Robo-Legs

Magazine Article by Michel Marriott

Eureka: Scientific Twists of Fate

Online Article

VIDEO TRAILER THINK central KEYWORD: HML8-934

How has SCIENCE changed our lives?

READING 10C Make subtle inferences and draw complex conclusions about the ideas in text and their organizational patterns. **10D** Synthesize and make logical connections between ideas within a text and across two texts. **RC-8(C)** Reflect on understanding to monitor comprehension.

The next time you answer a cell phone, turn on a light, or take your asthma medicine, think about the knowledge that was needed to create these things. Science has made it possible for doctors, engineers, and inventors to develop technologies and medicines that make our lives healthier and more convenient. In the following articles, you'll read about some of the amazing scientific breakthroughs that have allowed people to lead longer, better lives.

QUICKWRITE What is one scientific development that you feel you could not live without? Think beyond obvious technological gadgets such as your computer or cell phone. Write one paragraph telling what a day might be like if this discovery had never taken place.

ELEMENTS OF NONFICTION: ORGANIZATION OF IDEAS

Many nonfiction texts are organized in what might be called **part-by-part order.** One idea or group of ideas suggests another, which suggests another, and so on until the end. Each idea is related in some way to the one before it and the one after it, but not necessarily in the same exact way. For example, Michel Marriott begins "Robo-Legs" with Cameron Clapp's personal story. Then he presents information about artificial limb technology. Next he talks about how people's attitudes toward wearing such limbs are changing. Each new idea relates to the one before it—but not in any predictable way. To follow along, you need to pay attention to topic sentences and subheadings, which introduce new parts.

READING STRATEGY: MONITOR

When you **monitor** your reading, you pause to check your comprehension of the material. To monitor effectively, pause frequently and try the following strategies:

- **Ask questions** about the information presented.
- **Visualize,** or picture, events and details described.
- **Reread** passages that you find confusing.

Use a chart like the one shown to help you monitor.

Where I Paused	What Confused Me	How I Clarified the Information

VOCABULARY IN CONTEXT

How many of the boldfaced words do you know? Use context clues to figure out a definition for each.

1. People who lose an **appendage** can still exercise.
2. The pollution could **contaminate** the water supply.
3. **Infectious** diseases can be transmitted quickly.
4. I need **keener** eyesight to thread the needle.
5. Roberto gains **mobility** by using a wheelchair.
6. The **infection** was **pervasive** throughout her body.
7. Mrs. Blake needed **rehabilitation** following knee surgery.
8. The scientist's **serendipitous** discovery led to a cure.

Complete the activities in your **Reader/Writer Notebook.**

Meet the Author

Michel Marriott

born 1954

A Born Communicator

Michel Marriott says that he was "practically born talking." As a child, he talked all the time, and eventually he began writing out his thoughts on paper. Through his work at his school newspaper, Marriott realized that journalism was a good career choice. Since then, Marriott has worked for the *Washington Post, Newsweek,* and *The New York Times*, covering a variety of topics, including technology, fashion, and urban crime. In 1995, director Spike Lee produced *New Jersey Drive*, a film based on Marriott's series of articles about the desperate lives of young car thieves. The series was nominated for a Pulitzer Prize.

BACKGROUND TO THE ARTICLE

Marvelous Medical Inventions

Throughout history, scientists and inventors have worked to make life better for those with physical disabilities. The first eyeglasses were created in the 1200s. The first hearing aids, called "trumpets," were invented in the early 1800s. Prosthetics, used to replace missing arms and legs, were made of wood or metal as long ago as the days of ancient Rome. In medieval times, a knight who lost an arm could be fitted with a metal prosthetic that held a shield during battle. In the 1800s, wooden legs were fashioned to resemble real legs. They included springs and sockets to allow movement. Today, scientists draw on robotics and a better understanding of the human body to create prosthetics that are very similar to real limbs.

