POPULATION GENETICS

locus
allele
allele frequency
gene pool
n_1 A_1, n_2 A_2, $n_1 + n_2 = N$
$p = n_1 / N$, $q = n_2 / N$
$p + q = 1$
deterministic, stochastic

genotype
natural selection
fitness
mutations

GENERAL

A_1A_1	A_1A_2	A_2A_2
w_{11}	w_{12}	w_{22}
p^2	$2pq$	q^2

$p = p^2 + pq$

Hardy-Weinberg Equilibrium

$q_{t+1} = (p\,q\,w_{12} + q^2\,w_{22}) / \underline{w}$

$\Delta q = pq[p(w_{12}-w_{11})+q(w_{22}-w_{12})] / \underline{w}$

DOMINANCE

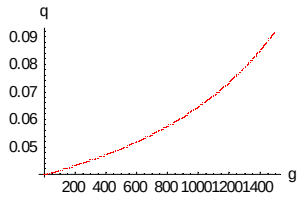
A_1A_1	A_1A_2	A_2A_2
w_{11}	w_{12}	w_{22}
1	1	1 + s
p^2	$2pq$	q^2

$\Delta q = pq[p(w_{12}-w_{11})+q(w_{22}-w_{12})] / \underline{w}$

$\Delta q = pq[p(1-1)+q(1+s-1)] / \underline{w}$

$w = p^2 + 2pq + (1 + s)q^2 = 1 + sq^2$

$\Delta q = pq^2s / (1 + q^2s)$

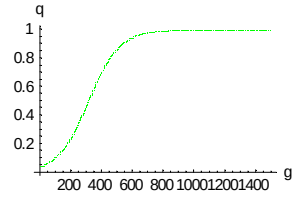


CODOMINANCE

A_1A_1	A_1A_2	A_2A_2
w_{11}	w_{12}	w_{22}
1	1 + s	1 + 2s
p^2	2pq	q^2

$\Delta q = pq[p(w_{12}-w_{11})+q(w_{22}-w_{12})] / \underline{w}$

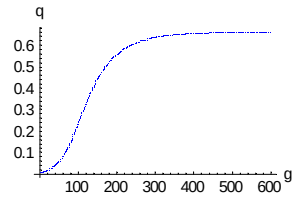
$\Delta q = pqs / (1 + 2spq + 2sq^2)$



OVER- & UNDER-DOMINANCE

A_1A_1	A_1A_2	A_2A_2
w_{11}	w_{12}	w_{22}
1	1 + s	1 + t
p^2	2pq	q^2

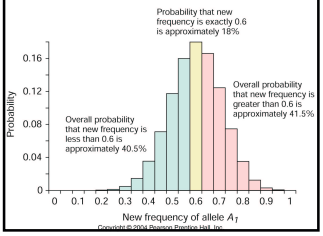
$\Delta q = 0$ at $q = 0$, 1, or $s / (2s - t)$

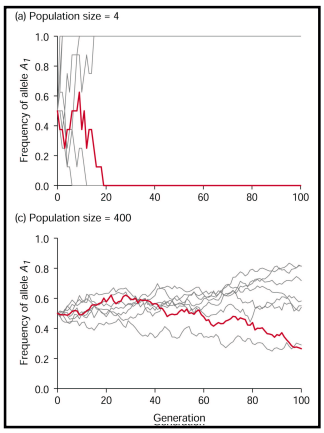


GENETIC DRIFT

stochastic sampling with finite population size N

leads to fixation, loss




(a) Population size = 4
Frequency of allele A_1
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
(c) Population size = 400
Frequency of allele A_1
1.0
0.8
0.6
0.4
0.2
0.0
0
20
40
60
80
100
Generation