Medical Innovators

ACADEMIC PATHWAYS

- Lesson A: Finding subjects in complex sentences Making inferences
- Lesson B: Understanding an article on technology
- Lesson C: Researching information for an essay Writing a research-based essay

Think and Discuss

- 1. In what ways has the treatment of disease and other illnesses changed over the past 100 years?
- 2. What kinds of breakthroughs, or innovations, do you think will happen in the next 100 years?

 A scientist holds a test tube at a molecular research laboratory, in Maryland, USA.

UNIT

Exploring the Theme

- **A.** Without reading the information in the time line, what do you think was the most important medical innovation of all time?
- **B.** Now read the information in the time line and discuss the questions.
 - 1. Before 400 BC, what was believed to cause disease?
 - 2. What was one of Ibn Sina's major contributions to medicine?
 - 3. How did the classification of blood types affect patient care?
 - 4. Think about your answer to the question in **A**. Is your answer still the same? Why, or why not?

A Time Line of Medical Innovations

1025 Experimental Medicine

Ibn Sina (left), also known as Avicenna, was a Persian philosopher-physician who wrote a five-volume medical work, *The Canon of Medicine*. The work put forward the basic rules of experimental medicine: Each drug should be tested in patients with a single medical condition; the doctor should begin with the smallest dose; and effective drugs should have a consistent effect.

1000

400 в.с. Scientific Study of Medicine

The Greek physician **Hippocrates** first recognized that disease is caused by a patient's environment, diet, and/or daily habits, not by a spiritual problem. Many scholars regard his discovery as the origin of modern medicine.

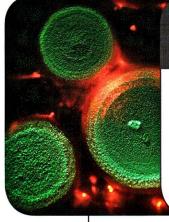
4th century A.D. First Hospitals

The earliest hospitals with trained doctors appeared in the fourth century in the Byzantine Empire (modern-day Turkey). By the ninth century, hospitals were common in Islamic cities such as Baghdad, Damascus, and Cairo.



1846 Anesthesia

An American dentist named **William Morton** was the first person to anesthetize a patient, using a gas called ether. The patient fell asleep and felt no pain while Morton extracted his rotten tooth.



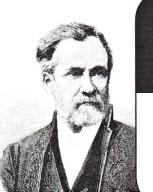
1928 Penicillin

The Scottish biologist **Alexander Fleming** discovered the effect of penicillin on bacteria. It is still used today as a powerful weapon against infection.

▲ A magnified view of mold in a teapot. The discovery of the antibiotic potential of molds led to the use of penicillin to fight infection.

1628 Theory of Blood Circulation

English physician William Harvey proved that the beating heart drives the body's blood circulation.



1859 Germ Theory of Disease

The work of French chemist and biologist **Louis Pasteur** (left) revealed how germs can infect and sicken a person.

1954 Organ Transplant

Doctors at a hospital in Boston, USA, performed the world's first successful organ transplant when they removed a healthy kidney from one man and placed it in his identical twin.

2000

1500

1867 Antiseptic Surgery

Until the mid-nineteenth century, about half of all surgery patients died following an operation. The English surgeon **Joseph Lister** realized it was not contact with the air itself that caused the deaths, but "minute organisms suspended in it." He successfully applied carbolic acid to kill the organisms that caused wound infection.

1901 Classification of Blood Types

In 1901, Austrian pathologist **Karl Landsteiner** began a series of experiments that resulted in the discovery of blood types A, B, and O; a year later, two of his colleagues identified the fourth basic type, AB. The discoveries helped explain why, until then, only certain types of blood transfusions were successful.

LESSON A PREPARING TO READ

- **A** | **Building Vocabulary.** Find the words in **blue** in the reading passage on pages 167–169. Use the context to guess their meanings. Then match the sentence parts below to make definitions.
 - 1. ____ If something or someone assists you,
 - 2. ____ If you are **capable** of doing something,
 - When you compile something such as a report, a book, or a program,
 - 4. ____ A document is
 - 5. _____ If you describe something as general,
 - 6. ____ If you manage to do something,
 - 7. _____ A manual is a book that explains
 - If someone is a pioneer of something,
 - 9. ____ If you translate something,
 - 10. _____ A **volume** is

- a. he or she is one of the first people to be involved in it.
- b. a written, printed, or electronic text that provides information.
- C. you have the skills or ability to do it.
- d. they help you to do something.
- e. you say or write it again in another language.
- f. you are able to do it, even though it is difficult.
- g. you produce it by collecting and putting together many pieces of information.
- h. you mean that it is not limited to any one thing or area.
- i. how to do something, or how a piece of machinery works.
- j. one book in a series of books.
- **B** | Using Vocabulary. Answer the questions. Share your ideas with a partner.

1. What kinds of things have you used a manual for?

- 2. When you want to **translate** something into your own language, what is your favorite resource? What kinds of things do you usually translate?
- 3. Describe a time when you managed to do something difficult.

C | **Brainstorming.** Discuss your answers to these questions in small groups.

