

Bone repair and repair tech

Your goal: Explain the stages of bone repair and evaluate one repair technology with a CER.

One product: Repair-stage timeline diagram (four stages with active cells labeled) plus a CER arguing when a specific repair technology is the best choice.

Question: How do repair cells and technology functions contribute different kinds of support?

Start the work

Describe the fracture pattern and named joint; keep healing predictions within the case facts.

1. Read the opening and cell definitions. Locate the hematoma/clot and osteoblast role. Use either the complete original practice or the teacher-supplied task, not both.
2. Read S1-S4 about hematoma, soft callus, hard callus and remodeling. Plan four connected diagram panels with the featured cell jobs.
3. Read C1-C3, R1 and the different M1 example. Identify the comparison criterion and two facts about repair technology.
4. Complete the four labeled diagram panels and timeline limit. Do not infer a fixed recovery duration from the arrows.
5. Write the CER beside the diagram, connecting technology function to the stated criterion. Check or revise the same document and submit using the assigned route.

If your section assignment or upload is blocked, save the combined work locally if possible and tell the teacher what is missing. After uploading, check that Schoology shows Submitted.

Words you will use

fracture

A crack or break in bone.

hematoma

A collection of blood outside damaged blood vessels. At a fracture, this blood can clot.

clot

Blood held in a mesh of proteins and trapped blood cells.

inflammatory cells

Immune cells active after injury. They help clear damaged material and coordinate repair.

macrophage

An immune cell that removes damaged material and helps coordinate other cells during repair.

fibroblast

A cell that makes fibers and other supporting material in connective tissue.

chondrocyte

A cartilage cell that produces and maintains cartilage material.

cartilage

A firm but flexible supporting tissue.

osteoblast

A cell that produces new bone matrix.

osteoclast

A cell that breaks down and removes bone tissue.

matrix

Material outside cells that gives a tissue support.

mineralization

The addition of minerals that make bone matrix harder.

callus

Repair tissue that forms around and across a fracture.

soft callus

An early bridge of fibrous tissue and cartilage in the repair model.

hard callus

A bridge containing new bone that replaces much of the soft bridge.

remodeling

Reshaping bone through coordinated removal and formation.

secondary healing

A common repair pathway that includes callus formation. It is the pathway modeled today.

casting

Use of an outside support to help keep a broken bone in position during healing.

internal fixation

Support from devices placed inside the body, such as plates and screws, to hold bone pieces in position.

bone graft

Bone or substitute material used to support bone repair in a gap or defect.

technology function

The job a tool or approach is designed to perform.

criterion

A stated requirement used to compare options.

CER

Claim, evidence and reasoning: an answer, its supporting facts, and an explanation connecting those facts to the answer.

limitation

What the evidence cannot establish.

conceptual timeline

A sequence of events without a measured duration. Arrows show order, not equal time.

0-8 minutes: Start with the cells supplied here

Use the actual route when the teacher supplies the assigned task, sources and criteria. Those inputs replace R1 and its original comparison. If inputs or access are missing, use the complete paper route here.

Keep the diagram and CER together as one document. Paper or a local document is enough. No physical experiment, cast application or simulation is required.

Carry forward: Describe the fracture pattern and named joint; keep healing predictions within the case facts.

A fracture can disrupt blood vessels. Escaped blood forms a hematoma and clot. Osteoblasts build bone matrix; osteoclasts remove bone. Inflammatory cells also contribute, so repair is more than a two-cell story.

Use the definitions alongside each later section. The opening check is to locate the clot and bone-building cell in this reading. A completed diagram is not expected yet.

8-25 minutes: Four connected stages

S1-S4 describe secondary healing, a common pathway with callus formation. This is a teaching model, not the only possible pattern of bone healing. Stages overlap; arrows do not set a timetable.

