

# Agribiotechnology

## ACADEMIC SKILLS

### AA SPEAKING AND LISTENING

AA1 Utilize effective verbal and non-verbal communication skills

AA2 Participate in conversation, discussion, and group presentations

AA3 Communicate and follow directions/procedures

AA4 Communicate effectively with customers and co-workers

### AB READING AND WRITING

AB1 Locate and interpret written information

AB2 Read and interpret workplace documents

AB3 Identify relevant details, facts, and specifications

AB4 Record information accurately and completely

AB5 Demonstrate competence in organizing, writing, and editing using correct vocabulary, spelling, grammar, and punctuation

AB6 Demonstrate the ability to write clearly and concisely using industry specific terminology

### AC CRITICAL THINKING AND PROBLEM SOLVING

AC1 Utilize critical-thinking skills to determine best options/outcomes (e.g., analyze reliable/unreliable sources of information, use previous experiences, implement crisis management, develop contingency planning)

AC2 Utilize innovation and problem-solving skills to arrive at the best solution for current situation

AC3 Implement effective decision-making skills

### AD MATHEMATICS

AD1 Perform basic and higher level math operations (e.g., addition, subtraction, multiplication, division, decimals, fractions, units of conversion, averaging, percentage, proportion, ratios)

AD2 Solve problems using measurement skills (e.g., distance, weight, area, volume)

AD3 Make reasonable estimates

AD4 Use tables, graphs, diagrams, and charts to obtain or convey information

AD5 Use deductive reasoning and problem-solving in mathematics

## **AE FINANCIAL LITERACY**

AE1 Locate, evaluate, and apply personal financial information

AE2 Identify the components of a budget and how one is created

AE3 Set personal financial goals and develop a plan for achieving them

AE4 Use financial services effectively

AE5 Demonstrate ability to meet financial obligations

## **AF INTERNET USE AND SECURITY**

AF1 Recognize the potential risks associated with Internet use

AF2 Identify and apply Internet security practices (e.g., password security, login, logout, log off, lock computer)

AF3 Practice safe, legal, and responsible use of technology in the workplace

## **AG INFORMATION TECHNOLOGY**

AG1 Use technology appropriately to enhance professional presentations

AG2 Demonstrate effective and appropriate use of social media

AG3 Identify ways social media can be used as marketing, advertising, and data gathering tools

## **AH TELECOMMUNICATIONS**

AH1 Select and use appropriate devices, services, and applications to complete workplace tasks

AH2 Demonstrate appropriate etiquette when using e-communications (e.g., cell phone, e-mail, personal digital assistants, online meetings, conference calls)

# EMPLOYABILITY SKILLS

## EA POSITIVE WORK ETHIC

EA1 Demonstrate enthusiasm and confidence about work and learning new tasks

EA2 Demonstrate consistent and punctual attendance

EA3 Demonstrate initiative in assuming tasks

EA4 Exhibit dependability in the workplace

EA5 Take and provide direction in the workplace

EA6 Accept responsibility for personal decisions and actions

## EB INTEGRITY

EB1 Abide by workplace policies and procedures

EB2 Demonstrate honesty and reliability

EB3 Demonstrate ethical characteristics and behaviors

EB4 Maintain confidentiality and integrity of sensitive company information

EB5 Demonstrate loyalty to the company

## EC SELF-REPRESENTATION

EC1 Demonstrate appropriate dress and hygiene in the workplace

EC2 Use language and manners suitable for the workplace

EC3 Demonstrate polite and respectful behavior toward others

EC4 Demonstrate personal accountability in the workplace

EC5 Demonstrate pride in work

## ED TIME, TASK, AND RESOURCE MANAGEMENT

ED1 Plan and follow a work schedule

ED2 Work with minimal supervision

ED3 Work within budgetary constraints

ED4 Demonstrate ability to stay on task to produce high quality deliverables on time

## **EE DIVERSITY AWARENESS**

EE1 Recognize diversity, discrimination, harassment, and equity

EE2 Work well with all customers and co-worker

EE3 Explain the benefits of diversity within the workplace

EE4 Explain the importance of respect for feelings, values, and beliefs of others

EE5 Identify strategies to bridge cultural/generational differences and use differing perspectives to increase overall quality of work

