The Institute for Research in Biomedicine (IRB Barcelona) is an independent, non-profit research centre engaged in basic and applied biomedical science. Its ultimate aim is to improve the quality of people’s lives by developing new applications for the remarkable discoveries being made in the life sciences.

IRB Barcelona was established in 2005 by the Government of Catalonia (through the Ministry of Innovation, Universities and Business and the Ministry of Health), the University of Barcelona and the Barcelona Science Park.

The main missions of IRB Barcelona are to promote multidisciplinary research of excellence at the interface between biology, chemistry and medicine, to foster collaborations with local, national and international research institutes, and to provide high-level training in the biomedical sciences to staff, students and visitors.

Research is organised into five interdisciplinary programmes, which focus on Cell and Developmental Biology, Structural and Computational Biology, Molecular Medicine, Chemistry and Molecular Pharmacology, and Oncology.

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The road to guaranteeing equality between men and women began some decades back, and although the progress made in certain sectors of society is unquestionable, we are still a long way from being able to state that equality exists in terms of women’s access to all spheres of society. Slowly but surely, women have come to occupy a space that democratically corresponds to them. However, access has been restricted in areas of power or those requiring further education. Thus we can affirm that we still fall far short of the democratic ideal in which gender differences cease to exist. We cannot afford to take our eye off the ball and think that we are heading in the right direction and so interventions are no longer required or, even worse, establish superficial and merely decorative actions that fail to address problems at their roots. Although such actions are well intentioned, they could have a perverse effect on upholding and disguising inequalities.

Research is one of the fields in which women’s progress is proving to be slow — a surprising phenomenon if we consider that in recent decades the presence of women in Catalan and Spanish universities has undergone spectacular growth. There are increasingly more women graduating from centres of higher education, to the point that they are beginning to overtake the number of men. In the European Union today women account for more than half the undergraduate student population and just over half the number of graduates. This high level of education has not translated into a proportional rise in the numbers of women in the upper echelons of scientific careers. The question that must be asked is whether an advanced society like ours can afford to reject or limit the development of a portion of its people. The answer is obviously that it cannot. The current situation is having an effect on the progress of our society. By limiting the presence of women in the field of research, we are rejecting an important potential that has been educated in our universities and we are devaluing highly skilled human capital.

The Government of Catalonia is aware of the complexity involved in addressing this phenomenon, which extends beyond the field of research and has its roots in employment and family inequalities. This is why we support transversal policies that have the main aim of correcting the structures that maintain and reproduce these inequalities. For a question of right and of morals, it is necessary to put paid to this imbalance; to speed up the path towards a society that recognises this capital and, above all, that judges it with the same parameters it uses for men. In the field of research, actions should be intensified in the ‘hard sciences’, where the entry of women is most restricted, even though they have demonstrated that they have the necessary attitudes and skills.

This publication allows us to get to the bottom of this reality — present to different extents in other countries — by examining its causes and looking at the various proposals being introduced to address them.

Marina Geli i Fàbrega  
MINISTER OF HEALTH, GENERALITAT DE CATALUNYA  
(GOVERNMENT OF CATALONIA)  
FIRST VICEPRESIDENT OF IRB BARCELONA, BOARD OF TRUSTEES
A Commitment to Equality

Science and innovation constantly require new ideas and the best ones unquestionably emerge in a diverse environment. That is why today more than ever we need to ensure that women’s talent is involved in this process. As a woman with a science background and as a member of a Government committed to equality for women in all spheres, in particular in the field of work, I believe that promoting a more innovative and entrepreneurial society, and doing so from a position of equality, is an ambitious challenge but one which we can achieve.

Firstly because the science, technology and business community is ready to achieve it and particularly because there is broad social and political consensus with regards to two concepts: the need to make knowledge the backbone of the country’s socioeconomic development and women’s new role in society.

This commitment comes at the right time, when increasing numbers of people are becoming aware of the importance of science and technology to their health, work, well-being and future possibilities, and when businesses and employees are waking up to the fact that we should and can progress towards a new model of economic development based on knowledge, environmental sustainability and social equity.

The present economic downturn and its inevitable negative impact on employment and economic activity is also forcing us to accentuate the role of people who devote their lives to research, as they form the human capital that will produce the ideas and technologies on which a good part of our future well-being will rest.

In particular, it forces us to accentuate the role of women, who have been relegated for decades, among other reasons because of their lack of integration in social and financial networks, and who have had to face a number of additional difficulties — difficulties which end up making them even stronger and more perseverant. An ambitious production system that aspires to competitiveness at the European level cannot ignore its women. Only by including this part of society’s talent, which is still underrepresented in the academic and research communities, can we address the future challenges we have set.

The Ministry of Science and Innovation is firmly committed to helping bridge the gender gap in our society and in particular that which affects the fields of further education, research and innovation.

It is a matter of concern to us and one we are working on. It is a commitment we assume in each policy the Ministry starts up and which we are going to reinforce with the imminent creation of a Women and Science Unit that will answer directly to my office and include the gender perspective in our activities. I would like to remind you that this is an ongoing task that requires the support of each and every member of the public, which is why I congratulate initiatives such as the compilation of these articles, which will help us to face some of our remaining challenges.

Cristina Garmendia Mendizábal
Minister of Science and Innovation
Government of Spain
Breaking the glass ceiling. Proposals to adjust the role of women in science

Introduction

It takes two to tango

There is no discrimination against women during the first stages of their careers. What is more, in some faculties women boast an immense majority. Neither is there discrimination in the assignation of pre-doctoral fellowships or in the realisation of doctoral theses. Again, women here are preponderant and on average obtain better grades.

The first crisis may arise when a woman scientist begins to consider a post-doc training period abroad, particularly if she has a stable partner. While it is widely accepted that a woman follows a man wherever he goes, the opposite is not true. Some women scientists may have a partner who is also a scientist with flexibility to relocate. Alternatively, her partner may find employment and accompany her to the new destination. Unfortunately, in some cases, highly qualified women renounce the possibility of a post-doc period in order to maintain a relationship in which her partner is not prepared or is unable to move away. Thus women take a decision which places them one step further away from positions of greater responsibility.

