BRVGS AP Biology Work and Checklist 4.3.20

BRVGS AP Biology Students and Parents,

Please see the outline and links below for upcoming work. We do not require or expect that students will work the week of Spring Break (April 6 through 10), but wanted to get this to everyone, for those who would like to get ahead.

Please note that individual teachers may send these assignments out and collect completed work via Google Classroom or local online learning systems. For those who do not, submissions of required work can be made to teachers by:

- Creating and sharing a Google Doc with your teacher and emailing him or her when the assignment is complete
- Printing or writing answers and mailing them to BRVGS at 14455 James Madison Hwy, Palmyra, VA 22963

Please note that **both Assignment 1 and Assignment 2** below must be completed by the dates listed. **Successful completion of both these assignments AND the "Upcoming Assignments" listed at the bottom of this page is required for students to receive BRVGS graduation credit for the AP Biology course.** "Successful completion" means that all components of the assignment are done and reflect real thought and effort in student work.

Please also note individual teachers may require additional activities, per their local instructional guidelines for the remainder of this school year. Please contact your BRVGS AP Biology teacher or Mr. Carraway at mcarraway@brvgs.k12.va.us for questions.

Assignment 1: AP Review

The purpose of the "choice" activities below is to help you begin the review process for the AP Exam with a good recap of your school year. **Please work to complete and share or submit these activities by 4 pm on April 17th**.

Although you are NOT required to work over spring break on this, PLEASE keep an eye out for possible emails with the updated information concerning AP Test dates and logistics. You may also reach out to your teacher or other BRVGS AP Bio teachers at any time for help/feedback.

Please submit ONLY 2 of the following activities to your teacher or to BRVGS by 4:00 PM on April 17th:

Option 1: **FRQ Activity**: Part 1: Long FRQ and Part 2: Short FRQs **(pages 1-19)** (Note: this counts as ONE activity)

Option 2: **Unit 1-6 Cheat Sheet Competition (page 20)** (this can be used for the AP test)

Option 3: **Tying Evolution To All Six Units (pages 21-22)** (To create your own copy of the Tying Evolution doc, click here - then please share with your teacher).

Assignment 2: Completion of the Funding Our Future Project (pages 23-24)

Please click on BRVGS AP Biology FOF Project Completion Guidelines to see requirements for the "presentation" component of the Funding Our Future Project. **This assignment is due to be submitted to your teachers or to BRVGS by 4:00 PM on April 24th.** We will survey students the week of April 13th to find out which option you choose to complete this project.

In addition to the presentation, you have the opportunity to improve your grade on your Funding Our Future paper by revising and resubmitting it. If you choose to do so, please submit revised papers to your teacher or to BRVGS **no later than 4:00 on May 1st**. Your teachers will be in touch individually regarding feedback and revisions.

Upcoming assignments and information:

- Additional AP Test review assignments will be posted by BRVGS on April 17th and May 1st.
- The new date for the AP Biology exam will be Monday, May 18.
- **Page 25** of this document has the textbook chapter alignments to the AP Bio Units

Assignment 1 - Option 1 - Part 1 of 2

The Long FRQ

1) On a piece of paper, brainstorm all the information you should put in your answer in relation to this question. 2) Time yourself: Allow for a maximum of nine minutes. (Roughly two minutes to read and seven to brainstorm a response)

Question 1 (#1 in image)

2019 AP® BIOLOGY FREE-RESPONSE QUESTIONS

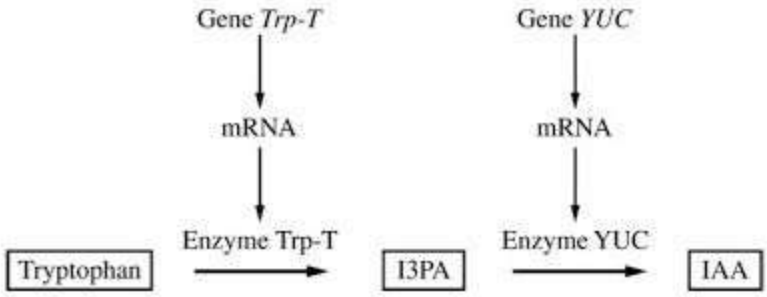

Figure 1. Model of two-step enzymatic plant pathway for synthesis of IAA from tryptophan

1. Auxins are plant hormones that coordinate several aspects of root growth and development. Indole-3-acetic acid (IAA) is an auxin that is usually synthesized from the amino acid tryptophan (Figure 1). Gene *Trp-T* encodes an enzyme that converts tryptophan to indole-3-pyruvic acid (I3PA), which is then converted to IAA by an enzyme encoded by the gene *YUC*.

   (a) **Circle** ONE arrow that represents transcription on the template pathway. **Identify** the molecule that would be absent if enzyme YUC is nonfunctional.

   (b) **Predict** how the deletion of one base pair in the fourth codon of the coding region of gene *Trp-T* would most likely affect the production of IAA. **Justify** your prediction.

   (c) **Explain** one feedback mechanism by which a cell could prevent production of too much IAA without limiting I3PA production.

   (d) Rhizobacteria are a group of bacteria that live in nodules on plant roots. Rhizobacteria can produce IAA and convert atmospheric nitrogen into forms that can be used by plants. Plants release carbon-containing molecules into the nodules. Based on this information, **identify** the most likely ecological relationship between plants and rhizobacteria. **Describe** ONE advantage to the bacteria of producing IAA.

   (e) A researcher removed a plant nodule and identified several "cheater" rhizobacteria that do not produce IAA or fix nitrogen. **Describe** the evolutionary advantage of being a bacterial cheater in a population composed predominantly of noncheater bacteria. Plants can adjust the amount of carbon-containing molecules released into nodules in response to the amount of nitrogen fixed in the nodule. **Predict** the change in the bacterial population that would cause the plant to reduce the amount of carbon-containing molecules provided to the nodule.

Before going to the next step: Answer the question of "Did you do all the words in BOLD in the question?"

2) Take the attached Scoring Guidelines and take three minutes to score yourself.

