Madison Public Schools

Biotechnology - Unit 5 - Bioinformatics

Unit Focus

The field of Bioinformatics is a multidisciplinary field that leverages computer science, math, and information processing and analysis to interpret biological data. Students will explore the biological side of this field in their classroom as they utilize the laboratory procedures and techniques from prior units to extract DNA from fish purchased from various sources. In doing so, students will begin the process of genetically determining if the species of fish that is advertised is authentic or fraudulent. Students will then send out the extracted DNA for detailed genetic analysis and then analyze the results through an online bioinformatics tool (BLAST) to develop their conclusions. The bioinformatics tools students will learn to use are those provided on the National Center for Biotechnology Information (NCBI) website.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science Standards (DCI)
Science: 10

- Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species" characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. *LS3.9.A1*

NGSS/NSTA Science & Engineering Practices
NGSS Science & Engineering Practices: 9-12

- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system. *SE.9-12.4.5*

Student Growth and Development 21st Century Capacities Matrix
Critical Thinking

- Analyzing: Students will be able to examine information/data/evidence to make inferences and identify possible underlying assumptions, patterns, and relationships. *MM.1.2*

Transfer

T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.

Meaning

Understanding(s)	Essential Question(s)
U1 How do you input lab data into a DNA database to uncover the source of the sample DNA? **U2** Established knowledge provides the foundation for future scientific and engineering advances. **U3** Conclusions can only be as strong as the quality of the evidence and the relevancy to the original question or problem.	**Q1** What is a DNA database and what information can it provide? **Q2** What do the results tell me? What patterns do I see or what conclusions can I draw? **Q3** How do I explain my results? What questions do I wonder about now?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 The NCBI database is used to study genes and proteins and determine what organism a given DNA sample came from. **K2** NCBI/CODIS is on online database used for storing DNA.	**S1** Learn how to navigate a national DNA database and decipher the information it provides. **S2** Apply knowledge of database usage to investigate genetic data gathered from lab. Use this database tool to uncover the identity of the fish based on its DNA alone.