Delaware Department of Education

CTE & STEM Office

401 Federal Street, Suite 256

Dover, DE 19901

PHONE: 302.735.4015 FAX: 302.739.1780

**DELAWARE CTE PROGRAM OF STUDY APPLICATION**

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| LOCAL EDUCATION AGENCY INFORMATION | | |
| **Local Education Agency (LEA):** | | |
| **School(s) where the Program of Study will be Located:** | | **Program of Study Start Date:** |
| **LEA CTE Coordinator Name:** **Phone:** **E-Mail Address:** | | |
| **Career Cluster Title:**  STEM | **Career Pathway Title:**  Science and Mathematics | **Program of Study Title:**  Biomedical Sciences |
| **CTE Program of Study Course Titles & Sequence:**   1. Principles of Biomedical Sciences (PBS) 2. Human Body Systems (HBS) 3. Medical Interventions (MI) | | |
| **CTE Program of Study Request:**  State-model CTE Program of Study  Local CTE Program of Study | | |
| ASSURANCES & SIGNATURES | | |
| CTE Program of Study approval and funding is contingent upon the following assurances:   1. The LEA will comply with Delaware Administrative Code, 14 Del.C. §525, Requirements for Career and Technical Education Programs and the Delaware State Plan for the Carl D. Perkins Career and Technical Education Act of 2006; 2. The LEA will submit CTE program data as required by the Delaware Department of Education; 3. All teachers are certified in the appropriate CTE area and participate in program specific professional learning; 4. The LEA will convene and engage a program advisory committee for the purposes of program development, implementation, and continuous improvement; 5. All students have equal access to the program of study as well as early career/early college options; 6. Career and Technical Student Organizations are integral components of the program of study; 7. The LEA will maintain safe facilities and equipment aligned with the program of study goals; and 8. A process for continuous improvement has been established, which includes a model of evaluation and program improvement. | | |
| LEA CTE Coordinator Signature: Date: | | |
| LEA Chief School Officer Signature: Date: | | |

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| PROGRAM ADVISORY COMMITTEE MEMBER INFORMATION |
| Complete the list of program advisory committee members. Program of study representatives should include, but are not limited to: CTE and academic teachers, CTE/curriculum district coordinators, school counselors, business and industry representatives, labor representatives, and post-secondary partners. Community stakeholders including parents and students can also be considered. *Attach additional information if applicable*. |
| Name: Title: |
| Affiliation: |
| Address: |
| Phone: E-Mail: |
| Area of Expertise: |
| Representing:  Business/Industry  Secondary Education  Post-Secondary Education  Community/Other |
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| Area of Expertise: |
| Representing:  Business/Industry  Secondary Education  Post-Secondary Education  Community/Other |
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| LABOR MARKET DEMAND |
| Certify that a labor market needs analysis has been completed for the proposed CTE program of study. Attach the [*Labor Market Information (LMI) Review*](http://www.doe.k12.de.us/Page/2016) document. |
| Access the [*Labor Market Information (LMI) Review*](http://www.doe.k12.de.us/Page/2016) document.  The LEA certifies that regional, state, and local labor market data have been reviewed to assure a demand exists for the POS occupations and that the number of POS completers will not significantly exceed this demand. Department of Labor data are available and/or documented. Supporting evidence of supply and demand is submitted with this proposal.  No data exist for POS due to a unique labor market demand. Supporting evidence of demand is submitted with this proposal. Evidence may include, but is not limited to: real-time labor market information, documentation of national, regional, state, or local labor trends, or letters from employers or workforce agencies documenting projected employment specific to the career pathway. |

