

Mitosisphere May Challenge

Question 1

Lebron James has just retired from the NBA to lock in for USABO. However, he does still miss being the king of the league, and he wonders what made him so good. He can partially attribute his success to his muscular system. Help Lebron identify the true statement about muscles below.

- A. Cardiac muscle cells have shorter action potentials compared to skeletal muscle cells, because they need to contract rapidly and rhythmically.
- B. Most muscles contain both fast and slow twitch fibers, but muscles of the eye and hand are exclusively fast-twitch.
- C. Since glycolysis produces ATP rapidly, all fast-twitch fibers only do glycolysis without aerobic respiration.
- D. Tetanic contractions are most common in cardiac muscle cells.
- E. Smooth muscle cell contractions happen when calmodulin binds to troponin, removing tropomyosin from myosin-binding sites on the actin thin chains.

Question 2

Infrqtion decided to test his novel drug, ubiquitinab, on Tanish, a child he locked in his basement. Ubiquitinab has been found to cause increased excretion of bile salts based on prior testing on mice. Assuming that he was a healthy child prior to the administration on Ubiquitinab into his mouth and that any feedback loop mechanisms related to bile salts haven't been activated yet, which of the following molecules would be found to have found at lower levels in Tanish's body?

- A. Maltose
- B. Cholesterol
- C. Arginine
- D. Blood plasma K^+
- E. $CaCl_2$

Question 3

Cobalamin (vitamin B12) deficiency often results in a form of macrocytic anemia caused by the accumulation of megaloblasts. Which of the following is the most likely mechanism by which this occurs?

- A. Conversion of methylcobalamin into 5'-deoxyadenosylcobalamin in environments with low amounts of B12 cause an inability to synthesize histone variants.
- B. A lack of cobalamin causes the inhibition of an enzyme that normally plays a role in the displacement of the N-groups in its porphyrin rings.
- C. Cobalamin deficiency directly prevents the demethylation of tetrahydrofolate to convert homocysteine into methionine, preventing its usage in other forms.
- D. A deficiency in cobalamin, which is normally an allosteric upregulator of dihydrofolate reductase, directly lowers folate's effects on cell division.
- E. A decrease in the conversion of hypoxanthine to inositol.

Question 4

Nebulin decided to sequence the DNA of the species *I.somerase*. Unfortunately, he is a dumbass and accidentally used the wrong sequencing method that resulted in only nucleosome-bound DNA being sequenced. Which of the following lab techniques did Nebulin accidentally use on *I.somerase*?

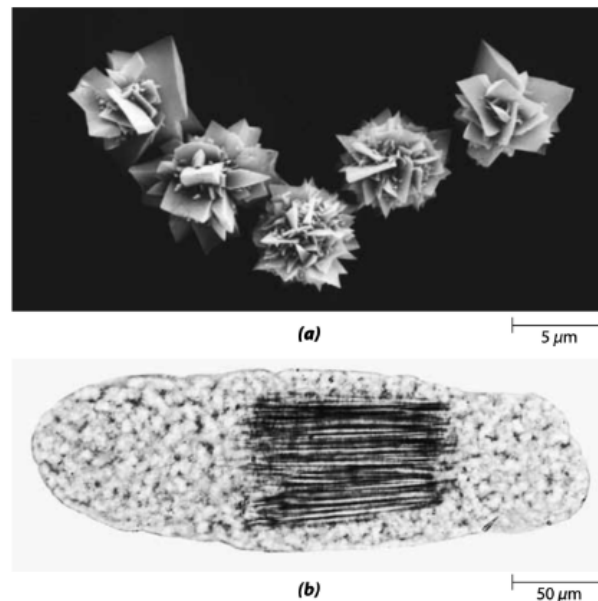
- A. Coimmunoprecipitation
- B. Southern Blotting
- C. ChIP
- D. Ion Torrent Sequencing
- E. Illumina Sequencing

Question 5

Robert is interested in how bacteria evolve over time in order to confer resistance to certain antibiotics. He has two strains of the novel diploid bacterium Tree Coli, 1 strain from a year ago, and 1 strain from the present day. The year old strain is sensitive to both erythromycin and penicillin due to homozygosity at the *erm*- and *pen*- genes. The new strain however, is homozygous for the *erm*+ and *pen*+ genes, and is thus resistant to both. (Homozygosity of both *erm*+ and *pen*+ are needed to confer resistance) Robert crosses these two strains, and then self-crosses the F1 generation and plates them on a petri dish with both erythromycin and penicillin. To his surprise though, he notices a 17% survival rate on his dishes. He concludes the genes must be linked, in cM, how far apart are the *erm* and *pen* genes?

