

Science and Detection

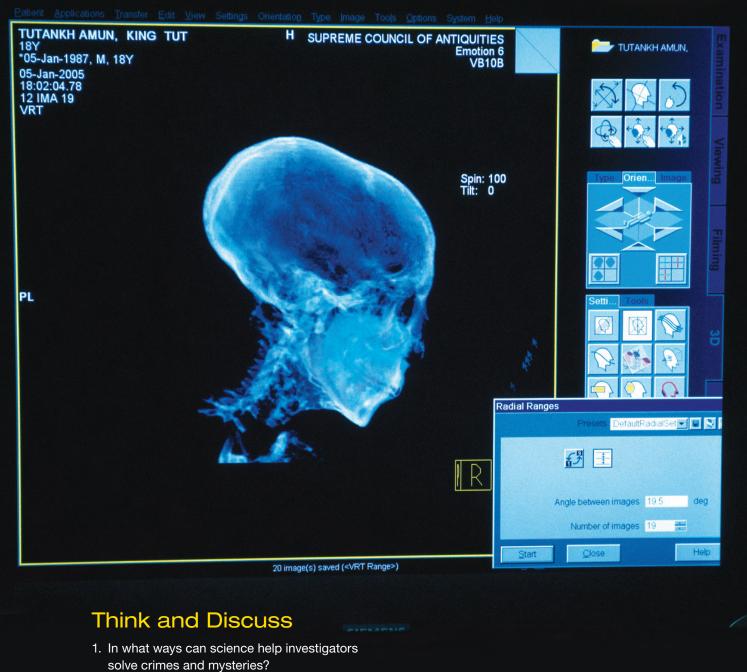
ACADEMIC PATHWAYS

Lesson A: Identifying a sequence of events

Distinguishing fact from speculation

Lesson B: Understanding a personal narrative/opinion article

Lesson C: Planning an opinion paragraph Writing an opinion paragraph



2. Do you know any historical mysteries or crime cases that were solved using technology?

▲ A CT scanner is used to investigate the cause of death of the Egyptian king Tutankhamun.

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Exploring the Theme

Read the information on these pages and discuss the questions.

- 1. What do CT scanners do? In what ways are they used?
- 2. When did people start using fingerprints to identify themselves? When were fingerprints first used to solve a crime?
- 3. Why is DNA a useful tool for identifying people? Where can it be found?

Centuries ago, and even as recently as decades ago, there were many questions that scientists and researchers could not find the answers to. However, as technology continues to advance, identifying criminals and solving mysteries of the past is gradually becoming easier. Some mysteries, however, remain to be solved.



CT Scanning

A CT scanner is a medical imaging device that can take three-dimensional images of the inside of almost any object. With it, a doctor can look for tumors, infections, and internal bleeding inside a patient's body without cutting the patient open. However, CT scanners are not used solely for medical purposes. The technology can also help scientists, researchers, and detectives to investigate mysteries that are otherwise difficult to solve.



Fingerprinting

Every person on Earth has a different fingerprint pattern. Oil from fingertips can stick to almost any surface a person touches, and the oil stays in the same shape as the prints on the individual's fingers. Even if you cut or burn your fingers, the same fingerprint pattern will grow back when the injury heals. Some societies were using fingerprints as identifying markers thousands of years ago. In the second millennium BC, people pressed their fingers into clay tablets to sign contracts. These days, fingerprints are most useful for helping police solve crimes. The first crime solved by fingerprint evidence occurred in Argentina in 1892.



DNA Tracking

First discovered in 1953, DNA is a tiny molecule containing a code that gives instructions for the growth of cells in a person's body. For example, the code determines if a person will have blue eyes or brown eyes, or red hair or blond hair. DNA is found in almost every part of the body, and every individual's DNA is unique, except for the DNA of identical twins. Because each person's DNA is distinctive, it is a valuable tool for identification. Today, DNA is used to solve crimes, to identify victims of accidents, and to trace an individual's family history back hundreds or thousands of years.

 French paleontologist Jean-Jacques Hublin makes a CT scan of a Neanderthal skull.

LESSON A PREPARING TO READ

A | Building Vocabulary. Find the words and phrases in blue in the reading passage on pages 27–29. Use the context to guess their meanings. Then write each word or phrase below next to its definition (1–10).

analysis commit [a crime] deduce detective attach identifv investigate prime extract suspect 1. _____: (verb) join or fasten something to an object 2. _____: (noun) a person who the police or authorities think may be guilty of a crime 3. _____: (adjective) the most important 4. _____: (verb) do something illegal or bad 5. _____: (noun) someone whose job is to find out what has happened in a crime 6. _____: (verb) reach a conclusion using information that you have 7. 8. _____ 9. _____: (verb) take a substance out from something else 10. _____: (verb) name someone or something and say who or what they are **B** | Using Vocabulary. Answer the questions. Share your ideas with a partner.

- 1. Do you think you would be good at **investigating** crimes? Why, or why not?
- 2. What are some ways that the police can **identify suspects**?
- 3. Read the following scenario. What information can you deduce from it?

