UNIT 4

Advances in Science

Zac Vawter on the Willis Tower, Chicago.
Zac was the first person to climb wearing a prosthesis controlled with his mind.

1. What are the most important advances in science today?

2. What do you think are the most important problems science and modern technology should try to solve?

3. What areas of science are most interesting to you—for example, biology, chemistry, astronomy, physics, geology? Why do you especially like these fields of science?

CHAPTER 10 Saving Lives with New Organs[1]


A starfish regenerating an arm


A gecko shortly after dropping its tail to avoid a predator

[1] **An organ** is a part of the body that has a specific function, for example, a heart, lung, kidney, or liver.

Prereading

1. Look at the photos of the animals above. What can these animals do?

2. Can human beings do this, too?

3. Read the title of the article. What do you think this article is about?

4. Why do some people need a new organ? What kinds of organs do they sometimes need?

1. Answers may vary. The correct answer is that these animals can grow new arms or tails.
2. No.
3. – 4. Answers may vary.

Reading

CD 1 TR 11

Read the passage carefully. Then complete the exercises that follow.

Saving Lives with New Organs

Starfish, salamanders, and lizards all have something in common: if a tail or a limb, e.g., a leg, is severed, or cut off, these animals can regrow that part of their body. This ability to regenerate, or regrow, a limb has fascinated scientists for centuries. They wondered how people might one day be able to regenerate a body part, too. However, no one had the technology or the know-how to do so until now.

Every year, hundreds of thousands of people who are sick or injured need organ transplants such as hearts, kidneys, or lungs. Unfortunately, many die while they are waiting for a new organ. These people could only hope for an organ or tissue from a donor, usually from someone who has just died. Even if they are lucky enough to find a donor, their immune system might still reject the transplant.

Reading

CD 1 TR 11

Read the passage carefully. Then complete the exercises that follow.

Today, scientists have developed a way to create some organs in a laboratory using a patient's own cells. This way, the patient's body will not reject this new organ because the new part came from the patient's own cells.

How do scientists create new organs? Which organ was one of the first to be created? Dr. Anthony Atala works at the Wake Forest Institute for Regenerative Medicine in Winston-Salem, North Carolina. He was able to create a "bioartificial" organ—in particular, a bladder[2]—from a patient's own diseased bladder. Dr. Atala developed something he calls the "bladder technique." This process involves taking healthy cells from a person's diseased bladder and then growing many more of them in a laboratory. Once the scientist has enough healthy cells, they are put into a mold with a growth solution. This is a special chemical mixture that helps them to grow. It takes about six to eight weeks to "grow" a healthy new bladder.

[2] A **bladder** is an organ in the body that holds urine from the kidneys until it passes from the body.

Reading

CD 1 TR 11

Read the passage carefully. Then complete the exercises that follow.

Kaitlyne McNamara was one of the first children to receive the bioartificial bladder. She was born with a very serious disease and had dozens of operations as a child. In spite of all the surgeries, her bladder was very weak. Dr. Atala took cells from Kaitlyne's weak bladder to grow her new bladder. "Now that I've had the transplant, my body actually does what I want it to do," Kaitlyne said. "Now I can go have fun and not worry."

Scientists are working on many other human organs and tissues as well. For example, they have successfully generated, or grown, a piece of liver. This is an exciting achievement since people cannot live without a liver. In other laboratories, scientists have created a human jawbone and a lung.

Reading

CD 1 TR 11

Read the passage carefully. Then complete the exercises that follow.

While these scientific breakthroughs are very promising, they are also limited. Scientists cannot use cells for a new organ from a very diseased or damaged organ. Consequently, many researchers are working on a way to use stem cells to grow completely new organs. Stem cells are very simple cells in the body that can develop into any kind of complex cells, such as skin cells or blood cells and even heart and liver cells. In other words, stem cells can grow into all different kinds of cells. Some stem cells come from a newborn baby's umbilical cord.[3] After a baby is born, its umbilical cord detaches. Blood in the umbilical cord contains stem cells. These cells are different from adult cells because adult cells will only grow into the type of tissue they came from. Thus, a cell that comes from a bladder will only grow into a bladder. In contrast, stem cells have the ability to become any kind of cell. Researchers have made stem cells into heart, liver, and other organ cells. However, the use of stem cells in medicine today is very controversial. Some people do not agree that using stem cells for this purpose is a good idea.

