Pre-Lab, Skills, and Standards Alignments

BIOINFORMATICS: USING *ALU* INSERTIONS TO STUDY POPULATION GENETICS

Students will learn about *Alu* insertions—segments of DNA that "jump" around in the genome—and use real population data to study variation in alleles, calculate allele frequencies, and examine Hardy-Weinberg equilibrium in populations. Computer simulations will be used to model genetic drift and natural selection.

Lab Length: 2.5 hours

Suggested Pre-Lab Teaching

- DNA structure, function and replication
- Mendelian genetics
- Hardy Weinberg equilibrium
- Mutation, natural selection, genetic drift, gene flow
- Polymerase Chain Reaction (PCR)

Lab Skills

- Calculate allele frequencies and apply Hardy-Weinberg equilibrium.
- Utilize online tools to simulate principles of population genetics.

Conceptual Knowledge/Skills (Post Lab)

- Explain how selection, gene flow and genetic drift affect allele frequencies in populations.

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 Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.	LS1.A: Structure and Function 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, which carry out most of the work of cells. (HS-LS1-1) (secondary to HS-LS3-1) 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	Science is a Human Endeavor Science and engineering are influenced by society and society is influenced by science and engineering. Technological advances have influenced the progress of science and science has influenced advances in technology. Scale, Proportion, and Quantity Some systems can only be studied indirectly as they are too small, too large, too fast, or too slow to observe directly. Stability and Change Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

	some have no as-yet known function. (HS-LS3-1) 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) •(NYSED) Environmental factors can cause mutations in genes. Only mutations in sex cells can be inherited. (HS-LS3-2)	

AP Biology Lab Alignment	**AP Biology Learning Objective**	**AP Biology Science Skill**
Investigation - #3 BLAST Lab	**EVO-1.K:** Describe the conditions under which allele and genotype frequencies will change in a population **EVO-1.L:** Explain the impacts on the population if any of the conditions of Hardy-Weinberg are not met	**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. 1.2 Hone ideas through reasoning, library research, and discussion with others, including experts. 2.1 Devise ways of making observations to test proposed explanations. 3.2 Apply statistical analysis techniques when appropriate to test if chance alone explains the results.	**Performance Indicators** 2.1 Explain how the structure and replication of genetic material result in offspring that resemble their parents 3.1 Explain the mechanisms and patterns of evolution.