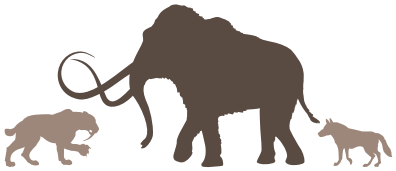
McKittrick Fossil Find Teaching Resource Guide



UCMP Lesson Plans

Overview: In this lesson, students play the roles of paleontologists on a dig. They "unearth" a few fossils at a time and attempt to reconstruct the animal the fossils represent. This activity is a companion activity to UCMP's McKittrick website: www.mckittrick.berkeley.edu

Lesson Concepts:

- Life forms of the past were in some ways very different from living forms of today, but in other ways very similar.
- Fossils provide concrete evidence of past life.
- Form is linked to function.
- Scientists pose, test, and revise hypotheses based on research outcomes.
- Science explains the natural world using evidence from the natural world.
- Science does not prove or conclude; science is always a work in progress.

Grade Span: 5–12

Materials needed:

- One envelope
- Scissors
- Printed worksheet of disarticulated skeleton of teachers choice
- Printed Fossil Find worksheet
- McKittrick Skeletal Resource Manual printed or online PDF

Advance Preparation:

- Cut up the mystery fossil sheets and place one set of fossils in each envelope, there are 3 mystery fossils to choose from. Leave white sapce around each fossil to facilitate cutting.
- Read through the Fossil Find worksheet and "After the story" for discussion questions and how to provide guidance during the activity.

Length of activity:

One class period

Grouping:

Can be played singly or in groups of 3-4 (if classroom setting available). Questions about working in groups can be changed for best use in classroom.

Teacher Background:

The paper cut out fossils are based on the most abundantly found genera at the McKittrick Site. The cut outs are incomplete skeletons to reflect somewhat the reality of finding fossils. This site is similar to the La Brea tar pits in Los Angeles but differs in location about 100 miles north west, but most significantly in asphalt tar seeps spread out over a large surface area versus tar pits, small lakes of tar and water. For more details: visit www.mckittrick.berkeley.edu/history-geology.

Teaching Tips:

1) Student enthusiasm will largely hinge on your showpersonship reading the provided script, or nominating a student who would be good at this!. Assure them that they are working with replicas of real fossils and functioning the way paleontologists actually work. If you would like to use this activity again in the future, make sure students put the fossils back in the envelopes after finishing.

2) Suggestion to turn off lights to simulate night time

3) The **Fossil Find Worksheet** is suitable for 6–12 grade students. Teachers of younger children may want to assemble more appropriate debriefing questions, such as:

- What do you think it was?
- How can you tell?
- Does it look like any animal you know today?

Procedure:

1. Pass out the envelopes of fossils, **McKittrick Fossil Find worksheets**
2. Tell the following story in **The Script** below (which includes instructions in parentheses) to the class.
3. Allow time after reading The Script for students to answer questions in their journal and think about what they found.
4. Have each team share with the entire class what they decided the fossil is. Ask for the evidence that led to their final hypothesis.
5. Ask if there is a general consensus on what the animal might have been. If there is no clear, final answer, ask what they would like to do to pursue it.
6. Allow students to search the Internet, use trade books, visit the library, or research the mystery at home.
7. Pass out the **McKittrick Skeletal Resource** manuals for them to check their answers.
8. Refer to the **After the Story** Resource for further discussion

The Script

Day 0: The hot August sun beats down on you as you pause to wipe the sweat from your brow. Looking around, you find yourself surrounded by low patches of brush clinging to dusty exposed soil and scattered rocks. Far in the distance you see mountains rising above the plain of California's vast Central Valley. Ahead of you the heat rising from the parched ground causes the air to shimmer, obscuring your destination, a range of low hills perhaps another mile away. Breathing deeply to catch your breath, you catch the sweet scent of sage mixed with a dusty alkali smell. Your teammates pull up alongside you, their footsteps crunching on the hard ground as they let their shovels and pickaxes clatter from their shoulders, grateful for the break. As you take a sip of water, you estimate that you've hiked about two miles from where you left the trucks parked. Only another mile to go, then the return trip for the tents and camping equipment. With a sigh you twist the cap tightly onto

your canteen, shoulder your pick and shovel, and once again begin trudging through the heat and dust.

That evening in camp, with the heat and exertion of the day behind you, your small team discusses plans for the excavation. The three of you agree that with the threat of mountain lions and rattlesnakes, it would be best for one person to keep watch for danger. That will leave only two people for the actual dig; one to swing the pick, and one to shovel dirt and look through it for fossils.

