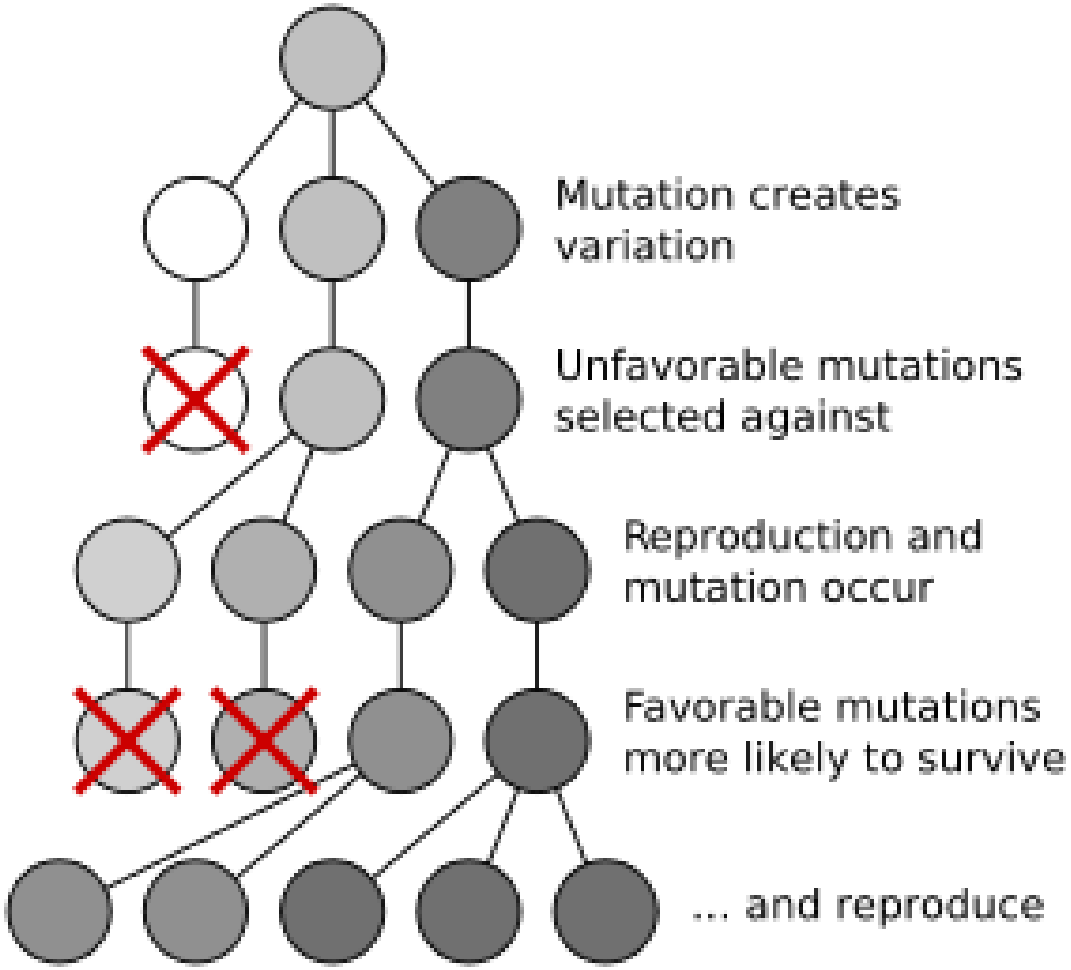
