AP® BIOLOGY
2014 SCORING GUIDELINES

Question 8

A research team has genetically engineered a strain of fruit flies to eliminate errors during DNA replication. The team claims that this will eliminate genetic variation in the engineered flies. A second research team claims that eliminating errors during DNA replication will not entirely eliminate genetic variation in the engineered flies. (**3 points maximum**)

(a) **Provide** ONE piece of evidence that would indicate new genetic variation has occurred in the engineered flies. (**1 point**; LO 1.10)

Piece of evidence
- New phenotypes
- Different DNA sequence
- New genotypes
- Chromosomal differences
- Different mRNA sequence
- Protein with different amino acid sequence

(b) **Describe** ONE mechanism that could lead to genetic variation in the engineered strain of flies. (**1 point**; LO 3.28)

Describe mechanism
- Sexual reproduction produces offspring with new combinations of alleles/traits
- Meiosis produces new combinations of alleles/traits
- Crossing over produces new combinations of alleles/traits
- Independent assortment produces new combinations of alleles/traits
- Random fertilization produces new combinations of alleles/traits
- Immigration/gene flow introduces new alleles/gene sequences
- Viral infection inserts DNA into genome
- Nondisjunction causes anomaly in chromosome number
- Chromosomal rearrangements (e.g., large deletions, duplications, translocations, inversions, transposons, etc.) inactivate genes or result in multiple copies of genes
- Radiation or chemicals or mutagens induce mutations/changes in DNA

(c) **Describe** how genetic variation in a population contributes to the process of evolution in the population. (**1 point**; LO 1.25)

Description
- Genetic variation is the basis of phenotypic variation that can be acted upon by natural selection
- Without genetic variation, there is no phenotypic variation on which natural selection can act

© 2014 The College Board.
Visit the College Board on the Web: www.collegeboard.org.

8A1

8. A research team has genetically engineered a strain of fruit flies to eliminate errors during DNA replication. The team claims that this will eliminate genetic variation in the engineered flies. A second research team claims that eliminating errors during DNA replication will not entirely eliminate genetic variation in the engineered flies.

   (a) **Provide** ONE piece of evidence that would indicate new genetic variation has occurred in the engineered flies.

   (b) **Describe** ONE mechanism that could lead to genetic variation in the engineered strain of flies.

   (c) **Describe** how genetic variation in a population contributes to the process of evolution in the population.

PAGE FOR ANSWERING QUESTION 8

8a.) One piece of evidence that would indicate a new variation has occured in the engineered flies would be the appearance of a new phenotype. If all the flies were engineered to have black eyes and if some generations down the line, a red-eyed fly appeared, genetic variation would have occured.

8b.) One mechanism that could lead to genetic variation in the engineered strain of fruit flies would be crossing over (chiasma) during meiosis. This exchange of genetic material leads to more genetic variation because during meiosis, some parts of DNA are exchanged between adjacent chromosomes, which leads to different DNA sequences, which would cause genetic variation in the engineered group of flies.

8c) Genetic variation contributes to the process of evolution because it leads to the expression of different phenotypes. Depending on environmental conditions, one phenotype may be more advantageous for an

Unauthorized copying or reuse of any part of this page is illegal.

©2014 The College Board.
Visit the College Board on the Web: www.collegeboard.org.

8A2

organism than ~~another~~ another. For example, if there are 2 types of ~~finches~~ birds, one short-billed and the other long-billed, and the long-billed beak allows the bird to gain more access to food, then the long-billed phenotype is more fit than the short-billed variety. This will ultimately mean that the long-billed bird has more of a chance of living to reproductive age, and will therefore have more offspring, and will help the long-billed trait to continue to thrive, meaning there will be more long-billed birds than short-billed birds in the population.

©2014 The College Board.
Visit the College Board on the Web: www.collegeboard.org.

8B1

8. A research team has genetically engineered a strain of fruit flies to eliminate errors during DNA replication. The team claims that this will eliminate genetic variation in the engineered flies. A second research team claims that eliminating errors during DNA replication will not entirely eliminate genetic variation in the engineered flies.

