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2020 AP® BIOLOGY

FREE PRACTICE TEST

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AP Biology
Section 1
You have 25 minutes to complete this section.

Electrons from the oxidation of glucose and other nutrients by glycolysis and the Krebs cycle are added to the electron-carrying compound NAD^+ to form NADH. To meet the continuous requirement for NAD^+ by cells, NADH is reduced back to NAD^+ through the electron transport chain, in the presence (+) of oxygen, or through fermentation, in the absence (−) of oxygen (Figure 1).

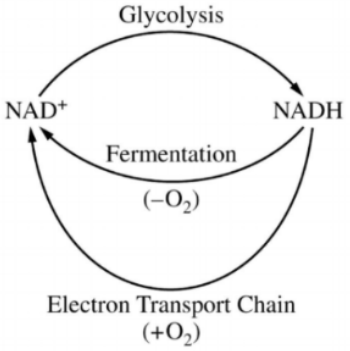

Figure 1. A simplified model of metabolism and the recycling of NAD^+

MT-ND5 is a mitochondrial gene that encodes a subunit of NADH dehydrogenase, the enzyme that catalyzes the initial oxidation of its substrate NADH to NAD^+ and H^+ in the electron transport chain of mitochondria. A mutation in MT-ND5 is associated with a rare genetic disorder that results in a buildup of lactic acid in the body. A researcher hypothesizes that the mutated NADH dehydrogenase has decreased activity but is not completely non functioning and that, by increasing the pool of NADH in cells, the activity of NADH dehydrogenase will increase.

To test this idea, the researcher treated a group of individuals with this disorder with a vitamin that is similar to NADH and measured the concentration of NAD^+ and lactic acid in the blood over the course of 20 weeks. The results from a representative individual are shown in Figure 2.

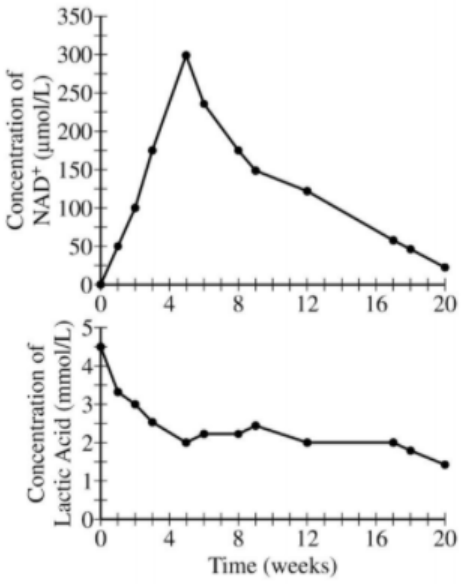

Figure 2. The concentration of NAD^+ (top) and lactic acid (bottom) in the blood of a representative treated individual

There are 10 parts to this question

(a) Describe the pattern of inheritance that is most likely associated with the mutation in the MT-ND5 gene.

(b) Explain why individuals are not typically heterozygous with respect to mitochondrial genes.

(c) Identify a dependent variable measured in the researcher's experiment.

(d) Identify one control that the researcher could use to improve the validity of the experiment.

(e) Justify the researcher analyzing blood samples at many intermediate time points instead of at only the beginning and the end of the 20-week period.

(f) Describe the relationship between the concentration of NAD+ in the blood and the concentration of lactic acid in the blood during the first 5 weeks of treatment with the vitamin.

(g) Based on Figure 2, Calculate the average rate of change in blood NAD+ concentrations from week 5 to week 17.

(h) The researcher performed a follow-up experiment to measure the rate of oxygen consumption by muscle and brain cells. Predict the effect of the MT-ND5 mutation on the rate of oxygen consumption in muscle and brain cells.

(i) Justify your prediction.

(j) The researcher had hypothesized that the addition of the vitamin that is similar in structure to NADH would increase the activity of the mutated NADH dehydrogenase enzyme in individuals with the disorder. Explain how the vitamin most likely increased the activity of the enzyme.

End of Section 1

Please make sure that you have written or typed your 8-digit AP ID and your initials on the top of each page you will be submitted.

If you have time remaining, please go back and review your work.

Do **not** proceed to the next section until your after you have submitted the first section.

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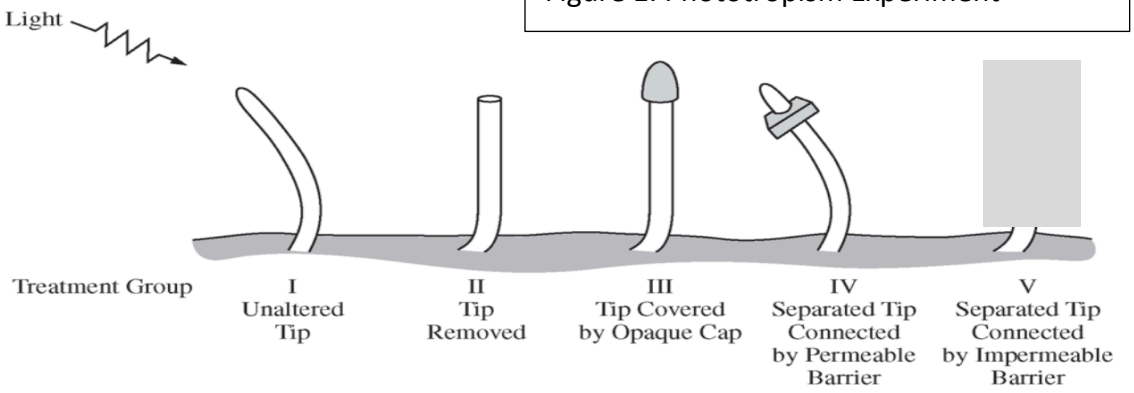
AP Biology Practice Exam #2 Sample Question 2 – Given May 6, 2020

Figure 1. Phototropism Experiment



Phototropism in plants is a response in which a plant shoot grows toward a light source. The results of four different experimental treatments from classic investigations of phototropism are shown in Figure 1. You will need to make a prediction about the last treatment Group.

(a) Identify the treatment Group that represents the control in this experiment.

(b) Explain how phototropism is an example of a cell signal pathway.

(c) In treatment Group IV the tip of the plant is removed and placed back onto the shoot using a *permeable* barrier. Explain the effect of this change on the response seen in treatment Group lV.

(d) Justify the claim that the cells located in the tip of the plant shoot detect the light. Use evidence from the results from treatment group l AND the results from treatment group ll and group lll in your response.

(e) A fifth treatment Group is added that has the tip of the plant removed and placed back onto the shoot using an *impermeable* barrier. Predict the response of treatment Group 5.

(f) Justify the prediction you made in (e).

End of Section 2

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Congratulations on finishing your exam!
Expect to receive feedback
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