11.4 Hardy-Weinberg Equilibrium

KEY CONCEPT

Hardy-Weinberg equilibrium provides a framework for understanding how populations evolve.

11.4 Hardy-Weinberg Equilibrium

- **Hardy-Weinberg equilibrium describes populations that are not evolving.**
  - Biologists use models to study populations.
  - Hardy-Weinberg equilibrium is a type of model.

11.4 Hardy-Weinberg Equilibrium

- **Hardy-Weinberg equilibrium describes populations that are not evolving.**
  - Genotype frequencies stay the same if five conditions are met.
    - very large population: no genetic drift
    - no emigration or immigration: no gene flow
    - no mutations: no new alleles added to gene pool
    - random mating: no sexual selection
    - no natural selection: all traits aid equally in survival

11.4 Hardy-Weinberg Equilibrium

- **Hardy-Weinberg equilibrium describes populations that are not evolving.**
  - Real populations rarely meet all five conditions.
    - Real population data is compared to a model.
    - Models are used to studying how populations evolve.

11.4 Hardy-Weinberg Equilibrium

- **The Hardy-Weinberg equation is used to predict genotype frequencies in a population.**
  - Predicted genotype frequencies are compared with actual frequencies.
    - used for traits in simple dominant-recessive systems
  - must know frequency of recessive homozygotes
    - $p^2 + 2pq + q^2 = 1$

	p	q
p	p^2	pq
q	pq	q^2

VARIABLES

p = frequency of allele *T* (dominant allele)

q = frequency of allele *t* (recessive allele)

p^2 = frequency of fish with *TT* (dominant homozygous genotype)

$2pq$ = frequency of fish with *Tt* (heterozygous genotype)

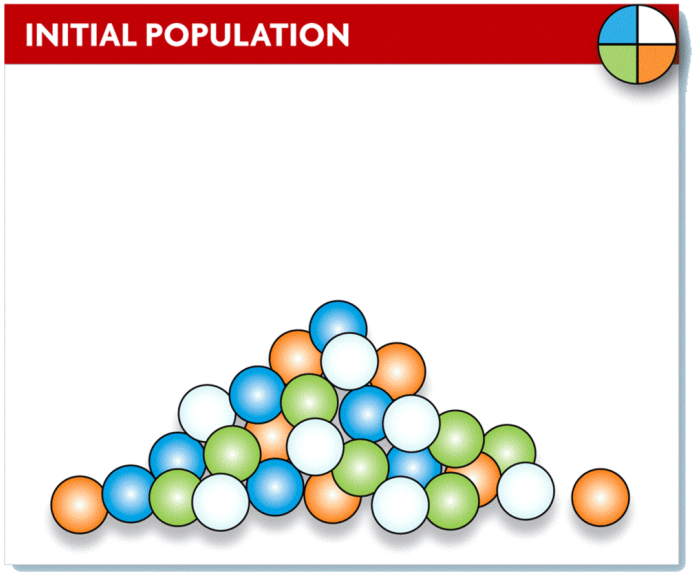
q^2 = frequency of fish with *tt* (recessive homozygous genotype)

