

Florida Department of Education
Curriculum Framework

The standards and/or benchmarks for this program were updated for the 2026-27 academic year.

Program Title: Biomedical Sciences
Program Type: Non Career Preparatory
Career Cluster: Health Science

Secondary – Non Career Preparatory	
Program Number	8708100
CIP Number	0326010201
Grade Level	9-12
Program Length	4 credits
Teacher Certification	Refer to the Program Structure section.
CTSO	HOSA
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Health Science career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Health Science career cluster.

The purpose of this program is to provide students with a foundation of knowledge and technically oriented experiences in the study and applications of biomedical sciences and the possibilities in the biomedical field.

The content includes but is not limited to the study of human body systems, medicine, health, key biological concepts, communication, transport of substances, locomotion, metabolic processes, defense, protection, research processes, engineering principles, and an introduction to bioinformatics. The program also includes the design and development of various medical interventions, including vascular stents, cochlear implants, and prosthetic limbs. In addition, students review the history of organ transplants and gene therapy, and stay updated on cutting-edge developments via current scientific literature.

Additional Information relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

Program Structure

Students complete the three foundation courses (8708110, 8708120, and 8708130) and the capstone course (8708140).

This program is a planned sequence of instruction totaling four credits.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title	Teacher Certification	Length	Level	Graduation Requirement
8708110	Principles of the Biomedical Sciences	BIOLOGY 1 @2 REG NURSE 7 G MED PROF 7 G PARAMEDIC @7 7G LAB TECH @7 7G PLTW HEALTH 7G	1 credit	3	EQ
8708120	Human Body Systems		1 credit	3	EQ
8708130	Medical Interventions		1 credit	3	EQ
8708140	Biomedical Innovation		1 credit	3	CT

(Graduation Requirement Codes: CT= Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA= Mathematics, PL= Personal Financial Literacy)

Florida's Career Readiness Skills for CTE Programs

Employability Skills	
01.0	Apply academic skills to workplace scenarios.
01.01	Use reading skills.
01.02	Use writing skills.
01.03	Use mathematical strategies and procedures.
01.04	Use scientific principles and procedures.
02.0	Design a solution to an industry problem.
02.01	Use critical thinking.
02.02	Use creativity.
02.03	Make sound decisions.
02.04	Solve problems.
02.05	Reason.
02.06	Plan and organize.
03.0	Manage resources within an industry project
03.01	Manage time.
03.02	Manage money or resources.
03.03	Manage materials.
03.04	Manage personnel.
04.0	Oversee the subcomponents, operations and output of a technical or organizational system.
04.01	Manage systems.
04.02	Monitor systems.
04.03	Improve systems.
05.0	Use information for decision making.
05.01	Locate information.
05.02	Organize information.
05.03	Use information.

05.04	Analyze information.
05.05	Communicate information.
06.0	Apply relevant technology to workplace scenarios to aid productivity.
06.01	Use technology.
07.0	Interpret and express interpersonal communication.
07.01	Communicate verbally.
07.02	Listen actively.
07.03	Comprehend written material.
07.04	Convey information in writing.
07.05	Communicate nonverbally.
07.06	Interpret nonverbal communication.
08.0	Interact with others to accomplish workplace goals.
08.01	Collaborate with others in a team.
08.02	Respond to customer needs.
08.03	Exercise leadership.
08.04	Negotiate to resolve conflict.
08.05	Respect others.
09.0	Manage personal behavior to maximize productivity and professional growth.
09.01	Demonstrate responsibility and self-discipline.
09.02	Adapt and show flexibility.
09.03	Work independently.
09.04	Demonstrate a willingness to learn.
09.05	Demonstrate integrity.
09.06	Demonstrate professionalism.
09.07	Take initiative.
09.08	Display positive attitude.
09.09	Take responsibility for professional growth.

