

I.D. #: G:

Name: _____

BIOL 230: Cell & Molecular Biology MIDTERM EXAM #3 Dr. Nathan Staples

Scantron Instructions:

1. Make sure you have a **200-** question, **RED/ORANGE** form!!
2. Use a **#2** or **HB** pencil to complete the form.
3. Write in your **name, date, and I.D. #** on **BOTH** the **scantron & each page of the examination.**
4. Fill-in on Scantron: **G#** ("G" = "0" + 8 digits), exam #: **233**, Form: **A**.
5. **Darkly** Fill-in the **entire rectangle** for the answer you choose.

M/C = _____ / **60**

Essays = _____ / **40**

Total = _____ /100

READ ALL QUESTIONS THOROUGHLY. FOR ALL M/C questions, PICK THE BEST ANSWER. 38 QUESTIONS, 2 or 20 POINTS EACH; 100 points total. (4 total pages = 2, double-sided sheets)
RELAX, CONCENTRATE, AND GOOD LUCK!!

***** IMPORTANT: Turn-in BOTH your signed Scantron and your signed copy of the Exam.**

Multiple Choice: Identify the letter of the choice that best completes the statement or answers the question.

1. You begin with 4 molecules of a target template DNA sequence, then mix the proper reactants and program a thermocycler to run for **7 PCR cycles**. How many **TOTAL** copies of your double-stranded DNA sequence will be present at the end of the program?
 - a. 14
 - b. 28
 - c. 128
 - d. 512
 - e. 1024
2. Which of the following is **NOT** an **advantage** of a **cdNA** gene library over a **genomic** DNA gene library?
 - a. Cloned sequences were from specifically expressed genes in the cells from which they were isolated
 - b. DNA regulatory sequences, such as promoters and enhancers, may be analyzed in the cloned sequences
 - c. The cloned sequences include the complete coding region of actual mRNA transcripts
 - d. cdNA's actually encode proteins, while genomic DNA may contain noncoding regions
 - e. There's just way too many volumes in a genomic library, and we'd have to climb too many flights of stairs to find anything. ☹
3. In a DNA Microarray experiment, which of the following identified sequences on a "Gene Chip" would be the most interesting? (eg: cancerous cell cdNA probes labeled green, normal cell cdNA probes labeled red)
 - a. Bright Red spots on the grid ("microarray")
 - b. Bright Green spots on the grid
 - c. Dark spots on the grid
 - d. Yellow (double-labeled) spots on the grid
 - e. Both A and B.
4. Which of the following statements about the flow of genetic information is true?
 - a. Proteins encode information that is used to produce other proteins of the same amino acid sequence.
 - b. RNA encodes information that is translated into DNA, and DNA encodes information that is transcribed into proteins.
 - c. DNA encodes information that is transcribed into RNA, and RNA encodes information that is translated into proteins.
 - d. Proteins encode information that can be translated into RNA, and RNA encodes information that can be transcribed into DNA.
 - e. None of the above
5. Which of the following is **NOT** an important component in the **initiation** of **Translation**?
 - a. A specific Aminoacyl tRNA
 - b. Promoter sequence
 - c. AUG sequence
 - d. Small ribosomal subunit
 - e. Large ribosomal subunit
6. The genetic code consists of
 - a. 2 nucleotide "words" in DNA
 - b. 2 nucleotide "words" in RNA
 - c. 3 nucleotide "words" in DNA
 - d. 3 nucleotide "words" in RNA
 - e. Combinations of 3 amino acids
7. During protein biosynthesis, a new amino acid enters the ribosome
 - a. At the A-site
 - b. At the P-site
 - c. At the E-site
 - d. At the 5' end of the message
 - e. All of the above
8. Eukaryotic chromosomes
 - a. contain linear molecules of double-stranded DNA.
 - b. have uncoiled DNA.
 - c. have multiple origins of replication.
 - d. have two replication forks that move in the same direction.
 - e. Both a and c
9. What is the "adapter" molecule that actually "reads" the nucleic acid sequence of a transcript, and carries in the proper amino acid specified by a codon?
 - a. mRNA
 - b. tRNA
 - c. rRNA
 - d. Ribosomal small subunit
 - e. Adobe Acrobat Reader ☹

