# Two Ways to Build a Bone Lab: Teacher Guide

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**Driving question.** How can a newborn's skull and a teen's leg bone both be unfinished, and in what ways do they differ?

## District section

BPS A&P Unit 2, Support and Movement, Section 7.4, Bone Development, Growth, and Repair (Student Edition pp. 234-237): distinguish between intramembranous and endochondral bones, and explain how such bones develop and grow. Used from the district list: Use the Practices 7.4 (Arguing from Evidence), Writing Connection: Bone Timeline (Tab 1 card order), Phenomenon Connection: CER Collect Evidence (Tab 3), and the idea behind the APR image of a teen's hand epiphyseal plate. **Additions** beyond the district list: the three-model growth test with Hales's data, the growth rule, and this lab.

## NYSSLS alignment

**HS-LS1-2.** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. **HS-LS1-1.** Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells (touched lightly, through specialized bone and cartilage cells).

**SEP 2** Developing and Using Models: Tab 1 stages, Tab 2 ideas, Question 11. **SEP 4** Analyzing and Interpreting Data: Questions 8, 9, 12. **SEP 5** Using Mathematics: Question 14. **SEP 6** Constructing Explanations: Question 16. **CCC 3** Scale, Proportion, and Quantity: Tab 2. **CCC 7** Stability and Change: stages and plate closure.

## Opening: pick a phenomenon

| Option | What it is | Notes |
|---|---|---|
| **Video** | A children's hospital surgeon on why a child's broken bone needs special care (Children's Wisconsin, first minute). Backup: Children's Hospital Colorado, bone growth. | Checked to embed. Not watched end to end: preview both. |
| **Activity** | The Cartilage You Still Have: bend your ear and nose tip, press the bridge of the nose. 3 minutes, no materials. | Own face only. This cartilage stays cartilage. |
| **Photos** | Two Gaps, No Breaks: a baby's soft spot and a young hand X-ray. | A real baby's head, no face shown. |

## Part by part

**Part 1, Tab 1.** Questions 1 to 3 are explore, read off the screen. The Learn It opens after every stage of both bones. Questions 4 to 6 are apply: the card order, the sort and the compare table.

**Part 2, Tab 2.** Questions 7 to 9 are explore. The 1727 box appears after all three records. The Learn It opens then. Questions 10 to 11 are apply. The misconception to watch: cartilage hardens into bone. It is replaced.

**Part 3, Tab 3.** Questions 12 to 13 are explore, on four real X-rays. The Learn It opens after all four calls. Questions 14 to 16 are apply. Say it plainly: a dark gap on a young X-ray is normal and is not a break.

## The model and its limits

Tab 1 is a drawing, not to scale, and stages are not spaced evenly in time. Tab 2 is a fixed model: gap and growth are Hales's, and the 50 mm start is a round number. Tab 3's rule fits only the last years of growth, and only the two knee plates; the femur figure is 9 mm in some sources.

## Sources

Hole's Essentials of Human Anatomy & Physiology 3e, teacher's manual, Section 7.4 (the student edition was not available to check page by page). Early history of the study of bone growth (1722-1875), International Orthopaedics, 2024, for Hales (1727), Duhamel (1739-1743) and Hunter. OpenStax Anatomy and Physiology 2e, Section 6.4, Bone Formation and Development. POSNA study guide, Epiphyseodesis Prediction and Technique, for the Menelaus rule (10 mm and 6 mm a year; plates close at about 14 in girls and 16 in boys). Pictures are credited on the lab page.