AP® BIOLOGY
2019 SCORING GUIDELINES

Question 1

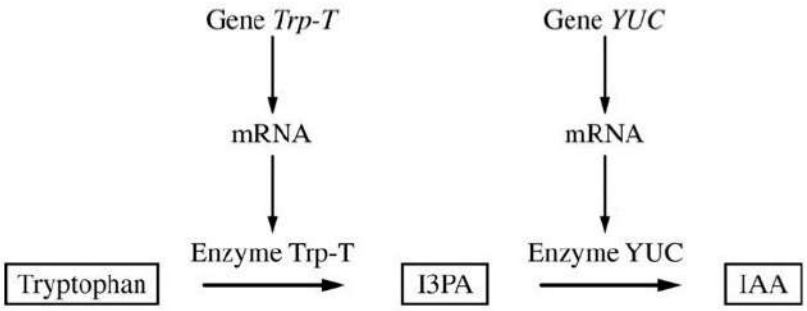

Figure 1. Model of two-step enzymatic plant pathway for synthesis of IAA from tryptophan

Auxins are plant hormones that coordinate several aspects of root growth and development. Indole-3-acetic acid (IAA) is an auxin that is usually synthesized from the amino acid tryptophan (Figure 1). Gene *Trp-T* encodes an enzyme that converts tryptophan to indole-3-pyruvic acid (I3PA), which is then converted to IAA by an enzyme encoded by the gene *YUC*.

(a) **Circle** ONE arrow that represents transcription on the template pathway. **Identify** the molecule that would be absent if enzyme YUC is nonfunctional.

Circle (1 point)

- Circle around either arrow pointing from a gene (*Trp-T* or *YUC*) to mRNA

Identification (1 point)

- IAA

(b) **Predict** how the deletion of one base pair in the fourth codon of the coding region of gene *Trp-T* would most likely affect the production of IAA. **Justify** your prediction.

Prediction (1 point)

- Reduction in IAA production OR No production of IAA

Justification (1 point)

- The mutation will result in the translation of an inactive/nonfunctional Trp-T enzyme.
- The mutation will result in no translation of the Trp-T enzyme.
- The mutation will result in no/reduced production of I3PA.

(c) **Explain** one feedback mechanism by which a cell could prevent production of too much IAA without limiting I3PA production.

Explanation (2 points)

- Negative feedback/feedback inhibition/increasing amounts of IAA inhibits the pathway.
- Production of YUC enzyme is inhibited OR YUC enzyme activity is inhibited.

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Question 1 (continued)

(d) Rhizobacteria are a group of bacteria that live in nodules on plant roots. Rhizobacteria can produce IAA and convert atmospheric nitrogen into forms that can be used by plants. Plants release carbon-containing molecules into the nodules. Based on this information, **identify** the most likely ecological relationship between plants and rhizobacteria. **Describe** ONE advantage to the bacteria of producing IAA.

Identification (1 point)

- Mutualism

Description (1 point)

- Increases habitat/number of nodules for the rhizobacteria.
- The bacteria receive carbon/carbon-containing molecules (as a result of increased plant growth).

(e) A researcher removed a plant nodule and identified several "cheater" rhizobacteria that do not produce IAA or fix nitrogen. **Describe** the evolutionary advantage of being a bacterial cheater in a population composed predominantly of noncheater bacteria. Plants can adjust the amount of carbon-containing molecules released into nodules in response to the amount of nitrogen fixed in the nodule. **Predict** the change in the bacterial population that would cause the plant to reduce the amount of carbon-containing molecules provided to the nodule.

Description (1 point)

- Cheaters/bacteria that benefit without producing IAA/fixing nitrogen have more energy for reproduction.

Prediction (1 point)

- Decrease in the nitrogen-fixing/noncheater bacteria
- Decrease in the amount of nitrogen fixed (by bacteria)

3) What score did you give yourself?

4) Give yourself a total of 12 minutes and Score the three students sample work. Write the scores you gave them down on your piece of paper.

STUDENT A

PAGE FOR ANSWERING QUESTION 1

1A1

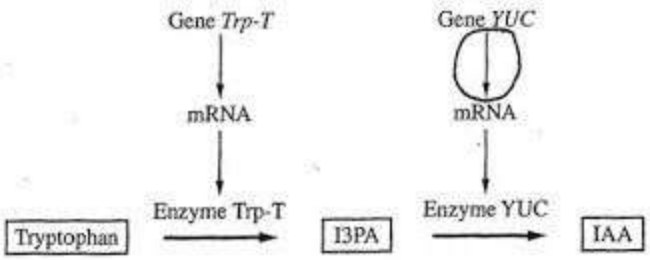

Figure 1. Model of two-step enzymatic plant pathway for synthesis of IAA from tryptophan

a) See diagram for circled arrow. If Enzyme YUC is nonfunctional, IAA will be absent.

b) The described deletion would likely significantly reduce IAA production. This is because a deletion of a base pair in a gene often causes a frame shift, which alters all subsequent codons in the gene. As the corresponding mRNA is translated, the altered codons append different amino acids than intended, resulting in a Trp-T Enzyme that is non-functional due to a differing primary structure.

c) To limit IAA production without limiting I3PA production, a cell would need a negative feedback loop that prevents Enzyme YUC availability in the presence of excess IAA. An example could consist of epigenetic markers produced in the presence of IAA that prevent transcription of the YUC gene, temporarily halting Enzyme YUC production.

d) The most likely ecological relationship between the plants & the rhizobacteria is mutualism. An advantage for the bacteria producing IAA is that the host roots will grow & develop in the presence of the IAA auxin, expanding the bacteria's habitat & ensuring the survival of the plant on which it depends.

e) Bacterial cheaters have an evolutionary advantage because they expend less energy