Generally speaking, women scientists manage until the time to decide to form a family. Problems arise because we have still not overcome the stereotyped social roles of men and women. In many aspects, we continue to be ruled by outdated behavioural patterns that

The Ten Commandments...
To Being a Scientist and Not Getting Stuck on the Ladder

What can women do to get and stay ahead in science? This question led to the production of a list of ten vital tips aimed at young women researchers to help them achieve this goal. The list evolved from a Forum entitled From Woman to Woman: Practical Advice on How to Get and Stay Ahead in Science held in July 2008 by the Institute for Research in Biomedicine (IRB Barcelona) and the BBVA Foundation and which included the participation of many women scientists.

Take note:
I. Plan the next step in your career and prepare yourself for it. Don’t waste time! Learn to optimise it. Finish your degree on schedule.
II. Develop the attitude of a life-long learner and acquire new skills and knowledge as your responsibilities and interests dictate. Widen your horizons regarding professional opportunities in science. Create your own opportunities.
are passed on to us through subtle mechanisms and, as shown in practice, they are very difficult to break. Often motherhood is postponed as long as possible and most of our women scientists are “mature mothers”. The now mother and talented scientist is faced with many social constraints. Only a Super-Woman would be able to keep up a competitive professional career and fulfil her traditional roles, but Super-Women exist only in fiction. In practice, it is not possible for a woman to perform both roles without support from her family and from society. Too often, circumstances do not allow this balancing act and she sees no option but to devote less effort to her profession, thereby freeing her to fulfil her other duties. However, men must become aware that the house and children are also their responsibilities. Home help can contribute to household chores but childcare should not be totally delegated as children clearly benefit from the presence of their parents. Therefore, the attitude of a woman’s partner is crucial for her full development. And perhaps a loving and respectful relationship consists of just this, in enjoying seeing how she grows wiser and more mature and how she flowers in all her capacities.

It is the responsibility of all of us, but particularly of men, to contribute to removing this subtle glass ceiling that prevents women from reaching the highest ranks in the profession. In this regard, a change in male attitudes toward women, in addition to amendments to laws and institutional policies, would be determinant. We can all do something in our day-to-day lives to contribute to altering this situation. The glass ceiling is formed by small catches which involve unfair, but accepted, ancestral privileges that we do not renounce; situations of contemptible blackmail. At the base of all this is egoism and lack of generosity. To their great merit, and in spite of all these social constraints, women have progressed greatly in recent years. One has only to look back and observe the darkness from which we have emerged.

At IRB Barcelona we endeavour to provide the conditions in which women scientists can progress both on a professional and personal level.

Joan J Guinovart
IRB Barcelona Director

III. Move, gain experience abroad and work with other scientists. Don’t stay glued to one spot.

IV. Find a good mentor (or more than one) to guide and advise you and to promote your professional career. Do the same for others.

V. Forge a solid network of contacts and nurture them. Join societies and associations.

VI. Put yourself in the running. Consistently apply for grants and project funds, locally and internationally.

VII. Trust yourself and take risks. Develop core strength and learn to say “no”.

VIII. Develop your professional image and promote it. You may be a genius inside your own lab but that won’t help you much if nobody knows about it. Learn how to transmit your message effectively and be aware of who your audience is.

IX. Be honest about your personal and professional goals. Know what you value. Periodically weigh these factors and make your decisions deliberately.

X. Make a good choice of the institute in which you wish to work, and find a partner who accepts and supports your career and ambitions. If one or both don’t work out, change them.

Sònia Armengou Casanovas
Media Relations, IRB Barcelona
This is a question that has been raised in many forums for more than thirty years. In recent decades, the number of women awarded graduate and doctorate degrees from universities has grown to match and even exceed the number of men, and their academic results are at least as good as those of their male colleagues, but after finishing their education and starting their professional lives as academics and/or researchers, their careers slow down or come to a halt. Why?

Is it the science world that erects barriers to women’s progress? Does society discourage women from following research careers? Do women and men have innate differences in cognitive abilities? Do they have different aspirations? Does motherhood put a brake on professional progress? These questions give rise to many others and have been answered in different fashions, suggesting that they should be addressed from a perspective of complexity, not simplicity. This article aims to respond to these questions as far as possible, describing the factors that have put the biggest brakes on women’s headway in science and proposing a number of good practices whose positive effects have already been shown.

Human Rights and Human Resources

Revealing the factors that limit women’s entry into, progress in and enjoyment of scientific activity, in the systematic exercise of knowledge, can be seen as a matter of human rights and human resources. It is a matter of human rights because in principle everyone should have access to knowledge without limitations based on their sex. Only ability, capacity and merit should determine people’s positions in academia and science. It is also a matter of human resources because society as a whole cannot deprive itself of the talent of part of its components.

For every woman with appropriate talent and knowledge who is turned down for a position, that position goes to a less-qualified man. The end result is that while some men in top science jobs probably are best suited for the job, others have far fewer merits than the women they displaced. In a knowledge society as ours is defined, upholding such inefficient selection mechanisms is incongruent. In democratic societies like ours and of which (although it could be greatly improved) we are proud, limiting the access of one part of the population to these rights reduces the quality of that democracy.

I do not want, for various reasons, to enter into the controversy over whether differences between the sexes are innately biological or cultural: partly because for every piece of solid research that suggests certain differences might be significant, there are others of similar repute which, for example, have found that differences between countries are greater than differences between the men and women of a same country. Also, every day we are seeing more clearly that certain environmental factors can cause or inhibit genetic conditions, thus weakening the old innate/
acquired dualism. In any case, the influence of factors of discrimination beyond women’s control and which permeate science institutions and society in general cannot be denied. It is to these factors and ways to free ourselves of them that I wish to devote this article.

Small Biases Generate Big Discriminations

In democratic societies with recognised equal rights it is not easy to find systematic cases of obvious active discrimination against women scientists, which leads many people to think there is no discrimination either large or small. In this respect, it is worth reflecting on the importance and the negative effects of ‘little discriminations’ and ‘small biases’. Richard F. Martell, David M. Lane and Cynthia Emrich carried out a computer simulation to observe the effect of little discriminations.1 They applied a 5% bias in favour of men at the lowest level of an eight-level professional pyramid and found that only 29% of women rose to the highest (i.e., eighth) level. The result of applying a bias of just 1% in favour of the men was even more dramatic: only 35% of women reached the top. Who can say whether our evaluation systems for entry into the profession, promotion and the awarding of projects, etc. do not have a bias of at least 1%? Therefore, even though I am going to analyse factors which may individually not carry much weight, when combined and multiplied, as the above-mentioned simulation shows, they have consequences that hold back the progress of women scientists.

