



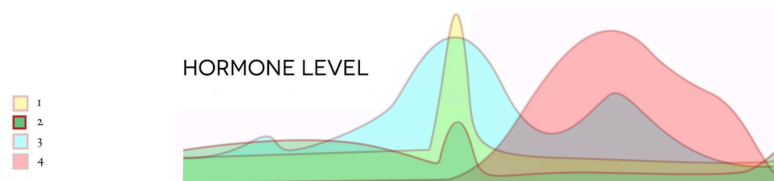
# 2025 Mitosisphere $p + q = 1$

## §1. Anatomy & Physiology, 12 questions

1. Isoprene, a talented biologist, wants to study the development of a newly discovered species called *J. iggle*. He engineers cells of the endoderm to express a foreign kanamycin resistance gene. If *J. iggle* develops similarly to humans, which of the following structures would be least expected to express the kanamycin resistance gene?

- A. Follicles of the thyroid gland
- B. White pulp of the spleen
- C. Hepatic lobules of the liver
- D. Acinar cells of the pancreas
- E. Epithelial lining of the terminal bronchioles

2. Which of the following is true regarding hormones of the menstrual cycle?



- A. In the first week of the menstrual cycle, substance 1 directly stimulates cells to secrete substance 3.
- B. At high concentrations, substance 3 inhibits the release of substance 1 and substance 2
- C. Substance 4 is synthesized from testosterone by the action of aromatase.
- D. Substance 1 is secreted from the hypothalamus and substance 2 is secreted from the anterior pituitary
- E. Substance 3 increases the expression of receptors for substance 4 in some of its target cells

3. Delphy has been locked in for USABO. In fact, he has read so many textbooks that he starts to wonder how his eyes work in the first place. Help Delphy determine the true statement below.
- A. Müller cells are glial cells that help photoreceptor cells maximize light absorption.
  - B. Nearsightedness can be corrected by convex lenses.
  - C. The fovea contains a high concentration of rods.
  - D. A rod with inactive rhodopsin molecules would not allow  $\text{Na}^+$  to enter it.
  - E. Retinal is a derivative of Vitamin C.
4. A Spanish student was doing a comedy skit when they suddenly fell off the third story and damaged their brain. Afterwards, they had difficulty comprehending language but were able to speak words fine. Which of the following areas were damaged during the fall, and which location correctly corresponds to this region?
- A. Wernicke's area, parietal lobe
  - B. Wernicke's area, temporal lobe
  - C. Wernicke's area, occipital lobe
  - D. Broca's area, parietal lobe
  - E. Broca's area, temporal lobe
5. The Among Us Impostor was lifting weights in the gym (unexpectedly). As he did so, he wondered which type of molecular mechanisms were at work in his musculoskeletal system. Which of the following is correct?
- A. Skeletal muscle: Dense bodies, which are mostly made of anchoring proteins, are important here.
  - B. Cardiac muscle: Desmosomes in intercalated disks are responsible for the synchronized contraction of the heart.
  - C. Skeletal muscle: Creatine phosphate is the primary source of energy for longer aerobic exercises here.
  - D. Skeletal muscle: Binding of ATP to myosin causes its disassociation from actin.
  - E. Smooth muscle: The DHP receptor is connected to the ryanodine receptor through foot proteins, thus releasing  $\text{Ca}^{2+}$  from the sarcoplasmic reticulum.
6. Which of the following would be MOST LIKELY to induce hypokalemia (low  $\text{K}^+$ ) in an adult human?
- A. Usage of triamterene, a diuretic that decreases sodium reabsorption in the cortical collecting duct.
  - B. Increased activity of  $\text{H}^+/\text{K}^+$  ATPases throughout the renal tubule in response to moderate ketoacidosis.
  - C. Administration of enalapril, an ACE inhibitor, due to hypertension.
  - D. Usage of furosemide, a diuretic that decreases sodium reabsorption in the loop of Henle.
  - E. Partial death of juxtaglomerular cells due to the ingestion of a toxin.

7. Which of the following incorrectly pairs an animal with their type of cleavage and blocks to polyspermy?

|               |            |                      |
|---------------|------------|----------------------|
| A. Seagull    | Slow block | Meroblastic cleavage |
| B. Sea urchin | Fast block | Holoblastic cleavage |
| C. Lizard     | Slow block | Meroblastic cleavage |
| D. Human      | Slow block | Holoblastic cleavage |
| E. Beetle     | Slow block | Holoblastic cleavage |

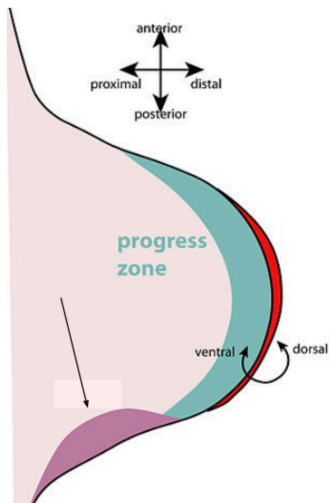
8. Uh oh! Isomerase has just been infected by the Brainrot virus, a newly discovered pathogenic species that integrates into the host genome before secreting Generation Alpha protein, which has not existed before this century. Which of the following parts of the immune system would be MOST effective against this foreign pathogen?

