Review Article

Gender inequality in Latin American Neuroscience community

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ABSTRACT

Gender bias in Science, Technology, Engineering, and Mathematics (STEM) has been identified since a long time ago. However, gender imbalance in neuroscience has not yet been adequately explored worldwide. Here we report the first study on the development of the careers of men and women neuroscientists in Latin America in relation to family life and their perceptions of obstacles to success. Apart from revealing gender inequality in the neuroscience field, distinctive Latin American traits have become evident, thus providing novel insights into the global comprehension of gender imbalance in the region, which is required for guiding future actions, including the design of public policies in the region.

Introduction

This study was conceived by the Latin American Regional Committee of IBRO (IBRO-LARC) during its 2018 annual meeting in Colima, Mexico. In this meeting, IBRO-LARC members Cecilia Bouzat (chair, Argentina), Gustavo Murer (Argentina), Jorge Quillfeldt (Brazil), Rosalinda Guevara and Luisa Rocha (Mexico), Adrián Palacios (Chile), and Raúl Russo and Ana Silva (Uruguay), agreed to promote a joint venture with the Economic Commission for Latin America and the Caribbean (ECLAC) to gather information about gender balance among Latin American neuroscientists. In August 2019, IBRO and ECLAC signed a Cooperation Agreement to conduct this study, which has been supervised by the Director of ECLAC office in Montevideo, Verónica Amarante, and coordinated by IBRO-LARC.

Despite the advances in the participation of women in science, specialized literature indicates the persistence of gender gaps in (i) scientific areas in which men and women are inserted (horizontal segregation), (ii) the progress of men and women in their training and research positions (vertical segregation); and (iii) the access to high-rank positions (glass ceiling). The expression of these gaps is found both in developed (UNESCO, 2018) and developing countries

(López-Bassols et al., 2018). Explanations for the causes of the gender gap in science are diverse, ranging from the influence of discrimination and gender stereotypes (Moss-Racusin et al., 2012; Nielsen, 2016), the importance of socialization, future expectation, and self-esteem (Eccles, 1994; Huang, 2013; Tenenbaum and Leaper, 2003), to the influence of gender roles and family life (Fox et al., 2011; Mason and Goulden, 2004).

Several reports have described gender inequalities in neuroscience, but the influence of the dimensions mentioned above remains underexplored within this discipline (Haak, 2002; McDermott et al., 2018; Mello-Carpes and Lloret, 2018; Schrouff et al., 2019).

Results and discussion

To explore possible gender gaps in academic trajectories in the Latin American Neuroscience (LAN) community, we designed and implemented the LAN survey (LANs). This survey delved into dimensions such as family structure, the field of study, career history, access to tenure positions, and perception of discrimination inquiring about female representation at high levels of leadership and in committees that deal with decision making in science policies. All members of the societies of

neuroscience of Argentina, Brazil, Chile, Cuba, Mexico, and Uruguay were invited to participate. A total of 763 neuroscientists (265 males and 498 females) completed the survey, representing 33% of the invited participants. The response rate varied among countries ranging from 19% (Cuba) to 80% (Uruguay). The final sample was made up of 313 responses from Argentina, 180 from Brazil, 101 from Mexico, 73 from Chile, 64 from Uruguay and 45 from Cuba. Only in Chile, men replied to the survey in a higher percentage than women did (56%), while in the rest of the countries, 60–70% of the respondents were women. The rich LANs data set allowed us to provide an in-depth study of an under-represented community-Latin American neuroscientists-whose socio-cultural identity certainly presents distinctive and unique aspects

impacting on the general problem of gender imbalance in science.

This final report has been recently released (www.ibro.org/evaluati on-of-gender-inequities-in-the-latin-american-neuroscience-communit y/). Thus, it is timely to share with the broad neuroscience audience some of the main results of this first study on gender balance among the LAN community to promote future actions, recommendations, and perspectives for further studies.

