

Name\_\_\_\_\_

TA\_\_\_\_\_

# MCDB 1A FINAL EXAMINATION

## DECEMBER 15, 2007

Scantron instructions:

1. Use a #2 pencil to complete the form.
2. Write your name and fill in the appropriate bubbles.
3. Write your **perm. number in the ID number box and fill in the bubbles.**
4. Write the color of your test in the space underneath the I.D. number box.
5. Fill in the entire rectangle of the **best** answer.

Part I. Biochemistry:	Dr. Feinstein	Questions 1-17 (3 pts each)	51 points
Part II. Cell Biology:	Dr. Ayoub	Questions 18-42 (2 pts each)	50 points
Part III. Genetics	Dr. Christoffersen	Questions 43-92 (3pts each)	150 points
		Test Color	<u>1 point</u>
			252 points

---

## Part I. Biochemistry—Dr. Feinstein

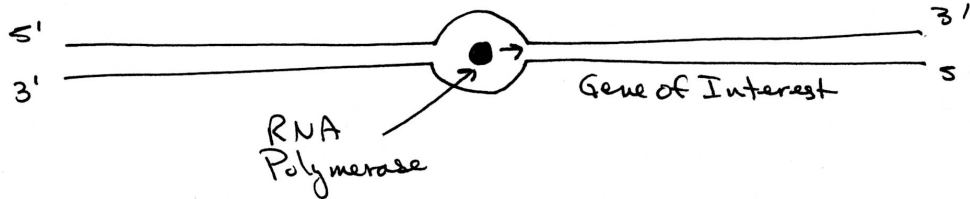
Questions 1 -17 (3 points each), 51 points total

Choose the one answer that best completes the statement or answers the question.

The GENETIC CODE and METABOLIC PATHWAYS are at the end of the Exam.

1. Consider a protein that is 345 amino acids long. When it folds up into its proper three-dimensional configuration, there is a hydrogen bond between the R groups of amino acid 47 and amino acid 222. Which level of protein structure best describes this interaction between amino acid 47 and amino acid 222?  
A. primary  
B. secondary  
☒ C. tertiary  
D. quaternary  
E. more information is necessary
2. Covalent bonds can be involved in how many different levels of protein structure (primary, secondary, tertiary, quaternary)?:  
A. 0  
B. 1  
C. 2  
☒ D. 3  
E. 4

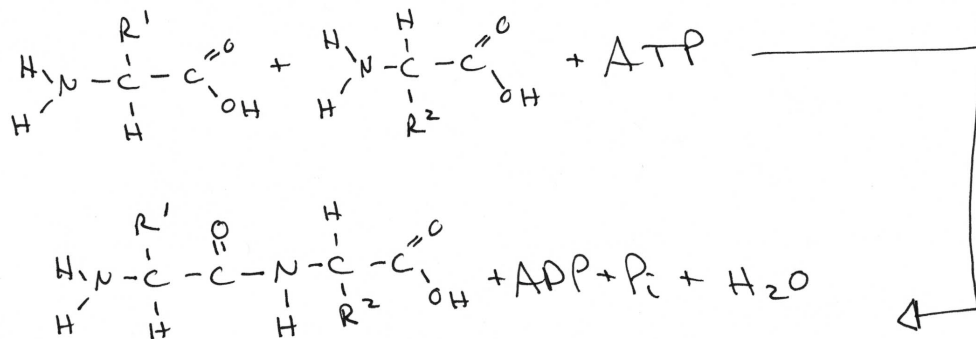
3. Which is a true statement?
- A. Okazaki fragments are found in the leading strand of DNA replication and are necessary because DNA polymerase can only synthesize DNA in the 3' to 5' direction.
  - B. Okazaki fragments are found in the leading strand of DNA replication and are necessary because DNA polymerase can only synthesize DNA in the 5' to 3' direction.
  - C. Okazaki fragments are found in the leading strand of DNA replication and are necessary because DNA polymerase can only synthesize DNA in the 3' to 5' direction.
  - ✓D. Okazaki fragments are found in the lagging strand of DNA replication and are necessary because DNA polymerase can only synthesize DNA in the 5' to 3' direction.
4. The  $\Delta G$  for the reaction:  $aa1 + aa2 \rightarrow aa1-aa2$  (peptide bond formation) is about +3 kcal/mole. What does this tell you about the reaction?
- A. It will proceed very quickly
  - B. It will proceed very slowly
  - C. It will proceed to near completion all by itself
  - ✓D. It will not proceed to near completion without input of additional energy
  - E. no conclusion can be made based solely on this information
5. Consider the segment of DNA drawn below. If the region of DNA encoding the gene of interest is located immediately to the right of the RNA polymerase, will it use the upper or lower strand of DNA for the template?



