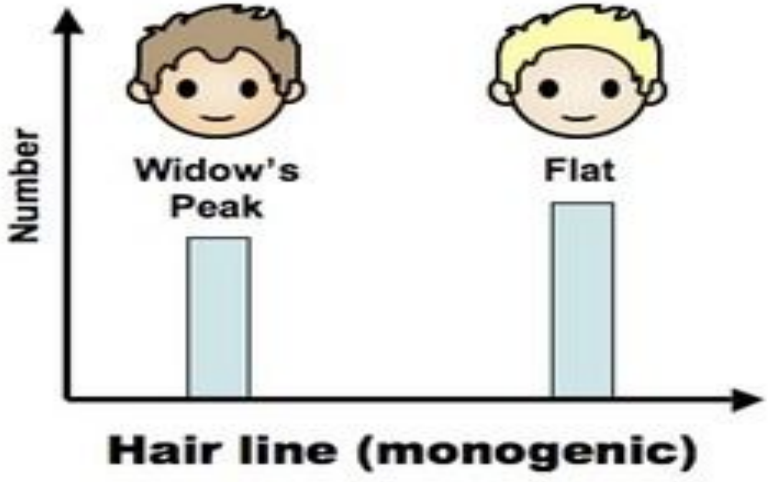
Single-Gene Traits

- Describe your hairline.

Single-Gene Traits

- A **single-gene trait** is a trait controlled by **only one gene**.

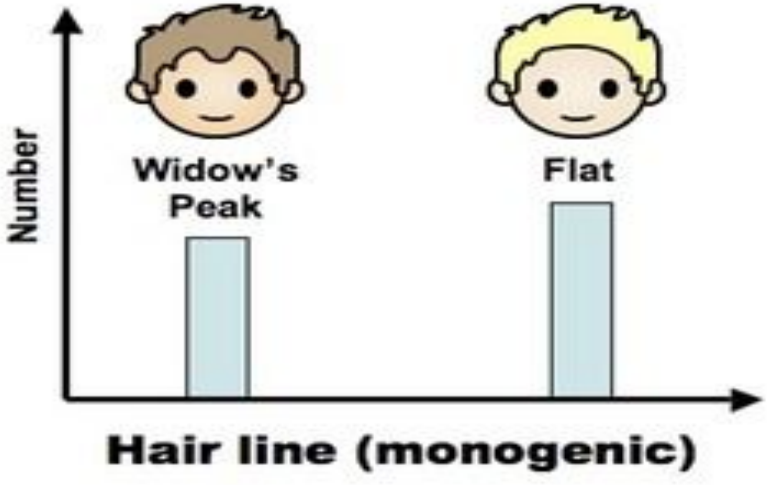
- Single-gene traits may have just two or three distinct **phenotypes**.



Single-Gene Traits

- **Dominance of an allele for a single-gene trait does NOT necessarily mean that the dominant phenotype will always appear with greater frequency in a given population.**

- Widow's peak (W) is dominant over a flat hairline (w)
  - Approximately 35% of the world population has a widow's peak



Polygenic Traits

- **Polygenic traits** are traits controlled by **two or more genes.**

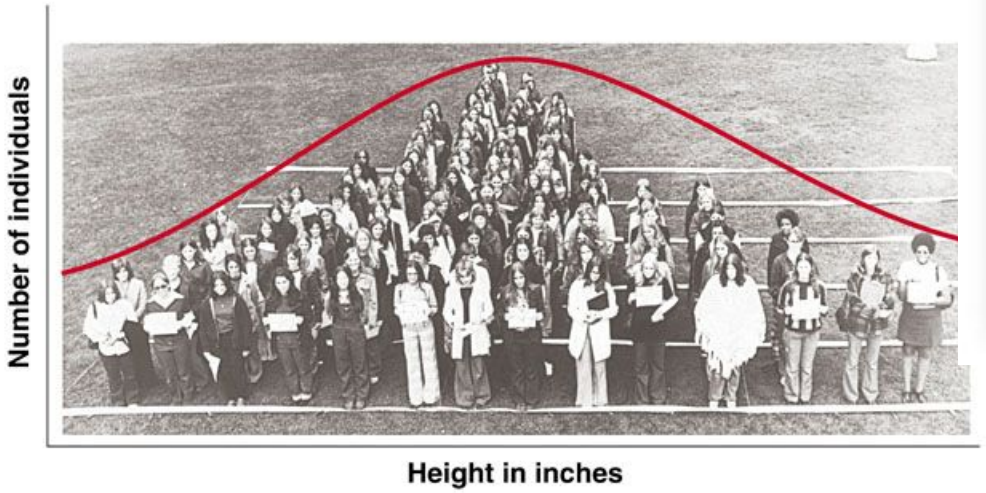
- Each gene of a polygenic trait often has **two or more alleles.**