EE6 Illustrate techniques for eliminating gender bias and stereotyping in the workplace

EE7 Identify ways tasks can be structured to accommodate the diverse needs of workers

EE8 Recognize the challenges and advantages of a global workforce

## **EF TEAMWORK**

EF1 Recognize the characteristics of a team environment and conventional workplace

EF2 Contribute to the success of the team

EF3 Demonstrate effective team skills and evaluate their importance in the workplace (e.g., setting goals, listening, following directions, questioning, dividing work)

## **EG CREATIVITY AND RESOURCEFULNESS**

EG1 Contribute new ideas

EG2 Stimulate ideas by posing questions

EG3 Value varying ideas and opinions

EG4 Locate and verify information

## **EH CONFLICT RESOLUTION**

EH1 Identify conflict resolution skills to enhance productivity and improve workplace relationships

EH2 Implement conflict resolution strategies and problem-solving skills

EH3 Explain the use of documentation and its role as a component of conflict resolution

## **EI CUSTOMER/CLIENT SERVICE**

EI1 Recognize the importance of and demonstrate how to properly acknowledge customers/clients

EI2 Identify and address needs of customers/clients

EI3 Provide helpful, courteous, and knowledgeable service

EI4 Identify appropriate channels of communication with customers/clients (e.g., phone call, face-to-face, e-mail, website)

EI5 Identify techniques to seek and use customer/client feedback to improve company services

EI6 Recognize the relationship between customer/client satisfaction and company success

## **EJ ORGANIZATIONS, SYSTEMS, AND CLIMATES**

EJ1 Define profit and evaluate the cost of conducting business

EJ2 Identify "big picture" issues in conducting business

EJ3 Identify role in fulfilling the mission of the workplace

EJ4 Identify the rights of workers (e.g., adult and child labor laws and other equal employment opportunity laws)

EJ5 Recognize the chain of command, organizational flow chart system, and hierarchy of management within an organization

## **EK JOB ACQUISITION AND ADVANCEMENT**

EK1 Recognize the importance of maintaining a job and pursuing a career

EK2 Define jobs associated with a specific career path or profession

EK3 Identify and seek various job opportunities (e.g., volunteerism, internships, co-op, part-time/full-time employment)

EK4 Prepare a resume, letter of application, and job application

EK5 Prepare for a job interview (e.g., research company, highlight personal strengths, prepare questions, set-up a mock interview, dress appropriately)

EK6 Participate in a job interview

EK7 Explain the proper procedure for leaving a job

## **EL LIFELONG LEARNING**

EL1 Acquire current and emerging industry-related information

EL2 Demonstrate commitment to learning as a life-long process and recognize learning opportunities

EL3 Seek and capitalize on self-improvement opportunities

EL4 Discuss the importance of flexible career planning and career self-management

EL5 Employ leadership skills to achieve workplace objectives (e.g., personal vision, adaptability, change, shared vision)

EL6 Recognize the importance of job performance evaluation and coaching as it relates to career advancement

EL7 Accept and provide constructive criticism

EL8 Describe the impact of the global economy on jobs and careers

## **EM JOB SPECIFIC TECHNOLOGIES**

EM1 Identify the value of new technologies and their impact on driving continuous change and the need for life-long learning

EM2 Research and identify emerging technologies for specific careers

EM3 Select appropriate technological resources to accomplish work

## **EN HEALTH AND SAFETY**

EN1 Assume responsibility for safety of self and others

EN2 Follow safety guidelines in the workplace

EN3 Manage personal health and wellness

# OCCUPATIONAL SKILLS

## OA DEVELOPMENT OF BIOTECHNOLOGY IN AGRICULTURE

- OA1 Define biotechnology and explore the historical impact it has had on agriculture
- OA2 Create a timeline and use it to explain the developmental progression of biotechnology
- OA3 Research and report on the major innovators and milestones in the development of biotechnology
- OA4 Investigate current applications of biotechnology in agriculture
- OA5 Research and report on current work being done in agricultural biotechnology
- OA6 Analyze the scope and impact of agricultural biotechnology in today's global society and economy
- OA7 Examine potential future applications of biotechnology in agriculture and compare them with alternative approaches to improving agriculture
- OA8 Research and report on emerging problems and issues associated with agricultural biotechnology
- OA9 Assess the future impact agricultural biotechnology could have on world populations