No surprises

Some of the scientific community's trends worldwide were confirmed for the LAN community with a strong gender bias in senior
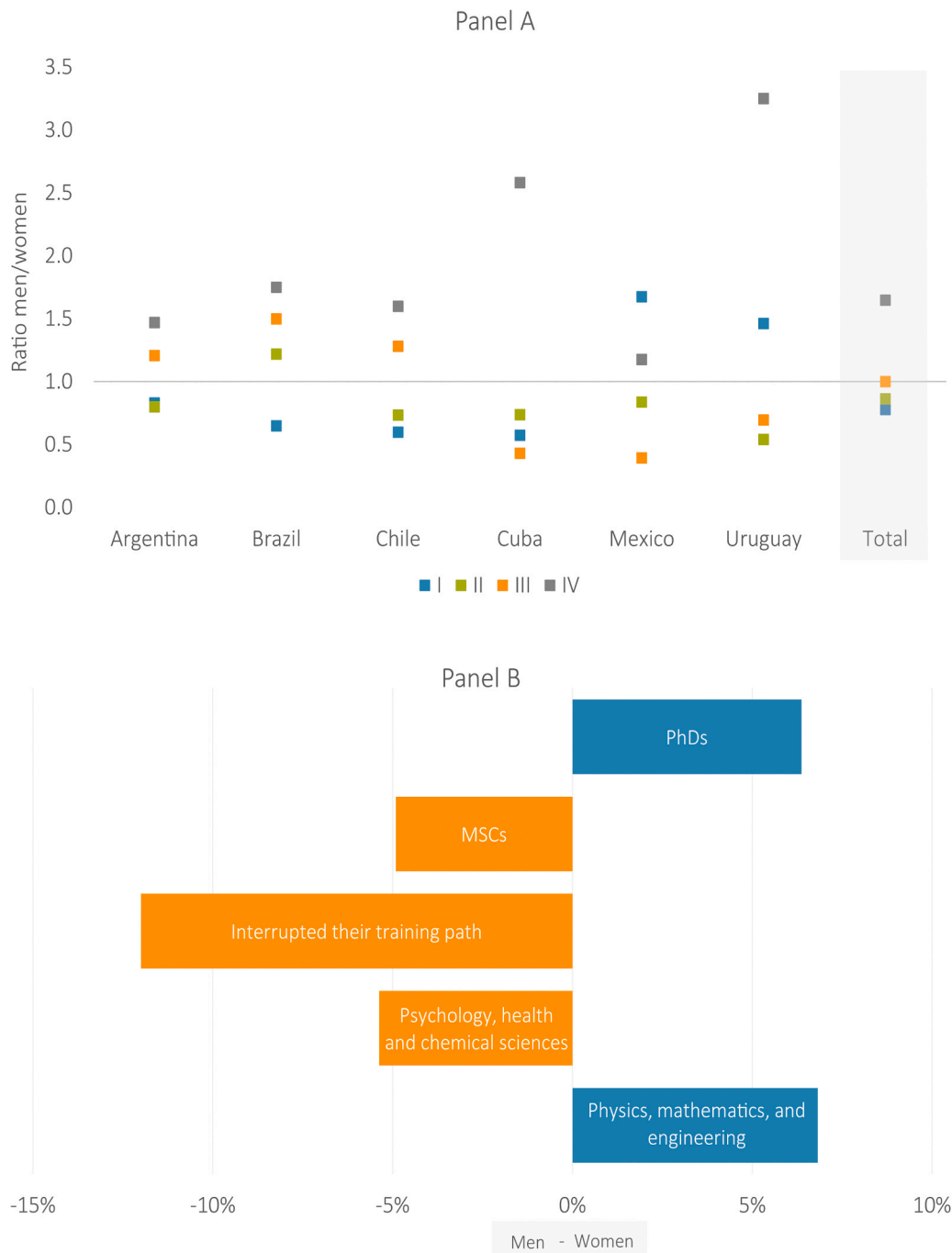
Fig. 1. Gender differences in the education path and academic career. Panel A. Percentage of men and women in each academic position. I and IV correspond to the lowest and highest grades of the scientific career, respectively. Panel B. Mean difference (in percentage) between men and women in educational attainment, training interruptions, and areas of expertize.

neuroscientists but not in early-career neuroscientists (Fig. 1, Panel A). In all countries, the ratio of men to women in the highest grade (Full-Professor or highest scientific category, Grade IV) is higher than one, thus reflecting the higher proportion of men. The highest disparities were found in Cuba and Uruguay, where this ratio is higher than 2.5.