Day 1: The next morning the sun is already illuminating the eastern side of your tent when the team arises. Anticipation fills the cool morning air as you have a quick breakfast, gather your digging tools, and walk the hundred or so yards to where you plan to dig.

An hour of clearing dry hard-packed soil from the asphalt layer is followed by several more hours of breaking off chunks of slightly sticky asphalt with a pick-axe. The sun is well into the sky now, and without shade it is merciless. The sweet smell of sage from yesterday is replaced with the hot, sulfurous smell of tar, like a highway baking in the summer heat. A thin layer of tar gums up the edges of your pick and shovel, small smears and globs of it stick to your skin and clothes, and over it all a layer of dust sticks to the tar and your own sweat as flies buzz around you constantly. The long effort of the day pays off when your team gets quite lucky in uncovering five (5) fossils. Packing them carefully in sacks, your team returns to camp that evening.

Without looking in the envelope, **randomly remove five (5) fossils** and lay them on the table. These are the cleaned-up fossils. Now that you are back in camp for the evening, arrange the fossils so they make as much sense as possible. Write on your worksheet what you think the animal might be.

(Allow students time to manipulate the fossils, reflect and record their hypotheses. Request that students not observe the workings of the other groups.)

Day 2: The second morning your team arises earlier, hoping to get as much digging done as possible before the summer heat becomes too intense. This day, however, dawns grey and windy, and almost as soon as you emerge from your tent a raging thunderstorm sweeps in from the northwest. It's almost noon by the time the storm passes, and your team finally gets to the dig site. Yesterday's gritty dust has been replaced by slippery mud that cakes your boots.

With the cloud cover gone, the temperature soars as the clean smell of fresh rain gives way once again to the odor of hot tar. The sticky mud bakes into a hard, cracked crust as your team fights through the heat and buzzing flies to unearth five (5) more fossils before evening falls. With the fossils carefully bagged up, you return to camp exhausted.

Again, without looking in the envelope, **withdraw five (5) fossils.**

Use the next few minutes to arrange the new fossils with the ones from yesterday. On your worksheets, record what you think the animal is now. (Allow a few minutes for this task.)

Day 3: Hoping to make up for lost digging time due to the previous day's storm, your team arises before dawn on the third day. You are already enjoying a warm breakfast as you watch the sun rise majestically over the far-distant peaks of the southern Sierra Nevada mountains, painting the sky in hues of lavender and pink before giving way to a clear blue. The stillness of dawn is broken by the singing of songbirds in the scrubby pinyon pines near camp as the team members gather their equipment and head out for what is to be the last digging day of the season. At the dig site, a turkey vulture wheels in wide lazy circles far overhead as you settle into the now-familiar digging rhythm of swing-scrape, swing-scrape, shovel, stare. By the time the team breaks for lunch, you have already uncovered four (4) more bones, for a total of fourteen(14) in this three-day dig. After lunch, spirits are high as the team fills in the hole they have dug, taking careful notes on its location and marking it on the map before returning to camp for the final time.

Again, without looking in the envelope, **withdraw the last four (4) fossils**. During the final evening in camp the team assembles its fourteen (14) fossils. Put them on the table with the others and see what you have. Record what you think it is now.

Day 4: Your team arises bright and early the next morning. The rain from two days ago has resulted in a patchwork scattering of pink and white wildflower blooms across the landscape, and the gentle the buzzing of bees fills the warm morning air as you pack up camp and begin the hike back to the trucks. Returning to the Museum of Paleontology you learn that other teams have also had successful expeditions this summer and would be glad to share their results.

Walk around the room and see what others have done with their fossils. Discuss your results with them and ask about theirs. (Allow a few minutes for this.) Now, with this additional information, write what you think the fossil is.

After exchanging ideas with other scientists, your team goes to the library and consults the **McKittrick Skeletal Resource Manual**, which has drawings of skeletons of vertebrate animals found there.

(Pass out the McKittrick Skeletal Resource Manuals.)

Look through the McKittrick Skeletal Resource Manual. Compare your fossils with the skeletons in the book. Record your final idea of what you think your fossil is. Answer all the questions on your worksheet and return the fossils to their envelope.

AFTER THE STORY

Now have every team share with the whole class what they figured the creature to be, and see how many were the same, and how many different interpretations were made.

