

# Women in Physics

Women Physicists in the Institute for Radium Research in Vienna, 1920-1938: A Statistical Report. <sup>1</sup>

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The Institute for Radium Research in Vienna from 1920 to 1938 constituted a paradoxical exception in the world of physics since it employed an extraordinary number of women physicists. In what follows, based on the participation of women in this site, I aim to dismantle the stereotypical image of the "patient" women in physics.

"I should expect to go further in influence and get more for my expenditure if in introducing young blood into a department of physics I picked one or two of the most outstanding younger men rather than if I filled one of my openings with a woman."<sup>2</sup> This is what Robert Millikan wrote in 1936, questioning the decision of W. Few, the President of Duke University, to appoint Hertha Spöner, a German physicist, to a full professorship. Millikan was convinced that the presence of women in a physics department lowered its prestige. As Margaret Rossiter argues, between the 1920s and the 1930s the efforts of established physicists such as Millikan and his colleagues to promote research opportunities for scientists were restricted to men.<sup>3</sup> Cases like Millikan's enforce and support the stereotype that women were excluded from physics especially in the beginning of the 20th century, when the academic mentality was particularly misogynist and discriminatory.

Nevertheless, the Institute for Radium Research in Vienna (*Institut für Radiumforschung*)<sup>4</sup> from 1920 to 1938 constitutes a paradoxical exception in the world of physics. It was one of the three most important European research centers on radioactivity from the early 1910s to the beginning of the Second World War, and it employed an extraordinary number of female physicists who participated actively in scientific research and administration. An interesting puzzle lurks behind the case of the Viennese institute. Not only did the Institute employ a large number of women physicists, but, in addition, the research of those women was comparable to that of their male colleagues, breaking with the stereotype of women as "patient" calculators and technicians. Focusing on the participation of women in the Radium Institute I aim to debunk and dismantle the stereotypical image of the "patient and meticulous" women. These women scientists were not merely technicians. They were not only relegated to limited jobs – e.g. carrying out calculations, using the scintillation counters or preparing the experimental settings for their male colleagues. Rather, they played a central role in the work of the Institute and the formation of their discipline. Most of all they were capable scientists

and this is how their male colleagues conceived of them.<sup>5</sup>

## The Radium Institute in Vienna

The Radium Institute in Vienna, flourished under the leadership of Stefan Meyer, an Austrian physicist, who worked on radioactivity since the early years of the Institute.<sup>6</sup> Meyer studied under Franz Exner a close friend of Wilhelm Roentgen who introduced x-ray research in Vienna.<sup>7</sup> In 1907 Meyer became Exner's assistant. Both of them worked for the development of the new discipline of radioactivity and in 1910 they succeeded in establishing an Institute devoted especially to radium research. Exner was named director of the Institute, but Meyer was in charge of the supervision of planning and handled the administration from the beginning.

The Institute was recognized as one of the three main research centers for radioactivity in the world, with close connections to the other two centers - the Curies' Radium Institute in France and Rutherford's laboratory in Cambridge University. Because the Vienna Institute had access to the radium resources of the Bohemian mines in St. Joachimsthal, not only did it become the main radium supplier for the other two institutes but it also afforded its scientists exceptional opportunities to conduct their own research.

Meyer was officially named director of the Institute after Exner's retirement in 1920. He remained the director until the Anschluss in 1938 when, being part Jewish, he was one of the firsts to be dismissed of the University.<sup>8</sup> Up to that time a remarkable number of women scientists were involved in studies of radioactivity at the Institute. Meyer's pleasant personality and his encouragement played a major role in this exceptional constellation of women. Some of them were attracted by Hans Pettersson's and Gerhard Kirsch's work on artificial disintegration.<sup>9</sup> Some others worked on the border zone between radiophysics and medicine. Most of them were fluent in the major European languages and moved easily from Vienna to the Curies' or Rutherford's laboratories for short periods of research. Women physicists participated as full colleagues in the work of the Radium Institute and played an important role in the broader scientific community.