- A. Neutrophils
- B. B cells
- C. T cells
- D. Macrophages
- E. Complement system

9. Bio Nerd has not been eating properly due to his constant quest for USABO insular knowledge. During his yearly check up he discovered that his blood has trouble clotting due to a vitamin deficiency. Which of the following is Mr. Nerd most deficient in?

- A. Tocopherol
- B. Phylloquinone
- C. Niacin
- D. Calciferol
- E. Riboflavin

10. The region represented below in pink plays a large role in embryonic limb formation. Which option correctly identifies the name of the region and the morphogen it mainly produces?



- A. AER; Fibroblast Growth Factor
  - B. AER; Sonic Hedgehog
  - C. ZPA; Sonic Hedgehog
  - D. ZPA; Tissue Plasminogen Activator
  - E. TPA; Fibroblast Growth Factor
11. While Chloe the Cat was eating a blobfish composed of 100% fat, she began to wonder how the fish would be digested. The fat was mainly dissolved by \_\_\_\_ in the \_\_\_\_, then mainly absorbed by the \_\_\_\_ via the \_\_\_\_.
- A. Salivary lipase; duodenum; lacteals; large intestine
  - B. Gastric lipase; stomach; lacteals; jejunum/duodenum
  - C. Pancreatic lipase; duodenum; lacteals; jejunum/duodenum
  - D. Pancreatic lipase; duodenum; circulatory system; jejunum/duodenum
  - E. Gastric lipase; stomach; circulatory system; jejunum/duodenum

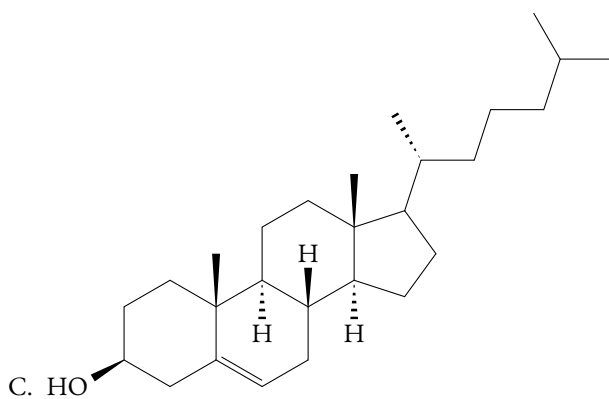
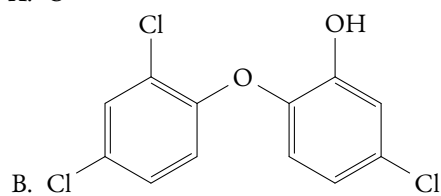
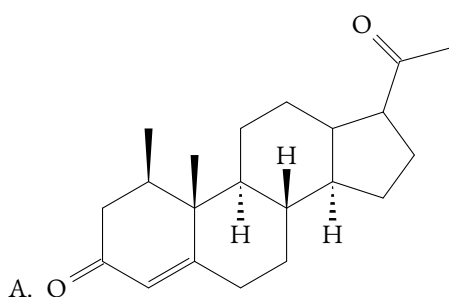
12. Nebulin, a neuroscience student, had trouble remembering information he learned in class. Desperate, he decided to do experiments on the neural mechanisms of *I. ntelligent*, a remarkable species with incredible memory capabilities. However, he soon discovered that *I. ntelligent*'s neural mechanisms were the same as his own, and that he simply has a skill issue. Given this, which of the following about the species is correct?
- A. If a loss-of-function genetic mutation is induced at the 11p15.5 locus, which codes for tyrosine hydroxylase, *I. ntelligent* will have trouble sleeping at night.
  - B. In *I. ntelligent*,  $\text{Na}^+$  influx through the NMDA receptor causes the closing of AMPA channels in presynaptic neurons, allowing for LTP to occur.
  - C. Atropine, a chemical that dilates pupils by inhibiting metabotropic ACh channels, has the opposite effect of muscarine on the *I. ntelligent* nervous system.
  - D. If a genetic mutation is induced that causes loss of function in 5-HT<sub>2a</sub> receptors, LSD's hallucinogenic effects on members of *I. ntelligent* will be amplified.
  - E. Sarin, a potent inhibitor of acetylcholinesterase, can cause fatal muscle relaxation if administered to members of *I. ntelligent*.

