BIOL 4620 Molecular Biology 4511 Exam 4 May 3, 2011 Name_____

PLEASE WRITE LEGIBLY. **IF THE GRADER CANNOT READ YOUR ANSWER IT WILL BE MARKED WRONG.**
Multiple choice questions (20 pts/ 1 pt each) **Please write the letter for the correct answer in the appropriate space .** (circled answers will not receive credit)

_____1. DNA replication is said to be semi-conservative because _____.
(a.) the parental duplex gives rise to two daughter duplexes, each containing one original parental strand and one new strand
b. the parental duplex gives rise to two daughter duplexes, one containing two parental strands and one containing two new strands
c. during replication all strands synthesized contain new nucleotides
d. only one strand is used as a template during DNA replication

_____2. How does the *Ecoli* circular chromosome stop replication?
a. Termination occurs when the supply of nucleotides is depleted
(b.) Short 23bp sequences called ter sites recognized by the Tus protein that stops replication
c. The oriC site is recognized by the Tus protein that terminates replication
d. A polymerase falls off at the correct time, different polymerases last different amounts of time

_____3. In bacteria, the annulus is:
a. A site in the inner bacterial membrane to which the chromosomal DNA is attached.
b. A protein complex in the cytoplasm to which the chromosomal DNA binds to form nucleoids.
(c.) A ring around the midcenter of the cell where the structure of the cell envelope is altered.
d. A DNA-protein complex that connects termination of DNA replication with cell division.

_____4. In eukaryotic chromosomes, replicons are:
(a.) activated independently once each during S phase
b. fired simultaneously once each during S phase
c. fired simultaneously twice each during S phase
d. activated independently twice each during S phase

_____5. What two proteins play a role in DNA replication by unwinding the duplex DNA and stabilizing the resulting single strands?
a. DNA polymerase and DNA primase
b. DNA primase and DNA helicase
(c.) DNA helicase and single-stranded DNA binding protein
d. DNA primase and single-stranded DNA binding protein

_____6. The activity of both gyrase and DnaB depends on _____.
a. methylation of the DNA
b. the DNA polymerase activity
(c.) ATP hydrolysis
d. the direction of DNA synthesis

_____7. Why is an RNA primer considered essential for DNA synthesis by DNA polymerase III?
(a.) The enzyme requires a free 3'-OH group.
b. The enzyme requires a free 3'-PO4 group.
c. The enzyme requires a free 5'-PO4 group.
d. The enzyme requires a free 5'OH group

_____8. The proofreading activity of a DNA polymerase is provided by:
a. 5'-3' exonuclease
(b.) 3'-5' exonuclease
c. nick translation
d. 3'-5' synthetase

_____9. The required elements for DNA ligase to seal a nick in double-stranded DNA are:
a. 5' and 3' phosphate ends adjacent to each and paired with another strand of DNA.
b. 5' and 3' OH ends adjacent to each other and paired with another strand of DNA.
c. A 5' phosphate and a 3' OH end adjacent to each other and paired with another strand of DNA.
d. A 5' OH and a 3' phosphate end adjacent to each other and paired with another strand of DNA.

_____10. Homologous recombination in eukaryotes typically occurs during:
a. Mitosis b. interphase c. Cell division d. Meiosis

_____11. A classic example of site-specific recombination is:
a. HIV virus integration c. Bacteriophage lambda integration
b. Meiotic recombination d. Recombination repair

_____12. What event initiates the process of yeast mating type switching?
a. A double strand break made at the MAT locus by Spo11 endonuclease
b. A single strand nick made at the MAT locus by Spo11 endonuclease
c. A double strand break made at the MAT locus by HO endonuclease
d. A single strand nick made at the MAT locus by HO endonuclease

_____13. Deamination of cytosine in DNA results in
a. A-T base pair c. G-C base pair
b. U-G base pair d. T-U base pair

_____14. How does the uvr system repair damaged DNA?
a. uvrAB attracts ligase to the damaged area, ligase cuts the DNA and uvrBC repairs the damage
b. uvrAB recognizes the damaged area out and uvrC displaces damaged as new DNA is synthesized
c. uvr AB combine to make DNA helicase II, uvrC excises the damaged area, and ligase repairs the nicks
d. uvrAB recognizes damage, uvrA dissociates with ATP, uvrBC makes two nicks in the DNA, DNA helicase II removes the damaged region

_____15. How are the parent and daughter strands of newly replicated DNA distinguished in E. coli?
a. the daughter strands are not immediately methylated
b. the daughter strands are methylated as soon as they are synthesized
c. the daughter strns contain ribonucleotides from RNA primers used to initiate DNA synthesis
d. the daughter strands are not immediately attached to histone proteins

