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**Wilhelm Konrad Röntgen
(1845-1923)**

Introduction

In the last decade of the nineteenth century, physicists throughout Europe believed that most of the known phenomena of nature had been successfully explained. The work by scientists in that century had elucidated the properties of electricity: it could be discharged through gases at low pressure; in vacuum tubes it flowed in rays from the negative cathode wire to the positive anode wire; “cathode rays” caused glass to fluoresce. English scientist William Crookes, in his experiments from 1879-1885, demonstrated the heating effects of cathode rays which he focused on a platinum target. In 1894, German physicist Philipp Lenard proved that the cathode rays passed through an aluminum window in the glass tube and excited phosphorescence a few millimeters away. Scientific investigators were intent only on measuring what was known with greater precision.

But in the fall of 1895, during some painstaking investigations on the properties of the Crookes tube, Professor Wilhelm Konrad Röntgen recorded a new kind of rays and revolutionized the world of physics and medicine. Although many experimenters, including Crookes himself, had actually produced these “X-rays” during experiments with vacuum tubes, only Röntgen recognized that the observed manifestations which other men attributed to cathode rays were the results of a previously unknown phenomenon.

Röntgen was born on March 27, 1845, the son of a textile merchant, in the little town of Lennep in the region of the lower Rhine. He spent his youth in Holland and was educated in a technical college in Switzerland. At the age of 24, he received his Doctorate of Philosophy from the University of Zurich, presenting his dissertation, “Studies on Gases.” In the years following graduation, the young physicist held several academic positions. In 1888, the University of Würzburg appointed him Professor of Physics. At Würzburg, Röntgen conducted the experiments that led to his discovery of the X-rays and the presentation of his historic preliminary communication, “On A New Kind Of Rays,” which is reprinted below.

When Röntgen was appointed rector of the University of Würzburg he wrote, “. . . the experiment is the most powerful and most reliable lever enabling us to extract secrets from nature.” He wanted to know whether cathode rays could penetrate the glass Crookes tubes, and set up an experiment to find out.

Late in the afternoon of November 8, 1895, while working alone in his laboratory with a cardboard-covered tube, he switched on the electricity and at first saw nothing, as he had expected. Then, surprised, he noticed a faint green glow

on a screen coated with barium platino-cyanide which was resting on a bench a yard away. Realizing that the glow was too far from the tube to be due to cathode rays—they could only travel a fraction of an inch outside the tube—he held a sheet of paper, a book, several books and aluminum in front of the screen and the green light still appeared. He thought the rays must be something new. Astounded by the discovery, he issued no reports until he had proven beyond all of his own doubts that the observations were correct.

Only his wife Bertha knew of Röntgen's secret work. One day, he instructed her to hold up a photographic plate which, when developed, showed the bones of her hand and the shadows of her two gold rings. Röntgen's shadow picture, which terrified his wife, marked the beginning of pictorial and diagnostic radiology.

After a few weeks of investigation, he presented his report to the Physical Society of Würzburg, and sent copies of it to several European physicists. Soon, he was inundated with congratulations and appeals from cripples seeking X-ray "cures." Newspapers around the world carried the story. On January 13, 1896, the Emperor summoned Röntgen to demonstrate his X-rays at a testimonial dinner, and decorated him with the Prussian Order of the Crown.

Crookes tubes were common in most laboratories, so other scientists easily duplicated Röntgen's X-rays and pictures. But Röntgen made the first true X-ray tube and devised a protective zinc-walled room to prevent over-exposure to X-rays.

The medical significance of the X-rays was immediately recognized. For the first time, the human eye was able to see the structures of the living human body, and in the months following Röntgen's announcement, X-rays were used to determine fractures and dis-

locations, to study diseases of the thorax and to diagnose calculus disease. In Chicago, Illinois, a Crookes tubemaker named Emil Grubbe placed the tube over the breast cancer of Mrs. Rose Lee, a mother of four, and initiated X-ray therapy. Mrs. Lee's tumor began to shrink and her pain disappeared, although she died soon afterwards.

Röntgen witnessed many of the developments which resulted from his discovery, particularly the work of Bequerel, the Curies, Thomson and Rutherford. He was the recipient of an honorary medical degree and numerous medals. The Kaiser even erected a bronze statue of him on Berlin's Potsdam Bridge. But the ascetic physicist did not enjoy the publicity he was receiving. He had pursued his investigations as a research scientist who sought only to add to the body of scientific knowledge. He never accepted remuneration for his work, and, like the Curies after him, sought no patents. He resented the invasion of his privacy and told a friend, "It is almost as if I had to apologize for discovering the rays."

So, when he was awarded the first Nobel prize in physics in 1901, he traveled alone to Stockholm. He would not give an official Nobel lecture or take part in any ceremonies or festivities, and he donated his prize money to the University of Würzburg.

Characteristically, Professor Röntgen never entered into any contracts for manufacturing diagnostic apparatus. Thomas Edison expressed the view that men should "see how to use [the X-ray] and how to profit by it financially," and American concerns began producing and selling X-ray machines.

Wilhelm Röntgen continued to live modestly, and after retiring from his professorship in 1919, went to live in a village suburb of Munich. He died in 1923 at the age of 78. The executors of his will followed his instructions and burned all of his scientific writings and correspondence.