Highlights of the 1st Latin American Conference of Women in Bioinformatics and Data Science

Lucy Jiménez[1,§], Liliane Costa Conteville[2,§], Ivana Feldfeber[3], Mercedes Garnham Didier[4], Georgina Stegmayer[5], Cristina Marino-Buslje[6], Ana Julia Velez Rueda[7,*]

[1]Universidad de Los Andes, Cra. 1 18a-12, 111171 Bogotá, Colombia
[2]Instituto Oswaldo Cruz, Fundação Oswaldo Cruz, 21040-900 Rio de Janeiro, Brazil
[3]Observatorio de Datos con Perspectiva de Género, 1428 Buenos Aires, Argentina
[4]Instituto de Investigaciones Biotecnológicas, Universidad Nacional de San Martín, Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Av. 25 de Mayo 1301-1367, Villa Lynch, 6660 Buenos Aires, Argentina
[5]Research Institute for Signals, Systems and Computational Intelligence, FICH-UNL, CONICET, Ciudad Universitaria UNL, 3000 Santa Fe, Argentina
[6]Fundación Instituto Leloir, C1405BWE Buenos Aires, Argentina
[7]Departamento de Ciencia y Tecnología, Universidad Nacional de Quilmes, CONICET, Roque Sáenz Peña 352, Bernal B1876BXD Buenos Aires, Argentina

Introduction

Many efforts have been made to bridge the gender gaps in science and technology, but disparities still persist within academic, scientific, and technologic fields (1, 2). The United Nations Educational, Scientific and Cultural Organization (UNESCO) surveys conducted in June 2019 show that women represent only 30% of the population of researchers globally (3). Going deeper into the analysis, women are restricted in access to decision-making positions, even in countries in which the participation of women in science is higher than the global trend (4). The representation of women in science in Latin America is higher (~40%), with differences within the region, but we believe that this also reveals a gender difference. Salaries in science are usually low and are even lower for women in the field (5), and they end up accepting them, while men do not (6). In science, technology, engineering, and mathematics areas, both horizontal and vertical barriers still persist for women, which is reflected in a reduced female presence in decision-making positions and the women struggling to reach senior leadership positions in various spheres of national scientific systems (7) or companies.

In the bioinformatics field in particular, a survey published in *PLOS Computational Biology* (8) shows that there are fewer female authors in postgraduate levels in computational biology compared with biology in general. The imbalance is also evident with the author hierarchy and the impact factor of the journals. In both biology and computational biology, the presence of a woman as the last author of

"§" equal contribution

"*" corresponding author

the work increases the probability that other authors in the article are also women. In addition, the majority of keynote speakers at conferences are men, giving women a secondary role. Although it has been observed that when women are on the organizing committee of a conference, the number of women speakers tends to increase (9). Another observation is that men are more prone to take part in question and answer sessions at meetings (10). Besides asking fewer questions, women make a disproportionate number of questions to women speakers, while men do the inverse (11), and their interactions are often more an explanation than a question, a kind of "mansplaining." All of this highlights a reality in terms of gender representation, pointing out the potential role of female leaders to influence the balance and give young researchers confidence in their work.

The Women in Bioinformatics and Data Science network in Latin America was created in 2019 with the aim of addressing some of these issues. This community has 3 main goals: (a) to promote and make visible women's research in the bioinformatics and data science fields; (b) to encourage women to establish collaborative research networks; and (c) to empower young scientists to be confident in work and capabilities.

As a result of a joint effort of women from all over Latin America, the first conference was held virtually in September 2020 with excellent results. The conference not only increased the visibility of women's work in science, but it also generated networks and promoted alliances to enhance collaborations and scientific work.

About the 1st Latin American Conference of Women in Bioinformatics and Data Science

The 1st Latin American Conference of Women in Bioinformatics and Data Science was a virtual and nonprofit meeting aimed at promoting and making visible the research carried out by women in these fields. It was open to the entire community, but only with women as keynotes and speakers. This conference brought together researchers from Latin America in the public and private sectors working in systems biology, omics technologies, artificial intelligence, machine learning, data science, data mining, and high-performance computing with applications in biology.

Over 800 participants from all over the world (Fig 1A) registered for the conference. The majority of participants came from South American countries, with Brazil, Argentina, Colombia, and Mexico accounting for 28%, 24.5%, 14.7%, and 7.4%, respectively. Most participants were women from academia and industry, followed by individuals who were identified as male (15.4%) and nonbinary (0.8%; Fig 1B). English was chosen as the official language, enabling students, academic researchers, and professionals from the industry to engage in thought exchange.

The conference received 168 abstract submissions, with a total of 637 authors covering different topics (Table 1). The scientific committee that reviewed the abstracts was a group of 27 Latin American women researchers. On the basis of the reviews, the 18 best scored abstracts were selected for oral presentations. All accepted abstracts are available on the event website and are published in an abstract book (12). The majority of the abstracts' authors were from Argentina, Brazil, and Colombia, but some were also from Europe (Spain, Germany, France), the United Kingdom, North America (United States), Asia (India and Malaysia), and Oceania (Australia).