STUDENT B

1B1

PAGE FOR ANSWERING QUESTION 1

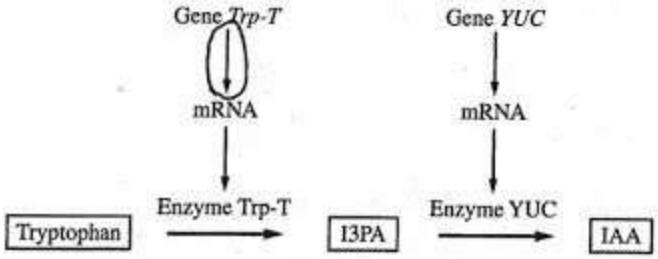

Figure 1. Model of two-step enzymatic plant pathway for synthesis of IAA from tryptophan

a.) The molecule that would be absent would be IAA.

b.) The deletion of one base pair could lead to the enzyme Trp-T to not be produced properly or at all b/c the deletion would affect the coding region of the gene, which would change the amino acid sequence, which would alter the protein that is produced after translation. IAA would not be produced b/c the Enzyme Trp-T would not be usable or produced, so tryptophan cannot become I3PA which cannot be converted to IAA.

c.) The cell could turn of the Gene YUC which would not create the Enzyme YUC which would mean I3PA could not be converted to IAA.

STUDENT C

PAGE FOR ANSWERING QUESTION 1

1C1

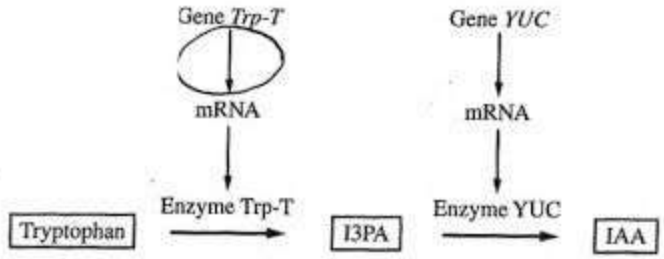

Figure 1. Model of two-step enzymatic plant pathway for synthesis of IAA from tryptophan

a) The molecule that would be absent if enzyme YUC is nonfunctional is indole-3-acetic acid (IAA).

b) The deletion of one base pair in the fourth codon of the coding region of gene Trp-T could stop the production of IAA. This is because a deletion of one base-pair can lead to a frameshift mutation, causing a different enzyme to probably be produced. If enzyme Trp-T is no longer produced by gene Trp-T, then I3PA cannot be made, which means nothing is available to be converted into IAA.

c) One feedback mechanism could be limiting the production of enzyme YUC. Without enough enzymes YUC, ~~I~~ a lot of I3PA will not be able to be converted to IAA even if there are many of I3PA.

5) Use the Scoring document below to compare how you scored the student responses with College Board scored them. Answer the question below on your paper.

- **Student A: How did your score compare? If yours was different, why?**
- **Student B: How did your score compare? If yours was different, why?**
- **Student C: How did your score compare? If yours was different, why?**

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Question 1 (continued)

bacteria more shelter." The response earned 1 point in part (e) for describing that "the bacteria that 'cheat' … do not have to expend energy … this would give the 'cheaters' more energy to reproduce."

Sample: 1C
Score: 6

The response earned 1 point in part (a) for circling the arrow pointing from Gene *Trp-T* to mRNA. The response earned 1 point in part (a) for identifying that the molecule that would be absent is indole-3-acetic acid (IAA). The response earned 1 point in part (b) for predicting that the deletion could "stop the production of IAA." The response earned 1 point in part (b) for justifying that "[i]f enzyme Trp-T is no longer produced … then I3PA cannot be made." The response earned 1 point in part (c) for explaining that "[o]ne feedback mechanism could be limiting the production of enzyme YUC." The response earned 1 point in part (d) for identifying that "[p]lants and Rhizobacteria most likely have a mutualistic relationship."

Assignment 1 - Option 1 - Part 2 of 2
The Short FRQ

1) On a piece of paper, brainstorm all the information you should put in your answer in relation to each question.
2) Time yourself: Allow for a maximum of nine minutes. (Roughly two minutes to read each one and 3.5 minutes for brainstorming each response)

Question 1 (#3 in image)

2019 AP® BIOLOGY FREE-RESPONSE QUESTIONS

3. The pyruvate dehydrogenase complex (PDC) catalyzes the conversion of pyruvate to acetyl-CoA, a substrate for the Krebs (citric acid) cycle. The rate of pyruvate conversion is greatly reduced in individuals with PDC deficiency, a rare disorder.

   (a) **Identify** the cellular location where PDC is most active.

   (b) **Make a claim** about how PDC deficiency affects the amount of NADH produced by glycolysis AND the amount of NADH produced by the Krebs (citric acid) cycle in a cell. **Provide reasoning** to support your claims based on the position of the PDC-catalyzed reaction in the sequence of the cellular respiration pathway.

   (c) PDC deficiency is caused by mutations in the *PDHA1* gene, which is located on the X chromosome. A male with PDC deficiency and a homozygous female with no family history of PDC deficiency have a male offspring. **Calculate** the probability that the male offspring will have PDC deficiency.

Question 2 (#4 in image)

2019 AP® BIOLOGY FREE-RESPONSE QUESTIONS

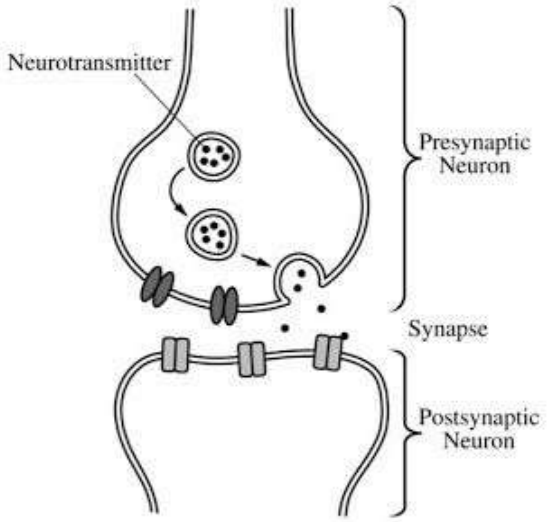

Figure 1. Release of neurotransmitters into the synapse in response to an action potential

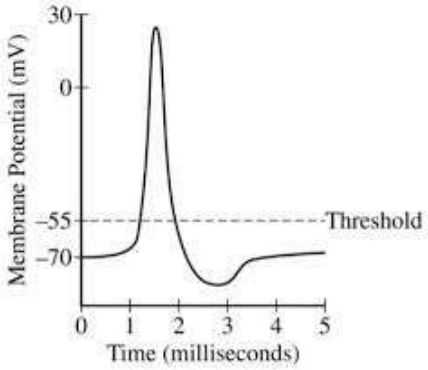

Figure 2. Model of a typical action potential in a neuron

4. Acetylcholine is a neurotransmitter that can activate an action potential in a postsynaptic neuron (Figures 1 and 2). A researcher is investigating the effect of a particular neurotoxin that causes the amount of acetylcholine released from presynaptic neurons to increase.