You may want to discuss their answers to the questions at this time:

- Is there general consensus on what the creature was? If so, discuss what the most telling clues were, and what influenced them most.
- Did the conclusions of others have any influence??? Is this the way that scientists work?
- If there is NOT consensus, discuss what solution seems "best", and why it seems best; what criteria are being used?
- What factors are influencing this decision? This would be a good place to consider what would make a "fair test", and discuss the elements of what is involved in how scientists select the "best" hypothesis out of competing ones.

In any case, if you happen to know, or even suspect, what the creature was, keep the mystery and refrain from telling your students! They will clamor to know, but you have to tell them that "science is NOT in the business of KNOWING; just coming as close as we can to the MOST LIKELY solution is the best we can do." Tell them this is what really happens in science...we often don't have all the pieces, and may never ever find them, so we simply rely on our "best" interpretation based on the clues we do have. Leave them with whatever they figured out.

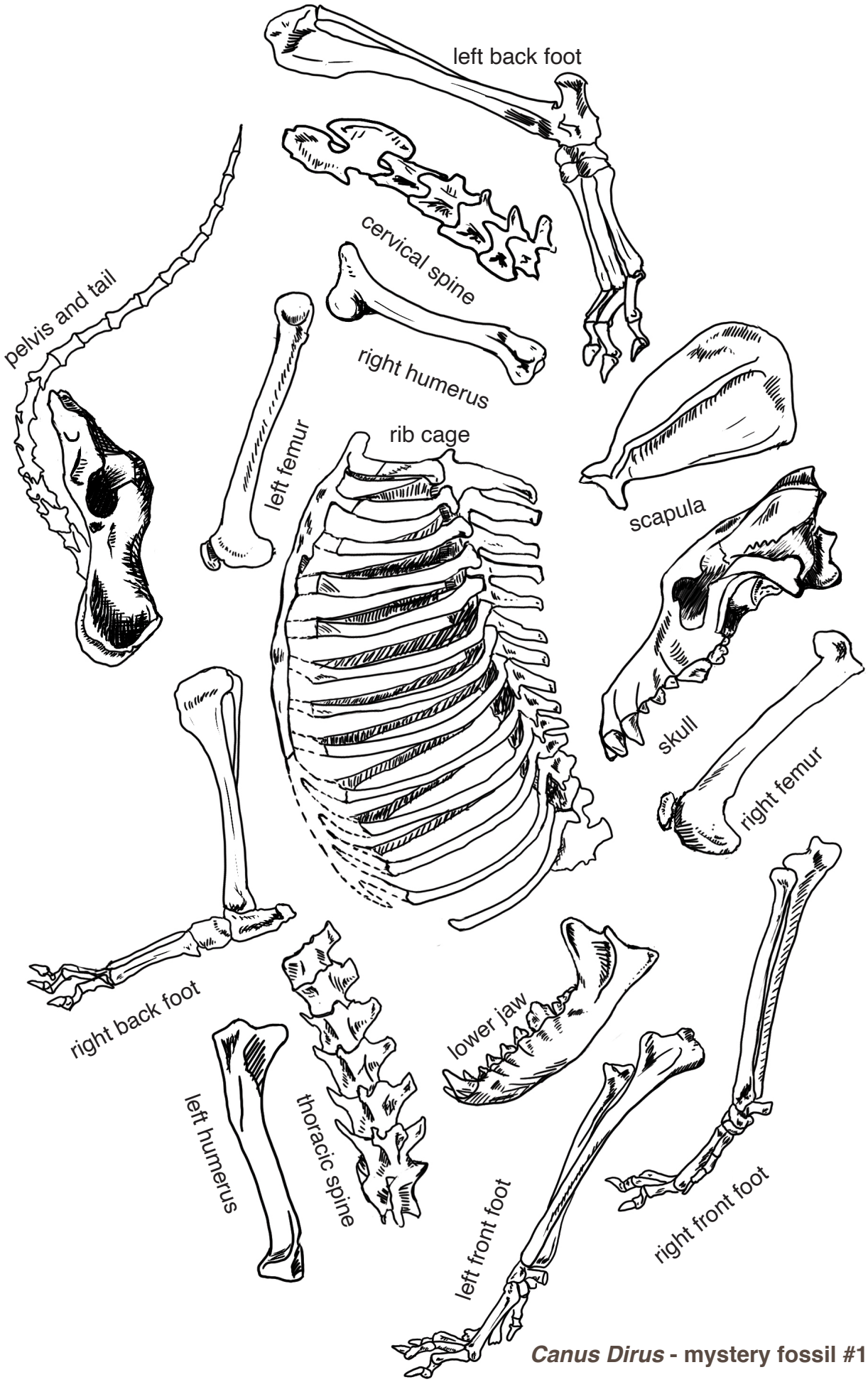
Below are some reasonable answers to the last few questions on the worksheet:

6. If this "Fossil Find" scenario is typical of the work of scientists, what features of the nature of science does it demonstrate?
Answer: Its uncertainty, and that teamwork is more efficient.