Career Exploration & Planning	
10.0	Explain career opportunities aligned with the regional economy and personal aspirations.
10.01	Describe regional occupations that are high-demand, high-growth, high-wage and/or high-skill.
10.02	Describe careers aligned with his or her interests, skills and values based on career assessment, experiential learning, career informational interviews, research and/or reflection.
11.0	Explain postsecondary pathways aligned with his or her career aspirations.
11.01	Compare and contrast postsecondary pathways, including education, employment, entrepreneurship and enlistment (the “Four Es”).
11.02	Compare and contrast regional postsecondary training provider options, including apprenticeships, technical colleges, state colleges, universities and industry-recognized certification providers.
11.03	Define postsecondary credentialing and stacking options, including industry-recognized certifications, apprenticeship certificates of completion, career certificates, licenses and associate or baccalaureate degrees.
11.04	Compare postsecondary training data for training programs of interest, such as total costs, average student loan debt, and median earnings and job placement rates after program completion.
12.0	Develop a personalized career and academic plan.
12.01	Prioritize an occupation, credential and postsecondary training provider for plan formation.
12.02	Self-assess progress toward meeting graduation requirements and skill-development goals.
12.03	Develop and complete a chronological checklist of steps and deadlines prior to postsecondary training or national service application that includes any required documentation to gather, writing prompts and examinations.
12.04	Identify a variety of financial aid opportunities, including scholarships, grants, savings, work, work-study programs, private loans and federal loans.
12.05	Develop a postsecondary training budget that is inclusive of living and school expenses.
Job Attainment	
13.0	Find, assess and apply to job opportunities.
13.01	Identify online job posts relevant to his or her career aspirations.
13.02	Compare and contrast the job posts’ required qualifications, job duties, compensation, benefits and employers.
13.03	Define what information, documentation and writing prompts are required for the positions.
14.0	Communicate personal competence, character and fit for a job opportunity.
14.01	Develop a resume.
14.02	Write a cover letter.
14.03	Curate a professional portfolio that includes work products.
14.04	Prepare for and experience a mock job interview.

15.0	Cultivate and leverage relationships to professionally advance.
15.01	Request a signed reference letter, letter of recommendation and/or an online skill/professionalism endorsement.
15.02	Develop a plan to cultivate a professional digital footprint.
15.03	Develop a networking plan for a specific industry of interest.

Standards

After successfully completing this program, the student will be able to perform the following:

Principles of the Biomedical Sciences

- 01.0** Demonstrate knowledge as a member of a forensic investigation team.
- 02.0** Explain the connection between structure and function in biology.
- 03.0** Describe how the systems of the body work together to maintain homeostasis.
- 04.0** Document patient information.
- 05.0** Explore aspects of emergency medicine and apply learning to hospitals and outbreaks.
- 06.0** Understand and describe the importance of blood in relation to the cardiovascular system and the human body.
- 07.0** Explain the role of DNA, RNA, and proteins in the inheritance of traits and the development of diseases or disorders.
- 08.0** Describe cell division and the process by which chromosomes replicate, leading to genetic diversity.
- 09.0** Analyze genetic information to predict patterns of inheritance.
- 10.0** Select and use appropriate tools, techniques, and/or technologies to analyze genetic information and diagnose disease.
- 11.0** Explain how the composition, structure, and activities of cells build functional systems in the human body.
- 12.0** Devise and execute a plan to solve a problem, using evidence to justify decisions.
- 13.0** Apply an iterative design process to creatively address a need or solve a problem.

Human Body Systems

- 14.0** Explain clinical tests that are used to diagnose malfunctioning organ systems.
- 15.0** Describe how imbalances in the body system can result in diseases.
- 16.0** Describe the structures and functions of the skeletal system.
- 17.0** Describe the structures and functions of the muscular system.
- 18.0** Describe the structures and functions of the integumentary system.
- 19.0** Describe the structures and functions of the cardiovascular system.
- 20.0** Describe the structures and functions of the nervous system.
- 21.0** Describe the structures and functions of the lymphatic and immune systems.
- 22.0** Describe the structures and functions of the respiratory system.
- 23.0** Describe the structures and functions of the endocrine system.
- 24.0** Describe the structures and functions of the digestive system.
- 25.0** Describe the structures and functions of the urinary system.
- 26.0** Describe the structures and functions of the reproductive system.

Medical Interventions

- 27.0** Investigate the variety of interventions involved in the prevention, diagnosis, and treatment of infectious diseases.
- 28.0** Explore the factors that contribute to the effectiveness of antibiotics against infectious diseases.
- 29.0** Investigate the pathology of hearing loss as a detrimental effect of infectious diseases.
- 30.0** Explore vaccination as a mode of infectious disease prevention.
- 31.0** Investigate the available types of genetic testing/screening and their ethical implications.

- 32.0** Examine the current reproductive and genetic technology and discuss the future of medical interventions.
- 33.0** Explore the diagnostic techniques and technology being used to better diagnose and understand cancer.
- 34.0** Explore the potential risk factors associated with cancer and the various situations that cause changes to DNA.
- 35.0** Investigate the treatments and therapies available to treat the physical, mental, and emotional effects of cancer.
- 36.0** Explore future medical interventions for cancer.
- 37.0** Explore the medical implications of proteins produced and purified in a laboratory setting.
- 38.0** Investigate the epidemiology and therapeutic interventions of kidney failure.
- 39.0** Explore the process, policies, and procedures involved in organ transplantation.
- 40.0** Investigate how advances in medical knowledge and technology can aid in building a better human body for the future.