- 1. Think of some innovators that you are aware of. What are some of their characteristics? Why do they invent the tools and techniques that they do?
- 2. How do you think medical knowledge has been passed down over the centuries?
- **D** | **Predicting.** Look at the pictures, read the title, and skim the reading passage on pages 167–169. What do you think the reading is about? As you read, check your prediction.
 - a. a medical innovator who lived in Spain many years ago
 - b. the man who built the first hospital in Europe
 - c. a doctor who found a cure for a common disease

Word Link *trans- = across:* transfer, transit, transition, translate

READING

The Laalap Fridada

track 2-05

A

10

IT IS THE YEAR 1005. In the Andalusian¹ city of Medina Azahara, a woman is giving birth. Through the window of the delivery room, she can see the city's elaborate² columns, fountains, and finely polished marble terraces.³ Her heart is pounding because she fears this is the last time she will see them. However, she has great faith in her doctor.

The doctor's name is al-Zahrawi, and, in later years, he will be known to Europeans as Abulcasis, one of the great pioneers of surgery. At the moment, all of al-Zahrawi's attention is focused on the difficult birth. He sees that the baby must be turned before it can pass through the birth canal. From his medical bag, he takes out a tool that he made himself—a pair of forceps with a semicircular end designed to pull the fetus from the mother. In fact, he pioneered the use of forceps about 50 years earlier, when he was just starting his medical career. "Will my baby live?" the desperate mother manages to ask between contractions.⁴ "Almost certainly," the doctor answers. "You have a healthy boy. But this next moment is going to be painful." The mother is happy to hear that her baby will live but, as the doctor warned, the pain is terrible. It is so strong that she loses consciousness for a few moments, but soon she is awakened by her baby's healthy cry.

- **1 Andalusia** is a region of southern Spain; during the medieval period of Muslim influence in Spain, the area was known as Al-Andalus.
- ² If something is **elaborate**, it is richly decorated with a lot of detail.
- ³ A terrace is a flat area of stone or grass next to a building.
- ⁴ Contractions are the tightening of the muscles of the uterus during childbirth.

D

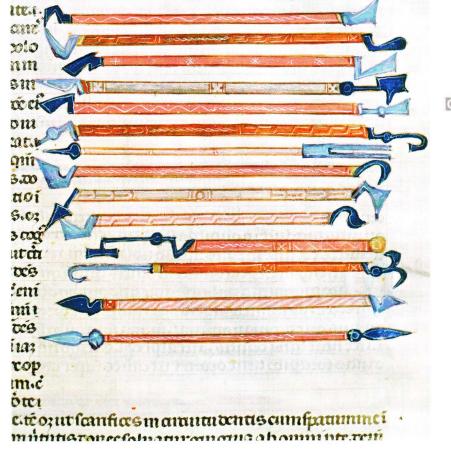
III.

The Method of Medicine

The forceps that al-Zahrawi used in the successful delivery are just one of 200 surgical instruments described in his work *Al-Tasrif*, or *The Method of Medicine*. Many of the instruments and techniques described in its pages were invented by al-Zahrawi himself. Born in Córdoba in 936, al-Zahrawi worked as a royal court physician at the height of Muslim civilization in Spain. During his decades-long career, he compiled huge amounts of medical knowledge based on existing texts and his own experience.

Al-Zahrawi brought all his knowledge together in the 30 volumes of *Al-Tasrif*, a compilation of everything that was known about medicine at the time. The collection begins with general concepts, then goes

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on to describe hundreds of topics including food and nutrition, skin diseases, and poisons. The final, and longest, volume deals with surgery and includes treatments for head and spinal injuries as well as techniques for amputating⁵ a limb without killing the patient.

The compilation also includes the world's first illustrations of surgical instruments—sketches of various surgical hooks, knives, scissors, and forceps many of which look very familiar today. Although surgery was still dangerous and painful, al-Zahrawi's tools would have helped to treat patients suffering from bone diseases, bladder⁶ stones, and wounds, as well as assisting in childbirth. One of al-Zahrawi's most significant inventions was the systematic use of catgut⁷ for stitching⁸ a patient internally after surgery.

Catgut was found to be the only natural substance capable of dissolving⁹ and being accepted by the body, and it is still used in surgeries today.

Al-Zahrawi described his instruments and methods in order to share his knowledge with others, including doctors who came after him. However, he may not have been aware of the extent to which his carefully documented knowledge would educate and inform surgeons centuries after his death. Amazingly, given its importance and influence, al-Zahrawi's single, handwritten copy of *Al-Tasrif* was almost lost forever during an attack on Medina Azahara in 1010, when many

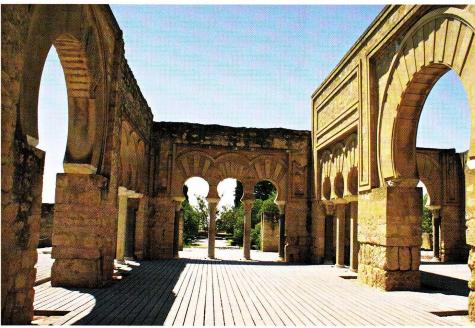
buildings and documents were destroyed. Fortunately, al-Zahrawi's work was saved. Over the next several decades,

- ⁵ Amputating a person's arm or leg means cutting all or part of it off in an operation.
- ⁶ Your **bladder** is the part of your body where urine is stored.
- ⁷ Catgut is a strong cord or thread made from the intestines of animals, usually sheep.
- ⁸ Stitching is using a needle and thread to close a wound or join two pieces of something together.
- ⁹ Dissolving is melting away or disappearing.
- Surgical instruments illustrated in a page from al-Zahrawi's Al-Tasrif (The Method of Medicine)



it was secretly passed from person to person. Eventually al-Zahrawi's writings were translated into Latin from its original Arabic, and, more than four centuries after they were written, parts of the work were finally printed in 1471.

