MEDICAL DETECTIVES

PLTW Gateway · Grade 6 Science

Course Syllabus · Semester 1, 2026–2027 School Year

Item	Detail
Course	PLTW Gateway — Medical Detectives (MD)
Grade level	6
Instructor	Mr. Huynh
Term	Semester 1: Monday, August 10 – Friday, December 18, 2026 (87 instructional days)
Room / Period	Room 203

1. Course Description

Medical Detectives is one of the Project Lead The Way (PLTW) Gateway units for middle school. PLTW describes it this way: "Students play the role of real-life medical detectives as they collect and analyze medical data to diagnose disease." Students work through the unit as a practicing clinician and public health investigator would — measuring, culturing, testing, interviewing, dissecting, calculating, and then defending a conclusion in front of an audience.

The unit is organized on PLTW's Activity–Project–Problem model. Short activities build a specific technical skill; a project at the end of each lesson requires students to combine those skills in an authentic case; and an end-of-unit problem demands that students transfer everything to a situation they have not seen before. Across the semester, students investigate three escalating scales of medical mystery:

- The individual patient — what is wrong with this person, and what evidence supports that conclusion?
- The nervous system — where in a communication pathway has the signal broken down, and what deficit does that location predict?
- The community — where did this outbreak come from, and how do we communicate that finding responsibly to the public?

Students maintain a Medical Detective's Notebook throughout the semester. It is the primary record of their reasoning and the primary object of instructor feedback.

2. Course Structure and PLTW Sequence

The table below is the official PLTW lesson and activity sequence, with PLTW's published lesson lengths.

PLTW Lesson	Activities, Projects, and Problems	PLTW days	Central investigative skills
Lesson 1 **Disease Detectives**	Activity 1.1 Vital Signs Activity 1.2 Exploring What's Vital Activity 1.3 Disease Agents Activity 1.4 Disease Diagnosis Project 1.5 Diagnostic Detectives	17 days	Vital-sign measurement and interpretation; experimental design; aseptic technique and bacterial culture; antibiotic-effectiveness testing; positive and negative controls; differential diagnosis; patient interviewing
Lesson 2 **Mysteries of the Human Body**	Activity 2.1 Secrets of the Nervous System Activity 2.2 Smart Signals Activity 2.3 Mysterious Miscommunications Activity 2.4 The Control Center Project 2.5 Mystery Disease	13 days	Stimulus–response pathways; neuron structure and signal transmission; physical and diagrammatic modeling; neurological examination; comparative brain anatomy (sheep brain dissection); localization of dysfunction
Lesson 3 **Outbreak!**	Activity 3.1 Food Fiasco Problem 3.2 Disease Detectives (end-of-unit problem)	10 days	Descriptive epidemiology; attack-rate calculation and probability; data organization and pattern analysis; evidence-based claim construction; public health communication

3. Learning Outcomes

The outcomes below are PLTW's own stated activity and project goals for this unit, grouped by lesson.

Lesson 1 — Disease Detectives

- Collect and analyze vital signs to draw conclusions; explain differences among vital sign readings.
- Use the experimental design process to investigate a question; design and conduct an experiment to draw conclusions; collaborate within a team.
- Analyze a patient's signs and symptoms to diagnose a problem; design, document, and conduct an experiment to draw conclusions and provide treatment options.
- Explore how disease agents are transmitted and treated; use aseptic techniques to culture bacteria.
- Analyze a patient's medical file and physician notes to request and interpret lab tests; identify the purpose of positive and negative controls.
- Conduct interviews to gather information; provide a diagnosis and treatment for a patient based on test results, patient interviews, and medical file information; demonstrate effective communication skills.

Lesson 2 — Mysteries of the Human Body

- Describe how the nervous system works to sense, process, and respond to stimuli in the world; identify the path of input and output signals through the nervous system.

- Describe the structure and function of neurons; model how a signal is transferred through and among neurons.
- Explore types of neurological tests; analyze a patient's medical file, physician notes, and medical examination tests to draw conclusions; identify the communication breakdown of a nervous system dysfunction.
- Describe the structure and function of the brain and its parts; compare human and sheep anatomy; predict dysfunction based on the location of brain injury or disorder.
- Plan an investigation to solve a problem; support the diagnosis with facts from the investigation.

Lesson 3 — Outbreak!

- Organize and analyze data to calculate probability; use attack rate calculations to determine the likely source of illness.
- Analyze medical evidence to determine the source of an outbreak; develop and carry out a plan to determine the source of illness.
- Use evidence from an investigation to support a claim; communicate effectively to the public about the source of the outbreak; collaborate within a team.

