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WOMEN IN SCIENCE: THE MISSING LINKS

Are women destined to be scientists? They are holding more and more positions in laboratories and universities. But even if the proportion of women participating in science increases, they are still far from playing on an even field with their male colleagues.

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Rare as hens' teeth?

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Even if they are far from reaching parity with their males colleagues, more females than ever are researchers. But they remain largely absent from the highest rungs of the profession and must often make difficult choices between professional career and private life.

When nuclear physicist, Fay Ajzenberg-Selove, was a post-doctoral researcher at Princeton University (USA) in the 1950s, she had to sneak into the particle accelerator building at night to work – it was out of bounds to women. While this could not happen today, a flurry of recent reports shows that women scientists are still often at a significant disadvantage compared to their male colleagues, especially as their careers advance.

Data for 2004 just published by the European Commission show that women make up just 29% of those employed as scientists and engineers in the European Union – even fewer (18%) in the business and enterprise sector. And it is precisely this sector that is expected to provide the resources for the EU to meet its Lisbon Strategy target of 3% of GDP for research by 2010. According to a 2006 EC publication, "this is likely to involve the creation of some 700,000 new research-related jobs by 2010 – which Europe will have trouble filling as long as half of its population remain sidelined in the S&T field."

A similar picture emerges globally. According to UNESCO's Institute for Statistics (UIS) women make up less than 30 percent of researchers in 34 out of 89 countries surveyed, while only 17 – 18% of countries have gender parity in science and technology research jobs. The picture changes slightly according to discipline, with women even forming the majority of researchers in life sciences and medicine. But, according to one observer in the USA, women are "rare as hens teeth" in mathematics and physics. A 1999 study at the Massachusetts Institute of Technology (MIT) revealed only 15 tenured women faculty in the School of Science, compared to 194 men. The figure had scarcely changed in the previous two decades, although swift policy changes in the light of the report have gone some way to improve the inequality.

For Renée Clair, UNESCO Executive Secretary of the L'Oréal-UNESCO For Women in Science programme, the 1995 World Conference on Women in Beijing (China) marked a turning point in awareness of this gender bias in science. "Before that, the issue didn't even arise," she says, blaming ingrained and largely unconscious stereotypes that promote the idea that women "aren't made to do science." As recently as January 2005, the president of Harvard University, Lawrence H. Summers sparked a furor by arguing that innate differences explain why fewer women succeed in maths and science careers, forcing his resignation. Findings in psychology and neuroscience tends to suggest that social stereotypes are the most potent negative influence for girls, although males

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Renée Clair, UNESCO Executive Secretary of the L'Oréal-UNESCO For Women in Science programme

and females may differ in the strategies they use to solve the kinds of problems encountered in scientific research.

One way to redress the imbalance, says Renée Clair, is to "change the image of science and the image of women in science," by providing attractive role models. After all, of the 513 Nobel Prizes for physics, chemistry and physiology or medicine awarded since 1901, only 12 have gone to women - two of them to the same person, Marie Curie. This, explains Renée Clair, is one function of the L'Oréal-UNESCO For Women in Science prizes awarded each year since 2000 to outstanding women scientists from five continents. The 2006 awards will be announced in Paris on XX February.

Boosting the number of female undergraduates studying science is one way towards parity in employment in scientific research, especially in countries where girls may be denied access to even basic education. "I didn't even know that one could do research in mathematics as a career," says Ramdorai Sujatha, winner of the 2006 Ramanujan prize for her work in mathematics at the Tata Institute of Fundamental Research in India. "There was absolutely no information dissemination."

But recent evidence suggests that other forms of discrimination emerge during the career of a woman scientist, effectively barring them from the top jobs – what has come to be known as the 'leaky pipeline'. A 2004 survey carried out by the Athena Project, a consortium of UK research funding bodies, universities and government science departments launched in 1999, found little evidence for discrimination at the bottom of the career ladder. Indeed, women were slightly more likely than men to succeed in their first application for a lectureship post. But women were significantly under-represented at senior levels and, in the older age groups, were more likely to be on short-term contracts.

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23-year-old Hansi Devi repairs a solar lantern at the Barefoot College in Tilonia, Rajasthan (India) after a 6-month training course

One of the difficulties women face is whether to interrupt their career to have children, often just when they also need to intensify their research output to get ahead. In the Athena survey, more women (32%) than men (4%) had taken career breaks. And a higher proportion of women (29%) than men (14%) reported difficulties in returning to work. For women, the difficulties were mainly centred on finding work, flexible hours of work and childcare, as well as the negative attitude of colleagues and managers. Not surprisingly, more women than men move 'sideways' into managerial posts and away from research.

