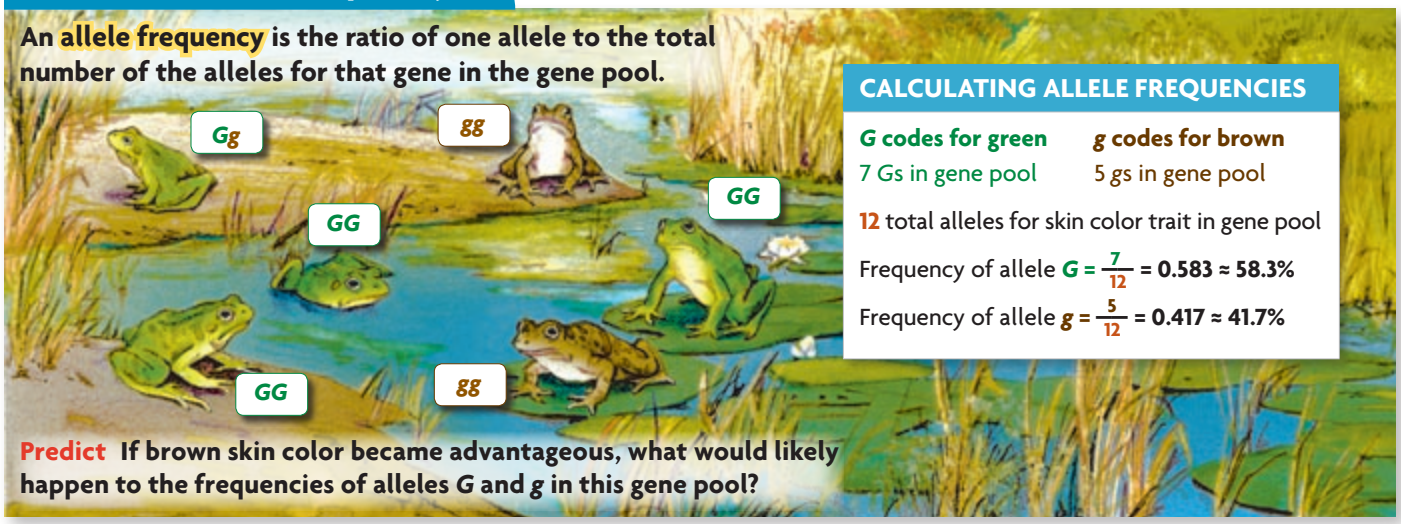
FIGURE 1.1 Allele Frequency

An allele frequency is the ratio of one allele to the total number of the alleles for that gene in the gene pool.



CALCULATING ALLELE FREQUENCIES

G codes for green — 7 Gs in gene pool

g codes for brown — 5 gs in gene pool

12 total alleles for skin color trait in gene pool

Frequency of allele $G = \frac{7}{12} = 0.583 \approx 58.3\%$

Frequency of allele $g = \frac{5}{12} = 0.417 \approx 41.7\%$

Predict **If brown skin color became advantageous, what would likely happen to the frequencies of alleles *G* and *g* in this gene pool?**

MAIN IDEA

Genetic variation comes from several sources.

Genetic variation comes from two main sources: mutation and recombination.

- **Mutation** A mutation is a random change in the DNA of a gene. This change can form a new allele. Mutations in reproductive cells can be passed on to offspring. This increases the genetic variation in the gene pool. Because there are many genes in each individual and many individuals in a population, new mutations form frequently in gene pools.
- **Recombination** New allele combinations form in offspring through a process called recombination. Most recombination occurs during meiosis—the type of cell division needed for sexual reproduction. When gametes are made, each parent's alleles are arranged in new ways. This shuffling of alleles results in many different genetic combinations.

Some biologists are studying hybridization as another source of genetic variation. Hybridization is the crossing of two different species that share common genes. Research suggests that this process occurs within many groups of animals, including birds and mammals, when similar species live in the same area and individuals cannot easily find mates of their own species.

Infer **Why aren't mutations in nonreproductive cells sources of genetic variation?**

CONNECT TO GENETICS

As you learned in **From DNA to Proteins,** mutations on noncoding regions of DNA do not affect phenotypes. Only mutations on coding regions of DNA can affect an organism's phenotype.

11.1 Formative Assessment

REVIEWING MAIN IDEAS

1. Why does genetic variation increase the chance that some individuals in a population will survive?
2. Describe two main sources of genetic variation.

CRITICAL THINKING

3. **Analyze** In what way is a **gene pool** representative of a population?
4. **Apply** If a certain trait's **allele frequency** is 100 percent, describe the genetic variation for that trait in the population.

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CONNECT TO GENETICS

5. How does crossing over during meiosis provide a source of genetic variation? Draw a diagram to show this process.