A man comes home from a night out with friends. He lives alone. The front door of his house is wide open. There is a shoe print on the outside of the door. He goes to the door and sees that the lock is broken. Inside, he finds that his laptop and his television are missing from the living room. His tablet computer, which was in the kitchen, is also missing. The man goes through the rest of the house and finds that nothing else is missing. However, the window in the kitchen is broken. There is blood dripping down the edges of the broken window. There is no broken glass on the kitchen floor. There is a lot of broken glass underneath the window outside the house.

- **C** | **Brainstorming.** What kind of evidence do you think detectives look for when they are investigating a crime? Discuss ideas in a small group.
 - **D** | **Predicting.** Skim the reading passage on pages 27–29. Check (✓) the types of cases that you think will be featured. As you read, check your predictions.
 - □ Plant DNA—a recent robbery
- □ Human DNA—a recent robbery
- ☐ Human DNA—a recent murder
- ☐ Plant DNA—a recent murder
- □ X-ray, CT scans—a prehistoric murder □ X-ray, CT scans—a prehistoric robbery

C Link The prefix extrameans outside of, e.g., extract, extraordinary, extracurricular, extraterrestrial (= outside Earth)

Word

READING

Tech Detectives

Police detectives have always made use of the latest technologies available to solve crimes. As three cases show, modern technology such as DNA analysis and CT¹ imaging can help scientists and detectives understand and solve mysteries both from the present and from the past.

Α

(Leech)Solves Robbery² Case in Australia

Leeches are not generally thought of as useful creatures; in fact, people usually try to avoid them. However, in 2009, detectives in Australia were able to think outside the box³ and use a leech to solve an eight-year-old robbery case. In 2001, two men robbed a 71-year-old woman in her home in the woods in Tasmania, stealing several hundred dollars. The men escaped, but, soon after, detectives investigating the crime scene found a leech filled with blood. The detectives speculated that the leech could have attached itself to one of the robbers, sucked his blood while he was traveling through the woods, and then fallen off during the robbery. The detectives extracted some DNA from the blood in the leech and kept it in their database.⁴

Eight years later, police arrested a suspect on an unrelated drug charge. As part of his examination, his DNA was analyzed, and it soon turned out to match that taken from the leech. After being questionned by the police, the suspect eventually admitted to committing the 2001 robbery.

¹ CT stands for Computer Tomography.

С

- $\ensuremath{^2}\xspace A$ robbery is the crime of stealing money or property, often using force.
- ³ When you **think outside the box**, you think creatively and come up with new and unusual ideas.
- ⁴ A database is a collection of data, or information, that is stored in a computer and can easily be accessed.

LESSON A READING



Plant Helps Solve Murder Case in Arizona

The first conviction⁵ based on plant DNA evidence occurred in the state of Arizona, in the United States. When a murder was committed in 1992 in the state capital, Phoenix, a pager⁶ found at the scene of the crime led the police to a prime suspect. The suspect admitted to giving the victim a ride in his truck, but denied any wrongdoing. In fact, he claimed that she had actually robbed him, thus explaining how his pager had been found at the crime scene. Forensic investigators examined his truck and found seed pods, which were later identified as the fruits of the palo verde tree. And indeed, a palo verde tree at the scene of the crime showed signs of having been hit by a truck.

However, this evidence alone was not enough. So an investigator wondered if it was possible to link the exact tree at the crime scene with the seed pods found on the truck. A geneticist at the University of Arizona in Tucson demonstrated that it was; individual plants—in this case palo verde trees—have unique patterns of DNA. Analysis proved that the truck had definitely been to the crime scene and had collided with one specific tree, contradicting the suspect's story. With this information, it was possible to convict the suspect of the crime.

Who Killed the Iceman?

Europe's oldest mummy,⁷ now known as the Iceman, was discovered by hikers in the frozen ice of the Italian Alps in 1991. Scientists believe he lived about 5,300 years ago in an area north of what is now Bolzano, Italy. Wounds on the Iceman's body have made it clear to scientists for some time that he died a violent death. But new DNA analysis, along with X-ray and CT imaging technology, has helped scientists piece together even more clues about the life and death of this ancient Neolithic⁸ human.

CT imaging identified an arrowhead buried in the Iceman's left shoulder, indicating that he was shot from behind. Scientists also found a wound on one of his hands, leading them to believe that he had been in a fight with one or more enemies who later chased after and killed him. While this may be the case, close analysis of this hand injury shows that the wound was already beginning to close and heal at the time of his death. So it is unlikely he sustained it in his final days. Moreover, a later study of the CT images revealed that the Iceman had a full stomach at the time he was killed. This meant that he ate a big meal immediately before his death-not something a person being chased by enemies would do. Scientists deduced that the Iceman was probably resting after a meal and was attacked from behind.

G

Н

Perhaps the most likely theory is that the Iceman was fleeing an earlier battle, but thought he was safe at the moment of his murder. Scientists continue to analyze the Iceman using the latest technology to find more clues to history's oldest murder mystery.

- ⁶ A **pager** is an electronic device that is used for contacting someone.
- ⁷ A mummy is a dead body that was preserved long ago, usually by being rubbed with special oils and wrapped in cloth.
- ⁸ If something is **Neolithic**, it is from the last part of the Stone Age, a period that occurred between 9000 and 6000 BC in Asia, and between 4000 and 2400 BC in Europe.