Almost 30% male neuroscientists reached the highest grade (Full-Professor, Grade IV), whereas less than 20% female neuroscientists achieved this senior academic level. On the contrary, women were overrepresented in the lowest grade (graduate students or junior researchers, Grade I), in which we found 27% and 21% female and male neuroscientists, respectively. This reveals the impact of the glass ceiling on the career development of women.

The mean duration of undergraduate and graduate studies was variable across Latin American countries but not significantly different between men and women. However, there were some interesting gender differences in the way participants conducted their careers (Fig. 1, Panel B). First, the percentage of Ph.D.-degree holders was higher for men whereas the percentage of masters (M.Sc.) was higher for women. Second, more women than men reported interruptions in their training path. The main reasons for these interruptions were also different between genders: childcare and pregnancy were for women whereas financial and health problems were for men. Third, there is evidence of horizontal segregation within LAN: most neuroscientists in the disciplines of physics, mathematics, and engineering were men whereas in the fields of psychology, health, and chemical sciences were women. Overall, our study confirms that it is harder for women than for men to success in neuroscientific careers in Latin America, as reported for other neuroscience communities studied across the world and in agreement with the global trend identified in STEM (European Commission, 2019; UNESCO, 2017).

Specific aspects of the LAN gender gap

Our methodological design allowed us to identify some novel or relatively unexplored gender differences in the training path, academic work, parenthood role, and personal experiences among Latin American neuroscientists (Fig. 2).

Interesting novel points arising from LANs data presented in Fig. 2 that deserve to be highlighted are as follows:

- More women than men did their master training abroad, while more men than women did their Ph.D. training abroad. This is probably an important issue specifically for the LAN community and may not be so relevant worldwide. It is crucial for Latin American students to study and work abroad to have access to state-of-the-art technology and to make contact with scientist groups of developed countries. Given that international networking is vital for LAN members to succeed, longer international training chances for young men compared to their women counterparts will positively impact on the short and long term of their careers.

- Most neuroscientists were trained by male supervisors. Among the male respondents, more than 50% had a male supervisor in their bachelor's, master's, and doctorate's degrees. At this higher level, the proportion of men as supervisors was the highest: 68% of the surveyed male neuroscientists were trained in their doctorate by a male tutor, only 20% had a female tutor and 12%, both. Among the female neuroscientists surveyed, the majority also had male supervisors at all levels, but in this case, the differences were smaller. At the doctoral level, 51% of the women had male tutors, and 38% were trained by female tutors, while the remaining 10% had tutors of both genders. These differences made us think about the underlying cause.

			Men	Women
Training path		Neuroscientists pursuing PhDs abroad	30%	24%
		Neuroscientists pursuing MSCs abroad	18%	24%
		Neuroscientists who had same-sex PhD supervisors	68%	38%
Academic work		The average number of undergraduate students supervised	3.2	4.5
		Average access time to the highest academic position (in years)	10.2	12.0
Parenthood		Neuroscientists whose careers were affected by parenthood	71%	83%
		Neuroscientists whose parenthood decisions were affected by their careers	29%	58%
Personal experiences		Neuroscientists dissatisfied with their academic careers	28%	44%
		Neuroscientists who perceived being discriminated against in the evaluation of their academic achievements	45%	76%
		Neuroscientists who experienced sexual harassment during their careers	2%	17%

Fig. 2. Gender differences in key aspects of training paths, academic work, parenthood, and personal experiences.

At least part of the predominance of male supervisors is probably due to the historical predominance of men in the highest academic positions. In a context of equity and non-discrimination, we should expect it to decline as women become better represented in these positions. But this result may also indicate the influence of gender role modeling, which, in turn, raises questions such as: Do men avoid female supervisors? Do women prefer male supervisors? These are fundamental questions that cannot be answered with our data but should be addressed in future studies to promote gender equality in the new generations of neuroscientists.

