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A Tale of Two Sexes

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This year marks the first time that the largest Neuroscience societies in the U.S. and Europe are led by females. Here we discuss the challenges that women face in moving through the ranks of academia and propose ways to increase women's representation in the field.

This year, for the first time ever, two of the largest neuroscience societies are led by a female scientist: the Society for Neuroscience (SfN), with nearly 42,000 members, and the Federation of European Neuroscience Societies (FENS), which represents more than 22,000 neuroscientists in 42 member societies across Europe. While the SfN has a history of female presidents, 9 out of 45, FENS welcomed its first female president only recently. Why do women move so slowly through the ranks of the system and why is it important that they do so? More urgently, what can be done to change this and by whom? Here we address current challenges and recommend concrete actions.

Housewife or Academic?

One of the traditional complaints is that there are no good women available for higher academic positions. To some extent this is true: the higher up in the system, the fewer women to choose from. At the end of the pipeline, there are indeed far fewer female candidates than males. But this is not true at the start. For decades, throngs of female students have entered universities to study neuroscience. Nowadays, the number of female graduate students in the life sciences is on a par with the men, both in Europe and the U.S. (European Commission, 2013; National Institute of Health, 2012). By all accounts, at every stage the pool gets smaller: at the level of undergraduate students, women are overrepresented; their representation is reduced to one in five at the level of full professor and less than one in ten at the level of university leadership (National Research Council, 2010; European Commission, 2013). Of course, we have to correct for societal changes over time. For instance, in the 1950s, the number of women entering university was much lower. Society at large was not ready for full participation of women in academia. When Dorothy Hodgkin—who, among many things, revealed the structure of vitamin B12—was awarded the Nobel Prize for Chemistry in 1964, *The Daily Mail* reported "Oxford Housewife wins Nobel." This may seem outrageous now, but probably few found this disconcerting at the time. It was news that someone from behind the sink had managed to become a distinguished scientist. In Western societies, intense social pressures pushed most women—who could afford it economically—to quit their jobs when they got married. The choice was to be a housewife and mother or to have an academic career; combining the two was rare. The image of femininity has long been at odds with women's desire to do science; our mothers worried that we would seem unattractive to potential mates (http://www.princeton.edu/main/news/archive/S39/65/47O06/index.xml?section=topstories).

This radically changed in the late sixties and seventies. By the eighties, when potential leaders of today were PhD students, already over one-third of the PhD theses in the U.S. and many European countries were written by female students (Snyder and Dillow, 2012). This cohort is the current pool of potential female leadership. So why has the representation by women plummeted from approximately 35% to way below 10%? Why do we still have to face the fact that women who start out with equally competitive credentials—as objectively measured by prestigious grants, prizes, and academy membership—progress more slowly to the next stage of their career and, if they do so, receive lower wages than their male counterparts (European Commission, 2013; Shen, 2013)?

Today's Hurdles

Explanations for the leaky pipeline have been outlined in many scientific and news articles (e.g., Cohen, 2013; Shen, 2013). Our overview is by no means exhaustive but will just highlight some important reasons.

The most obvious reason is that women start a family when they are at the most vulnerable stage of their career. To proceed in an academic career, one must build a research group from scratch, acquire the funding to do so, produce the first papers from one's own line of research, and expand the international network during conferences and visits to leading groups nationally and abroad, and all this in the light of heavy competition among peers for a limited number of faculty positions. Of course, men of that age also start a family and a career. They may even share or take over chores at home and in some cases stay at home for one day a week to take care of the family. Studies show, however, that the distribution of tasks at home is still uneven among the sexes, with women in the U.S. spending 70% more time on household tasks than men (http://www.bls.gov/tus/). Even if women work fulltime, they usually put in fewer hours into their job. Some funding agencies in Europe do compensate for child birth and even award bonuses to scientists who take maternity leave, but not being able to spend many hours in the lab in the evenings and weekends is a hidden inequality that explains some of the differences in output between men and women. It certainly doesn't

help that the age at which the first grants and tenured positions come in sight—and hence the duration of years of great uncertainty—has gradually increased over the past decades. In the U.S., the average age at which the first R01 is acquired is now 42 (National Institute of Health, 2012), about the time that the millions of oocytes that women start their life with have dwindled to insignificant numbers. Getting pregnant at age 65, when you have all the time of the world, might seem the best answer to the eternal juggling between children and career, but nature thinks otherwise. Inevitably, there is competition between fostering children and fostering a career.

