RESEARCH ARTICLE

The gender gap in highly prestigious international research awards, 2001–2020

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ABSTRACT

This study examines gender disparities in the world's 141 most prestigious international research awards. I find that (a) from 2001 to 2020 these awards were received 3,445 times by 2,011 men and 262 women; (b) women's share increased from an annual average of 6% during 2001–2005 to an annual average of 19% during 2016–2020; (c) 49 of the 141 awards were not received by women during 2016–2020; and (d) when the numbers of female full professors are taken into consideration, the gender gap remains highly disproportionate in biological and life sciences, computer science, and mathematics. Overall, women would be expected to increase their share of awards by nearly 50% to achieve parity with men today. The study shows great similarities between men and women award recipients in journal articles per author, the average number of authors per article, the proportion of articles in top journals, citations per article, and participation in large research groups and international collaborations. I conclude that the gender gap in highly prestigious research awards is largely a result of demographic inertia and other factors that deserve further investigation.

1. INTRODUCTION

Studies of the gender gap in academia almost always report that women are underrepresented in scientific disciplines, publish fewer articles, receive fewer research grants and awards, are underpaid, progress more slowly through senior and leadership positions, have shorter research careers, have fewer senior authorship positions and less presence in prestigious journals and that their work attracts fewer citations relative to their male counterparts (Aguinis, Ji, & Joo, 2018; Freund, Raj et al., 2016; Holman, Stuart-Fox, & Hauser, 2018; Huang, Gates et al., 2020; Larivière, Ni et al., 2013; Lincoln, Pincus et al., 2012; Ma, Oliveira et al., 2019). There is also extensive, yet fragmented, evidence that, despite the various science-policy initiatives, educational reform, and national and international legislation, the gender gap continues to persist, even among researchers with similar careers and records (Nielsen, 2017; Sá, Cowley et al., 2020). Factors contributing to the gender gap in academia include, but are not limited to, family responsibilities, lifestyle choices, career preferences, stereotypes, implicit bias, discriminatory work culture and environment, and lack of effective efforts and initiatives to address gender inequities (Blickenstaff, 2005; Ceci, Ginther et al., 2014; Ceci & Williams, 2011; Charlesworth & Banaji, 2019; Holman et al., 2018; Holmes, Myles, & Schneider, 2020; Leslie, Cimpian et al., 2015; Ngila, Boshoff et al., 2017; Reuben, Sapienza, & Zingales, 2014; Shaw & Stanton, 2012; Wang & Degol, 2017).

Research on women's underrepresentation in academia—reviewed comprehensively by Astegiano, Sebastián-González, and Castanho (2019) and Chan and Torgler (2020)—has frequently focused on the gender productivity gap by comparing the research output of men and women, as well as their citations, salaries, rank, leadership positions, funding, and so on. In contrast, this study examines the gender gap in peer recognition and, more specifically, in highly prestigious international research awards.

Studying the gender gap in highly prestigious international research awards is important because such accolades are compelling signs of research excellence and are among the highest forms of recognition that researchers accord one another (Gallus & Frey, 2017). In addition, these awards put scientists on the radar of their peers, the media, funding agencies, tenure committees, and the public, help them advance in their careers, and encourage them to produce more pioneering work (Ma et al., 2019). Institutions benefit, too, as high-profile awards received by their members bestow prestige and impact in national and international rankings and help attract more funding, donations, and high-quality students and faculty (Cadwalader, Herbers, & Popejoy, 2014; Charlesworth & Banaji, 2019; Holmes et al., 2020; Lincoln et al., 2012). Studying the gender gap in prestigious awards is also important to influence policies, set priorities, raise awareness, correct gender imbalances, improve practices for selecting awardees, and provide another standard against which to check progress or lack thereof in narrowing the gender gap in this area—benefits that would pay dividends for the whole scientific community (Charlesworth & Banaji, 2019; Holmes et al., 2020; Lincoln et al., 2012; Lunnemann, Jensen, & Jauffred, 2019; Ma et al., 2019).

A major reason that necessitates this study of the gender gap is the substantial increase over the past two decades in the number and proportion of women among senior faculty—defined here as faculty members with the rank of full professor (*professor* hereafter). For example, in the United States, the number and proportion of female professors in all fields increased from 37,051 (or 23%) in 2001 to 62,189 (or 33%) in 2018 (De Brey, Snyder et al., 2021); in Canada from 4,830 (16%) in 2001 to 6,975 (29%) in 2019 (Statistics Canada, 2021); and in the United Kingdom from 1,691 (13%) in 2001 to 5,720 (28%) in 2019 (European Commission, 2003; Higher Education Statistics Agency, 2021). In the European Union countries, the number and proportion of female professors increased from 22,343 (16%) in 2004 to 35,896 (24%) in 2016 (European Commission, 2006, 2019), and in Australia, the figures for women with ranks above senior lecturers (i.e., associate professors and professors) increased from 1,213 (or 17%) in 2001 to 5,919 (or 36%) in 2020 (Higher Education Statistics, 2021). With these developments, we must examine the extent to which improvements in women's representation at the highest levels in academia have led to equivalent shares of highly prestigious international research awards. This study both provides empirical evidence of the extent of the gap that may still persist in this area, and serves as a call to action for improving the status quo.