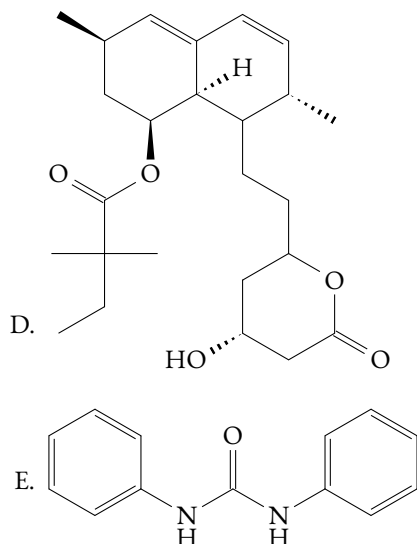
## §2. Cell & Molecular Biology, 10 questions

13. A researcher at the IGBC lab has just discovered a new class of antibodies, which he has named IgBC. After this hallmark discovery, he wants to test the protein interactions between subunits of the IgBC antibody and other proteins. Which of the following lab techniques would most effectively accomplish this?
- A. Sanger sequencing
  - B. FRET
  - C. Mass spectrometry
  - D. Western blotting
  - E. Electroporation

14. The endoplasmic reticulum plays roles in a wide range of biological functions. Knowing what you do about the endoplasmic reticulum, order the following cell types in the order you would expect to have the highest to lowest ratio of smooth ER to rough ER.
- I.  $\beta$ -Cell of the pancreas
  - II. Plasma cell
  - III. Hepatocyte
  - IV. Cardiac muscle cell
- A. III, IV, I, II
  - B. III, II, I, IV
  - C. IV, III, II, I
  - D. IV, III, I, II
  - E. IV, II, I, III
15. In *E. coli*, DNA replication at the replication fork travels at a rate of roughly 1000 nucleotides per second. Assuming that the *E. coli* genome is roughly  $4.6 \times 10^6$  bp long, in minutes, how long would you expect it to take for an *E. coli* cell to completely replicate its genetic material?
- A. 77 minutes
  - B. 38 minutes
  - C. 30 minutes
  - D. 24 minutes
  - E. 87 minutes
16. While eating their lunch of agar plates, Joy Cheesnut begins to wonder how horizontal gene transfer works between the delicious bacteria. Which of the following is INCORRECT regarding a method of horizontal gene transfer and its mechanism of action?
- A. Conjugation involves the transfer of a plasmid from a  $F^+$  cell to a  $F^-$  cell from the pili
  - B. Transformation involves the uptake of compatible free DNA from the environment
  - C. The lytic cycle does not involve integration of the viral genome into the host genome
  - D. Bacteria can retain multiple copies of a plasmid
  - E. Hfr cells are unable to conduct conjugation due to their  $F^+$  gene being integrated into the chromosome

17. While working in the Mitosphere laboratory, Wsgcuhladoo has discovered a new protein! The protein, which he has named the Skibidi transporter, is a chloride ion transporter. Which of the following is not a likely candidate for the sequence of the transmembrane portion of this protein?
- A. GEGTRASHYKTGKGRG
  - B. KGCTRHSGGAAAKRHGG
  - C. DADEAEDEDGDEGDEAA
  - D. KRHAAGVRHKKTKHRRR
  - E. GYRGYKYYFKCYRSAFAY
18. The newly discovered Rizz receptor was discovered on the surface of the nuclear membrane. Which of the following molecules would be the LEAST likely to target the receptor?





19. Which of the following about signal transduction mechanisms is INCORRECT?

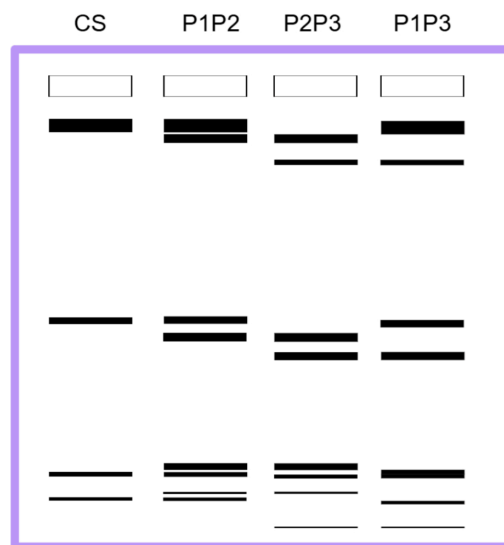
- A. PIP2 is converted to DAG and IP3 by phospholipase C
- B. DAG acts as a secondary messenger by activating protein kinase C and indirectly phosphorylating other proteins involved in signal transduction
- C. In receptor tyrosine kinases, phosphorylation of the intracellular tyrosine residues attracts signaling molecules
- D. IP3 acts by releasing additional calcium ions from the ER to act as secondary messengers
- E. Cortisol acts by activating cAMP-dependent signaling pathways to induce cell metabolism and division

