

# What is Genetic Variation in Populations?

## Worksheet

Genetic variation refers to differences in DNA sequences among individuals in a population, arising mainly from mutation, recombination (crossing over), independent assortment, and gene flow.

## Questions

- Which of the following is a source of genetic variation?
  - Mutation
  - Genetic drift
  - Natural selection
  - Bottleneck effect
- What happens to genetic variation during a population bottleneck?
  - It increases
  - It decreases
  - It stays the same
  - It doubles
- Crossing over during meiosis increases genetic variation by...
  - duplicating chromosomes
  - creating new combinations of alleles
  - doubling chromosome number
  - eliminating recessive alleles
- A locus has allele frequencies  $p = 0.7$  and  $q = 0.3$ . What is the expected heterozygosity ( $2pq$ )?
  - 0.21
  - 0.42
  - 0.49
  - 0.09
- A locus has two alleles: A (frequency 0.6) and a (frequency 0.4). Calculate the expected heterozygosity.
- In a population of 500 individuals, 50 new mutations arise at a locus in one generation. Calculate the per-individual mutation rate.
- Two populations exchange migrants: 20 individuals move into a population of 200 each generation. Calculate the migration rate ( $m$ ).
- Define: What is genetic variation?
- Define: What are the four main sources of genetic variation?
- Define: How does genetic drift affect genetic variation?

## Answer Key

1. A) Mutation - Mutation creates new alleles; drift, selection, and bottlenecks tend to reduce existing variation.
2. B) It decreases - A bottleneck drastically reduces population size and, with it, allele diversity.
3. B) creating new combinations of alleles - Crossing over exchanges chromosome segments, producing new allele combinations.
4. B)  $0.42 - 2pq = 2 \cdot 0.7 \cdot 0.3 = 0.42$ .
5.  $H = 2pq = 2 \cdot 0.6 \cdot 0.4 = 0.48$  (48% of individuals are expected to be heterozygous)
6. Mutation rate = new mutations / population size =  $50 / 500 = 0.1$  mutations per individual per generation
7.  $m = \text{migrants} / \text{total population} = 20 / 200 = 0.10$  (10% migration rate)
8. Differences in DNA sequences and alleles among individuals in a population - the raw material for evolution.
9. Mutation, recombination (crossing over), independent assortment, and gene flow (migration).
10. It randomly reduces variation, especially in small populations (e.g., bottleneck effect, founder effect).

### **Bounlu**

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