MARCO LEARNING®

Welcome to AP® Hacks!

AP Biology

AP Biology students are penguins because they are dressed for success!

You are now an AP Bio Penguin!

Favorite Resources

AP Bio Penguins

- @apbiopenguins (Instagram, Twitter, YouTube & TikTok)
- Website: apbiopenguins.weebly.com
- AP Biology Review Guide
- TONS of Review PowerPoints

Additional Resources

- Podcast: @theapsoluterecap
- YouTube: Bozeman Biology
- Review Book: Barron's (7th Edition)

Exam Options

Paper Administration

- May 14th @ 8am Local
- Traditional Exam: 60 MC/2 Long + 4 Short FRQ

Digital Administration

- May 27th @ 12pm Eastern

  OR
- June 11th @ 12pm Eastern
- Traditional Exam: 60 MC/2 Long + 4 Short FRQ
- Students will not be asked to draw or graph as part of their response (#2 or #5)

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Tips from Marco

Pace Yourself
Present Practice
Persevere
Penguin

Photosynthesis

Big Ideas:

- What are the steps?
- What goes into step?
- What comes out of step?
- Where does step occur?
- Why is step important?

Photosynthesis

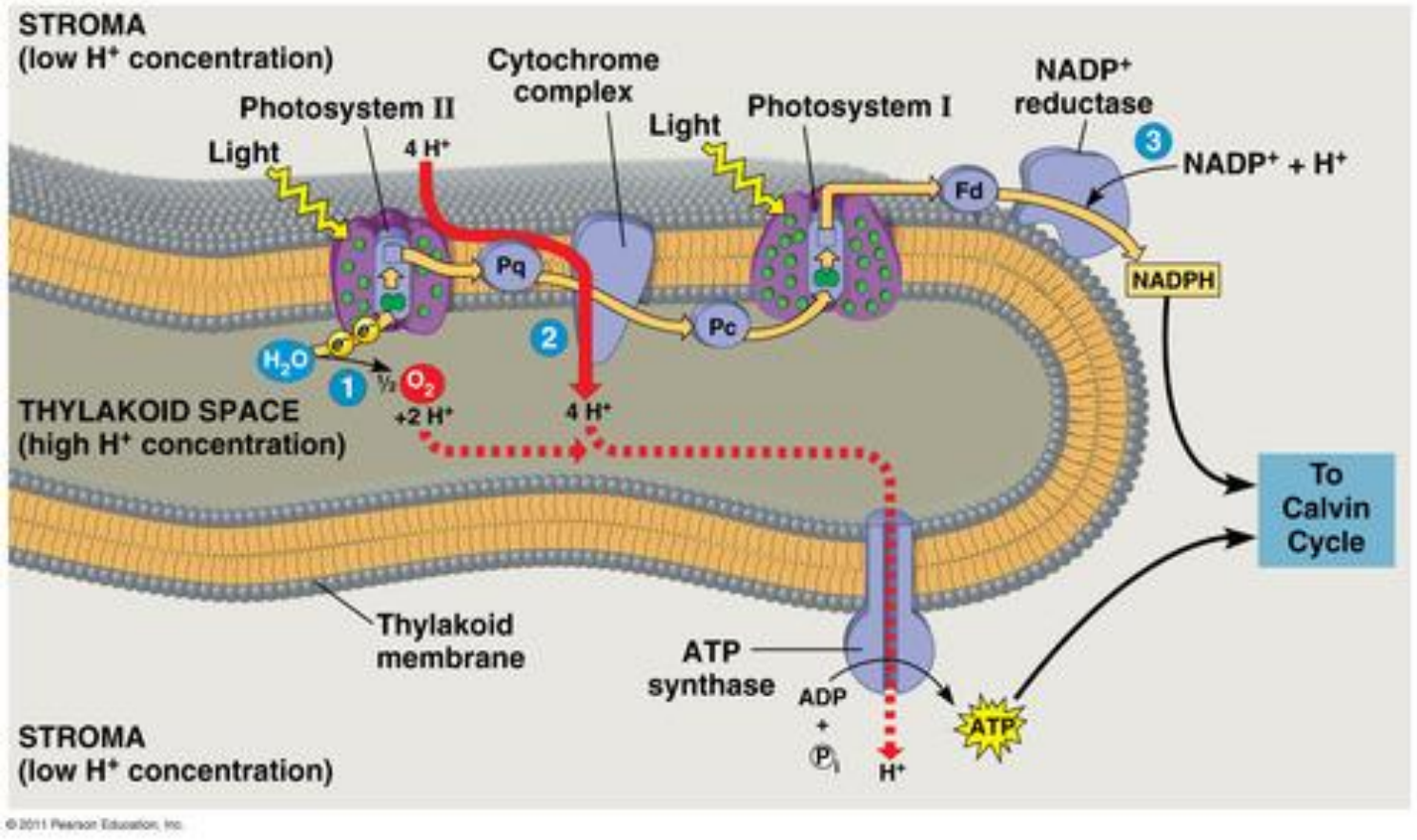
Light Reactions

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
Photons H_2O	ATP NADPH O_2	Thylakoid Membrane	ATP produced to fuel Calvin cycle NADPH shuttles electrons for reduction of carbon

Photosynthesis

Important Concept

- Protons pumped into the thylakoid space
- Water resupplies the lost electron in PS II