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## Statistical Findings

As Galison points out, there is no doubt that the Institute became a "mecca for women exploring the complex of fields surrounding nuclear physics, radiochemistry and radiophysics."<sup>10</sup> Proposed explanations for the disproportionate role of women in radioactivity research and especially for the case of the Radium Institute have focused on the painstaking and repetitive character of the work that makes it especially appropriate to patient female researchers.<sup>11</sup> As Rossiter argues, women are usually willing to enter unpromising fields and accept strenuous and difficult work conditions.<sup>12</sup> However, the image of women as tolerant assistants performing auxiliary tasks rests on the stereotype of their technological ineptitude and their patient nature. A close look at the Radium Institute reveals that there was an extraordinary constellation of women who worked as highly productive researchers. Most prominent among them were Berta Karlik, Marietta Blau, Elizabeth Rona, Hertha Wambacher, Hilda Fonovitz-Smerekker and Elisabeth Kara-Mikhailova.<sup>13</sup>

A survey of the Almanac of the Academy of Sciences from 1920 to 1938 reveals that the percentage of women working at the Institute was exceptionally high, close to 36%. Out of 153 scientists who used the facilities of the institute or were actually employed by it, 55 were women.<sup>14</sup> Additionally, a closer look at the *Mitteilungen*, the annual bulletin of the Institute, for the same period uncovers a surprising element. The female scientists were not meticulous assistants preparing the experimental settings for their male colleagues and they did not merely count flashes on scintillation screens.<sup>15</sup> The list of publications from 1920 to 1938 indicates that women performed their own research and published on their own projects. The *Mitteilungen* were devoted exclusively to the publications of the physicists working in the Institute. In total there were 139 authors, 47 of whom were women, a percentage of 34%. This distribution remained fairly constant over the years.<sup>16</sup> An analysis of the number of publications per year from 1920 to 1938 demonstrates that women made consistent and steady contributions to the work of the Institute and were as scientifically productive as their male colleagues.

As the **chart 1** shows, there is very little divergence in the percentage of publications between men and women in all four categories. Most of the women published

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either one or two papers but the same holds for men. 10.6% of women published more than ten papers, a percentage that is impressively close to 12% for men. This indicates that the most productive core of scientific researchers in the Institute was comprised of just 16 people, one third of whom were women. The main collaborations occurred within this core. Moreover, 30% of the total collaborations were between men and women while 13% were between women only. Most interesting is the fact that women who worked with men were as prestigious and well published as their male colleagues. For example both Elisabeth KaraMichailova and Berta Karlik collaborated extensively with Karl Przibram, assistant at the Institute and the most published of the physicists in the *Mitteilungen*. KaraMichailova worked with Hans Pettersson as well, who was second in the

Przibram, did not act as authoritative leaders but more like intermediaries to young researchers without any discrimination against women.<sup>18</sup> As Rona recollects "*The atmosphere at the institute was most pleasant. We were all members of one family. Each took an interest in the research of the others, offering help in the experiments and ready to exchange ideas. Friendships developed that have lasted to the present day. The personality of Meyer and that of the associate director, Karl Przibram, had much to do with creating that pleasant atmosphere.*"<sup>19</sup>

Contrary to the standard view in the literature, most of these women were paid. Some of them such as Rona, KaraMichailova, Blau and Karlik had paychecks delivered either every month or every two months and some for the particular tasks they performed. The same holds for a few of their male col-

used to explain why women were attracted in the field. Women's meticulous nature and willingness to perform difficult and usually dangerous tasks in radium research are added in the list of explanations. Nevertheless, personal dispositions and stereotypical images about women's work in science are not enough to clarify the case of the Radium Institute. The interweaving of cultural matters and political upheavals characteristic of the early 20th century Vienna in relation to the strong scientific tradition of the time and the position of women in the Viennese society could elucidate another side of the same story. A closer look at the actual work performed at the institute and further research is definitely needed. At this point the above case study poses a question and reveals a possible historical flaw: is the Radium Institute just a paradoxical exception or the stereotype of "patient" women influences our method of writing the history of science in such a way that we missed similar cases elsewhere? The data from the Radium Institute are not enough to answer such a question but they are enough to raise suspicion about the current historiography.

Chart 1

x publishing n papers

% of x publishing n papers

number of publications	x publishing n papers			% of x publishing n papers		
	men	women	authors in general	men	women	authors in general
1	62	33	95	67.4	70.2	68.4
2	12	6	18	13	12.8	12.9
3-9	7	3	10	7.6	6.4	7.2
> 10	11	5	16	12.0	10.6	11.5
<b>total</b>	<b>92</b>	<b>47</b>	<b>139</b>	<b>100</b>	<b>100</b>	<b>100</b>

number of publications.