[3] The umbilical cord connects the baby to the mother before the baby is born. It supplies nutrients and oxygen to the developing baby.

Reading

CD 1 TR 11

Read the passage carefully. Then complete the exercises that follow.

Although medical research can be very controversial, helping people lead better lives is something everyone can agree on.

A scientist working with a bladder mold

Fact Finding

Read the passage again. Then read the following statements. Check (√) whether each statement is True or False. If a statement is false, rewrite it so that it is true. Then go back to the passage and find the line that supports your answer.

1. ___✓___ True _____ False Some patients die before they can receive an organ transplant.

_____

2. _____ True ___✓___ False A patient's immune system always accepts the new organ.

A patient's immune system might reject the new organ.

3. _____ True ___✓___ False Patients' bodies will not accept organs that come from their own cells.

Patients' bodies will accept organs that come from their own cells.

4. ___✓___ True _____ False Scientists can sometimes grow organs in a laboratory.

_____

Fact Finding

Read the passage again. Then read the following statements. Check (√) whether each statement is True or False. If a statement is false, rewrite it so that it is true. Then go back to the passage and find the line that supports your answer.

5. ____ True ✓ False Kaitlyne McNamara received an organ transplant from a donor.

Kaitlyn received a bioartificial organ that was grown with cells from her own bladder.

6. ____ True ✓ False Scientists can use cells from any organ to make a new organ.

Scientists can use cells from an organ to make the same type of organ.

7. ✓ True ____ False Stem cells can grow to become any kind of cell.

8. ____ True ✓ False Everyone agrees that using stem cells is a good idea.

Some people disagree that using stem cells is a good idea.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

1. Read lines 1–5.

   a. To **have something in common** means

      1. like the same things.
      2. live in the same environment.
      3. share something that is the same.

   b. A **limb** is

      1. a tail.
      2. an arm or a leg.
      3. any part of the body.

   c. **E.g**. means

      1. for example.
      2. in addition.
      3. except for.

   d. **Severed** means

      1. regrown.
      2. cut off.
      3. injured.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

e. **Regenerate** means
1. regrow.
2. injure.
3. reattach.

f. Between the two words *regenerate* and *regrow* is , **or**. This means
1. the two words are antonyms.
2. the two words are synonyms.
3. the two words are scientific.

g. **Know-how** means
1. training.
2. education.
3. skill and ability.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

2. Read lines 6–10.
   a. An organ or tissue **transplant** means taking an organ or tissue
      1. from a dead person only and giving it to someone else.
      2. from a dead or living person and giving it to someone else.
      3. from a dead or living person and growing it in a laboratory.
   b. A **donor**
      1. gives an organ or tissue.
      2. receives an organ or tissue.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

3. Read lines 9–10.
   a. The purpose of the **immune system** is to
      1. kill any new organ or tissue in the body.
      2. protect the body from disease.
      3. help new organs or tissue grow well.
   b. If the immune system **rejects** an organ or tissue,
      1. the person will begin to feel better.
      2. it starts to regrow an organ or tissue.
      3. it does not accept the organ or tissue.
4. In line 12, a **patient** is
   a. an organ donor.
   b. a sick or injured person.
   c. a scientist.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

5. Read lines 16–17.

a. Why is **bioartificial** in quotation marks (“ ”)?

1. Because it is a direct quote from Dr. Atala
2. Because it is a word from another language
3. Because it is a new word

b. The term **bioartificial organ** means that the organ

1. was created, but is not a healthy organ.
2. was created, and is not a real organ.
3. was created, but is still a real, living organ.

c. What is a **bladder**?

