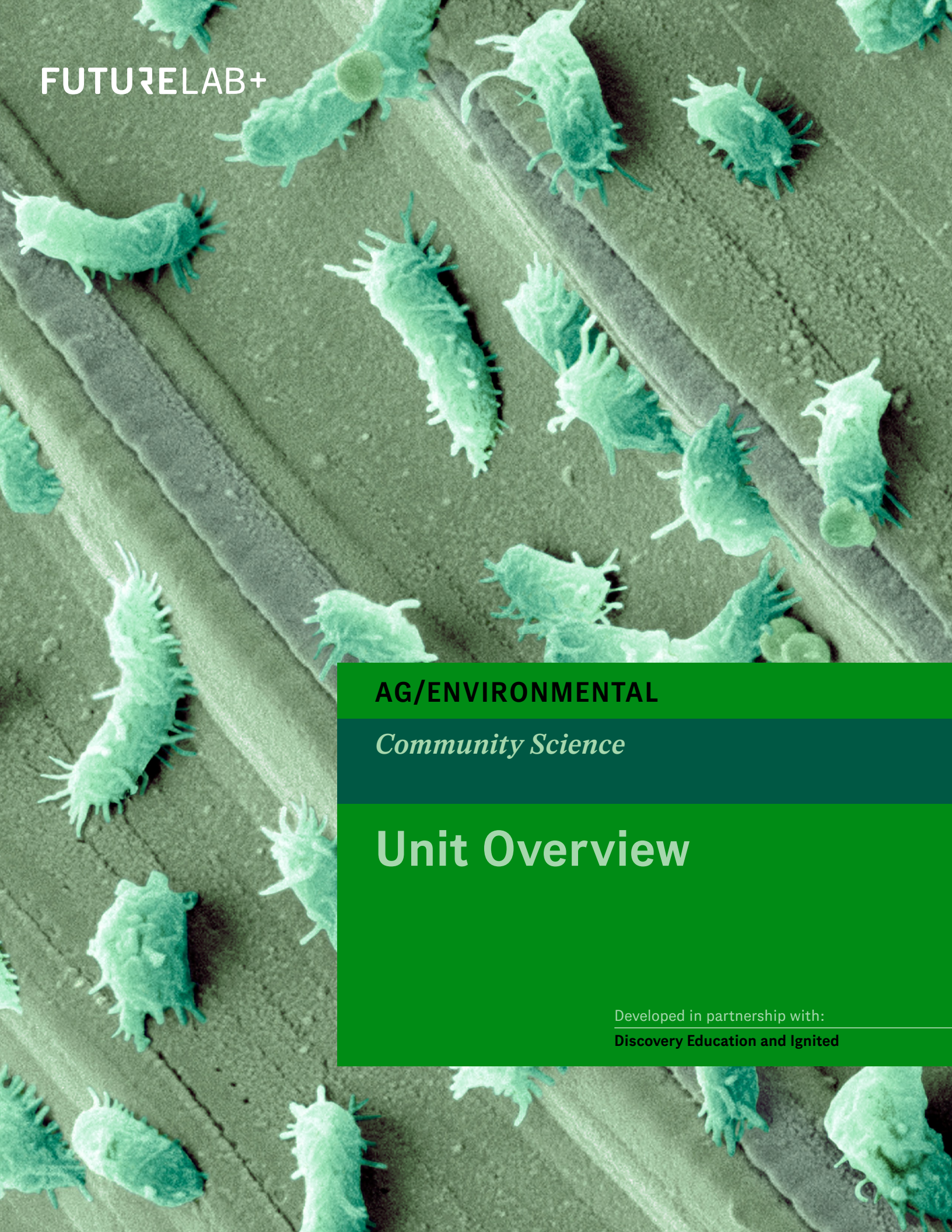
FUTURELAB+



AG/ENVIRONMENTAL

Community Science

Unit Overview

Developed in partnership with:

