# Chapter 14

1. Microevolution – evolution of populations.
   A. Populations as unit of evolution
   B. Population Genetics
      - Gene Pools and Allele Frequency
      - Five Agents of Evolution
         - Mutation
         - Genetic Drift
         - Non-Random Mating
         - Gene Flow
         - Natural Selection

2. Macroevolution – speciation
   1. Species Definition
   2. Speciation – Reproductive Isolation
      A. Geographical Isolation
      B. Post-Mating Isolation

Populations –
group of potentially interbreeding individuals.
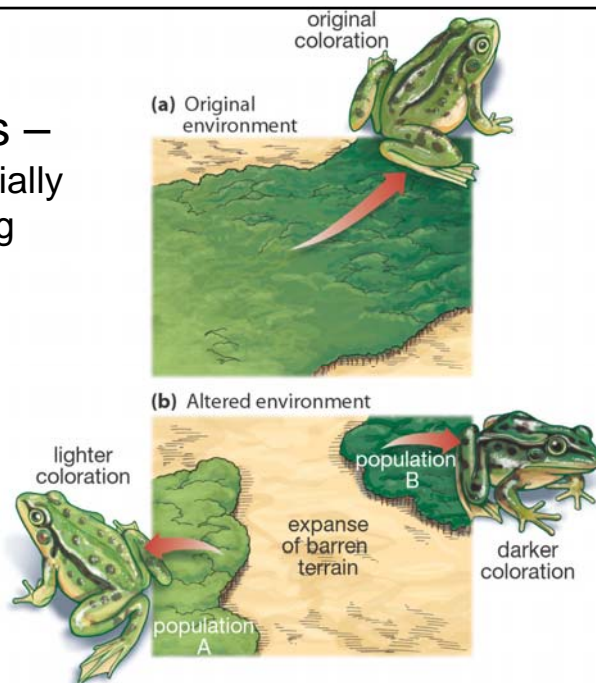
Allele Frequencies
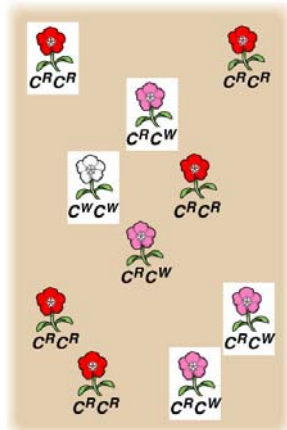
Generation 1
p (frequency of C^R) = 0.7
q (frequency of C^W) = 0.3

- **Gene pool** is sum of all alleles in a population

- **Allele frequency** is the percentage of any particular allele in a population. For example the frequency of the c^R (Red) allele in this population is 70%.

- **Evolution** can be defined as changes in allele frequency in populations.

Imagine what would happen in this population if the pollinator of flowers in this environment preferred white flowers over red or pink –evolution.
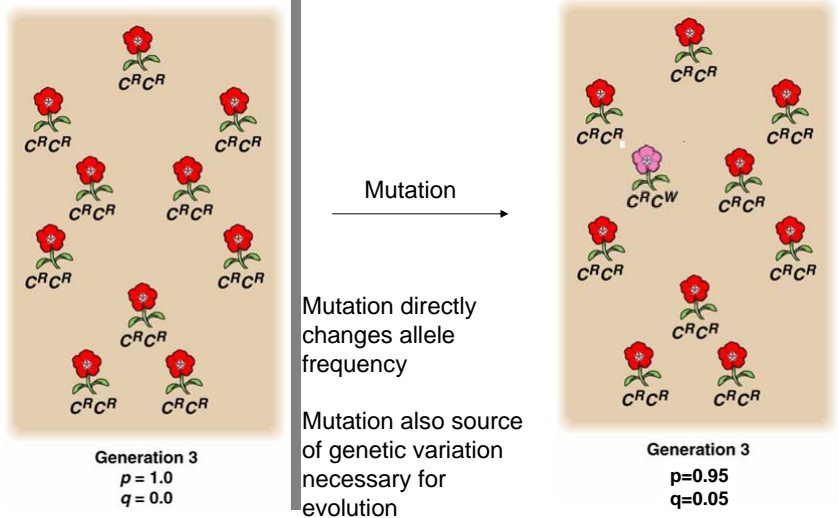
5 Agents of evolution

Table 17.1 Agents of Change: Five Forces That Can Bring about Change in Allele Frequencies in a Population

Agent	Description
Mutation	Alteration in an organism's DNA; generally has no effect or a harmful effect. But beneficial or "adaptive" mutations are indispensable to evolution.
Gene flow	The movement of alleles from one population to another. Occurs when individuals move between populations or when one population of a species joins another, assuming the second population has different allele frequencies than the first.
Genetic drift	Chance alteration of gene frequencies in a population. Most strongly affects small populations. Can occur when populations are reduced to small numbers (the bottleneck effect) or when a few individuals from a population migrate to a new, isolated location and start a new population (the founder effect).
Nonrandom mating	Occurs when one member of a population is not equally likely to mate with any other member. Includes sexual selection, in which members of a population choose mates based on the traits the mates exhibit.
Natural selection	Some individuals will be more successful than others in surviving and hence reproducing, owing to traits that give them a better "fit" with their environment. The alleles of those who reproduce more will increase in frequency in a population.