It is an organ in the body that holds urine from the kidneys until it passes from the body.

d. Where did you find this definition?

at the bottom of the page

e. This is called

1. an index.
2. a footnote.
3. a preface.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

6. Read lines 20–22.

a. A **mold** is

(1.) an empty form that gives shape to whatever is put into it.

2. a dish for storing a number of objects.

3. a flat surface for mixing things.

b. Why did the scientists put the bladder cells into a mold?

1. So the chemical mixture has time to grow

(2.) So the cells take on the shape of a bladder as they grow

3. So the chemical mixture wouldn't spoil

c. What is a **growth solution**?

A growth solution is a special chemical mixture. It helps cells in a mold to grow.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

7. Read lines 24–25. **In spite of** means
   a. thanks to.
   b. because of.
   c. regardless of.
8. Read lines 29–31.
   a. **Achievement** means
      1. failure.
      2. success.
      3. transplant.
   b. What is **this exciting achievement**?

The achievement is that scientists have successfully generated a piece of liver.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

9. Read lines 33–38.

a. A scientific **breakthrough** is

1. a problem in science.
2. an advance in science.
3. a question in science.

b. If something is **promising**, it is

1. encouraging.
2. certain.
3. clear.

c. What are **stem cells**?

Stem cells are very simple cell in the body that can develop into any kind of complex cells.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

10. Read lines 38–40.

a. How does **in other words** help you?

1. It introduces additional information.
2. It introduces a different idea.
3. It introduces the same information in different words.

b. What is an **umbilical cord**?

An umbilical cord connects the baby to the mother before the baby is born. It supplies nutrients and oxygen to the developing baby.

c. Where did you look for this information?

at the bottom of the page

d. This is called a footnote.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

11. Read lines 39–43.

a. **Detaches** means
   1. separates.
   2. connects.
   3. falls.

b. **Thus** means
   1. however.
   2. therefore.
   3. additionally.

c. **In contrast** introduces
   1. an opposite idea.
   2. a similar idea.
   3. the same idea in different words.

Reading Analysis

Read each question carefully. Circle the letter or the number of the correct answer, or write the answer in the space provided.

12. Read lines 44–46. If an issue or idea is controversial,
    a. many people argue for and against the idea.
    b. a few people disagree with the idea.
    c. a few people agree with the idea.
13. What is the main idea of the passage?
    a. Some scientists have been able to grow new organs such as bladders, livers, and lungs.
    b. Scientists are making advances in organ regeneration using both adult cells and stem cells.
    c. Scientists have helped people lead better lives with controversial research.

Vocabulary Skills

PART 1

Recognizing Word Forms
In English, there are several ways that verbs change to nouns. Some verbs become nouns by adding the suffix *-tion* or *–ation*, for example, *inform (v.), information (n.); educate (v.), education (n.).*

Complete each sentence with the correct word form on the left. Write the correct form of the verbs in either the affirmative or the negative. The nouns may be singular or plural.

fascinate *(v.)*
fascination *(n.)*

1. A lizard's ability to regrow limbs _____ many people, including scientists. Because of this _____, scientists had the idea to regrow organs to help people.

fascinates (or has fascinated)

fascination

create *(v.)*
creation *(n.)*

2. Scientists _____ bioartificial organs in laboratories. The _____ of new organs can help to save many people's lives.

create

creation

Vocabulary Skills

Complete each sentence with the correct word form on the left. Use the correct form of the verb. The nouns may be singular or plural.

operate *(v.)*
operation *(n.)*

3. 3. As a child, Kaitlyne was very sick and had a lot of ___operations___ Although many doctors ___operated___ on her, she was still very ill.

generate *(v.)*
generation *(n.)*

4. Scientists are working on the ___generation___ of many organs using patient's cells. Recently, they ___generated___ a piece of a liver, a jawbone, and a lung.

reject *(v.)*
rejection *(n.)*

5. A patient's body ___will not reject___ a new organ that comes from his or her own cells. However, ___rejection___ sometimes happens when a patient receives an organ from a donor.