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| ACADEMIC AND TECHNICAL SKILL STANDARDS |
| List the academic, technical, and workplace skills and knowledge used to develop the program of study. |
| **Title and source of academic standards:**  [Common Core State Standards (CCSS)](http://www.corestandards.org/)  The Common Core State Standards (CCSS) are national standards that set clear college- and career-ready expectations for kindergarten through 12th grade in English language arts/literacy and Mathematics. The standards help to ensure that students graduating from high school are prepared to take credit bearing introductory courses in two- or four-year college programs and enter the workforce. The standards were developed by the nation's governors and education commissioners, through their representative organizations, the National Governors Association Center for Best Practices (NGA) and the Council of Chief State School Officers (CCSSO). Teachers, parents, school administrators, and experts from across the country provided input into the development of the standards. The implementation of the Common Core, including how the standards are taught, the curriculum developed, and the materials used to support teachers as they help students reach the standards, is led entirely at the state and local levels. For more information on CCSS, please visit the link above.  [Next Generation Science Standards (NGSS)](http://www.nextgenscience.org/)  The Next Generation Science Standards (NGSS) are national standards for science that lay out the disciplinary core ideas, science and engineering practices, as well as crosscutting concepts that students should master in preparation for college and careers. The standards were developed through a state-led effort that was managed by Achieve. The development of the NGSS involved the National Research Council (NRC), the National Science Teachers Association (NSTA), the American Association for the Advancement of Science (AAAS), and other critical partners such as K–12 teachers, state science and policy staff, higher education faculty, scientists, engineers, cognitive scientists, and business leaders. For more information on the NGSS, please visit the link above.  Project Lead the Way (PLTW) is a national Career & Technical Education instructional program that incorporates aspects of the Common Core State Standards for English language arts/literacy and Mathematics, the Next Generation Science Standards, and other national standards where appropriate. A standards and objectives alignment tool is available for all courses at: <http://alignment.pltw.org/> |
| **Title and source of technical skill standards:**  [National Consortium for Health Science Education (NCHSE) – National Healthcare Skill Standards:](http://www.healthscienceconsortium.org/index.php)  The National Consortium for Health Science Education (NCHSE) in partnership with the U.S. Department of Education and Labor has established eleven common healthcare foundation standards and four career pathway standard sets; Diagnostic, Therapeutic, Environmental and Health Information, which help to guide curriculum related materials for healthcare programs. More than 1,000 healthcare employers, college and university faculty, secondary teachers and professional organization representatives provided input to identify common practices, reviewed the content for each standard, and pilot tested the results within their agency or organization. For more information on the National Healthcare Skill standards, please visit the link above.  Project Lead the Way (PLTW) is a national Career & Technical Education instructional program that incorporates aspects of the National Consortium for Health Science Education. A standards and objectives alignment tool is available for all courses at: <http://alignment.pltw.org/> |
| **Title and source of workplace or other skill standards, as applicable:**  [Common Career Technical Core (CCTC)](http://www.careertech.org/CCTC)  The Common Career Technical Core (CCTC) are national standards for Career & Technical Education (CTE) that help to inform the establishment of state standards and/or programs of study. The CCTC were developed by educators, school administrators, representatives from business and industry, faculty from higher education, as well as workforce and labor markets economists.  The CCTC include a set of standards for each of the sixteen (16) Career Clusters and the corresponding Career Pathways that help to define what students should know and be able to do after completing instruction in a program of study. The CCTC standards for the STEM Career Cluster have been embedded into each course within the Project Lead the Way (PLTW) Biomedical Sciences program of study. The program has students apply the CCTC STEM standards, specifically the Science and Mathematics Career Pathway standards. For more information on the CCTC, please visit the link above.  [Career Ready Practices (CRP)](http://www.careertech.org/career-ready-practices)  The Career Ready Practices (CRP) are a component of the CCTC framework and includes twelve (12) statements that address the knowledge, skills, and dispositions that are important to becoming career ready. The CRP describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline, or level of education and should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a career pathway. The CRP statements are embedded throughout the Project Lead The Way (PLTW) Biomedical Sciences program of study to ensure students display the appropriate soft skills and workplace requirements necessary to be successful in a career. For more information on the CRP, please visit the link above. |