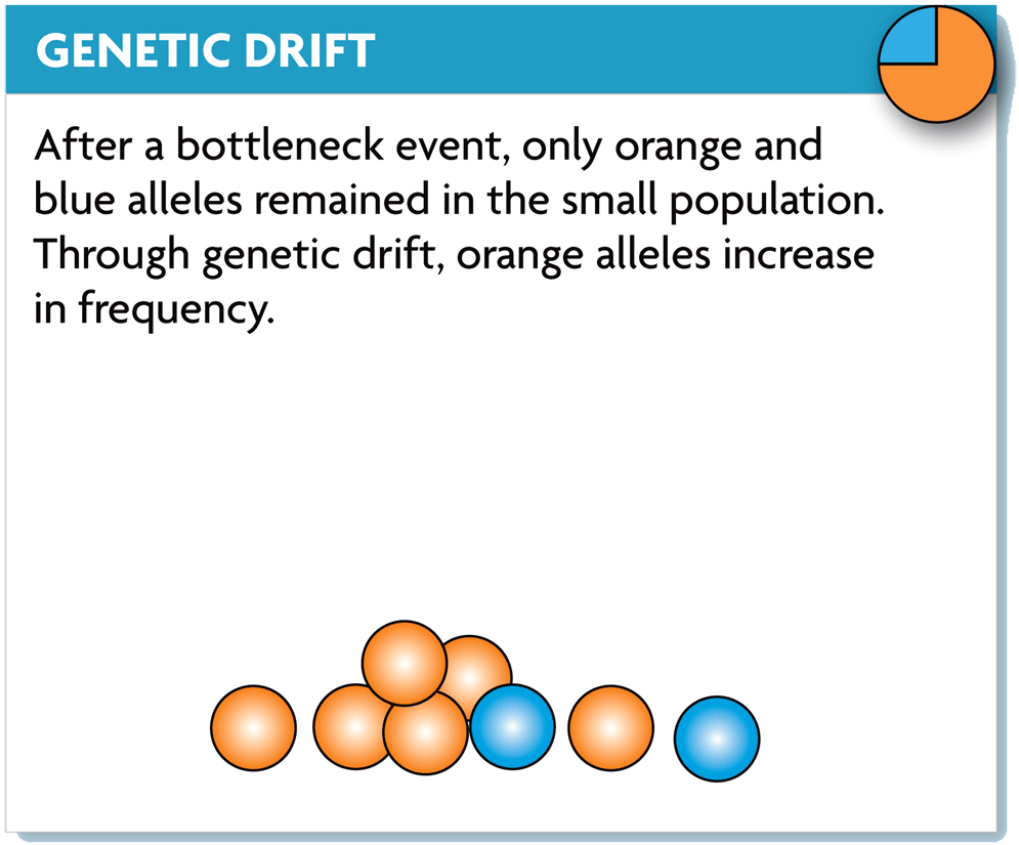
11.4 Hardy-Weinberg Equilibrium

- There are five factors that can lead to evolution.

11.4 Hardy-Weinberg Equilibrium

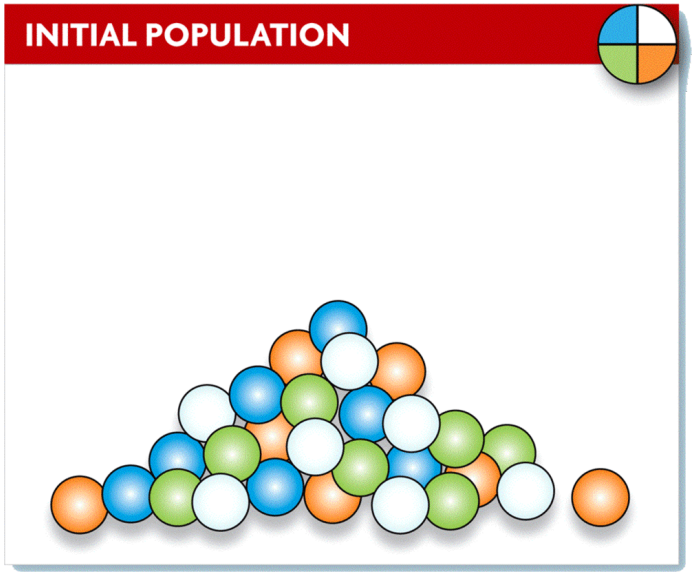
- Genetic drift changes allele frequencies due to chance alone.