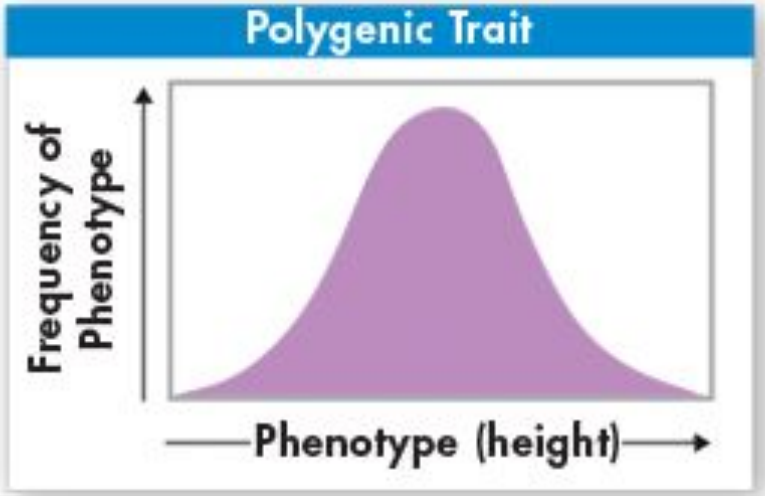
- A polygenic trait often has many possible genotypes and a **range of phenotypes**.

Polygenic Traits

- Human height, which varies from very short to very tall, is an example of a polygenic trait.

- The **bell-shaped curve** is typical of **polygenic** traits.





Natural Selection on Single-Gene Traits

- Natural selection for a single-gene trait can lead to **changes in allele frequencies**.

- Changes in allele frequencies lead to **evolution**.

- For example, imagine that a population of lizards experiences mutations in one gene that determines body color.
  - ✔ The normal color for lizards is brown.
  - ✔ The mutations produce red and black forms.