2. METHODS

We collected data on highly prestigious international research awards from 2001 to 2020. We identified the list of these awards using four methods to ensure quality and inclusiveness:

1. Tiered-checklist (Dennison, 2000), a method based here on six lists of highly prestigious awards: Inventory of International Awards developed by the government of Canada[1]. list of awards used by the Center for World University Rankings[2], list of the International

[1] https://www.canada.ca/en/services/science/researchfunding/researchawards.html

[2] https://cwur.org/

Congress of Distinguished Awards[3], list of "top" awards from the Shanghai Ranking[4], list of 213 "highly prestigious" awards developed by the US National Research Council for assessing the quality of doctoral programs (also used as one of the four "phase I" Association of American Universities membership indicators)[5], and Wikipedia's list of prizes known as the Nobel of a field or the highest honors of a field[6]. We selected those awards commonly mentioned on three or more of these six lists (n = 67 awards).

2. Reputation surveys, a method based on the results of two studies (Jiang & Liu, 2018; Zheng & Liu, 2015) which sought the opinions of thousands of experts regarding 180 and 207 selected awards, respectively. Of the 110 awards rated by respondents important, very important, or having the same importance as the Nobel Prize, we selected 70 that were international in scope and were included in at least one of the six lists used in the above-mentioned tiered-checklist method[7]; we imposed the latter criterion to reduce the impact of potential bias within the survey method (Dillman, Smyth, & Christian, 2014).
3. Highly Cited Researchers by Clarivate Analytics[8]. We considered highly prestigious all awards that had 50% or more of their recipients classified as highly cited researchers in the 2001 and 2014–2020 editions of Highly Cited Researchers (n = 82 awards).
4. Wikipedia Pageviews[9]. We used as a crude proxy for prestige the number of views the Wikipedia award recipient's page received from 2015 to 2020 (Ma et al., 2019). We used as a threshold the median number of views of all awards identified through the aforementioned three methods—32,500. This method resulted in identifying 84 awards.

The four methods together resulted in identifying 141 highly prestigious international research awards: five, 10, 19, and 17 awards were unique to the first, second, third, and fourth methods, respectively. Agreement among methods regarding which awards are most prestigious was largest in engineering, biological and life sciences, physical sciences, and multidisciplinary awards and was lowest for mathematics, computer science, and social and behavioral sciences awards (Table S1 in the supplementary information). The 141 awards were received 3,040 times by 2,011 men and 405 times by 262 women. Our data show that in both cases, awards are concentrated among a small group of elite researchers: 23% of women and 25% of men received 50% of all awards in their respective gender categories (Ma & Uzzi, 2018). Moreover, among women, 23% received more than one award, 12% received more than two awards, and 6% received more than three awards during 2001–2020 (Table S2 in the supplementary information); among the men, the ratios were 26%, 11%, and 6%, respectively (Table S3 in the supplementary information), suggesting great similarities between both groups with regard to potential for the presence of a Matthew Effect (Azoulay, Stuart, & Wang, 2014; Chan, Gleeson, & Torgler, 2014; Merton, 1968).

[3] https://www.icda.org/. We used only those awards rated most notable (5.0), gold standard (4.0), mega prizes (3.6), challenge prizes (3.4), prototype awards (3.2), and highly esteemed (3.0).

[4] https://www.shanghairanking.com/subject-survey/awards.html

[5] https://researchdevelopment.vpr.virginia.edu/faculty-awards-directory-has-information-over-1000-honors-and-awards

[6] https://en.wikipedia.org/wiki/List_of_prizes_known_as_the_Nobel_of_a_field_or_the_highest_honors_of_a_field

[7] The study by Zheng and Liu identified 99 awards rated important, very important, or as important as the Nobel Prize. These 99 awards form the basis of the IREG List of International Academic Awards. Per the definition of "international" in this study, 13 of the 99 awards did not meet the criterion; also, 16 awards were not in any of the six lists used in the checklist method.

[8] https://clarivate.com/webofsciencegroup/solutions/researcher-recognition/

[9] https://pageviews.toolforge.org/

We focused on the 2001–2020 period to examine recent developments in the gender gap in international research awards. We determined the gender of each award recipient through their Wikipedia pages and, when necessary, Google searches. We considered an award international if given to recipients from more than one country during the most recent 10 years (for annual awards) or the most recent 20 years for awards given once every 2 or more years. Examples of highly prestigious awards that did not meet this definition are the ASME Medal, Henry Draper Medal, John Fritz Medal, John Scott Award, NAS Award in Chemical Sciences, Priestley Medal, and the Welch Award in Chemistry. We defined a research award as one where half or more of its recipients were affiliated with academic or research institutions.

