

A large, stylized DNA double helix graphic is positioned in the background, spanning across the top and middle of the page. The helix is rendered in a light purple/pink color, matching the background gradient. The background itself is a smooth gradient from blue on the left to pink on the right.

TBAT Biology

Sample Questions

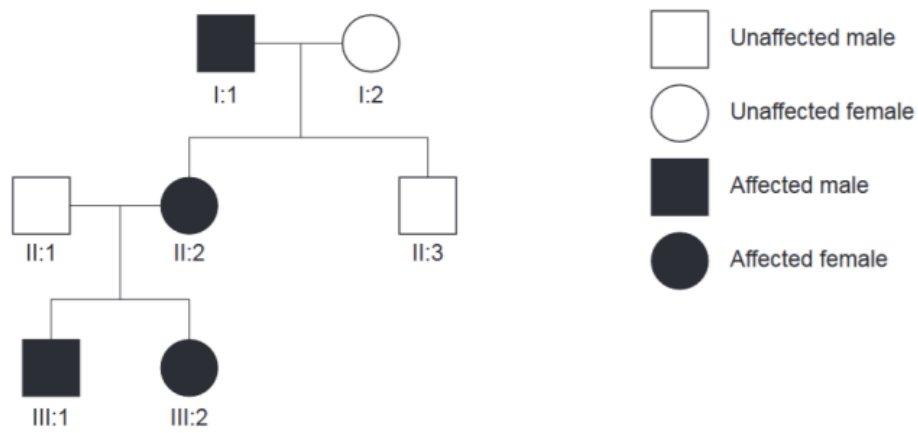
1

Glycolysis does not require oxygen to occur in cells. However, under anaerobic conditions, glycolysis normally requires fermentation pathways to occur to continue to produce ATP. Which best describes why glycolysis is dependent on fermentation under anaerobic conditions?

- A. Glycolysis requires fermentation to generate pyruvate for a later step in the pathway.
- B. Glycolysis requires fermentation to produce more glucose as a substrate.
- C. Glycolysis requires fermentation to generate ATP and NADH molecules for using in Krebs cycle.
- D. Glycolysis requires fermentation to generate ATP molecules to complete the early steps of the pathway.
- E. Glycolysis requires fermentation to synthesize lactic acid and restore NADH to NAD⁺.

2

The pedigree chart shows the inheritance of three generations of Duane syndrome, a condition caused by a dominant allele that affects alignment of the eyes.

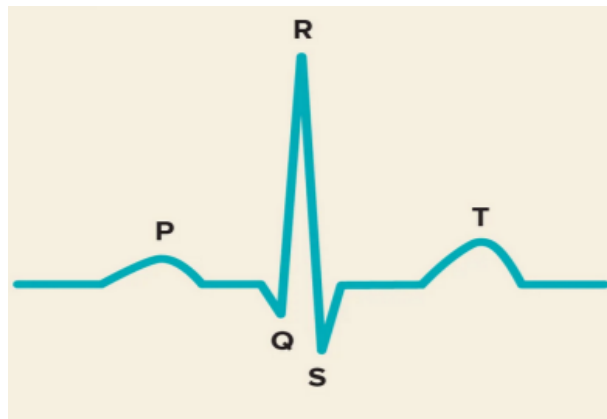


If individuals II:1 and II:2 had a third child, what is the probability that the child would have Duane syndrome?

- A. 12.5%
- B. 25 %
- C. 50 %
- D. 75 %
- E. 100 %

3

The figure shows an electrocardiogram.



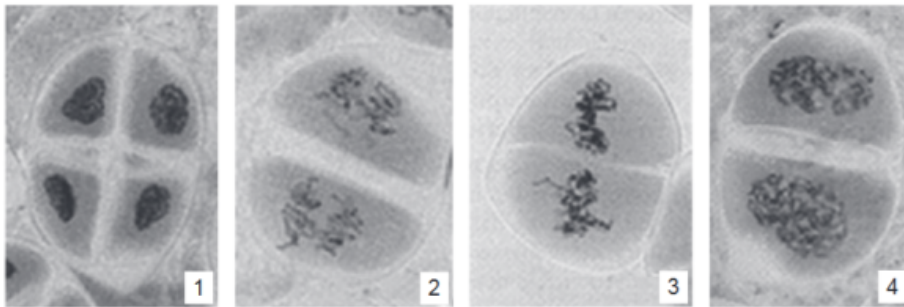
Which statement is/are CORRECT?

- I. P is atrial repolarization
- II. QRS is ventricular depolarization
- III. T is atrial relaxation

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

4

The micrographs show four different phases from meiosis II. What is the correct order?



