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Magallón Portolés, Carmen
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IMPROVE SCIENCE AND LIVES

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SCIENCE FROM WOMEN'S LIVES. BETTER SCIENCE?

HOW GENDERED STUDIES IMPROVE SCIENCE AND LIVES

CARMEN MAGALLÓN

Recent gender analyses have been opening new paths for innovation and excellence. They are the basis for the *Gendered Innovations* project, led by the science historian Londa Schiebinger, in joint collaboration with the European Union. However, this work did not come out of nowhere; it is supported by decades of gender and science studies consisting of different research lines that critically reviewed the history of science and recovered the story of women's contributions to different scientific fields. This paper reviews the origin and genealogy of the project, highlights its positive effects, and highlights examples of its achievements.

Keywords: gender innovations, gender and science, female scientists, Londa Schiebinger, history of science.

The *American Journal of Physics* published an editorial several years ago on the number of Physics PhDs obtained by men and women in the United States. Romer (1988) used quite an overt title, «958 men, 93 women—How many Lise Meitners among those 865?», and wondered how many women with the talent of Lise Meitner had been lost along the road. The figures the author used corresponded to 1985-1986, and so two decades have now passed since that wake-up call emerged from the core of the scientific community.

The questioning that once pushed the identification of historical obstacles and difficulties for women trying to gain access to scientific institutions – universities, scientific societies, great academies, and diverse forums – is now taking a positive turn. Following on from Romer, the questions are now: what are we missing when we do not include the talent of half of humanity? What happens when we do not modify the institutions that maintain these obstacles? What is the outcome when we do not include gender and sex analyses in basic and applied research? The first two questions focus

on achieving more inclusive scientific institutions, but the last one is the most novel and can be operationally posed as follows: how can researchers take advantage of gender analysis in order to make new discoveries?

In 2005, at Stanford University, California, USA, this latter question was the origin of an interesting

**«SCIENCE ITSELF
CONTRIBUTED TO
EXCLUDING WOMEN,
ESTABLISHING THEORIES
THAT CONCEPTUALISED
THEIR NATURE IN A BIASED
MANNER»**

project named *Gendered Innovations*. Since then, under the leadership of the science historian Londa Schiebinger, more than sixty scientists, engineers, and gender experts (first in the United States and later in Canada, Europe and Asia), started gathering in interdisciplinary working groups to develop methods to analyse, identify, and exemplify case studies under

this paradigm. Today, the search for new knowledge and technologies arising from the application of gender analysis to research has reached the level of international collaboration and garnered the support of institutions such as the European Commission, which created a group of experts to join the project in 2011, and the National Science Foundation, which did the same in 2012.

U.S. Nuclear Regulatory Commission



Lise Meitner is among the female scientists whose legacy has been rescued from oblivion by gendered scientific studies. In the picture, the Austrian physicist and a group of her students at the stairs of Bryn Mawrs College, Pennsylvania (1959).

This fruitful research programme did not come out of nowhere; its genealogy can be traced back almost four decades, to a time when female philosophers and science historians documented gender biases in traditional science and gave life to a new research field: gender and science studies.

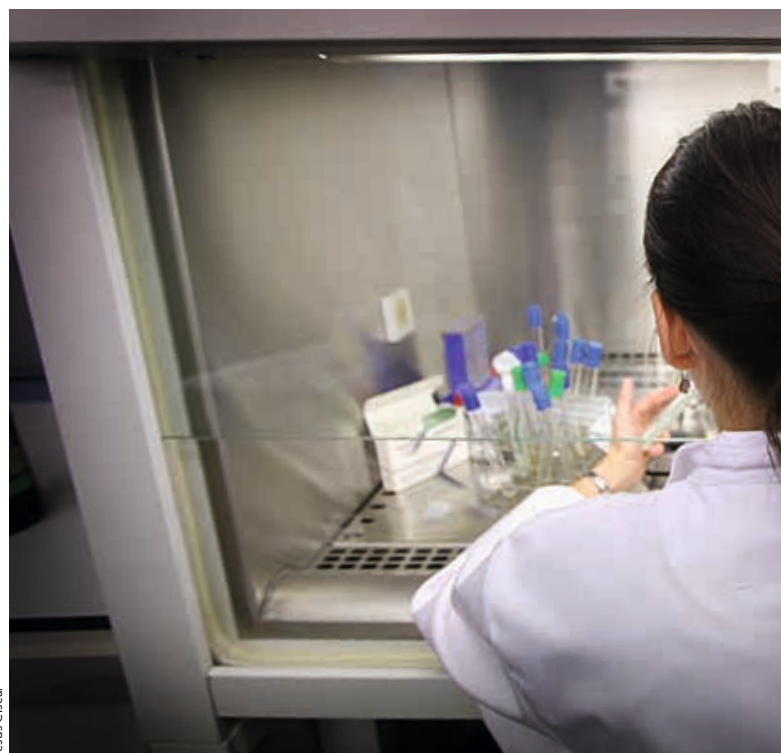
■ LINES OF RESEARCH IN GENDER AND SCIENCE

In order to understand the significance and potential of current work in this area, we must first remember the road behind us, the great lines of research that eventually formed a new body of knowledge about science. Londa Schiebinger, leader of the *Gendered Innovations* project, first led me to think about this idea.