Further analysis of these collaborations leads to the identification of the different scientific teams. Women seem to thrive in all of them. I distinguish four:

a) The group of Gerhard Kirsch and Hans Pettersson working on artificial disintegration between 1923 and 1927. Among the women who joined the group were Elisabeth Rona, Marietta Blau, Berta Karlik, Dagmar Pettersson and Elisabeth KaraMichailova.

b) Around the beginning of the '20s Przibram worked mainly with KaraMichailova on radiophotoluminescence. After 1933 he worked on the fluorescence of fluorides with Karlik and Rona. However, a number of other female scientists such as Maria Belar, Berta Zecker, Louisa Groeger, Elfride Eysnak and Irmberta Leitner worked with Przibram and published along the same lines.

c) From 1932 to 1938 Blau and Hertha Wambacher worked together on photographic emulsions, a method for trapping and counting charged nuclear particles.<sup>17</sup>

d) In the 30's one more important research direction was Rona's work on the preparation of polonium sources. She co-authored papers with Margarete Hoffer and worked further on the artificial radioactivity with Elisabeth Neuninger and Hertha Scheichenberger.

The characteristic of the Vienna group working on radioactivity is that the main researchers, for example Meyer and

leagues too. In the Institutverrechnung, a notebook recording monthly financial revenues and expenses, one finds detailed reports on the amounts paid to the researchers. A few *Bestätigungen*, receipts signed by women scientists, confirm that they were paid for chemical and photographic tasks they performed as well for the preparation of radioactive sources.

Last, besides their active participation in radioactivity research, women physicists occupied important positions in the administration of the Institute. It is worth noticing that between 1919 and 1922 Hilda Fonovits-Smerker was one of the two assistants at the Institute. KaraMichailova worked as *Wissenschaftliche Hilfskraft* from 1928 to 1934 when Karlik succeeded her. For a short period Marietta Blau deputized for Karlik when the latter visited Pettersson's oceanographic institute in Gotenborg for a few months in 1935.

Such being the case it is surprising that for the same period data for the United States show that women physicists faced severe discrimination in their professional careers.<sup>20</sup> Almost all of them were working in women's colleges and had difficulties in being promoted to higher academic positions. However, as my research indicates, women in the Radium Institute from 1920 to 1938 were extremely productive and participated actively in the research and administration of the Institute. Proposed explanations focus on and overemphasize the role of the director Meyer and his supportive attitude towards women. Curie's fame and her role as an exemplar for women in science and especially in radioactivity is

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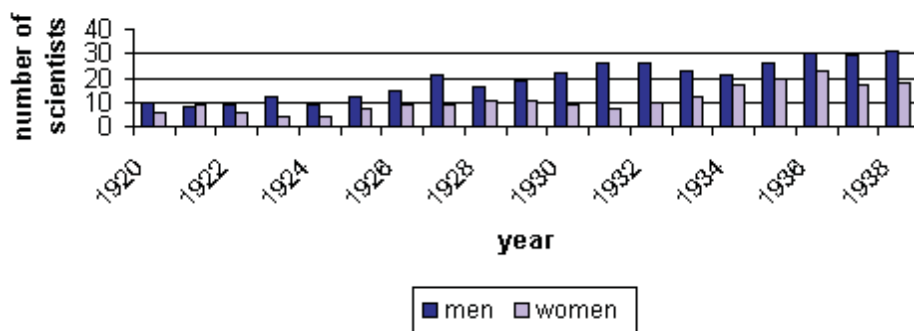
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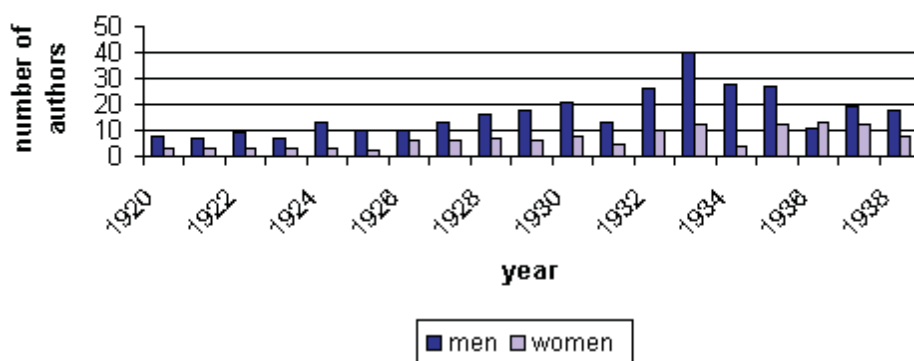
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**Appendix 1**  
**Distribution of the IRR Scientists by Gender**  
**Almanach of the Austrian Academy of Sciences, 1920-1938**



