

GLENZ



Evolution and Natural Selection Tutorial

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In this lesson, you will learn:

- How natural selection provides a mechanism for evolution.
- Natural selection results from selective pressures in the environment and is not random.
- There are also random processes like genetic drift that can upset genetic equilibrium.
- Only natural selection results in adaptation.

***Evolution

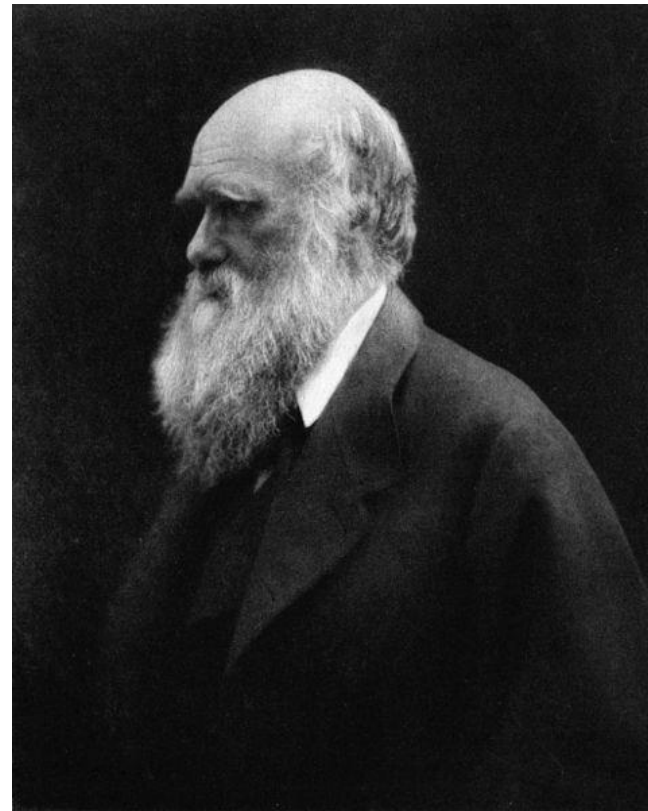
- **Evolution** – includes all of the changes in the characteristics and diversity of life that occur throughout time.
- = **Changes in species over time**
- Evolution can occur on both large and small scales.
 - Microevolution
 - Macroevolution

Introduction

- The concept of **evolution**, that organisms may change over time, was not new in Darwin's time.
- However, it was not a widely accepted concept because no one understood how it could work.
- A **mechanism** was missing.

