

Maria Skłodowska Curie

Madame Curie



*From Poland to France,
from France to Poland*

by Stanislaw Penczek and Malgorzata Sobieszczak-Marciniak

The year 2011 was proclaimed the International Year of Chemistry (IYC) by the General Assembly of the United Nations in December 2008. This IUPAC initiative was facilitated by UNESCO and brought to the General Assembly of the UN by Ethiopia, a member country of IUPAC. The year 2011 coincides with the centenary of Maria Skłodowska Curie's (Madame Curie) being awarded her second Nobel Prize, on that occasion for the discovery of two new elements that she named "polonium" and "radium." While starting to think about how to celebrate the Year of Chemistry, the authors offer a fast track version of Curie's journey, from her birth in 1867 to her first Nobel prize in 1903 to her impact on the field of chemistry.

The Nobel Prize in Chemistry is awarded every year with a few exceptions, but the impact of awarded contributions differ. Curie's discovery of polonium and radium was of revolutionary importance for chemistry, physics, and medicine. Prior to this discovery, Marie and Pierre Curie had properly described the nature of radiation as observed by Antoine Henri Becquerel a few years earlier—an accomplishment for which the three scientists were awarded the Nobel Prize in Physics in 1903. In physics, these discoveries opened the door for understanding the structure of an atom; in medicine, they enabled a novel approach to treating



The young Maria Skłodowska who became Madame Curie, is shown standing at left, behind her father, Wladyslaw, with her sisters Bronya and Helena at right.

Photo: Courtesy of the Curie and Joliot Association/Curie and Joliot-Curie Fund.

cancer. These breakthroughs established Marie Curie's place in the history of science. Moreover, she was not only a great scientist but a magnificent human being.

Early Years in Poland

Maria Salomea Skłodowska was born in Warsaw, 7 November 1867, the youngest of five children born to Wladyslaw Skłodowska and Bronislawa (née Boguska). Manya (as she was called by her family and friends) and her entourage believed that Poland could become free only through intellectual accomplishments. Like many of his compatriots, Maria's father, a physics professor, was convinced that education was the means for Poland to regain its independence.

Wladyslaw Skłodowska educated his children in science, mathematics, and literature at every opportunity. When Maria worked as a governess, far from home, to collect money to help her older sister Bronya in her studies, her father sent letters with mathematical problems, and Maria sent back solutions. He read his children poetry and literature in one of five languages he knew, simultaneously translating the work into Polish. This level of education and devotion to culture were common among Polish intellectuals.

Maria graduated from high school in Warsaw at 16, receiving a gold medal for finishing first among girls in the city. That was the atmosphere in which young Maria was raised, developing, thanks to her father, not merely interest but real enthusiasm for science. Her dream was to continue her education and then earn a position as a teacher in Poland.

From Poland to France

In 1891, 24-year-old Maria received an invitation from her sister to join her in Paris at Sorbonne University.

At that time, the Sorbonne was considered one of the most prestigious universities in Europe. Maria's sister had married a fellow Polish exile, Kazimierz (Casimir) Dłuski, while studying medicine at Sorbonne. It was common then for the most intellectual Poles to go to Paris. In this friendly country they received the education necessary for achieving Polish independence, which was finally established in 1918.

In France, Maria (sometimes written "Marya"—it can be found this way on the ceiling of the Sorbonne subway station in Paris) changed her name to the French "Marie." While attending Sorbonne, she met young Polish pianist Ignacy Paderewski, future prime minister of the Polish Republic, and young Stanislaw Wojciechowski, who later became the president of Poland.

In 1893, Marie graduated from Sorbonne with a degree in physics, becoming the first woman to graduate with such a degree from the university. The following year, she graduated with a degree in mathematics, made possible by a scholarship from Poland.

Her plan was to study physics and return to Poland to teach children. However, she was offered a position in Paris studying the magnetic properties of steel.

"If the existence of the new metal is confirmed, we propose to call it polonium from the name of the country of origin of one of us."

