

Remarkable female researcher in STEM - in the past and today

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In this exhibition portraits about female researcher are shown who were and are working in different fields of STEM, and who contributed to theories and practical applications in their scientific disciplines. Portraits are shown about female researcher in computer science, in mathematics, and in physics. Looking back, one may ask why women scientists entered the world of academia so late, and why only few female researchers are known.

The history of women mathematicians and scientists was and is thus closely linked to the respective general history as well as the economic, social and educational history of the countries concerned. The exclusion and discrimination of women, the lack of equal educational, access and work opportunities formed the background that must be taken into account. From the 17th to the 19th century, there were only limited opportunities for women to pursue their inclination towards science: as private scholars, as translators of mathematical, physical and astronomical works, or as employees in a laboratory or observatory run by a brother or husband. Quiet famous were the Berlin astronomer family Gottfried (1639-1710) and Maria Margaretha (1670-1720) Kirch, and the astronomer Wilhelm (William) Herschel (1738-1822) and his sister Caroline Herschel (1750-1848). At the turn of the 20th century, the first women scientists - the exceptions - entered the laboratories and lecture halls.

It was a long way until women were able to study and do their doctorates with equal rights in most countries. Germany was one of the most backward countries in Europe in this "women's issue"; it was not until 1900 that the universities and technical colleges in the German states opened their doors to female students. (cf. Vogt (2007)) The first female professors in modern times were the mathematician Sof'ja V. Kovalevskaja (1850-1891) in Stockholm in 1884, the physicist Marie, née Sklodowska Curie (1867-1934) in Paris in 1906, and the geneticist Kristine Bonnevie (1872-1948) in Oslo in 1912. In contrast to the later widespread legend that a woman had to choose between science or family, two of the three female professors had been married and had one or two daughters. At the beginning of the 20th century, some female physicists became internationally recognised and world-famous - beside Marie Curie and her elder daughter Irène Curie (1897-1956) who was working together with Frédéric Joliot (1900-1958) in the lab in Paris, in Berlin the physicist Lise Meitner (1878-1968) devoted herself to the study of radioactivity. Marie Curie in Paris and Lise Meitner in Berlin and later in Stockholm were exceptions.

The Nobel Prize in Physics has only been awarded to a female physicist four times in its more than 100-year history: in 1903 to Marie Curie, and in 1963 to Maria Goeppert-Mayer (1906-1972). Only in 2018, Donna Strickland (b. 1959) received the prize, and in 2020 Andrea Ghez (b. 1965). The four female Nobel Laureates in physics, eight in chemistry and 12 in the life sciences say less about the achievements of the many female scientists than about the practices of the respective Nobel Committees. Therefore, the awarding of the prestigious Nobel Prize should not be taken as a "measure" of excellence of female scientists.

Looking at the awards for mathematicians - the Fields Medal, awarded since 1936, and the Abel Prize, awarded since 2003 - the situation for women mathematicians is no better. It was only in 2014 that Maryam Mirzakhani (1977-2017) received the Fields Medal, and in 2022 Maryna Viazovska (b. 1984) became the second female mathematician to be awarded. Karen K. Uhlenbeck (b. 1942) was the first mathematician to receive the Abel Prize in 2019. In the computer sciences and informatics, the A. M. Turing Award has been awarded since 1966, an award at least as prestigious as the Abel Prize. From 1966 to 2022, a total of 76 scientists received the Turing Award, but only three of them were women: Frances (Fran) Elizabeth Allen (b. 1932) in 2006, Barbara Liskov (b. 1939) in 2008 and, together with Silvio Micali, the computer scientist Shafi Goldwasser (b. 1959) in 2012; in the last 10 years, only men received the Turing Award (again).

It has also been more difficult for women scientists to receive lifelong recognition for their scientific achievements. A "side effect" of the lack of academic recognition, e.g. not being accepted as a member of Academies of Science and the lack of prizes, is the resulting under-representation of women scientists in encyclopaedias and other reference works, or more recently in the lack of entries in Wikipedia.

The centuries-long exclusion of women scientists from Academies of Science or the "overlooking" of women scientists as potential members for the Academies has less to do with the possible failure of the criteria of achievement, scientific attitude and objectivity, but it had (and has) social causes, starting with the exclusion of women from higher education at universities until the end of the 19th century, to fewer opportunities for advancement and careers in academia until well into the middle of the 20th century, to the longevity of prejudices and stereotypes, e.g. of the "typical female". In addition, there are structural barriers, called the "glass ceiling" in the 21st century. (cf. Vogt (2007), Wobbe (2003))

Current studies on the situation of female academics still show some barriers and the "glass ceiling". According to the Federal Statistical Office, the share of women in professorships in the Federal Republic of Germany was 27 % in 2021; the year before, in 2020, it was 26 %. Differentiated by scientific discipline, the proportion of female professors was only 15% in engineering, only 21% in mathematics and the natural sciences, 33% in law, economics and social sciences, and highest in the humanities at 42%. (Cf. the data of the Federal Statistical Office, in: Newsletter of the Contact Point Women in EU Research (FiF), 21.12.2022)

A reflection of these figures is shown by the data on female members in three Academies of Sciences in the Federal Republic of Germany (cf. Leopoldina (2022), p. 8):

weibliche Mitglieder Leopoldina, 2021	= 16 %
weibliche Mitglieder BBAW, 2021	= 18 %
weibliche Mitglieder ACATECH, 2021	= 16 %

The Leopoldina is the German Academy of Sciences Leopoldina, on 14 July 2008 it became the National Academy of Sciences. In 2002, the technology scientists founded acatech - the German Academy of Science and

Engineering - which became the National Academy of Sciences in 2008. The BBAW is the Berlin-Brandenburg Academy of Sciences and Humanities. The table illustrating the current situation in academia was compiled by a working group of the Leopoldina, which looked at the under-representation of women in the German science system and formulated recommendations to improve the situation in September 2022. (Cf. Leopoldina (2022), p. 4)

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