_____16. What is the function of glycosylases and lyases in DNA repair?
a. To convert cytosine into uracil
b. To remove nucleotides from the 5' end of DNA
c. To remove nitrogenous bases from DNA
d. To remove nucleotides from the 3' end of DNA

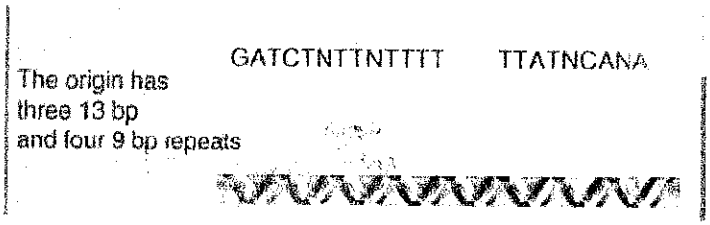
_____17. All insertion sequences contain a single open reading frame that codes for _____.
a. reverse transcriptase b. transposase c. helicase d. resolvase

_____18. _____ have the intrinsic ability to excise and transpose.
a. Transposase c. nonAutonomous controlling elements
b. Somatic controlling elements d. Autonomous controlling elements

_____19. How do cells minimize the potentially harmful effects of transposition?
a. transposon seqeunces are methylated
b. immunoglobulins bind to the transposon-encoded proteins
c. transposon sequences are condensed into highly packed chromatin
d. transposon proteins are targeted for degradation within proteasomes by ubiquitin

_____20. Which of the following are RNA transposons that lack long terminal repeats (LTRs) and but encode their own reverse transcriptases?
a. long interspersed nuclear elements (LINES)
b. short interspersed nuclear elements (SINES)
c. endogenous retroviruses (ERVs)
d. P elements

21. (2) Adenovirus has a double strand linear genome. How is DNA synthesis initiated as the ends of the Adenovirus genome? proteins covalently linked to 5' ends act as primers



22. (2) E. coli replication origin is shown in the figure. Why do origins of replication contain a core of AT rich DNA? A-T base pairs have fewer H-bonds than G-C there for an A-T rich core is easier to melt than if it were G-C rich

23. (2) How are the replication forks initiated at the E. coli origin of replication? DnaA binds to the OriC region and brings in DNAB which has helicase activity to separat the strand with the help of DNaC which helps load the helicase

24. (2) What is the function of Dna B in DNA replication? Dna B has helicase activity

25. (2) What is the function of primase (DnaG)? DnaG adds a RNA primer to start transcription because DNA pol III needs a free 3'OH to attach to and start polymerization.

26. (2) Why are single stranding binding proteins (SSB and RPA) important in DNA replication? SSB keep the strands from coming together again either with the opposite strand or with itself

27. (2) Why can't the DNA polymerase move continuously on both strands during replication? _____

DNA polymerase can only move 5'-3' and because the replication fork only opens a segment of DNA at a time the lagging strand (3'-5') must be replicated discontinuously

28. (2) How are Okazaki fragments primed in E coli? Primase (DNA G)

29. (2) How are Okazaki fragments primed in eukaryotes? primase adds a primer and DNA pol α starts to synthesize and the DNA pol δ/ε take over

30. (2)Removal of the primer is especially important on the lagging strand. Why must the primer be removed? The primer is made up of RNA which contain Uracil which is not a DNA base.

31. (2) The lagging strand contains one primer for each Okazaki fragment. How is each primer removed in E coli? [illegible] is removed when DNA Pol I uses nick translation to replace the RNA with DNA

32. (2) How are Okazaki fragment primers removed in eukaryotes? Flap endonuclease flips out the primer and DNA pol δ/ε synthesis DNA

33. (2) Why is one clamp loader needed at the replication fork when there are two template strands being replicated? The clamp loader holds the helicase in place which separates the 2 strands it doesn't its self have anything to do with the template strands

34. (2) How does the yeast cell ensure that its genome is replicated completely only once per cell cycle? The licensing factor used can only be used once and then the cell must wait for a new licensing factor to come into the nucleus, which doesn't occur until the cell goes through the cell cycle

35. (2) E coli DNA polymerase III and other high fidelity DNA polymerase have proofreading activity. What is DNA proofreading? DNA proofreading is looking for errors in replication. Things such as mismatches, lesions, alkylations. 3'→5' endonuclease activity and base discrimination

36. (2) Why do all cells have error-prone DNA polymerases since their use is guaranteed to make mistakes? Having mutated DNA is a better alternative then the cell dieing because the DNA was lost.

