



## Unit 2: CTE Alignment Matrix

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## Executive Summary

Sponsored by Genentech, Futurelab+ brought together a coalition of partners to develop an innovative, modular, 2-year biotechnology curriculum, along with instructional materials, to expose students and educators to the breadth of education and career pathways across biotechnology. To increase adoption and access to such curricula in California and beyond, the modular curriculum was designed to align with the [California Career Technical Education \(CTE\) Model Curriculum Standards for Biotechnology](#), meet at least 1 year of the [University of California science \(D\) subject requirement](#), and incorporate some of the three-dimensional learning innovations of the [Next Generation Science Standards](#). The 2-year biotechnology curriculum has four core units per year; each core unit has nine lessons and a lab that each take approximately 1 week to complete (9–10 weeks for the full unit). In total, the biotechnology curriculum has 72 lessons and eight labs that span 2 full instructional years. Because the Futurelab+ biotechnology curriculum is modular, teachers can select specific units and materials to design biotechnology courses that are relevant and appropriate for their students and teaching environments.

The purpose of this report is to provide teachers an independent review of which California CTE biotechnology standards are addressed within the curriculum and where they are addressed. The matrices that follow indicate the assignments and/or activities in which students demonstrate their understanding of a particular standard.

**This review was completed on materials received October 18, 2021 and has not been updated to reflect any revisions made to materials since then.** Only the standards met within Unit 2 are included in the matrices.

## Anchor Standards

Standard	Description	Assessed (all student sections)
<b>4.0 Technology:</b> Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Health Science and Medical Technology sector workplace environment. (Direct alignment with WS 11–12.6)		
4.3	Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.	<b>Lesson 3, Day 1</b> <i>How Do Pathogens Reproduce?</i> —capture sheet <b>Lesson 3, Day 2</b> <i>Bacterial Infectious Diseases Poster</i> —rubric <b>Lesson 3, Day 3</b> <i>How Do Antivirals Work?</i> —capture sheet <b>Lesson 3, Day 4</b> <i>Disparities in the Treatment of Infectious Diseases</i> —rubric <b>Lesson 6, Day 2</b> <i>Letter to Clinical Trial</i> —rubric <b>Lesson 6, Day 3</b> <i>VAERS</i> —graphic organizer <b>Lesson 6, Day 5</b> <i>Vaccine Poster</i> —rubric
<b>5.0 Problem Solving and Critical Thinking:</b> Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Health Science and Medical Technology sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques. (Direct alignment with WS 11-12.7)		
5.1	Identify and ask significant questions that clarify points of view to solve problems.	<b>Lesson 6, Day 2</b> <i>Letter to Clinical Trial</i> —rubric <b>Lesson 6, Day 3</b> <i>VAERS</i> —graphic organizer <b>Lesson 6, Day 5</b> <i>Vaccine Poster</i> —rubric
5.4	Interpret information and draw conclusions, based on the best analysis, to make informed decisions.	<b>Lesson 3, Day 1</b> <i>Discussion</i> , whole group—strategy, assessment at teacher discretion <i>How Do Pathogens Reproduce?</i> —capture sheet <b>Lesson 3, Day 2</b> <i>Bacterial Infectious Diseases Poster</i> —rubric <b>Lesson 3, Day 3</b> <i>Bacterial Infectious Diseases Poster Reflection</i> —capture sheet <i>Social Awareness Campaign Project</i> —design journal <i>How do Antivirals Work?</i> —capture sheet

Standard	Description	Assessed (all student sections)
		<p><i>Antiviral and Antibiotic Review</i>—capture sheet</p> <p><b>Lesson 3, Day 4</b></p> <p><i>Disparities in the Treatment of Infectious Diseases</i>—rubric</p> <p><b>Lesson 6, Day 1</b></p> <p><i>Clinical Trials</i>—capture sheet</p> <p><b>Lesson 6, Day 2</b></p> <p><i>Diverse Enrollment</i>—capture sheet  <i>Letter to Clinical Trial</i>—rubric</p> <p><b>Lesson 6, Day 3</b></p> <p><i>Vaccine Compensation Response</i>—exit ticket</p> <p><b>Lesson 6, Day 4</b></p> <p><i>Vaccine Dilemma Journal Response</i>—capture sheet  <i>Vaccine Dilemma Journal Response</i>—rubric  <i>Social Awareness Campaign Project</i>—design journal</p> <p><b>Lesson 6, Day 5</b></p> <p><i>Vaccine Poster</i>—rubric</p>