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Robo-Legs

Michel Marriott

Analyze Visuals ▶

This photo shows Cameron Clapp competing at the 2005 Endeavor Games. Based on his body language and facial expression, what can you **conclude** about Clapp's personality?

*New prosthetic limbs[1] are providing increased **mobility** for many amputees—and blurring the line between humans and machines*

mobility (mō-bĭl′ĭ-tē) *n.* the capability of moving from place to place

With his blond hair, buff torso, and megawatt smile, Cameron Clapp is in many ways the typical California teenager. There are, however, a few things that set him apart: For starters, this former skater boy is now making his way through life on a pair of shiny, state-of-the-art[2] robotic legs. A

"I make it look easy," he says.

Clapp, 19, lost both his legs above the knee and his right arm just short of his shoulder after getting hit by a train almost five years ago near his home in Grover Beach, California. Following years of **rehabilitation** and a series of prosthetics, each more technologically advanced than the last, he has become part of a new generation of people who are embracing breakthrough technologies as a means of overcoming their own bodies' limitations.

"I do have a lot of motivation and self-esteem," Clapp says, "but I might look at myself differently if technology was not on my side."

The technology he's referring to is the C-Leg. Introduced by Otto Bock HeathCare, a German company that makes advanced prosthetics, the C-Leg combines computer technology with hydraulics. Sensors monitor how the leg is being placed on the ground, and microprocessors[3] guide the limb's hydraulic system, enabling it to imitate a natural step. It literally does the walking for the walker. The technology, however, is not cheap; a single C-Leg can cost more than $40,000. B

The C-Leg is one of the examples of how blazing advancements, including tiny programmable microprocessors, lightweight materials, and **keener** sensors, are restoring remarkable degrees of mobility to amputees, says William Hanson, president of . . . a Massachusetts company that specializes in developing and distributing advanced prosthetic arms and hands.

A ORGANIZATION
Reread lines 1–5. To whom are you introduced here? What does Marriot emphasize about him?

rehabilitation (rē′hə-bĭl′ĭ-tā′shən) *n.* the process of restoring someone to physical capability, usually through exercise and physical therapy

B MONITOR
Examine lines 16–21. What words and phrases help you **visualize** Clapp's legs? Compare your mental image with the photo on page 936.

keener (kēn′ər) *adj.* more acutely sensitive

1. **prosthetic limbs** (prŏs-thĕt′ĭk lĭmz)**:** artificial arms and legs.
2. **state-of-the-art:** made using the newest technology available.
3. **microprocessors:** tiny computer parts that operators can program, or give new instructions to.

Clapp's prosthetic legs feature several attachments to suit different purposes.

Three Sets of Legs

For example, Clapp, who remains very involved in athletics despite his
30 condition, has three different sets of specialized prosthetic legs: one for walking, one for running, and one for swimming. He put all of them to use at the Endeavor Games in Edmond, Oklahoma—an annual sporting event for athletes with disabilities—where he competed in events like the 200-meter dash and the 50-yard freestyle swim. C

C MONITOR
What **questions** do you have after reading this paragraph? Decide whether to reread or read on for answers.

Man or Machine?

But increased mobility is only part of the story. Something more subtle, and possibly far-reaching, is also occurring: The line that has long separated human beings from the machines that assist them is blurring, as complex technologies become a visible part of the people who depend upon them.

40 Increasingly, amputees, especially young men like Clapp, and soldiers who have lost limbs in Afghanistan and Iraq, are choosing not to hide their

prosthetics under clothing as previous generations did. Instead, some of the estimated 1.2 million amputees in the United States—more than two-thirds of whom are men—proudly polish and decorate their electronic limbs for all to see. . . . D

Many young people, especially those who have been using personal electronics since childhood, are comfortable recharging their limbs' batteries in public and plugging their prosthetics into their computers to adjust the software, Hanson says.

Nick Springer, 20, a student at Eckerd College in St. Petersburg, Florida, who lost his arms and legs to meningitis when he was 14, recalls doing just that at a party when the lithium-ion batteries[4] for his legs went dead.