Discovery Education and Ignited

AG/ENVIRONMENTAL / COMMUNITY SCIENCE

Unit Overview

FINAL PROJECT PRODUCT

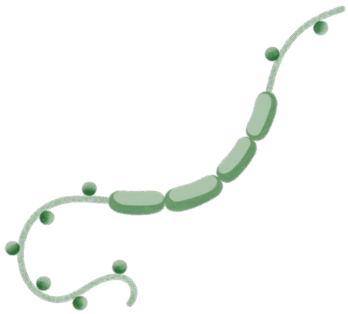
Community DNA Collection Kit Design

OVERVIEW

In this unit, students will identify important community issues and investigate DNA identification techniques that could be used to address those issues. Students will collect data to identify an issue that can be addressed using DNA identification, will select an appropriate technique to answer the question, and will create a crowdfunding proposal for how to market or deploy their ideas to a target audience in their community. Throughout the unit, students will also consider stakeholders and issues of inclusion, and learn how DNA technologies can be leveraged to make positive community change. The final artifact for the unit will include an elaborated pitch deck describing the proposal, an elevator speech to pitch students' ideas to funders, and a portfolio of supporting evidence for the proposal.

STUDENT-FACING UNIT TASK

You will learn about community science and the use of DNA technology in solving challenges. This will enable you to determine a local challenge that could be addressed with DNA identification technology. Analyzing existing products and services on the market, identifying stakeholders, and analyzing needs and concerns will give you even more insight and understanding about the aspects of DNA technology implementation. From there, you will review DNA structure and function, and learn about technologies such as Sanger sequencing, digital PCR, and NextGen sequencing. For your final product you will create a decision tree to guide you in selecting the appropriate DNA identification technique to then design a DNA kit. You will pitch this kit to stakeholders and develop a community funding proposal, including a model of the kit, visual pitch deck, and an elevator speech.



Lesson 1: Community Applications of Identification

DRIVING QUESTION

How can individuals and communities use the power of DNA identification tools to solve local problems?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Explain the role of the community in community science. **Identify** an area of interest in which DNA identification technology can be used to solve problems. **CTE:** 7.2, A1.6, A5.1, A5.2	Students will explore careers as **business development managers, environmental scientists,** and **food scientists**. In this lesson, students identify applications of DNA technology and begin the process of brainstorming how that technology could be employed in their own communities. This lesson connects to the **discovery** phase of the product life cycle.	Communities Journal, Part 1 Community Science Example: Young Sleuths Target Sushi Community Science Resource Packet Community Science Topic Overview Capture Sheet Community Science Topic Summary Board Template (optional) Learning Artifact Graphic Organizer: Coyote Example Learning Artifact Graphic Organizer Final Topic Interest Survey	In this lesson, students will learn what community science entails, and will answer journal prompts about what constitutes a community. Students will then spend time collecting samples or data for a current community science project. With that concept as a lens, they will then use a Jigsaw to learn about how DNA technologies are being used in environmental, health and safety, and personal interest issues. Students will learn about novel ways DNA is being used to solve problems and create a topic summary board to share. After a class discussion, they will be presented with example learning artifacts for the unit.	This is the introduction to the unit. Students will be introduced to ideas for how DNA identification can be used to solve community problems.

PD 1: Analyzing Community Needs and Proposal Identification

DRIVING QUESTION

What issues, problems, or challenges in our community could be addressed with DNA identification technology?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview
Identify important contacts and leaders in their communities. **Develop** and employ a variety of techniques, including surveys and interviews, to collect data about community issues. **Analyze** data from surveys and interviews to determine key issues in a community. **Define** issues that can be addressed with DNA identification technology. **Create** a proposal for how DNA identification technology could be used to solve a specific community issue. **CTE:** 2.4, 2.5, A1.1, A1.6, A5.2, A6.1, A6.4	Students will explore careers as **GIS developers, public opinion researchers,** and **project managers**. In this lesson, students identify potential areas where DNA identification technology could be used to address issues in their own communities. This lesson connects to the **discovery** stage of the product life cycle, as students are collecting information that will be used to guide the development of their proposals.	Ideas for Community Action Teacher's Guide Butcher paper and writing utensils for posters Sticky notes Communities Journal, Part 2 Identifying Community Leaders Capture Sheet Data Collection Plan Capture Sheet Data Collection Resources Project Management Tool Project Proposal Capture Sheet Project Proposal Peer Feedback Capture Sheet	In this lesson, students will employ a variety of methods to collect data about issues related to their selected topic area within their communities. Student groups will identify community organizations, leaders, and others who could offer insight into community issues and will develop and employ appropriate data collection techniques, including surveys, interviews, and assets and deficits mapping. Groups will determine how to appropriately analyze the data they collected and identify areas where DNA identification technology could be employed to address a concern or solve a problem. Each group will then select one of those areas as the topic for their funding proposal. Groups will present their ideas to the class, and revise their plans to develop the main focus of the proposal they will work on throughout the unit.

