Evolution by Genetic Drift

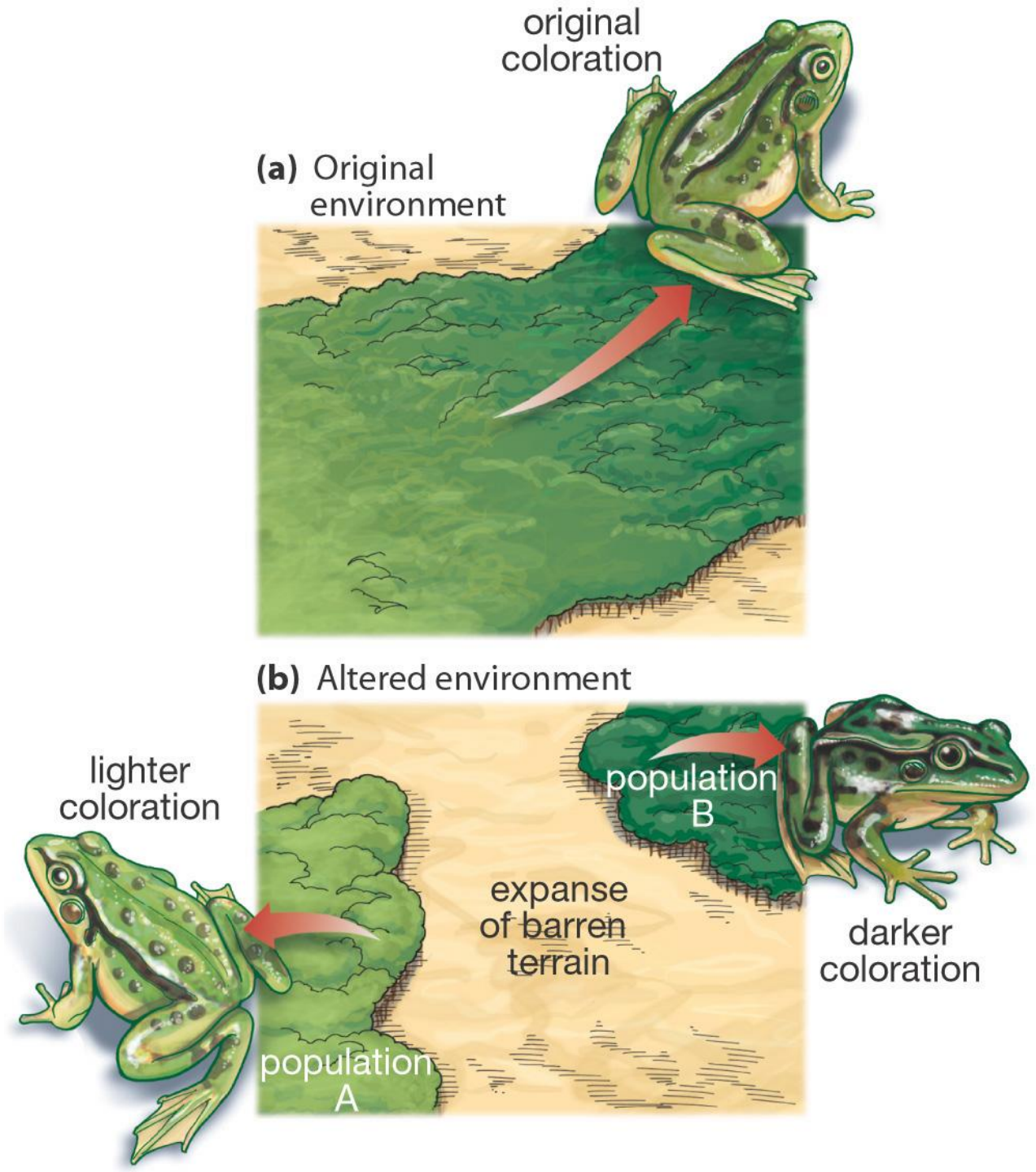
Founders Effect

&

Bottleneck Effect

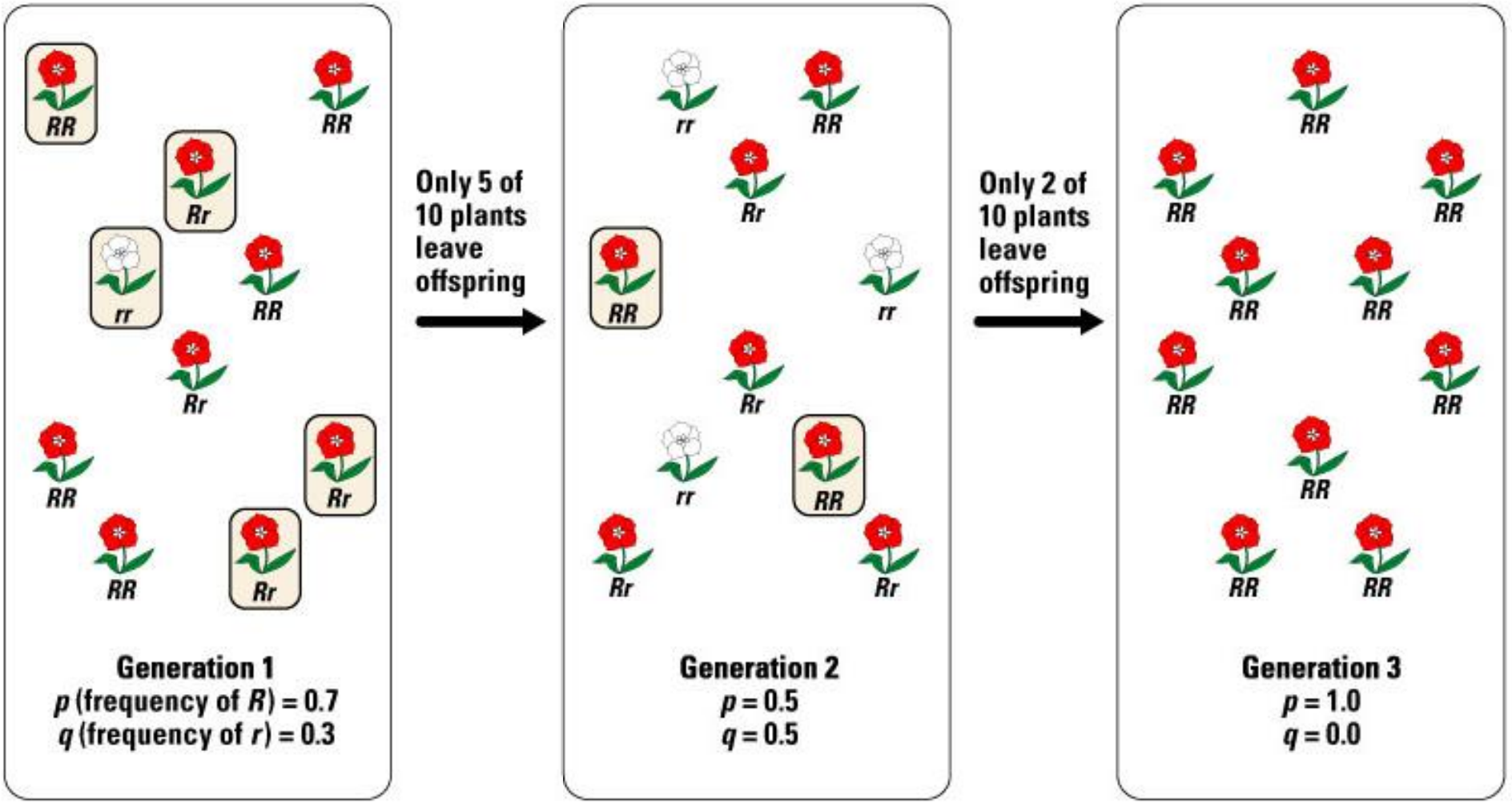
Populations Are the Units of Evolution

A population is a group of interbreeding organisms present in a specific location at a specific time.



Genetic drift is random fluctuation in allele frequency between generations.

The effects of genetic drift are pronounced in small populations.