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| EARLY CAREER AND EARLY COLLEGE OPPORTUNITIES |
| Identify CTE program of study early career opportunities, industry-recognized certifications and licenses, options for early college credit, two- and four-year degree and certification program alignment, and the technical skill attainment measures for the program of study. *Attach articulation/dual enrollment agreement(s)*. |
| **Describe early career opportunities (i.e. work-based learning experiences and industry-mentored projects):**  In the Project Lead The Way (PLTW) Biomedical Sciences program of study, students are asked to investigate, document, and analyze evidence to solve case-based scenarios. Students explore a range of careers in biomedical sciences as they learn content in the context of real-world, hands-on activities, projects, and problems. Students apply math and science to hands-on projects.  They explore the roles of biomedical professionals as they study the concepts of human medicine, physiology, genetics, microbiology, and public health. Students examine the structures and interactions of human body systems and explore the prevention, diagnosis, and treatment of disease – all while working collaboratively to understand and design solutions to the most pressing health challenges of today and the future. Schools will offer a minimum of three courses: Principles of Biomedical Sciences (PBS), Human Body Systems (HBS), and Medical Interventions (MI). Work-based learning experiences and industry-mentored projects are included in each course and will be reviewed with the Local Education Agency (LEA) Program Advisory Council to further identify opportunities to engage the community. |
| **List industry-recognized certifications and/or licenses, as appropriate (include the partner organization and credential):**  Project Lead The Way (PLTW) provides industry-based assessments which are known as End of Course assessments for participating schools. PLTW will report valid and reliable scores on overall student performance for each course. The End of Course assessment(s) give students an objective evaluation of their achievement and stakeholders the opportunity to obtain and use data to make informed decisions. End of Course assessments are available for all PLTW Biomedical Sciences courses. |
| **Describe early college credit options (i.e. advanced placement, dual enrollment, transcripted and/or articulated credit, credit by exam, pre-apprenticeship, other) and options for two- and four-year degree and/or certification program alignment (attach articulation/dual enrollment agreement). The partner organization and hours of credit earned should be included, as applicable:**  Project Lead The Way partners with more than 150 [colleges and universities](https://www.pltw.org/our-network/college-and-university-partners/scholarships-admissions-preference-and-college-level) across the country to recognize and reward the great work being accomplished by PLTW schools, students, and teachers. Opportunities for students typically include scholarships, admission preference, and college-level recognition based on program completion and End of Course assessment scores. For more information on national recognition opportunities, please visit the link above.  Delaware students who successfully complete ALL COURSES in the pathway and who have demonstrated college readiness in math and ELA will receive advanced credit in the Emergency Medical Certificate, Medical Assistant, Human Services, Practical Nursing, Business Administration (University of Delaware transfer option) or Electronics Engineering Technology (biomedical option) programs at Delaware Technical Community College for:   * BIO110 – Essentials of Anatomy and Physiology (4 credits)   The Department of Education is currently negotiating articulation agreements with the University of Delaware. |
| **List technical skill attainment measures for the program of study (i.e. industry recognized certification or license, advanced placement, dual enrollment, transcripted and/or articulated credit, dual enrollment, credit by exam):**  Certification/credentialing exam (specify):  Licensing exam (specify):  Nationally recognized exam (specify): PLTW End of Course Assessments  Advanced standing (specify):  Delaware Technical Community College:  BIO110 – Essentials of Anatomy and Physiology (4 credits)  Other (specify): |