- A. 3-4-2-1 B. 2-3-4-1 C. 4-2-3-1 D. 4-3-2-1 E. 3-2-4-1

5

In the analysis of an 8-amino acid sequence from a coding DNA strand, a deletion occurs at base position 13 (in the region marked by the arrow):

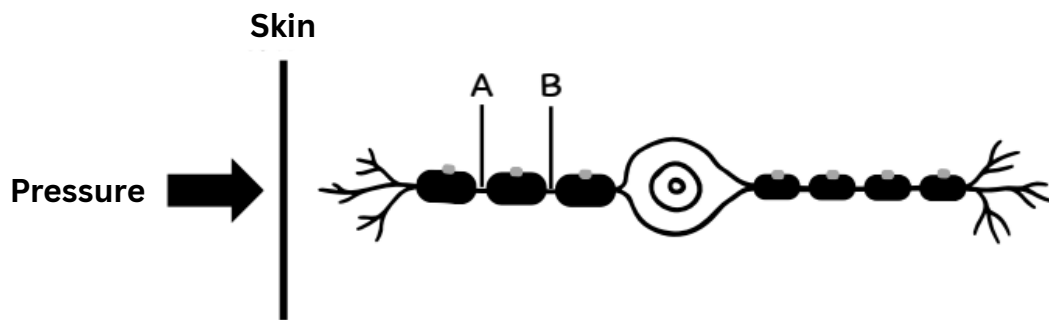
5'-ATGCCTTTTATATGACGCATGCATAA-3'

Which statement is incorrect?

- A. There is an abnormality in the genotype
- B. The resulting protein cannot function
- C. The produced polypeptide chain is shorter
- D. The produced polypeptide chain is longer
- E. A stop codon is generated, terminating translation

6

A scientist is studying a disease that affects the process of myelin formation in a laboratory rat. The study focuses on the speed of nerve impulse conduction (action potential) in the axon of sensory neurons. The scientist stimulates the neurons by applying pressure to the skin and uses electrodes to observe nerve impulses at points A and B, as shown in the diagram. The time differences at which the nerve impulses occur at these two points are recorded in the table.



Experimental group	Time difference of nerve impulses at two points (ms: milliseconds)
Normal lab rat	3.7
Diseased lab rat	14.8

Consider the following statements:

- A. The nerve impulse conduction in the diseased lab rat is slower than in the normal lab rat.
- B. The scientist conducted the experiment using bipolar neurons.
- C. The location where the electrode is plugged in contains a potassium channel (K^+ channel).

Which statement(s) is/are correct?

- A. A only
- B. A and B
- C. A and C
- D. B and C
- E. A, B, and C

7

A scientist wanted to test the fear response in experimental mice by placing them in a cage and introducing a stimulus. The mouse's behavior was observed for 2 minutes. If the stimulus induced fear, the mouse would respond by immediately freezing in place. 2,5-dihydro-2,4,5-trimethylthiazoline (TMT) is a chemical found in the urine of red foxes. This chemical has been shown to induce fear in various small mammalian species. The scientist wanted to test the effect of this chemical on mice that had never been exposed to its scent before. The experimental design was as follows:

Date	Stimulus Given	Duration of Freezing Behavior (seconds)
1	9 kHz sound	9
2	TMT scent	66
3	9 kHz sound and TMT scent	62
4	9 kHz sound	64

Consider the following statements:

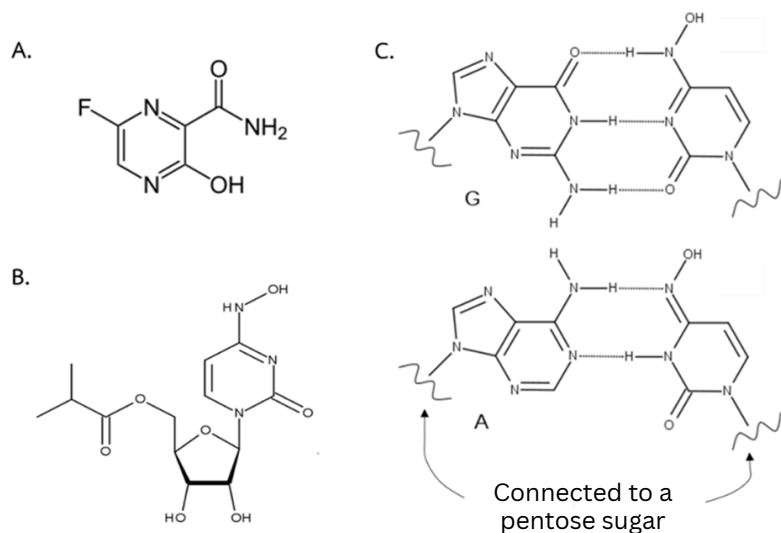
- A. On day 4, the 9 kHz sound is not a conditioned stimulus (unconditioned stimulus).
- B. The freezing behavior of the mouse when smelling TMT on day 2 is an innate behavior.
- C. On day 4, the mouse shows freezing behavior when hearing the 9 kHz sound, indicating it has an imprinting behavior.

