

Principles of Biomedical Science Period 1-2

THE STATIC CASE (CASE A)



Hello, Period 1-2. This week the Static case goes to autopsy on Monday, the tissue slides come back from the lab on Tuesday, Wednesday is catch-up, John Carroll visits Thursday, and Friday is your first unit test. Every bold word below has a reference page in this packet (R1 to R18), and every day has a story section that walks you into the work before you open the sheet.

Unit 1 Test: Friday, October 2. 40 minutes, on paper, at the start of class. It covers what we have done in class so far this unit.

1. Read the **Study Guide**: https://mendozabiomed.org/exams/study-guides/PBS_unit-1-medical-investigation_endunit_guide.pdf

2. Take the **Practice Test**, then check the key at the end: https://mendozabiomed.org/exams/study-guides/PBS_unit-1-medical-investigation_n_practice-test.pdf

3. Use the 6 Rs: Record and Reduce your notes early in the week, Review and Recite the night before, then Reflect and Revise after the practice test.

Monday, Sept 28

Investigation Day 13, Autopsy Day (story p. 4). The medical examiner's findings packet opens (an **autopsy** is the examination of a body after death, R1). Rotate through the stations: copy each finding onto the **body diagram** in location words (R2), decide whether each wound shows **vital response** (the body's own time stamp, R3), and find the chambers, valves, and vessels of a preserved sheep heart (R4, Artifact A1). Daily Evidence Sheet, Day 13, Part B wants each finding "exactly as written in the packet," with meaning kept in its own column. Goggles and nitrile gloves at the heart station; wait for my safety approval. In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Activity 1.2.4 Histology and Activity 1.2.5 Gross Anatomy Examination.

Turn in: Daily Evidence Sheet, Day 13 (the day's worksheet), every Part complete, as one PDF to Wk5 D13 · Autopsy Day (PLTW 1.2.4 and 1.2.5).

Today's page: mendozabiomed.org/learn/pltw-pbt/day/2026-09-28

Tuesday, Sept 29

Investigation Day 14, The Fabric Under the Lens (story p. 6). The tissue **slides** come back (thin slices of organ on glass, stained so cells show color, R6). Learn the four **tissue families** (R7), then read each printed slide card beside its healthy reference card: describe, name the pattern, connect it to a Day 13 finding (R8 to R10). Part A asks you to "Name the four tissue families and one job each, from the reading"; Part B3 turns a **field of view** into a real size (R5, Artifact A3). In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Activity 1.2.4 Histology, and finish its analysis section.

Turn in: Daily Evidence Sheet, Day 14, every Part complete, as one PDF to Wk5 D14 · The Fabric Under the Lens (PLTW 1.2.4).

Today's page: mendozabiomed.org/learn/pltw-pbt/day/2026-09-29

Wednesday, Sept 30

Catch-up day (story p. 8). First, check everything due since your last catch-up day: the day page lists nine items, from the Sept 17 presumptive test report to the Day 14 sheet. Turn in anything you still owe. Then Research Track session 14 (CRISPR-Cas9), or the Unit 1 practice test.

Turn in: Anything you still owe, each to its own Schoology assignment.

Today's page: mendozabiomed.org/learn/pltw-pbt/day/2026-09-30

Thursday, Oct 1

John Carroll bioethics debate 2: Should we ban antibiotic use in livestock? (story p. 9). Bring your preparation assignment. John Carroll leads minutes 0 to 40: sides are assigned in the room, then rebuttals, then you write where you stand. The science words (**antibiotic resistance**, **selective pressure**) are on R18; a **CER** is on R17. Minutes 40 to 80: In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Activity 1.2.4 Histology, and pick up where you stopped.

Turn in: Hand in your debate worksheet at the end of the session (Schoology: Wk6 CER: JCU bioethics 2, should we prohibit antibiotic use in livestock?). Absent? Write the CER described on the day page when you return.

Today's page: mendozabiomed.org/learn/pltw-pbt/day/2026-10-01

Friday, Oct 2

UNIT 1 TEST during the first 40 minutes: on paper, in class. Bring a pencil. Then **Investigation Day 15, Where Claims Must Stop** (story p. 11): audit a made-up review file where a conviction failed, find the **reasoning failures** in it (R15, R16), and write your own **claim ceiling** (the strongest sentence your evidence can carry, R14) before you know your answer. The four sentences to audit are in the Day 15 sheet, SEC 01B. In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Project 1.2.6 Case Closed, and read its overview and reporting requirements.

Turn in: Daily Evidence Sheet, Day 15, every Part complete, as one PDF to Wk6 D15 · Where Claims Must Stop (PLTW 1.2.6) by 11:59 PM tonight. Start it in class and finish at home.

Today's page: mendozabiomed.org/learn/pltw-pbt/day/2026-10-02

Words on this page: the **Daily Evidence Sheet** is the day's worksheet you turn in; the **pack** is the day's briefing you read; **Schoology** is where you upload; **myPLTW** is the PLTW course site, in Clever next to Schoology; a **Cornell page** is a notes page with a question column and a summary at the bottom. Each day's page has the steps, readings and links. Absent? Open that day's page, follow the steps, and see me when you return. Questions? Ask me in class or message me in Schoology. **Go Hornets!** Mr. Mendoza

What is inside, and where to find it

Each class day has a story section that walks you into the case or the lab and explains the science as it unfolds. Each lesson day also has an explainer: what the lesson was trying to teach, and what the full professional lab would look like. The reference pages (R1 to R18) explain every term the week uses, assuming you have never seen it before. The artifacts are fully labeled diagrams that support your sheets; they never replace one.

Marcus Bell, Statik Sound, and everyone in this case are fictional, built for our class. The science is real. Nothing in this packet answers a question on a Daily Evidence Sheet. It stops where your reasoning starts.

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Investigation Day 13: the examiner opens the findings packet



The heart station on Monday. Goggles and nitrile gloves stay on the whole time; the probe points, it never cuts.

Marcus Bell was 34, the owner and producer of Statik Sound, a neighborhood recording studio. On a Monday morning his business partner found him on the studio floor behind the mixing console. Since then your teams have worked the scene exactly as it was left: tape at the door, the outline behind the console, a fallen speaker cabinet and a moving blanket over the lower body. Last week, three independent clocks agreed on one window of time. (Marcus Bell, Statik Sound, and everyone in this case are fictional, built for our class. The science is real.)

Today the case moves to the examination table. First, the medical examiner finished the external examination, documenting the outside of the body before anything was disturbed. Then the examination went inside, “organ by organ, with every finding described before it is interpreted.” Each organ was looked at, weighed, and written down in plain describing words: size, color, weight, what was torn and what was intact. Only after that did anyone ask what any of it meant.

The goal today is narrow and powerful: to tell which injuries happened while Marcus Bell was alive, and which could have happened after. The test for that has a name, **vital response** (R3). A living body answers an injury in more than one way, and Part A asks you to find them in the reading. The one you can see with your own eyes is color. When the heart is still beating, blood pushes out of broken vessels and soaks into the tissue around a wound, leaving a purple-red stain under the skin. Once the heart stops, nothing pushes the blood anywhere. Hold on to the pack's analogy: “only a running engine leaks oil when punctured.”

At the heart station you hold the organ itself. A preserved sheep heart is gray-brown and firm, because a fixative has stopped it from decaying. Find the two thin-walled upper chambers, the atria, and the two thick lower pumping chambers, the ventricles. Find the valves, the one-way doors between them, and the great vessels at the top (R4, Artifact A1). The thin vessels running over the outside, tucked in fat, are the coronary arteries, which feed the heart muscle itself.

One more thing surfaces today. During an inventory of the studio office, an insulin pen turns up in the desk drawer (Exhibit 015, chemistry thread). Team D writes down the question it raises. Nobody answers it yet.

Your move. Now open Daily Evidence Sheet, Day 13. Part A asks what the reading says a living body does in response to injury; copy the first three words of the sentence you used. Then build the Part B table: the region in the diagram's words (R2), the finding exactly as written, the vital-response call with its sign, and an interpretation that names the finding it rests on (R3).

Monday explainer: what the lesson teaches, and what the full lab looks like

1. What this lesson was trying to teach

The big idea, in the pack's words: "A wound that bled tells you the person was alive when it happened. Vital response is the body time-stamping its own injuries." **The skill**: keep two columns honest. What the examiner saw goes in one column; what it might mean goes in the other and names the finding it rests on.

PLTW connection. In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Activity 1.2.4 Histology and Activity 1.2.5 Gross Anatomy Examination. The day page says to record your slide observations in 1.2.4 and your heart-anatomy labels in 1.2.5. The heart station in our case practices that same skill: find real structures on a real organ, name them, and write down only what you actually located.

2. If we had the full lab

Monday was already hands-on: you handled a preserved sheep heart and read a findings packet. You did not examine a human body, and no one in our room will. In a medical examiner's office, a forensic pathologist (a doctor trained to find the cause of death) works in an autopsy suite like the one below.

1. The body is photographed, weighed, and measured, and every mark on the outside is photographed beside a ruler. **2.** The internal examination usually begins with a Y-shaped cut that starts at each shoulder and meets at the bottom of the breastbone. **3.** Organs come out in a set order; each is weighed on the organ scale and described before anyone interprets it. **4.** Small pieces of tissue go into jars of 10 percent neutral buffered formalin, a fixative that stops decay. Those pieces become Tuesday's slides. **5.** Fluids are saved in tubes for the chemistry and toxicology labs: blood, urine, and vitreous fluid, the clear gel inside the eye, which resists decay longer than other body fluids.

Safety: gown, gloves, eye protection and a mask, because body fluids can carry infection; sharp tools handled one at a time; formalin kept closed because its fumes irritate eyes and lungs. **Time:** the examination takes hours; the slides and lab results come back later. **How it connects:** your findings packet is the pathologist's written record, the sheep heart stands in for the organ on the scale, and your vital-response calls are the same calls the pathologist makes at a wound's edge.



A medical examiner's autopsy suite, shown empty. Everything you did Monday on paper happens here with real instruments.

Investigation Day 14: the slides come back from the lab



Reading tissue: the slide sits on the stage, the printed micrograph cards sit beside the microscope, and the healthy reference card never leaves the table.

The pack says it in one line: “Yesterday's organ findings said WHERE; today's slides say WHAT PROCESS.” Monday told you which organs raised questions. Tuesday asks what was happening inside them, down at the level of cells.