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| POS OVERVIEW, COURSE DESCRIPTIONS, END-OF-COURSE, AND PROGRAM ASSESSMENTS |
| Provide a CTE program of study overview that broadly describes the program and student expectations. Identify end-of-program assessment(s) and opportunities for students to participate in early college and early career experiences. List each course title in the CTE program of study. Provide an overview of each course and define what students should know and be able to demonstrate upon completion of each level. Identify appropriate end-of-course assessment(s). |
| **CTE Program of Study Overview:**  The Project Lead the Way (PLTW) Biomedical Science program of study is a three (3) course Career & Technical Education (CTE) instructional program that engages students in open-ended problem solving where students study the concepts of human medicine, physiology, genetics, microbiology, and public health. The program prepares students for further education and careers in biomedical sciences and healthcare. The CTE program consists of three courses, Principles of the Biomedical Sciences (PBS), Human Body Systems (HBS), and Medical Interventions (MI).   * **Principles of Biomedical Sciences (PBS)** allows students to explore concepts of biology and medicine to determine factors that led to the death of a fictional person. While investigating the case, students examine autopsy reports, investigate medical history, and explore medical treatments that might have prolonged the person’s life. The activities and projects introduce students to human physiology, basic biology, medicine, and research processes while allowing them to design their own experiments to solve problems. * **Human Body Systems (HBS)** allows students to examine the interactions of human body systems as they explore identity, power, movement, protection, and homeostasis. Exploring science in action, students build organs and tissues on a skeletal Maniken®; use data acquisition software to monitor body functions such as muscle movement, reflex and voluntary action, and respiration; and take on the roles of biomedical professionals to solve real-world medical cases. * **Medical Interventions (MI)** allows students to follow the life of a fictitious family as they investigate how to prevent, diagnose, and treat disease. Students explore how to detect and fight infection; screen and evaluate the code in human DNA; evaluate cancer treatment options; and prevail when the organs of the body begin to fail. Through real-world cases, students are exposed to a range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics. |
| **End-of-Program Assessment(s):**  Certification/credentialing exam (specify):  Licensing exam (specify):  Nationally recognized exam (specify): Project Lead The Way End of Course Assessments – PBS, HBS, and MI  Other (specify): |
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| **Course title:**  Principles of the Biomedical Sciences (PBS) |
| **Course description (include prerequisites):**  The Principles of Biomedical Science (PBS) course provides students with the opportunity to investigate the human body systems and various health conditions including heart disease, diabetes, sickle-cell disease, hypercholesterolemia, and infectious diseases. Students determine the factors that led to the death of a fictional person, and investigate lifestyle choices and medical treatments that may have prolonged the person’s life. The activities and projects introduce students to human physiology, medicine, research processes, and bioinformatics. This course is designed to provide an overview of the Biomedical Sciences program and lay the scientific foundation for subsequent coursework. |
| **Course knowledge and skills (what students will know and be able to do):**  By the end of this course, students will:   1. Design a controlled experiment and recognize that external variables need to be controlled to understand how principles of biomedical science can be used for further investigation.      1. Describe the relationship between DNA, genes, and chromosomes; recognize that gel electrophoresis can be used to examine DNA differences between individuals; and demonstrate the steps of gel electrophoresis to investigate the role and usefulness of DNA in solving medical and forensic mysteries. 2. Demonstrate the role of insulin in transferring glucose from blood into cells and diagram the feedback relationship of blood glucose and the hormones insulin and glucagon to understand how the human body uses feedback mechanisms to maintain homeostasis and that diabetes is a feedback disorder caused by insufficient insulin or the inability of insulin to function properly. 3. Recognize that the structure of macromolecules is related to their function in the human body and perform calorimetric measurements on food items to understand how carbohydrates, lipids, and proteins are broken down and reassembled for use in the human body and to measure the amount of energy stored in the chemical bonds of those macromolecules. 4. Recognize that a sequence of nucleotides in DNA determines the sequence of amino acids in a protein, explain the process of protein synthesis, demonstrate transcription and translation to create a simulated protein and analyze the effect that base pair mutations have on a simulated protein to understand that changes in the genetic material that creates a new protein may cause changes in the structure and function of the resulting protein. 5. Draw and analyze pedigree charts and compare the experimental probability and the theoretical probability of inheriting a trait to provide evidence that genetic material is transferred from generation to generation and that some forms of genes are dominant over others. 6. Create anatomical models of the human heart, measure heart rate and blood pressure manually and with scientific software and probes to understand the “normal” and “abnormal” structure and function of the human heart muscle. 7. Demonstrate the transmission of a simulated infectious agent and describe how the immune system responds when an antigen enters the body to illustrate the relative threat to human health and safety posed by infectious diseases and to outline the natural defenses provided by the human immune system. |
