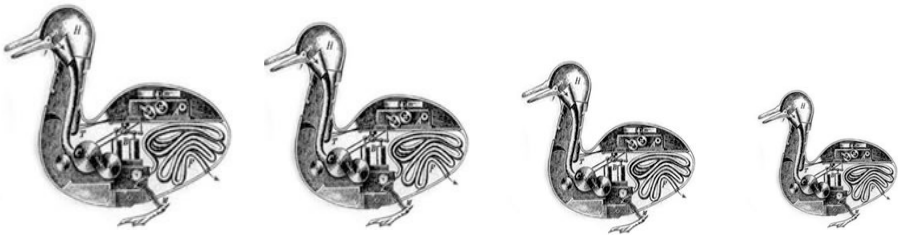
MCDB 1150-003 4th MidTerm, FINAL, and IKIN tests



NAME:

_____

Directions: You have to take, the fourth midterm and the cumulative final. There are 25 questions each worth 6 points (150 points total.) Most questions have two parts - multiple choice + explaining why a wrong answer is wrong**, although some are different.**

YOU HAVE THE OPTION OF TAKING one or more "I know it now!" (IKIN!) tests. If you want to take these questions, **you must check here, or we will not grade it! Each consist of 4 questions, worth 4 points each).**

I am taking:

❑ IKIN exam 1 (for midterm 1) ❑ IKIN exam 2 (for midterm 2) ❑ IKIN exam 3 (for midterm 3)

FINAL COURSE GRADES:

_____ % reading (possible 100) = _____ points

midterm 1 exam _____ + IKIN1 _____ = _____ points (out of 84)

midterm 2 exam _____ + IKIN2 _____ = _____ points (out of 105)

midterm 3 exam _____ + IKIN3 _____ = _____ points (out of 84)

midterm 4 + final exam _____

+ in class _____= _____ points (out of 150)

total possible points 528 (max) _____ total _____ percent ____ letter grade

FOURTH MIDTERM + CUMULATIVE FINAL EXAM:

1. If the coding regions of two genes overlapped,
❏ A. it is likely that the expression of one would not effect the expression of the other
❏ B. It is likely that both would be expressed at high levels at the same time
❏ C. a single mutation could change the primary sequence of both polypeptides.
❏ D. they would share a common regulatory sequence ❏ no idea
___ is wrong because (you might want to use a drawing to make your argument clear).

2. Consider two similar organisms, one an obligate parasite and the other free living. We would be justified to predict that …
❏ A. there are fewer genes in the free living organism
❏ B. there would be fewer genes in the parasite
❏ C. most of the genes in the parasite would physically overlap with one another
❏ D. there is no basis upon which to make predictions about gene number ❏ no idea
___ is wrong because

3. Assuming that you can determine (map) the sites of specific mutations along a DNA molecule, one approach to defining the regulatory region of a gene would be …
❏ A. to examine the effects of mutations on the structure of the polypeptide
❏ B. to determine the effects of mutations on the level of gene expression
❏ C. to define the effects of mutations on the organism's behavior
❏ D. mutations cannot be used to map a gene's regulatory sequence ❏ no idea
___ is wrong because

4. Consider a human somatic cell going through mitosis; after DNA replication is complete, but before chromosome segregate (M-phase) and the cell divides (cytokinesis), the cell contains...
❏ A. one copy of its genome
❏ B. two copies of its genome
❏ C. four complete copies of its genome
❏ D. half of the DNA found in the fertilized egg ❏ no idea
___ is wrong because

5. Consider the four cells produced when meiosis is complete; each cell contains...
❏ A. one copy of its genome
❏ B. two copies of its genome
❏ C. four complete copies of its genome
❏ D. the same amount of DNA as is found in a fertilized egg ❏ no idea
___ is wrong because

6. If genomes were static, and there was no gene or genome duplication…
❑ A. there would be no effect on evolution or speciation
❑ B. selection would be primarily disruptive
❑ C. conservative selection would act to limit the appearance of new activities
❑ D. mutations would not occur ❑ no idea
___ is wrong because

7. You are studying a large unicellular amoeba, these cells normally divide only after they reach a certain critical size. In a version of a classic experiment, you inject cytoplasm from one cell into another. Compared to uninjected cells, you would expect that the injected cell would …
❑ A. divide earlier
❑ B. divide later
❑ C. divide at the same time, but produce larger daughters
❑ D. never divide ❑ no idea
___ is wrong because

