Indiana CTE

Agriculture, Food and Natural Resources

Agricultural, Food and Natural Resources, Agri-Science- Plants or Animals

I **Principles of Agriculture** 7117

a Domain: AFNR Systems 7117.D1

1 Describe the role of agriculture in US and global societies through the domestication and distribution of the world's important crop and livestock species. 7117.D1.1

2 Recognize the diversity of AFNR systems in the US and the world. 7117.D1.2

3 Understand the size and productivity of farms and ranches in the US and around the world. 7117.D1.3

4 Understand US production systems for major grain crops, including Crop Rotation Systems, Tillage Systems, Variety Selection, and Harvest and grain storage technology. 7117.D1.4

5 Understand US production systems for major livestock animals. 7117.D1.5

6 Research, examine, and discuss issues and trends that impact AFNR systems on local, state, national and global levels. 7117.D1.6

7 Examine technologies and analyze their impact on AFNR systems. 7117.D1.7

b Domain: Agribusiness 7117.D2

1 To have students develop an understanding of how economics relates to agriculture, and how economic principles are used to analyze and solve problems in agriculture and agribusiness. 7117.D2.1

2 To have students understand the structure of the U.S. Agriculture and how agriculture interacts with the aggregate economic system. 7117.D2.2

3 To have students recognize the role of producers, input suppliers, food marketing organizations, and consumers in the U.S. Agricultural economy. 7117.D2.3

4 Help students understand the qualities and characteristics employers in agribusiness expect in prospective employees and how students can develop those qualities and characteristics. 7117.D2.4

5 Describe the diversity of jobs and careers in agricultural industries in Indiana and the US. 7117.D2.5

c Domain: Safety, Health, and Environment Management Systems 7117.D3

1 Identify and explain the implications of required regulations to maintain and improve safety, health and environmental management systems. 7117.D3.1

2 Summarize the importance of safety, health and environmental management in the workplace. 7117.D3.2

3 Use appropriate protective equipment and demonstrate safe and proper use of AFNR tools and equipment. 7117.D3.3

d Domain: Careers 7117.D4

1 Evaluate the nature and scope of AFNR systems in society and the economy 7117.D4.1

2. Describe career opportunities and means to achieve those opportunities in AFNR systems 7117.D4.2
3. Identify how key organizational structures and processes affect organizational performance and the quality of products and services 7117.D4.3
4. Demonstrate those qualities, attributes, and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society. 7117.D4.4

e. Domain: Leadership 7117.D5
1. Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings 7117.D5.1
2. Recognize and explain the role of the FFA in the development of leadership, education, employability, communications, and human relations skills 7117.D5.2
3. Examine roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment 7117.D5.3
4. Acquire the skills necessary to positively influence others 7117.D5.4
5. Develop a skill set to enhance the positive evolution of the whole person 7117.D5.5

f. Domain: Supervised Agriculture Experience (SAE) 7117.D6
1. Explain the nature of and become familiar with those terms related to an SAE program. 7117.D6.1
2. Explore the numerous possibilities for an SAE program which a student might develop. 7117.D6.2
3. Develop an individual SAE program and implementation plan for record keeping skills. 7117.D6.3

II Animal Science 5008

a Domain: Historic and Current Trends in the Animal Systems Industry 5008.D1

1. Students evaluate the implications of animal origin and analyze common animal production methods from both producer and global perspectives. 5008.D1.1
2. Evaluate and describe characteristics of animals that developed in response to the animal's environment and led to their domestication. 5008.D1.2
3. Describe the historical and scientific developments of different animal industries and summarize the products, services and careers associated with each. 5008.D1.3
4. Explain the role of animal agriculture within the food system in meeting food and nutritional security. 5008.D1.4
5. Analyze the impact of animal production methods on end product qualities (e.g., price, sustainability, marketing, labeling, animal welfare, etc.) 5008.D1.5
6. Calculate costs of marketing versus predicted increases in sales 5008.D1.6
7. Analyze and evaluate the accuracy and effectiveness of records used in an animal system business. 5008.D1.7
8. Analyze the structure of laws governing animal industries, international trade and animal production policies. 5008.D1.8
9. Analyze the local and global impact of sustainable animal agriculture practices on human and environmental systems. 5008.D1.9

b Domain: Animal Husbandry and Welfare 5008.D2

1. Students demonstrate management techniques that ensure animal welfare and analyze procedures to ensure animal safety while maintaining safe animal products. 5008.D2.1
2. Design production plans that assure the welfare of animals and prevent abuse or mistreatment 5008.D2.2
3. Analyze and document animal welfare procedures used to ensure safety and maintain low stress when moving and restraining animals. 5008.D2.3
4. Analyze and document animal husbandry practices and their impact on animal welfare. 5008.D2.4
5. Utilize tools, technology, and equipment to perform animal husbandry and welfare tasks. 5008.D2.5
6. Analyze consumer concerns with animal production practices relative to human health. 5008.D2.6
7. Analyze and summarize the impact of animal trace-back capabilities on producers and consumers. 5008.D2.7

c Domain: Animal Nutrition 5008.D3

1. Students analyze the nutritional needs of animals and evaluate feed rations for effectiveness. 5008.D3.1

2. Differentiate between nutritional requirements of animals in different growth stages and production systems (e.g., growth, maintenance, gestation, natural, organic, etc.). 5008.D3.2
3. Correlate a species' nutritional needs to feedstuffs that could meet those needs. 5008.D3.3
4. Determine the relative nutritional value of feedstuffs by evaluating their general quality and condition. 5008.D3.4
5. Appraise the adequacy of feed rations using data from the analysis of feedstuffs, animal requirements and performance. 5008.D3.5
6. Compare and contrast methods that utilize feed additives and growth promotants with production practices that do not, (e.g., organic versus conventional production methods). 5008.D3.6
7. Utilize tools and equipment to perform animal nutrition tasks. 5008.D3.7
8. Analyze and apply information from a feed label and feeding directions to feed animals. 5008.D3.8
9. Analyze technologies used to provide animal nutrition and summarize their potential benefits and consequences. 5008.D3.9

d. Domain: Animal Reproduction 5008.D4

1. Students evaluate animals for reproduction readiness and soundness and apply scientific principles to breeding programs. 5008.D4.1
2. Analyze the functions of major organs in the male and female reproductive systems. 5008.D4.2
3. Assess and describe factors that lead to reproductive maturity. 5008.D4.3
4. Evaluate reproductive problems that occur in animals. 5008.D4.4
5. Compare and contrast the use of genetically superior animals in the production of animals and animal products. 5008.D4.5
6. Demonstrate how to determine probability trait inheritance in animals. 5008.D4.6
7. Analyze how DNA analysis can detect genetic defects in breeding stock 5008.D4.7
8. Analyze the care needs for breeding stock in each stage of growth. 5008.D4.8
9. Calculate the potential economic benefits of natural versus artificial breeding methods. 5008.D4.9
10. Develop an understanding of artificial insemination, embryo transfer, and cloning. 5008.D4.10
11. Analyze the processes of major reproductive management practices, including estrous synchronization, superovulation, flushing and embryo transfer. 5008.D4.11
12. Compare and contrast quantitative breeding value differences between genetically superior animals and animals of average genetic value. 5008.D4.12

e Domain: Environmental Considerations of Animals 5008.D5

1 Design animal housing, equipment, and handling facilities for the major systems of animal production. 5008.D5.1

2 Critique designs for an animal facility and prescribe alternative layouts and adjustments for the safe, sustainable and efficient use of the facility. 5008.D5.2

3 Analyze the use of modern equipment, technology and handling facility procedures and determine if they enhance the safe, economic, and sustainable production of animals. 5008.D5.3

4 Analyze animal facilities to determine if standards have been met. 5008.D5.4

5 Analyze the structure of laws pertaining to animal systems. 5008.D5.5

f Domain: Anatomy and Physiology 5008.D6

1 Classify animals according to taxonomic classification systems and use (e.g., agricultural, companion, etc.). 5008.D6.1