Biomedical Innovation

- 41.0** Investigate biomedical problems related to clinical care by designing an effective emergency care center.
- 42.0** Explore the variety of research study designs available and investigate how to set up and conduct valid and reliable studies.
- 43.0** Explore the process, knowledge, and skills required to design a medical innovation.
- 44.0** Explore biomedical innovation through investigating water contamination.
- 45.0** Evaluate a public health issue and combat the problem using knowledge of epidemiology, disease diagnosis, and public health resources.
- 46.0** Understand medical research and the process of writing a scientific grant.
- 47.0** (Optional) Use modern molecular biology techniques to clone and transfer DNA.
- 48.0** (Optional) Assuming the role of a medical expert, investigate a mysterious death using forensic autopsy techniques.
- 49.0** (Optional) Students work independently in an area of interest in the biomedical sciences and outline milestones in a long-term, open-ended problem using skills learned throughout the program to complete the project.

**Florida Department of Education
Student Performance Standards**

Course Title: Principles of Biomedical Science

Course Number: 8708110

Course Credit: 1

Course Description:

Students investigate the human body systems and various health conditions. This course is designed to provide an overview of all the courses in the Biomedical Sciences program and lay the scientific foundation for subsequent courses. Students are introduced to human physiology, medicine, research processes, and bioinformatics. Key biological concepts, including homeostasis, metabolism, inheritance of traits, and defense against disease, are embedded in the curriculum. Engineering principles, including the design process, feedback loops, and the relationship of structure to function, are also incorporated.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks	
01.0	Demonstrate knowledge as a member of a forensic investigation team. The student will be able to:
01.01	Analyze forensic evidence to draw conclusions.
01.02	Analyze autopsy information to determine the cause of death.
02.0	Explain the connection between structure and function in biology. The student will be able to:
02.01	Describe the anatomy and physiology of key human body systems as well as the organization and interaction of these systems.
02.02	Understand that interactions between internal and external sources can affect body systems and cell functions.
02.03	Explain how organ anatomy (such as that of the heart or brain) is related to function.
02.04	Demonstrate how a change in structure in the body impacts function.
03.0	Describe how the systems of the body work together to maintain homeostasis. The student will be able to:
03.01	Cite examples of how body systems collaboratively function to maintain homeostasis and health.

CTE Standards and Benchmarks	
03.02	Demonstrate how feedback loops help maintain homeostasis in the body.
03.03	Create, describe, and analyze models of biological processes to explain proper and improper functioning.
04.0	Document patient information. The student will be able to:
04.01	Use medical terminology to transcribe and communicate information, data, and observations.
04.02	Maintain accurate patient records and demonstrate why this is important.
04.03	Demonstrate adherence to HIPAA guidelines to maintain patient privacy.
05.0	Explore aspects of emergency medicine and apply learning to hospitals and outbreaks. The student will be able to:
05.01	Using information about how our bodies fight disease, describe how infectious disease can be spread, treated, prevented, and controlled.
05.02	Analyze evidence to trace the source of an infection, map the etiology of the disease, and stop the spread.
05.03	Describe the steps of risk assessment at a medical emergency.
05.04	Select the most appropriate route of delivery and dosage for a medication.
05.05	Propose strategies for responding to disasters and large-scale health crises that involve effective crisis communication, bleeding and injury control, and measures for control of medical surge.
06.0	Understand and describe the importance of blood in relation to the cardiovascular system and the human body. The student will be able to:
06.01	Explain that blood is a liquid connective tissue composed of erythrocytes, leukocytes, and thrombocytes that are suspended in liquid plasma.
06.02	Compare and contrast the functions of erythrocytes, leukocytes, and thrombocytes.
06.03	Recognize that blood is a major transport for many substances in the body that must be replenished throughout life, including hormones, gases, molecules, waste, and nutrients.
07.0	Explain the role of DNA, RNA, and proteins in the inheritance of traits and the development of diseases or disorders. The student will be able to:
07.01	Describe the structure and function of nucleic acids and the relationship among genes, alleles, chromosomes, proteins, and traits.
07.02	Explain how the order and chemical properties of amino acids influence a protein's structure and function.
07.03	Describe the processes of DNA replication and protein synthesis.
07.04	Explain how mutations in nucleic acids can lead to diseases or disorders or promote evolutionary change.

