

California Education and the Environment Initiative

Increasing Environmental Literacy for K–12 Students...
Because the Future is in Their Hands



TEACH COMMON CORE STANDARDS WITH THE EEI CURRICULUM

Created with your needs in mind, this document shows the correlation between the EEI Curriculum and the California Common Core State Standards. By teaching the EEI unit lessons in your classroom, you will be simultaneously addressing the Common Core standards depicted in this guide.

B.5.c.—High-Tech Harvest: Genetic Engineering and the Environment



Students examine the history of genetically engineered rice in California, and explore how traditional and modern forms of genetic engineering work. Students identify how genetically engineered products can influence natural systems and human health, and discover the range of influences genetically engineered products can have. Students learn how “super rice” has influenced natural systems, and they analyze the factors involved in decisions about genetically engineered products.

		SL.9–10.1	SL.9–10.2	SL.9–10.3	SL.9–10.4	SL.9–10.6	SL.11–12.1	RST.9–10.1	RST.9–10.2	RST.9–10.4	RST.9–10.5	RST.9–10.6	RST.9–10.7	RST.9–10.8	RST.9–10.10	RST.11–12.2	WHST.9–10.1	WHST.9–10.2	WHST.9–10.7	WHST.9–10.9	WHST.11–12.2	
LESSONS	California Connections							✓		✓	✓	✓	✓	✓	✓			✓				
	1		✓					✓	✓	✓	✓	✓	✓		✓			✓				
	2	✓	✓		✓					✓			✓					✓				
	3	✓			✓		✓		✓	✓					✓							
	4	✓		✓	✓	✓		✓	✓	✓							✓		✓	✓		
	5	✓			✓		✓	✓		✓			✓	✓	✓	✓	✓	✓		✓		
	6	✓	✓		✓				✓	✓	✓	✓		✓						✓	✓	
	Traditional Assessment								✓									✓			✓	
	Alternative Assessment							✓	✓					✓				✓		✓	✓	

COMMON CORE STANDARDS

Note: For your reference, the list of California Common Core State Standards abbreviations is on the following page.

Using the EEI-Common Core Correlation Matrix

The matrix on the front page identifies a number of Common Core standards that are supported by this EEI unit. However, the check marks in the matrix do not necessarily signify that the Common Core standards checked will be taught to mastery by using this EEI unit alone. Teachers are encouraged to select which Common Core standards they wish to emphasize, rather than teaching to every indicated standard. By spending more time on selected standards, students will move toward greater Common Core proficiency in comprehension, critical thinking and making reasoned arguments from evidence. Teaching this EEI unit will provide opportunities for teachers to implement the shift in instructional practice necessary for full Common Core implementation.

California Common Core State Standards Abbreviations

- **CCSS:** California Common Core State Standards
- **RST:** Reading Standards for Literacy in Science and Technical Subjects
- **SL:** Speaking and Listening Standards
- **WHST:** Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects

Note: Since each Common Core standard includes a breadth of skills, in this correlation, the portion of the standard description that is featured in the Common Core standards applications is cited, using “...” to indicate omitted phrases. For a list of the complete standard descriptions, please see the Common Core Reference Pages located on pages 19–20 of this document.

A Note about Common Core Speaking and Listening Standards

Throughout this unit, students participate in various learning structures and groups to analyze, discuss, and synthesize data, which supports the skill in Speaking and Listening Standard 1 “Participate effectively in a range of collaborative discussions (one-on-one, groups...) with diverse partners.” With prior instruction on collaborative discussions, these various groupings and the materials students examine lend themselves to prime discussion material for collaborative discussions. Learning structures with tasks for pairs and groups are in the following lessons:

- **Lesson 1:** Whole class, pairs
- **Lesson 2:** Groups of four
- **Lesson 3:** Whole class, groups of four
- **Lesson 4:** Six groups
- **Lesson 5:** Groups of four
- **Lesson 6:** Same groups as Lesson 4

National Geographic Resources

No maps or posters are used with this unit.