Standard	Description	Assessed (all student sections)
5.6	Read, interpret, and extract information from documents.	<p><b>Lesson 3, Day 1</b> <i>How Do Pathogens Reproduce?</i>—capture sheet</p> <p><b>Lesson 3, Day 2</b> <i>Bacterial Infectious Diseases Poster</i>—rubric</p> <p><b>Lesson 3, Day 3</b> <i>How do Antivirals Work?</i>—capture sheet</p> <p><b>Lesson 3, Day 4</b> <i>Disparities in the Treatment of Infectious Diseases</i>—rubric</p> <p><b>Lesson 6, Day 1</b> <i>Placemat Strategy</i>, small group—strategy, assessment at teacher discretion <i>Gallery Walk</i>, small group—strategy, assessment at teacher discretion <i>Clinical Trials</i>—capture sheet</p> <p><b>Lesson 6, Day 2</b> <i>Gallery Walk</i>, small group—strategy, assessment at teacher discretion <i>Diverse Enrollment</i>—capture sheet <i>Letter to Clinical Trial</i>—rubric</p> <p><b>Lesson 6, Day 3</b> <i>VAERS</i>—graphic organizer</p> <p><b>Lesson 6, Day 4</b> <i>Vaccine Dilemma Journal Response</i>—capture sheet <i>Vaccine Dilemma Journal Response</i>—rubric</p>

## Pathway Standards

Standard	Description	Assessed
<b>A1.0:</b> Define and assess biotechnology and recognize the diverse applications and impact on society.		
A1.1	Use data to explain how biotechnology fields such as pharmaceuticals, agriculture, diagnostics, industrial products, instrumentation, and research and development are impacting human life.	<p><b>Lesson 2, Day 2</b> <i>Infectious Disease PowerPoint Presentation</i>—rubric</p> <p><b>Lesson 2, Day 3</b> <i>Multiplying Microbes</i>—data sheet</p> <p><b>Lesson 2, Day 4</b> <i>Distribution Data Record and Data Analysis</i>, Parts 1 and 2—capture sheet</p> <p><b>Lesson 2, Day 5</b></p>

Standard	Description	Assessed
		<i>Introduction to Inequity in Healthcare Jigsaw</i> —capture sheet <i>Social Awareness Campaign Project</i> —design journal <b>Lesson 8, Day 3</b> <i>Social Awareness Campaign Guidelines and Planning, Project Components: PSA Video, Advertisement or Infographic, Social Media Outreach</i> —capture sheet
A1.4	Research and identify public misunderstandings related to biotechnology and discern the source of these misunderstandings.	<b>Lesson 8, Day 1</b> <i>Elements of Effective Social Awareness Campaigns</i> —capture sheet <b>Lesson 8, Day 3</b> <i>Social Awareness Campaign Guidelines and Planning, Project Components: PSA Video, Advertisement or Infographic, Social Media Outreach</i> —capture sheet
<b>A2.0: Understand the ethical, moral, legal, and cultural issues related to the use of biotechnology research and product development.</b>		
A2.5	Describe the dilemma of health care costs related to advancements in biotechnology and public access to treatments.	<b>Lesson 7, Day 3</b> <i>Paper Chat</i> , small group—strategy, assessment at teacher discretion <b>Lesson 7, Day 3</b> <i>Encourage Vaccination</i> —rubric <b>Lesson 7, Day 4</b> <i>Politics in Vaccines Anticipation Guide</i> —capture sheet <b>Lesson 7, Day 5</b> <i>Social Awareness Campaign Project</i> —design journal
<b>A3.0: Demonstrate competencies in the fundamentals of molecular cell biology, including deoxyribonucleic acid (DNA) and proteins and standard techniques for their purification and manipulation.</b>		
A3.1	Define and describe the structure and function of DNA ribonucleic acid (RNA) and proteins, explain the consequences of DNA mutations on proteins.	<b>Lesson 4, Day 1</b> <i>Functions of the Adaptive Immune System</i> —capture sheet <b>Lesson 4, Day 4</b> <i>DNA/RNA</i> , small group—strategy, assessment at teacher discretion <i>Social Awareness Campaign Project</i> —design Journal <b>Lesson 4 Extension (optional)</b> <i>DNA and RNA Modeling</i> —capture sheet
A3.4	Employ standard protein techniques, including antibody production, enzyme	<b>Laboratory Investigation, Day 1</b> <i>ELISA</i> —questions