PD 2: Competitive Landscape Analysis

DRIVING QUESTION

What characteristics of a new product or service makes it unique from existing ones?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Define "competitive landscape analysis" and explain why it is used. Identify appropriate keywords to guide internet research. **Analyze** competitors for strengths and weaknesses. **Explain** how their proposal fills a gap or fits a need within their topic area. **CTE:** 2.5, 3.6, A1.1, A1.6, A5.2	Students will explore careers as **market analysts**. In this lesson, students will complete a competitive landscape analysis where they compare their potential product to competitors in the market. This connects to the **discovery** phase of the product life cycle, because students are researching competitors in the market that are solving similar challenges, and to the **development** phase as they figure out how to design a product with a more targeted audience than existing competitors.	Social Media Capture Sheet Who's the Competition? Capture Sheet Analyzing the Competition Capture Sheet Competitive Landscape Analysis Summary Report Capture Sheet Competitive Landscape Analysis Feedback Form Capture Sheet Devices with internet access	In this lesson, students will learn about the industry tool of competitive landscape analysis, and will take on the role of a market analyst preparing a competitive landscape analysis for their topic area. Students will begin by identifying keywords related to their topic proposals. They will locate potential competitors from industry, academia, and community science initiatives, and will prepare a summary report outlining ways their proposal is unique from existing competitors. Groups will share their findings in short presentations and will receive feedback from their peers. The results of this analysis will inform their decisions about how to pitch their ideas in their final artifact for the unit.	Students are researching information that will inform the development of their final proposal. At the end of the lesson, students will have identified unique features of their proposal that could be used to promote their ideas in the final product.

PD 3: Stakeholders and Inclusion

DRIVING QUESTION

How should the needs and concerns of stakeholders be taken into consideration during product development?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Define "stakeholder" and explain why identifying stakeholders is important in project planning. **Analyze** the needs of their stakeholders. Identify the target market for their project. **CTE:** A1.1, A1.6, A5.2	Students will explore careers as **market analysts** and **community liaisons**. In this lesson, students determine stakeholders who might be in favor of, opposed to, or somehow impacted by the **development** of their product. This connects to the **development** phase of the product life cycle because students are understanding the community and the potential impacts of their product.	Agree Signs Stakeholder Analysis Preparation Capture Sheet Stakeholder Analysis Inclusion Grid Capture Sheet	In this lesson, students will identify and analyze stakeholders for their project. To accomplish this, they will first complete a brainstorming session where they list possible stakeholders and then, as a group, explain their decisions. Students are then introduced to empathy and its role in stakeholder analysis. Next, they will complete an activity where they take a position about statements that will facilitate a discussion about stakeholders and their understanding of science and DNA. Each group will have time to think about how these statements pertain to their specific project. Finally they will complete a summative assessment for their final artifact.	In this lesson, students identify stakeholders related to their overall proposal topic. They will identify their target audience and will reflect on how to make their final proposals more inclusive. The stakeholders and inclusion grid will be used to develop their final artifact addressing a community problem.