I met Schiebinger while I was working on my dissertation *Pioneras españolas en las ciencias* ("Female Spanish pioneers in science"). We ran into each other in the same symposium, the XIX Conference on the History of Science, organised by the University of Zaragoza, in 1993. I remember her contribution, titled «The gendered ape», in which she stated that the first reports on apes had more to say about the habits of European people than about the natural habitat of the animals (the communication was later published in Schiebinger, 1993).

In the corpus of studies in the field of gender and science, Schiebinger (1987) identified lines of research that classified the different efforts made to bring the historical scientific contributions of women to the foreground. These lines of research are still alive,

**«TODAY, FEMALE SCIENTISTS
ARE NO LONGER ORPHANS
IN TERMS OF HISTORY»**



Jesus Ciscar

The history of science has shown how issues and questions emerged from female interests and concerns (for example, the analysis of food, water, cosmetics, etc.) had often been devalued and denied the status of being «scientific». Science would later incorporate them into its core.

intersect and complement each other, and form a rich tapestry of knowledge. Here I will briefly review them.

The first line of research, the study of outstanding female scientists, focused on recovering and

publicising the history and achievements of great female scientists of the past, who fit the paradigm of «celebrated men». The investigation yielded many more historical cases than those usually studied in mainstream history: female scientists who

were recognised at the time but whose contributions were later forgotten. We discovered that Hypatia of Alexandria was the origin of many female physicians, physicists, mathematicians, astronomers, chemists, philosophers that form a long line along the centuries... Hence, the lives and contributions to science by Hypatia, Émile de Chatêlet, S  fia Koval  vskaia, Ada Lovelace, Lise Meitner, Rosalind Franklin, and so many others were studied and published (Alic, 1986).

The second line of work studied the processes by which women as a group entered different scientific fields and noted that, as with other processes, the

Stanford University



professionalisation of scientific work carried a different meaning for men and women. This usually meant that access to higher education was required in order to graduate and participate in the scientific forums in which new professionals debated work and upcoming changes. Meeting these requirements was not easy for women because of gender prejudices towards particular sexes in certain professions. What was an advancement for men – professionalisation – meant the appearance of new obstacles for women, because defending the prestige of emerging professions led to people who were considered amateurs, as women were usually assumed to be, to be denied entry into such specialised forums. These obstacles and exclusion practices were documented over time, as were the strategies used by women to demolish them. Margaret Rossiter (1982, 1995) masterfully illustrated the methodology for this line of work, and some of us applied these in our historical contexts (Magallón, 2004).

The third research course tried to track how science itself contributed to excluding women, establishing theories that conceptualised their nature in a biased manner. It addressed the critical review

**«WITH THE INCLUSION OF PREVIOUSLY
HIDDEN FEMALE KNOWLEDGE THE
SCIENTIFIC TRADITION WAS EXPANDED»**

of how sciences – especially biology and medicine – defined what they called «the nature of women». In the history of science, biased conceptualisations about the body and mind of «the woman» were abound. Some even situated women closer to the animal kingdom, naturalising and refuelling the social prejudice of each era. An example of this was the use of cranium studies to brace the prejudice that attributed lower intelligence to women and to other «inferior races» (Delgado, 2007; Schiebinger, 1993).

The fourth investigative track tried to highlight the hallmarks of sexism and distortions that were embedded in scientific rules and methods as a result of the historical exclusion, in roles that were key for the construction of modern science, of women and other human groups (Keller, 1991). Feminist epistemologies highlighted the ideological and methodological biases that impregnated the set of practices known as the «scientific method»: traces of the ideology of the dominant majority group in science (namely, the archetype of a white western



The science historian Londa Schiebinger (Stanford University) leads *Gendered Innovations*, which has collaborated with the European Union since 2011. This project is the continuation of decades of studies in lines of research that have critically reviewed the history of science.

middle-class man) were present in the selection and formulation of problems, in the observation of facts, in hypotheses, and the corroboration of the validity of such hypotheses through experimentation. Feminist critique trends joined the voices of the different social movements that, based on Thomas Kuhn, tried to analyse the content of science without isolating it from the historical and social circumstances in which it was constructed, questioning whether science was the neutral reflection of reality it declared itself to be.