The Social and Academic Reproduction of Male Supremacy

The societies we have evolved from were based on male supremacy (among other forms of discrimination) and social institutions tend to perpetuate this supremacy. Early gender-differentiated socialisation is the initial factor in this perpetuation. In the initial process of self-awareness, a young child identifies with the most frequent social roles of his or her sex, leading to self-perception marked by gender. Without entering into more sophisticated debates about the female-male dualism, I should say that there is nothing wrong with a human being identifying with the most common social roles for his or her sex, so long as they have a similar social value. But that is not the case. Male roles are overvalued in relation to female ones; a girl may build her awareness during childhood with less value than would a boy. Also, from infancy there is certain social control over boys’ and girls’ lives which can frequently condition their very expectations, given the different prospects they see that society has for them (regarding family, educational environment, the other sex, etc.) for their future.

Scientific and academic institutions share the gender biases of the societies of which they form part and which, in turn, they shape. As a result, unless there is an active policy of identification of the factors or points of discrimination and possible solutions, institutions will continue to uphold male supremacy in science and hinder the participation of females in the numbers and quality it would be reasonable for them to achieve.

The European Commission’s She Figures2 for 2006 found that women held fewer than 15% of professorships in Europe, despite having made up more than half the student population for a number of years. In Spain, Académicas en cifra 2007 found that in the 2005-2006 academic year 60.3% of new graduates were female, compared to 39.6% male.3 It also found that, in line with the European and worldwide patterns, only 13.9% of full professors in Spain that year were women: there was one male full professor for every 2.3 male associate professors, and one female full professor for every 8.4 female associate professors. Something similar appears to be occurring with the possibilities of women scientists to obtain funding for research projects. Indeed, a meta-analysis of 21 studies found that men have 7% more possibilities than women of getting their projects funded (Ledin, A. et al., 2007).4 This being the case, let us look at the factors that are most hindering women scientists’ progress in their professional careers. Leaving
aside the analysis of motherhood, a factor that affects women exclusively, whether scientists or not, here I briefly describe some of the other factors of an academic nature that appear to be the most persistent:

**a) View of science, especially the so-called ‘hard sciences’, as masculine**

The attributes science requires (rationality, objectivity, dedication to something outside the intimate and personal sphere, etc.) coincide much more with supposedly ‘masculine’ traits than with the dominant stereotypes about supposed ‘feminine’ traits (emotionality, subjectivity, dedication to the personal, family sphere, etc.). Obviously, the success of female students in ‘hard sciences’ indicates that women are just as competent as men and have the aptitude and attitude needed to triumph in such areas of science.

**b) Science as a source of power**

Science and technology make those who master them more powerful in comparison with the rest of the population who lack this knowledge. Given that men have mastered and are recognised as having mastered a good part of science and technology, they continue to exercise this power in science institutions, and only conscious and determined attitudes and policies can improve this tendency towards the reproduction of male power.

**c) Model of a scientist based on patterns of a society founded on men as economic providers and women as housewives (reproducers and replenishers of the workforce)**

This is a model that is pretty much outdated in contemporary life, where both men and women work outside the home and both take care of (even if to an unequal degree) their private, personal and family environments.

**d) The gender bias in science content**

Science has been made by a small subset of human beings, mostly Western middle and uppermiddle-class white men and it is easy to understand how the questions this small group has established and tried to find answers to do not necessarily match the problems experienced by the rest of humanity, or how the perspectives they used to approach these problems do not include the alternatives or options that people with different cognitive universes and life experiences may have provided. Feminist criticism of the supposed objectivity of science affords abundant examples in the most diverse disciplines of the scarce objectivity of science in relation to gender.

These four large cognitive and institutional frameworks, and ones drawn from the daily practice of male predominance in science, condition the day-to-day workings of women’s professional lives to a more or less visible degree. On the one hand, generalisations and negative stereotypes about women’s abilities affect the ideas continually being made about them and which they often make themselves with regard to their work and expectations. This all leads to biased practices in the evaluation of activities, projects and curricula, as numerous research studies have found. On the other hand, the early and not-so-early socialisation of females fails to inspire them to want to achieve power, and in many cases they find it hard to handle both the social cues that promote the transition from apprentice to master and the mechanisms to exercise power. Thirdly, the intense nature of research work means that any small distractions from the paths of promotion (maternity, a partner changing residence, looking after parents, etc.) can sideline women and men who fail to follow the pattern of the scientist concerned exclusively with his or her professional career. It is necessary to degenerate (Capitolina Díaz, 2006) both professional practice and its content.

**What Can be Done?**

Having realised that the problem affects society overall, it is necessary to consider general social measures that may further the exercise of equality between men and women. I refer to consolidation measures of
why is women’s progress in science careers so slow?

In any case, in this article I will focus strictly on proposals for the academic and scientific fields. These proposals should be implemented in two areas: institutional and personal. Here I am mainly going to address actions that can be taken at the institutional level. Other articles that appear in this issue (such as the one by Catherine Didion) focus on measures that can be taken at the personal level to contribute towards women’s progress in their careers as researchers. For the institutional sphere, I would like to list a number of measures that have been proposed in diverse publications, particularly from the European Commission.\footnote{A good many of these measures require no further explanation and are simply listed, but first I would underline that none of them is an impediment to academic and research activity continuing to be governed by the principles of merit and ability. In fact, quite the opposite: without the implementation of the corrective measures mentioned above, the principles of merit and ability would not be met because of active or passive discrimination against women scientists (See box “Implementation of Corrective Measures”).}

### Implementation of Corrective Measures

#### General Measures

- Inclusion of across-the-board gender equality in academic and scientific activity, integrating gender aspects into:
  - Structures (maintaining sex-disaggregated statistics for all academic and scientific activity and seeking a gender balance in professional associations and rotation of single positions).
  - Programmes (including content on gender equality and considering the gender impact on particular research work).

