

THINK ABOUT IT

Why do biological family members resemble each other, yet also look so different?



Students, write your response!

THINK ABOUT IT

Similarities come from shared genes.

Differences come from gene shuffling during reproduction, environmental influences, and mutations.



Genetics Joins Evolutionary Theory

- Researchers discovered that heritable traits are controlled by **genes**.
- Changes in genes and chromosomes generate **variation**.

Genotype and Phenotype in Evolution

- An organism's _____ is the particular combination of alleles it carries.



Genotype and Phenotype in Evolution

- An individual's genotype, together with environmental conditions, produces its _____.



Genotype and Phenotype in Evolution

- An organism's **genotype** is the particular combination of alleles it carries.
- An individual's genotype, together with environmental conditions, produces its **phenotype**.
 - Phenotype includes all physical, physiological, and behavioral characteristics of an organism.

Genotype and Phenotype in Evolution

- Natural selection acts directly on _____,
not _____.

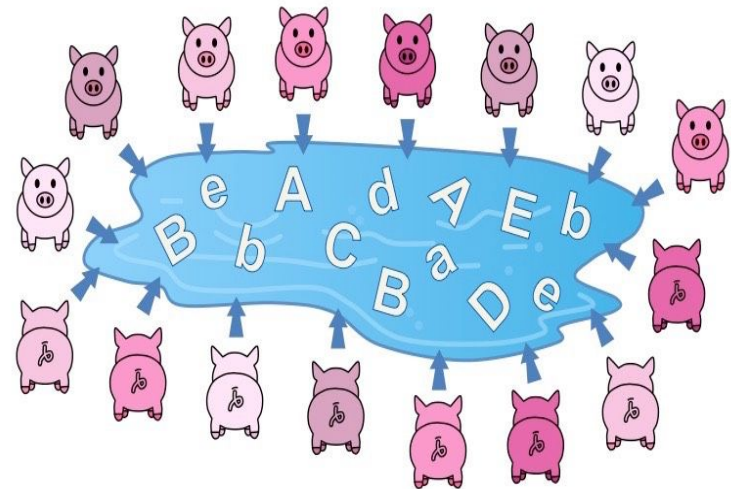


Genotype and Phenotype in Evolution

- Natural selection acts directly on **phenotype**, not **genotype**.

Populations and Gene Pools

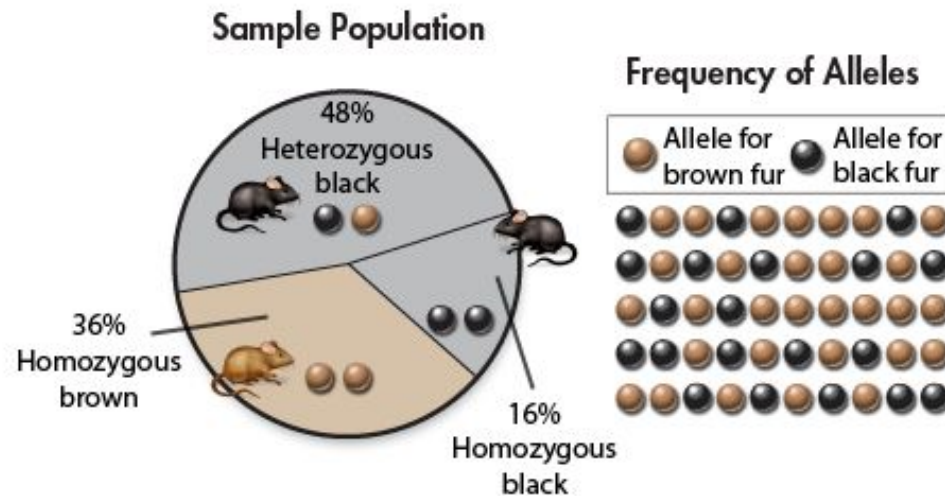
- A **population** is a group of individuals of the same species that mate and **produce offspring**.
- A **gene pool** consists of all the **genes**, including all the different **alleles** for each gene that are present in a population.



