

Commentary on the Nobel Prize that has been granted in Medicine-Physiology, Chemistry and Physics to notable female scientists

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Abstract

The Nobel Prize was established by Alfred Nobel in 1901 to award people who have made outstanding achievements in physics, chemistry and medicine. So far, from 852 laureates, 45 have been female. Marie Curie was the first woman to receive the Nobel Prize in 1903 for physics and eight years later also for chemistry. It is remarkable that her daughter Irene and her husband also received the Nobel Prize for chemistry in 1935. Other two married couples, Cori and Moser, have also been awarded the Nobel Prize. The present commentary attempts to show the female participation in the progress of scientific activities. (Gac Med Mex. 2015;151:264-8)

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Introduction

In the year of 2014, the Medicine Nobel Prize was awarded to a woman, May-Britt Moser, acknowledging her studies on the neuronal orientation-related physiological mechanism, which have contributed to clarify the cerebral behavior in spatial representation. For this reason, reviewing the contributions to scientific research by women who have been honored with this award was considered to be appropriate.

As everybody knows, the Nobel Prize was instituted by the Swede Alfred Nobel (Fig. 1), discoverer of nitroglycerine and its impressive explosive power, who decided to create a trust that would allow for those investigators who had contributed with their discoveries or inventions to the wellbeing of the human being

to be awarded every year. Since 1901, this prize has been awarded in the areas of physics, chemistry, physiology and medicine to 852 persons, out of which 45 have been women¹.

The first woman to receive the Physics Nobel Prize was Marie Curie, together with her husband Pierre, in 1903; of note, eight years later she was awarded with the Chemistry Nobel Prize in 1935. Table 1 shows the female scientists that have been awarded throughout history and the areas they stood out in.

Marie Curie (1867-1934) was born in Warsaw on November 7 1867. Daughter of a secondary school teacher named Sklodowska who started her in her training, in 1891 she moved to the Sorbonne University in Paris, where she was assigned to Pierre Curie's laboratory, who was a professor at the School of Physics, with whom she married and had her daughter Irene

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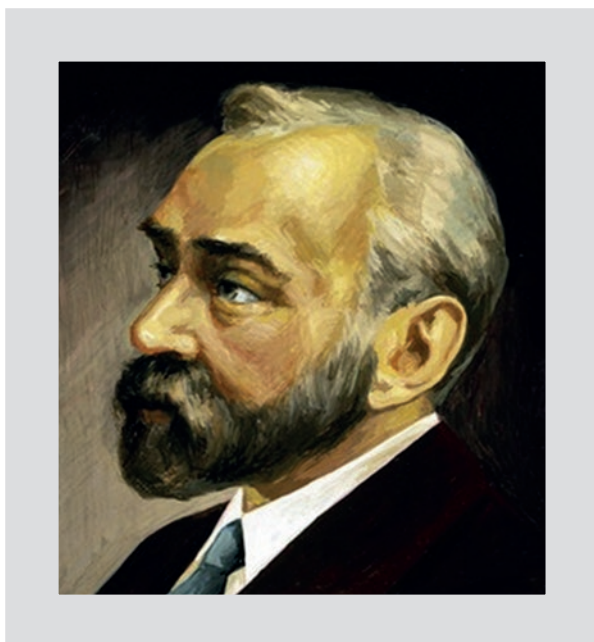


Figure 1. Classical painting of Alfred Nobel's portrait (1833-1896).

in 1897. After the tragic death of her husband Pierre in an urban traffic accident, she was appointed general physics professor and put in charge of the laboratory (Fig. 2). The next woman to obtain the Chemistry Nobel Prize was Irene Joliot-Curie (Paris, 1897-1956), which