Unit Assessment Options

Assessments	Common Core Standards Applications
Traditional Assessment	
<p>Students write short-answer, answer multiple-choice questions, and answer an essay question.</p>	<p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p> <p>WHST.11–12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p>
Alternative Assessment	
<p>Students create an essay that examines the factors involved in making decisions about a genetically engineered product.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific...processes.</p> <ol style="list-style-type: none"> a) Introduce a topic and organize ideas, concepts, and information... b) Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information... c) Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts. d) Use precise language and domain-specific vocabulary... e) Provide a concluding statement or section that follows from and supports the information or explanation... <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p> <p>WHST.11–12.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p>

Lesson 1: Super Rice in California

Students learn about the topic of genetic engineering by examining the extent to which genetically engineered products pervade American society. Students study the history of genetically engineered rice in California to understand how and why it differs from typical rice.



Use this correlation in conjunction with the **Procedures** located on pages 38–39 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context...</p>
<p>Step 3: Project Growth of Genetically Modified Crops Since 1996 (Visual Aid #1) and ask students what this graph tells them about genetically modified crops. Project Types of Genetically Modified Crops (Visual Aid #2) and help students decode the data. Ask students to summarize what they have learned from these graphs.</p>	<p>RST.9–10.7: ...translate information expressed visually...into words.</p> <p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats...</p>
<p>Step 4: Students turn to California Connections: Rice Farming in California, Part 1 (Student Edition, pages 2–4) and read Part 1: Russ Greenwald and Ventria Bioscience individually. Students are then paired and given discussion questions.</p> <p>Suggestion: To increase Common Core applications, ask students to note how science terms are defined during the text. In addition, ask them to note how the text structures the ideas and to determine the author’s purpose in providing each explanation.</p> <p>In addition to reading California Connections for content, students should look at several key elements on how the writing is structured. This can be done while they’re reading or during a second reading of the material. Students who have been familiarized with this process can identify these structural elements as they read by themselves and then they can be discussed as a class.</p> <p>Refer to the Reading California Connections Using a Common Core Reading and Writing Focus on pages 15–18 to view specific suggestions for integrating Common Core standards while reading the selection not only for content, but for text structure as well.</p>	<p>RST.9–10.4: Determine the meaning of...key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context...</p> <p>RST.9–10.5: Analyze the structure of the relationships among concepts in a text, including relationships among key terms...</p> <p>RST.9–10.6: Analyze the author’s purpose in providing an explanation,... defining the question the author seeks to address.</p> <p>RST.9–10.10: ...read and comprehend science...texts...independently and proficiently.</p>

Student Tasks	Common Core Standards Applications
<p>Step 5: Tell students to turn to California Rice Pharming (Student Workbook, page 3). Have students answer the questions based on the information in Part 1: Russ Greenwald and Ventria Bioscience.</p> <p>Tip: <i>If Student Workbooks need to be reused from year to year, students should not write in them. Some strategies teachers use to preserve the workbooks are:</i></p> <ul style="list-style-type: none"> ■ <i>Have students use binder paper or other lined or unlined paper.</i> ■ <i>Have students use a sheet protector over the page and write with a whiteboard marker.</i> ■ <i>Do together as a class on a projector or chart paper.</i> ■ <i>Project the digital fill-in version and do together as a class.</i> ■ <i>Students use digital devices to fill in the digital version found on the website.</i> ■ <i>Make student copies when necessary.</i> 	<p>RST.9–10.1: Cite specific textual evidence to support analysis of...texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas...; trace the text’s explanation or depiction of a complex process...or concept; provide an accurate summary of the text.</p> <p>WHST.9–10.2: Write informative/explanatory texts...</p>

Lesson 2: Taking Genes, Making Products

Students explore how traditional and modern forms of genetic engineering work in order to identify how breeders and scientists use naturally occurring ecosystem goods, such as DNA, and processes, such as sexual reproduction, to create genetically modified crops, animals, and bacteria.



