

TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

CORE AGRISCIENCE 9

Grade 9

Regional Agriscience & Biotechnology Program

2016

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**Core Agriscience 9
Grade 9
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The Trumbull Board of Education will continue to take Affirmative Action to ensure that no persons are discriminated against in its employment.

CORE VALUES AND BELIEFS

The Trumbull High School community engages in an environment conducive to learning which believes that all students will **read and write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities **that present problem-solving through critical thinking**. Students will use technology as a tool applying it to decision making. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION & PHILOSOPHY

The Trumbull Agriscience Program is a four-year sequence of instruction. The first two years are introductory and exploratory; students are exposed to the major areas within the broad field of agriculture and agriscience. Students select an area of concentration in which they will specialize during their junior and senior years.

Agriscience 9 covers all areas that are now being offered within the Agriscience program. A student enters the course at any of the four main units, and during the year has the opportunity to explore all four areas: agricultural mechanics, plant science, animal science, and agricultural biotechnology. In addition, the program focuses on the development of leadership and entrepreneurial skills, career preparation, and activities that allow students to apply their classroom learning in authentic situations.

The Trumbull Agriscience Program is based on a comprehensive agriscience model. This instructional triad model provides the agriscience student with appropriate classroom/laboratory instruction, personal development through FFA (intra-curricular) leadership activities, and Supervised Agricultural Experiences (SAE). These three components are integrated so they complement each other, illustrating the dynamic nature of the Agriscience program.

The classroom/laboratory experience is the foundation of the Agriscience program. With increased attention on connecting school-based and work-based learning, the instructional program teaches context as well as content in order to prepare the agriscience student for careers and lifelong learning.

FFA (intra-curricular) activities and award programs bring learning to life and allow students to apply knowledge and skills learned in the classroom and laboratory. This gives the agriscience student experience and practice in leadership development as he/she engages in a variety of competitive activities.

The Supervised Agricultural Experience program (SAE) is a work-based learning experience that helps prepare the agriscience student for useful, interesting and challenging careers. It provides both hands-on experience and career exploration.

COURSE GOALS

The following course goals derive from the 2014 Connecticut State Department of Education Agricultural Science and Technology Education Standards.

- CR-FS.01 Examine the importance of health management systems in organizations and their importance to performance and regulatory safety, and environmental compliance.
- CT-FS.02. Demonstrate those qualities, attributes, and skills necessary to succeed in, or further prepare for, a chosen career.
- CT-FS.03 Utilize economic principles to establish and manage an AFNR [Agriculture, Food, and Natural Resources] enterprise.
- CT-FS.04 Apply principles of environment science.
- CT-FS.05 Apply safety/health practices to AFNR worksites.
- CT-FS.06 Utilize and maintain tools used in AFNR.
- CT-FS.07 Utilize appropriate management planning principles in AFNR business enterprises.
- CT-FS.08 Utilize technology within AFNR.
- CT-FS.09 Utilize scientific inquiry as an investigative method.
- CT-FS.10 Compare and contrast issues affecting the AFNR industry.
- CT-FS.11 Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- CT-FS.12 Identify how key organizational structures and processes affect organizational performance and the quality of products and services.
- CT-LS.01 Acquire the skills necessary to positively influence others.
- CT-LS.02 Develop a skill set to enhance the positive evolution of the whole person.
- CT-LS.03 Demonstrate those qualities, attributes, and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society.
- CT-LS.04 Understand the concepts, strategies, and tools needed which contribute to premier leadership, personal growth, and career success through the participation in FFA.

The following course goals derive from the 2016 *FFA Manual*.

- CS-M Communication: Effectively interact with others in personal and professional settings.

- PG-H Social Growth: Successfully interact with others and adapt to various social situations.
- PL-A Action: Assume responsibility and take the necessary steps to achieve the desired results, no matter what the goal or task at hand.
- PL-D Character: Conduct oneself appropriately in relation to others regardless of the situation.
- CRP.01 Act as a responsible and contributing citizen and employee. Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others.
- CRP.02 Apply appropriate academic and technical skills. Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive.
- CRP.04 Communicate clearly, effectively, and with reason. Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods.
- CRP.09 Model integrity, ethical leadership and effective management. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem.

The following course goals derive from the 2010 Connecticut Core Standards.

