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Marie Curie
A life of discovery

Key words
Marie Curie
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Nobel Prize

Marie Curie in 1903 when she was awarded the Nobel Prize in Physics

Marie Curie won two Nobel Prizes, the only woman to have done so. She is still the only person to have won awards in both Physics and Chemistry. She has both an element in the periodic table and a cancer hospice charity named after her. In this article, ***Vicky Wong*** *looks at her achievements and explains why she is still remembered today, nearly 90 years after she died.*

From Poland to Paris

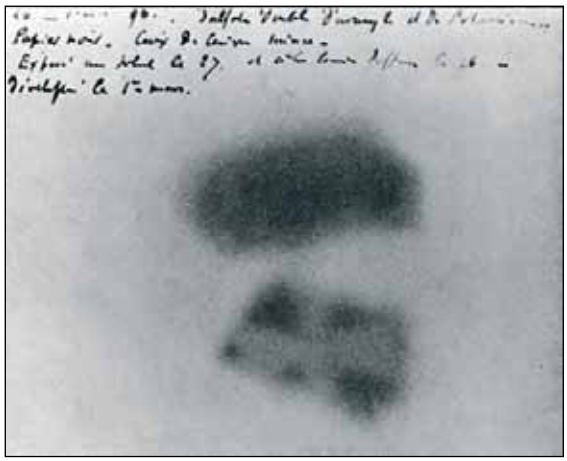
Marie Curie was born in Poland in 1867. Her family were not wealthy. Her parents were both teachers and ensured that she had a good education. However, advanced scientific training was not possible for women in Poland, so she worked as a governess before going to Paris in 1891 aged 24.

Marie had been away from her studies for 6 years. She wrote:

'It was like a new world opened to me, the world of science, which I was at last permitted to know in all liberty.'

After two years she took her degree in Physics with the highest marks of any candidate and the following year came second in a degree in mathematics. During this time, she met physicist Pierre Curie. He was 8 years older and already had an international reputation; they married in 1895.

1895 was the year in which X-rays were discovered. A year later, Henri Becquerel discovered that uranium emitted a new type of invisible radiation.



The photographic plate produced by Henri Becquerel to demonstrate the existence of radioactivity

Marie Curie decided to study this, and after only a few days she discovered that the element thorium gives off the same rays as uranium. She called this phenomenon 'radioactivity'.

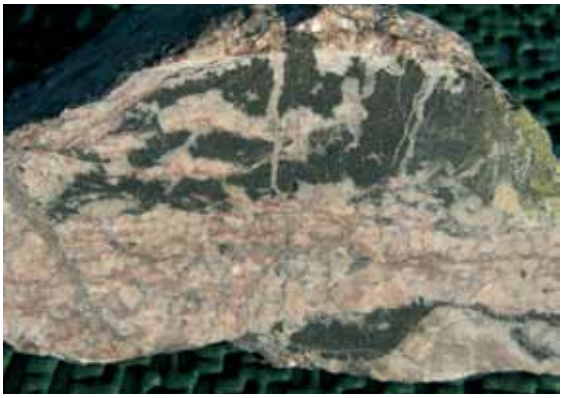
Marie also discovered that the strength of radiation did not depend on the particular compound that was being studied – it only depended on the amount of uranium or thorium present. Usually, chemical compounds of the same element have very different chemical and physical properties. For example, sodium chloride is table salt; sodium chlorate (I) is bleach. Marie concluded that the ability to radiate did not depend on the arrangement of atoms in a molecule and therefore it must be linked to the atom itself.

Are atoms divisible?

This idea was completely revolutionary and is considered to be her most important contribution to Physics. At the time, atoms were thought to be the smallest unit of matter and indivisible. Marie then found that, of the known elements, only uranium and thorium gave off the radiation.

Marie's next idea was to study pitchblende, a natural ore that contains uranium and

thorium. This was a brilliant idea; she found that pitchblende was four to five times as radioactive as expected from the amount of uranium present. She hypothesised that a new element was in the ore which was even more active than uranium.



A uranium ore showing pitchblende (black) and dolomite (red).

By 1898, she and Pierre had evidence for the existence of two new elements that they suggested be called polonium, after Marie's native country, and radium. In order to be certain that they had indeed discovered new elements, they needed to produce them in reasonably large amounts and determine their atomic weights. They obtained tonnes of material from the spoil heaps of a mine and set about purifying it.

To do this they needed space. The principal of the school where Pierre worked offered them a large shed. Marie carried out chemical separations, processing 20 kilos of raw material at a time. She wrote:

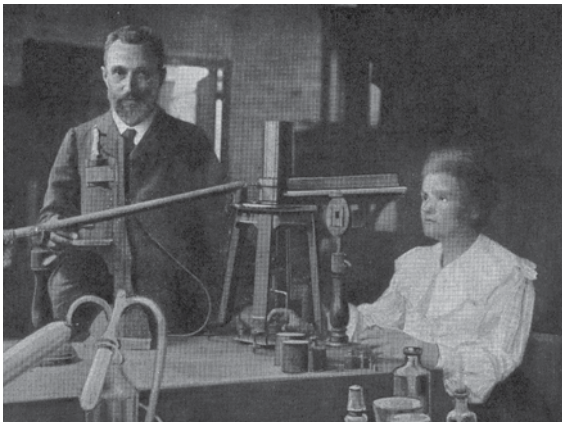
'Sometimes I had to spend a whole day stirring a boiling mass with a heavy iron rod nearly as big as myself.'

The shed was not ideal. A visitor described it as a cross between a stable and a potato shed. Eventually, after thousands of crystallisations, Marie had purified several tonnes of ore to produce 0.1 g of radium chloride. She determined radium's atomic weight as 225. When she presented her findings, the examination committee said that it was the greatest scientific contribution ever made in a doctoral thesis.

Poor health

In 1903 the Curies were jointly awarded the Nobel Prize for Physics with Henri Becquerel for their research into radioactivity. Their health was poor, however. Both were tired and Pierre was in pain from his legs, which shook. Both had scarred hands. Doctors suggested their symptoms were linked to the draughty shed and the long hours they worked, not to the radioactive materials they studied.

Pierre Curie died in 1906 before he ever had a real laboratory to work in. In 1908 Marie was appointed Professor at the Sorbonne University in Paris. There she isolated pure metallic radium.



Pierre and Marie Curie in their laboratory

In 1911 she was awarded the Nobel Prize for Chemistry for her work on radium and polonium.

During the First World War, Marie Curie was actively involved in developing the use of radiation for treating soldiers. She installed radiation equipment in field hospitals, trained young women in simple to use it and taught doctors how to interpret the results. She even drove a radiology van. The radiation she used came from glass tubes containing radon gas, an emitter of gamma radiation, similar to X-rays.

Marie Curie died of leukaemia in 1934. She was truly a pioneer of modern science and blazed a trail along which many women, including her daughter and granddaughter, have followed.

Vicky Wong is Chemistry editor of Catalyst.

The Radium Institute which housed Marie Curie's laboratory from 1914 to 1934. This is now a museum where you can see Marie Curie's laboratory, office and original equipment.

Look here!

For further information on Marie Curie and her work: *http://www.aip.org/history/curie/contents.htm*

For two silent video clips of Marie Curie: *http://tinyurl.com/cfo7rqy*