2 Explain how animals are classified using a taxonomic classification system. 5008.D6.2

3 Appraise and evaluate the economic value of animals for various applications in the agriculture industry. 5008.D6.3

4 Analyze the visual characteristics of an animal or animal product and select correct classification terminology when referring to companion and production animals. 5008.D6.4

5 Apply principles of comparative anatomy and physiology to uses within various animal systems. 5008.D6.5

6 Analyze the functions of each animal cell structure. 5008.D6.6

7 Analyze the processes of meiosis and mitosis in animal growth, development, health, and reproduction. 5008.D6.7

8 Compare and contrast animal cells, tissues, organs, body system types and functions among animal species. 5008.D6.8

9 Select and train animals for specific purposes and maximum performance based on anatomy and physiology. 5008.D6.9

10 Compare and contrast desirable anatomical and physiological characteristics of animals within and between species. 5008.D6.10

11 Compare and contrast procedures to sustainably and efficiently develop an animal to reach its highest performance potential with respect to its anatomical and physiological characteristics. 5008.D6.11

12 Evaluate and select products from animals based on industry standards. 5008.D6.12

g Domain: Animal Health and Safety 5008.D7

1 Students design programs to prevent animal diseases, parasites and other disorders and analyze biosecurity measures utilized to ensure animal welfare. 5008.D7.1

2 Describe and demonstrate the proper use and function of specific tools and technology related to animal health management. 5008.D7.2

3 Perform simple health-check evaluations on animals and practice basic emergency response procedures related to animals. 5008.D7.3

4 Identify and describe common illnesses and disorders of animals based on symptoms and problems caused by wounds, diseases, parasites and physiological disorders. 5008.D7.4

5 Research and analyze data to evaluate preventive measures for controlling and limiting the spread of diseases, parasites, and disorders among animals. 5008.D7.5

6 Assess the safety and effectiveness of facilities and equipment used for surgical and nonsurgical veterinary treatments and procedures. 5008.D7.6

7 Analyze procedures at the local, state, and national levels to ensure biosecurity of the animal industry. 5008.D7.7

8 Analyze the health risk of different zoonotic diseases to humans and identify prevention methods. 5008.D7.8

h Domain: Environmental Impacts of Animal Agriculture 5008.D8

1 Students design and evaluate environments for animals to promote animal health and husbandry. 5008.D8.1

2 Assess the effectiveness of methods of reducing the effects of animal agriculture on the environment. 5008.D8.2

3 Critique the reliability and validity of evidence presented to support claims regarding the effects of environmental conditions on animal populations and performance (e.g., population changes, emerging species, extinction, etc.). 5008.D8.3

4 Implement and evaluate the effectiveness of methods to ensure optimal environmental conditions for animals. 5008.D8.4

i Domain: Biotechnology in Animal Agriculture 5008.D9

1 Investigate and explain the roles and issues of biotechnology in animal agriculture. 5008.D9.1

2 Research and summarize the evolution of biotechnology in animal agriculture. 5008.D9.2

3 Assess and summarize current work in biotechnology being done to add value to animal agriculture and society. 5008.D9.3

4 Distinguish between current and emerging applications of biotechnology in agriculture. 5008.D9.4

5 Compare and contrast the benefits and risks of biotechnology compared with alternative approaches to improving agriculture. 5008.D9.5

6 Assess and summarize the role and scope of agencies that regulate biotechnology. 5008.D9.6

7 Research and summarize public perceptions of biotechnology in agriculture. 5008.D9.7

8 Assess and argue the pros and cons of transgenic species. 5008.D9.8

9 Research genetic engineering and CRISPR procedures used in production of animal species. 5008.D9.9

10 Assess the benefits, risks, and opportunities associated with using biotechnology to promote animal health. 5008.D9.10

j Domain: Careers 5008.D10

1 Students examine the scope of career opportunities in and the importance of agriculture to the economy. 5008.D10.1

2 Evaluate the nature and scope of animal sciences in agriculture, society, and the economy 5008.D10.2

3 Describe career opportunities and means to achieve those opportunities in animal sciences 5008.D10.3

4 Identify how key organizational structures and processes affect organizational performance and the quality of products and services 5008.D10.4

5 Demonstrate those qualities, attributes, and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society. 5008.D10.5

k Domain: Leadership 5008.D11

1 Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well-rounded agricultural education. 5008.D11.1

2 Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings 5008.D11.2

3 Recognize and explain the role of the FFA in the development of leadership, education, employability, communications, and human relations skills 5008.D11.3

4 Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment 5008.D11.4

5 Acquire the skills necessary to positively influence others 5008.D11.5

6 Develop a skill set to enhance the positive evolution of the whole person 5008.D11.6

l Domain: Supervised Agriculture Experience 5008.D12

1 Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well-rounded agricultural education. 5008.D12.1

2 Explain the nature of and become familiar with those terms related to an SAE program 5008.D12.2

3 Explore the numerous possibilities for an SAE program which a student might develop 5008.D12.3

4 Develop an individual SAE program and implementation plan for record keeping skills 5008.D12.4

III Plant and Soil Science 5170

a Domain: Classifying 5170.D1

1 Students classify agricultural plants according to taxonomy systems. 5170.D1.1

2 Explain systems used to classify plants 5170.D1.2

3 Compare, contrast, and classify agricultural plants according to the hierarchical classification system, life cycles, plant use and as monocotyledons or dicotyledons 5170.D1.3

5 Describe the morphological characteristics used to identify agricultural plants 5170.D1.4

b Domain: Plant Reproduction 5170.D2

1 Students analyze the germination of seeds and plant reproduction to successfully grow and propagate plants. 5170.D2.1

2 Explain pollination, cross-pollination and self-pollination of flowering plants 5170.D2.2

3 Diagram the process of plant fertilization 5170.D2.3

4 Design and implement a plan to control the pollination of plants 5170.D2.4

5 Demonstrate planting techniques and provide favorable conditions for seed germination 5170.D2.5

6 Conduct tests associated with seed germination rates, viability, and vigor 5170.D2.6

c Domain: Environmental Factors 5170.D3

1 Students evaluate the environmental factors affecting plant growth to productively cultivate plants. 5170.D3.1

2 Describe the effects air, temperature, and water have on plant metabolism and growth 5170.D3.2

3 Determine the optimal air, temperature and water conditions for plant growth 5170.D3.3

4 Design, implement and evaluate a plan to maintain optimal conditions for plant growth 5170.D3.4

5 Describe the qualities of light that affect plant growth 5170.D3.5

6 Describe and evaluate plant responses to light color, intensity, and duration 5170.D3.6

7 Students differentiate plant cell parts and functions as they apply to cell physiology and reproduction. 5170.D3.7

8 Identify structures in a typical plant cell and summarize the function of plant cell organelles 5170.D3.8

9 Diagram a typical plant cell and identify plant cell organelles and their functions 5170.D3.9

10 Compare and contrast mitosis and meiosis 5170.D3.10

d Domain: Plant Structure and Function 5170.D4

1 Students establish knowledge of plant parts and functions to successfully cultivate plants for the food, fiber, and natural resource industry. 5170.D4.1

2 Identify the components, the types and the functions of plant roots 5170.D4.2

3 Identify the components and the functions of plant stems 5170.D4.3

4 Describe the processes of translocation 5170.D4.4

5 Discuss external leaf morphology and the functions of leaves 5170.D4.5

6 Explain how leaves capture light energy and allow for the exchange of gases 5170.D4.6

e Domain: Energy Synthesis 5170.D5

1 Students apply and adapt photosynthesis and respiration in plants to make decisions on plant production. 5170.D5.1

2 Explain the basic process of photosynthesis and its importance to life on Earth 5170.D5.2

3 Explain requirements necessary for photosynthesis to occur and identify the products and byproducts of photosynthesis 5170.D5.3