- Supervision of selection procedures (entrance, promotion, awarding of sabbaticals, project funding, scholarships, etc.).

- Systematic accountability of progress in terms of equality.

- Assistance so that activities that use public money respect the principles of equality (from the criteria that govern appointments in the Royal Academies to the science committees of congresses and national prizes or eligible positions).

#### Measures Relating to Motherhood

- Quality crèches at work.

- Pause for the biological clock, i.e., when women give birth or adopt a child, their scientific production should be calculated at one year less (where appropriate).

- Temporary reduction in teaching activities or project management during the period of maternity.

#### Positive Action Measures

- Additional points for projects or curricula of women who have passed the quality threshold.

- Money and/or reserved positions to achieve a numerical balance between women and men.

- Active recruitment of women (seeking potential candidates when women do not apply for a post), particularly for senior positions.
Altogether, an analysis of the present system shows this system is not enough to implement institutional measures to generate a number of women-friendly research centres, but rather that it is necessary to make it clear, for the reasons mentioned above, that the better we are at positioning all the components and developing our potential, the greater will be the benefits to our science and our society. We need inclusive science in an inclusive society.

NOTES

How to Achieve Gender Equity in Science

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Women are entering science careers in greater numbers than ever before. But almost ten years after the ETAN Report, progress up the career ladder is still slower for women than for men in many European countries. What can be done to level the playing field and speed up the rate of change? How important are political and legal actions in removing the barriers women face to career advancement? How important are access to resources and the attitude of institutional leadership to work-life balance questions? Can mainstreaming, networking and family-friendly policies make a significant difference, or should, as in the US, funding be related to progress on gender issues?

In 1992 I wrote a letter to Nature. In the letter I stated that, “There is no evidence that sex is related to success in scientific research and women are prepared to be judged by the same objective standards as their male colleagues. However, in return, women have the right to demand the same job opportunities and the same resources and to enjoy the same privileges given to men at similar stages in their careers.” At the time less than 1% of directors in the Max Planck Society were female and my concern then, as now, was the lack of women in top positions in science in Europe.

In the US, action on this issue started in the 1970s, stimulated by the Title IX amendment that linked institutional funding to progress on equity issues. In Europe, Finland and Sweden issued government reports in 1982. Several national meetings were held in the 1990s and the first EU meeting on Women and Science was held in 1993.

In 1998, as a result of growing concern at the lack of women among career scientists and the people who shape science policy, I was asked by the EU Research Directorate to select and chair the ETAN committee charged with examining the status of women in science within the EU. This committee included fourteen senior scientists from different disciplines in ten Member States drawn from universities, research institutes, business and politics. Carmen Vela, Managing Director of Ingenasa, was the representative from Spain.

The ETAN Report, published in 2000, provided for the first time reliable international comparative data on women in science. It advocated the use of mainstreaming as well as positive action to advance gender equity. It concluded that the under-representation of women threatened the goals of science in achieving excellence, as well as being wasteful and unjust, and it made recommendations to a wide range of bodies including the European Commission, the European Parliament, the Member States and organisations that educate, fund and employ scientists.

Changes since the ETAN Report

At the EU level, success rates are now monitored by panel and by gender. In the Sixth Framework Programme, 27% of advisory group members, 29% of programme committee
members and 30% of evaluators were female. Gender-disaggregated statistics are collected for 30 countries on an ongoing basis by the Helsinki Group, and resulted in the She Figures publications 2003 and 2006, which allowed meaningful comparisons between Member States. Women’s participation in important EU committees that set policy and control funds has increased substantially. Thus some 25% of the members of The European Research Advisory Board and the Scientific Council for the European Research Council (ERC) are female. Success at the EU level also demonstrates the importance of individuals in implementing equal opportunities and I note the crucial roles played by the former Research Commissioner, Philippe Busquin, by Achilles Mitsos, and by members of the European Parliament. Nicole Dewandre, the first head of the Women’s Unit, was a key figure throughout.

Fig. 1 shows the crux of the problem for academia, illustrated here by a ‘scissors’ diagram plotted for the EU-25 average for 2003. While more than 50% of students were female, only 15% of Grade A or full-professor positions were held by women. This number increased by only 0.6% per year between 1999 and 2003.

The ETAN Report showed that the proportion of top academic staff positions occupied by women differs greatly between European countries. In 2004, in Germany, the Netherlands, Austria and Belgium, it was around 9%, whereas in Romania, Latvia and Turkey it exceeded 25% (Fig. 2). Note there is some ambiguity about the number for Spain (in note 4 cited as 17.6% for 2004, but in note 5 as 13.8% for 2006). Why such differences? In the ETAN Report we speculated that it might be due to the greater prestige of a professor in the first group of countries or to a better availability of childcare in some Mediterranean countries. However, we were told firmly by female scientists from Spain and Portugal that the answer was different. They had worked so hard to get where they were on the career ladder that they would not think of giving up their career just because they had children!

Even within a single country the proportion of women in top positions at different universities can vary enormously, as shown by data from the UK, the Netherlands and Australia.

Positive-action solutions can make enormous differences in the short and medium terms. For instance, in the Asplasia Programme in the Netherlands, 146 women were promoted to associate professor and as a consequence the percentage of such posts occupied by women increased from 8% to 16% in six years.
Quotas as a solution to the low number of women in top science positions in Germany have been suggested by Ernst Ludwig Winnacker, the former President of the German Research Foundation. At the University of Geneva, one in four new faculty positions must be filled by women.

There are few data divided by gender and level for industry — a fact commented on both in the ETAN Report and in the EU report entitled Women in Industrial Research. Data for Germany suggest once again a ‘scissors’ diagram — lots of women in the lower ranks and very few at the top!

Women occupy an increasing percentage of seats on science boards. Norway, Sweden and Finland lead this table and have almost reached parity, but other Member States lag far behind. There are no data for Spain.

A very recent study from the Netherlands shows a strong positive correlation between the number of women on appointment boards and the likelihood that a woman will be appointed. In addition, the significant increase in the number of Pioneer Awards won by women in the US has been attributed at least in part to the rise in the number of women on the jury.

