NEW

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Marie Curie

7 November 1867 - 4 July 1934

Marie Sklodowska Curie was a Polish-born French physicist and chemist famous for her work on radioactivity. She was a pioneer in the field of radioactivity and the first person honored with two Nobel Prizes-in physics and chemistry. She was also the first female professor at the University of Paris. She was born Maria Sklodowska in Warsaw (then in Vistula Land, Russian Empire; now in Poland) and lived there until she was twenty-four. In 1891 she followed her older sister Bronislawa to study in Paris, where she obtained her higher degrees and conducted her subsequent scientific work. She founded the Curie Institutes in Paris and Warsaw. Her husband Pierre Curie shared her Nobel prize in physics. Her daughter Irène Joliot-Curie and son-in-law, Frédéric Joliot-Curie, also shared a Nobel prize. She was the sole winner of the 1911 Nobel Prize for Chemistry. Curie was the first woman to win a Nobel Prize, and she is the only woman to win the award in two different fields.

Her achievements include the creation of a theory of radioactivity (a term she coined), techniques for isolating radioactive isotopes, and the discovery of two new elements, polonium and radium. Under her direction, the world's first studies were conducted into the treatment of neoplasms (cancers) using radioactive isotopes. While an actively loyal French citizen, she never lost her sense of Polish identity. She named the first new chemical element that she discovered polonium (1898) for her native country, and in 1932 she founded a Radium Institute (now the Maria Sklodowska-Curie Institute of Oncology) in her home town, Warsaw, headed by her physician sister Bronislawa.

Early life

Maria Sklodowska was born in Warsaw, Poland, on 7 November 1867, the fifth and youngest child of well-known teachers Bronislawa and Wladyslaw Sklodowski. Maria's older siblings were Zofia (born 1862), Józef (1863), Bronislawa (1865), and Helena (1866). Maria's grandfather Józef Sklodowski had been a respected teacher in Lublin, where he had taught the young Boleslaw Prus. Her father Wladyslaw Sklodowski taught mathematics and physics, subjects that Maria was to pursue, and he also was director of two Warsaw gymnasia for boys, in addition to lodging boys in the family home. Her mother, Bronislawa, operated a prestigious Warsaw boarding school for girls. She suffered from tuberculosis and died when Maria was twelve.

On both the paternal and maternal sides, the family had lost their property and fortunes through patriotic involvements in Polish national uprisings. This condemned each subsequent generation, including that of Maria, her elder sisters, and brother to a difficult struggle to get ahead in life.

Maria made an agreement with her sister, Bronislawa, that she would give her financial assistance during Bronislawa's medical studies in Paris, in exchange for similar assistance two years later.

Marie and Pierre Curie

In October 1891, at her sister's insistence she decided to go to France. In Paris, Maria briefly found shelter with her sister and brother-in-law before renting a primitive garret and proceeding with her studies of physics, chemistry, and mathematics at the Sorbonne (the University of Paris). Sklodowska studied during the day and tutored evenings, barely earning her keep. In 1893 she was awarded a degree in physics and began work in an industrial laboratory at Lippman's. Meanwhile she continued studying at the Sorbonne, and in 1894, earned a degree in mathematics. That same year, Pierre Curie entered her life. He was an instructor at the School of Physics and Chemistry, the École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI). Sklodowska had begun her scientific career in Paris with an investigation of the magnetic properties of various steels; it was their mutual interest in magnetism that drew Sklodowska and Curie together. In July 1895, she and Pierre Curie married, and thereafter the two physicists hardly ever left their laboratory.

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New elements

In 1896 Henri Becquerel discovered that uranium salts emitted rays that resembled X-rays in their penetrating power. He demonstrated that this radiation, unlike phosphorescence, did not depend on an external source of energy, but seemed to arise spontaneously from uranium itself. Becquerel had, in fact, discovered radioactivity. Sklodowska-Curie decided to look into uranium rays as a possible field of research for a thesis. She used a clever technique to investigate samples. Fifteen years earlier, her husband and his brother had invented the electrometer, a sensitive device for measuring electrical charge. Using the Curie electrometer, she discovered that uranium rays caused the air around a sample to conduct electricity. Using this technique, her first result was the finding that the activity of the uranium compounds depended only on the quantity of uranium present. She had shown that the radiation was not the outcome of some interaction of molecules, but must come from the atom itself. In scientific terms, this was the most important single piece of work that she conducted.