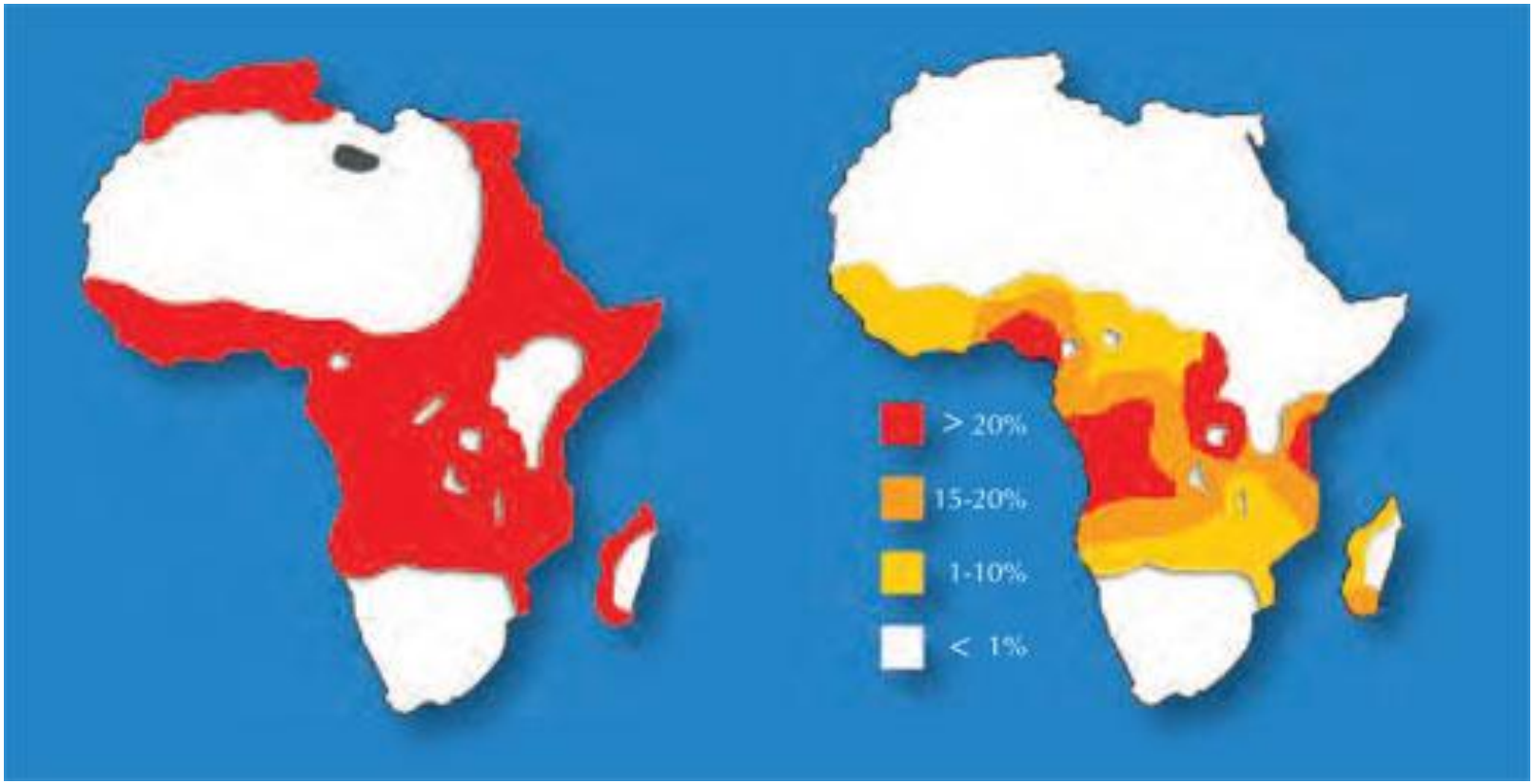
Natural Selection
8.1