What are the Major Challenges that Lie Ahead for the EU and the Member States?

The Lisbon Protocol documents the need to raise Europe’s competitiveness. If Europe is to find 500,000 additional researchers by 2010 it must provide better career structures for both female and male researchers.

Why do women advance up the academic career ladder so slowly? The National Academies Report entitled Beyond Bias and Barriers was published in September 2006 and looked at women in science in the US. The report concluded it is not lack of talent but unintentional bias and outmoded institutional structures that hinder the access and advancement of women. It recommended universities alter procedures for hiring and evaluation, change the typical timetables for tenure and promotion and provide more support for working parents. It argued that such changes would be good for men as well as women.

In addition, it examined and refuted eleven commonly held beliefs about women in science, including those raised by Larry Summers, who was forced to resign as President of Harvard over this issue. For instance, the report counteracted the argument that women are not as good at mathematics by pointing out that female performance in high-school maths now matches that of males. It refuted the argument that we have only to wait and the problem will be fixed by pointing out
Funding Issues

Funding and resources are extremely important issues. Wenneras and Wold showed in their 1997 analysis of postdoctoral grants awarded by the Swedish Medical Research Council that there was severe discrimination against women.9 A more recent analysis of European postdoctoral and Young Investigator Awards shows women are receiving a substantial fraction of these prestigious honours. For three such programmes, women had lower success rates (80-90% of the male rate) but for some Marie Curie Mobility Actions women had higher success rates.

For European Research Council starting grants awarded in 2007, women were very successful in the humanities, where they won up to 50% of the grants. However, in life sciences, the female-to-male success rate was only around 35%!

Thanks to the Helsinki Group, we now have some data on research-grant funding by gender and Member State. In 2004, men had higher success rates in 17 European countries; women in eight. Again, alas, there are no data for Spain. Thus far there is little analysis of the causes behind this or even whether men and women in the Member States ask for and receive the same average amounts. In this regard, the recent analysis of Mega Grants awarded by the Swedish Medical Research Council is of particular interest. For instance, only 1 out of 20 Linne Grants (eight million euros over five years per grant) went to a project in which a woman was a coordinator.

What Kind of Measures Will be Needed in the Future to Promote Gender Equity?

My answer here is relatively simple: we need to change the institutions and also to insist that institutions document progress on gender equity as a prerequisite for receiving research funding.

At the European level, we need to continue the mainstreaming of equality that started in the Fifth and Sixth Framework Programmes and to realise that a strong and committed Women’s Unit at the EU level is essential to this process.

At the Member State level, we need to insist on best-practice policies in the recruitment and employment of scientists. These include the open advertisement of jobs, high-quality peer review and selection procedures and family-friendly employment policies.

We need, however, to put most emphasis on changing universities and research institutions that women’s representation decreases with every step along the tenure track and in the academic leadership hierarchy, even in fields that have had a large proportion of women PhDs for the past 30 years. It cited evidence showing that women faculty are equally productive as their male colleagues and that the crucial factor affecting publication productivity was access to institutional resources. Marriage and children had minimal effects. The Report contained much valuable information and suggestions for change.

Issues of concern for female faculty starting out in the US, taken from note 8, are shown in the box “Aspects that influence the promotion of a female workforce”, on the next page. The overriding concern was the need to balance work with family responsibilities. Difficulties faced by dual-career couples were also mentioned. In contrast, the dual-career problem that affects women more than men has attracted little attention in Europe.

For female scientists, the choice of a supportive partner is also important for career progression. So is adequate childcare provision, where Spain, like Germany, is at the bottom of the European scale.
and making them more inclusive at all levels. The best reason for doing this is the one given by Nancy Hopkins: “Changing hearts and minds one by one is much too slow — change the institution and the hearts and minds will follow”.

Institutions can be changed in various ways. Firstly, through the individuals who head the management structure. Progress in equal-opportunity issues should be included in assessments of management performance and salaries. Secondly, through an Advance-type programme as in the US. In this programme, the National Science Foundation has given $US3-4 million to each of some 40 US institutions to develop gender-equity programmes. Thirdly, as currently in the UK, through a programme to modernise human resources in universities. This includes the development of more transparent systems of appointment and promotion, gender pay reviews and better attention to work-life balance issues.

The Massachusetts Institute of Technology (MIT) example is also instructive. Women currently form 13% of the MIT science faculty and 14% of the engineering faculty. Women on the MIT faculty are as successful as their male counterparts and get tenure at the same 50% rate. Plotting the absolute number of female faculty versus time shows two major increases — one in 1972 in response to the requirement for all institutes receiving federal funding to document efforts to increase the participation of women, and one from 1997 to 2000 in response to the MIT Report on Women Faculty (Fig. 3). From 1972 to 1997, and after 2000, when Dean Birgenau left, the hiring of female faculty levelled off, except in the chemistry and engineering faculties. As stated in the report, at MIT there is “general agreement that increases in the representation of women do not just happen but that specific pressures, policies and positive initiatives are required to ensure that women are hired and that when such pressures decrease hiring progress stops or even reverses.” The study goes on to suggest that innovative measures may be necessary to identify and hire outstanding women and puts the responsibility for enforcing change clearly on management and in particular on the MIT Deans and President.

Legal measures can be very effective, as shown by laws in Norway, Sweden and the UK that govern gender balance in public bodies. In 2008, Norway introduced similar legislation requiring a minimum of 40% of both genders on boards of private companies as well. Without the law on access to public records in Sweden, the 1997 study by Wenneras and Wold would not have been possible. However, only very few Member States have such laws. An EU directive requiring employers to keep gender-disaggregated statistics, as suggested...
Aspects that Influence the Promotion of a Female Workforce*

- Combining work and family responsibilities.
- The negative effect of a widespread science culture that tends to discourage academic careers for women.
- More teaching burdens and pressure to participate in committees in the case of women.
- Limited presence of female colleagues and hence problems establishing a network of contacts and mentors for students and postdoctoral fellows.
- The need to fight hard to obtain the recognition of managers and administrators.
- In couples where both partners have a professional career, women usually accept more junior positions.


in the ETAN Report, would also be of enormous value.