- Cyclic vs. Linear Electron Flow



Photosynthesis

Calvin Cycle/Dark Reactions

INPUT	OUTPUT	WHERE OCCURS	WHY IMPORTANT
6 NADPH 9 ATP	G3P (glyceraldehyde-3-phosphate)	Stroma	Stores energy in the form of G3P Inorganic Carbon -> Organic Carbon

Multiple Choice Question

The chemical reaction for photosynthesis is

$6\ CO_2 + 12\ H_2O + \text{light energy} \rightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$

If the input water is labeled with a radioactive isotope of oxygen, ^{18}O, then the oxygen gas released as the reaction proceeds is also labeled with ^{18}O. Which of the following is the most likely explanation?

a. During the light reactions of photosynthesis, water is split, the hydrogen atoms combine with the CO2, and oxygen gas is released.

b. During the light reactions of photosynthesis, water is split, removing electrons and protons, and oxygen gas is released.

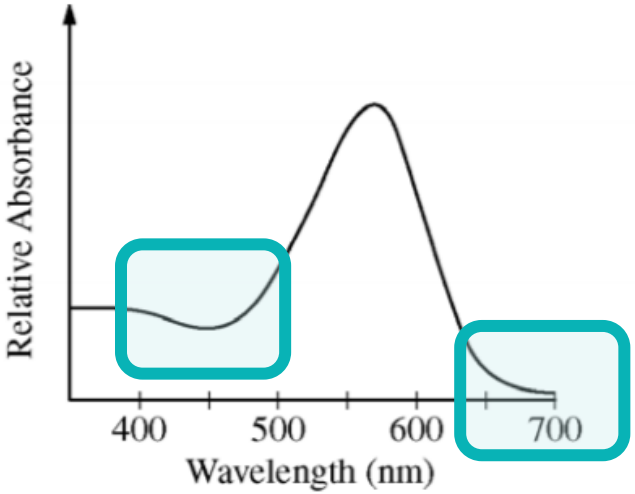
c. During the Calvin cycle, water is split, regenerating NADPH from NADP+, and oxygen gas is released.

d. During the Calvin cycle, water is split, the hydrogen atoms are added to intermediates of sugar synthesis, and oxygen gas is released.

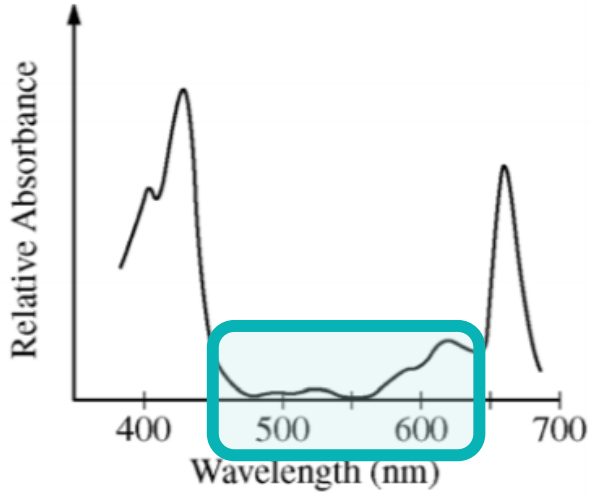
B

Free Response Question

One of the pigments is chlorophyll a, commonly found in green plants. The other pigment is bacteriorhodopsin, commonly found in purple photosynthetic bacteria.



