

Centenary of Radioactivity

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[The United Nations' Educational, Scientific and Cultural Organisation (UNESCO) and International Union of Pure and Applied Chemistry (IUPAC) declared the year-1911 as the "International Chemistry Year". It is also the centenary year of International Association of Chemical Societies (IACS)-later name changed to IUPAC.]

THE POLISH-FRENCH scientist Marie Skoldowska Curie (1867-1934) was awarded the Nobel Prize in Chemistry in 1911 for discovery of Radium. This was her second Nobel Prize. Her first Nobel Prize was in 1903 in Physics jointly with her husband Pierre Curie (1859-1906) and her professor Antoine Henry Becquerel (1852-1908) for the discovery of spontaneous radioactivity. Pierre Curie and Marie Curie discovered Radium-226 and Polonium-209 in the mineral 'Pitch-Blend'. Curie couple was the first husband and wife Nobel Laureate. However, Becquerel was interested in Luminescence, the property of emitting light. After a conversation with Wilhelm Conrad Rontgen (1845-1923), Professor of Physics at Wurzburg University, Germany and the first Nobel Laureate in Physics in 1902 for discovery of Xrays in 1895, Becquerel wondered if there was a connection between X-rays and phosphorescence. He found that uranium salts, which phosphoresce after exposure to light, darkened a wrapped photographic plate. The uranium rays that penetrated the wrapping to expose the photographic plate also ionized gases, as did X-rays, but were not deflected by electromagnetic field. This is known as 'Becquerel Effect' (1896).

Pierre Curie and Marie Curie continued working on the methodology of isolating Radium from Pitch-Blend. Unfortunately Pierre died at a road accident in 1906 but Marie finished the work of isolating Radium and for this discovery, she was awarded the Nobel Prize in Chemistry in 1911.

Thus she happened to be the first Double Nobel Laureate (Physics, 1903 and Chemistry, 1911) and also the first female Nobel Laureate (both single and double). Incidentally, the International Chemistry Year, 1911 is declared by UNESCO to honour this historic event. It follows the trail of International Physics Year, 1905 that honoured the publication of five epoch-making papers on theoretical physics in 1905 by Albert Einstein (1879-1955), Nobel Laureate in Physics, 1921. Both occasions are unique in the history of science.

Radioactivity stands at the common frontier of physics and chemistry. Its evolution started at the junction of the 19th and 20th century. Chemistry is as old as mankind and is one of the ancient sciences. The English word-'Chemistry' is equivalent of the Greek word-'Khemia'/'Khemeia' (meaning art of transmuting metals), of the Latin word-'alchemia and the Arabic word-'Alchemy'-all carrying the same meaning.

There is evidence of using different metals around 5000 BC after the end of the stone age. Primitive metal industry developed using gold, copper, bronze and iron. This was the first instance of applied chemistry. During the Indus Civilization (peak around 2500 BC) there is evidence of different ovens for melting metals. Since antiquity there has been application of chemistry in glass works and herbal medicine. It developed along with astronomy and

mathematics. It entered into modern age in 18th and 19th century through the pioneering research of the French Scientist Antoine Laurent Lavoisier (1743-1794), Italian physicist Amedeo Conte di Quaregna Avogadro (1776-1856), English scientist John Dalton (1766-1844) and other scientists. Physics, Chemistry and Mathematics are complementary to one another.

In the 20th century science moved from its classical path to new avenues. A few scientific discoveries at the juncture of the 19th and 20th century revolutionized the whole world of science and significant among them were the discoveries of X-rays by Rontgen in 1895, radioactivity by Becquerel in 1896, electron by the English scientist Joseph John Thomson (1856-1940), Nobel Laureate in Physics, 1906 and Quantum Mechanics by the German physicist Max Karl Ernest Ludwig Planck (1858-1947), N L Physics, 1918. All these generated a new wave in the world of physics and chemistry. The concept of the structure of matter and the Periodic Table based on it was radically changed after the discovery of proton and neutron.

New Zealander physicist Ernest Rutherford (1871-1937), N L Chemistry, 1908 for his investigations into the phenomenon of radioactivity, showed in 1899 the existence of two components *alpha* and *beta* rays in the radioactive emanation of uranium, and in 1902, with the British physicist and chemist Frederick Soddy (1877-1956), N L Chemistry, 1921, Rutherford established the general nature of radioactivity and initiated research into the radioactive series. In 1908 he showed the identity of the alpha particles with helium ions and in 1911 he propounded the theory of atomic structure. In 1919 he found evidence of the disintegration of nitrogen by collision of its atoms with alpha particles which initiated subsequent development in atomic physics.

In 1903, Rutherford's colleagues also discovered the gamma rays-the electromagnetic wave.

Radioactivity can be of two types-natural radioactivity and artificial radioactivity. In 1934 the French scientists Irene Joliot Curie (1897-1956), eldest daughter of Marie Curie and Frederic Joliot Curie (1900-1958), son-in-law of Marie Curie were able to produce artificial radioactivity from non-radioactive material and for this discovery they were awarded Nobel Prize in Chemistry in 1935. To date, this remains the only instance of Father-Mother-Daughter-Son-in Law Nobel Laureates : Pierre Curie (Father), Marie Curie (Mother), Irene Joliot Curie (Daughter) and Frederic Joliot Curie (Son-in-Law). The science of radioactivity could be considered as a family contribution of Curies to the world of science.

Marie Curie established "Radium Institute" in 1914 for treatment of cancer by radioactivity. Because of radium contact in her own laboratory, she herself developed cancer. Cancer is a social misbehavior of cells composing the human body. Use of radioactivity for cancer treatment is her supreme contribution to medicine. □□□