- By the time respondents were completing the LANs, women neuroscientists were tutoring an average of five undergraduate students and men an average of three. At the postgraduate level, both men and women were tutoring an average of two master students and two doctoral students. When discriminating between teaching grades, we observed, as might be expected, that the higher grades have a higher average number of students tutored. However, it is striking that women in the highest positions accumulated more undergraduate students than their male peers, at least four more students on average. At the same time, this does not occur with master's and doctoral students. This difference suggests that men concentrate efforts in tutoring the more productive master and Ph.D. students. It also indicates that either undergraduate students may feel more comfortable with female tutors or women may give more importance than men to undergraduate student formation. Likewise, this result again draws attention to the hypothesis of the influence of gender role models in science.

- A differentiating factor in men's and women's trajectories among the surveyed neuroscientists is how they access their current positions. Although on average, women accessed the lowest positions at younger ages (27 years old) than their male colleagues (28 years old), the situation is reversed in the highest positions (Grades III and IV). In the latter, women reached the position one or two years later than men.

- The endogeneity between parenthood and career emerges as a precise result. Becoming parents delays neuroscience careers for both men and women in Latin America, but this delay is gender dependent. It took three more years for mothers than for women without kids to reach the highest academic positions, while only one more year for fathers with respect to men without kids. At the same time, parenthood decisions were shown to be related to career paths, especially in motherhood.

- Essential differences are detected in more subjective aspects of personal experiences. A relevant proportion of men and women declared themselves as dissatisfied or very dissatisfied with their careers, being the percentage higher for women (44%) than for men (28%). Although men and women shared some of the reasons for dissatisfaction, which include those attributed to the difficulties of scientific work in developing contexts (such as the lack of funding and access to academic positions), a higher proportion of women than men were also dissatisfied with the way they reconcile family life and academic career. Although dissatisfaction due to difficulties in funding and academic position is a collateral result of this study, it should be considered an important issue to be addressed in organisms of science in all Latin American countries. It is striking that whereas most individuals declared that vocation was the main reason for choosing a scientific career, the career does not appear to meet their expectations.

- Having experience of discrimination was strongly sex biased. Moreover, the causes behind discrimination differed by sex. Women perceived discrimination based on gender, age, and pregnancy or dependent care. In contrast, men perceived discrimination mainly due to age, race/ethnicity, or social class. Also, a greater percentage of women than of men declared having suffered sexual harassment during their careers. However, it is essential to note that witnessing or learning about these situations was also sex biased. In other words, men did not perceive as much as women the sexual harassment suffered by their peers.

From awareness to action

IBRO-LARC members, as representatives of the present generation of neuroscientists, men and women alike, feel responsible for providing a field of equal opportunities for the upcoming generations, and this commitment inspired the initiative to conduct this study. Two main conclusions arise: First, an essential impact of this study is that it contributes to the first set of quantitative gender data from the LAN community. In this sense, this study raises awareness of the problem, which is a mandatory step. Secondly, it is interesting to note that this study highlights that gender bias in LAN is the same for worldwide science. Women need to struggle harder than men to reach influential positions, and more women than men give up in the middle of the way. For more than 30 years now, biomedical careers have a gender bias in favor of women at the beginning and men at the top. It is thus clear that awareness of gender inequity is not enough for changes to occur. If, as is the case, the diagnosis of gender inequity in science is indisputable, trustworthy, and global, is it fair to trust that time will solve this problem? Monitoring the evolution of gender gaps through prospective studies that allow evaluating the real impact of the greater participation of women in science will be key in the future. This work contributes one more input for the design of public policies to address gender inequity within Latin American countries and within LAN and global scientific communities. It is time to fix the real causes of stopping women from succeeding in their science careers and helping women break this glass ceiling, which is no longer invisible. We thus call for the commitment of science-policy makers to promote acceptable practices to assure equal opportunities for women and men in the development of their scientific careers.

Acknowledgments

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