Projects like Athena have already begun to bear fruit, with research funding bodies drawing up 'best practice' guidelines for equal opportunities, with incentives for research institutes that introduce them. Meanwhile, other obstacles are beginning to emerge. In countries like India, with its technology boom, young women are preferring to go for highly-paid jobs in information technology – ironically once an all-male preserve, but increasingly dominated by women. ■

Peter Coles in London, United Kingdom

Argentina: the illusion of equality

In Argentina, one researcher out of two is female. But these numbers hide other inequalities.

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Silvia Kochen

The latest statistics look promising: 46 percent of all scientific researchers in Latin America and the Caribbean are women. Argentina, where this figure rises to 51 percent, has just broken through the gender parity barrier, meaning that women form the majority in a research industry made up of 35,300 people. Yet behind these rosy-looking numbers lurks the truth that women are still far from achieving real equality.

"The statistics are interesting in that they reveal how a critical mass of women has occupied this sector, but we still have to see what else is taking place. When you look at the whole life-span of careers in science, you see how the proportion of women starts to decline, that women don't hold important positions, that there is no equity in access to grants, which has serious repercussions for a researcher's autonomy and ends up generating more inequality," argues Silvia Kochen, a doctor of medicine and neurologist, currently employed as a researcher by the National Council of Scientific and Technical Research (Conicet). Kochen is also a member of specialist neurological associations, and has the dubious privilege of being the only female associate professor in her specialized field in the University of Buenos Aires' School of Medicine.

"Even within this School," she says, "most graduates are women, yet there is not a single one on the Board of Directors. And everyone thinks this is normal. The same applies to Conicet: there is just one woman on its board. In the University of Buenos Aires, it's the same story. These figures conceal the hostility which women suffer on a daily basis."

Kochen, who also forms part of the Argentine Network of Gender, Science and Technology (RAGCyT), points to an interview she had for an academic job as one example of this hostility. "They asked me what my private life was like, whether I had any children, if I was married.... I asked around, and found that none of the men had been asked the same."

Many female scientists; few at the top

Women make up 59 percent of university students from all disciplines in Argentina. Among those who finish their degrees, women represent 66 percent of the total, and also achieve on average higher final grades. But looking at the scientific and teaching profession as a whole, it is clear that the presence of women thins out

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Students in chemistry lab

at the top: over the last few years, for instance, the percentage of female grantees has risen over 50 percent, but the percentage of women classified as "high researchers" - the top category - has stayed extremely low at 10 percent. The same applies to the class of independent researchers, one step below the top research grade, where women make up 25 percent of the total. Research institutes are mostly run by men, with the exception of those linked to the study of philosophy and literature. In Conicet, meanwhile, women make up around 40 percent of total research staff, but represent only 12 percent of the Qualification and Promotion Board, and a similar number in other standing committees.

These figures are to be found in the report Women's participation in science and technology in Argentina, prepared in 2003 by María Elina Estébanez, who states that the situation has changed little since the study was drafted. The information provided by 290 male and female researchers for her report also shows that women as well as men tend to prefer male scientific role models, such as in their choice of research supervisors. But the report also identifies the specific obstacles that women face in their careers: the surveyed scientists declared that marriage and children do affect the development of a career in science, and that this is made worse by the fact that doctorates, post-doctorate studies and trips to international congresses coincide with a woman's fertile age.

Within Conicet, top appointments are made by government officials, who make their choices from a list of candidates put forward by working researchers. Noemí Girbal is the first, and for now the only woman to have been chosen by her peers and to have made it to the Board of Directors. The other seven directors, including the chair and two deputy chairs, are men. A doctor in history and a higher researcher, Girbal, who secured a second term as a director in 2005, has argued in public against affirmative action for women. She insists that it is important not to be led astray by stop-gap, makeshift solutions, but to get to the roots of the problem: "scientific language conveys political power. Participation in the world of science has a lot to do with power, management, and the prestige of arriving at certain career rankings – and all of that is male."

© Sol Levinas

Noemí Girbal

Prestige counts

The best strategy, Girbal insists, is to lay bare the inequalities and hurdles to gender parity, which are far from being insuperable, and can be altered by political decisions. In the Sixth Iberoamerican Science, Technology and Gender Congress, held in the Spanish city of Zaragoza in September 2006, she made precisely this argument in her paper Sex in science. An assessment of gender equality in the Argentine scientific system, which included several noteworthy observations: "There are no female deans in private universities, and very few in public ones. In scientific journals, the editors and editorial committee are often men, but articles are written by women, meaning that they do the work. On the other hand, we cannot maintain that in Argentina – unlike other countries – there are still wage differentials between male and female scientists; yet there is no doubt that differences arise as women are prevented from reaching certain posts. That is why I say this is not about substantive economic inequality, but essentially a question of prestige and power."