To the sexist distortions identified by Schiebinger, we must also add the ones that were based on teaching science, both in the past and today. Therefore, a fifth investigative line focused on reviewing the content of the science curriculum both for children and for the scientific training of teachers throughout the history of education. This research found that the lower number of women in some scientific fields was influenced by an educational deficiency which girls themselves were not responsible for. Finally, a sixth line delves into current science didactics, examining how science should be taught to appeal to both sexes equally, a concern that took off in the late 1980s when a decrease in scientific vocations sparked the debate on how to make science more «girl-friendly».

■ FROM THE PROBLEM OF WOMEN TO THE PROBLEM OF SCIENCE

The initial question, born from the observation of exclusion, looked at the problem of women in science: why there were so few, where the women were, what was happening to them... Studies in the field of gender and science enabled the epistemological escalation of the problem, in a direction cleverly formulated by Sandra Harding (1986) when she proposed a change, away from problematising women and rather, questioning science: asking ourselves, what is happening in science, how is it constructed, and what partialities hide behind its supposed neutrality?

Complaint approaches have presided over gender studies and feminist movements. These approaches were necessary because recognition of many historical female scientists has had to be rescued from oblivion and many of the biases that distort disciplines had to be criticised, thus giving rise to the great breadth of research now available (Miqueo, Barral, & Magallón, 2008). However, these were not enough to acknowledge the diversity, richness, and complexity of women's experiences. They also situated women in the role of victims: of oblivion, of prohibition, of prejudice, when they were more than that: many enjoyed scientific authority among



Bindaas Madhavi

Gendered research has also studied science teaching in the past and present, and has found that the lower number of women in some scientific fields is influenced by educational gaps in girls' education.

«THE ABSENCE OF WOMEN IN THE SCIENTIFIC COMMUNITY IN THE PAST LED TO BIASED AND INCOMPLETE SCIENCE»

their contemporaries; others, despite being unknown, developed fields and work that also constitute an essential legacy for humanity as a whole.

Projecting Harding's thinking to other fields leads us to state that in order to radically eliminate gender bias in knowledge and institutional design, we must move from the problem of women – in science, in politics, in economy, in whichever discipline or institution – to the problem of science, of politics, of economy, of any of these disciplines or institutions. Because the problem lies not in women, but in science and in institutions, and the way they were built (Magallón, 2012). The transforming ability and the future projection of this change resounds in the new course adopted by the *Gendered Innovations* project (European Commission, 2013).

■ GENDER AND THE LIVES OF WOMEN AS A RESOURCE

Gender and science studies opened up the path towards two conclusions: first, that conceiving science as being created from a biased and exclusive-thinking



Posters for the campaign *Make the call*, created by the United States Office on Women's Health in 2011. A series of images provide information about heart attack symptoms in women, which were largely unknown by those who might be affected.

«GENDER STEREOTYPES PREVENTED
THE ADEQUATE CONCEPTUALISATION
AND INVESTIGATION OF SEVERAL
PROBLEMS, AS IN THE CASE
OF CARDIOVASCULAR DISEASES»

structure could not be accepted as closed and complete; and second, that the development of gender studies had led to significantly better knowledge than had previously been obtained. The history of science has shown how issues and questions which emerged from female interests and concerns (for example, the analysis of food, water, cosmetics, etc.) had often been devalued and denied a «scientific» label. However, the evolution of science meant that they would ultimately be included at its core. Social sciences, biology, psychology, the history of science, and medicine, among other disciplines, have benefited from the results obtained by female researchers who reacted critically to the knowledge they were offered.

With the inclusion of previously hidden female knowledge the scientific tradition was expanded. Today, female scientists are no longer orphans in terms of history. Lise Meitner and so many others support their presence and provide role models for young girls who can now be inserted into a tradition of female scientists. We can say that the talents of the past drive the process of rescuing talents in the present and future. This is in the knowledge that, in many cases, these pioneers posed new questions which have allowed us to think about issues that still remain for systematic exploration from the sex-gender perspective in many fields. Developing this research will make it possible to create new knowledge and technologies, and to keep improving science and lives.

Gender analyses, configured as a critical review of the predominant androcentrism and sexism in society which also impregnates science, are now being used as a resource. This leap, taken during women's long fight to achieve equal status in science, moves on from merely «complaining» to being a resource, and shows the potential of the philosopher Alexandra Bochetti's thinking when she wrote: «We don't gain access to politics through what we lack, but rather through what we have» (Bochetti, 1996, p. 314). I would also like to add that there is no access to science, economy, or speech if we are not aware; in order to project something new onto the world we must start with what we have instead of focusing on what we lack.