Talking about competition: the fact that funding has not kept pace with the number of bright young people aspiring to a career in science has resulted in a ruthless competition (Alberts et al., 2014; Couzin-Frankel, 2014). It takes a tough skin to survive science today. Typically, the "fittest" person is very much concentrated on his or her own career and will do whatever helps to build a competitive CV. It may seem generous to share knowledge, help other people out, or invest time in educating and mentoring more junior colleagues, but many young scientists reason that at the end of the day, their next employer will look primarily at the number and quality of their papers and their earning capacity. Of course, we all know that this is rather shortsighted. For the long-term survival of science, it is quintessential to be generous and teach the next generation. However, the truth is that there is little bonus for postdocs to be so kind and outreaching as long as the system works as it does. And this is where many women fall short; they simply don't like the fierce competition (Niederle and Vesterlund, 2007). There is a strong selection toward those that enjoy the game.

A final issue we face is that able women *are* asked to take on challenging positions but often turn down the offer; this occurs in many fields, not just neuroscience (Sheets, 2014). It can be due to time constraints, making choices necessary. Those keeping many things in the air do not want to take on new responsibilities that require yet more time spent (see the juggling problem above). Time constraints are also a direct consequence of numbers. As long as the pool of women is considerably smaller than that of men, the burden of tasks puts much pressure on the chosen few. But limited time resources are certainly not the only reason why women so often decline prestigious jobs. Those who have survived the system have a tendency to plan things carefully and to control the details of their life. They always strive for perfect results, to beat the system; and not being able to have or manage it all brings frustration and a sense of inadequacy (Spar, 2013). Facing a new job with unknown challenges has an element of uncertainty that cannot be controlled for; there always is a risk of failing that doesn't marry easily with perfectionism. The very qualities that brought them where they are hold them back from jumping in at the deep end. Their gut reaction is to question their suitability for the new job. It takes a very persuasive and supportive senior colleague or partner to convince them that objectively they *are* the best candidate. The absence of such supportive mentors, especially when combined with innate modesty—which is a noble trait but not very helpful in the current scientific circus—is a disastrous mix, contributing to an unnecessarily low number of women in positions of leadership.

Why Bother?

Is the leaky pipeline really a problem? Does it matter that women are underrepresented in the higher ranks of neuroscience? After all, the field survived quite nicely with men at the steering wheel for over a century.

Again, others have supplied a myriad of good reasons to reject the situation as it is. We highlight a few of these considerations and their economic and societal impact. First, time-wise it makes little sense to educate and carefully steer trainees through the system and then watch helplessly as they drop out. As pointed out earlier, the continuity of neuroscience requires solid education at a high level of excellence. If trainees and their mentors invest time and energy in achieving optimal results, observing this going to waste for unnecessary reasons is frustrating on both sides. Of course, there can be many arguments, personal or skill-wise, why people leave neuroscience, but if this step is avoidable, every effort should be made to keep people on board. It is not just a single person dropping out; the exodus is much bigger (Sauermann and Roach, 2012). Indirectly, a signal reaches students in earlier phases of training that says, "Look, if she can't make it to the top, what does that mean for me?"

Second, we simply need all the talent out there to move the field ahead. Disorders of the nervous system take up one-third of the entire health budget. As calculated in 2011, the European Union spends a staggering 800 billion euros annually on brain disorders, a number that steadily increases (Gustavsson et al., 2011). The only way this development can be reversed is by doing excellent research: to better understand who is at risk, come to an earlier diagnosis, and develop novel treatment strategies based on improved knowledge of how the brain works in health and disease. This is a huge challenge and we need all the intellectual resources available, be it male, female, white, black, yellow, or purple. We owe it to patients, their relatives, and society at large.