- A. upper strand of DNA
  - ✓B. lower strand of DNA
  - C. need more information to be sure
6. Imagine that you are a very hungry cell and suddenly get a big supply of citric acid (also known as citrate). How many ATPs can you generate from each citric acid molecule, including those derived from electron transport/oxidative phosphorylation?
- A. 9
  - B. 11
  - ✓C. 12
  - D. 13
  - E. some other number

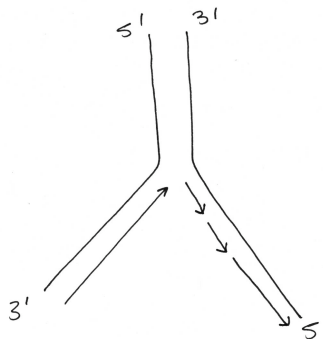
7. Imagine that you are an astronaut visiting Mars. You not only discover life on Mars, but you also discover that the general principles of macromolecular synthesis are very similar to those present on Earth. For example, Martian DNA has the same 4 nucleotides as on Earth, and replication and transcription are identical as on Earth. On the other hand, there are some differences at the protein level. Among the most interesting differences that you discover is that Martian proteins are much simpler than Earth proteins - they only use 11 amino acids! Based on the rationale for our genetic code, how many nucleotides would you hypothesize make up a codon on Mars?
- A. 1
  - ✓B. 2
  - C. 3
  - D. some other number
  - E. more data is necessary before a speculation could be made
8. Sickle cell anemia is caused by the substitution of a valine for a glutamic acid at position 6 of hemoglobin. Everything else in the primary structure of the protein is the same as the wild type. At some point way back in history, there must have been an event that caused this mutation. The most likely molecular explanation for this causative event is:
- A. substitution of one nucleotide for another during transcription
  - ✓B. substitution of one nucleotide for another during replication
  - C. deletion or addition of three nucleotides during transcription
  - D. deletion of or addition of three nucleotides during replication
  - E. there are too many plausible possibilities, so it is impossible to call one "most likely"
9. If the gene encoding cat insulin has 20% A, how much C will it have?
- A. 20%
  - B. 25%
  - ✓C. 30%
  - D. impossible to predict
  - E. some other number
10. Consider the gene encoding some protein of interest to you. How many of the following mutational events could possibly generate a nonsense mutation (i.e., an early chain termination event) in that gene?
- Deletion of six nucleotides composing codons 87 and 88
  - Substitution of a C for an A somewhere in the coding region for the protein
  - Substitution of an A for a C somewhere in the coding region for the protein
  - Deletion of 2 nucleotides somewhere in the coding region for the protein
- A. 1
  - ✓B. 2
  - C. 3
  - D. 4

11. Is this the proper chemistry for peptide bond formation?



- ☒ A. yes
- ☐ B. no

12. Is this a correct depiction of replication?



- ☒ A. yes
- ☐ B. no

13. What will be the third protein in the chain?

- A. alanine
- B. arginine
- C. phenylalanine
- ☒ D. lysine
- E. some other amino acid

14. Recall the Meselson-Stahl experiment in which cells were grown in N-14 and N-15 containing media. What was the most important question being addressed in this experiment?

- A. What is the genetic material?
- B. Is mRNA the intermediary between genetic material in the chromosomes and protein synthesis at the ribosomes?
- C. Is RNA synthesized from only one strand on the DNA?
- ☒ D. Do the two strands of DNA separate from one another during replication?

15. Consider the following mRNA molecule. When it gets translated into a protein, how many amino acids will there be in the resulting protein?

5' AACGAUGCAGAAAGUGACTTATUGUCATCATUAGTCCTACCGAUAGCT 3'

- A. 4
  - B. 6
  - C. 8
  - D. 10
  - ✓E. some other number
16. Imagine that you are studying a type of cell that normally makes a protein called "MaybeTheGiantsWillBeBetterNextYear." This protein should be 500 amino acids long. Upon investigation, however, you determine that the particular cells you are studying are not making the normal protein but are making a shorter protein (only 200 amino acids long) which is identical to "MaybeTheGiantsWillBeBetterNextYear" for the first 178 amino acids, but then the last 18 amino acids are completely different and then the protein ends. What kind of molecular defect(s) might readily explain these observations?
- ✓A. an insertion or deletion of 1 or two nucleotides after codon 178, causing a frameshift in the reading frame;
  - B. a substitution mutation of an A to a C at codon 179;
  - C. an error in RNA splicing at the codon 178-179 junction
  - D. two of the above are plausible explanations
  - E. none of the above are plausible explanations;
17. To keep the final from being too long, here's a free question. Just fill in "a" for 3 free points!
- ✓A. Thanks for the 3 points! I'll take 'em!
  - B. Forget it - I don't want the points!