4 Distinguish between the light-dependent and light-independent reactions that occur during photosynthesis and apply the knowledge to plant management 5170.D5.4

5 Explain cellular respiration and its importance to plant life 5170.D5.5

6 Explain factors that affect cellular respiration and identify the products and byproducts of cellular respiration 5170.D5.6

f Domain: Plant Pests 5170.D6

1 Identify types of plant pests and disorders 5170.D6.1

2 Identify major local weeds, insect pests and infectious and noninfectious plant diseases 5170.D6.2

3 Describe damage caused by plant pests and diseases 5170.D6.3

4 Diagram the life cycles of major plant pests and diseases 5170.D6.4

5 Describe pest control strategies associated with integrated pest management 5170.D6.5

6 Describe types of pesticide controls and modes of action 5170.D6.6

7 Employ pest management strategies to manage pest populations, assess the effectiveness of the plan and adjust the plan as needed 5170.D6.7

8 Explain risks and benefits associated with the materials and methods used in plant pest management 5170.D6.8

9 Evaluate environmental and consumer concerns regarding pest management strategies 5170.D6.9

g Domain: Sustainable Agriculture Systems 5170.D7

1. Students apply principles and practices of cropping systems to plant production to recommend the ideal system for their local community. 5170.D7.1
2. Identify the current topics in crop production and the role those topics play in the management & production of agronomic crops 5170.D7.2
3. Assess the importance of long-term impacts on sustainable agriculture systems in relation to global food security 5170.D7.3
4. Evaluate the various methods of land preparation and seeding based on soil and plant characteristics 5170.D7.4
5. Research and summarize production methods focused on soil management (e.g., crop rotation, cover crops, etc.) 5170.D7.5
6. Analyze the alignment of modern technologies used in production systems (e.g., precision agriculture, gene editing technologies, etc.) 5170.D7.6
7. Describe sustainable agriculture practices and how they relate to conventional agricultural practices 5170.D7.7
8. Compare and contrast the differing management techniques related to environmental factors & their effect on plants. 5170.D7.8
9. Evaluate practices in support of sustainable agriculture 5170.D7.9

h. Domain: Crop Fertilization 5170.D8

1. Students connect soil nutrients and soil management to promote healthy plant growth. 5170.D8.1
2. Identify the essential nutrients in the soil for plant growth and development and their major functions 5170.D8.2
3. Calculate the content of N-P-K in a fertilizer container from information on the package and calculate the amount of nitrogen needed for an acre of a crop using a selected nitrogen source 5170.D8.3
4. Describe nutrient deficiency symptoms and recognize environmental causes of nutrient deficiencies 5170.D8.4

i. Domain: Soil Properties 5170.D9

1. Students analyze the physical properties of soil to determine crop selection, cropping drainage, and soil conservation. 5170.D9.1
2. Explain the process of soil formation through weathering 5170.D9.2
3. Demonstrate techniques used to identify soil types 5170.D9.3
4. Report examples of how humans are dependent upon soil, directly or indirectly, for their food, clothing, and shelter 5170.D9.4
5. Describe how the basic components and physical qualities of a soil influence its possible uses 5170.D9.5

j. Domain: Soil Water 5170.D10

1. Students evaluate soil and water relationships to encourage optimum plant growth. 5170.D10.1

2. Identify the categories of soil water 5170.D10.2
3. Discuss how soil drainage and water holding capacity can be improved 5170.D10.3
4. Assess the physical qualities of the soil that determine its potential for filtration of groundwater supplies and the likelihood of flooding 5170.D10.4
5. Describe properties of watersheds and identify the boundaries of local watersheds 5170.D10.5

k. Domain: Soil Conservation Practices 5170.D11

1. Students apply and adapt the soil conservation practices necessary to keep soil productive. 5170.D11.1
2. Propose management practices and cropping systems when given features and land capabilities that would help improve the usefulness of the land 5170.D11.2
3. Analyze effects of water and mechanical practices on erosion 5170.D11.3
4. Explain how the programs and services provided by conservation agencies contribute to successful soil management 5170.D11.4
5. Calculate soil loss using current models 5170.D11.5
6. Measure slope and explain the relationship between steepness of slope and erosion 5170.D11.6

l. Domain: Soil Fertility and Health 5170.D12

1. Students will connect physical, chemical, and biological properties that make up soil health to impacts on yield and water quality. 5170.D12.1
2. Assess and describe the short- and long- term effects production methods have on soil 5170.D12.2
3. Identify key indicators of soil health 5170.D12.3
4. Describe the biodiversity (earthworms, nematodes, and microorganisms) found in soil and the contribution to soil health 5170.D12.4
5. Describe factors that contribute to soil compaction and its effects on plants and productivity 5170.D12.5
6. Contrast pH and cation exchange capacity between different soil types 5170.D12.6

m. Domain: Careers 5170.D13

1. Students examine the scope of career opportunities in and the importance of agriculture to the economy. 5170.D13.1
2. Evaluate the nature and scope of plant and soil sciences in agriculture, society, and the economy 5170.D13.2
3. Describe career opportunities and means to achieve those opportunities in plant and soil sciences 5170.D13.3
4. Identify how key organizational structures and processes affect organizational performance and the quality of products and services 5170.D13.4

5. Demonstrate those qualities, attributes, and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society 5170.D13.5

n. Domain: Leadership 5170.D14

1. Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well-rounded agricultural education. 5170.D14.1
2. Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings 5170.D14.2
3. Recognize and explain the role of the FFA in the development of leadership, education, employability, communications, and human relations skills 5170.D14.3
4. Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment 5170.D14.4
5. Acquire the skills necessary to positively influence others 5170.D14.5
6. Develop a skill set to enhance the positive evolution of the whole person 5170.D14.6

o. Domain: Supervised Agriculture Experience 5170.D15

1. Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well-rounded agricultural education. 5170.D15.1
2. Explain the nature of and become familiar with those terms related to an SAE program 5170.D15.2
3. Explore the numerous possibilities for an SAE program which a student might develop 5170.D15.3
4. Develop an individual SAE program and implementation plan for record keeping skills 5170.D15.4

IV Advanced Life Science, Plants and Soils (L) 5074

a Domain: Taxonomy and Classification 5074.D1

1. Students analyze the classification of organisms to understand diversity and the roles of each plant organism. 5074.D1.1
2. Explain the classification of organisms based on a hierarchical taxonomy 5074.D1.2
3. Distinguish the five kingdoms of organisms, and more specific taxonomy of agricultural species of plants 5074.D1.3
4. Identify plants using a taxonomic key 5074.D1.4
5. Develop a detailed knowledge base in plant biology (this includes cell biology, physiology, morphology, anatomy, genetics, classification, evolution and ecology of plants) 5074.D1.5

b Domain: Molecules and Plant Cells 5074.D2

1. Students connect basic concepts of chemistry, biochemistry, and biological functions as they relate to the field of agriculture science. 5074.D2.1
2. Compare and contrast molecules 5074.D2.2
3. Explain the concepts of monomers and polymers 5074.D2.3
4. Compare and contrast the different types of chemical bonds 5074.D2.4
5. Identify and differentiate between common groups of molecules 5074.D2.5
6. Compare and contrast animal, plant, and bacterial cells at the biological and chemical levels 5074.D2.6
7. Describe biochemistry and functions of plant cells, membranes, organelles, and cell walls 5074.D2.7
8. Identify and demonstrate the principles of genetic expression within a genome 5074.D2.8
9. Describe and compare cellular respiration in plants and animals 5074.D2.9
10. Evaluate the impact of photosynthesis and cellular respiration and the factors that affect them on plant management, culture and production problems. 5074.D2.10

c Domain: Development and Function of Plant Systems 5074.D3

1. Students confirm that plants have a variety of cells and tissues with specific functions and systems to illustrate the relationship between certain specific chemicals in their processes. 5074.D3.1
2. Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems 5074.D3.2
3. Define primary and secondary growth and the role of the apical meristem on regulating growth. 5074.D3.3
4. Relate the active and passive transport of minerals into and through the root system to plant nutrition 5074.D3.4