Use this correlation in conjunction with the **Procedures** located on pages 50–51 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context...</p>
<p>Step 1: Project Selective Breeding for Mini-Watermelons (Visual Aid #3) to explain the process of selective breeding. Ask students:</p> <ul style="list-style-type: none"> ■ Where did the DNA for the new trait come from? ■ What process did breeders use to alter the gene pool? <p>Suggestion: <i>The class discussion should be structured to allow for all students to participate. One suggestion is for students to use sentence stems to further the discussion. Examples include:</i></p> <p><i>The main idea is... The most important details are... I learned... My partner pointed out... My partner mentioned that... We agreed that... We decided that...</i></p>	<p>RST.9–10.7: ...translate information expressed visually or mathematically... into words.</p> <p>SL.9–10.1: ...participate effectively in a range of collaborative discussions...</p>
<p>Step 3: Divide students into groups of four. Distribute a Student Edition to each student and tell them to turn to Taking Genes, Making Products: Resource Information (Student Edition, page 5). Have students read through the information with their group, note any vocabulary that is new to them, and then use their Key Unit Vocabulary to define any new words. Ask groups to work together to interpret the diagram.</p> <p>Have volunteers share their vocabulary lists with the class. Project Genetically Engineered Corn 1 and 2 (Visual Aids #4–5). Ask volunteers from each group to explain one step from the diagram, and discuss any misunderstandings as a class.</p>	<p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...</p> <p>RST.9–10.7: ...translate information expressed visually...into words.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p>
<p>Step 4: Ask students to discuss the following questions with their groups:</p> <ul style="list-style-type: none"> ■ How are selective breeding and genetic engineering similar? ■ How are they different? <p>Have volunteers share their answers to the questions above with the class, then ask students:</p> <ul style="list-style-type: none"> ■ Where did the DNA inserted into the corn come from? ■ What naturally occurring processes did scientists use to alter the genetic makeup of the corn? 	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...with diverse partners...</p>

Student Tasks	Common Core Standards Applications
<p>Steps 5 and 6: Tell students to turn to Taking Genes, Making Products: Group Activity Sheet (Student Edition, page 6). Distribute a Supply Set to each group for use in recreating the way scientists use genetic resources and processes to recombine DNA in ways not previously possible. Explain that groups will use the yarn, tape, and construction paper to create visual models of this process. Tell them to be creative with how they illustrate the process of genetic engineering with these materials.</p> <p>Give groups two to three minutes to briefly present their models to the rest of the class.</p>	<p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats...</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p>
<p>Step 7: Tell students to turn to Taking Genes, Making Products (Student Workbook, page 4). Tell the students to complete the assignment for homework.</p>	<p>WHST.9–10.2: Write informative/explanatory texts...</p> <p>c) Use varied transitions and sentence structures.</p>
<p>Step 8: Discuss where desirable new traits in any species might be found to make novel genetically engineered products. Ask students the following questions:</p> <ul style="list-style-type: none"> ■ Where might scientists look if they wanted to create the first blue rose? ■ How would scientists produce a potato that has a greater amount of protein? <p>Ask students, “What are the implications for genetic engineering if worldwide species diversity declines?”</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...with diverse partners...</p> <p>c) Propel conversations by posing and responding to questions...</p> <p>d) Respond thoughtfully to diverse perspectives,...qualify and justify their own views and understanding and make new connections in light of the...reasoning presented.</p>

Lesson 3: Down on the Pharm

Students read about two genetically engineered products, Bt corn and malaria-resistant mosquitoes, in order to identify how these products can influence the composition, biological diversity, and viability of the natural systems, as well as human health.



Use this correlation in conjunction with the **Procedures** located on page 64 of the Teacher's Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...</p>
<p>Step 1: Tell students to turn to Influences of Genetically Engineered Products (Student Workbook, page 5). Distribute a Student Edition to each student and tell them to turn to Bt Corn (Student Edition, page 7). Give students a few minutes to read Bt Corn.</p>	<p>RST.9–10.10: ...read and comprehend science...texts...independently and proficiently.</p>
<p>Step 3: Project Influences of Genetically Engineered Products (Visual Aid #6). Ask students to use the information they just read to identify how Bt corn can influence the composition of the natural system in which it is grown. Record students' answers in the first cell on the projected table, accordingly. Have students fill in their individual tables as you fill in the Visual Aid. Ask, "How might the corn influence biological diversity within a natural system?" and fill in the second cell in the table. Continue the discussion until you complete the first row of the table.</p> <p>Suggestion: Create a poster-size diagram to model the process.</p>	<p>SL.9–10.1: ...participate effectively in a range of collaborative discussions...</p>
<p>Step 4: Tell students to turn to Malaria-Resistant Mosquitoes (Student Edition, page 8). Organize students into groups of four. Have students read Malaria-Resistant Mosquitoes together to complete the second row (malaria-resistant mosquitoes) on Influences of Genetically Engineered Products. Each student should complete his or her own table.</p>	<p>RST.9–10.2: Determine the central ideas...; trace the text's explanation or depiction of a complex process, phenomenon, or concept...</p> <p>RST.9–10.10: ...read and comprehend science...texts...independently and proficiently.</p>
<p>Step 5: Discuss with students their opinions about the release of malaria-resistant mosquitoes. Ask students to back up their opinions with evidence about how the mosquitoes might influence the natural system, biodiversity, and human health.</p>	<p>SL.9–10.1: ...participate...in a range of collaborative discussions...</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p> <p>SL.11–12.1c: ...probe reasoning and evidence...</p>