Not having access to a proper laboratory, she was introduced by her friends to Pierre Curie, who worked on related topics at the School for Physics and Chemistry of the City of Paris. Pierre was an established scientist; by 1880, he and his brother had discovered piezoelectricity,

a phenomenon used today in many areas, including quartz watches (in an electrical field, crystals become compressed).

Pierre was 35 when he met 27-year-old Marie. Their backgrounds and devotion to science were similar. Although they were born in different countries and received their primary education under different circumstances, it is interesting to note how both of their families developed similar ideas and attitudes about humanity and society. Both families believed that Poland should be a republic, and both were agnostic (although Marie's mother was a devout Roman Catholic). Pierre and Marie married a year later, in 1895.

Marie Curie's Scientific Journey

At the end of the nineteenth century, Wilhelm Roentgen discovered what he called X-rays, which allowed him to see bones through soft matter. At the same time, Becquerel observed that when uranium salts were exposed to sunlight (which he assumed was necessary), they produced an exposure on a photographic plate. It was, however, the work of Marie (in her Ph.D. thesis) and Pierre that explained that this phenomenon is a genuine property of the atoms and does not require any exterior influence, such as sunlight.

Marie became interested in studying whether other elements behaved similarly; she found that pitchblende possessed a great degree of activ-



Simulated photograph of the first Solvay Conference in 1911 at the Hotel Metropole. Seated (L-R): W. Nernst, M. Brillouin, E. Solvay, H. Lorentz, E. Warburg, J. Perrin, W. Wien, M. Curie, and H. Poincaré. Standing (L-R): R. Goldschmidt, M. Planck, H. Rubens, A. Sommerfeld, F. Lindemann, M. de Broglie, M. Knudsen, F. Hasenöhr, G. Hostenet, E. Herzen, J.H. Jeans, E. Rutherford, H. Kamerlingh Onnes, A. Einstein and P. Langevin. The historic invitation-only 1911 Conseil Solvay was the first world physics conference. Following the initial success of 1911, the Solvay Conferences have been devoted to outstanding preeminent open problems in both physics and chemistry.

Maria Skłodowska Curie—Madame Curie

ity. Therefore, Marie assumed an element with much stronger radioactivity (a term she coined) than uranium should exist. She decided to extract this substance from the ore by ordinary methods of chemical analysis. Over the years, Curie stressed that successful separation was possible because she received a thorough education in chemical analysis at secondary school in Poland. Marie wrote, "If Professor Milicer and his assistant lecturer, Dr. Kossakowski, hadn't given me a sound grasp of analysis in Warsaw, I would have never separated out radium." During the same period, Curie separated another new element (although not in its pure form at that time): polonium. She wrote in her paper, "If the existence of the new metal is confirmed, we propose to call it polonium from the name of the country of origin of one of us."

The discovery of radium (Ra) as a new element was not accepted by some prominent scientists. Some of them (e.g., Lord Kelvin) insisted that it was merely a mixture of the already known elements. Marie, with help from her assistants (and after the untimely death of Pierre) during five years of research from 1906 until 1911, finally prepared metallic Ra and described its major properties. During these difficult years (including nationalistic attacks on Marie), she always had around her a group of close French friends from the

highest levels of French society, such as Jean-Baptiste Perrin, Émile Borel, Pierre-Cécile Chavannes, and André-Louis Debierne.

In 1910, during the International Congress of Radiology, it was decided to call the unit of radioactivity the "curie." This standard is still used worldwide.

After Pierre's death, Marie was offered his former chair at Sorbonne. She accepted, becoming the first woman to teach at the 800-year-old university. Then, in 1909, the idea of the Radium Institute (Institut du Radium) was developed. The institute, which opened in 1914, is located at Pierre and Marie Curie Street in Paris.

During World War I, Curie and her older daughter Irene helped train hundreds of physicians in the use of X-rays, and she organized an army of cars—known as "petit Curie"—equipped with the pertinent equipment. When the war ended, she began a search for radium to use for research. Unfortunately, Curie was unable to get the French government to pay for the expensive element. Help came from the USA during her first visit in May 1921. Marie received 1g of radium (worth more than USD 100 000 at the time) from President Warren Harding, who expressed profound respect for her and stressed the friendship between the USA and France, her adopted nation, and Poland, her native land:

"We welcome you as an adopted daughter of France, our earliest supporter among the great nations. We greet you as a native-born daughter of Poland. . . . In you we see the representative of Poland restored and reinstated to its rightful place. . . . It has been your fortune, Madame Curie, to accomplish an immortal work for humanity."