Natural Selection

- Darwin provided that mechanism with his theory of **Natural Selection.**

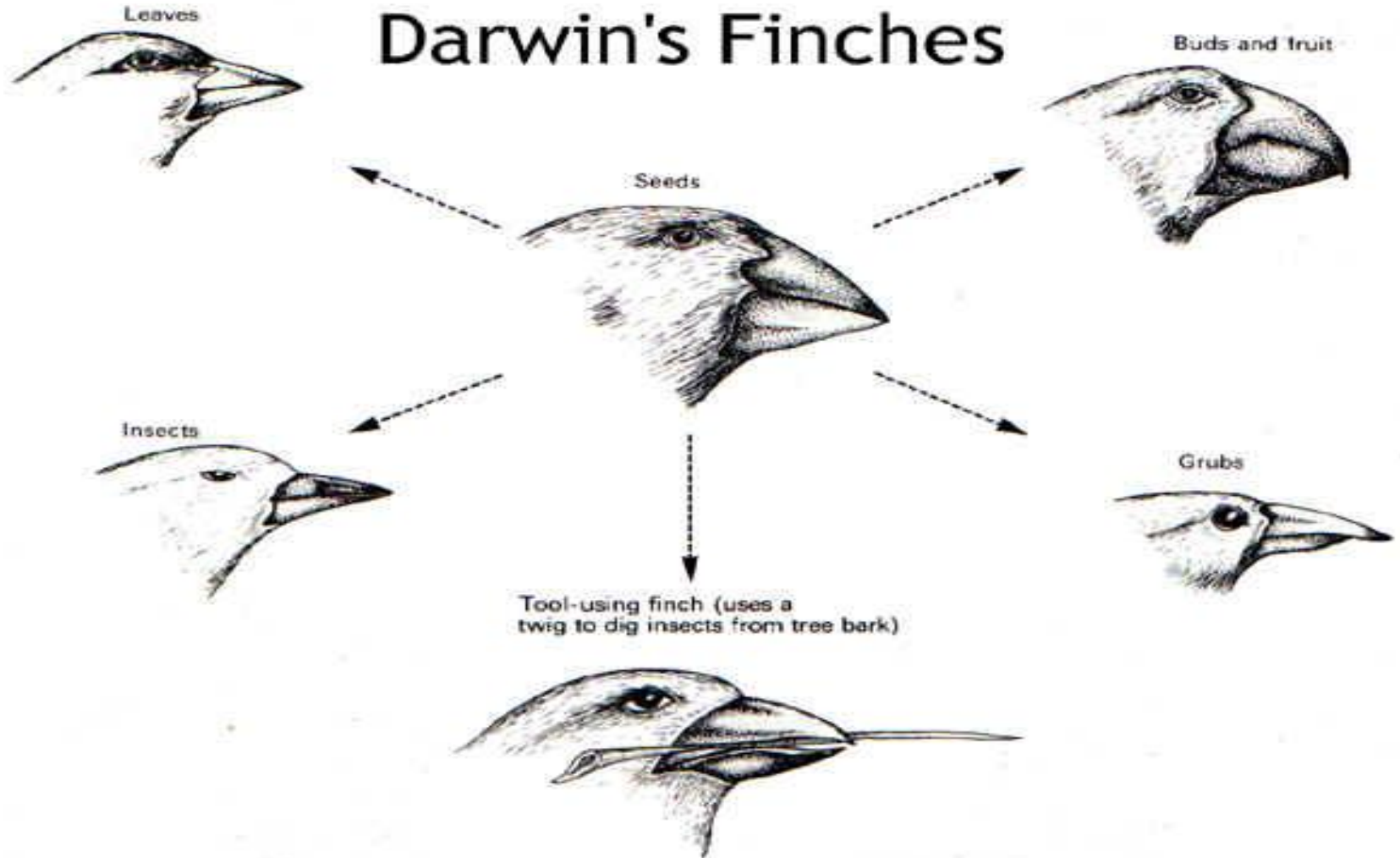


Use your book Notes

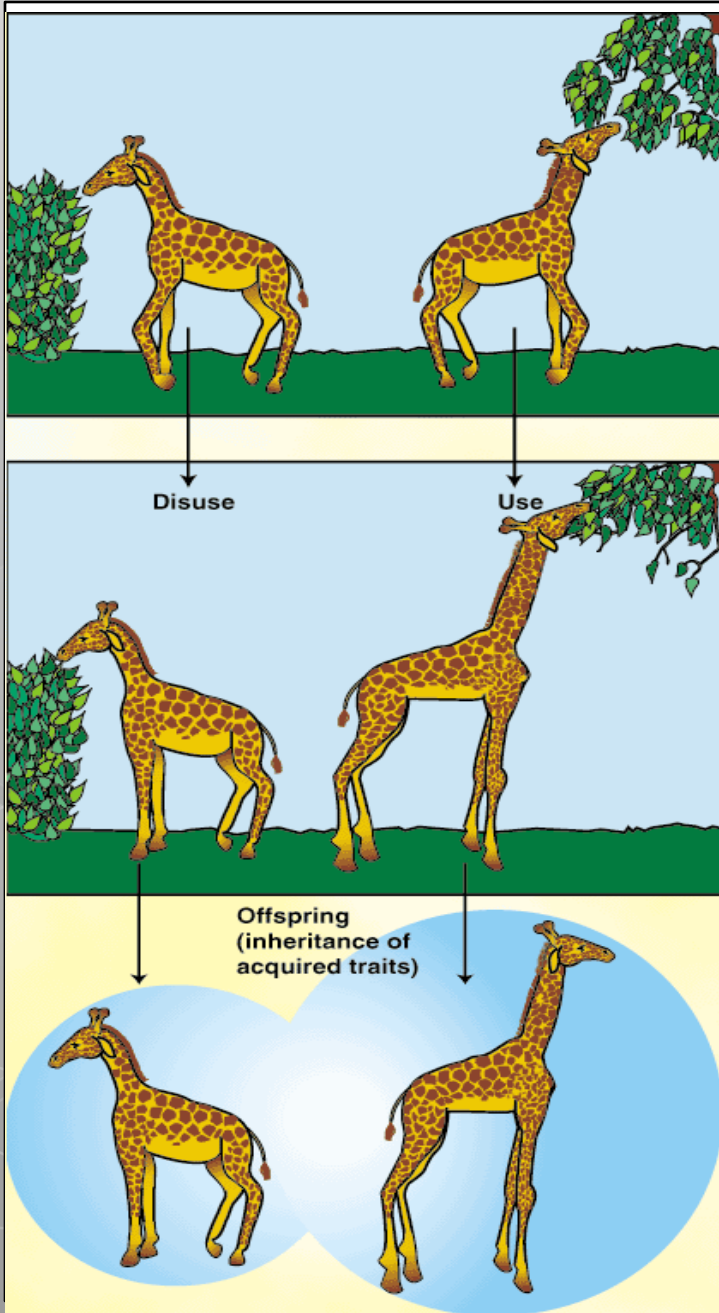
- What is Evolution?
- What is **Natural Selection**?
 - What are the 5 parts of Natural Selection?

