



- Chapter 20~
*The Evolution of
Populations*



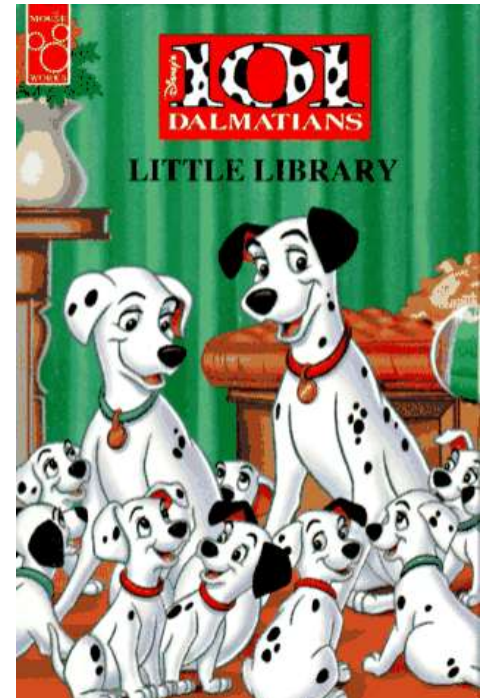
HETEROZYGOATS

Just allele uneven.

Population genetics

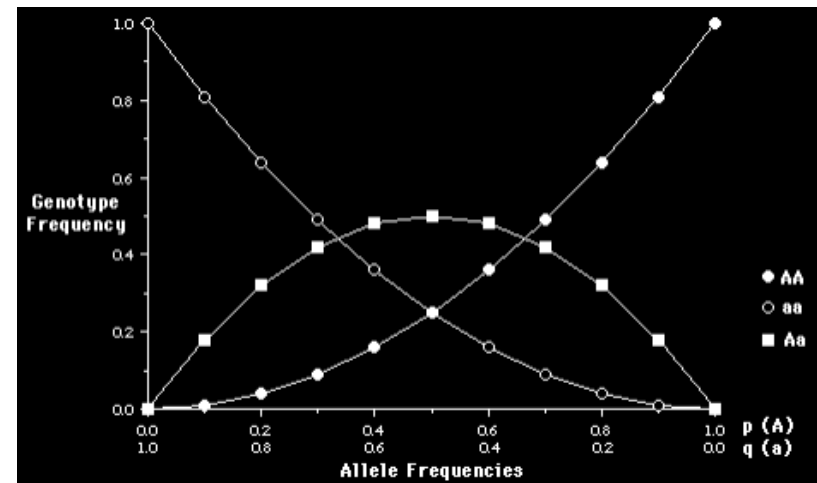
- Population: *a localized group of individuals belonging to the same species*
- Species: *a group of populations whose individuals have the potential to interbreed and produce fertile offspring*
- Gene pool: *the total aggregate of genes in a population at any one time*
- Population genetics: *the study of genetic changes in populations*
- Modern synthesis/neo-Darwinism

- *“Individuals are selected, but populations evolve.”*



Hardy-Weinberg Theorem

- *Serves as a model for the genetic structure of a nonevolving population (equilibrium)*
- 5 conditions:
 - 1- Very large population size;
 - 2- No migration;
 - 3- No net mutations;
 - 4- Random mating;
 - 5- No natural selection