5 Devise plans for plant management that applies knowledge of transpiration, translocation and assimilation on plant growth. 5074.D3.5

6 Explain how leaves capture light energy and allow for the exchange of gases 5074.D3.6

7 Identify the different types of flowers, the components of a flower, the functions of a flower and the functions of lower components 5074.D3.7

8 Identify the macro and micronutrients essential for plant growth and describe some of their functions in plants 5074.D3.8

9 Select and defend the use of specific plant growth regulators to produce desired responses from plants 5074.D3.9

d Domain: Plant Genetics – Chemistry, Expression, and Modification 5074.D4

1 Students apply concepts of the roles of t-RNA, m-RNA, DNA, other chemistry of genes and genomes, and a plant's environment in reproduction and expression to understand how plants reproduce and can be modified genetically. 5074.D4.1

2 Explain the structures of DNA and RNA 5074.D4.2

3 Explain the molecular basis for heredity and the tools and techniques used in DNA and RNA manipulations 5074.D4.3

4 Analyze factors that influence gene expression 5074.D4.4

5 Validate how genotype influences phenotype 5074.D4.5

6 Research the term genome 5074.D4.6

7 Compare and contrast DNA replication in mitosis and meiosis 5074.D4.7

8 Compare the different methods of genetic modification of crops throughout the history of domestication. 5074.D4.8

9 Evaluate the impact of plant breeding and other forms of genetic modification of crops on production practices, both locally and globally. 5074.D4.9

10 Evaluate and explain how scientists use the scientific method to develop new plant crop varieties 5074.D4.10

11 Evaluate methods of genetic modification for their short- and long-term benefits and risks 5074.D4.11

12 Devise and support an argument in favor of or against an ethical issue associated with biotechnology in agriculture 5074.D4.12

e Domain: Evolutionary Trends and Ecology 5074.D5

1 Students evaluate a variety of environmental factors to understand how they contribute to the development and survival of plant species. 5074.D5.1

2 Explain the significance of genetic diversity to evolution. 5074.D5.2

3 Compare and contrast natural selection with artificial selection 5074.D5.3

4 Compare and contrast adaptations of plants for survival and seed dispersal in different environmental conditions 5074.D5.4

5 Explain how climate is a factor in the selection of both crop and ornamental plants 5074.D5.5

6 Define hybridization, and describe how it can lead to the development of unique species and varieties 5074.D5.6

7 Describe methods of producing transgenic plants and ways in which they are used 5074.D5.7

8 Explain the roles of plants in the global carbon cycle 5074.D5.8

9 Describe the nitrogen and phosphorus cycles 5074.D5.9

10 Describe various approaches to control plant and animal pests 5074.D5.10

11 Explain how plants sense changes in their environment and respond 5074.D5.11

12 Develop a familiarity with plants and sharpen observational skills and appreciate their role in human affairs. 5074.D5.12

f Domain: Physical Environment: Soils – Formation, Nutrients, and Chemistry 5074.D6

1 Students evaluate different soil types to understand how they are formed, determined and how they compare to each other. 5074.D6.1

2 Define and describe the role of water holding capacity and hydraulic conductivity for and how that influences irrigation and drainage practices. 5074.D6.2

3 Describe how decomposers affect organic material formation 5074.D6.3

4 Describe the inverse relationship between drainage and oxygen availability 5074.D6.4

5 Compare and contrast ion exchange capacity in natural soils and artificial media 5074.D6.5

6 Define anion and cation, and describe their roles in soil science 5074.D6.6

7 Describe the physical and chemical structures and functions of soil components including sand, silt, clay, and organic matter 5074.D6.7

8 Identify and describe the various soil horizons and their roles 5074.D6.8

9 Explain the physical, chemical, geological, and biological processes of soil formation 5074.D6.9

10 Discuss the effects of soil pH on mineral availability and toxicity and apply necessary changes for maximum fertility. 5074.D6.10

11 Interpret laboratory analyses of soil and tissue samples and prescribe applications based on the results. 5074.D6.11

12 Identify, calculate, and calibrate appropriate fertilizer applications to meet plant nutrient needs. 5074.D6.12

g Domain: Careers 5074.D7

1 Students examine the scope of career opportunities in and the importance of agriculture to the economy. 5074.D7.1

2. Evaluate the nature and scope of animal sciences in agriculture, society, and the economy 5074.D7.2
3. Describe career opportunities and means to achieve those opportunities in plant and soil sciences 5074.D7.3
4. Identify how key organizational structures and processes affect organizational performance and the quality of products and services 5074.D7.4
5. Demonstrate those qualities, attributes, and skills necessary to succeed in, or further prepare for a chosen career while effectively contributing to society 5074.D7.5

h. Domain: Leadership 5074.D8

1. Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well-rounded agricultural education. 5074.D8.1
2. Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings 5074.D8.2
3. Recognize and explain the role of the FFA in the development of leadership, education, employability, communications and human relations skills 5074.D8.3
4. Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment 5074.D8.4
5. Acquire the skills necessary to positively influence others 5074.D8.5
6. Develop a skill set to enhance the positive evolution of the whole person 5074.D8.6

i. Domain: Supervised Agriculture Experience 5074.D9

1. Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well-rounded agricultural education. 5074.D9.1
2. Explain the nature of and become familiar with those terms related to an SAE program 5074.D9.2
3. Explore the numerous possibilities for an SAE program which a student might develop 5074.D9.3
4. Develop an individual SAE program and implementation plan for record keeping skills 5074.D9.4

V **Advanced Life Science: Foods** 5072

a Domain: Safety, Sanitation, and Quality of Food 5072.D1

1 Students analyze and manage operational and safety procedures in food product and processing facilities. 5072.D1.1

2 Construct plans that ensure implementation of safety programs for food products, processing facilities, and the environment. 5072.D1.2

3 Devise and implement strategies to maintain equipment and facilities for food products and processing systems. 5072.D1.3

4 Describe the importance of performing quality-assurance tests on food products and applying corrective procedures as needed. 5072.D1.4

5 Demonstrate procedures for safe handling of food products. 5072.D1.5

6 Develop and implement operating procedures aligned with current industry regulations. 5072.D1.6

7 Students apply food safety and sanitation procedures in the handling and processing of food products to ensure food quality. 5072.D1.7

8 Identify sources of contamination in food products and/or processing facilities and develop ways to eliminate contamination 5072.D1.8

9 Examine, interpret, and report outcomes from safe handling procedures and results from quality assurance tests. 5072.D1.9

10 Interpret and evaluate results of quality assurance tests on food products and examine steps to implement corrective procedures. 5072.D1.10

11 Conduct and interpret microbiological tests for food-borne pathogens. 5072.D1.11

12 Characterize, identify, and research the physical, chemical, and biological properties of microbes as they pertain to food spoilage and foodborne illness. 5072.D1.12

13 Students apply food safety procedures when storing food products to ensure food quality. 5072.D1.13

14 Prepare plans that ensure implementation of proper food storage procedures. 5072.D1.14

15 Implement and evaluate the effectiveness of a documented procedure used within a food product and processing facility and recommend improvements. 5072.D1.15

b Domain: Nutrition, Biology, Microbiology, and Chemistry of Food Products 5072.D2

1 Students apply principles of nutrition, biology, microbiology, and chemistry to develop food products that provide a safe, wholesome, and nutritious food supply for local and global food systems. 5072.D2.1

2 Analyze the physical, chemical, and biological properties of food products (e.g. oxidation, rancidity, hydrogenation, enzymatic browning, structures of essential nutrients, etc.) to evaluate nutritional value. 5072.D2.2