Sklodowska-Curie's systematic studies had included two uranium minerals, pitchblende and torbernite (also known as chalcolite). Her electrometer showed that pitchblende was four times as active as uranium itself, and chalcolite twice as active. She concluded that, if her earlier results relating the quantity of uranium to its activity were correct, then these two minerals must contain small quantities of some other substance that was far more active than uranium itself. It was her idea and no one helped her formulate it, and although she took it to her husband for his opinion she clearly established her ownership of it. In her systematic search for other substances beside uranium salts that emitted radiation, Sklodowska-Curie had found that the element thorium likewise, was radioactive.

She was acutely aware of the importance of promptly publishing her discoveries and thus establishing her priority. Had not Becquerel, two years earlier, presented his discovery to the Académie des Sciences the day after he made it, credit for the discovery of radioactivity, and even a Nobel Prize, would have gone to Silvanus Thompson instead. Sklodowska-Curie chose the same rapid means of publication. Her paper, giving a brief and simple account of her work, was presented for her to the Académie on 12 April 1898 by her former professor, Gabriel Lippmann.

Pierre Curie was sure that what she had discovered was not a spurious effect. He was so intrigued that he decided to drop his work on crystals temporarily and to join her. On 14 April 1898 they optimistically weighed out a 100-gram sample of pitchblende and ground it with a pestle and mortar. They did not realize at the time that what they were searching for was present in such minute quantities that they eventually would have to process tonnes of the ore. As they were unaware of the deleterious effects of radiation exposure attendant on their chronic unprotected work with radioactive substances, Sklodowska-Curie and her husband had no idea what price they would pay for the effect of their research upon their health.

In July 1898, Sklodowska-Curie and her husband published a paper together, announcing the existence of an element which they named "polonium", in honor of her native Poland, which would for another twenty years remain partitioned among three empires. On 26 December 1898 the Curies announced the existence of a second element, which they named "radium" for its intense radioactivity - a word that they coined. The Curies undertook the arduous task of separating out radium salt by differential crystallization. From a ton of pitchblende, one-tenth of a gram of radium chloride was separated in 1902. By 1910 Sklodowska-Curie, working on without her husband, who had been killed accidentally in 1906, had isolated the pure radium metal. In 1903, under the supervision of Henri Becquerel, Marie was awarded her DSc from the University of Paris.

Nobel Prizes

In 1903, the Royal Swedish Academy of Sciences awarded Pierre Curie, Marie Curie and Henri Becquerel the Nobel Prize in Physics, "in recognition of the extraordinary services they have rendered by their joint researches on the radiation phenomena discovered by Professor Henri Becquerel." Sklodowska-Curie and her husband were unable to go to Stockholm to receive the prize in person, but they shared its financial proceeds with needy acquaintances, including students.

On receiving the Nobel Prize, Marie and Pierre Curie suddenly became very famous. The Sorbonne gave Pierre a professorship and permitted him to establish his own laboratory, in which Sklodowska-Curie became the director of research. In 1897 and 1904, respectively, Sklodowska-Curie gave birth to their daughters, Irène and Eve Curie. She later hired Polish governesses to teach her daughters her native language, and sent or took them on visits to Poland.

Sklodowska-Curie was the first woman to be awarded a Nobel Prize. Eight years later, she would receive the 1911 Nobel Prize in Chemistry, "in recognition of her services to the advancement of chemistry by the discovery of the elements radium and polonium, by the isolation of radium and the study of the nature and compounds of this remarkable element." A month after accepting her 1911 Nobel Prize, she was hospitalized with depression and a kidney ailment.