"None of this is reflected in the statistics, but is hidden: we have to deal with it in a different way, by looking into the deeper causes behind what is going on," says Kochen, who insists on the end to draw up new indicators, a project that has been underway for several years in RAGCyT. ■

Soledad Vallejos in Buenos Aires, Argentina

Budding Plant Research

Laureate for Africa of the 2007 L'ORÉAL-UNESCO Awards, Ameenah Gurib-Fakim has spent much of her life taking inventory of plants in her homeland, Mauritius.

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What if, one day soon, medicinal plants could cure diarrhea in children, at little cost? Or bitter melon – Momordica charantia – provide a treatment for certain forms of diabetes? Ameenah Gurib-Fakim believes in this. Her team has actually investigated the virtues of the exotic fruit, which acts as a starch blocker to slow the release of free glucose into the bloodstream.

When you see Professor Gurib-Fakim sitting at her pro-vice-chancellor's desk at the University of Mauritius, elegant in her tailored suit, her appearance doesn't exactly evoke the countryside. Yet the 45-year-old professor of organic chemistry, who received her degree from the University of Exeter (United Kingdom), has devoted much of her life to tracking the myriad plants of her native land, the island of Mauritius.

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Back when she began, the study of the yellow fan palm, bois goudron (Antirrhoa frangulacea) or liane calli (Sarcostemma viminale) was hardly in vogue among young scientists. "Plant research wasn't very credible," she admits. Even less so for a female researcher. "When you're a woman, it's only when you've made it past the barrier of prejudice and you have a list of accomplishments that you're taken seriously. That's why many women give up along the way," deplores the scientist and mother of two.

A long-term project

Ameenah Gurib-Fakim didn't give up. On the contrary. Thanks to her, a full inventory exists of the medicinal and aromatic plants on Mauritius and the neighboring island of Rodriguez. A long-term project, considering Mauritius is a true reservoir of biodiversity. Out of 634 known medicinal plants, 15% are endemic (i.e., found only on the island).

Professor Gurib-Fakim took a particular interest in the pharmacological properties of these plants, an aspect not covered in previous studies. In addition to taking the usual samples, the researcher and her team visited villages to collect traditional knowledge. They had to get past the resistance of local

healers, not always enthusiastic about sharing their wisdom with outsiders.

As a number of these plants could be used as alternatives to commercial medicines sold in pharmacies, the interest they represent is more than anecdotal. Nearly 80% of the population of poor countries already relies on medicinal plants for treatment. What matters now is making sure the poor countries don't miss out on the commercial exploitation of these products, for the profit of big industrial firms.

"Africa has already lost so much," declares Gurib-Fakim, due to the absence of a legal framework to protect intellectual property. This was one of her reasons for becoming a founding member of the Association for African Medicinal Plants Standards. Since its creation in 2005, the organization, which regroups scientists, industrialists, exporters and herbal therapists, has pursued its aim to bring to the world market African plant remedies that meet international norms.

The plant cause

The initiative is promising, as long as these plants with their multiple benefits don't die out. And some are already threatened. On Rodrigues, out of 193 medicinal plants, 23 of them endemic, about 20 have dwindled down to only one or two clumps. "Young people have to be made aware that plants are both rare and useful," she stresses. As a contribution, she published a guide book in 1983 on the flora of Mauritius intended for the general public.

Ameenah Gurib-Fakim doesn't hesitate to come out of her laboratory to advocate for plants. In 1998, she participated in a World Bank project to create small gardens in schools to cultivate medicinal plants.

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"When we give endemic plants value as ornamental plants, it helps to propagate them," she explains.

The international recognition she is receiving today will certainly be helpful to her cause. It also distinguishes this woman scientist as a role model of success for young female scientists in the South. "To encourage girls," she insists, "you have to impart self-confidence very early on, so that they believe they have a chance to succeed." ■

Amina Osman, in Port Louis, Mauritius

The trailing spouse syndrome

Women scientists, especially physicists, are likely to marry other scientists – which can create problems if both partners look for jobs at the same institution.

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Like about half of her friends at the time, molecular biologist, Claire Wyman, met her husband, Roland Kanaar, when they were graduate students at the University of California, Berkeley (USA). The crunch came when they both started to look for permanent jobs. "We were open to all sorts of options in terms of jobs and where we might end up," she says. But, as Roland was slightly ahead of Claire in his career at the time, "he was offered three pretty good positions and I didn't even get an interview." Claire did not want to live apart from her husband, or to take a teaching job – alternatives that face many young, dual-career scientists. So the couple decided to take up one of the offers, and move to the Netherlands, where Roland was born.

