Finite-population genetics: inheritance, drift, and fixation — review sheet

Use this after attempting the worked examples and practice. Explain each claim in words before calculating.

Key ideas

- Diploid allele frequencies count copies; genotype frequencies count individuals.
- Independent gametes give probabilities p^2, $2p(1-p)$, $(1-p)^2$.
- Neutral drift can change one trajectory while preserving ensemble expected frequency.
- At fixed p, one-generation frequency variance scales as $1/(2N)$.
- Without mutation or migration, zero and one are absorbing boundaries.

Common errors and repairs

Using AB frequency as A allele frequency. Count two A copies per AA and one per AB, then divide by 2N.

Interpreting the dashed expectation as a required trajectory. One finite-population realization can differ; even a finite ensemble mean fluctuates.

Declaring every upward fluctuation evidence of selection. Neutral random sampling can produce upward changes; compare competing explanations with appropriate data.

Retrieve without your notes

- At $p = 0.5$, what are the three genotype probabilities?
- At fixed p, what happens to one-generation variance when N doubles?
- Why does sampling without replacement from the entire pool fail to create the modeled drift?

Readiness check

- Compute allele frequency from diploid genotype counts without confusing copies and individuals.
- Derive the three offspring genotype probabilities for independent gametes.
- Explain the difference between an expected frequency and one finite-population trajectory.
- Predict how population size changes one-generation sampling variation.
- Check probability totals, attainable frequencies and absorbing limits.