- CCSS.ELA-Literacy.RI.9-10.3 Analyze how the author unfolds an analysis or series of ideas or events, including the order in which the points are made, how they are introduced and developed, and the connections that are drawn between them.
- CCSS.ELA-Literacy.W.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-Literacy.W.9-10.6 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
- CCSS.ELA-Literacy.SL.9-10.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.

COURSE SYLLABUS

Course Name

Core Agriscience 9

Level

Advanced College-Preparatory

Prerequisites

Intention to enroll in the full four-year Agriscience Program sequence. Active participation in FFA and a Supervised Agriscience Experience (SAE) program required.

Materials Required

None

General Description of the Course

Core Agriscience 9 is designed for students to explore the broad field of agriculture. This essential course emphasizes technical communication, processing, and college-ready skill enhancement necessary to progress through upper-level course work. Some of the areas that will be explored include, but are not limited to, the following: Plant Science, Animal Science, Food Science, Natural Resource and Environment, Agriculture Mechanics, and Agribusiness. All students are required to participate in the FFA and have a Supervised Agriscience Experience (SAE) program.

Assured Assessments

- Participation in the FFA
- Development of the SAE plan
- Quizzes, tests, and projects
- Active class participation
- Written and oral presentations
- Laboratory reports

Core Texts

- Burton, L. DeVere, and Elmer L. Cooper. *Agriscience: Fundamentals & Applications*. 2nd ed. New York: Delmar, 1995. Print.
- Herren, Ray V., and Elmer L. Cooper. *Agricultural Mechanics: Fundamentals & Applications*. 4th ed. New York: Delmar, 2002. Print.
- Kausch, Albert P. *The Way We Work with Life*. PowerPoint Educational Presentation, 2001. Print.
- Reiley, H. Edward, and Carroll L. Shry, Jr. *Introductory Horticulture*. 7th ed. Albany, NY: Delmar, 2007. Print.
- University of Nebraska Crop Lessons. UNLA Internet Educational Service.
- Current *FFA Student Handbook*

UNIT FFA & SAE

FFA & Supervised Agricultural Experience (SAE)

As part of Trumbull’s Regional Agriscience & Biotechnology Program, students are introduced to FFA and the Supervised Agricultural Experience (SAE) program, an ongoing Unit throughout Core Agriscience 9.

The FFA youth organization is an integral part of the Agriscience & Biotechnology Program. Through various activities, students develop skills in leadership and personal growth. They practice the leadership and human relations skills critical for personal growth and career success. They demonstrate interpersonal skills in teamwork, communications, human relations, and social interactions. The student experience is based on the FFA model, which provides incentives and recognition for outstanding achievement.

In Core Agriscience 9, the FFA/Leadership component is integrated into all four marking periods, with students participating in FFA meetings, leadership workshops, Agriscience field trips, fundraising activities, and other events sponsored by the Agriscience Program. Students spend time each marking period studying FFA/Leadership components using the FFA Student Handbook, meeting with FFA Officers from their chapter and from the State-level FFA organization, and classroom discussion led by their Agriscience teachers. FFA/Leadership participation is ten percent of a student’s grade each marking period and is based on each student’s attendance at one Chapter FFA meeting, and participation in two Agriscience-sponsored activities that marking period.

The FFA/Leadership component allows students to explore styles of leadership and qualities of successful leaders. They practice communication, problem-solving, and decision-making skills while learning about their roles in organizing and maintaining a successful FFA Chapter and in planning for their grades 9 and 10 Supervised Agricultural Experience Program.

Their fourth quarter, students begin looking at and planning their Supervised Agricultural Experience (SAE). An SAE is a work-based learning experience to help prepare students for useful, interesting and challenging careers. The four main categories of SAE are: Exploratory, Research/Experimentation and Analysis, Ownership/Entrepreneurship, and Placement. See details in the Appendix of this Curriculum Guide. The SAE plan is 10% of the student’s fourth-quarter grade.

