

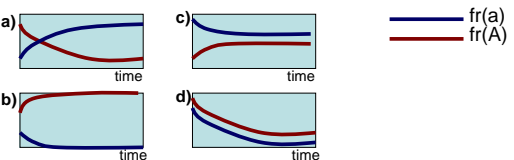
1. Recessive allele **h** codes for hemophilia. Blood of hh homozygotes does not clot and they often bleed to death even from minor wounds. In a population you've studied frequency of h allele is 0.3.

Individuals with hemophilia tend to have hemorrhages and have a higher mortality rates. Hemophilic women do not survive childbirth.

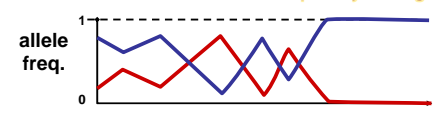
What type of natural selection is acting on a population?

- directional for the dominant phenotype
- directional selection for the recessive phenotype
- balancing selection
- disruptive selection

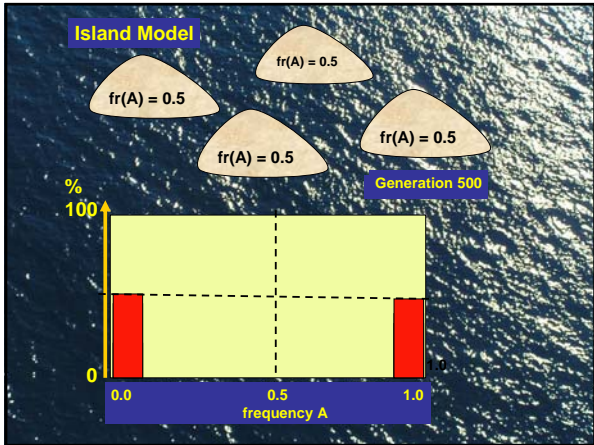
2. Which of the following charts illustrates allele frequency change caused by the mode of natural selection described above?



Genetic Drift: allele frequency change



- Drift has no direction
- Evolutionary change accumulates with time
- Causes loss of genetic variation in a population
- Increase of genetic difference between populations
- two special forms of drift: founder effect and bottle neck



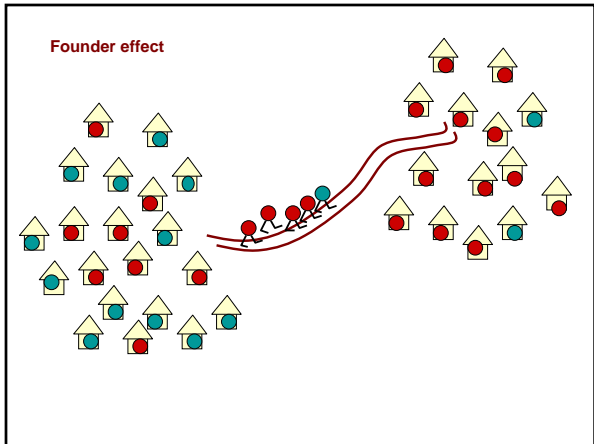
Probability of allele fixation

fr(A) = 0.5, fr(a) = 0.5 N=8 What is the probability (P) that all alleles in the next generation are A?

#genes = 2N = 16 $P(\text{all A}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \dots = (\frac{1}{2})^{2N}$


$P(\text{all a}) = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \dots = (\frac{1}{2})^{2N}$

$P(\text{fixed}) = P(\text{all A}) + P(\text{all a}) = 2 \times (\frac{1}{2})^{2N} = 2(0.5)^{16}$