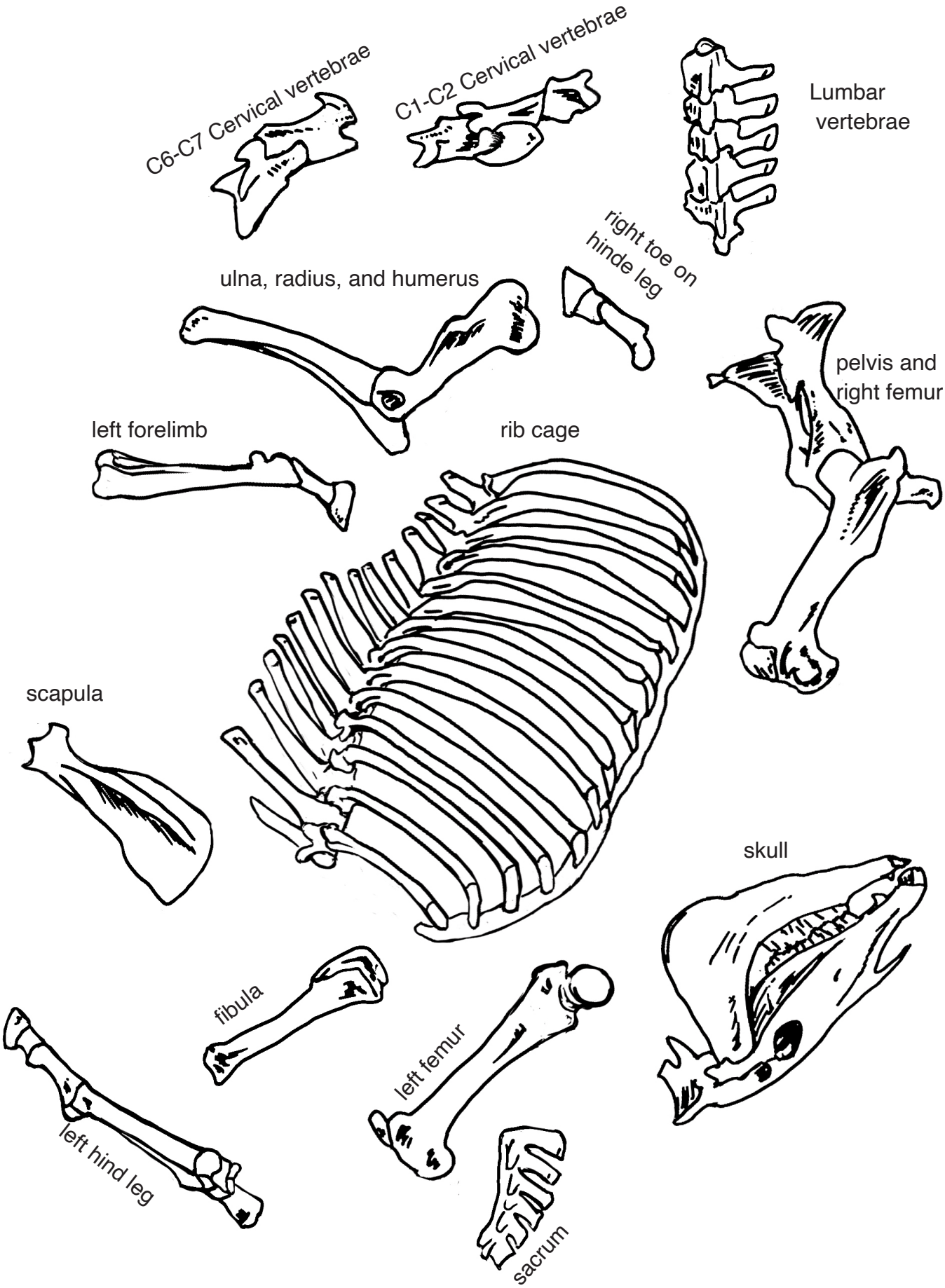
7. From looking at the fossil and the resource manual, what could you say about how and where this animal lived?
Answer. Probably on land, non-aquatic. The Pleistocene is fairly recent time period and the ecosystem is similar today but less hot and dry.