"I usually get 30 hours out of them before I have to charge them again," he says. "But I didn't charge them up the day before."

Terminator Legs

When his legs ran out of power, he spent most of his time sitting on a couch talking to people while his legs were plugged into an electrical outlet nearby. According to Springer, no one at the party seemed to care, and his faith in his high-tech **appendages** appears unfazed. "I love my Terminator[5] legs," he says. E

Springer also remembers going to see *Star Wars: Episode III—Revenge of the Sith* with his father. While he liked the movie, he found the final scenes—in which Anakin Skywalker loses his arms and legs in a light-saber battle and is rebuilt with fully functional prosthetics to become the infamous Darth Vader—a little far-fetched.

"We have a long way to go before we get anything like that," he says. "But look how far humanity has come in the past decade. Who knows? The hardest part is getting the ball rolling. We pretty much got it rolling."

Nick Springer plays hockey with the help of specially-made prosthetics. © Dith Pran/New York Times/Redux.

4. **lithium-ion batteries** (lĭth'ē-əm–īŏn' băt'ə-rēz)**:** very light, small batteries with a great deal of energy packed into a small space.
5. **Terminator:** a robotic character in a 1984 film, *The Terminator.*

D ORGANIZATION
Is the topic still Clapp and his sets of legs? If not, what is the new topic? How is it related to the previous topic?

appendage (ə-pĕn'dĭj) *n.* a body part, such as an arm or leg, that is attached to the main part of the body

TEKS 10C

E ORGANIZATION
In a magazine article, subheads often signal that the writer is shifting to a new idea. But sometimes a subhead is inserted mainly to break up a long block of text. Does the subhead "Terminator Legs" introduce a new idea, or do lines 55–59 support the idea introduced under the previous subhead? Explain your answer.

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A ORGANIZATION
What main idea is introduced in this paragraph? Based on the last sentence of this paragraph, how do you expect the next part of this article to be related to it?

serendipitous (sĕr′ən-dĭp′ĭ-təs) *adj.* found by fortunate accident

pervasive (pər-vā′sĭv) *adj.* present throughout

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PBS

EUREKA:
Scientific *Twists of Fate*

. . . We are all familiar with the tale of Newton's apple. While sitting in his orchard one day in 1665, Isaac Newton's[1] curiosity was sparked by a falling apple, leading him to "discover" the law of gravity. As doubtful as the story sounds, writings by Newton and his contemporaries verify the incident. Though science often seems an orderly and methodical process, history is dotted with surprising discoveries such as these. Were they merely luck? Or the results of a gifted mind? Actually, a bit of both. Sometimes scientific discoveries come from the most unexpected places, when talented people are watching out for them. Here are two examples of similarly **serendipitous** finds. A

The Smallpox Cure

In the late 1700s, Edward Jenner, a young English doctor-in-training, was told by a local milkmaid that she was safe from smallpox[2] because she had already had cowpox. Like its deadly cousin, cowpox also produced painful blisters, yet doctors had not made a connection between the two diseases. After extensive research, Jenner discovered that what she said was true—milkmaids exposed to a common strain of cowpox almost never contracted smallpox.

Jenner's supervising physicians took little interest in his findings. Then, in 1796, he injected a young boy named James Phipps with tissue taken from a cowpox blister on a milkmaid's hand. He then exposed the boy to the deadly smallpox virus. So **pervasive** and devastating was this disease at the time that the boy's family was willing to take this unimaginable risk. But their gamble paid off. Young James remained completely healthy, and the vaccination process was born.

Jenner's idea opened the door not only to the eradication of smallpox but to the subsequent perfection of the immunization procedure by Louis Pasteur.[3] The modern

1. **Isaac Newton:** mathematician and scientist (1642–1727) who developed the theory of gravity.
2. **smallpox:** a highly infectious, often fatal disease characterized by high fevers and blisters that leave pockmarks on the skin.
3. **Louis Pasteur** (lo͞o′ē păs-tûr′)**:** French chemist (1822–1895) who founded modern microbiology and developed several life-saving vaccines.