Founder effect in Salinas village, Dominican Republic

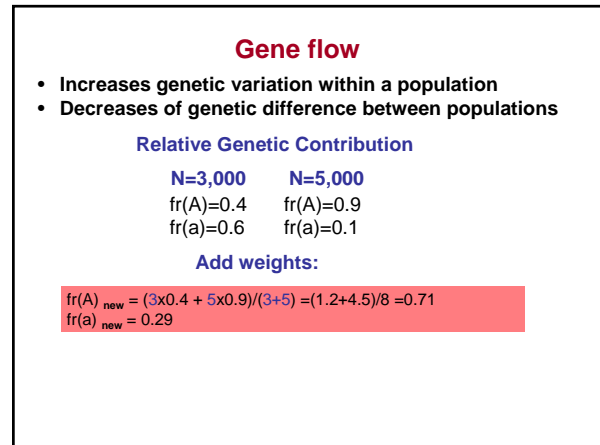
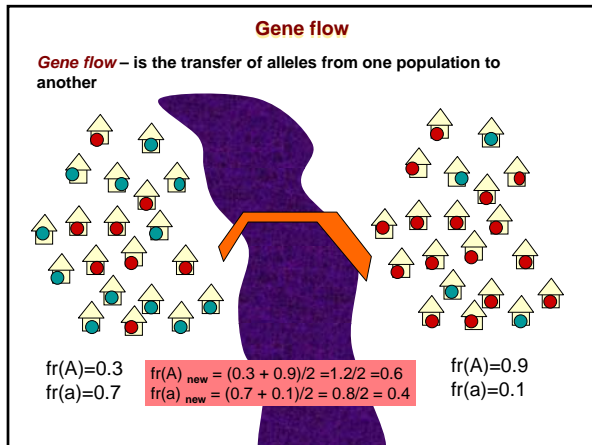
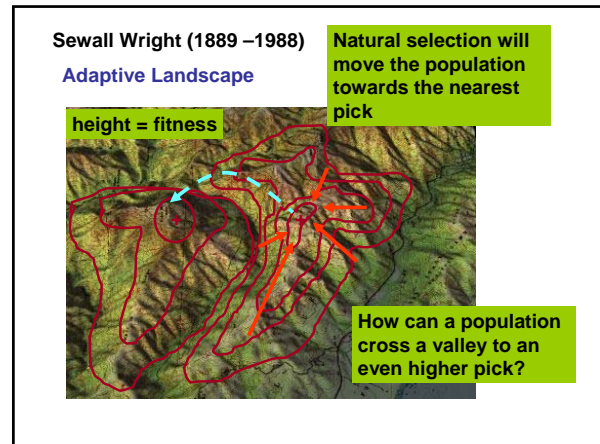
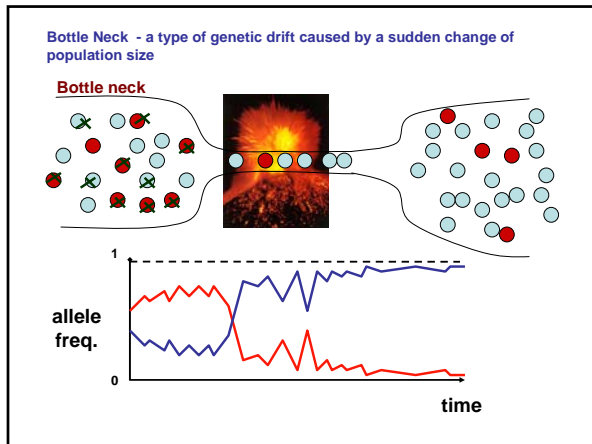
one of the founders:
Altagracia
 – heterozygous for a single base substitution in 5-alpha-reductase-2 autosomal gene



5-alpha-reductase-2 is an enzyme that converts testosterone into dehydrotestosterone necessary for testes development

low activity of this enzyme in homozygotes

XY individuals develop as females until puberty



The recessive allele *d* codes for negative rhesus factor in humans. The average frequency of allele *d* among the native peoples of Siberia is 0.1. The average frequency of allele *d* among in the populations of European Russia is 0.7.

In 1893 the village of Gusevka was founded in Siberia during the construction of the Trans-Siberian Railway. With the fast growing industry many immigrants from the European part of Russia moved to Gusevka that became a city known as Novosibirsk. In 1993, 100 years later, the frequency of *d* allele in Novosibirsk was 0.3.

a) Find the genetic contributions of Russians and Siberian natives to the hybrid population of Gusevka:

Russians = 33.3% Siberians = 66.7%

fr(*d*)_S = 0.1 wfr(*d*)_R + (1-w) fr(*d*)_S = 0.3

fr(*d*)_R = 0.7 0.7w + 0.1(1-w) = 0.3

0.7w + 0.1 - 0.1w = 0.3

0.7w - 0.1w = 0.2

0.6w = 0.2 w = 0.2/0.6 = 0.333