---

## Part II. Cell Biology—Dr. Ayoub

Questions 18-42 (2 points each), 50 points total

Choose the one answer that best completes the statement or answers the question.

18. A benefit of the many steps involved in protein kinase cascades is that they allow for
- A. specificity of the response.
  - B. amplification of the signal.
  - C. information originally at the plasma membrane to be communicated to the nucleus.
  - D. Both A and C
  - ✓E. All of the above

19. Which of the following statements about homologous chromosome pairs is false?
- A. They undergo synapsis during meiosis I
  - B. They usually contain slightly different versions of the same genetic information.
  - C. They separate from each other during meiosis I.
  - ✓D. They come from only one of the individual's parents.
  - E. Each contains two sister chromatids at the beginning of meiosis I.
20. The microtubules of the mitotic spindle attach to a specialized structure in the centromere region of each chromosome called the
- A. aster
  - B. nucleosome.
  - C. equatorial plate.
  - ✓D. kinetochore..
  - E. centrosome.
21. The electric signal for a contraction passes rapidly from one cardiac muscle cell to the next by way of
- A. tight junctions.
  - B. desmosomes.
  - ✓C. gap junctions.
  - D. integral membrane proteins.
  - E. freeze-fractures.
22. The gray crescent
- A. is a homeobox gene.
  - ✓B. is observable in the frog zygote.
  - C. controls cellular affinities.
  - D. induces formation of the optic cup.
  - E. can be mimicked by retinoic acid.
23. The basic structure of chromatin has sometimes been referred to as beads on a string of DNA. These beads are called
- A. chromosomes.
  - B. chromatids.
  - C. supercoils.
  - D. interphases.
  - ✓E. nucleosomes.
24. One result of the movement of ions through ion channels is the creation of a membrane potential. The membrane potential is.....
- ✓A. a charge imbalance across the plasma membrane.
  - B. the difference in ion concentrations on either side of the plasma membrane.
  - C. the difference in ATP concentrations on either side of the plasma membrane.
  - D. the capacity for active transport.
  - E. the ability of macromolecules to recognize and adhere to one another.

25. Which of the following structures is (are) involved with the movement of organelles within a cell?
- A. Golgi apparatus
  - B. Endoplasmic reticulum
  - C. Mitochondrion
  - ✓D. Microfilaments
  - E. Intermediate filaments
26. The  $O_2$  gas produced during photosynthesis is derived from
- A.  $CO_2$ .
  - B. glucose.
  - ✓C. water.
  - D.  $CO$ .
  - E. bicarbonate ions.
27. Vitamin A is a relatively small, lipid-soluble molecule that can behave as a hormone. Based on what you have learned, which of the following would you predict about its receptor?
- A. It would be an ion channel receptor.
  - B. It would be a protein kinase receptor.
  - C. It would involve a G protein.
  - ✓D. It would not be connected to the plasma membrane.
  - E. It would not exist; vitamin A would not have a receptor.
28. A graph that plots the rate at which  $CO_2$  is converted to glucose versus the wavelength of light illuminating a leaf is called
- A. a Planck equation.
  - B. an absorption spectrum.
  - C. enzyme kinetics.
  - D. an electromagnetic spectrum.
  - ✓E. an action spectrum.
29. In both photosynthesis and respiration, protons are pumped across a membrane during
- ✓A. electron transport.
  - B. photolysis.
  - C.  $CO_2$  fixation.
  - D. reduction of  $O_2$ .
  - E. glycolysis.
30. Which of the following is an example of passive transport?
- ✓A. Facilitated diffusion
  - B. The sodium/potassium pump
  - C. Phagocytosis
  - D. Exocytosis
  - E. Pinocytosis

31. Which of the following are not specialized cell junctions?
- A. Gap junctions
  - B. Tight junctions
  - C. Desmosomes
  - ✓D. Cytoplasmic plaques
  - E. Both A and B
32. How does a nucleus in G2 differ from a nucleus in G1?
- ✓A. The G2 nucleus has double the amount of DNA as the G1 nucleus.
  - B. DNA synthesis occurs only in the G1 phase.
  - C. Inactive cells are arrested only in the G2 phase.
  - D. During G2, the cell prepares for S phase.
  - E. All of the above
33. During mitosis and meiosis the chromatin compacts. Which of the following processes takes place more easily because of this compaction?
- ✓A. The orderly distribution of genetic material to two new nuclei
  - B. The replication of the DNA
  - C. Exposing the genetic information on the DNA
  - D. The unwinding of DNA from around the histones
  - E. The disappearance of the nuclear membrane
34. The mesoderm
- A. is the result of cleavage to form a blastocyst
  - ✓B. lies between the endoderm and the ectoderm.
  - C. is found in blastula-stage embryos.
  - D. gives rise to the linings of the gut.
  - E. is made of cells surrounding the inner cell mass
35. Which of the following phases of the cell cycle is not part of interphase?
- ✓A. M
  - B. S
  - C. G1
  - D. G2
  - E. G0
36. The total DNA content of each daughter cell is reduced during meiosis because
- A. chromosomes do not replicate during the interphase preceding meiosis I.
  - ✓B. chromosomes do not replicate between meiosis I and II.
  - C. half of the chromosomes from each gamete are lost during fertilization.
  - D. sister chromatids separate during anaphase of meiosis I.
  - E. chromosome arms are lost during crossing over.
37. Accidents during meiosis that can result in trisomies and monosomies are called
- A. recombinations.
  - B. inversions.
  - C. reciprocal translocations.
  - ✓D. nondisjunctions.
  - E. acrocentricities.