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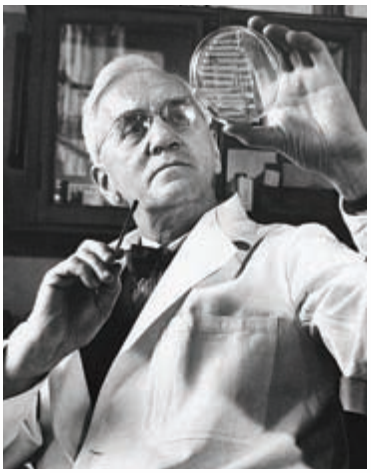
term "vaccine," from the Latin word for "cow," honors Jenner and his life-saving inspiration. . . . B



Alexander Fleming

Penicillin

Arguably the most important medical discovery of the 20th century came about purely by accident. Throughout the 1920s, Scottish scientist Alexander Fleming was searching for a cure for **infectious** disease, the major cause of death throughout much of human history. As part of his research, Fleming was cultivating several species of bacteria in separate petri dishes.

One day, Fleming noticed that a mold had **contaminated** the petri dish containing the bacteria *Staphylococcus,* a common microbe responsible for a variety of ailments ranging from the earaches to deadly post-operative infections. But before tossing away the moldy dish, Fleming realized that the intruder had actually killed off much of the bacteria culture.

The tiny, wind-born mold spore must have landed in the *Staphylococcus* colony during a brief moment Fleming had uncovered the dish. Fleming isolated the mold and identified it as a member of the genus *Penicillium.* He called the antibiotic substance it secreted penicillin.

Fleming's further investigation found that penicillin killed off several, but not all, strains of the disease-causing microbes he was growing in his lab. Had the penicillium contaminated a different dish, Fleming might never have discovered its medicinal benefits.

Additionally, Fleming found penicillin was non-toxic to humans and animals. Realizing the strategic advantage in possessing the world's first antibiotic, the U.S. and Britain joined forces to mass-produce the drug, and treated thousands of Allied troops wounded in the D-Day invasion of Europe. It has saved countless lives ever since. In 1945, Fleming shared the Nobel Prize in Medicine for his work on the "Wonder Drug" penicillin. . . . C

Serendipity or Smarts?

Each of these examples of serendipity helped advance the scope of human knowledge by great leaps and bounds. But these accidents and twists of fate are not quite as random as they seem. Each discovery occurred in the presence of a well-trained intellect. . . . As Louis Pasteur once said, "In the fields of observation, chance favors only the prepared mind."

Internet

B MONITOR
Reread the subheading of this section. Based on this, what question about smallpox should you be able to answer? If you can't answer this question for yourself, **reread** lines 9–25.

infectious (ĭn-fĕk'shəs) *adj.* capable of being transmitted by infection

contaminate (kən-tăm'ə-nāt') *v.* to make impure or unclean through contact

Language Coach
Homonyms Homonyms are words with the same spelling and sound but different meanings. Which context clues help clarify that the word *mold* in line 35 refers to a fungus, not to a container for shaping liquids or plastics as they harden?

C MONITOR
Why is penicillin important? Reread this section if you don't know the answer.

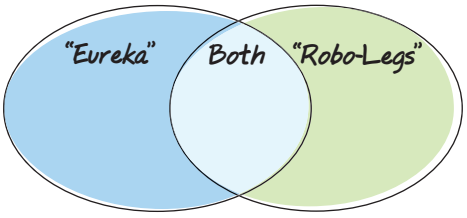
Comprehension

1. **Recall** How does the C-Leg described in "Robo-Legs" work?
2. **Summarize** According to "Robo-Legs," what is different about the way young amputees feel about their prosthetic limbs?
3. **Clarify** James Phipps is mentioned in "Eureka: Scientific Twists of Fate." Why was his family willing to risk his exposure to the smallpox virus?