   (a) **Describe** the immediate effect of the neurotoxin on the number of action potentials in a postsynaptic neuron. **Predict** whether the maximum membrane potential of the postsynaptic neuron will increase, decrease, or stay the same.

   (b) The researcher proposes two models, A and B, for using acetylcholinesterase (AChE), an enzyme that degrades acetylcholine, to prevent the effect of the neurotoxin. In model A, AChE is added to the synapse. In model B, AChE is added to the cytoplasm of the postsynaptic cell. **Predict** the effectiveness of EACH proposed model. **Provide reasoning** to support your predictions.

3.) Take the attached Scoring Guidelines and take 4 minutes (2 per question) to score yourself.

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2019 SCORING GUIDELINES

Question 3

The pyruvate dehydrogenase complex (PDC) catalyzes the conversion of pyruvate to acetyl-CoA, a substrate for the Krebs (citric acid) cycle. The rate of pyruvate conversion is greatly reduced in individuals with PDC deficiency, a rare disorder.

(a) **Identify** the cellular location where PDC is most active.

Identification (1 point)

- Mitochondria
- Mitochondrial matrix

(b) **Make a claim** about how PDC deficiency affects the amount of NADH produced by glycolysis AND the amount of NADH produced by the Krebs (citric acid) cycle in a cell. **Provide reasoning** to support your claims based on the position of the PDC-catalyzed reaction in the sequence of the cellular respiration pathway.

(1 point per row; 2 points max.)

	Claim	Reasoning
Glycolysis	No change	• Glycolysis continues; PDC is not needed. • Glycolysis occurs before conversion of pyruvate to acetyl-CoA.
Krebs cycle	Decrease	• The Krebs cycle is greatly reduced/slowed down if there is no/less acetyl-CoA. • The Krebs cycle occurs after conversion of pyruvate to acetyl-CoA.

(c) PDC deficiency is caused by mutations in the *PDHA1* gene, which is located on the X chromosome. A male with PDC deficiency and a homozygous female with no family history of PDC deficiency have a male offspring. **Calculate** the probability that the male offspring will have PDC deficiency.

Calculation (1 point)

- The probability of inheritance is 0.
- The offspring cannot/will not have PDC deficiency.

What score did you give yourself?

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Question 4

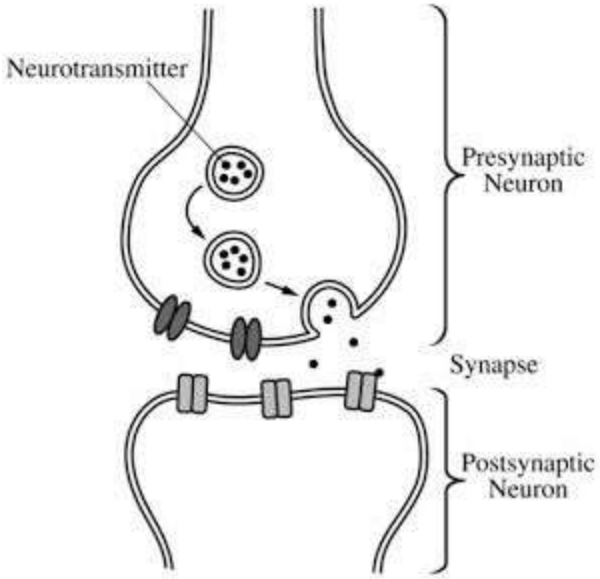


Figure 1. Release of neurotransmitters into the synapse in response to an action potential

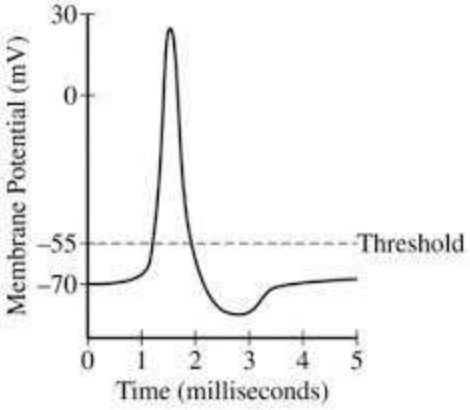


Figure 2. Model of a typical action potential in a neuron

Acetylcholine is a neurotransmitter that can activate an action potential in a postsynaptic neuron (Figures 1 and 2). A researcher is investigating the effect of a particular neurotoxin that causes the amount of acetylcholine released from presynaptic neurons to increase.

(a) **Describe** the immediate effect of the neurotoxin on the number of action potentials in a postsynaptic neuron. **Predict** whether the maximum membrane potential of the postsynaptic neuron will increase, decrease, or stay the same.

Description (1 point)

- It will increase the number of action potentials.

Prediction (1 point)

- It will stay the same.

(b) The researcher proposes two models, A and B, for using acetylcholinesterase (AChE), an enzyme that degrades acetylcholine, to prevent the effect of the neurotoxin. In model A, AChE is added to the synapse. In model B, AChE is added to the cytoplasm of the postsynaptic cell. **Predict** the effectiveness of EACH proposed model. **Provide reasoning** to support your predictions.

(1 point per row; 2 points max.)