At Erasmus University, Claire could work part-time, which, she says, "was virtually unheard of in universities in the USA at the time." They found the flexibility at Erasmus enabled Claire to take time off to have children, while remaining active in her field, supported by grants. "I was finally offered an associate professor position in the same department as my husband," she says. "We ended up working on the same topic and now have overlapping research groups." In the USA, she adds, "it would have been much more difficult to work part time when my children were small - and to have maintained the respect of my colleagues while doing that."

It's even harder for physicists

The 'dual-career' problem is at its most acute in physics, where the gender gap is at its widest. Out of roughly 40,000 members of the American Physical Society, only about 2,400 (6%) are women. And, according to a major survey of women physicists carried out in 1998 by Laurie McNeil of the University of North Carolina and Marc Sher of the College of William and Mary, about 68% are married to scientists, half of them physicists. Even though a smaller proportion (17%) of male physicists marry scientists, the study suggests "it is increasingly likely that the top candidate in a search (for a job) will have a spouse who is also seeking professional employment." In most cases, if there is no opening for the spouse, he or she is expected to accept a part-time, or less secure job, dependent on grant funding. And, according to the survey, "the lower-level offer goes more commonly to the female member of the couple." This, obviously, perpetuates the scarcity of women in high-level physics research.

According to the survey, some university faculties in the USA find dual-career couples an awkward complication, which they would rather avoid. "I went to a number of job interviews," says geographer, Rutherford Platt, of Gettysburg College, "and some were quite unprofessional. I had people pull me aside and ask me about my spouse, whether she was in academia and looking for a job as well." But, as more women compete for permanent positions in science faculties in the USA, higher education institutions are under pressure to become more flexible.

Creative solutions

One solution, originally favored by smaller teaching universities, like Gettysburg, and slowly catching on in major research institutions, is to split a tenured position into two, part-time posts. This is particularly attractive to young academics looking for their first tenured job.

"We have a joint appointment now," says Rutherford Platt. "My wife and I are considered 1.5 people. I've maintained my full-time position and Monica has a part-time, tenure-track position. She's a permanent part of the faculty and has half of the teaching obligations. We have a small child and that works well for us. It would have been harder to negotiate two full-time positions. This is better for us, at our point in our life."

Rutherford Platt acknowledges that they were fortunate. "We both fit in the same department," he says, "but our expertise is different. We compliment each other. If two people are in different departments, one of the departments may have no incentive to make it work for the other person."

Increasingly, says Claire Wyman, the male partner may well be the 'trailing spouse', and even the big research universities in the USA are willing to find a solution, especially for more senior positions. "There are many more highly talented and desirable female scientists now," she says, "and I see universities accommodating them. I don't think it's because they are enlightened. If you want that person to come, you have to accommodate what they want. If what they want is a building named after them, then you do that. If they want a position for their partner, maybe you do that. It can be a matter of market forces. And women are more interested in demanding an appointment for their partner than a building named after them." ■

© Claire Wyman

Peter Coles in London, United Kingdom

"We need the best people as scientists"

Baroness Greenfield, Professor of pharmacology at Oxford University and author of a UK report on women in science, advocates stronger strategic approaches to addressing the issue of female under-representation in scientific careers.

Question: What is the situation of women in the field of science?

Answer: It has changed a lot over the past ten or twenty years, but there is still a lot of work to be done. It is easier now for women at the junior level than when I was an undergraduate and there were relatively few women students. Now, in biomedical sciences, almost 50% of the students are women but there are still problems in the physical sciences. I think that at the junior level it is getting easier for women to do this. However, there are still serious problems as women progress in their careers.

© Baroness Susan Greenfield

The report (SET FAIR, 2002) shows that in the physical sciences, you have 90% men and 10% women across the board. In biological sciences, however, there are about the same number of men and women in the beginning of university studies. But around the late 20's, early 30s, women begin to drop out. By the stage of Professor, the rate in biological sciences is just as bad as for the physical sciences, that is 90% men and 10% women.

Question: What is the biggest hurdle that women science researchers face?

Answer: In particular, as you can see in my report, the big problem is for women in their late 20's when they have to make a choice about whether to have children. Do they choose not to have children and carry on doing science? This is what I did. Or do they choose to have children at the biologically optimal age but run the risk that they won't come back to a job at all because they don't yet have tenure? Or do they delay having a child until they are beyond the biologically optimal age, in which case they may run into fertility issues? None of these choices are really ideal for women—it's a problem that hasn't been solved. How can the scientific community accommodate women so that they can have children without compromising their careers? How can we allow women scientists to have as much choice as they want?

