# Feminist Epistemology: How a Case Study from the History of Science Undermines Harding's Standpoint Theory[1]

*Maria Rentetzi*

## Abstract

In her 'Women's Standpoints on Nature: What Makes Them Possible' (1997) Sandra Harding supports feminist standpoint theory by introducing the new idea that men and women belong to different cultures, *gendered cultures*, a belonging which endows them with different standpoints about nature. Central to her article is the assumption that nature is heterogeneous, in the sense that there exist several aspects of natural regularities to which men and women are differently exposed. She concludes that 'differences between cultures are also differences between the resources available to sciences' (1997: 190). She further identifies four categories of such differences aiming to explain the 'obvious fact', which other feminist analysts have already pointed out: women scientists produce the less sexists and androcentrist readings of nature (1997: 187).

Based on an example from the history of science during the Nazi period, I argue that Harding's gendered cultures downplay the complexity of human relations, flatten the differences among women and underestimate the contribution of several other factors besides gender, such as race, ideology and political attitude. Specifically, I discuss the case of the Jewish Viennese physicist Marietta Blau and her Nazi colleague Hertha Wambacher who in 1938 discovered what Peter Galison refers to as the 'first emulsion golden event' (1997b: 44). My focus is on their complex, power-tense relation with its political, gender and racial dimensions. I conclude that women's culture is not a universal, monolithic and natural category. Instead, gender analysis of science needs to be historically sensitive and to have a multilevel approach to human relations.

## Standpoint theory of the 1980s: Women's experiences

Western thought has been understood mainly in terms of canons. Scholars have drawn boundaries between different approaches, used labels in order to distinguish them and divided thought into categories. Following the

same dominant pattern, feminist theory has also been fragmented into numerous approaches. One of the most influential categorisations in feminist theory is Sandra Harding's classification of feminist critiques of science. According to her, feminist epistemology can be divided into two well-developed programs: (a) feminist empiricism and (b) feminist standpoint theory. A third approach—feminist postmodernism—put forward in the early 1980s, represented according to Harding more a promising epistemological agenda than a fully developed program.

The area of convergence in the last two approaches at least, is the replacement of the term *sex* to that of *gender* and the function of gender as an analytical category, that is, a way of talking about systems of social and sexual relations. Gender can be represented as the crossroads of sexual differences and the power relationships imposed by these differences. Within this framework, Harding's definition of feminist epistemology (1986: 138) becomes explicit: feminist epistemology formulates theories, which represent women's practices as fully social, emphasising the social relations between genders as explanatory in human history.

Feminist standpoint theory took advantage of the conceptual shift from sex to gender and Harding's work represents this change of perspective: 'from the woman question in science to the science question in feminism' (1986: 15). Her argument unfolds in the following way:

> Women's social experience provides the possibility of more complete and less perverse human understanding—but only the possibility. Feminism provides the theory and motivation for inquiry, and the direction of political struggle through which increasingly more adequate descriptions and underlying causal tendencies of male domination are revealed. Only through feminist inquiry and struggle can the perspective of women be transformed into a feminist standpoint—a morally and scientifically preferable 'location' from which to observe, to explain, and design social life (1987b: 130–131).

What is privileged in the feminist standpoint approach is women's experience. This is the taken-for-granted basis of scientific knowledge, which, moreover, is presented as unified. Harding holds that 'what we do shapes and constrains what we can know' (1987a: 185). This claim can be interpreted in two ways: first, that women can base their know-

ledge of the world on their common experiences; second, by occupying such a 'location' already, women can transform their knowledge based on experiences into an epistemological tool through their participation in the feminist movement. According to feminist standpoint theorists, this thesis can be justified through the following two approaches: the Marxist (Rose 1976; Hartsock 1987) and the psychoanalytic (Chodorow 1974). Independently of the justificatory strategies appealed to, the goal of feminist standpoint theory is to reconstruct modern scientific methods and inquiry processes. As Harding claims (1986: 142), standpoint epistemologies are "successor science' projects: in significant ways, they aim to reconstruct the original goals of modern science'.