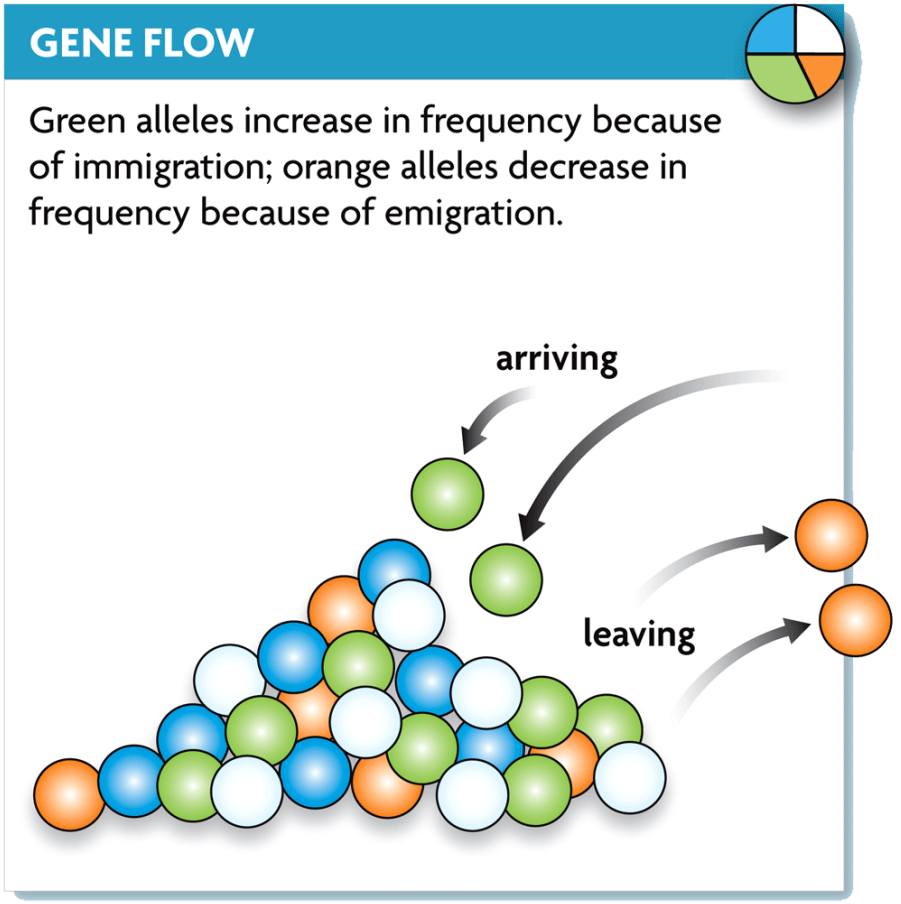




11.4 Hardy-Weinberg Equilibrium

- Gene flow moves alleles from one population to another.

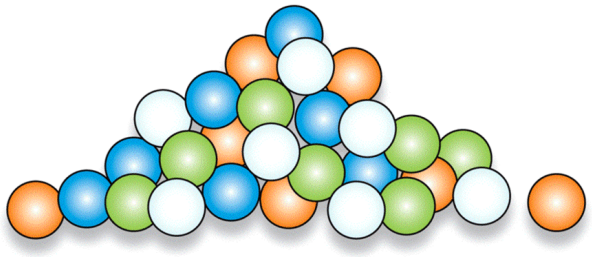




11.4 Hardy-Weinberg Equilibrium

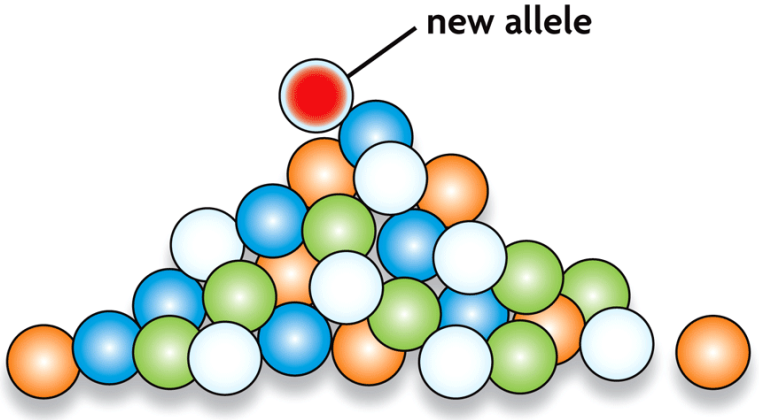
- Mutations produce the genetic variation needed for evolution.