Question: What can we do to change things?

Answer: There is no quick fix. Men and childless women are not taking time off. If you are taking

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Margaret Brimble, New Zealand

time off, it is happening just at the time that you have to publish papers to get ahead. One option that I have proposed is a funding scheme that give money to women who have children. That way women who want children could apply for a fellowship that is not available to anyone else. This enables women to come back and work for two years to reestablish themselves in their field. They would be competing with other women in the same situation.

Question: Why is the lack of women in science important?

Answer: Because we are entering into an era where science and technology are at the centre of society, and we need the best people as scientists. Not just doing research, but in the media, politics, industry. You need the best possible brains and it is crazy to eliminate 50% of the talent. And also each individual should be able to fulfill herself to the best of her potential. If you have great potential as a scientist it is a great shame if you are prevented from doing that because you are a woman. Also the world can't afford to have all that expensive education and training wasted.

Question: What opportunities are there for young women studying science today?

Answer: What women don't realize is that science has a very exciting range of options. So for example, I am in the House of Lords now—and there are about 10% of us who have some sort of science credentials. It is hugely exciting to go into politics or to do law or the media as a scientist. It is not just bench science because science is so central now. Traditionally the worst sectors in terms of female representation are biotechnology and academia. ■

Interview by Edna Yahil

No statistics, no problem, no policy...

Myanmar has the world's highest proportion of women researchers at 85%, according to the UNESCO Institute for Statistics. But why are research hotspots like China and the United States missing from the list of 100 countries with available data? A careful look behind the statistics.

Only about one-quarter of the world's researchers are women, according to estimates by the UNESCO Institute for Statistics (UIS). This is hardly surprising, given the hidden barriers and glass ceilings of so many laboratories and lecture halls.

But eyebrows might rise after a closer look at the statistics illustrated in the map below, where research magnets – like China, the United Kingdom and the United States – slip into the grey zone of 'no data available'.

Are these countries ignoring women in science? Or is the UIS sleeping on the job? Fortunately, the answer is no to both questions. But these countries are using different techniques to collect the data which cannot be compared internationally.

For example, the UIS and other organizations generally rely upon headcounts of men and women working in these fields. But many of the most developed countries calculate full-time equivalencies instead. "So they're not actually counting people but shifts," explains Ernesto Fernández Polcuch, who is responsible for science and technology (S&T) statistics at the UIS.

So strangely enough, the UIS can report that Myanmar and Lesotho have the world's highest proportions of women researchers at 85% and 76% respectively, topping the list of about 100 countries and territories. But the Institute cannot provide these statistics for countries like Australia or the US.

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Analysis of water samples for trace elements, Athens, Greece

Detailed information, but not enough

And yet the US probably collects some of the most detailed information on the gender, ethnicity and disability status of its scientists. The National Science Foundation (NSF) isn't just counting the number of women scientists and engineers but keeping tabs on the numbers of patents they receive and even their demographic circumstances.

For example, men on average have 12 subordinates compared to nine for women, among supervisor scientists and engineers in the private sector. The NSF has also found that family responsibilities are cited as the reason for not working by about 27% of women with science and engineering doctorates who are either unemployed or out of the labor force compared to just 1.5% of men. Women scientists and engineers are also more likely than men to be divorced and separated.

This gold-mine of information can lay the foundations for national policy-making, even if most of the data cannot be compared internationally. But for other countries, like those of the European Union, comparability is critical in efforts to harmonize science policies and put women researchers on the political agenda.