Standard	Description	Assessed
	assays, spectrophotometry, gel electrophoresis, and chromatography and document and evaluate results.	<p><b>Laboratory Investigation, Day 2</b>  <i>Student Guide, Part 1: Pre-Lab</i>  <i>Turn and Talk—exit ticket</i></p> <p><b>Laboratory Investigation, Days 3 &amp; 4</b>  <i>Student Guide, Part 2: Lab</i></p> <p><b>Laboratory Investigation, Day 4</b>  <i>Student Guide, Part 3: Data Analysis</i></p> <p><b>Laboratory Investigation, Day 5</b>  <i>Student Guide, Part 3: Data Analysis</i>  <i>Student Guide, Part 4: Arguing from Evidence</i></p> <p><b>Laboratory Investigation, Day 5</b>  <i>Student Guide, Part 4: Arguing from Evidence</i>  <i>CER—rubric</i></p>
<b>A4.0:</b> <i>Recognize basic concepts in cell biology and become familiar with the laboratory tools used for their analysis.</i>		
A4.7	Conduct indicator tests for the common macromolecules of the cell.	<p><b>Laboratory Investigation, Days 3 &amp; 4</b>  <i>Student Guide, Part 2: Lab</i></p>
<b>A5.0:</b> <i>Integrate computer skills into program components.</i>		
A5.1	Use the Internet and World Wide Web to collect and share scientific information.	<p><b>Lesson 3, Day 1</b>  <i>How Do Pathogens Reproduce?—capture sheet</i></p> <p><b>Lesson 3, Day 2</b>  <i>Bacterial Infectious Diseases Poster—rubric</i></p>
<b>A6.0:</b> <i>Implement use of the metric system, orders of magnitude, and the pH scale in preparation of reagents, analysis of data, and graphing.</i>		
A6.1	Apply knowledge of symbols, algebra, and statistics to a graphical data presentation.	<p><b>Lesson 1, Day 1</b>  <i>Epidemiologic Classification, Part 2—assignment</i></p> <p><b>Lesson 1, Day 2</b>  <i>Disease Detective—capture sheet</i></p> <p><b>Lesson 1, Day 3</b>  <i>Measures of Disease Frequency, Part 3—capture sheet</i>  <i>Social Awareness Campaign Project—design journal</i></p> <p><b>Lesson 1, Day 5</b>  <i>Future Outbreak Prediction Student Video—rubric</i>  <i>Social Awareness Campaign Project—design journal</i></p> <p><b>Laboratory Investigation, Building Lab Skills</b>  <i>Serial Dilution and the Standard Curve</i></p>

Standard	Description	Assessed
		<p><b>Laboratory Investigation, Day 2</b> <i>Student Guide, Part 1: Pre-Lab</i></p> <p><b>Laboratory Investigation, Days 3 &amp; 4</b> <i>Student Guide, Part 2: Lab</i></p> <p><b>Laboratory Investigation, Day 4</b> <i>Student Guide, Part 3: Data Analysis</i></p> <p><b>Laboratory Investigation, Day 5</b> <i>Student Guide, Part 3: Data Analysis</i> <i>Student Guide, Part 4: Arguing from Evidence</i></p>
A6.3	Calculate and prepare solutions of various molarity; calculate and prepare buffers of various pH; and prepare serial dilutions.	<p><b>Laboratory Investigation, Building Lab Skills</b> <i>Serial Dilution and the Standard Curve</i></p>
A6.4	Create data tables and graphs using Excel for the purpose of collecting and analyzing data.	<p><b>Laboratory Investigation, Days 3 &amp; 4</b> <i>Student Guide, Part 2: Lab</i></p> <p><b>Laboratory Investigation, Day 5</b> <i>Student Guide, Part 3: Data Analysis</i> <i>Student Guide, Part 4: Arguing from Evidence</i></p> <p><b>Laboratory Investigation, Building Lab Skills (Optional Extension)</b> <i>Micropipetting Practice ROY GEE BIV</i></p>
<p><b>A7.0:</b> <i>Understand the function of regulatory agencies for the biotechnology industry and the lasting impact of routine laboratory and communication practices on product development and manufacturing.</i></p>		
A7.1	Identify agencies at the local, state, and federal levels.	<p><b>Lesson 6, Day 3</b> <i>VAERS—graphic organizer</i></p> <p><b>Lesson 7, Day 1</b> <i>FDA vs. CDC—capture sheet</i> <i>FDA vs. CDC Skit—rubric</i></p> <p><b>Lesson 7, Day 2</b> <i>Medical Research Initiative—capture sheet</i></p> <p><b>Lesson 7, Day 5</b> <i>Vaccination Flow Chart—rubric</i></p> <p><b>Lesson 7, Day 5</b> <i>Social Awareness Campaign Project—design journal</i></p>
A7.2	Be aware of the role of agencies in promoting patient safety, quality control, and entrepreneurship.	<p><b>Lesson 6, Day 2</b> <i>Gallery Walk, small group—strategy, assessment at teacher discretion</i></p>

