

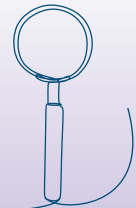
THE DISCOVERY OF X-RAYS: A NEW KIND OF CAMERA



Modern-day x-ray equipment.

WHY IT MATTERS

- By enabling doctors to see within the body, x-rays opened a whole new world of possibilities in medicine.
- While overexposure to x-ray radiation can be dangerous, x-rays can be safely used to diagnose and treat illnesses.



DID YOU KNOW? X-rays are used in many areas beyond medicine. Believe it or not, NASA uses x-rays to help scientists see into space!

Let's think about the similarities and differences between x-rays and photographs. Both have essentially the same function—taking pictures, yet they are very different. Do you remember the last time you had an x-ray taken? Perhaps it was at your last dentist visit. After setting up the machine, the technician covered you with a lead apron and dashed from the room. Click! The x-ray was produced, and the technician returned to examine the “pictures.” Well, have you ever seen a photographer flee the room right before snapping your photo? What do x-ray technicians have to fear? Additionally, a camera takes pictures only of what is on the surface, while an x-ray shows what is under the surface. When you think about it, it sounds a little like science fiction! Whoever **devised**¹ the idea of a camera that can see into the human body?



Dentists take x-rays of the teeth to check for cavities.

DISCOVERING X-RAYS

Actually, the answer is quite simple—nobody did! X-rays, like many other fantastic inventions, were discovered by accident. German scientist Wilhelm Röntgen was experimenting in his lab when he noticed something odd. He was **tinkering**² around with a cathode ray tube when he noticed that a nearby screen was glowing from the light of the rays **emitted**³ from the tube. This was very strange, indeed, because the cathode ray tube was covered in heavy black paper. How did the light **penetrate**⁴ the paper to reach the screen?

To Röntgen's credit, he did not leave the question unanswered. For seven long weeks, he closeted himself in his laboratory, investigating this strange phenomenon. He stopped giving classes at the university, cut off contact with the outside world, and spent all day working alone to find the answer to the mystery.



The x-ray that made history—the image of Mrs. Röntgen's hand. Notice the ring on her finger.

1 **Devised** – thought of

2 **Tinkering** – experimenting in a casual way; fiddling around

3 **Emitted** – given off

4 **Penetrate** – pass into or through

He wouldn't reveal the details of his new project to anyone, not even his wife, who loyally brought his meals to the lab. Finally, in December 1895, he invited her into his laboratory. At last, he was ready to share his discovery with the world. Using x-rays, he took a "picture" of his wife's hand, including her wedding ring.

THE WORLD TAKES NOTICE

Röntgen called the new rays "x-rays" because he wasn't sure what the strange new rays were. X means unknown, like the x used in algebra.

Now we know that x-rays are waves of energy and are a form of **radiation**.⁵ Light is another form of radiation; however, it is much weaker and cannot penetrate objects. Röntgen discovered that x-rays can penetrate some objects, like soft body tissue, but not others, like solid bone. Bone tissue, which blocks x-rays, usually appear white in an x-ray image, while the soft tissue appears black or dark gray. Now, Röntgen could view the forms of the bones and organs within a human body!

Röntgen promptly published news of his discovery in a medical journal. But he did not leave it at that. He was determined that the world should sit up and take notice. On January 1, 1896, he sent out 90 copies of the article to scientists all over Europe. In some of the copies, he included the remarkable pictures that he had taken.

The image of the bones in his wife's hand took the world by a storm. At first, people thought of it as a new form of photography, but before long, the medical significance of x-rays was recognized. Now, doctors could easily diagnose broken bones, locate swallowed objects, and more.

In 1901, Röntgen was awarded the Nobel Prize for his contribution to science. His discovery had opened up a whole new world of medicine.

The new machines were used extensively during World War I, when special cars brought x-ray equipment to the front lines. There, the machines were used to locate bullets in wounded soldiers, guiding the doctors to provide precise surgical treatment, thereby saving countless lives.

X-RAYS' BENEFITS AND DANGERS

X-rays were hailed as a **boon**⁶ to humanity, as they opened up a whole new world of medical treatment. However, there were also dangers accompanying their use. At first these went unrecognized.

Mistakenly thinking of x-rays as no more than a unique method of photography, the public used them in an **unrestrained**⁷ manner. People would line up to get their x-rays taken at fairs, thinking of them as a special **memento**.⁸ Hoping to capture the imaginations of the little ones who came to their stores (and by extension, their parents' pocketbooks), shoe stores would offer free x-rays of the foot so that children could watch their toes wiggle under their new shoes. It was all great fun—but it was dangerous.