Taking the list of authors that submitted abstracts and crosslinking with the information obtained from the registration, we analyzed the authorship with a gender perspective. We found, as expected, that although the conference was open to the entire community, the works received were mainly with women as first authors (87.5% compared with 7.1% men). However, we found the opposite tendency when looking at the last position. The last authors, an authorship position generally associated with higher reputation or senior researchers (13, 14), were predominantly male (57.7%; Fig 1C). In 55.4% of the cases, men were in the last author position, while women were the last authors in 44.6% of the cases.
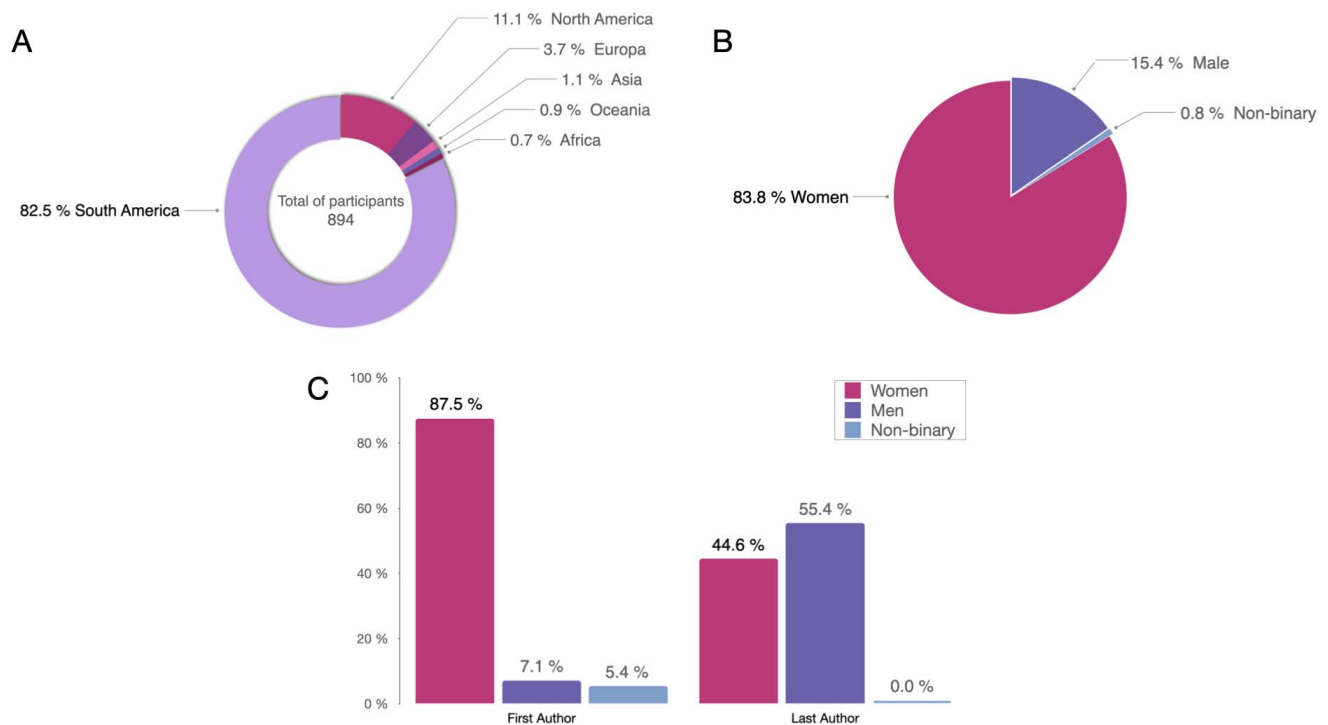
Fig 1. Distribution of participants in the congress on the basis of the information obtained from the registration. (A) Percentage of participation by region. (B) Representation of participants from industry and academy by gender. (C) Authorship position analysis by gender.

Twenty-four female speakers with experience in a broad range of topics were invited. With the exception of Professor Shoshana Wodak from Belgium, all other speakers were Latin American women researchers, mainly from Argentina ($n = 10$), but also Brazil and Mexico ($n = 3$), Chile and Colombia ($n = 2$), and Peru, Puerto Rico, and Uruguay ($n = 1$). On average, 180 people attended each day, and a total of 500 people participated in 3 days.

Closing the conference, there was a discussion about gender and science, with the participation of specialists in gender from different areas: Diana Maffía (PhD and researcher in philosophy) and Valeria Edelsztein (researcher in chemistry and science promoter) from Argentina, Diana Farías (researcher in chemistry) from Colombia, and Márcia Barbosa (researcher in physics and winner of the L'Oréal UNESCO prize for women in science) from Brazil. We provided simultaneous translating (Portuguese and Spanish) to allow speakers to address the theme in their native languages.

The last day consisted of 6 workshops on state-of-the-art topics, with 12 experienced women as teachers. This allowed knowledge exchange between scientists with different levels of expertise and different backgrounds. The hands-on courses covered genotyping-by-sequencing data analysis, molecular phylogenetics, machine learning applied to drug design, analysis of molecular

Table 1. Number of abstracts submissions in each topic.

