



ALTOONA AREA
SCHOOL DISTRICT



What is the Biomedical Science Pathway?

A challenging and relevant four-course PLTW Biomedical Science sequence that allows students to investigate the roles of biomedical professionals as they study the concepts of human medicine, physiology, genetics, microbiology, and public health. Students engage in activities like investigating the death of a fictional person to learn content in the context of real-world cases. They 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. Each course in the Biomedical Science sequence builds on the skills and knowledge students gain in the preceding courses.

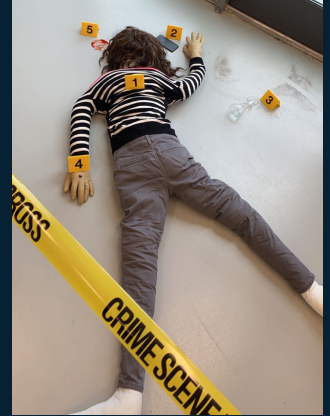
Why should I take these courses?

- Prepares students for college courses in the medical field
- Students obtain a variety of laboratory, clinical, and professional skills
- Students are exposed to real world challenges in the medical field
- Students engage in hands-on activities, working collaboratively to develop solutions
- Students have access to many of the same tools used by professionals in hospitals and labs
- Students receive a sash to wear at graduation after successful completion of all 4 courses
- Students have the opportunity to attend an actual open heart surgery at Allegheny General Hospital in Pittsburgh, PA

Overview of Courses:

Principles of Biomedical Science

In this course, students explore concepts of biology and medicine as they take on roles of different medical professionals to solve real-world problems. Over the course of the year, students are challenged in various scenarios including investigating a crime scene to solve a mystery, diagnosing and proposing treatment to patients in a family medical practice, to tracking down and containing a medical outbreak at a local hospital, stabilizing a patient during an emergency, and collaborating with others to design solutions to local and global medical problems



Human Body Systems

Students experience real-world scenarios and cases to see medicine in action – as they diagnose and provide treatment and rehabilitation to patients at an outpatient center, keep clients safe and healthy on adventure medicine trips in remote locations, and work in a research center to design laboratory investigations to explore development and aging.

Medical Interventions

Students 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.



Biomedical Innovation

In the final course of the PLTW Biomedical Science sequence, students build on the knowledge and skills gained from previous courses to design innovative solutions for the most pressing health challenges of the 21st century. Students address topics ranging from public health and biomedical engineering to clinical medicine and physiology. They have the opportunity to work on an independent project with a mentor or advisor from a university, medical facility, or research institution.

Principles of Biomedical Science

Year 1 - 1 Credit - Full Year

PLTW

BIO MEDICAL SCIENCE



This course serves to provide foundational knowledge and skills in fields such as biology, anatomy & physiology, genetics, microbiology, and epidemiology as well as engage students in how this content can be applied to real-world situations, cases, and problems.



Unit 1: Medical Investigation

In unit 1 students will investigate a crime scene to solve a murder mystery. Students will work together as members of a forensic investigation team to analyze clues left at the scene of a woman's death.

Unit 2: Clinical Care

In unit 2 students assume the role of different medical professionals working at a family care clinic. They will collect and analyze vital signs from a patient, investigating how each vital sign relates to the overall health and homeostasis of the body as well as how these vital signs can be used as part of clinical care and disease diagnosis.

Unit 3: Outbreaks & Emergencies

Unit 3 challenges students to investigate an outbreak at a local hospital. Students will work together to determine how the patients are getting sick and design a strategy to resolve the outbreak. Part II of Unit 3 allows students to learn about emergency response teams.



Unit 4: Innovation Inc.

In Unit 4 students are able to engage in experiences in areas of research, innovation and design. Students will investigate innovation in medical device development and drug delivery.

