

BIOLOGY 121 - PRACTICE EXAM #2
SPRING, 2003

READ THIS SECTION CAREFULLY: Here are a few questions taken from some of Dr. Loker's old exams. Please note the following:

1. The questions are **similar** to ones that will appear on the next 121 exam you will take. They are not necessarily **exactly** like the ones to appear on the new exam because the coverage of the material has been slightly different this semester, but they will give you an idea of the kinds of questions to expect.

Note that these questions have a few more choices than you might be used to. Don't let it throw you. You will have plenty of time on the exam to work carefully through all the choices. **This type of question does require your knowledge about the subject to be precise!**

2. All the questions on your next exam will come from the lecture notes (including handouts) you have taken since the first exam. Anything mentioned in those lectures is fair game. The questions will be evenly distributed from all lectures.

3. You will be required to connect material from one lecture with material from another lecture.

4. **Don't panic. The questions you will be asked are straight-forward (no trick questions intended) and as long as you have studied well and really know your notes, you should do just fine.**

5. The correct answer for each question is listed at the end of this practice exam. See if you can get the correct answer without peeking.

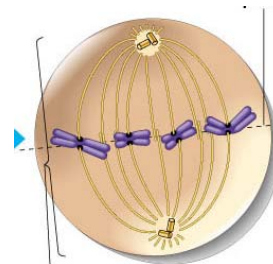
DIRECTIONS: Read all the choices for each question carefully. Indicate the SINGLE MOST CORRECT ANSWER.

1. Which of the following accurately describes the results of meiosis?

- a. each gamete produced has the haploid number of chromosomes
- b. within a particular individual, each gamete produced contains exactly the same genetic information
- c. each gamete produced contains both members of a homologous pair of chromosomes
- d. all of the above

2. Which of the following are you looking at in the illustration to the right?

- a. prophase I of meiosis
- b. prophase II of meiosis
- c. prophase of mitosis
- d. metaphase I of meiosis
- e. metaphase of mitosis
- f. anaphase of mitosis



3. Why is meiosis necessary?

- a. it prevents mixing of paternal and maternal genetic information
- b. if meiosis did not occur, the diploid chromosome number would double during each generation
- c. it is the only way of creating a multicellular organism from a single-cell zygote
- d. chromosomes must periodically condense or they get strung out

4. A chromosome visible in the cell during prophase of mitosis contains two chromatids joined by a centromere. Which of the following statements accurately describes this chromosome?

- a. each chromatid contains a double stranded DNA molecule, and the two chromatids are genetically identical to one another
- b. each chromatid contains a double stranded DNA molecule, but the two chromatids are not genetically identical
- c. each chromatid contains a single stranded DNA molecule
- d. each chromatid contains a double stranded RNA molecule

5. Crossing over

- a. refers to the exchange of pieces of homologous chromosomes
- b. occurs during prophase in cells undergoing meiosis or mitosis
- c. usually results in the death of the cells involved
- d. can occur only if the cell contains single-stranded DNA
- e. refers to a cell that used to make country music but that now makes popular music
- f. both a and b are correct
- g. both c and d are correct

6. Which of the following human cells would have the greatest total amount of DNA in it?

- a. a somatic cell in the G1 phase of the cell cycle
- b. a sperm cell
- c. a daughter cell resulting from mitosis
- d. a cell entering prometaphase of mitosis
- e. a daughter cell resulting from meiosis I

7. Which of the following is/are ways that mitosis and meiosis are similar.

- a. both regularly allow for the possibility of crossing over
- b. both are preceded by duplication of the genetic material
- c. both result in the production of daughter cells that are genetically identical to one another
- d. both require the chromosomes to "condense" and to attach to the spindle
- e. only a and c are correct
- f. only b and d are correct

8. Which of the following is/are true of a non-dividing human somatic cell?

- a. it has 23 pairs of autosomes
- b. it has 22 pairs of autosomes and no sex chromosomes
- c. it has 22 pairs of autosomes and 1 pair of sex chromosomes
- d. it has 23 chromosomes, one member of each pair
- e. it has 45 pairs of autosomes and one pair of sex chromosomes

9. In eukaryotes, messenger RNA

- a. when first produced has only exons, and introns are added later
- b. when first produced has a 5' cap and a poly-A tail that have to be cleaved off by enzymes
- c. undergoes extensive processing but only *after* leaving the nucleus
- d. has its introns removed by spliceosomes which contain "snurps"
- e. both a and c are correct
- f. both b and d are correct

10. Which of the following would be the most logical thing for a cell to be making during the G2 phase of the cell cycle?