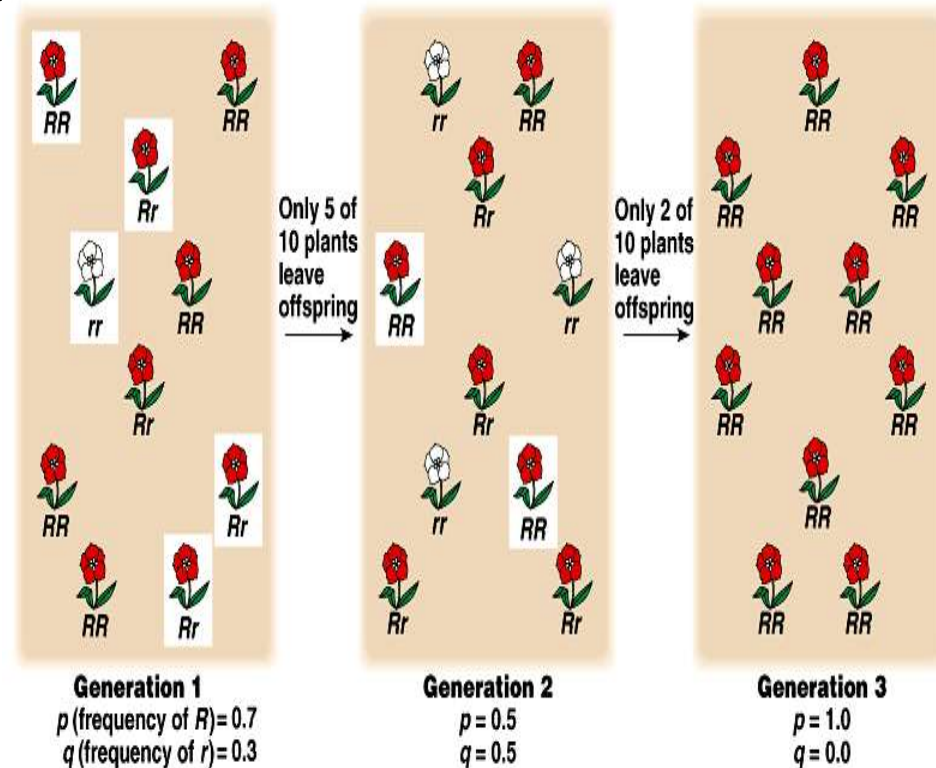
Hardy-Weinberg Equation

- p =frequency of one allele (A); q =frequency of the other allele (a);
- $p+q=1.0$
- ($p=1-q$ & $q=1-p$)

- P^2 =frequency of AA genotype; $2pq$ =frequency of Aa plus aA genotype; q^2 =frequency of aa genotype;
$$p^2 + 2pq + q^2 = 1.0$$

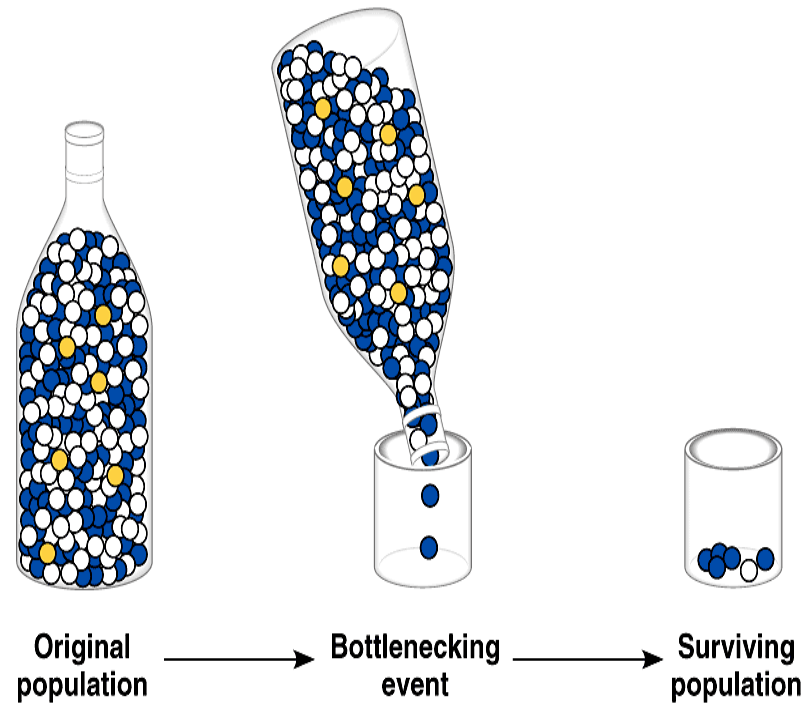
Microevolution, I

- *A change in the gene pool of a population over a succession of generations*
- 1- Genetic drift: changes in the gene pool of a small population due to chance (usually reduces genetic variability)