Standpoint epistemological theory has been challenged from many different perspectives. The main critiques address the two core assumptions of the theory: firstly, that men and women occupy different epistemological standpoints; secondly, that women's standpoint is privileged in the sense of producing more accurate and coherent accounts of knowledge. Neither of these assumptions is well supported[2] and, moreover, they presuppose the existence of the universal categories of man and woman.[3]

## Standpoint theory of the 1990s: The shift to gendered cultures

In 'Women's Standpoints on Nature: What Makes Them Possible?' (1997) Harding restates her standpoint theory while introducing a new concept. In place of different standpoints between men and women as based on their different experiences, she proposes the more complex dichotomy of distinctive cultures. Biological sex differences, as well as socially determinate gender differences, play the role of scientific knowledge sources. Harding tries to identify the features within the situation of women that provide distinctive resources for the growth of scientific knowledge. Based on the works of Keller (1983), Martin (1991) and several other feminist scholars, Harding concludes that: 'there was the obvious fact that it was mainly (but not exclusively) women historians, biologists, philosophers and researchers and scholars in other disciplines

who were producing the less sexist and androcentrist readings of nature and of what turned out to be culturally local (because gendered) scientific processes of nature and of science' (1997: 187). It is open to question whether these facts are as 'obvious' as Harding claims, and this quite apart from what 'culturally local scientific processes' means. Let me begin, however, with Harding's main concept, which is that of gendered culture.

Gendered culture cuts across all the known cultural distinctions based on ethnicity, nationality or cultures formed at schools, laboratories and the military, emphasising the gender segregation present in all the different life patterns. On the one hand, men and women seem to share the same cultures but, on the other, Harding claims, this conceals the fact that inside every such pattern there are several practices which contribute to the discrimination of women and to the separation of gender roles. These roles and practices form a culture by themselves, a gendered one, which differentiates women from men. Speaking specifically about academic life where knowledge is produced, gendered cultures are less distinct since academic policy excludes discriminate practices and gender segregation. It is precisely this, however, that serves as the basis of Harding's argument: the right politics weaken gendered cultures, thereby proving that they exist, rather than denying the division.

Further, Harding claims in her argument that because of their different cultures, men and women have access to different sources of knowledge, provided by their distinctive natural and social locations. '...[D]ifferences between cultures also are differences between the resources available to sciences that frame their projects from the perspective of men's life and those that (also) start from women's lives' (1997: 191). Harding identifies four categories of such differences: (a) the distinctive way that men and women perceive natural regularities and are exposed to them; (b) the differences in desires and interests between the two gender cultures; (c) the different relation that men and women bear to the cultural metaphors used in scientific discourse; and (d) accepting that scientific work is a kind of social labour, the different ways of organising this labour that produce differences in the cognitive content of science.

By natural regularities Harding means natural patterns which occur in everyday life, from climate conditions to biological characteristics and from diseases to forms of food or clothing. Different cultures interact in different ways and gender cultures follow the same rule. Moreover, the two cultures understand these regularities differently, providing different cognitive standpoints. As Harding characteristically claims, 'culture's different locations in heterogeneous nature expose them to different regularities of nature and that exposure to such 'local environments' is a valuable resource for advancing collective human knowledge through what initially always appear as local knowledge' (1997: 191). She draws an analogy and asserts that 'cultures are like scientific disciplines' (1997: 192), in the sense that they produce local knowledge based on the distinct ways that both genders are exposed to nature in the same way that different scientific disciplines focus on different aspects of a heterogeneous nature. Harding goes further by assuming that 'research that starts from feminist understanding of women's bodies and interactions with nature—not just men's—will arrive at more comprehensive and accurate understandings of natural regularities and underlying causal determinants' (1997: 193).

Studies on how diverse cultural interests shape different patterns of scientific knowledge can be extended to lend support to Harding's claim that the diversity of gender interests and desires lead to a different understanding of nature. Women's needs prompt different research projects. As I mentioned, Harding stresses the role of metaphors in scientific discourse. Cultural presuppositions are reflected in language and scientific metaphors, which means that metaphors and models are not value-free. Consequently, because of their different cultures, men and women produce different models and use different metaphors that carry gender meanings. 'Standpoints of women call for other than masculinist models and metaphors in scientific and technological discourse' (1997: 196). Finally, deriving legitimisation from social constructivist studies and stressing the role of culture in scientific research, Harding applies the same to gendered cultures.

