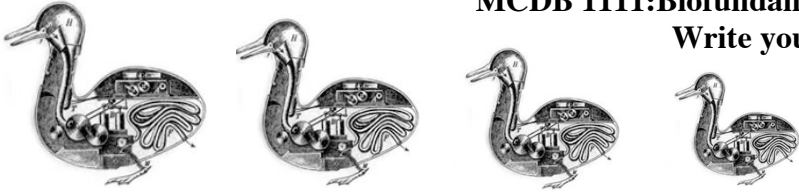


MCDB 1111: Biofundamentals '07 Final and IKIN Exams  
Write your name on the back of the last page



**Mostly multiple choice**  
(15 questions, each worth a maximum of 4 points): If you pick

- A, B, or C and you are correct, you get +4 pts
- A, B, or C and you are wrong, you get -2 pts
- A or B, B or C, or A or C and one is correct, you get +2 pts
- A or B, B or C, or A or C and neither is correct, you get -1 pt
- If you are aware that you do not know ("no idea"), you get +1 point.
- If your answer requires a written response, and your answer does not make sense, you may receive -1 point.

On the "I know it now!" (IKIN!) exams, there is no "no idea" option. If you take an IKIN exam (each are six questions/24 points), you must answer all of the questions - unanswered questions will be -1 point.  
**If you are taking one or more IKIN exams, you must check here, or we will not grade it!**

I am taking a I KNOW IT NOW! exam  
**Midterm 1**  **Midterm 2**  **Midterm 3**

**1. In your studies (in the mutation lab) and in Luria and Delbruck's work, it was concluded that the presence of phage ....**

- A. selected phage-resistant bacteria already present in the population.
- B. induced the appearance of mutations that lead to phage resistance.
- C. induced an immune reaction, leading to resistance to phage infection.
- A or B  B or C  A or C  no idea
- This question cannot be answered unless I know \_\_\_\_\_  
\_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_  
\_\_\_\_\_

**2. In most bacteria, there is a single origin of DNA replication. You introduce a mutation that removes this sequence - the most likely effect of such a mutation is that DNA replication ...**

- A. begins at another site, and the cell divides more or less normally.
- B. begins at multiple sites, and is aberrant.
- C. does not begin.
- A or B  B or C  A or C  no idea  This question cannot be answered unless I know \_\_\_\_\_  
\_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_  
\_\_\_\_\_

**3. With regards to question 2; there are mutations in other genes that could mimic the loss of the origin of replication; one such mutation would be in a gene that encodes ...**

- A. a protein that binds to DNA.
- B. a protein that binds specifically to the origin sequence.
- C. a tRNA.
- A or B    B or C    A or C    no idea
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**4. During mitotic cell division in eukaryotes, a cell produces two daughters that have the same chromosome number as itself. In meiosis, the number of chromosomes in the cells produced is ....**

- A. unchanged
- B. increased by 2-fold
- C. decreased by 2-fold
- A or B    B or C    A or C    no idea
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**5. Organisms of the same species differ genetically because ....**

- A. they contain different genes
- B. they contain different alleles
- C. their genes are organized differently on their chromosomes
- A or B    B or C    A or C    no idea
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**6. Consider two different mutation, one (mutation A) disrupts the production of a transcription factor, while the other (mutation B) disrupts a transcription factor binding site in the regulatory region of a gene. Which is likely to produce the more sever phenotype?**

- A. mutation A    B. mutation B
- C. no reason to pick one over the other
- A or B    B or C    A or C    no idea
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**7. In a classic experiment, performed by David Prescott of MCDB, part of amoebas' cytoplasm was repeatedly removed; the effect was to block cell division. The positive control for this experiment was to ...**

- A. to examine the behavior of unmanipulated cells.
- B. determine whether the manipulated cell would divide if left alone.
- C. cut the cell, but put the pieces back together again.
- A or B    B or C    A or C       no idea
- This question cannot be answered unless I know \_\_\_\_\_