Sklodowska-Curie's second Nobel Prize, in 1911, enabled her to talk the French government into funding the building of a private Radium Institute (Institut du radium, now the Institut Curie), which was built in 1914 and at which research was conducted in chemistry, physics, and medicine. The Institute became a crucible

of Nobel Prize winners, producing four more, including her daughter Irène Joliot-Curie and her son-in-law, Frédéric Joliot-Curie.

World War I

During World War I, Sklodowska-Curie pushed for the use of mobile radiography units, which came to be popularly known as petites Curies ("Little Curies"), for the treatment of wounded soldiers. These units were powered using tubes of radium emanation, a colorless, radioactive gas given off by radium, later identified as radon. Sklodowska-Curie provided the tubes of radium, derived from the material she purified. Also, promptly after the war started, she donated the gold Nobel Prize medals she and her husband had been awarded, to the war effort.

Post-war years

In 1921, Sklodowska-Curie was welcomed triumphantly when she toured the United States to raise funds for research on radium. These distractions from her scientific labors and the attendant publicity caused her much discomfort but provided resources needed for her work. Her second American tour in 1929 succeeded in equipping the Warsaw Radium Institute, founded in 1925 with her sister, Bronislawa, as director. In her later years, Sklodowska-Curie headed the Pasteur Institute and a radioactivity laboratory created for her by the University of Paris.

Death

Her death on 4 July 1934 at the Sancellemoz Sanatorium in Passy, in Haute-Savoie, eastern France, was from aplastic anemia, almost certainly contracted from exposure to radiation. The damaging effects of ionizing radiation were not then known, and much of her work had been carried out in a shed, without proper safety measures. She was interred at the cemetery in Sceaux, alongside her husband Pierre. Sixty years later, in 1995, in honor of their achievements, the remains of both were transferred to the Paris Panthéon. She became the first - and so far only - woman to be honored in this way. Her laboratory is preserved at the Musée Curie.

Legacy

The physical and societal aspects of the work of the Curies contributed substantially to shaping the world of the twentieth and twenty-first centuries. Cornell University professor L. Pearce Williams observes:

The result of the Curies' work was epoch-making. Radium's radioactivity was so great that it could not be ignored. It seemed to contradict the principle of the conservation of energy and therefore forced a reconsideration of the foundations of physics. On the experimental level the discovery of radium provided men like Ernest Rutherford with sources of radioactivity with which they could probe the structure of the atom. As a result of Rutherford's experiments with alpha radiation, the nuclear atom was first postulated. In medicine, the radioactivity of radium appeared to offer a means by which cancer could be successfully attacked.

If the work of Maria Sklodowska-Curie helped overturn established ideas in physics and chemistry, it has had an equally profound effect in the societal sphere. To attain her scientific achievements, she had to overcome barriers that were placed in her way because she was a woman, in both her native and her adoptive country. This aspect of her life and career is highlighted in Françoise Giroud's Marie Curie: A Life, which emphasizes Sklodowska's role as a feminist precursor. She was ahead of her time, emancipated, independent, and in addition uncorrupted. Albert Einstein is reported to have remarked that she was probably the only person who was not corrupted by the fame that she had won.

Awards

Marie Sklodowska-Curie was the first woman to win a Nobel prize and the first person to win two Nobel Prizes.

- Nobel Prize in Physics (1903)
- Davy Medal (1903)
- Matteucci Medal (1904)
- Elliott Cresson Medal (1909)
- Nobel Prize in Chemistry (1911)

The life of famous scientists is not always necessarily luxurious. The Curies reportedly used part of their award money to replace wallpaper in their Parisian home and install modern plumbing into a bathroom.

Honors

Madame Curie was decorated with the French Legion of Honor. In Poland, she had received honorary doctorates from the Lwów Polytechnic (1912), Poznan University (1922), Kraków's Jagiellonian University (1924), and the Warsaw Polytechnic (1926). Her elder daughter, Irène Joliot-Curie won a Nobel Prize for Chemistry in 1935 for discovering that Aluminium could be made radioactive and can emit neutrons when bombarded with alpha rays. Her younger daughter, Ève Curie, later wrote a biography of her mother.

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