20. Gain-of-function mutations in which of the following genes may result in cancerous growth?

- I. *TP53* (codes for p53)
- II. *HRAS* (codes for a Ras protein)
- III. *BRCA1*
- IV. *EGF1*

- A. I only
- B. II and III only
- C. II and IV only
- D. I, III, and IV only
- E. II, III, and IV only

21. Roughly 50% of cells' dry weight is made up of proteins. However, protein coding genes only account for roughly 2% of the genome. The other 98% is made up of genes whose end products are RNAs, termed ncRNAs. Which of the following choices incorrectly describes the function of a ncRNA?
- A. miRNAs: Binding to mRNAs, targeting them for degradation and inhibiting translation.
  - B. piRNAs: Protecting the germ cell line from transposable elements
  - C. snoRNAs: Processing and modifying rRNAs
  - D. rRNAs: forms the subunits of ribosomes
  - E. snRNAs: Scaffold for RNAs and proteins, complexing them together.
22. Detective Ken is investigating a crime scene. Nathaniel was murdered and there are currently 3 major suspects: Euna (P1), Charles (P2), and Connor (P3). Detective Ken was able to find a blood sample at the crime scene that was not Nathaniel's, he sent this sample to forensics, who purified the DNA from the sample and subjected it to multiple rounds of PCR. They then placed the sample in a solution with various restriction nucleases and stained the resulting DNA with ethidium bromide and ran it on a polyacrylamide gel to separate the fragments. The data can be found below:

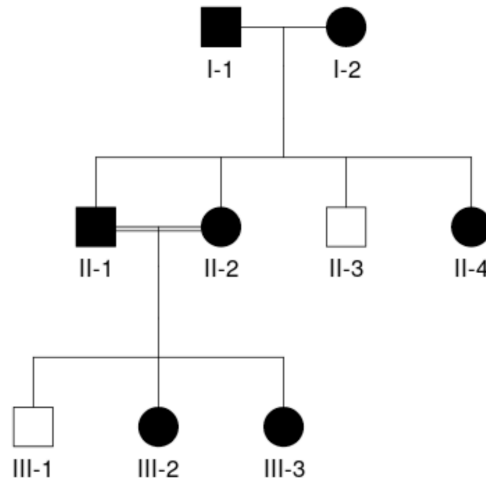


Forensics also ran the DNA from the 3 major suspects that Detective Ken was able to come up with, however somehow forensics mixed up the samples of blood and ended up with samples of different pairs of people as shown above. The different pairs were run adjacent to the sample found at the crime scene labeled "CS". Which of the following people murdered Nathaniel?

- A. Euna
- B. Charles
- C. Connor
- D. Either Euna or Charles, but it cannot be determined which one.
- E. Either Charles or Connor, but it cannot be determined which one.

### §3. Genetics, 10 questions

23. *DUBQ* is a gene that causes the overproduction of deubiquitinase, an enzyme that removes ubiquitin from proteins. A mutation in the *DUBQ* gene causes Ubiquitin syndrome, characterized by a severe deficiency in reading comprehension. Jiggle is curious why his sisters all have the disease but he doesn't, and wants to trace the history of the disease in his family. Based on the pedigree, what is the most likely genotype of I-2?



- A. aa
  - B. AA
  - C.  $X^A X^A$
  - D.  $X^A X^a$
  - E.  $X^a X^a$
24. Which of the following conditions is incorrectly stated as a requirement for Hardy-Weinberg Equilibrium?
- A. Large population to minimize the effects of genetic drift
  - B. No immigration/emigration to eliminate gene flow.
  - C. Random mating
  - D. Equal reproductive success for all genotypes
  - E. Allele frequencies remain relatively constant, but genotype frequencies fluctuate over generations

25. A rabbit lives in an environment where the gene that expresses fur color has two alleles, white and black. However, the trait shows incomplete dominance and the most common rabbit color is gray. What type of selection is likely occurring?
- A. Disruptive Selection
  - B. Directional Selection
  - C. Stabilizing Selection
  - D. Negative Selection
  - E. Artificial Selection
26. John Mingleford is breeding mice, studying three different traits. He conducts a trihybrid cross studying three different traits: fur color (b), ear size (e), and eye color (c). Assume black fur, large ears, and blue eyes are dominant to grey fur, small ears, and brown eyes. The results of the cross can be found below:

|     |     |
|-----|-----|
| bEC | 485 |
| Bec | 512 |
| bEc | 79  |
| beC | 97  |
| bec | 45  |
| BEC | 48  |
| bEc | 8   |
| BeC | 5   |

Which of the following choices correctly describes the distance between the genes for fur color, ear size, and eye color in map units?