Microevolution, II

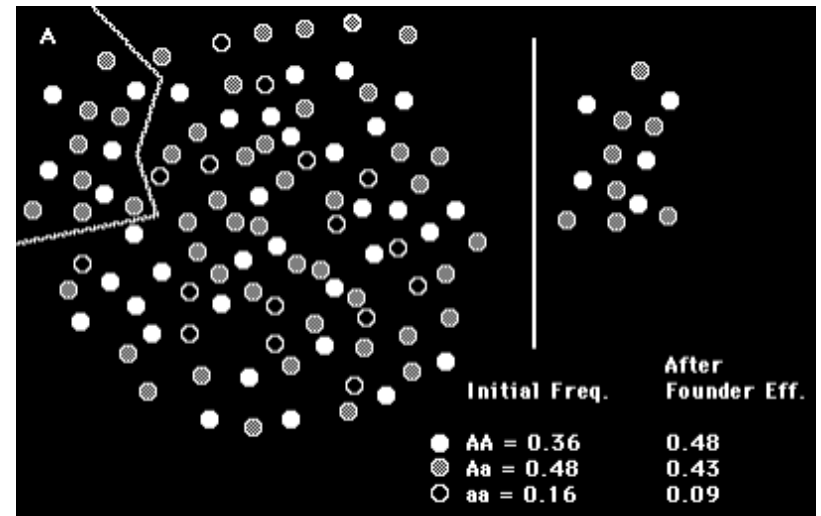
- The Bottleneck Effect: type of genetic drift resulting from a reduction in population (natural disaster) such that the surviving population is no longer genetically representative of the original population



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Microevolution, III

- Founder Effect:
a cause of genetic drift attributable to colonization by a limited number of individuals from a parent population



Microevolution, IV

- 2- Gene Flow: genetic exchange due to the migration of fertile individuals or gametes between populations (reduces differences between populations)



Microevolution, V

- 3- Mutations: a change in an organism's DNA (gametes; many generations); original source of genetic variation (raw material for natural selection)



Microevolution, VI

- 4- Nonrandom mating:
inbreeding and
assortive mating (both
shift frequencies of
different genotypes)



Shania Twain:



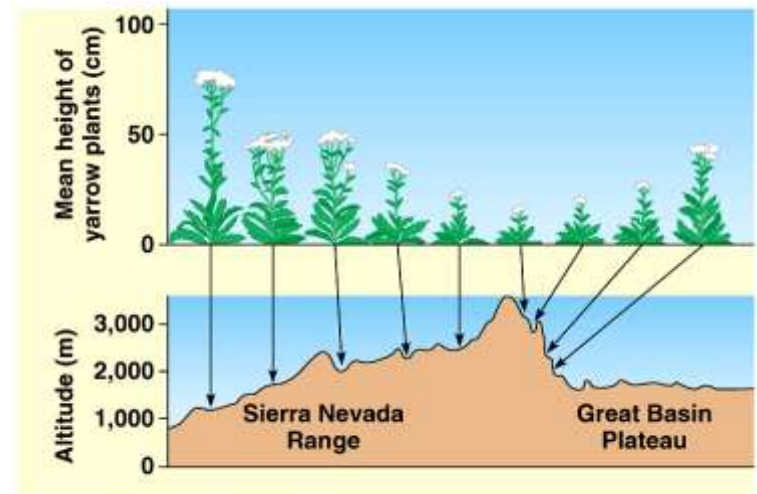
Microevolution, VII

- 5- Natural Selection: differential success in reproduction; only form of microevolution that adapts a population to its environment