38. Which of the following is **false**?
- A. Cells are bombarded with numerous signals, but they respond to only a few.
  - B. A cell's receptors determine whether or not the cell will respond to a signal.
  - C. Receptor proteins are very specific.
  - ✓D. Membrane-bound receptors are proteins, while cytosolic receptors are steroids.
  - E. None of the above are false
39. Osmosis moves water from a region of \_\_\_\_\_ to a region of \_\_\_\_\_.
- A. high concentration of dissolved material; low concentration of dissolved material
  - ✓B. low concentration of dissolved material; high concentration of dissolved material
  - C. hypertonic solution; hypotonic solution
  - D. negative osmotic potential; positive osmotic potential
  - E. low concentration of water; high concentration of water
40. In order for a G protein to play its part in moving events forward in a signal pathway,
- ✓A. GDP must be released and a GTP must occupy the nucleotide-binding site.
  - B. GTP must be released and a GDP must occupy the nucleotide-binding site.
  - C. cGMP must occupy the otherwise empty nucleotide-binding site.
  - D. cGMP must leave the otherwise occupied nucleotide-binding site.
  - E. None of the above
41. Genetically diverse offspring result from
- A. mitosis.
  - B. cloning.
  - ✓C. sexual reproduction.
  - D. cytokinesis.
  - E. fission.
42. How does the surface area-to-volume ratio of a 1-mm sphere compare to the surface area-to-volume ratio of a 3-mm sphere?
- A. The 3 mm sphere has a higher ratio.
  - B. The ratio increases as the sphere becomes larger.
  - C. Increasing the volume increases the ratio.
  - ✓D. The ratio decreases as the sphere becomes larger.
  - E. The ratio does not change.

---

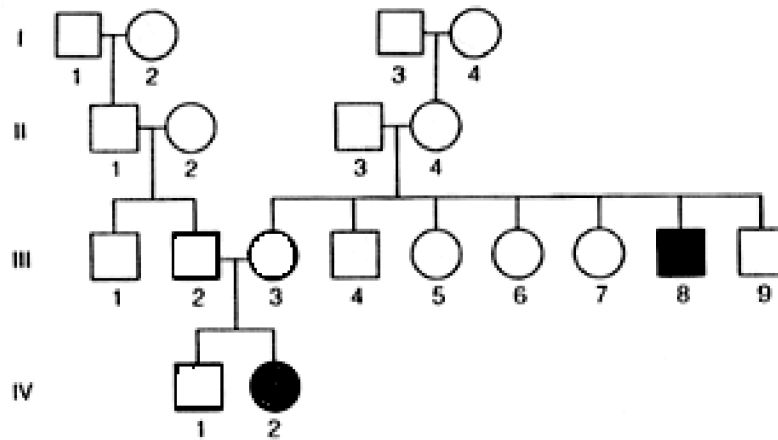
## Part III. Genetics—Dr. Christoffersen

Questions 43 -92 (3 points each); 150 points total

*Assume genes will follow Mendelian inheritance unless indicated.*

43. When a monohybrid is selfed, it will characteristically produce progeny phenotypes in the ratio
- A. 1:1
  - ✓B. 3:1
  - C. 9:3:3:1
  - D. 1:1:1:1
  - E. none of the above
44. The influenza virus and the HIV virus differ in that only the influenza virus can
- A. produce and use reverse transcriptase
  - B. use RNA as its genetic material
  - ✓C. use RNA as genetic information and mRNA without generating a DNA molecule
  - D. infect both horses and humans
  - E. All of the above
45. When influenza virus enters an animal cell, its \_\_\_\_\_ bind to proteins located on the surface of the cell membrane.
- A. CD4 proteins
  - B. phospholipids
  - ✓C. envelope glycoproteins
  - D. capsid proteins
  - E. envelope receptors
46. The probability of having a crossing-over event occurring between two genes is
- A. inversely proportional to the map distance between them.
  - B. dependent on whether the alleles are dominant or recessive.
  - C. unrelated to the map distance between two genes.
  - D. dependent on the proximity of the genes to the centromere
  - ✓E. none of the above
47. RFLP is a technique that
- A. has been developed to help researchers clone genes involved in genetic diseases.
  - B. is used to detect cancerous cells.
  - ✓C. allows researchers to detect differences in DNA sequences and serve as genetic markers.
  - D. stands for Research Flag Length Protein.
  - E. None of the above

48. Following pedigree is for a rare trait.



What is the probability that III-5 is heterozygous?