| **End-of-Course Assessment(s):**  Teacher designed assessment  LEA designed assessment  Certification/credentialing exam (specify):  Licensing exam (specify):  Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – PBS  Other (specify): |
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| **Course title:**  Human Body Systems (HBS) |
| **Course description (include prerequisites):**  In Human Body Systems (HBS) 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 actions, 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.  Prerequisite: Principles of Biomedical Sciences |
| **Course knowledge and skills (what students will know and be able to do):**  By the end of this course, students will:   1. Describe how multiple body systems are interconnected and how those interconnections and interactions are necessary for life to show the relationship between multiple human body systems and understand how complex systems function together to maintain homeostasis. 2. Identify characteristics of the four categories of human tissue and analyze the structure of various human tissue types to infer various tissue functions. 3. Recognize that the nervous system relies on specialized cells called neurons to pass signals to and from the brain and spinal cord and analyze experimental data to explore reaction time and reflexes in the human body to interpret how a breakdown in communication in the central nervous system would impact the function of the human body. 4. Recognize that the human body uses feedback mechanisms to maintain proper hormone levels and model a feedback loop that shows how the body maintains homeostasis to recognize how a hormone imbalance can lead to disease or dysfunction. 5. Describe the structure and function of the organs in the digestive, respiratory and circulatory system to understand how human body systems work to create, process, and distribute the body’s main resources – food, water, and oxygen. 6. Describe how the three types of muscle tissue differ in structure and function, recognize the connection between nerves and muscle, and interpret muscle function by examining its structure and its attachment to bones to understand the specific function of each type of muscle tissue and how nerves interact with muscle tissue to initiate contraction and/or relaxation sequences to produce motion in an organism. 7. Investigate the structure and function of the integumentary, skeletal and lymphatic systems to understand how multiple systems work together to protect the human body from and/or repair the body due to injury and infection. 8. Explain how human body systems work together to maintain homeostasis in the body and to complete basic functions such as movement and communication to recognize how medical interventions can be used to restore homeostasis when or if it is disturbed. |
| **End-of-Course Assessment(s):**  Teacher designed assessment  LEA designed assessment  Certification/credentialing exam (specify):  Licensing exam (specify):  Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – HBS  Other (specify): |
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| **Course title:**  Medical Interventions (MI) |
| **Course description (include prerequisites):**  In Medical Interventions (MI) students investigate a 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; screen and evaluate the code in human DNA; prevent, diagnose and treat cancer; and 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. Lifestyle choices and preventative measures are emphasized throughout the course as well as the important roles scientific thinking and engineering design play in the development of interventions of the future.  Prerequisite: Principles of Biomedical Sciences and Human Body Systems |
| **Course knowledge and skills (what students will know and be able to do):**  By the end of this course, students will:   1. Recognize that medical interventions are measures to improve health or alter the course of an illness and can be used to prevent, diagnose, and treat disease and that medical interventions can help maintain health and homeostasis in the body. 2. Explain the method of action for different classes of antibiotics and to simulate the effects of antibiotics on a bacterial population during an infection to illustrate how antibiotics disrupt the pathways that bacteria use to survive and how the use and misuse of antibiotics will promote the selection of resistant bacteria. 3. Describe how vaccines interact with the human immune system to indicate the mechanism by which vaccines activate the immune system to recognize a disease antigen and produce antibodies necessary to defend the body. 4. Recognize that various vectors, including viruses, can be used to transfer DNA into human cells to understand the mechanisms and risks involved with gene therapy. 5. Describe the differences in the appearance of normal cells and cancer cells to recognize that there are many different types of cancer, each with specific risk factors, manifestations in the body, and treatment options. 6. Recognize that organ donation/replacement, mechanical substitutes and gene technology are all options for treating symptoms related to organ failure in human subjects to understand how alternatives can be utilized for replacing missing proteins (gene technology), filtering or pumping fluids (mechanical substitution), or for replacing the failing organ (organ donation/replacement). |
| **End-of-Course Assessment(s):**  Teacher designed assessment  LEA designed assessment  Certification/credentialing exam (specify):  Licensing exam (specify):  Nationally recognized exam (specify): Project Lead The Way End of Course Assessment – MI  Other (specify): |