I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

**8. Consider the cellular slime mold *Dictyostelium*; how is it possible that natural selection could lead to the organism's "communal behavior" in which individual cells aggregate, but only a small number go on to produce offspring?**

- A. In the real world, the cells involved are related and willing to sacrifice themselves
- B. This behavior would increase the chance that a cell, or its close relatives, will survive; "selfish" cells would be more likely to perish
- C. This is an example of trait that appeared due to a process like a founder effect or genetic drift.
- A or B    B or C    A or C       no idea
- This question cannot be answered unless I know \_\_\_\_\_

I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

**EXTRA CREDIT: 2 Pts - What type of mutation would lead to cellular behavior that would "cheat" the rest of the cells in the population?** \_\_\_\_\_

**9. In an asexual organism, a mutation occurs and leads to a harmful, but not lethal phenotype. Ten generations after the original mutation occurred, you find that organisms with this original mutation are present, but at a very low frequency. You take a (much deserved) vacation and when you return, ~ 200 generations later, you find that organisms with the original mutation account for more than 98% of the population. Which is most likely to explain this observation.**

- A. the original mutation mutated back to wild type
- B. the original mutant strain went extinct; the organisms you found on your return were derived from a new mutation
- C. new mutations occurred that enhanced the ability of the organisms to compete.
- A or B    B or C    A or C       no idea
- This question cannot be answered unless I know \_\_\_\_\_

I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

**10. You began as fertilized egg (before that, you were not you). Since that point, you developed as a clone (no offence intended, but it is true). Which process was not involved in the development of your body...**

- A. DNA replication     B. mitosis     C. meiosis
- A or B     B or C     A or C     no idea
- This question cannot be answered unless I know \_\_\_\_\_
  
- I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

**11. Different version of a gene (alleles) can differ in a number of ways. What is the likely effect of a change in the regulatory region of a gene?**

- A. changes in where, when and how much of a gene product is produced
- B. changes in the structure of the gene product
- C. changes in the stability of the gene product
- A or B     B or C     A or C     no idea
- This question cannot be answered unless I know \_\_\_\_\_
  
- I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

**12. Recently, it has become possible to take the nucleus of a differentiated cell, like a cell lining the gut, and use it to generate a new organism. This type of experiment indicates that ....**

- A. no genetic information was lost during the process that produced the gut cell
- B. genetic information in the egg cytoplasm is added to that present in gut cell nucleus
- C. the genetic information required to form an embryo is located in the egg's cytoplasm
- A or B     B or C     A or C     no idea
- This question cannot be answered unless I know \_\_\_\_\_
  
- I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

**13. There is a suggestion, based on the "collar" structure found in choanoflagellates (unicellular eukaryotes) and some of cells found in sponges (multicellular eukaryotes) that choanoflagellates are the group of unicellular eukaryotes most closely related to sponges in particular, and multicellular animals in general. This is an argument that assumes that the collar structure in both choanoflagellates and sponge cells are ...**

- A. analogous
- B. homologous
- C. different structures with different functions
- A or B     B or C     A or C     no idea
- This question cannot be answered unless I know \_\_\_\_\_
  
- I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

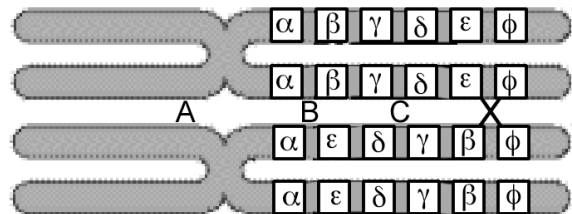


**14. Following the division of a stem cell, one cell becomes different from the other. This is must be due to ...**

- A. random chance
- B. intracellular or extracellular asymmetries
- C. differences in which genes each cell inherited
- A or B    B or C    A or C    no idea
- This question cannot be answered unless I know \_\_\_\_\_

