Maryland CTE Programs of Study

Biomedical Science I (2025)

GENERAL REQUIREMENTS. This course is recommended for students in Grades 9-12, and there are no prerequisites. 1

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INTRODUCTION 2

A Career and Technical Education (CTE) instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions. 2.A

B The Health and Human Services Career Cluster promotes whole health in individuals and communities through diverse services. This sector includes technical, mental, and therapeutic services and personal care supported by medical and social sciences. By addressing social determinants of health and leveraging health data and science, this Cluster aims to enhance the overall health and resilience of individuals, families, and communities. 2.B

C The Biomedical Science Program of Study immerses students in scientific principles, laboratory techniques, clinical practices, and professional skills essential for success in today's healthcare and biotechnology fields. Throughout the program, students learn to address complex biomedical challenges, incorporate ethical and regulatory considerations, and remain adaptable to rapidly evolving technologies and healthcare demands. By completing the Biomedical Science program, graduates are well-prepared to advance into higher education, seek industry-recognized credentials, and contribute to developing innovative medical treatments, pharmaceuticals, devices, and solutions that enhance individuals', families', and communities' health and resilience. 2.C

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D **Biomedical Science I introduces students to the fundamental principles, practices, and professional skills of the biomedical sciences. Through hands-on laboratory investigations, students learn essential techniques such as aseptic handling, DNA extraction, and microscopy, while developing competencies in scientific inquiry, data analysis, and effective communication. Students explore core concepts in cell biology, genetics, anatomy, infectious disease, and bioethics, gaining insight into how societal, environmental, and technological factors impact human health. Emphasizing teamwork, project management, and problem-solving, this foundational course prepares students for advanced studies, industry-recognized credentials, and meaningful careers in healthcare, biotechnology, and biomedical research.** 2.D

E **Students will participate in at least two Career-Connected Education and Work-Based Learning experiences in this course, which might include informational interviews or job shadowing relevant to the program of study.** 2.E

F **Students are encouraged to participate in extended learning experiences through aligned Career and Technical Student Organizations (CTSOs). CTSOs are a cocurricular requirement in the Carl D. Perkins Act, and alignment to CTSO activities is an expectation for CTE programs in the state of Maryland.** 2.F

KNOWLEDGE AND SKILLS 3

A **The student demonstrates the necessary skills for career development, maintenance of employability, and successful completion of course outcomes. The student is expected to:** 3.A

1. Identify and demonstrate positive work behaviors that enhance employability and job advancement, such as regular attendance, promptness, proper attire, maintenance of a clean and safe work environment, and pride in work. 3.A.1
2. Demonstrate positive personal qualities such as flexibility, open-mindedness, initiative, active listening, and a willingness to learn. 3.A.2
3. Employ effective reading, writing, and technical documentation skills. 3.A.3
4. Solve problems using critical thinking techniques and structured troubleshooting methodologies. 3.A.4
5. Demonstrate leadership skills and collaborate effectively as a team member. 3.A.5
6. Implement safety procedures, including proper use of software and following privacy guidelines. 3.A.6
7. Exhibit an understanding of legal and ethical responsibilities in the biomedical science field, following copyright laws and regulations. 3.A.7
8. Demonstrate time-management skills and the ability to prioritize tasks in a technical setting. 3.A.8

B **The student identifies various career pathways in the biomedical science field. The student is expected to:** 3.B

. Develop a career plan that includes the necessary education, certifications, job skills, and experience for specific roles in healthcare. 3.B.1

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2 Create a professional resume and portfolio that reflect skills, projects, certifications, and recommendations. 3.B.2

3 Demonstrate effective interview skills for roles in biomedical science fields. 3.B.3

C The student develops technology and digital literacy skills. The student is expected to: 3.C

1 Use technology as a tool for research, organization, communication, and problem-solving. 3.C.1

2 Use digital tools, including computers, mobile devices, collaboration platforms, and cloud services, to access, manage, and create information. 3.C.2

3 Demonstrate proficiency in using emerging and industry-standard technologies. 3.C.3

4 Understand ethical and legal considerations for technology use, including the principles of data protection, copyright, and responsible technology use. 3.C.4

D The student integrates core academic skills into biomedical science practices. The student is expected to: 3.D

1 Demonstrate the use of clear communication techniques, both written and verbal, that are consistent with industry standards. 3.D.1

2 Apply English concepts such as writing informative texts when documenting procedures and articulating goals. 3.D.2

3 Use mathematical concepts for measurement and conversion (Fahrenheit vs. Celsius), ratios and proportions as well as fraction and decimal conversions. 3.D.3

E The student demonstrates competence in laboratory techniques and analytical methods essential to biomedical research and diagnostics. The student is expected to: 3.E

1 Practice aseptic techniques to prevent contamination in laboratory settings. 3.E.1

2 Culture, plate, and identify bacteria, including performing Gram staining procedures. 3.E.2

3 Perform dissections with proper technique and anatomical understanding. 3.E.3

4 Extract DNA and separate nucleic acids using gel electrophoresis. 3.E.4

5 Analyze physical evidence such as fingerprints and hair samples. 3.E.5

6 Prepare and interpret karyotypes to identify chromosomal abnormalities. 3.E.6

7 Utilize applied mathematics to calculate concentrations, create standard curves, and interpret quantitative data. 3.E.7