Graph I



Graph II

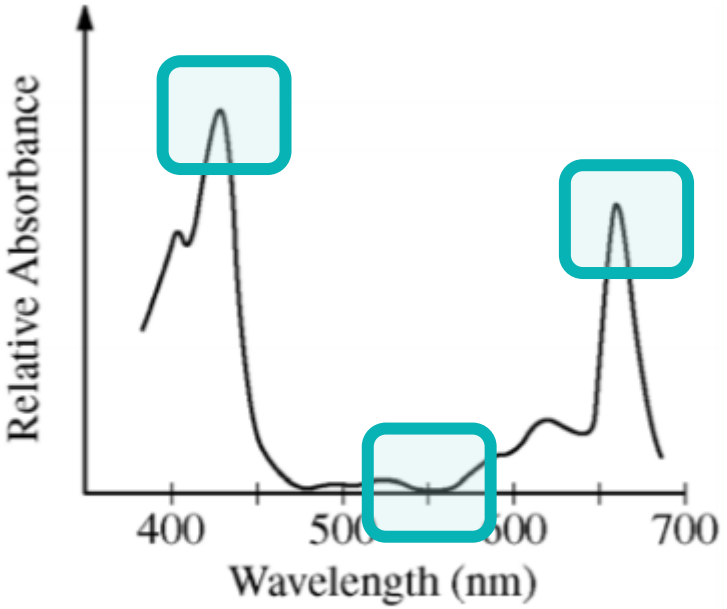
Color	Wavelength (nm)
Violet	380–450
Blue	450–475
Cyan	475–495
Green	495–570
Yellow	570–590
Orange	590–620
Red	620–750

Identify the pigment (chlorophyll a or bacteriorhodopsin) used to generate the absorption spectrum in each of the graphs above. Explain and justify your answer.

Free Response Question

Practice Question

In an experiment, identical organisms containing the pigment from Graph II as the predominant light-capturing pigment are separated into three groups. The organisms in each group are illuminated with light of a single wavelength (650 nm for the first group, 550 nm for the second group, and 430 nm for the third group). The three light sources are of equal intensity, and all organisms are illuminated for equal lengths of time. **Predict** the relative rate of photosynthesis in each of the three groups. **Justify** your predictions.



Graph II

Free Response Question

Practice Question

Wavelength (Group)	Prediction (**1 point each box**)	Justification (**1 point each box**)
650 nm (1st Group)	Intermediate rate	An intermediate level of absorption occurs at 650 nm (compared to 430 nm and 550 nm); *therefore*, an intermediate amount of energy is available to drive photosynthesis.
550 nm (2nd Group)	Lowest rate	The lowest level of absorption occurs at 550 nm; *therefore*, the least amount of energy is available to drive photosynthesis.
430 nm (3rd Group)	Highest rate	The highest level of absorption occurs at 430 nm; *therefore*, the greatest amount of energy is available to drive photosynthesis.

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Teacher ShoutOuts

Mrs. Trieller
Mrs. Foley
Ms. Tamayo
Ms. Nuskiewicz
Mrs. Speer
Mrs. Francis
Mr. Barth
Mrs. Parker

Mr. Monsour
Mr. Terzian
Ms. Moss
Mrs. Vrij
Mr. Reta
Ms. Nelson
Ms. Labiste
Mr. Lowe

You cross two yellow-round (heterozygous) peas. Does it follow independent assortment?

You observed:

Round Yellow Peas	Round Green Peas	Wrinkled Yellow Peas	Wrinkled Green Peas
219	81	69	31

Step 1: Complete the Punnett Squares to determine the EXPECTED values

	Y	y
Y	YY	Yy
y	Yy	yy

Yellow: ¾
Green: ¼

	R	r
R	RR	Rr
r	Rr	rr

Round: ¾
Wrinkled: ¼

Yellow & Round: ¾ x ¾ = 9/16
Yellow & Wrinkled: ¾ x ¼ = 3/16
Green & Round: ¼ x ¾ = 3/16
Green & Wrinkled: ¼ x ¼ = 1/16

Chi Square & Genetics

Step 2: Create & Fill in Your Chart

	Observed	Expected	O-E	$(O-E)^2$	$(O-E)^2/E$
Yellow & Round	219				
Yellow & Wrinkled	69				
Green & Round	81				
Green & Wrinkled	31				
Total	400				

Round Yellow Peas	Round Green Peas	Wrinkled Yellow Peas	Wrinkled Green Peas
219	81	69	31

Yellow & Round: 9/16
Yellow & Wrinkled: 3/16
Green & Round: 3/16
Green & Wrinkled: 1/16