Darwin's Theory

Darwin's Finches



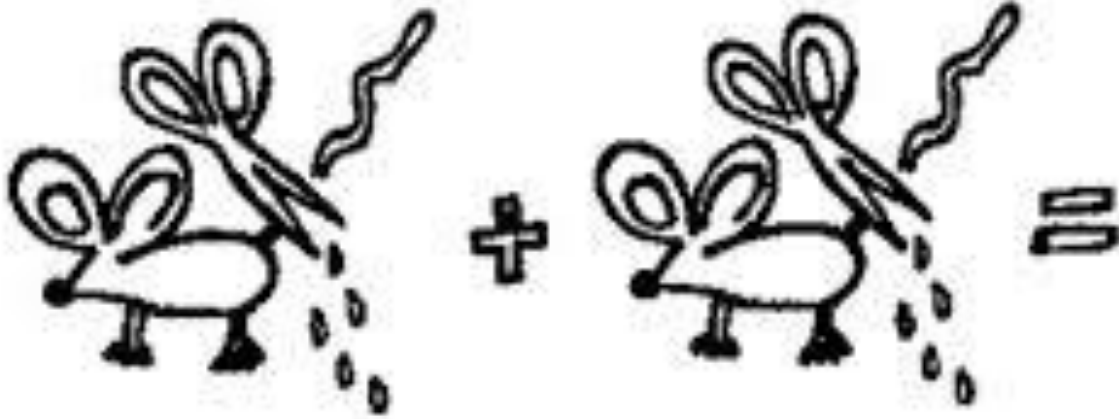
Lamarck's Theory



Lamarck vs. Darwin

Mouse #899: Female

Mouse #900: Male



Lamarck vs. Darwin

Mouse #899: Female

Mouse #900: Male

Mouse #901: Baby



+



=



Natural Selection

- In any population of organisms there is natural variation.
- Some of these variations will allow the organisms possessing them to survive and reproduce better than those without these particular traits.



Natural Selection

- The successful traits will spread through the population.
- This change in the frequency of alleles in the population is **evolution**.

**Write
these
on
bottom
of p. 4.**

***Natural Selection – High Reproductive Potential

- Darwin observed that **overproduction** of offspring results in competition for food and resources.
- **Population size would quickly become unmanageable if all of the offspring survived.**



***Natural Selection – **Variation** is Heritable

- Which individuals will survive is often not a matter of luck.
- Populations show **variation** – individuals are not identical.
 - They differ in many different traits.
- Over time the **variation** will become the norm as those members of the species with the beneficial variations **Survive**
 - It can be passed down from one generation to the next.



