

Biotechnology - Unit 4 - DNA Analysis Using Gene Amplification

Unit Focus

This unit will be taught primarily through an extensive, complex lab experience using the common industry technique called Polymerase Chain Reaction (PCR). Students will learn how to amplify, analyze, and manipulate DNA using PCR as they conduct a multi-day protocol. Students will be looking for a particular piece of DNA that is present in the genes of many people. Students will have the opportunity to use their own DNA, from their cheek or hair follicle, during this procedure, to determine if they have the gene in question. Students will also explore various applications of this technology in the field of biotechnology.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
<p>Next Generation Science Standards (DCI) <i>Science: 11</i></p> <ul style="list-style-type: none"> 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. <i>LS3.9.A1</i> <p>NGSS/NSTA Science & Engineering Practices <i>NGSS Science & Engineering Practices: 9-12</i></p> <ul style="list-style-type: none"> 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. <i>SE.9-12.4.1</i> <p>Student Growth and Development 21st Century Capacities Matrix <i>Critical Thinking</i></p> <ul style="list-style-type: none"> Synthesizing: Students will be able to thoughtfully combine information/data/evidence, concepts, texts, and disciplines to draw conclusions, create solutions, and/or verify generalizations for a given purpose. <i>MM.1.3</i> 	T1 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	U1 PCR is used to amplify (copy) genes so that multiple copies are available for scientific analysis. U2 PCR technology has the ability to amplify specific sections of DNA. U3 PCR has applications in many fields included biotechnology and forensics.	Q1 What role do PCR and gene amplification play in explaining the anchoring axolotl phenomenon? Q2 How would a scientist define a region of DNA to amplify and what process would be used to achieve amplification?
	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
K1 The steps involved in amplifying DNA using Polymerase Chain Reaction (PCR). K2 Primers are designed to define the segment of DNA that will be amplified by the PCR process. K3 How PCR primers are designed. K4 How electrophoresis is used to identify/verify and isolate a PCR product. K5 Examples of real world applications of the PCR technique K6 Vocabulary: Polymerase Chain Reaction (PCR), primer, 3', 5', anneal, denature, Alu repeat, Short Tandem Repeat (STR), DNA ladder	S1 Designing PCR primers to isolate a specific segment of DNA. S2 Identifying and verifying the presence of a PCR product using electrophoresis and a DNA ladder.	