E.

D

⁵ If someone has a **conviction**, they are found guilty of a crime in a court of law.

An artist's view of the Iceman's final moments: An arrowhead discovered in the Iceman's left shoulder indicates that he was shot from behind and was probably unaware of his killers.

LESSON A

UNDERSTANDING THE READING

A | Identifying Main Ideas. Which technologies were used in each investigation? Check (✓) the correct columns in the chart below for items 1–3.

	Leech Solves Robbery Case in Australia	Plant Helps Solve Murder Case in Arizona	Who Killed the Iceman?
1. X-rays			
2. CT imaging			
3. DNA			
4. What evidence gave investigators useful information about the crime?	a filled with	from from a palo verde tree	in the Iceman's shoulder; a full

B | Identifying Key Details. What evidence was useful to investigators? Complete item 4 in the chart above with information from the reading passage.

CT Focus: Distinguishing Fact from Speculation

A **speculation** is an opinion or a guess based on incomplete information. To **distinguish fact from speculation**, look for key words. These words usually indicate a fact: *absolutely, clear, definitely, discover, know, prove, show.* These words usually indicate a speculation: *argue, believe, could, may, might, claim, likely/unlikely, opinion, perhaps, probably, speculate, theory.*

- C | Critical Thinking: Distinguishing Fact from Speculation. Read these statements about the reading passage. Write **F** for *fact* or **S** for *speculation* next to each one. Circle the words that support your answers.
 - 1. <u>S</u> The detectives speculated that the leech could have attached itself to one of the robbers.
 - 2. _____ Analysis proved that the truck had definitely been to the crime scene.
 - 3. _____ Perhaps the most likely theory is that the Iceman was fleeing an earlier battle, but thought he was safe at the moment of his murder.
 - 4. _____ Wounds on the Iceman's body have made it clear he died a violent death.
 - 5. _____ It is unlikely he sustained [the wound] in his final days.
- **D** | **Speculating.** What do investigators think probably happened to the Iceman? Do you agree? Can you think of other interpretations of the evidence? Discuss your answers with a partner.

DEVELOPING READING SKILLS

Reading Skill: Identifying a Sequence of Events

A crime must happen before detectives can investigate and find evidence. When you are trying to understand the sequence of events in a mystery or detective story, think about two time periods: the sequence of events *at the time of* the crime and the sequence of events *after* the crime.

Look for certain words and phrases in the story to help you understand the sequence, or order, of events.

once

new

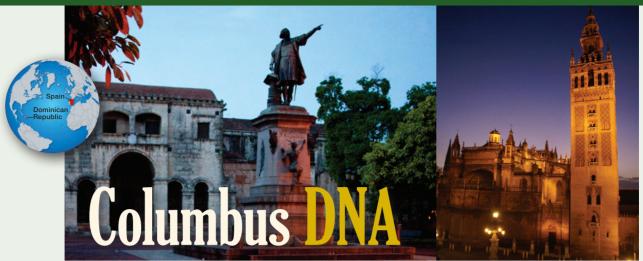
before	earlier	(one year) ago	already
Words that indica	te that one event happ	pened before another event:	
on Monday	in March	in 1991	at 5:30
Time markers suc	h as days, months, ye	ears, and times of day:	

Words that indicate that one event happened after another event: *later now*

Words and phrases	that indicate that two e	vents occurred at the sar	ne time:
at the time of	at that moment	at the same time	while
Words and phrases	that indicate that some	thing happened much ea	rlier:
a long time ago	for some time	in ancient (times)	in prehistoric (times)

- A | Analyzing. Read the information about the Iceman. Underline the words and phrases that show order. Then number the events in the order that they occurred.
 - □ Europe's oldest mummy, now known as the Iceman, was discovered by hikers in the frozen ice of the Italian Alps in 1991.
 - □ Scientists believe he lived about 5,300 years ago in an area north of what is now Bolzano, Italy.
 - □ New DNA analysis, along with X-ray and CT imaging technology, has helped scientists piece together even more clues about the life and death of this ancient Neolithic human.
- **B** | **Applying.** Reread the story "Leech Solves Robbery Case in Australia." Number the events in the order that they occurred. Think about both the sequence of events at the time of the crime and after the crime.
 - a. $\underline{\mathbf{9}}$ The suspect admitted that he committed the robbery.
 - b. _____ Police arrested a suspect on a drug charge.
 - c. _____ Police analyzed the drug charge suspect's DNA.
 - d. _____ Two men entered a house to rob the woman who lived there.
 - e. _____ The leech fell off of the robber.
 - f. _____ A leech sucked blood from a robber.
 - g. _____ Detectives found a leech filled with blood in the house.
 - h. _____ Detectives took blood out of the leech.
 - i. _____ Detectives matched the DNA from the leech with the DNA of the suspect.

VIEWING



Are the remains of Christopher Columbus buried in a cathedral in Seville, Spain (right), or in the Cathedral of Santa Maria in Domincan Republic (left)? Scientists hope to solve the mystery with the help of DNA.