Finally, it is a well-established fact that companies with women in the board of directors have a 35% higher return on investment capital (Joy et al., 2007). It is the contribution of the group as a whole—combining experts with different skills and perspectives—that determines the outcome. Time and again a balanced mixture has been shown to give an optimal result. Of course, measuring performance in academia is less straightforward than in the commercial world, where every company is keen on knowing its return on investment. To transfer this argument to science, we first have to define what "good performance" is. Yet, there is every reason to believe that this principle of an optimal balance holds in science too. We need the diversity of women and men in every layer and facet of academia. Women can provide unique approaches to solutions in research, programs, and personnel interactions, as they are supremely effective in networking, building consensus, and problem solving.

Toward a Better Balance

So, we have to change. But how? Which actions are helpful? And what can big

professional societies like SfN and FENS do to support women along the steps of their academic career, to maintain that 50:50 ratio throughout the ranks?

One of the very first actions is making sure that women aspire to a career in neuroscience. Role models are crucial, not only for junior female scientists but already way before that. Interestingly, a study by Nosek et al. (2009) showed that 70% of men *and* women across 34 countries view science as more male than female. There is an objectively demonstrable gender bias in considering men or women suitable for academic jobs (Moss-Racusin et al., 2012). This perception is desperately in need of updating. We should start at the grassroots. Eager young girls in primary school gradually lose interest, and able junior scientists drop out. This is a multifaceted problem, but it helps if there are enthusiastic advocates; female scientists that reach out to kids in school, to Bachelor and Master's students to talk about their work, sharing the spark that ignites their own interest. Brain Awareness Week is a wonderful opportunity to channel such outreach, to go to primary or secondary schools and promote neuroscience, while simultaneously sending the implicit message that neuroscience is for boys and girls alike. At a more senior level, it involves having inspiring female lecturers at university, supportive staff members, and to have women at the highest level of academic and administrative ranks. And these women should not deny the uneven distribution—possibly because they are afraid that otherwise everyone thinks they made it to the top *because* they are a woman—but rather be supportive advocates for initiatives that intend to change the situation. SfN has a good record of having even representation of men and women as symposium and plenary speakers during their annual meetings. FENS has now made this a priority as well; just raising awareness of the uneven representation in the past was sufficient to substantially raise the number of female speakers for the FENS Forum in 2014. Compiling a list of good female speakers from which societies can draw when shortlisting their plenary speakers (see http://anneslist.net) is one of the instruments that has been shown to be effective.

A second step is to obtain and disseminate more solid information about women in neuroscience, worldwide. It helps tremendously when numbers are available: what is the percentage of female representation, at all levels of the academic world? What are career perspectives of female versus male recipients of R01 grants or European equivalents like the ERC Starting Grant and, if there are differences, what are the explanations and how can these be addressed? What is the percentage of women working part-time compared to men, and how does that influence chances on a scientific career? What is the impact of the "hidden" lack of time (outlined above) on scientific output? These are just a few examples of questions that need to be addressed. Facts and figures are indispensable for convincing policy makers that the situation must be changed, if only for economic reasons. Organizations like the International Brain Research Organization (IBRO), especially its Women in World Neuroscience Committee, could take the lead and coordinate data collection by country (see http://www.uis.unesco.org/Education/Documents/unesco-world-atlas-gender-education-2012.pdf).

Raising awareness is certainly also necessary among female scientists themselves. It is very useful if experienced neuroscientists point out early on that certain choices can have long-lasting consequences for one's CV and hence competitiveness. You have to be exceedingly bright to overcome the handicap of not moving to outstanding labs or expanding your network. Doing useful work without getting the credit is another trap that one should avoid. It helps if senior scientists point out these mismoves to undergraduate and graduate students, i.e., at a stage at which they can still be mended. Also societies like SfN and FENS can be more proactive, by targeting female students and organizing workshops that raise awareness for these issues, and supplying tools for optimizing chances for a career in science (http://www.sfn.org/careers-and-training/neurojobs-career-center and http://www.fens.org/Training/NENS/Concrete-support/).

