What began as a chance accident in a darkened room was only the beginning. Today, technology allows people to produce clear and complete pictures of the human body. From X-rays to ultrasound to the latest computerized scans, accidental discoveries have enabled us to study and diagnose the inner workings of the human body.

Being able to see inside the body without cutting it open would have seemed unthinkable in the early 1890s. But within a year of the discovery of the X-ray in 1895, doctors were using technology to see through flesh to bones. In the time since then, techniques for making images have advanced to allow doctors to see soft tissue, muscle, and even to see how body systems work in real time. Many modern imaging techniques employ X-ray technology, while others employ sound waves or magnetic fields.

**EVENTS**

1880 1890

**APPLICATIONS AND TECHNOLOGY**

**1895**

**Accidental X-Ray Shows Bones**

Working alone in a darkened lab to study electric currents passing through vacuum tubes, William Conrad Roentgen sees a mysterious light. He puts his hand between the tubes and a screen, and an image appears on the screen—a skeletal hand! He names his discovery the X-ray, since the images are produced by rays behaving like none known before them. Roentgen uses photographic paper to take the first X-ray picture, his wife’s hand.

**APPLICATION**

**Doctor Detectives**

Within a year of Roentgen’s discovery, X-rays were used in medicine for examining patients. By the 1920s, their use was widespread. Modern day X-ray tubes are based on the design of William Coolidge. Around 1913, Coolidge developed a new X-ray tube which, unlike the old gas tube, provides consistent exposure and quality. X-ray imaging changed the practice of medicine by allowing doctors to look inside the body without using surgery. Today, X-ray images, and other technologies, like the MRI used to produce the image at the left, show bones, organs, and tissues.
1898
Radioactivity
Building on the work of Henri Becquerel, who in 1897 discovers “rays” from uranium, physicist Marie Curie discovers radioactivity. She wins a Nobel Prize in Chemistry in 1911 for her work in radiology.

1914–1918
Radiologists in the Trenches
In World War I field hospitals, French physicians use X-ray technology to quickly diagnose war injuries. Marie Curie trains the majority of the female X-ray technicians. Following the war, doctors return to their practices with new expertise.

1955
See-Through Smile
X-ray images of the entire jaw and teeth allow dentists to check the roots of teeth and wisdom teeth growing below the gum line.

APPLICATION
Better Dental Work
Throughout the 1940s and 1950s dentists began to use X-rays. Photographing teeth with an X-ray allows cavities or decay to show up as dark spots on a white tooth. Photographing below the gum line shows dentists the pattern of growth of new teeth. By 1955, dentists could take a panoramic X-ray, one which shows the entire jaw. In the early years of dental X-rays, little was known about the dangers of radiation. Today, dentists cover a patient with a lead apron to protect them from harmful rays.
**1976**

**New Scans Show Blood Vessels**

The first computerized tomography (CT) systems scan only the head, but whole-body scanners follow by 1976. With the CT scan, doctors see clear details of blood vessels, bones, and soft organs. Instead of sending out a single X-ray, a CT scan sends several beams from different angles. Then a computer joins the images, as shown in this image of a heart.

**1977**

**Minus the X-ray**

Doctors Raymond Damadian, Larry Minkoff, and Michael Goldsmith, develop the first magnetic resonance imaging (MRI). They nick-name the new machine “The Indomitable,” as everyone told them it couldn’t be done. MRI allows doctors to “see” soft tissue, like the knee below, in sharp detail without the use of X-rays.

**1973**

**PET Shows What’s Working**

The first positron emission tomography machine is called PET Scanner 1. It uses small doses of radioactive dye which travel through a patient’s bloodstream. A PET scan then shows the distribution of the dye.

**TECHNOLOGY**

**Ultrasound: Moving Images in Real Time**

Since the late 1950s, Ian Donald’s team in Scotland had been viewing internal organs on a TV monitor using vibrations faster than sound. In 1961, while examining a female patient, Donald noticed a developing embryo. Following the discovery, ultrasound imaging became widely used to monitor the growth and health of fetuses.

Ultrasound captures images in real-time, showing movement of internal tissues and organs. Ultrasound uses high frequency sound waves to create images of organs or structures inside the body. Sound waves are bounced back from organs, and a computer converts the sound waves into moving images on a television monitor.
Although discovered over 100 years ago X-rays are certain to remain a key tool of health workers for many years. What will be different in the future? Dentists have begun the trend to stop using film images, and rely on digital X-rays instead. In the future, all scans may be viewed and stored on computers. Going digital allows doctors across the globe to share images quickly by email.

Magnetic resonance imaging has only been in widespread use for about 20 years. Look for increased brain mapping—ability to scan the brain during a certain task. The greater the collective data on brain-mapping, the better scientists will understand how the brain works. To produce such an image requires thousands of patients and trillions of bytes of computer memory.

Also look for increased speed and mobile MRI scanners, which will be used in emergency rooms and doctor’s offices to quickly assess internal damage after an accident or injury.

**ACTIVITIES**

**Writing About Science: Brochure**
Make a chart of the different types of medical imaging used to diagnose one body system. Include an explanation of how the technique works and list the pros and cons of using it.

**Reliving History**
X-rays use radioactivity which can be dangerous. You can use visible light to shine through thin materials that you don’t normally see through. Try using a flashlight to illuminate a leaf. Discuss or draw what you see.