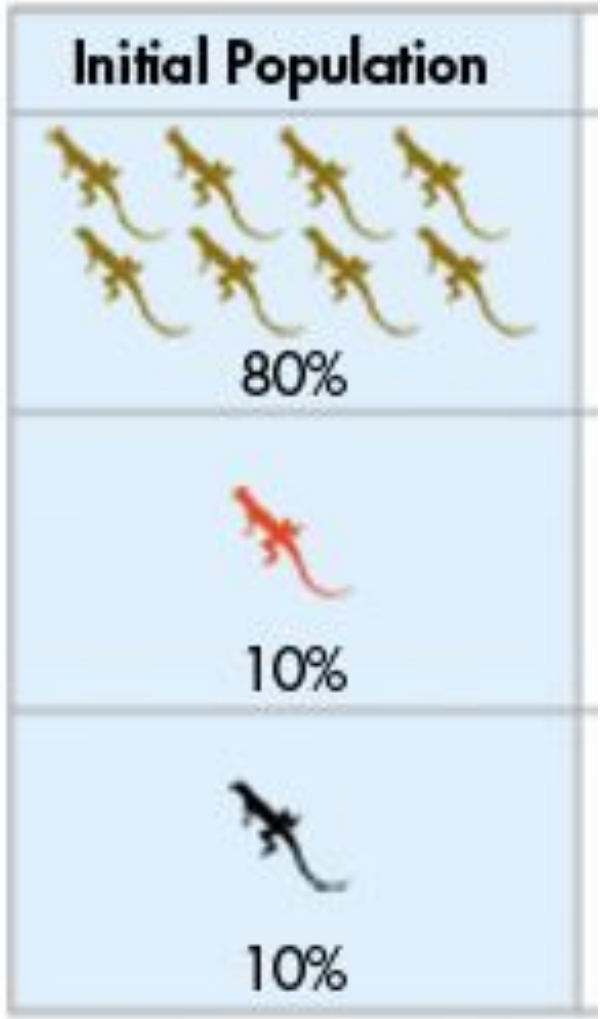
Natural Selection on Single-Gene Traits

- If red lizards are more visible to predators, they might be less likely to survive and reproduce.

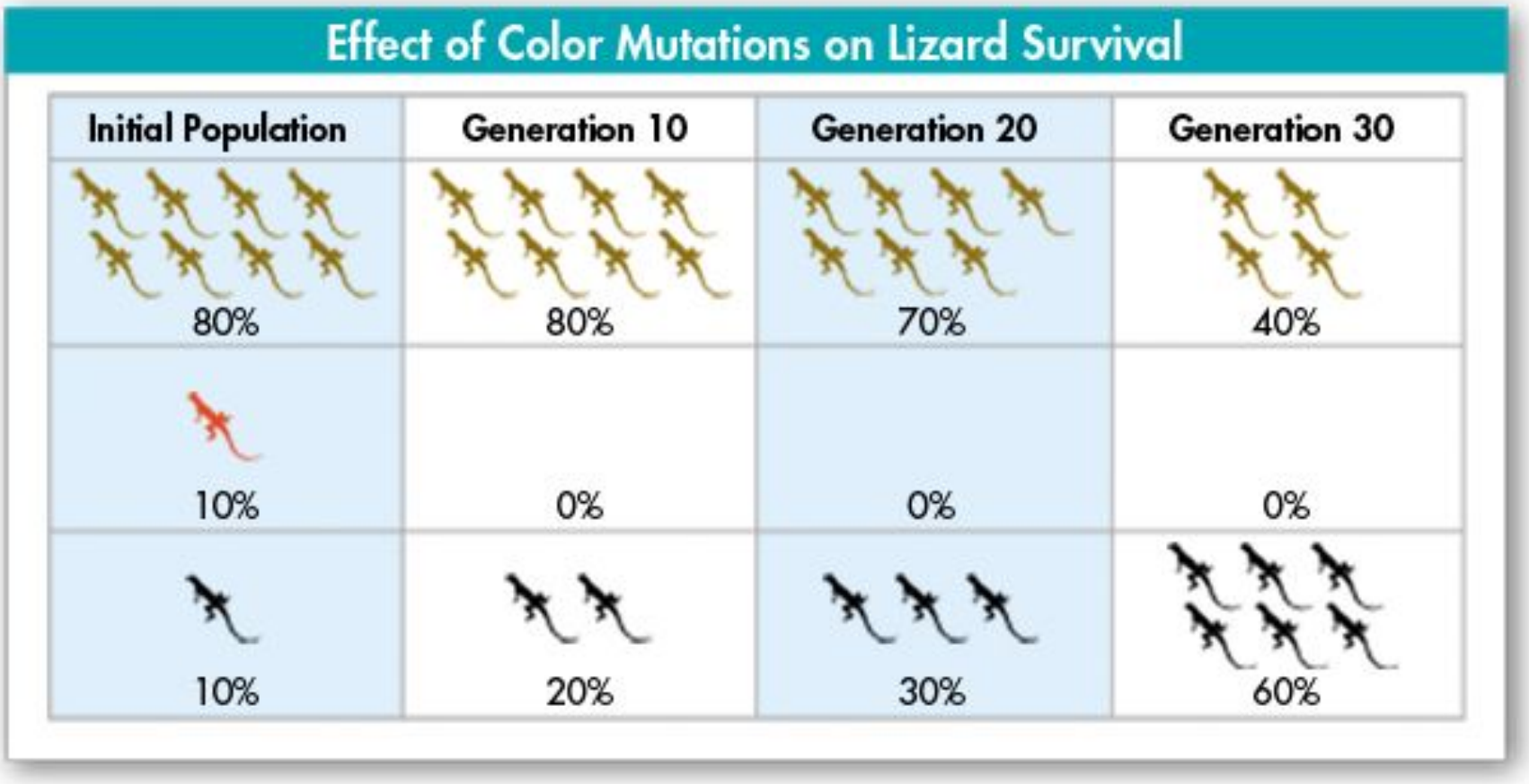
- Black lizards might be able to absorb sunlight. Higher body temperatures may allow the lizards to move faster, escape predators, and reproduce.