Lesson 4: Going Beyond the Field

Working in small groups, students read about a genetically engineered product and identify how it can influence natural systems and human health. By comparing group findings, students discover the range of possible influences such products can have.



Use this correlation in conjunction with the **Procedures** located on pages 74–75 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...</p>
<p>Step 1: Distribute a Student Edition to each student. Organize the class into six groups. Project Going Beyond the Field: Group Instructions (Visual Aid #7). Assign each group one of the readings: Microdiesel: Biofuels from Bacteria, Toxic-Avenger Trees and More, Eat Your Vaccine, Anthrax Vaccine from Tobacco, From Lab to Farm, or Golden Rice (Student Edition, pages 9–20).</p> <p>Tell groups to read and analyze their case study using the same three categories (natural systems, biological diversity, and human health) they used to examine Bt corn and malaria-resistant mosquitoes in Lesson 3. Tell students to turn to Going Beyond the Field (Student Workbook, pages 6–8). Have students answer the questions and prepare to report their findings and discussion points to the rest of the class.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text...; provide an accurate summary of the text.</p> <p>WHST.9–10.7: Conduct...research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Step 3: Write the following questions on the board and tell students that their group must address each question as part of their presentation to the class:</p> <ul style="list-style-type: none"> ■ What is your product? ■ What was the reason, or rationale, for genetically engineering this organism? ■ What are the effects of this product on the composition, biological diversity, and viability of natural systems, as well as human health? <p>Give the groups approximately 20 minutes to read and discuss their case studies, answer the questions for their genetically engineered product on Going Beyond the Field, and prepare their presentation for the class.</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on <i>grades 9–10 topics, texts, and issues</i>, building on others’ ideas and expressing their own clearly and persuasively.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p> <p>a) Plan and deliver an informative/explanatory presentation that: presents evidence in support of a thesis...</p>

Student Tasks	Common Core Standards Applications
<p>Step 3 (continued)</p>	<p>WHST.9–10.1: Write arguments focused on <i>discipline-specific content</i>.</p> <p>WHST.9–10.7: Conduct...research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p>
<p>Step 4: Before students report to the class on their particular case studies, call their attention to the rest of the rows on Going Beyond the Field. Explain that students should complete the remaining rows as they listen to the reports.</p>	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions...</p> <p>a) Come to discussions prepared, having read and researched material under study...</p> <p>SL.9–10.3: Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose...</p> <p>SL.9–10.6: Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate...</p>

Lesson 5: Return to Super Rice

Students examine what happened to the super rice described in Lesson 1 in order to identify how the rice has influenced natural systems. They study the beneficial, neutral, and detrimental effects of this rice on components of natural systems.



Use this correlation in conjunction with the **Procedures** located on page 98 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...</p>
<p>Step 1: Distribute a Student Edition to each student. Tell them to turn to California Connections: Rice Pharming in California, Part 2 (Student Edition, pages 21–22). Direct students to read Part 2: From the Flavr Savr to the 2007 Rice Crop individually.</p>	<p>RST.9–10.10: ...read and comprehend science...texts...independently and proficiently.</p>
<p>Step 2: Organize students into groups of four. Project Discussion/Notes Guide (Visual Aid #9) and distribute writing paper to students. Ask students to discuss, within their groups, the points listed on the visual aid. Following the discussion, each student should take notes, answering the discussion questions.</p>	<p>RST.9–10.7: ...translate information expressed visually...into words.</p> <p>SL.9–10.1: ...participate...in a range of collaborative discussions (...in groups...).</p> <p>c) Propel conversations by posing and responding to questions...; actively incorporate others into the discussion; and clarify, verify and challenge ideas and conclusions.</p>
<p>Step 3: Facilitate a class discussion of the reading by asking the following questions:</p> <ul style="list-style-type: none"> ■ How can genetically engineered rice influence human health? ■ How did different groups and individuals react to the testing and growth of genetically engineered rice? ■ Is it possible to produce rice, or other genetically engineered organisms, that will have no effect on natural systems? 	<p>SL.9–10.1: ...participate...in a range of collaborative discussions (...in groups...).</p> <p>c) Propel conversations by posing and responding to questions..., actively incorporate others into the discussion; and clarify, verify and challenge ideas and conclusions.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p> <p>SL.11–12.1c: ...probe reasoning and evidence...</p>