Curie became famous also because radium was found to cure numerous cases of cancer. However, it was her status as a scientist that led younger scientists to request references from her. One of them was Albert Einstein (12 years younger than Curie); in her letter of recommendation for his professorship at the University of Prague, she wrote, "I much admire the work which Mr. Einstein has published on matters concerning modern theoretical physics."

From France to Poland

In 1913, Curie opened the first radiology laboratory in Warsaw, at which she served as director. She was an honorary member of a few scientific societies, including the Warsaw Scientific Society and the Polish Chemical Society. In 1918, when Poland regained inde-

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Marie Curie's birthplace in Warsaw, Poland.

From Poland to France, from France to Poland

pendence she wrote that “My greatest dream is to build a Radium Institute in Warsaw.” In the 1920s, Curie and her sister Bronya were responsible for the construction of the Radium Institute in Warsaw, which received enthusiastic financial support from the Polish people. In 1926, Warsaw University of Technology presented Curie with an honorary doctorate.

Then, in 1929, when Curie visited the USA again, hoping to raise the necessary funds to buy radium for the Radium Institute in Warsaw, it was President Herbert Hoover who presented her with a check and referred to the discovery of radium: “And like all great discoveries of fundamental substance and fact it has found application to human use. In the treatment of disease, especially of cancer, it has brought relief of human suffering to hundreds of thousands of men and women.”

Curie died of leukemia on 4 July 1934, but her legacy did not disappear with her death. She will always be known as “the woman who opened the nuclear age.” A large number of institutions, particularly in Poland, bear her name. Maria Skłodowska Curie University is in Lublin (Poland); the large Museum of Maria Skłodowska Curie is in Warsaw, in the same building where Manya was born in 1867; there is also the Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology, and the Society in Tribute to Maria Skłodowska Curie. About 50 schools in Poland are named after her.

She wrote about herself, “It is a short, simple story, lacking great events. I was born in Warsaw, in a professor’s family. I married Pierre Curie and I had two children. My scientific work I did in France.” Einstein said of her, “Marie Curie was the only one not spoiled by fame.”

In 1935, one year after she passed away, her daughter Irene and son-in-law Frédéric Joliot-Curie were awarded the Nobel Prize for their discovery of artificial radioactivity.


A Google search of “Marie Curie” and “Maria Skłodowska Curie” generates results such as “Marie Curie

Fellowship,” “Marie Curie Scholarship,” “Marie Curie Program,” “Marie Curie Reintegration Grant,” “Maria Curie Stipends,” and “Marie Curie Programme” (which

has 1 620 000 hits). In Paris, the largest French university (the former Department of Exact Sciences at Sorbonne) has been renamed University Pierre and Marie Curie, as proposed by the prominent French scientist Pierre Sigwalt.

On 20 April 1995, more than 60 years after her death, Madame Curie was recognized for her achievements in a spectacular way. Under the chairmanship of the presidents of France (François Mitterrand) and Poland (Lech Walesa), the ashes of Marie and Pierre Curie were moved to rest under the famous dome of the Pantheon in Paris, not far from the Curie Institute, located at Pierre and Marie Curie Street. Madame Curie was the first woman to be

buried at the Pantheon in recognition of her own accomplishments.

An abundant literature describes the life and scientific work of Maria Skłodowska Curie. Today, many of these sources are available on the Internet, and the interested reader may find there much more extensive texts than this short article. The best known is the *Maria Curie* biography, written by her daughter Eve (Ewa). 

Parts of this article (e.g., texts of the speeches given by the American presidents) are based mostly on information borrowed from an article by Denise Ham, published in *21st Century Science & Technology Magazine*, Winter 2002–2003, pp. 30–68; *Nobel Lectures, Chemistry* (Elsevier 1966); and <www.nobelprize.org>.

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Pierre and Marie Curie in their laboratory in 1899.