3 Construct methods to design a healthy daily food guide for a variety of nutritional value. 5072.D2.3

4 Design and conduct experiments to determine the chemical and physical properties of food products. 5072.D2.4

5 Devise and apply strategies to determine what additives are utilized and why they are included in a variety of food products (artificial sweeteners, preservatives, color, etc.). 5072.D2.5

6 Develop and implement plans to engineer new food items using biochemistry concepts. 5072.D2.6

7 Describe enzymes, the changes they cause in foods, and the physical and chemical parameters that affect enzymatic reactions. 5072.D2.7

8 Analyze digestion and absorption of essential nutrients. 5072.D2.8

9 Describe enzymes, the changes they cause in foods, and the physical and chemical parameters that affect enzymatic reactions. 5072.D2.9

10 Students apply principles of human behavior to develop food products to provide a safe, wholesome and nutritious food supply for local and global food systems. 5072.D2.10

11 Determine a strategy to prepare and label foods according to the established standards of regulatory agencies. 5072.D2.11

12 Design new food products that meet a variety of goals (e.g., consumer preferences, market, nutritional needs, regulatory requirements, etc.). 5072.D2.12

13 Perform sensory-testing and marketing functions to characterize and determine consumer preference and marketing potential. 5072.D2.13

c Domain: Storage, Distribution, and Consumption of Food 5072.D3

1 Implement selection, evaluation, and inspection techniques to ensure safe and quality food products. 5072.D3.1

2 Outline procedures to assign quality and yield grades to food products according to industry standards. 5072.D3.2

3 Develop, apply, and evaluate care and handling procedures to maintain original food quality and yield. 5072.D3.3

4 Examine and respond to consumer concerns about the inspection and harvesting techniques of animals using accurate information based on regulatory, agency approved or industry-approved techniques. 5072.D3.4

5 Evaluate and grade food products from different classifications of food products. 5072.D3.5

6 Students design and apply techniques of food processing, preservation, packaging, and presentation for distribution and consumption of food products. 5072.D3.6

7 Design plans to formulate and package food products using a variety of weights and measures. 5072.D3.7

8 Evaluate food quality factors on foods prepared for different markets (e.g., shelf life, shrinkage, appearance, weight, etc.). 5072.D3.8

9 Devise and apply strategies to preserve different foods using various methods and techniques. 5072.D3.9

10 Construct and implement methods of selecting packaging materials to store a variety of food products. 5072.D3.10

11 Students create food distribution plans and procedures to ensure safe delivery of food products. 5072.D3.11

12 Devise and defend a strategy to determine ways for food distribution to reduce environmental impacts. 5072.D3.12

13 Make recommendations to improve safety procedures used in food distribution scenarios to ensure a safe product is being delivered to consumers. 5072.D3.13

14 Propose distribution plans for food products that meet specific market demands. 5072.D3.14

d Domain: History and Current Development of the Food Industry 5072.D4

1 Students examine the scope of the food industry by evaluating local and global policies, trends, and customs for food production. 5072.D4.1

2 Articulate and defend a personal point of view on policies and legislation that affect the food products and processing system in the US or around the world. 5072.D4.2

3 Devise and implement a strategy to create food products that meet a specific consumer trend in a specific market. 5072.D4.3

4 Propose and implement culturally sensitive food processing and distribution practices. 5072.D4.4

5 Predict and defend upcoming changes and trends in the food products and processing industry. 5072.D4.5

6 Examine and respond to consumer concerns about the environment and safety of the food supply using accurate information regarding food products and processing systems and practices. 5072.D4.6

7 Research and evaluate the feasibility of implementing a current or emerging technology to improve a current food product or process used in a facility. 5072.D4.7

8 Demonstrate an ability to critically evaluate the validity of information that commonly appears in newspapers, magazines, radio, and television (e.g., food recalls) 5072.D4.8

9 Students identify and explain the purpose of industry organizations, groups, and regulatory agencies that influence the local and global food systems. 5072.D4.9

10 Construct and implement methods to obtain data about organizations, groups, and regulatory agencies that affect the food products and processing industry. 5072.D4.10

11 Construct and implement plans that ensure adherences to industry standards for food products and processing facilities. 5072.D4.11

12 Analyze current government regulations. 5072.D4.12

13 Research and evaluate the impact of supplemental government programs (e.g., SNAP, Free & Reduced meals, WIC, etc.). 5072.D4.13

e Domain: Careers 5072.D5

1 Students examine the scope of career opportunities in and the importance of food science to the economy. 5072.D5.1

2 Evaluate the nature and scope of animal sciences in agriculture, society, and the economy 5072.D5.2

3 Describe career opportunities and means to achieve those opportunities in plant and soil sciences 5072.D5.3

4 Identify how key organizational structures and processes affect organizational performance and the quality of products and services 5072.D5.4

5 Demonstrate those qualities, attributes and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society 5072.D5.5

f Domain: Leadership 5072.D6

1 Students validate the necessity of leadership skills development in conjunction with participation in the national FFA Organization (FFA) and/or Family, Career and Community Leaders of America (FCCLA) as a critical component of the course. 5072.D6.1

2 Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings 5072.D6.2

3 Recognize and explain the role of the CTSO in the development of leadership, education, employability, communications, and human relations skills 5072.D6.3

4 Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment 5072.D6.4

5 Acquire the skills necessary to positively influence others 5072.D6.5

6 Develop a skill set to enhance the positive evolution of the whole person 5072.D6.6

VI Advanced Life Science, Animals (L) 5070

a Domain: Historic and Current Trends Impacting the Animal Systems Industry 5070.D1.1

1 Evaluate the development and implications of animal origin, domestication and distribution and assess animal production methods for use in animal systems based on effectiveness. 5070.D1.2

2 Evaluate the implications of animal adaptations on production practices and the environment. 5070.D1.3

3 Predict trends and implications of future developments within different animal industries on production practices and the environment. 5070.D1.4

4 Evaluate the effectiveness of different production methods and defend the use of selected methods using data and evidence. 5070.D1.5

5 Devise and evaluate marketing plans for an animal agriculture product or service. 5070.D1.6

6 Select and defend the use of a specific record management system based upon its effectiveness for a business related to animal systems. 5070.D1.7

7 Devise and evaluate plans to manage wildlife populations to achieve optimal ecological health. 5070.D1.8

b Domain: Global Perspective of Laws and Sustainability 5070.D2

1 Analyze and apply laws and sustainable practices to animal agriculture from a global perspective. 5070.D2.1

2 Evaluate the impact of laws pertaining to animal agriculture (e.g., pros, cons, effect on individuals, effect on businesses, etc.) and assess the compliance of production practices with established regulations. 5070.D2.2

3 Select, evaluate, and defend the use of sustainable practices in animal agriculture. 5070.D2.3

c Domain: Animal Husbandry and Welfare 5070.D3

1 Demonstrate management techniques that ensure animal welfare and analyze procedures to ensure safety of animal products. 5070.D3.1

2 Implement and evaluate quality-assurance programs and procedures for animal production. 5070.D3.2

3 Devise, implement and evaluate safety procedures and plans for working with animals by species using information based on animal behavior and responses. 5070.D3.3

4 Devise economical recommendations to increase the welfare of animals in animal systems. 5070.D3.4

5 Select, evaluate, and defend the use of specific tools, technology or equipment used to perform animal husbandry and welfare tasks. 5070.D3.5