…does not occur by chance



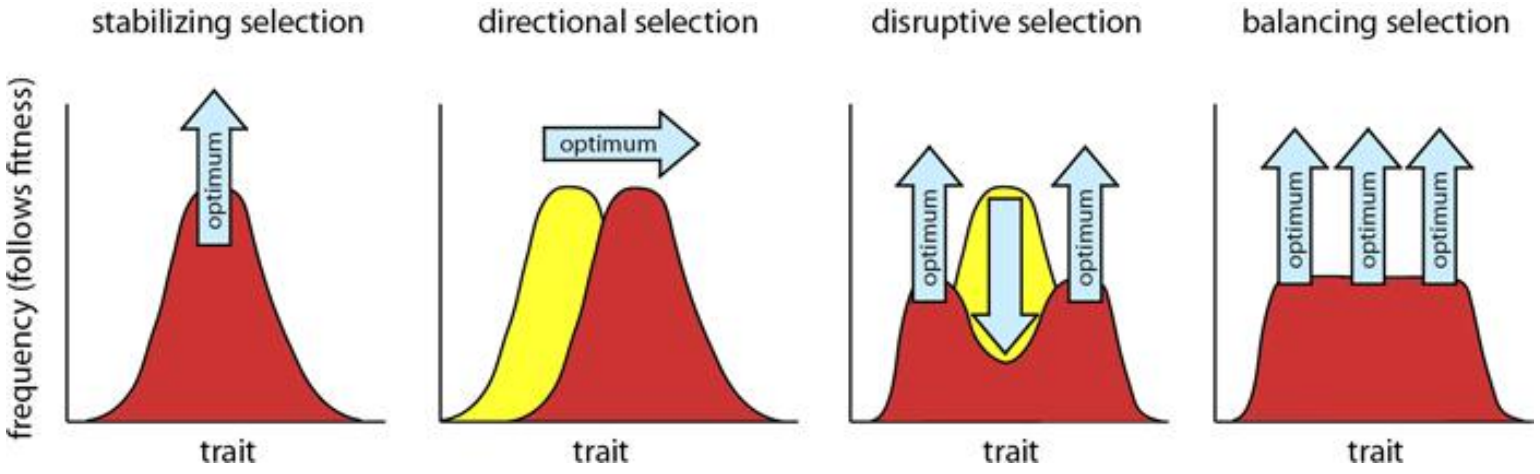
Sickle-cell anemia



Individuals that are heterozygous are resistant to malaria and thus more likely to survive and pass on the sickle-cell allele to the next generation.

Patterns of Selection

- directional selection
- stabilizing selection
- disruptive selection



ation

Original population

(a) Directional selection

(b) Disruptive selection

(c) Stabilizing selection

Directional Selection

Tibetan populations

-Living in the Himalayan mountains for thousands of years
-Tibetans do not exhibit elevated RBC counts

-**Directional selection** has favoured a number of genetic mutations that increase the oxygen-carrying capacity of their blood

(when people from lowlands move to this elevation their RBC count increases, however it is not ideal because the blood becomes more viscous placing stress on the heart → results in reduced fertility and increased child mortality)

Experiments with mice…

Populations of mice that spend the most time on exercise wheels….

How many generations do you think it took to see a change in results?

