IOSR Journal Of Humanities And Social Science (IOSR-JHSS)
Volume 23, Issue 2, Ver. 2 (February. 2018) PP 49-52
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Madame Curie: An Icon of Modern Science

Celso Luis Levada, Huemerson Maceti, Ivan J. Lautenschleguer, Miriam de Magalhães Oliveira Levada
Science Teaching Group of the Hermínio Ometto Foundation - Brazil
Corresponding author: Celso Luis Levada

ABSTRACT: This paper discusses the participation Marie Curie and her daughter in the development of chemistry. These two women developed surveys and participated actively in the dissemination of science, helping to establish it as a modern science as we know it today. These women contributed much to science, and their involvement could have been even greater if it were not for the restrictions imposed by society on their work.

Keywords: Curie, Radioactivity, Women in Science

Date of Submission: 23-01-2018 Date of acceptance: 09-02-2018

I. INTRODUCTION

Marie Slodowska is probably the most famous scientist woman. She was born in Warsaw, Poland, November 7, 1867, and was the first person to be awarded two Nobel prizes, one in Physics and one in Chemistry. Marie graduated in Physical Sciences in 1893, and soon after, in 1894, she graduated in Mathematics, starting her successful career in the research laboratory of Lippmann. His marriage to Pierre Curie on July 25, 1895 marked the beginning of a partnership that has achieved significant results for the scientific world (MARTINS [11]).

Pierre was mainly engaged in the physical study of the new radiations; Marie endeavored to obtain pure radio, which earned her a doctorate in Sciences in June 1903. In 1903 the Curie couple shared with Becquerel the Nobel Prize in Physics for the discovery of radioactivity. In 1911, Marie again won the top prize of Science. In addition, his daughter, Irene, in 1935, was also awarded the prize. In 1922, Curie directed her research to the study of the chemistry of radioactive substances and the medical applications of these substances, where she was very successful.

In the year 2011 was the 100th anniversary of the Nobel Prize in Chemistry awarded to Marie Curie, for the discovery of radio elements (Ra) and polonium (Po), the latter a tribute to her homeland.

Thus, on the initiative of UNESCO (United Nations Educational, Scientific and Cultural Organization) and IUPAC (International Union of Pure and Applied Chemistry), 2011 was the International Year of Chemistry.

The commemoration was approved at the 63rd General Assembly of the United Nations (UN), with the objective of celebrating the great achievements of Chemistry, especially by Marie Curie, and its enormous contribution to the well-being of mankind.

II. MARIE, SUCCESSFUL SCIENTIST ICON

According to SIMINO and NICASTRO [18], over the years women have been gaining more space in society, failing to perform only household activities and standing out in several organizations. It is important to emphasize that this achievement took a long time to happen and was carried out in a gradual way, being more pronounced only in the 1970s.

However, for a long time, women were excluded from social participation, being associated exclusively with domestic tasks and activities related to motherhood.

In fact, since the creation of the world, the book of Genesis highlights the figure of Adam and Eve in the following way: "[...] for man did not find the help that corresponded to him, then, from the rib of Adam, God modeled the woman" (ALMEIDA [1]).

In a way, from the beginning of the world until the beginning of the last century, most decisions about the fate of the most important facts have always been in the hands of men. Governments, formal education, and technological development positions are examples where the prominent roles belonged to men, while secondary and subordinate roles were handed over to women (SCOTT [17]).

Science, for example, has always been seen as an activity performed by men and it was only after the second half of the twentieth century that changes occurred in this picture. During the fifteenth, sixteenth and seventeenth centuries, centuries marked by various events and changes in society that enabled the emergence of science that we know today, a few aristocratic women played important roles as interlocutors and tutors of renowned natural philosophers and early experimentalists. Nevertheless, their qualities and skills were not allowed access to the discussions that took place in scientific societies and academies.

RAGO [(15)] comments on the feminist revolution that occurred in the 20th century, provoking not only the access of women to citizenship, but also emphasizing the phenomenon of feminization of culture, which is equally profound and less perceptible. Based on the thinking of RAGO, it is not surprising that there is little female participation in academia.