Of course, not everyone who aspires to an academic career and has a competitive CV succeeds in getting a tenured position. This is true for both men and women. However, it is just a little bit truer for women. A study in the Netherlands showed that 77% of all newly appointed medical full professors in the period 1999–2003 were recruited through a closed appointment procedure, i.e., not involving advertisements (Van den Brink, 2011). Understandably, committee members look for candidates who are a younger version of themselves, in other words, Caucasian men around age 40. Just pointing out this fact helped to change things. SfN's IWiN project, sponsored by the National Science Foundation (http://www.sfn.org/careers-and-training/women-in-neuroscience/department-chair-training-to-increase-diversity), has uncovered many ways to successfully recruit, retain, and promote women in the field. Search committees need to be diverse and their members educated on how implicit bias influences the hiring process (Moss-Racusin et al., 2012), from how applications are reviewed and letters of recommendation are written, to how salaries are determined.

Once women are in the system, mentoring has proven to be an enormously useful instrument. At all ages and stages, junior female neuroscientists benefit from having a mentor who is supportive and with whom they can identify. SfN gives several awards to women and men who have been great mentors to women in science (http://www.sfn.org/awards-and-funding/individual-prizes-and-fellowships/promotion-and-mentoring-of-women-in-neuroscience). We make a call to all mentors to share narratives on how you manage life and career. Form a mentoring committee for every incoming junior faculty—to advise them on setting up their lab and hiring students and staff, when and where to publish, how to network and make oneself known, and how much and what type of service they should do. But that is not where it should stop. Women are usually overmentored but undersponsored (http://blogs.hbr.org/2010/08/women-are-over-mentored-but-un/). So to all mentors: give your sage advice; sponsor or suggest your mentee for positions and awards and try not to stay within your own "colony."

Often institute directors will say that they have so few female group leaders and that talented young women drop out or do not accept challenging positions

… and leave it at that. It is so important that they make a follow-up step and ask themselves: why? What is the reason and is there something *I* can do to change it? Sometimes temporary measures—like arranging for a brief leave of absence, helping to find a place in a daycare center, or facilitating employment for the spouse of a prospective candidate from abroad—may help in solving the problem. Suggesting and aiding that little extra step can do wonders for a career. Beyond the temporary measures, we must campaign for better childcare arrangements at the work place; many European countries are more advanced in this respect than the U.S. SfN's iWIN project (see above) outlines ways to improve the institutional climate for women.

What certainly needs to be promoted is the message to talented women that failing doesn't hurt and isn't the end of the world. The message of Sheryl Sandberg's book *Lean In* (Sandberg, 2013) can be instructive as a route for change. Don't shy away from stepping up and saying yes to being involved. Only by having more women in positions of influence will more equitable opportunities be created for everyone. It is a well-known fact that representations below 15% won't change the system, because minorities then assimilate to the majority (Dahlerup, 2006). The tipping point is somewhere between 15% and 30%. If female representation is over 30%, women will significantly affect group dynamics and leadership style.

This brings us to the final point. Biomedical science (and neuroscience is no exception) has become a highly competitive occupation, to the point that it begins to be counterproductive. Time, money, effort, and careers go down the drain because of a system that, some argue, is failing (Alberts et al., 2014; http://www.scienceintransition.nl/english). Without implicating a causal or coincidental relationship between having had a largely male leadership for decades and driving the competition beyond any sense, it is time to call for action and bring other qualities in the equation. Teamwork, reaching out, helping the next generation, and doing something for the greater good rather than only for your own credentials … these actions should be given higher value than over the past few decades. This can only be changed by the joint effort of powerful parties in biomedical sciences: societies like SfN and FENS, who take a stand, figureheads in neuroscience. But we also need the voice of the large pool of junior neuroscientists, both men and women, whose future can benefit from a shift in paradigm. We all can and should see this as our responsibility. Such a shift in paradigm will make neuroscience a more welcoming place to be, where everyone, and notably women, will enjoy making new and important discoveries.

Note: this article forms a basis for our presentations at a Special Interest Event on Women in Neuroscience, at the Ninth FENS Forum of Neuroscience in Milan, July 6th, 18:45. Speakers include M.J. (President of FENS) and C.M. (President of SfN), Elena Cattaneo (Milan), Ilona Obara (Durham), and Martha Davila-Garcia (Howard University).

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