Chi Square & Genetics

Step 3: Solve

	Observed	Expected	O-E	$(O-E)^2$	$(O-E)^2/E$
Yellow & Round	219	= 9/16 (400) = 225			
Yellow & Wrinkled	69	= 3/16 (400) = 75			
Green & Round	81	= 3/16 (400) = 75			
Green & Wrinkled	31	= 1/16 (400) = 25			
Total	400	400			

Chi Square & Genetics

Step 3: Solve

	Observed	Expected	O-E	$(O-E)^2$	$(O-E)^2/E$
Yellow & Round	219	= 9/16 (400) = 225	= 219 – 225 = – 6		
Yellow & Wrinkled	69	= 3/16 (400) = 75	= 69 – 75 = – 6		
Green & Round	81	= 3/16 (400) = 75	= 81 – 75 = 6		
Green & Wrinkled	31	= 1/16 (400) = 25	= 31 – 25 = 6		
Total	400	400			

Chi Square & Genetics

Step 3: Solve

	Observed	Expected	O-E	$(O-E)^2$	$(O-E)^2/E$
Yellow & Round	219	= 9/16 (400) = 225	= 219 – 225 = – 6	= $(-6)^2$ = 36	
Yellow & Wrinkled	69	= 3/16 (400) = 75	= 69 – 75 = – 6	= $(-6)^2$ = 36	
Green & Round	81	= 3/16 (400) = 75	= 81 – 75 = 6	= $(6)^2$ = 36	
Green & Wrinkled	31	= 1/16 (400) = 25	= 31 – 25 = 6	= $(6)^2$ = 36	
Total	400	400			

Chi Square & Genetics

Step 3: Solve

	Observed	Expected	O-E	$(O-E)^2$	$(O-E)^2/E$
Yellow & Round	219	= 9/16 (400) = 225	= 219 – 225 = – 6	= $(-6)^2$ = 36	= 36/225 = 0.16
Yellow & Wrinkled	69	= 3/16 (400) = 75	= 69 – 75 = – 6	= $(-6)^2$ = 36	= 36/75 = 0.48
Green & Round	81	= 3/16 (400) = 75	= 81 – 75 = 6	= $(6)^2$ = 36	= 36/75 = 0.48
Green & Wrinkled	31	= 1/16 (400) = 25	= 31 – 25 = 6	= $(6)^2$ = 36	= 36/25 = 1.44
Total	400	400			= 2.56

Step 4: Accept or Reject

Null Hypothesis: The experiment has NO effect. There is no difference between the two treatment groups.

In our case, the experiment follows the 9:3:3:1 ratio demonstrating independent assortment

Degrees of Freedom: Number of Samples – 1
4 (phenotypes) – 1
Degrees of Freedom = 3