Before Viewing

A Using a Dictionary. Here are some words and expressions you will hear in the video. Match each word or expression with the correct definition. Use your dictionary to help you.

conclusive presumed	contamination there's more to [so	controversy mething] than meets	outcome the eye
1	: a final result		
2	: showing that som	ething is certainly true	

- 3. _____: the process of making something dirty or polluted
- 4. _____: thought to be, assumed to be
- 5. _____: disagreement or argument about a particular subject
- 6. _____: the situation is more complex than it appears to be
- **B** | **Thinking Ahead.** What do you know about Christopher Columbus? What do you already know about DNA? Discuss with a partner.

While Viewing

Read questions 1–4. Think about the answers as you view the video.

- 1. Why were Columbus's remains moved to Hispaniola after he was originally buried in Spain?
- 2. What happened to his remains in 1795?
- 3. Why is there controversy about where Columbus is buried?
- 4. Whose bones are scientists studying in order to determine where Columbus is buried?

After Viewing

- **A** | Discuss your answers to questions 1–4 above with a partner.
 - **B** | **Critical Thinking: Synthesizing.** Think about the stories in "Tech Detectives" and the video. How has technology allowed us to discover things that we could not know before?

PREPARING TO READ

comprises	conduct	consequence	examination	identity	
infectious	obtain	sample	scholar	vulnerable	

- 1. A(n) ______ of a substance is a small amount of it that is studied and analyzed.
- 2. A(n) ______ is a person who studies an academic subject and knows a lot about it.
- 3. You can get a(n) ______ disease by being near a person who has it.
- 4. If something ______ a number of things or people, it includes or contains them.
- 5. Someone who is ______ is weak and without protection, and can be easily hurt physically or emotionally.
- 6. A(n) ______ of something is a close study of it.
- 7. Your ______ is who you are.
- 8. To ______ something is to get it.
- 9. If you ______ an investigation or an activity, you organize it and do it.
- 10. A(n) ______ of something is a result or an effect of it.

B | Using Vocabulary. Discuss these questions with a partner.

- 1. What are some possible **consequences** of committing a crime?
- 2. What are some things that can make a person vulnerable to illness?
- 3. What kinds of things can a person show or do to prove his or her identity?

C | **Brainstorming.** What do you already know about Egyptian pharaohs and King Tutankhamun? List ideas in a small group.

D | **Predicting.** Read the title and the headings in the reading passage on pages 34–38 and answer the question. As you read, check your prediction

What major mysteries does the passage investigate?

- a. what the pharoah's political career was like
- b. what caused the pharoah's death
- c. who the pharoah's family members were

Word Link

com-/con- =
together, with:
comprise, combine,
compact, companion,
conceive, conduct,
consequence,
consensus, construct

READING

King Tut's Family Secrets

DNA evidence reveals the truth about the boy king's parents and new clues to his mysterious death.

by Zahi Hawass, Egyptian Minister of State for Antiquities

track 1-04

Α

As an archaeologist and scholar of ancient Egyptian history, I have conflicting feelings about conducting scientific research on mummies. On the one hand, I believe that we should honor these ancient dead and let them rest in peace. On the other hand, there are some secrets of the ancient Egyptian kings, or pharaohs, that we can learn only by studying their mummies. Let me use the example of King Tutankhamun to illustrate what I mean.

Unlocking a Mystery

When Tutankhamun died about 3,000 years ago, he was secretly buried in a small tomb in a desert area near what is now the city of Luxor. When the tomb was rediscovered in 1922, the king's treasures—more than 5,000 artifacts¹—were still inside. Among the artifacts was the pharaoh's solid gold coffin holding his mummified remains. There was a gold mask of the king and a golden fan showing him riding a chariot and hunting birds. There were also 130 staffs, or walking sticks. Mysteriously, there were also two mummified fetuses² found in the tomb. Another mystery: an examination of Tutankhamun's mummy revealed a hole in the back of his skull. Could it be related to the cause of his death?

These mummies and artifacts were an extremely important archaeological discovery, but they did not answer many questions about the young pharaoh and his family. How did he die? Who were his mother and father and his wife? Were the two mummified fetuses his unborn children? To solve these mysteries required further study and the use of modern technology.

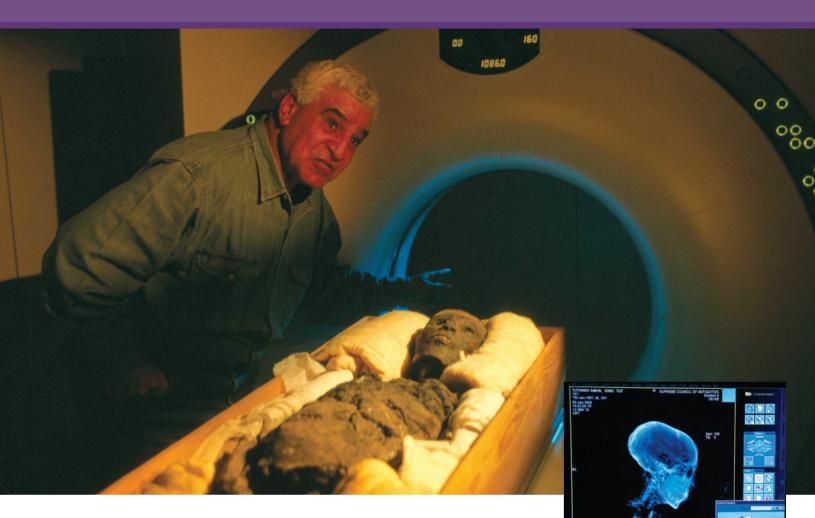
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CT Scans and DNA Analysis