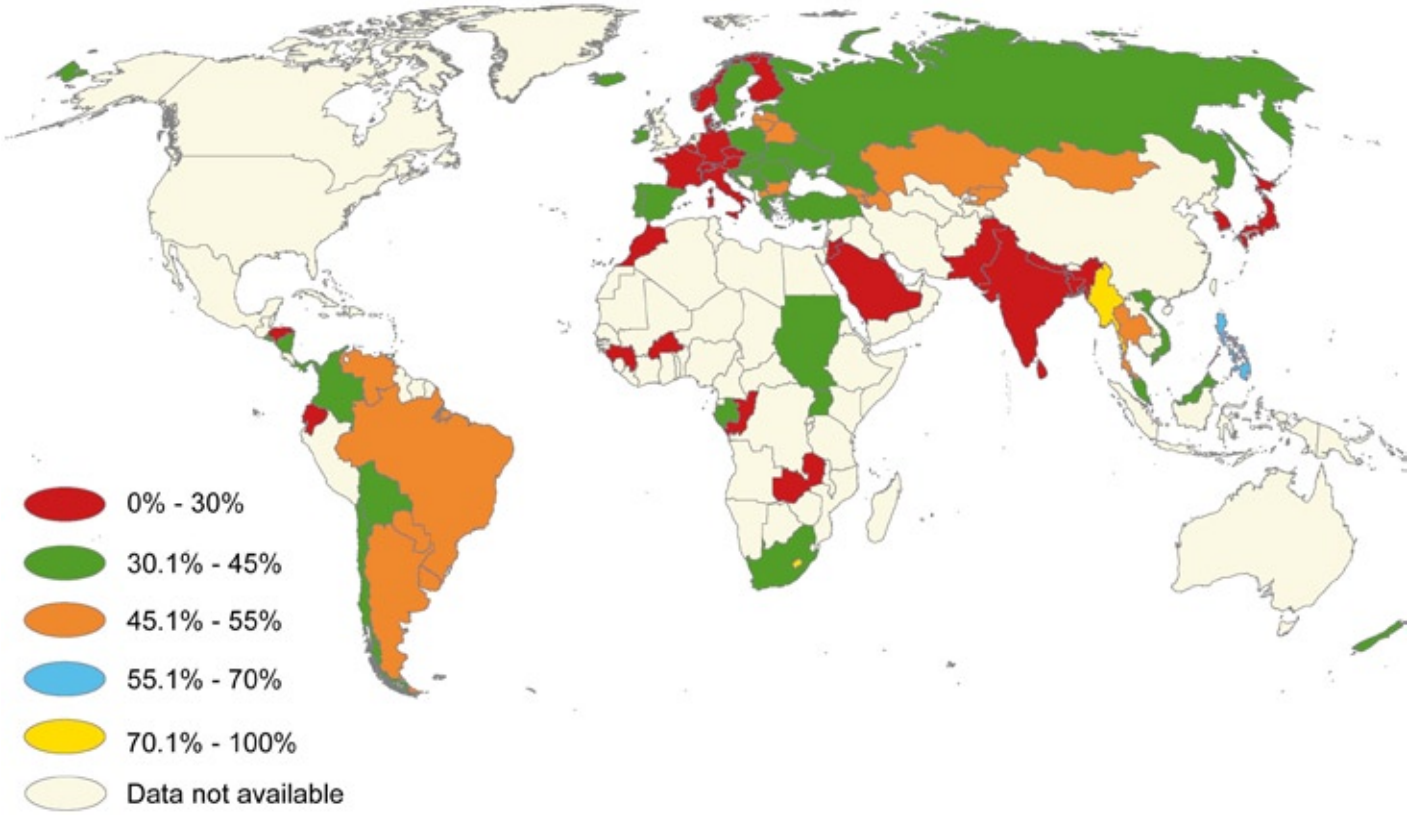
"No statistics, no problem, no policy," as stated by Dr Hilary Rose* of University of Bradford (UK). "You just get gestures. Statistics help identify problems and can monitor the effectiveness of remedies."

Rose's comments resonate in countries like Austria, Germany and The Netherlands, where there are low percentages of female scientists and relatively little data on them, according to the European Commission's Helsinki Group on Women in Science. In contrast, many of the newer members of the European Union and associated countries benefit from the communist legacy of good statistics and high proportions of women scientists and researchers.

Finding innovative monitoring solutions

Through the Helsinki Group, a network of statisticians is trying to better identify and monitor the factors that bring women in and out of the research field. They are not simply looking at how many women pursue research but how they progress in their careers.

For example, to what extent do women set the scientific agenda? Part of the answer lies in the



Map: © UNESCO Institute for Statistics

Share of women researchers, 2003 (UIS)

composition of scientific boards. Only in Finland and Sweden do women constitute more than 40% of board members, followed by the UK and Denmark with more than 30%. But in most EU countries, the share varies from one in five to even less than one in ten, according to the report She Figures 2006.

Another innovative tool is the Glass Ceiling Index, which compares women's and men's chances of reaching a top academic position. Basically the higher the score, the 'thicker' the so-called ceiling to women's advancement. Romania and Turkey report the most positive results, with 1.1 and 1.4 respectively, compared to the EU average of 2.1. In contrast, the greatest barriers were found in Malta (11.7) followed by Lithuania (3.2).

At the UIS, Fernández Polcuch dreams of collecting this kind of data internationally. While glass ceilings are beyond his reach, he will soon have a new source of data arising from a joint project between the UIS, Eurostat and the Organisation for Economic Co-operation and Development (OECD).

Inspired by a US survey, the three organizations have developed a way to track the careers of doctorate holders internationally. In particular, the UIS designed a model questionnaire to help countries with little experience in this field conduct their own surveys. So for the first time, developing and industrialized countries will be able to compare the salaries of male and female engineers, for example, or the time it takes them to find jobs in their field.