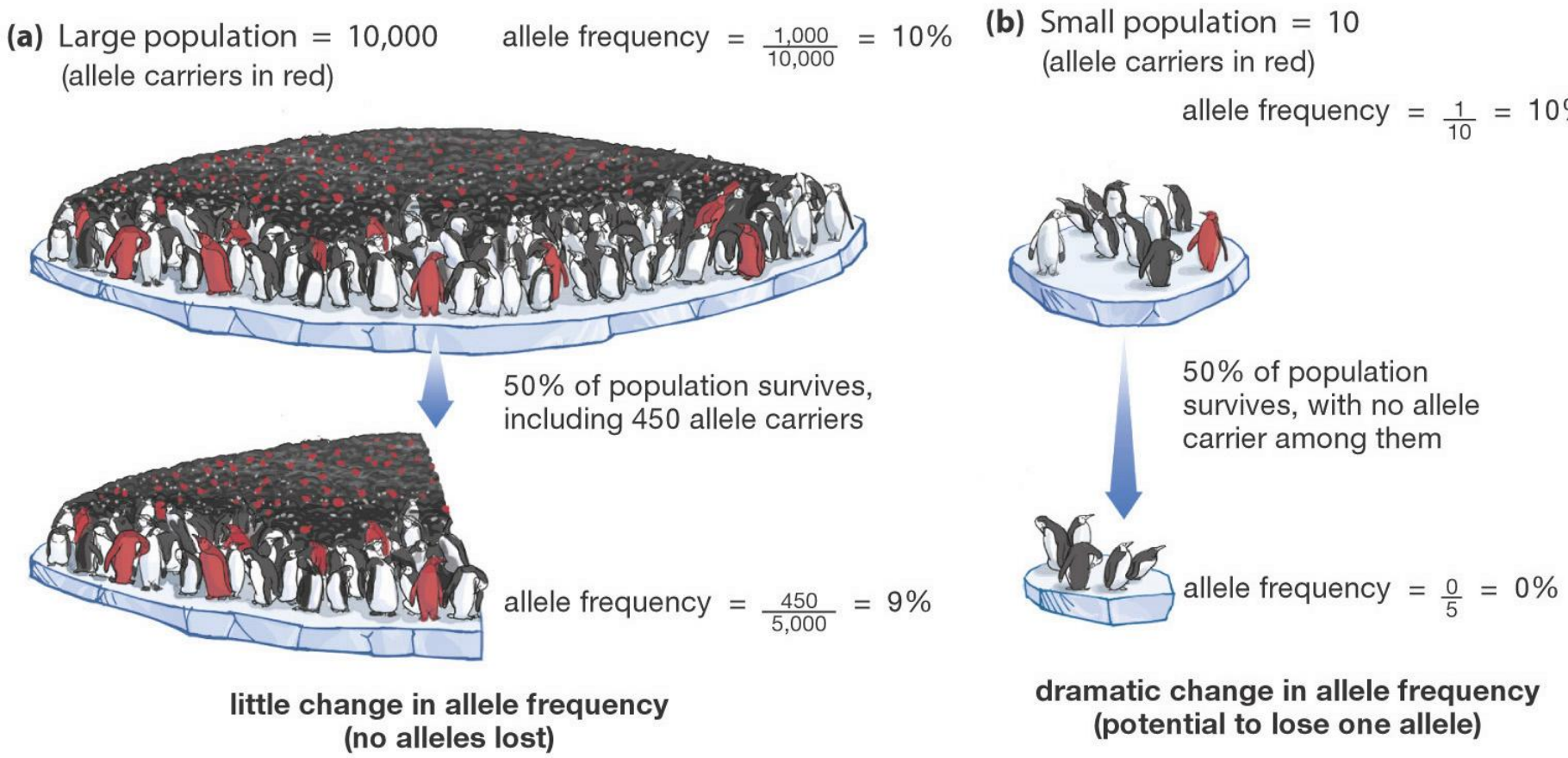


Genetic Drift and Population Size

Large stable populations typically experience little genetic drift.

Small dynamic populations can be profoundly affected.