## OB REGULATION

- OB1 Describe the role of agencies that regulate biotechnology
- OB2 Interpret the major regulatory issues related to biotechnology
- OB3 Research, evaluate, and articulate a major regulatory issue pertaining to biotechnology

## OC ETHICS OF BIOTECHNOLOGY

- OC1 Explore ethical, legal, and social biotechnology issues
- OC2 Evaluate the benefits and risks associated with biotechnology.
- OC3 Research, evaluate, and articulate the implications of an ethical, legal, social, or cultural biotechnology issue
- OC4 Explore the emergence, evolution, and implications of bioethics
- OC5 Examine an ethical dilemma associated with biotechnology by identifying its components
- OC6 Research and debate an ethical issue associated with biotechnology
- OC7 Explain the meaning of intellectual properties as related to biotechnology
- OC8 Examine intellectual properties associated with biotechnology by defining their component
- OC9 Analyze an intellectual property issue associated with bioethics

OC10 Describe how agribiotechnology impacts the global economy

OC11 Compare conventional fossil fuel production to biotechnological alternative fuel production (e.g., ethanol, biodiesel)

## OD LABORATORY RECORDS

OD1 Maintain a biotechnology laboratory notebook

OD2 Analyze strengths of the research based on data, procedures, and propose future investigation

OD3 Utilize external reviews and compare them to research conducted

## OE LABORATORY EQUIPMENT

OE1 Operate basic laboratory equipment and measurement devices (e.g., microscope, micropipette, autoclave, centrifuge)

OE2 Operate advanced laboratory equipment and measurement devices (e.g., thermal cycler, electrophoresis equipment, microarray, spectrometer)

OE3 Calibrate laboratory equipment and conduct instrument qualification tests

## OF LABORATORY PROCEDURES

OF1 Demonstrate basic aseptic techniques in the biotechnology laboratory

OF2 Demonstrate advanced aseptic techniques in the biotechnology laboratory

OF3 Perform bioassays and experiments under aseptic conditions

OF4 Perform procedures with biological materials according to directions

OF5 Select an appropriate standard operating procedure for working with biological materials

OF6 Develop a standard operating procedure for a biological process

## OG MATERIAL MANAGEMENT

OG1 Prepare simple chemical solutions using standard operating procedures

OG2 Prepare buffers, reagents, solutions, and media

OG3 Verify the physical properties of buffers, reagents, solutions, and media

OG4 Identify and describe hazards associated with biological and chemical materials

OG5 Identify the process to inventory biological and chemical materials, and maintain accurate records of supplies and expiration dates

OG6 List the procedures to order, stock, and maintain supplies of biological and chemical materials

OG7 Maintain a safe environment by properly identifying and disposing of laboratory waste

OG8 Diagram the flow of waste after it leaves the laboratory

OG9 Devise a management plan to reduce laboratory waste

## **OH MICROBIOLOGY/MOLECULAR/ENZYMولوجY/IMMUNOLOG**

OH1 Differentiate the types of organisms and demonstrate how to handle them safely

OH2 Isolate, maintain, quantify, and store cell cultures

OH3 Characterize the physical, chemical, and biological properties of microbes

OH4 Explain the structures of DNA and RNA and how genotype influences phenotype

OH5 Explain the molecular basis for heredity and the tools and techniques used in DNA and RNA manipulations

OH6 Analyze factors that influence gene expression

OH7 Extract and purify DNA and RNA

OH8 Perform electrophoretic techniques and interpret electrophoresis fragmentation patterns

OH9 Perform DNA and RNA recombinations such as basic cloning/subcloning, blotting, sequencing, and amplification

OH10 Perform simple enzyme activity assays to detect proteins

OH11 Perform protein separation techniques and interpret the results

OH12 Characterize the biochemical properties of proteins

OH13 Describe how antibodies are formed and how they can be used in biotechnology applications

OH14 Conduct an Enzyme-Linked Immunosorbent Assay (ELISA)

OH15 Use antibodies to detect and quantify antigens

OH16 Explain reasons for detecting microbes and identify sources of microbes

OH17 Research and describe the use of biotechnology to detect microbes

OH18 Design and perform an assay to detect a target microorganism in food, water, or the environment