Here is how a slide gets made. First, at autopsy, the examiner cut small pieces from the organs that raised questions and dropped them into formalin, a chemical that stops decay and firms the tissue. Next, the histology lab soaked each piece in wax until it was solid enough to slice, shaved it thinner than a single cell, floated the slice on warm water, and lifted it onto glass. A slice that thin is nearly colorless, so the lab stained it with two dyes. Hematoxylin colors the nucleus of every cell purple; eosin colors the rest of the cell and the fibers between cells pink (R6). That stain is the indicator that makes the invisible visible. Without it you would be staring at clear glass.

The goal today is to identify the process behind each organ finding. The method is **histology**, reading tissue under a microscope, and it runs in a strict order: describe the whole field first, name the pattern second, connect it to a Day 13 finding third. The pack warns what happens if you flip the order: “Name first and you start seeing what the name predicts.”

Every organ in the body is woven from four tissue families, and the reading names them (R7 shows what each one looks like). Disease and injury change the weave. Fluid can pool where it should not be. A crowd of small dark nuclei can arrive where the tissue was calm. A pathologist sees those changes only by comparison, so the examiner released a healthy reference card of the pancreas (Exhibit 016) along with three case slides: one from the pancreas, one from the kidney, and one from the edge of a wound (Exhibits 017 to 019). What those three slides show is your call to make, not mine.

Every card lists its magnification, like 200x. That number is what lets you turn a picture into a real size (R5, Artifact A3).

Your move. Now open Daily Evidence Sheet, Day 14. Part A asks you to “Name the four tissue families and one job each, from the reading.” Then Part B: one row per slide, with the healthy reference card on the table while you read. Describe before you name.

Tuesday explainer: what the lesson teaches, and what the full lab looks like

1. What this lesson was trying to teach

The big idea, in the pack's words: "Organs are built from four tissue families. Disease and injury change the weave, and the microscope reads the weave." **The skill**: describe a field before you name it, name it before you connect it, and always read against a healthy reference. A second skill rides along: turning magnification into a real size.

PLTW connection. In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Activity 1.2.4 Histology. The day page says to go back to it and "Finish its analysis section using your reference comparisons." Our case practices that exact move: every case slide is read beside its healthy reference card.

2. If we had the full lab

Tuesday was a paper-data day. You read printed photographs of slides, not glass slides, and you did not stain anything. A hospital or medical examiner's histology lab makes those slides like this.

1. Fix: the tissue piece sits in 10 percent neutral buffered formalin until it is firm and preserved. **2. Process:** a machine moves it through alcohol baths that pull out the water, then xylene (a solvent that clears the alcohol), then melted paraffin wax that soaks all the way in. **3. Embed:** the tissue is set in a small block of wax inside a plastic cassette. **4. Cut:** a microtome shaves slices a few micrometers thick, thinner than one cell; they come off as a ribbon. **5. Float and mount:** the ribbon floats on a warm water bath to flatten, then is lifted onto a glass slide and dried. **6. Stain:** the wax is dissolved away; the slide goes through hematoxylin (nuclei turn blue-purple), a rinse, then eosin (cytoplasm and fibers turn pink), then back through alcohol and a clearing agent. **7. Coverslip:** a drop of mounting glue and a thin glass coverslip seal it for reading at 40x to 400x.

When H&E is not enough, the lab can add special stains, or an antibody stain (immunohistochemistry) that colors one chosen protein brown. **Safety:** formalin and xylene are handled in a fume hood with gloves and goggles, because the fumes irritate eyes and lungs; the microtome blade is razor sharp, so its guard stays on whenever hands are near. **Time:** usually more than a day from tissue to slide, because each soaking step takes time. **How it connects:** every card you read Tuesday is a photograph of a slide made this way, which is why nuclei look purple and fibers look pink.



A histology bench: microtome, water bath, and the staining line from hematoxylin to eosin.

Catch-up day: every sheet is part of the thread



A catch-up desk: the Daily Evidence Sheets, the Investigative Notebook, and one upload at a time.

Investigators on a real case do not get a day off from the file, but they do get a day to put it in order. Today is yours. Each sheet you turn in is evidence of what you know. A missing sheet is a hole in your own case file, and Friday's test will find it faster than I will.

First, open today's day page and check the list of everything due since your last catch-up day. Anything unchecked is what today is for:

Thu, Sept 17	Maybe Is a Result	Presumptive test report
Fri, Sept 18	Whose Blood, Whose DNA	Serology worksheet
Mon, Sept 21	Barcodes and Panels	Match matrix and panel sheet
Tue, Sept 22	Who Speaks for the Dead	Ethics review-board worksheet
Wed, Sept 23	The Clock in the Body	Time-of-death worksheet
Thu, Sept 24	Should ELISA testing be mandatory?	CER built from your debate worksheet
Fri, Sept 25	Week 5 review	Week 5 Review Record, Parts A to E
Mon, Sept 28	Tissue and heart lab (Day 13)	Daily Evidence Sheet, Day 13
Tue, Sept 29	Analyze histology evidence (Day 14)	Daily Evidence Sheet, Day 14

Once you are caught up, open Research Track session 14, “CRISPR-Cas9: programmable molecular scissors,” or start the Unit 1 practice test. Both links live on the day pages; the study guide and practice test are in the “Unit 1 Test prep” box under Sources. Use the 6 Rs for Friday: Record and Reduce your notes early in the week, Review and Recite the night before, then Reflect and Revise after the practice test.

There is no new lesson today, so there is no explainer box after this section.

Your move. Now open today's day page and start with the first item you have not turned in.

John Carroll debate 2: a valley, a herd, and a hard question about antibiotics



Debate day: two sides, one facilitator, and a worksheet in every hand.

Picture an isolated mountain valley with clear streams and no industry. A bacterial outbreak hits the local livestock, so the community treats the herds with a large course of antibiotics. Weeks later, researchers find antibiotic traces in the stream water, a shifted bacterial population, and new antibiotic resistance genes. That is the scenario read aloud at the start of class, and then the question lands: should we ban antibiotic use in livestock? You will not pick your side. It is handed to you.

Here is the science both sides stand on (R18). An antibiotic is a drug that kills bacteria or stops them from growing. In any large population of bacteria, a few may already carry genes that let them survive a particular antibiotic. When the drug arrives, the bacteria it can reach die or stop growing, and the survivors are mostly the resistant ones. They multiply into the space the others left. Scientists call that **selective pressure**: the drug removes the competition, and the resistant few inherit the valley. Bacteria can also pass resistance genes to other bacteria, which is why the scenario tracks genes and not only germs.

The day page gives each side a first argument. For the ban: “Even low concentrations of antibiotics apply selective pressure.” Against the ban: antibiotics “do degrade in the environment through biodegradation, hydrolysis and photolysis,” meaning microbes, water, and sunlight break them down, at rates that depend on pH, temperature, and sunlight. The U.S. Food and Drug Administration adds a fact both sides must answer: antimicrobial use in animals “can contribute to the emergence of antimicrobial resistance in bacteria that can be transferred to people.”

In a lab, the indicator for resistance is something you can see. On a plate covered with bacteria, an antibiotic disk clears a ring where nothing grows, and any colony growing inside that ring survived the drug (R18). Science can estimate consequences like that one. A value judgment still has to choose between them, and that is what the debate trains.

Your move. Now take out your preparation assignment and your worksheet's five boxes: your side, your three strongest arguments, the opposing point, your answer to it, and where you stand now (a **CER** helps, R17). At minute 40, In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Activity 1.2.4 Histology, and pick up where you stopped.

Thursday explainer: what the lesson teaches, and what the full lab looks like

1. What this lesson was trying to teach

The big idea, from the day page: a defensible decision “separates scientific evidence from value judgments, identifies who may benefit or be burdened, and states the uncertainty and tradeoffs that remain.” **The skill**: argue a side you were assigned, and answer the other side's strongest point instead of its weakest.

PLTW connection. The debate is John Carroll's session, not a PLTW activity. For the second half of the block, In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Activity 1.2.4 Histology, and pick up where Tuesday stopped. The skill the two halves share is Tuesday's: keep what you observed separate from what you concluded.

2. If we had the full lab

Nobody cultured bacteria this week; the debate runs on the scenario and your preparation. If a research team wanted real data on the valley, here is what they would do.

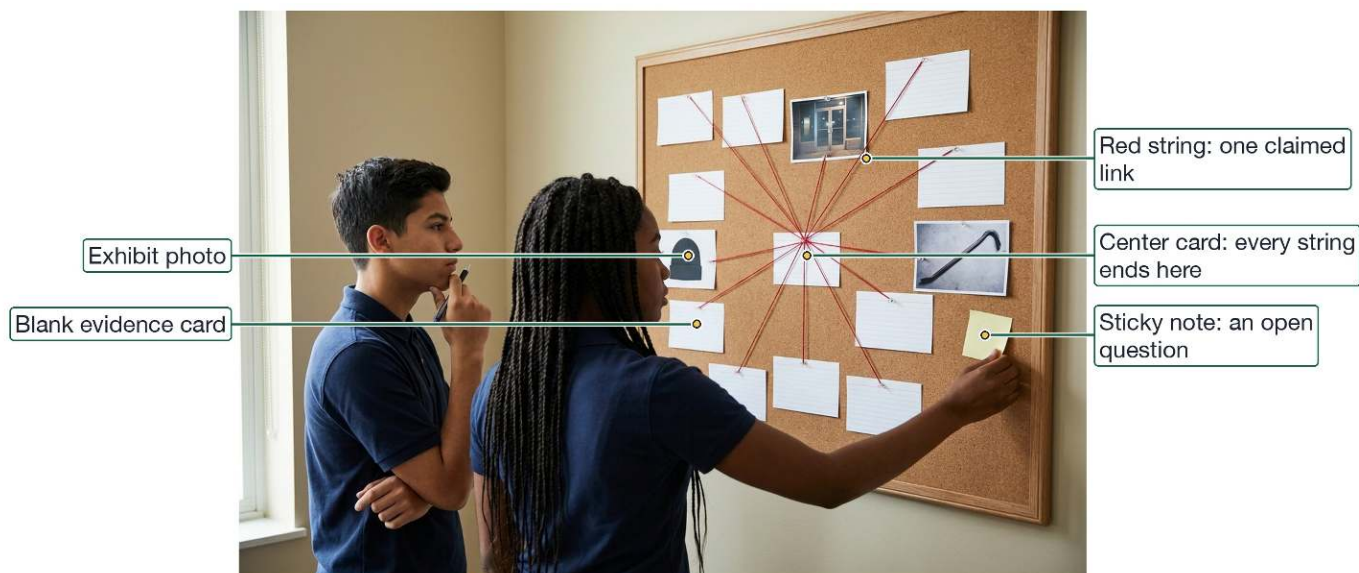
1. Collect stream water upstream and downstream of the herds in sterile bottles and keep it cold. **2.** Pour a measured volume through a membrane filter whose pores are too small for bacteria to pass, using a vacuum funnel. **3.** Lay each filter on agar in a petri dish, some plain and some with the antibiotic mixed in, and keep them in a warm incubator, usually for about a day. **4.** Count the colonies; each dot grew from a single bacterium or a small clump. Colonies on the antibiotic plate divided by colonies on the plain plate estimates the fraction that is resistant. **5.** Test single colonies with antibiotic disks: a clear zone of inhibition means the drug stopped them, and a small or missing zone, judged against a published chart, points to resistance (R18). **6.** Use PCR, which copies one stretch of DNA millions of times, to check whether known resistance genes are present. **7.** Send water to a chemistry lab, where a mass spectrometer measures how much antibiotic is left.

