Biology Midterm Exam 2

1. The experiments by Frank Stahl and Matthew Messelson demonstrated that DNA strands separate during DNA replication. They showed that DNA replication is what kind of process?

- A. Distributive
- B. Semi-Conservative
- C. Conservative
- D. None of the above

2. Which of the following removes excessive supercoiling ahead of the replication fork?

- A. DNA Helicase
- B. Topoisomerase
- C. Single Stranded Binding Protein
- D. DNA Polymerase

3. Which of the following creates the short oligonucleotides that are used as starting blocks by DNA polymerase during replication?

- A. RNA Primase
- B. Telomerase
- C. RNA Polymerase
- D. Translesion DNA Polymerase

4. During replication DNA polymerase reads the template strand in which direction?

- A. 3' to 5'
- B. 5' to 3'
- C. Both A and B
- D. None of the above

5. During replication DNA polymerase synthesizes the new DNA strand in which direction?

- A. 3' to 5'
- B. 5' to 3'
- C. Both A and B
- D. None of the above

6. Which of the following is a true statement regarding DNA Polymerase?

- A. It is a processive enzyme
- B. It contains proofreading activity
- C. It requires a short primer or oligonucleotide to start synthesizing new DNA strands
- D. All of the above

7. Okazaki fragments are found on which of the following strands of DNA?

- A. Leading Strand
- B. Lagging Strand
- C. Both A and B
- D. None of the above

8. At the replication bubble how many polymerases are being simultaneously used?

- A. 1
- B. 2
- C. 4
- D. 8

9. Which of the following removes all but one base of the primer?

- A. Topoisomerase
- B. MutH
- C. RNase H
- D. DNA Ligase

10. Which of the following strands requires DNA Telomerase to replicate the ends of the linear chromosome?

- A. Leading Strand
- B. Lagging Strand
- C. Both A and B
- D. None of the above

11. Polymerase Chain Reaction (PCR) is used to amplify DNA fragments. The first step is to denature DNA by heating it to 95°C. Which of the following molecules is used during cellular replication to accomplish the same task?

- A. DNA Helicase
- B. Topoisomerase
- C. Single Stranded Binding Protein
- D. Sliding Clamp

12. Assume that you are trying to amplify a single molecule of double stranded DNA. After 5 rounds of PCR how many molecules would you have (assume you started with a single molecule)?

- A. 5
- B. 10
- C. 25
- D. 32

13. Which of the following cellular components are not used during PCR?

- A. DNA Polymerase
- B. Oligonucleotide Primers
- C. DNA Ligase
- D. Double stranded template DNA

14. Which of the following is true about the origin of replication?

- A. All organisms have a single origin of replication per chromosome
- B. Replication occurs at random (non-sequence specific) locations along the chromosome
- C. The replication machinery binds to the minor groove along the entire length of the chromosome
- D. Origins of replication contain AT rich domains as well as several specific recognition sequences

15. Plasmids are small naturally occurring circular pieces of DNA and are found mainly within bacteria. They have been manipulated for use in cloning experiments. Which of the following features of a plasmid allows for a bacterial cell to survive during a cloning experiment?

- A. Multiple Cloning Site
- B. Origin of Replication
- C. Antibiotic Resistance Gene
- D. Transposable Element

16. Which of the following features allows for a plasmid to incorporate DNA that has been digested with restriction enzymes?

- A. Multiple Cloning Site
- B. Origin of Replication
- C. Antibiotic Resistance Gene
- D. Transposable Element

17. What is most likely to happen if you try to ligate (glue) plasmid DNA that has been digested with the restriction enzyme EcoR1 to human genomic DNA that has been digested with the restriction enzyme BamH1?

- A. The human genomic DNA insert will be ligated successfully to the plasmid DNA since all restriction enzymes recognize and digest the same DNA sequences.
- B. The human genomic DNA fragments will not be ligated into the plasmid DNA due to the sequence incompatibility of the ends
- C. The ends of both the plasmid and genomic DNA are blunt and thus can be successfully ligated together.
- D. None of the above

18. What is the most likely outcome of plating bacteria that have been transformed with a plasmid carrying ampicillin resistance onto agar media containing the amoxicillin antibiotic?

- A. Only transformed cells (those that have taken up the plasmid) will grow on the agar media
- B. All cells will grow on the agar media
- C. All cells will die when plated onto the agar media
- D. Cannot be determined

19. What is average size of DNA fragments that are generated after digesting the mouse genome with a restriction enzyme that recognizes the 6bp sequence GAATTC?

- A. 4bp
- B. 256bp
- C. 1024bp
- D. 4096bp

20. What would happen if bacteriophage genomic DNA were methylated prior to being inserted into a bacterial cell?

- A. The host restriction enzymes would cleave the bacteriophage genome
- B. The bacteriophage genome would escape the host restriction enzymes
- C. Both host and bacteriophage genomes would be cleaved by the restriction enzymes
- D. none of the above

21. The Mismatch Repair System normally is attached to the sliding clamp and thus immediately fixes errors that are made by DNA Polymerase. How does it recognize and excise errors exclusively on the newly synthesized strand of DNA?

- A. MutH can recognize hemimethylated DNA and excises only the new (non-methylated) DNA strand
- B. MutH makes physical contact with the newly synthesized strand and recruits MutS to the new strand
- C. MutH recognizes methylated histones, which are bound to just the newly synthesized strand
- D. The Mismatch Repair System actually excises the newly synthesized strand only 50% of the time

22. What would be the effect of a mutation within Dam methylase that altered its specificity so that it instead of recognizing the GATC sequence it actually added a methyl group to GATCCG?