S1. Hematoma and early response. Damaged vessels release blood that forms a clot near the break. Inflammatory cells, including macrophages, help clear damaged material and coordinate repair. Draw two bone ends with a clot between them. Label: bone ends, clot, inflammatory cells.

S2. Soft callus. Fibroblasts help form fibrous support, and chondrocytes produce cartilage. This creates a soft bridge around and across the break. Bone formation can also begin nearby. Draw a flexible bridge joining the bone ends. Label: soft bridge, fibroblasts, chondrocytes.

S3. Hard callus. Much of the soft bridge is replaced with new bone. Osteoblasts produce bone matrix, which becomes mineralized. Osteoclasts also remove damaged bone during repair. Draw a bony bridge across the break. Label: new bone, osteoblasts, matrix.

S4. Remodeling. Osteoclasts remove excess bone while osteoblasts form bone as the repair is reshaped. These jobs work together; one cell type does not simply take over forever. Draw a more continuous bone outline. Label: reshaped bone, osteoclasts, osteoblasts.

Diagram text equivalent: bone ends with clot, then a soft bridge, then a new bony bridge, then reshaped bone. Connect those four panels in that order. Add each named cell and its job.

For the cell-matching step, label the featured roles supplied in each panel. Do not invent a ranking of which cell is quantitatively most active. Roles can overlap across panels.

25-45 minutes: Compare functions using supplied sources

C1. Casting. Educational function: provide support outside the body to help hold a bone in position. This is a mechanical support function. A cast does not itself supply new bone material. Whether casting is appropriate for a person requires clinical assessment. Source: AAOS-FUNCTIONS.

C2. Plates and screws, an internal fixation example. Educational function: hold bone pieces in position using support inside the body. This is a mechanical support function. Hardware does not itself become new bone tissue. The choice of hardware for a person requires clinical assessment. Source: AAOS-FUNCTIONS.

C3. Bone graft. Educational function: supply bone or substitute material to support repair in a gap or defect. This is a material contribution to repair. It is not interchangeable with holding pieces steady. A graft may be combined with other support; suitability and success are not established here. Source: MEDLINE-GRAFT.

R1. Original classroom comparison, no patient. A museum display has a labeled gap between two model bone ends. Its missing information card must explain a technology that supplies bone or substitute material to support repair in a gap. The criterion is material contribution, not outside or inside mechanical support. Compare C1-C3 and choose the best match for that stated function. No fracture type, age, medical history, outcome or treatment need is supplied.

Read M1 before drafting a claim for R1. Use the card IDs and source names to record supporting facts on the same combined document. External links provide optional context; the required facts are printed here.

Research here means reading and comparing the supplied educational source summaries. Actual PLTW task instructions and stopping point are still required for official completion. The original comparison does not replace proof of that work.

45-62 minutes: Make the annotated diagram

Draw four panels linked by arrows. In each, name the stage, show the repair feature and label the featured cells with their jobs. Simple line shapes and written labels are enough.

Use the complete S1-S4 text descriptions if drawing is difficult: four labeled text boxes linked by arrows form an accessible diagram. Keep the same stage and cell content.

Add this limit beside the arrows: conceptual order, not measured time. Do not add days, a patient image or a claim of full strength. No separate copying sheet is required. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

62-75 minutes: Write the CER beside the diagram

For original R1, claim which technology function best meets the stated criterion. Cite two relevant facts from C1-C3 by card and source. Explain how function meets the requirement.

End with a limitation: the display comparison does not select a person's treatment. Do not add a patient, prognosis or technique instructions. Actual-route learners use the genuine task and evidence with the same claim boundary.

Solo check: compare each sentence with a supplied fact. If it names a medical outcome or instruction not supplied, remove or qualify it. With a partner, check each other's reasoning, then revise your own document.

Recovery: return to the R1 criterion. It asks for material to support repair in a gap. Check which C card describes a material contribution and which describe mechanical support, then explain that distinction in your own words. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

75-80 minutes: Check one document and your next action

Check the diagram and CER using the six criteria below. Make corrections in the same document. No second CER, exit ticket or simulation report is required.

