Pre-Lab, Skills, and Standards Alignments

FORENSIC DNA PROFILING

This lab examines a highly variable tandem repeat polymorphism on chromosome 1 called D1S80, similar to loci used by the FBI to create a genetic profile. Students will prepare a sample of their own DNA from cells obtained by saline mouthwash. After amplification by PCR, the improved size resolution of a DNA chip allows students to identify their genotype, something impossible with traditional agarose gel electrophoresis.

Lab Length: 4 hours

Suggested Pre-Lab Teaching

- DNA structure and function
- Central Dogma (genes to proteins)
- Coding Vs. Non-coding DNA

Lab Skills

- Measure small volumes of liquid using micropipettes.
- Isolate DNA from epithelial cells.
- Amplify DNA sequences using PCR.
- Visualize DNA using agarose gel electrophoresis.
- Follow a multi-step procedure to complete a controlled experiment.

Conceptual Knowledge/Skills

- Explain the steps of PCR to amplify DNA.
- Interpret lab results to determine individual D1S80 genotypes.
- Compare and contrast agarose gel electrophoresis and DNA chip technology for genotyping.
- Discuss why the FBI uses many loci to prepare an individual's DNA profile.

New York State Science Learning Standards/NGSS

Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
Engaging in Argument from Evidence Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. Analyzing and Interpreting Data Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.	LS3.A: Inheritance of Traits 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. (HS-LS3-1)	Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. Empirical evidence is needed to identify patterns. Systems and System Models Systems can be designed to do specific tasks. Nature of Science: Science is a Human Endeavor Technological advances have

	LS3.B: Variation of Traits In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. (HS-LS3-2)	influenced the progress of science and science has influenced advances in technology.

AP Biology Lab Alignment	**AP Biology Learning Objective**	**AP Biology Science Skill**
Extension of AP Biology Investigation #9 – Restriction of Enzyme Analysis of DNA	**IST – 1.P:** Explain the use of genetic engineering techniques in analyzing or manipulating DNA.	6D: Explain the relationship between experimental results and larger biological concepts, processes, or theories.

NYS Living Environment *Standard 1*	**NYS Living Environment** *Standard 4*
Performance Indicators 1.1 Elaborate on basic scientific and personal explanations of natural phenomena 2.1 Devise ways of making observations to test proposed explanations.	**Performance Indicators** 2.1 Explain how the structure and replication of genetic material result in offspring that resemble their parents 5.1 Explain the basic biochemical processes in living organisms and their importance in maintaining dynamic equilibrium.