AP Bio FRQ Fridays

2014 #8
Genetic Engineering & Natural Selection

FRQ Friday #24

2014 #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.

Piece of evidence

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

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

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.

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

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

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

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.

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

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

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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 organism than another. For example, if there are 2 types of 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.