Tech 1: DNA Recap

DRIVING QUESTION

How does the structure of DNA allow for DNA identification?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Describe the structure of DNA. **Explain** how the structure of DNA relates to its function. **Explain** how the structure and function of DNA allow for DNA identification. **CTE:** A3.1, A4.5	Students will explore careers as **research scientists**. In this lesson, students review the physical structure of DNA and relate the structure to its function. This molecular lens connects to the **discovery** phase, as students act as researchers and consider how DNA can be used for identification.	Sample of DNA Pieces Sample of DNA Analysis Capture Sheet DNA Identification Techniques Reading DNA Identification Techniques Overview Capture Sheet	In this lesson, students will review the structure of DNA and its function. Some teachers may decide to skip this depending on student understanding. Others might find it an important review for the structure of DNA. Each group of students is provided with the "pieces" that make up DNA. Students will then collect quantitative data about the chemical makeup of DNA. With that data, they will create a claim about the structure of DNA and support it with the data from the table. Students will then complete follow-up questions about other important aspects of DNA. Lastly, they will discuss how the structure of DNA allows for DNA identification techniques.	This lesson is the first stepping stone to future lessons focusing on DNA identification technologies. To understand how the technologies work, students will need to know the basics of DNA as well as the central dogma.

Tech 2: Sanger Sequencing

DRIVING QUESTION

How does Sanger sequencing work as a DNA identification technique?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Explain the purpose of Sanger sequencing. **List** types of information that can be gathered using Sanger sequencing. **Evaluate** the pros and cons of Sanger sequencing as a DNA identification technique. **CTE:** A1.6, A3.1, A5.2	Students will explore careers as **laboratory technicians** and **biotechnologists**. In this lesson, students learn about Sanger sequencing and compare it to other DNA sequencing methods. This dive into the science and technology principles behind GE products connects to the **discovery** aspect of the product life cycle, as students learn about biotechnology lab procedures.	Four Color Chromatogram Capture Sheet Modeling Sanger Sequencing Capture Sheet Baggies of beads Background Reading: Sanger Sequencing Technology Overview Capture Sheet, Part 1: DNA Identification	In this lesson, students are presented chromatograms that are the result of automated Sanger sequencing, and must infer their purpose. They will then model what happens in Sanger sequencing. After the modeling activity, they will read about Sanger sequencing with a partner and each will be responsible for identifying the pros and cons of the technique. The final portion of the lesson will be to add what they learned about the process of Sanger sequencing to their DNA Identification Technologies table that is part of the Decision Tree Assessment.	This lesson is the second in a series on major technologies used in DNA identification. Students will be selecting among these technologies as they prepare their final artifact proposals.

Tech 3: Digital PCR

DRIVING QUESTION

How does digital PCR work as a DNA identification technique?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Explain the purpose of digital PCR. **List** types of information that can be gathered using digital PCR. **Describe** the pros and cons of digital PCR as a DNA identification technique. **CTE:** 4.5, A1.6, A5.2, A8.7	Students will explore careers as **fish and wildlife managers** and **water quality specialists**. In this lesson, students compare traditional PCR and digital PCR, and understand how these technologies could help solve varied environmental challenges. This connects to the **development** stage of the product life cycle as students think about different DNA sequencing techniques they could later apply to their product design.	Digital PCR Scenario Cards Digital PCR Scenario Analysis Capture Sheet Technology Overview Capture Sheet, Part 1: DNA Identification	In this lesson, students will begin by learning about eDNA and aDNA, and the challenges in collecting and analyzing those forms of DNA. Students will then examine dPCR as a potential technology tool for analyzing eDNA and aDNA. Students will examine several research-based scenarios where dPCR was used to collect data to address a community issue, and will develop a general understanding of the types of community issues that could be investigated with dPCR. In the final portion of the lesson, students will add what they learned about the process of digital PCR to the Decision Tree Assessment.	This is the third lesson in a series on major technologies used in DNA identification. Students will be selecting among these technologies as they prepare their final artifact proposals.