> There are also indications that women's characteristic patterns of social relations in everyday life tend to lead women scientists to organise their laboratories, their choices of scientific projects, and their publishing strategies differently than do

> their male peers. Starting off research from women's culturally distinctive organisation of scientific and technological work can lead to more comprehensive and accurate scientific and technological claims about nature (1997: 198).

In her concluding remarks Harding claims that women's cultural and natural locations lead to different scientific perspectives and distinctive representations of natural regularities. The two distinct gendered cultures exist, according to Harding, and support the feminist standpoint theory of knowledge. Scientific research bears the distinctive cultural marks of gender not just as another factor in the social construction of science, but as a well-structured culture in itself.

Criticising Harding I want to emphasise the following three points:

(1) The picture of gendered cultures and women's standpoints on nature that Harding sketches views such cultures as self-contained and autonomous structures. Culture is treated as a fixed set of meanings rather than as a forceful assemblage of human relations, where the production of meanings and the use of language are only a few among its many characteristics. Harding implicitly regards gendered cultures as wholes, as distinct and rigid forms of life. For example, women purportedly tend to produce less sexist readings of nature while men have an androcentrist perspective on it; or men often abandon a scientific field moving in a more prosperous one, which, by default becomes thus a women's area. Invariably, men are set up against women in each and every case (1997: 187, 189). Such an understanding of gendered cultures excludes or in the best case impedes one to perceive and explain differentiations within each of these cultures. How could one explicate differences among women when their gendered culture is perceived as monolithic?

(2) Moreover, in Harding's analysis, the two cultures differ linguistically. Metaphors and models have different uses and different values in each, carrying different gender meanings. For reasons that are not at all clear, Harding believes that 'women, like other non-dominant groups, are less susceptible to thinking the language as transparent to the world. They tend to be more alert to the presence of cultural metaphors, models

and ways of organising research that inappropriately devalue women and their activities, as histories of popular culture reveal' (1997: 196). However, Harding does not offer a rigorous argument to support her claim. Are women really a homogenous non-dominant group and even if one accepts that they are, why should this presume a more alert perception of cultural metaphors? Only an answer that presupposes an essentialist understanding of gender could count here.

(3) In the world of standpoint theory, gendered culture is presented as the main culture within culture. The feminism of the 1960s has emphasised gender as the dominant difference in society, developing a competitive relation to the rest of the '*isms*' of the time. In 1997, Harding makes gender once more the dominant culture within all cultures, the one that cuts across all the rest. In such an approach factors like race, class, religious beliefs, ideology, and political attitudes are downplayed and the complexity of human cultures and relations within them is neglected.

## A case study from the history of physics undermines Harding's obvious facts

The point that makes science and epistemology what they are, is the fact that they often question the obvious, the self-evident. Harding seems to forget this in the context of developing her feminist standpoint theory. The focus here is on the 'obvious fact' that women produce less sexist science, they are more sensitive to discriminating science policies, and offer more comprehensive readings of nature (1997: 187). Based on a particular historical episode, I argue that it is far from obvious that it is always women who produce the better science. Gendered cultures get blurred when one is confronted with complex human relations and equally complex forms of scientific collaboration, especially during periods where history moves rapidly. Moreover, I claim that in the case of physics there is a more fundamental question of whether women's different resources on nature and different gendered culture lead them to produce 'less sexist physics', a notion that needs further explanation. I will illustrate

this by the example of the Jewish Viennese physicist Marietta Blau, and her Nazi colleague, Herta Wambacher, focusing on the complexity of their power relations.

Blau was born in 1894 in a prosperous Viennese family. Her father was a court lawyer with great interest in the cultural scene of the *fin-de-siecle* Vienna and a well-known music publisher. From her high school years Blau was very interested in mathematics and physics and obtained her Matura, or school graduation certificate, with distinction (Bischof 2001). She studied physics at the University of Vienna and completed her thesis on the absorption of gamma rays in 1919.[4] The academic work opportunities for women in physics were scarce and so she turned to industry. In 1921 she moved to Berlin in order to work for a manufacturer of X-ray tubes. She gave up this position to become a research assistant at the Institute for Medical Physics at the University of Frankfurt (am Main). In 1923 Blau returned to Vienna and joined one of the three most prestigious research institutes on radioactivity of her time, the *Institut für Radiumforschung*.

