

Cn3D Activity and Learning Objectives

Summary:

In this lesson, students use an online resource to analyze nucleotide or amino acid sequences and visualize 3-dimensional structures. The lesson begins by having students become familiar with the online site by using a specific DNA sequence and the amino acid it describes. Students obtain the sequence from the NCBI Structure database and using PDB ID information work through the controls of the site. Once students are familiar with the controls they can investigate other assigned proteins and make conclusions based on what they find.

This type of online resource is commonly used by researchers to understand protein structure and changes to that structure based on mutations. Students would be able to discuss the effects of hydrophilicity/hydrophobicity, amino acid side chain structure and chemistry and overall protein structure types in normal versus altered proteins. They will be able to visualize some of the structural motifs common to proteins such as helices, sheets and barrels. Based on these investigations, students can develop a profile for a specific protein and compare this to common variants of the protein, for example comparing normal sickle cell hemoglobin structures.

NGSS Alignment

HS-LS1-1

Construct an explanation based on evidence for how the structure of DNA determines the structure or proteins, which carry out the essential functions of life through systems of specialized cells

Learning Objectives for specific lesson

At the end of this lesson, students will be able to -

- Access a public bioinformatic tool used to analyze DNA sequences and amino acid sequences
- Use the Cn3D to compare normal (wild-type) and variants of a specific protein due to known mutations
- Make claims about changes of a protein's secondary and higher order structure based on the chemistry and structure of its primary structure (sequence)
- Make predications about a protein's function based on changes of its structure