was shared with her husband Frederic Goliot (Fig. 2). The 1947 Nobel Prize was awarded to the Czech biochemist Gerty Radnitz Cori (1896-1957), who was the first woman to obtain it in the area of medicine, together with her husband Carl Cori, for their discoveries on the course of the catalytic conversion of glycogen, which is widely known as the "Cori cycle". Maria Goeppert-Mayer (1906-1972) was born in Poland and migrated to the USA, where she continued her studies in physics; she received the Nobel Prize for the discovery of the nuclear shell structure, thanks to the model named "*nuclear shell model*". Dorothy Crowfoot Hodgkin (1910-1994), born in Egypt, but of the English nationality, received the Nobel for her studies on vitamin B₁₂; she is regarded as the founder of protein crystallography. Rosalyn Yalow (1921-2011) was born and obtained her PhD in physics in the USA; she was the creator of radioimmunoanalysis, widely applied in biomedicine³. Barbara McClintock (1902-1992), an American geneticist, was awarded with the Nobel in Physiology and Medicine for the discovery of "jumping genes" in the genome of corn, currently known as transposons. The Italian physician Rita Levi-Montalcini (1909-2012) discovered the existence of nervous growth factors and for that she was awarded with the Medicine Nobel Prize (Fig. 2). Gertrude B. Elion (1918-1999), and American chemist specialized in

Table 1. Women awarded with the Nobel Prize

| Year | Name | Age | Country | Area | Investigation |
|------|--|-----|-----------|-----------|----------------------------------|
| 1903 | Marie Curie/Pierre Curie (husband) | 36 | France | Physics | Radioactivity |
| 1911 | Marie Curie | 44 | France | Chemistry | Isolation of radium and polonium |
| 1935 | Irene Joliot-Curie/Frederic Goliot (husband) | 38 | France | Chemistry | Artificial radioactivity |
| 1947 | Gerty Cori/Carl Cori (husband) | 51 | USA | Medicine | Carbohydrates (Cori cycle) |
| 1963 | Maria-Goeppert-Mayer | 57 | USA | Physics | Protons and neutrons |
| 1964 | Dorothy Crowfoot Hodgkin | 54 | England | Chemistry | Crystallography of proteins |
| 1977 | Rosalyn Yalow | 56 | USA | Medicine | Radioimmunoassay |
| 1983 | Barbara McClintock | 81 | USA | Medicine | "Jumping genes" (transposons) |
| 1986 | Rita Levi-Montalcini | 77 | USA | Medicine | Growth factor |
| 1988 | Gertrude Elion | 70 | USA | Medicine | Chemotherapy |
| 1995 | Christiane Nusslein Volhard | 53 | Germany | Medicine | Genetics and embryology |
| 2004 | Linda Diane Brown Buck | 57 | USA | Medicine | Olfactory genes |
| 2008 | Francoise Beré-Sinoussi | 61 | France | Medicine | HIV-AIDS |
| 2009 | Ada E. Yonath | 70 | Israel | Chemistry | Ribosomes |
| 2009 | Elizabeth Blackburn | 61 | Australia | medicine | Telomeres |
| 2009 | Carol W. Greider | 47 | USA | Medicine | Telomeres |
| 2014 | May-Britt Moser/Edvard Moser (husband) | 51 | Norway | Medicine | Neuronal orientation |