- A. b(14.4)e(10.4)c
  - B. b(10.4)c(14.4)e
  - C. e(14.4)b(10.4)c
  - D. b(10.4)e(14.4)c
  - E. e(10.4)b(14.4)c
27. Which one of the following diseases is incorrectly matched with its mode of inheritance?
- A. Marfan Syndrome: Autosomal dominant inheritance
  - B. Hemophilia A: X-linked recessive inheritance
  - C. Tay-Sachs Disease: Autosomal recessive inheritance.
  - D. Rett Syndrome: Autosomal dominant inheritance
  - E. Albinism: Autosomal recessive inheritance

28. In an attempt to locate which chromosome the gene for a new novel genetic disorder, *Dhawandrome*, is on, a researcher decided to analyze the occurrence of different SNPs in three groups of people. Group 1 consisted of 500 women from Australia who were all healthy and showed no signs or history of *Dhawandrome*, Group 2 consisted of 500 men from the United States, who were all affected by *Dhawandrome*, and Group 3 consisted of a mix of 250 healthy, and 250 affected men and women from Chile. The data for different SNP occurrences among individuals can be found below:

|         | Ch3 B27182 T | Ch7 B482 T | Ch7 B91399 T | Ch9 B922744 T | Ch10 B67828 T | Ch14 B28982 T |
|---------|--------------|------------|--------------|---------------|---------------|---------------|
| Group 1 | 87%          | 58%        | 42%          | 12%           | 98%           | 13%           |
| Group 2 | 84%          | 56%        | 50%          | 94%           | 99%           | 17%           |
| Group 3 | 85%          | 52%        | 54%          | 44%           | 95%           | 11%           |

*Ch1 B2418 A* would correspond to an adenine nucleotide at base pair 2418 on chromosome 1; likewise, *ChX B1784 C* would correspond to a cytosine nucleotide at base pair 1784 on the X chromosome.

The percentage corresponds to the occurrence of that nucleotide at that position in each group. Which of the following statements about *Dhawandrome* is likely true based on the data?

- A. *Dhawandrome* is linked to a thymine SNP located on chromosome 10.
  - B. *Dhawandrome* is likely more prevalent in the Americas due to environmental factors.
  - C. *Dhawandrome* is linked to a thymine SNP located on chromosome 9.
  - D. *Dhawandrome* is more prevalent in group 2 due to a mix of SNPs on chromosomes 10 and 14.
  - E. *Dhawandrome* likely follows an X-linked recessive pattern of inheritance.
29. Identify all the NON-pleiotropic genes in the following list:
- I. *TUBA1A* ( $\alpha$ -Tubulin)
  - II. *XPB* (a DNA helicase)
  - III. *LCT* (lactase)
  - IV. *PAH* (phenylalanine hydroxylase)
- A. II only
  - B. III only
  - C. II, III
  - D. I, III, IV
  - E. I, II, III, IV

30. A trihybrid cross investigating three linked genes (A, B, and C) is performed between two *Drosophila* flies. By carefully counting the offspring, you determine the gene linkages to be A-B: 20%, B-C: 12%, and A-C: 28%. Which of the following COULD NOT have been the genotypes for the two parental flies?
- A.  $ABC/abc \times ABC/abc$
  - B.  $ABC/abc \times abc/abc$
  - C.  $ABC/abc \times abc/ABC$
  - D.  $ABC/ABC \times abc/abc$
  - E.  $ABC/abc \times aBC/abc$
31. Selena is starting a new business that sells genetically engineered fluorescent sea-horses, called *Selena-Horses*. They are all purple, and the idea is that you can customize the degree of pigmentation. There are 5 simple dominant/recessive genes for pigmentation. Each dominant allele corresponds to a graded increase in pigment production, each recessive allele corresponds to no pigment production. Assuming each dominant allele contributes an equal amount of pigment, how many possible *Selena-Horse* color phenotypes are there?
- A. 5
  - B. 11
  - C. 32
  - D. 64
  - E. 81
32. Xander is interested in the dragon color gene (g), which is a simple dominant/recessive gene. He is puzzled by its pattern of inheritance though. When Xander crossed a golden female (gg), with a wild-type, black male (GG), the offspring produced were all golden. However, when he crossed a true breeding black female with a true-breeding golden male, he observed all black offspring. When he crossed the all black F1 generation with the all golden F1 generation, he once again observed all black offspring! If Xander was to self-cross this F2 generation, what would be the expected ratio of black to golden offspring on the F3 generation?
- A. All black
  - B. 2:1
  - C. 3:1
  - D. 9:7
  - E. 15:1