8 Accurately measure and transfer liquids using micropipettors with precision. 3.E.8

9 Operate microscopes to view, analyze, and document microscopic specimens. 3.E.9

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'he student demonstrates foundational clinical skills and patient-focused nethodologies that support health assessment and care. The student is expected

to: 3.F

1. Conduct blood testing, typing, and basic bloodwork analysis. 3.F.1
2. Demonstrate proper blood drawing techniques and understand related safety protocols. 3.F.2
3. Measure and interpret vital signs, including blood pressure and heart rate. 3.F.3
4. Exhibit clinical empathy when interacting with patient cases and simulations. 3.F.4
5. Understand and apply HIPAA guidelines to maintain patient confidentiality. 3.F.5
6. Record patient information accurately and maintain clear, organized patient documentation. 3.F.6
7. Construct and analyze pedigrees to trace inheritance patterns of traits or conditions. 3.F.7
8. Apply controlled bleeding techniques and basic triage methods to simulated emergencies. 3.F.8

G The student demonstrates proficiency in utilizing equipment, software, and computational tools to collect, analyze, and present biomedical data. The student is expected to: 3.G

1. Operate specialized software and tools such as ArcGIS, TinkerCAD, and Microsoft Office (Excel, Word, PowerPoint) to manage and display data. 3.G.1
2. Employ probes, sensors, and data acquisition software to measure physiological and environmental parameters. 3.G.2
3. Use and maintain a light microscope, gel electrophoresis apparatus, micropipettors, and electronic balances to ensure accurate and reliable data collection. 3.G.3

H The student demonstrates scientific experimentation skills, employing systematic inquiry to design, conduct, analyze, and communicate experiments. The student is expected to: 3.H

1. Design and conduct reliable, repeatable scientific experiments that address testable research questions. 3.H.1
2. Analyze and interpret laboratory data, including constructing and interpreting graphs. 3.H.2
3. Interpolate and extrapolate data from graphical representations to identify trends and patterns. 3.H.3
4. Draw evidence-based conclusions supported by experimental data. 3.H.4
5. Communicate results and conclusions effectively, both orally and in writing. 3.H.5

I The student demonstrates the ability to apply an iterative design process to solve biomedical problems or create innovative products. The student is expected to: 3.I

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1. Use an iterative design process to identify problems, propose solutions, and refine outcomes. 3.I.1

2 Collaborate with a design team, sharing responsibilities and integrating diverse ideas. 3.I.2

3 Document the design process and create detailed design briefs. 3.I.3

4 Brainstorm to generate multiple potential solutions and evaluate them against established criteria and constraints. 3.I.4

5 Compare and select the best solution path, then evaluate the final design for effectiveness. 3.I.5

J The student demonstrates professional skills that foster success in biomedical fields. The student is expected to: 3.J

1 Work effectively as part of a team, respecting others' viewpoints and contributions. 3.J.1

2 Engage in peer review and constructive feedback to improve work quality. 3.J.2

3 Manage projects efficiently through planning, organization, and adherence to deadlines. 3.J.3

4 Employ problem-solving strategies to address challenges in laboratory and research contexts. 3.J.4

5 Develop oral presentation skills and produce clear, technically accurate written documents. 3.J.5

6 Exercise ethical reasoning when confronted with biomedical dilemmas and research decisions. 3.J.6

K The student demonstrates a broad understanding of core biomedical concepts, integrating foundational knowledge of human biology, disease, and the societal impact of biomedical science. The student is expected to: 3.K

1 Describe fundamental concepts in cell biology, anatomy, physiology, molecular biology, and genetics. 3.K.1

2 Explain principles of cancer biology, infectious diseases, and their prevention and treatment. 3.K.2

3 Understand the interplay among body systems, homeostasis, and disease states, as well as mechanisms like feedback loops. 3.K.3

4 Discuss inheritance patterns, including the application of Punnett squares and pedigree analysis. 3.K.4

5 Investigate forensic and crime scene techniques, manner and mechanism of death, and drug design principles. 3.K.5

6 Examine bioethical considerations, biomedical science careers, and the global implications of biomedical research. 3.K.6

7 Explore methods such restriction fragment length polymorphism (RFLP) analysis and relate DNA structure and mutations to protein function and disease. 3.K.7

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'he student engages in varied experiences and activities that promote hands-on earning and real-world application of biomedical concepts. The student is expected to: 3.L

1. Participate in laboratory investigations, simulations, and instant challenges to solve problems. 3.L.1
2. Analyze case studies to connect theoretical knowledge with practical applications. 3.L.2
3. Engage in role-playing scenarios, digital design projects, and thought experiments. 3.L.3
4. Employ design thinking strategies to develop creative solutions to complex biomedical challenges. 3.L.4