Confirm your section, current assignment directions and deadline. Save the combined document if possible. Save the file, follow the assigned official task separately and check that Schoology shows Submitted after uploading.

Ask for the actual task, rubric and stopping point; check that Schoology shows Submitted after uploading. The class schedule names Project 1.1.6 Break a Leg; ask the teacher for its task details.

The next class is Friday, February 19, Bioethics: performance enhancement. Take the difference between a supported claim and an unsupported promise into that discussion.

M1: Outside support, a separate worked CER

M1. Separate worked comparison, no patient. Another museum display needs a card explaining support outside the body that helps hold bone in position. Its criterion is outside mechanical support, not added bone material. This differs from R1.

Worked claim: Casting best matches M1's outside-support criterion. Worked evidence: C1 describes outside support; C2 describes support inside the body. Both facts come from AAOS-FUNCTIONS.

Worked reasoning: The required location is outside, so C1 meets that criterion more directly than C2. C3 addresses material for repair rather than outside support.

Worked limitation: This compares functions for a display. It does not show that a cast is the right treatment for any person. Do not copy M1 as a second CER. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Try the decision

Original route: R1 asks for material that supports bone repair in a gap, not merely a mechanical holding function. Which claim stays within that criterion? Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

- Compare each technology's function with R1's material-contribution criterion, without determining any person's treatment.
- Plates are always best because more severe injuries require more advanced technology.
- A cast is best for every soft-callus stage, so the stage alone determines treatment.

Explain your choice using the reading. Discuss it or say it to yourself. This practice does not add another submission.

Your 80-minute flow

0–8 minutes	Read the opening and cell definitions. Locate the hematoma/clot and osteoblast role. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.
8–25 minutes	Read S1-S4 and remaining cell definitions. Plan the four diagram panels without copying a separate worksheet. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.
25–45 minutes	Read C1-C3, R1 and M1. Identify the criterion and two facts in the combined document. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.
45–62 minutes	Complete the four connected, labeled diagram panels and timeline limit. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.
62–75 minutes	Write the CER beside the diagram. Check or revise it alone or with a partner. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.
75–80 minutes	Check the single product, identify your next action and preview the actual February 19 topic. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Your response record

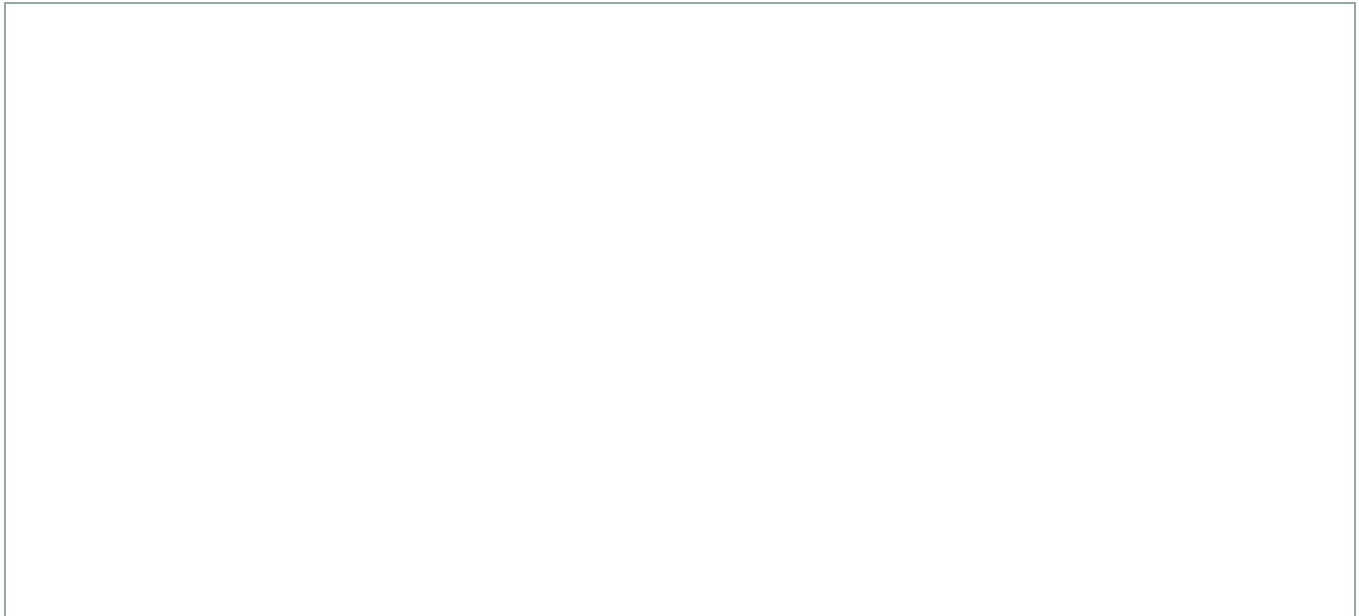
Use these labels on paper or in your document. The space below also works when this page is printed.

