Madison Public Schools

Biotechnology - Unit 3 - DNA Analysis Using Restriction Enzymes

Unit Focus

In this unit students will learn what restriction enzymes are, how they are used in nature, and how they can be exploited by the field of biotechnology for the purposes of DNA analysis and manipulation. Students will also be introduced to the common DNA analysis technique called gel electrophoresis. Restriction Fragment Length Polymorphism (RFLP) and Short Tandem Repeats (STRs) will be covered from the perspective of their use in forensic science, genetic markers for genetic disorders, and paternity tests, for example. This unit is lab-based and students will need to apply their content understanding from prior units to the laboratory investigations they will perform throughout the unit.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science Standards (DCI)
Science: 10

- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. *LS1.9.A2*
- 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

- Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems. *SE.9-*

Transfer

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

Meaning

Understanding(s)	Essential Question(s)
U1 Good experimental design leads to precise and accurate data. **U2** Established knowledge provides the foundation for future scientific and engineering advances. **U3** Recombinant DNA technology has provided many medical and scientific advances that have improved lives.	**Q1** How do the techniques of biotechnology laboratory investigations maintain the integrity of the results and allow scientists to progress in the field? **Q2** How do I use tools and materials to carry out my test? How do I collect and record quality data? **Q3** What do the results tell me? What patterns do I see or what conclusions can I draw? **Q4** How do scientists take advantage of the structure and function of DNA to advance progress in biotechnological discoveries?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 What restriction enzymes are, how they are used in nature, and how they have been exploited by the biotech industry. **K2** What gel electrophoresis is and how/why it works. **K3** Practical applications of gel electrophoresis	**S1** Employing and evaluating biotechnology techniques (use of restriction enzymes, gel electrophoresis, Southern Blotting) from the perspective of the molecular characteristics of DNA and protein that make these techniques possible.

Stage 1: Desired Results - Key Understandings		
12.2.6 **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*	technology. **K4** Vocabulary: Restriction enzymes, Gel electrophoresis, RFLP analysis, VNTRs, Southern blotting, probe hybridization, autoradiography	**S2** Applying concepts of biotechnology techniques to real-world uses.