I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

**15. Consider a sexual organism in which the maternal copy of chromosome 4 (shown) has an inversion compared to the paternal homolog. During meiosis, there was a crossing-over event, marked by the "X". Where would a second crossing-over event lead to the loss of genetic information in one of the gametes?**



- A.                       B.                       C.
- A or B    B or C    A or C                       no idea
- This question cannot be answered unless I know \_\_\_\_\_

I am picking \_\_\_\_ because I am assuming \_\_\_\_\_

The "I KNOW IT NOW!" EXAM #1 (6 questions worth 24 points)

**NOTE: Some questions may have more than one correct answer; pick "and/or" and explain.**

**1. The importance of natural selection in understanding biological systems is that it ...**

- A. provides a mechanism that circumvents the laws of thermodynamics.
- B. provides an explanation for homologies between organisms.
- C. explains why human beings exist
- A and/or B**     **B and/or C**     **A and/or C**
- This question cannot be answered unless I know

\_\_\_\_\_

\_\_\_\_\_



- I am picking \_\_\_ because I am assuming \_\_\_\_\_

**2. Pick and justify the scientifically correct statement:**

- A. Evolution always produces organisms of increasing complexity
- B. A primitive looking organism can be descended from more complex predecessors.
- C. Random process cannot lead to the high levels of information observed in living organisms.
- A and/or B**     **B and/or C**     **A and/or C**
- This question cannot be answered unless I know \_\_\_\_\_

- Because I am assuming \_\_\_\_\_

**3. The importance of the Miller-Urey experiment was that it ....**

- A. proved that the conditions used were the same as those that existed on the early earth.
- B. demonstrated that many organic molecule could be synthesized under simple conditions.
- C. suggested that key organic molecules require cells to form.
- A and/or B**     **B and/or C**     **A and/or C**
- This question cannot be answered unless I know \_\_\_\_\_

- I am picking \_\_\_ because I am assuming \_\_\_\_\_

**4. Assuming that aliens visited the earth once (and only once) at some random time during the last 4 billion years. What are the odds that they would find humans?**

- A. More than 85%
- B. Less than 50%
- C. Less than 1%
- A and/or B**     **B and/or C**     **A and/or C**
- This question cannot be answered unless I know \_\_\_\_\_

- I am picking \_\_\_ because I am assuming \_\_\_\_\_

**5. The appearance of lactose tolerance is due to mutations; some populations of human show high levels of lactose tolerance, other do not. This is evidence that ...**

- A. humans are still evolving
- B. lactose tolerance is the ancestral state of mammals
- C. human technologies can shape human evolution
- A and/or B     B and/or C     A and/or C
- This question cannot be answered unless I know \_\_\_\_\_

I am picking \_\_\_ because I am assuming \_\_\_\_\_

Even more credit (2 pts): How would you tell whether the lactose tolerance in two human subpopulations was homologous or analogous? \_\_\_\_\_

**6. You are doing an experiment on acupuncture. A good negative control would be ...**

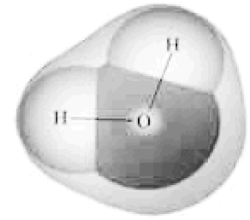
- A. not using needles
- B. placing the needles where they should not have an effect, but not telling the person that.
- C. using needles, an anesthetic, and not allowing the person to see whether the needle had been inserted or not
- A and/or B     B and/or C     A and/or C
- This question cannot be answered unless I know \_\_\_\_\_

I am picking \_\_\_ because I am assuming \_\_\_\_\_

THIS IS THE "I KNOW IT NOW!" EXAM #2 (6 questions worth 24 points).

1. Which is **not** a common feature of both photosynthesis and respiration?

- A. an electron transport chain
- B. a H<sup>+</sup>-dependent, ATP synthase
- C. the extraction of electrons from H<sub>2</sub>O
- A or B     B or C     A or C
- This question cannot be answered unless I know \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_



2. You are studying a cell with bacteriorhodopsin in its membrane. In the light, glucose starts to enter the cell. It would not be unreasonable to assume that the cell's membrane contains ...