CTE Standards and Benchmarks	
	07.05 Demonstrate how environmental factors can lead to genetic mutations.
08.0	Describe cell division and the process by which chromosomes replicate, leading to genetic diversity. The student will be able to:
	08.01 Differentiate between mitosis and meiosis and model how these processes lead to genetic diversity.
	08.02 Analyze karyotypes to diagnose chromosomal abnormalities.
09.0	Analyze genetic information to predict patterns of inheritance. The student will be able to:
	09.01 Predict the pattern of gene inheritance using Punnett squares.
	09.02 Predict the pattern of gene inheritance using pedigree analysis.
10.0	Select and use appropriate tools, techniques, and/or technologies to analyze genetic information and diagnose disease. The student will be able to:
	10.01 Explain and demonstrate techniques in molecular biology (DNA extraction, restriction digestion, gel electrophoresis) and interpret results.
	10.02 Utilize bioinformatics to analyze and compare genetic information.
11.0	Explain how the composition, structure, and activities of cells build functional systems in the human body. The student will be able to:
	11.01 Differentiate between prokaryotic and eukaryotic cells.
	11.02 Describe the relationship of cells, tissues, organs, and systems in the human body.
	11.03 Identify the structure and function of macromolecules that are used in the body.
	11.04 Demonstrate how the structure of the cell membrane impacts homeostasis.
	11.05 Interpret the interaction between cells and between cells and their environment.
12.0	Devise and execute a plan to solve a problem, using evidence to justify decisions. The student will be able to:
	12.01 Synthesize information from multiple credible sources, such as literature, databases, policy documents, and diverse perspectives from multiple disciplines, to explore causes and solutions to problems.
	12.02 Devise and execute a plan to solve a problem while considering the impacts of the possible solutions.
	12.03 Conduct research using credible resources to craft explanations and draw conclusions while acknowledging the limitations, opposing views, and biases.
13.0	Apply an iterative design process to creatively address a need or solve a problem. The student will be able to:
	13.01 Assess how design and innovation can help solve a problem in biomedical science.

CTE Standards and Benchmarks

- | | |
|-------|--|
| 13.02 | Identify and define visual, functional, and structural design requirements (criteria) and realistic constraints, against which solution alternatives can be evaluated and optimized. |
| 13.03 | Compare competing solution ideas and justify the selection of a solution path with respect to design requirements and constraints. |
| 13.04 | Develop a solution and implement a plan to test and evaluate a potential solution to verify that it meets all constraints and complies with all design criteria. |

**Florida Department of Education
Student Performance Standards**

Course Title: Human Body Systems

Course Number: 8708120

Course Credit: 1

Course Description:

Students examine the interactions of body systems as they explore identity, communication, power, movement, protection, and homeostasis. Students design experiments, investigate the structures and functions of the human body, and use data acquisition software to monitor body functions such as muscle movement, reflex and voluntary action, and respiration. Exploring science in action, students build organs and tissues on a skeletal manikin, work through interesting real-world cases, and often play the role of biomedical professionals to solve medical mysteries.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks	
14.0	Explain clinical tests that are used to diagnose malfunctioning organ systems. The student will be able to:
14.01	Analyze spirometry data to determine tidal volume, vital capacity, and minute volume.
14.02	Analyze urinalysis results to diagnose disease and dysfunction in human body systems.
14.03	Measure peripheral pulses using Doppler ultrasound and calculate an ankle brachial index (ABI).
14.04	Use electrocardiography (EKG) to describe the conduction system of the heart and identify abnormal heart rhythms.
14.05	Interpret EMG data to assess muscle function.
14.06	Interpret X-rays to determine specific types of bone fractures.
15.0	Describe how imbalances in the body system can result in diseases. The student will be able to:
15.01	Explain how events can cause organ system dysfunction and lead to disease.
15.02	Describe and evaluate medical intervention strategies that can treat or cure diseases.

CTE Standards and Benchmarks

15.03	Explain how lifestyle choices can lead to disease.
15.04	Analyze physical symptoms of a patient and relate these symptoms to errors in hormonal levels.
15.05	Analyze how structural dysfunction of blood vessels impacts overall health.
15.06	Interpret how a breakdown in communication in the central nervous system impacts the function of the human body.
16.0	Describe the structures and functions of the skeletal system. The student will be able to:
16.01	Illustrate the structure, development, growth, and function of compact and spongy bone.
16.02	Locate and identify individual bones and bone features.
16.03	Describe the structure of the major types of joints and how these influence mobility and stability.
17.0	Describe the structures and functions of the muscular system. The student will be able to:
17.01	Compare and contrast the structural and functional similarities and differences between skeletal, cardiac, and smooth muscle.
17.02	Explain the processes involved in the sliding filament model and biochemical mechanisms that provide energy for muscle contraction and relaxation.
17.03	Identify the major muscles on a diagram, model, or through dissection.
18.0	Describe the structures and functions of the integumentary system. The student will be able to:
18.01	Analyze the structural characteristics and functional importance of the integumentary system.
18.02	Investigate the consequences of injury and disease to the integumentary system.
19.0	Describe the structures and functions of the cardiovascular system. The student will be able to:
19.01	Investigate the structures and functions of the cardiovascular system.
19.02	Relate the structure and functions of the cardiovascular system to maintaining homeostasis.
19.03	Analyze the functions of blood involved in maintaining homeostasis; including nutrient, gas, and waste exchange.
20.0	Describe the structures and functions of the nervous system. The student will be able to:
20.01	Investigate the structural and functional components of the nervous system.
20.02	Describe the structures and the basic functions of different types of neurons.