Student Tasks	Common Core Standards Applications
<p>Step 4: Extend student thinking by asking them: “Can you tell if the author of <i>California Connections: Rice Pharming in California, Part 2</i> is for, against, or neutral about genetically engineered rice in California? Are there excerpts that provide clues to the author’s opinion?”</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.</p> <p>RST.9–10.10: By the end of grade 10, read and comprehend science/technical texts...independently and proficiently.</p> <p>RST.11–12.2: Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.</p> <p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on <i>grades 9–10 topics, texts, and issues</i>, building on others’ ideas and expressing their own clearly and persuasively.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p>
<p>Step 5: Tell students to turn to Genetically Engineered Rice in California (Student Workbook, pages 9–10) and have them complete the assignment for homework, using their notes from the group discussion.</p>	<p>WHST.9–10.1: Write arguments focused on <i>discipline-specific content</i>.</p> <p>WHST.9–10.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>

Lesson 6: Making Decisions about Genetic Engineering

Students read and analyze documents that address a wide range of considerations necessary to determine whether particular genetically engineered products should be developed, field-tested, and grown. Students identify various stakeholders, lobbyists, and interest groups that may want a say in the decision-making process.



Use this correlation in conjunction with the **Procedures** located on pages 108–109 of the Teacher’s Edition. Only procedure steps with a Common Core correlation are included in the table below.

Student Tasks	Common Core Standards Applications
<p>Vocabulary Development: For depth of understanding, vocabulary may be featured within the context of the unit instead of or in addition to the beginning of the lesson.</p>	<p>RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...</p>
<p>Step 1: Students brainstorm examples of stakeholders involved in decisions about genetically engineered products, and record student answers on the board.</p>	<p>RST.9–10.5: Analyze the structure of the relationships among concepts in a text, including relationships among key terms...</p>
<p>Step 2: Distribute a Student Edition to each student. Tell students to turn to California Connections: Rice Pharming in California, Part 2 (Student Edition, pages 21–22). Give students 10 minutes to read Part 2: From the Flavr Savr to the 2007 Rice Crop individually.</p> <p>Project Making Decisions about Pharm Rice (Visual Aid #10). Ask the students to list items for the column named “Factor to be Considered.” After they have identified the factors, ask them to identify the stakeholders that may be most concerned with this issue. Begin filling in each factor on the visual aid.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.</p> <p>RST.9–10.7: ...translate information expressed visually or mathematically (e.g., in an equation) into words.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Step 3: Organize students into the same small groups as in Lesson 4. Tell them to turn to Making Decisions about Genetic Engineering Chart (Student Workbook, page 11). Have students in each group turn to the reading that they were assigned in Lesson 4: Microdiesel: Biofuels from Bacteria, Toxic-Avenger Trees and More, Eat Your Vaccine, Anthrax Vaccine from Tobacco, From Lab to Farm, and Golden Rice (Student Edition, pages 9–20), and their work on Going Beyond the Field (Student Workbook, pages 6–8).</p> <p>Each group should generate three to six factors. One student from each group will present the group’s list of factors and stakeholders to the rest of the class. Remind students to consider environmental, economic, and health factors in their discussions and as they generate their presentations.</p>	<p>RST.9–10.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.</p> <p>RST.9–10.2: Determine the central ideas or conclusions of a text...; provide an accurate summary of the text.</p> <p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p> <p>a) Plan and deliver an informative/explanatory presentation that: presents evidence in support of a thesis...</p>

