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Throughout this module, you and your students will investigate the question *What is the system that gets food from farm to table, and how does this system affect the environment?* This question is more complicated than it may seem. You and your students will learn more about the complex nature of our food system in this module, and begin to explore the impact of human activity on the natural world.

As you begin your investigations, you’ll find yourself immersed in a world of interconnected systems. You will be exploring the subsystems of our immense, technological farm-to-table system — packaging, processing, transportation, and the byproducts, including waste, that are produced by this system. This module is an interweaving of learning about science, technology, and society. You and your students will come to understand that technology is not innately good or bad. Typically, the effects produced by technology are hard to estimate accurately and likely to have different values for different people at different times. In this module you and your students will create a time line of the food system with milestones in packaging, transportation, food processing, energy, and garbage. Additionally, student readings will enhance your studies with a deeper sense of the history of the food system. Overall, we hope students come away with a fuller appreciation of the enormous effects that our ability as humans to invent tools and processes have on the lives of other living things, on natural systems, and on the state of our collective environment.

As part of a complex biological system, humans have responsibilities to the other parts of our system. To insure our own survival, we must respect the wide diversity of living creatures — both large and small — and the physical components that all life depends on for growth and sustainability. Our planet has limited resources that cannot be carelessly wasted or polluted without running the risk of jeopardizing life on Earth. By investigating this module’s question, your students will become informed citizens, prepared to make choices that will help support a sustainable future for generations to come.

If you have access to a school garden, we encourage you to engage your students in growing their own food. Such gardens can also serve as living laboratories where students can set up investigations and monitor them over time. Gardens are a great place to monitor the effects of changing weather conditions on ecosystems, decomposition, the seed-to-table life cycle of garden plants, and much more. The National Gardening Association’s Web site (www.kidsgardening.org) is an excellent resource for both ideas and materials.

**Overview**

This module consists of six units, each with its own driving question.

**Unit 1**

*Becoming Food Scientists* introduces LiFE and explores the question *What is a food scientist?* Investigating corn motivates students to study food. Studying grapes introduces students to LiFE’s QuESTA Learning Cycle. Assessing what students already know about our farm-to-table food system and how this system affects the environment offers a baseline to track student growth throughout this module.

**Unit 2**

*Interacting Parts* introduces students to thinking about the farm-to-table system in terms of its parts and how the various parts relate to and interact with each other to create a “whole” through the question *What is the system that gets food from farm to table?* Students investigate processing, packaging, and transportation as subsystems within our larger food system. They explore different kinds of packaging and investigate modes of transportation. They begin long-term observations of what happens to fresh foods that are left out in their classroom, to gain an understanding of why we preserve food. Students tie together what they have learned by mapping out the relationships and interactions of the parts to build a new conceptual understanding of the whole.

**Unit 3**

*Food Processing* asks students to dive deeper into exploring the changes food undergoes in our food system with...
the question *What happens to food as it moves from farm to table?* Students continue their long-term observations of fresh foods left out in the classroom and develop theories to explain the changes they observe. They learn about several methods of preserving food through understanding what microorganisms need to grow and methods to prevent their growth. Students experience being food processors by creating cornmeal, whole-wheat flour, and butter, then using these ingredients to make pancakes from scratch. Through continuing with pancakes and the various ways they are available in our marketplace, they examine differing degrees of processing that food can undergo. They culminate their studies by becoming food preservers, making pickles. The unit ends with the students synthesizing what they have learned about the science and technology of food processing.

**Unit 4**

*Environmental Effects* leads students through a critical examination of the effects of our dependence on such a highly technological food system through an exploration of the question *What are the environmental effects of our farm-to-table system?* Students investigate what is needed to sustain the natural environment and how we, as humans, use natural resources to create “goods” that will meet our needs. The students revisit transporting, packaging, and processing food to layer onto what they learned an understanding of the trade-offs and impacts of our farm-to-table system. Following this, they examine the importance of fossil fuels in our society and how our dependence on fossil fuels affects the environment, specifically exploring these fuels’ role in increasing greenhouse-gas emissions and global warming. Students examine how by-products of our food system can contaminate the air, water, and soil that we depend on to produce food.

**Unit 5**

*Waste* allows students to conduct research that is a practical application of what they have learned by doing waste-analysis investigations. Through this they explore the question *How can we reduce the food-related waste that we produce?* Students conduct studies of how much food and food-packaging waste are produced by themselves, their families, and their communities. They learn about reducing, recycling, reusing, and composting as ways to decrease waste production. They develop and carry out a research plan to investigate how much food-related waste is generated by the school cafeteria. Finally, they analyze their personal food habits.

**Unit 6**

*Making Choices* brings the module to a close and encourages students to make informed decisions and changes in their lives by asking, *How can we use the science we learned to make ecologically sound food-system choices?* In this unit, students put on a *Farm to Table & Beyond* expo to share what they have learned about the global food system. As a post-assessment, students revisit the food-system posters they made in Lesson 4. Finally, they develop their own food-choice guidelines based on what they’ve learned throughout the module.

