How do scientists UNLOCK the past?

Everyone knows bones and corpses can’t talk. Or can they? As you may know from true-crime shows or sci-fi thrillers, human remains often have their own stories to tell. As police detectives unravel intricate cases and scientists investigate unexplained phenomena, these remains often tell stories that help piece the past together.

**DISCUSS** What types of criminal or scientific investigation do you know about? With a partner, choose a type to discuss. List the methods investigators use to track down the truth. Then briefly explain the purpose of each method.

<table>
<thead>
<tr>
<th>Method</th>
<th>Purpose</th>
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<tr>
<td>FBI fingerprinting</td>
<td>Identify suspect</td>
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<td>2.</td>
<td>3.</td>
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**Background**

Stumbling onto a Mummy

“Who Killed the Iceman?” chronicles some of the theories surrounding the death of a man who met his demise around 3000 B.C. The “Iceman,” the oldest frozen mummy ever found, was discovered by German hikers vacationing in the Alps. When they spied a body embedded in the ice, the hikers assumed they had found the remains of a mountain climber who’d met a dismal fate. They had no idea they’d stumbled onto a 5,000-year-old relic. The Iceman now resides at the South Tyrol Museum of Archaeology in Bolzano, Italy.

**Crime-Fighting Scientists**

“Skeletal Sculptures” describes how forensic anthropologists help police track down the truth. Anthropology is the scientific study of humans—our origins, behavior, environment, and physical features. Forensics is the use of science to solve crimes. Forensic anthropologists use their knowledge of human characteristics to assist in cracking tough cases involving human remains. The scientists identify the victim’s age, sex, race, and physical characteristics. They also determine the likely cause of death, which makes them an integral part of many murder investigations.
He spent some 5,000 years frozen in a mountain glacier on the Austro-Italian border before passing hikers discovered him, sprawled in the melting snow, in 1991. He now resides in a refrigerated room at a museum in Italy. Over the 11 years since his discovery the Iceman mummy has been examined from every possible angle. But not until this past summer did those studying his still frozen body notice a crucial piece of evidence that dramatically rewrites his story: “Ötzi,” nicknamed for the Ötztal Alps where he was found, didn’t freeze to death in a sudden snow storm while tending sheep as some had suggested. Instead he was killed, a victim of warfare, murder, or human sacrifice.

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Clues Discovered

X-rays reveal an arrowhead buried deep in the Iceman’s left shoulder—an injury that could not possibly have been self-inflicted. This discovery consequently led archaeologists to believe that the Iceman had been killed. The wound, visible as a small dark smudge beneath the mummy’s leathery skin, had been overlooked in all previous examinations. Though no arrow shaft protrudes from the wound and no blood marks the arrow’s entrance, it’s now clear that the Iceman was shot in the back. But who did it? And why?

Differing Theories

“There’s no way anyone can ever really know,” says archaeologist Johan Reinhard, a National Geographic Society explorer-in-residence. “It might have been murder. Or it might have been ritual sacrifice.”

Reinhard knows mummies. Among the many he has discovered is the Inca “ice maiden,” a victim of sacrifice, on the frozen slopes of Peru’s Nevado Ampato in 1995. His experience studying mountain cultures in the Andes, the Himalayas, and elsewhere has convinced him that the Iceman’s death was not a random killing.

1. ritual sacrifice: a sacrifice that is part of a religious ceremony.
“Look at where he died,” Reinhard says. “It’s a prominent pass, between two of the highest peaks in the Ötztal Alps. This is the kind of place where people from mountain cultures have traditionally made offerings to their mountain gods. We know that mountain worship was important in prehistoric Europe during the Bronze Age,” he says. “And there is good evidence that it may also have played a role earlier, in the Copper Age.”

Reinhard’s interpretation seems to answer questions about artifacts found with the mummy that have long puzzled experts. For example, breaking objects was a ceremonial practice in Neolithic Europe. This might explain the broken arrows lying near the mummy. The Iceman’s copper ax—the oldest prehistoric ax in Europe with its bindings and handle intact—is also significant. Its copper had to have been mined, and mountains, as the source of valuable metals used to make tools, “were worshiped by miners throughout the world,” says Reinhard. “This helps explain why the ax was left with the body after the killing.” Murderers would likely have taken something so useful with them. But people performing a ritual might have left it for the Iceman’s use in the afterlife or as a tribute to the gods.

