BIO 226R
EXAM III (Sample)

_____ _____
PRINT YOUR NAME **SSN**

Please sign below if you wish to have your grades posted by the last five digits of your SSN

_____
Signature

BIO 226R Exam III has 8 pages, and 26 questions.
There are a total of 100 points. It will count as one third of your final grade.
Place your name at the top of each page and check that your exam is complete.
*Answer **ALL** questions.*
Be brief and precise in your answers. Do not ramble!

Copying and all other forms of cheating will be met with the appropriate disciplinary action.

YOU MUST HAND OVER YOUR COMPLETED EXAM TO A PROCTOR WHEN LEAVING THE ROOM
MAKE SURE THAT YOU SIGN YOUR NAME ON THE SIGN-OUT SHEET

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Circle the BEST answer for questions 1-12: (3 points each)

1. Mutations can be induced by

   a. ultraviolet light
   b. nitrosoguanidine
   c. oligonucleotides
   d. all of these

2. Lethal mutations can be recovered in haploid organisms if they are

   a. dominant
   b. recessive
   c. conditional
   d. morphological

3. Which of the following units is the smallest one that can be altered to produce a mutation?

   a. codon
   b. gene
   c. nucleotide
   d. operon

4. Which type of mutation is likely to be the MOST harmful one early in the gene?

   a. a +1 frame shift
   b. a +3 frame shift
   c. a base substitution in which valine is replaced by leucine
   d. a base substitution in which lysine is replaced by arginine

5. Which of the following methods of gene transfer will be affected (reduced) the most if you had Dnases (enzymes that degrade DNA) in your transfer reaction?

   a. conjugation
   b. transformation
   c. transduction
   d. all of these

6. An F^- bacterium can:

   a. transfer DNA to another F^- cell
   b. transfer DNA to an F^+ cell.
   c. transfer DNA to an Hfr cell
   d. only act as a recipient during conjugation

7. Which of the following best represents the order of gene transfer in an Hfr X F^- mating?

   a. All plasmid genes followed by some or all of the chromosome
   b. Part of the plasmid followed by the chromosome
   c. Chromosome followed by the plasmid
   d. Part of the chromosome followed by all of the plasmid

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8. Which of the following statements regarding transposons is INCORRECT?

a. Transposons require homologous recombination to survive in a host
b. Transposons carry the gene for transposase
c. Transposons may replicate at the original site and insert the copy at another site
d. Transposons are found both in prokaryotes and eukaryotes

9. When cI repressor is present in relatively low amounts as compared to cro, the bacteriophage lambda undergoes _____ cycle.

a. lysogenic b. lytic

10. Restriction endonucleases in bacteria probably evolved in order to

a. carry out natural DNA transfer
b. protect bacteria from viral infection
c. utilize nucleic acids as a source of energy
d. all of the above

11. DNA fragments are easily separated from one another by _____.

a. cloning b. gel electrphoresis
c. site directed mutagenesis d. polymerase chain reaction

12. You want to isolate a clone containing the promoter and operator region of the lactose operon from *E. coli*. For this you'll use a _____ library.

a. cDNA b. genomic

Short Answers:

Answer either Q# 13A OR 13B. We will ONLY grade the first one you answer
13A. (6 points) Which characteristic(s) of the Genetic code is mainly responsible for allowing eukaryotic genes to express themselves in a prokaryotic cell?

13B. (6 points) How does Wobble base pairing affect the frequency of mutations in a cell?

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Answer either Q# 14A OR 14B. We will ONLY grade the first one you answer

14A. (6 points) How do the DNA repair enzymes know which strand of the DNA has been "newly / recently" synthesized and which one was the template?

14B. (6 points) DNA repair involves 3 steps: recognition and removal of the altered portion of the DNA strand by enzymes called _____, resynthesis of the excised region by _____ and resealing the remaining nick by _____.