Safety: treat every environmental sample as possibly harmful: lab coat, gloves, goggles, no food, a disinfected bench, and plates steam-sterilized (autoclaved) before they are thrown away. **Time:** a day to grow colonies, longer for gene and chemistry results. **How it connects:** these measurements could answer how much antibiotic survives, for how long, and where the genes go. They still would not choose a policy. That last step is the value judgment the debate trains.



Environmental microbiology: stream water through a membrane filter, filters onto agar, colonies counted, genes checked by PCR.

Unit 1 Test, then Investigation Day 15: a case that went wrong



An audit board: when every string runs to one card, ask what you should be seeing if that card is wrong.

The first 40 minutes belong to the Unit 1 Test: on paper, in class, pencil in hand. Then the investigation turns around and looks at itself.

Today's review file is DOC-7, "the corner store case," a compact fictional composite built from patterns that real investigators study on purpose. Twenty years ago a corner-store clerk was injured in a late-night robbery. A customer who saw the robber for several seconds through door glass picked suspect R. from a photo array two days later and said, "I will never forget that face. One hundred percent." A hair from a knit cap dropped at the scene was examined under a microscope; the analyst called it "consistent with" R.'s sample, and in closing the prosecutor told the jury the hair "matched the defendant." R.'s cousin testified that R. was at a birthday party that night. Investigators stopped developing other leads, and a second man seen running two streets over was never interviewed. R. was convicted.

Nine years later, DNA from the cap's inner band excluded R. entirely. Here is the science inside that sentence. A DNA profile is read at a set of locations on the chromosomes where a short piece of code repeats a different number of times in different people (R15). If the cap's profile and R.'s profile disagree at even one location, the two cannot come from the same person. That is an exclusion. A hair under an ordinary microscope can only ever say "consistent with," because many people share a color and a width.

The goal today is to identify where the reasoning in DOC-7 failed and which process rule would have caught it. The method is an audit: quote the exact sentence, classify it, and name the rule. The indicator you are hunting is language that claims more than its evidence carries. Then the mirror turns. Before the final records open on Day 16, you write the claim ceiling for your own case report, "so the ceiling cannot bend to fit the verdict" (R14).

Your move. Now open Daily Evidence Sheet, Day 15. The DOC-7 file and the four sentences to audit are printed in SEC 01B, under "The four sentences to audit (quote them exactly)." Part B asks you to quote each one, classify it, write the rule that would have caught it, and name where this unit taught that rule.

Friday explainer: what the lesson teaches, and what the full lab looks like

1. What this lesson was trying to teach

The big idea, in the pack's words: "The most dangerous evidence is the kind that makes you stop looking. Tunnel vision is a process failure, and process failures have process fixes." **The skill**: audit a record sentence by sentence, then set your own limits before you know your answer.

PLTW connection. In myPLTW, open Principles of Biomedical Science > Lesson 1.2 Master the Morgue > Project 1.2.6 Case Closed. The day page says to read its overview and reporting requirements by the end of today. The audit practices the skill that report will demand: every claim stays inside what its evidence can carry.

2. If we had the full lab

Nobody in our room ran DNA. DOC-7 simply tells you a DNA test was done nine years later. Here is what that test looks like in a forensic DNA lab.

1. Protect the evidence: the analyst works in a mask, hair cover, gloves and lab coat inside a clean-air hood, because her own skin cells would contaminate the result. **2. Sample:** a sterile cotton swab is rubbed along the inside band of the cap, where skin cells and sweat collect. **3. Extract:** chemicals break the cells open and the DNA is purified into a small tube. **4. Measure:** the lab checks how much human DNA it recovered. **5. Copy:** PCR copies a set of short tandem repeat locations millions of times; since 2017 the FBI's national database has required 20 core locations for known profiles. **6. Sort:** a genetic analyzer pulls the copies through a hair-thin capillary tube with an electric field; shorter pieces move faster, so the instrument reads the length at each location. **7. Compare:** the cap's profile is compared with the reference profile. A difference at any location is an exclusion; a full match is reported with a statistic for how rare that profile is.

Safety: gloves and eye protection for the chemicals, and separate work areas before and after copying so copied DNA cannot drift into new samples. **How it connects:** the certainty in DOC-7's courtroom came from a person; the exclusion came from a measured difference in DNA. Your claim ceiling is where you decide which kind of sentence your own evidence can carry.



A forensic DNA lab: swab, extract, copy with PCR, then read each repeat length on a genetic analyzer.

R1 Autopsy, and the medical examiner who performs it



Weighing an organ: in our room, a preserved sheep heart on a lab balance.

PLAIN DEFINITION

An **autopsy** is a careful examination of a body after death to find out what happened. In a death investigation it is done by a forensic pathologist, a doctor trained to find the cause of death, usually working for a medical examiner's office.

WHAT IT IS FOR

To document every finding, outside first and then inside, so the cause and mechanism of death can be reasoned from evidence instead of guessed.

COMMON MISTAKE

Calling a number “normal” or “enlarged.” The Day 13 worked example logs the number without a judgment, because that judgment “needs a reference range you were not given.”

WHAT IT LOOKS LIKE

A steel table, an organ scale, jars for tissue, tubes for fluids, and a camera (Monday explainer). In our room it looks like a findings packet, a body diagram, and a preserved heart on a balance.

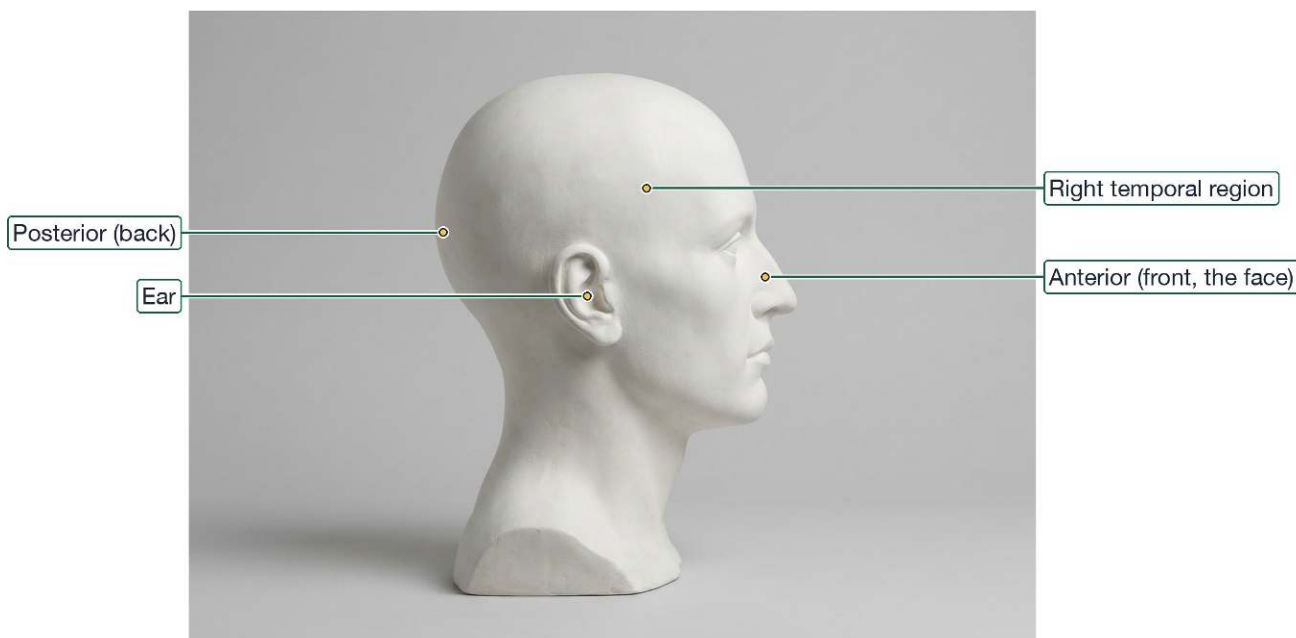
HOW TO READ IT

The order is outside-in: external documentation, then organ by organ, each finding described before it is interpreted. A weight is a finding. To compare an organ with body size, convert kilograms to grams, then divide. Practice (not a sheet answer): a 280-gram heart in an 80-kilogram person: $80 \times 1,000 = 80,000$ g, and $280 \div 80,000 = 0.0035 = 0.35$ percent of body mass.

WHERE IT SHOWS UP THIS WEEK

D13 pack SEC 02: “An autopsy runs outside-in.” D13 sheet, worked example Step 5 and Part B3.

R2 Reading a body diagram: the location words



A teaching bust seen from its right side. The temporal region sits above and in front of the ear.

PLAIN DEFINITION

A **body diagram** is an outline of the body, front and back, where each finding is drawn in its exact spot. Location words describe the body standing in anatomical position: facing you, arms at the sides, palms forward.

WHAT IT IS FOR

So any reader can find the same spot you found, without guessing what “by the head” meant.

COMMON MISTAKE

Writing “left” because a mark sits on your left as you face the diagram. When the diagram faces you, the person's right side is on your left.

WHAT IT LOOKS LIKE

Front and back outlines in your Investigative Notebook (“Body diagram, front and back”), with findings marked and labeled.

HOW TO READ IT

Anterior means front (the face side); **posterior** means back. **Superior** means toward the head; **inferior** means toward the feet. The **temporal region** is “the side of the head above and in front of the ear.” Right and left always mean the person's own right and left.

WHERE IT SHOWS UP THIS WEEK

D13 sheet Part B column: “BODY REGION (USE THE DIAGRAM'S TERMS)”; worked example Step 1: “Region in the diagram's terms, not everyday words.”