	Prediction	Reasoning
Model A	Effective	Acetylcholine is in the synapse.
Model B	Not effective	Acetylcholine is not in the cytoplasm of the postsynaptic cell.

What score did you give yourself?

Give yourself 6 minutes and Score the three students' sample work. Write the scores you gave them down on your piece of paper.

5) Use the Scoring Document for each question to compare how you scored the student responses with how College Board scored them. Answer the questions below on your paper.

- **Student A: How did your scores compare? If yours was different, why?**
- **Student B: How did your scores compare? If yours was different, why?**
- **Student C: How did your scores compare? If yours was different, why?**

Question 1 (#3 in image)

STUDENT A

3A

3. The pyruvate dehydrogenase complex (PDC) catalyzes the conversion of pyruvate to acetyl-CoA, a substrate for the Krebs (citric acid) cycle. The rate of pyruvate conversion is greatly reduced in individuals with PDC deficiency, a rare disorder.

   (a) **Identify** the cellular location where PDC is most active.

   (b) **Make a claim** about how PDC deficiency affects the amount of NADH produced by glycolysis AND the amount of NADH produced by the Krebs (citric acid) cycle in a cell. **Provide reasoning** to support your claims based on the position of the PDC-catalyzed reaction in the sequence of the cellular respiration pathway.

   (c) PDC deficiency is caused by mutations in the *PDHA1* gene, which is located on the X chromosome. A male with PDC deficiency and a homozygous female with no family history of PDC deficiency have a male offspring. **Calculate** the probability that the male offspring will have PDC deficiency.

PAGE FOR ANSWERING QUESTION 3

a. PDC is most active in a cell's mitochondria.

b. A PDC deficiency does not change the amount of NADH produced [redacted] by glycolysis, but it decreases the amount of NADH produced in the Krebs cycle. This occurs because the PDC-catalyzed reaction (to make acetyl CoA) occurs after glycolysis, leading to no impact, and before the Krebs cycle. Without acetyl CoA, the Krebs cycle cannot occur, so a PDC deficiency would halt all NADH production in this step.

c. Male - X^mY, where m = mutation

Female - XX

X	X	
X^m	X^mX	X^mX
Y	XY	XY

There is a 0% probability that a male offspring will have PDC deficiency.

Student B

3B1

3. The pyruvate dehydrogenase complex (PDC) catalyzes the conversion of pyruvate to acetyl-CoA, a substrate for the Krebs (citric acid) cycle. The rate of pyruvate conversion is greatly reduced in individuals with PDC deficiency, a rare disorder.

   (a) **Identify** the cellular location where PDC is most active.

   (b) **Make a claim** about how PDC deficiency affects the amount of NADH produced by glycolysis AND the amount of NADH produced by the Krebs (citric acid) cycle in a cell. **Provide reasoning** to support your claims based on the position of the PDC-catalyzed reaction in the sequence of the cellular respiration pathway.

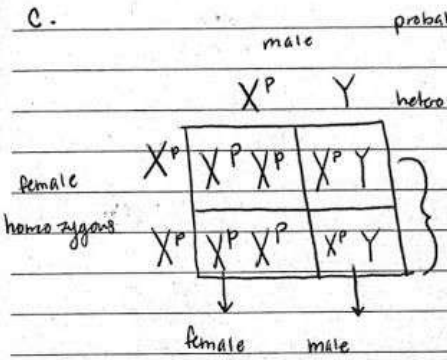
   (c) PDC deficiency is caused by mutations in the *PDHA1* gene, which is located on the X chromosome. A male with PDC deficiency and a homozygous female with no family history of PDC deficiency have a male offspring. **Calculate** the probability that the male offspring will have PDC deficiency.

PAGE FOR ANSWERING QUESTION 3

a. It is most active in the cytoplasm of eukaryotic cells.

b. The PDC catalyzed reaction occurs at the end of glycolysis, prior to entering the Krebs cycle so a deficiency would not affect the amount of NADH produced by glycolysis. However, a deficiency would decrease the amount of NADH produced by the Krebs cycle because it would prevent the conversion, or significantly decrease, the ~~abbe~~ amount of acetyl-CoA which is a necessary substrate to trigger the Krebs cycle. If the Krebs cycle is not activated, the production of NADH during cellular respiration would be reduced, though it would not affect the existing amounts produced by glycolysis earlier in the overall process.

c. probability = 0



X^P = dominant sex-linked trait for PDHA1 mutation

X^p = recessive

Y = y-chromosome

STUDENT C

3C

3. The pyruvate dehydrogenase complex (PDC) catalyzes the conversion of pyruvate to acetyl-CoA, a substrate for the Krebs (citric acid) cycle. The rate of pyruvate conversion is greatly reduced in individuals with PDC deficiency, a rare disorder.

   (a) **Identify** the cellular location where PDC is most active.

   (b) **Make a claim** about how PDC deficiency affects the amount of NADH produced by glycolysis AND the amount of NADH produced by the Krebs (citric acid) cycle in a cell. **Provide reasoning** to support your claims based on the position of the PDC-catalyzed reaction in the sequence of the cellular respiration pathway.

   (c) PDC deficiency is caused by mutations in the *PDHA1* gene, which is located on the X chromosome. A male with PDC deficiency and a homozygous female with no family history of PDC deficiency have a male offspring. **Calculate** the probability that the male offspring will have PDC deficiency.

PAGE FOR ANSWERING QUESTION 3

A: PDC is most active in the mitochondria.

B: PDC deficiency will cause NADH production to decrease because there will be less energy.

C: X^h Y The male offspring have a 0% chance of having a PDC deficiency.

X^H X^HX^h X^HY

X^H X^HX^h X^HY

How did your score compare to College Board?

AP® BIOLOGY
2019 SCORING COMMENTARY

Question 3

Note: Student samples are quoted verbatim and may contain spelling and grammatical errors.