Ötzi was found at approximately 10,500 feet in the Ötztal Alps on the border between Austria and Italy. After closely examining Ötzi’s clothing and possessions—including a sheath and dagger (shown at right)—archaeologists realized they had uncovered a 5,300-year-old find.

3. **Bronze Age . . . Copper Age:** The Bronze Age in Europe, when bronze tools began to be used, lasted roughly from 3500 B.C. to 1000 B.C. The Copper Age overlaps with the earliest part of the Bronze Age.

4. **Neolithic** (nəˈlīthik): having to do with the prehistoric period when food growing began, but before metal tools were used—about 4000 B.C. in Europe.
Another clue: The Iceman’s body was found in a naturally formed trench along the pass. Prior explanations had him taking shelter there from sudden bad weather. “But the trench is not deep and is at a high point of the pass. It would have been a poor place to sit out a storm,” explains Reinhard. Perhaps, instead, the Iceman was buried there by whoever killed him, which would account for the body’s being so well preserved.

Reinhard’s ideas have not been met with enthusiasm by European experts. In contrast with his beliefs, the mummy’s caretaker, pathologist Eduard Egarter Vigl of South Tyrol Museum of Archaeology, believes that Ötzi may have been fleeing from an attacker, saying, “The Iceman was hit by an arrow from behind.” Others maintain that arrows aren’t efficient means of ritual killing and that no clear evidence of any other Copper Age sacrifice exists.

So Who Killed the Iceman?

“They view the idea of human sacrifice as too sensational,” says Reinhard. “But they can’t refute what I’ve pointed out, and I believe my theory better explains the known facts.”

“I know it’s controversial,” he admits. “But it’s time to compile all the evidence and reexamine it from a different perspective. Let’s look at these artifacts not only relative to each other but also within social, sacred, and geographical contexts.”

MONITOR
One important part of monitoring your reading is evaluating the information that’s provided. Do you find Reinhard’s theory convincing? Why or why not?

refute (rɪ-fyʊt) v. to prove false by argument or evidence

compile (kəm-pɪl) v. to put together by gathering from many sources
Dr. Michael Charney is an expert in forensic anthropology. His expertise has enabled him to take a few pieces of a skeleton found in Missouri and compile a portrait of a five-foot, 120-pound Asian woman in her mid-twenties. Still, that isn’t enough to identify her.

The dead woman’s “face” needs to be brought back to life.

Reconstructing the likeness of a person in clay, using the skull as a guide, is a last resort at identification, Dr. Charney says. It gives police a new lead to follow, a visual clue that can be photographed and displayed in the media.

Facial reconstruction is not an identifying tool, he warns. The goal is to trigger someone to recognize the model and to identify the person through scientific means.

“All that’s needed is a general recognition that it looks like so-and-so,” he says.

Before re-creating a face, Dr. Charney and forensic sculptor Nita Bitner search the skull for signs of disease, injury, and structural defects.

“We look for things that shouldn’t be there,” Bitner says. “Sometimes we find broken noses, cuts, or dentures.” These affect the face’s appearance and aid in the identification process. If the nose bone is curved to one side, for example, it’s important to show it in the face because it’s a distinguishing feature.

“Have to be careful, however, not to include anything that happened at the time of death,” Bitner notes, “because it wouldn’t be recognizable to others.”

Age also influences how a face is built. Wrinkled skin, which might help illustrate an older person, is often incorporated into a sculpture for accuracy.

After studying the Missouri woman’s skull, Bitner makes a latex mold and pours a plaster cast. Now she’s ready to sculpt the face.

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1. forensic: having to do with applying scientific methods to crime investigation.
Forensic sculptor Nita Bitner begins a facial restoration by cutting round rubber pegs into different lengths. The pegs, called landmarks, represent the thickness of the soft tissue (muscle, fat, and skin) at different points on the face. These tissue depths, which vary for men and women of varying ages, were first calculated from corpses by nineteenth-century scientists and later updated.

2. She then glues the rubber pegs to the skull cast.

3. Bitner “connects the dots” with strips of modeling clay. When attaching the strips of clay, she begins at the forehead and works her way down to the cheekbones, nasal area, chin, and mouth.

4. Once the dots are connected, Bitner fills in the spaces with clay and fleshes out the face. Now the prominent cheekbones of the Missouri woman become strikingly clear. Suddenly her broad face and delicate nose emerge.
5. As Bitner smooths the clay with her thumb and fingers, the face develops like a photograph.