X^2	= 2.56

Chi Square Significance Table

Degrees of Freedom (n)	5% Probability Value (P)
1	3.84
2	5.99
3	7.81
4	9.49

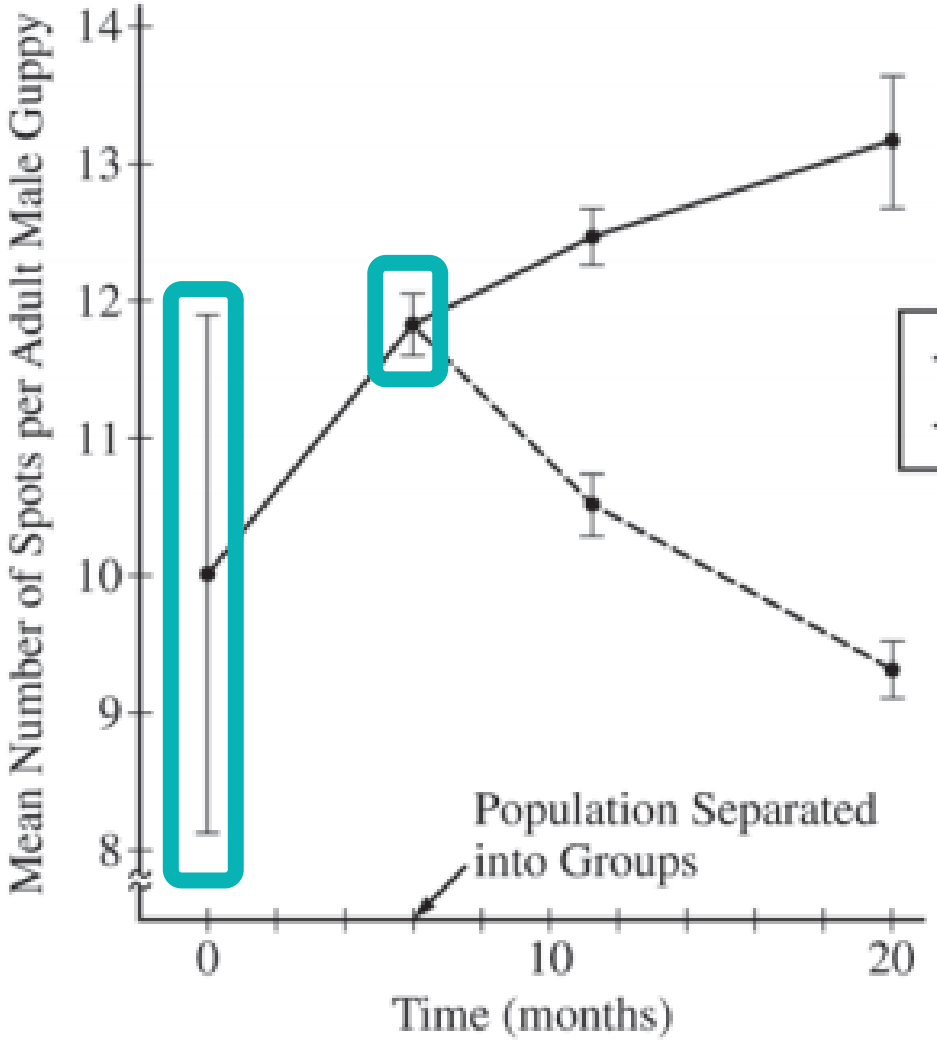
7.81> 2.56
Accept the null hypothesis

This demonstrates a 9:3:3:1
This demonstrates independent assortment

Is it time for my snack break?

Error Bars Discussion

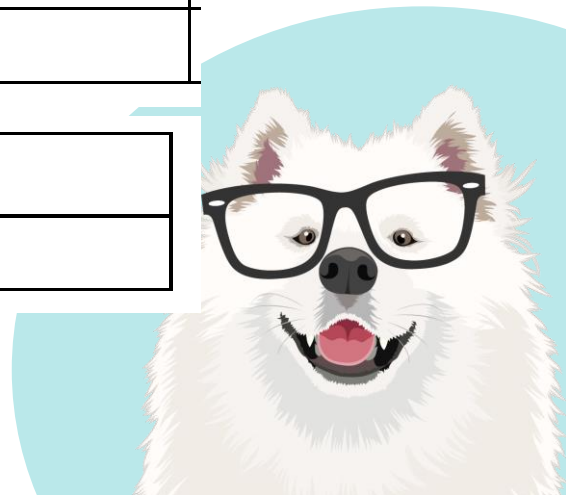
2014 #4



Describe the change in genetic variation in the population between 0 and 6 months and **provide** reasoning for your description based on the means and SEM.

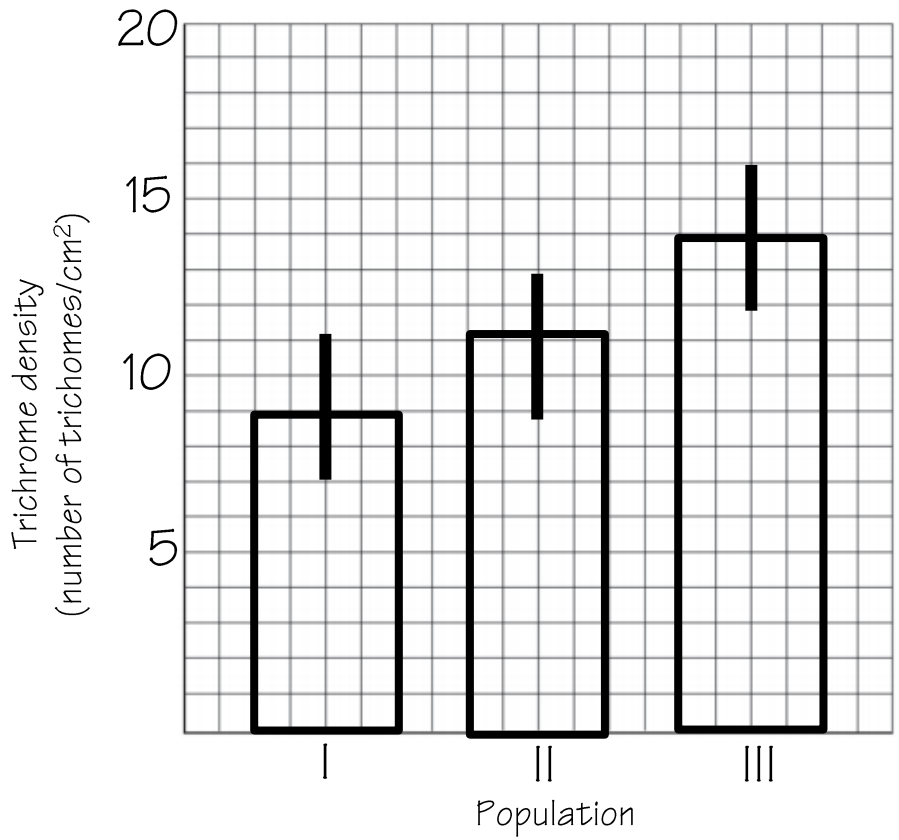
Describe change (**1 point**)
Genetic variation is decreasing

