



Read this account of important moments in the history of science. Then answer the questions that follow.

## Luck Favors the Prepared

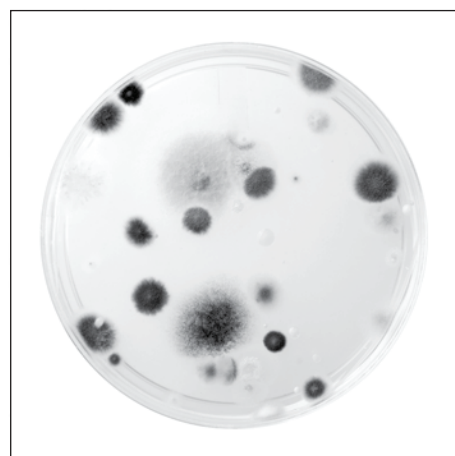
*by Maria Malzone*

1 Making a great discovery generally requires hard work, years of study, and experiment after experiment. However, people sometimes accidentally stumble upon amazing discoveries. Some of the things we use in everyday life—such as sticky notes, microwaves, and artificial sweeteners—were all chance discoveries that changed the way we live. The inventor of the sticky note just happened to stumble on a type of glue that could be reused. The scientist who discovered microwaves wasn't looking for them. He was doing experiments with a new type of vacuum tube. Then one day the chocolate bar in his pocket began to melt, and he realized the machine in front of him could change the way people cooked. A scientist who was trying to find new uses for coal tar happened by chance to notice that it tasted sweet, thus discovering the first artificial sweetener.

2 It is exciting to think that anyone could discover something important, such as sticky notes or microwave ovens. However, most of the accidental discoveries you hear about required more than just luck. While the discoverers may have been lucky, they were also prepared. Some of the most famous “accidental” discoveries were made by scientists who had been working to solve problems for a long time.

3 The discovery of penicillin, which is a medicine used to kill bacteria, is one of the most famous stories of accidental discovery. In the early 1900s, a scientist named Alexander Fleming was trying to find ways to cure diseases and infections. While doing his research, Fleming grew bacteria on special plates called petri dishes.

4 One day he noticed a type of mold, called penicillin, growing on the plate. To Fleming's amazement, the mold killed the bacteria. He discovered that the mold could be used as an antibiotic, which is a medicine that fights bacterial infections. The penicillin antibiotic was used to treat cuts, infections, and diseases that made many people seriously ill. Because of this, it was called a “miracle drug.” It is still used today to help save lives.



Mold growing in a petri dish. Alexander Fleming's chance observation of how a type of mold killed bacteria led to the development of modern antibiotics.



5 X-rays were another accidental discovery. A scientist named Wilhelm Röntgen, who had studied physics and engineering, was working as a professor in the late 1800s. At that time, Röntgen was performing experiments by passing an electric current through gas. His experiments sometimes produced sparks in the gas. Röntgen noticed that every time the gas sparked, a plate treated with a special chemical lit up. Röntgen thought that perhaps the sparks were producing some sort of rays. These rays were not like anything known at the time, however. For this reason, Röntgen called them X-rays.

6 After making this discovery, Röntgen decided to investigate the rays further. For example, he placed different objects in front of the rays. He tested whether the X-rays would pass through the objects or be blocked by them. Röntgen's most famous image is the X-ray shadow of his wife Bertha's hand. This image shows that the rays do not pass through bone. Doctors quickly realized that they could use X-ray images to look at broken bones.

7 Another scientist who made an accidental discovery was Charles Goodyear. Goodyear was experimenting with natural rubber because he hoped to find a way to make it more useful. Natural rubber, which comes from the sap of rubber trees, is too soft and sticky to be used in many products. Goodyear was determined to find a way to change the rubber so that it would be more durable but also remain elastic, or stretchy. He tried to change the rubber in countless ways, but each attempt disappointed him. Goodyear even patented one method of changing the rubber, but he was still unhappy with the results.

8 One day, Goodyear spilled a mixture containing natural rubber onto a hot stove. The result was the hard, strong rubber he had been seeking. The process resulted in what we now call vulcanized rubber. Goodyear patented a process for making vulcanized rubber in 1844 and then sold his product to manufacturers. Today vulcanized rubber is used in everything from bowling balls to car tires to shoe soles.

9 These scientists and inventors are all known for their accidental discoveries. Could these discoveries have been made by anyone else? Perhaps. But Fleming, Röntgen, and Goodyear all studied and worked hard for many years. When their lucky accidents happened, they had learned enough to understand what they saw. They then worked hard to make their observations useful. Lucky accidents can happen to anybody, but great discoveries are almost always the result of hard work.



the first X-ray photograph, showing Bertha Röntgen's hand



**1** Which sentence from the article **best** supports the idea that the discovery of X-rays helped to improve people's health?