The Effect of Genetic Drift is Inversely Related to Population Size



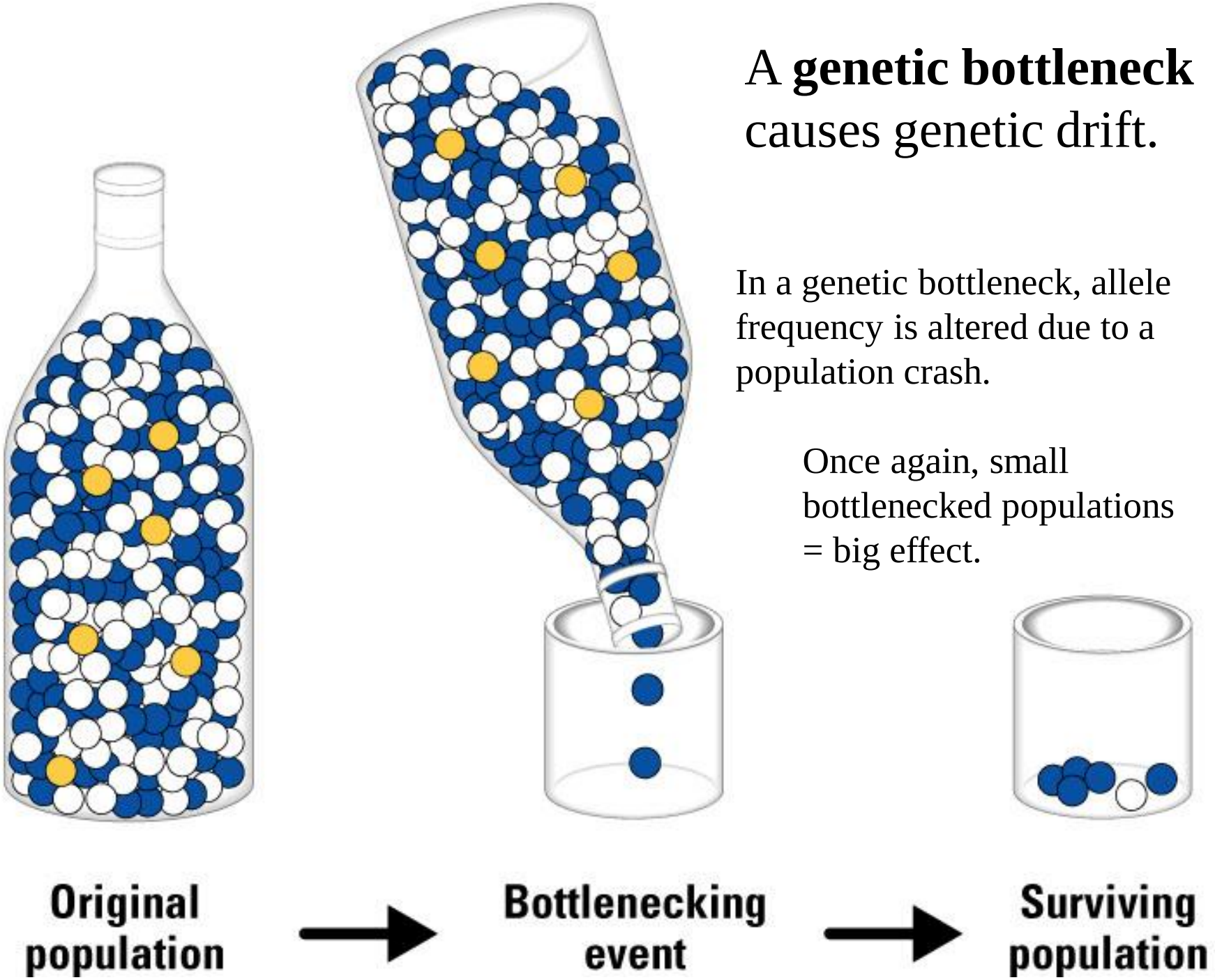
Large populations = small effects.

Small populations = large effects.