INITIAL POPULATION



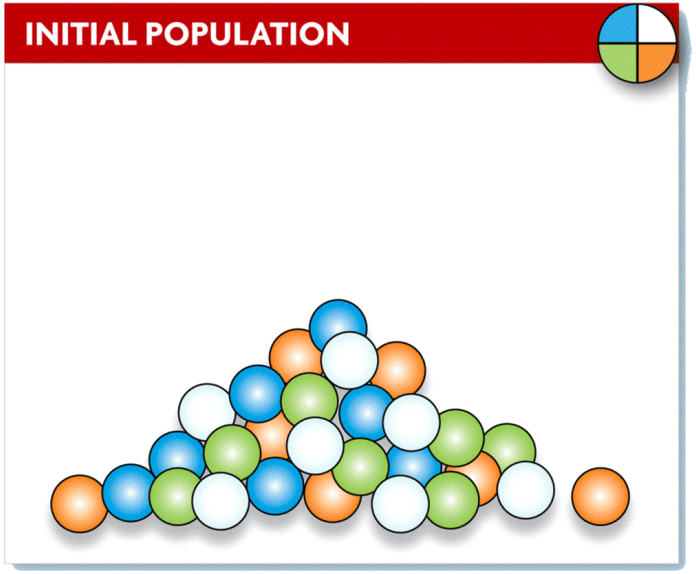
MUTATION

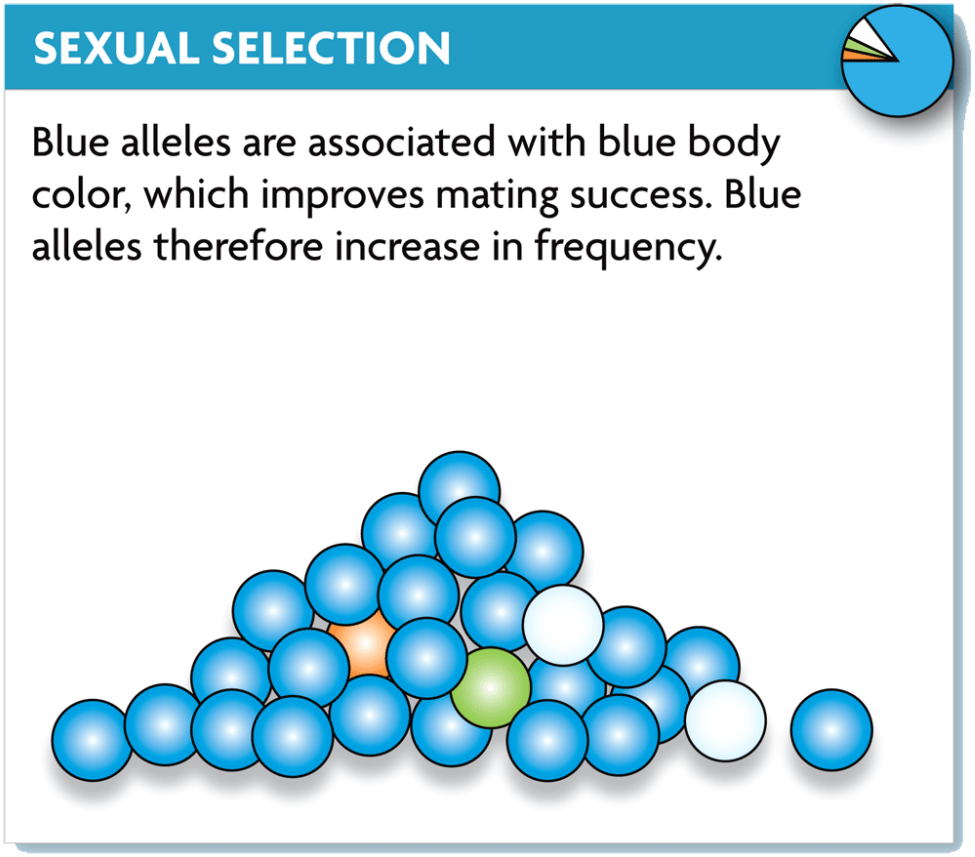
A new allele, associated with red body color, is formed through mutation. This could affect sexual selection if red body color improves mating success. It could affect natural selection if red body color increases the chance for survival.