The printed translation enabled al-Zahrawi's innovations and observations to spread throughout Europe, where they had an enormous influence on medicine and surgery. *The Method of Medicine* was used as a manual for surgery in medical schools for centuries. Al-Zahrawi's legacy¹⁰ can still be seen in many of the techniques and tools used in modern hospitals, and he continues to be regarded today as the "father of modern surgery."



 The ruins of Medina Azahara Palace, near Córdoba, Spain

¹⁰ A person's **legacy** is something that a person does or creates that will continue to exist after he or she is dead.

LESSON A UNDERSTANDING THE READING

A | Identifying Main Ideas. Skim the reading again. Write the correct paragraph letter next to each main idea.



- _____ 1. Al-Zahrawi described medical techniques and instruments such as forceps in *The Method of Medicine*.
- 2. Al-Zahrawi's 30-volume set of books explains general ideas about medicine, and specific concepts such as surgery and skin diseases.
- 3. After it was translated and printed, al-Zahrawi's work helped doctors for centuries, and it even influences medicine today.
- _____ 4. A doctor named al-Zahrawi helps a woman through a difficult birth using forceps that he designed.
- ____ 5. The doctor's important collection of knowledge was almost destroyed, but it was saved and then translated into Latin.

CT Focus: Making inferences

Based on information the writer provides, you can **make inferences**, or guesses, as you read. For example, you can make inferences about a writer's **intended audience**. Ask yourself: What does the writer assume the audience knows or doesn't know? Is he or she writing for a general audience—people interested in many things? Or a specific audience—people with a particular interest or skill? You can also make inferences about the writer's **purpose**. Why does the writer include particular information? How does the information explain his or her purpose?

🎽 B

B | **Critical Thinking: Making Inferences.** Answer the questions and discuss your answers with a partner.

- 1. Which description best fits the writer's intended audience? Why do you think so? Look for evidence in the article to support your answer.
 - a. a general audience who is not familiar with al-Zahrawi
 - b. medical professionals who are familiar with al-Zahrawi
- 2. The writer begins with an anecdote, or a personal story, in paragraphs A–C. What is his purpose for including this anecdote? Circle all the statements that apply.
 - a. to show what the state of medicine was like in this place and time
 - b. to show al-Zahrawi's professional and personal skills as a doctor
 - C. to show how dangerous it was to have a baby at this time

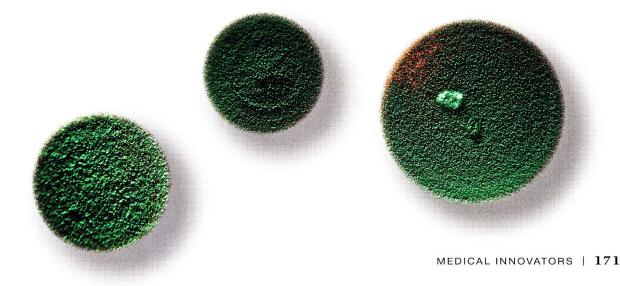
- C | Identifying Key Details. Answer the questions about "The Healer of Córdoba."
 - 1. Where did al-Zahrawi live?
 - 2. When was he born?
 - 3. What was the name of his collection of books? How many volumes did it have?

4. What are three things that he invented, designed, or was the first to do?

- 5. When and how was his work almost destroyed?
- 6. How was the information in al-Zahrawi's work passed on to the rest of the world?

D | Discussing Ideas. Discuss these questions in a small group.

- 1. In what ways do you think modern medicine might be different if *The Method of Medicine* had been destroyed in 1010?
- 2. Al-Zahrawi's knowledge was almost lost. Do you think it's possible to lose important scientific information like this today? How can we protect valuable knowledge from being lost?
- 3. Can you think of any other book, or books, that had a major impact on science or society? Why were they significant?



Reading Skill: Finding Subjects in Complex Sentences

Sometimes it can be difficult to identify the subject of a complex sentence. A complex sentence has an independent, or main, clause and one (or more) dependent, or subordinate, clauses. An independent clause is one that has a subject and a verb and can stand alone as a sentence. A dependent clause also has a subject and a verb. It modifies, or gives more information about, the independent clause. A dependent clause does not express a complete thought, and it cannot stand alone as a complete sentence.

Dependent clauses often begin with words and phrases such as after, although, as, because, before, even if, even though, if, in order to, once, rather than, since, so, that, than, though, unless, until, whatever, when, where, while, who, and why.