- A. a H<sup>+</sup>/glucose symporter.
- B. a H<sup>+</sup>/glucose antiporter.
- C. the enzymes required to extract electrons from water.
- A or B     B or C     A or C
- This question cannot be answered unless I know \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_

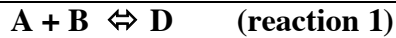
3. Oils are insoluble in water, while lipids form complex structures, such as micelles and bilayers. Why?

- A. Lipids have both hydrophilic and hydrophobic domains
- B. Lipids are shaped so that their van der Waals interactions favor micelle/bilayer formation
- C. Lipids have smaller hydrophobic domains than do oils
- A or B     B or C     A or C
- This question cannot be answered unless I know \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_

4. Consider bacterial cells growing in a dilute salt solution. You add an antibiotic that inhibits the assembly of new cell walls. What happens?

- A. Cell growth stops.
- B. Cells will continue to grow, but without a cell wall.
- C. Growing cells will swell and burst.
- A or B     B or C     A or C
- This question cannot be answered unless I know \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_

**5. Consider the reactions:**



(relax, read slowly, and take your time)



**All three reactions are catalyzed by enzymes, and so the system reaches equilibrium. What happens to the concentration of A if M is removed from the system?**

- A. it increases
- B. it decreases
- C. nothing
- A or B     B or C     A or C
- This question cannot be answered unless I know \_\_\_\_\_  
\_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_  
\_\_\_\_\_

**6. Increasing the temperature increases the reaction rates because**

- A. The energy of the "activation" state is reduced.
- B. A larger proportion of the molecules have enough energy to reach the "activation" state.
- C. The nature of the activation state of the reaction is altered.
- A or B     B or C     A or C
- This question cannot be answered unless I know \_\_\_\_\_  
\_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_  
\_\_\_\_\_

**THIS IS THE "I KNOW IT NOW!" EXAM #3 (6 questions worth 24 points)**

**NOTE: Some questions may have more than one correct answer; pick "and/or" and explain.**

**1. How does the hydrophobic effect most directly influence DNA structure?**

- A. It favors base stacking.
- B. It determines the specificity of base pairing.
- C. It mediates interactions with proteins.
- A and/or B    B and/or C    A and/or C
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**2. What would happen if mRNA transcription began randomly along DNA?**

- A. translation might begin at the wrong place
- B. polypeptides would be longer
- C. many abnormal polypeptides would be produced
- A and/or B    B and/or C    A and/or C
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**3. How do different tRNA differ from one another?**

- A. they have different anti-codons
- B. they interact differently with the enzymes that attach amino acids
- C. they interact differently with release factor
- A and/or B    B and/or C    A and/or C
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**4. Why is the R-group of the amino acid leucine [ -CH<sub>2</sub>-CH-CH<sub>3</sub> ] considered to be hydrophobic?**



- A. it is symmetrical
- B. C-H bonds are nonpolar
- C. C-H bonds are polar
- A and/or B    B and/or C    A and/or C
- This question cannot be answered unless I know \_\_\_\_\_
- \_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_
- \_\_\_\_\_

**5. A protein has a short half-life, that means....**

- A. it is rarely synthesized.
- B. it is rarely degraded.
- C. it is rapidly degraded.
- A and/or B    B and/or C    A and/or C
- This question cannot be answered unless I know \_\_\_\_\_  
\_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_  
\_\_\_\_\_

**6. Two transcription factors bind to overlapping DNA sequences present in the Nan-E gene; one acts positively, the other negatively. In response to a signal from outside the cell, the negatively acting transcription factor is inactivated. What do you expect to happen to the level of Nan-E RNA?**

- A. increase
- B. decrease
- C. it will not change
- A and/or B    B and/or C    A and/or C
- This question cannot be answered unless I know \_\_\_\_\_  
\_\_\_\_\_
- I am picking \_\_\_ because I am assuming \_\_\_\_\_  
\_\_\_\_\_