Natural Selection on Single-Gene Traits

What will possibly happen to the allele frequencies in this population of lizards over time?



Natural Selection on Single-Gene Traits



Red lizards have been **selected against** because they are more visible to predators, while black lizards have been **selected for** because they can move faster and avoid predators. As a result, red lizards have been **eliminated** and black lizards have become **more common.**

Natural Selection on Polygenic Traits

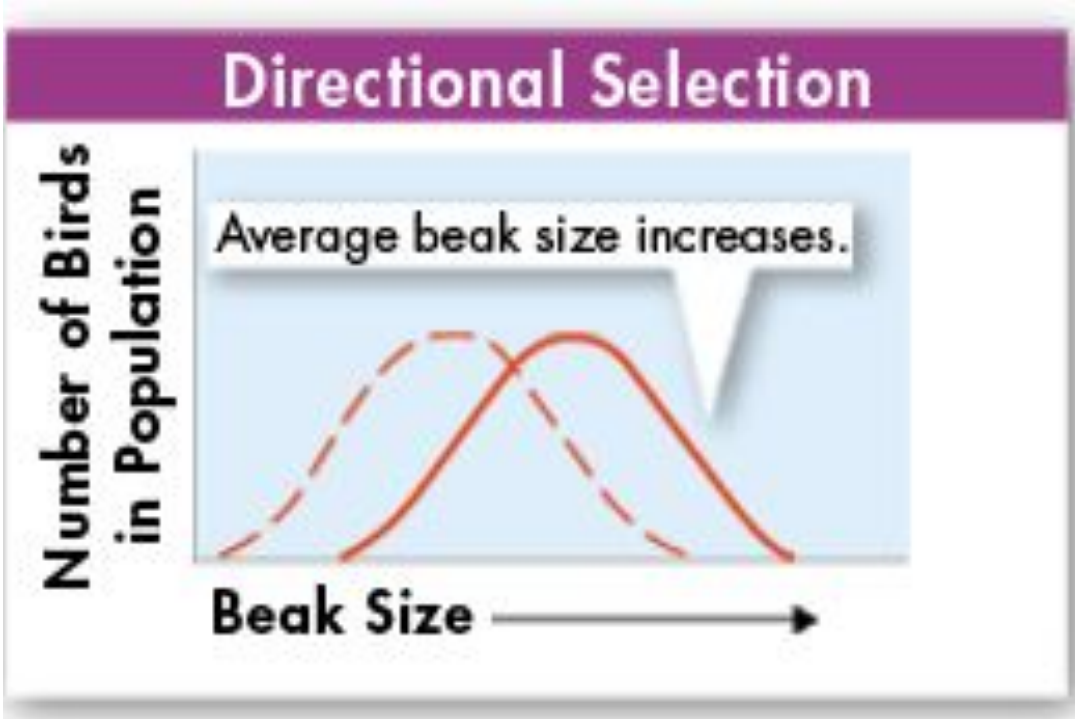
- Natural selection on polygenic traits can affect the relative fitness of the **range of phenotypes**.
- The fitness of individuals may vary from one end of a bell curve to the other.
- Where fitness varies, natural selection can act.

Natural Selection on Polygenic Traits

- Directional selection occurs when **individuals at one end of the curve have higher fitness than individuals in the middle or at the other end.**
  - The range of phenotypes **shifts in one direction** because some individuals are more successful at surviving and reproducing than others.

Directional Selection

- For example, if only large seeds were available, birds with larger beaks would have an easier time feeding and would be more successful in surviving and passing on genes.