R3 Findings, interpretations, and vital response



A silicone training pad (not the case): a scrape with bruising beneath it, a pale scrape with none, and a torn cut.

PLAIN DEFINITION

A **finding** is “what the examiner saw, measured, or weighed, written before any meaning is attached.” An **interpretation** is “what a finding might mean.” **Vital response** is “signs a wound happened while the person was alive: swelling, bleeding into tissue.” (All three from the D13 sheet.)

WHAT IT IS FOR

To time-stamp an injury against the moment of death, one wound at a time.

COMMON MISTAKE

Putting meaning into the finding column (“bruise from a fall”). The finding column copies the packet word for word; meaning goes next door.

WHAT IT LOOKS LIKE

Packet words, defined by the D13 sheet: **abrasion**, a scrape that removes the top skin layer; **laceration**, a tear in the skin from a blunt edge; **edema**, swelling from fluid where it should not be; **congested**, heavy with blood or fluid; **grossly unremarkable**, normal to the naked eye; **nonspecific**, a finding many different deaths share; **defensive wounds**, cuts or bruises on the hands and forearms from blocking a blow.

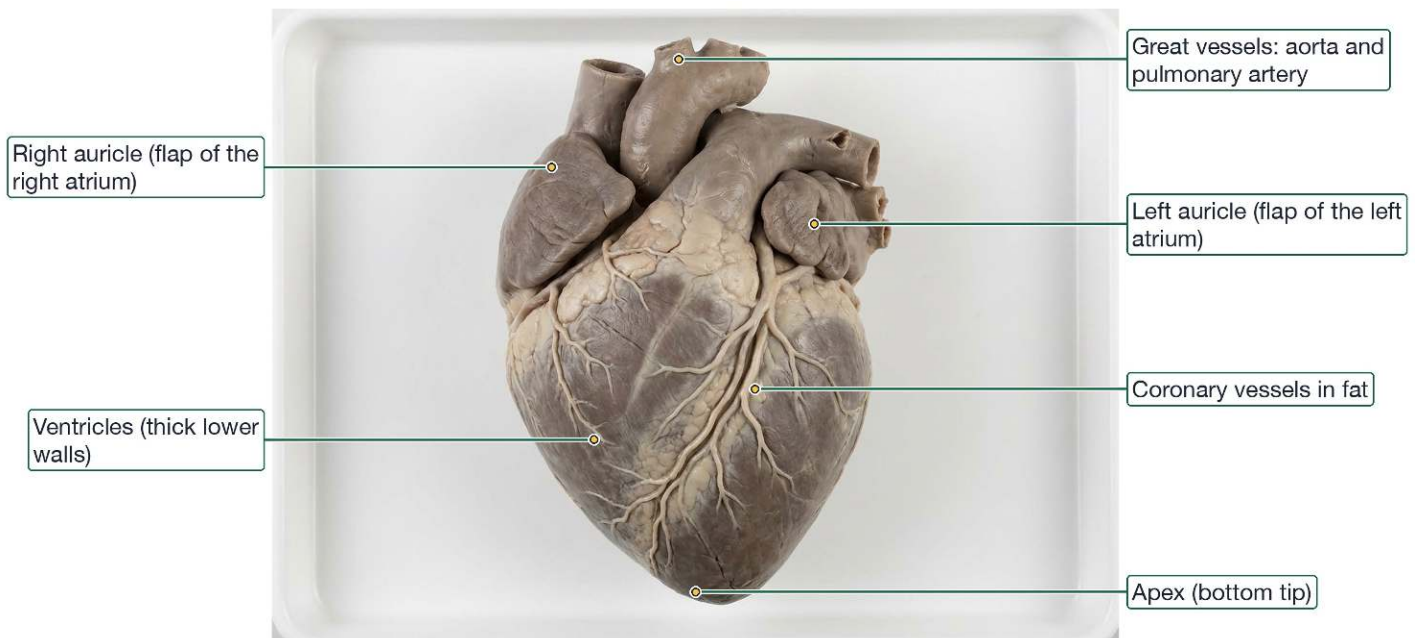
HOW TO READ IT

Look at each wound's edges and the tissue beneath. Write the call (yes, no, or cannot tell) and the sign you saw. Then, in a separate column, write what it might mean and name the finding it rests on.

WHERE IT SHOWS UP THIS WEEK

D13 sheet Part B (the four-column table) and Part C; D13 pack SEC 02, the paragraph that begins “The concept that...” and defines vital response.

R4 The heart: chambers, valves, and great vessels



A preserved sheep heart, front view. Artifact A1 on the next page shows the inside.

PLAIN DEFINITION

The **heart** is a muscular pump with four chambers: two **atria** on top that receive blood and two **ventricles** below that pump it out. **Valves** are one-way doors (tricuspid, pulmonary, mitral, aortic). The **great vessels** are the large vessels at the top. **Coronary arteries** run over the outer surface and feed the heart muscle.

WHAT IT IS FOR

The pack calls it orientation: “enough anatomy to read the examiner’s findings and know which findings matter.”

COMMON MISTAKE

Naming sides from your own point of view. Also, calling the ear-shaped flaps (auricles) extra chambers; they are pouches of the atria.

WHAT IT LOOKS LIKE

Gray-brown and firm when preserved, with pale fat along the grooves, a pointed tip (the apex) at the bottom, and cut vessels at the top.

HOW TO READ IT

When the heart faces you, its right side is on your left. Ventricle walls are thicker than atrial walls; the left ventricle's wall is the thickest. The pack's reading names which vessel leaves which ventricle: “the aorta leaving the left ventricle, the pulmonary artery leaving the right.”

WHERE IT SHOWS UP THIS WEEK

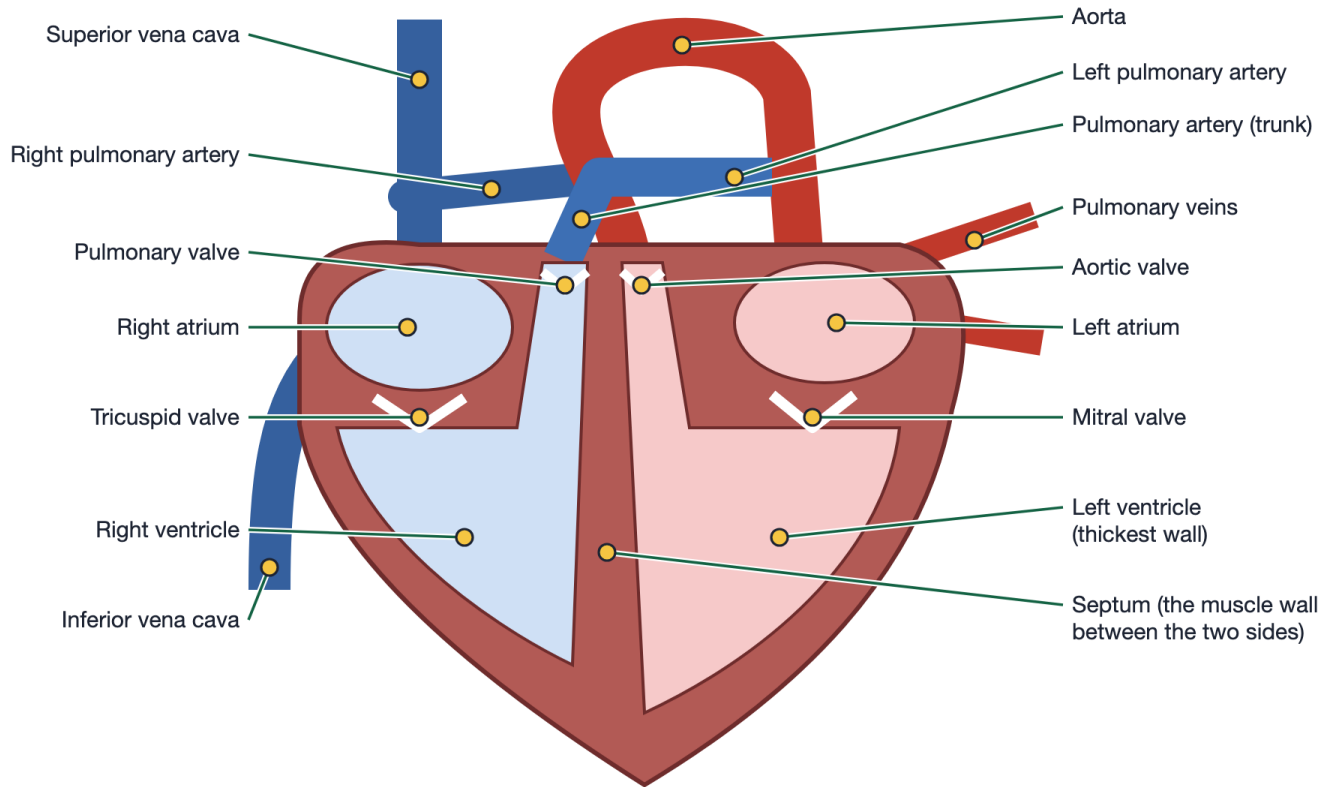
D13 pack SEC 02, “The heart station”; D13 sheet Part B3 and Part E2.

ARTIFACT

Artifact A1 · supports R4

Artifact A1 · The heart, cut open and seen from the front (teaching diagram, not to scale)

The heart faces you, so its RIGHT side is on YOUR left. Blue = oxygen-poor blood, red = oxygen-rich blood (a color code).



Coronary arteries run on the OUTSIDE of the heart, so a cut-open view hides them (see the photo in R4).

No flow arrows on purpose: tracing the path of blood is your job in Daily Evidence Sheet, Day 13, Part B3.

Artifact A1: the heart cut open, fully labeled. No flow arrows, on purpose.

R5 The compound microscope, and how magnification becomes a real size



A student compound light microscope, side view.

PLAIN DEFINITION

A **compound light microscope** magnifies a thin, lit sample through two lenses in a row, the eyepiece and an objective. **Magnification** is “how many times larger the image is than the real tissue.” The **field** is “the circle you see through the microscope.” (D14 sheet)

WHAT IT IS FOR

Seeing cells and tissue patterns far too small for the naked eye, and measuring them.