Thus, within a markedly masculine environment, as was the scientific environment, Nunes et al [(13)] cite Madame Curie as an icon of a successful scientist. The emergence of Curie represented the rupture with the conception of time in which women failed to ascend to the knowledge of the exact and natural sciences.

In honor of Marie Curie, who had been awarded the Nobel Prize for Chemistry for 100 years, researchers from at least 37 countries, including Brazil, met on January 18, 2011, in different parts of the world, by videoconference, for the which was called a "world breakfast".

The event was a tribute to all women in science who were guided by the achievements of Marie Curie, the first woman to gain space in the academic universe and the only one to win two Nobel Prizes, besides she was honored during the International Year of Chemistry (2011). AIQ-2011 was promoted by UNESCO and the International Union of Pure and Applied Chemistry (CASTRO [(5)]).

III. WHAT IS RADIOACTIVITY?

Radioactivity is a natural or artificial phenomenon by which some substances or chemical elements, called radioactive, are able of emitting radiation capable of impressing photographic plates, ionizing gases and passing through bodies.

Radioactivity can also be defined as the ability of some physically unstable elements to emit energy in the form of particles or electromagnetic radiation. The radiation was discovered accidentally through the observation that a uranium ore was capable of darkening a photographic film.

The beginnings of the discovery of natural radioactivity date from 1896, when Becquerel investigated the phenomena of fluorescence. According to GLEISER[(8)], Becquerel put samples of a mineral, a copper cross, and a photographic plate all wrapped in the drawer of his laboratory desk. For some mysterious reason, a week later, Becquerel decided to reveal the film he had stored in the drawer when he noticed the imprint of the cross on the photographic plate. As the sample of the mineral possessed the chemical element uranium, Becquerel called his rays of "uranic rays".

Continuing his investigations he began to experiment with other uranium compounds and all had the same effect, from which he concluded that the emissions that impressed the photographic plate came from this element.

Following the Becquerel conclusions, Marie Curie and her husband Pierre Curie found that radio and polonium were substances that had the same properties described. Because radio emissions are more efficient, the generic name for radioactive emissions phenomena has been introduced.

A further development in the ensuing experiments was the realization that radioactive emissions were capable of discharging electrically charged bodies, i.e. uranium, radio and polonium, should emit electric charges contrary to those previously existing on the surface under consideration (BANDEIRA DE MELLO[(2)]).

The atoms that had this property were called radioactive and these elements are called radio nuclides. Stable atoms do not emit radiation. Unstable is a reference to atoms that possess in their nucleus an excess of nuclear particles.

As described by CARDOSO and BARROSO [(4)], when a radioactive atom undergoes decay, it loses some of the excess energy of its nucleus, trying to stabilize itself. Unstable atoms tend to lose excess energy spontaneously, in search of greater energy stability. This lost energy can be in the form of alpha, beta, gamma or electromagnetic wave emission. Stable chemical elements can become radioactive when bombarded with nuclear particles. Induced radioactivity is produced when certain nuclei are bombarded with appropriate particles.

According to KERR [(10)], the effects caused by exposure to radioactivity are manifested at the somatic level, whose maximum expression is death, as they also occur at the genetic level, characterized by the presence of future mutations. These effects depend on the nature of the radiation, its life time, the intensity, the organs where it is accumulated and the capacity of penetration in the tissues.

Alpha radiation is the least penetrating, and only becomes dangerous if it reaches internal organs if some emitting material has been ingested. The beta particle is more penetrating than the alpha particle, so they

can cross the skin and penetrate the body. Gamma radiation is very penetrating and can cross obstacles like the human body.

Properly using radioactivity can bring benefits to man, for example through radiotherapy, which had origin in the application of the radio element by the Curie couple, to destroy cancer cells. Initially known as "curietherapy", it changed its name to radiotherapy over time.