Provide reasoning (**1 point**)
SEM gets smaller



2014 #1

(a) On the axes provided, **create** an appropriately labeled graph to illustrate the sample means of the three populations to within 95% confidence (i.e., sample mean ± 2 SEM).



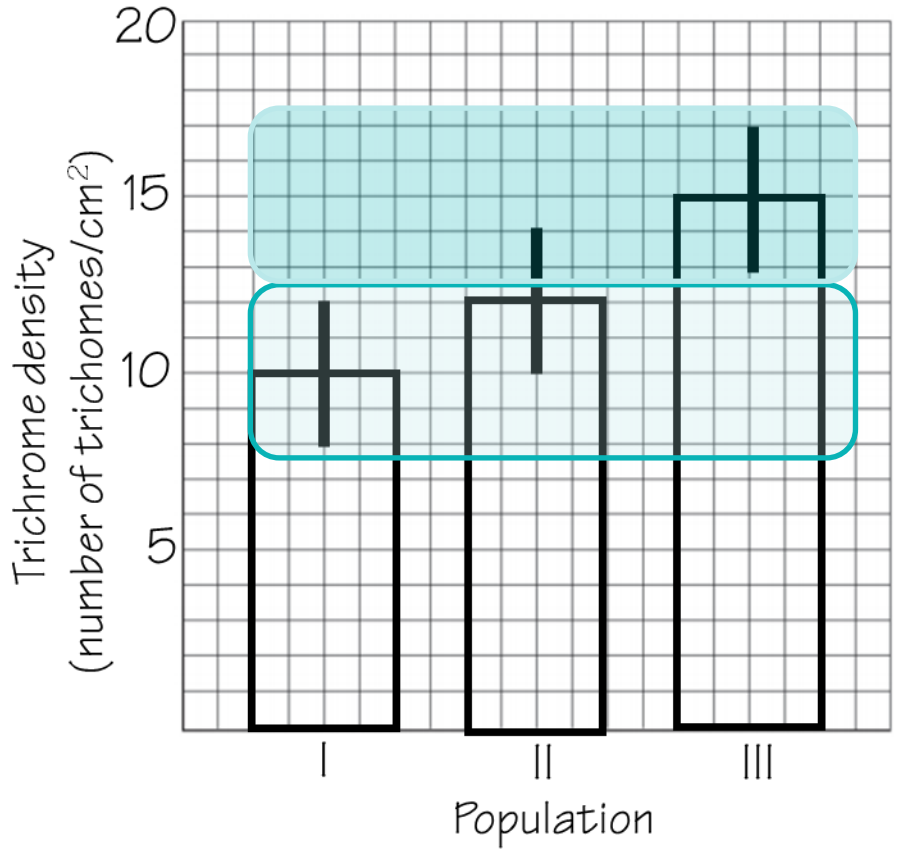
TRICHOME DENSITY IN THREE PLANT POPULATIONS (number of trichomes/cm²)

Population	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant 6	Mean	Standard Error of the Mean (SEM)
I	8	11	9	10	8	6	9	1
II	12	6	15	9	13	8	11	1
III	13	17	9	14	12	16	14	1

Error Bars Discussion

2014 #1

(b) Based on the sample means and standard errors of the means, **identify** the two populations that are most likely to have statistically significant differences in the mean stem trichome densities. **Justify** your response.