Lab Skills

- Dissection
- Blood Testing and Typing
- DNA Gel Electrophoresis
- Aseptic Technique
- Micropipetting
- Bacterial Analysis

Clinical Skills

- Blood Drawing
- Blood Pressure
- HIPPA Legislation
- Triage
- Clinical Empathy
- Controlled Bleeding

Course Knowledge

- Crime Scene Investigation
- Infectious Disease Transmission
- Molecular Biology
- Structure of DNA
- Inheritance



Human Body Systems

Year 2 - 1 Credit - Full Year

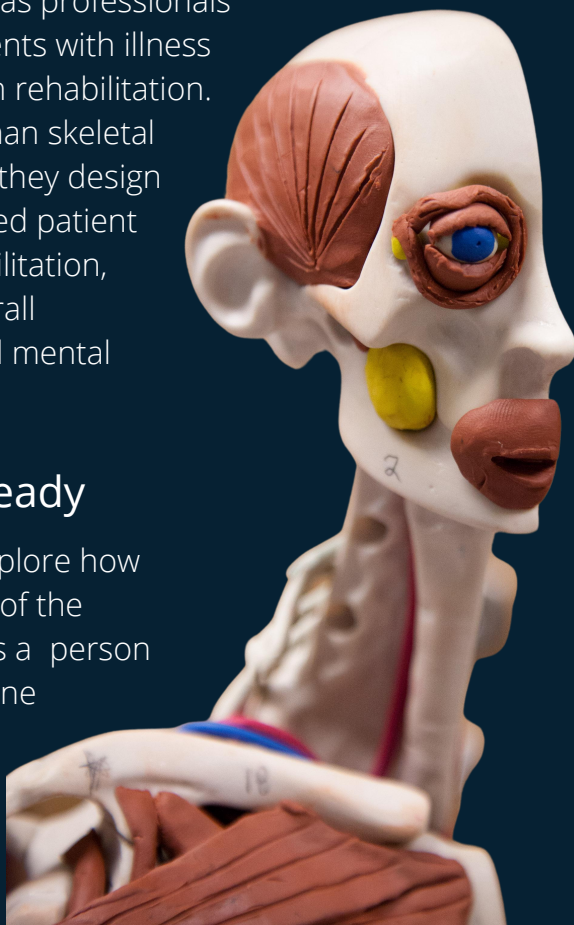
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Unit 1: Road to Rehabilitation

In this unit students work as professionals dedicated to helping patients with illness or injury progress through rehabilitation. Students explore the human skeletal and muscular systems as they design a solution for their assigned patient - involving physical rehabilitation, assistive devices, and overall strategies for physical and mental well-being.

Unit 2: Research Ready

Students research and explore how the brain and other parts of the nervous system change as a person ages and how the endocrine system controls how a person's body carries out various processes.



Unit 3: Adventure Awaits

In this unit, students join a team of expedition leaders who escort adventure travelers through a series of activities and events in extreme or remote environments. They are tasked to ensure the health and wellness of their group— focusing on the cardiovascular, respiratory, and immune systems—as they identify and address health risks or challenges travelers may encounter in these environments.

Unit 4: Patient Perspectives

Students are biomedical science advisors working on the development of an interactive exhibit. Ins and Outs of the Body: Patient Perspectives will combine art and storytelling into an immersive experience that spotlights the stories of real patients to investigate the structure and function of the urinary and digestive systems.

Lab Skills

- Dissection
- Blood Testing and Typing
- DNA Gel Electrophoresis
- Aseptic Technique
- Micropipetting
- Bacterial Analysis

Clinical Skills

- EKG Analysis
- Spirometry
- Urinalysis
- Tissue Histology
- Physical Therapy
- Kinesiology Taping

Course Knowledge

- Structure and Function of all Human Body Systems
- Language of Anatomy
- Cardiac Cycle
- Exercise Physiology
- Human Immunity



Medical Interventions

Year 3 - 1 Credit - Full Year

This course will explore how to prevent and fight infection, how to screen and evaluate the code in our DNA, how to prevent, diagnose, and treat cancer, and how to prevail when the organs of the body begin to fail. Students will be exposed to the wide range of interventions related to immunology, surgery, genetics, pharmacology, medical devices, and diagnostics.