8. In mammals, adults are typically lactose intolerant. In humans, however, adult lactose tolerance is found in a number of populations. The mutation involved in adult lactose tolerance is likely to involve ….
❑ A. a defect in the process of X-inactivation
❑ B. a gene's coding sequence
❑ C. a mutation that occurs during an individual's embryonic development
❑ D. a gene's regulatory sequence ❑ no idea
___ is wrong because

9. Adult lactose tolerance is an example of a evolutionary adaptation based ...
❑ A. solely on chance
❑ B. a retained memory of how good milk tastes
❑ C. a selective advantaged associated with social organization and technology
❑ D. a conscious decision to drink milk ❑ no idea
___ is wrong because

10. To best decide whether adult lactose tolerance is an homologous or an analogous trait in different people, you would want to determine …
❑ A. whether their ancestors came from the same continent ❑ no idea
❑ B. whether their ancestors drank milk as adults
❑ C. whether all humans share a common ancestor
❑ D. the molecular nature of their alleles involved in adult lactose tolerance
___ is wrong because

11. In a social slime mold, why would individual cells give up their ability to reproduce to make a multicellular slug?

❏ A. They would not, as it contradicts evolutionary theory

❏ B. Because they are likely to be closely related to their neighbors; if any survive, they also (in a sense) survive.

❏ C. They recognize that this behavior at least gives some of them a chance to survive.

❏ D. suggests that each cell is making a conscious, self-sacrificing choice. ❏ no idea

___ is wrong because

12. Imagine that you remove a nucleus from a monkey skin cell and implant it into a human egg (after having removed the egg's nucleus). Assuming that embryonic development occurs, the resulting organism would ...

❏ A. look like a human, and if fertile produce human offspring

❏ B. look like a monkey, and if fertile produce monkey offspring

❏ C. look like a human / monkey hybrid and be sterile

❏ D. look like a human, but if fertile produce monkey offspring

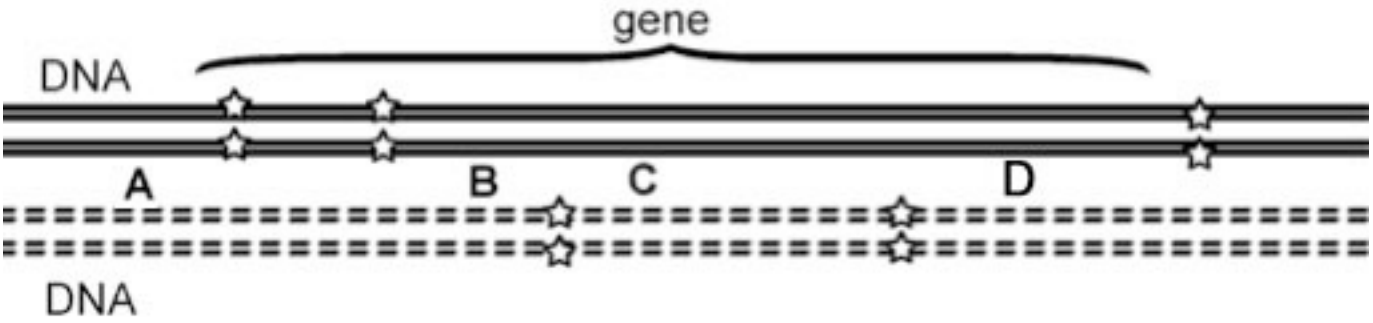
___ is wrong because

13. During meiosis, replicated homologous chromosomes pair (maternal are solid lines, paternal are dashed). The figure illustrates a single gene. The position of sequence differences between the maternal and paternal alleles are marked by the stars.

Part 1) Where would crossing-over events between maternal and paternal chromosomes not produce a new allele of the gene?

❏ A. ❏ B. ❏ C. ❏ D

❏ A or D ❏ B or C ❏ A or B



Part 2) Where would cross over events have to occur to produce an allele that had lost all of the starred (different) sites.