In 2005, my colleagues and I carried out CT scans³ of Tutankhamun's mummy. We were able to show that the hole in Tutankhamun's skull was not the cause of his death, but was made during the

В



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 Dr. Zahi Hawass, shown above preparing Tutankhamun's body for a CT scan (right), was the leader of the archaeological team investigating the king's family secrets.

mummification process. Our study also showed that Tutankhamun died when he was only 19, soon after fracturing his left leg. However, the CT scans alone could not solve the mystery of how the king died, or why he died so young.

In 2008, my colleagues and I decided to analyze samples of Tutankhamun's DNA extracted from bone tissue of his mummy. Early in the study, our team made some new discoveries: Tutankhamun's left foot was clubbed,⁴ one toe was missing a bone, and bones in part of the foot were destroyed by a condition known as necrosis, or tissue death. The club foot and bone disease would have made it difficult for the young king to walk. The discovery shone light on why so many staffs had been found in Tutankhamun's tomb. Some scholars had argued that the staffs were symbols of power. Our DNA study showed that the king did not just carry staffs as symbols of power. He also needed them to walk.

E

Our team also tested Tutankhamun's mummy for evidence of infectious diseases. We found the presence of DNA from a parasite⁵ called *Plasmodium falciparum*, which meant that Tutankhamun suffered from malaria. Did malaria kill the king? Perhaps. Its most serious forms can lead to death. My opinion, however, is that Tutankhamun's health was endangered the moment he was born. To explain what I mean, let me describe our study of Tutankhamun's royal family.

- ¹ An **artifact** is an ornament, a tool, or other object that is made by a human being, especially one that is culturally or historically interesting.
- ² A fetus is an animal or a human being in its later stages of development before it is born.
- ^a A CT scan, or CAT scan, is an image that can show cross-section views of the inside of a person's body.
- ⁴ When a foot is **clubbed**, it is deformed so that the foot is twisted inward and most of the person's weight rests on the heel.
- ⁵ A parasite is a small animal or plant that lives on or inside a larger animal or plant.



Tracing Tut's Family Tree

G

H

J

Our team analyzed Tutankhamun's DNA and that of ten other mummies we believed were members of his royal family. We knew the identities of three members of his family—Amenhotep III as well as Yuya and Tuyu (the parents of Amenhotep III's wife, Tiye). The other seven mummies were unknown. They comprised an adult male and four adult females found in tombs near Tutankhamun's, and the two fetuses in Tutankhamun's tomb.

We first obtained DNA samples from the male mummies to solve the mystery of Tutankhamun's father. Many scholars believed his father was the pharaoh Akhenaten, but the archaeological evidence was unclear. Through a combination of CT scans and a comparison of DNA, our team was able to identify Amenhotep III and Tiye, one of the unidentified female mummies, as the grandparents of Tutankhamun. Moreover, our study revealed that the unidentified male adult mummy was almost certainly Akhenaten, a son of Amenhotep III and Tiye. This supported the theory that Akhenaten was Tutankhamun's father.

What about Tutankhamun's mother? We discovered that the DNA of one of the unidentified female mummies matched that of the young king. To our surprise, her DNA proved that, like Akhenaten, she was a child of Amenhotep III and Tiye. This meant that Akhenaten's wife was his own sister—and Tutankhamun was their son.

How Did Tut Die?

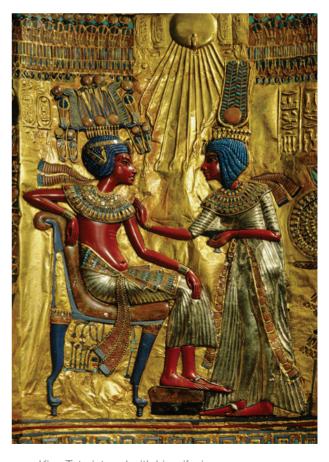
As I mentioned earlier, I believe that Tutankhamun's health was compromised⁶ from birth. As our study showed, his mother and father were brother and sister. Such a relationship was not uncommon among royal families in ancient Egypt, as it offered political advantages. However, it also had dangerous consequences. Married siblings are more likely to pass on harmful genes, leaving their children vulnerable to a variety of genetic defects.⁷ Tutankhamun's clubbed foot and bone disease may therefore have been genetic conditions. These problems, together with an attack of severe malaria or a leg broken in an accident, may have combined to cause the king's premature⁸ death.