Unit 1: How to Fight Infection

In unit 1 students will explore the diagnostic process used to identify an unknown infection, the use of antibiotics as a treatment, how bacteria develop antibiotic resistance, how hearing impairment is assessed and treated, and how vaccinations are developed and used to prevent infection.

Unit 2: How to Screen What is in Your Genes

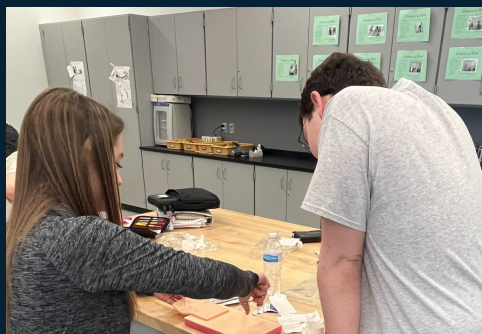
The goal of this lesson is for students to examine the available types of genetic testing and screening and discuss ethical implications of these tests. Assuming the role of genetic counselors, students will analyze a patient case concerning issues of genetic testing and provide appropriate recommendations.

Unit 3: How to Conquer Cancer

Students will look at the physiology of cancer and investigate the genes involved with cancer. Students will examine the technology that is being used to give researchers a better understanding of the differences in gene expression in both cancer cells and normal cells, and how this technology is being used to potentially develop personalized medicine for treating cancer.

Unit 4: How to Prevail When Organs Fail

Students will explore protein production, blood sugar regulation, dialysis, organ donation and transplantation, and non-invasive surgery techniques. In addition students will create a bionic human.



Lab Skills

- Bacterial Plating
- Bacterial Transformation
- Restriction Enzyme Digest
- DNA Gel Electrophoresis
- Micropipetting

Clinical Skills

- ELISA Analysis
- Interpreting Audiograms
- Blood Typing
- Tissue Typing
- Karyotyping

Course Knowledge

- Epidemiology
- Antibiotic Resistance
- Bacterial Gene Transfer
- Hearing Loss
- Vaccine production and mechanism

Biomedical Innovation

Year 4 - 1 Credit - Full Year



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. They have the opportunity to work on an independent project and may work with a mentor or advisor from a university, hospital, physician's office, or industry. Throughout the course, students are expected to present their work to an adult audience that may include representatives from the local business and healthcare community. Below is an example of some of the topics covered in this course.

Design of an Effective Emergency Room

In this problem students apply their knowledge of emergency medical careers, diagnostic testing and patient evaluation, human body systems, and medical interventions to analyze the workings of an emergency room and discuss inefficiencies that may hinder appropriate clinical care. Student teams will work collaboratively to design a more efficient emergency medicine delivery system.

Investigating Environmental Health

In this problem students will explore how substances or chemicals in the environment impact human health. Students will test water samples for the presence of contaminants that could be detrimental to human health and use molecular biology techniques to identify specific microorganisms. Students will then compile a comprehensive environmental health profile and action plan for their local area.

Forensic Autopsy

In this problem students will work as forensic pathologists and will examine a fetal pig using the same protocol as a human autopsy. Students will then design a fictional death case. Students will showcase the clues left behind in the body and tell the story of how the person died through medical documents, including an autopsy report and medical history forms. Students will finally be tasked with solving another group's proposed case.

Lab Skills

- Bacterial Plating
- Bacterial Transformation
- Restriction Enzyme Digest
- DNA Gel Electrophoresis
- Micropipetting

Clinical Skills

- ELISA Analysis
- Aseptic Technique
- Statistical Analysis
- Interpret Laboratory Data
- Micropipetting

Course Knowledge

- Biomedical Science Careers
- Emergency Room Efficiency
- Water Quality Testing
- Epidemiologic Studies