❏ A. ❏ B. ❏ C. ❏ D B and D

❏ A or D ❏ B or C ❏ A or B

14. Given what you know about DNA, what must happen during a crossing over event?

❑ A. A double-strand break in each DNA molecule
❑ B. A single strand break in DNA in one molecule
❑ C. Unwinding of both DNA molecules
❑ D. The replication of both DNA molecules ❑ no idea

___ is wrong because

15. From a scientific and medical perspective, why is it critical that a disease be unambiguously defined?

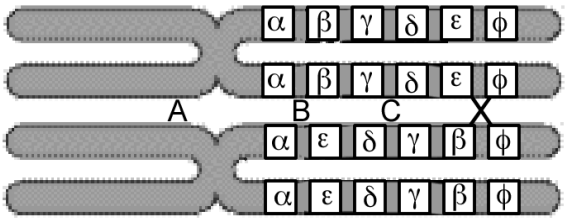
❑ A. so that drug companies can make a profit treating it
❑ B. so that it is possible to tell if different people have the same or different diseases
❑ C. so that the pathogen that causes the disease can be identified ❑ no idea
❑ D. while B is true, it is of greater practical importance to determine whether a specific treatment cures or does not cure a specific disease

___ is wrong because

16. In this picture, replicated maternal and paternal chromosomes during meiosis I are illustrated; the greek letters indicate complete genes (including both regulatory and coding regions). There is a crossing-over event at the site marked by an "X". What type of mutation would a crossing over event between a maternal and a paternal chromosome at point C produce?

❑ A. a non-sense mutation
❑ B. a mis-sense mutation
❑ C. duplicated genes
❑ D. deleted genes
❑ E. both duplications and deletions

___ is wrong because



17. When starved Dictyostelium cells aggregate and differentiate into stalk and spore cells. Spore cells survive, stalk cells die. Assume that there is a mutation that leads cells to form spores rather than stalk. Over time...

❑ A. more spores will be created, and the mutation will increase
❑ B. there will be a decrease in the ability of colonies to form stalks, which will influence their ability to escape hostile environments; the population (and the mutation) will become extinct.
❑ C. there will be no effect on the success of the population compared to "wild type" (non-mutant) populations
❑ D. evolutionary success will be determined solely on the basis of genetic drift.

___ is wrong because

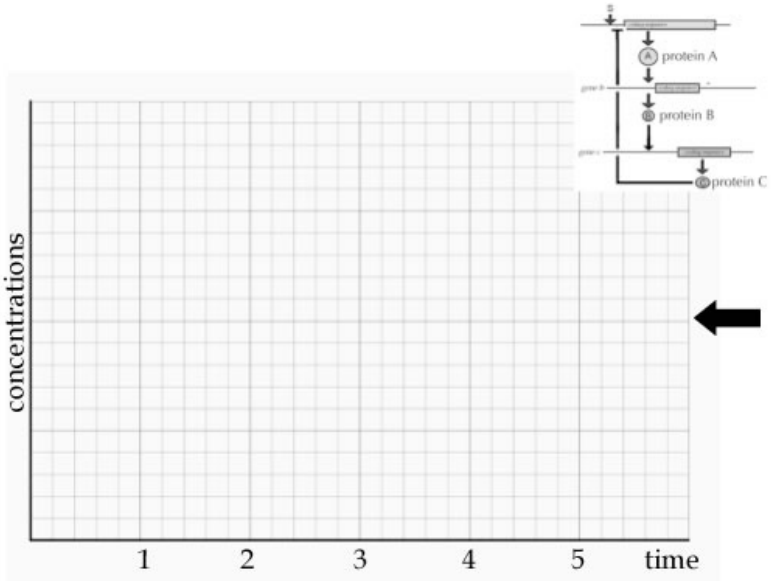
18. One defense that Dictyostelium cells could use against "selfish" mutations, would be
❏ A. to actively kill cells that behave differently from "normal"
❏ B. to actively exclude abnormal cells from the "slug"
❏ C. both A and B seem to be possible strategies, but they depend upon a mechanism to identify abnormal cells.
❏ D. There is no way to avoid this behavior, social cooperation always disappears due to selfish mutations ❏ no idea
___ is wrong because

19. Ignoring meiotic recombination, the probability that your daughter would inherit the exact same chromosome set you inherited from your mother would be higher if ….
❏ A. humans had many more than 23 chromosome pairs
❏ B. humans had many fewer than 23 chromosomes pairs
❏ C. chromosome number does not influence the calculation.
❏ D. each chromosome were longer ❏ no idea
___ is wrong because