4. Standards Alignment

Next Generation Science Standards — performance expectations

Performance Expectation	Verbatim NGSS text	Where it is addressed	Alignment
MS-LS1-3	"Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells."	Lesson 1 (vital signs as evidence of interacting circulatory and respiratory subsystems; differential diagnosis); Lesson 2 (nervous system structure and function; brain anatomy)	Strong — anchor PE
MS-LS1-8	"Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories."	Lesson 2 (Activities 2.1–2.3: stimulus–response pathways, neuron signaling, neurological examination)	Strong
MS-LS1-1	"Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells."	Lesson 1 (Activity 1.3: aseptic technique, bacterial culture, microscopy; explicit unicellular-versus-multicellular and bacteria-versus-virus discussion is added to complete the alignment)	Partial — requires added discussion
MS-ETS1-3	"Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success."	Lesson 1 (Activity 1.3 antibiotic-effectiveness data compared across candidate treatment protocols against stated criteria)	Partial — claim only when framed as evaluating treatment protocols

Science and Engineering Practices exercised

- Practice 1 — Asking Questions and Defining Problems: generating diagnostic hypotheses (L1); framing outbreak questions (L3).
- Practice 2 — Developing and Using Models: neuron and brain models, signal-transmission diagrams (L2).
- Practice 3 — Planning and Carrying Out Investigations: the antibiotic-effectiveness experiment with positive and negative controls (L1). This is the strongest practice in the unit.
- Practice 4 — Analyzing and Interpreting Data: culture results and laboratory panels (L1); attack-rate tables and epidemic curves (L3).
- Practice 5 — Using Mathematics and Computational Thinking: vital-sign ranges (L1); attack rate, proportion, and probability (L3).
- Practice 6 — Constructing Explanations and Designing Solutions: diagnosis and treatment recommendation (L1, L2); outbreak-source explanation (L3).
- Practice 7 — Engaging in Argument from Evidence: predicting deficit from lesion location (L2); defending the identified source (L3).
- Practice 8 — Obtaining, Evaluating, and Communicating Information: disease-agent research (L1); the patient-education resource (L2); the community briefing (L3).

Crosscutting Concepts exercised

- Cause and Effect: Mechanism and Explanation — the dominant concept of the unit: pathogen → symptom, lesion location → deficit, contaminated source → case cluster. The middle-school extension that "some cause and effect relationships in systems can only be described using probability" is precisely the reasoning of Lesson 3.
- Systems and System Models — body systems with interacting subsystems; the outbreak modeled as a population-level system.
- Structure and Function — neuron anatomy, brain regions, and the dissection: function depends on the relationships among parts.
- Patterns — symptom clusters in diagnosis; distribution of cases by exposure and time in epidemiology.
- Scale, Proportion, and Quantity — a deliberate three-scale through-line: microbial scale → individual patient → population. Students are asked at each lesson boundary to state the scale at which they are reasoning.

Common Core connections

- RST.6-8.1 — Cite specific textual evidence to support analysis of science and technical texts. (Officially listed with MS-LS1-3.)
- RI.6.8 — Trace and evaluate the argument and specific claims in a text. (MS-LS1-3.)
- WHST.6-8.1 — Write arguments focused on discipline-specific content. (MS-LS1-3.)
- WHST.6-8.7 — Conduct short research projects to answer a question. (MS-LS1-1.)
- WHST.6-8.8 — Gather relevant information from multiple print and digital sources; assess the credibility and accuracy of each source. (MS-LS1-8.)

- SL.6.5 — Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information. (MS-LS1-2 and MS-ETS1.)
- MP.2 and 6.SP — Reason abstractly and quantitatively; statistics and probability. Applied to attack-rate and probability work in Lesson 3. Ratio and proportion standards 6.RP.A.1 and 7.RP.A.2 are integrated as departmental mathematics support rather than as NGSS-listed connections.