T1: Start one combined document

Record your date and chosen route. Reserve one diagram area and one CER area.

Original route uses S1-S4 and R1. Authentic inputs replace original practice. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

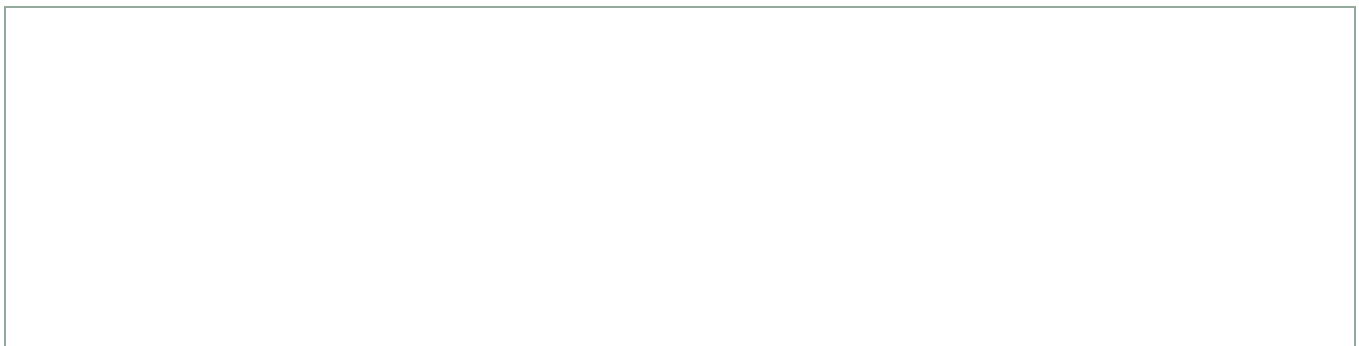


T2: Prepare your evidence

Original route: identify the R1 criterion and two relevant C-card facts with source IDs. Keep these as short notes beside the future CER.

These are planning notes within the same document, not another submission. Compare a chosen function with an alternative. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.



T3: Complete the repair-stage diagram

Original route: draw or write S1-S4 as four connected panels. Include the stage, repair feature, named cells and jobs. Add the timeline limit.

Use the supplied panel descriptions. Arrows show order, not a measured time or a promise of strength. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.



T4: Complete the CER

Original route: write a claim for R1, two supported facts, reasoning and a limitation. Keep it beside the diagram.

State best for this classroom criterion. Do not recommend care for a person or reproduce M1 as extra work. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.