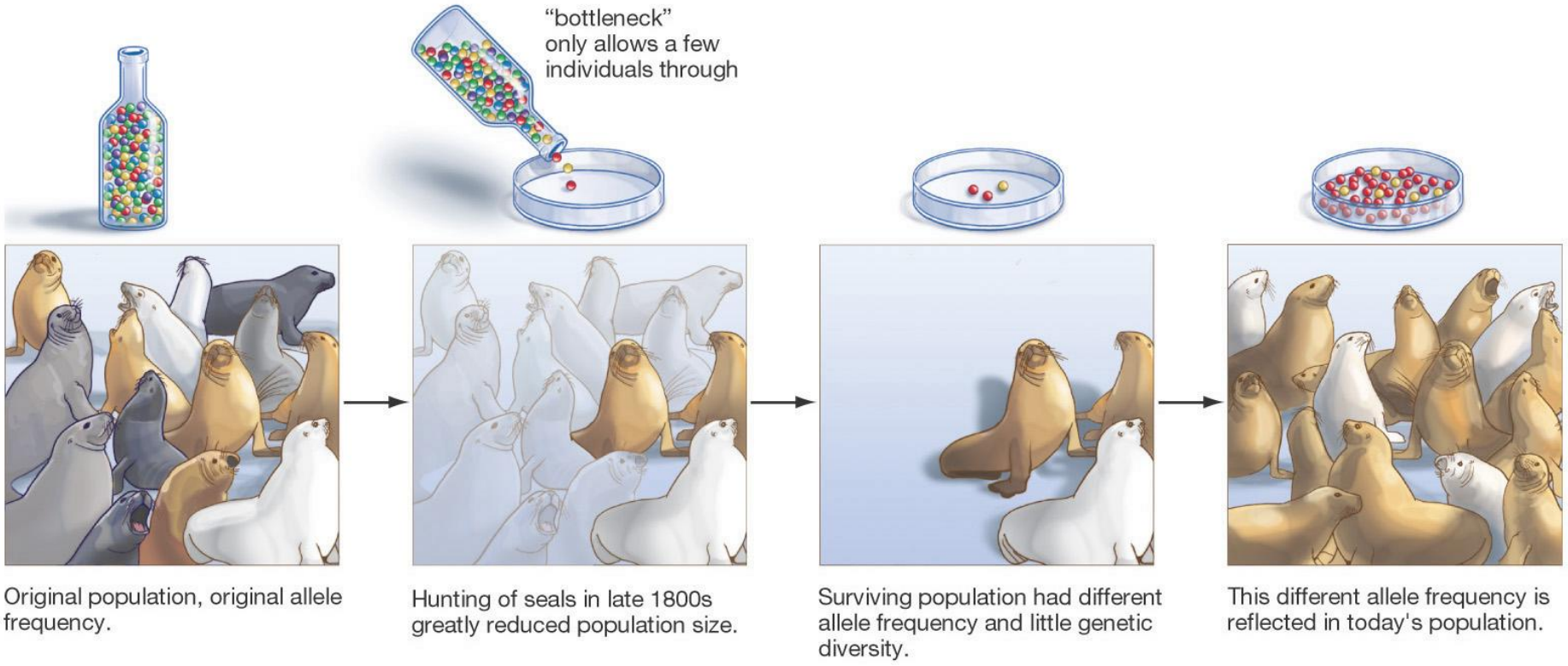
A **genetic bottleneck** causes genetic drift.

In a genetic bottleneck, allele frequency is altered due to a population crash.

Once again, small bottlenecked populations = big effect.



