Texas CTE: Health Science

Principles of Bioscience

Implementation. A

1 The provisions of this section shall be implemented by school districts beginning with the 2023- 2024 school year. A.1

2 School districts shall implement the employability skills student expectations listed in §127.15(d)(1) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course. A.2

General requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course. B

b General requirements. This course is recommended for students in Grades 9 and 10. Students shall be awarded one credit for successful completion of this course. B

Introduction. C

1 Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions. C.1

2 The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostics services, health informatics, support services, and biotechnology research and development. C.2

3 Principles of Bioscience provides an overview of biotechnology, bioengineering, and related fields. Topics related to genetics, proteins, and nucleic acids reinforce the applications of Biology content. Students will further study the increasingly important agricultural, environmental, economic, and political roles of bioenergy and biological remediation; the roles of nanoscience and nanotechnology in biotechnology medical research; and future trends in biological science and biotechnology. C.3

4 Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations. C.4

5 **Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.** C.5

Knowledge and skills. D

1 **The student explores biotechnology career opportunities. The student is expected to:** D.1

- A determine interests in the field of biotechnology through explorations such as career assessments, interactions with biotechnology professionals, media, and literature; D.1.A
- B identify career options in the field of biotechnology; D.1.B
- C identify reliable sources of career information; D.1.C
- D research and communicate interests, knowledge, educational level, abilities, and skills needed in a biotechnology-related occupation; D.1.D
- E identify conventional and non-conventional career opportunities that match interests and aptitudes; D.1.E
- F research applications of biotechnology in medicine, the environment, and settings such as pharmaceutical, agricultural, and industrial; D.1.F
- G use technology to research biotechnology topics, including identifying and selecting appropriate scholarly references; and D.1.G
- H analyze and discuss professional publications such as academic and peer-reviewed journals and technical reports. D.1.H

2 **The student evaluates ethical and legal issues in biotechnology. The student is expected to:** D.2

- A identify current ethical and legal issues; D.2.A
- B describe the history of biotechnology and related ethical and legal issues; D.2.B
- C discuss legal and technology issues for at least two biotechnology-related areas; and D.2.C
- D analyze examples of biotechnology views supported by objective and subjective sources such as scientific data, economic data, and sociocultural contexts. D.2.D

3 **The student examines federal, state, local, and industry regulations as applied to biotechnological processes through researching credible sources. The student is expected to:** D.3

- A identify local, state, and federal agencies responsible for regulating the biotechnology industry such as the U.S. Department of Agriculture (USDA), the Environmental Protection Agency (EPA), the U.S. Food and Drug Administration (FDA), and the Centers for Disease Control and Prevention (CDC); D.3.A
- B identify professional organizations participating in the development of biotechnology policies; D.3.B
- C identify and define terms related to biotechnology regulations such as Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP), and Globally Harmonized System (GHS); and D.3.C
- D outline the methods and procedures used in biotechnology laboratories to follow local, state, and federal regulations such as those in the agricultural and health areas. D.3.D

4 **The student demonstrates knowledge of the business climate for biotechnology industry sectors in the current market. The student is expected to:** D.4

- A identify professional publications; D.4.A
- B identify the various biotechnology industry sectors; D.4.B
- C investigate and report on career opportunities in the biotechnology industry sectors; and D.4.C
- D identify professional organizations such as those at the local, state, and national levels. D.4.D

5 **The student researches and exhibits employability skills that support a career in the biotechnology industry. The student is expected to:** D.5

- A demonstrate verbal, non-verbal, written, and electronic communication skills; D.5.A
- B demonstrate skills used to secure and maintain employment; D.5.B
- C demonstrate appropriate workplace etiquette; D.5.C
- D display productive work habits and attitudes; and D.5.D
- E identify appropriate safety equipment and practices as outlined in Texas Education Agency-approved and industry-approved safety standards such as the use of personal protective equipment (PPE) and safety data sheets (SDS). D.5.E

6 **The student investigates how biotechnology impacts the origins of waste and resource recovery. The student is expected to:** D.6

- A identify biotechnology manufacturing processes and their end products, including waste and marketable products; D.6.A
- B explore the impacts of waste on biotic and abiotic factors in the environment such as effects on biological life cycles and pollution from nonbiodegradable single-use materials and microplastics; D.6.B
- C analyze the results of manufacturing refuse; D.6.C
- D explain the negative impacts of waste with respect to the individual, society, and the global population; D.6.D
- E investigate solutions to waste through bioremediation; and D.6.E
- F investigate evidence supporting waste management through regulations, public policy, and technology development. D.6.F

7 **The student examines the relationship of biotechnology to the development of commercial products. The student is expected to:** D.7

- A identify applications of agricultural biotechnology such as selective breeding of livestock and plants, aquaculture, horticultural products, and genetically modified organisms; D.7.A
- B identify applications of industrial biotechnology such as fermented food and beverages, genetically engineered proteins for industry, biocatalysts, bio polymers, biosensors, bioremediation, and biofuels; D.7.B
- C identify applications of medical and pharmaceutical biotechnology such as genetically modified cells, antibodies, vaccine and gene therapy, genetic testing for human disease/disorders, three-dimensional bio-printing, and medicines from plants, animals, fungi, and bacteria; D.7.C
- D identify applications of research and development in biotechnology such as deoxyribonucleic acid (DNA) and protein synthesis and sequencing, genetic testing and screening, DNA identification, RNAi, siRNA, miRNA, the CRISPR/Cas9 system, and synthetic biology; D.7.D
- E identify the applications of biotechnology in the fields of forensics, law enforcement, nanotechnology, and bioinformatics; D.7.E
- F research ethical considerations, laws, and regulations for biotechnological applications such as bioinformatics, genetic engineering, and nanotechnology; and D.7.F
- G identify the function of laboratory equipment, including a microscope, thermocycler, pH meter, hot plate stirrer, electronic balance, autoclave, centrifuge, transilluminator, micropipette, incubator, electrophoresis unit, vortex mixer, water bath, laboratory glassware, biosafety cabinet, and chemical fume hood. D.7.G