Student Tasks	Common Core Standards Applications
Step 3 (continued)	
	<p>WHST.9–10.7: Conduct short...research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Step 4: When all groups are ready to present, tell students to turn to Pulling It All Together: Spectrum of Factors (Student Workbook, pages 12–13). Instruct students to complete the table as they listen to the group presentations.</p>	<p>SL.9–10.2: Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally), evaluating the credibility and accuracy of each source.</p> <p>WHST.9–10.9: Draw evidence from informational texts to support analysis, reflection, and research.</p>
<p>Step 5: Have one representative from each group present to the class a summary of that group’s factors and stakeholders. Give each group approximately two minutes to present. Allow two minutes (per group) for classmates to ask questions.</p>	<p>SL.9–10.4: Present information, findings, and supporting evidence clearly, concisely, and logically...</p> <p>a) Plan and deliver an informative/explanatory presentation that presents evidence in support of a thesis...</p>
<p>Step 6: Conclude the lesson by discussing the following overarching questions:</p> <ul style="list-style-type: none"> ■ Of all the stakeholders listed, who do you think has the most influence or say in the future of genetically engineered products in the United States? In other countries? ■ Given the diversity of opinions about genetically engineered products and the number of groups that have interests in the outcomes, how should decisions be made about whether products should be developed, tested, and sold? 	<p>SL.9–10.1: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on <i>grades 9–10 topics, texts, and issues</i>, building on others’ ideas and expressing their own clearly and persuasively.</p> <p>c) Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</p>

Unit Assessment

Refer to the introduction pages at the front of this document for information regarding the Traditional and Alternative Assessments for this unit and their Common Core correlations.

Reading *California Connections* using a Common Core Reading and Writing Focus

Reading

Science teachers can further enhance the teaching of Common Core Reading Literacy Standards by noting the suggestions below and in the following pages while reading the *California Connections* selection for content. Explicitly teach students to pay attention to the structure of the text by noting the following:

- Note how the author cites evidence to support main points; note any gaps or inconsistencies. **(RST.9–10.1 and RST.11–12.1)**
- Note how the author sets up the central ideas or conclusions; trace the text’s explanation or depiction of a process or concept; summarize concepts, processes, and information by paraphrasing the text and the text as a whole. **(RST.9–10.2 and RST.11–12.2)**
- Note how the author explains multi-step procedures. **(RST.9–10.3 and RST.11–12.3)**
- Note how the author explains the meaning of key terms, symbols, domain specific words, and phrases. **(RST.9–10.4 and RST.11–12.4)**
- Analyze the structure of the relationships among concepts in a text, and the relationships among key terms, including categories or hierarchies. **(RST.9–10.5 and RST.11–12.5)**
- Analyze the author’s purpose in providing an explanation, or describing a procedure, and how this defines the question the author seeks to address; identify important unresolved issues. **(RST.9–10.6 and RST.11–12.6)**
- Note how the information in the *California Connections* text integrates with information provided throughout the unit in diverse formats, including tables, charts, maps, and quantitative data. **(RST.9–10.7 and RST.11–12.7)**
- Assess the extent to which the reasoning and evidence in a text support the author’s claim; evaluate the analysis and conclusions in the text. **(RST.9–10.8 and RST.11–12.8)**
- When other documents are included, compare and contrast findings presented in this text to those in other sources, noting when the findings support or contradict previous explanations. **(RST.9–10.9 and RST.11–12.9)**
- Note comprehension strategies for understanding text. **(RST.9–10.10 and RST.11–12.10)**

Note: Standard descriptions are paraphrased using a mix of grades 9–10/11–12 terminology that applies to reading a *California Connections* selection.

Writing

Many *California Connections* selections can be used as a model for future student writing tasks applying the Writing Literacy Standards by noting how the author structures the text, organizes the ideas, and provides well-chosen relevant and sufficient facts, extended definitions, concrete details, quotations, or other information and examples.

The following pages feature the *California Connections* selection, identifying specific locations in the text that demonstrate Common Core Reading and Writing Literacy Standards for Science and Technical subjects.

Using the *California Connections* Selection

The following pages note specific places where the *California Connections* selection provides examples for specific Writing Literacy Standards for Science and Technical subjects, using this selection as a writing model. They also provide suggestions for teaching students to analyze text structure using the Reading Literacy Standards for Science and Technical subjects. Teachers can incorporate more suggestions from the list above.

RST.9–10.10: ...read and comprehend science/ technical texts...independently and proficiently.

WHST.9–10.2a:

Introduce a topic and organize ideas...

Suggestion: Discuss with students how the introduction sentences are used to capture the reader's attention.

RST.9–10.5: Analyze the structure of the relationships among concepts in a text...

