What Is Genetic Drift in Populations?

Worksheet

Genetic drift is a random change in allele frequencies due to chance events in reproduction and survival; unlike natural selection, it is not driven by fitness differences and can even reduce a population's adaptedness.

Questions

1. Genetic drift has the strongest effect in

A) Very large populations
B) Very small populations
C) Populations with no mutation
D) Populations under strong selection only

2. Which formula estimates the variance in allele frequency change due to drift?

A) a = v/t
B) Var(p) = pq/(2N)
C) E = mc
D) F = ma

3. A population bottleneck is an example of

A) Natural selection
B) Gene flow
C) Genetic drift
D) Mutation pressure

4. Unlike natural selection, genetic drift is

A) Always beneficial
B) Based on fitness differences
C) Random with respect to fitness
D) Only found in plants

5. A population of N = 25 beetles has allele frequency p = 0.5. Estimate the variance in allele frequency change next generation.

6. A large population of N = 5,000 has the same p = 0.5. Compare its drift variance to the N = 25 population above.

7. After a flood, a population of 1,000 mice is reduced to 10 survivors by chance, unrelated to their genotype. What phenomenon does this illustrate, and what happens to genetic diversity?

8. Define: What is genetic drift?

9. Define: In which populations is genetic drift strongest?

10. Define: What is a population bottleneck?

Answer Key

1. B) Very small populations - Because drift is a sampling effect, its relative impact grows as population size shrinks.

2. B) Var(p) = pq/(2N) - Var(p) = pq/(2N) is the standard one-generation drift variance formula.

3. C) Genetic drift - A bottleneck randomly reduces population size and genetic diversity - a drift phenomenon.

4. C) Random with respect to fitness - Drift changes allele frequencies by chance, regardless of whether alleles are helpful or harmful.

5. Var(p) = pq/(2N) = 0.50.5/(225) = 0.25/50 = 0.005 SD 0.005 0.071 (a ~7% swing is plausible)

6. Var(p) = 0.50.5/(25000) = 0.25/10000 = 0.000025 SD 0.000025 0.005 (a ~0.5% swing) Conclusion: drift variance is ~200 weaker in the larger population (drift scales as 1/N)

7. A drastic, chance reduction in population size = a population bottleneck (a form of genetic drift) Rare alleles are likely lost entirely if none of the 10 survivors carry them Overall genetic diversity drops sharply Subsequent generations start from this smaller, less diverse gene pool

8. Random change in allele frequencies from generation to generation due to chance, not selection.

9. Small populations - chance events have a much larger relative effect.

10. A sharp, chance-driven reduction in population size that randomly reduces genetic diversity.