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| PROGRAM OF STUDY CURRICULUM |
| Identify the method of technical and academic curriculum development (adopted, adapted, or developed in accordance with guidance from the program advisory committee). |
| **POS technical and academic curriculum will be:**  Adopted (specify source): State-model program of study  Adapted (specify source):  Developed locally (describe):  Other (specify): |

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| TEACHER CERTIFICATION |
| Provide valid teacher certification(s), candidate experience, pre-requisite and requisite licensure or certification requirement(s) for POS teachers. |
| **POS teacher requirements include:**  Teacher certification(s) (list): Biology Education or Skilled and Technical Science (STS) Science and Mathematics (Biomedical Sciences)  Candidate experience (describe): Candidate may have experience in a general program of biology at the introductory, basic level or a program in biology or the biological sciences that is undifferentiated as to title or content. Includes instruction in general biology and programs covering a variety of biological specializations focusing on medical applications. For more information, please see the Bureau of Labor Statistics: Registered Nurses.  Pre-requisite professional licensure or certification requirement(s) (list):  Requisite professional licensure or certification requirement(s) (list): Biology teacher certification or current Delaware Registered Nurse License from the Delaware Division of Professional Regulation’s Board of Nursing. Before teaching PLTW courses, teachers must attend PLTW licensed training.  Other (describe): |

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| VALUE-ADDED OPPORTUNITIES |
| List extended early career and college credit opportunities available during the student’s senior year. Document transition services, cooperative learning experiences, additional dual enrollment, or other. |
| **Opportunities for extended and accelerated learning include:**  Cooperative education (describe):  Structured internship (describe):  Dual enrollment (list):  Advanced Placement (list):  Transition services (describe):  Other (describe): |

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| CAREER AND TECHNICAL STUDENT ORGANIZATIONS |
| Indicate the Career and Technical Student Organization (CTSO) affiliation by checking the appropriate box. |
| HOSA |

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| PROGRAM OF STUDY MATRIX |
| Complete the program of study matrix to demonstrate the alignment of academic and technical courses, culminating early career and/or early college experiences. Identify appropriate certification and licensure options, opportunities for obtaining early college credit (courses with articulated or dual enrollment credit agreements should be appropriately designated within the matrix), the post-secondary program sequence, and potential career options. *Attach the Program of Study Matrix*. |
| Access the [Program of Study Matrix](http://www.doe.k12.de.us/Page/2016). |

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| DEPARTMENT OF EDUCATION PROGRAM OF STUDY APPROVAL | | |
| The following section will be completed by staff from the Delaware Department of Education, CTE & STEM Office and reported to the LEA as part of the CTE program of study approval process. | | |
| **Date Delaware CTE Program of Study Application Received:** | | |
| **Local Education Agency (LEA):**    **School(s):** | | **Program of Study Start Date:** |
| **LEA CTE Coordinator Name:** **Phone:** **E-Mail Address:** | | |
| **Career Cluster & Code:**  STEM / 15 | **Career Pathway & Code:**  Science and Mathematics / 15.02 | **Program of Study Title Code:**  Biomedical Sciences / 15.02602 |
| **CTE Program of Study Course Titles, Course Codes, and Funding Levels:**  1. Principles of Biomedical Sciences / 15.0260211 / 2  2. Human Body Systems / 15.0260222 / 3  3. Medical Interventions / 15.0260233 / 3 | | |
| **CTE Concentrator/Completer Course Titles:**  Concentrator Course: Human Body Systems (HBS)  Completer Course: Medical Interventions (MI) | | |
| **CTE Program of Study Request:**  State-model CTE Program of Study  Local CTE Program of Study | | |
| **CTE Program of Study Attachments:**  Labor Market Information (LMI) Review;  Articulation/Dual Enrollment Agreement(s); and  Program of Study Matrix. | | |
| DDOE CTE & STEM Director Signature: Date: | | |
| DDOE Chief Academic Officer Signature: Date: | | |