Vocabulary Skills

PART 2

Recognizing Sentence Connectors

Sentence connectors, such as con*sequently, in contrast, in other words, in spite of*, and *unfortunately*, connect ideas and help to make them clearer.

Complete each sentence with *consequently, in contrast, in other words, in spite of*, or *unfortunately*. Use each sentence connector only once.

1. _____ the small chance of getting a transplant, Katrin put her name on a waiting list.
2. Julio was on a waiting list for a heart transplant. _____, he has been waiting for three years.
3. Stella is an ideal person for a lung transplant. _____, she is healthy enough to live through the transplant operation and become well.
4. Thomas feels that stem cell research should continue. _____, his sister is against it.
5. A bladder is shaped like an empty bag. _____, a mold that is used to generate a bladder must be round and empty, too.

Vocabulary in Context

Read the following sentences. Complete each sentence with the correct word or phrase from the box. Use each word or phrase only once.

achievement *(n.)*	in spite of	rejected *(v.)*	thus *(adv.)*
breakthroughs *(n.)*	molds *(n.)*	severed *(v.)*	transplants *(n.)*
detached *(v.)*	patient *(n.)*		

1. Patricia enjoys making candy at home. She carefully pours melted chocolate into small, round _____molds_____. Her candy is always delicious!
2. Because of so many medical _____breakthroughs_____, doctors can help more people than ever before.
3. The last day of class is next Friday. _____Thus_____, we must finish all of our assignments by Thursday.
4. When the power cord _____detached_____ from my laptop, I was unable to finish writing an email.
5. Carlos was a _____patient_____ in the hospital for several weeks before he started to feel better.

Vocabulary in Context

Read the following sentences. Complete each sentence with the correct word or phrase from the box. Use each word or phrase only once.

achievement *(n.)*	in spite of	rejected *(v.)*	thus *(adv.)*
breakthroughs *(n.)*	molds *(n.)*	severed *(v.)*	transplants *(n.)*
detached *(v.)*	patient *(n.)*		

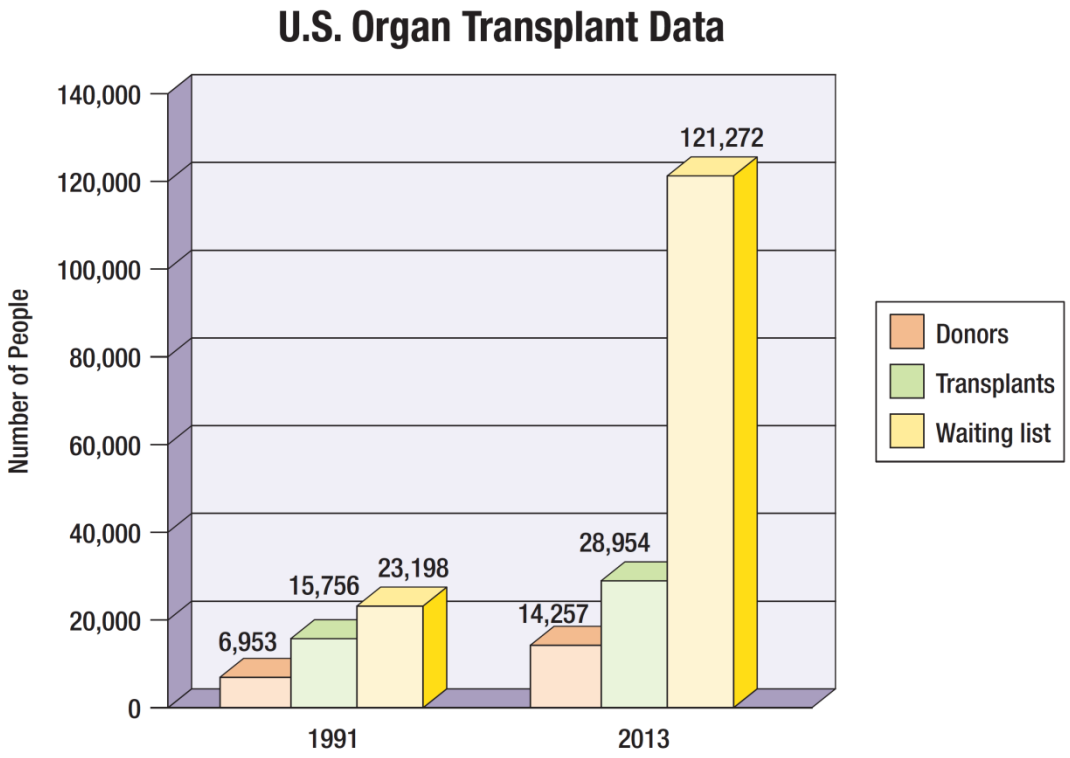
6. Brian received a robotic arm after he _____severed_____ his limb in a car accident.
7. It was an incredible _____achievement_____ when I graduated college last year.
8. In the past, kidney _____transplants_____ were very unusual. Now they are quite common.
9. When the college _____rejected_____ her application, Helen had to apply to a different university.
10. _____In spite of_____ the cold weather, the children played happily in the park.