While the data are still incomplete, our study also suggests that one of the mummified fetuses is Tutankhamun's daughter and that the other may also be his child. We have only partial data from the two other unidentified female mummies. One of these may be the mother of the infant mummies and Tutankhamun's wife, possibly a woman named Ankhesenamun. We know from history that she was the daughter of Akhenaten and his wife, Nefertiti, and therefore probably was Tutankhamun's half sister. The two unborn children may have been the result of another genetic defect, one which did not allow Tutankhamun and Ankhesenamun to conceive a living heir.⁹

⁶ If someone's health is compromised, it is weakened.

Κ

- ⁷ Genetic defects are health problems that are inherited, or passed down, through a family line.
- ⁸ Something that is **premature** happens earlier than people expect.
- ⁹ An heir is someone who has the right to inherit a person's money, property, or title when that person dies.



 King Tut pictured with his wife, in a scene from the pharoah's golden throne.



An End . . . and a New Beginning

After Tutankhamun's death, a new pharaoh, Ramses I, came to power, marking the start of a new dynasty.¹⁰ Under his grandson, Ramses the Great, Egypt rose to new heights of imperial power. As their power grew, the rulers of this new dynasty tried to erase all records of Tutankhamun and his royal family from history. Through ongoing DNA research, our team seeks to honor the members of Tutankhamun's family and keep their memories alive. Tutankhamun's treasures, including this decorated collar (below) and golden mask (above), continue to draw crowds of tourists to the Egyptian Museum in Cairo.



L

¹⁰ A **dynasty** is a series of rulers of a country who all belong to the same family.

UNDERSTANDING THE READING

- **A** | **Identifying Main Ideas.** Write the paragraph letter for each of these main ideas from the reading.
 - 1. _____ Hawass and his team studied King Tut's DNA and found out that he had a bone disease.
 - 2. ____ King Tut's health may have been weakened because his parents were brother and sister.
 - 3. _____ Hawass decided to use technology to answer some questions remaining from the discovery of King Tut's tomb.
 - 4. _____ Hawass and his team used DNA samples to try to determine who King Tut's father was.
 - 5. _____ Hawass has conflicting feelings about studying mummies.
 - 6. _____ Hawass's analysis of King Tut's DNA revealed that he had suffered from malaria.

B | Identifying Meaning from Context. Find and underline the following words in the reading passage on pages 34–38. Use context to help you identify the part of speech and meaning of each word. Write your answers, and then check your ideas in a dictionary.

1.	honor (paragraph A)	Part of speech:
2.	illustrate (paragraph A)	Part of speech:
	Meaning:	-
З.	tomb (paragraph B)	Part of speech:
	Meaning:	
4.	staffs (paragraph B)	Part of speech:
	Meaning:	
5.	mummification (paragraph D)	Part of speech:
	Meaning:	
6.	fracturing (paragraph D)	Part of speech:
	Meaning:	
7.	siblings (paragraph J)	Part of speech:
	Meaning:	

- **C** | **Identifying Supporting Details.** Find details in the reading passage and the photos to answer the following questions.
 - 1. Who were Tutankhamun's parents?
 - 2. Who might have been Tutankhamun's wife?
 - 3. According to the reading, what is one possible reason why Tutankhamun and his wife did not have any living children?
 - 4. What are two medical problems that Tutankhamun had?

LESSON B

UNDERSTANDING THE READING

- 5. Hawass believes that Tutankhamun's health was weak from the moment he was born. Why does he think so?
- **D** | Identifying a Sequence of Events. Number these events in the order that they occurred. Look for words and phrases in the reading that show sequence of events. Think about both the time period when King Tut lived and the time of Hawass's team's research.
 - 1. _____ Hawass and his team discovered that Tutankhamun had a club foot and bone disease.
 - 2. ____ Hawass and his team decided to study DNA from Tutankhamun's mummy.
 - 3. _____ Tutankhamun's tomb was rediscovered.
 - 4. _____ A hole was made in Tutankhamun's skull.
 - 5. <u>1</u> Tutankhamun died.
 - 6. _____ Hawass and his team extracted DNA from the male mummies in the tomb.
 - 7. _____ Hawass and his team made CT scans of Tutankhamun's mummy.
 - 8. _____ Hawass and his team studied DNA from one of the female mummies in the tomb.
- **E** | **Critical Thinking: Distinguishing Fact from Speculation.** Read these statements about the reading. Write **F** for *fact* or **S** for *speculation* next to each one. Circle the words that support your answers.
 - 1. _____ When the tomb was rediscovered in 1922, the king's treasures—more than 5,000 artifacts—were still inside.
 - 2. _____ We were able to show that the hole in Tutankhamun's skull was not the cause of his death.
 - 3. _____ Early in the study, our team made a new discovery—bones in part of the foot were destroyed by a condition known as necrosis.
 - 4. ____ Did malaria kill the king? Perhaps.
 - 5. _____ My opinion is that Tutankhamun's health was endangered the moment he was born.
 - 6. _____ To our surprise, the unidentified female mummy's DNA proved that, like Akhenaten, she was a child of Amenhotep III and Tiye.
 - 7. _____ Tutankhamun's clubbed foot and bone disease may have been genetic conditions.
 - 8. _____ One of these mummies may be the mother of the infant mummies and Tutankhamun's wife, possibly a woman named Ankhesenamun.

F | Critical Thinking: Synthesizing. Discuss answers to these questions in a small group.

