

*Pre-Lab, Skills, and Standards Alignments*

**BACTERIAL TRANSFORMATION**

The bacterial transformation experiment illustrates the direct link between an organism's genetic complement (genotype) and its observable characteristics (phenotype). Two genes, for antibiotic resistance and luminescence, are introduced into the bacterium *E. coli*. Following overnight incubation, transformed bacteria are compared to non-transformed bacteria for their ability to grow in the presence of ampicillin and glow when exposed to ultraviolet light.

**Lab Length:** 2.5 hours

**Suggested Pre-Lab Teaching**

- DNA Structure
- Bacterial cell components, including plasmids
- Asexual reproduction
- Central Dogma (genes to proteins)

**Lab Skills**

- Measure small volumes of liquid using micropipettes.
- Use sterile technique while working with bacteria.
- Culture experiment results in Petri dishes.

**Conceptual Knowledge/Skills**

- Explain the steps of bacterial DNA transformation.
- Describe how bacterial cells can be used to manufacture human proteins.
- Predict experimental and control results.
- Examine experimental results and calculate transformation efficiency.

**New York State Science Learning Standards/NGSS**

Science and Engineering Practices	Disciplinary Core Ideas	Cross Cutting Concepts
<p><u>Engaging in Argument from Evidence:</u> Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.</p>	<p><u>LS1.A: Structure and Function</u> 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)</p> <p><u>LS3.B: Variation of Traits:</u> Advances in biotechnology have allowed organisms to be modified genetically</p>	<p><u>Patterns</u> 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.</p> <p><u>Cause and Effect</u> Systems can be designed to cause a desired effect.</p> <p><u>Structure and Function</u> Investigating or designing new systems or structures requires a detailed examination of the</p>

		<p>properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.</p> <p><u>Science is a Human Endeavor:</u> 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.</p>
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AP Biology Lab Alignment	AP Biology Learning Objective	AP Biology Science Skill
Investigation #9 – Bacterial Transformation	IST – 1.P: Explain the use of genetic engineering techniques in analyzing or manipulating DNA.	6.D: Explain the relationship between experimental results and larger biological concepts, processes, or theories.

NYS Living Environment Standard 1	NYS Living Environment Standard 4
<p><b>Performance Indicators</b></p> <p>1.1 Elaborate on basic scientific and personal explanations of natural phenomena 2.1 Devise ways of making observations to test proposed explanations.</p>	<p><b>Performance Indicators</b></p> <p>1.2 Describe and explain the structures and functions of the human body at different organizational levels. 1.3 Explain how a one-celled organism is able to function despite lacking the levels of organization present in more complex organisms. 2.1 Explain how the structure and replication of genetic material result in offspring that resemble their parents 2.2 Explain how the technology of genetic engineering allows humans to alter genetic makeup of organisms. 3.1 Explain the mechanisms and patterns of evolution. 4.1 Explain how organisms reproduce their own kind.</p>