Unit Goals

At the completion of this unit, students will:

- | | |
|------|---|
| CS-M | Communication: Effectively interact with others in personal and professional settings. |
| PG-H | Social Growth: Successfully interact with others and adapt to various social situations. |
| PL-A | Action: Assume responsibility and take the necessary steps to achieve the desired results, no matter what the goal or task at hand. |

PL-D	Character: Conduct oneself appropriately in relation to others regardless of the situation.
CCSS.ELA-Literacy.RI.9-10.3	Analyze how the author unfolds an analysis or series of ideas or events, including the order in which the points are made, how they are introduced and developed, and the connections that are drawn between them.
CCSS.ELA-Literacy.W.9-10.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-Literacy.W.9-10.6	Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
CCSS.ELA-Literacy.SL.9-10.6	Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
CRP.01	Act as a responsible and contributing citizen and employee. Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others.
CRP.02	Apply appropriate academic and technical skills. Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive.
CRP.04	Communicate clearly, effectively, and with reason. Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods.
CRP.09	Model integrity, ethical leadership and effective management. Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem.

Unit Essential Questions

- What personal, leadership, and career development skills can be developed through participation in FFA?
- What careers are available in the agricultural industry?

Scope and Sequence

- Practice of opening/closing ceremonies and speaking/writing the FFA Creed paragraphs within the class
- Participation in FFA activities in which students not only learn new things but meet other students
- Participation in FFA activities such as a dog wash or a plant sale
- Participation in FFA activities such as a Fall Festival or Farm Fair
- Reading of the *FFA Student Handbook* and relevant agriscience readings
- Creation of a career project or organized notebook
- Finding and gaining of an appropriate SAE project

Assured Assessments

- Announced and unannounced quizzes and tests
- Reference readings, exercises, and worksheets
- Notebook checks
- Career projects scored with the weight of a test
- Homework assignments and quizzes related to the FFA Creed
- The SAE plan (10% of fourth-quarter grade)

Resources

Core

- Current *FFA Student Handbook*. Print.

Time Allotment

- Each marking period, 5 days of the class should be devoted to FFA and/or SAE:

Marking Period 1

FFA mission, motto, 3-circle structure	1 day
FFA emblem	1 day
FFA meeting (opening & closing)	1 day
FFA official dress	1 day
Proficiency Areas	1 day

Marking Period 2

FFA Creed paragraph 1	1 day
FFA Creed paragraph 2	1 day
FFA Creed paragraph 3	1 day
FFA Creed paragraph 4	1 day
FFA Creed paragraph 5	1 day

Marking Period 3

Greenhand Degree	5 days
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Marking Period 4

SAE plan development	5 days
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UNIT 1

Agricultural Mechanics

In the Unit, students will develop skills in basic hand tool identification and use. They will practice proper safety, identification, and use of hand tools through hands-on projects. They will demonstrate interpersonal skills in teamwork, communications, human relations, and social interactions as they apply to a working “shop” environment. Students will be introduced to the many career opportunities ahead of them in an area related to agricultural mechanics.

Students will learn how a workshop is set up to provide maximum safety and efficiency. The main focus is hand tool identification, safety and use, providing a foundation for future concepts and techniques. In addition, students are given background on the “old world” process of tooling and the new and emerging technologies discovered every day.

Unit Goals

At the completion of this unit, students will:

1. Understand the concepts, tools, and strategies for proper fire safety and fire prevention in a workshop.
2. Understand the potential for personal injury in a workshop and agricultural setting, and the strategies and techniques used to prevent personal injury.
3. Interpret appropriate material safety data sheets for given substances.
4. Develop proper measuring skills and understand the importance of taking accurate measurements when working on a project.
5. Develop basic skills in identification and safe use of hand tools found in a workshop.
6. Determine how mechanical skills, concepts, and principles are used in agriculture and related occupations.
7. Identify, choose, and apply appropriate finishing techniques for a given project.
8. Develop communication and interpersonal skills with others in a work environment.

Unit Essential Questions

- What is Agricultural Mechanics?
- How does Agricultural Mechanics relate to me, my community, the United States, and the world?
- What safety measures need to be taken in the agricultural setting?
- Which tools are appropriate for certain tasks in Agricultural Mechanics?
- How can mechanical information be evaluated, mapped, and communicated?
- What steps are involved in creating a project completely by hand?
- What mechanics-based careers exist in the agricultural industry?