Already a year earlier Hans Pettersson, a Swedish physicist, had come to the Institute to work on artificial disintegration bringing in research money from Swedish sponsors and the Rockefeller Institute, as well as instruments and resources which he generously made available to his colleagues in Vienna. Pettersson and his collaborator Gerhard Kirsch were involved in a controversy with Ernest Rutherford and James Chadwick on the disintegration of elements heavier than magnesium. Of crucial importance to the conflict was the improvement of the counting techniques of the alpha particles emitted from the radioactive sources. A number of young scientists were attracted by Pettersson's project and among them Blau was assigned the improvement of the photographic emulsion technique.

When Wambacher came into the scene in the beginning of the 1930s Blau had already extensively published on the importance of the photographic method. Nine years younger than Blau, Wambacher completed her thesis on desensitisers in 1930 having Blau as an advisor and immediately after this started to work on the improvement of the photographic method. The two women worked closely together. Their first

publication on photographic detection of protons liberated by neutrons came out in 1932. During Blau's research stay at the Marie Curie Institute in Paris in 1933, Wambacher collaborated with Gerhard Kirsch, who strongly sympathised with the National Socialist Party (NSDAP), which was gaining immense power in Austria. She was also intimately connected to Stefan Stetter, another physicist at the Radium Institute and active member of the NSDAP. Wambacher herself had already been a member of the Nazi Party since 1934.

The most striking success of the two women occurred in 1937 when they exposed their photographic plates on a mountain near Innsbruck. The results were impressive since they discovered several contamination stars and for the first time the centre of disintegration was apparent. As Berta Karlik wrote to Pettersson, who at the time was in Sweden, 'Heisenberg takes personally the most vivid interest in it [the new phenomenon] and is in continual correspondence with Blau and Wambacher. He has been talking about it in a conference with the Upper Ten in Bologna'.[5] Not only Heisenberg but also a number of theorists and experimentalists took an interest in their work. However, while they were getting a publication ready Stetter interfered in the relationship of the two women. He approached Blau and accused her of being unfair to Wambacher. Moreover he suggested that the order of the names on their publication should be reversed. Wambacher after all, as Stetter argued, was the first to look into the microscope and find the first star. For the colleagues who knew Blau, and Karlik was definitely one of them, she was absolutely miserable after Stetter's intervention. 'Now you know that this is the worst thing you can do to Frauline Dr. Blau: to tell her she is unfair to anybody' Karlik explains to Pettersson. Being really close to Blau Karlik knew very well that 'Etta Blau in spite of her poor health has been working like a nigger for the last months (the enormous pleasure the work gave her actually made her feel a little stronger). Hertha Wambacher has certainly been very diligent, too, since the summer (chiefly examining the plates in the microscope) but Etta Blau has done all the very tiresome calculating' and she continues in a footnote 'quite apart from the fact that she is, of course, still the more mature partner'.

Wambacher was already involved in an affair with Stetter and was strongly attached to him. At the same time she was able, always according to Karlik, to see that his approach to the situation was not quite correct. 'Poor thing: zwei Seelen wohnen, ach, in ihrer Brust'[6] Karlik assumes. Her behaviour towards Blau was extreme; it ranged from rudeness to bouts of enormous generosity, turning the relationship into an uneasy one.

Meanwhile the political situation was becoming worse with the fascists pushing democratic scientists into the wings at the university and controlling teaching appointments (Stadler and Webel 1995). In 1938 and right after the *Anschluss*—the annexation of Austria by Nazi Germany —one third of the professors and lecturers of the physics faculty was dismissed (Reiter 1988 and 1995). The Radium Institute lost a quarter of its staff. Blau was fortunate to have left Vienna only a few months before the Anschluss. Her collaboration with Wambacher was obviously coming to an end. She was unable to work with her and a trip to Oslo where Ellen Gleditsch offered her a research position for a few months seemed the perfect solution at the time. The temporary distance from the Institute and her Nazi colleague turned out to become a permanent struggle for existence. After Norway Blau emigrated to Mexico and finally to the United States. Long after the Second World War had ended and Blau was back in Vienna, she confided to Halpern that the Gestapo had confiscated all of her scientific notebooks as she was leaving Germany from Hamburg. These had most probably, according to her, ended up in the hands of her colleagues. Wambacher was one of those who, apparently, used Blau's work after she left. Collaborating with Stetter (Galison 1997b: 47) Wambacher continued to publish on photographic emulsions during the war, work which is suspiciously similar to Blau's confiscated research notebooks.