Tech 4: NextGen Sequencing

DRIVING QUESTION

How does NextGen sequencing work as a DNA identification technique?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Explain the purpose of NextGen sequencing. **Identify** types of information that can be gathered using NextGen sequencing. **Describe** the pros and cons of NextGen sequencing as a DNA identification technique. **CTE:** 4.3, A1.6, A3.3, A8.7	Students will explore careers as **epidemiologists** and **environmental health specialists**. In this lesson, students take on the roles of epidemiologists and environmental health specialists as they use DNA sequencing to identify the microbes behind a food poisoning outbreak. This connects to the **discovery** phase of the product life cycle as students determine how existing biotechnology tools are used in public health fields.	The Next Generation of Food Safety Case Study Capture Sheet Citizen Interviews County Health Department—DNA Sequencing Sampling Request Form Capture Sheet Data Analysis 1 Capture Sheet Sampled DNA Sequences by Location Data Analysis 2 Capture Sheet NextGen Sequencing Reading NextGen Sequencing Check for Understanding Capture Sheet Technology Overview Capture Sheet, Part 1: DNA Identification	In this lesson, students will assume the role of a member of an outbreak investigation team for a local health department. This allows students to integrate their content learning with scientific thinking. Initially they will need to identify potential areas of contamination by reading interviews of multiple community members. From the interviews, they need to decide the locations from which to sample DNA. Students will get the results of sequencing (similar to that of NextGen sequencing) and use the Basic Local Alignment Search Tool (BLAST) from National Center for Biotechnology Information (NCBI) to determine the species associated with the outbreak. Next, they will research the species to determine which ones could cause the issues explained through the community member interviews. They will continue to analyze data to determine which location was the cause of the contamination, and use a Claim-Evidence-Reasoning conclusion format to justify the species and the location. Students will complete a formative assessment where they read about NextGen sequencing technology and compare it to the case study. Students will also add what they learned about the process of NextGen Sequencing to their Decision Tree Assessment.	This lesson is the fourth in a series on major technologies used in DNA identification. Students will be selecting among these technologies as they prepare their final artifact proposals.

Lesson 9: Decision Tree Creation

DRIVING QUESTION

Which DNA identification technique should be used to answer a given question?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Describe the pros and cons of Sanger sequencing analysis, digital PCR analysis, and NextGen sequencing. **Identify** factors that must be considered in selecting a DNA identification tool. **Create** a decision tree to guide the selection of appropriate DNA identification techniques. **CTE:** A1.6, A5.2, A8.7	Students will explore careers as **regulatory affairs managers**. In this lesson, students are developing a decision tree that guides which DNA identification technology is appropriate in certain contexts. This connects to the **discovery** stage of the product life cycle, as students deepen their knowledge of existing technology, and to the **development** stage as students define which GE technology should be used to solve specific problems.	Technology Overview Capture Sheet, Part 1: DNA Identification Technology Overview Capture Sheet, Part 2: Decision Tree Creation Materials for creating a decision tree (depending on option chosen, may include paper/markers, whiteboards, online collaborative whiteboard apps, etc.) Decision Tree Feedback Capture Sheet	In this lesson, students will reflect on the previous lessons about different DNA identification techniques and identify major differences among them. They will also reflect on what factors need to be considered in selecting a DNA identification technique. Students will discuss their ideas in small groups, exchange ideas with representatives from other groups, and create and revise a final visual decision tree to guide the selection of techniques. The decision tree will be used in their final unit project to identify the appropriate tool to use to answer their question.	This lesson follows completion of the four DNA technology lessons. Students will use their summary tables from the earlier DNA technology lessons as a starting point for developing the decision tree.

Lesson 10: Collection Kit Design

DRIVING QUESTION

How can a user's perspective inform communication techniques?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Identify the parts of the design process. **Empathize** with individuals who will be using their product. **Define** the problem they are trying to solve. **Ideate** possible design solutions. **Design** a visual model of their DNA Collection Kit. **CTE:** 2.5, 2.8, A6.1	Students will explore careers as **product designers** and **data analysts**. In this lesson, students go through the stages of the design process to identify the specific problem they are solving with GE technology, and begin modeling how they will collect DNA to address this challenge. This connects to both the **development** phase of the product life cycle as students build a deep understanding of the community needs around their problem, and the **manufacturing** phase as students start to design their final products.	Large white board or multiple sheets of poster paper Markers (dry erase) (two colors per group) Whiteboard Design Challenge Task List Capture Sheet DNA Test Kit Model Requirements Capture Sheet	In this lesson, students will engage in a modified "whiteboard" design challenge to determine how to collect DNA that will be used to help solve their designated community-focused issue. They will use productive group work to explore design options, create a design, and then communicate it. All planning and designing will be completed on a "whiteboard" so that the brainstorming, thinking, and revising is documented. They will include the finalized diagram and plan for the kit and collection in the final pitch to stakeholders. Given constraints, they will not create a physical model.	This will be a piece of the final proposal and is a design exercise for how the DNA will be collected. This is what the group would deploy to have the community take part in the project.