Reading Skill

Understanding a Bar Graph

Bar graphs often contain important information. It's important to understand bar graphs. Bar graphs compare numbers or amounts, and they give you information about the reading.

Look at the bar graph and answer the questions that follow.



Source: http://www.organdonor.gov/about/data.html

Reading Skill

Read the line graphs. Then answer the questions.

1. How many more transplants were there in 2013 compared to 1991?
   a. The number has almost doubled.
   b. The number has almost tripled.
   c. The number has stayed the same.
2. How much has the number of people waiting for organ transplants increased from 1991 to 2013?
   a. The number has increased more than 500 percent.
   b. The number has doubled.
   c. The number has tripled.
3. In both 1991 and 2013, there were more organ transplants than there were organ donors. What do you think is a reason for this?
   a. Some people died during surgery, and the organ was used again.
   b. Some donors give more than one organ.
   c. Some people's bodies rejected the organ, and it was used for someone else.

Information Recall

Read the passage again. Then answer the questions.

1. What is a serious problem that people face when they need an organ transplant?

   A serious problem that people face is that their body might reject the organ that is transplanted. OR A serious problem that people face is that they will have to wait a long time for an organ transplant, and they may die before receiving the transplant.

Information Recall

Read the passage again. Then answer the questions.

2. What have scientists developed to help save the lives of people who need new organs or tissues?

   Scientists have developed the ability to generate an organ from a patient's own cells.

3. What are some advantages of using stem cells to generate organs and tissues?

   When stem cells are used to generate organs and tissues, the body will most likely not reject them. Stem cells can be used to generate any kind of organ.

Information Recall

Writing a Summary

A summary is a short paragraph that provides the most important information from a reading. It usually does not include details, just the main ideas. When you write a summary, it is important to use your own words, and not copy directly from the reading.

Write a brief summary of the passage. The summary should not be more than four sentences. Use your own words.

Answers will vary. Many people need organ transplants, but there is a long waiting list and many people die before receiving them. Even if they get a transplant, their body may reject the new organ. However, scientists have been working to develop ways to create organs using a person's own tissue. Scientists are beginning to have success with this research and are continuing their work. While controversial, stem cell research is a promising area because these cells can grow into any kind of organ or tissue.

Topics for Discussion and Writing

1. When a baby is born, its umbilical cord is detached because the baby doesn't need it anymore. Usually, it is thrown away, but now scientists can use stem cells from the umbilical cord to generate new organs and tissue. Do you agree or disagree with this use? Explain your reasons.
2. Most people have two healthy kidneys, but it is possible to live a healthy life with only one kidney. If a family member or friend needed a kidney, would you donate one of yours to that person? Why or why not? Explain your reasons.
3. Write in your journal. Imagine you have just had a baby who is born with a serious disease the way Kaitlyne McNamara was. Your doctor asks you for permission to use the baby's stem cells to try to grow a new organ to help the baby. Write about how you feel, the decision you make, and the reasons you make this decision.

Answers will vary.

Critical Thinking

Answers will vary.