Not surprisingly, Wambacher, being the only woman in the group of Nazi scientists working on emulsions, was also the only one who never regained a professional position after the war. She died in 1950.[7] Blau's career was also strongly affected by the political upheavals of her time. Because of her absence from major centre of research after 1938 she found herself isolated in the world of big physics. Cecil Powell discovered the pion in emulsions based on her method in 1947, having adapted

the original method to the demands of big laboratories and large scientific teams. He received the Nobel Prize in 1950 a prize that should have been shared with Blau for her decisive contribution on the development of the method (Perlmutter 2001). In the late 1960s and because of her exposure to radioactivity, Blau's eyesight became poor. She returned to Vienna in order to have an operation. Blau had been unpaid for many years of her professional career, and consequently had no health insurance to be able to afford an operation in the United States. She died in 1970 in the intensive care ward of a Vienna hospital.

The challenging question is how one could analyse the kind of science the two women produced and their distinctively gendered standpoints on nature according to Harding's notion of gendered cultures. Women's situations and lives generate such resources that enable them to produce the less androcentrist science, Harding argues. Was Wambacher then producing less androcentrist science than any of her male colleagues who were facing the racism of the National Socialists? Moreover, for Harding, both Blau and Wambacher belong, as women, to the same gendered culture. Their standpoint on nature had the same resources and they both experienced similar discrimination based on their gender in a man's world of physics. However, it seems obvious to me that they followed different directions and made different choices that a 'standpoint' perspective cannot count for. In order to support my claim I would like to raise two issues.

(1) Harding's claim that scientific research is social labour and the ways laboratories are organised reflect cultural and social values are widely accepted. In the case of the Viennese laboratory in the 1920s and early 1930s research was organised in a collaborative and collegial way between men and women as well as among women. Accounts of the strong friendships among them can be found in letters and archival material as well as in the relevant literature (Rayner-Canham 1997; Bischof 2000). Having strong personalities supportive to women such as the director Stefan Meyer, the assistant Karl Prizbram, and Hans Pettersson, research was done in a 'less sexist' way and women were able to perform their own research, publish regularly in the institute's

annual bulletin, and collaborate with their male and female colleagues on equal terms (Reiter 2001; Rentetzi 2001). When the political situation changed the balance among the researchers was distracted. The National Socialists such as Wambacher, were able to impose their own rules, methods of cooperation, and research projects indirectly at first and directly after 1938. How could a monolithic gendered culture explain such a shift? According to Harding women and men tend to organise work and their research facilities differently. In our case, however, gender was one and not the main factor among others that determined work and research organisation.

The history of science has been sensitive to several cultural contexts and the analysis of historical episodes in science has successfully underlined each. The function of gender as an analytical category in the history of science has long been emphasised (Jordanova 1993). Under such an approach women are not considered a mere part of the big historical picture, they are not listed as famous scientists or pre sented as victims of the male dominated scientific disciplines. 'Gender' is not a descriptive term but a sophisticated concept, which expresses social and cultural differences, shapes experiences, represents the complexity of human relations between men and women. More-over it is subject to historical changes and ensures the quasi-autonomy status of gender relations among other analytical categories such as class and race. Blau's and Wambacher's relationship is one of these examples of gender playing a crucial role in the understanding of science. On the one hand, the inversion of their relationship—the fact that at the beginning Blau was the one who invited Wambacher to work with her and later on the ardent Nazi took advantage of her position and her political supporters against Blau—cannot be ana-lysed in terms of women's versus men's culture. On the other hand, if one wants to use Stetter's interference in this relation as an excuse for Wambacher's behaviour one has to assume that she was a mere victim of male dominance without any agency, an explanatory schema that once more treats gender as a descriptive category. What is lacking then in Harding's approach is a conceptual flexibility and a sensitivity to multiple historical and cultural contexts. The fully distinctive cultures impose gender as the

crucial factor in all historical analysis and dismisses the role of other factors such as ideology, politics and religious beliefs.