Genetic Bottleneck – A Historical Case



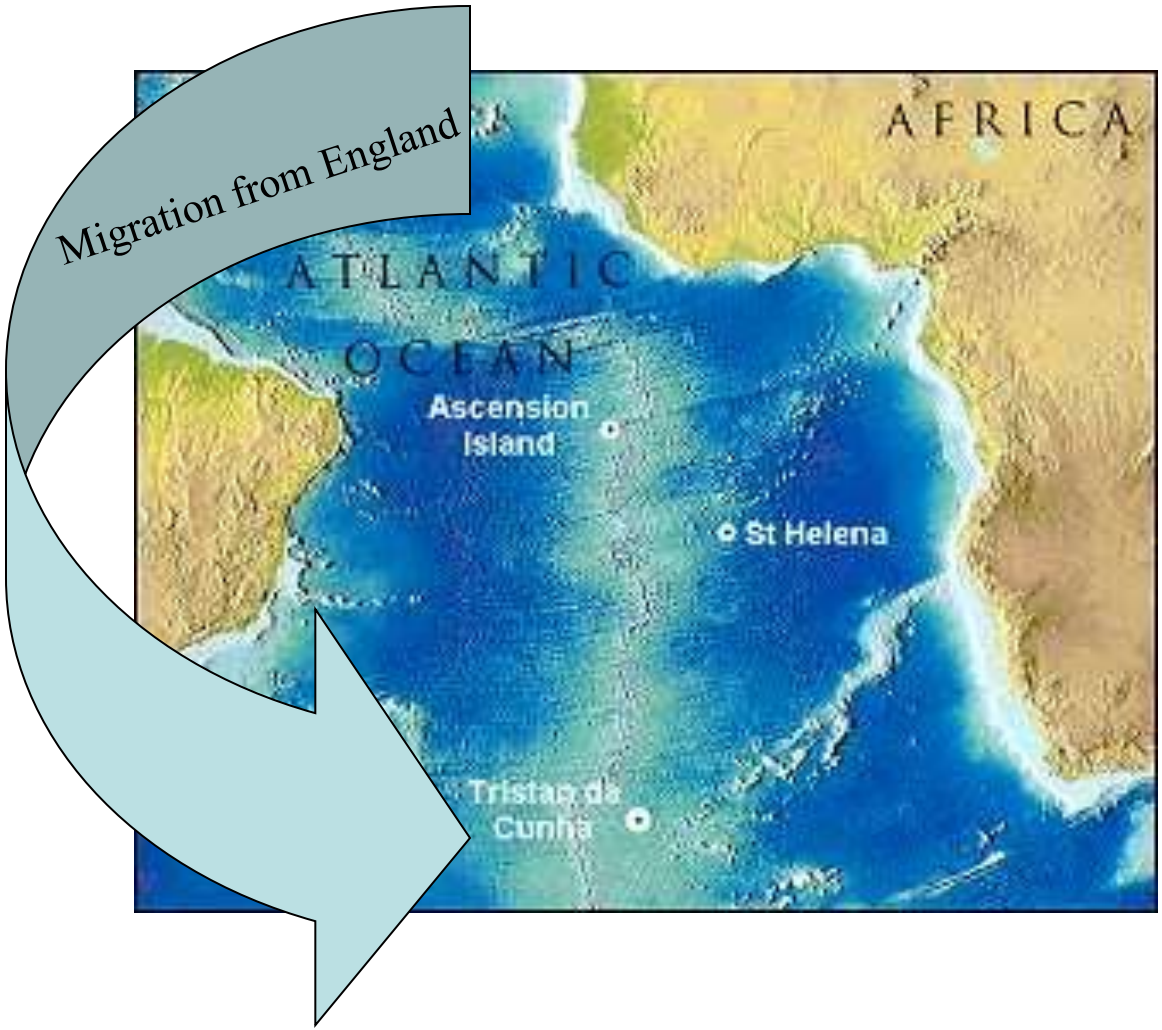
A severe genetic bottleneck occurred in northern elephant seals.

Other animals known to be affected by genetic bottlenecks include the cheetah.

Endangered Species Are in the Narrow Portion of a Genetic Bottleneck and Have Reduced Genetic Variation

The **Founder Effect** is another cause of genetic drift

A founder effect occurs when a small number of individuals from one population found a new population that is reproductively isolated from the original one.



Allele Frequency & Founders Effect

A population of 100 birds inhabit a coastal area. Two alleles, W and w, affect wing color. The dominant W allele produces red wings, while the recessive w allele produces white wings. In the population 96/100 birds have red wings (64 WW & 32 Ww), and only 4 have white wings (ww). A hurricane blows 10 birds 500 miles out to sea, where they land on a small island. Two of the birds have white wings (ww) and 8 have red wings (4 WW & 4 ww). Compare the allele frequency of the original and new island populations.

Allele Frequency & Founders Effect

Original Population Allele Frequency:

W = 160/200 = 0.8

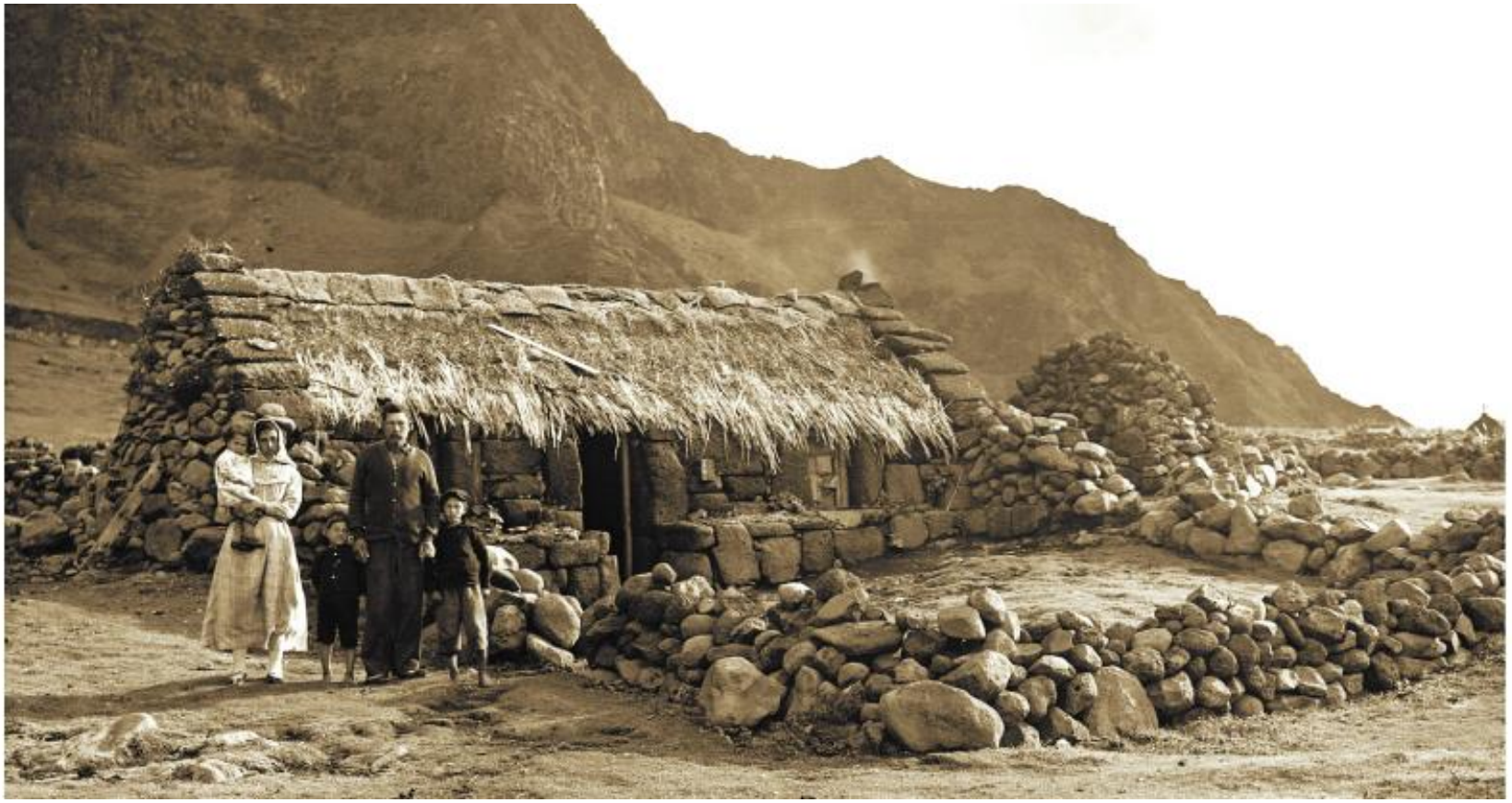
w = 40/200 = 0.2

Island Population Allele Frequency:

W = 12/20 = 0.6

W = 8/20 = 0.4

The Founder Effect is Another Variation of Genetic Drift



The South Atlantic island of Tristan da Cunha was colonized by 15 Britains in 1814, one of them carrying an allele for retinitis pigmentosum. Among their 240 descendents living on the island today, 4 are blind by the disease and 9 others are carriers.

The Founder Effect

Old Order Amish populations are derived from a few dozen colonists who escaped religious persecution in Germany in 1719 to settle in Pennsylvania.

The community is closed.

Allele and genetic disease frequencies in Amish are significantly different from the German ancestral and the surrounding local populations.

The Founder Effect

Genetic Disorders Hit Amish Hard

(Page 1 of 2)

GEAGUA COUNTY, Ohio, June 8, 2005

This Amish girl suffers from a genetic disorder. (CBS)

QUOTE

"I don't think the Amish really understand that it's a genetic disorder that causes the handicapping condition."
Iva Byler, mother of three sick sisters

(CBS) It doesn't get much more peaceful than the simple life among the Amish in rural Ohio. They have no cars, no electricity, no televisions.

But their children have medical conditions so rare, doctors don't have names for them yet, reports correspondent Vicki Mabrey.

The Amish make up only about 10 percent of the population in Geagua County in Ohio, but they're half of the special needs cases. Three of the five Miller children, for example, have a mysterious crippling disease that has no name and no known cure.

Their father, Bob Miller, says he realizes there is a crisis in the

April 5, 2006 11:35am

CBS NEWS

Genetic Drift in Humans?