Lesson 11: Final Artifact

DRIVING QUESTION

How are crowdfunding campaigns used to build support for a new service or product?

Student Objectives and CTE Standards	Connections to Careers and the Product Life Cycle	Lesson Materials	Lesson Overview	Phenomena and Connection to the Unit Storyline
Synthesize complex scientific and technical information with data on community needs and markets, and appeal to stakeholders to create an engaging final proposal. **Communicate** clearly and concisely about their ideas to other students and members of the community. **CTE:** 2.4, 2.5, 7.1, A1.6, A5.2, A8.7	Students will explore careers as **communication directors, grant writers, graphic designers, marketing directors,** and **diversity and inclusion directors**. In this lesson, students are developing and presenting their final proposals for how DNA identification technology could be used to address issues in their own communities. This lesson connects to both the **manufacturing** and the **commercialization** phases of the product life cycle, as students are designing final product prototypes and also considering how to advertise their ideas to the community.	What Makes a Successful Crowdfunding Campaign? Capture Sheet Final Artifact Proposal Specifications Resource for Interpreting Personality Test Results Final Artifact Roles Story Creation Brainstorm Capture Sheet Project Management Tool DNA Identification: Final Artifact Task Capture Sheet Daily Progress Check Capture Sheet Peer Feedback Form Capture Sheet, Group Spokesperson Peer Feedback Form Capture Sheet, Peer Reviewer Group Feedback Review Capture Sheet Pitch Evaluation Capture Sheet Elaborated Pitch Deck Example Final Assessment Rubric	In this lesson, students will develop their final community level funding proposals based on their learning from previous lessons. The final funding proposal artifact will include the model of their proposed DNA collection kit (developed in Lesson 9), visual aid(s) detailing the proposal, and a polished “elevator speech” pitch for their idea. Students will engage with proposals from their peers through constructive feedback and a summative elevator pitch sharing session. Students may also have the option of presenting their ideas at a community or school event.	This lesson represents the culmination of student work throughout the unit. Students will use what they have learned and developed from all previous lessons to create a professional and engaging artifact about their proposal and develop a final elevator speech to pitch their proposal to potential funders.

Career and Technical Education (CTE) Standards

Anchor Standards

2.0 Communications
Acquire and accurately use Health Science and Medical Technology sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats. (Direct alignment with LS 9–10, 11–12.6)

2.4
Demonstrate elements of written and electronic communication, such as accurate spelling, grammar, and format.

2.5
Communicate information and ideas effectively to multiple audiences using a variety of media and formats.

2.8
Understand and use correct medical terminology for common pathologies.

3.0 Career Planning and Management
Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. (Direct alignment with SLS 11–12.2)

3.6
Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society.

4.0 Technology
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.

4.5
Research past, present, and projected technological advances as they impact a particular pathway.

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Career and Technical Education (CTE) Standards

Anchor Standards

Continued

7.0 Responsibility and Flexibility
Initiate and participate in a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Health Science and Medical Technology sector workplace environment and community settings. (Direct alignment with SLS 9–10, 11–12.1)

7.1
Recognize how financial management impacts the economy, workforce, and community.

7.2
Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.

Health Science and Medical Technology Standards

A1.0
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.

A1.6
Explore and outline the various science and non-science fields and careers associated with biotechnology.

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.

A3.1
Define and describe the structure and function of DNA, ribonucleic acid (RNA), and proteins and explain the consequences of DNA mutations on proteins.

A3.3
Employ standard techniques of DNA extraction, purification, restriction digests, bacterial cell culture, and agarose gel electrophoresis and document and evaluate results.

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Career and Technical Education (CTE) Standards

Health Science and Medical Technology Standards

Continued

A4.0
Recognize basic concepts in cell biology and become familiar with the laboratory tools used for their analysis.