Red Fox



Black Fox



Chestnut Fox



Golden Fox



Grey Fox



White Fox



Black and White Fox



Tan and White Fox



Black and White Fox



Brown and Black Fox

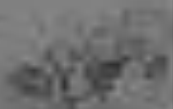


White Fox



Black and White Fox

The Foxes of the Forest



**Natural Selection – Limited Resources=Competition

- **Resources** that organisms need to survive are **limited**.
 - Food, water, shelter, nesting sites, etc.
 - Survivors represent a small part of the individuals produced each generation.

**Natural Selection – Some traits Enhance Survival

- Some of the traits found in the population enhance the survival and reproduction of the organisms possessing them.

- Because they could survive Competition



VS.



Natural Selection – **Adaptation**

- The favored traits will spread through the population.
- Over many generations, the species will become **adapted** to its environment.
- Over time, these changes can lead to the formation of a new species.

Adaptation

- When an environment changes, natural selection may result in adaptation to the new conditions.
- **Sometimes this results in a new species.**

Homologous & Analogous Structures

Homologous structures

Similar in anatomy
Doing dissimilar functions
Develop in related animals

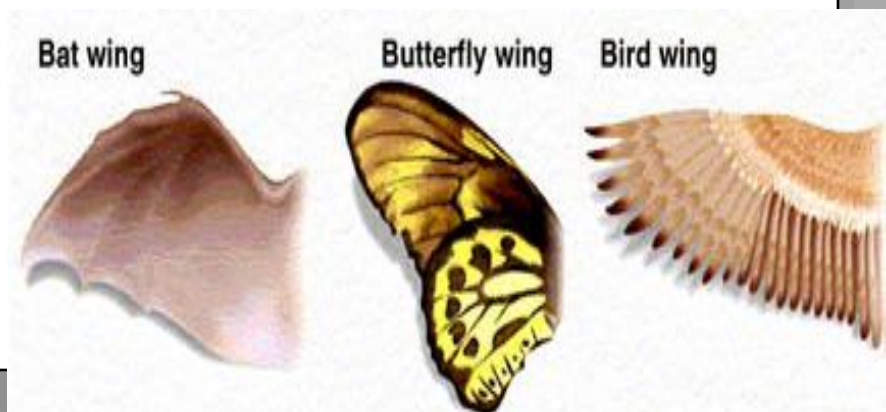
*From a similar ancestor



Analogous structures

Dissimilar in anatomy
Doing similar functions
Develop in unrelated animals

* Not from similar



Upsetting Genetic Equilibrium

- **Natural selection** is not the only way that allele frequencies can change from one generation to the next.
 - **Genetic Drift** – a random loss of Traits.
 - **Mutation** – a new mutation can add Adaptations.
 - **Nonrandom mating** – inbreeding increases the number of same traits.
 - **Migration** – shuffles traits between populations; can prevent speciation.

Evolutionary Trends

Much of the diversification of species seems to be related to

.....

- (1) **Co-Evolution:** plants vs. herbivores vs. carnivores
grass vs. horses, crabs vs. snails
- (2) **Mutualisms:** flowering plants + pollinators + seed dispersers