## **OI GENETIC ENGINEERING**

OI1 Explain biological, social, agronomic, and economic reasons for genetic modification of eukaryotes

OI2 Diagram the processes and describe the techniques used to produce transgenic eukaryote

OI3 Design and conduct an experiment to evaluate an existing transgenic eukaryote

OI4 Describe enzymes, the changes they cause in foods and the physical/chemical parameters that affect enzymatic reactions

OI5 Describe processes by which enzymes are produced through biotechnology

OI6 Use biotechnology tools or microbial strain selection to improve or discover enzymes for use in food processing

OI7 Compare and contrast the use of natural organisms and genetically engineered organisms in the treatment of wastes

OI8 Diagram the process by which organisms are genetically engineered for waste treatment

OI9 Monitor and evaluate the treatment of a waste product using a genetically engineered organisms

OI10 Describe the benefits and risks associated with the use of biotechnology to increase productivity and improve quality of aquatic species

OI11 Investigate and report on genetic engineering procedures used in the production of aquatic species

OI12 Conduct field or clinical trials for genetically modified aquatic species

## OJ BIOTECHNOLOGY PROCESSES IN AGRICULTURE

OJ1 Explain the functions of hormones in animals

OJ2 Describe the processes used to produce animal hormones from transgenic organisms

OJ3 Administer hormones to enhance animal health, growth, or reproduction and monitor/analyze the results

OJ4 Identify foods produced through fermentation

OJ5 Compare and contrast bioengineering and conventional pathways used in food processing

OJ6 Process food using biotechnology

OJ7 Explain the process of fermentation

OJ8 Describe the process used in producing alcohol from biomass

OJ9 Produce alcohol and co-products from biomass

OJ10 Explain the process of transesterification

OJ11 Diagram the process used in producing biodiesel from biomass

OJ12 Produce biodiesel and co-products from biomass

OJ13 Explain the process of methanogenesis

OJ14 Illustrate the process used in producing methane from biomass

OJ15 Produce methane and co-products from biomass

## **OK BIOTECHNOLOGY TO MONITOR PROCEDURES IN AGRICULTURE**

OK1 Describe the selective plant breeding process

OK2 Select biotechnology tools used to monitor and direct plant breeding

OK3 Design and conduct an experiment using biotechnology tools to evaluate selectively bred plants

OK4 Describe biotechnology processes applicable to animal health

OK5 Assess the benefits, risks, and opportunities associated with using biotechnology to promote animal health

OK6 Implement animal-care protocols that use biotechnology tools to ethically monitor and promote animal systems (Institutional Animal Care and Use Committee develops animal-care protocols)

OK7 Give examples of instances in which bioremediation can be applied to clean up environmental contaminant

OK8 Describe the use of biotechnology in bioremediation

OK9 Monitor and evaluate the effectiveness of bioremediation efforts by participating in a bioremediation project

OK10 Explain the use of microorganisms in biological waste management

OK11 Describe the processes involved in biotreatment of biological wastes

OK12 Monitor and evaluate the treatment of biological wastes with microorganisms

OK13 Explain the role of microorganisms in industrial chemical waste treatment

OK14 Interpret the processes involved in biotreatment of industrial chemical wastes

OK15 Monitor and evaluate the treatment of industrial chemical wastes with microorganisms

OK16 Explain the global importance of biodiversity

OK17 Select biotechnology tools used to measure biodiversity

OK18 Use biotechnology tools to measure biodiversity in a population

OK19 Explain the consequences of agricultural practices on wild populations

OK20 Explain how biotechnology tools can be used to monitor the effects of agricultural practices on wild populations

OK21 Analyze the implications of biotechnology on wild species

OK22 Explain biomass and sources of biomass

OK23 Assess the characteristics of biomass that make it useful for biofuels production

OK24 Evaluate the technologies used to create biofuels from biomass

OK25 Define industrial biotechnology, describe the benefits and risks associated with its use in the manufacturing of fabrics, plastics, and other products

OK26 Describe the processes used in the production of molecules for use in industrial applications

OK27 Monitor and evaluate biotechnology processes used in the synthesis of a molecule