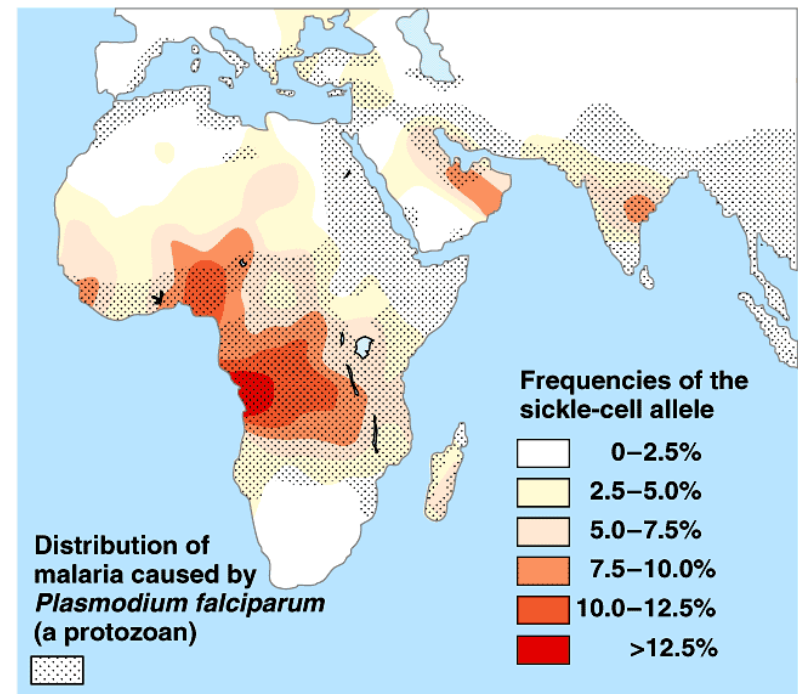
Population variation

- Polymorphism:
coexistence of 2 or more distinct forms of individuals (morphs) within the same population
- Geographical variation:
differences in genetic structure between populations (cline)



Variation preservation

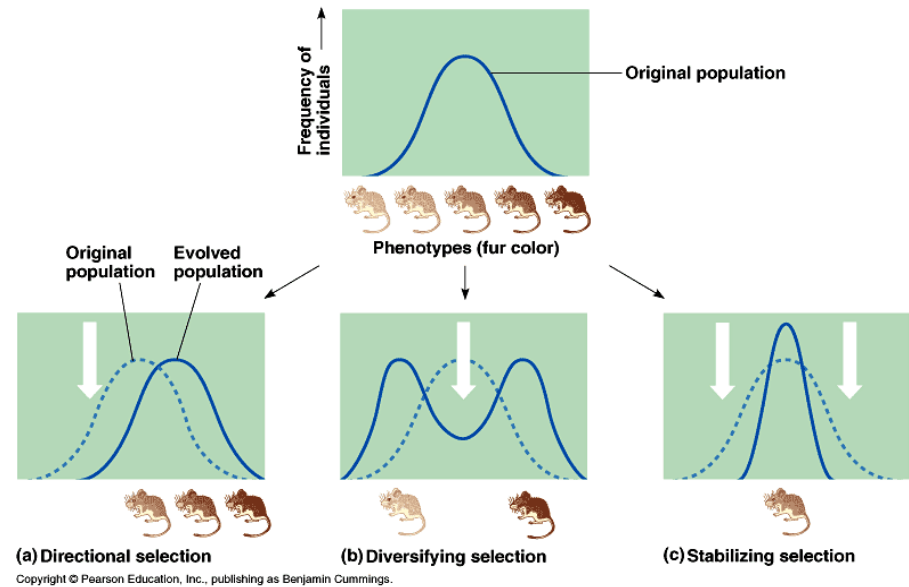
- Prevention of natural selection's reduction of variation
- Diploidy
2nd set of chromosomes hides variation in the heterozygote
- Balanced polymorphism
 - 1- heterozygote advantage (hybrid vigor; i.e., malaria/sickle-cell anemia);
 - 2- frequency dependent selection (survival & reproduction of any 1 morph declines if it becomes too common; i.e., parasite/host)



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Natural selection

- Fitness: *contribution an individual makes to the gene pool of the next generation*
- 3 types:
- A. Directional
- B. Divergent
- C. Stabilizing



Sexual selection

- Sexual dimorphism:
secondary sex
characteristic distinction
- Sexual selection:
selection towards
secondary sex
characteristics that leads to
sexual dimorphism