6 Research and evaluate programs to assure the safety of animal products for consumption. 5070.D3.6

7. Evaluate the effectiveness of animal and/or premise identification programs for a given species. 5070.D3.7

d. Domain: Animal Nutrition 5070.D4

1. Analyze the nutritional requirements of animals and analyze feed rations to assess their effectiveness 5070.D4.1
2. Assess nutritional needs for an individual animal based on its growth stage and production system. 5070.D4.2
3. Design and defend the use of a nutritional program by demonstrating the relationship between the nutrient requirements and the feedstuffs provided. 5070.D4.3
4. Identify essential and non-essential nutrients. In addition, describe the relationship between amino acids, vitamins, and minerals in the health of cells and organs. 5070.D4.4
5. Select appropriate feedstuffs for animals based on a variety of factors (e.g., economics, digestive system and nutritional needs, etc.). 5070.D4.5
6. Select and utilize animal feeds based on nutritional requirements, using rations for maximum nutrition and optimal economic production. 5070.D4.6
7. Make and defend decisions regarding whether to use feed additives and growth promotants after researching and considering scientific evidence, production system needs and goals, and input from industry professionals. 5070.D4.7
8. Select, evaluate, and defend the use of specific tools or equipment used to perform animal nutrition tasks. 5070.D4.8
9. Evaluate and summarize the potential impacts, positive and negative, of compliance and/or noncompliance with a feed label and feeding directions. 5070.D4.9
10. Research and recommend technology improvements to provide proper nutrition to animals. 5070.D4.10

e. Domain: Animal Reproduction 5070.D5

1. Students evaluate animals for breeding readiness and soundness and apply scientific principles to select and care for breeding animals. 5070.D5.1
2. Select breeding animals based on characteristics of the reproductive organs. 5070.D5.2
3. Evaluate and select animals for reproductive readiness. 5070.D5.3
4. Treat or cull animals with reproductive problems. 5070.D5.4
5. Summarize the process of sexual maturation 5070.D5.5
6. Identify and discuss various breeding systems in domesticated animals 5070.D5.6
7. Describe the function of the animal/host defense mechanism 5070.D5.7
8. Discuss the direct and indirect impact of disease on animal health 5070.D5.8

9 Compare and contrast the reproductive organs for male and female domesticated animal species. 5070.D5.9

10 Describe ectoderm, endoderm, and mesoderm as three germ layers that give rise to tissues and organs. Describe blastula and gastrula formation, and the function of morphogens, and recognize their importance in the developmental processes of vertebrates. 5070.D5.10

11 Define and describe estrous cycle(s). Describe how hormones act during the estrous cycle and how they are used to suppress it. 5070.D5.11

12 Discuss the social implications of reproductive and genetic technologies used in animal husbandry (e.g., embryo transfer, artificial insemination, gene transfer, cloning). 5070.D5.12

13 Describe spermatogenesis and sperm motility. List and explain factors that affect both. 5070.D5.13

14 Describe the steps in lactation. 5070.D5.14

15 Describe parturition and the method(s) used to predict when it occurs. 5070.D5.15

16 Select and evaluate a breeding system based on the principles of genetics. 5070.D5.16

17 Select and evaluate breeding animals and determine the probability of a given trait in their offspring. 5070.D5.17

18 Perform a DNA analysis and use the data to make and defend breeding decisions. 5070.D5.18

19 Create a plan to differentiate care of a species of breeding animals throughout their growth stages. 5070.D5.19

20 Describe ways that animals prevent inbreeding and discuss genetic diversity. 5070.D5.20

21 Compare and contrast natural selection with artificial selection, as used by humans to domesticate animals and breed improved varieties. 5070.D5.21

22 Compare and contrast adaptations of animals for survival in different environmental conditions. 5070.D5.22

23 Describe the role of biotechnology on the process of selection. 5070.D5.23

24 Explain the science behind mammalian cloning. Compare and contrast cloning a gene and an animal. 5070.D5.24

25 Describe the relationship between genotype and phenotype. 5070.D5.25

26 Select animal breeding methods based on reproductive and economic efficiency. 5070.D5.26

27 Evaluate the implementation and effectiveness of artificial insemination techniques. 5070.D5.27

28 Create and evaluate plans and procedures for estrous synchronization, superovulation, flushing, embryo transfer and other reproductive management practices. 5070.D5.28

29 Select and assess animal performance based on quantitative breeding values for specific characteristics. 5070.D5.29

f Domain: Animal Environmental Considerations 5070.D6

1 Students design animal housing, equipment, and handling facilities for the major systems of animal production that comply with government regulations and safety standards. 5070.D6.1

2 Design an animal facility focusing on animal requirements, economic efficiency, sustainability, safety, and ease of handling. 5070.D6.2

3 Select, use, and evaluate equipment, technology and handling procedures to enhance sustainability and production efficiency. 5070.D6.3

4 Evaluate facility designs and make recommendations to ensure that it meets standards for the legal, safe, ethical, economical, and efficient production of animals. 5070.D6.4

5 Evaluate the impact of laws pertaining to animal systems. 5070.D6.5

g Domain: Animal Classification, Anatomy, & Physiology 5070.D7

1 Students classify animals according to taxonomic classification systems and use (e.g., agricultural, companion, etc.). 5070.D7.1

2 Assess taxonomic characteristics and classify animals according to the taxonomic classification system. 5070.D7.2

3 Recommend different uses for an animal species based upon an analysis of local market needs. 5070.D7.3

4 Apply knowledge of classification terms to communicate with others about animal systems in an effective and accurate manner. 5070.D7.4

5 Define the terms hypertonic, hypotonic, and isotonic. Describe the phenomena of osmosis, and predict the direction that water will move given the concentrations of solutes in adjacent cells. 5070.D7.5

6 Describe the biochemistry and functions of animal cell membranes. In doing so, describe the fluid mosaic model of the membrane and the role of the cell membrane proteins in transporting materials in and out of cells. 5070.D7.6

7 Describe cellular respiration. Recognize that animals perform only respiration, while plants perform both photosynthesis and respiration. Also, describe the transformation of energy during respiration, and the role of ATP produced in respiration for other metabolic processes. 5070.D7.7

8 Students apply principles of comparative anatomy and physiology to uses within various animal systems. 5070.D7.8

9 Correlate the functions of animal cell structures to animal growth, development, health, and reproduction. 5070.D7.9

10 Apply the processes of meiosis and mitosis to solve animal growth, development, health and reproductive problems. 5070.D7.10

11 Apply knowledge of anatomical and physiological characteristics of animals to make production and management decisions. 5070.D7.11

12 Compare and contrast muscle function under anaerobic and aerobic conditions 5070.D7.12

13 Identify and explain the major organ systems found in vertebrae systems (Muscular, Skeletal, Circulatory, Respiratory, Digestive, Nervous, Endocrine, Integumentary, Excretory, Urinary, Immune) 5070.D7.13

14 Describe the organization of the animal body, cells, tissues, organs, and organ systems 5070.D7.14

15 Discuss four basic tissue types: epithelial, connective, muscle, and nervous 5070.D7.15

16 Students select and train animals for specific purposes and maximum performance based on anatomy and physiology. 5070.D7.16

17 Evaluate and select animals to maximize performance based on anatomical and physiological characteristics that affect health, growth, and reproduction 5070.D7.17

18 Choose, implement and evaluate sustainable and efficient procedures (e.g., selection, housing, nutrition, and management) to produce consistently high-quality animals that are well suited for their intended purposes. 5070.D7.18

19 Evaluate and select animals to produce superior animal products based on industry standards. 5070.D7.19

h Domain: Animal Health 5070.D8

1 Students design programs to prevent animal diseases, parasites and other disorders and ensure animal welfare. 5070.D8.1

2 Select and use tools and technology to meet specific animal health management goals. 5070.D8.2

3 Determine when an animal health concern needs to be referred to an animal health professional. 5070.D8.3

4 Treat common diseases, parasites, and physiological disorders of animals according to directions prescribed by an animal health professional. 5070.D8.4

5 Design and implement a health maintenance and a disease and disorder prevention plan for animals in their natural and/or confined environments. 5070.D8.5

6 Identify and describe surgical and nonsurgical veterinary treatments and procedures to meet specific animal health care objectives. 5070.D8.6

7 Describe the function of the animal/host defense mechanism 5070.D8.7

8 Describe the use of antibiotics in animal health and describe how antibiotics work. Discuss the impact improper use of antibiotics has on antibiotic resistance. 5070.D8.8

