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.

DCI
DISCIPLINARY CORE IDEA

LS3.A · Inheritance of Traits

> *Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.*

Genes sit on chromosomes inside cells. Each gene chiefly codes for a specific protein, and proteins do most of the actual work: building structures, running reactions, sending signals. A mutation is a change in the gene's sequence. Sometimes that change alters the protein. Sometimes the altered protein changes a trait. **Harmful, beneficial, or neutral, depending on what the protein does and what changed.**

SEP
SCIENCE & ENGINEERING PRACTICE

Developing and Using Models

> *Develop and use a model to describe phenomena.*

Students aren't memorizing mutation types. They're building a model that links three layers: the gene sequence, the protein it codes for, and the trait the organism shows. **A working model lets them describe why one change in the DNA can ripple all the way up to something visible, or not ripple at all.**

CCC
CROSSCUTTING CONCEPT

Structure and Function

> *Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts.*

This standard is pure structure-and-function. The shape of a protein determines what it can do. A change in the gene can change the protein's structure. A different structure can mean a different function. **The model has to make that chain visible at a scale students can't directly observe.**