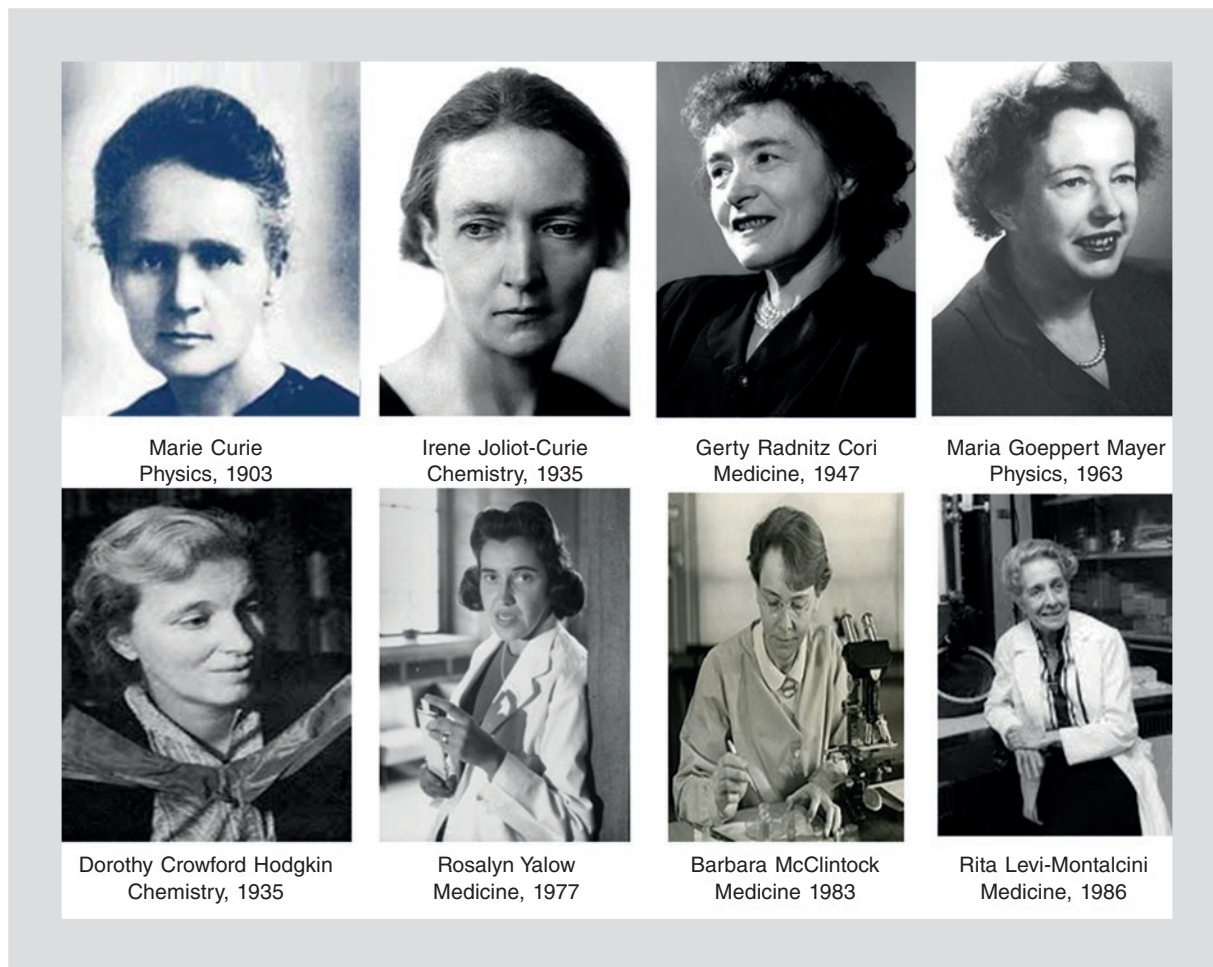


Figure 2. Group of women awarded with the Nobel Prize, with their names and areas of distinction.

pharmacology, developed drugs to be used in organ transplantation and in neoplastic and viral diseases. The German biologist Christiane Nüsslein-Volhard (1942) demonstrated the genetic mechanism of embryonic development in the fruit fly where 120 genes intervene (Fig. 3). Linda Diane Brown Buck (1947) was born in Seattle, Washington and obtained an immunology PhD at the University of Texas in 1980; her area of investigation was olfactory receptors (Fig. 3). The biochemist Françoise Barré-Sinoussi (1947) was born in Paris (Fig. 3), obtained a virology PhD in France and later she completed her training at the NIH of USA; back to the Pasteur Institute, she identified the retrovirus causative of human immunodeficiency (AIDS). Ada E. Yonath (1939), born in Jerusalem (Israel), where she currently resides, is a doctor in x-ray crystallography for the Weizmann Institute; she identified the ribosomal structure (Fig. 3). Elizabeth H. Blackburn (1948), native to Australia, received her PhD in molecular biology;

she was awarded for her investigations with telomeres and telomerase. The same subject was investigated by the American Carol W. Greider (1961), a molecular biologist from Berkeley University, who was a student of Blackburn, with whom she shared the Nobel (Fig. 3). Neurophysiologists May-Britt Moser (1963) and her husband Edvard Moser, from the University of Norway, have received the 2014 Medicine and Physiology Nobel Prize for their investigations on neuronal mapping, which helps understanding environmental shifting in living beings; this is the fourth time a couple shares such an important honor (Fig. 4).