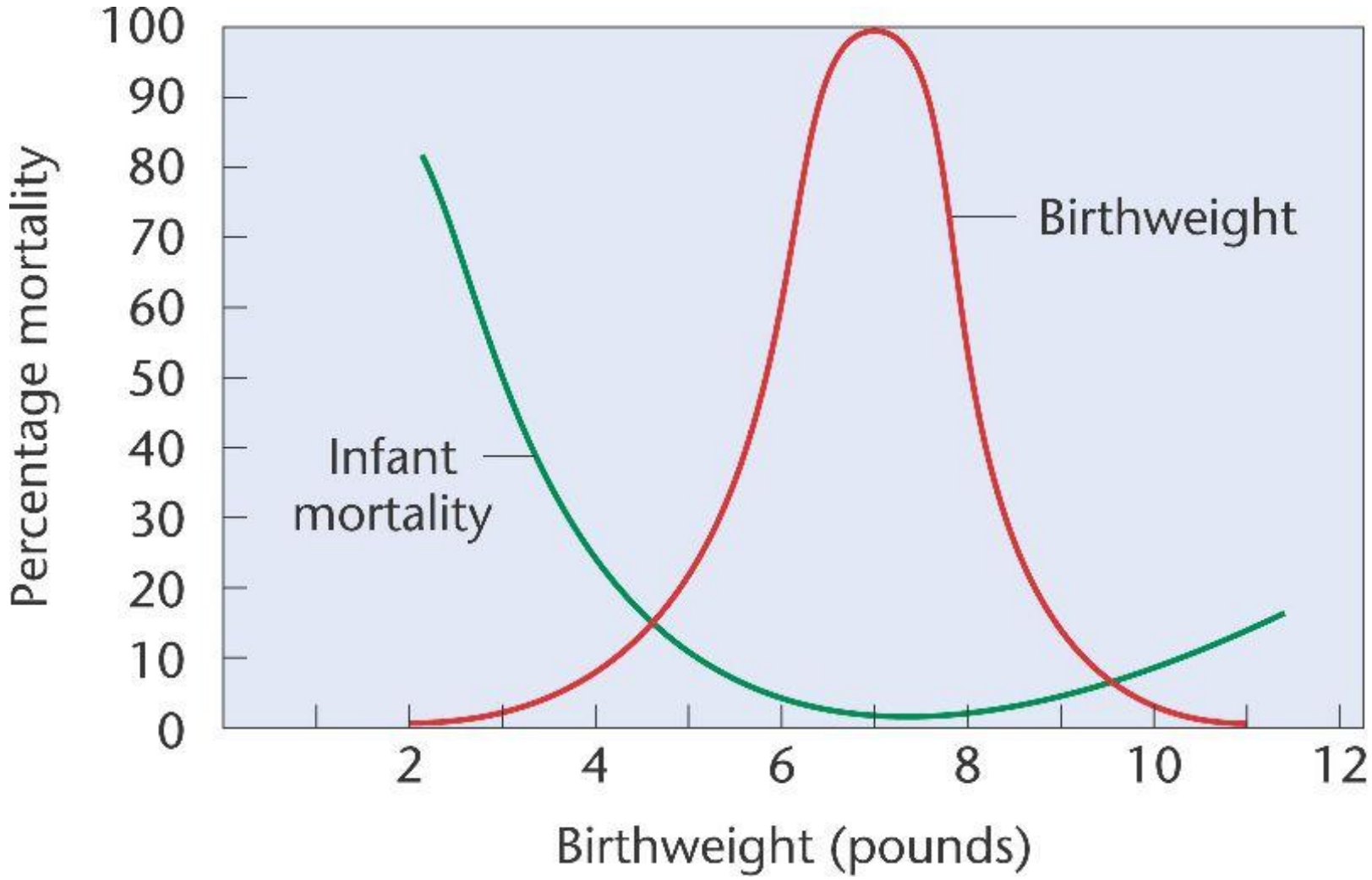
Experiments with mice…

After only 10 generations, the populations exhibited much higher running distances and average speeds when compared to control populations

Stabilizing selection

Human birth weights…..what would be the best human baby weight?

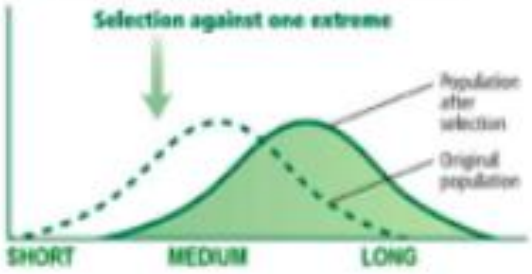
Stabilizing selection



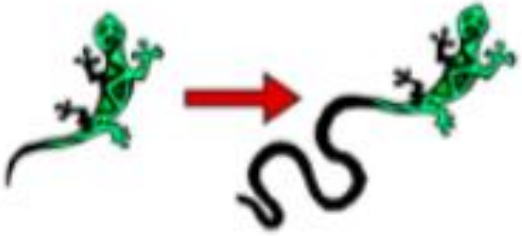
Let's look at Tails.....

HOW does the trait change?

Directional Selection

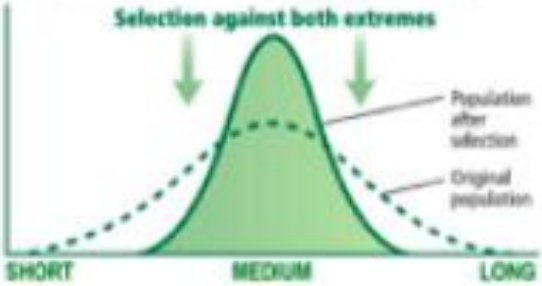


FOR: one extreme trait
AGAINST: the other extreme



EX. Long wiggly tails look like a snake and scare predators. The longer the tail, the more it looks like a snake.

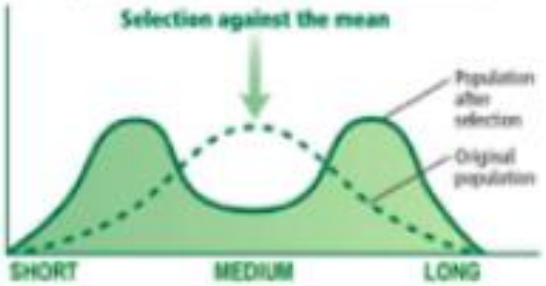
Stabilizing Selection



FOR: moderate traits
AGAINST: both extremes

EX. Short tails mess up the cat's balance. Long tails drag on the ground. Medium tails are best.