#### §4. Plant Biology, 8 questions

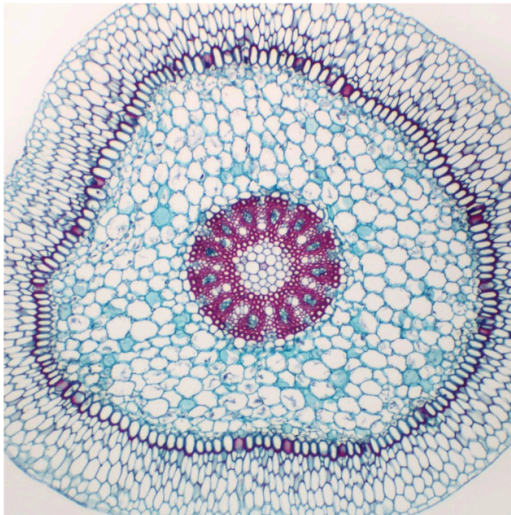
33. Which of the following plant hormones would be BEST for resistance against a herbivore?

- A. Salicylic Acid
- B. Absciscic Acid
- C. Jasmonic Acid
- D. Auxin
- E. Gibberellins

34. Which of the following INCORRECTLY pairs a plant cell type with its role and a plant it can be found in ?

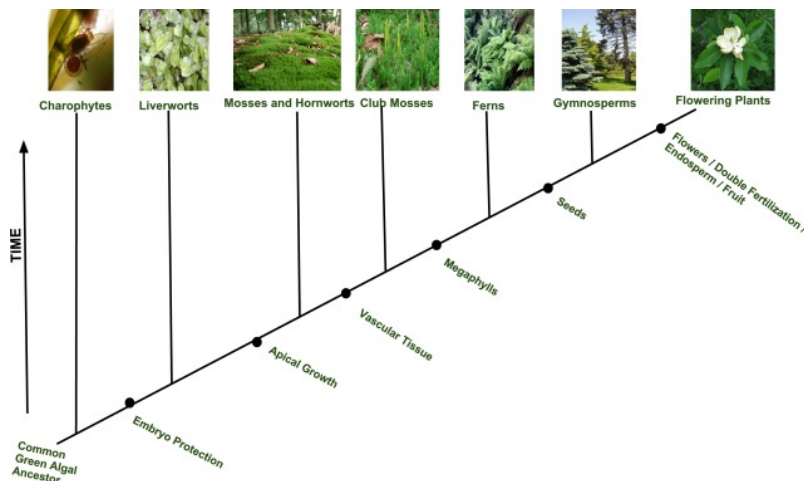
|                        |                                             |          |
|------------------------|---------------------------------------------|----------|
| A. Parenchyma          | Storage, wound healing                      | Monocots |
| B. Vessel elements     | Xylem conduction through perforation plates | Conifers |
| C. Sclerenchyma        | Heavily lignified, dead at maturity         | Monocots |
| D. Strassburger cells  | Companion cells to sieve cells              | Cycads   |
| E. Sieve tube elements | Phloem symplastic transport                 | Eudicots |

35. Which of the following choices best describes this plant cross section?



- A. Monocot root
- B. Angiosperm stem
- C. Eudicot root
- D. Monocot stem
- E. Eudicot stem

36. Which of the following conclusions can be drawn based on the image below?



- A. Double fertilization is an ancestral trait to all angiosperms
- B. Seeds are a derived trait to all plants
- C. Mosses and hornworts are direct descendants of liverworts
- D. The length of the line segment is an exact measurement of time since divergence
- E. Embryonic protection is a derived trait to land plants

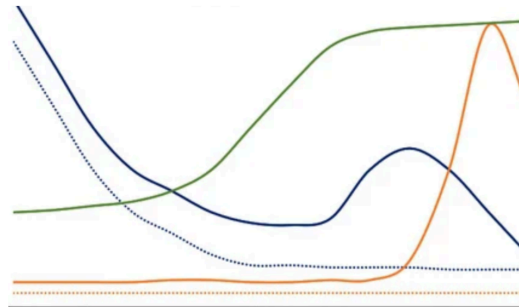
37. According to the ABCDE hypothesis of flower development, which of the following statements is NOT true?