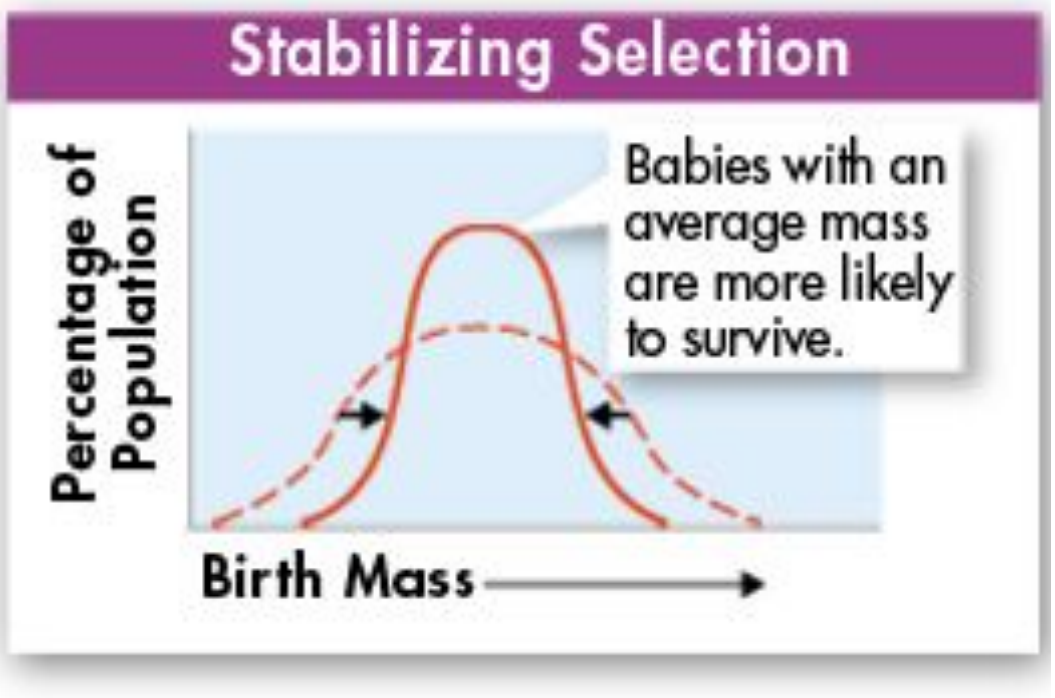


Natural Selection on Polygenic Traits

- Stabilizing selection occurs when **individuals near the center of the curve have higher fitness than individuals at either end.**
  - This situation keeps the center of the curve at its current position, but it **narrows** the overall graph.

Stabilizing Selection

- For example, very small and very large babies are less likely to survive than average-sized individuals. The fitness of these smaller or larger babies is therefore lower than that of more average-sized individuals.

