AP® BIOLOGY
2016 SCORING GUIDELINES

Question 8

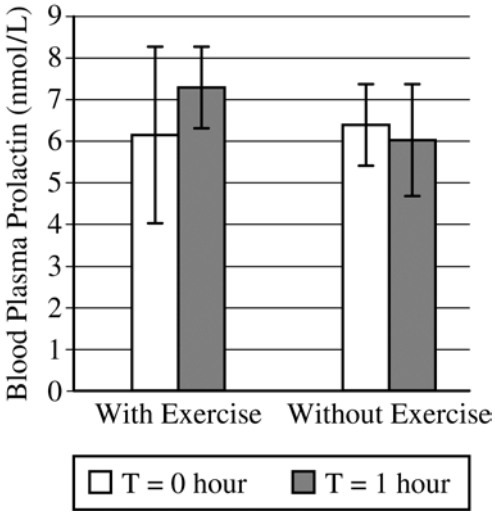


Figure 1. Effect of exercise on blood prolactin levels in adult males. The data represent the mean $\pm 2SE_{\bar{X}}$.

Researchers conducted a study to investigate the effect of exercise on the release of prolactin into the blood. The researchers measured the concentration of prolactin in the blood of eight adult males before (T = 0 hour) and after one hour (T = 1 hour) of vigorous exercise. As a control, the researchers measured the concentration of blood prolactin in the same group of individuals at the same times of day one week later, but without having them exercise. The results are shown in Figure 1.

(a) **Justify** the use of the without-exercise treatment as the control in the study design. **(1 point)**

Justification (1 point)

- Attribute changes in the concentration of blood prolactin to exercise only
- Rule out normal fluctuations in prolactin release/levels

(b) Using evidence from the specific treatments, **determine** whether prolactin release changes after exercise. **Justify** your answer. **(2 points)**

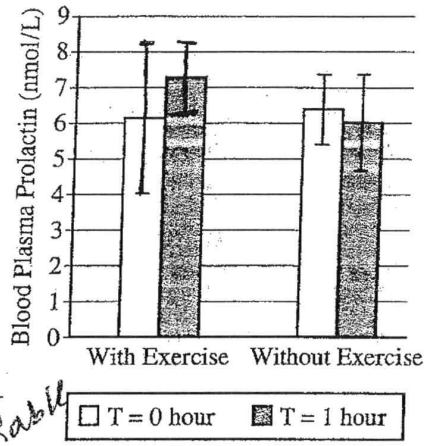
Determination (1 point)

- Exercise does not affect prolactin release

Justification (1 point)

- The T=1 hour with-exercise mean and the T=1 hour without-exercise mean are within $\pm 2SE_{\bar{X}}$.
- The $\pm 2SE_{\bar{X}}$ error bars for the T=1 hour with-exercise time point and the T=1 hour time without-exercise point overlap.
- The $\pm 2SE_{\bar{X}}$ error bars for the T=0 and T=1 hour with-exercise time points overlap.
- The T=0 hour with-exercise mean and the T=1 hour with exercise-mean are within $\pm 2SE_{\bar{X}}$.

8A1



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11:10

Overlap - no dif.

control group to see what normal levels are w/out exercise at same exact time, eliminates time as variable

8. Researchers conducted a study to investigate the effect of exercise on the release of prolactin into the blood. The researchers measured the concentration of prolactin in the blood of eight adult males before (T = 0 hour) and after one hour (T = 1 hour) of vigorous exercise. As a control, the researchers measured the concentration of blood prolactin in the same group of individuals at the same times of day one week later, but without having them exercise. The results are shown in Figure 1.

(a) **Justify** the use of the without-exercise treatment as the control in the study design.

(b) Using evidence from the specific treatments, **determine** whether prolactin release changes after exercise. **Justify** your answer.

- no error bars overlap, no sig. difference.