20. 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
___ is wrong because

21. The process of fertilization leads to
❏ A. diploid cells forming a diploid embryo
❏ B. haploid cells forming a diploid cell
❏ C. haploid cells remaining haploid
❏ D. no change in chromosome number ❏ no idea
___ is wrong because

22. The cells in the picture are attached at one end to an extracellular surface. After cell division, the two daughter cells behave differently, why….
❏ A. because they contain different

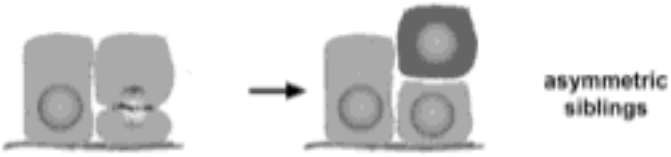


genes

❏ B. because they experience different environments

❏ C. they would be the same, since they are closely related

___ is wrong because



23.Assume that there is a mutation in the coding region of a gene. The encoded polypeptide is 449 amino acids long. The mutation inserts a single base pair into the DNA. In terms of polypeptide structure and function, which is true?

❏ A. the closer the mutation is to the start of the coding region the less severe its effect

❏ B. the effect of an insertion is independent of the site of the insertion

❏ C. the closer the mutation is to the end of the coding region the less severe its effect

❏ D. the mutation will influence the rate of transcription where ever it occurs ❏ no idea

___ is wrong because

24. For the GFO gene to be expressed, four different transcription factors must bind to its regulatory region. You analyze two different cell types (muscle and liver) and you find that i) all four transcription factors are present at similar levels in both but ii) GFO is actively expressed (transcribed) only in muscle. Which is unlikely to be a plausible explanation?

❏ A. differences in chromatin packaging between muscle and liver cells

❏ B. the presence of a negatively acting transcription factor in liver, but not muscle cells

❏ C. the presence of a protein that binds to and inactivates one of the transcription factors in liver cells

❏ D. somatic mutations that occurred specifically in muscle cells ❏ no idea

___ is wrong because

25. Here is a simple network. S is added at time 0 and remains at a constant concentration thereafter; when S is present, gene A is expressed (that is, transcribed)

When protein C appears and reaches a sufficient concentration (marked by the black arrow C completely inhibits the transcription of gene A

Draw the appearance of proteins A and C as a function of time. Assume that [C] reaches the inhibitory concentration at time 3.

How would your graph change if there were a mutation that blocked the regulation of gene C by protein B.

"I KNOW IT NOW!" EXAM #1 (16 total points 2+2)

1. Evolutionary outcomes (that is, the types of organisms and the details of molecular and cellular systems) is not predictable because
- ❑ A. the presence of sexual selection
- ❑ B. the random nature of mutations and genome dynamics
- ❑ C. the stochastic nature of genetic drift, founder effects, population bottlenecks
- ❑ D. both of the effects of both B and C
- ❑ E. they are predictable because biological systems are physiochemical systems

___ is wrong because

2. It is estimated that around 70,000 years ago, the number of humans dropped to about 10000 individuals scattered over regions of Africa. This event could have led to an increase in the frequency of non-adaptive alleles in modern humans, because ….
- ❑ A. the presence of non-adaptive traits is impossible according to evolutionary theory
- ❑ B. random events associated with population bottlenecks and genetic drift.
- ❑ C. excessive reliance on sexual selection and associated inappropriate behaviors
- ❑ D. subsequent social evolution has selected for non-adaptive traits

___ is wrong because

3. The importance of the Miller-Urey and Wohler's synthesis of urea is that …..
- ❑ A. they proved that the origin of life is a simple process
- ❑ B. there is nothing "unnatural" about the formation of organic molecules
- ❑ C. an intelligent actor (such as human or supernatural entity) is required for the origin of life

___ is wrong because

"I KNOW IT NOW!" EXAM #1 (16 total points 2+2)

