Medical Detectives at a Glance

PLTW Medical Detectives (MD) is a nine-week, STEM unit of study. In the MD unit, students play the role of real-life medical detectives as they collect and analyze medical data to diagnose disease. They solve medical mysteries through hands-on projects and labs, measure and interpret vital signs, dissect a sheep brain, investigate disease outbreaks, and explore how a breakdown within the human body can lead to dysfunction.

Throughout the unit, students discover how healthcare professionals act as medical detectives to identify, treat, and prevent illness in their patients. Students apply their knowledge of the human body systems, analyze patient symptoms, perform lab analyses of patient samples, and use other clues to come up with diagnoses.

Medical Detectives uses the PLTW activity-, project-, and problem-based (APB) instructional design approach, which centers on hands-on, real-world activities, projects, and problems that help students understand how the knowledge and skills they develop in the classroom can be applied in everyday life. The APB approach scaffolds student learning through structured activities and projects that empower students to become independent in the classroom and help them build skill sets to apply to a real-world problem.

The student learning progression starts with basic concepts and practices in Lesson 1 and moves to more advanced concepts and practices in Lessons 2 and 3. Students learn and add more tools to their tool belts as they progress through the unit.

The following is an overview of the lessons in the PLTW Medical Detectives unit, including the end-of-unit problem. The lessons scaffold the students' knowledge and skills in the functions of the human body, disease diagnoses, and ways to improve human health.

Lesson 1: Disease Detectives

Students discover how healthcare professionals act as medical detectives to identify, treat, and prevent illness in their patients. Students collect and interpret vital signs to evaluate patient health, explore different infectious disease agents, and design and conduct experiments to test the effectiveness of antibiotics on bacteria. In the end-of-lesson project, students collect and analyze medical data to diagnose a patient with a mystery illness.

Placing Antibiotic Discs on Agar Plate

Activity 1.1 Vital Signs

Students discover how healthcare professionals act as medical detectives to identify, treat, and prevent illness in their patients. Students collect and interpret vital signs to evaluate patient health, explore different infectious disease agents, and design and conduct experiments to test the effectiveness of antibiotics on bacteria. In the end-of-lesson project, students collect and analyze medical data to diagnose a patient with a mystery illness.

Activity 1.2 What's Vital

Students learn how to measure pulse, temperature, respiratory rate, and blood pressure as they develop an introductory understanding of why collecting this information is important. The students are introduced to the unit problem in a "Breaking News" video clip about a disease outbreak in a local community!

Activity 1.3 Disease Agents

Students explore different types of disease agents and modes of transmission to examine a case file for a patient with an unknown infection. Using a disease dictionary, they discover how vital signs can be used to diagnose an infection. Students then use experimental design to create an experiment to help them determine the most effective antibiotic to treat their patient.

Activity 1.4 Disease Diagnosis

Building upon their knowledge of vital signs and disease agents, students examine case notes that include patient symptoms and doctors' notes to determine the cause of an infection in a sick patient. Students then analyze laboratory findings to compare positive and negative test results to confirm the diagnosis.

Project 1.5 Diagnostic Detectives

Students use their knowledge and skills of vital signs, patient symptoms, modes of transmission, and lab analysis to diagnose a new patient. They are given initial intake information and then must develop investigative questions to further the interview. After gathering all necessary information, they analyze all the evidence including lab results to diagnose their patient.

Lesson 2: Mysteries of the Human Body

This lesson introduces the human body as a collection of body systems, with a focus on the nervous system. Students investigate how the nervous system collects information from the outside world, moves this information through neurons, processes this information in the brain, and initiates the body's response accordingly. Students create neuron models and perform a sheep brain dissection.

Sheep Brain Dissection

They use their knowledge to explore symptoms as they relate to specific nervous system dysfunction and analyze evidence to identify the cause of the dysfunction. In the end-of-lesson project, students create educational resources to help their patient understand the medical condition.

Activity 2.1 Secrets of the Nervous System

Students begin to explore the nervous system. They investigate the functions of the peripheral and central nervous system and map a series of inputs and outputs traveling through the human body.

Activity 2.2 Smart Signals

Students continue to build their knowledge of the nervous system by building a 3D model of a neuron. They then model signal transmission through and between their neuron models.

Activity 2.3 Mysterious Communications

Students explore the different types of neurological tests to diagnose nervous system disorders. Then they analyze the patient's results for each of these tests to determine where the communication breakdown is occurring within the nervous system.

Activity 2.4 The Control Center

Students dive deeper into the brain anatomy and learn how the brain processes information. By completing a sheep brain dissection, students explore and label the basic structure and function of each region of the brain.

Project 2.5 Mystery Disease

Students apply their knowledge and skills from the Lesson 2 activities to analyze a case file and develop a protocol to diagnose their patient. A sheep brain serves as a model for students to explore problems that may be present in their patient's brain. Students then create patient education materials to explain and model what is happening in the patient's body.

Lesson 3: Outbreak!

A mysterious toxin is endangering the health of a community. Using their understandings of human body systems, students describe how the suspected toxin has impacted the health of a patient. Students analyze patient symptoms and perform lab analyses of patient samples to identify the culprit and determine how it's spreading.

Toxin Testing Lab Materials

In the end-of-unit problem, students locate the source of the toxin using a map of the community, patient histories, and lab data, then present their findings to help community leaders mitigate the situation.

Activity 3.1 Food Fiasco

Students develop an understanding of epidemiology to examine a case study about an outbreak that occurred from food consumed at a picnic. While performing risk calculations, students draw conclusions about which food was the most likely source of the illness.

Problem 3.2 Disease Detectives

In this end-of-unit problem, students apply knowledge and skills from the entire unit to investigate an outbreak in a local community. They analyze epidemiology interviews, food logs, location menus, and medical case files to deduce the neurotoxin responsible for the illness and the food source responsible for the outbreak. They

perform laboratory tests of patient samples to gather more information and confirm their conclusions. Finally, students write a press release to update the public about the outbreak.