THE STANDARD

Mutations

Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

ANCHORING PHENOMENON

Sickle Cell Trait: Same Mutation, Two Different Outcomes

A single change in one gene affects a protein called hemoglobin, which carries oxygen in red blood cells. People with two copies of the changed gene can develop sickle cell disease, where red blood cells bend into a sickle shape and cause serious problems. People with just one copy of the changed gene usually feel fine, and in regions where malaria is common, that single copy actually offers some protection against the malaria parasite. One mutation. Harmful in one situation. Beneficial in another. Students will keep circling back to this all week.

> DRIVING QUESTION
>
> *"How can the exact same gene change be harmful for one person and beneficial for another?"*

INVESTIGATIVE 1

Lactase Persistence: A Change That Lets Adults Digest Milk

Most mammals stop making the enzyme lactase after they're weaned. In some human populations, a mutation in a regulatory region near the lactase gene keeps the enzyme switched on into adulthood. Those adults can drink milk without trouble. Adults without the mutation often can't. Use this one to sharpen the "beneficial depends on context" lens the anchor is pushing on: the mutation is helpful in populations that raise dairy animals, neutral in populations that don't.

> DRIVING QUESTION
>
> *"Why does the same gene change count as beneficial in one population and not really …ther?"*

INVESTIGATIVE 2

Albinism in Animals

Most animals make a pigment called melanin that colors skin, fur, feathers, and eyes. A mutation in one of the genes for melanin production can stop the pigment from being made. The result is an animal with white fur or feathers and pink or pale eyes. Same species, same general body plan, very different appearance. Use this one to make protein function visible: the mutation disrupts a pigment-making protein, and the trait change is immediate and obvious.

> DRIVING QUESTION
>
> *"How can one broken protein change something as visible as an entire animal's color?"*