- A.  $1/4$
- B.  $1/3$
- C.  $1/2$
- ✓D.  $2/3$
- E. Can't be determined from this pedigree

49. The measured distance between genes *D* and *E* in a two point test cross is 50 map units. What does this mean in physical terms?

- A. *D* and *E* are on different pairs of chromosomes.
- B. *D* and *E* are linked and exactly 50 map units apart.
- C. *D* and *E* are linked and at least 50 map units apart.
- D. either *D* and *E* are on different pairs of chromosomes or *D* and *E* are linked and exactly 50 map units apart
- ✓E. either *D* and *E* are on different pairs of chromosomes or *D* and *E* are linked and at least 50 map units apart

50. The following recombination frequencies (%RF) were observed in dihybrid testcrosses between three different pairs of three genes.

<u>Gene Pair</u>	<u>Observed RF</u>
A-C	50%
B-C	30%
A-B	40%

What is the correct gene order of these three genes on the genetic map?

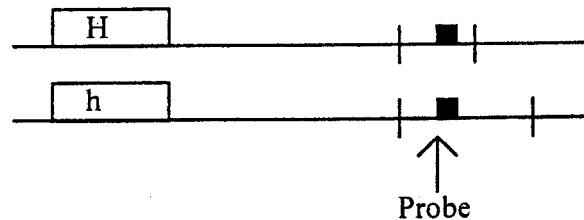
- A. C - B - A
- ✓B. A - C - B
- C. C - A - B
- D. The order can't be determined from the data presented

51. What fraction of offspring of the cross  $AabbDd \times aaBbdd$  are expected to be either recessive for all three traits or dominant for all three traits?
- A. 8/64
  - ✓B. 16/64
  - C. 24/64
  - D. 32/64
  - E. none of the above
52. A particular strain contains a mutation in the lac repressor protein so that it can not bind to the lac operator. Among the following growth conditions, predict the conditions and lac operon expression (answers A-D) which would **NOT** be true in this strain:
- A. - lactose -glucose = lac operon on
  - B. + lactose -glucose = lac operon on
  - C. - lactose +glucose = lac operon off
  - D. + lactose + glucose = lac operon off
  - ✓E. all of the above are correct
53. Dihybrid crosses helped reveal the Law of Independent Assortment.
- ✓A. True
  - B. False
54. The retrovirus HIV enters a host cell
- ✓A. by fusion of its envelope with the host's plasma membrane
  - B. by endocytosis
  - C. by vectors
  - D. through cytoplasmic connections between cells (plasmodesmata)
  - E. by phagocytosis
55. Suppose the  $A$  and  $B$  genes are on the same chromosome but separated by 5 map units. What fraction of the progeny from the cross  $AB/ab \times ab/ab$  would be phenotypically  $Ab$ ?
- ✓A. 2.5 %
  - B. 5 %
  - C. 10 %
  - D. 90 %
  - E. 95 %
56. Exons are
- A. spliced out of the original transcript.
  - ✓B. spliced together from the original transcript.
  - C. spliced to introns to form the final transcript.
  - D. much larger than introns.
  - E. larger than the original coding region.

57. The alleles of the *I* gene determine the ABO blood groups. The AB blood group is an example of interaction between a multiple allelic series with the following alleles:  $I^A$ ,  $I^B$  and  $i$  alleles.  
A woman with type A blood has a child with type O blood. She is unsure of who the father is among two young men she has known. One of them is type B and the other is type O. What can be concluded concerning the paternity of this child?
- A. Type B is the father
  - B. Type O is the father
  - ✓C. Either one could be the father
  - D. Neither one of the young men could be the father.
58. It is found that a certain enzyme is responsible for the catabolic breakdown of uracil. When cellular uracil levels are too high, this enzyme is produced in the cells. The gene for this enzyme is most likely regulated by \_\_\_\_\_ gene regulation.
- ✓A. inducible
  - B. positive
  - C. negative
  - D. repressible
  - E. positive-negative
59. After the HIV viral RNA enters the host cell, it is:
- ✓A. copied into DNA and integrated into the host chromosome.
  - B. copied into DNA in the cytoplasm
  - C. copied into RNA and packaged into virion particles in the nucleosome
  - D. copied into RNA and packaged into virion particles in the cytoplasm
  - E. none of the above
60. Suppose the A and B genes are on the same chromosome but separated by 40 map units. What fraction of the progeny from the cross  $AB/ab \times AB/ab$  would be phenotypically aB (genotype =  $aaB_$ )?
- A. 10%
  - ✓B. 16%
  - C. 20%
  - D. 40%
  - E. 50%
61. In garden peas, the tallness trait is dominant over the dwarf condition. Also, the round-seed trait is dominant over the wrinkled-seed trait. These genes are on separate chromosomes. Suppose that two plants that are heterozygous for both conditions are crossed and 320 offspring are produced. About how many will be dwarf with round seeds?
- A. 20
  - B. 30
  - C. 45
  - ✓D. 60
  - E. 90