**Promoting Inquiry**

Teaching science as inquiry makes science a process of doing and thinking instead of learning a set of predetermined facts. This changes your role as teacher. Instead of being a source of science facts, you are a partner with your students as you seek answers or explanations. It means turning students’ questions back on them. If a student asks, “*Why does food rot?*” respond with, “*Well, I’m not sure. How shall we find out?*” This sends a powerful message — that knowing how to find an answer is as important as knowing the answer.

Ask open-ended questions that promote reflection and further questions. “*How*” and “*why*” questions work well: “*Why do you think that is?*” or “*How would we find out?*” Ask questions that encourage critical thinking, like: “*What evidence or observation leads you to that conclusion?*” Help your students develop theories and bring closure to their explorations and experiments by asking: “*How would you explain your results?*” and “*What theories can you think of to explain this?*”

**QuESTA Learning Cycle**

How students learn is as important as what they learn in the LiFE Curriculum Series. The questions that drive the modules and units in LiFE challenge students to explore, question, investigate, analyze, synthesize, and act. LiFE’s five-phase learning cycle, QuESTA, guides students through this process.

Students explore their prior knowledge and experiences related to the area of study and develop and refine meaningful questions to guide further inquiry. They also share their current conceptions about the topic so that any misconceptions can be addressed.
Students plan and conduct experiments to answer the questions within the area of study. Thus, students identify problems, state hypotheses, select methods, display results, and draw conclusions from these experiments to further their knowledge.

Students seek out other information already known about their topic through readings provided in the lessons, researching in the library or on the computer, and interviewing people.

Through thoughtful reflection and synthesis of what they have learned in the previous phases, students develop their own theories and constructs about how the world works. Students gain skills that enable them to articulate theories, give evidence to support their arguments, and appropriately challenge the theories of others.

Students apply the new constructs and processes they learned through the unit to decisions and actions they make each day. Students develop new questions to continue their exploration in the area of study. This phase of QuESTA is also an opportunity for you and your students to extend the LiFE activities. For example, in Lesson 2, as students learn about grapes, you may wish to have them investigate what climate grapes grow in, where the grapes they buy in their local market are grown, and how far the grapes have to travel to reach the market. Look for ideas for going further on the LiFE Web site (www.tc.edu/life).

Using QuESTA
The activities that focus on questioning, experimenting, and searching are engaging and often easy to implement in the classroom. Activities that call for students to theorize and apply to life help students refine their abilities to construct explanations and theories about what they have learned from their exploring and experimenting and to apply their learning to their daily lives. Pay special attention to the theorizing and application activities in the lessons. These activities will help you meet some important and challenging standards. The National Science Education Standards and the American Association for the Advancement of Science Project 2061 Benchmarks suggest that in addition to making observations, and designing and conducting investigations, students should:

• use logical reasoning and critical thinking to link evidence with explanations;
• use communication skills to describe observations, summarize results, articulate theories and constructs about how the world works, consider alternative explanations, and challenge the explanations proposed by others;
• apply scientific constructs and processes to everyday decisions and actions.

Assessment Strategies
Authentic assessment tasks provide students with opportunities to construct meaning from what they have learned. The LiFE Curriculum Series offers different assessment strategies to help you track your students’ progress. Many of these are integrated into the lessons.

Pre-Assessment
Lesson 4 serves as this module’s pre-assessment. Students answer the Module Question What is the system that gets food from farm to table, and how does this system affect the environment? As students respond to this question, remind them that they will not be graded on their answers. Encourage students to write down what they know and think now.

Post-Assessment
In Lesson 30, students revisit the Module Question, look at their responses to the question in the pre-assessment, and reflect on what they have learned. Make this post-assessment an exciting academic challenge for your students. As a teacher you not only want your students to know the content taught; you want them to be able to use their knowledge and skills in the real world.

Ongoing Assessment
Throughout the module, students have multiple opportunities to participate in full-class discussions, work and discuss materials in small groups, and present their work to the class. These interactions offer oppor-
**QUESTA PHASES AND ASSOCIATED TERMS**

This table includes terms for each phase of QuESTA. We developed these lists to help you and your students understand and differentiate among the types of action or activities appropriate for each phase. These terms are used throughout the teacher and student materials.

<table>
<thead>
<tr>
<th><strong>QUESTIONING</strong></th>
<th><strong>EXPERIMENTING</strong></th>
<th><strong>SEARCHING</strong></th>
<th><strong>THEORIZING</strong></th>
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...to assess how students are thinking about the topics being studied, their level of sophistication in what they are thinking and saying, and their ability to engage in discussions, debates, and scientific arguments with their peers. These ongoing assessments may be particularly helpful for students who are challenged by writing and public speaking. In each lesson, students write in their LiFE Logs, reflecting on what they have learned. This reflective writing gives students the freedom to express in their own words what they are learning in class. Often the LiFE Log assignment will be an answer to an open-ended question, which will help you assess how students have internalized what they learned in the lessons, how they made meaning of new concepts, and how they brought earlier ideas to bear on new understandings.