When you read a complex sentence, ask yourself these questions:

- Which clause is the main, or independent, clause?
- What is the subject and verb of this clause?

independent clause

dependent Clause

<u>Al-Zahrawi was a doctor</u> who lived in Spain during the 10th and 11th centuries.

dependent	independent
In order to improve medical treatments,	he invented many instruments and techniques.

- A | Applying. Read the sentences about the reading passage. For each sentence, underline the main clause and circle its subject.
 - 1. (Her heart) is pounding because she fears this is the last time she will see the city.
 - 2. The pain is so strong that she loses consciousness for a few moments.
 - 3. In fact, al-Zahrawi pioneered the use of forceps about 50 years earlier, when he was just starting his medical career.
 - 4. During his decades-long career, he compiled huge amounts of medical knowledge based on existing texts and his own experience.
 - 5. The book also includes the world's first illustrations of surgical instruments—sketches of various surgical hooks, knives, scissors, and forceps—many of which look very familiar today.
 - 6. Although surgery was still dangerous and painful, al-Zahrawi's tools would have helped to treat patients suffering from bone diseases, bladder stones, and wounds.
 - 7. Amazingly, given its importance and influence, *Al-Tasrif* was almost lost forever during an attack on Medina Azahara in 1010.
 - 8. The printed translation enabled al-Zahrawi's innovations and observations to spread throughout Europe, where they had an enormous influence on medicine and surgery.

VIEWING

Healthcare Innovator

Before Viewing

A | Using a Dictionary. Here are some words and phrases you will hear in the video. Match each one with the correct definition. Use your dictionary to help you.



attachment	close to	diagnose	mitigate	monitor	process
1.	: make	something les	ss severe, painf	ful, or serious	
2		ice that can be to enable it to			e in
3	: regu	arly check the	progress of so	mething	
4	: ident	ify (an illness o	or a disease)		
5	: put i	nformation int	o a computer i	in order to org	ganize or read it
6	: almo	st, approximat	ely		

B | **Thinking Ahead.** Read the caption for the photo. How do you think a cell phone might be useful for testing people's health? Discuss with a partner.

While Viewing

A | Read questions 1–3. Think about the answers as you view the video.

- 1. Why are infectious diseases so dangerous?
- 2. According to Aydogan Ozcan, more than what percent of cell phones are used in developing parts of the world?
- 3. Why is the cell phone a good device to use as a diagnostic tool?
- **B** | Number the steps for using the cell phone as a diagnostic tool in the correct order (1–4).
 - _____ Send the result to a central server. ______ Click on the image of the diagnostic test.

_____ Insert the attachment onto the back of the phone. _____ Click on "Malaria."

After Viewing

A | Discuss your answers to exercises **A** and **B** above with a partner.

B | **Critical Thinking: Synthesizing.** What do Aydogan Ozcan and al-Zahrawi have in common?

People in developing countries often live very far away from hospitals. Aydogan Ozcan is using existing technology to enable traveling healthcare workers to use cell phones to test people for infectious diseases.

LESSON B

PREPARING TO READ

A | Building Vocabulary. Find the words and phrases in blue in the reading passage on pages 175–178. Use the context to guess their meanings. Then write the correct word or phrase from the box to complete each sentence.

adjacent	laboratory	option	procedure	reject
replacement	seek to	solution	sphere	transplant

- 1. A(n) ______ is a building or a room where scientific experiments and research are carried out.
- 2. If you ______ do something, you try to do it.
- 3. If two things are _____, they are next to each other.
- 4. A(n) ______ is an object that is completely round in shape, like a ball.
- 5. One thing or person that takes the place of another can be referred to as a(n)
- 6. A(n) ______ is a liquid in which a solid substance has been dissolved.
- 7. A(n) ______ is a way of doing something, especially the usual or correct way.
- 8. A(n) ______ is a medical operation in which a person receives a new body part.
- 9. If you ______ something, you do not accept it.
- 10. A(n) ______ is a choice between two or more things.
- **B** | Using Vocabulary. Discuss these questions with a partner.
 - 1. What options are you considering for your future career?
 - 2. What are some things in your house or school that sometimes need replacement?
 - 3. Describe a procedure that you know well. Explain it to your partner.
- **C** | **Brainstorming.** Discuss these questions with a partner.

What do you already know about organ transplants? What do you already know about cancer treatments such as radiation, chemotherapy, and surgery?

- **D** | **Predicting.** Read the title and the headings and look at the photos in the reading passage on pages 175–178. What is the passage about? As you read, check your prediction.
 - a. some recent medical innovations
 - b. the history of medical transplants
 - C. dangers of medical experiments

B Word Link *labor* = working: collaborate, elaborate, laboratory

> V Partners Use procedure with: (x) follow a procedure, perform a procedure; (adj.) simple procedure, standard procedure, surgical procedure.

Word

READING

PIONEERS OF MEDICINE

FOR CENTURIES, medical pioneers have refined a variety of methods and medicines to treat sickness, injury, and disability, enabling people to live longer and healthier lives. Two of the most exciting fields of medical science today are regenerative medicine and nanotechnology.