Good statistics are required to set policies both at the Member State and EU levels and to allow international comparisons which may spur countries with low female representation to take action to try to catch up. Here I would like to acknowledge the importance of the work of the Helsinki Group that resulted in the She Figures 2003 and 2006 publications.

Finally, I want to emphasize a point I first made 15 years ago as rapporteur of the first EU meeting on Women and Science and which is repeated in the ETAN Report, the MIT study and the National Academy of Sciences Report. If the speed of change is too slow — and I believe in many EU Member States it is — then the most effective way would be to require institutions that receive research funding from the EU or from national sources to document progress on gender-equity issues as a condition for receiving funding. This is what has been done in the US since the 1970s.

NOTES

2. In 2008 the figure was 6%.
Mentoring: A Key to Success at Your Institution

Catherine Didion
Committee on Women in Science, Engineering, and Medicine
The National Academies, USA

“Mentoring should provide benefits to the individuals involved and the institutions of which they are a part.”

Successful mentoring programmes can help retain students and staff at all levels. Yet mentoring is often misunderstood and not structured in a manner to make it rewarding and effective for mentors, protégées and the institution. This article briefly outlines why mentoring can be critical for the advancement of women and then explores the common mistakes in mentoring programmes and gives advice on how to foster strong and effective mentoring relationships. Most of us approach situations from the assumption that it must be similar to a football match and therefore a zero-sum game, i.e., if you are winning, I must be losing. Good mentoring relationships benefit all involved — the protégée, the mentor and the institution that fosters such relationships. Mentoring is not often viewed as “mission critical” to a scientific or technical institution, but one can make an argument that innovation and discovery thrive in an environment that facilitates interactions beyond one’s own lab, discipline or building. Well-constructed mentoring programmes do this and create an ecosystem of mentoring where current protégées, having experienced good mentoring, will value its importance and participate as mentors in the future.

Why is Mentoring Important?

“The students who had a mentor seemed to have an edge over other students. They presented

Recommendations for Starting Mentoring Programmes

1. Focus on specific transition points for your mentoring programme (e.g. 1st-year graduate students or new staff).
2. Provide institutional support (in kind and euros) for mentoring.
3. Give staff access to specialised training, seminars and workshops; include gender as topics in training programmes.
4. Include mechanisms of accountability and evaluation in all programmes.
5. Provide food at all events (“Eat, listen, and eat again” formulas work well).
6. Agree on a minimum number of interactions per month between mentors and protégées.
at national conferences. They met influential people in specialty areas. They seemed to have more direction and got through the programme faster. I don’t think they received any special favours. The personal and professional relationship with their mentor just seemed to motivate them to work harder.”

Mentoring is important for all students, but in particular good mentoring relationships inspire younger generations of women scientists by providing role models and mentors for women in science and engineering and by helping “set up women for success.”

There has been much research on how poor teaching, low self-esteem and lack of positive reinforcement strongly affect women in particular. A recent University of California – Berkeley study demonstrated that women were less likely to be “very satisfied” or “satisfied” with the quality of guidance given them by their postdoctoral sponsor as demonstrated by Fig. 1 below.

Good mentoring reduces attrition rates and serves as a mechanism to ameliorate some of the disparities between men and women in science. In addition, these mentoring relationships often help facilitate the future goals of the protégées and provide contacts and open doors for them as they progress in their careers.

**Common Mistakes in Mentoring Programmes**

Assuming that your institution values mentoring and wants to either update its existing programme or implement a new one, there are...
mentoring: a key to success at your institution

many errors that can be made with the best of intentions.

First — This is NOT a cloning experiment. A mentor is there to provide guidance and knowledge of the institution and the field he or she represents. The goal of mentoring students in research is “not to mould them in your image, but to give them a taste of research to help them decide what kind of future they will choose for themselves.”

Second — Good mentoring traits are not innate but are skills which are learned. Training is a critical component of successful mentoring programmes. All institutions should provide guidance and training for new faculty and ensure there are opportunities for junior mentors to seek guidance from more established mentors. In addition, there are many on-line and in-person mentoring training resources available. It is important to ensure that any mentoring your institution supports is helping and not harming your protégées. This is best done through regular assessment of your mentoring programme. Consider creating a Code for Mentoring, or incorporating mentoring into existing Codes of Ethics and creating guidelines that foster high quality career and workforce mentoring.

Third — Value and reward your mentors! As noted by the National Academy of Sciences in the US, “Unless good mentoring is embedded in institutional systems of rewards and promotions, it is unfair to expect faculty members to assign high priority to good mentoring.” This report recommended that “institutions incorporate mentoring and advising effectiveness in the criteria used for appraisals of faculty performance, including evaluations for the purposes of promotion and tenure.”

Fourth — Clarify expectations of mentors and protégées. Develop a minimum amount of contact expected between the mentor and protégée per term. Help these relationships flourish by creating informal opportunities for mentors and protégées to gather. Review the rights and responsibilities of protégées with them before they participate and create a clear contact point for the programme.

Ten Commandments for Mentors

1. Thou shalt not play God.
2. Thou shalt not play mother or father.
3. Thou shalt remember that thou art a companion — not a bolt of lightning.
4. Thou shalt know that body language tells truth.
5. Active listening is golden time and thou shalt not be judgmental in thy listening.
6. Thou shalt not do for someone what they can do themselves.
7. Thou shalt not lose heart because of repeated disappointments.
8. Thou shalt be aware that some people move in straight lines, others in fuzzy curves. Everyone is different. Thy protégée is not thy clone.
9. Thou shalt know thou can move mountains — one stone at a time.
10. Thou shalt not desire thy neighbour’s success; other fields only seem greener.

Source: The Uncommon Individual Foundation
www.mentor1.com

Looking for a Mentor? What Can You Do?

The easiest way to find a mentor is to use existing structures, such as professional science and engineering societies, where you can engage with senior professionals in your field. Many of these organisations have specific allocations for “young” or “student” members and often are looking for new committee members. Getting involved in these organisations can often give you access to mentors in your field that are outside
of your laboratory or group. It is healthy to seek out more than one mentor and having one outside of your immediate group can be very useful for giving you a broader perspective.