Scope and Sequence

1. Class discussion of fire safety with handouts, visual aids, and walking tour of workshop
2. Class discussion of personal safety, hazards and safeguards in our workshop, hazards and safeguards in the agriscience industry, accident prevention, and response to accidents
3. Class discussion and annotation of MSDS examples
4. Class discussion of layout tools and how to use them; practice reading and drawing with rulers; measuring tasks

5. Class discussion and hands-on practice with layout tools
6. Class discussions and career exploration project
7. Class discussion and demonstration of available finishes and proper techniques
8. Use of appropriate communication skills to work with others in a workshop

Assured Assessments

1. Successful completion of fire safety quiz
2. Successful completion of personal safety quiz with signature of parent/guardian; various writing prompts
3. Completion of MSDS poster assignment
4. Successful completion of measurement quiz; various drawings completed by hand; participation in measurements relay
5. Student use of tools through various projects and successful completion of hand tool identification quiz
6. Completion of individual agricultural mechanics career exploration project
7. Completion of two shop projects
8. Class participation during discussions and effective skills shown throughout the unit that a student can productively work with others

Resources

Core

- Herren, Ray V., and Elmer L. Cooper. *Agricultural Mechanics: Fundamentals & Applications*. 4th ed. New York: Delmar, 2002. Print.

Time Allotment

- One marking period 45 days

	Introduction	2 days
1./2.	Personal, shop, & fire safety	5 days
3.	MSDS	1 day
4.	Drawings & sketches	2 days
5.	Measuring	4 days
6.	Tool identification	4 days
7.	Projects & finishing	20 days
8.	Career opportunities in agricultural mechanics	2 days
	FFA	5 days

UNIT 2

Plant Science

This Unit is the ninth-grade agriscience student's first exposure to the study of plant science. The goal of the unit is to expose students to the importance of plant science and horticulture in their lives. Also, the concepts, terminology, and skills learned by students in this unit will be used in the sophomore and later years for more advanced plant technology concepts.

Unit Goals

At the completion of this unit, students will:

1. Discuss the aesthetic and economic importance that plants have on our lives and society.
2. Research career opportunities in plant science technology.
3. Identify the structures and functions of plant parts.
4. Classify and name plants using the binomial plant classification system.
5. Select and use appropriate techniques to demonstrate methods of plant propagation.
6. Explore new trends and emerging techniques in plant science technology.

Unit Essential Questions

- Why is it important that we learn about plant science technology?
- What are the important plant parts that we need to know in order to understand plant science technology?
- How are plants named and classified?
- How can we increase the numbers of specific plants so they can be studied, sold, or used for ornamental design?
- What career opportunities exist in the plant science and horticulture areas?
- What plant science technologies will affect our lives in the future?

Scope and Sequence

1. Class discussion based on state and national data related to the plant science and horticulture industries
2. Use of career materials and Internet websites (e.g., National FFA, *Occupational Outlook Handbook*) to identify and research careers related to plant science technology
3. Use of visual and stereomicroscopic techniques to identify structures in plant leaves, flowers, roots, and stems
4. Use of dichotomous plant identification keys to identify unknown plant species marketed through the Agriscience Program; collection and identification of outdoor plants around the students' residences
5. Demonstration of the following plant propagation techniques using video resources and demonstrations in the Agriscience greenhouses and plant tissue culture lab:
 - Softwood cuttings with greenhouse and house plants
 - Hardwood cuttings of outdoor plants
 - Division and separation of perennials
 - Sexual propagation via seeds
 - Micropropagation or plant tissue culture

6. Use of the school's hydroponic projects; demonstration of plant tissue culture techniques using online resources including YouTube videos and news from current plant industry online newsletters

Assured Assessments

1. Written essay on effects of plant technology on students' daily lives
2. PowerPoint presentation on identified plant science careers
3. Student drawings and identifications of plant parts and structures; quiz on plant anatomy
4. Correct identification of twenty different plants using both binomial and common names; use of both binomial and common names to correctly identify ten plants growing in or around students' homes
5. Plant propagation projects to be assessed by students' use of proper technique and the success rates of the propagation; quiz on plant propagation techniques
6. Oral presentation with visuals

Resources

Core

- Reiley, H. Edward, and Carroll L. Shry, Jr. *Introductory Horticulture*. 7th ed. Albany, NY: Delmar, 2007. Print.