We divided the awards and their recipients into six broad science and engineering fields using the U.S. National Science Foundation classification: biological and life sciences (including health), computer science, engineering, mathematics, physical sciences, and social and behavioral sciences (including psychology)[10]. We assigned an award to a specific broad field if at least 75% of its recipients came from that field. For example, the Kavli Prize in Nanoscience included three recipients whose major broad field is biological and life sciences and 15 recipients whose major broad field is physical sciences. We considered this prize physical sciences because 15 (or 83%) of its recipients came from this field. In the case of multidisciplinary awards (e.g., the Japan Prize and the Nobel Prize in Chemistry—Seeman & Restrepo, 2020), we assigned each given award the field to which the recipient belonged. As 2,146 (or 94%) of the award recipients had individual Wikipedia pages providing detailed research and academic background information, we used the encyclopedia to determine the research or academic fields of these authors.

We verified the accuracy of the Wikipedia field classification by examining the publication records of the award recipients in both Scopus and Essential Science Indicators (ESI) databases. These databases classify publications into 27 and 22 subject categories, respectively (e.g., chemistry, engineering, mathematics, and medicine/clinical medicine). For each award recipient, we retrieved all of their publications in the database and examined the three subject categories with the largest number of publications. Results showed over 99% match between Wikipedia field description of the award recipients and the subject categorization of awardees' publications by Scopus and ESI. We subsequently used these two databases as follows to determine the field classification of the 127 awardees who lacked Wikipedia entries:

- If the great majority of an author's publications were classified by Scopus or ESI under a single subject category (e.g., immunology) or two or more related subject categories (e.g., medicine and neuroscience), we recorded this author under the broad field to which these subjects belong (in this case, biological and life sciences).
- In the cases where the great majority of an author's publications were classified under two or more different fields (e.g., engineering and mathematics), and where Scopus and ESI differed as to which field was most representative, we searched the web for additional information on the awardees to decide which of these two fields to assign to the author.

We used Scopus (author name search) to determine the institutional and country affiliation of all 2,273 award recipients. For each award recipient, we recorded all the institutions and countries with which the author had at least one-fourth of her or his publications and/or *h*-index papers. In cases where the award recipient had very few or no records in Scopus, we recorded all the institutions and countries with which the person was affiliated for more

[10] US National Science Foundation: https://www.nsf.gov/statistics/srvydoctoratework/

than 10 years. Overall, 52% of the award recipients had multiple affiliations or have changed affiliations during their careers (Schlagberger, Bornmann, & Bauer, 2016).

We used professors for comparison because over 94% of the 2,273 award recipients are or were affiliated with universities and research institutions, 96% have doctoral degrees, the average age of the individuals at the time of receiving the award was 66 (well above the average age of professors, which stands at around 55 in the United States), and researchers receive these awards an average of 37 years after their PhDs (European University Institute, 2018). We used the proportion equation to determine the magnitude of the gap between men and women while taking into consideration their respective population sizes within the scientific community. We analyze data in 5-year intervals (2001–2005, 2006–2010, 2011–2015, and 2016–2020) because of the small number of awards received by women per year.

3. RESULTS

The results of this study show that women's recognition by highly prestigious international research awards has increased noticeably over the years. During 2001–2005, women were recognized by 30% of the 111 awards available at the time, increasing to 39% (of 132 awards) during 2006–2010 and up to 65% (or 92 of all 141) awards available during 2016–2020 (Figure 1). Despite the improvement, it is remarkable that from 2016 to 2020 not a single woman scientist or engineer was recognized for her research achievements by 49 (or 35%) of all available awards. Even when examining 20 years (2001–2020), women still did not get recognized by 22 (or 16%) of the 141 awards examined in this study (Table S1 in the supplementary information), including the two awards named after women: Maryam Mirzakhani Prize in Mathematics (given four times since 2001) and Queen Elizabeth Prize for Engineering (received by 14 individuals since its inauguration in 2013).