Overview

Students were asked to consider the cellular location of pyruvate dehydrogenase complex (PDC), the enzyme that converts pyruvate to acetyl-CoA, and describe the consequences in the cell when the activity of the enzyme is greatly reduced in the genetic disorder PDC deficiency. Students used their understanding of cellular organelles to identify the location of the enzyme. They also used their understanding of glycolysis and aerobic respiration to make a claim (and justify it) about how PDC deficiency affects the amount of NADH produced by these two processes. Lastly, they used their knowledge of the inheritance of X-linked traits to determine the probability of a child inheriting PDC deficiency given information about the genotypes of the parents. Within the question, students needed to provide claims and reasonings as well as calculate a probability.

Sample: 3A
Score: 4

The response earned 1 point in part (a) for identifying the mitochondria. The response earned 1 point in part (b) for making a claim that PDC deficiency does not change the amount of NADH produced by glycolysis and providing reasoning that "the PDC-catalyzed reaction occurs after glycolysis." The response earned 1 point in part (b) for making a claim that PDC deficiency decreases the amount of NADH produced in the Krebs cycle and providing reasoning that the PDC-catalyzed reaction occurs before the Krebs cycle. The response earned 1 point in part (c) for calculating that "[t]here is a 0% probability."

Sample: 3B
Score: 3

The response earned 1 point in part (b) for providing reasoning that the PDC-catalyzed reaction occurs at the end of glycolysis and making a claim that deficiency would not affect the amount of NADH produced by glycolysis. The response earned 1 point in part (b) for making a claim that a deficiency would decrease the amount of NADH produced by the Krebs cycle and providing reasoning that "it would prevent the conversion, or significantly decrease, the amount of acetyl-CoA which is a necessary substrate to … the Krebs cycle." The response earned 1 point in part (c) for calculating that the "probability = 0."

Sample: 3C
Score: 2

The response earned 1 point in part (a) for identifying that PDC is most active in the mitochondria. The response earned 1 point in part (c) for calculating that "[t]he male offspring have a 0% chance of having a PDC deficiency."

Give yourself 6 minutes and Score the three students' sample work. Write the scores you gave them down on your piece of paper.

6) Use the Scoring Document for each question to compare how you scored the student responses with how College Board scored them. Answer the questions below on your paper.

- **Student A: How did your scores compare? If yours was different, why?**
- **Student B: How did your scores compare? If yours was different, why?**
- **Student C: How did your scores compare? If yours was different, why?**

Question 2 (#4 in image)
STUDENT A

4A1

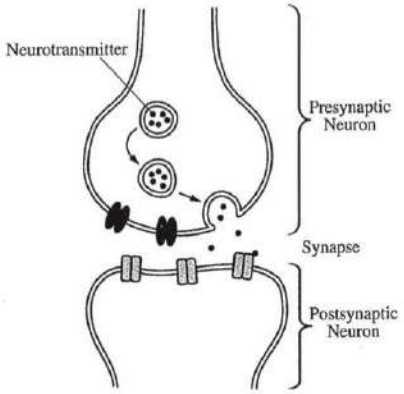


Figure 1. Release of neurotransmitters into the synapse in response to an action potential

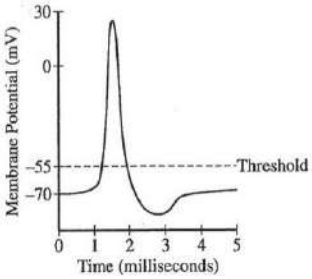


Figure 2. Model of a typical action potential in a neuron

4. Acetylcholine is a neurotransmitter that can activate an action potential in a postsynaptic neuron (Figures 1 and 2). A researcher is investigating the effect of a particular neurotoxin that causes the amount of acetylcholine released from presynaptic neurons to increase.

(a) **Describe** the immediate effect of the neurotoxin on the number of action potentials in a postsynaptic neuron. **Predict** whether the maximum membrane potential of the postsynaptic neuron will increase, decrease, or stay the same.

(b) The researcher proposes two models, A and B, for using acetylcholinesterase (AChE), an enzyme that degrades acetylcholine, to prevent the effect of the neurotoxin. In model A, AChE is added to the synapse. In model B, AChE is added to the cytoplasm of the postsynaptic cell. **Predict** the effectiveness of EACH proposed model. **Provide reasoning** to support your predictions.

PAGE FOR ANSWERING QUESTION 4

a) The number of action potentials will increase as a result of the neurotoxin as Acetylcholine will be increased and thus, bind to the receptors more frequently. The maximum membrane potential should remain the same, however.

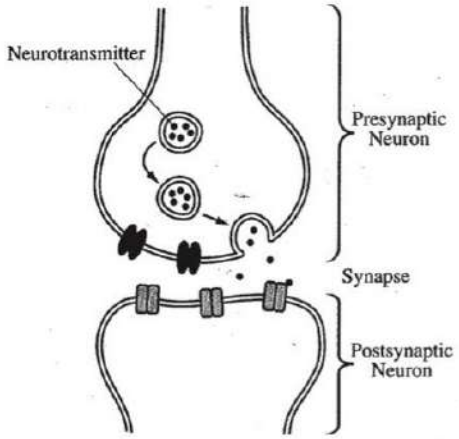
4A2

ADDITIONAL PAGE FOR ANSWERING QUESTION 4

b) Model A will be effective in preventing the effects of the neurotoxin, as AChE will degrade the Acetylcholine in the synaptic cleft, where it affects the action potential cascade. Model B will be ineffective as there is no Acetylcholine in the post-synaptic cell, so the AChE will not prevent the effects of the neurotoxin.

STUDENT B

4B1



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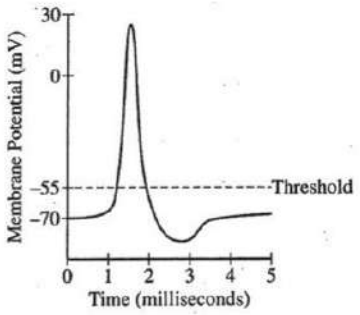

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PAGE FOR ANSWERING QUESTION 4

A) The neurotoxin will increase the number of action potentials because more neurotransmitters will be available in the synapse to bind to the postsynaptic neuron receptors and start an action potential.