- a. DNA
- b. tubulin dimers
- c. enzymes required for DNA synthesis
- d. intermediate filaments
- e. massive amounts of protein for export

11. Which is/are true of the cell cycle?

- a. it is controlled in part by the concentration of cyclin
- b. it occurs spontaneously and once a cell enters G1 it automatically follows all the way through to M phase
- c. all cells continually divide
- d. the shortest phase of the cell cycle is the S phase because DNA polymerase works so fast
- e. it isn't of interest because it has no relevance to human health

12. How does asexual reproduction differ from sexual reproduction?

- a. it is much less fun
- b. asexual reproduction typically involves one parent and sexual reproduction involves two parents
- c. asexual reproduction can produce a clone of identical individuals whereas sexual reproduction does not
- d. asexual reproduction involves mitosis whereas sexual reproduction involves meiosis
- e. all of the above are correct

13. In dogs, the tendency to bark while running is a dominant trait (B) while remaining silent while running is a recessive trait (b). Erect ears is a dominant trait (E) while droopy ears is recessive (e). What phenotypic ratio is expected in the progeny of two erect-eared barkers who are heterozygous for both traits? Assume the two traits assort independently.

- a. 3:1
- b. 9:3:3:1
- c. 1:2:1
- d. 1:1

14. For the same cross described in the previous question, indicate the expected genotypic ratio of the progeny.

- a. 1:2:1
- b. 1:2:3:2:1
- c. 1:1:2:2:4:2:2:1:1
- d. there is too little information given to answer the question

15. In chickens, a crested head is produced by a dominant gene (C) and a plain head by a recessive gene (c). Suppose you had a chicken with a crested head and you wanted to know its genotype. Which of the following procedures would best enable you to answer this question?

- a. cross your unknown chicken with one with a plain head
- b. cross your unknown chicken with one with a crested head
- c. perform amniocentesis on the unknown chicken
- d. There is no need to do any crosses. Because your unknown chicken has a crest, it must have the genotype CC

16. A woman with type A blood marries a man with type B blood and they have a child with type O blood. She later marries a man with AB blood and tells her second husband that it is he who is actually the father of her child. Is she right?

- a. Possibly, because the second husband could have contributed an i allele
- b. no, because the second husband can not contribute an i allele
- c. yes, because her first husband could not possibly have fathered an O child
- d. yes, because AB fathers always have O children

17. In mice, black color (B) is dominant to white (b). At a different locus, a dominant allele (A) produces a band of yellow just below the tip of each hair in mice with black fur. This gives a frosted appearance known as agouti. Expression of the recessive allele (a) results in a solid coat color. If mice that are heterozygous at both loci are crossed, what is the expected phenotypic ratio of their offspring?

- a. 9 black: 3 agouti: 3 white: 1 albino
- b. 9 agouti: 3 black: 3 white: 1 albino
- c. 9 agouti: 3 black: 3 white: 1 albino
- d. 9 agouti: 3 black: 4 white
- e. 1 agouti: 2 black: 1 white

18. An aneuploid person is obviously female but her cells have two Barr bodies. What is the probable complement of sex chromosomes in this individual?

- a. XY
- b. XX
- c. XXY
- d. XXX
- e. XYY

19. In humans, color-blindness is a sex-linked recessive trait. Suppose a colorblind man marries a woman with normal color vision, and they have a colorblind son. Which of the following choices is correct?

- a. the son inherited the trait solely from his father
- b. the son inherited the trait solely from his mother
- c. the son received one colorblind allele from each parent
- d. a mutation must have occurred in the father's sperm cells

20. Suppose you had two parents with the genotype AaBbCcDdEe. What would be the chance that these two parents would produce an offspring with the genotype AABBCCDDEE?

- a. $\frac{1}{4}$
- b. $\frac{1}{256}$
- c. $\frac{1}{512}$
- d. $\frac{1}{1024}$

21. Assume you are studying inheritance of flower color in sweet peas, and you cross a plant with the genotype PPCC (has purple flowers) with one that has the genotype ppcc (has white flowers). All the F1 progeny have purple flowers. When the F1 plants are crossed, a ratio of 9 purple flowered plants and 7 white flowered plants is obtained in the F2 generation. This is an example of

- a. polygenic inheritance
- b. multiple allelism
- c. epistasis
- d. sex linkage
- e. nondisjunction
- f. incomplete dominance

22. Which of the following statements is/are accurate about transcription and translation?

- a. in prokaryotes, transcription and translation of the same mRNA molecule can occur simultaneously
- b. in prokaryotes, translation of a particular mRNA molecule always comes before transcription
- c. in eukaryotes, the two processes are physically separated with one occurring in the nucleus and one in the cytoplasm
- d. tRNA is required for translation in eukaryotes but not in prokaryotes
- e. both a and c are correct
- f. both b and d are correct

23. Which of the following phases of the typical cell cycle is matched with the characteristic event that actually occurs during that phase?