9 Discuss the role of blood in host defense 5070.D8.9

10 Discuss the impact of disease on animal health. 5070.D8.10

11 Describe the various parasites and their impact on organ systems. Discuss host specificity and the importance of it. 5070.D8.11

12. Students analyze biosecurity measures utilized to protect the welfare of animals on a local, state, national, and global level. 5070.D8.12
13. Design and evaluate a biosecurity plan for an animal production operation. 5070.D8.13
14. Research and evaluate the effectiveness of zoonotic disease prevention methods and procedures to identify those that are best suited to ensure public safety and animal welfare. 5070.D8.14

i. Domain: Environmental Impacts of Animal Production 5070.D9

1. Design and implement methods to reduce the effects of animal production on the environment. 5070.D9.1
2. Devise a plan that includes measures to reduce the impact of animal agriculture on the environment. 5070.D9.2
3. Apply valid and reliable research evidence to predict the potential effects of different environmental conditions for an animal population. 5070.D9.3
4. Devise and improve plans to establish favorable environmental conditions for animal growth and performance based on a variety of factors (e.g., economic feasibility, environmental sustainability, impact on animals, etc.). 5070.D9.4

j. Domain: Leadership 5070.D10

1. Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well-rounded agricultural education. 5070.D10.1
2. Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings 5070.D10.2
3. Recognize and explain the role of the FFA in the development of leadership, education, employability, communications, and human relations skills 5070.D10.3
4. Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment 5070.D10.4
5. Acquire the skills necessary to positively influence others 5070.D10.5
6. Develop a skill set to enhance the positive evolution of the whole person 5070.D10.6

k. Domain: Supervised Agriculture Experience 5070.D11

1. Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well-rounded agricultural education. 5070.D11.1
2. Explain the nature of and become familiar with those terms related to an SAE program 5070.D11.2
3. Explore the numerous possibilities for an SAE program which a student might develop 5070.D11.3
4. Develop an individual SAE program and implementation plan for record keeping skills 5070.D11.4

- Domain: Careers 5070.D12
  1. Students examine the scope of career opportunities in and the importance of agriculture to the economy. 5070.D12.1
  2. Evaluate the nature and scope of animal sciences in agriculture, society, and the economy 5070.D12.2
  3. Describe career opportunities and means to achieve those opportunities in animal science 5070.D12.3
  4. Explain the nature of and become familiar with those terms related to an SAE program 5070.D12.4
  5. Explore the numerous possibilities for an SAE program which a student might develop 5070.D12.5

VII Food Science 5102

a History and Current Trends of the Food Industry 5102.D1

1. Explain the scope of the food industry and the historical and current developments of food products and processing. 5102.D1.1
2. Discuss the history and current trends to describe and explain the components (e.g., processing, distribution, byproducts) of the food products and processing industry. 5102.D1.2
3. Analyze the similarities and differences amongst policies and legislation that affect the food products, processing systems, and supply in the U.S. or around the world. 5102.D1.3
4. Analyze food production and distribution outcomes based on cultural customs. 5102.D1.4
5. Discuss the issues of safety and environmental concerns about foods and food processing (e.g., Genetically Modified Organisms, organics, microorganisms, contamination, irradiation). 5102.D1.5
6. Identify and explain the purpose of industry organizations, groups, and regulatory agencies that influence the local and global food systems. 5102.D1.6
7. Evaluate the purposes and changes in the food products and processing industry brought about by industry organizations or regulatory agencies 5102.D1.7
8. Explain the importance, application, and usage of industry standards in food products and processing 5102.D1.8
9. Prepare an implementation plan for industry standards in food products and processing systems 5102.D1.9

b Domain: Food Safety Principles and Processing Systems 5102.D2

1. Students develop and implement procedures to ensure safety, sanitation, and quality in food product and processing facilities. 5102.D2.1
2. Describe contamination hazards (physical, chemical, and biological) associated with food products and processing 5102.D2.2
3. Outline procedures to eliminate possible contamination hazards associated with food products and processing 5102.D2.3
4. Analyze the effectiveness of a food product and processing company's Critical Control Point (CCP) procedures 5102.D2.4
5. Analyze and document attributes and procedures of current safety programs in food products and processing facilities. 5102.D2.5
6. Assess specifications and maintenance needs for equipment and processing systems (e.g., specifications for machines, sanitation procedures, repair protocol, etc.) 5102.D2.6
7. Students apply safety and sanitation procedures to understand the handling, processing, and storing of food products. 5102.D2.7

8 Explain and demonstrate techniques and procedures for the safe handling of food products 5102.D2.8

9 Describe the importance of and perform quality-assurance tests on food products 5102.D2.9

10 Describe the effects food-borne pathogens have on food products and humans 5102.D2.10

11 Conduct and interpret microbiological tests for food-borne pathogens and implement corrective procedures 5102.D2.11

12 Discuss documentation procedures in a food products and processing system 5102.D2.12

13 Explain safety standards that must be observed in facility design and equipment use 5102.D2.13

14 Outline guidelines for personnel safety in the food products and processing industry 5102.D2.14

15 Evaluate a facility to determine the implementation of safety procedures 5102.D2.15

c Domain: The Science and Nutrition of Food Products and The Processing Industry 5102.D3

1 Students apply principles of nutrition, biology, microbiology, chemistry, and human behavior to make healthy food selections. 5102.D3.1

2 Discuss essential nutrients (proteins, carbohydrates, fats, vitamins, minerals, and water). 5102.D3.2

3 Explain the application of chemistry and physics to food science. 5102.D3.3

4 Explain the MyPlate recommendations in relation to essential nutrients for the human diet. 5102.D3.4

5 Identify common food additives (e.g., preservatives, antioxidants, buffers, stabilizers, colors, flavors). 5102.D3.5

6 Identify the key components of a food label and their significance to create an informed consumer. 5102.D3.6

d Domain: Processing, Preservation, Quality Control, and Packaging of Food Products 5102.D4

1 Design and apply techniques of food processing, preservation, packaging, and presentation for distribution and consumption of food products. 5102.D4.1

2 Identify and assign quality and yield grades to meat, poultry, fish, dairy, fruits, vegetables, grains, legumes, and oilseeds. 5102.D4.2

3 Select raw food products based on yield grades, quality grades and related selection criteria. 5102.D4.3

4 Perform quality-control inspections of raw food products for processing. 5102.D4.4

5 Identify and describe acceptable animal treatment and processing techniques. 5102.D4.5

6 Explain desirable and undesirable characteristics of both pre-mortem and post-mortem animals in relation to the inspection and production of food products. 5102.D4.6

7 Students will apply processes, preservation, packaging, and food presentation to food products for sale and distribution to understand product development. 5102.D4.7

8 Compare weights and measurements of products and perform conversions between units of measure. 5102.D4.8

9 Outline appropriate methods and prepare foods for sale and distribution for different markets. 5102.D4.9

10 Analyze and document food preservation processes and methods on a variety of food products. 5102.D4.10

11 Analyze the degree of desirable food qualities of foods stored in various packaging. 5102.D4.11

12 Explain materials and methods of food packaging and presentation. 5102.D4.12

13 Describe factors in planning and developing a new food product. 5102.D4.13

e Domain: Careers 5102.D5

1 Students examine the scope of career opportunities in and the importance of agriculture to the economy. 5102.D5.1

2 Evaluate the nature and scope of natural resources in agriculture, society, and the economy 5102.D5.2

3 Describe career opportunities and means to achieve those opportunities in natural resources 5102.D5.3

4 Identify how key organizational structures and processes affect organizational performance and the quality of products and services. 5102.D5.4

5 Demonstrate those qualities, attributes, and skills necessary to succeed in, or further prepare for, a chosen career while effectively contributing to society. 5102.D5.5

f Domain: Leadership 5102.D6

1 Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well-rounded agricultural education. 5102.D6.1