Suggestion: This sentence sets up the structure of this text. Have students trace its development while reading.

California Connections: Rice Farming in California, Part 1
Lesson 1 | page 1 of 3

Rice Farming in California

Part I: Russ Greenwald and Ventria Bioscience



Russ Greenwald climbed out of his pickup as the big harvesters flushed blackbirds from the rice fields. Moving back and forth in the heat of midday, they carefully mowed between dark levees. Russ is a big man in his late 40s, a third generation California rice farmer.

Feeding the World
Lately he has seen many changes in the industry. "Rice is the engine that drives many rural economies in the Sacramento Valley," he said. "The small farmer used to know what to expect. Now, the future seems less certain."
California has been a major rice-producing state since 1920. Approximately 40,000 Chinese immigrants—all of whom depended on rice as their staple food—joined the thousands who flocked to northern California to find their fortunes during the Gold Rush of 1849. Farmers at that time found that the new rice crop they planted to feed this influx of Chinese immigrants grew easily in the heavy clay soil of the Sacramento Valley.
From a patchwork of 500,000 acres, California farmers now harvest approximately seven metric tons of rice per year, more rice



Aerial view of farming in Sacramento Valley

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RST.9–10.7: ...translate information expressed visually...into words.

Suggestion: Have students provide textual evidence to support the use of this picture.

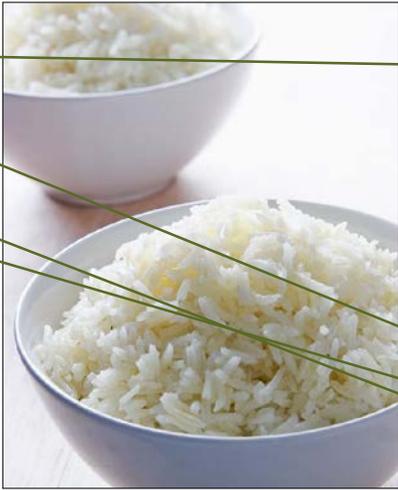
RST.9–10.1: Cite specific textual evidence to support analysis of science...texts, attending to the precise details of explanations or descriptions.

Suggestion: While reading, have students summarize sections of the material, citing evidence from the text.

RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...

- rehydration
- genetically modified
- lactoferrin
- lysozyme

California Connections: Rice Pharming in California, Part 1
Lesson 1 | page 2 of 3



Rice ready to eat

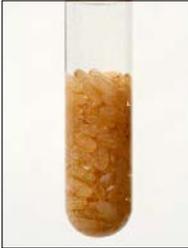
per acre than any other region in the world. Japan buys nearly half of California's yearly rice crop; Taiwan, Turkey, and South Korea also buy large quantities of California rice. The rest of the state's rice crop finds its way to dinner tables and sushi restaurants and into rice beer and pet food in the United States. Today more people

consume rice than any other grain on Earth; a third of the world's population eats rice every day.

Genetically Modified Rice
In 1998, the U.S. Department of Agriculture approved a Sacramento-based company's plan to carry out biogenetic experiments with rice. Using

rice as a host, Sacramento-based Ventria Bioscience hoped to develop an oral rehydration solution, that would help cure infectious diarrhea. Doctors use rehydration solutions to help replace the body fluids lost in people suffering from diarrhea. Every year 2 million children around the world die of complications from this disease. It is the second largest killer of children under the age of five in developing countries. If not controlled, serious diarrhea can cause the human body to lose dangerous amounts of fluid, causing dehydration and potentially death.

Ventria Bioscience used a bioengineering technology to design a genetically modified rice grain that produces the natural proteins lactoferrin and lysozyme.



Rice in test tube

CALIFORNIA EDUCATION AND THE ENVIRONMENT INITIATIVE | Unit B.5.c. | High Tech Harvest: Genetic Engineering and the Environment | Student Edition 3

RST.9–10.8: Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

RST.9–10.6: Analyze the author's purpose in providing an explanation...

Suggestion: Ask what the author's purpose is for including this explanation.

WHST.9–10.2a: Introduce a topic and organize ideas...

Suggestion: Discuss with students how the introduction sentences are used to capture the reader's attention.

RST.9–10.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases...

- genome
- transgenic
- cross-pollinating
- self-pollinating

RST.9–10.1: Cite specific textual evidence to support analysis of science...texts, attending to the precise details of explanations or descriptions.