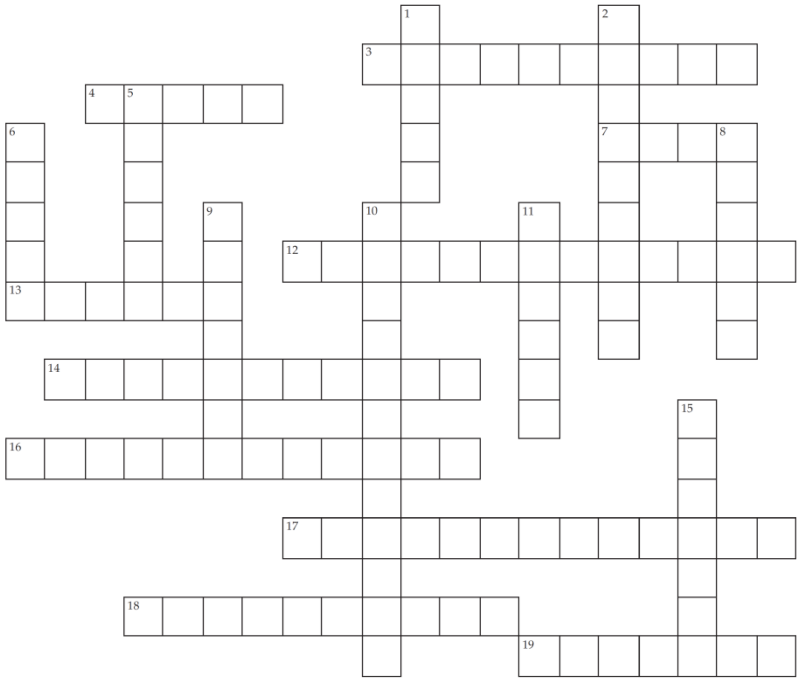
1. Many sick people die while they are waiting for transplants. Why do you think this happens? Think about possible reasons for this. Discuss this with your classmates.
2. Do you want to be an organ donor after you die? Why or why not? Talk about this with a partner.

Researcher studying stem cells

Crossword Puzzle

Review the words in the box below. Then read the clues on the next page. Write the words in the correct spaces in the puzzle.

achievement	controversial	limited	reject
bioartificial	detach	mold	sever
bladder	donor	patient	tissue
breakthrough	immune	promising	transplant
consequently	limbs	regenerate	



Crossword Puzzle Clues

ACROSS CLUES

3. Some animals can _regenerate_ a whole leg!
4. Arms and legs are _limbs_. A tail is not.
7. A _mold_ is an empty shape we can use to form things with.
12. A _bioartificial_ organ is made of human cells but is grown in a laboratory.
13. People who receive an organ from another person often worry that their body will _reject_, or not accept it.
14. The ability to use cells to create a new organ is an amazing _achievement_. This medical success will save many lives.
16. A major advance in science is called a _breakthrough_. Advances can take place in any field!
17. Stem cell research is very _controversial_. People sometimes become angry and argue about it.
18. Doctors can _transplant_ many types of organs from one person to another, for example, a lung, heart, liver, or kidney.
19. A _bladder_ is the organ that holds urine from the kidney until it passes from the body.

Crossword Puzzle Clues

DOWN CLUES

1. If you ___sever___, or cut off, a lizard's tail, the tail will regrow.
2. The future of medical research is very ___promising___. Doctors are hopeful of making many improvements.
5. Our ___immune___ system protects our bodies from infection and disease.
6. A ___donor___ is a person, living or dead, who has agreed to provide organs or tissues to help others.
8. After birth, doctors ___detach___ a baby's umbilical cord because the baby doesn't need it any longer.
9. A ___patient___ is a person who is in a doctor's care.
10. Kaitlyne McNamara received a new bladder that was grown from her own cells. ___consequently___, her body accepted the bladder.
11. ___Tissue___ is part of an organ, for example, a piece of liver or muscle.
15. Right now, research in regrowing organs is ___limited___, but in the future, researchers will surely make a lot of progress in this area.