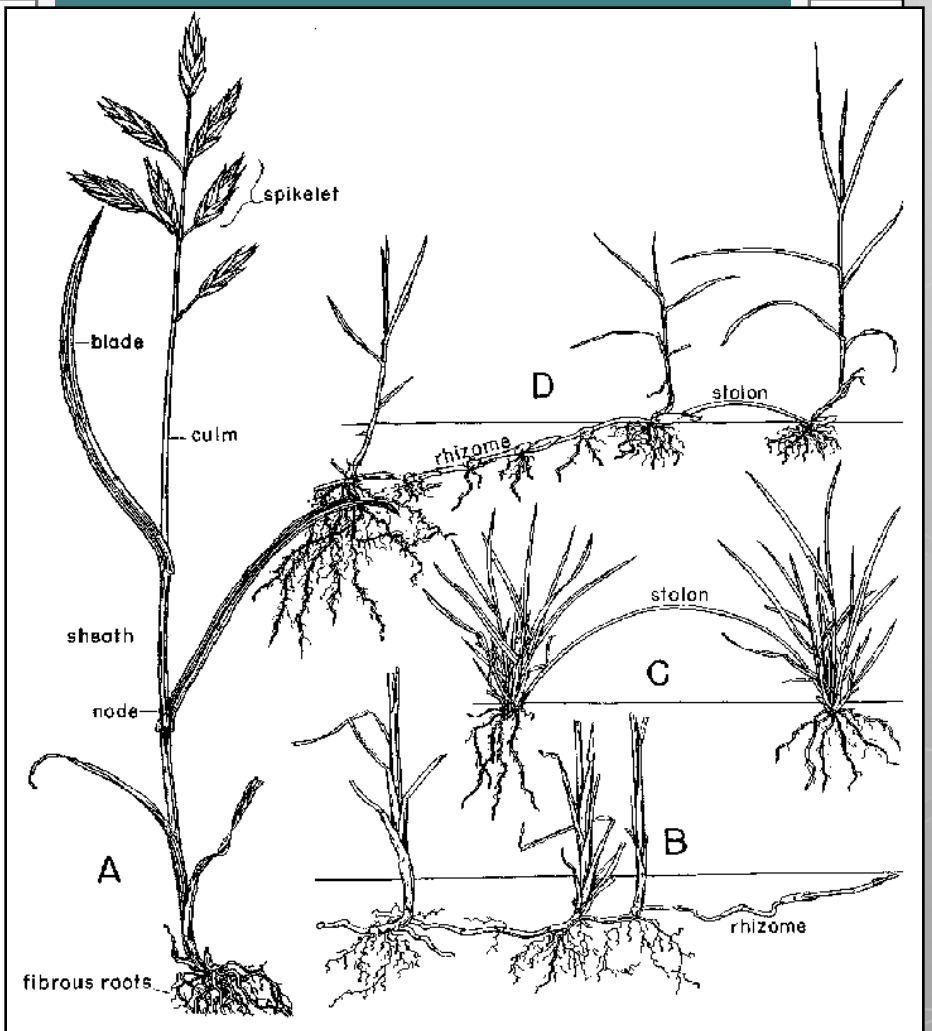
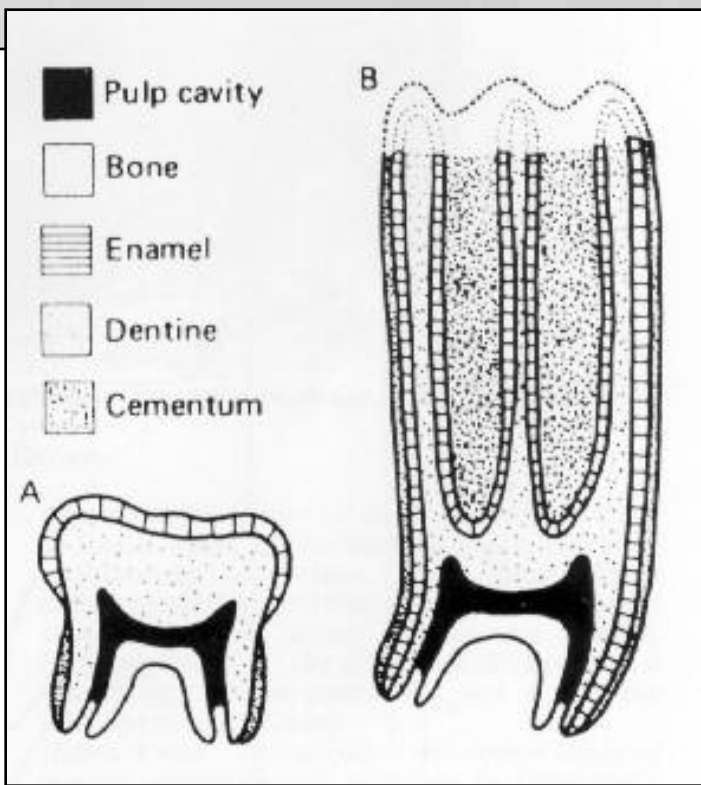
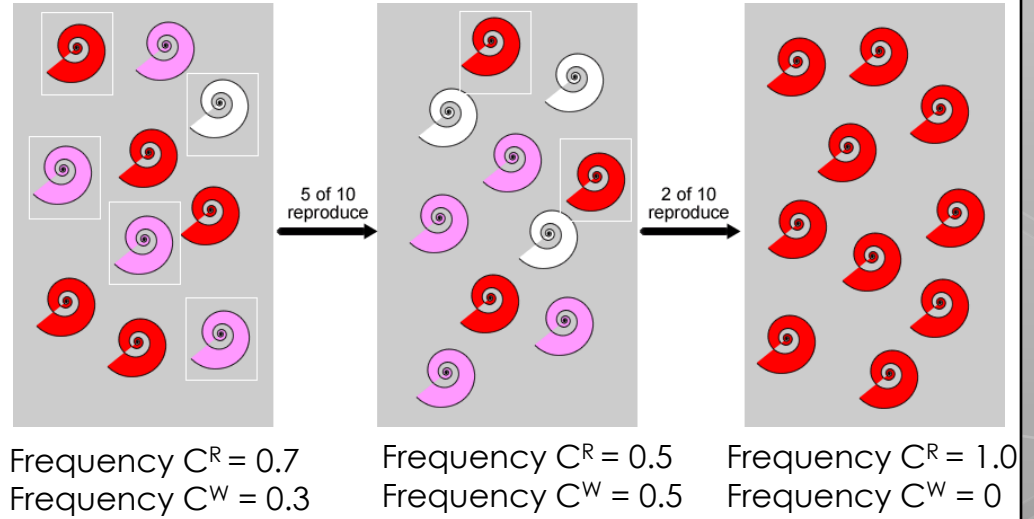