A4.5
Discuss the structure and function of the macromolecules that compose cells, including carbohydrates, lipids, DNA, RNA, and protein molecules.

A5.0
Integrate computer skills into program components.

A5.1
Use the internet and world wide web to collect and share scientific information.

A5.2
Use a variety of methods, including literature searches in libraries, computer databases, and online, for gathering background information, making observations, and collecting and organizing data.

A6.0
Implement use of the metric system, orders of magnitude, and the pH scale in preparation of reagents, analysis of data, and graphing.

A6.1
Apply knowledge of symbols, algebra, and statistics to graphical data presentation.

A6.4
Create data tables and graphs using Excel to collect and analyze data.

A8.0
Follow sustainable and safe practices with high regard for quality control.

A8.7
Determine what equipment is appropriate to use for a given task and the units of measurement used.

Third Party Evaluator Evidence/Findings

Completed by: American Institute of Research

Sponsored by Genentech, Futurelab+ brings together a coalition of partners to develop an innovative, modular, two-year biotechnology curriculum, including 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 one 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* (NGSS).

The two-year biotechnology curriculum provides four core units per year; each core unit has nine lessons and a lab that each take approximately one week to complete, or 9–10 weeks for the full unit. In total, the biotechnology curriculum has 72 lessons and eight labs that span two 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 environment.

Unit 8: Community Science

Version Reviewed/ Date: April 18, 2022

California (CTE) Model Curriculum Standards for Biotechnology

Full Report

[Futurelab+... priority to meet California CTE Biotech Standards...] Evidence of which California CTE Biotechnology standards are addressed within the curriculum and where they are addressed is included in the *full report*.

University of California Science (D)

Full Report

Because teachers and schools can choose which portions of the curriculum to include in their final course designs, this *report series* provides evidence of where each unit meets specific criteria for the UC science (D) subject requirement and, when incorporated into a full year-long course, where the curriculum could meet at least one year of the UC science (D) subject requirement, contingent upon review and approval by UC. Subsequently, the evidence provided within the report can be used by teachers for submitting Futurelab+ course materials for UC science (D) subject approval.

The purpose of this report is to provide evidence for alignment of Unit 8 of the Futurelab+ Biotechnology Curriculum with the UC science (D) subject requirement. To help educators submit their final courses for UC science (D) subject review, the American Institutes for Research (AIR) also provides a sample unit and lab summaries, which follow the guidelines for writing a UC science (D) course (March 17, 2021).

Specifically, AIR reviewed each unit for evidence of the extent to which they meet the eight Course Content Guidelines for the UC science (D) subject requirement. This report provides specific examples to demonstrate where and how materials satisfy these criteria. Based on our review, we believe there is a strong body of evidence that will translate to Unit 8 meeting the UC science (D) subject matter requirement.

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Third Party Evaluator Evidence/Findings

Continued

Next Generation Science Standards (NGSS)

Full Report

As an organizational partner, the American Institutes for Research (AIR) provided external feedback on alignment to the three sets of standards to Futurelab+ curriculum developers during the formative period of the biotechnology curriculum. AIR is now providing external feedback and evidence on the final curriculum's alignment to each set of standards: CTE, UC science (D) subject requirement, and NGSS in a series of three reports. The eight reports in the NGSS series provide feedback on aspects of NGSS in a sample of the curriculum (one lesson from each unit). AIR randomly selected PD 1 (Analyzing Community Needs and Proposal Identification) from Unit 8 (Community Science) for this report.

Of note, because the primary design element of the curriculum was alignment to CTE, AIR used the NGSS Lesson Screener (not the Educators Evaluating the Quality of Instructional Products [EQuIP] Rubric) to identify aspects of the curriculum that incorporate NGSS. The EQuIP Rubric is typically used to determine whether a unit was designed for the NGSS. Because the curriculum was designed to align primarily to CTE standards, it was not expected that the curriculum would meet all NGSS criteria. Nevertheless, in their current form, the materials from Unit 8, PD 1, meet three lesson screener criteria and approach the remaining three lesson screener criteria. AIR created the approaching rating to indicate where a modification to materials would increase the rating to adequate. For more information, please see the *full report*.