Time Allotment

- One marking period 45 days
 - Introduction 2 days
 - 1. Introduction of plant science to society 4 days
 - 2. Career opportunities in plant science technology 5 days
 - 3. Plant anatomy 8 days
 - 4. Plant taxonomy 4 days
 - 5. Plant propagation 12 days
 - 6. New and emerging plant science technologies 5 days
 - FFA 5 days

UNIT 3

Animal Science

This Unit, designed as exploratory instruction in the animal sciences, serves as a foundation for a study of the world of livestock, equine, laboratory animals, and companion animals. First, the classroom/laboratory component of the course focuses on animal science terms; the animal industry as it applies to the State of Connecticut and the United States; the humane treatment of animals; careers in animal science; animal feeding, care, and management of the animals on the school farm; cost of food and the farmer's share of the food dollar; animal contribution to human needs; and animal identification. Second, the FFA component emphasizes the development of leadership skills, personal growth, and career success through class, chapter, state and national activities. Career Development Events (CDEs) and Career Leadership Events (CLEs) provide opportunities to develop life skills. Third, the Supervised Agricultural Experience (SAE) program component is a planned, supervised, work-based application of concepts and skills learned in agricultural education instruction. The premise behind the SAE is to motivate students to see the real-world connections between what they are learning and what they will be doing when they graduate.

Unit Goals

At the completion of this unit, students will:

1. Recognize the importance of animals and their influence on society.
2. Describe the global utilization of Connecticut's food, fiber, and related agricultural occupations.
3. Recognize common breeds of animals, including both farm and companion animals.
4. Be acquainted with and use terms associated with animal science
5. Compare and contrast characteristics of common farm animals, including dairy and beef cattle, sheep, swine, horses, goats, and rabbits.
6. Identify and describe the products obtained from beef and dairy cattle, their breed characteristics and history, and nutritional and health requirements.
7. Investigate the characteristics, nutritional needs and health requirements, and consumer uses of various farm and companion animals.
8. Know the factors determining prices, expenses, and profits.
9. Investigate careers in animal science, knowing the personal and educational qualifications, training required, and employment opportunities.
10. Begin to develop a Supervised Agricultural Experience (SAE) related to animal science.

Unit Essential Questions

- What is animal science?
- In what ways do animals affect the quality of life?
- How do animals play a multi-faceted role in sustaining and improving the quality of human life?
- How do animals contribute to human needs?

Scope and Sequence

1. Reading of “Animal Contributions to Human Needs”; classroom discussion of economic and social value of animals in human society and the role of organizations such as humane societies and People for the Ethical Treatment of Animals (PETA)
2. Orientation to and discussion of Connecticut’s agricultural base as it relates to animal agriculture; attendance at either The Big E or the Durham Fair
3. Lecture and discussion on characteristics of “ideal” body types of farm animals; compilation of information on farm animals from farm tour or fair visit; research of animals’ nutritional requirements
4. Compilation of a glossary of animal science terms
5. Small-group activity in which students conduct Internet research to review animal characteristics and the rearing and management programs or operations for each species; worksheet on the ruminant digestive system
6. Lecture and discussion on the dairy and beef industries: terms associated with the industries and products; film *The Amazing Ruminant Animal*; origin and background of the breeds; genetic principles concerning breed color
7. Industry handout “Good Things from Beef Cattle”; Internet research and classroom discussion on various breed groups
8. Film *Are Food Prices Too High? Compared to What?*; collection, analysis, and graphing of animal economic information
9. Lecture and discussion on career opportunities related to animal science, including development of career portfolio
10. Lecture and discussion on SAE requirement; handouts and online and other research to obtain career information, including www.FFA.org to research awards and financial support from FFA; chapter, state, and national programs; and scholarships

Assured Assessments

1. Completion of questions, graphing, and quiz related to “Animal Contributions to Human Needs”; participation in classroom discussion through thoughtful and critical questions and answers regarding animal agriculture
2. Questionnaire related to The Big E or the Durham Fair
3. Completion of the Farm Tour handout, and related quiz
4. Accurate use in discussion of the terms related to animal characteristics and care
5. Group project involving Venn diagram of animal characteristics; completion of worksheet questions
6. Quiz on beef and dairy cattle
7. Student research on assigned animal groups
8. Completion of *Are Food Prices Too High? Compared to What?* Exercise
9. Development of career portfolio based on rubric
10. Successful search for online SAE information and development of summer SAE proposal

Resources

Core

- Burton, L. DeVere, and Elmer L. Cooper. *Agriscience: Fundamentals & Applications*. 2nd ed. New York: Delmar, 1995. Print.