Populations and Gene Pools

- Researchers study gene pools by examining the relative **frequency** of an allele.
- The **allele frequency** is the number of times a particular allele occurs in a gene pool, compared with the number of times other alleles for the same gene occur.

For example, this diagram shows the gene pool for fur color in a population of 25 mice. Each mouse has 2 alleles for fur color.

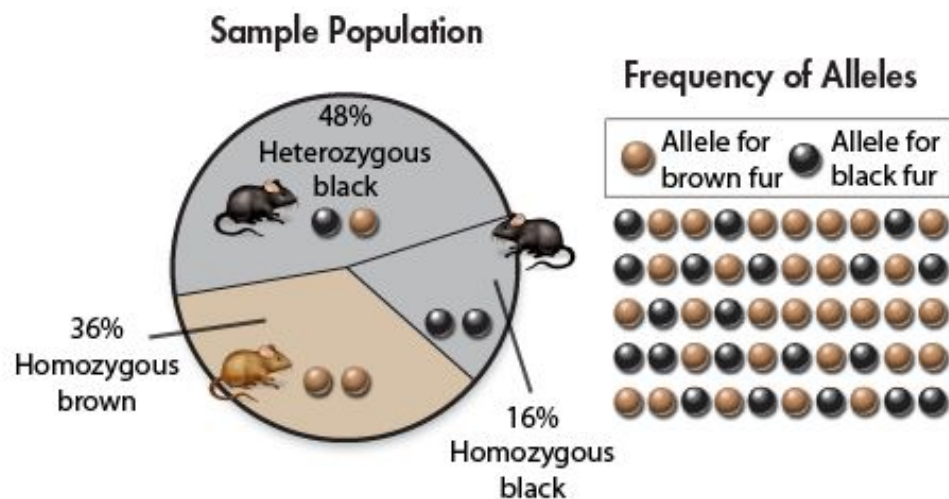


In a total of 50 alleles, 20 alleles are B (black) and 30 are b (brown). What is the black allele frequency?



Students, write your response!

For example, this diagram shows the gene pool for fur color in a population of 25 mice. Each mouse has 2 alleles for fur color.

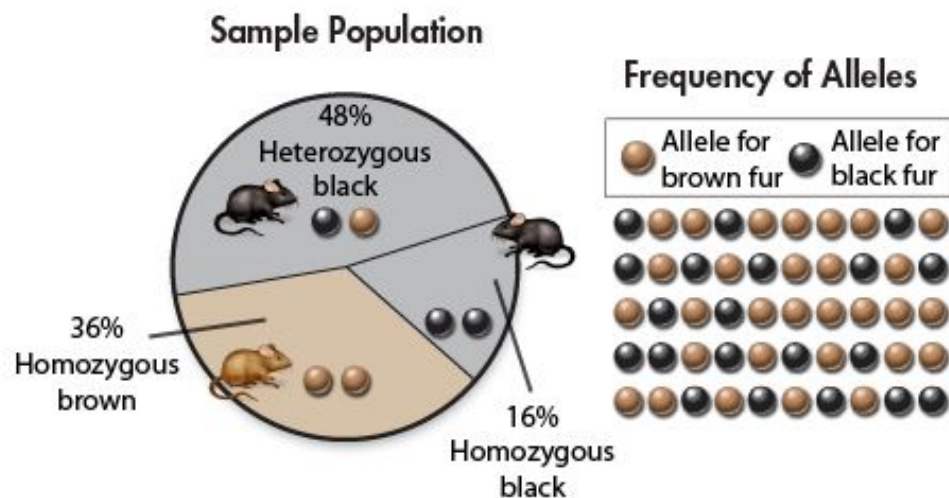


In a total of 50 alleles, 20 alleles are B (black) and 30 are b (brown). What is the brown allele frequency?