CTE Standards and Benchmarks	
20.03	Identify and model how action potentials are generated, the ions and channel proteins involved, and the basic structural and functional aspects which allow for synaptic connection.
20.04	Explore the anatomy of the eye, its functional layers, and its function.
21.0	Describe the structures and functions of the lymphatic and immune systems. The student will be able to:
21.01	Identify the structures and functions of the lymphatic and immune system.
21.02	Understand that pathogens are agents of disease and possess identifying surface structures called antigens.
21.03	Investigate the differences between innate and acquired immunity and explain how these types of immunity defend against infection.
21.04	Describe how the immune system responds when an antigen enters the body.
21.05	Describe immune-based prevention of and treatment for various infectious agents.
22.0	Describe the structures and functions of the respiratory system. The student will be able to:
22.01	Identify and locate major organs of the respiratory system and describe their functions.
22.02	Investigate lung volume and assess the impacts of varying capacities.
23.0	Describe the structures and functions of the endocrine system. The student will be able to:
23.01	Investigate the structure and function of the endocrine system.
23.02	Demonstrate how changes in hormone levels impact homeostasis throughout the body systems.
23.03	Discuss the structural and functional differences between an endocrine gland and an exocrine gland.
23.04	Describe the relationship between the endocrine and exocrine functions of the pancreas and digestion and blood sugar regulation.
24.0	Describe the structures and functions of the digestive system. The student will be able to:
24.01	Identify and locate the organs of the digestive system and describe their functions.
24.02	Investigate the identity and function of enzymes of the digestive system.
24.03	Explain how the microbiome of the gut plays important roles in the body.
25.0	Describe the structures and functions of the urinary system. The student will be able to:
25.01	Identify and locate organs of the urinary system and discuss their functions.

CTE Standards and Benchmarks

25.02 Describe the function of the kidneys in maintaining homeostasis of bodily fluids and blood pressure.

25.03 Illustrate the nephron showing its structural components and the functional processes of filtration, secretion, and reabsorption.

25.04 Investigate how the kidneys respond to excess water intake and to dehydration.

26.0 Describe the structures and functions of the reproductive system. The student will be able to:

26.01 Identify and locate major and accessory organs of the female and male reproductive systems and discuss their functions.

26.02 Discuss the role of hormones in the reproductive system.

**Florida Department of Education
Student Performance Standards**

Course Title: Medical Interventions
Course Number: 8708130
Course Credit: 1

Course Description:

Students investigate the variety of interventions involved in the prevention, diagnosis and treatment of disease as they follow the lives of a fictitious family. The course is a “How-To” manual for maintaining overall health and homeostasis in the body as students explore: how to prevent and fight infection; how to screen and evaluate the code in human DNA; how to prevent, diagnose and treat cancer; and how to prevail when the organs of the body begin to fail. Through these scenarios, students are exposed to the wide range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks	
27.0	Investigate the variety of interventions involved in the prevention, diagnosis, and treatment of infectious diseases. The student will be able to:
27.01	Research various medical interventions and explain how these interventions help prevent, diagnose, and treat disease.
27.02	Define bioinformatics and explore how it is used in the collection, classification, storage, and analysis of biochemical and biological information.
27.03	Explain how bacteria can be identified using DNA sequencing.
27.04	Investigate the roles of diagnostic tests for infectious diseases.
27.05	Graphically organize connections between individuals in a fictitious disease outbreak.
27.06	Determine the concentration of infectious bacteria in simulated body fluids and identify infected patients using antibody-based diagnostic tests, such as ELISA assay.
28.0	Explore the factors that contribute to the effectiveness of antibiotics against infectious diseases. The student will be able to:
28.01	Analyze and describe the structure of a bacterial cell.
28.02	Investigate how antibiotics disrupt the physiological pathways that bacteria need to survive.