REGENERATIVE MEDICINE

"A salamander¹ can grow back its leg. Why can't a human do the same?" asked Peruvian-born surgeon Dr. Anthony Atala in a recent interview. The question, a reference to work aiming to grow new limbs for wounded soldiers, captures the inventive spirit of regenerative medicine. This innovative field seeks to provide patients with replacement body parts. These parts are not made of steel; they are the real thing—living cells, tissue, and even organs.

Regenerative medicine is still mostly experimental, with clinical applications limited to procedures such as growing sheets of skin on burns and wounds. One of its most significant advances took place in 1999, when a research group at North Carolina's Wake Forest Institute for Regenerative Medicine conducted a successful organ replacement with a laboratorygrown bladder. Since then, the team, led by Dr. Atala, has continued to generate a variety of other tissues and organs—from kidneys to ears.

¹ A salamander is a small lizard-like animal.

D

E

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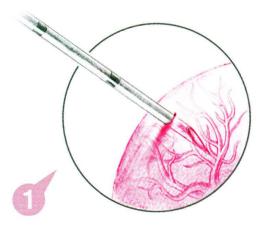
The field of regenerative medicine builds on work conducted in the early twentieth century with the first successful transplants of donated human soft tissue and bone. However, donor organs are not always the best option. First of all, they are in short supply, and many people die while waiting for an available organ; in the United States alone, more than 100,000 people are waiting for organ transplants. Secondly, a patient's body may ultimately reject the transplanted donor organ. An advantage of regenerative medicine is that the tissues are grown from a patient's own cells and will not be rejected by the body's immune system.

Today, several labs are working to create bioartificial body parts. Scientists at Columbia and Yale Universities have grown a jawbone and a lung. At the University of Minnesota, Doris Taylor has created a beating bioartificial rat heart. Dr. Atala's medical team has reported long-term success with bioengineered bladders implanted into young patients with spina bifida.² And at the University of Michigan, H. David Humes has created an artificial kidney.

So far, the kidney procedure has only been used successfully with sheep, but there is hope that one day a similar kidney will be implantable in a human patient. The continuing research of scientists such as these may eventually make donor organs unnecessary and, as a result, significantly increase individuals' chances of survival.

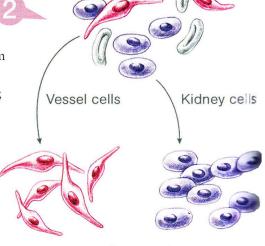
² **Spina bifida** is a birth defect that involves the incomplete development of the spinal cord.





Sample a tiny bit of the patient's kidney.

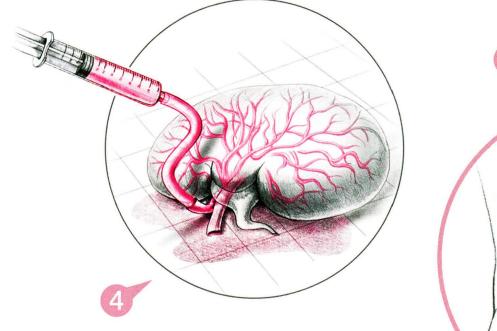
Sort kidney tissue cells from those of blood vessels running through it.



At North Carolina's Wake Forest Institute of Regenerative Medicine, cells are grown to match organs or body parts, such as replacement ears for wounded soldiers. Multiply both types of cells in lab cultures.³

(Re)grow a Kidney

More people are waiting for a kidney than any other organ, but it's one of the hardest to grow. Here is the strategy being followed by the research group at Wake Forest in its search to create the first transplantable bioartificial human kidney:

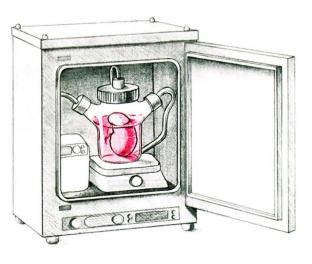


Inject the cultured cells of the patient into a scaffold, which is made by washing a pig kidney with mild detergent⁴ until the pig cells are gone, and only the tough collagen⁵ remains.

a functioning human organ into the patient.

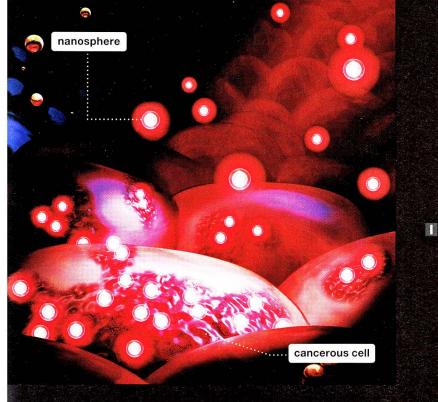
Incubate⁶ at 98.6 F° (37 C°) in a bioreactor that delivers oxygen and nutrients to the

growing tissue.