READING 10C Make subtle inferences and draw complex conclusions about the ideas in text and their organizational patterns. **10D** Synthesize and make logical connections between ideas within a text and across two texts. **RC-8(C)** Reflect on understanding to monitor comprehension.

Critical Analysis

4. **Examine the Message** Reread the first paragraph of "Robo-Legs" as well as lines 23–28 and 35–39. Based on the information stated and the descriptive words and phrases used, what do you think is the message the author wants to share about science and technology?
5. **Interpret Quotation** "Eureka: Scientific Twists of Fate" contains this quote from Louis Pasteur: "In the fields of observation, chance favors only the prepared mind." What does he mean? Use examples from the article to support your answer.
6. **Evaluate Monitoring Techniques** Look back at the chart you created as you read. Which strategy best helped you understand the articles? Explain.
7. **Analyze and Compare Organization of Ideas** In a few sentences, describe the part-by-part organization of each article—that is, how each part is related to the next. Then identify one way in which the two authors use part-by-part organization similarly or differently.
8. **Compare Texts** Use a Venn diagram like the one shown to record similarities and differences between the articles. Consider the subject matter, purpose, tone, and organization of ideas in each article. Why do you think these two articles were presented together in a single lesson?



Extension and Challenge

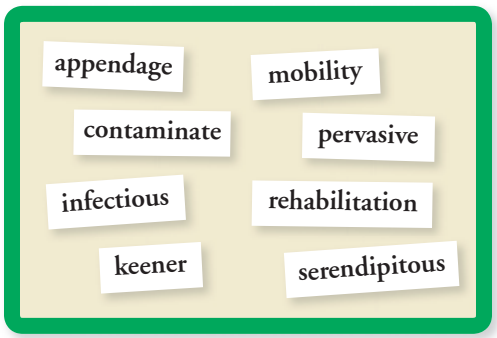
9. **Readers' Circle** Both "Robo-Legs" and "Eureka: Scientific Twists of Fate" describe medical advancements that have helped people lead better lives. What problems would you like science to solve? Discuss your answer with a small group.
10. **SCIENCE CONNECTION** Robotics has become an exciting field of study. Other than prosthetics, what is another way robotics is being used today? Research to find an answer. Then present your findings to the class.

How has SCIENCE changed our lives?

What insights did you gain about science and technology from reading these selections?

Vocabulary in Context

VOCABULARY PRACTICE



Answer each question to show your understanding of the vocabulary words.

1. Which is an **appendage,** a boy's back or his leg?
2. Which can **contaminate** your dinner, bacteria or salt?
3. Which are **infectious,** colds or injuries?
4. If your eyesight gets **keener,** does it get better or worse?
5. Which provides **mobility,** an armchair or a car?
6. If an attitude is **pervasive,** do many people share it or just a few?
7. Would you need **rehabilitation** to recover from a broken leg, or from a cold?
8. If you make a **serendipitous** discovery, are you lucky or unlucky?

ACADEMIC VOCABULARY IN WRITING

• challenge • communicate • design • job • method

What technology would you like to **design** to improve people's lives? Write a paragraph describing the invention or improvement of an existing technology. Try to use at least one of the Academic Vocabulary words in your response.

VOCABULARY STRATEGY: THE LATIN ROOT *pend*

The vocabulary word *appendage* contains the Latin root *pend,* which means "hang." Many English words contain this root. To figure out the meaning of words with this root, use context clues and your knowledge of the root's meaning.

PRACTICE Choose the word from the web that best completes each sentence. Then explain how the root *pend* relates to the meaning of the word.

1. If an employee is ____, he will not keep his job very long.
2. Dogs are pack animals, so they hate being left alone; however, cats are fairly ____ creatures.
3. She wore a diamond____ around her neck.
4. The detective has several cases ____, but none of them are resolved.
5. The elephant's trunk swung ____ from side to side.

READING 2A Determine the meaning of grade-level academic English words derived from Latin roots.