11.4 Hardy-Weinberg Equilibrium

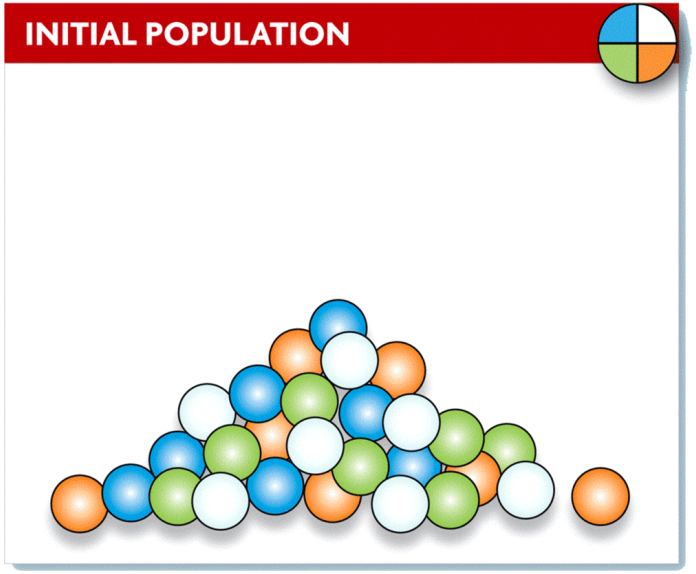
- Sexual selection selects for traits that improve mating success.

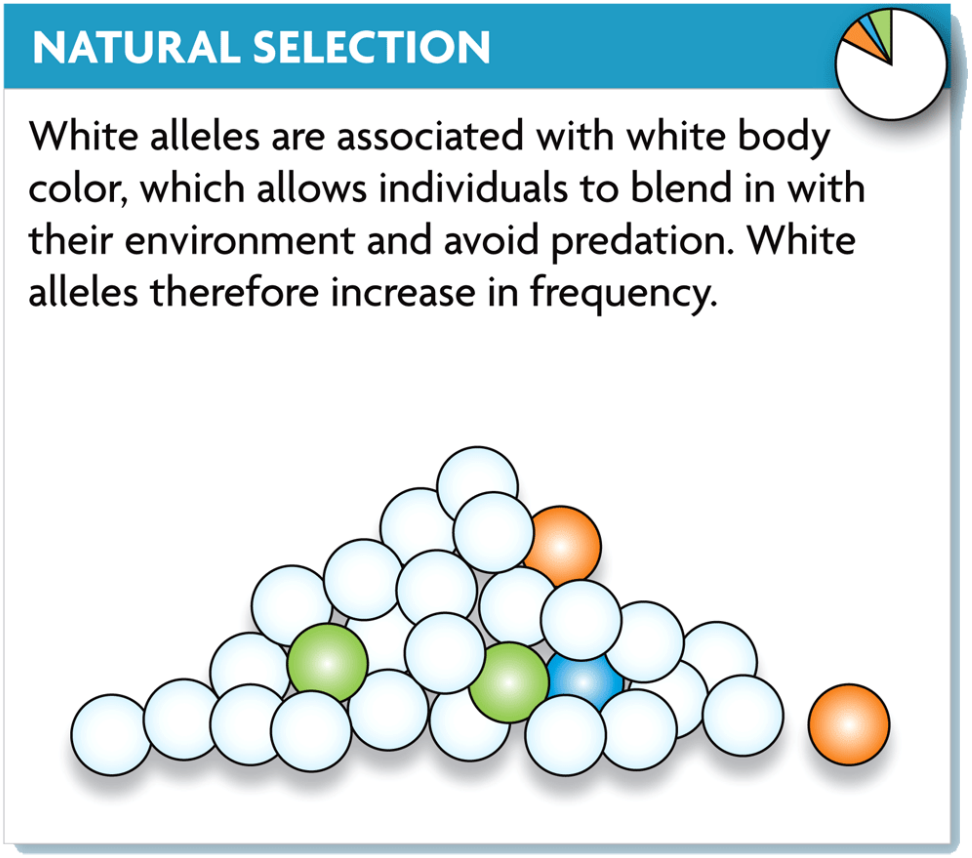




11.4 Hardy-Weinberg Equilibrium

- Natural selection selects for traits advantageous for survival.





11.4 Hardy-Weinberg Equilibrium

- In nature, populations evolve.
  - expected in all populations most of the time
  - respond to changing environments