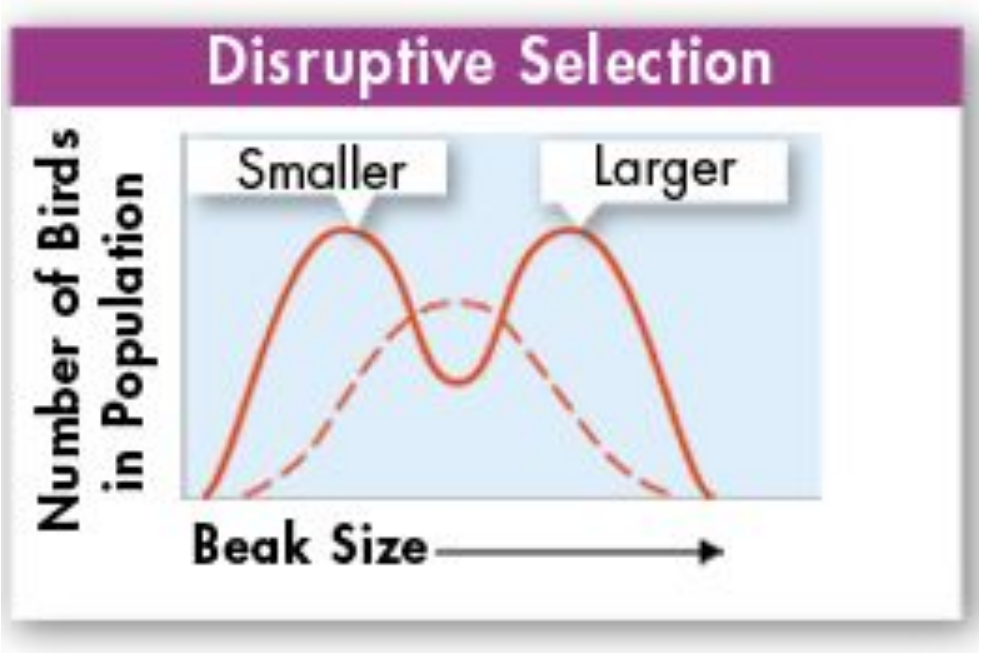


Natural Selection on Polygenic Traits

- Disruptive selection occurs when i**ndividuals at the upper and lower ends of the curve have higher fitness than individuals near the middle**.
  - Disruptive selection acts against individuals of an **intermediate** type and can create **two distinct** phenotypes.

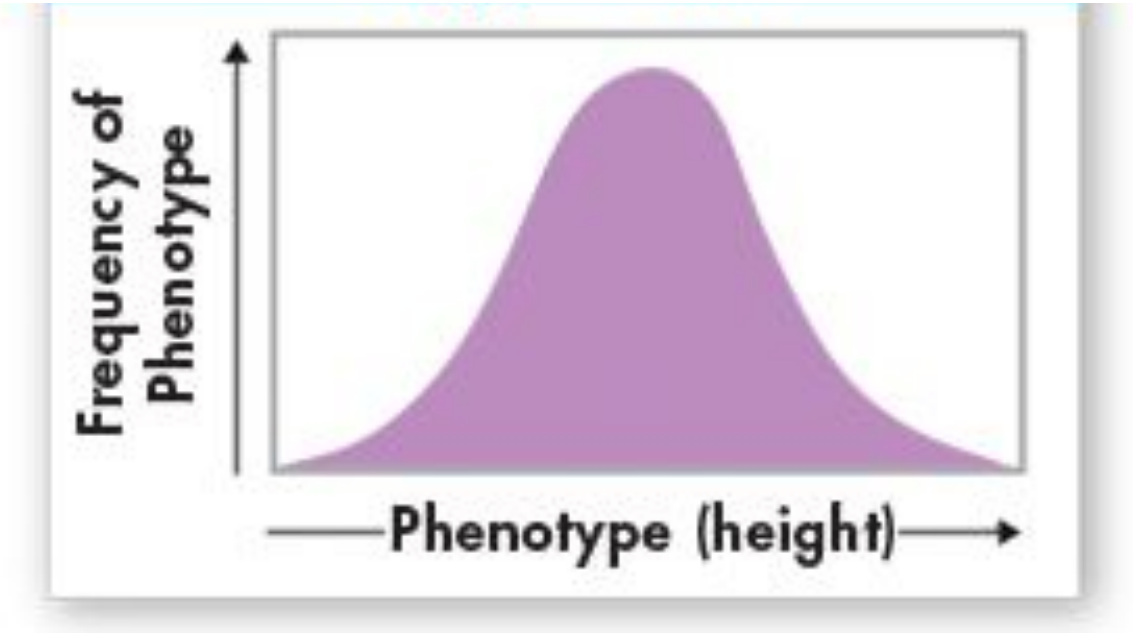
Disruptive Selection

- For example, in an area where medium-sized seeds are less common, birds with unusually small or large beaks would have higher fitness. Therefore, the population might split into two groups—one with smaller beaks and one with larger beaks.



