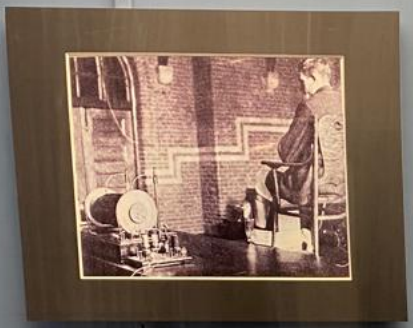
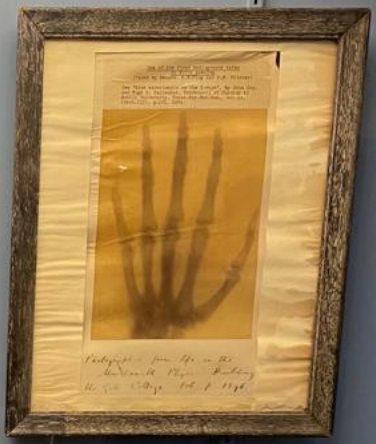
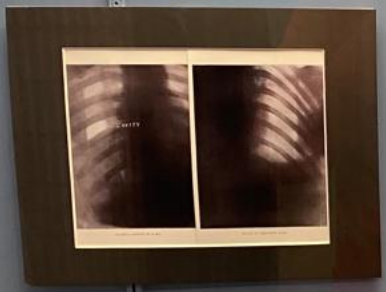
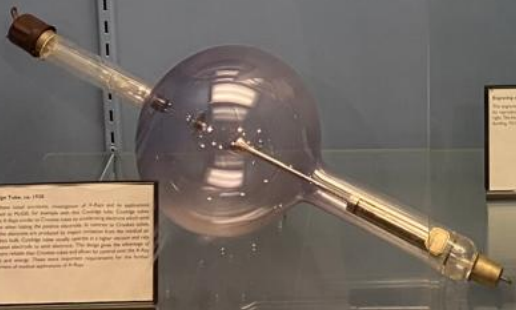
Early X-Ray Studies at McGill









Photograph of the Taking of a X-Ray Image at McGill University, 1896

X-Rays were discovered in November 1895 as part of the radiation emitted by Crookes tubes. At the time, these instruments were commonplace in physics laboratories which allowed scientists to immediately start the investigation of the new radiation, its properties and applications. McGill University's newly founded physics department was among the first laboratories in North America to experiment with X-Rays and only a few months after their discovery X-Ray images were taken in Montreal for the first time. The technique was quickly adapted to aid in medical procedures.

This photograph shows physics professor John Cox during the taking of a X-Ray image of his leg in the Macdonald Physics Building.

X-Ray Image, 1896

This picture of a hand, taken on February 7th 1896, is one of the first X-Ray images taken in North America. It was published in the Montreal Medical Journal where the radiological process is described as:

"The process simply consists in placing the object to be pictured between a Crookes tube and a [photo]sensitive plate enclosed in an ordinary plate holder, or, better, in black and orange paper. The operation is carried on in ordinary daylight, since the plate is never exposed to it. The plate is developed and fixed in the usual way."
John Cox, Professor at McGill University,
Montreal Medical Journal, March 1896

The full paper can be found here:

X-Ray Image in the Montreal Medical Journal, 1896

This is the first radiological image used to aid in a surgery, it was made at McGill University with a Crookes tube and a photographic plate. A man had been shot in the leg and surgeons at the Montreal General Hospital were unable to find the bullet, so it remained in the body until the patient developed severe pain a few months later. An X-ray image revealed the location of the bullet which was removed and the patient recovered.

"As this is probably one of the earliest cases of the successful application of Roentgen's rays, especially in penetrating such a thickness of flesh, the negative, which clearly shows the flattened bullet lying between the tibia and fibula, will be seen with interest."

John Cox, Professor at McGill University, Montreal Medical Journal, March 1896

X-Ray Image in the Montreal Medical Journal, 1896

This is the first radiological image used to aid in a surgery, it was made at McGill University with a Crookes tube and a photographic plate. A man had been shot in the leg and surgeons at the Montreal General Hospital were unable to find the bullet, so it remained in the body until the patient developed severe pain a few months later. An X-ray image revealed the location of the bullet which was removed and the patient recovered.

"As this is probably one of the earliest cases of the successful application of Roentgen's rays, especially in penetrating such a thickness of flesh, the negative, which clearly shows the flattened bullet lying between the tibia and fibula, will be seen with interest."
John Cox, Professor at McGill University, Montreal Medical Journal, March 1896

Medical X-Ray Images of Lungs, 1896

These two X-Ray images of a healthy and an infected lung illustrate how X-Radiography was used at McGill University and Montreal hospitals to aid in diagnoses and surgeries:

"Pus cavity in lung. In this case the diagnosis from the ordinary methods was very uncertain. A cavity, however, was very clearly indicated as a dark shadow in the [X-Ray image] negative. If the cavity had been full of pus at the time, it would have been indicated as a lighter patch, the transparency of liquid being less than that of lung tissue when distended with air."

John Cox and Hugh Callendar, Professors at McGill University, Transactions of the Royal Society of Canada, 1896

The full paper can be found here:

Medical X-Ray Images of Lungs, 1896

These two X-Ray images of a healthy and an infected lung illustrate how X-Radiography was used at McGill University and Montreal hospitals to aid in diagnoses and surgeries:

"Pus cavity in lung. In this case the diagnosis from the ordinary methods was very uncertain. A cavity, however, was very clearly indicated as a dark shadow in the [X-Ray image] negative. If the cavity had been full of pus at the time, it would have been indicated as a lighter patch, the transparency of liquid being less than that of lung tissue when distended with air."

John Cox and Hugh Callendar, Professors at McGill University, Transactions of the Royal Society of Canada, 1896

The full paper can be found here:

Crookes Tube, ca. 1910

X-Rays were discovered by Wilhelm Conrad Röntgen in November 1895 when experimenting with Crookes tubes similar to the one shown here. Crookes tubes are partially evacuated glass bulbs with two electrodes between which a high voltage is applied. The electric field accelerates naturally occurring electrons in the remaining air which produce more electrons and ions by collisions with neutral gas molecules. The positively charged ions get accelerated towards the negatively charged electrode (cathode), the round metal plate on the side of the tube. Upon collision with the cathode surface electrons are released from the metal. These electrons are in turn attracted by the positively charged electrode (anode) in the middle of the tube and create a beam called a cathode ray. When the cathode ray hits the metal of the anode X-Rays are emitted. In this tube the anode is angled to control the direction of the emitted X-Rays.

Engraving of a X-Ray Image, date unknown

This engraving of the first X-Ray photo taken at McGill University was made for reproducing the image for publication. A print can be seen above on the right. The inscription reads: "Photographed from life, in the MacDonald Physics Building. McGill College Feb. 7. 1896."

Coolidge Tube, ca. 1920

After these initial successes, investigation of X-Rays and its applications continued at McGill, for example with this Coolidge tube. Coolidge tubes produce X-Rays similar to Crookes tubes by accelerating electrons which emit radiation when hitting the positive electrode. In contrast to Crookes tubes, where the electrons are produced by impact ionisation from the residual air in the glass bulb, Coolidge tubes usually operate at a higher vacuum and rely on a heated electrode to emit electrons. This design gives the advantage of being more reliable than Crookes tubes and allows for control over the X-Ray intensity and energy. These were important requirements for the further development of medical applications of X-Rays.