37. (2) How does methylation of GATC regulate initiation of replication in E coli
The A in GATC is methylated and that methylation is recognized by DnaA

38. (2) In E coli the A of the sequence GATC is methylated. What is the role of methylation in mismatch repair? The daughter strand is not immediately methylated after replication so the unmethylated strand is recognized and preferentially changed when a mismatch is found b/c it is most likely the strand that has a mistake

39. (10) DNA damage may be **directly repaired, repaired via nucleotide excision or repaired via base excision**. Which process is used for the repair of:

a. Thymidine dimers in plants during daylight directly repaired

glycos – b. Thymidine dimer in humans during daylight nucleotide excision

c. Thymidine dimers in E coli during daylight directly repaired

d. Thymidine dimers in E coli at nighttime nucleotide excision

e. Spontaneous deamination of cytosine nucleotide excision

40. (2) If a replication error that creates an AG mismatch is not repaired before the next round of replication, what will be the sequences of the two daughter DANs after replication?
AT and GC

A
G

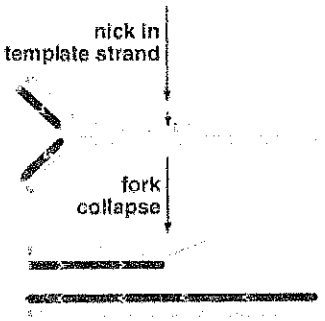
• base excision
• Oracl
• Omethyl G

41. (2) Why are transcriptionally active genes preferentially repaired?_____

because they are more likely to have a debilitating effect on the organism

42. (2) RecA, Rad51 and Dmc1 have equivalent roles in recombination. What is the role of these proteins? Pairing of homologous DNA & strand invasion

43. (2) When DNA polymerase encounters as a nick in one strand of the template, it results in replication fork collapse. If this is not repaired, the cell may die. How is this repaired in E. coli? _____

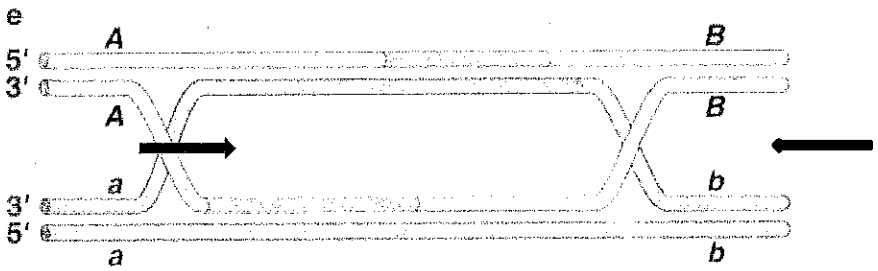


The nicked strand invades the non nicked Strand and uses that newly synthesized strand as a template until it bypasses the nick then the fork is remade further along and synthesis continues

44. (2) Homologous recombination, homologous repair and gene conversion begin in a similar way. How are these processes initiated? _____

A double strand break

45. (2) What is the result if resolution of the Holliday junction begins with nicks in both sets of exchanged strands? Patch recombination



Resolution of Holliday junction:

? 46. (2) How are recombinases (eg lambda integrase or Cre recombinase) similar to topoisomerase I? ___

Both break bonds in the DNA; break 1 strand at a time

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47. (2)Lambda is a bacteriophage (bacterial virus) that can integrate into the E.coli genome. What is the mechanism of integration (integration at random target site, site specific recombination, homologous recombination)? site specific recombination

48. (2) HIV (a human retrovirus) can integrate into the human genome. What is the mechanism of integration (integration at random target site, site specific recombination, homologous recombination)? integration at random target site

Modified T/F (2 points each). Indicate whether the statement is true or false. If false, why is it false?

49. ORC complexes associate with the eukaryotic replication origin only during S phase.
False ORC are bound throughout the cell cycle but are activated during S phase

50. E coli replication origin is regulated by a licensing factor and by DNA methylation state.
True the A in GATC must be methylated

51. DNA polymerase I is the major replicating polymerase in E coli.
False DNA Polymerase III

52. Each eukaryotic chromosome contains a single origin of replication
False contains multiple [illegible]

53. All RNA transposons (retrotransposons) move via replicative transposition
True RNA is [illegible] to be transcribed to make cDNA [illegible] from an [illegible]

54. DNA transposons are only found in prokaryotes
False eukaryotes also have DNA transposons

55. The human disorder *xeroderma pigmentosum* is caused by mutations genes important for nucleotide excision repair. True
xeroderma pigmentosum can't handle UV light very well b/c the thymine dimers cannot be repaired by nucleotide excision repair

56. Short intersperse nuclear elements (SINES) are non autonomous LTR containing transposons.
False SINES do not contain LTR

Bonus (2points): What feature of the Ti plasmid makes it attractive for use in the generating genetically modified plants? It can be used to transfer genes into the plant nucleus b/c the T-DNA portion of the plasmid is transferred in a mechanism similar to conjugation