CTE Standards and Benchmarks	
28.03	Explain how bacteria use adaptations to gain resistance to antibiotics.
28.04	Demonstrate one of the pathways through which bacterial cells transfer genes.
28.05	Use a model to simulate the effects of antibiotics on the population of bacteria during an infection.
29.0	Investigate the pathology of hearing loss as a detrimental effect of infectious diseases. The student will be able to:
29.01	Distinguish the properties of sound waves; including frequency and amplitude.
29.02	Explain the anatomy of the ear and create a model of the ear demonstrating how its structure relates to its function.
29.03	Identify diagnostic tests that assess and evaluate hearing loss.
	• Perform diagnostic tests to assess and evaluate hearing loss.
29.04	Research interventions and services available to aid those with hearing loss.
29.05	Investigate and debate the bioethical concerns related to the use of cochlear implant technology.
30.0	Explore vaccination as a mode of infectious disease prevention. The student will be able to:
30.01	Explain how vaccines act as medical interventions to defend the body against infectious invaders.
30.02	Explore laboratory methods in which vaccines are produced.
30.03	Describe the structure and function of plasmids and explain their significance in genetic engineering.
30.04	Investigate the importance of epidemiologists and their impact on public health.
30.05	Describe how vaccines interact with the human immune system.
30.06	Interpret data from a disease outbreak to determine the course of the infection.
30.07	Explore general perspectives on the use of vaccinations.
31.0	Investigate the available types of genetic testing/screening and their ethical implications. The student will be able to:
31.01	Describe genetic testing and how it is used to determine if someone has a genetic disorder.
31.02	Explain how genetic counseling impacts a patient's health outcome.
31.03	Amplify a segment of DNA in the laboratory using the Polymerase Chain Reaction (PCR) procedure.

CTE Standards and Benchmarks	
31.04	Use laboratory techniques such as DNA extraction, PCR, and restriction analysis to identify single base pair differences in DNA.
31.05	Utilize laboratory results to analyze the relationship between genotype and phenotype.
31.06	Analyze prenatal genetic screening results.
31.07	Describe the basics of proper prenatal care as well as specified medical interventions used to monitor a pregnancy.
31.08	Investigate how a person's ability to taste the chemical PCT, their phenotype, relates to their results from laboratory genetic testing their genotype.
32.0	Examine the current reproductive and genetic technology and discuss the future of medical interventions. The student will be able to:
32.01	Explore how gene therapy can be used to treat genetic disorders.
32.02	Discuss and debate the safety and effectiveness of gene therapy.
32.03	Explore the various medical interventions parents have available to choose the sex of their future child, including sperm sorting and embryo selection by pre-implantation genetic diagnosis (PDG).
32.04	Discuss the possibility of reproductive cloning and the ethical concerns.
32.05	Evaluate and debate the potential impact of reproductive technology from moral, ethical, and scientific perspectives.
33.0	Explore the diagnostic techniques and technology being used to better diagnose and understand cancer. The student will be able to:
33.01	Investigate the physiology of cancer and discuss how cancerous cells differ from healthy cells.
33.02	Describe the different uses of x-rays, CT scans, and MRI scans.
33.03	Investigate what DNA microarrays measure and how this information is used to determine differences in gene expression between differing tissues samples.
33.04	Using statistical analysis, determine the similarities between gene expression patterns of multiple patients.
34.0	Explore the potential risk factors associated with cancer and the various situations that cause changes to DNA. The student will be able to:
34.01	Describe the potential risk factors for different types of cancer as well as the ways to reduce the risk.
34.02	Explore some of the various cancer screening techniques that can be used to predict risk for developing cancer.
34.03	Investigate the risk factors of viruses and explain the role viruses' play as a risk factor for certain cancers.
35.0	Investigate the treatments and therapies available to treat the physical, mental, and emotional effects of cancer. The student will be able to:
35.01	Identify the major differences between chemotherapy and radiation therapy.

CTE Standards and Benchmarks	
35.02	Describe how chemotherapy drugs interact with and destroy cancer cells.
35.03	Explore biofeedback therapy and how it is utilized to treat cancer and its symptoms.
35.04	Synthesize designs that advances and benefit prosthetic technology for those who have lost their limbs.
35.05	Explain how physical and occupational therapists help patients with disabilities and those recovering from surgery/injury.
36.0	Explore future medical interventions for cancer. The student will be able to:
36.01	Discuss reasons why therapy drugs do not produce the same effect in all individuals.
36.02	Explain how SNP profiles factor into the decision to prescribe a specific medication.
36.03	Explore the field of pharmacogenetics and its contributions to the improvement of individualized patient treatment.
36.04	Research and present how cases of misuse and abuse have led to strict regulations of human participation in clinical trials.
36.05	Describe the importance of nanomedicine, particularly for cancer research and the development of medical interventions.
37.0	Explore the medical implications of proteins produced and purified in a laboratory setting. The student will be able to:
37.01	Discuss the evolution of diagnosis and treatment of diabetes from the 1800s through today.
37.02	Explain the various aspects of the bacterial transformation process.
37.03	Define chromatography and how it is used to separate items in a mixture.
37.04	Interpret electrophoresis results to determine the molecular weight of specific proteins in a mixture.
37.05	Explore and discuss specific biomedical careers in the manufacturing of therapeutic proteins.
38.0	Investigate the epidemiology and therapeutic interventions of kidney failure. The student will be able to:
38.01	Describe End Stage Renal Disease (ESRD) and how it is diagnosed.
38.02	Describe the physiological effects on the body when kidneys do not function properly and its impact on the production of red blood cells.
38.03	Explore the medical options for treatment for persons with ESRD including hemodialysis, peritoneal dialysis, and kidney transplant.
39.0	Explore the process, policies, and procedures involved in organ transplantation. The student will be able to:
39.01	Discuss factors to consider when deciding who should receive an organ transplant.

