

Biotechnology I: High School

Foundational Standards

- 1 Incorporate safety procedures in handling, operating, and maintaining tools and machinery; handling materials; utilizing personal protective equipment; maintaining a safe work area; and handling hazardous materials and forces.** F.1

- 2 Demonstrate effective workplace and employability skills, including communication, awareness of diversity, positive work ethic, problem-solving, time management, and teamwork.** F.2

- 3 Explore the range of careers available in the field and investigate their educational requirements and demonstrate job-seeking skills including resume-writing and interviewing.** F.3

- 4 Advocate and practice safe, legal, responsible, and ethical use of information and technology tools specific to the industry pathway.** F.4

- 5 Participate in a Career and Technical Student Organization (CTSO) to increase knowledge and skills and to enhance leadership and teamwork.** F.5

- 6 Demonstrate effective infection control techniques as defined by the Centers for Disease Control and Prevention (CDC) and The Joint Commission guidelines.** F.6

Career Opportunities

- 1 Trace the history of biotechnology and the emergence of biotechnology careers.** 1
 - a Identify scientific fields related to biotechnology. 1.A

Laboratory Procedures and Technical Skills

- 2 Use a microscope to observe and record measurements and characteristics of specimens** 2
 - a Prepare slides for microscopic examination. 2.A

- 3 Use scientific notation, significant digits, and decimals when performing and recording laboratory calculations.** 3

- 4 Adjust the pH of specific solutions with commonly used acids and bases, using a pH meter to verify results.** 4
 - a Explain the principle by which a pH meter works. 4.A

- 5 Perform polymerase chain reaction (PCR) to amplify a DNA sample, diagnose a disease, or isolate a pathogen.** 5

- 6 Perform DNA extraction.** 6

7 Demonstrate techniques used in working with recombinant DNA. 7

8 Maintain bacterial cultures, including preparing growth media and culturing microorganisms. 8

Biochemistry

9 Explain concepts of molecular mass, mole, and formula weight. 9

a Calculate molecular mass of specific molecules and the molarity of a solution. 9.A

10 Explain cell theory, correlating key cellular components to functions. 10

a Describe the interactions among cells, and between cells and their environment. 10.A

Genetics and Cell Biology

11 Construct models demonstrating the process of meiosis and the cell cycle, explaining the hereditary significance of each. 11

a Distinguish between spermatogenesis and oogenesis, using charts or models to illustrate differences between them. 11.A

12 Contrast typical and atypical chromosome karyotypes. 12

a Describe the structure of eukaryotic chromosomes, including transposons, introns, and exons. 12.A

13 Explain the significance of Mendel's work in the development of the modern science of genetics, including the laws of segregation and independent assortment. 13

14 Describe and illustrate inheritance patterns based on gene interactions. 14

a Predict patterns of heredity using pedigree analysis, including incomplete dominance, codominance, and multiple allelism. 14.A

15 Compare and contrast sex linkage, autosomal linkage, crossover, multiple alleles, and polygenes. 15

16 Model protein synthesis and explain the procedure, citing the central dogma of molecular biology. 16

17 Research and report on methods cells use to regulate gene expression and demonstrate their effect on protein synthesis. 17

18 Diagram and explain the replication of DNA and RNA viruses, including lytic and lysogenic cycles. 18

19 Research and report on factors that cause genetic mutations, including the effects of genetic variability on adaptations. 19

a Describe how DNA mutations impact both individual organisms and populations. 19.A

20 Explain how the Hardy-Weinberg principle provides a baseline for recognizing evolutionary changes in gene frequency due to genetic drift, gene flow, non-random mating, mutation, and natural selection. 20

Genetic Innovations

21 Obtain, evaluate, and share information about applications of biotechnology in a variety of settings, including plant, animal, microbial, forensic, and marine environments. 21

22 Explain the development, purpose, findings, and applications of the Human Genome Project, and discuss ethical, social, and legal implications. 22

- a Identify and explain medical uses of gene therapy, including vaccines and tissue and antibody engineering. 22.A
- b Utilize computer bioinformatics resources to provide information regarding DNA, protein sequences, and human genetic diseases. 22.B