(2) In the analytic tradition physics has been considered as the most paradigmatic science of all sciences; and bringing physics under scrutiny is thus a central task for the feminist and sociological critiques of science. Yet, until now, physics has not proved to be especially tractable to these critiques; for this reason physics serves as what one could call the *resistance-science* to their approaches. It would appear that the mathematical language, which constitutes the core of physics, seems impervious to background assumptions, contextual and cultural values. The challenge is to provide an account of physics, which is coherent and accurate on the one hand, but also demonstrates how background assumptions, gender metaphors and cultural values regarding gender influence physics and thereby the scientific enterprise in general on the other hand. Adopting Harding's epistemological approach one has to prove how 'gender-segregated socially assigned activities' (1997: 192), and cultural metaphors lead to different physics if this means not just a different way to perform physics research but is taken further to argue for the production of different physical theories. Moreover, one has to explain what kind of questions women ask which are determined by their gendered culture that in the case of physics lead to a less sexist science. However, one can avoid such a deadlock adopting instead the view of Schiebinger who argues that

> The content of physics is not distinct from its cultures; cultures—shared beliefs, expectations, 'taken-for-granteds', and material well being—mould many aspects of the various sciences. The greatest physicists have been those who ask the right questions [...] Ultimately, the culture of physics sets conditions for who has the training and the opportunity to ask questions (1999: 178).

Within this culture of physics and of science in general is where gender counts as an analytical category, as a factor among several others, a quasi-autonomous category of historical and sociological analysis. Thus gender exists among other cultures and a historical analysis also takes into account the historicity of these cultures and their concepts.

## Conclusion

Harding defends standpoint theory by making an epistemological shift: in place of different experiences as sources for distinctive standpoints on nature, she introduces the idea of different cultures. She claims that men and women, by having different desires and interests, by being exposed to different aspects of natural regularities and by being embedded in different linguistic metaphors and models form and inhabit different gender cultures. It is not only biological differences which serve as different sources of knowledge for different genders; it is not just different life experiences which determine the way of learning and understanding. The whole culture of being and living, understanding and theorising differs between men and women. According to Harding, gendered cultures become the main forms of culture and provide the sources for different standpoints on nature. Being incommensurable and self-contained like scientific disciplines, they capture the heterogeneity of nature and explain the disunity of science. Furthermore, Harding asserts that women's standpoints on nature obviously produce a non-sexist and less androcentrist science.

I have argued that gendered cultures, the power relations between men and women and all that is implied therein, undergo several exchanges, most of which are complex and unclear and very far from being obvious. In addition, I have suggested that gendered cultures exist within other forms of culture, such as the political, the ideological and the religious, all forming together a mosaic of different colours. The complexity of power relations in Blau's and Wambacher's collaboration extends to the wider scientific community and includes multiple cultural dimensions besides gender. The dichotomy between women's and men's distinctive standpoints on nature can at best describe only one of these.

## Notes

[1] I would like to thank Richard Burian, Aristides Baltas, Gary Hardcastle, Peter Machamer and Cassandra Pinnick for their decisive comments and suggestions

on the first drafts of the present paper. I owe my sincerest thanks to Leopold Halpern for giving me an interview on March 5, 1999. Without the help and the grand-in aid from the American Institute of Physics this would not have been possible. I am grateful to the archivist Anders Larsson for his generous help concerning the correspondence between Berta Karlik and Hans Pettersson that is kept at the archives of the University of Goeteborg.

2 See in *Signs*, Winter 1997, 22 (2) the discussion on feminist standpoint theory among Hekman, Hartsock, Collins, Harding and Smith.

3 Several postmodern critiques underline this point. See, for example, the work of Flax, Haraway, Irigaray, Cixous.

4 As Leopold Halpern, a close friend of Blau argues, Jews were denied access to modern studies for a long time. Many Jews moved into physics in the late 19th and early 20th centuries. Blau was no doubt a part of the general trend. (Leopold Halpern to Maria Rentetzi, interview on March 5, 1999, Miami. Deposited to the American Institute of Physics, US.)

5 Berta Karlik to Hans Pettersson, December 30, 1937, Archives of the University of Goeteborg (in English).

6 There are two emotions in her heart.

7 For more on the relationship between Blau and Wambacher see Galison 1997a, b; Halpern 1993, 1997 and Perlmutter 1998.

## References

Bischof, Brigitte (2001), 'Marietta Blau (1894–1970): Physikerinnen der Universität Wien-Portrait', *Koryphae* 29: 6–7.

