First physics Nobel offered glimpse into the future

X-ray's 1895 discovery opened up new heights for scientists, doctors to aspire — successfully

EDITOR'S NOTE — A century ago the painstaking work of a German scientist translated into one of the first bonanzas of physical science — X-rays. The discovery won the first Nobel Prize in physics, and gave medicine its first detailed look inside the living human body.

By JOHN BARBOUR
Associated Press

One hundred years ago in Wurzburg, Germany, a dedicated scientist named Wilhelm Konrad Roentgen came to the realization that his wife was concerned that he was driving himself too hard. She worried he was losing his sanity.

To allay those fears, he took her to his downstairs laboratory to show her the new apparatus that was taking so much of his time and attention. He asked her to place her hand on a photographic plate and switched on the machine. It hummed with the flow of electricity. Then he removed the plate to develop it.

When he returned with the developed photo, the woman was astonished. There before her eyes were the very bones of her fingers and wrist. And on her third finger was the bright white image of her wedding band.

In his careful way he dated the photograph Dec. 22, 1895. Thus was the age of X-rays born.

The world did not learn about it for another month, when Roentgen's paper was published. It electrified scientific circles. When the Nobel Prizes were instituted in 1901, Roentgen's was the first to be awarded in physics.

please see **X-RAY**/G2

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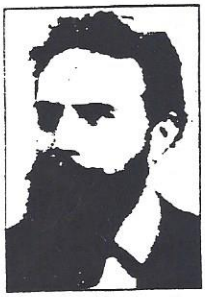
ER: Emergency room resident Gretchen Bell (left) looks at X-rays of a head trauma victim at Chicago's Cook County Hospital.

When he demonstrated his machine to fellow scientists they were gripped with the same astonishment his wife felt. One can imagine the incredible awe that rippled through the hall.

Roentgen told them:

"Paper is very transparent; behind a bound book of about 1,000 pages I saw the fluorescent screen light up brightly, the printer's ink offering scarcely a noticeable hindrance. In the same way the fluorescence appeared behind a double deck of cards ... a sheet of tinfoil is also scarcely perceptible ... thick blocks of wood are also transparent."

Ditto sheets of hard rubber more than an inch thick. He told of how he tried a variety of liquids and solids, revealing another peculiarity of the rays. They passed through glass plates readily but leaded glass impeded the rays depending on the amount of lead in the glass.



ROENTGEN

The technology is taken for granted today. Developments over the century have married more powerful, more precise X-ray machines to computers to conjure up three-dimensional images of, for instance, the brain. The uses of the rays far exceed anything Roentgen imagined.

Fifty years after Roentgen's discovery the Nobel was again awarded for X-ray work, this time to Allan M. Cormack of Tufts University and British engineer Godfrey Newbold Hounsfield for their mathematical model or algorithm that led to the now commonly used CT scan.

Today X-rays are used to authenticate paintings, stamps, coins and in quality control laboratories to check the manufacture of countless products.

When Roentgen's discovery was announced those hundred years ago, scientists wanted to call the rays Roentgen-rays. The physicist demurred, preferring "X" because their characteristics were largely unknown.

The public, not used to the parade of startling scientific discoveries we take for granted today, read about the new rays first in Vienna's newspaper Die Presse, and the

FIRST KNOWN X-RAY: X-ray inventor Wilhelm Konrad Roentgen — whose wife apparently wasn't thrilled about the time he was spending in his lab — used her as a guinea pig and won her c wowing her with this X-ray photo of her har plete with wedding ring.

word quickly flashed around the world.

The quiet of Roentgen's world was shattered. Amid the flood of messages from around the world, came one from Kaiser Wilhelm:

"If the [newspaper] report is correct, I congratulate you from my heart and praise God that to our fatherland was given the triumph of science which, hopefully, will be a rich blessing for mankind."

With that the Kaiser asked for a command performance of the apparatus, which was given in Berlin before a select audience.

The excitement traveled through the ranks of acadame. Students marched by torchlight to Roentgen's Wurzburg home. Magazines published verse proclaiming:

The town's ablaze
with the new phase
of X-rays' ways.

And:

For nowadays
I hear they'll gaze
through cloak and gown
and even [corset] stays,
these naughty, naughty Roentgen rays.

Quickly following the announcement came signs of fear. The mysterious new rays would endanger everyone's privacy, a concern in America then as now. One state legislature introduced a bill that would ban X-rays from opera glasses or any other aids to vision.

(That was decades before Superman's X-ray vision allowed him to see through walls into the next room.)

The New York Times interviewed Thomas Alva Edison, who said he was already at work on a salable X-ray machine that would use a screening device he called a fluoroscope. In typical Edison fashion, his team of technicians was working dozens of hours straight through.

Then one of them, his glassblower, showed visible skin damage from the radiation. Edison dropped the project.

A warning sign, but clearly due to abuse. The glassblower had suffered numerous radiation burns demonstrating the miraculous rays at the New York Exposition of 1896 and died of their effects in 1904. He was the first person known to die of radiation in the United States.

Roentgen himself went on trying the versatility of the rays. He made an X-ray photograph of his hunting rifle and found a flaw in the metal of the barrel. It was the beginning of a new use for the rays: nondestructive testing, still widely used in commercial product inspection.

X-rays revealed that Thomas Gainsborough's "Blue Boy" was painted over a painting of a man. X-rays have also revealed the skeletons of Egyptian mummies.