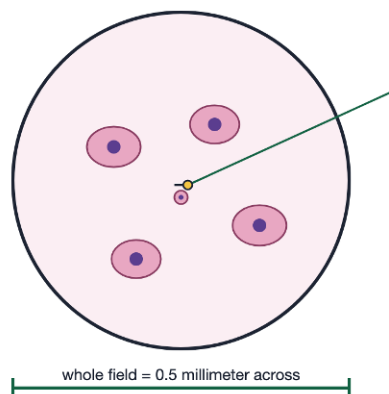
COMMON MISTAKE

Skipping the magnification. The Monday day page puts it plainly: “apparent size means nothing without it.” Also, cleaning a lens with anything but lens paper.

ARTIFACT

Artifact A3 · supports R5

Artifact A3 · Turning a field of view into a real size (practice numbers, not a sheet answer)



One small cell spans about 1/25 of the field.

Step 1. Real size = field width x fraction
= 0.5 mm x 1/25 = 0.02 mm

Step 2. 1 mm = 1,000 micrometers, so
0.02 mm x 1,000 = 20 micrometers

Step 3. Honest precision: “about 20 micrometers, give or take a few,” because you judged 1/25 by eye.

Total magnification = eyepiece x objective,
for example 10x eyepiece x 40x objective = 400x.

Artifact A3: a worked field-of-view estimate with practice numbers.

WHAT IT LOOKS LIKE

Eyepiece on top, objectives on a turning nosepiece, a flat stage with clips, focus knobs on the side, a light in the base.

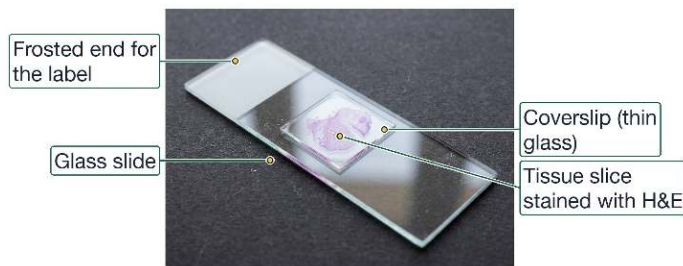
HOW TO READ IT

Total magnification = eyepiece x objective. Start on the lowest objective, focus, then climb one step at a time. Real size = field width x the fraction of the field the object spans; 1 millimeter = 1,000 micrometers (Artifact A3 works one practice example).

WHERE IT SHOWS UP THIS WEEK

D14 sheet Part B definitions (field, magnification) and Part B3; D14 worked example Steps 2 and 6.

R6 Histology, the tissue slide, and the H&E stain



A finished slide: tissue slice under a thin coverslip.

PLAIN DEFINITION

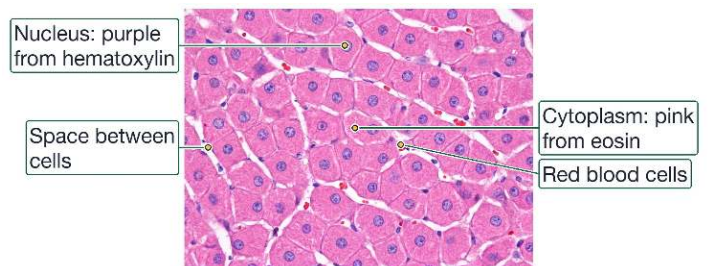
Histology is “reading tissue under a microscope” (D14). A **tissue slide** is a slice of tissue a few micrometers thick on glass under a coverslip. A **stain** is a dye that colors certain parts of cells. **H&E** is the standard pair: hematoxylin and eosin.

WHAT IT IS FOR

Naming the process behind an organ finding, which the naked eye cannot see.

COMMON MISTAKE

Reading one cell and calling a pattern. The D14 reading warns: “histologists read patterns, not single cells,” and staining quality varies from slide to slide.



The same kind of slide at high power: H&E colors at work.

WHAT IT LOOKS LIKE

Hematoxylin stains nuclei purple; eosin stains cytoplasm and fibers pink. Red blood cells show as small bright red disks. White means empty space or clear fluid.

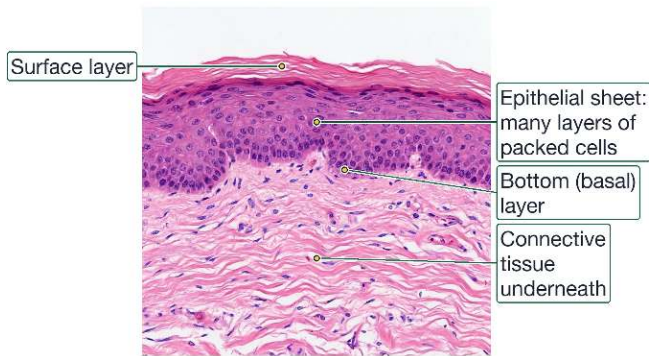
HOW TO READ IT

Look at the whole field before any single cell: how tightly packed, how many nuclei, where the pale spaces are. Then compare with the healthy reference card.

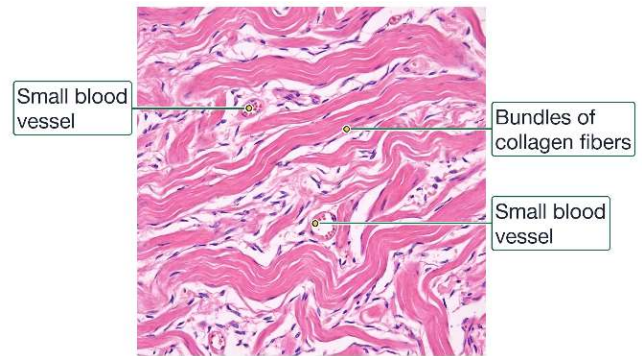
WHERE IT SHOWS UP THIS WEEK

D14 pack SEC 02; Exhibits 016 to 019, each marked with its magnification.

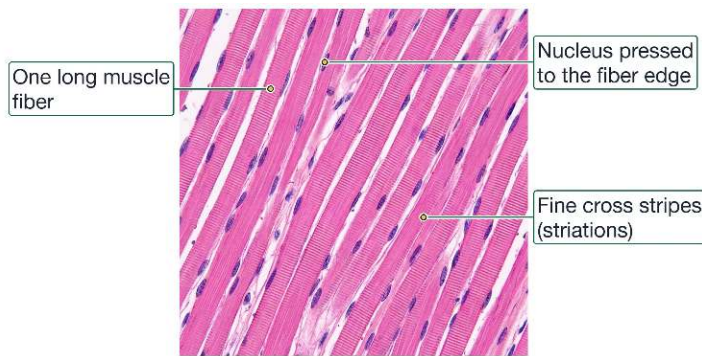
R7 The four tissue families, and what each looks like on a slide



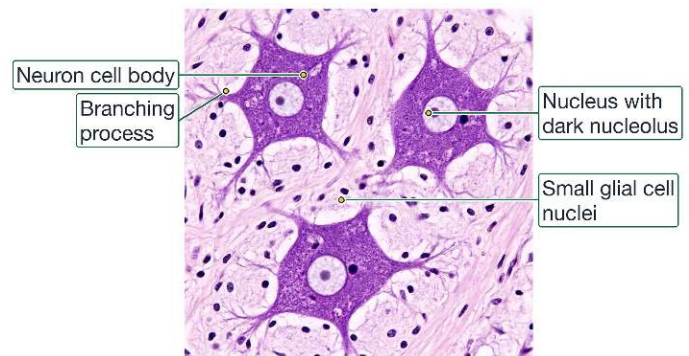
Epithelial tissue (skin surface).



Connective tissue (dense fibers).



Muscle tissue (skeletal muscle).



Nervous tissue (spinal cord).

PLAIN DEFINITION

Every organ is woven from four **tissue families**: **epithelial**, **connective**, **muscle**, and **nervous**. The jobs belong to Part A; find them in the D14 reading.

WHAT IT IS FOR

Sorting what you see into a family before you name anything specific.

COMMON MISTAKE

Expecting one family per slide. The reading: “real slides mix families in one field.” The skin panel above shows two families at once.

WHAT IT LOOKS LIKE

Epithelial: cells packed edge to edge in sheets, often layered. Connective: cells scattered in lots of material between them. Muscle: long fibers; skeletal muscle shows cross stripes with nuclei at the edges. Nervous: large cell bodies with a big round nucleus and branching processes, among many small glial nuclei.

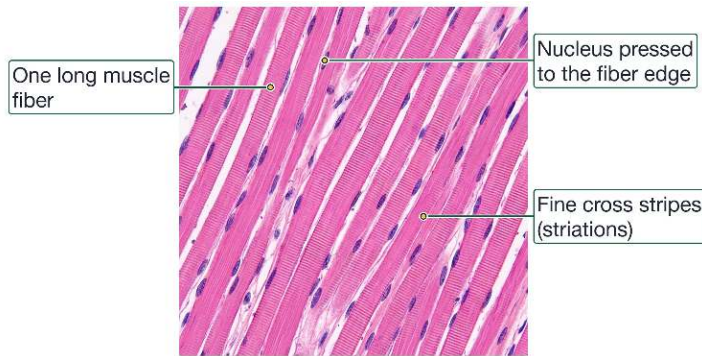
HOW TO READ IT

Ask: are the cells packed or scattered? Long fibers or round cells? Branches? Then check the healthy reference card for that family.

WHERE IT SHOWS UP THIS WEEK

D14 sheet Part A1 and Part E3; pre-lab gate: Histology, Four Tissue Types simulation.

R8 Reading change on a slide: edema and inflammatory cells



Healthy reference: tight, parallel, striped fibers.

PLAIN DEFINITION

Edema is “swelling from fluid where it should not be.”

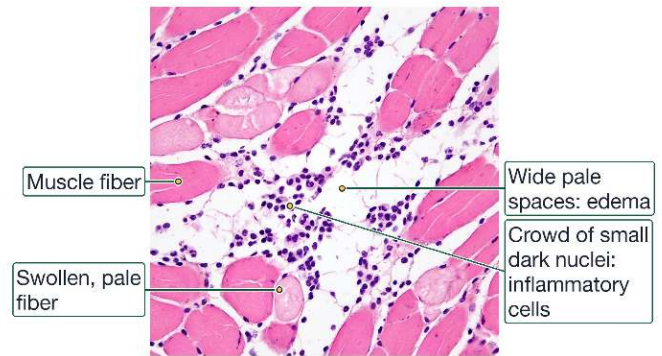
Inflammatory cells are “the body’s response crew: small cells with dark nuclei that crowd into injured or infected tissue.” (D14 sheet)

WHAT IT IS FOR

Each change is what the pack calls a “mechanism footprint”: evidence of a process that happened in the tissue.

COMMON MISTAKE

Calling every dark dot inflammation. Healthy tissue has nuclei too. It is the crowding, compared with the reference, that counts.