6. Bitner sets the plastic brown eyes in their sockets.

7. Next come the eyelids.

8. Bitner then sculpts the sides of the nose.

9. She measures the nose with a ruler to ensure it is the correct width.
10. Now it’s time to mold the upper lip.

11. The face is nearly complete. Because the Missouri woman is presumed to be Asian, Bitner will add a black wig. She will then add a scarf for a finishing touch.

12. The model is now ready to be photographed and publicized in the media so that millions of amateur detectives can help solve the riddle of her identity.

presumed (prɪ-zəʊmd) adj. thought to be true

presume v.

TEXT FEATURES
Review the photographs illustrating the process. Which step do you think is the most critical for transforming a skull into a recognizable human face? Explain your answer.
Comprehension

1. Recall Why is the Iceman nicknamed Ötzi?
2. Summarize What is Johan Reinhard’s theory about how the Iceman died?
3. Clarify What is facial reconstruction, and for what is it used?

Critical Analysis

4. Summarize Notes Review the notes you took as you read “Skeletal Sculptures.” Using these, summarize the process of facial reconstruction.
5. Draw Conclusions In your opinion, is disagreement between scientists helpful or harmful to further investigation? Use evidence from “Who Killed the Iceman?” to support your conclusion.
6. Analyze Text Features If you had simply scanned the text features—the title, subheads, and graphic aids—of “Who Killed the Iceman?” would you have had an accurate idea of what the article was about? Explain your answer.
7. Evaluate Complete the chart below, noting the information that each method of investigation provided to the scientists studying the Iceman. Which method do you think yielded the most crucial information? Explain.

<table>
<thead>
<tr>
<th>Method of Investigation</th>
<th>Information Provided</th>
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<tbody>
<tr>
<td>X-rays of Ötzi’s shoulder</td>
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<tr>
<td>Analysis of where the body was found</td>
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<tr>
<td>Evaluation of artifacts found with the Iceman’s body</td>
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READING-WRITING CONNECTION

WRITING PROMPT

Short Response: Compare and Contrast
How do Reinhard’s theories about the mummy’s death and the evidence he offers differ from those of the other scientists mentioned in “Who Killed the Iceman?” Using your notes and examples from the text, write one or two paragraphs comparing and contrasting Reinhard’s theories with the other scientists’ beliefs.

REVISING TIP

Review your response. Did you clearly explain each of the differing theories? Did you include the evidence each theory relies upon?

How do scientists UNLOCK the past?

How does learning about the past give us insight into our own time?
Vocabulary in Context

**VOCABULARY PRACTICE**

Decide whether these statements are true or false.

1. A wildflower originally identified centuries ago is an ancient artifact.
2. If I refute an argument, I make a convincing case against it.
3. To write a good report, you should compile information from several sources.
4. A person interested in animal behavior might want to study anthropology.
5. Someone presumed to be at fault has already been proved wrong.

**ACADEMIC VOCABULARY IN SPEAKING**

conclude  construct  implicit  primary  specific

When you listen to oral instructions, you can’t rely on illustrated steps like those in “Skeletal Sculptures,” but you can include clarifying questions in your notes to ask the speaker directly. Use at least two Academic Vocabulary words each as you practice giving and following oral instructions: Think of a task or process you’ve performed or a specific problem you’ve solved by following steps. Prepare the steps as instructions and present them orally to a partner. Then switch roles. Can you conclude that you understood each other’s instructions? Explain.

**VOCABULARY STRATEGY: SPECIALIZED FIELDS, OR “OLOGIES”**
The words for many fields of study, such as anthropology, end with the Greek suffix -ology, meaning “study of.” The word for the person doing the studying often ends in -ologist, as in anthropologist. Many of these words, such as toxicology (the study of poisons), are recognizable because they have a familiar root. Others, like penology (the study of prisons), have a Greek or Latin root you may have to learn.

**PRACTICE** Choose the word in parentheses that fits each sentence. Use context clues, your knowledge of roots, or, if necessary, a dictionary.

1. Because his grandfather had Alzheimer’s disease, Jeremy decided to specialize in (gerontology, geology).
2. A (cosmetologist, criminologist) was brought in to examine the murder scene.
3. If you study (ornithology, psychology), you will become an expert on birds.
4. Please have your hearing checked by an (audiologist, ecologist).
5. Ed, an amateur (cytologist, herpetologist), viewed lizards, snakes, and turtles near the beach.
6. Learning a little about (meteorology, oncology) helped me anticipate thunderstorms.