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a.) The without-exercise treatment serves as the control group to see what normal levels of prolactin are, without exercise, at that exact time. It removes time as a possible variable.

b.) Prolactin release does not change after exercise because the error bars of from t = 0 hour and t = 1 hour on the with exercise bars,

8A2

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overlap.

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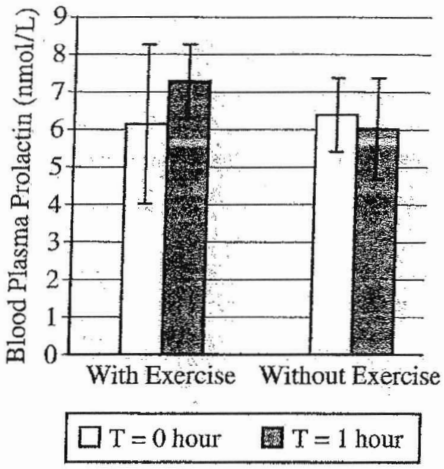
8B,



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a) ~~The without-exercise makes sure~~ ~~that~~

The without-exercise allows the researchers to have data to compare the with-exercise group with.

b) Prolacton release does not change after exercise because the bar after 1

8B2

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hour falls within the standard error bars of the T=0 hour bar in the with-exercise group.

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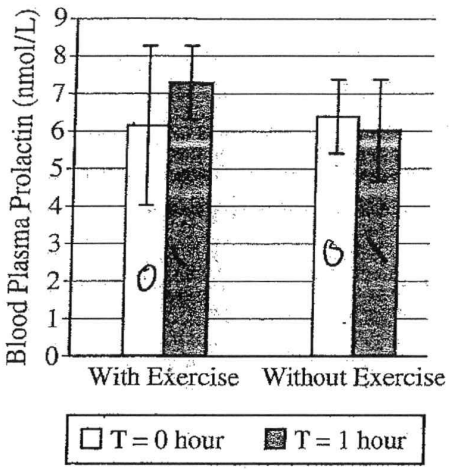
8C1



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   (a) **Justify** the use of the without-exercise treatment as the control in the study design.

   (b) Using evidence from the specific treatments, **determine** whether prolactin release changes after exercise. **Justify** your answer.

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a) The without-exercise treatment is a control because if the scientist were to just test with exercising they would not be able to tell what amount increase or decrease in release of prolactin there was. The no exercise shows the release of prolactin on a normal basis so it can be compared to the release of

8c

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prolactin with exercise, so a conclusion can be drawn on what effect exercise had on prolactin release.

b) Prolactin release increases with exercise because after an hour with exercise treatment blood plasma prolactin increased from about 6.1 nmol/L to 7.2 nmol/L. While without exercise after 1 houre prolactin levels went from about 6.4 nmol/L to 6 nmol/L.

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AP® BIOLOGY
2016 SCORING COMMENTARY

Question 8

Question 8 was written to the following Learning Objectives in the AP® Biology Curriculum Framework: 2.21, 2.28, 2.35, and 2.36.

Overview

This question focused on experimental design and data analysis. Students were given a graph showing the results of an experiment to test the effect of exercise on prolactin release. Students were asked to justify the use of a without-exercise treatment as the experimental control. Students were then asked to analyze the data to determine whether prolactin release changes after exercise and to justify their response.

Sample: 8A
Score: 3

The response earned 1 point in part (a) for justifying that the control group can rule out normal fluctuations over time. The response earned 1 point in part (b) for determining that prolactin release does not change after exercise. The response earned 1 point in part (b) for justifying that the [standard] error bars of the exercise group at T=0 hour and T=1 hour overlap.

Sample: 8B
Score: 2

The response earned 1 point in part (b) for determining that prolactin release does not change after exercise. The response earned 1 point in part (b) for justifying that the [standard error] bar of the exercise group at T=1 hour overlaps the standard error bar of the exercise group at T=0 hour.

Sample: 8C
Score: 1

The response earned 1 point in part (a) for justifying that the control group can attribute changes in the blood prolactin concentration to exercise and not to normal prolactin release.