- 1. What technologies were mentioned in both reading passages in this unit?
- 2. How is Hawass's team's examination of Tutankhamun similar to scientists' examination of the Iceman? How are the investigations different?
- **G** | **Critical Thinking: Inferring Attitude.** Discuss answers to these questions in a small group.
 - 1. Why does Hawass have "conflicting feelings" about studying mummies?
 - 2. Why do you think he decided to study the mummies in Tutankhamun's tomb?

EXPLORING WRITTEN ENGLISH

GOAL: Writing an Opinion Paragraph

In this lesson, you are going to plan, write, revise, and edit a paragraph on the following topic: *Should scientists conduct scientific research on mummies?*

A | Brainstorming. Reread the first paragraph of the reading on page 34. Think of some reasons why scientists *should* and *should not* conduct scientific research on mummies. List your ideas in the chart.

Reasons Why Scientists Should Conduct Research on Mummies Reasons Why Scientists Should Not Conduct Research on Mummies

to understand how they died

to honor the dead

Free Writing. Look at your brainstorming notes and decide whether you feel scientists should or should not conduct research on mummies. Choose one or two ideas from your notes and write for five minutes. Develop your arguments to support your opinion.

B | Read the information in the box below. Then complete the paragraph on page 42 with modals of obligation and possibility.

Language for Writing: Review of Modals of Obligation and Possibility

When writers express an opinion, they sometimes use the modal *should* to talk about an **obligation**, or the best thing to do.

On the one hand, I believe that we **should** honor these ancient dead people and let them rest in peace.

Writers may also use the modals of **possibility** *might* and *could* to support their reasons by showing the potential results of the action they recommend. Note that *could* is also the past tense form of *can*.

We **could** learn more about the prehistoric world if scientists received government funds to conduct further studies of the Iceman.

Remember that modals are followed by the base form of a verb.

Many people believe that all crime suspects ______ give DNA samples to the police. Moreover, some governments want to pass laws requiring all possible suspects to provide DNA samples. I believe that people _______ not be required to give samples of their DNA in these situations. First, there is the possibility that a technician _______ misread a DNA sample in the laboratory. For example, if the technician is tired, he _______ state that there is an 80 percent match between the suspect's DNA and the DNA found at a crime scene when in fact there is only an 8 percent match. Because the person is a possible suspect, saying the match is 80 percent accurate _______ lead police to believe that the person committed the crime. This mistake _______ lead to the conviction of an innocent person—that is, a person who did not commit the crime. The other reason I believe governments _______ have simply been at the crime location by chance. However, the existence of an innocent person's DNA at the crime scene _______ lead to a conviction.

C | **Applying.** Write 3–4 sentences giving your opinion on the issue discussed above: Should all crime suspects have to give DNA samples to the police? Give reasons for your opinion.

Writing Skill: Planning an Opinion Paragraph

When you are giving your opinion about a topic in a paragraph, be sure to include the following three elements:

A topic sentence: a sentence that clearly states your opinion on the topic (This is often—but not always—the first sentence of the paragraph.)

Supporting ideas: sentences that give reasons for your opinion

Details: examples that support your reasons (The expressions for *example,* or for *instance* are often used to give details.)

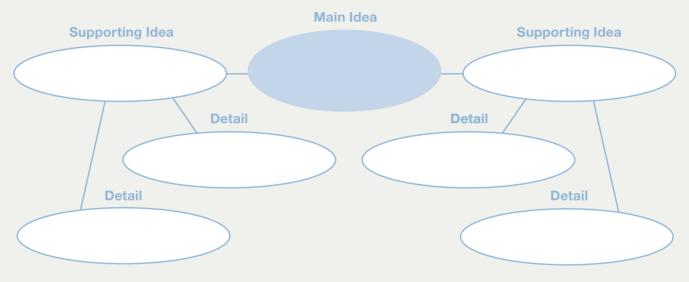
(See Unit 1 page 19 for more on paragraph writing.)

D | Identifying Parts of an Opinion Paragraph. In the paragraph above from exercise **B**, circle the topic sentence and underline the supporting ideas. Check (✓) the sentence(s) with a detail or an example.

- E | Critical Thinking: Analyzing. The sentences below belong in one paragraph about eyewitness accounts. Eyewitness accounts are reports given in court by people who witnessed, or saw, a crime occur. Read the sentences and, for each one, write T for topic sentence, S for supporting idea or reason, or D for detail or example.
 - a. I do not believe that eyewitness accounts should be used in trials.
 - _____b. For instance, our memory might change when we receive additional information about an event we experienced in the past.
 - _____ C. Another reason is that witnesses sometimes believe that if the police think a suspect committed a crime, that person must be guilty.
 - _____ d. One reason is that research shows we do not always remember things exactly the way they actually happened.
- **F** | Now use the sentences from exercise **E** to write a paragraph.

LESSON C WRITING TASK: Drafting and Revising

- **A** | **Planning.** Follow the steps to make notes for your paragraph.
 - Step 1 Think about this question: Should scientists conduct scientific research on mummies? Write your opinion in the center of the idea map. Your opinion will be the main idea of your paragraph.
 - **Step 2** Decide the two best supporting ideas that give information about your opinion. Note these ideas in the idea map.
 - **Step 3** Think of two details that explain each supporting idea. Note these details in the idea map.