8. Is it possible for scientists to do studies about what happened 11,000 to millions of years ago?
Answer. Yes. All sorts of clues, from fossil bones, pollen, leaves, ripple marks in sandstone, volcanic rocks, etc., scientists can do an amazingly accurate reconstruction of life and activity in the distant past.

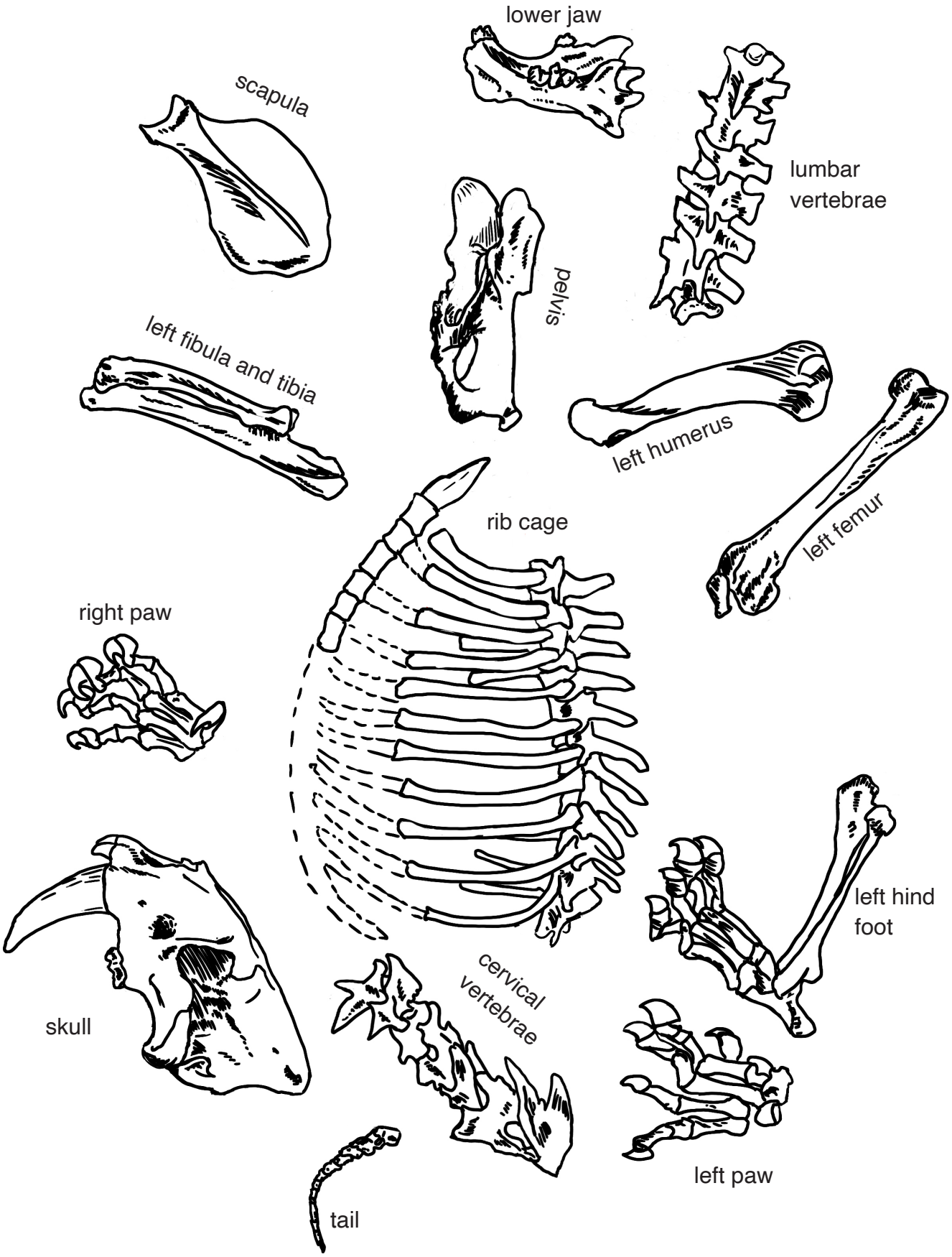
9. On the back of this sheet, list what you see as the 3 goals of this experience.
Answer: a. Show the uncertainty of science. b. Show how it helps to work together to solve problems. c. To see how scientists develop hypotheses from observation, then test those hypotheses. d. Gave us some "experience" working with "fossil bones".



***Canus Dirus* - mystery fossil #1 key**



Horse (*Equus*) - mystery fossil #2 key



***Smilodon* - mystery fossil #3 key**