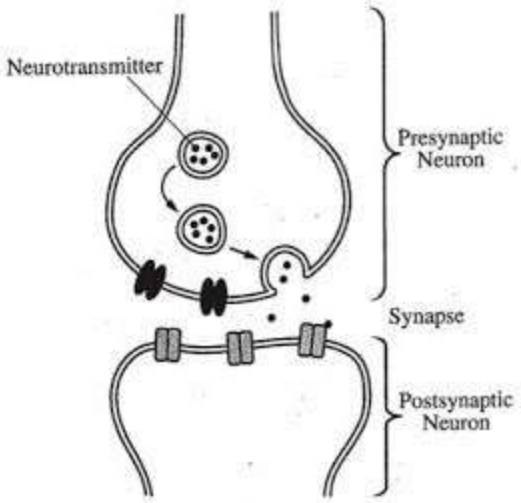
4B2

ADDITIONAL PAGE FOR ANSWERING QUESTION 4

B) Model A would be effective because it would break down some acetylcholine in the synapse to bring the number of neurotransmitters down to normal levels. Model B would be ineffective because it does nothing to the number of neurotransmitters because the acetylcholine will leave the presynaptic neuron ~~and~~, go into the synapse, bind to the receptors on the outside of the postsynaptic neuron, then return to the presynaptic neuron through reuptake so if acetylcholinesterase is in the cytoplasm of the postsynaptic cell, it won't come into contact with the acetylcholine being released.

STUDENT C

4C



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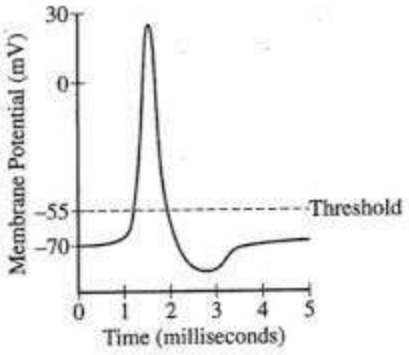

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PAGE FOR ANSWERING QUESTION 4

a) there will be more action potentials and the maximum membrane potential will stay the same

b) for the AChE added to the synapse is going to be more effective in having less action potentials while if it is added to the post synaptic neuron there will be no effect on the action potentials

How did your score compare to College Board?

Assignment 1 - Option 2

Unit 1-6 Cheat Sheet Competition (This MAY be used on the AP Exam)

BRVGS Class Cheat Sheet Competition

Spring 2020

Who can make the BEST Cheat Sheet?

THE RULES!!

Format Choices: Drawn Images only (may include small captions/labels) OR Shortcuts to Remembering OR Old School (get as much info on a page as possible)

Font Size: You will NOT have a magnifying glass, so must be size 10-12 font

One normal 8x11 page front and back AND must be submitted digitally by taking pictures and emailing to your teacher OR a copy can be mailed to BRVGS at 14455 James Madison Hwy., Palmyra, VA 22963

Content: The main focus should be on **College Board AP Bio Units 1-6**.

Cheat Sheets will be judged on: accuracy, amount of information and creativity

Assignment 1 - Option 3
Tying Evolution To All Six Units

AP Biology Review - Natural Selection

"Nothing in biology makes sense except in the light of evolution." - Theodosius Dobzhansky (1973)

What similarities do organisms have in common? How do their differences help them survive in different environments? How do we explain all of the diversity of life on this planet, while at the same time explaining the basic similarities that all living things share?

Instructions: While the AP test will not specifically focus on Unit 7 (Natural Selection), the topics of evolution and natural selection tie in with every other concept covered in AP Biology.

For **each** of the six topics/units listed below:

- Write a 75-100 word summary on how the topics of evolution/natural selection relate to the unit/topic

  -OR-

- Provide 4 specific examples of how the topics of evolution/natural selection relate to the unit/topic.

Example: A specific example for Unit 1- Chemistry of Life - *All organisms are mostly made of the same elements (CHONPS), and these elements can be combined into chemicals that all living things require (carbohydrates, lipids, proteins, and nucleic acids). This provides evidence of the interrelatedness/common descent of all organisms.*

Possible Ideas to Consider:

- Similarities and differences between prokaryotes and eukaryotes
- Similarities and differences between animals/plants/fungi/microorganisms in terms of structure (overall anatomy, cell structure, etc)
- Similarities and differences between animals/plants/fungi/microorganisms in terms of function (reactions, metabolism, etc.)
- Basic similarities of all animals (or plants, fungi, prokaryotes, etc), as well as specific differences between types of animals (or plants, fungi, prokaryotes, etc)

Your answers can focus on specific examples, along with more "big picture" ideas. Feel free to email your teacher if you need any help!

IMPORTANT NOTE: The unit numbers refer to the specific units outlined by the College Board for AP Biology, and may be different from specific units covered in your AP Biology class.

1. How does evolution/natural selection relate to Unit 1 - Chemistry of Life?

- Potential topics include: macromolecule structure and function, chemical bonding, water chemistry

2. How does evolution/natural selection relate to Unit 2 - Cell Structure and Function?

- Potential topics include: cell structure and function (prokaryotic vs eukaryotic), membrane transport, cellular responses to changes in the environment

3. How does evolution/natural selection relate to Unit 3 - Cellular Energetics?

- Potential topics include: photosynthesis, cellular respiration, enzymes

4. How does evolution/natural selection relate to Unit 4 - Cell Communication and Cell Cycle?

- Potential topics include: signal transduction pathways, feedback loops, cell division

5. How does evolution/natural selection relate to Unit 5 - Heredity?

- Potential topics include: genetic diversity, reproduction, genetics

6. How does evolution/natural selection relate to Unit 6 - Gene Expression and Regulation?

- Potential topics include: transcription and translation, DNA/RNA structure and function, regulation of gene expression

ASSIGNMENT 2

BRVGS AP Biology FOF Project Completion Guidelines

The goal for the remainder of this project is for students to use the information that they researched and wrote about to create a persuasive "virtual presentation" or written product to support and "sell" the proposal established by the group at the project workday. **Students may do this final activity as an individual, or with some OR all of your same-group classmates.**

Individual activities (choose 1 of the 2 options listed here):
Please note that either of these can be submitted electronically OR written by hand and returned to BRVGS by mail.