In the meantime, sandwiched between honorary degrees and almost 30 medals, prizes and plaques, countless interviews and trips, Roentgen's own work went on within the shelter of his simple laboratory. Others probably were making more progress than he had time for.

He refused to have his device patented. The result was that its design was open to anyone to use. A number of entrepreneurs pursued him because, as X-ray uses multiplied, potential licensing fees would have been worth a fortune.

Mixed with such benefits was a growing awareness of the damage X-rays could do. At the same time there was promise that X-radiation therapy could destroy tumors, there were alarms that it could cause cancer. There was promise that it could detect tuberculosis, but no hope of a cure.

People who worked with the rays began to register a large number of premature deaths and genetic mutations. Slowly, information accumulated which led to proper shielding with lead aprons and walls.

The design of X-ray equipment became more sophisticated over time. Better focused, more powerful rays cut down peripheral damage.

Nevertheless a certain naivete seemed to tag along with the new science. Shoe stores in the midcentury installed X-ray machines so that mothers could see for sure that a pair of shoes really fit their child and didn't cramp the feet.

That practice was ultimately eliminated, but not before generations of children and their mothers were irradiated unnecessarily. In the 1960s, rules were laid down to circumscribe the use of X-rays.

In his careful, precise way, Roentgen himself probably avoided the dangers that befell many others.

He was allowed to smoke at the age of 15 as was the custom in the Netherlands where he spent his childhood. An uncle gave him a meerschaum mouthpiece and warned him to be careful because until it cured it would leave a bad taste in his mouth. Seeing no reason for this inconvenience, young Roentgen built a small suction device which smoked his first two cigars for him.

Such caution continued all through his life. One reason he avoided the X-ray burns and skin damage that beset other researchers was the metal box in which he performed most of his experiments in his simple laboratory.

His love of fine Dutch tobacco followed him all through his life, however. He died of heart failure in his 78th year.

If his X-rays have outgrown even his own expectations, they have

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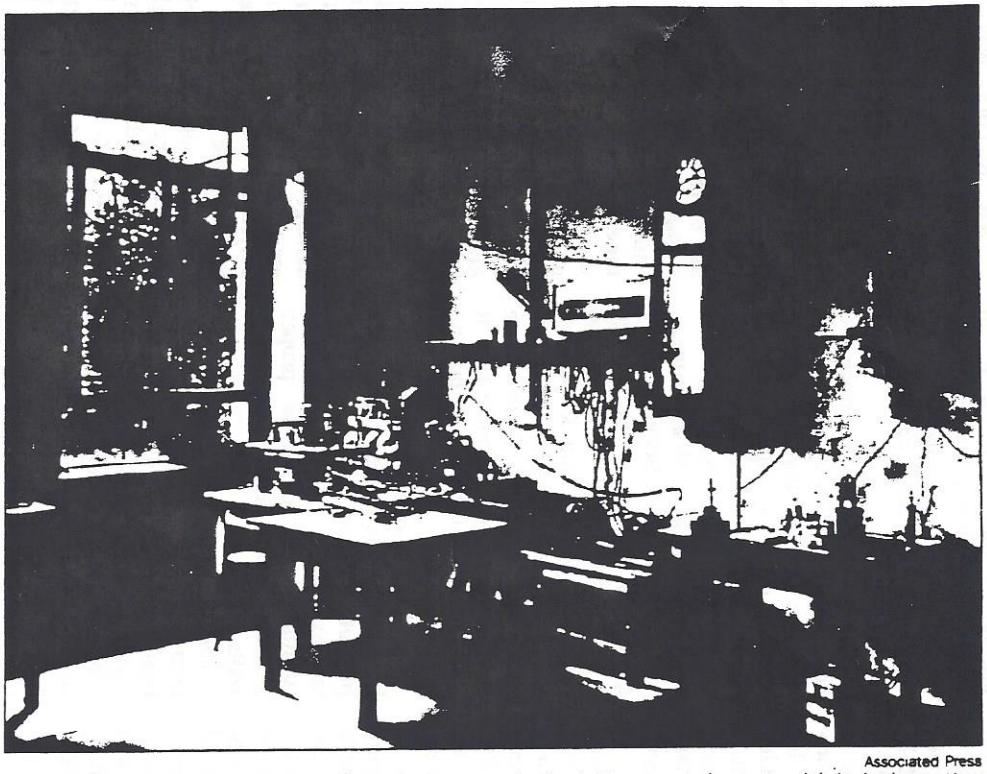

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DISCOVERY SITE: Wilhelm Roentgen conducted the experiment which led to the discovery of the X-ray in this laboratory at Bavaria's University of Wurzburg. Prior to the discovery of the rays, he spent long evenings here experimenting with evacuated tubes to determine the effects of cathode rays. It was then that he discovered the invisible rays which could penetrate opaque materials.

USES FROM G2

fallen short of others' schemes. A professor in New York wanted to project X-rays of the anatomy directly into the brains of medical students to speed up the memorization process. A college student wanted to use X-rays to transmute common coins into gold. And a leader of the temperance movement wanted to use the rays to show drunkards the effects of demon rum on their bodies.

Wilhelm Roentgen may have forseen fanciful uses some might find for his marvelous rays. But he also was well aware of their potential in matters of life and death.

A year after his discovery, in 1896, X-rays were used to locate bullets lodged in soldiers wounded in the Spanish-American War. Today, a century later, they are a fixture at airports — to locate guns.