Alabama CTE

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