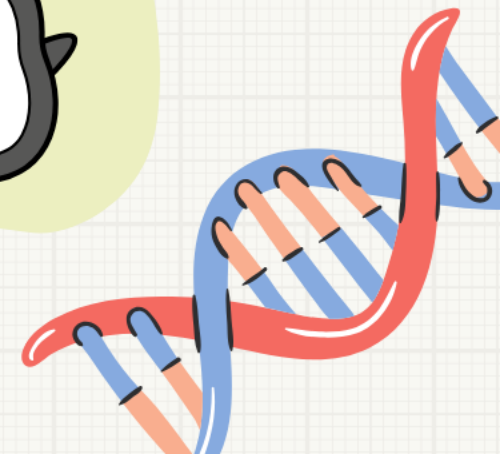
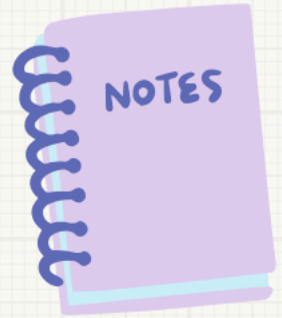
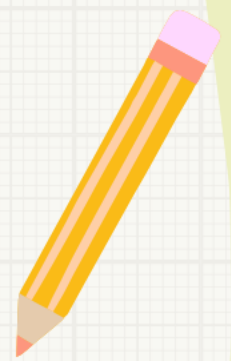


AP Bio FRQ Fridays

2021 #3
Cellular Respiration



Researchers hypothesize that the plant compound resveratrol improves mitochondrial function. To test this hypothesis, researchers dissolve resveratrol in dimethyl sulfoxide (DMSO). The solution readily passes through cell membranes. They add the resveratrol solution to mammalian muscle cells growing in a nutrient-rich solution (culture medium) that contains glucose. They measure ATP production at several time points after the addition of the resveratrol solution and find an increase in ATP production by the muscle cells.

(a) **Describe** the primary advantage for a mammalian muscle cell in using aerobic respiration over fermentation.

- | | | |
|-----|---|----------------|
| (a) | Describe the primary advantage for a mammalian muscle cell in using aerobic respiration over fermentation. | 1 point |
| | <ul style="list-style-type: none">• More ATP (per glucose molecule) is produced by aerobic respiration. | |



FRQ Friday #9

2021 #3

(a) **Describe** the primary advantage for a mammalian muscle cell in using aerobic respiration over fermentation. **1 point**

- More ATP (per glucose molecule) is produced by aerobic respiration.

a) Aerobic respiration can produce up to 36 ATP from a single glucose molecule, while fermentation produces only two ATP. This means that cells produce more energy per glucose molecule with aerobic respiration.



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(b) **Identify** an appropriate negative control for this experiment that would allow the researchers to conclude that ATP is produced in response to the resveratrol treatment.

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1 point

Accept one of the following:

- The researchers must run the experiment without adding resveratrol.
- The researchers must treat the cells with DMSO alone.



- (b) **Identify** an appropriate negative control for this experiment that would allow the researchers to conclude that ATP is produced in response to the resveratrol treatment.

1 point

Accept one of the following:

- The researchers must run the experiment without adding resveratrol.
- The researchers must treat the cells with DMSO alone.

b) A negative control would be to repeat the experiment with mammalian muscle cells grown in a nutrient-rich solution without resveratrol.



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(c) **Predict** the effect on short-term ATP production when resveratrol-treated mammalian muscle cells are grown in a culture medium that lacks glucose or other sugars.

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1 point

Accept one of the following:

- No ATP production
- Reduced ATP production



- (c) **Predict** the effect on short-term ATP production when resveratrol-treated mammalian muscle cells are grown in a culture medium that lacks glucose or other sugars.

1 point

Accept one of the following:

- No ATP production
- Reduced ATP production

c) ATP production will decrease because the cells will not have carbohydrates to utilize for respiration and the production of energy.



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(d) The researchers find that resveratrol stimulates the production of components of the electron transport chain. The researchers claim that treatment with resveratrol will also increase oxygen consumption by the cells if glucose is not limiting. **Justify** the claim.

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1 point

- More electrons can be transferred so that more oxygen is required as the final electron acceptor.



- (d) The researchers find that resveratrol stimulates the production of components of the electron transport chain. The researchers claim that treatment with resveratrol will also increase oxygen consumption by the cells if glucose is not limiting. **Justify** the claim. 1 point
- More electrons can be transferred so that more oxygen is required as the final electron acceptor.

d) Oxygen acts as the final electron acceptor for the electron transport chain, so if resveratrol stimulated production of ETC components, the electron transport chain will become more active and require more oxygen molecules to transfer electrons to when ~~receiving~~ establishing the proton gradient.



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