Standard	Description	Assessed
		<p><b>Lesson 6, Day 2</b> <i>Diverse Enrollment</i>—capture sheet</p> <p><b>Lesson 6, Day 3</b> <i>VAERS</i>—graphic organizer</p> <p><b>Lesson 6, Day 3</b> <i>Vaccine Compensation Response</i>—exit ticket</p> <p><b>Lesson 6, Day 4</b> <i>Vaccine Dilemma Journal Response</i>—capture sheet <i>Vaccine Dilemma Journal Response</i>—rubric</p> <p><b>Lesson 6, Day 5</b> <i>Vaccine Poster</i>—rubric</p> <p><b>Lesson 7, Day 1</b> <i>FDA vs. CDC</i>—capture sheet <i>FDA vs. CDC Skit</i>—rubric <i>Skit Response</i>—exit ticket</p> <p><b>Lesson 7, Day 2</b> <i>Medical Research Initiative</i>—capture sheet <i>Pipeline Vaccines Chart</i>—rubric</p> <p><b>Lesson 7, Day 5</b> <i>Vaccination Flow Chart</i>—rubric</p> <p><b>Lesson 7, Day 5</b> <i>Social Awareness Campaign Project</i>—design journal</p>
<b>A8.0: Follow sustainable and safe practices with high regard for quality control.</b>		
A8.1	Follow written protocols and oral directions to perform a variety of laboratory and technical tasks.	<p><b>Laboratory Investigation, Building Lab Skills</b> <i>Building Lab Skills: Micropipetting</i>—practice sheet <i>Precision Pipetting Cards</i></p> <p><b>Laboratory Investigation, Building Lab Skills</b> <i>Serial Dilutions and the Standard Curve</i></p> <p><b>Laboratory Investigation, Day 2</b> <i>Student Guide, Part 1: Pre-Lab</i></p> <p><b>Laboratory Investigation, Days 3 &amp; 4</b> <i>Student Guide, Part 2: Lab</i></p> <p><b>Laboratory Investigation, Day 4</b> <i>Student Guide, Part 3: Data Analysis</i></p> <p><b>Laboratory Investigation, Day 5</b> <i>Student Guide, Part 3: Data Analysis</i> <i>Student Guide, Part 4: Arguing from Evidence</i></p>

Standard	Description	Assessed
		<b>Laboratory Investigation, Building Lab Skills (Optional Extension)</b> <i>Micropipetting Practice ROY GEE BIV</i>
A8.6	Properly and safely use and monitor a variety of scientific equipment, including pH meters, microscopes, spectrophotometers, pipets, micropipettes, and balances.	<b>Laboratory Investigation, Building Lab Skills</b> <i>Building Lab Skills: Micropipetting—practice sheet</i> <i>Precision Pipetting Cards</i> <b>Laboratory Investigation, Building Lab Skills</b> <i>Serial Dilution and the Standard Curve</i> <b>Laboratory Investigation, Days 3 &amp; 4</b> <i>Student Guide, Part 2: Lab</i> <b>Laboratory Investigation, Building Lab Skills (Optional Extension)</b> <i>Micropipetting Practice ROY GEE BIV</i>
A8.7	Determine which equipment is appropriate to use for a given task and the units of measurement used.	<b>Laboratory Investigation, Building Lab Skills</b> <i>Building Lab Skills: Micropipetting—practice sheet</i> <i>Precision Pipetting Cards</i> <b>Laboratory Investigation, Building Lab Skills (Optional Extension)</b> <i>Micropipetting Practice ROY GEE BIV</i>
<b>A9.0: Understand that manufacturing represents inter-connectedness between science and production.</b>		
A9.1	Describe the major steps of a product's move through a company's product pipeline.	<b>Lesson 5, Day 1</b> <i>Train or Pass it On</i> , whole group—strategy, assessment based on teacher discretion <i>Snowball Fight</i> , whole group—strategy, assessment based on teacher discretion <i>Failure Modes and Effects Analysis (FMEA)</i> —capture sheet <b>Lesson 5, Day 2</b> <i>Stages of Vaccine Production</i> —capture sheet <i>What Can go Wrong?</i> —capture sheet <i>Revised Vaccine Manufacturing Process</i> —capture sheet
A9.2	Identify several products obtained through recombinant DNA technology.	<b>Lesson 5, Day 2</b> <i>How are Pathogens Grown?</i> —capture sheet <b>Lesson 5, Day 3</b> <i>Social Awareness Campaign Project</i> —design journal

Standard	Description	Assessed
A9.3	Outline the steps in production and delivery of a product made through recombinant DNA technology.	<p><b>Lesson 4, Days 2 &amp; 3</b>  <i>Why are there Different Types of Vaccines? Research and Discovery</i>—capture sheet</p> <p><b>Lesson 5, Day 1</b>  <i>Failure Modes and Effects Analysis (FMEA)</i>—capture sheet</p> <p><b>Lesson 5, Day 2</b>  <i>Stages of Vaccine Production</i>—capture sheet  <i>What Can go Wrong?</i>—capture sheet  <i>Revised Vaccine Manufacturing Process</i>—capture sheet</p>



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