Disruptive Selection



FOR: both extremes
AGAINST: moderate traits

EX. Short tails help keep predators from catching you on the ground. Long tails are good for balance in the trees. Medium tails don't help.

Sexual Selection

- female mate choice
- male-versus-male competition

Female Mate Choice

Male-male Competition

Natural Selection & Sexual Selection

- https://www.youtube.com/watch?v=RxHdzw7E0wU

Genetic Drift

- random shifting of genetic makeup of a population (change in frequency of alleles)
- the effect on smaller populations is greater

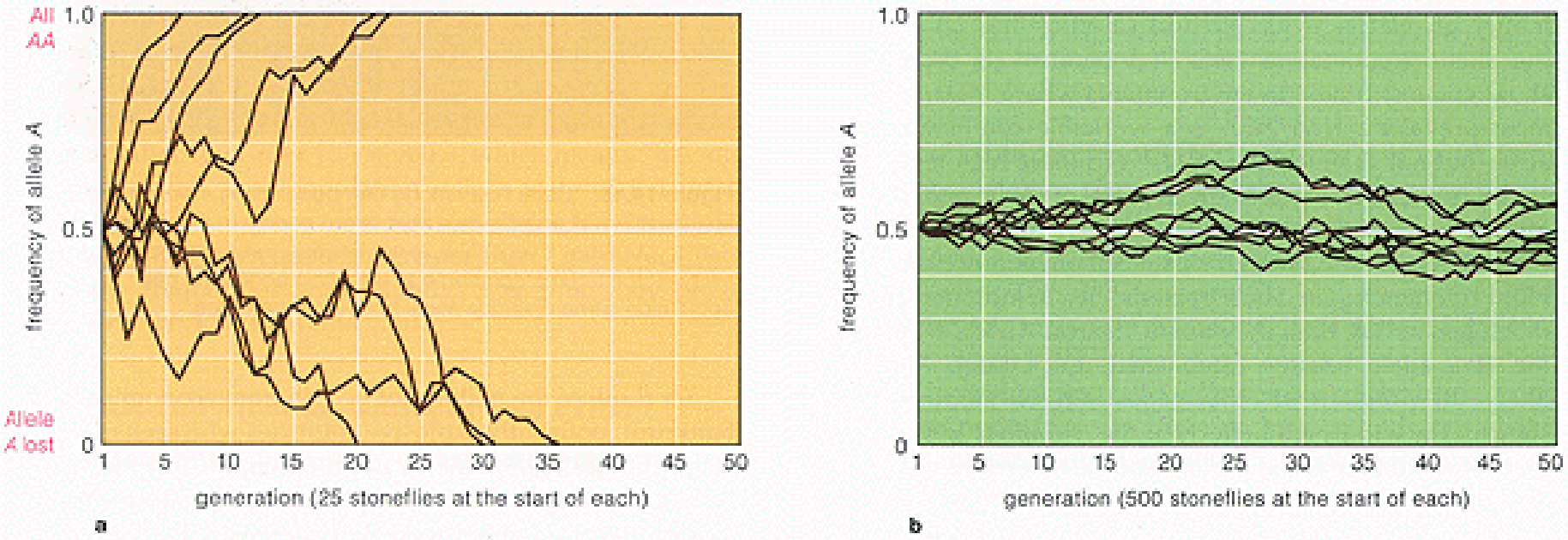


Figure 14.19 Computer simulations of the effect of genetic drift on an allele's frequency in small and large populations. In nine groups of stoneflies, population size was maintained at 25 breeding individuals every generation, for fifty generations. Population size of nine more groups was maintained at 500 for fifty generations. (**a**) Allele *A* became fixed in five of the small populations (the lines reaching the top of the graph) and was lost from four of them (the lines plummeting off the bottom of the graph). As this tells you, even the "best" allele doesn't always win. (**b**) The allele did not become fixed in any large population. Thus the magnitude of drift was much less in every generation than in the small populations.