- ³ A lab **culture** is a group of bacteria or cells grown in a laboratory as part of an experiment.
- ⁴ **Detergent** is a type of soap, usually in the form of a powder or a liquid, which is used for washing things such as clothes or dishes.
- ⁵ **Collagen** is a type of protein found in bone, cartilage, and connective tissue.
- ⁶ When you **incubate** something, you put it in an environment with a specific temperature to let it develop or grow.

LESSON B READING



Attack of the Nanospheres: Tiny silica spheres like the ones in this illustration may be used one day to kill cancerous cells in human patients.

NANDTECHNOLOGY

The main thing to know about nanotechnology is that it is small—really small. *Nano*, a prefix that means "dwarf"⁷ in Greek, is short for *nanometer*, one-billionth of a meter. To get an idea of how small a nanometer is, a comma (,) consists of about half a million nanometers. The nail on your little finger is about ten million nanometers across. To put it another way, a nanometer is the amount a man's beard grows in the time it takes him to lift a razor to his face.

How can nanotechnology be applied to medicine? One of the potential applications is as an aid in surgery. Scientists at Rice University have used a solution of nanoshells—tiny silica⁸ balls covered with gold—to reconnect two pieces of animal tissue. Someday soon, surgeons may be able to use a nanoshell treatment like this to reconnect veins⁹ that have been cut during surgery. "One of the hardest things a doctor has to do during a kidney or heart transplant is reattach cut arteries," says André Gobin, a graduate student at Rice. "They have to sew the ends [of cut arteries] together with tiny stitches. Leaks are a big problem." The nanoshells will enable a surgeon to make a clean join between the two ends of a cut artery, preventing blood from leaking out.

Cancer patients may also benefit from nanotechnology. While cancer treatments such as chemotherapy,¹⁰ radiation, and surgery are severe and may weaken the patient, nanotechnology promises treatment without the risks or side effects. Researchers at Rice University have engineered gold-covered silica spheres that are about 120 nanometers wide-about 170 times smaller than a cancer cell. Injected into the bloodstream, they can infiltrate¹¹ cancerous tumors.¹² When an infrared laser is focused on the tumor, the intense light passes through healthy tissue but heats up the nanoshells. In laboratory tests using mice, the treatment killed cancerous cells while leaving adjacent tissue unharmed. The technique has the potential one day to be applied to human cancer patients.



- A mouse injected with nanoparticles of cadmium selenide glows under ultraviolet light.
- ⁷ The word dwarf is used to describe something small.
- Silica is a material used for making glass and ceramics. It often exists in sand.
- Your veins are the thin tubes in your body through which your blood flows toward your heart.
- ¹⁰ Chemotherapy is the treatment of disease using chemicals. It is often used in treating cancer.
- ¹¹ When one substance **infiltrates** another, it goes inside the second substance.
- ¹² A tumor is a mass of diseased or abnormal cells that has grown inside a person's or an animal's body.

G

UNDERSTANDING THE READING

A	Identifying	Main Ideas.	Complete the main ideas	of the paragraphs listed below.
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	1.	Paragraph A:	and	_ are two
			of the most interesting new areas of medicine.	
	2.	Paragraph D:	The first transplant of organs eventual	ly led to a
			more effective solution for people who need new organs.	
	3.	Paragraph H:	Future surgeons will use tiny balls called	_ to
			the ends of cut arteries during surgery.	
	4.	Paragraph I:	Nanotechnology treatment will also help patients by killing	
			without negative side effects.	
В	rea	ading passage o	ning from Context. Find and underline the following words and expressions on pages 175–178. Use context to help you identify the part of speech and m pressions. Complete the definitions. Check your answers in a dictionary.	
	1.		If someone has refined something, he or she has	
		it by making s	mall changes.	
	2.	0 1	If something has many applications , it has many	
	3.	Paragraph D: I of it available.	If something is in short supply , there	
	4.	Paragraph G: '	"To put it another way" means	
	5.	Paragraph H:	If you reattach two things, you	
С			Referencing. Read the sentences from the reading passage. For each senter the boldfaced pronoun refers to.	ence,
	1.		or organs are not always the best option. First of all, they are in short supple die while waiting for an available organ.	ly,
	2.	More people a hardest to gro	are waiting for a kidney than any other organ, but it 's one of the w.	
	3.	cut arteries," s	ardest things doctors have to do during a kidney or heart transplant is reatt says André Gobin, a graduate student at Rice. " They have to sew the ends [her with tiny stitches."	
	4	D 1		120

4. Researchers at Rice University have engineered gold-covered silica spheres that are about 120 nanometers wide—about 170 times smaller than a cancer cell. Injected into the bloodstream, they can infiltrate cancerous tumors.

LESSON B UNDERSTANDING THE READING

D	Identifying Supporting Details. Find details in the reading passage to answer the
	following questions.

- 1. In the field of regenerative medicine, what are replacement parts made of?
- 2. What did Dr. Atala's team do successfully in 1999?
- 3. Why are donated organ transplants not always the best option?
- 4. In Wake Forest's procedure for growing a new kidney, what do they use as a scaffold?
- 5. Why might nanotechnology be a good option in surgery and cancer treatment?

E | Critical Thinking: Making inferences. Discuss answers to these questions with a partner.