- A. A plant expressing only genes A, B, E would develop only sepals and petals
- B. A plant exhibiting only genes A, B, D would not develop sepals or petals.
- C. A plant exhibiting only genes A, C, E would be unable to produce microspores
- D. A plant exhibiting genes B, C, D, E would be unable to produce megaspores
- E. A plant exhibiting genes A, B, E would be unable to produce megaspores

38. Which of the following statements regarding plant tissue is NOT true?

- A. Most parenchyma, sclerenchyma, and collenchyma are derived from the ground meristem.
- B. Fibers' cell walls are rigid due to the presence of lignin, while collenchymas are pliable due to the presence of pectin.
- C. In woody plants the epidermis is usually replaced by the periderm.
- D. Sclerenchyma is dead at functional maturity, while parenchyma and collenchyma are not.
- E. Sclerenchyma occurs as horizontal "rays" in the secondary vascular tissue.

39. Richard lives on a farm and is researching fruit development and the physiological controls of the plant that occur during this time. He is also interested in the difference between climacteric fruits and nonclimacteric fruits. (Climacteric fruits may continue to ripen after being harvested). In order to conduct his study, Richard monitors several different variables regarding his fruits development up until the day of harvest. The data can be found below:



Which of the following statements correctly determines what the dotted lines likely refer to, as well as what the orange and blue lines are measuring respectively?

- A. Dotted: Climacteric, Orange: Ethylene, Blue: Respiration rate
  - B. Dotted: Climacteric, Orange: Ethylene, Blue: Photosynthesis rate
  - C. Dotted: Climacteric, Orange: Brassinosteroid, Blue: Respiration rate
  - D. Dotted: Non-climacteric, Orange: Ethylene, Blue: Respiration rate
  - E. Dotted: Non-climacteric, Orange: Brassinosteroid, Blue: Photosynthesis rate
40. Which of the following incorrectly matches a fruit with its type?
- A. Apple; Simple fruit
  - B. Raspberry; Aggregate fruit
  - C. Peanut; Simple fruit
  - D. Fig; Multiple fruit
  - E. Pomegranate; Multiple fruit

## §5. Ethology, 3 questions

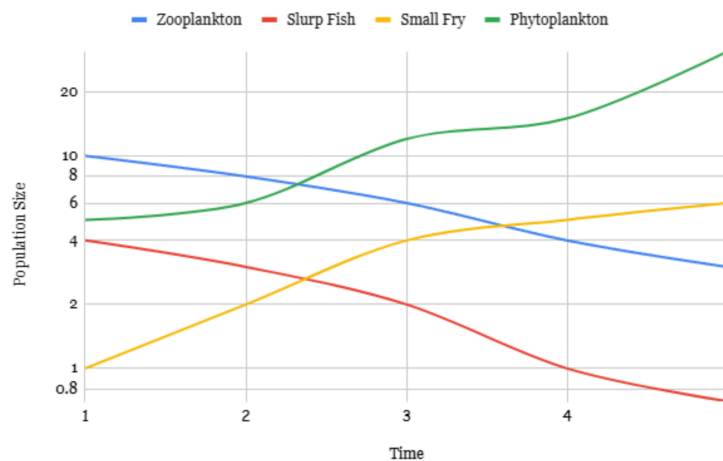
41. You steal a time machine from the 12th century, wishing to claim the discovery of fixed action patterns as your own. In your experiments, you first inject a mother bird with a known chemical that acts as a sign stimulus for the birds to feed their offspring. You then swap the bird's hatchlings with a bunch of rats that are clearly not related in any way to the birds. If the bird were to continue on the basis of a fixed action pattern, which of the following observations would be true?
- A. The bird ignored the rats, deciding to feed themselves to increase fitness.
  - B. The bird was unable to find the nest due to the lack of its offspring to help it pilot.
  - C. The bird was killed by the rats.
  - D. The bird continued to feed the rats.
  - E. The birds did not feed the rats and left to form a new nest.
42. Male satin bowerbirds construct and decorate bowers to attract mates. Researchers observed that females prefer bowers with more blue objects and symmetrical arrangements. Which of the following statements BEST explains this behavior?
- A. Male bowerbirds with more decorated bowers have higher reproductive success because they are more visible to predators, demonstrating their survival skills.
  - B. Female preference for decorated bowers likely arises from intersexual selection, where traits indicating male fitness are favored.
  - C. The preference for symmetrical bowers may reflect an evolved tendency to associate symmetry with genetic diversity.
  - D. The behavior of bower building is primarily driven by kin selection, as it increases the fitness of related males in the population.
  - E. Female bowerbirds use the complexity of bower decoration as a signal of the male's cognitive abilities.
43. For some reason, Fletcher is thoroughly interested in birds.... However, his best friend Anthony couldn't care less about birds. To mess with Fletcher, he likes to tell him random bird facts that are not true. Which of the following statements is NOT something that Anthony might've told Fletcher?
- A. Fletchings are more closely related to crocodiles than turtles.
  - B. Blue jays are viviparous.
  - C. Birds first appeared in the Cambrian explosion.
  - D. Quails have relatively large cerebellums compared to reptiles.
  - E. Birds have highly reduced teeth, which is a consequence of evolving beaks.