5 **Radiation** – energy waves

6 **Boon** – benefit; blessing

7 **Unrestrained** – uncontrolled

8 **Memento** - souvenir

Even when used with good reason for medical purposes, no precautions were taken at first. There were no lead aprons and no technicians exiting the room back in the early days. It was just a regular photography session.

The effects were not long in coming. **Radiologists**⁹ and scientists were the first to feel the harmful power of the rays. They began to report burns and hair loss. Gradually, it dawned on the scientific community that these new rays were powerful—powerful in their diagnostic ability and powerful in their danger. Besides burns and hair loss, **prolonged**¹⁰ exposure was linked to cancer later in life.



A modern-day x-ray image of a hand holding a computer mouse.

Scientist Nikola Tesla, who did a great deal of research on x-rays, spoke publicly about their dangers and urged caution. (Some say that Tesla actually discovered x-rays before Röntgen, though Röntgen was the one to receive the credit.) Soon, new precautions were introduced. Radiologists began to cover patients with special lead aprons so that only the body parts being x-rayed would be exposed to the rays. These technicians were advised to leave the room before administering the x-ray. Since the amount of radiation used is minimal, an occasional x-ray is not harmful to the patient. Only overexposure can be dangerous.

Recognition of x-rays' power also made scientists realize that radiation can be used beneficially to treat cancer. Today, around 50% of people with cancer receive radiation therapy as part of their treatment.

Modern-day x-rays have many uses. They help doctors locate tumors and growths in the body and cavities in the teeth. Additionally, the discovery of x-rays has led the way to other forms of medical imaging, such as magnetic resonance imaging (MRI), ultrasounds, and echocardiography. These have enabled doctors to effectively diagnose and treat a wide range of illnesses and medical conditions.

Can you imagine what modern medical treatment would be like without this new kind of “camera”?

⁹ **Radiologists** – doctors who use imaging machines (such as x-rays) to diagnose and treat illnesses
¹⁰ **Prolonged** – going on for a long time

QUESTIONS



1. *At first, people thought of it as a new form of photography, but before long, the medical significance of x-rays was recognized.*

As used in this sentence, “form” most nearly means

- A. shape
- B. fashion
- C. document
- D. type

2. **In which sentence is the word “boon” used correctly?**

- A. He left his homework at home, but the teacher gave him the boon of the doubt, because he had been up late the night before.
- B. Not only were the pants cheap and fit well, but the extra pockets in the front were an additional boon.

3. **Number the following events in the order in which they took place.**

- _____ People used x-rays in an unrestrained manner.
- _____ Röntgen discovered by accident that the rays he was tinkering with could penetrate paper.
- _____ Röntgen took a picture of his wife’s hand using x-rays.
- _____ Röntgen published his discovery in a medical journal.
- _____ Nikola Tesla advocated increased safety measures.

4. **Why did Röntgen closet himself in his laboratory?**

- A. He wanted to avoid the harmful effects of unrestrained x-rays.
- B. He wanted to x-ray his wife’s hand.
- C. He wanted to explore his new scientific discovery.
- D. He wanted to publish his discovery in a medical journal.



5. What is the author’s purpose in including the following sentence?

Hoping to capture the imaginations of the little ones who came to their stores (and by extension, their parents’ pocketbooks), shoe stores would offer free x-rays of the foot so that children could watch their toes wiggle under their new shoes.

- A. The author is providing an example of the unrestrained use of x-ray technology.
- B. The author is providing an exception to the rule of x-ray safety.
- C. The author is providing a reason why radiologists reported burns and hair loss.
- D. The author is comparing unrestrained x-ray use with modern-day safety precautions.

6. How have x-rays changed the field of medicine?

- A. X-rays have caused people to be exposed to dangerous levels of radiation, requiring treatments for overexposure.
- B. X-rays have led to the development of new types of medical imaging.
- C. X-rays have helped scientists discover that radiation therapy can prevent people from developing cancer.
- D. X-rays are the most effective way to diagnose all medical conditions.

7. Which quote from the lesson provides the best evidence for the answer to the previous question?

- A. Besides burns and hair loss, prolonged exposure was linked to cancer later in life.
- B. The new machines were used extensively during World War I, when special cars brought x-ray equipment to the front lines.
- C. Today, around 50% of people with cancer receive radiation therapy as part of their treatment.
- D. Additionally, the discovery of x-rays has led the way to other forms of medical imaging, such as magnetic resonance imaging (MRI), ultrasounds, and echocardiography.

8. Compare and contrast cameras and x-rays.

9. How did the use of x-rays change over time? How did it stay the same?

10. If x-rays had not been discovered, what would be different today?