5. Assessment and Grading

Category	Weight	What it contains	Why it is weighted this way
Laboratory investigations and the Medical Detective's Notebook	**30%**	Experimental design pages, data tables, aseptic-technique performance, dissection records, conclusions written as Claim–Evidence–Reasoning.	Writing about content reliably raises learning (mean effect size 0.30 across 56 experiments, grades 1–12, with middle school specifically confirmed). The notebook is where reasoning becomes visible and correctable.
PLTW Projects and the End-of-Unit Problem (1.5, 2.5, 3.2)	**30%**	Diagnostic Detectives, Mystery Disease, and the Outbreak community briefing — assessed with PLTW rubrics for accuracy of diagnosis, quality of evidence, teamwork, and communication.	These are the transfer tasks. Guided inquiry produces a mean effect size of about 0.50 over traditional instruction, with the largest gains when the teacher structures the reasoning.
Cumulative assessments	**30%**	Three lesson assessments plus a cumulative semester assessment. Every assessment after the first is deliberately cumulative: roughly 60% current lesson, 40% prior lessons.	Delayed, cumulative retrieval is the single best-evidenced move for durable retention. Testing that feels harder now produces markedly higher recall weeks later (56% versus 42% at one week in the classic study).
Case File Warm-Ups and formative checks	**10%**	Daily 5-minute retrieval warm-ups and mid-lesson checks, scored for completion and effort rather than accuracy.	Retrieval practice only works if students attempt it without fear. Keeping the stakes low protects the mechanism; the learning is banked on the cumulative assessments.

Grade scale

A	B	C	D	F
90–100%	80–89%	70–79%	60–69%	Below 60%

Revision, retake, and late work

- Any laboratory investigation or notebook entry may be revised once, within one week of receiving feedback, for full credit. Revision requires that the student state what changed and why.
- Cumulative assessments are not retaken in isolation, because the design already retests prior content. A student who underperforms on Lesson 1 content has a second and third scored opportunity on that content built into the Lesson 2 and semester assessments, and the more recent evidence carries more weight.

- Late work will be accepted, granted it is complete and with academic integrity.
- Extended absence during a laboratory sequence is addressed with a make-up laboratory session or a validated simulation, not with a worksheet substitute.

6. Extension and Support

Extensions for students who are ready for more

This is not extra work. They are deeper work on the same case, and they are available to any student who has met the core expectation.

- Quantify rather than describe convert plate observations into a zone-of-inhibition data set, then rank antibiotic efficacy with a defended measure of central tendency and spread.
- Model the outbreak: construct an epidemic curve from the case data and argue from its shape whether the exposure was a point source, continuous, or propagated.
- Read a primary source: analyze a real CDC Morbidity and Mortality Weekly Report outbreak investigation and compare its methodology to the Lesson 3 protocol.
- Push localization further: give a novel lesion location, predict the deficit and then defend the prediction against a peer assigned to refute it.
- Design the control given a flawed published protocol, identify the missing control and write the corrected design with a justification of what each control rules out.
- Prepare a health-science pathway artifact suitable for a HOSA-style competitive event or a district science showcase.

Support for students who need to close a skill gap

- Pre-teach the academic vocabulary of each lesson three days before it is needed, using a Frayer model with the term, definition, a labeled visual, and a non-example.
- Provide partially completed worked examples for every quantitative task (vital-sign ranges, attack rate), fading the scaffold across the lesson. Correct examples alone are more effective than mixing in incorrect ones; average effect on mathematics performance is g = 0.48.
- Supply a structured notebook template with sentence frames for Claim–Evidence–Reasoning, so the cognitive load falls on the science rather than on the format of the writing.
- Pair every diagram with a spoken or recorded verbal description delivered at the same time, with labels placed directly on the structure rather than in a separate key.
- Shorten the retrieval set rather than removing it. Three items answered from memory is more valuable than ten items copied.
- Schedule a mid-lesson mastery check with immediate corrective feedback so misconceptions are caught inside the lesson rather than at the assessment.

7. Required Materials and Required Procedures

- Bound composition notebook, dedicated exclusively to this course, to serve as the Medical Detective's Notebook (graph-ruled preferred).

- Two pens of different colors — one for the first attempt at retrieval, one for correction. This is a requirement, not a preference.
- Pencils, a metric ruler, and a basic calculator.
- Closed-toe shoes on all laboratory days. Students in open-toe footwear cannot participate in the microbiology or dissection laboratories and will be assigned the alternative task.
- Long hair tied back on laboratory days.
- Safety goggles, gloves, and aprons are provided by the school.
- School-issued device, charged, for PLTW digital resources and the online course platform.

8. Laboratory Safety — Required Reading

No student participates in any laboratory activity before completing safety certification and returning a signed safety contract.

Microbiology: culturing bacteria (Lesson 1, Activity 1.3)

- All microbiology work in this course is conducted at Biosafety Level 1 under the American Society for Microbiology guidelines for teaching laboratories.
- Students' culture only instructor-supplied, known, non-pathogenic organisms. Students are to never take culture samples taken from their own bodies, from other people, from animals, or from environmental surfaces such as phones, doorknobs, or sinks.
- Plates are sealed before incubation and are never reopened by students. Sealed plates are autoclaved or chemically disinfected by the instructor before disposal.
- Incubation is held at or below 30 degrees Celsius, which disfavors organisms adapted to human body temperature.
- Gloves and goggles are required whenever cultures are handled. Hands are washed before and after every microbiology session. No food, drink, or gum is permitted in the laboratory at any time.
- Any spill or broken plate is reported to the instructor immediately and is cleaned only by the instructor.