## §6. Ecology, 5 questions

44. Kian is exploring the countryside of Virginia when the green-eared leopard piques his interest. However, throughout the duration of his trip, he only encounters 5 of them. He concludes this might be because one time that he saw a green-eared leopard near another green-eared leopard, they began to attack one another. Despite their violent nature however, Kian is determined to learn about these green-eared leopards and manages to get near enough to paint their ears red. He ends up coming back to the countryside 3 weeks later, and this time, he is much luckier, encountering 17 green-eared leopards. To his shock, out of these 17 leopards, only 3 of them have red ears.

Calculate the estimated population size of the green eared leopards and identify their most likely pattern of dispersion.

- A. 255 individuals, clumped dispersion
  - B. 28 individuals, uniform dispersion
  - C. 21 individuals, random dispersion
  - D. 255 individuals, uniform dispersion
  - E. 28 individuals, random dispersion
45. Meowsles is monitoring the oxygen levels of Loot Lake in order to make sure they don't fall too low. Everything had been fine for many years; however, recently the levels began to fall substantially. In an attempt to figure out what was going on, he decided to check his data on the relative population sizes of different organisms in the lake. The data can be found below:



Which of the following conclusions that can be drawn based on the data would account for the rapid decrease in oxygen concentration in the lake?

- A. Loot Lake is a bottom-up ecosystem, the increase in phytoplankton caused a decrease in small fry populations.
- B. Loot Lake is a top-down ecosystem, the decrease in slurp fish caused an increase in phytoplankton.
- C. Loot Lake is a bottom-up ecosystem, the increase in slurp fish caused an increase in small fries.
- D. Loot Lake is a bottom-up ecosystem, the decrease in small fry caused a decrease in zooplankton.
- E. Loot Lake is a top-down ecosystem, the increase in slurp fish caused a decrease in phytoplankton.

46. After watching Avengers' Endgame, you have decided to embody the ideals of Thanos. You wonder how you can use the principles of Thanos to help improve the ecosystem of your fish tank. Which of the following are correct statements?

| Species      | Count |
|--------------|-------|
| Vander fish  | 5     |
| Raven fish   | 3     |
| Albert fish  | 10    |
| Insular fish | 25    |

- I. Using a machine to transform 5 Insular fish to Raven fish would increase the Shannon's diversity index
- II. The Shannon's diversity index of this community is currently approximately 1.5
- III. Adding an additional 20 Albert fish would increase the Shannon's diversity index

- A. I only
  - B. I, II only
  - C. II, III only
  - D. I, III only
  - E. I, II, III only
47. The BDNF server, which was previously uninhabited, was just colonized by Ubiquitin, who, through his insular knowledge, allowed for the formation of the nerd community there. Which of the following best describes the type of succession and role of Ubiquitin?
- A. Primary succession, climax species
  - B. Secondary succession, climax species
  - C. Primary succession, pioneer species
  - D. Secondary succession, keystone species
  - E. Secondary succession, pioneer species

48. Consider a trophic cascade in a marine ecosystem where an oviparous keystone predator reduces the density of herbivores that feed on algae. How would the introduction of an invasive species that competes with the keystone predator for its habitat and preys upon its eggs likely affect stability of the trophic cascade?
- A. The invasive species would stabilize the trophic cascade by reducing predation on herbivores.
  - B. The invasive species would likely destabilize the cascade, leading to an overabundance of herbivores and a reduction in algae abundance and primary productivity.
  - C. The invasive species would enhance the effects of the trophic cascade by increasing predation on primary producers.
  - D. The invasive species would disrupt the trophic cascade by increasing predation on herbivores, reducing their impact on algae.
  - E. The invasive species would have no impact on the trophic cascade due to the redundancy of ecological functions in the system.

## §7. Biosystematics, 2 questions

49. Which of the following regarding fungi is NOT true?
- A. Microsporidians are unicellular parasitic fungi with highly reduced mitochondria.
  - B. Cryptomyetes and microsporidians are the only two classes of fungi known to have retained flagellated spores.
  - C. Mucormycetes are the fungi responsible for the rotting of food like bread and strawberries.
  - D. Ascomycetes produce non-motile spores called ascospores which develop inside of saclike structures called asci.
  - E. Basidiomycetes life cycle is characterized by a long lived dikaryotic mycelium.
50. Which of the following is NOT a trait shared by all members of the phylum Chordata?
- A. Pharyngeal slits
  - B. Dorsal hollow nerve cord
  - C. Backbone
  - D. Notochord
  - E. Post-anal tail