Time Allotment

- One marking period 45 days
 - Introduction 4 days
 - Farm tour 3 days
 - Animal contributions to human needs 5 days
 - Livestock industry in Connecticut and the entire United States 4 days
 - Terms associated with various animals 3 days
 - (Non) ruminant digestive systems 3 days
 - Overview of the dairy industry and products 3 days
 - Good things from beef, lamb, and pork 2 days
 - Animal health, nutrition, and genetics 5 days
 - Student research about an animal species 3 days
 - FFA/Supervised Agricultural Experience program 6 days
 - Career exploration in animal science 4 days

UNIT 4

Agricultural Biotechnology

This Unit's grade 9 introduction to agricultural biotechnology serves as a foundation for a study of the world of genetics, molecular biology, genetic engineering, and bioinformatics. The classroom/laboratory component of the course focuses on obtaining an understanding of the history of agricultural biotechnology and its place in the students' life experience. Students will also achieve a preliminary exposure to cellular reproduction and nucleic acid synthesis. Second, the FFA component emphasizes the development of leadership skills, personal growth, and career success through class, chapter, state, and national activities. Finally, the Supervised Agricultural Experience (SAE) program component is a planned, supervised, work-based application of concepts and skills learned in agricultural education instruction. The premise behind the SAE is to motivate students to see the real-world connections between what they are learning and what they will be doing when they graduate

Unit Goals

At the completion of this unit, students will:

1. Recognize the importance of agricultural biotechnology and its influence on society.
2. Understand the historical development of agricultural biotechnology and its impact on societal advancement.
3. Compare and contrast prokaryotic and eukaryotic cell anatomy.
4. Understand modern consumer applications of biotechnology.
5. Explore the processes involved in DNA replication and protein synthesis from mRNA synthesis to protein production.
6. Investigate the gene therapy applications of adult pluripotent stem cells and CRISPER Cas-9 technologies.
7. Explore the technologies involved in biotechnology analysis and applications, including gel electrophoresis, PCR, Southern blot analysis, and plasmid insertion.
8. Investigate current commercial applications of modern biotechnology.
9. Investigate the importance of genetically modified organisms and the processes involved in their production.
10. Discuss the concerns being voiced regarding ethical issues related to agricultural biotechnology.
11. Investigate careers in biotechnology, including personal and educational qualifications, required training, and employment opportunities.
11. Understand the history and mission of FFA and begin to develop a Supervised Agricultural Experience (SAE) program.

Unit Essential Questions

- What are the benefits of biotechnology for humans and for the environment?
- How are basic principles of molecular biology exploited to create powerful tools for biotechnology?
- What ethical issues arise from advances in biotechnology, and how are they mitigated?

Scope and Sequence

1. Classroom discussions of economic and social value of agricultural biotechnology and its applications in human society.
2. Compilation of timeline of significant historical events in agricultural biotechnology
3. Use and discussion of terms related to cellular anatomy and cell function; Venn diagram of similarities and differences between cell types
4. Lecture on food, fiber, pharmaceutical, and engineering-based products used on a daily basis that come from agricultural biotechnology
5. Lecture and discussion on the principles of DNA replication and protein synthesis; student teamwork to produce DNA models using craft beads and pipe cleaners
6. Lecture and discussion on APSC technology and CRISPER discovery and applications to medicine and gene therapy; relevant TED Talks
7. Explanation and demonstration of equipment involved in biotechnology research, including micropipetters and gel electrophoresis separation technology
8. Classroom discussions of technologies involved in genome sequencing and nucleic acid blotting, including evaluation of technologies involve PCR and RT PCR
9. Classroom discussions of impact of GMOs in crop production
10. Lecture and discussion on ethical dilemmas related to applications of agricultural biotechnology, including pro/con discussion
11. Discussion of various options related to careers in agricultural biotechnology, including job opportunities and educational requirements
12. Discussion of the mission of FFA education and the duties of members at FFA meetings; review of appropriate information in *FFA Student Handbook*

Assured Assessments

1. Participation in classroom discussion through thoughtful and critical questions and answers regarding biotechnology in agriculture; relevant written answers and quiz
2. Written answers to questions on class handouts; quiz
3. Venn diagram comparing and contrasting prokaryotic and eukaryotic cell anatomy
4. Written answers to quiz questions
5. Laboratory report on DNA synthesis activity
6. Written and oral answers to questions on this Unit module
7. Laboratory report on electrophoresis separation of negatively charged dyes
8. Written answers to questions associated with Unit module
9. Written answers to questions associated with Unit module on gene insertion technologies and applications
10. Written answers to quiz questions on issues of importance in agricultural biotechnology ethics
11. Careers roundtable discussion in class
12. Written answers to quiz questions on appropriate FFA topics

Resources

Core

- Kausch, Albert P. *The Way We Work with Life*. PowerPoint Educational Presentation, 2001. Print.
- University of Nebraska Crop Lessons. UNLA Internet Educational Service.

