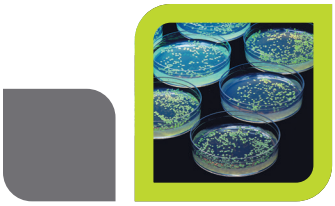
pGLO Bacterial Transformation Kit for General Biology



Next Generation Science Standards* Alignment

The following table lists the Next Generation Science Standards Performance Expectations as well as the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts that are addressed by the activities included in the pGLO Bacterial Transformation Kit for General Biology. The table also provides details on how the activities align with those elements.

Standards	Description	pGLO Bacterial Transformation Kit for General Biology Alignment Details	Lessons 1	2	3
Performance Expectations			✓	✓	✓
HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.	Students will design experiments, collect data, and use their results to construct an argument about how a gene from jellyfish transferred into bacteria can product green fluorescent protein.	✓	✓	
HS-LS3-1	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristics traits passed from parents to offspring.	After observing both fluorescent jellyfish and bacteria, students ask questions about the role of the GFP gene in causing their fluorescence. Students perform bacterial transformation experiments and create explanations that include how bacteria pass genetic traits to their offspring.	✓	✓	
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritization criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.	Students will design and evaluate their own and each other's proposals for biosensors that solve real-world problems. Students will describe the strengths, limitations, and trade-offs of their solutions.			✓

* Next Generation Science Standards is a registered trademark of WestEd. Neither WestEd nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of this product, and do not endorse it.

BIO-RAD

General Biology: Curriculum Alignment

Standards	Description	pGLO Bacterial Transformation Kit for General Biology Alignment Details	Lessons 1	2	3
Science and Engineering Practices			✓	✓	✓
Constructing Explanations and Designing Solutions	Construct and/or revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	Students will use results from their own experiments to construct an argument about how a gene from jellyfish transferred into bacteria can produce green fluorescent protein. Students will design biosensors to solve a real-world problem.		✓	✓
Planning and Carrying Out Investigations	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.	Students will design and carry out two experiments that will provide evidence to support their claims about gene expression and gene regulation.		✓	
Developing and Using Models	Develop and/or use a model based on evidence to illustrate the relationships between components of a system	Multiple times throughout the activities, students create or revise their models based on new evidence to illustrate both gene expression and the nature of bacterial transformation. Students will create models that describe their biosensors and how they solve a real-world problem.	✓	✓	✓
Engaging in Argument from Evidence	Evaluate the claims, evidence, and reasoning behind currently accepted explanations of solutions to determine the merits of arguments.	Students generate claims based on the results of their experiments.		✓	
Asking Questions and Defining Problems	Ask questions that arise from examining models or a theory to clarify relationship.	After observing both fluorescent jellyfish and bacteria, students ask questions about the role of the GFP gene in causing fluorescence. Students will define a real-world problem and then design a biosensor to solve it.	✓	✓	✓
Disciplinary Core Ideas			✓	✓	✓
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.	Students will design experiments, collect data, and use their results to construct an argument about how a gene from jellyfish transferred into bacteria can produce green fluorescent protein.	✓	✓	
LS3.A	Inheritance of Traits Many characteristics of organisms are inherited from their parents.	Students will analyze experimental evidence to explain how bacteria pass on genetic traits to their offspring.	✓	✓	
ETS1.A	Defining and Delimiting Engineering Problems	Students will describe a real-world problem and define constraints that may influence possible solutions.			✓
ETS1.B	Developing Possible Solutions	Students will propose solutions to a real-world problem and describe how those solutions address the problem and comply with any defined constraints.			✓

General Biology: Curriculum Alignment

Standards	Description	pGLO Bacterial Transformation Kit for General Biology Alignment Details	Lessons 1	2	3
Crosscutting Concepts			✓	✓	✓
Structure and Function	Investigating or designing new systems of structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.	Students will examine the components and processes of gene expression and gene regulation in the pGLO plasmid bacterial transformation system. Students will use their understanding of the bacterial transformation process and gene expression to design a biosensor.	✓	✓	✓
Cause and Effect	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.	Students will analyze evidence from their experiments to determine cause and effect in gene expression and gene regulation in the pGLO plasmid bacterial transformation system.	✓	✓	
Systems and System Models	Models (e.g., physical, mathematical, computer) can be used to simulate systems and interactions — including energy, matter, and information flows — within and between systems at different scales.	Multiple times throughout the activities, students will create, revise, and use their models to understand and explain gene expression, gene regulation, and the nature of bacterial transformation.	✓	✓	
Influence of Science, Engineering, and Technology on Society and the Natural World	New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.	Students will evaluate the impact of a proposed solution using a biosensor for a real-world problem.			✓