Curb your shyness — almost everyone likes to give advice, so do not hesitate to approach leaders in your field and ask them for a brief informal meeting. If you are still too intimidated, invite a few of your colleagues who are at your level to extend an invitation. From many such meetings, mentoring relationships have developed and thrived. Remember that a good mentor is anyone you can learn from and that some of the best matches for protégées are mentors who are different in personality and therefore will challenge one’s assumptions.8

When you are looking for a mentor think about your needs and what you would like mentoring on — seek out a mentor who is knowledgeable about the issues you want advice on. If you are seeking mentoring on different career paths such as industry or academia, make sure you have mentors representing these sectors.

When asked in a Wall Street Journal interview about the importance of mentors, Sheryl Sandberg, Vice President of Global Online Sales and Operations of Google, Inc. stated that “You need different kinds of mentors for different parts of your life — professional and personal.” She then explained that, “A better question than ‘Can you help me?’ is ‘I have this problem and I’d love your views on this.’” Finally Sandberg implores that, “Mentors aren’t stamps; you can’t collect them indiscriminately. You have to really develop those relationships.”9

Recognise that your peers are important to your success as well. Make the time to talk to these colleagues. Often these “horizontal mentors” will develop into an extensive network as they move to other positions and organisations.

Finally, seek external validation and awards, as not only do they give you access to a whole new set of mentors but such recognition will change how your current institution and set of mentors view you and your stature in the field.

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Where the Air Turns: References and Experiences

María Teresa Miras Portugal
Chair of the Royal National Academy of Pharmacy

What does a neuroscientist and teacher say when asked to write about aspects of the sociology of science? Could my experiences and memories really be useful? Could my reflections on what I have seen and experienced possibly be of interest? How exactly have I been conditioned by the undeniable biological fact of my being female?

First Reflections

The first reflection that occurs to me is that I have always felt pressured by a lack of time, that scarce good, as I had to combine my work with looking after a family. I had to follow the advice of the master, Baltasar Gracián: “There are activities that are moths of precious time”. But it is precisely these activities, even with the added time loss, that make it possible to connect with other people, to defend your work, to fight for laboratories and equipment and to participate in the management bodies of diverse institutions. Are we women participating in these decision-making organs in proportion to the numbers of us working in universities or in the Spanish National Research Council? Now, looking back at the early days from the length of the road travelled, I believe I was wrong— that if we want visibility and proportionality it is not enough just to work, we have to also be willing to build society in line with our criteria and needs. I believe such an approach would translate into an enhanced rationality of the employment of resources and a greater facility for combining the aspects of one’s personal life that are essential to society, i.e., motherhood, the development of a professional career and being more in tune with a world that we want to make as ‘liveable’ and harmonious as possible.

I have entitled this article “Where the Air Turns” in allusion to the writer Torrente Ballester and his trilogy Los gozos y las sombras (The Joys and Shadows), as the light and chiascuros of all human life. I could have just as easily called it “When the Air Turns”, as this would summarise the period I was destined to live in. Females of my age in this country have witnessed the birth of a society where women have become an essential element, an engine of change, a creator of wealth, aware of their rights and their obvious quality.

I will attempt to extract from among my memories and experiences those that may be of use to other women in science, as, without realising it, I have been witness to a number of exceptional situations. For the most part I was not aware of them at the time and considered them quite ordinary; it was not until later that I understood that I really do belong to a generation that has forged a path and faced numerous problems without understanding the reason for these anachronistic situations.

The Start of My Career

I began studying pharmacy in Santiago de Compostela in the 1965-66 academic year. At the time, the faculty was housed in the
beautiful Palacio de Fonseca building, where the wood creaked and the laboratories were simple, but where we carried out many practical experiments and had a large number of young professors who had recently won tenure. There were more females than males in the classrooms, but this was not reflected in the staff, where there were only a handful of female instructors for practical classes and two assistant professors. One of them passed the exam for associate professor in the course of 1966-1967, the only way-in at the time to a chair at the university. She latter become the first female full professor of physiology in our country and her name was Pilar Fernández Otero. At the time, I was not conscious of the fact that I was witnessing an unprecedented and therefore historic event.

Santiago de Compostela at that time drew students from across Latin America and Europe, the children of emigrants, and exuded freedom and rebelliousness – possibly because Madrid was a fair way off, especially considering communications at the time. I never felt discriminated against for being a woman...in fact, I did not imagine it could even exist. I enjoyed a warm relationship with my teachers and a buzzing university life, with activities, sport, excursions and so on – I was even able to act in university theatre productions.

When I arrived in Madrid in 1968 to study 4th-year pharmacy, there were far more female students than male. Again there were female assistant professors, but there was no female full professor. The university environment was more closed. The professors, particularly the full professors, inhabited a different world; there were far fewer practical classes and the faculty was older.

The Experiences of a Young Female Researcher

When I finished my degree I spent a number of months in the department of biochemistry where, curiously, many women were doing doctoral theses and working as instructors in practical classes but where there was only one assistant professor, i.e., Ana Galarza, who would go on to become, in the academic year 1971-72, the first associate professor of biochemistry and later the first female full professor in biochemistry in Spain. I was not fully aware of the significance of that historic event, either.

I went to France to do my thesis and found myself in an even worse situation at the Centre for Neurochemistry in Strasbourg and its associated faculty of medicine. There were many female lab technicians, a number of lower-ranking researchers and no female professor in the faculty of medicine – a situation that is apparently still the case in countries like Germany and Belgium today. Anecdotally, I would just add that in 1992, the chair of the department of physiology at Dusseldorf University’s faculty of medicine invited me to give a talk, after having worked together on a European project. An unusually high number of faculty members attended – but not a single woman among them. My host was at pains to explain that such turnout at group conferences in the field of basic research was unusual, but that when they had seen the announcement that there would be a “Frau Dr. Professor” they wanted to see exactly what it entailed...

The Centre for Neurochemistry in Strasbourg was a meeting point for neuroscientists from around the world, and many professors and researchers, particularly Americans, took a sabbatical year there. It was the ideal place to gain an insight into the universal nature of knowledge and how quickly it can become outdated, as indicated by a comment made by an eminent professor at a Harvard graduation ceremony, i.e., “half of what we taught you is wrong: the problem is we don’t know which half” – indicating the overwhelming need for unifying teaching and research at all times if we want to belong to the group of advanced countries.