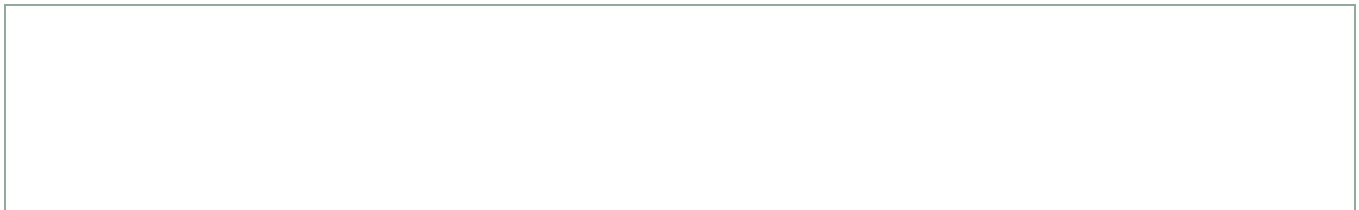


T5: Review and check your next step

Review the same combined document. Save your work and tell the teacher about any access problem. After uploading, check that Schoology shows Submitted.

Save the file, ask for help with a blocked upload and check that Schoology shows Submitted after uploading. Ask the teacher for separate official-task directions before doing that work. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Use this space or the same labeled section in your existing document. Add paper when your table, graph or drawing needs more room.



Check your product

- My one combined document identifies the chosen route and includes both diagram and CER.
- My diagram has four stages in order, with arrows and the repair feature in each.
- My stage labels name the supplied cell roles without claiming those roles are exclusive.
- Original route: My CER uses two supplied facts with source IDs to compare a technology with the stated criterion. Actual route: I use the genuine task evidence and teacher criteria. Neither route selects treatment for a person.
- My reasoning explains the functional match and does not choose treatment for a person.
- Include evidence limits in the timeline and CER. Use only evidence from work you actually do and check Schoology after uploading. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

Keep the limit: This is a simplified repair model and a comparison of technology functions. It cannot select treatment for a person or establish healing time, strength, readiness for activity or official completion.

Turn in your work

Submit diagram and CER as a single combined document. Section 1292 uses assignment 8544567923; section 6792 uses 8544567950. Both are titled Wk5 CER: Bone repair and repair tech. Confirm current directions and deadline. Actual route: use the teacher-supplied task and criteria instead. Do not also complete the original R1 practice.

If your section assignment or upload is blocked, save the combined work locally if possible and tell the teacher what is missing. After uploading, check that Schoology shows Submitted.

[Section 1292: Wk5 CER: Bone repair and repair tech](#)

[Section 6792: Wk5 CER: Bone repair and repair tech](#)

Carry forward

Bone repair involves overlapping cell roles; compare support functions without turning a classroom model into a treatment decision.

On February 19, use this evidence boundary in Bioethics: performance enhancement. A proposed benefit needs evidence and a limit. What evidence would a claim of performance benefit need?

Sources and resources

[Open today's page](#)

OS-REPAIR · Fractures: Bone Repair

OpenStax, Anatomy and Physiology 2e, section 6.5

<https://openstax.org/books/anatomy-and-physiology-2e/pages/6-5-fractures-bone-repair>

AAOS-FUNCTIONS · Fractures (Broken Bones)

American Academy of Orthopaedic Surgeons, OrthoInfo

<https://www.orthoinfo.org/diseases--conditions/fractures-broken-bones/>

MEDLINE-GRAFT · Bone graft

MedlinePlus Medical Encyclopedia

<https://medlineplus.gov/ency/article/002963.htm>

MACROPHAGE-STUDY · Osteal macrophages promote in vivo intramembranous bone healing in a mouse tibial injury model

Alexander and colleagues, 2011, Journal of Bone and Mineral Research, DOI 10.1002/jbmr.354

<https://pubmed.ncbi.nlm.nih.gov/21305607/>

CELL-REVIEW · Cellular Biology of Fracture Healing

Bahney and colleagues, 2019, Journal of Orthopaedic Research; review, not an original experiment

<https://pmc.ncbi.nlm.nih.gov/articles/PMC6542569/>