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10. **Extra Credit:** You isolate three *threonine* biosynthesis mutants (auxotrophs) in yeast. Mutant X can grow only with added threonine, mutant Y can grow with added threonine or homoserine or aspartate- semialdehyde, and mutant Z can grow with only added homoserine or added threonine. Which mutation damaged the gene that encodes the earliest enzyme in the threonine pathway?
- X
 - Y
 - Z
 - Both X and Y
 - Both X and Z
11. The direction of DNA Replication proceeds _____, while Transcription proceeds _____, and Translation proceeds _____.
- 5'→3'; 5'→3'; N→C.
 - 5'→3'; 3'→5'; C→N.
 - 3'→5'; 3'→5'; N→C.
 - 5'→3'; 5'→3'; C→N.
 - 5'→3'; 3'→5'; N→C.
12. The nucleotide codon 5'-CAG-3' in a transcribed message is recognized by the tRNA with the anticodon _____.
- 5'-CAG-3'.
 - 5'-GAC-3'.
 - 5'-GTC-3'.
 - 5'-CUG-3'.
 - 5'-GUC-3'.
13. The energy used to drive the addition of each new amino acid to a growing polypeptide during translation by a ribosome is derived from
- A proton gradient
 - NADPH
 - The high-energy bond attaching the amino acid to the "charged" tRNA.
 - FADH₂
 - A few swift kicks to the side of the ribosome to get it started. ☺
14. Under which of the following conditions would you expect high expression of the *lacZ* gene (encoding β-galactosidase) in *E. coli* cells?
- High galactose, and high glucose
 - Low lactose, and high glucose
 - Low galactose, and high glucose
 - High lactose, and high glucose
 - High lactose, and low glucose
15. DNA sequencing is made possible by the use of fluorescently labeled dideoxy nucleotide triphosphates that terminate DNA synthesis when incorporated into a growing strand. As compared to natural deoxy NTPs, dideoxy NTPs lack
- 5' phosphate
 - 5' OH
 - 3' OH
 - 2' OH
 - 3' phosphate
16. Which of the following molecules is considered a "starvation" signal in many types of living cells
- NADH
 - NADPH
 - Glucose
 - cAMP
 - ATP
17. The initiation sites for replication, transcription, and translation, respectively are:
- Start codon, Promoter, and Operator
 - Operator, Origin, and Start codon
 - Origin, Promoter, and Start codon
 - Origin, Promoter, and Operator
 - Origin, Operator, and Start codon
18. During the Lytic phase of bacteriophage replication
- The *cro* gene is highly expressed
 - The *cI* gene is highly expressed
 - The phage genome integrates into the host chromosome.
 - The *cI* protein is bound to the *cro* promoter/operator
 - The host cells glow with a brilliant red fluorescence.
19. The term "lysogeny" refers to
- exchange of genetic material between a bacteriophage and a bacterium.
 - the excision of bacteriophage DNA from the bacterial chromosome.
 - the lysing of a bacterium by a bacteriophage.
 - stable integration of bacteriophage DNA into the bacterial chromosome.
 - mutation induced by a bacteriophage.
20. The transfer of genes by a bacteriophage vector characterizes which type of gene transfer in bacteria?
- Transformation
 - Conjugation
 - Transduction
 - Transposition
 - Both a and b
21. Retroviruses do not follow the "central dogma" because they
- Contain RNA that is used to make DNA.
 - Contain DNA that is used to make more RNA.
 - Contain Protein that is used to make RNA.
 - Contain only RNA as the genetic material.
 - Do not contain either DNA or RNA as the genetic material.
22. Which of the following is necessary to fully activate the *lac* operon?
- Lactose
 - cAMP
 - CRP
 - Low glucose
 - All of the above