- 1. What inferences can you make about the writer's audience for this passage? Where might you find this kind of article? Look for evidence in the passage to support your answer.
- 2. What inferences can you make about the writer's opinion of regenerative medicine and nanotechnology? Is the writer's attitude basically positive or negative in each case? Look for evidence in the passage to support your answer.
- F | Critical Thinking: Synthesizing. Write answers to the questions. Then discuss your ideas with a partner.
 - 1. What is one way that regenerative medicine and nanotechnology might be used together?
 - 2. What do al-Zahrawi and Dr. Atala have in common?
 - 3. How is al-Zahrawi's use of catgut similar to applications of nanotechnology?

EXPLORING WRITTEN ENGLISH

GOAL: Writing a Research-Based Essay

In this lesson, you are going to plan, write, revise, and edit an essay on the following topic: **Research a current innovator in the medical field. Explain what this person's contributions to the field are, and why these contributions are important or significant.**

A | **Brainstorming.** Make a list of medical innovations that you are aware of. You can list innovations from this unit and other ones you know or have heard about.

Writing Skill: Researching Information for an Essay

When you are doing research online to write a paper, it's important to evaluate the websites that you find. What should you think about when evaluating websites?

Purpose/Point of View: Is the purpose of the website to deliver information, or is it trying to promote or sell something? If it is trying to sell something, the information on the site may not be completely accurate.

Authority: Who is the author of the blog or article? Is the author an expert on the topic? If the website is a news or magazine site, is it a trustworthy source—that is, does it present facts and balanced arguments? Note that URLs ending in *.gov*, *.edu*, or *.org* are usually trustworthy sources: *.gov* indicates a government site, *.edu* is a school's site, and *.org* is a site that belongs to a non-profit organization.

Accuracy: Is the information correct? Are you able to check the information against other sources?

Currency: When was the content written? Is the information still accurate or is it outdated?

Coverage: Is the information thorough? Is important information left out—for example, are facts or arguments missing because they do not fit the author's purpose or point of view?

B | **Critical Thinking: Evaluating Sources.** Imagine you are researching a newly discovered plant that may have some health benefits. Read the descriptions of five websites. Consider the questions in the Writing Skill box and rank the websites according to their usefulness (1 = most useful). Share your reasons for your opinions with a partner.

- ____ a. A newspaper's website. The newspaper is owned and operated by a political group. Information is updated every day. The site's URL ends in *.com*.
- ____ b. A blog whose URL ends in *.com*. The blogger is a doctor and has worked as a professional nutritionist for 20 years. She writes a new post every day.
- ____ C. A *.gov* website that focuses on nutrition. There is a lot of information on the site. The latest information on nutrition research is two years old.
- ____ d. An *.org* website that focuses on nutrition. The contributors are doctors and researchers. Information is updated weekly.
 - ____ e. A .com site that sells diet and nutrition pills. It contains a lot of information about a newly discovered plant and is offering a diet pill made from the plant.

LESSON C EXPLORING WRITTEN ENGLISH

- **C** | **Beginning Your Research.** Look at your brainstorming list. Do research online to find out who was responsible for each innovation. Circle the three innovations and innovators that you can find the most information about.
- **D** | Read the information in the box below. Then reread Paragraph **E** of "The Urban Visionary" on page 60. Write a quote and a paraphrase that explains Richard Wurman's 19.20.21 project.

Language for Writing: Referring to Sources Using Quotes and Paraphrases

When you write a paper about a particular topic, you can quote or paraphrase sources to support your thesis statement. A quote is a person's exact words as they appear in the source. Use quotation marks ("") and a comma to indicate a quote. You can use the word says and the phrase according to to introduce a quote.

"One of the hardest things a doctor has to do during a kidney or heart transplant is reattach cut arteries," **says** André Gobin, a graduate student at Rice.

According to André Gobin, a graduate student at Rice, "One of the hardest things a doctor has to do during a kidney or heart transplant is reattach cut arteries."

When you paraphrase, you restate information from a source in your own words. Look at these paraphrases of the quotes above.

André Gobin, a graduate student at Rice, **says that** sewing cut arteries back together is one of the most difficult things that a doctor has to do in a kidney or heart transplant surgery.

André Gobin is a graduate student at Rice. **According to** Gobin, one of the most difficult things that a doctor has to do when performing a kidney or heart transplant is sew cut arteries back together.

Notice that the sentence structure in the paraphrases is different from the original source, and some of the words have been replaced with synonyms. In the second example, notice that you can break a longer sentence into two sentences. You can also use the words *states/claims/reports/concludes + that* to introduce a paraphrase.

For more information about paraphrasing, see page 249.

1. a quote that explains the 19.20.21 project:

2. a paraphrase that explains the 19.20.21 project: _

WRITING TASK: Drafting

- A | Planning. Follow the steps to make notes for your essay.
 - Step 1 Choose one of the innovations/innovators that you circled in exercise C on page 182. Research your innovator and look for reasons why he or she deserves recognition. Some questions you can ask: How has the innovation changed the field of medicine? How has it improved our lives? Write the innovator's name and the innovation in the outline below.
 - Step 2 Complete the thesis statement in the outline.
 - Step 3 Identify two reasons and write them as topic sentences in the outline.
 - Step 4 Now write two examples or details for the topic sentence in each body paragraph.
 - Step 5 Paraphrase your thesis statement and make notes for a final thought.