CTE Standards and Benchmarks

39.02	Describe the importance of blood and tissue matching for a successful organ transplant.
39.03	Describe the general steps involved in a live donor laparoscopic nephrectomy.
39.04	Compare the major similarities and differences between a heart and a kidney transplant.
39.05	Explain the most common ways members of the surgical transplant team work together to ensure a successful transplant.
40.0	Investigate how advances in medical knowledge and technology can aid in building a better human body for the future. The student will be able to:
40.01	Explore how a variety of tissues and organs can be transplanted from one organism to another.
40.02	Describe the general process of how xenotransplantation and tissue engineering works, as well as potential risks, benefits, challenges, and ethical/moral concerns.
40.03	Reflect on how current methods of medical intervention can be improved.
40.04	Describe how advancing medical knowledge and technology will enable scientists to delay the effects of aging and disease by enhancing the functions of the human body.
40.05	Design a potential “super” human using knowledge of the human body and available medical interventions.

**Florida Department of Education
Student Performance Standards**

Course Title: Biomedical Innovation
Course Number: 8708140
Course Credit: 1

Course Description:

In this capstone course, students apply their knowledge and skills to answer questions or solve problems related to the biomedical sciences. Students design innovative solutions for the health challenges of the 21st century as they work through progressively challenging open-ended problems, addressing topics such as clinical medicine, physiology, biomedical engineering, and public health.

CTE Standards and Benchmarks	
41.0	Investigate biomedical problems related to clinical care by designing an effective emergency care center. The student will be able to:
41.01	Evaluate the role that biomedical innovation plays in treating disease, reducing wait time, and promoting efficient care in emergency room and emergency care centers.
41.02	Assess overall credibility of a website by analyzing its content.
41.03	Produce an effective presentation of scientific information by using oral communication skills and PowerPoint presentation.
41.04	Research and propose solutions to healthcare delivery problems in the 21 st century.
41.05	Design an innovative emergency medicine delivery system.
41.06	Demonstrate proficiency in using online search engines and journal databases to locate scientific articles.
42.0	Explore the variety of research study designs available and investigate how to set up and conduct valid and reliable studies. The student will be able to:
42.01	Critique science data presented in popular media and compare this with data presented in scientific journals.
42.02	Analyze the results of experimental studies using knowledge of specified statistical analysis methods.
42.03	Design, conduct and analyze an experimental study to answer a question regarding one or more body systems.
42.04	Using at least three statistical fallacies, assume the role of an advertisement sales person selling a fictitious product.
42.05	Describe the various biomedical career fields related to clinical or research studies.
43.0	Explore the process, knowledge, and skills required to design a medical innovation. The student will be able to:

CTE Standards and Benchmarks	
43.01	Investigate the evolution of biomedical products.
43.02	Brainstorm ideas for a new biomedical product or methods to improve an existing product.
43.03	Discuss the role of the scientific design process and how it is significant to medical innovation.
43.04	Identify a problem related to the medical field and research the past and present solutions to this problem.
43.05	Examine possible design solutions to the selected problem, determine the best approach and develop a design proposal.
43.06	Design a marketing plan to pitch the chosen solution to potential investors.
44.0	Explore biomedical innovation through investigating water contamination. The student will be able to:
44.01	List and describe multiple causes of water contamination.
44.02	Explain why water quality is a global issue.
44.03	Extrapolate on the cause of non-point source pollution and its implications.
44.04	Using knowledge of specific assays, interpret the results of various chemical and culture assays and identify specific contaminants found.
44.05	Research and propose solutions to prevent or treat water contamination.
44.06	Determine local potential hazards or sources of contamination of local water samples and research local and Internet resources to investigate the condition of the local water delivery system.
44.07	Research and report on the quality of the local water.
45.0	Evaluate a public health issue and combat the problem using knowledge of epidemiology, disease diagnosis, and public health resources. The student will be able to:
45.01	Discuss the significant role that epidemiologists and public health investigators play in a public health crisis.
45.02	Describe how to set-up case control and cohort studies.
45.03	Discuss how measures of association are used to illustrate the correlation between specific risk factors and the development of disease.
45.04	Calculate the measures of association used to assess risk in case control and cohort studies.
45.05	List and discuss the various components that may be involved in a public health intervention plan.
45.06	Determine the source of a mystery illness by examining evidence documents and data including laboratory results, imaging results, disease maps, and molecular data.