**Appendix 2**  
**Distribution of Authors by Gender**  
**Mitteilungen of the IRR, 1920-1938**



**Notes**

- 1 I would like to thank Prof. Richard Burian for his decisive suggestions and insightful comments on the first draft of the present paper. Dr. Ulrich Dolata has graced me with his help to present my statistical data. I am also grateful to the archivist Dr. Stefan Sienell for his generous help and invaluable guidance related to the archival material. To Dr. Hannelore Sexl I owe my thanks for her help related to the archives of the Institute and also her bibliographical suggestions. I would like to thank the Albert Einstein Archives and the Radium/Archiv of the Austrian Academy of Sciences for their permission to use their archival sources.
- 2 Rossiter, *Women Scientists in America* Vol. I, (1984), p. 192.
- 3 Rossiter, *Women Scientists in America* Vol. I, (1984), p. 194.
- 4 Referred to as the Radium Institute from here on.
- 5 For example in a letter on 14 February 1938 to William Edward Zeuch, chief of Anglo American Studies at the Centro De Estudios Pedagogicos in Mexico, Einstein recommending Blau referred to her as "gifted experimental physicist." (Albert Einstein Archives, letter num. 52602, Permission granted by the Albert Einstein Archives, The National and University Library, The Hebrew University of Jerusalem, Israel). Karl Przibram describing his research team referred to his colleague Rona as a chemist and not as a technician (Przibram, "1920 bis 1938," (1950), p. 32).
- 6 For more on Meyer's life and work see Reiter, "Stefan Meyer: Pioneer in Radioactivity," (2001), pp. 106-127.
- 7 Sime, *Lise Meitner*, (1996), p. 12.
- 8 Sime, *Lise Meitner*, (1996), p. 287; Reiter, "Stefan Meyer: Pioneer in Radioactivity," (2001), p. 120; Reiter, "Oesterreichische Wissenschaftsemigration," p. 713.
- 9 Pettersson and Kirsch were involved in a debate concerning the contradictory experimental and observational results generated by the disintegration of nitrogen nuclei carried out by Ernest Rutherford and his collaborator James Chadwick in Cambridge. For more on this controversy see Stuewer, "Artificial Disintegration," (1985), pp. 239-307.
- 10 Galison, *Image and Logic*, (1997), p. 150.
- 11 For a detailed analysis of this argument see Rayner-Canham M. and G., *A Devotion to Their Science*, (1997); See also Galison, *Image and Logic*, (1997), p.199 and Stuewer, "Artificial Disintegration," (1985), pp. 239-307, specifically for the case of the Institute for Radium Research.
- 12 Rossiter, *Women Scientists in America*, Vol. I, (1984), p. 139.
- 13 For a more detailed description of the work of these women see Bischof, "Frauen am Wiener Institut für Radiumforschung," (2000).
- 14 See Appendix 1.
- 15 According to the standard view in the literature, that was the stereotypical role of the women scientists working at the Institute. See Galison, *Image and Logic*, (1997), p. 199; Stuewer, "Artificial Disintegration" (1985), pp. 286-8.
- 16 See Appendix 2.
- 17 For more on this collaboration see Galison, *Image and Logic*, (1997); Galison, "Marietta Blau: Between Nazis and Nuclei" (1997), pp. 42-8; Halpern, "Marietta Blau (1894-1970)" (1993); Halpern "Marietta Blau: Discoverer of the Cosmic Ray 'Stars'," (1997), pp. 196-204.
- 18 As Rayner-Canhams point out one unique feature of the Vienna group is that almost all the possible collaborations among the women physicists in fact occurred. In contrast, the English group revolved around Rutherford himself (Rayner-Canham M. and G., *A devotion to their Science*, (1997), 26) with little collaboration among subsidiary figures. The collaborative mode adopted in Vienna led to a close network that was not only professional but social too.
- 19 Rona, *How it Came About*, (1978), 15-6.
- 20 Rossiter, *Women Scientists in America*, Vol. I, (1984), p. 264

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