62. A DNA sequence, which can be distant from the gene, stimulates transcription when bound by a protein. This sequence is called a(n)
- A. TATA box
  - B. operon
  - ✓C. enhancer
  - D. promoter
  - E. consensus sequence

63. The following diagram shows the genetic map of the region of a gene that has a dominant allele *H* which causes the lack of a coat in a Mexican hairless dogs. The DNA probe hybridizes to a segment of DNA that is known to be about 8 map units away from the *H/h* gene.



This hairless dog was bred with a dog with a normal coat who was homozygous for the long DNA fragment. Southern blot analysis of a newborn puppy indicated that their DNA had only long fragments. What is the likelihood that this puppy will develop a coat (not hairless)?

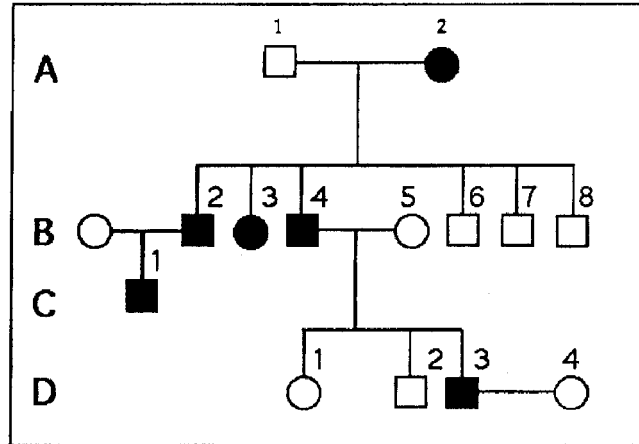
- A. 96%
  - ✓B. 92%
  - C. 8%
  - D. 4%
  - E. 100%
64. A human male carrying an allele for a trait on the X chromosome is:
- A. heterozygous.
  - B. homozygous.
  - ✓C. hemizygous.
  - D. monozygous.
  - E. holozygous.
65. Human gene therapy involves inserting a good copy of a gene into patients who are afflicted by recessive genetic diseases. One approach involves inserting the good gene into cultured cells isolated from the patient. This process is called\_\_\_\_\_ gene therapy.
- A. in vitro
  - B. in vivo
  - C. ex vitro
  - ✓D. ex vivo
  - E. C and D

66. Mental retardation by Fragile-X is caused by
- ☒ A. 200-2000 repeats of the sequence CGG in the promoter of the FMR1 gene.
  - B. an X chromosome that is easily broken.
  - C. the absence of an X chromosome.
  - D. a low number of the repeated sequence CGG in the promoter of the FMR1 gene.
  - E. a mutation on the Y chromosome that leaves the X chromosome more susceptible to mutations.
67. If a human sperm carrying a Y chromosome fertilizes an egg with two X chromosomes, how many Barr bodies will be apparent in the resulting offspring?
- A. none
  - ☒ B. one
  - C. two
  - D. cannot be determined
68. When a cross is made and a trait from a male parent disappears in the F1 generation, only to reappear in F2 males, the trait is probably:
- A. sex-linked dominant
  - B. epistatic
  - C. incompletely sex dominant
  - D. autosomal recessive
  - ☒ E. X-linked recessive
69. When a true-breeding albino ( $AAcc$ ) mouse strain is crossed with true-breeding black strain ( $aaCC$ ), the resulting offspring are all agouti. When these hybrid F1 agouti mice are allowed to interbreed, the next generation consists of agouti, black and albino mice in a ratio of 9 agouti: 3: black : 4 albino. If you then crossed the hybrid F1 agouti mice ( $AaCc$ ) with the true-breeding albino strain from above, what phenotypic ratio would be expected among the progeny?
- (Allele symbols:  $A$ =agouti;  $a$ =black;  $C$ = pigmented;  $c$  = albino)
- A. 1 black : 2 agouti : 1 albino
  - B. 1 black : 1 agouti
  - C. 3 agouti : 1 albino
  - ☒ D. 1 agouti : 1 albino
  - E. 1 agouti : 2 albino : 1 black
70. A particular strain contains a mutation in the CRP protein so that it always binds to the lac promoter independent of cAMP concentration. If a cell carrying this mutation was cultured in the different media listed below, which would prevent expression lac operon (Mark all that apply):
- ☒ A. - lactose, -glucose
  - B. + lactose, -glucose
  - ☒ C. - lactose, +glucose
  - D. + lactose, + glucose
  - E. none of the above.