CTE Standards and Benchmarks	
45.07	Research local, national, and global health issues and analyze how culture, geographic location, and access to health care affect health and wellness.
45.08	Write a grant proposal outlining an intervention plan for a particular public health issue.
45.09	Present and defend the proposed intervention plan to a professional audience.
46.0	Understand medical research and the process of writing a scientific grant. The student will be able to:
46.01	Define and elaborate on what medical research is used for and how funding for it is obtained.
46.02	Explain the role of a grant in relation to medical research.
46.03	Understand the difference between what constitutes a credible source opposed to a non-credible source when conducting a literature search.
46.04	Distinguish between primary and secondary sources.
46.05	Discuss potential bias based on construct and funding sources of research.
46.06	Discuss the role of an IRB in ensuring safety of a research project prior to data initiation.
46.07	Understand and identify the process by which a grant is created and the principle components that are included in scientific grant proposals (i.e. abstract, specific aims, background and significance, preliminary data/progress, project description, resources, supplemental materials).
46.08	Prepare and present a detailed grant proposal for a research project that will impact a specific aspect of a disease or medical condition.
47.0	(Optional) Use modern molecular biology techniques to clone and transfer DNA. The student will be able to:
47.01	Explain the structure and function of plasmids and how they are used in genetic engineering.
47.02	Describe the role restriction enzymes and how they interact with plasmids.
47.03	Interpret plasmid maps to determine the results of specific digestions with restriction enzymes.
47.04	Explain how to assemble recombinant DNA and clone a gene of interest using bacterial cells.
47.05	Interpret gel electrophoresis results to determine the success of a cloning experiment.
47.06	Using the process of bacterial transformation, insert a new plasmid into bacterial cells.
47.07	Draw and label possible ligation products and describe digestion results for each product.
48.0	(Optional) Assuming the role of a medical expert, investigate a mysterious death using forensic autopsy techniques. The student will be able to:

CTE Standards and Benchmarks

48.01	Describe observations of the internal and external anatomy of a fetal pig.
48.02	Evaluate a fetal pig for any abnormalities that may have led to the pig's death.
48.03	Complete an autopsy report for the fetal pig.
48.04	Solve the cause of death for a fetal pig by assuming the role of a forensic pathologist.
48.05	Design a fictitious death scenario using knowledge of the human body.
48.06	Create fictitious documents including an autopsy report and medical history to illustrate clues left behind in a dead body.
48.07	Research and reflect on the various biomedical careers involved in forensic pathology and describe two of these careers in detail.
49.0	(Optional) Students work independently in an area of interest in the biomedical sciences and outline milestones in a long-term, open-ended problem using skills learned throughout the program to complete the project. The student will be able to:
49.01	Choose a topic and describe work previously completed pertaining to that topic.
49.02	Interpret charts, graphs, data sets, and any other information related to the project.
49.03	Utilize time and project management skills to complete the approved project in the time allotted.
49.04	Apply skills and knowledge of researching a topic, evaluating information, and decision making in order to complete the project.
49.05	Write a well-constructed final report describing the purpose, procedures, and results of the project and present this information orally.
49.06	Write a self-analysis of what was learned during the project with a focus on whether things should have been done differently or not.
49.07	Prepare a portfolio of all artifacts related to the project in order to demonstrate the work progression.

Additional Information

Laboratory Activities

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at sala@fldoe.org.

Special Notes

This program uses a combination of activity-based, project-based and problem-based (APPB) learning styles to engage students.

Hands-on projects include designing experiments, investigating the structures and functions of body systems, and using data acquisition software to monitor body functions such as muscle movement, reflex and voluntary actions, and respiratory operation. Using 3D imaging, data acquisition software, and current scientific research, students design a product that can be used as a medical intervention.

The capstone course gives student teams the opportunity to work with a mentor, identify a scientific research topic, conduct research, write a scientific paper, and defend team conclusions and recommendations to a panel of outside reviewers.

Career and Technical Student Organization (CTSO)

CTSOs are co-curricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. Other CTSOs not listed in this curriculum framework or recognized by the Florida Department of Education are permissible provided they support student mastery over the standards and benchmarks of this curriculum framework.

Cooperative Training – OJT

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.