- a. G1 phase – DNA replication
- b. S phase – the spindle is made
- c. G2 phase – the cell prepares to copy the DNA
- d. M phase – chromosomes are divided evenly to the daughter cells
- e. Cytokinesis – crossing over occurs

24. Which of the following accurately describes differences between transfer RNA (tRNA) and messenger RNA (mRNA)?

- a. a typical tRNA has many more nucleotides than a mRNA
- b. a typical tRNA is single stranded whereas mRNA is always double-stranded
- c. a typical tRNA is a linear molecule whereas a typical mRNA is extensively folded into a "cloverleaf" shape
- d. during translation, tRNA serves as an important "adaptor" molecule whereas mRNA provides the information needed to make a polypeptide
- e. all of the above are correct
- f. none of the above are correct

25. Which of the following is/are true of the genetic code?

- a. the code used by prokaryotes is totally different from the code used in eukaryotes
- b. it is a triplet code, meaning that a series of 3 particular bases is required to signify a particular amino acid
- c. only a small number of the 64 possible codons are used to specify amino acids
- d. each of the 64 different possible codons specifies a different and unique amino acid
- e. both a and c are correct
- f. both b and d are correct

26. Transcription

- a. requires a DNA template and the enzyme RNA polymerase
- b. takes place in the nucleus of eukaryotic cells
- c. has initiation, extension and termination stages
- d. always proceeds in the 5' to 3' direction
- e. all of the above are correct
- f. only a and b are correct

27. Suppose the following piece of **DNA** served as the template strand for transcription. What would be the sequence of amino acids eventually derived from it? Assume the whole sequence is transcribed. Hint: consult the genetic code provided and remember you are starting with DNA.

5' TCATGCGCTGCGGTGCAT 3'

- it is impossible to tell from the information given
- met - phe - leu - thr - pro
- met - his - arg - ser - ala
- ser - thr - arg - arg - his - val
- ser - arg - asp - glu - his
- met - his - tyr - cys - met

| | | Second base | | | | | |
|---|-----|--------------|-----|-----|------|-----|------|
| | | U | C | A | G | | |
| U | UUU | Phe | UCU | UAU | Tyr | UGU | Cys |
| | UUC | | UCC | UAC | | UGC | |
| | UUA | Leu | UCA | UAA | Stop | UGA | Stop |
| | UUG | | UCG | UAG | Stop | UGG | Trp |
| C | CUU | | CCU | CAU | His | CGU | |
| | CUC | Leu | CCC | CAC | | CGC | Arg |
| | CUA | | CCA | CAA | Gln | CGA | |
| | CUG | | CCG | CAG | | CGG | |
| A | AUU | | ACU | AAU | Asn | AGU | Ser |
| | AUC | Ile | ACC | AAC | | AGC | |
| | AUA | | ACA | AAA | Lys | AGA | Arg |
| | AUG | Met or start | ACG | AAG | | AGG | |
| G | GUU | | GCU | GAU | Asp | GGU | |
| | GUC | Val | GCC | GAC | | GGC | Gly |
| | GUA | | GCA | GAA | Glu | GGA | |
| | GUG | | GCG | GAG | | GGG | |

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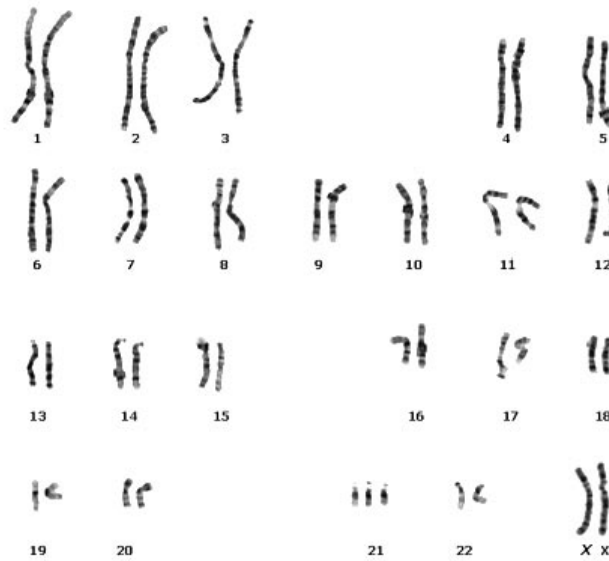
28. What would be the anticodon that would correspond to the second codon specified by the messenger RNA transcribed from the DNA listed above.

- UAC
- CAG
- GUG
- UGC
- ACG
- GTG

29. Which of the following is/are true of translation?

- it requires mRNA, tRNA, ribosomes, and amino acids
- it proceeds in 3 recognizable steps: initiation, elongation, and termination
- it involves the formation of peptide bonds
- the growing polypeptide chain is held by tRNA molecules during the process
- all of the above are correct
- only a and c are correct

30. Which of the following phenomena are exemplified by the human karyotype (the array of chromosomes present in an individual) that you see below?



- a case of nondisjunction
- the person shown is a male
- the person shown would be normal as best as can be told
- the karyotype shown is for a gamete
- the karyotype shows evidence of a chromosomal inversion

Answers

- | | |
|-------|-------|
| 1. a | 16. b |
| 2. e | 17. d |
| 3. b | 18. d |
| 4. a | 19. b |
| 5. a | 20. d |
| 6. d | 21. c |
| 7. f | 22. e |
| 8. c | 23. d |
| 9. d | 24. d |
| 10. b | 25. b |
| 11. a | 26. e |
| 12. e | 27. c |
| 13. b | 28. c |
| 14. c | 29. e |
| 15. a | 30. a |