1. Write a 2 to 3-page grant application letter to the Gates Foundation, outlining (and selling!) your proposal, and providing basic information on:
    a. WHAT you propose to do
    b. WHY you propose to undertake this specific action (what is your goal?),
    c. HOW much funding you will need, and WHAT the funds that you request will be spent on.
    d. HOW you will know if your actions have been successful (what will you measure?)
2. Create and draw an infographic, consisting of images or drawings and text, that CLEARLY includes ALL of the information listed above. See examples of infographics on the next page.

OR Group activity: any number of students from the same topic group can be a "group," (so if you had 6 or 7 people in your originally-assigned group, but only 2 or 3 people want to do the group project, that is OK).

1. The group will create a slideshow, following the guidelines from the project website. The first slide must be an "introduction" slide, contributed to by all group members, that explains the background of your topic.
2. Each group member will create 2 slides and will assist with intro and conclusion slides, as follows:
    a. If you have 2 - 3 members participating, you can largely focus on "selling" your proposal, with relatively little information needed for budgeting or measurement of success (that info can be referenced on conclusion slide)
    b. If you have 4-5 members participating, you should focus on "selling" your proposal and include at least two slides for budgeting plans. No need to focus on how you will measure success
    c. If you have 6 or more members participating, you will need to include all of the "WHAT," "WHY" and "HOW" information listed in the Individual Activity # 1 above.
3. Presentation information should be provided in the "speaker notes" section of the slideshow. Groups can also provide a "voiceover" on each slide IF they choose (Ms. Outten can assist with how do that)
4. Individual students in the group MAY opt to do one slide and a brief (40 seconds to 1 minute) video presentation, rather than two slides, to embed in the slideshow
5. A conclusion slide, summing up the actions and providing one last effort at "selling" the proposal, must be created by the group, PLUS a citation slide for all specific information and pics.

Successful completion of this project means that a student has done the following:

1. The student or group has successfully introduced the topic with an overview as to importance and possible future directions.
2. The student clearly explains the group's proposed action(s), with all required "WHAT," "WHY" and "HOW" information.
3. The work must reflect factual, research-based information about your topic
4. All factual evidence must be cited.
5. All grammar and spelling must be correct and all writing should be clear and "professional" in tone

Please note that while this work will not be given a grade of "A," "B" or "C," successful completion of this assignment is required for BRVGS graduation credit for this course.

MDA Summer 2016 Research Grants

Grants were awarded in **4 countries**

Washington, D.C. and **12 states** across America

22 research grants made to established investigators

2 development grants made to young researchers on the brink of becoming independent investigators

1 research infrastructure grant to fund the development of tools, techniques or services to facilitate therapy development

By The Numbers

MDA awarded **25** new research, development and research infrastructure grants totaling nearly **$7 million** with broad applicability across the diseases in MDA's program

$300,000 Average research grant award

$180,000 Average development grant award

MDA now committed to more than **150 research projects around the world**

The world's leading **neuromuscular disease clinicians and scientists** serve on MDA's Research Advisory Committee and recommend the top science projects for approval by MDA's Board of Directors

MDA takes a big-picture perspective across neuromuscular diseases to uncover breakthroughs that will accelerate treatments and cures. The power in this research approach is that knowledge and information from one disease can often yield progress in others to speed urgently needed answers for families.

MDA® **#MDAResearch**

For more information on MDA research projects, please visit **mda.org/research.**

CENTER FOR WATER RESOURCE SUSTAINABILITY

SERVES TO:

✓ Conduct research on water resources-related issues in Hawai'i and the U.S.-affiliated Pacific Islands

✓ Facilitate access to interdisciplinary expertise within the university to enhance understanding of water issues

RESULTING IN:

The use of data and science based evidence to inform management and policy decision-making on water quality, quantity, wastewater management, and infrastructure best practices

Sea Grant University of Hawai'i

The Center for Water Resource Sustainability partners with the University of Hawai'i at Mānoa Water Resources Research Center (WRRC) which Hawai'i Sea Grant has been administering since 2013.

For **MORE THAN 50 YEARS**, the WRRC has been conducting research, education, and outreach addressing the unique water and wastewater management problems and issues in Hawai'i and the Pacific.

THE WRRC IS ONE OF 54 WATER RESOURCES RESEARCH INSTITUTES NATIONWIDE, INCLUDING PUERTO RICO, THE U.S. VIRGIN ISLANDS, AND GUAM IN COOPERATION WITH THE U.S. GEOLOGICAL SURVEY.

The Center for Water Resource Sustainability facilitates access to interdisciplinary expertise within the university to enhance understanding of environmental problems and to identify effective solutions.

SIGNATURE PROJECTS

NATIONAL SCIENCE FOUNDATION EPSCoR PROJECT

INCREASING ACCESS TO SAFE DRINKING WATER ON HAWAI'I ISLAND

Campbell 10e's Chapters Aligned to AP Units

Unit	Chapters in Campbell, 10e
1: Chemistry of Life	Ch 3, (4), 5
2: Cell Structure and Function	Ch 6, 7 (Ch 27 prokaryotes, Ch 36 water potential, Ch 44 osmoregulation)
3: Cellular Energetics	Ch 8, 9, 10
4: Cell Communication and Cell Cycle	Ch 11, 12 (Ch 39 plant signaling, Ch 43 immune, Ch 45 endocrine, Ch 48 nervous)
5: Heredity	Ch 13, 14, 15
6: Gene Expression and Regulation	Ch 16, 17, 18, 20 (Ch 19 viruses, Ch 21 genome evolution)
7: Natural Selection	Ch 22, 23, 24, 25, and 26 (Ch 19 viruses, Ch 21 genome evolution)
8: Ecology	Ch 51, 52, 53, 54, 55, 56

For other textbooks please contact your teacher for the breakdown