Identification (**1 point**)

- Populations I and III

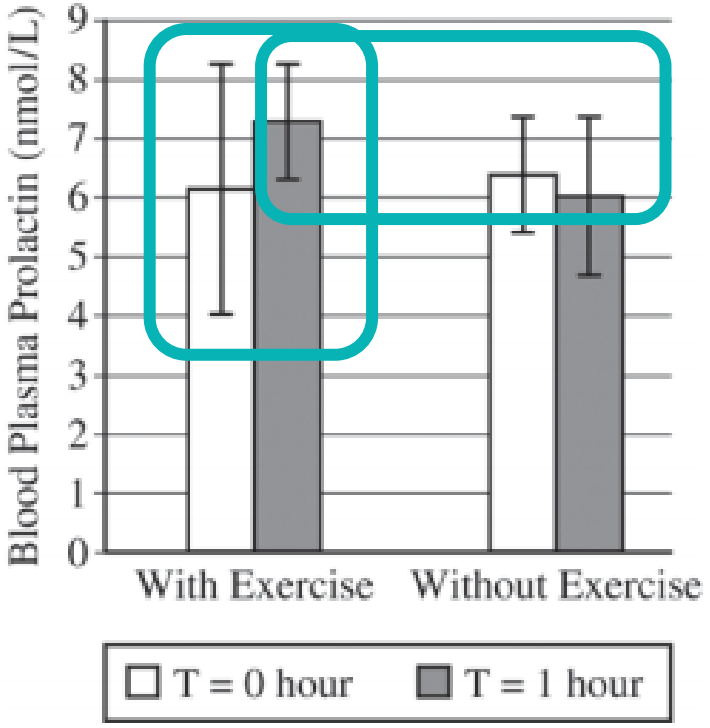
Justification (**1 point**)

- The error bars/95 percent confidence intervals for populations I and III do not overlap
- (Sample mean + 2 SEM of population I) < (Sample mean – 2 SEM of population III)

Error Bars Discussion

2016 #8

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



(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 $\pm 2SE_{\bar{x}}$.

Error Bars Discussion

2017 #1

(a) On the axes provided, **construct** an appropriately labeled graph to illustrate the effect of caffeine on the probability of bees revisiting a nectar source (memory). **(3 points)**