Students, write your response!

For example, this diagram shows the gene pool for fur color in a population of 25 mice. Each mouse has 2 alleles for fur color.



If the current generation of homozygous brown mice had no offspring, how would this affect the allele frequency of the b allele in the next generation?



Students, write your response!

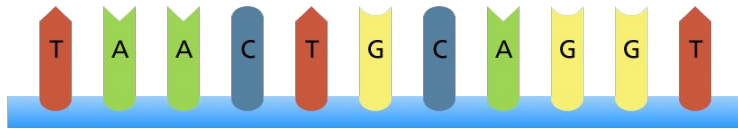
Populations and Gene Pools

- Evolution is any change in the relative **frequency of alleles** in the gene pool of a population over time.
- Natural selection operates on **individuals**, but resulting changes in allele frequencies show up in **populations**.
- **Populations, rather than individuals, evolve.**

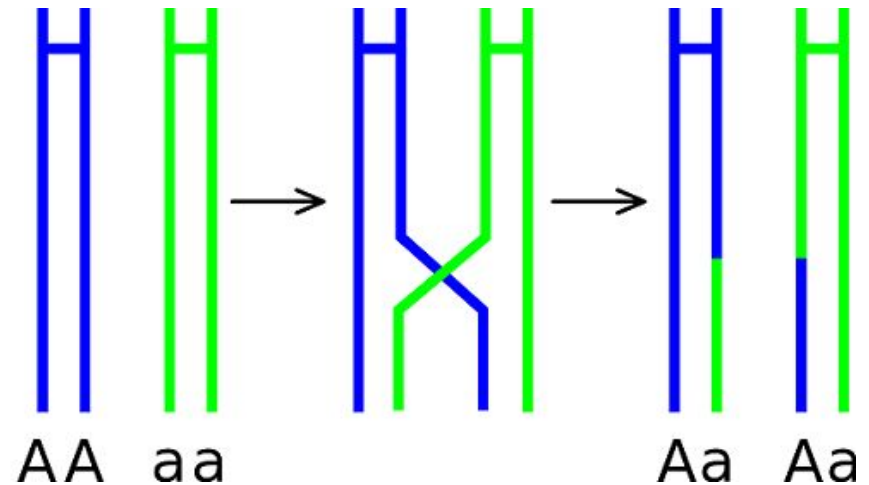
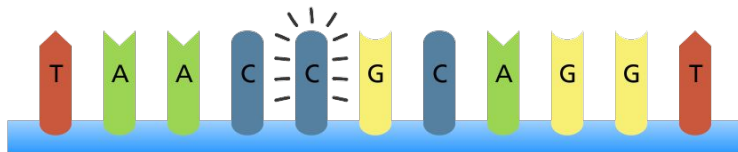
Sources of Genetic Variation

- Two sources of genetic variation are:
 - ✓ **Mutation**
 - ✓ **Genetic recombination during sexual reproduction**

Original sequence



Point mutation



Mutations

- Mutations that produce changes in **phenotype** may or may not affect **fitness**.
 - Some mutations may be lethal or may lower fitness; others may be beneficial.
- Mutations matter in evolution only if they are **heritable**.

Genetic Recombination in Sexual Reproduction

- You do not look exactly like your parents, even though they gave you all their genes. Chromosomes move independently during meiosis (known as **independent assortment**).
 - In humans, who have 23 pairs of chromosomes, the process can produce 8.4 million gene combinations.
- **Crossing-over** is another way in which genes are recombined. In crossing-over, paired chromosomes can swap sections of DNA at random.

Genetic Variation

Which source of variation brings more diversity into a gene pool – mutation or sexual reproduction? Explain.



Students, write your response!

Genetic Variation

- Most diversity in a gene pool is due to **sexual reproduction, not mutations**, because millions of gene combinations can be produced through independent assortment and crossing-over.