- A. 35 cM
- B. 34 cM
- C. 18 cM
- D. 9 cM
- E. 16 cM

Question 6



- (i) Identify the structures labeled (a) and (b) in the figure above:
- (ii) Determine what the structures are made of:

Question 7

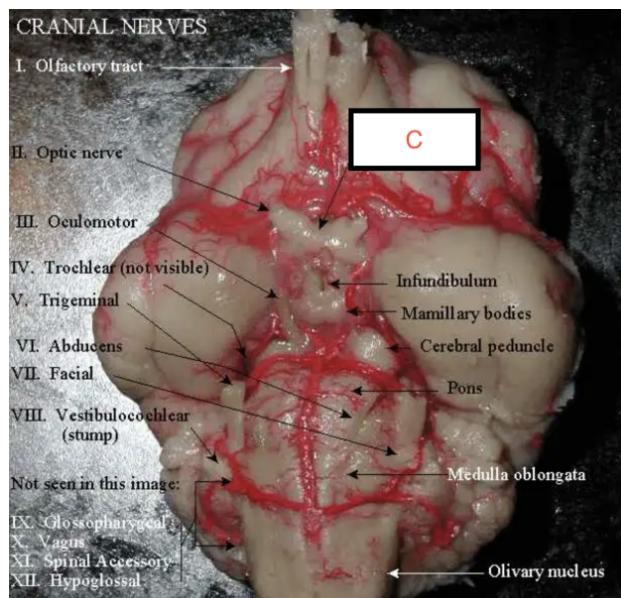
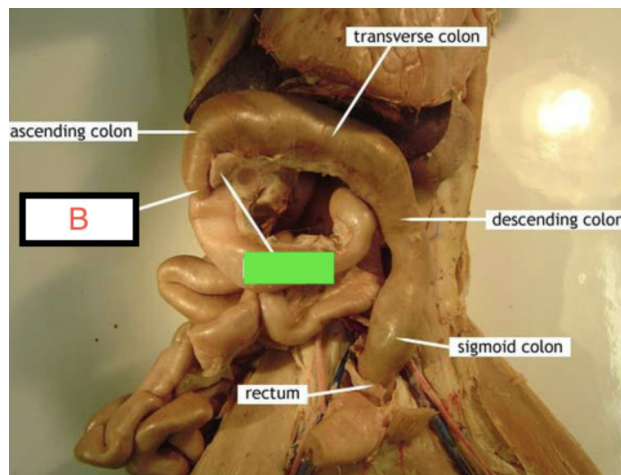
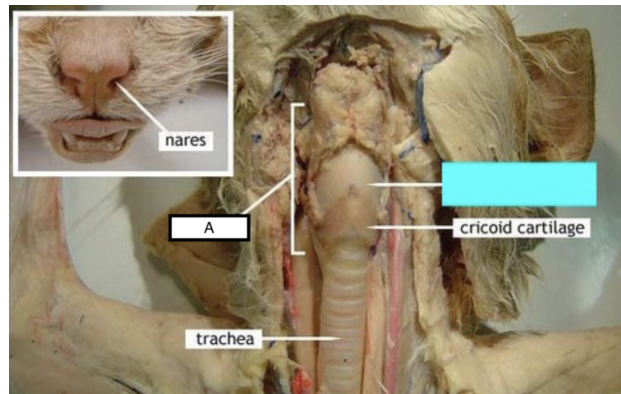
A forest ecologist surveys a small section of woodland and counts four different tree species with the following numbers of individual trees:

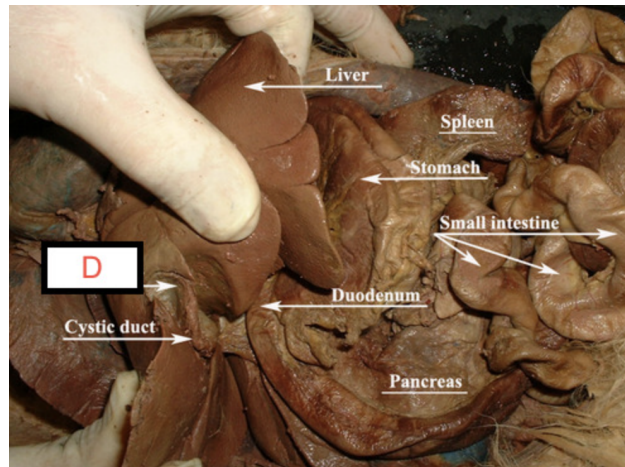
Species	Number of Individuals
Species A	10
Species B	30
Species C	60
Species D	100

Question 8

What are the differences between acoelomates, pseudocoelomates and coelomates? Provide an example of each.

Histology! You are conducting a cat dissection in your class and your teacher has decided to quiz you on what the following organs are (true story). Be as specific with your descriptions as you can.





Tiebreaker!

Name every hormone you can think of and where they are produced.