A training image (not a case slide): the same tissue, changed.

WHAT IT LOOKS LIKE

Edema: tissue that should be tight is pushed apart by wide, pale, watery spaces, the pack’s “waterlogged sponge.”

Inflammation: many small, round, dark nuclei crowding where the reference shows few.

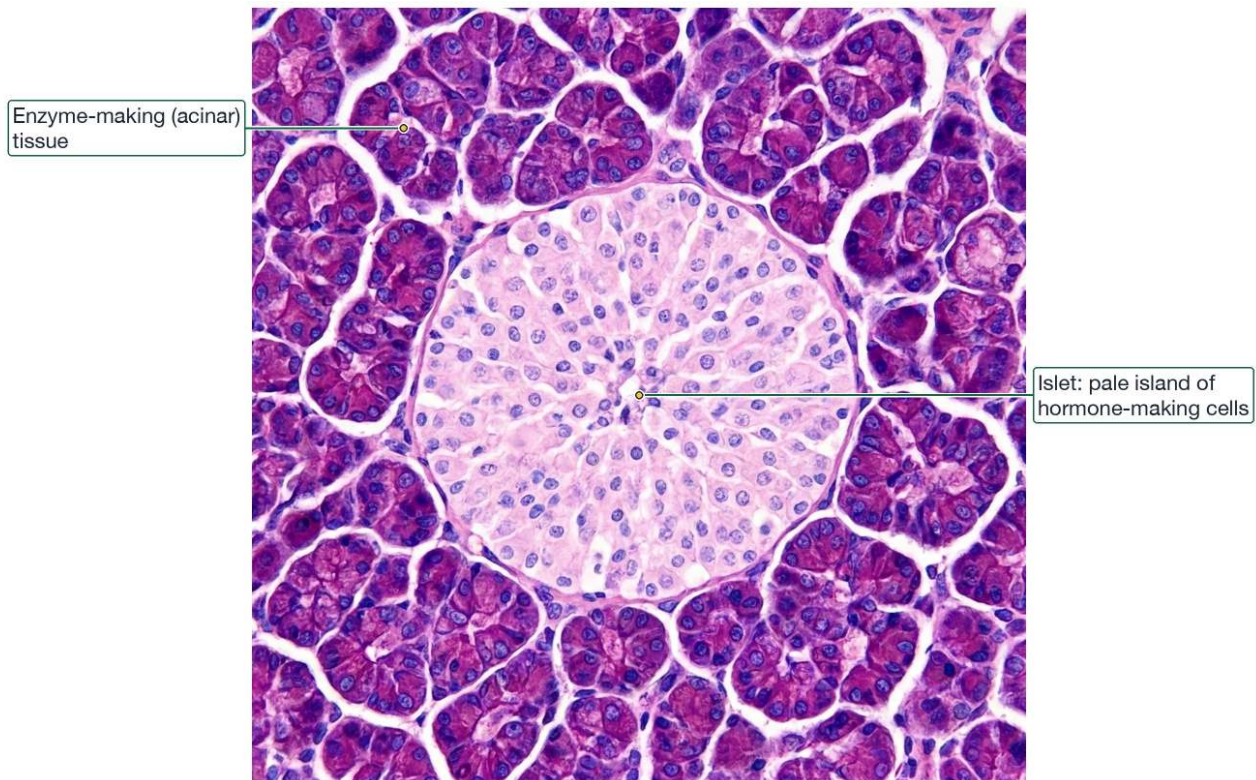
HOW TO READ IT

Put the healthy reference beside the slide. Describe first (spaces, cells, structure), then name the pattern each feature earns, then connect it to an organ finding.

WHERE IT SHOWS UP THIS WEEK

D14 sheet worked example (training card T-4), Part B2 and Part E1.

R9 The pancreas, its islets, and insulin



A healthy pancreas at 200x: one pale islet in darker enzyme-making tissue.

PLAIN DEFINITION

The **pancreas** sits behind the stomach and does two jobs. Most of it makes digestive enzymes (acinar tissue). Scattered **islets** make hormones, including **insulin**, “a hormone made by the pancreas that helps glucose get into your cells to be used for energy” (NIDDK). Islets make up only about 1 to 2 percent of the pancreas.

WHAT IT IS FOR

Exhibit 016 is exactly this: “Reference slide: healthy pancreatic islet (200x).” It is the normal you compare the case slide against.

COMMON MISTAKE

Judging the case slide without the reference card on the table.

WHAT IT LOOKS LIKE

A pale, round island of lightly stained cells, surrounded by darker purple clusters of enzyme-making cells.

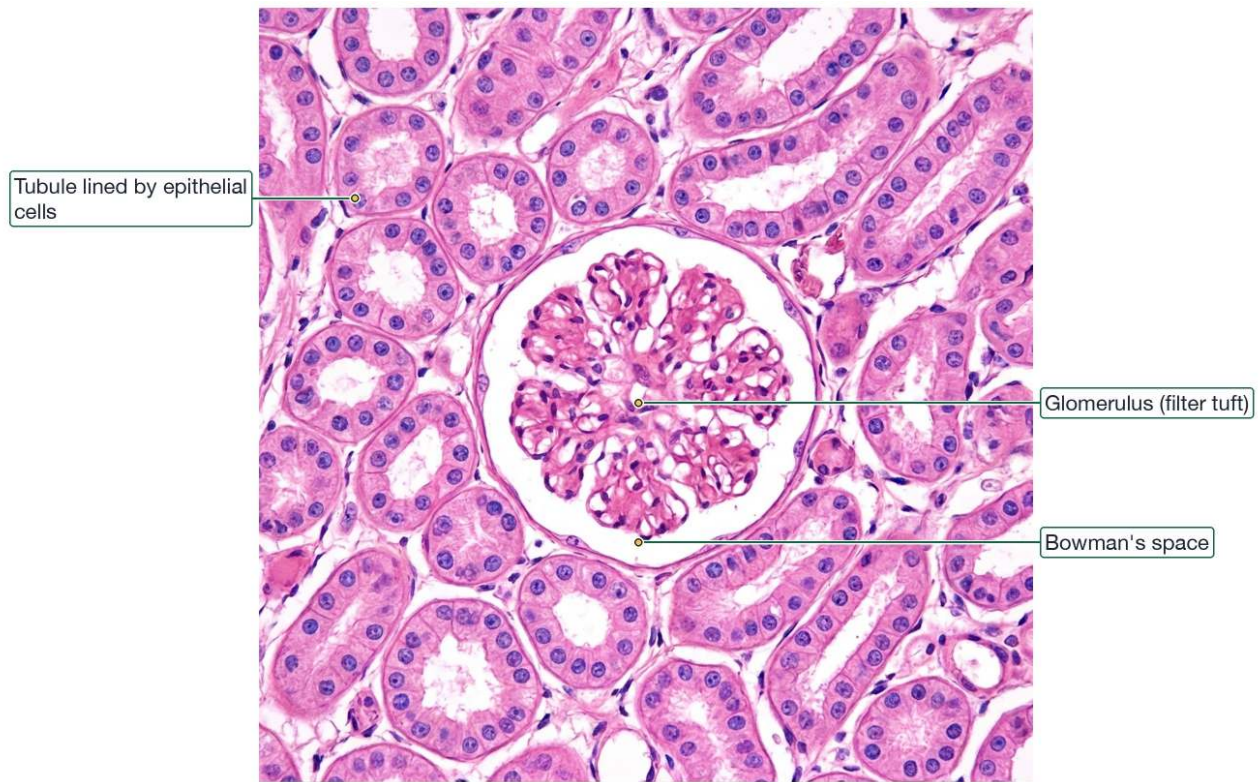
HOW TO READ IT

Find the island. Describe its size, its cells, and what sits at its edge, then compare each feature with the healthy card. Case-file words: **glucose**, blood sugar, the body's main fuel; **mg/dL**, milligrams dissolved in one tenth of a liter; **ketones**, acids the body makes when it burns fat for fuel; **vitreous**, the clear gel inside the eye.

WHERE IT SHOWS UP THIS WEEK

D14 pack SEC 07, Exhibits 016 and 017; D14 sheet Part B.

R10 The kidney: glomerulus, tubules, and the word “osmotic”



A healthy kidney at 200x: one glomerulus surrounded by tubules.

PLAIN DEFINITION

The kidney filters blood. A **glomerulus** is a tuft of tiny capillaries where blood is filtered; the filtrate collects in Bowman's capsule and flows into a **tubule**, whose epithelial lining cells take back what the body needs. **Osmosis** is water moving across a membrane toward the side with more dissolved particles; **osmotic** means caused by it.

WHAT IT IS FOR

Exhibit 018 is a kidney slide. The set has no healthy kidney card, so the D14 sheet says to compare with the healthy islet card for what normal tissue looks like.

COMMON MISTAKE

Calling the thin clear ring around the glomerulus damage. That space (Bowman's space) is normal.

WHAT IT LOOKS LIKE

A round, knotted tuft inside a thin clear ring, surrounded by circles and ovals of tubules lined with pink, cube-shaped cells.

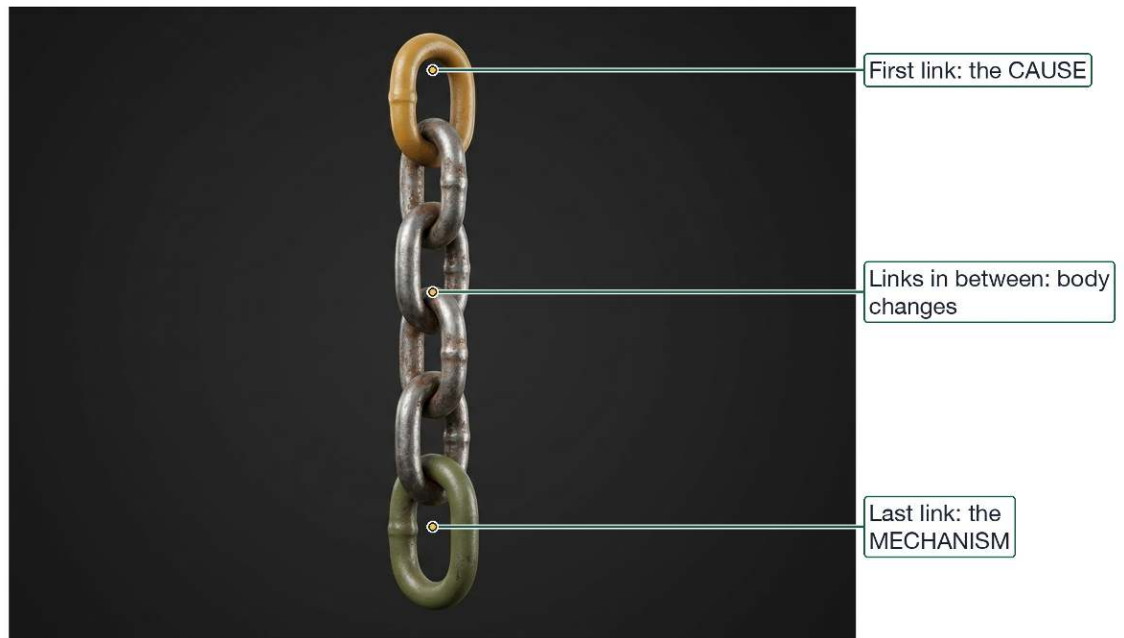
HOW TO READ IT

Find the glomerulus, then look closely at the tubule lining cells: their shape, color, and texture, compared with healthy tissue.