A number of countries have already piloted the survey, while others prepare to implement it. The results, expected by 2008, should considerably expand the global perspective on women in science while shrinking those disconcerting grey zones of 'no data available'. ■

Amy Otchet, UNESCO Institute for Statistics (UIS)

The Courier looks back

The October 1967 issue of The UNESCO Courier carried an excerpt of a memorandum on international science scholarships presented by Marie Curie to the League of Nations in 1926. Twice laureate of the Nobel Prize, for chemistry and physics, she made a plea for the encouragement of vocations in science.

"At this post-university stage of their lives, young students who contemplate careers in science are brought face to face with pressing demands. In most cases the family has done its utmost to help the young man or woman to come this far and, unable to make further sacrifices, it now asks them to become self supporting. And even in well-to-do families the wish to take up very advanced studies may encounter a lack of understanding, such studies being considered as an extravagance or a mere whim.

Yet what in fact are the best interests of society in this matter? Should it not give every encouragement to those called to a scientific vocation? Is it really so well-endowed that it can afford to reject the vocations it is offered?

I believe, on the basis of personal experience, that the sum total of the aptitudes called for by a true scientific vocation is an infinitely frail and precious thing, a rare treasure that is both absurd and criminal to throw away, a gift to which great care must be devoted so that it may grow and fructify.

What, in reality, are some of the qualities required of the person who aspires to success in the field of independent scientific research? The intellectual qualities are an intelligence capable of learning and understanding, a sure judgment capable of appraising the significance of theoretical and experimental demonstrations, an imagination capable of creative effort. Equally important are the moral faculties: perseverance, zeal and above all the unselfish dedication that guides the novice along a path which, in most cases, will never lead him to material rewards comparable to those offered by careers in industry or business.

Thus to foster and safeguard the scientific vocation is a sacred duty for each society which has the interests of the future at heart. It is gratifying to see that public opinion is becoming increasingly conscious of this duty".

Marie Curie

“Science has neither frontiers nor gender barriers”

Ligia Gargallo, a professor at the Catholic Pontifical University of Chile, located in Santiago, is the winner of the 2007 L’Oréal-UNESCO prize for Latin America. In her opinion, the relative scarcity of women in science is the effect of cultural bias, which education can and must help overcome.

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Ligia Gargallo

When you come face-to-face with a scientific problem, do you feel there is a distinctively female approach, a sort of sixth sense?

I believe there is room for all sorts of human beings. One single scientific phenomenon can be viewed in different ways according to the characteristics, curiosity and emotions of the observer. This means that the way to enrich science is to draw equal contributions from both genders.

Is it possible to speak of a specifically female contribution to science?

Science has neither frontiers nor gender barriers. It is one discipline, and it is completely global. What I will say is that the contribution of women is much smaller than it should be. I think it’s a fantastic idea to spur women to study science and encourage more women to become professional scientists. Besides everything else, they can give a lot to science, such as their female intuition, their sensibility and their curiosity.

What are conditions like for women scientists in Latin America, and particularly Chile? Are there wage differentials or other sorts of differences with male researchers?

Female scientists are in a minority in Latin America, as they are in Chile. Inequality of course becomes more or less visible according to the specific field you are looking at. But the relative lack of women in science is in the first place a cultural problem, although you must not rule out the possibility that some women deliberately choose not to study science. In any case, it is clear that we urgently need to draw up programmes that will enable us to encourage young talented people. We should start to work from high school onwards to stimulate a love for science. Young women must be convinced that they can rise to be outstanding scientists without giving up their entitlement to motherhood, if that is what they want.

As regards wages, there are still differences between men and women in industrial science,

though thankfully they have practically disappeared from the academic environment.

Could you explain for us the main research that you are doing at the moment?

I work in fundamental science, especially in compound systems built out of large molecules, giant molecules, macromolecules or polymers. These types of systems can be found everywhere, but their behaviour is complex and quite different from that of small molecules. Natural polymers such as proteins, polysaccharides, cellulose and starch form part of living beings. And synthetic polymers, for instance new and modern materials such as polystyrene, polymethacrylates, nylon and polyethylene, are part of our daily lives, and have taken the place of older substances. We are currently studying the properties of these synthetic polymers when they are disturbed by mechanical or electrical forces, with the aim of understanding why they becomes viscous or elastic, for example. We are convinced that the only way to use these materials in new technologies to the benefit of mankind is by understanding what is going on at the most basic, fundamental level – and that is what we are looking for. ■

UNESCO's Santiago Office (Chile)
in collaboration with L'Oréal Chile

Discoverers - Portraits of Women

by José Banaag

Marie Curie
(1867-1934)

The first woman to receive the Nobel Prize in 1903, for physics, she and her French husband discovered natural radioactivity. Further research led her to the new elements radium and polonium, named after her native Poland. For this, she was the sole laureate of another Nobel, in 1911, for chemistry.