Suggestion: While reading, have students summarize sections of the material, citing evidence from the text.

California Connections: Rice Pharming in California, Part 1
Lesson 1 | page 3 of 3



Rice ready for shipment

Lactoferrin and lysozyme are proteins found in mother's milk, tears, and saliva. Lactoferrin acts as an anti-bacterial agent and stimulates the immune system. Lysozyme can make dangerous bacteria less likely to be harmful. These proteins do not grow naturally in rice. Ventria tested inserting human genes for these proteins into the rice genome using bioengineering technology, creating a transgenic rice plant. Transgenic plants contain a gene or genes transferred from another species. When these rice-produced human proteins were extracted from the rice and added to an oral rehydration solution, they were intended to act together to reduce the risk of infectious diarrhea and inflammation of the intestinal tract.

Originally Ventria planted its test rice in separate plots away from commercial rice fields. The company aimed to reduce the risk of cross-pollinating the engineered rice with the traditional rice crops. Such cross-pollination could allow the medicinal proteins to make their way into regular rice. Ventria planned to grow

more acres of its genetically modified rice in California after completing the experimentation phase of the project.

Biopharming
In 1999, Ventria asked Russ Greenwald to assist with its experiments. The company wanted to use part of his land for "biopharming," or growing genetically modified rice containing the diarrhea-preventing proteins. The word "biopharming" is a combination of "pharmaceutical" (meaning medical drugs) and "farming." Biotech and pharmaceutical companies see biopharming as a way to produce large quantities of useful drugs that can be delivered relatively cheaply and easily, especially to people in developing countries.

Self-pollinating Rice
Ventria offered to pay Greenwald by the acre to develop a rice farm in northern California. The company said it would plant self-pollinating rice, which allows the rice plants to fertilize themselves with their own pollen. This appealed to Greenwald, who would not have to worry about keeping the genetically modified rice from mixing with his regular crop. It was at that time that he agreed to become a "pharmer."

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RST.9–10.5: Analyze the structure of the relationships among concepts in a text...

WHST.9–10.2a: ...include formatting (e.g., headings)... when useful to aiding comprehension.

Suggestion: Note headings and their purpose.

California Common Core State Standards Descriptions for Grades 9–10

Reading Literacy Standards in Science and Technical Subjects

- **RST.9–10.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- **RST.9–10.2:** Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
- **RST.9–10.4:** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 9–10 texts and topics*.
- **RST.9–10.5:** Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).
- **RST.9–10.6:** Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
- **RST.9–10.7:** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **RST.9–10.8:** Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.
- **RST.9–10.10:** By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.

Speaking and Listening

- **SL.9–10.1:** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 9–10 topics, texts, and issues*, building on others’ ideas and expressing their own clearly and persuasively.
 - a) Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well-reasoned exchange of ideas.
 - c) Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
 - d) Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.
- **SL.9–10.2:** Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source.
- **SL.9–10.3:** Evaluate a speaker’s point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.
- **SL.9–10.4:** Present information, findings, and supporting evidence clearly, concisely, and logically (**using appropriate eye contact, adequate volume, and clear pronunciation**) such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose (**e.g., argument, narrative, informative, response to literature presentations**), audience, and task. **CA**
 - a) **Plan and deliver an informative/explanatory presentation that: presents evidence in support of a thesis, conveys information from primary and secondary sources coherently, uses domain specific vocabulary, and provides a conclusion that summarizes the main points. (9th or 10th grade.) CA**
- **SL.9–10.6:** Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. (See grades 9–10 Language standards 1 and 3 for specific expectations.)

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects

- **WHST.9–10.1:** Write arguments focused on *discipline-specific content*.
- **WHST.9–10.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
 - a) Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
 - b) Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.
 - c) Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.
 - d) Use precise language and domain-specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.
 - e) Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
- **WHST.9–10.7:** Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under
- **WHST.9–10.9:** Draw evidence from informational texts to support analysis, reflection, and research.

California Common Core State Standards Descriptions for Grades 11–12

Reading Literacy Standards in Science and Technical Subjects

- **RST.11–12.2:** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Speaking and Listening

- **SL.11–12.1:** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grades 11–12 topics, texts, and issues*, building on others’ ideas and expressing their own clearly and persuasively.
 - c) Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.

Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects

- **WHST.11–12.2:** Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.