Which statement(s) is/are correct?

- A. Only statement A
- B. Only statement B
- C. Only statement C
- D. Statements A and B
- E. Statements B and C

8

From the structural diagrams of the COVID-19 antiviral drugs, namely favipiravir (Image A) and molnupiravir (Image B), both drugs, once metabolized, are converted into their active forms, which are nucleoside analogs. These analogs can mimic the nucleotides that serve as building blocks for the synthesis of the viral genomic RNA. Image C illustrates the base pairing of the COVID-19 antiviral drugs after they have been metabolized and incorporated during RNA synthesis.



Are the following statements true or false?

- Both drugs have structures similar to nitrogenous bases.
- After entering the cell, both drugs undergo phosphoribosylation, transforming into structures resembling ribonucleoside triphosphates.
- Molnupiravir contains a structural part similar to base C or U, so when incorporated into an RNA strand, it pairs with base G or A, respectively.
- Both drugs cause base substitutions in the viral RNA, resulting in genomic RNA that differs from the original. This inhibits the production of new viral particles and thus prevents the development of severe disease symptoms.

- Only 1, 2 and 3 are true
- Only 1, 3 and 4 are true
- Only 1 and 2 are true
- Only 3 and 4 are true
- Only 2 and 4 are true

9

A study was conducted on a unicellular organism that normally has a shape resembling a rose apple. Two mutant strains, mutant A and mutant B, were isolated. Both mutants lost the ability to maintain their normal cell shape and instead became spherical. Further investigation revealed that mutant A has a defect in protein A, while mutant B has a defect in protein B. An experiment was performed to separate the cell membrane from the cytoplasm. The membrane fraction was then washed with urea solution and centrifuged. This process caused the cell membrane to pellet at the bottom of the tube, while proteins that were washed off the membrane remained in the supernatant. The presence of protein A and/or protein B was compared between wild-type cells and the two mutant strains, and the results are shown in the table:

	First fractionation		After washing with urea solution and centrifugation	
	Cell membrane fraction	Cytosolic fraction	Cell membrane	Supernatant
Normal cell	Both protein A and B are detected	-	Only protein A is detected	Only protein B is detected
Mutant A	Only protein A is detected	Only protein B is detected	Only protein A is detected	-
Mutant B	Only protein A is detected	Only protein B is detected	Only protein A is detected	-

(Note: "-" means neither protein A nor protein B was detected.)

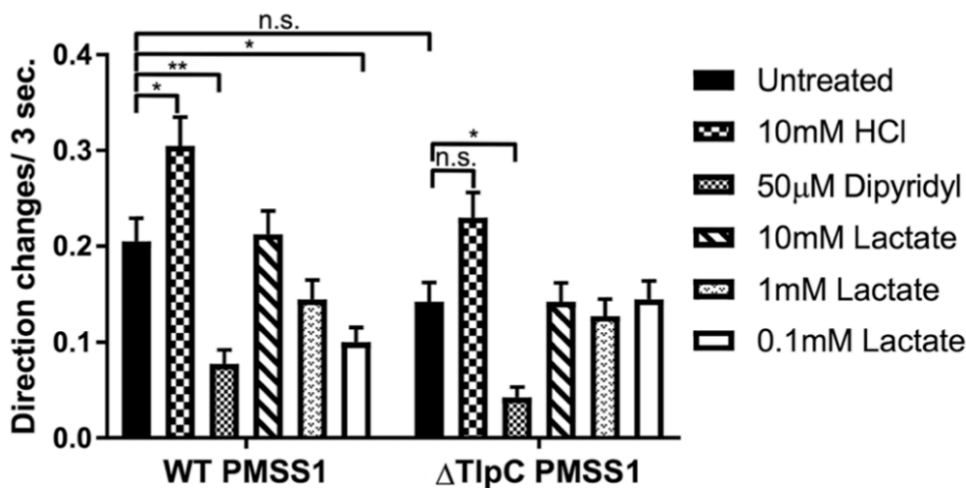
Are the following statements true or false?

