Population genetics - II

Genetics 371B Lecture 34 3 Dec. 1999

Evolution:

Quantifying genetic variation

Factors that alter allele frequencies

Genetic drift

Altered allele frequency due to random fluctuation…

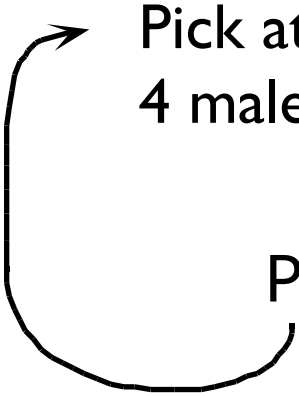
Result: loss of variation (a.k.a. loss of heterozygosity)

Warwick Kerr, Sewall Wright

Drosophila experiment:

Wildtype x forked bristle mutant

+ = p = 0.5
forked (f) = q = 0.5



Pick at random:
4 males x 4 females, 100 parallel crosses

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Progeny

Expected: $p^2 + 2pq + q^2$

Observed, after 16 generations:

Consequence of random genetic drift:
heterozygotes are exchanged for homozygotes

…drift towards homozygosity

Ultimately:

How likely is the *Drosophila* result if 4000 males and females are chosen?

Calculating rate of loss due to drift

Rate of drift (loss of alleles) α

Loss of heterozygosity per generation =

Fraction heterozygous after *t* generations H_t …

Effect of inbreeding:

Founder effect: small population established from small initial sample

e.g., achromatopsia in Pingelap atoll

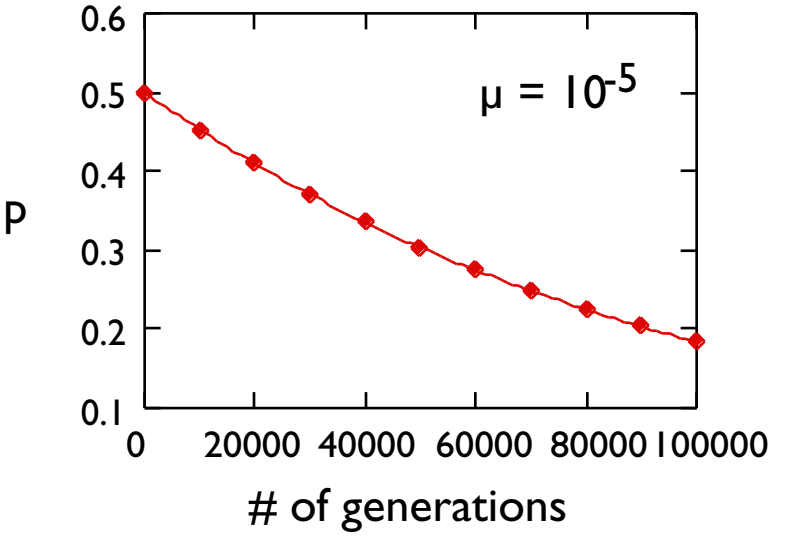
What counters the trend towards homozygosity?

Mutation

Mutation rate μ:

If initial frequency(A) = p0, then frequency(A) after 1 generation –

p_1 =



Mutation rate vs. genetic drift:

To counter loss of allele **a** (rate: 1/N) from drift…
would need mutation rate μ such that μ ≥ 1/N