71. Genes  $A/a$  and  $B/b$  are linked and known to be 30 map units apart. Individuals heterozygous for both of these genes (genotypes=  $Ab/aB$ ) were mated with each other. If there are 2000 offspring from this cross, how many of the offspring would you expect to show the  $ab$  phenotype combination?
- A. 300
  - B. 180
  - C. 60
  - ✓D. 45
  - E. none of the above
72. Calico cats are heterozygous for two coat color alleles, one for black and the other for orange. Their fur consists of patches of black and orange color. What causes this mosaic pattern of allele expression?
- ✓A. Each cell imprints an X-chromosome for inactivation and this is propagated through mitotic divisions forming a patch of cells all with the same choice of inactive chromosome.
  - B. Deletion of one allele or the other during early development causes hemizyosity in the coat color locus
  - C. Cross chromosome interference prevents one allele or the other from being expressed.
  - D. Segregation of the X chromosome among the skin cells so each cell patch has a different allele
  - E. none of the above
73. The genes  $A/a$  and  $B/b$  are linked with 24 map units between. The  $A/a$  and  $B/b$  alleles show simple dominance and recessiveness. Two parental strains of the following genotypes,  $AAbb$  and  $aaBB$  were crossed. The heterozygous offspring from these parental strains were testcrossed to a strain with the genotype  $aabb$ . If you had 1000 progeny from this testcross, how many would you expect to have the phenotype AB
- A. 900
  - B. 760
  - C. 380
  - D. 240
  - ✓E. 120
74. Which of the following F2 phenotypic ratios would indicate codominance?
- A. 1:1
  - B. 2:1
  - C. 3:1
  - ✓D. 1:2:1
  - E. 1:1:1
75. The technique of positional cloning can be used to study a disease as long as
- A. the disease has an autosomal recessive pattern of inheritance
  - B. the disease has an autosomal dominant pattern of inheritance
  - ✓C. the disease is characterized by polymorphic genetic markers
  - D. chromosomal deletions are associated with the disease
  - E. None of the above



76. Below is a pedigree chart for a family, some of whose members exhibit the dominant trait, premature white hair ( $W$ ) whereas the normal recessive trait ( $w$ ) allows for hair pigment deposition. Affected individuals, those with white hair, are indicated by a filled square or circle.



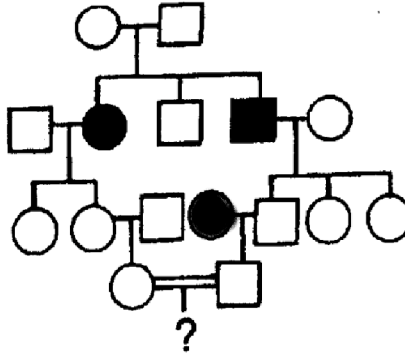
What is the genotype of individual D-1?

- A.  $WW$  only
  - B.  $Ww$  only
  - ✓C.  $ww$  only
  - D.  $WW$  or  $Ww$
  - E.  $ww$  or  $Ww$
77. An allele that expresses its phenotype when present in a single copy is termed:
- A. recessive
  - B. recombinant
  - ✓C. dominant
  - D. parental
  - E. independent
78. Mendel's law of segregation predicts the equal separation of alleles into gametes during meiosis. What aspect of meiosis causes the 1:1 allele ratio among the products of meiosis?
- A. Equalization of centromeres in Prophase II
  - B. Pairing of nonsister chromatids during metaphase II
  - C. Equal pairing of sister chromatids during anaphase I
  - ✓D. The separation of homologous chromosomes during Meiosis I
  - E. The equal chance of crossing over between alleles during Prophase I
79. In eukaryotic cells, promoters are
- A. transcribed.
  - B. transcribed and translated.
  - ✓C. neither transcribed nor translated.
  - D. transcribed and then removed.
  - E. sequences of RNA that are spliced out.