Innovation:
Innovator:
Thesis statement for introductory paragraph:
Body Paragraph 1: Topic sentence:
Example/Detail 1:
Example/Detail 2:
Body Paragraph 2: Topic sentence:
Example/Detail 1:
Example/Detail 2:
Paraphrase of thesis statement for concluding paragraph:
Final thought, e.g., prediction or question:

B | **Draft 1.** Use your outline to write a first draft of your essay. Explain the person's contributions and why they are important.

C | **Critical Thinking: Analyzing.** Work with a partner. Read the research paper about Aydogan Ozcan. Then follow the steps to analyze the paper.

Imagine that you are in a remote village somewhere with no access to medical treatment. You become very sick, and you don't know what is wrong with you. You have to wait until a mobile medical unit arrives to help you. Once the doctors get to you, they examine you and take blood samples, but they won't be able to help you until they take the samples back to the hospital to find out what is wrong and then return to give you treatment. Even though you may only have a simple infection, you might die because of the delay. Thanks to one man, many people may never be in this situation. Aydogan Ozcan, an electrical engineer at UCLA, has made an important contribution with a new medical innovation. He and his research team have developed a way to turn regular cell phones into diagnostic tools.

Ozcan's invention is important because it is very accurate and easy to use. According to an article on National Geographic's website, even if doctors in remote areas have microscopes and other tools to help them make diagnoses, they do not always have the training to correctly interpret what they see. As a result, they may diagnose illnesses incorrectly. The article explains that with Ozcan's cell-phone technology, mobile health workers can take a special photo of a blood sample and send it over the Internet to a central computer at a hospital. The computer will then interpret the photo, diagnose the disease in the blood, and send a diagnosis back in a few minutes.

Another reason that Ozcan's invention is important is that it is inexpensive. The article states that many highly effective diagnostic tools exist, but often they cannot be used in remote areas because these areas don't always have reliable electricity. His technology only requires a modified cell phone and an Internet connection. According to the article, more than four billion people already have cell phones. Making modifications to a cell phone so that it can be used as a diagnostic tool is fairly inexpensive.

By inventing a medical tool that uses existing technology—cell phones—Aydogan Ozcan and his team have invented a medical tool that is accurate and easy to use. Therefore, it can be used effectively almost anywhere. Ozcan's simple tool might save the lives of millions of people all over the world.

- Step 1 Underline the thesis statement.
- **Step 2** Underline the topic sentences.
- Step 3 In the two body paragraphs, check (✓) sentences that answer possible reader questions about the main idea of the paragraph.
- **Step 4** Underline the final thought.

D | **Revising.** Follow steps 1–4 in exercise **C** to analyze your own essay.

E | Peer Evaluation. Exchange your first draft with a partner and follow the steps below.

Step 1 Read your partner's essay and tell him or her one thing that you liked about it.

Step 2 Complete the outline below showing the ideas that your partner's essay describes.

Innovation:	
Innovator:	
Thesis statement for introductory paragraph:	
Body Paragraph 1: Topic sentence:	
Example/Detail 1:	
Example/Detail 2:	
Body Paragraph 2: Topic sentence:	
Example/Detail 1:	
Example/Detail 2:	
Summary statement for concluding paragraph:	
Final thought, e.g. prediction or question:	

Step 3 Compare this outline with the one your partner created in exercise A on page 183.Step 4 The two outlines should be similar. If they aren't, discuss how they differ.

F | **Draft 2.** Write a second draft of your essay. Use what you learned from the peer evaluation activity and your answers to exercise **D**. Make any other necessary changes.

LESSON C 🖉 WRITING TASK: Editing

G | **Editing Practice.** Read the information in the box. Then find and correct one mistake with quotes or paraphrases in each of the sentences (1–5).

In sentences with quotes and paraphrases, remember to:

- use a comma at the end of the phrase that starts with according to.
- use quotation marks and a comma to separate a person's exact words from the rest of the sentence.
- make sure all the information in your paraphrase is accurate.
- 1. The article "The Healer of Córdoba" explains that al-Zahrawi was born in Córdoba in 963.
- 2. According to the article al-Zahrawi was a physician for the royal court.
- 3. The article says, more than four centuries after they were written, parts of the work were finally printed in 1471.
- 4. "When income rises, people have money to buy more space, says urban planner Shlomo Angel in the article "Living on an Urban Planet."
- 5. According to Richard Wurman, an architect and urban planner "People flock to cities because of the possibilities of doing things that interest them."

Yes

No

H | **Editing Checklist.** Use the checklist to find errors in your second draft.

Editing Checklist

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 sentence openers correctly when referring to sources?
- 6. Are verb tenses correct?
- I Final Draft. Now use your Editing Checklist to write a third draft of your essay. Make any other necessary changes.