Properly using radioactivity can bring benefits to man, for example through radiotherapy used to destroy cancer cells. Initially known as "curieterapia", it changed its name to radiotherapy over time.

For CHASSOT[6], radioactivity is an example of a branch of science that significantly influences society, since the effect of radiation on living tissue, especially the human body, has become a matter of public concern. It should be noted that part of the radiation is found in nature, from the cosmic rays and also from radioactive substances present in the Earth's crust.

In addition, we also have X-rays used in diagnostics and therapies, as well as radioactive substances used by industry. However, the largest amount of radioactive substances is caused by waste, discarded from nuclear power plants, atomic waste. One of the applications of Nuclear Medicine used in hospitals is to inject a radioactive substance into a patient. This substance will accumulate in certain places within the human body and then undergo radioactive decay.

The result is characterized by the emission of gamma rays which are recorded by a detector, producing a color-coded image on the screen of a monitor, with the possibility of obtaining a diagnosis.

On the other hand, radioactive substances occurring in nature provide a way of estimating dates of prehistoric events. Thus, by measuring the nuclear activity of a radioactive substance extracted from a rock, for example, it is possible to determine its age. For this, the activity of the radioactive sample is compared to a current standard (HALLIDAY, RESNICK and WALKER [9]).

IV. RADIOACTIVITY: A TRANSDISCIPLINARY THEME

Radioactivity characterizes a scientific field that has rapidly evolved in recent years, finding applications in many different areas, and is essentially interdisciplinary, involving chemists, physicists, biologists, geologists and physicians, among other professionals. Interdisciplinary arises from the idea that it is necessary to relate the different contents of the disciplines, that is, to interact different areas of knowledge in search of a global understanding.

In general, it is perceived that the question of interdisciplinary has been little explored in science classes and, in general, in education. This work is a suggestion for the teaching of Sciences related to other knowledge, especially in terms of History of Science. An interdisciplinary work based on the exposed theme can enable a better teacher-student interaction as a facilitator of the teaching-learning process and pedagogical interaction.

Interdisciplinary allows a different view of the world, because a diversification of approaches around the same subject allows broadening their understanding, opening space for new ideas. The reading of texts about the life and work of Marie Curie can motivate young people to the area of Sciences, arousing the interest among them to dedicate themselves to the career of professor. In addition, it can encourage professionals to produce teaching materials, exhibitions and actions for the improvement of elementary and middle school in the area of Sciences.

V. FINAL CONSIDERATIONS

According to FENELON and ALMEIDA [7], a remarkable moment in the history of the Cancer Institute of Belo Horizonte of Brazil occurred due to the visit of Marie Curie and her daughter Irene in August 1926 to the capital of Minas Gerais. On August 17, after a long train trip, from Rio de Janeiro, Marie and Irene, mother and daughter went to meet the Institute, leaving their signatures in the visitors log book.

Awarded the Nobel Prize in Chemistry for her research on the properties of radioactivity, the Curie family was received in a special way by Brazilian scientists.

On the occasion, Marie Curie and her daughter Irene gave a lecture at the Faculty of Medicine on radioactivity and its applications in medicine. Metaphorically, we can say that Science thanked the efforts of Marie Curie, because her daughter Irene also received the Nobel Prize in Chemistry in 1935.

GIOVANA PASQUALINI, quoted by MELO[12], emphasizes that Marie's pioneering spirit was one of the most important steps for opening up science to women, encouraging a generation of women who gradually gained more space in the scientific area. "If today Brazil walks to have more women than men in the research, it is because in the past women like her have opened the way," completes PASQUALINI.

Based on the biographies of these women, a historical profile of the development of female participation in this science can be traced. Marie and Irene represented paradigm breaks since they were willing to research and work with aspects of chemistry, being Nobelists in the area, until then restricted to men.

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Celso Luis Levada "Madame Curie: An Icon of Modern Science." IOSR Journal of Humanities And Social Science (IOSR-JHSS). vol. 23 no. 2, 2018, pp. 49-52.