Mutation

- Source of New Alleles

Mutation

Mutation directly changes allele frequency

Mutation also source of genetic variation necessary for evolution

Generation 3
$p = 1.0$
$q = 0.0$

Generation 3
$p=0.95$
$q=0.05$

Gene Flow

- Alleles can enter a population from nearby population my migration.

(a) Hawaiian silversword
(b) Tarweeds in California

North America

Hawaiian Islands

Pacific Ocean

Gene flow

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Genetic Drift

(a) Population size = 10,000

(b) Population size = 4
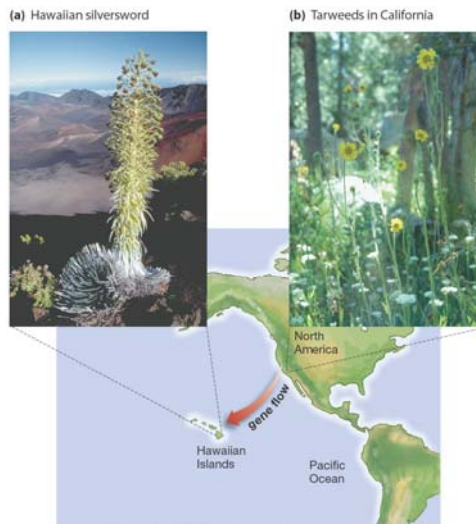
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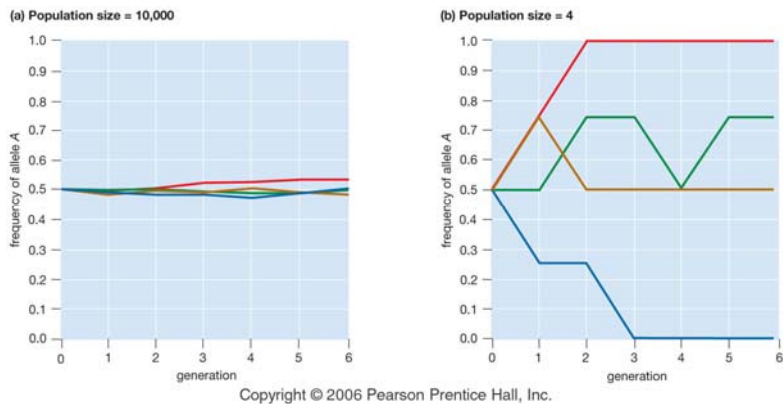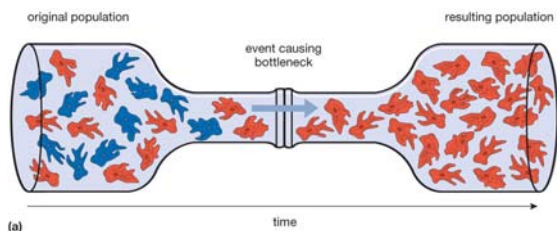
Genetic Drift – changes in allele frequency due to effects of chance because of nature of random fertilization of gametes

Genetic Drift always is occurring – but only has a significant effect when populations are small.

Genetic Drift
Genetic Bottle Neck

original population

event causing bottleneck

resulting population

(a)

time

(b)

(c)

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4

Non-Random Mating

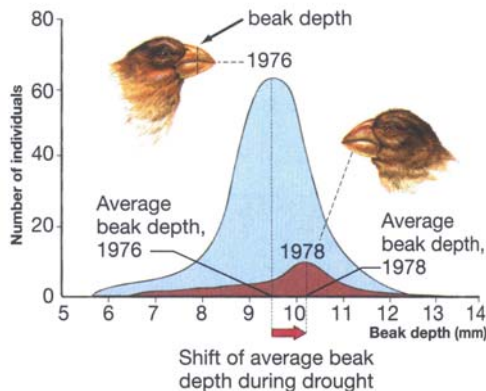- Sexual Selection – Changes in allele frequencies in a population because of mate preference.

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Selection

Daphne's Finches – on the Galapagos Islands

Seed Eaters with specialized beaks

1970's drought changed the plant population – fewer small seed, more large seed.

Evolution of beak size in population of finches in result to change in seed size.

Macroevolution
Speciation

- What is a species?
  - Natural populations which can freely interbreed with one another under natural conditions.

Speciation

- Reproductive Isolation
  - Geographical Isolation

(a) Abert squirrel, south rim of Grand Canyon

(b) Kaibab squirrel, north rim of Grand Canyon

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Post-mating Isolation

- Hybrid Infertility

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