Animal dissection: preserved sheep brain (Lesson 2, Activity 2.4)

- Lesson 2, Activity 2.4 (The Control Center) includes a preserved sheep brain dissection. This is a PLTW curriculum component and is the highest-value structure-and-function experience in the unit.
- Written notice will be sent home no fewer than ten school days before the dissection, stating the date, the specimen, the preservative used, and the alternative option.
- Under California Education Code sections 32255 through 32255.6, a student with a moral objection to dissecting or otherwise harming or destroying animals or any part of an animal may refrain from participating, provided the objection is substantiated by a note from a parent or guardian.
- A student who exercises this right will be offered an alternative education project that provides an alternate avenue to the same knowledge. By statute, the alternative must require comparable time and effort and may not be more arduous than the original project. The approved alternative for this course is a validated three-dimensional virtual brain dissection with the same identification, localization, and prediction tasks.
- By statute, a student may not be discriminated against or penalized in grading for exercising this right. Each teacher using animals or animal parts is required to inform students of these rights, and this syllabus serves as that notice.
- Legislation to expand these provisions, Assembly Bill 347 (Kalra), passed the Assembly in June 2025 and was held under submission in Senate Appropriations in August 2025. It had not been enacted as of the most recent verifiable record. Should it become law, this section will be revised and reissued.

9. Classroom Expectations

- Arrive on time and begin the Case File Warm-Up without prompting. The warm-up is closed-notebook and starts when the bell rings.
- Attempt retrieval before checking notes. A wrong first attempt that is then corrected produces more durable learning than a correct answer copied from a page. Errors made in good faith are treated as instructional data, never as a deficiency.
- Speak the discipline. Students are expected to use precise academic language — pathogen rather than germ, symptom versus sign, afferent versus efferent, attack rate rather than how many got sick.
- Collaborate honestly. Team projects require every member to contribute to the reasoning, not merely to the product. Individual accountability is assessed through the notebook and the cumulative assessments.
- Handle patient case files as confidential professional material. Cases are fictional; the professional discipline is not.
- Respect every specimen and every organism. Careless handling of a sheep brain or a culture plate ends laboratory participation for that day.

10. Academic Integrity

- Work submitted must represent the student's own reasoning. Copying a peer's data, notebook conclusions, or diagnostic reasoning is academic dishonesty even when the underlying case is shared by the team.
- Generative artificial intelligence may be used only where the instructor has explicitly authorized it for a named purpose, and its use must be disclosed in the notebook. It may not be used to produce diagnoses, conclusions, or Claim–Evidence–Reasoning writing.
- Fabricating or altering laboratory data is the most serious violation available in a science course, because the entire discipline rests on the trustworthiness of the record. It results in a zero, a required redesign and re-collection, and a family conference.
- First-instance violations are addressed instructionally: the work is redone under supervision, with the original score replaced by the redone work rather than averaged. Repeated violations follow the school's discipline policy.

11. Semester 1 Pacing Calendar

Built on the district-adopted 2026–27 academic calendar (adopted June 24, 2025). Semester 1 runs Monday, August 10 through Friday, December 18, 2026 — 87 instructional days. Non-instructional days accounted for below: September 7 (holiday), one non-instructional day in October (confirm the exact date with the site calendar), November 11 (holiday), and the November 23–27 recess.

