

BIOS 100 - Fall, 2006pm
Exam II, 20 Oct, 2006
Michael Muller, Instructor

Name:
TA:

This exam consists of 54 questions over 7 pages. Please check to see that all the pages are present before you begin. Use a #2 pencil and bubble in all answers. If you do not bubble in your last name first, I will remove all extra credit points from your score. Your score will be posted on the UIC Blackboard site as soon as they are in. There is a Codon Chart at the end of the exam. Good Luck!

Matching - Use the key below to select the best answers for questions 1 - 8. Here's a hint - most people get really thrown by this section, so take the rest of the exam and come back to it.

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|-------------------------------|--------------------------------------|
| I. Glycolysis | VI. Lactic Acid Fermentation |
| II. Oxidation of Pyruvate | VII. Non-cyclic Photophosphorylation |
| III. Krebs Cycle | VIII. Cyclic Photophosphorylation |
| IV. Oxidative Phosphorylation | IX. Calvin Cycle |
| V. Alcohol Fermentation | |

- This/these processes produce CO₂
A. III only B. II, III **C. II, III, V** D. II, III, VI E. II, III, V, VI
- How many of the above processes have a net production of ATP?
A. 4 **B. 5** C. 6 D. 7 E. 8
- This/these processes produce NADH
A. II only B. III only C. II, III **D. I, II, III** E. I, II, III, IV
- This/these processes convert NADH to NAD⁺
A. V only B. V, VI C. IV only **D. IV, V, VI** E. III, IV, V, VI
- This/these processes produce O₂, oxygen gas
A. IV only B. V only **C. VII** D. VIII only E. VII, VIII
- This/these processes produce NADPH
A. IV only B. V only **C. VII** D. VIII only E. VII, VIII
- This/these processes consume O₂, oxygen gas
A. I only B. III only **C. IV only** D. III, IV E. I, III, IV
- This/these processes have a net consumption of ATP
A. V only B. VI only **C. IX only** D. V, VI E. V, VI, IX
- From where does p680 (PSII) replenish its lost electron?
A. Water B. O₂ C. CO₂ D. NADPH E. NADH
- Plant cells contain functional mitochondria and can perform aerobic respiration
A. True B. False

21. What was the conclusion of Griffith's work with *Streptococcus pneumoniae*?
- A. He demonstrated that rough (R) colonies were non-virulent while smooth (S) colonies were virulent
 - B. He demonstrated that in order for transformation to occur, the cells must be living
 - C. He demonstrated that something in heat-killed smooth (S) colonies could transform rough (R) colonies into smooth (S) colonies**
 - D. He demonstrated that DNA was the molecule of transformation
 - E. None of the above

Matching - Match the scientist on the left to their contribution on the right

- | | | |
|-----------------------|----------|---|
| 22. Hershey & Chase | D | A. Utilized proteases and DNAses in order to determine whether DNA was the molecule of heredity |
| 23. Sanger | E | B. X-ray crystallographer whose data was used to determine the 3-dimensional structure of DNA |
| 24. Rosalind Franklin | B | C. Developed PCR (polymer chain reaction) |
| | | D. Utilized radiolabeled proteins & DNA to determine that DNA was the molecule of heredity |
| | | E. Used dideoxy nucleoside triphosphates (ddNTPs) to sequence DNA |

25. Which of the CsCl tubes below represents what Meselson and Stahl found in the second generation of bacterial growth with N^{14} nitrogen

14/14

15/14

15/15

A. B. C. **D.** E.

26. Which of the following statements (A-D) about DNA replication is FALSE? If statements A-D are true, then choose E
- A. DNA polymerase III requires a primer or some other double stranded nucleotide sequence in order to initiate DNA synthesis
 - B. DNA synthesis by DNA polymerase III is always in the 5' to 3' direction
 - C. Okazaki fragments are located on the lagging strand
 - D. Topoisomerase unwinds the double stranded DNA**
 - E. All of the above statements about DNA replication are TRUE

27. Telomeres:

- A. Are regions of repeating nucleotide bases located at the ends of linear chromosomes**
- B. Are origins of DNA replication
- C. Are involved in transcription of genes
- D. Are regions of prokaryotic DNA
- E. None of the above

Matching - Match the enzyme on the left to the appropriate description on the right

- | | | |
|---------------------------|----------|--|
| 28. Primase | B | A. Catalyzes joining of Okazaki fragments
B. A form of RNA polymerase |
| 29. Ligase | A | C. A reverse transcriptase
D. A DNA polymerase stable at 94°C |
| 30. <i>Taq</i> polymerase | D | E. Enzyme which removes supercoils in DNA |

Use the below **non-template** strand of DNA to answer questions 31-33.

5' C A G A T G G C T T T T C T C A A G A T T A A C C G A T C C C 3'

31. Which of the following strands of DNA represents the template strand of DNA
A. 5' C A G A T G G C T T T T C T C A A G A T T A A C C G A T C C C 3'
B. 3' C A G A T G G C T T T T C T C A A G A T T A A C C G A T C C C 5'
C. 5' G G G A T C G G T T A A T C T T T G A G A A A G C C A T C T G 3'
D. 3' G G G A T C G G T T A A T C T T T G A G A A A G C C A T C T G 5'
32. What is the third amino acid in the polypeptide sequence coded by this gene?
A. Methionine B. Alanine **C. Phenylalanine** D. Valine
33. If the base marked A were changed to a T, what kind of mutation would occur?
A. neutral (silent) mutation B. missense mutation
C. nonsense mutation D. frame shift mutation
34. What amino acid is attached to a tRNA with the following anticodon: 3' GCA 5'
A. Alanine B. Threonine **C. Arginine** D. Cysteine
35. Which site on a ribosome contains the open codon that must be matched to the anticodon of a tRNA?
A. P Site **B. A Site** C. E site
36. Which of the following is not required for initiation of protein synthesis?
A. A small ribosomal subunit B. Large ribosomal subunit
C. The appropriate tRNA D. Initiation factors
E. All of the above are required for initiation of protein synthesis
37. Which of the following conditions will yield the greatest rate of transcription of the *lac* operon?
A. Low glucose, low lactose **B. Low glucose, high lactose**
C. High glucose, low lactose D. Hi glucose, high lactose
E. C & D