- A. The Mismatch repair system would be unable to recognize the newly synthesized strand and would not fix any errors made by DNA polymerase
- B. Restriction enzymes would cleave DNA before it could be methylated and protected
- C. DNA polymerase would actually make 4 additional errors for every one that the Mismatch repair system attempted to fix.
- D. The Mismatch repair system would excise the newly synthesized strand only 50% of the time

23. The Ames Test is used to test for the mutagenicity of chemical compounds. In an experiment the background mutation rate gives 10 colonies while treatment with several compounds gives the following number of colonies (A = 10 colonies; B = 100 colonies; C = 1,000 colonies; D = 10,000 colonies). Which compound is the most mutagenic?

- A. Compound A
- B. Compound B
- C. Compound C
- D. Compound D

24. At what stage of the cell cycle is the Mismatch repair system active?

- A. G1
- B. S
- C. G2
- D. M

25. Which of the following is capable of fixing thymine dimers?

- A. DNA Photolyase
- B. Methyltransferase
- C. Base Excision Repair
- D. Fail Safe Glycosylase

26. Which of the following systems leaves the damaged base intact and removes the incorrectly added base on the opposite strand?

- A. Nucleotide Excision
- B. Transcription Coupled Repair
- C. Methyltransferase
- D. Fail Safe Glycosylase

27. Which of the following mechanisms will fix a damaged or mis-incorporated base only 50% of the time on the right strand?

- A. Base Excision
- B. Mismatch Repair
- C. Nucleotide Excision
- D. DNA Photolyase

28. As a percentage which of the following organisms has the highest coding-gene content?

- A. Bacteria
- B. Yeast
- C. Mouse
- D. Maize

29. Which of the following organisms has the most transposable elements with its genome?

- A. Bacteria
- B. Yeast
- C. Fruit Fly
- D. Maize

30. Which of the following allows a transposable element to cut itself out of the genome and paste itself into a new location?

- A. DNA Polymerase
- B. Transposase
- C. Terminal Inverted Repeats
- D. B and C

31. Plasmids and transposable elements have been combined to create transformation vectors for creating transgenic Drosophila strains. Which of the following is used as a selectable marker for identifying transformant flies?

- A. White Gene
- B. Antibiotic Resistance Gene
- C. Multiple Cloning Site
- D. Transposase Gene

32. During the process of creating transgenic Drosophila strains which of the following is true about the “helper” plasmid?

- A. The helper plasmid contains an intact transposase gene
- B. The helper plasmid contains defective inverted repeat elements
- C. The helper plasmid lacks an eye color selectable marker
- D. All of the above

33. In the article entitled “Vine times” it is mentioned that the genome of the grape variety “pinot noir” has been completely sequenced. Which of the following information from the genome could be used to make a genetically modified grape vine that could grow anywhere in the world and produce a flavorful wine?

- A. Genes that code for enzymes that produce flavorings and aromatic compounds (for smell)
- B. Genes that confer resistance to bacterial, viral and fungal infections
- C. A and B
- D. None of the above

34. Based on the article entitled “The long and the short and the tall” which of the following is a true statement?

- A. Short legs (also called chondrodysplasia) are due to the reactivation of a “dead” version of a gene involved in the regulation of growth.
- B. “Dead” or inactive genes are common and are favored by natural selection
- C. The growth gene was reactivated by the insertion of a LINE-1 element, which jumps around the genome like a transposable element
- D. All of the above

35. Based on the article entitled “Filling tomorrow’s rice bowl” which of the following is a true statement?

- A. Genetically modified crops have allowed rice strains to survive total immersion under water thus allowing for the protection of rice plants that are grown in countries that are subject to floods.
- B. Researchers are also trying to convert C₃ plants into C₄ plants because C₄ plants can survive better in arid conditions such as deserts.
- C. A and B
- D. None of the above

36. Based on the article entitled “Mysterious ways” which of the following is a false statement?

- A. DNA methylation patterns are inherited from parent to child (called epigenetic imprinting)
- B. Monozygotic twins do not always suffer from the same diseases such as schizophrenia
- C. The methylation pattern of DNA in monozygotic twins is the same
- D. Monozygotic twins have identical genomic sequences

37. Based on the article entitled “Methylated spirits” which of the following is a false statement?

- A. Embryonic stem cells are more methylated than lung cells
- B. A large proportion (approximately 25%) of methylated cytosines in stem cells are found in the transcribed parts of the gene rather than the promoter
- C. Methylation of cytosine residues within transcribed parts of genes leads to a lower transcription rate
- D. Methylation of cytosine residues within promoter regions leads to a lower rate of transcription.

38. Based on the article “DNA drugs come of age” which of the following is a true statement?

- A. The core component of the DNA vaccine is a plasmid that contains one or more genes from a pathogen but not the entire genome
- B. Transcription and translation of pathogen genes will elicit a long-term immune response
- C. One problem with DNA vaccines is that several delivery mechanisms do not get the plasmid vaccine into enough cells
- D. All of the above

39. Based on the article entitled “Taking your genes in hand” which of the following is a false statement?

- A. Genetic test kits are designed to identify risk factors for a variety of diseases
- B. Many genetic test kits make false connections or correlations between mutations and disease states
- C. Most diseases can be linked to mutations within a single gene
- D. All of the above

40. Which men’s basketball team do you want to win this weekend? (both answers will get credit)

- A. Indiana
- B. Northwestern

EXAM 2 ANSWER KEY

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