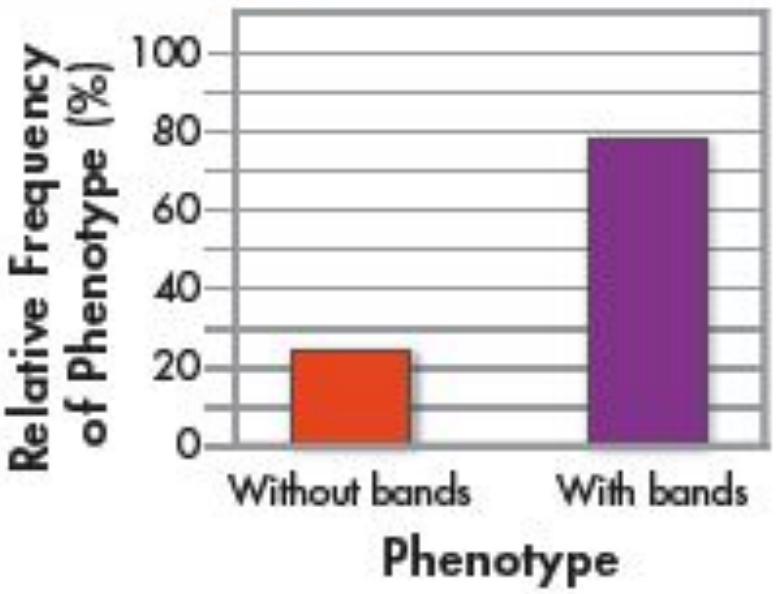
Let's Review

The following graph represents what type of trait?



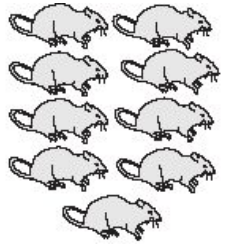
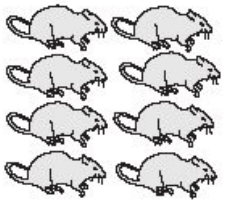
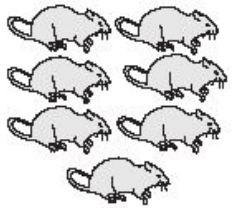
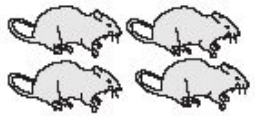
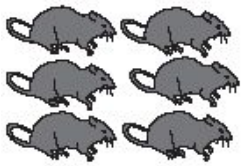
Let's Review

The following graph represents what type of trait?



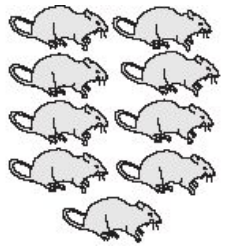
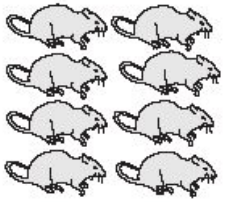
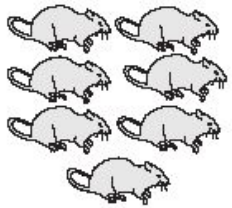
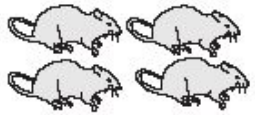
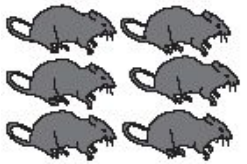
Let's Review

Is the trait for fur color in the mouse population below a single-gene trait or a polygenic trait? Explain your answer.

Initial Population	Generation 10	Generation 20	Generation 30
90% 	80% 	70% 	40% 
10% 	20% 	30% 	60% 

Let's Review

Describe how the relative frequencies of fur color alleles is changing in this population and propose an explanation for this change.

Initial Population	Generation 10	Generation 20	Generation 30
90% 	80% 	70% 	40% 
10% 	20% 	30% 	60% 

Students, write your response!

Let’s Review

Individuals at the upper and lower ends of the curve have higher fitness than individuals near the middle.

What type of selection is this describing?

Let's Review

Individuals at one end of the curve have higher fitness than individuals in the middle or at the other end.

What type of selection is this describing?

Let's Review

Individuals near the center of the curve have higher fitness than individuals at either end.

What type of selection is this describing?

Let’s Review

What effect does stabilizing selection have on variation in a population?

Let's Review

Draw the missing line in the graph on the right to show how disruptive selection affects beak size.