- **B** | **Draft 1.** Use your idea map to write a first draft of your paragraph on the topic: *Should scientists conduct scientific research on mummies?*
- **C** | **Revising.** The following paragraphs **a** and **b** express an opinion about national DNA databanks.

(DNA databanks are collections of DNA information about all of the individuals in a country.) Some people think governments should require everyone to provide their DNA. Others think this is a bad idea.

Which is the first draft? _____ Which is the revision? _____

In my opinion, people should be required to give DNA samples to be kept in a national databank. First of all, it would save time and money. Currently in many countries, people cannot be forced to provide a DNA sample, even if they are accused of a crime. With a DNA databank, police might be able to identify criminals more quickly and easily if they had access to everyone's DNA information. Investigations could take less time and fewer resources, and this would save the government and taxpayers money. Second, it could help people be healthier and live longer. If doctors had access to their patients' DNA information, they might be able to determine what diseases a patient might get. For example, DNA information might tell a doctor that a patient is likely to develop cancer. Then that patient could receive cancer screenings every year in order to catch the cancer and treat it in its early stages.

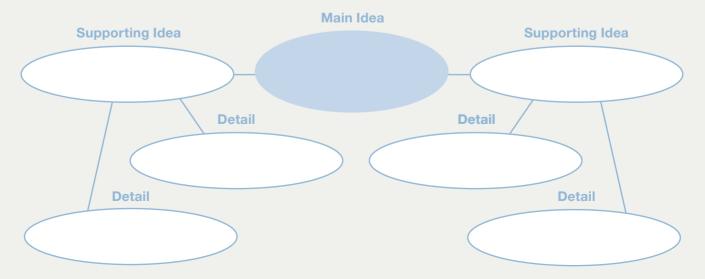
- Б Some people believe strongly in the importance of national DNA databanks. Others don't believe that DNA databanks should exist. People on both sides of the issue have strong reasons for their opinions. In fact, the topic has sparked many debates in the legal community. If people were required to give DNA samples that were to be kept in a national databank, it would save time and money. Currently in many countries, people cannot be forced to provide a DNA sample, even if they are accused of a crime. With a DNA databank, police might be able to identify criminals more quickly and easily if they had access to everyone's DNA information. Investigations could take less time and fewer resources, and this would save the government and taxpayers money. Second, it could help people be healthier and live longer.
- D | Critical Thinking: Analyzing. Work with a partner. Compare the two paragraphs by answering the following questions about each one. Check (\checkmark) the column(s).

1. Does the paragraph have one main idea?	Υ	Ν	Υ	Ν	
2. Is there a topic sentence that states the writer's opinion about the topic?	Υ	Ν	Υ	Ν	
3. Does the paragraph include at least two reasons for the writer's opinion?	Υ	Ν	Υ	Ν	
4. Are there details and examples that support both reasons?	Y	Ν	Υ	Ν	
5. Are modals of obligation and possibility used correctly?	Υ	Ν	Υ	Ν	

Now discuss your answer to this question: Which paragraph is better? Why?

E | **Revising.** Answer the questions above about your own paragraph.

- **Peer Evaluation.** Exchange your first draft with a partner and follow the steps below. F
 - Step 1 Read your partner's paragraph and tell him or her one thing that you liked about it.
 - Step 2 Complete the idea map below showing your partner's opinion, supporting ideas, and details.



Б

LESSON C WRITING TASK: Editing

- **Step 3** Compare this idea map with the one that your partner created in exercise **A** on page 44.
- **Step 4** The two idea maps should be similar. If they aren't, discuss how they differ.
- **G** | **Draft 2.** Write a second draft of your paragraph. Use what you learned from the peer evaluation activity and your answers to exercise **E**. Make any other necessary changes.
- **H** | **Editing Practice.** Read the information in the box. Then find and correct one mistake with modals of obligation and possibility in each of the sentences (1–5).

With modals of obligation and possibility, remember to:

- use *should* or *should not* to express an opinion about the best thing to do or not to do (obligation).
- use *might* or *could* to show potential (possible) results of an action.
- follow a modal with the base form of a verb.
- 1. If governments had national DNA databanks, police could finding criminals more easily.
- 2. In my opinion, no one could have to give DNA samples to the police.
- 3. Dishonest detectives might going to use DNA information in illegal ways.
- 4. I think researchers could continue to study the Iceman to learn more about the lives of people in prehistoric times.
- 5. Some researchers want to do CT scans of other pharaohs' mummies. It is possible the scans should prove how the pharaohs died.
- **I Editing Checklist.** Use the checklist to find errors in your second draft.

Editing Checklist	Yes	No
1. Are all the words spelled correctly?		
2. Is the first word of every sentence capitalized?		
3. Does every sentence end with the correct punctuation?		
4. Do your subjects and verbs agree?		
5. Did you use modals of obligation and possibility correctly?		
6. Are verb tenses correct?		
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J | Final Draft. Now use your Editing Checklist to write a third draft of your paragraph. Make any other necessary changes.