Wk	Dates (2026)	Days	PLTW focus	Retention routine and additions	Assessment
1	Aug 10–14	5	Course launch — teacher-designed foundation, not PLTW content: laboratory safety and personal protective equipment certification; the Medical Detective's Notebook; metric measurement and data tables; introduction to Claim–Evidence–Reasoning; the three scales of the course.	Establish the Case File Warm-Up routine on day 2. Baseline diagnostic on body-systems prior knowledge.	Safety contract; baseline diagnostic (ungraded)
2	Aug 17–21	5	Activity 1.1 Vital Signs — measure and interpret pulse, respiration, blood pressure, temperature; explain variation among readings.	Warm-ups retrieve safety protocol and measurement conventions. Explain-the-mechanism prompt: why does pulse rise before temperature?	Notebook check 1
3	Aug 24–28	5	Activity 1.2 Exploring What's Vital — pose an investigable question about a vital sign; design and conduct the experiment.	Teacher-modeled experimental design with a partially worked example, then fading. Interleave variable types.	Experimental design plan (rubric-scored)
4	Aug 31–Sep 4	5	Activity 1.2 concluded — data analysis and written conclusion. Extension: argue from vital-sign evidence that the body is a system of interacting subsystems (MS-LS1-3).	First spaced return to Activity 1.1 content. Mixed review set 1.	CER conclusion, Activity 1.2
5	Sep 8–11	4	Activity 1.3 Disease Agents, part 1 — disease agent types and transmission; aseptic technique; culture setup. (Sep 7 is a holiday.)	Aseptic technique performance check before any student touches a plate. Frayer models for bacterium, virus, fungus, protist.	Aseptic technique performance check
6	Sep 14–18	5	Activity 1.3 concluded — read cultures, analyze antibiotic effectiveness, recommend treatment options.	Quantify zones of inhibition; upper-quartile extension on measures of spread. Interleave bacterial versus viral agents and their treatments.	Antibiotic investigation report
7	Sep 21–25	5	Activity 1.4 Disease Diagnosis — read a medical file and physician notes; request and interpret laboratory tests; explain positive and negative controls.	Deep explanatory questioning on controls: what does each control rule out? Mixed review set 2 (weeks 2–6).	Laboratory-test interpretation task
8	Sep 28–Oct 2	5	Project 1.5 Diagnostic Detectives — conduct patient interviews, integrate test results and file information, reach a diagnosis and treatment plan.	Required mid-project checkpoint before conclusions are drawn. Individual notebook accountability alongside the team product.	Project 1.5 in progress
9	Oct 5–9	5	Project 1.5 presentations and professional feedback round. Lesson 1 consolidation.	Cumulative retrieval across all of Lesson 1. Feedback returned before scores; error analysis is completed in the notebook.	**Project 1.5 final; Lesson 1 cumulative assessment**
10	Oct 12–16	5	Activity 2.1 Secrets of the Nervous System — sense, process, respond; trace input and output pathways.	Warm-ups now interleave Lesson 1 content at roughly 40%. Interleave sensory versus motor pathways.	Pathway tracing task

Wk	Dates (2026)	Days	PLTW focus	Retention routine and additions	Assessment
11	Oct 19–23	5	Activity 2.2 Smart Signals — neuron structure and function; build and use a neuron model; model signal transfer within and among neurons.	The model is mapped onto the labeled schematic in the same session, with labels adjacent to structures. Verbal description delivered simultaneously with the diagram.	Neuron model and annotated schematic
12	Oct 26–30	4–5	Activity 2.3 Mysterious Miscommunications — neurological test types; analyze a patient file to locate the communication breakdown.	Mixed review set 3. One non-instructional day falls in October on the district calendar; confirm the date and absorb it here.	Neurological case analysis
13	Nov 2–6	5	Activity 2.4 The Control Center — brain structure and function; sheep brain dissection; compare human and sheep anatomy; predict dysfunction from injury location.	Dissection is immediately followed by mapping to the labeled diagram and vocabulary. Alternative virtual dissection available under Education Code 32255.	Dissection record; localization prediction with defense
14	Nov 9–13	4	Project 2.5 Mystery Disease — plan an investigation, analyze the patient file and examination results, support the diagnosis with evidence. (Nov 11 is a holiday.)	Peer refutation round: each team must attempt to refute another team's localization claim.	Project 2.5 in progress
15	Nov 16–20	5	Project 2.5 presentations and the patient-education resource. Lesson 2 consolidation. (Nov 23–27 is Thanksgiving recess.)	Assessment is deliberately cumulative: approximately 60% Lesson 2, 40% Lesson 1.	**Project 2.5 final; Lesson 2 cumulative assessment**
16	Nov 30–Dec 4	5	Activity 3.1 Food Fiasco — organize and analyze case data; calculate attack rates and probability; identify the likely source.	Partially worked attack-rate examples, faded across the week. Extension: construct and interpret an epidemic curve.	Attack-rate analysis
17	Dec 7–11	5	Problem 3.2 Disease Detectives — the end-of-unit problem: develop and execute an investigation plan using community maps, patient histories, and laboratory data.	Required plan approval checkpoint before data collection. Claim–Evidence–Reasoning is the required format for the determination.	Investigation plan; evidence log
18	Dec 14–18	5	Problem 3.2 concluded — present findings to community leaders. Health-science career pathways and reflection.	Semester cumulative retrieval across all three lessons. Written reflection on which study strategies produced retention, using each student's own assessment record as evidence.	**Problem 3.2 briefing; semester cumulative assessment**