Time Allotment

- One marking period 45 days
 1. Introduction to agricultural biotechnology 2 days
 2. History of agricultural biotechnology 2 days
 3. Prokaryotic and eukaryotic cell anatomy 2 days
 4. Applications of agricultural biotechnology 4 days
 5. DNA replication and protein synthesis 5 days
 6. Adult stem cell and CRISPER Cas-9 technology 3 days
 7. Principles of DNA sequencing and gene transfer 7 days
 8. Tools and techniques of biotechnology 5 days
 9. Genetically modified organisms 5 days
 10. Ethics of agricultural biotechnology 2 days
 11. Career exploration in agricultural biotechnology 2 days
 12. FFA/Supervised Agricultural Experience program 6 days

COURSE CREDIT

One credit
One class period daily for a full year

PREREQUISITES

Entrance into the Trumbull Regional Agriscience & Biotechnology Program.

ASSURED STUDENT PERFORMANCE RUBRICS

- Trumbull High School School-Wide Writing Rubric
- Trumbull High School School-Wide Problem-Solving Rubric
- Trumbull High School Independent Learning and Thinking Rubric

SCHOOL-WIDE RUBRICS

Rubric 2: Write Effectively

Category/ Weight	Exemplary 4 Student work:	Goal 3 Student work:	Working Toward Goal 2 Student work:	Needs Support 1-0 Student work:
Purpose X_____	<ul style="list-style-type: none"> • Establishes and maintains a clear purpose • Demonstrates an insightful understanding of audience and task 	<ul style="list-style-type: none"> • Establishes and maintains a purpose • Demonstrates an accurate awareness of audience and task 	<ul style="list-style-type: none"> • Establishes a purpose • Demonstrates an awareness of audience and task 	<ul style="list-style-type: none"> • Does not establish a clear purpose • Demonstrates limited/no awareness of audience and task
Organization X_____	<ul style="list-style-type: none"> • Reflects sophisticated organization throughout • Demonstrates logical progression of ideas • Maintains a clear focus • Utilizes effective transitions 	<ul style="list-style-type: none"> • Reflects organization throughout • Demonstrates logical progression of ideas • Maintains a focus • Utilizes transitions 	<ul style="list-style-type: none"> • Reflects some organization throughout • Demonstrates logical progression of ideas at times • Maintains a vague focus • May utilize some ineffective transitions 	<ul style="list-style-type: none"> • Reflects little/no organization • Lacks logical progression of ideas • Maintains little/no focus • Utilizes ineffective or no transitions
Content X_____	<ul style="list-style-type: none"> • Is accurate, explicit, and vivid • Exhibits ideas that are highly developed and enhanced by specific details and examples 	<ul style="list-style-type: none"> • Is accurate and relevant • Exhibits ideas that are developed and supported by details and examples 	<ul style="list-style-type: none"> • May contain some inaccuracies • Exhibits ideas that are partially supported by details and examples 	<ul style="list-style-type: none"> • Is inaccurate and unclear • Exhibits limited/no ideas supported by specific details and examples
Use of Language X_____	<ul style="list-style-type: none"> • Demonstrates excellent use of language • Demonstrates a highly effective use of standard writing that enhances communication • Contains few or no errors. Errors do not detract from meaning 	<ul style="list-style-type: none"> • Demonstrates competent use of language • Demonstrates effective use of standard writing conventions • Contains few errors. Most errors do not detract from meaning 	<ul style="list-style-type: none"> • Demonstrates use of language • Demonstrates use of standard writing conventions • Contains errors that detract from meaning 	<ul style="list-style-type: none"> • Demonstrates limited competency in use of language • Demonstrates limited use of standard writing conventions • Contains errors that make it difficult to determine meaning