1. Protein A is an integral membrane protein.
2. Protein B is a peripheral membrane protein located on the inner side of the membrane.
3. The defect in protein A in mutant A prevents protein B from binding to the membrane.
4. The defect in protein B in mutant B prevents protein B from binding to protein A.

- A. Only 1, 2 and 3 are true C. Only 1 and 3 are true E. All statements are true
 B. Only 2, 3 and 4 are true D. Only 2 and 4 are true

10

The bacterium *Helicobacter pylori* has chemoreceptors that enable chemotaxis. A study investigated the role of the *TlpC* gene in the chemotaxis of *H. pylori* toward lactate, using both the wild-type strain (WT) and a mutant strain lacking the *TlpC* gene ($\Delta TlpC$). The test measured the change in the direction of bacterial movement within 3 seconds after exposure to various substances, compared to the control condition with no substance (untreated), 10 mM HCl as a repellent, and 50 μ M dipyridyl as an attractant. The results are shown in the figure.



n.s. = not statistically significant

★, ★★ = statistically significant difference ($p < 0.05$ and $p < 0.01$, respectively)

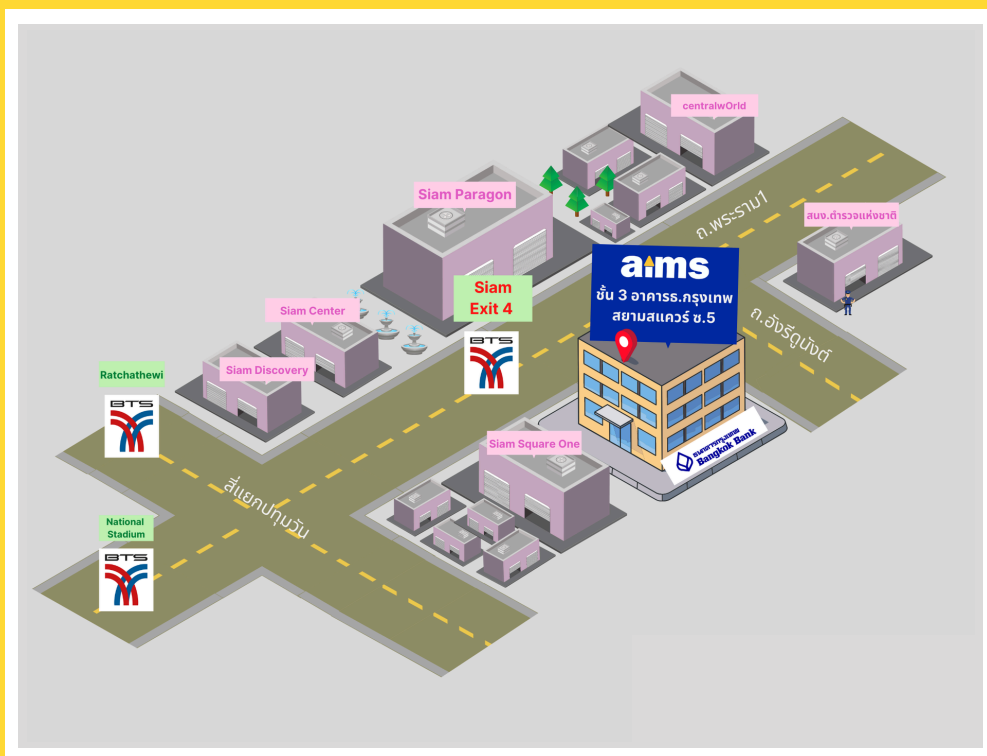
Are the following statements true or false?

- Under normal conditions without chemical stimulation (untreated), the WT strain and $\Delta TlpC$ strain of *H. pylori* show a statistically significant difference in the change of movement direction.
- The WT strain of *H. pylori* shows less change in movement direction in 0.1 mM lactate, indicating that the WT strain is attracted to lactate.
- In the $\Delta TlpC$ strain of *H. pylori*, it still responds to dipyridyl, but loses the response to HCl.
- From the experiment, it can be concluded that the *TlpC* gene is important for the movement of *H. pylori* toward lactate.

- A. Only 1, 3 and 4 are true
B. Only 2, 3 and 4 are true

- C. Only 1 and 3 are true
D. Only 2 and 4 are true

- E. All statements are true




aims Siam Square

BTS Siam Exit 4 (opposite to Siam Paragon)
3rd Fl., Bangkok Bank Building (Siam Square Soi 5)
Rama 1 Rd., Pathumwan, Bangkok




 aims.school

 aims_school

 aims_school

 aims.school

 02-254-9300
02-658-4253 (-4)