- A** "After making this discovery, Röntgen decided to investigate the rays further."
- B** "He tested whether the X-rays would pass through the objects or would be blocked by them."
- C** "Röntgen's most famous image is the X-ray shadow of his wife Bertha's hand."
- D** "Doctors quickly realized that they could use X-ray images to look at broken bones."

**Answer Form**

1 (A) (B) (C) (D)

2A (A) (B) (C) (D)

3 (A) (B) (C) (D)

4 (A) (B) (C) (D)

5 (A) (B) (C) (D)

6 (A) (B) (C) (D)

**Number Correct**

/ 6

**2** Answer Parts A and B below.

**Part A**

Which statement is true about Alexander Fleming's initial understanding of penicillin?

- A** He hoped that penicillin would cure certain diseases.
- B** He was unaware that penicillin would have any effect.
- C** He was sure penicillin would be a helpful medicine.
- D** He knew penicillin was deadly to some bacteria.

**Part B**

Select **two** pieces of evidence from "Luck Favors the Prepared" that support the answer to Part A.

- "one of the most famous stories of accidental discovery"
- "a medicine used to kill bacteria"
- "trying to find ways to cure diseases and infections"
- "To Fleming's amazement"
- "the mold could be used as an antibiotic"
- "it was called a 'miracle drug'"



- 3** The author believes that Charles Goodyear was a dedicated scientist who kept improving on his work. Which sentence from the article **best** supports this statement?
- A** "Another scientist who made an accidental discovery was Charles Goodyear."
  - B** "He tried to change the rubber in countless ways, but each attempt disappointed him."
  - C** "One day, Goodyear spilled a mixture containing natural rubber onto a hot stove."
  - D** "Goodyear patented a process for making vulcanized rubber in 1844 and then sold his product to manufacturers."
- 4** Which of the following **best** matches a central idea from the text with a detail that supports it?
- A** Central idea: Many important discoveries are made during experiments.  
Supporting detail: Doctors began using X-rays to examine injured patients.
  - B** Central idea: Some important discoveries are not well understood at first.  
Supporting detail: Artificial sweetener was based on a kind of coal tar.
  - C** Central idea: Some scientists make accidental discoveries that help people.  
Supporting detail: Penicillin is still used in modern times to save lives.
  - D** Central idea: Dedicated scientists may accidentally become great inventors.  
Supporting detail: Fleming used plates called petri dishes to grow bacteria.
- 5** Vulcanized rubber continues to be an important part of modern products. How does the author illustrate this idea in the passage?
- A** She lists examples of different uses for vulcanized rubber.
  - B** She tells the story of the invention of vulcanized rubber.
  - C** She compares vulcanized rubber with natural rubber.
  - D** She notes the year in which vulcanized rubber was patented.



**6** Which of the following **best** summarizes the article?

- A** Sticky notes, microwaves, and artificial sweeteners all have something in common. Each of these useful things was discovered by accident. The same is true of a number of other discoveries, including penicillin, X-rays, and vulcanized rubber.
- B** Many important scientific discoveries have been made by accident. These include the discoveries of penicillin, X-rays, and vulcanized rubber. In each case, the scientist making the discovery had the experience to see the usefulness in what others might have considered a mere “accident.”
- C** Alexander Fleming may be the person who made the most important accidental discovery of all time. He was working in his lab when he noticed a type of bread mold that killed bacteria. This led to the invention of penicillin, an antibiotic that has saved countless lives.
- D** When a good scientist discovers something by accident, the discovery involves more than just luck. Microwaves, penicillin, and X-rays are all examples of useful things discovered by scientists who knew how to turn a mistake into something good. Their “lucky accidents” had more to do with hard work than good luck.

**7** Explain how the author uses anecdotes, or stories, to illustrate key ideas of the passage. Use details from the passage to support your answer.

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**8** Below is information from paragraphs 5 and 6 of the passage “Luck Favors the Prepared.” Organize the information by writing each phrase from the passage into the proper section of the table: central idea, supporting detail, and example used to make a point.

Röntgen was performing experiments by passing an electric current through gas.  
Röntgen’s image of his wife’s hand showed that X-rays do not pass through bone.  
X-rays were another accidental discovery.  
Every time the gas sparked, a plate treated with a special chemical lit up.

Central idea	
Supporting detail	
Supporting detail	
Example used to make a point	



## Performance Task—Extended Response

9

How does the author introduce and illustrate the differences between truly “accidental” discoveries and those made by hard-working scientists? How does the author feel about the two kinds of discoveries? Write an essay of two to three paragraphs explaining your answer. Be sure to include examples from the passage in your answer.

In your answer, be sure to

- explain how the author presents the differences between these discoveries
- explain how the author feels about these types of discoveries
- use examples from the passage in your answer

Check your writing for correct spelling, grammar, capitalization, and punctuation.

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