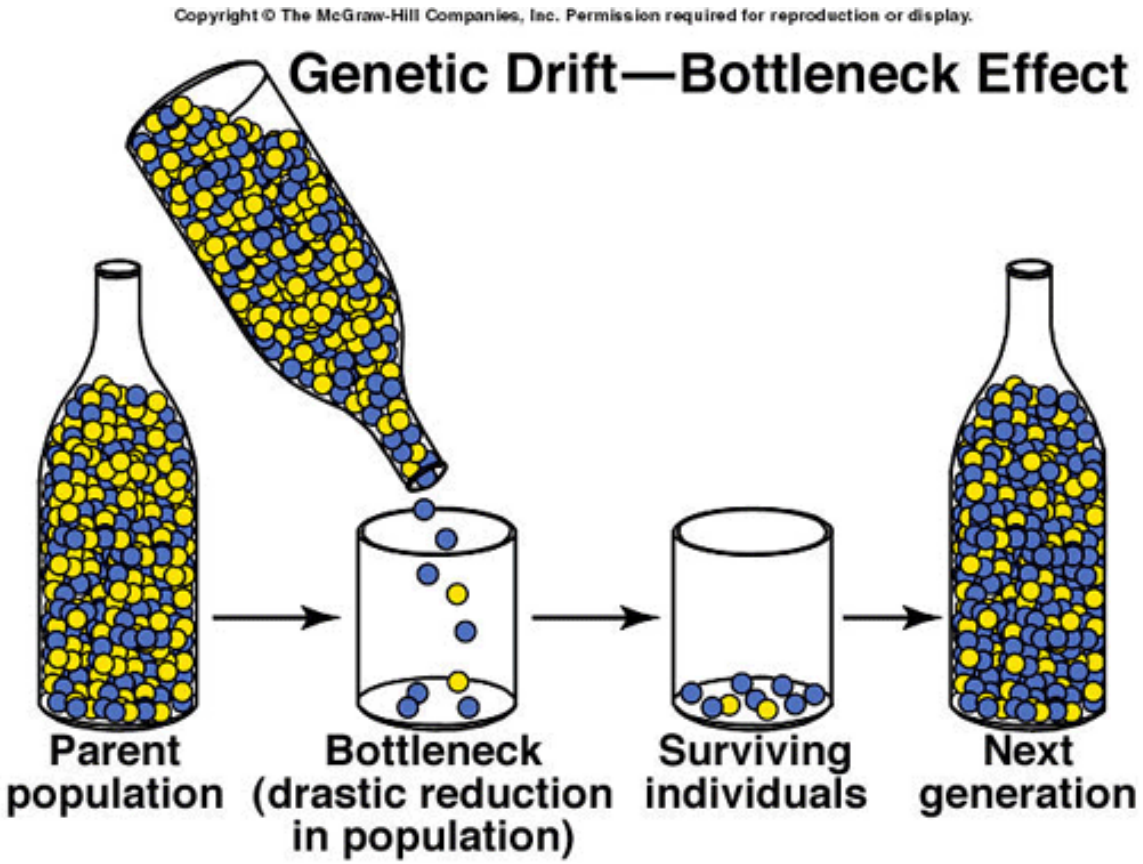
Equal fitnesses assumed for these simulations:

$AA = 1$
$Aa = 1$
$aa = 1$

In small populations, genetic drift can result in a particular allele becoming either very common or disappearing entirely over a number of generations.

Graph 1: dramatic changes in allele frequency
Graph 2: In larger populations, genetic drift is not usually significant

Genetic Bottlenecks



Ex. population of 10 000 individuals is reduced to only 50.
Results in many alleles (particularly rare alleles) to be eliminated

Bottlenecks

10 000 years ago, a severe bottleneck effect resulted in an estimated seven individuals.
Effect: vulnerable to disease and high juvenile mortality rates