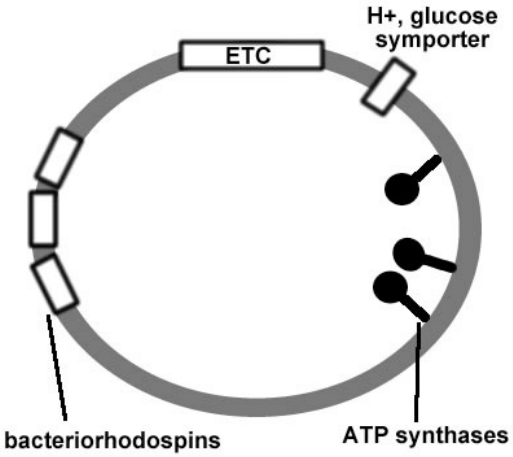
4. Among unicellular eukaryotes collared-flagella are found only in choanoflagellates. Because structurally similar choanocytes are found in sponges (the simplest metazoans) it has been argued that
- ❑ A. swimming structures are common in both unicellular and multicellular organisms
- ❑ B. human sperm cells once had a collar, like that found in choanoflagellates
- ❑ C. choanoflagellates are the closest unicelllular relative of metazoans
- ❑ D. we are descended from choanoflagellates

___ is wrong because

THIS IS THE "I KNOW IT NOW!" EXAM #2 (4 questions, 16 possible points)

1A. You are studying a cell with bacteriorhodopsin in its plasma membrane. The cell lives in a dilute glucose solution. You add a toxin that blocks the activity of the ATP synthase You find that …

- ❑ A. glucose import continues
- ❑ B. no H+ gradient forms
- ❑ C. ATP synthesis continues



1B. Now you remove the ATP synthase inhibitor and add an unregulated H+ channel. You find that …

- ❑ A. glucose import continues
- ❑ B. no H+ gradient forms
- ❑ C. ATP synthesis continues

2. The only molecules that are <u>not</u> attracted to one another are….

- ❑ A. those that have polarized bonds
- ❑ B. those that generate London Dispersion forces
- ❑ C. those that are hydrophobic
- ❑ D. ions of the same charge
- ❑ D. large molecules like proteins and nucleic acids

___ is wrong because

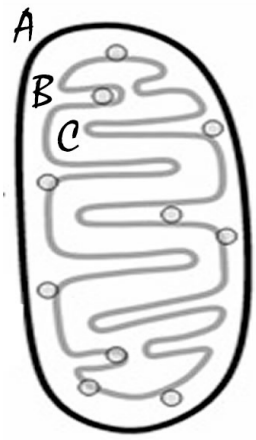
3. For reactions to be coupled, which is necessarily true?

- ❑ they must share a common reaction component
- ❑ they must all be thermodynamically favorable
- ❑ there must be active catalysts present
- ❑ their reaction rates must be influenced by temperature

___ is wrong because

4A Given the apparent endosymbiotic origin of mitochondria and chloroplasts you would predict that if DNA were present in these organelles (at it is) it would be located in compartment ..

❑ A ❑ B ❑ C ❑ D –somewhere else



4B Indicate where the H+ gradient associated with active respiration is located

- ❑ between A and B
- ❑ between B and C
- ❑ outside of the mitochondria
- ❑ on the plasma membrane

THIS IS THE "I KNOW IT NOW!" EXAM #3 (16 points total, 4 points each)

1. A protein is composed of 12 different polypeptides, which are the products of twelve distinct genes. To disrupt the function of the protein

❏ A. you would need mutations in all 12 genes
❏ B. you would need mutations in at least half of the genes
❏ C. a mutation in a single gene could disrupt the protein's function
❏ D. disrupting the protein's function would require a major genomic rearrangement

___ is wrong because

2. In a population of bacteria, one cell has a mutation that creates a non-sense suppressor. It can still make polypeptides at a normal rate, but if you were to look closely you would find. ….

❏ A. many missense mutations in the polypeptides made
❏ B. some polypeptides would be located in the wrong regions of the cell
❏ C. a number of polypeptides would be longer than they should be
❏ D. most polypeptides would be less stable than those in the "wild type" cells

3. Consider a gene that encodes a membrane protein; it is anchored to the membrane through its hydrophobic C-terminal tail domain. A non-sense mutation occurs "upstream" of the sequence that encodes this C-terminal domain. I would expect to find mutant protein ….

❏ A. anchored to the membrane
❏ B. secreted from the cell
❏ C. within the cytoplasm
❏ D. it would not be made

___ is wrong because

4. A mutation that inactivated the proof-reading function of the DNA-dependent, DNA polymerase would ….

❏ inhibit the synthesis of mRNA
❏ inhibit the synthesis of the DNA-dependent, DNA polymerase
❏ increase the rate of mutations associated with DNA replication
❏ decrease the efficiency of DNA repair of radiation induced mutations.

___ is wrong because