WHERE IT SHOWS UP THIS WEEK

D14 pack SEC 07, Exhibit 018; D14 sheet Part B.

R11 Cause, mechanism, and manner of death



One chain of events: where it starts, and where it ends.

PLAIN DEFINITION

The **cause** of death is the disease or injury that started the chain of events. The **mechanism** is “the specific physiological breakdown inside the body that directly ends life, such as a fatal heart rhythm or blood loss, separate from the underlying cause” (day page). The **manner** is the category for how the death came about; in the United States: natural, accident, suicide, homicide, undetermined, or pending.

WHAT IT IS FOR

Separating what the body can prove from what the circumstances must prove.

COMMON MISTAKE

Letting a tissue finding name a manner. The D14 ceiling: “Tissue findings support mechanisms; they do not name manners.”

WHAT IT LOOKS LIKE

On a report: one line for cause, one for manner. In our case: the Day 18 goal to name “the manner and cause of death,” each backed by “at least four exhibits across three different evidence types.”

HOW TO READ IT

Cause is the first link, mechanism the last link, and manner describes the circumstances around the whole chain, which usually needs evidence beyond the body: scene, records, timeline.

WHERE IT SHOWS UP THIS WEEK

D14 pack SEC 03 claim ceiling; D15 sheet Part C.

R12 Exhibits, threads, and the chain of custody



A sealed exhibit, its marker, and the custody form that travels with it.

PLAIN DEFINITION

“**Exhibit** means one numbered piece of evidence. **Thread** means the team lane it belongs to (Scene, Trace, Serology and DNA, Toxicology, Medical Examiner, Records).” (day page). The **chain of custody** is the written record of every person who handled an exhibit, when, and why, from collection to court.

WHAT IT IS FOR

An exhibit with a gap in its custody record can be challenged, however good the science.

COMMON MISTAKE

Writing “the pen” or “the slide” instead of the exhibit number, or breaking a seal without logging it.

WHAT IT LOOKS LIKE

A sealed bag with tamper-evident tape, an exhibit number, and a form with a signature line for every handoff.

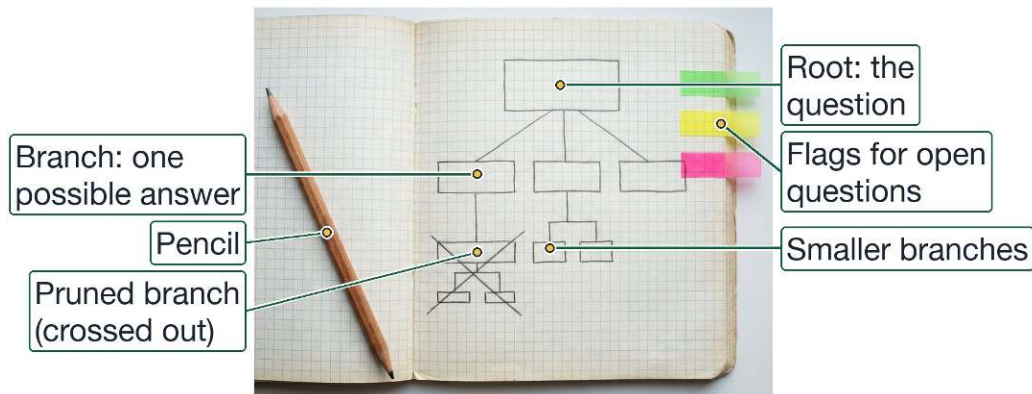
HOW TO READ IT

Cite exhibits by number. The insulin pen is Exhibit 015 (chemistry thread) in the pack and on the day page; the D13 sheet calls the same object “E6.” Same pen: cite Exhibit 015.

WHERE IT SHOWS UP THIS WEEK

D13 pack SEC 07: “EXHIBIT 015 · Chemistry thread”; D14 pack SEC 07, Exhibits 016 to 019.

R13 The logic tree, pruning, and the evidence board



A logic tree in a notebook, with one branch pruned.

PLAIN DEFINITION

A **logic tree** starts with the question and lists every possible explanation as a branch. **Pruning** means crossing out a branch because an exhibit rules it out. An **evidence board** is a physical layout of exhibits grouped under the claims they support; your team builds one on a later day.

WHAT IT IS FOR

Keeping every explanation alive until evidence, and only evidence, removes it.

COMMON MISTAKE

Pruning a branch because it feels unlikely, or because one exhibit was interesting.

WHAT IT LOOKS LIKE

Boxes and lines, with some branches crossed out and exhibit numbers beside each X (Artifact A2 below).

HOW TO READ IT

For each branch, list evidence for and against by exhibit number. The D14 pack sets today's limit: "The tree prunes further today, but it does not resolve."

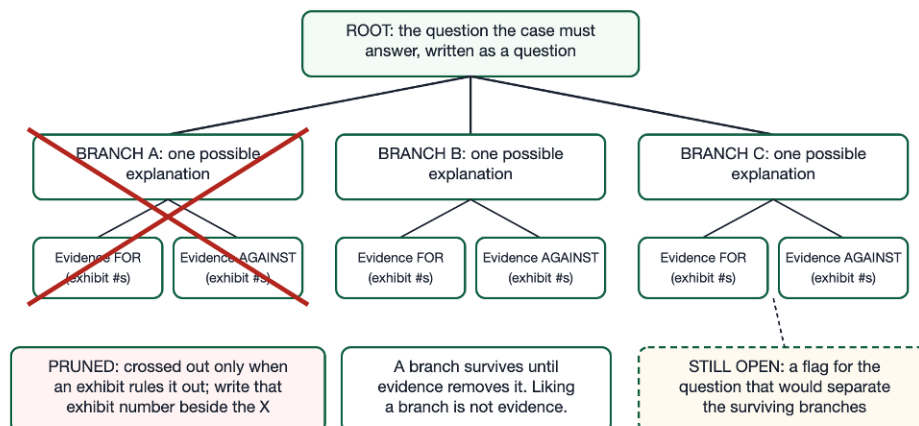
WHERE IT SHOWS UP THIS WEEK

D13 notebook page "Logic tree pruning notes"; D14 notebook page "Logic tree update"; D14 turn-in "Logic tree pruning noted."

ARTIFACT

Artifact A2 · supports R13

Artifact A2 · A labeled, blank logic tree layout (copy it into your Investigative Notebook)



Artifact A2: a labeled, blank logic tree layout.

R14 Corroboration, convergent evidence, and the claim ceiling



Three independent strands, one stronger rope.

PLAIN DEFINITION

Corroboration is support from an independent line of evidence; the unit's rule is "no conclusion on one line of evidence." **Convergent evidence** means "multiple independent lines of evidence that all point to the same conclusion, each collected by a different method" (day page). The **claim ceiling** is "the strongest sentence the evidence can carry. Say that sentence and no stronger." (D15)

WHAT IT IS FOR

Writing sentences that stay true when someone challenges them.

COMMON MISTAKE

Counting one piece of evidence twice. Two reports about the same test are one thread, not two.

WHAT IT LOOKS LIKE

The pack's analogy for the ceiling: "a load limit sign on a bridge."

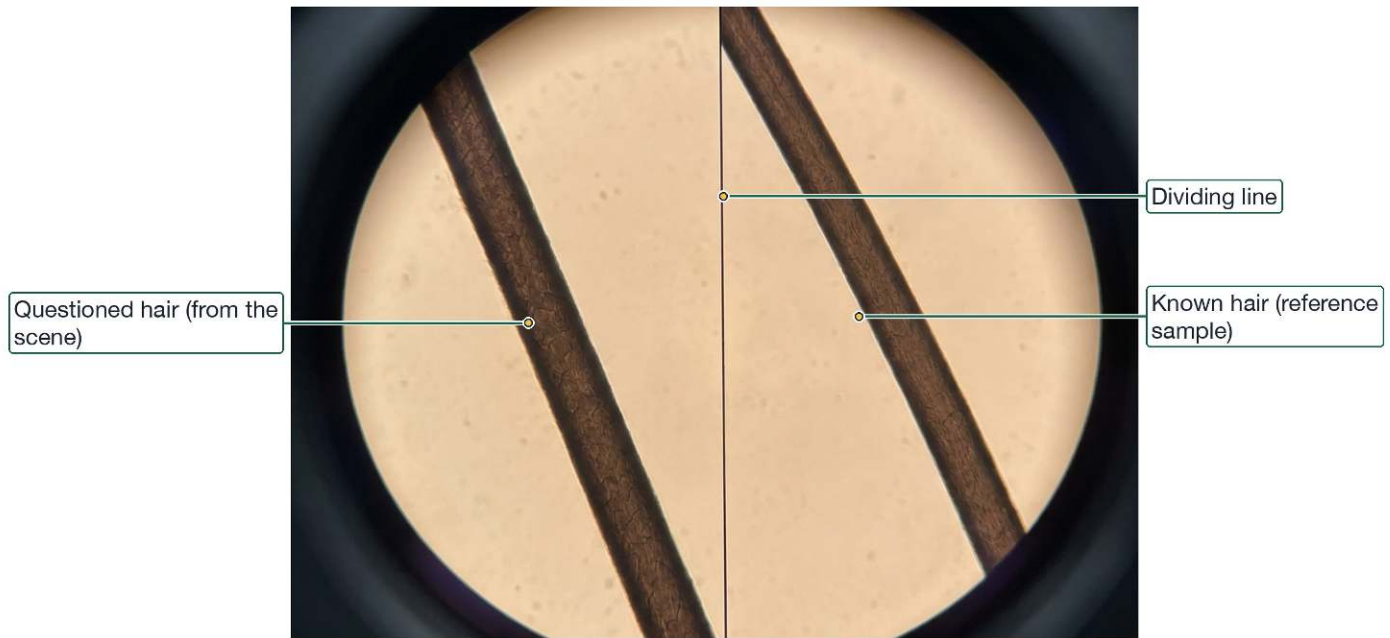
HOW TO READ IT

Count your independent threads. Were they collected by different methods? Then write the strongest sentence they jointly support, and stop there.