Nobel awarded to couples

As previously mentioned, in 1903, the Curie couple jointly received the Nobel Prize in Physics, and, remarkably, their daughter Irene received the Chemistry Nobel Prize in collaboration with her husband Frederic



Figure 3. Another group of women awarded with the Nobel Prize and their area of work.

Joliot in 1935 (Fig. 4). Additionally, the Cori and Moser couples were awarded in the areas of medicine and physiology (Fig. 4).

In 1990, E. Donnall Thomas was awarded with the Nobel Prize in Physiology or Medicine for demonstrating that bone marrow transplantation can cure leukemia and other forms of cancer. It should be remembered that Thomas was married to Dorothy, who recently passed away at 92 years of age (Fig. 5), his partner and collaborator, who changed her career as an outstanding journalist to graduate as a technician in Thomas' laboratory and take care of blood tests; in addition, she was responsible for the selection of transplantation-related literature. Dorothy did the writing and editing of the scientific publications that Thomas was awarded for; frequently, he declared that his only task was actually to sign the manuscript submitted for publication. In general, it is considered that if Donnall is the father of bone marrow transplantation, the mother is Dorothy, even if she didn't share the Nobel Prize with her husband.

Addendum

It should be mentioned that the Endocrinology, Diabetes and Metabolism Research Unit of the IMSS has three professional investigators of the IMSS with the degree of doctors in sciences and qualified as members of the National Investigators System (SNI/CONACYT).

Epigraph

"The prizes for Physics and Chemistry shall be awarded by the Swedish Academy of Sciences; for Physiological or Medical Works, by the Carolinska Institute in Stockholm; for Literature, by the Academy in Stockholm, and for Advocates of Peace, by a committee of five persons to be selected by the Norwegian Storting. It is my express wish that in the awarding of the prizes no consideration shall be given to national affiliations of any kind, so that the most worthy shall receive the prize, whether he be Scandinavian or not." (Alfred Nobel's will) (Fig. 6).