80. High levels of cellular cAMP are the result of .....
- A. glucose but not lactose being available to the cell
  - B. both lactose and glucose are present
  - C. lactose from being metabolized in the presence of glucose
  - D. the repressor
  - ✓E. None of the above
81. When a virus infects a bacteria and inserts its genome into the host chromosome without causing the cell to burst open, this kind of viral life cycle is called
- A. virogenic
  - ✓B. lysogenic
  - C. replicative
  - D. lytic
  - E. none of the above
82. Assuming that two genes, *A* and *B* never recombine, what would be the phenotypic ratio produced in the F<sub>2</sub> generation if the original parental generation had the following genotypes: *AAbb* x *aaBB*?
- A. 1*AB*: 1*Ab*: 1*aB*: 1*ab*
  - B. 9*AB*: 3*Ab*: 3*aB*: 1*ab*
  - C. 3*AB*:1*ab*
  - D. 1*Ab*: 2*ab*: 1*aB*
  - ✓E. none of the above
83. A rare dominant trait which is exhibited in men, is transmitted to all their sons and none of their daughter. The gene for this trait is carried on
- A. the X chromosome
  - B. an autosome
  - ✓C. the Y chromosome
  - D. a cytoplasmic factor
  - E. none of the above
84. Nondisjunction in a male can led to an XXX offspring when it occurs at
- A. the first meiotic division,
  - ✓B. the second meiotic division
  - C. either the first or second meiotic division
  - D. the mitotic phase of spermatogenesis
  - E. none of the above, XXX individuals can only arise due to nondisjunction in females.
85. Suppose that in plants, smooth seeds (*S*) are dominant to wrinkled seeds (*s*) and tall plants (*T*) are dominant to short plants (*t*). A tall plant with smooth seeds was backcrossed to a parent that was short and wrinkled. What proportion of the progeny is expected to be homozygous for short and wrinkled?
- A. 1/2
  - ✓B. 1/4
  - C. 1/8
  - D. 1/16
  - E. 0

86. If you are a female, the X chromosome that you inherited from your father contains genes derived from:
- ☒ A. your paternal grandmother only.
  - B. your maternal grandmother only.
  - C. both your paternal and maternal grandfathers.
  - D. both your paternal grandfather and grandmother.
  - E. both your maternal grandfather and grandmother.
87. Congenital generalized hypertrichosis (CGH) causes extreme hairiness and in the past individuals with this syndrome have often wound up in circus side shows. CGH is now known to be caused by an X-linked dominant allele. If a man with CGH marries a normal woman, you would expect that
- ☒ A. his mother must also have CGH
  - B. his father must also have CGH
  - C. all of his sons will have CGH.
  - D. none of his daughters will have CGH
  - E. none of the above
88. When a particular dihybrid black, straight-winged fly was crossed to a double-recessive brown, curly-winged fly, the following progeny were observed:
- |                      |    |
|----------------------|----|
| black curly wing     | 66 |
| brown, straight wing | 74 |
| black, straight wing | 26 |
| brown, curly wing    | 34 |
- What is the map distance between the gene for body color and the gene for wing shape?
- A. 15 m.u.
  - ☒ B. 30 m.u.
  - C. 50 m.u.
  - D. 60 m.u.
  - E. none of the above
89. In the question above, black =  $B$ ; brown =  $b$ ; Straight wing =  $C$ ; curly wing =  $c$ . Which genotype best describes the dihybrid black, straight-winged fly?
- A.  $BBCC$
  - B.  $BC/bc$
  - ☒ C.  $Bc/bC$
  - D.  $BbCc$
  - E. none of the above
90. How many Barr bodies would you expect to find in an XXXX human female?
- A. 4
  - ☒ B. 3
  - C. 2
  - D. 1
  - E. 0

91. The following pedigree is for a rare autosomal recessive trait; it also shows a consanguineous marriage.



The probability that a child of IV- 1 and IV-2 will be affected is

- A. 1/8
  - B. 1/9
  - C. 1/16
  - ✓D. 1/64
  - E. none of the above
92. Hereditary fructose intolerance is a liver enzyme deficiency which inherited as an autosomal recessive trait. Affected individuals can not digest fruit sugar. When afflicted infants eat fruit it causes vomiting, liver impairment, and weight loss. A man whose aunt has fructose intolerance and a woman whose maternal grandmother also suffered from the same trait, marry and are considering having children. What is the probability that their first child will also have fructose intolerance?
- A. 1/16
  - ✓B. 1/18
  - C. 1/24
  - D. 1/36
  - E. 1/64
93. The color of your exam is (worth 1 point)
- A. Yellow
  - B. White

End of Exam!

Please Return your scantron and exam to your TA.

If you don't have a TA, return your scantron and exam to Dr. Bush

You can pick up your exam after the first week of class of the Winter Quarter 2005

Scores will be posted on the course web site after Dec. 19

Lab books for MCDB1BL/ EEMB2L for the Winter Quarter will be on sale at AS Notes in the UCEN after the first the Year.

## Happy Holidays and safe New Years!