

**Program:** Science's Greatest Woman: Marie Curie

**Speaker:** Richard Gunderman, MD, PhD, Chancellor's Professor, IUPUI

**Introduced by:** Jerry Kurlander

**Attendance:** 160

**Guests:** Martha Born, Pete Benner, Mark Sperka, Tom Daugherty, Steve Daugherty, Andrea Zeek,

Holly Vanderhert, Terry Karwowski, Chris Colglazier

**Scribe:** Tom Lauer

**Editor:** Bonnie Carter

Dr. Gunderman is a Chancellor's Professor, Bicentennial Professor, Radiology, Pediatrics, Medical Education Philosophy, Liberal Arts, Philanthropy, Medical Humanities and Health Studies; John A. Campbell Professor of Radiology, Indiana University

He began his talk stating that, arguably, Marie Curie was the most important female scientist who ever lived.

- 1867-1934 (aged 66)
- Born: Warsaw, Poland (Maria Sklodowska)
- Citizenship: Poland by birth, French by marriage
- Children: Irene Joliot-Curie (1897-1956); Eve Curie (1904-2007)

Major Accomplishments:

- First female professor – University of Paris
- First woman to win Nobel Prize: (Physics)1903
- Only woman to win in two fields: (Chemistry) 1911
- Radioactivity first described by Marie Curie, with husband Pierre (married 1895, died 1906)
- Added two elements: polonium and radium to the periodic table

Early Years:

She graduated with honors from boarding school in 1883, but was unable to get enrolled in higher education because she was a woman, as well as, had financial restraints. She made an agreement with her sister, Bronislawa, that she would fund her sister's education in Paris and that after her graduation, her sister would reciprocate. Working as a governess, she fell in love with Kazimir Zorawski, but his family refused to allow the marriage. They did not feel Maria was good enough, or wealthy enough for their son. Maria was heartbroken. Kazimir went on to earn a doctorate in mathematics and teach at Krakow University.

Eventually Maria went to Paris, changed her first name to Marie and enrolled in the Sorbonne (now the University of Paris) in late 1891. Most women were studying romance languages, etc., however, Marie studied physics. She finished first in her class in 1893 and earned a second degree in 1894, despite limitations of not knowing French well.

Early Professional Years:

She worked with magnets and electricity and eventually met Pierre Curie as a head of a laboratory. 1859-1906. He was a home-schooled prodigy, most noted for piezoelectricity - electronic circuits -which has importance today. Her attraction to Pierre Curie was

rather unusual; it was based on science, not romance. His uncanny proposal was accepted and they were married in 1895.

Henri Becquerel was an important French physicist dealing with uranium salts and sunlight. He identified that uranium salts emitted radioactivity, but was unaware of the mechanism. He gave the thought to Pierre Curie to pursue for her thesis. After some time working with radioactivity, Marie's husband, Pierre, joined her in the research. The Curies worked long and hard on radiation, with a focus on the mineral pitchblende. Eventually, they isolated radium and polonium. Pierre was awarded a Nobel prize with Marie and Becquerel for this discovery

#### Middle Professional Years and Family Life:

Pierre and Marie had two daughters, Irene and Eva. Because of the demanding work schedule, the daughters were raised largely by their paternal grandfather. Moreover, when Eva, the youngest, was just two years old, Pierre was killed by a horse-drawn carriage in a tragic accident. Irene was quoted as saying, "On that day in April, Marie Curie became not only a widow, but a pitiful and incurably lonely woman."

Paul Langevin was a student of Pierre Curie, and also the doctoral dissertation advisor for Marie Curie's daughter. Langevin invented sonar. Paul Langevin's marriage was not the best and Marie Curie made a play for him, with an affair that followed. Mrs. Langevin threatened to kill her and the Paris tabloids created a press scandal that almost cost Marie Curie to lose a Nobel Prize. Despite the international cries against Curie, she was awarded a second Nobel Prize in 1911 in Chemistry, discovering two new elements, radium and polonium. Paul Langevin eventually got back with his wife.

1914: During World War I, Marie Curie believed that X-ray equipment could be mounted in trucks and used in a wide variety of places. During the war, Marie and her team made over 1,000,000 radiographs, and worked closely with her daughter Irene.

#### Later Years:

Following the war, she continued her research on radiation, but eventually died in 1934 from aplastic anemia. It was believed that her exposure from the X-rays she took during the war was responsible for the problem. She and her husband are interred at the Pantheon in France.

#### Other Notes:

- Her oldest daughter, Irene, married Frederick Joliot and both changed their names to Joliot-Curie. They achieved an alchemist's dream; they changed one element into another element, for which both won a Nobel Prize.
- The other daughter Eve's husband won the Nobel Peace Prize in the 1950s.
- Marie did not patent the radium purification process, but rather, believed that some processes should be available to all.
- She didn't accept awards on her behalf. These went to institutions she worked for. Albert Einstein once said she was the "only person he ever knew that couldn't be corrupted by fame."

#### Audience Questions & Comments:

Matricide – People theorized she was killed by her own radioactive elements. However, she was likely done in by the X-rays taken in WW1, a "martyr for science."

At what point did they determine that radium is dangerous? After it was isolated as a radium salt, Becquerel took some and put it in an amulet worn around his neck, causing burns.

The daughters were raised by their paternal grandfather. A lingering discomfort was that Marie was working long hours and needed someone to watch the girls.

X-ray machines were retrofitted to examine a shoe's fit after WWII. Radium also was found on watch dials painted by women; they became sick.

What about dental X-rays? Are they problematic? Maybe low-level radiation is not harmful but is beneficial. Dr. Gunderman is not sure about this, however.

It took tons of pitchblende to make a few grams of radium after an Incredible amount of work.

Who developed the machinery on which Marie and she took the million X-rays? Dr. Gunderman is not sure.

Adverse biological effects from radiation – after a big dose you are doomed. However, stochastic effects are random and unpredictable.

The Marie Curie story can't be told without understanding the rest of the world's environment. She found the courage and vision to carry on her work. It is an incredibly inspiring story.



**Dr. Gunderman**