38. How many codons can code for the amino acid leucine
A. Two B. Three C. Four D. Five **E. Six**
39. Which of the following statements (A-D) about transcription is FALSE? If statements A-D are true, then choose E.
A. RNA polymerase must bind to the promoter region of the gene
B. Introns must be removed from both prokaryotic and eukaryotic mRNA's
C. Transcription factors such as sigma in prokaryotes and TATA binding protein in eukaryotes must also bind to the DNA to initiate transcription
D. Translation enhancers and inhibitors affect the rate of ribosomal binding to the mRNA
E. All of the above statements about transcription and translation are TRUE
40. If a *lac* operon was mutated so that the operator could never bind to the bind to the operator, how would this affect transcription rates of the *lac* operon?
A. It would permanently be turned off
B. It would permanently have a low rate of transcription
C. It would permanently have a high rate of transcription
D. Transcription rate would depend on the glucose concentration
E. None of the above
41. Which of the following conditions are required to turn off the *trp* operon?
A. Low tryptophan concentration
B. High tryptophan concentration
C. Low tryptophan and a high glucose concentration
D. High tryptophan and a high glucose concentration
E. High tryptophan and a low glucose concentration
42. What does the cAMP-CAP complex do?
A. It binds to the operator of the *lac* operon, turning it off
B. It binds to the repressor protein, allosterically regulating it
C. It stabilizes RNA polymerase binding to the promoter in the *lac* operon
D. It inhibits RNA polymerase binding to the promoter in the *lac* operon
E. None of the above
43. What would happen if the genes which produce TATA binding proteins (TBP) became mutated and produced TBP's that could no longer bind to the TATA box?
A. Transcription of a few genes would be affected, but it would not significantly affect the organism
B. Transcription of many genes would be affected, but the organism could still survive
C. Transcription of almost all genes would be affected, and the organism would die
D. Not enough information to make a prediction

44. Which of the following is NOT an example of transcriptional control of eukaryotic genes?
- A. **Removal of introns**
 - B. TATA binding protein binding to the TATA box
 - C. Other transcription factors binding to the DNA
 - D. RNA polymerase binding to the promoter and becoming activated
 - E. All of the above are examples of transcriptional control
45. A protein has a helix-turn-helix domain. What prediction could you make about this protein?
- A. **It is a DNA binding protein**
 - B. It is a transcription factor
 - C. It is an enzyme
 - D. It is a trans-membrane protein
 - E. It is a hormone
46. Which of the following is not true about transcription enhancers?
- A. They stabilize transcription factor binding
 - B. They work even if their 5' to 3' orientation is flipped
 - C. **They must be close to the promoter to function**
 - D. They can function even if their location in the chromosome is moved
 - E. All of the above statements about transcription enhancers are true
47. What is cDNA?
- A. DNA from a chloroplast
 - B. **DNA synthesized by reverse transcriptase from a mRNA template**
 - C. The non-template strand
 - D. DNA composed exclusively of cytosine nucleotides
 - E. None of the above
48. Which of the following was NOT done when using recombinant DNA technology to create bacteria capable of producing human growth hormone?
- A. Create cDNA from pituitary cells and insert this cDNA into plasmids
 - B. Isolate the bacteria which had taken in the plasmids
 - C. **Use a radioactive probe to kill off bacteria which had not taken in the plasmid**
 - D. Insert the gene coding for human growth hormone into a plasmid with a bacterial promoter and allow other bacteria to take in this plasmid
 - E. All of the above were done when using recombinant DNA technology to create bacteria capable of producing human growth hormone
49. Which of the following statements about restriction endonucleases is FALSE?
- A. Restriction endonucleases are naturally found in bacteria
 - B. Restriction endonucleases cleave DNA at specific DNA sequences
 - C. Many restriction endonucleases leave “sticky ends”
 - D. Most restriction endonucleases recognize and bind to palindromic DNA sequences
 - E. **Bacteria protect their DNA from being cut by restriction endonucleases by wrapping the DNA in histone proteins**
50. Identical twins will have identical DNA fingerprints
- A. **True**
 - B. False

EXTRA CREDIT - did you bubble in your name, last name first? - EXTRA CREDIT

51. What is special about dideoxynucleoside triphosphates?
- A. **They lack a 3' -OH group**
 - B. They have three phosphates bound to the 1' carbon
 - C. They have unique nitrogenous bases
 - D. They cannot bind to the active site of DNA pol III
 - E. None of the above
52. The Sanger method of DNA sequencing utilizes all of the following EXCEPT?
- A. ddNTPs
 - B. DNA polymerase
 - C. **Taq polymerase**
 - D. Electrophoresis gels
 - E. Primers with radioactive labels
53. More modern methods of DNA sequencing utilize what?
- A. Non-radioactive primers
 - B. Taq polymerase
 - C. X-ray film
 - D. **Phosphorescent ddNTPs**
 - E. Plasmids with antibiotic resistant genes
54. Given the gel below, which potential father is the father of this offspring?

Father B

I gave everyone 4 bonus extra credit points, but only IF you bubbled in your last name first.