Bischof, Brigitte (2000), 'Frauen am Wiener Institut für Radiumforschung', Diplom-arbeit, Universität Wien.

Bischof, Brigitte (1998), *Physikerinnen: 100 Jahre Frauenstudium an den Physikalischen Instituten der Universität Wien*, (Brochure of the Exhibition) Universität Wien.

Chodorow, Nancy (1974), 'Family Structure and Feminine Personality', in J. Kourany *et al*. (Eds.), *Feminist Philosophies: Problems, Theories and Applications*, Hemel Hempsted: Harvester Wheatsheaf: 309–22.

Galison, Peter (1997a), *Image and Logic*, Chicago: University of Chicago Press.

Galison, Peter (1997b), 'Marietta Blau: Between Nazis and Nuclei', *Physics Today*, November.

Halpern, Leopold (1993), 'Marietta Blau (1894–1970)', in L. Grinstein (Ed.), *Women in Chemistry and Physics: A Bibliographic Sourcebook*, Westport, CT: Greenwood Press: 57–64.

Halpern, Leopold (1997), 'Marietta Blau: Discoverer of the Cosmic Ray 'Stars", in M.F. Rayner-Canham and G.W. Rayner-Canham (Eds.), *A Devotion to Their Sciences: Pioneer Women to Radioactivity*, McGill-Queen's University Press: 196–204.

Harding, Sandra (1986), *The Science Question In Feminism*, Ithaca: Cornell University Press.

Harding, Sandra (1987a), *Feminism and Methodology*, Indiana: Indiana University Press.

Harding, Sandra (1987b), 'The Gender in The Machine: Gender Relations, the Processes of Science, and Feminist Epistemological Strategies.' in N. Nersessian (Ed.), *The Process of Science*, Boston: Martinus Nijhoff: 125–137.

Harding, Sandra (1997), 'Women's Standpoints on Nature. What Makes Them Possible?', *Osiris* 12: 186–200.

Hartsock, Nancy (1987), 'The Feminist Standpoint. Developing the Ground for a Specifically Feminist Historical Materialism', in S. Harding (Ed.) (1987a): 181–190.

Jordanova, Ludmilla (1993), 'Gender and the Historiography of Science', *BJHS* 26: 469–483.

Keller, Evelyn Fox (1983), *A Feeling for the Organism. The Life and Work of Barbara McClintock*, New York: Freeman and Company.

Martin, Emily (1991), 'The Egg and the Sperm: How Science Has Constructed a Romance Based on Stereotypical Male Female Roles', *Signs* 16: 485–501.

Moore, Walter (1989), *Schroedinger: Life and Thought*, Cambridge: Cambridge University Press.

Perlmutter, Arnold (1998) 'More on Marietta Blau and the Physicists of Pre-, Postwar Vienna', *Physics Today*, August: 81–83.

Perlmutter, Arnold (Forthcoming), 'Marietta Blau's Work After the World War II'.

Rayner-Canham, M.F and G.W. Rayner-Canham (1997), *A Devotion to Their Sciences: Pioneer Women to Radioactivity*, McGill-Queen's University Press.

Reiter, Wolfgang (1988), 'Österreichische Wissenschaftsemigration am Beispiel des Instituts für Radiumforschung der Österreichischen Akademie der Wissenschaften', in F. Stadler (Ed.), *Vertriebene Vernuft II: Emigration und Exil Österreichischer Wissenschaft* (Internationales Symposion 19. bis 23. October 1987 in Wien), Wien/München: Jugend und Volk.

Reiter, Wolfgang (1995), 'The Year 1938 and its Consequences for the Sciences in Austria', in F. Stadler and P. Weibel (Eds.), *Vertreibung der Vernunft: The Cultural Exodus from Vienna*, New York/Wien:Springer.

Reiter, Wolfgang (2001), 'Stefan Meyer: Pioneer in Radioactivity', *Physics Perspectives* 3: 106–127.

Rentetzi, Maria (2001), 'Women in Physics: Women Physicists in the Institute for Radium Research in Vienna, 1920–1938: A Statistical Report', *Soziale Technik* 2: 9–12.

Rose, Hilary and Steven Rose (1976), *Ideology of/in the Natural Sciences*, Cambridge, MA: Schenkman.

Schiebinger, Londa (1999), *Has Feminism Changed Science?*, Cambridge, MA: Harvard University Press.