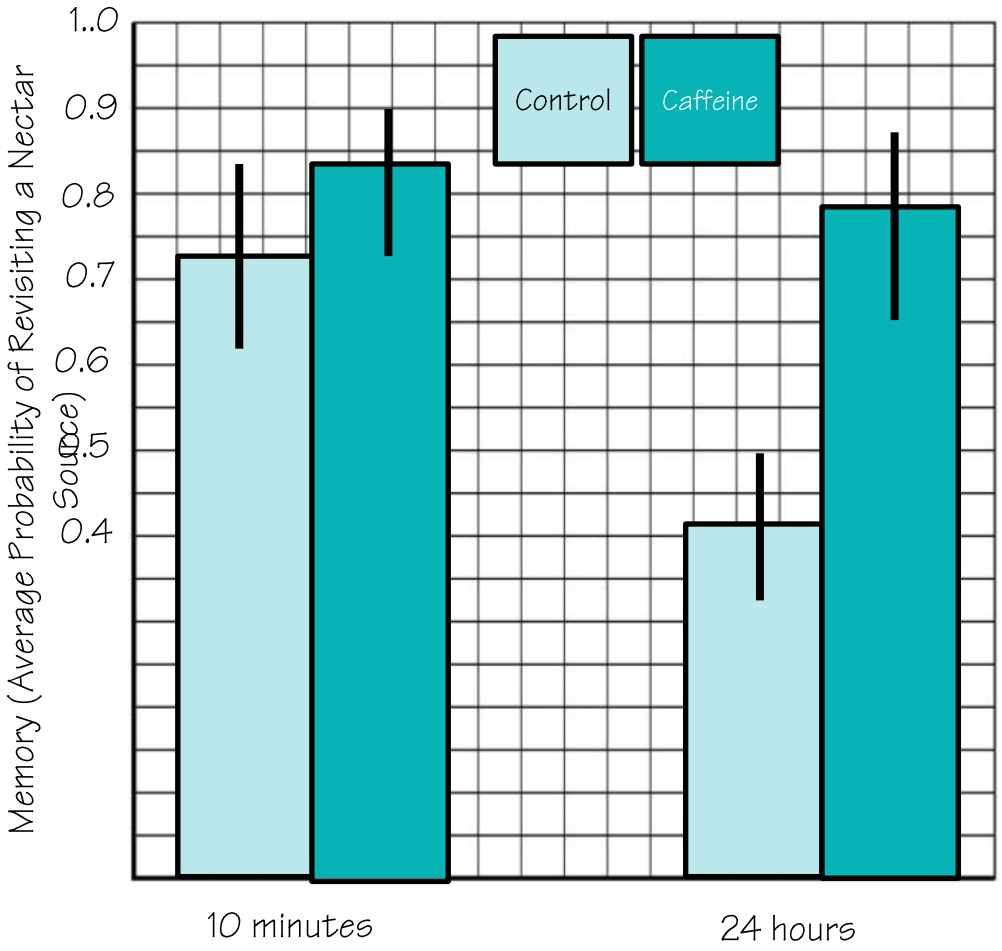


TABLE 1. EFFECT OF 0.1 mM CAFFEINE ON MEMORY IN BEES

Treatment	Memory (average probability of revisiting a nectar source $\pm 2SE_{\bar{x}}$)	
	10 Minutes	24 Hours
Control	0.72 ± 0.09	0.41 ± 0.07
Caffeine	0.83 ± 0.07	0.78 ± 0.08

Construct graph (3 points)

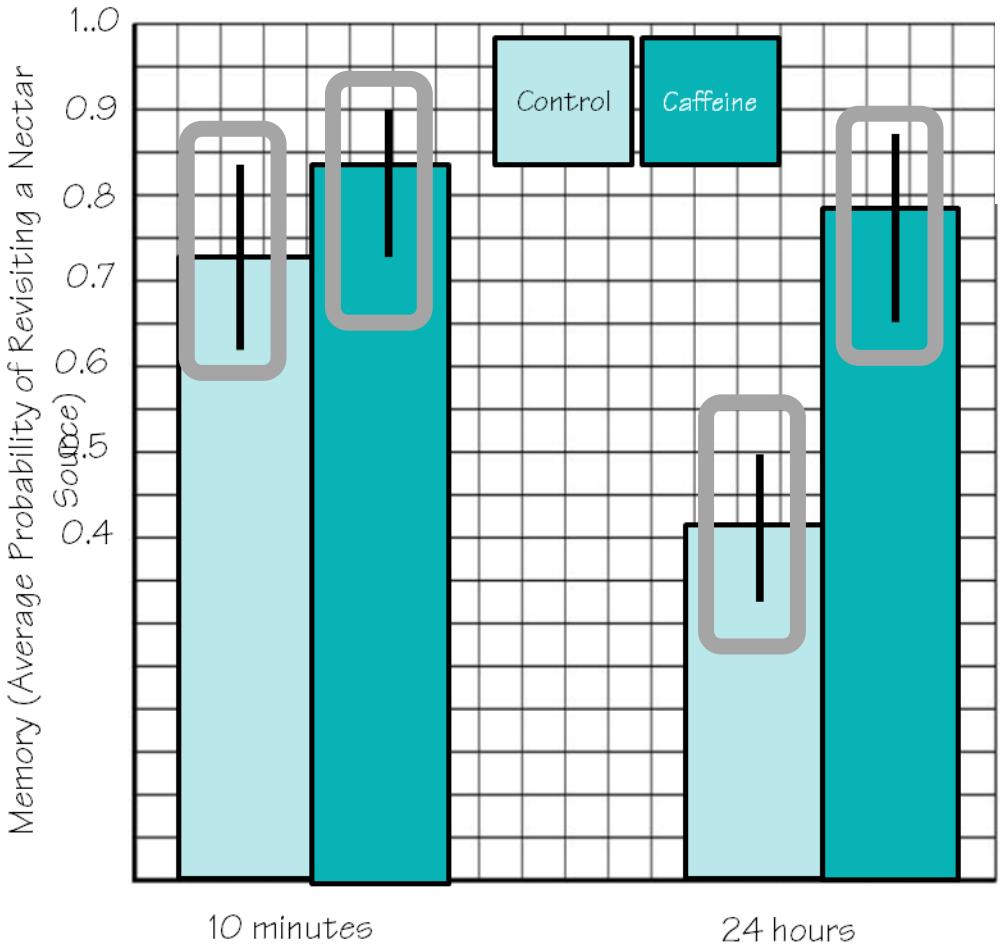
- Correctly plotted means on a bar graph/modified bar graph
- Appropriate labels, units, and scaling
- Correctly plotted error bars

2017 #1

Error Bars Discussion

(b) Based on the results, **describe** the effect of caffeine on each of the following: **(2 points)**

- Short-term (10 minute) memory of a nectar source
- Long-term (24 hour) memory of a nectar source



Description (2 points)

Short-term	Caffeine does not affect short-term memory/memory at 10 minutes.
Long-term	Caffeine improves/increases the long-term memory/memory at 24 hours.

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Party on Penguin

Unit 4/5 Q&A
@apbiopenguins
3/21 @ 8pm ET