WHERE IT SHOWS UP THIS WEEK

D15 sheet vocabulary and Part C; D15 reading: "limits set before protect the truth."

R15 Class and individual evidence, and what a DNA exclusion means



A comparison microscope: two hairs side by side in one split view.

PLAIN DEFINITION

Class evidence narrows a source to a group, such as a paint color or a hair's color and width. **Individual evidence** can point to one source, such as a DNA profile.

“Consistent with” means the item could share a source with many others. An **exclusion** is a difference that shows two samples did not come from the same source.

WHAT IT IS FOR

Deciding how strong a sentence an item of evidence can support. From the day page: “A hair consistent with a person proves a hair like theirs was present, not that the person was, and never when.”

COMMON MISTAKE

Upgrading the words when you retell the result. Keep the analyst's exact phrase.

WHAT IT LOOKS LIKE

A comparison microscope joins two microscopes so the questioned sample and the known sample sit side by side in one view.

HOW TO READ IT

Ask how large the class is. For DNA, a profile is read at short tandem repeat locations; a difference at even one location excludes that person.

WHERE IT SHOWS UP THIS WEEK

D15 sheet SEC 01B, DOC-7 summary parts 2 and 3; D15 Part E2.

R16 How careful people still go wrong: tunnel vision, certainty, and accuracy



Blinkers keep a horse's eyes on the road ahead, and off everything beside it.

PLAIN DEFINITION

Tunnel vision is “locking onto one suspect or one story so early that evidence against it stops getting looked at.” A **process failure** is “a mistake built into how the work was done, not a bad person.” (D15) The reading calls **certainty** and **accuracy** “different dials”; Part A asks which one counts, and the one-pager in SEC 01B says what certainty measures.

WHAT IT IS FOR

Auditing a record for the places where reasoning bent, and naming a process rule that would have held it straight. The reading names the fixes; Part B asks you to match one to each failure.

COMMON MISTAKE

Blaming a villain. The lesson is the pattern, and patterns have process fixes.

WHAT IT LOOKS LIKE

The pack's analogy is “driving with the mirrors folded in.” A horse in blinkers is the same idea: the view ahead stays sharp while the sides disappear.

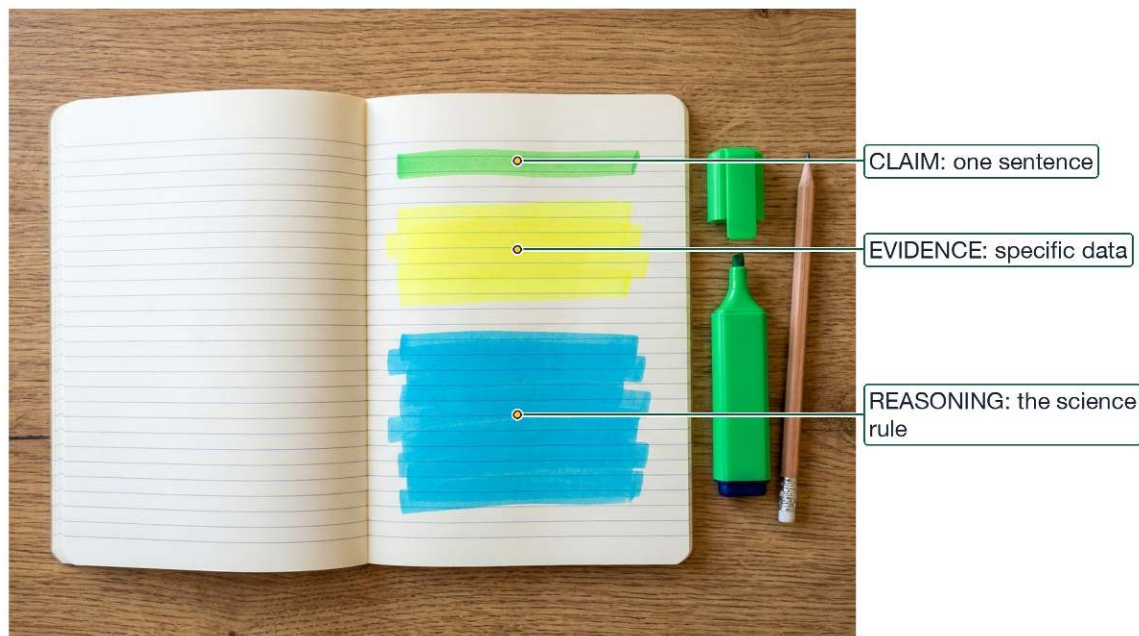
HOW TO READ IT

For each sentence, ask: what did this person actually observe, and what did they add? What should they have seen if their theory was wrong, and did anyone look?

WHERE IT SHOWS UP THIS WEEK

D15 sheet vocabulary, Part A, Part B, and “The four failure patterns (from the one-pager)” in SEC 01B.

R17 CER: claim, evidence, reasoning



A CER laid out before any writing: one claim, specific evidence, then the reasoning that links them.

PLAIN DEFINITION

CER stands for Claim, Evidence, Reasoning: make a claim, back it with evidence, explain your reasoning. Add a **limitation**: what your evidence cannot show.

WHAT IT IS FOR

Every written call this unit, from the debate worksheet to your case report.

COMMON MISTAKE

Evidence that only repeats the claim, or reasoning that only repeats the evidence. Reasoning names the rule.

WHAT IT LOOKS LIKE

Claim: one sentence that answers the question. Evidence: specific data, measurements, or exhibit numbers. Reasoning: the science rule that connects the evidence to the claim.

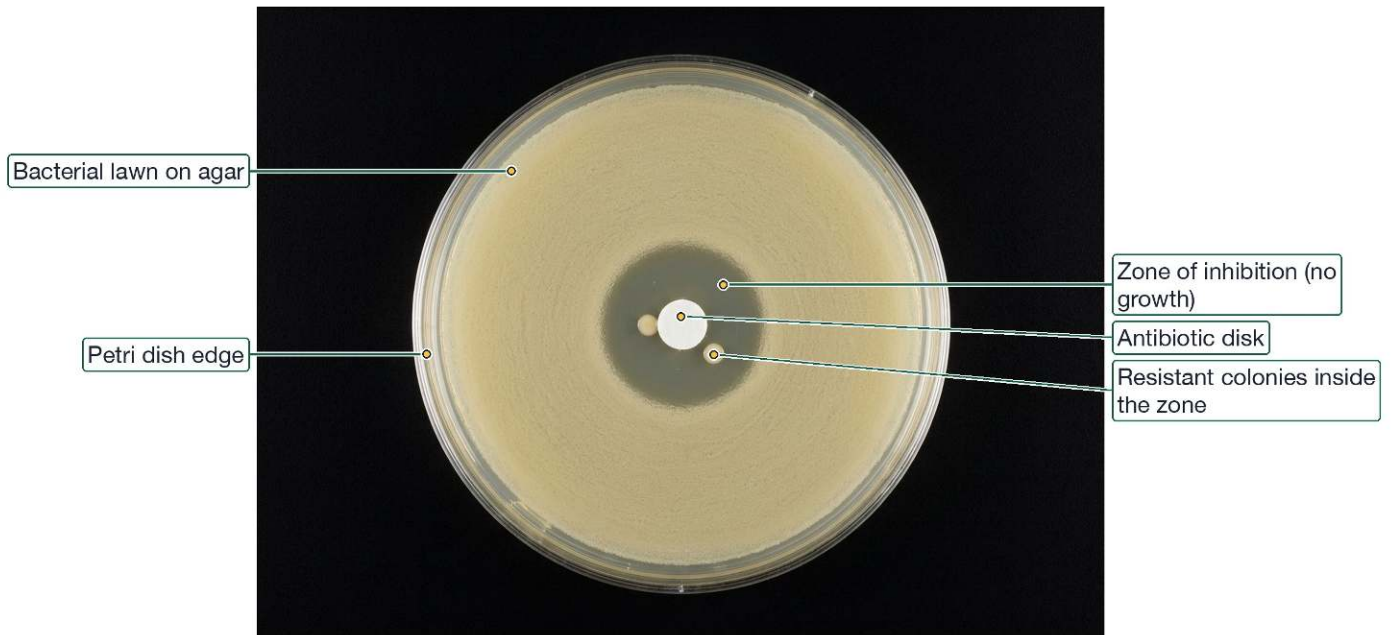
HOW TO READ IT

For a rebuttal, the Thursday day page offers a frame: "That would be true if ___, but ___." If you cannot fill the second blank, their point stands.

WHERE IT SHOWS UP THIS WEEK

Thursday debate worksheet (five boxes); the Tuesday day page CER; D15 Part C.

R18 Antibiotics, resistance, and the words of the livestock debate



An antibiotic disk on a lawn of bacteria: the clear zone, and two survivors inside it.

PLAIN DEFINITION

An **antibiotic** kills bacteria or stops their growth.

Antimicrobial resistance is “the ability of microorganisms such as bacteria, to resist the effects of antimicrobials” (FDA). **Selective pressure**: the drug removes susceptible bacteria, so resistant ones take over.

WHAT IT IS FOR

Weighing the livestock question. Debate words from the day page: **beneficence**, acting to benefit; **nonmaleficence**, not causing harm; **justice**, sharing benefits and burdens fairly; **stakeholder**, anyone affected by the decision.

COMMON MISTAKE

Saying the bacteria “learned” or “decided” to resist. Resistance comes from genes some bacteria already carry or receive from other bacteria.

WHAT IT LOOKS LIKE

An **agar plate** is a **petri dish** of nutrient jelly. A **lawn** is bacteria grown edge to edge; a **colony** is one visible dot of bacteria. The clear ring around an antibiotic disk is the **zone of inhibition**.

HOW TO READ IT

A wide clear zone means the drug stopped that strain. Colonies growing inside the zone survived it. Always compare zones for the same drug; different drugs are not ranked by zone size alone.

WHERE IT SHOWS UP THIS WEEK

Thursday day page: the valley scenario, the case for and against, and the bioethics vocabulary.