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23. As a *repressible* system, the *trp* operon
- Encodes anabolic enzymes
 - Is negatively regulated by its own end product
 - Conserves energy by turning off during times when there is plenty of product
 - Normally has its operator unbound by repressor
 - All of the above
24. An inducer
- binds to the promoter and prevents the repressor from binding to the operator.
 - combines with a repressor and prevents it from binding the promoter.
 - binds to the operator and prevents the repressor from binding at this site.
 - combines with a repressor and prevents it from binding the operator.
 - binds to the termination codons and allows protein synthesis to continue.
25. Which of the following is involved in Prokaryotic gene expression, but NOT in Eukaryotic gene expression?
- Polysomes
 - Repressor proteins
 - Simultaneous transcription and translation
 - Enhancers
 - RNA processing
26. When the concentration of glucose in the bacterial growth medium falls, the concentration of _____ rises.
- repressors
 - ATP
 - cAMP
 - inducers
 - lactose
27. Which of the following gene regulatory factors is NOT involved in "Negative" gene regulation (turning genes OFF)?
- Enhancers
 - Repressors
 - Operators
 - Silencers
 - Co-Repressors
28. Which of the following cellular molecules does NOT contain RNA as part of its active structure?
- Ribosome
 - Telomerase
 - snRNP's
 - XIST* gene product
 - All of the above contain RNA
29. Which of the following processes makes use of the nucleic acid base-pairing rules?
- DNA replication
 - Transcription
 - Translation
 - Sequencing of genes, PCR, & hybridization
 - All of the above
30. What is the nucleotide sequence of the RNA strand transcribed from the following DNA molecule template: 5'-GATCCAGCAAT-3'?
- 3'-TAACGACCTAG-5'
 - 5'-UAACGACCUAG-3'
 - 3'-CTAGGTCGTTA-5'
 - 3'-CUAGGUCGUUA-5'
 - 5'-CUAGGUCGUUA-3'
31. Which of the following is not part of RNA processing in eukaryotes?
- Alternate splicing of exons
 - Reverse transcription
 - Addition of a 5' cap
 - Addition of a poly A tail
 - Intron removal
32. A DNA sequence, which can be very distant from the gene it regulates, INHIBITS transcription when bound by a protein. This sequence is a(n)
- TATAA.
 - Activator.
 - Enhancer.
 - Promoter.
 - Silencer.
33. Proteins destined for a very short lifespan
- Carry signals for fast ubiquitination
 - Have a short poly-A tail
 - Have a long poly-A tail
 - Have no carboxy terminus
 - Are synthesized in the rough ER
34. Which of the following provides a strong exception to Beadle and Tatum's theory on molecular genetics?
- Capping of mRNAs
 - Alternative splicing
 - Polyadenylation of mRNAs
 - Binding of multiple transcription factors
 - Availability of multiple different RNA Polymerases
35. Which of the following is NOT a possible mechanism of Genetic Recombination within a living cell?
- Transduction
 - Transformation
 - Binary fission
 - Conjugation
 - Transposition

Short Essays (40 pts total): On the **NEXT** page, **Answer #35** and **ONLY ONE** of the last 2 questions **BRIEFLY** but **COMPLETELY**. Use diagrams whenever helpful.

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35. (20 pts., **MANDATORY:**) Describe the three processes, and the molecular players (major enzymes, and resulting polymers) that define the direction and flow of genetic information in living systems. What is the name of this fundamental theory voiced by Sir Francis Crick?

36. (20 pts.) Compare and contrast regulation of the *Lac* Operon and the *Trp* Operon. When is each turned ON or OFF? What controls the activity of the regulatory proteins involved (both positive and negative regulation)? Explain how each type of regulation is appropriate for an operon encoding catabolic or anabolic enzymes.

➤ **OR:**

37. (20 pts.) Describe and **DIAGRAM** at least 5 ways that gene structure, transcription, and transcriptional and post-transcriptional regulation differ between Prokaryotes and Eukaryotes.

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BIOL230 AA/AB PRACTICE MIDTERM #3

Answer Key -- Fall Semester

Only look here AFTER you have thoughtfully and thoroughly completed the Practice Exam!!! NO CHEATING!!

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