Rubric 3: Problem Solving through Critical Thinking

Category/Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Understanding X_____	Student demonstrates clear understanding of the problem and the complexities of the task	Student demonstrates sufficient understanding of the problem and most of the complexities of the task	Student demonstrates some understanding of the problem but requires assistance to complete the task	Student demonstrates limited or no understanding of the fundamental problem after assistance with the task
Research X_____	Student gathers compelling information from multiple sources including digital, print, and interpersonal	Student gathers sufficient information from multiple sources including digital, print, and interpersonal	Student gathers some information from few sources including digital, print, and interpersonal	Student gathers limited or no information
Reasoning and Strategies X_____	Student demonstrates strong critical thinking skills to develop a comprehensive plan integrating multiple strategies	Student demonstrates sufficient critical thinking skills to develop a cohesive plan integrating strategies	Student demonstrates some critical thinking skills to develop a plan integrating some strategies	Student demonstrates limited or no critical thinking skills and no plan
Final Product and/or Presentation X_____	Solution shows deep understanding of the problem and its components. Solution shows extensive use of 21st Century Technology Skills.	Solution shows sufficient understanding of the problem and its components. Solution shows sufficient use of 21st Century Technology Skills.	Solution shows some understanding of the problem and its components. Solution shows some use of 21st Century Technology Skills.	Solution shows limited or no understanding of the problem and its components. Solution shows limited or no use of 21st Century Technology Skills.

Rubric 5: Independent Learners And Thinkers

Category/Weight	Exemplary 4	Goal 3	Working Toward Goal 2	Needs Support 1-0
Proposal X_____	Student demonstrates a strong sense of initiative by generating compelling questions, creating uniquely original projects/work.	Student demonstrates initiative by generating appropriate questions, creating original projects/work.	Student demonstrates some initiative by generating questions, creating appropriate projects/work.	Student demonstrates limited or no initiative by generating few questions and creating projects/work.
Independent Research & Development X_____	Student is analytical, insightful, and works independently to reach a solution.	Student is analytical, and works productively to reach a solution.	Student reaches a solution with direction.	Student is unable to reach a solution without consistent assistance.
Presentation of Finished Product X_____	Presentation shows compelling evidence of an independent learner and thinker. Solution shows deep understanding of the problem and its components. Solution shows extensive and appropriate application of 21 st Century Skills.	Presentation shows clear evidence of an independent learner and thinker. Solution shows adequate understanding of the problem and its components. Solution shows adequate application of 21 st Century Skills.	Presentation shows some evidence of an independent learner and thinker. Solution shows some understanding of the problem and its components. Solution shows some application of 21 st Century Skills.	Presentation shows limited or no evidence of an independent learner and thinker. Solution shows limited or no understanding of the problem. Solution shows limited or no application of 21 st Century Skills.

TYPES OF SAEs

Exploration

Students broaden and then clarify their interests in agriscience and the environment through carefully planned experiences. Exploratory SAEs are a foundation for research, ownership, and placement.

Examples:

- Assist on a farm for a day
- Shadow a veterinarian
- Observe a florist
- Interview an agribusiness salesperson
- Tour a fish hatchery
- Interview a veterinarian about animal health careers
- Visit with a local grocery store manager and learn about retail food careers
- Volunteer for community-based activities

Research/Experimentation and Analysis

Students conduct carefully planned, curriculum-based and long-term investigations of applied or basic areas related to agricultural and environmental science.

Examples:

- Water and soil analysis
- Evaluation of media for tissue culture
- Plan and conduct agricultural experiments in biotechnology agriscience and other courses
- Determine the impact of protein levels on fish growth.
- Analyze display effectiveness on garden center plant sales.
- Grow plants in a milk jug “greenhouse”

Ownership/Entrepreneurship

Students create and/or own agricultural businesses to meet unique market needs.

Examples:

- Raise ornamental fish
- Own and operate a lawn care service
- Grow and sell poinsettias or other flowers
- Operate a roadside stand
- Raise small animals or livestock
- Create agriculturally-themed artwork and sell it
- Grow apples and make jam from fruit

Placement

A student works for a specific business to develop career skills in agricultural or environmental areas, and does not require earning a wage. Placement can be at a for-profit or a non-profit organization.

Examples

- Sell farm supplies
- Work as a riding stable attendant
- Secure an apprenticeship with a landscaper
- Work as an apprentice to a biotechnology technician
- Propagate plants for a nursery
- Work on a farm (crop or livestock)
- Work in a fish hatchery
- Work at a farm supply store
- Form an internship arrangement with a local business or farm