So immersed was I in surviving the Centre that I did not have a minute spare – but years later I realised that not a single one of the professors or researchers on sabbatical in Strasbourg during my four-year stay was a woman. Perhaps, regardless of country, mobility is restricted if one has family burdens? The question is how to address a number of apparently simple logistical aspects, such as travelling to congresses, or perhaps
Seeking Causes

An excellent book for starting any analysis is *Mujer y Ciencia: La situación de las mujeres investigadoras en el sistema español de ciencia y tecnología* (Women and Science: The Situation of Female Researchers in the Spanish Science and Technology System), published by the Spanish Foundation for Science and Technology.

The first surprise comes when analysing the figures for doctorates in health and experimental sciences, where despite having made up the majority of undergraduate students for the past 15 years, in 2001 the number of female doctoral students was just 41% and by 2004 had climbed to only 51%.

So what is happening in the universities? In 2004, women accounted for 34% of the total professors, of which only 3% were full professors. The vast majority occupied the lowest categories, with 30% being associate professors and approximately 36% assistant professors. These values held steady between 1997 and 2004. The figures themselves do not concern me as long as they continue to rise, even if this growth is slow. However, there are two aspects that do worry me. The first is that Ramon y Cajal researchers are mainly men and the second is that the number of women occupying the instructor category has fallen from 8.5% in 1997-1998 to 5% in 2002-2003. This drop is highly relevant because it is an indication of renovation in the near future. It would be interesting to carry out similar surveys and seek analogical statistics in our country to the ones the American associations Women in Science and the National Science Foundation did in a study entitled *Factors that Affect the Retention of Women in Science Careers*, which analysed data on women’s poor presence in laboratories and even worse presence in top jobs. Among all the data gathered, of note was a poll of senior scientists with regard to the order of their values. Men put their science career first, followed by their children, partner, etc., while women always put their children first, then their partner and finally their career. Another figure statistically analysed with particular cases referred to sacrificing one’s career when there were family problems: the result was that 25% of the female respondents had done so compared to just 12% of the men. When there are family changes (children) in a couple that is already stable in their science careers, the woman gives her time over to looking after the family and the man devotes his to making more money.

The researchers also found that if a woman was already integrated in the system, family responsibilities did not generally mean abandonment of the profession, as her salary was necessary for a better quality of life, but they did result in missed promotions and mobility, and increased the possibility of accepting other, more junior positions, including as lab technicians, in order not to upset the family structure.

My question is this: How many female lab technicians are there in Spain who have degrees or even doctorates? How many have devoted themselves to promoting their husbands’ careers? How many have not even been thanked for having done so at tributes? This is another of the components of the silent female workforce, and one that makes me cross.

Another key phenomenon referred to women’s childbearing age, which usually peaks right when they are finishing their undergraduate studies and during their doctoral years: I would like to see reliable figures in this country about family affairs that affect the trajectory of women scientists at the start or during the postdoctoral period. I would also like to know the fate of future female researchers if they have to take time out of their research work. What happens if they don’t get another position or stable contracts? How many drop out of the profession altogether and what is the probability of abandonment in line with scientific area?
simply making a work visit of a few short weeks to a laboratory before having children. The social network is so complex that many successful women scientists have been able to succeed only at the price of painful decisions in their personal lives. As a group we cannot think in abstract terms if we belong to the real world: instead, we have to make that world more sensible. Maybe in days gone by women invented the protective matriarchal tribe!

**The Return of Female Researchers and Their Recognition**

After reading my science thesis in 1975 I returned to Spain. The difference was abysmal — the university laboratories were impoverished, equipment was scarce and the possibility of obtaining a post as an assistant, a researcher or anything at all was remote, particularly if you had not kept up contacts in preparation for when you returned. And don’t think that the situation has changed much since then!

Now we have the Ramón y Cajal researchers positions, which are supposed to be an important step towards the selection of new candidates recruited mainly from outside the country. But what percentage are women? And how old are they?

If we look at figures from the Conference of Rectors of Spanish Universities, the reflection is inevitable: in the two decades between 1982 and 2002, the number of female university students enrolled in experimental sciences rose from 47% to 60%; those in health sciences grew from 50% to 75%, and the number of female engineering and technology students was up from 11% to 28%. How then to explain the overall figures we see published in the newspapers in which 60% or more graduates are women and only 13% of them are professors if they have been equal in number or the clear majority with respect to male classmates these past 20 years? In the Spanish National Research Council, the top category of research professors in 2003 included 15.4% of women. Possibly these figures are higher now, but I have just taken a few figures by way of illustration to look at the evolution of the present model.

What is happening in neighbouring countries with a longstanding science tradition? The following figures are taken from the European Commission publication *Women and Science*: in Belgium, the number of graduates is similar to ours, but only 7% of professors are female in Wallonia and 5% in Flanders. In The Netherlands only 5% of professors are female and in France the figure is 13.8%, only slightly higher than here...and this from the country that has role models like Madame Curie and Émile de Châtelet! These overall figures indicate little about the evolution and perspectives of women in science careers and disciplines. So what does explain the differences? Where does the inertia in the system lie?

**Final Reflection**

Men have cultivated associations for a long time, whether getting together to eat, play golf or simply for informal gatherings. I would recommend women do the same. We have each had to face problems and periods of loneliness we could have solved much better together. But where do we find the time? That is what I really envy about men — that they seem to have all the time in the world. What can be done about the mobility of women scientists? We tend to forget that men are not our rivals: they are our companions, the other part, and they are, by and large, excellent professionals. We need their complicity; we need to convince them that we are extraordinarily creative; that we are great organisers and that the future can only exist on an equal footing. Remember the words of the philosopher Baruch Spinoza: "Men think themselves free inasmuch as they are conscious of their volitions and desires, and never even dream, in their ignorance, of the causes which have disposed them so to wish and desire". This is true for both men and women, and anguish about uncertainty is common to both. We are our own worst enemies if we accept without argument outmoded patterns of behaviour that have no obvious grounds.

We have to think about the future we want and make it a reality. We should stand firm but keeping cheerful spirit.
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