2 Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings 5102.D6.2

3 Recognize and explain the role of the FFA in the development of leadership, education, employability, communications, and human relations skills. 5102.D6.3

4 Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. 5102.D6.4

5 Acquire the skills necessary to positively influence others. 5102.D6.5

6. Develop a skill set to enhance the positive evolution of the whole person. 5102.D6.6

g. Domain: Supervised Agriculture Experience 5102.D7

1. Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well-rounded agricultural education. 5102.D7.1
2. Explain the nature of and become familiar with those terms related to an SAE program. 5102.D7.2
3. Explore the numerous possibilities for an SAE program which a student might develop. 5102.D7.3
4. Develop an individual SAE program and implement record keeping skills. 5102.D7.4

VIII Agriculture Biotechnology Capstone 7230

a Domain: Competency 1 7230.D1

1. Investigate and explain the relationship between past, current and emerging applications of biotechnology in agriculture 7230.D1.1
2. Research and summarize the evolution of biotechnology in agriculture. 7230.D1.2
3. Examine and categorize current applications and gains achieved in applying biotechnology to agriculture. 7230.D1.3
4. Distinguish between current and emerging applications of biotechnology in agriculture. 7230.D1.4
5. Compare and contrast the benefits and risks of biotechnology compared with alternative approaches to improving agriculture. 7230.D1.5
6. Evaluate the scope and implications of regulatory agencies on applications of biotechnology in agriculture and protection of public interests 7230.D1.6
7. Compare and contrast differences between regulatory systems worldwide. 7230.D1.7
8. Research and document major regulatory issues related to biotechnology in agriculture. 7230.D1.8
9. Explain the relationship between regulatory agencies and the protection of public interests such as health, safety and the environment. 7230.D1.9
10. Analyze the relationship and implications of bioethics, laws, and public perceptions on applications of biotechnology in agriculture. 7230.D1.10
11. Research and summarize the emergence, evolution and implications of bioethics associated with biotechnology in agriculture. 7230.D1.11
12. Research and summarize legal issues related to biotechnology in agriculture (e.g., protection of intellectual property through patents, copyright, trademarks, etc.). 7230.D1.12
13. Research and summarize public perceptions of biotechnology in agriculture (e.g., social and cultural issues). 7230.D1.13

b Domain: Competency 2 7230.D2

1. Read, document, evaluate and secure accurate laboratory records of experimental protocols, observations, and results. 7230.D2.1
2. Maintain and interpret laboratory records documented in a laboratory to ensure data accuracy and integrity (e.g., avoid bias, record any conflicts of interest, avoid misinterpreted results, etc.). 7230.D2.2
3. Research and summarize the need for data and information security in a laboratory and demonstrate best practices. 7230.D2.3
4. Evaluate the role of bioinformatics in agriculture and summarize the types of databases that are available (e.g., genomic, transcriptomics, etc.). 7230.D2.4

5 Implement standard operating procedures for the proper maintenance, use and sterilization of equipment in a laboratory. 7230.D2.5

6 Identify, interpret, and implement standard operating procedures for laboratory equipment. 7230.D2.6

7 Manipulate basic laboratory equipment and measurement devices (e.g., water bath, electrophoresis equipment, micropipettes, laminar flow hood, etc.). 7230.D2.7

8 Perform sterilization techniques for equipment in a laboratory using standard operating procedures. 7230.D2.8

9 Apply standard operating procedures for the safe handling of biological and chemical materials in a laboratory. 7230.D2.9

10 Demonstrate advanced aseptic techniques in the laboratory (e.g., sterile work area, sterile handling, personal hygiene, etc.). 7230.D2.10

11 Examine and implement standard operating procedures for the use of biological materials according to directions and their classification (e.g., proper handling of bacteria or DNA before, during and after use). 7230.D2.11

12 Formulate and prepare solutions using standard operating procedures (e.g., proper labeling, storage, etc.). 7230.D2.12

13 Examine and perform scientific procedures using microbes, DNA, RNA, and proteins in a laboratory. 7230.D2.13

14 Characterize the physical and biological properties of organisms. 7230.D2.14

15 Compare and contrast the structures of DNA and RNA and investigate how genotype influences phenotype. 7230.D2.15

16 Perform electrophoretic techniques and interpret electrophoresis fragmentation patterns (e.g., gel electrophoresis, southern blotting, etc.). 7230.D2.16

17 Examine and document the role and applications of proteins in agricultural biotechnology. 7230.D2.17

18 Synthesize the relationship between proteins, enzymes, and antibodies. 7230.D2.18

c Domain: Competency 3 7230.D3

1 Apply biotechnology principles, techniques, and processes to create transgenic species through genetic engineering. 7230.D3.1

2 Summarize biological, social, agronomic, and economic reasons for genetic modification of eukaryotes. 7230.D3.2

3 Summarize the process of transformation of eukaryotic cells with transgenic DNA. 7230.D3.3

4 Analyze the benefits and risks associated with the use of biotechnology to increase productivity and improve quality of living species (e.g., plants, animals such as aquatic species, etc.). 7230.D3.4

5 Define and summarize epigenetics and synthesize the relationship between mutation, migration and evolution of transgenes in the environment. 7230.D3.5

6 Apply biotechnology principles, techniques, and processes to enhance the production of food using microorganisms and enzymes. 7230.D3.6

7 Summarize reasons for detecting microbes and identify sources of microbes. 7230.D3.7

8 Examine enzymes, the changes they cause and the physical and chemical parameters that affect enzymatic reactions (e.g., food, cellulosic bioenergy, etc.). 7230.D3.8

9 Identify and categorize foods produced using biotechnology (e.g., fermentation, etc.) to change the chemical properties of food for an intended purpose (e.g., create desirable nutritional profile, preservation, flavor, etc.) 7230.D3.9

10 Apply biotechnology principles, techniques, and processes to protect the environment and maximize use of natural resources (e.g., biomass, bioprospecting, industrial biotechnology, etc.). 7230.D3.10

11 Examine the consequences of agricultural practices on natural populations. 7230.D3.11

12 Define and summarize industrial biotechnology and categorize the benefits and risks associated with its use in manufacturing (e.g., fabrics, plastics, etc.). 7230.D3.12

13 Research and summarize the potential applications of bioprospecting in biotechnology and agriculture. 7230.D3.13

14 Apply biotechnology principles, techniques, and processes to enhance plant and animal care and production 7230.D3.14

15 Research and describe the aims and techniques involved in selective plant-breeding process. 7230.D3.15

16 Examine and classify biotechnology processes applicable to animal health (e.g., genetic testing, etc.). 7230.D3.16

17 Research and categorize the types of pharmaceuticals developed for animals and humans through biotechnology 7230.D3.17

18 Summarize the need for global biodiversity and applications of biotechnology to reduce threats to biodiversity. 7230.D3.18

19 Apply biotechnology principles, techniques, and processes to produce biofuels (e.g., fermentation, transesterification, methanogenesis, etc.). 7230.D3.19

20 Examine and synthesize the need for biofuels (e.g., cellulosic bioenergy, etc.). 7230.D3.20

21 Differentiate between biomass and sources of biomass. 7230.D3.21

22 Research and explain the process of fermentation and its potential applications. 7230.D3.22

23 Define and summarize the process of transesterification and its potential applications. 7230.D3.23

24 Examine the process of methanogenesis and its potential applications. 7230.D3.24

25 Apply biotechnology principles, techniques, and processes to improve waste management (e.g., genetically modified organisms, bioremediation, etc.). 7230.D3.25

26 Compare and contrast the use of natural organisms and genetically engineered organisms in the treatment of wastes. 7230.D3.26

27 Summarize the purpose of microorganisms in biological waste management. 7230.D3.27

28 Analyze the role of microorganisms in industrial chemical waste treatment. 7230.D3.28

29 Provide examples of instances in which bioremediation can be applied to clean up environmental contaminants. 7230.D3.29