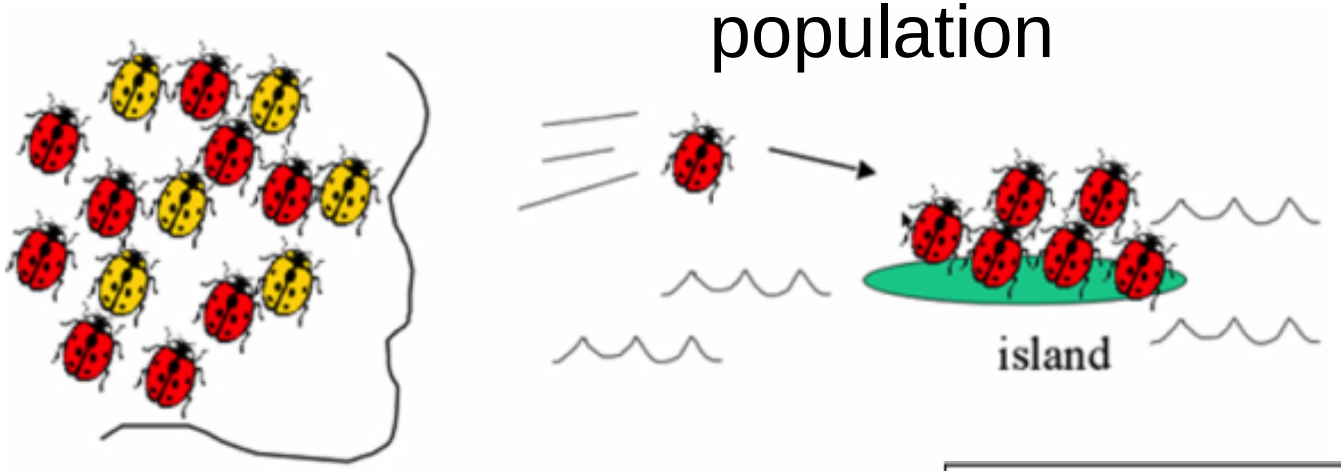
Bottlenecks

1890's:
The northern elephant seal population was reduced by overhunting to 20 individuals

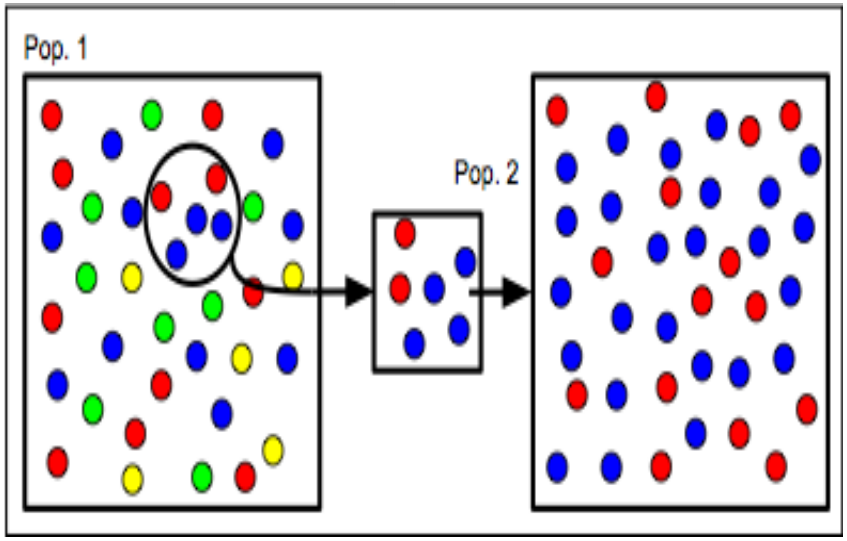
The population has rebounded to over 127 000 individuals

Effect: genetically very similar

Founder Effect: occurs when a small number of individuals establish a new population



Natural selection is usually the major driver behind changes that result in the evolution of a significant adaptation. It is the only mechanism known that is able to shape a species to its environment



Classwork:

p. 335 #1 - 8

Ahh, the first day teaching Natural Selection is always the best day.

Genetic Drift modelling activity

A. Yes, there was evidence of genetic drift. The ratios of the alleles changed each time and the predictions were incorrect. It seemed like the changes were random each time?

B. No, the changes in allele frequencies seemed random. The most common allele frequencies went up sometimes and down sometimes

Genetic Drift modelling activity

C. There may be one or two occurrences of a lost allele (in an entire class)

D. Genetic drift cannot add new alleles to a population, but it can sometimes remove alleles. It is therefore more likely to cause a decrease in genetic diversity of a population.

Cumulative Selection

Do Tutorial 1 (p.330-331)

- binocular vision in primates
- poison dart frogs
- bromeliads