■ GENDER INNOVATIONS

The existence of a hierarchical relationship between sexes and genders overshadowed the differential features of sex (e.g., frame, bodyweight, pregnancy, etc.) as well as attitudes and activities (e.g., work, thoughts, practices...) with which entire generations of women grew. As the Colombian anthropologist Arturo Escobar stated in 2012, we do not inhabit a *universe*, but a *pluriverse*, and those vital scorned universes still harbour questions and lines of inquiry that can lead to a broadening of science.

Some questions arise from these universes: does car safety equipment take into account the lower weight and size of women and the fact that many drive when pregnant? Millions of women do drive during pregnancy, yet seatbelts do not take that into

«THE SEARCH FOR NEW KNOWLEDGE AND TECHNOLOGIES ARISING FROM THE APPLICATION OF GENDER ANALYSIS TO RESEARCH HAS REACHED THE LEVEL OF INTERNATIONAL COLLABORATION»



Anna Mateu / MÈTODE

The absence of gender perspectives is clear in the different branches of technological and scientific research. For instance, the development of car safety equipment has omitted factors related to women, such as their lower average weight and size and the fact that many of them drive when they are pregnant.

consideration. As a consequence, according to Weiss et al. (quoted in Schiebinger & Schraudner, 2011, p. 159), 82 % of foetal deaths with known causes are due to vehicle crashes. Addressing this problem requires thinking out and designing safety tests with the appropriate robots or dummies.

Gender perspective refers to a theoretical framework that affects both women and men. Gender stereotypes prevented the adequate conceptualisation

and investigation of several problems, as in the case of cardiovascular diseases which were described as male diseases. Despite the fact that cardiovascular diseases are the main cause of death in women, females are less commonly diagnosed with these diseases both in the United States and in Europe. Something similar happens with men and osteoporosis, a disease which appears after menopause in women and is traditionally considered to be a female problem, when in reality, one third

of hip fractures caused by this disease occur in men (Schiebinger & Schraudner, 2011). Thus, looking for innovation through analysis and methods that question gender stereotypes has the potential to improve sciences and lives, because it questions constructed knowledge and uncovers evidence for knowledge gaps. This is the objective of the *Gendered Innovations* project.

In this project, interdisciplinary collaboration groups in which scientists, engineers, and gender experts participated, identified twelve routes, ranging from strategic processes to routine tasks, by which sex-gender analysis could be introduced into each step of research. They are as follows: 1. Rethinking research priorities and outcomes. 2.

Rethinking concepts and theories. 3. Formulating research questions. 4. Analysing sex. 5. Analysing gender. 6. Analysing how sex and gender interact. 7. Analysing factors intersecting with sex and gender. 8. Engineering innovation processes. 9. Designing health and biomedical research. 10. Participatory research and design. 11. Rethinking standards and reference models. 12. Rethinking language and visual representations (Schiebinger, 2014).

Gendered Innovations includes cases of illustrative studies, which consider the problem, the method applied, and the results obtained. For instance, changing research priorities led Andrew Szeri's mechanical engineering laboratory at the University of California, Berkeley, to include more women in his team and move away from applied physics towards biomedical engineering; the same mathematical models could be used to understand the physics of a problem or to develop biomedical applications. One of the problems they dealt with was HIV in Sub-Saharan Africa where this disease causes 72 % of deaths. The subordinate position of women often prevents them from negotiating safe sex, and the only protection, female condoms, is detectable and frequently rejected by their partners. Szeri's team developed a microbicide gel that allowed women to control their protection against HIV. In this case, fluid mechanics focused on achieving the exact characteristics for the gel to be able to fulfil its purpose: covering the entirety of the vagina and not falling off due to gravity (Schiebinger, 2014).

The aforementioned example is one of many that show how this type of approach, used in

science, health and medicine, and engineering, improves excellence and leads to innovation. This corroborates the critiques of science made by the feminist historians and philosophers mentioned at the beginning of this essay, as it states that the absence of women in the scientific community in the past led to biased and incomplete science; it also confirms that both their inclusion and an approach based on gender perspectives can improve both sciences and lives. ⊕

**«LOOKING FOR INNOVATION
THROUGH ANALYSIS AND
METHODS THAT QUESTION
GENDER STEREOTYPES HAS
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SCIENCES AND LIVES»**

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Carmen Magallón Portolés. PhD in Physical Sciences, authorised by ANECA as a tenured university school professor in the area of Arts and Humanities. She is a member of the Interdisciplinary Seminar for Women's Studies at Zaragoza University and is the director of the SIP Foundation (Spain).