Photo: © The Nobel Foundation, Stockholm

Lise Meitner
(1878-1968)

She entered the University of Vienna only in 1901 because of restrictions on women's enrolment. She concentrated in nuclear physics, collaborating for 30 years with Nobel laureate Otto Hahn. Together, they developed uranium fission.

Photo: © American Institute of Physics, Emilio Segrè Visual Archives

Gerty Cori
(1896-1957)

This Prague-born doctor worked as a researcher for free while her husband taught pharmacology at the same American university. Their long professional partnership was crowned with a Nobel Prize in 1947 for discovering the metabolism of glycogen.

Photo: © The Nobel Foundation, Stockholm

Irène Joliot-Curie
(1897-1956)

Daughter of Marie Curie, wife of a physicist, she and her husband discovered artificial radioactive elements for which they shared the Nobel Prize in 1935. She actively campaigned for the social and intellectual advancement of women in France.

Photo: © The Nobel Foundation, Stockholm

Maria Goeppert-Mayer (1906-1972)

For love of physics, this unemployed wife of a university professor continued her research through the American Depression. She and two other physicists made important discoveries on the nuclear shell structure, receiving the Nobel Prize in 1963.

Photo: © The Nobel Foundation, Stockholm

Rita Levi-Montalcini
(1909-)

In 1936, Mussolini passed laws discriminating against non-Aryan Italians. This doctor built a secret laboratory in her bedroom, the first of several wartime hideouts. She shared the Nobel Prize with a colleague in 1986 for discovering growth factors essential in the treatment of severe burns.

Photo: © The Nobel Foundation, Stockholm

Barbara McClintock
(1902-1992)

Sole recipient of the 1983 Nobel Prize in Physiology or Medicine, this American geneticist observed coloration patterns of maize kernels. She found that genes are mobile, that they can move around chromosomes.

Photo: © The Nobel Foundation, Stockholm

Grace Murray Hopper
(1906-1992)

She was the first to use the term "bug" when she opened her malfunctioning computer and found a moth inside. This mathematician and rear admiral of the United States Navy is one of the developers of UNIVAC, the first commercial computer, in the late 1940s.

Photo: Courtesy of UPI/Cortis-Bettman

Dorothy Crowfoot Hodgkin (1910-1994)

She devoted most of her life teaching chemistry in women's colleges in the United Kingdom. Her research led her to crack the structures of biochemical substances, notably penicillin, vitamin B12 and insulin. She was awarded an unshared Nobel Prize in Chemistry in 1964.

Photo: © The Nobel Foundation, Stockholm

Gertrude Elion
(1918-1999)

When her father went bankrupt during the American Depression, she got a scholarship. When laboratories offered few jobs for women, she found an assistantship without pay. She discovered acyclovir, an antiviral treatment against herpes and chicken pox, receiving the Nobel Prize in 1988.

Photo: © The Nobel Foundation, Stockholm

Rosalyn Yalow
(1921-)

Graduate schools were reluctant to grant fellowships to women, so she worked as a secretary at Columbia University. Her later career in physics culminated in the invention of a technique to measure the amount of insulin for which she received the 1977 Nobel Prize.

Photo: © The Nobel Foundation, Stockholm

Jocelyn Bell
(1943-)

While at Cambridge Observatory in 1967, she and fellow astronomer Anthony Hewish discovered pulsars - quickly rotating, strongly magnetised neutron stars which regularly emit radio signals. Today there are 700 known pulsars.

Photo: © 1998 WGBH

Rosalind Franklin
(1920-1958)

Because her father frowned on higher education for women, an aunt offered to pay her dues at Cambridge University. This scientist's study of living cells led to crucial keys in the molecular structure of DNA. She also made important findings in virology.

Photo : Courtesy of the Cold Spring Harbor Laboratory Archives

Christiane Nüsslein-Volhard (1942-)

Some 40,000 fruit fly families provided the keys to her groundbreaking study of early embryonic development, useful for scientists to better understand human development. The Nobel Foundation awarded the 1995 prize to this German geneticist and two others.

Photo: © The Nobel Foundation, Stockholm

Linda B. Buck
(1947-)

She and fellow American Richard Axel received the 2004 Nobel Prize for giving a deeper understanding of our sense of smell. They catalogued odorant receptors, describing the vast family of 1,000 genes which enable us to recognize some 10,000 different smells.

Photo: © The Nobel Foundation, Stockholm

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