15. (8 points) a. Which of the following selection (screening) procedure will you use preferentially to isolate a proline auxotroph of *E. coli* ? (Initial culture is a prototroph).

Direct plating on selective medium / Replica plating (Circle the correct answer)

b. Would you be able to exploit penicillin enrichment to achieve this? Explain briefly.

16. (8 points) Ames test is a mutational reversion assay by which you can determine the carcinogenicity / mutagenicity of a given chemical.

A. Mention the most important characteristic of the *Salmonella typhimurium* mutant which was essential for carrying out this assay.

Essential characteristic: _____

B. What is the purpose of adding liver extract in the Ames test? Explain briefly.

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17. (6 points) Mention the MAIN difference between generalized and specialized transduction?

18. (6 points) Mention one way in which the transformation in *S. pneumoniae* differs from that in *Haemophilus influenzae* and one in which it is similar?

Difference:

Similar:

Answer either Q# 19A OR 19B. We will ONLY grade the first one you answer

19A. (4 points) Mention one essential and one useful characteristic that a DNA cloning vector should have.

Essentail: _____

Useful: _____

19B. (4 points) List 2 MAIN differences between chemical and enzymatic synthesis of DNA. (Please do NOT say one is chemical and one needs enzymes. Think of the direction of synthesis, speed, need for template, primer etc.)

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Use the genetic code given below to answer EITHER Q # 20A OR 20B.
We will only grade the first one you answer.

20A. (10 points) The following m RNA codes for a pentapeptide (5 amino acids).
Use this m RNA sequence to answer the following:

5'- A A U G A G C U U C C A A A U C U G A A A-3'

a. Circle the start codon.

b. Name the amino terminal amino acid: _____

c. Name the carboxy terminal amino acid: _____

d. The following sequence shows a mutation (the underlined nucleotide).

5'- A A U G A <u>A</u> C U U C C A A A U C U G A A A-3'

Compared to the first sequence, this results in a <u>silent / missense / nonsense</u> mutation.
(Circle the correct answer)

e. Is this change a transition / transversion / frame shift mutation? _____

20B. (10 points)

a. Which amino acid would you expect a t RNA with the anticodon 5' - GAA - 3' to carry?

A. lysine B. glutamine C. leucine D. phenylalanine

b. Would the t RNA (mentioned above) be able to recognize more than one codon? <u>Yes / No</u>
(Circle the correct answer)
If "yes" which ones? _____

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Answer either Q# 21A OR 21B. We will ONLY grade the first one you answer

21A. (6 points) Sanger's sequencing method normally uses a DNA / RNA Primer (about 15 nucleotides long). The primer is complementary to the 3' / 5' end of the DNA strand to be sequenced. It provides a free 3' / 5' hydroxyl group to which the incoming nucleotides are attached by DNA polymerase. (Circle the correct answers)

21B. (6 points) What is the purpose of using dideoxyribonucleotides (ddNTPs) in Sanger's sequencing?

22. (4 points)

a. What is the purpose of the Polymerase chain reaction?

b. Mention the chemicals / reagents needed for PCR.

Extra credit: (15 points)

23. (3 points) Define EITHER back mutation OR forward mutation.

24. (5 points) What is the MAIN difference between photoreactivation and SOS as mechanisms for DNA repair?

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Answer either Q# 25A OR 25B. We will ONLY grade the first one you answer

25A. (3 points) Circle the best answer for each of the mating experiments shown below:

	After successful conjugation the recombinant cell is
H fr X F^-	F^- / F^+ / F ' / Hfr
F ' X F^-	F^- / F^+ / F ' / Hfr
F^+ X F^-	F^- / F^+ / F ' / Hfr

25B. (3 points) Which of the following is a possible fate for a donor DNA in a recipient cell?

a. Integration into the host chromosome
b. Independent replication
c. Degradation
d. All of the above

26. (4 points) In 20 - 50 words write about ONE topic that you enjoyed / learned a lot about in BIO 226R.