Abstract topics	n
Bioinformatics and disease	47
Genomics and evolution	41
Structural bioinformatics and biomolecular simulations	31
Deep learning, chemoinformatics, and drug discovery	20
Data mining and big data analysis	15
System biology	11
Education	3
Total	168

dynamics simulations, introduction to machine learning with R language with tidymodels, and introduction to R language with tidyverse. The workshops had a total of 159 attendees: 93 were female; 23 were male; and 45 did not indicate a gender in the registration form.

Discussion and future perspectives

The 1st Latin American Conference of Women in Bioinformatics and Data Science initiative aimed at creating spaces for discussion and training in our community, not only in science and technology, but also from a gender perspective. As we discussed before, science and technology are masculinized environments in which gender disparities still remain as part of the structure. The data generated, even in this particular event created by women and especially for women, reinforced the evidence of the predominance of men in leadership roles. The glass ceiling effect with respect to differential access to leadership positions for women and men is still evident (15–18). In personal communication, the speakers and attendees expressed that they felt very comfortable and considered the conference venue to be a friendly environment to exchange, to learn, and to discuss ideas.

In this report, we conclude from the great response of the community, evidenced by the large number of attendees, submitted abstracts and participating speakers, and the results obtained from our analysis, that there is a need for these types of spaces as provided through the 1st Latin American Conference of Women in Bioinformatics and Data Science. Women working in bioinformatics and data science are still waiting to be properly recognized. We need to create spaces that encourage participation and continuing education opportunities for women, and we need to analyze our research reality from a gender point of view, if we really want to contribute to reducing the gender disparity gap.

REFERENCES

1. Shen, H. 2013. Inequality quantified: mind the gender gap. *Nature* 495(7439):22–24.
2. Larivière, V., C. Ni, Y. Gingras, B. Cronin, and C. R. Sugimoto. 2013. Bibliometrics: global gender disparities in science. *Nature* 504(7479):211–213.
3. UNESCO Institute for Statistics. 2019. Fact Sheet No. 55: Women in Science. UNESCO Institute for Statistics, Montreal, Canada.
4. Merchán, M. L. M. 2019. La sociedad del conocimiento y las brechas de género en ciencia, tecnología e innovación. *Cuad Latam de Admón* 15(29):74–86.
5. Wodon, Q., and B. de la Brière. 2018. Unrealized Potential: The High Cost of Gender Inequality in Earnings. The World Bank, Washington, DC.
6. Babcock, L., and S. Laschever. 2004. Women Don't Ask: Negotiation and the Gender Divide. Princeton University Press, NJ.
7. López-Bassols, V., M. Grazzi, C. Guillard, y M. Salazar. 2018. Las brechas de género en ciencia, tecnología e innovación en América Latina y el Caribe: resultados de una recolección piloto y propuesta metodológica para la medición. Banco Interamericano de Desarrollo, Washington, DC.
8. Bonham, K. S., and M. I. Stefan. 2017. Women are underrepresented in computational biology: an analysis of the scholarly literature in biology, computer science and computational biology. *PLOS Comput Biol* 13(10):e1005134.
9. Casadevall, A., and J. Handelsman. 2014. The presence of female conveners correlates with a higher proportion of female speakers at scientific symposia. *MBio* 5(1):e00846–13.
10. Hinsley, A., W. J. Sutherland, and A. Johnston. 2017. Men ask more questions than women at a scientific conference. *PLOS ONE* 12(10):e0185534.
11. Telis, N., E. C. Glassberg, J. K. Pritchard, and C. Gunter. 2019. Public discussion affects question asking at academic conferences. *Am J Hum Genet* 105(1):189–197.
12. 1st Congress of Women in Bioinformatics and Data Science Latin America. 2020. Abstracts. Accessed 19 July 2021. https://wbds.la/conferences/1WBDSLAC/index.html.
13. Drenth, J. P. H. 1998. Multiple authorship: the contribution of senior authors. *J Am Med Assoc* 280(3):219–221.
14. Bendels, M. H. K., R. Müller, D. Brueggmann, and D. A. Groneberg. 2018. Gender disparities in high-quality research revealed by Nature Index journals. *PLOS ONE* 13(1):e0189136.
15. Rosser, S. V. 2004. The Science Glass Ceiling: Academic Women Scientist and the Struggle to Succeed. Routledge, New York.
16. Bertrand, M. 2017. The Glass Ceiling. Working Paper No. 2018-38. Becker Friedman Institute for Research in Economics, Chicago, Il. Accessed 1 May 2021. https://ssrn.com/abstract=3191467.
17. Crawley, D. 2014. Gender and perceptions of occupational prestige: changes over 20 years. *SAGE Open* 4(1):1–11.
18. Oliveira, D. F. M., Y. Ma, T. K. Woodruff, and B. Uzzi. 2019. Comparison of National Institutes of Health grant amounts to first-time male and female principal investigators. *J Am Med Assoc* 321(9):898–900.