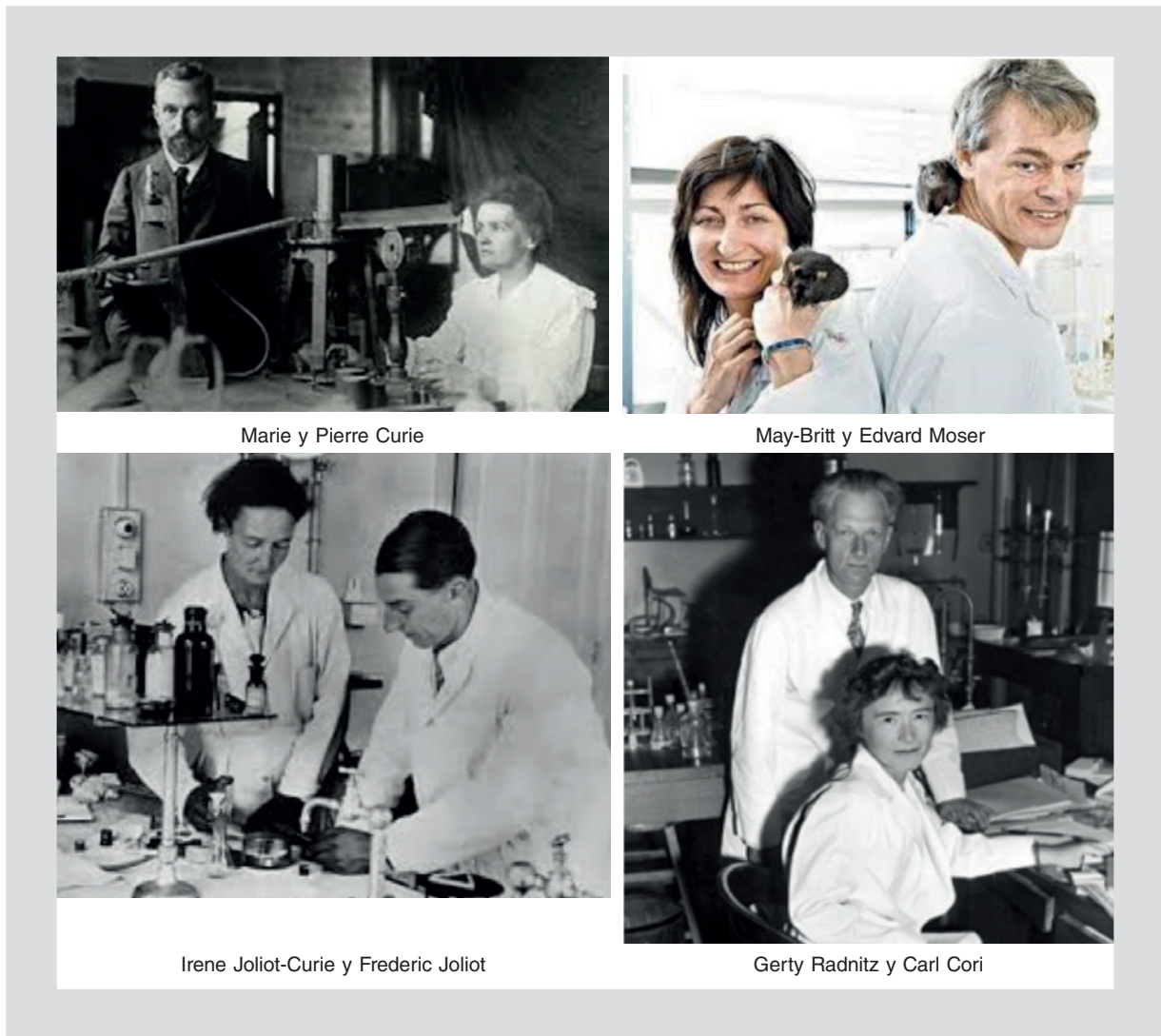


Figure 4. The four couples that have been jointly awarded. Note that two of them belong to the Curie family.

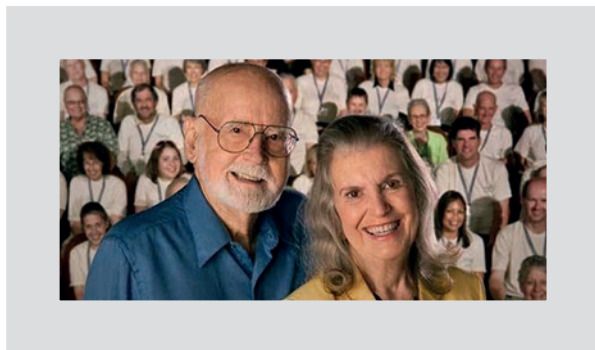


Figure 5. Couple formed by Thomas E. Donnell (1990 Nobel Prize) and Dorothy.

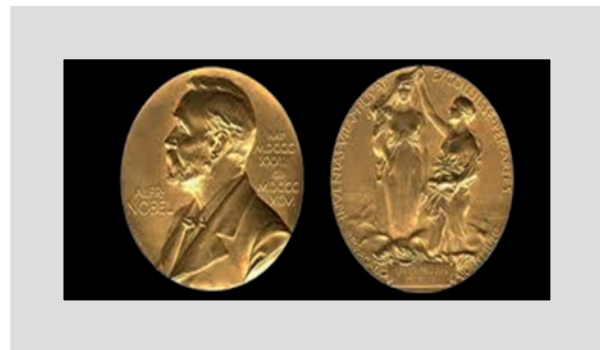


Figure 6. Photograph of front and back of the Nobel Prize medal awarded on December every year to all winners.

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