   (a) **Provide** ONE piece of evidence that would indicate new genetic variation has occurred in the engineered flies.

   (b) **Describe** ONE mechanism that could lead to genetic variation in the engineered strain of flies.

   (c) **Describe** how genetic variation in a population contributes to the process of evolution in the population.

PAGE FOR ANSWERING QUESTION 8

(a) one piece of evidence to show genetic variation has occured is a new trait being expressed (phenotype)

(b) Mutations can lead to genetic variation in a strain of flies. mutations ~~are~~ are random changes in the genome of an organism. A mutation changes the dna of an organisms, and if new traits arise due to the mutation, there will be genetic variation

(c) with genetic variation, certain traits will be selected against and the traits that make an

Unauthorized copying or reuse of any part of this page is illegal.

©2014 The College Board.
Visit the College Board on the Web: www.collegeboard.org.

ADDITIONAL PAGE FOR ANSWERING QUESTION 8

8 B2

individual better adapted to the environment will increase its survival and reproductive rate. Slowly, a population will begin to evolve so that the advantageous trait is more common and any traits not advantageous will decrease in the gene pool.

GO ON TO THE NEXT PAGE.

©2014 The College Board.
Visit the College Board on the Web: www.collegeboard.org.

8C

8. A research team has genetically engineered a strain of fruit flies to eliminate errors during DNA replication. The team claims that this will eliminate genetic variation in the engineered flies. A second research team claims that eliminating errors during DNA replication will not entirely eliminate genetic variation in the engineered flies.

   (a) **Provide** ONE piece of evidence that would indicate new genetic variation has occurred in the engineered flies.

   (b) **Describe** ONE mechanism that could lead to genetic variation in the engineered strain of flies.

   (c) **Describe** how genetic variation in a population contributes to the process of evolution in the population.

PAGE FOR ANSWERING QUESTION 8

a) "The research team has genetically engineered a strain of fruit flies..." This statement shows that the fruit flies have been genetically altered.

b) A mutation could lead to genetic variation in the flies.

c) Genetic variation helps determine what organisms will survive or die. The organism with the better adaptations will have a better success of reproduction than those who struggle. For example, if one ~~bug~~ bee had a longer proboscious than bee number two, Bee number one's variation has given him a better chance of survival and will cause evolution if it reproduces.

Unauthorized copying or reuse of any part of this page is illegal.

©2014 The College Board.
Visit the College Board on the Web: www.collegeboard.org.

AP® BIOLOGY
2014 SCORING COMMENTARY

Question 8

Question 8 was written to the following Learning Objectives in the AP Biology Curriculum Framework: 1.10, 1.25, and 3.28.

Overview

Question 8 asks students to refine evidence from hypothetical data to explain how genetic variation contributes to the process of evolution. Students were presented with a description of a strain of fruit flies that has been engineered to eliminate errors during DNA replication. Students were asked to provide evidence that would indicate new genetic variation has occurred in the engineered flies. Students were then asked to explain a process that could lead to genetic variation. Finally, students were asked to describe how genetic variation in a population contributes to the process of evolution, using the engineered fruit flies as a model.

Sample: 8A
Score: 3

The response in Sample 8A earned 1 point in part (a) for providing "the appearance of a new phenotype" as a piece of evidence that indicates new genetic variation has occurred.

The response earned 1 point in part (b) for describing crossing over during meiosis as a mechanism that could lead to genetic variation in the engineered strain of flies.

The response earned 1 point in part (c) for describing that new phenotypes may provide a selective advantage to the individual.

Sample: 8B
Score: 2

The response in Sample 8B earned 1 point in part (a) for providing "a new trait being expressed (phenotype)" as a piece of evidence that indicates new genetic variation has occurred.

The response earned 1 point in part (c) for describing that new traits may be acted upon by natural selection.

Sample: 8C
Score: 1

The response in Sample 8C earned 1 point in part (c) for describing that genetic variation can lead to adaptations that contribute to differential reproductive success.

© 2014 The College Board.
Visit the College Board on the Web: www.collegeboard.org.