Figure 1a. Structure of plant. A, general habit of grass; B, rhizomes; C, stolon; D, rhizome and stolon intergradation.

Genetic Drift

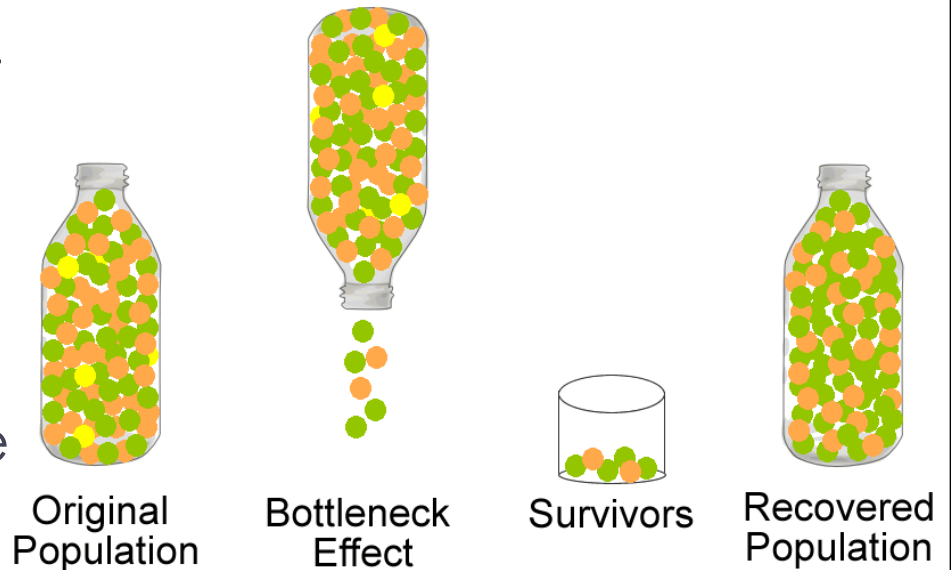
- Which allele gets lost is due to **random chance**.
- Over time, drift tends to reduce genetic variation through random loss of alleles.



- $C^R C^R$ = red
- $C^R C^W$ = pink
- $C^W C^W$ = white

The Bottleneck Effect

- Sometimes a catastrophic event can severely reduce the size of a population.
- The random assortment of survivors may have different allele frequencies.
- This is a type of genetic drift called the **bottleneck effect**.



The Bottleneck Effect

- The actions of people sometimes cause bottlenecks in other species.
 - N. California elephant seal population reduced to 20-100 individuals in the 1890s.
 - Current population > 30,000.
 - Variation *drastically* reduced – 24 genes with 1 allele.