Similar to women's recognition by different awards, the ratio of individual awards received by women increased, too, during the period 2001–2020, going up from 6% (or 41 of all 693 awards) given during 2001–2005 to 19% (or 187 of all 1,001 awards) given during 2016–2020. Despite the steady increase, the 19% share by women of the world's most prestigious

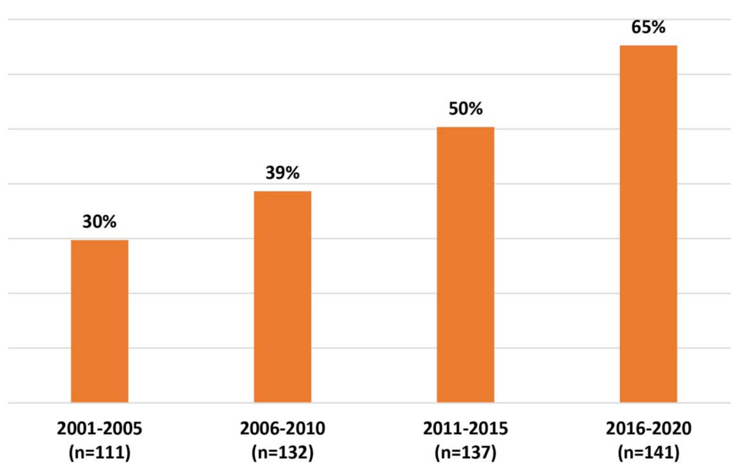

Figure 1. Percentage of awards recognizing distinguished female scientists and engineers. The figures in parentheses are the number of different awards available during that period. The chart can be read as follows: During 2001–2005, there were 111 different highly prestigious international research awards available; women were represented as recipients in 30% of these 111 awards.

international research awards during 2016–2020 is still notably lower than the 28% share of science and engineering professor positions currently held by women (Figure 2) and lower than the 33% of research articles in which women are lead authors (Larivière et al., 2013). Considering women's numbers and proportions among science and engineering professors during 2016–2020, the results show that women's share of the highly prestigious research awards will have to increase by 47% (to go up from 19% to 28% share) to achieve parity with men.

When examining the results by field, we noticed important differences (Figure 3). In biological and life sciences, the data show steady improvement in the number and proportion of awards received by women, increasing from 20 (or 7% of all 268) awards given during 2001–2005 to 81 (or 21% of all 382) awards conferred during 2016–2020. Given that the proportion of female professors in the field has increased by 42% from 2001–2005 to 2016–2020 (moving up from 24% to 34%) compared to an increase by 200% in the proportion of awards received during the same period, one could conclude that the gender gap in awards in the field is closing at a remarkable rate. Women in biological and life sciences, however, still need to increase their share of the awards by 67% (that is, go up from 21% to 34% share) to achieve parity with men.

Unlike all other fields, where increases in the number of awards received by women were in line with increases in the number of female professors, in computer science, women's share of awards fluctuated markedly in the past 20 years even though (a) the number of female professors has increased from 140 during 2001–2005 to 600 during 2016–2020; (b)

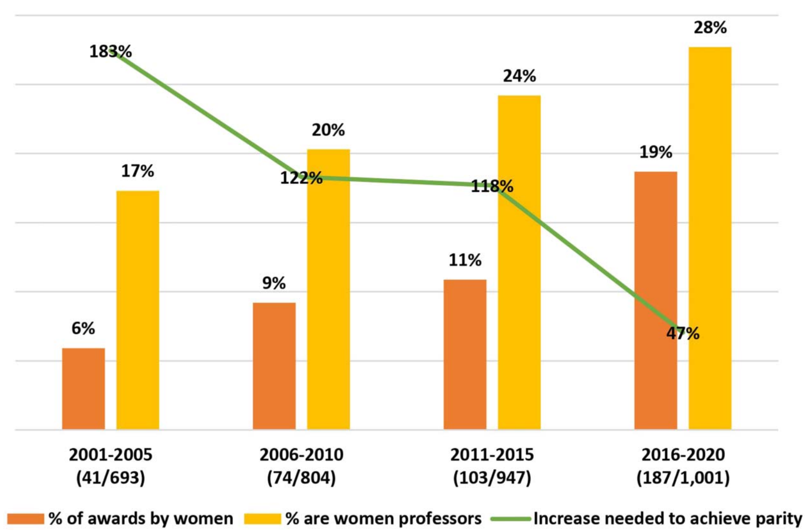

Figure 2. Percentage of awards received by women, the proportion of female professors, and increase in the share of awards needed to achieve parity with men. The data for female professors (orange columns) represent the share of positions held by women during the respective period, using the gender distribution of professors in the United States as a proxy for the worldwide distribution. These data, which are used in the biennial publication *Women, Minorities, and Persons with Disabilities in Science and Engineering* (https://ncses.nsf.gov/pubs/nsf19304), were retrieved from the Survey of Doctorate Recipients, sponsored by the US National Science Foundation and the US National Institutes of Health (https://www.nsf.gov/statistics/srvydoctoratework/). The figures for each 5-year interval represent the midpoint or the annual average during that period (e.g., the data for the 2016–2020 period are the average of the years 2017 and 2019). The green line represents the proportion of increase needed in the share of awards by women to achieve parity with men. The figures between parentheses are the number of awards received by women/the number of awards received by men and women.

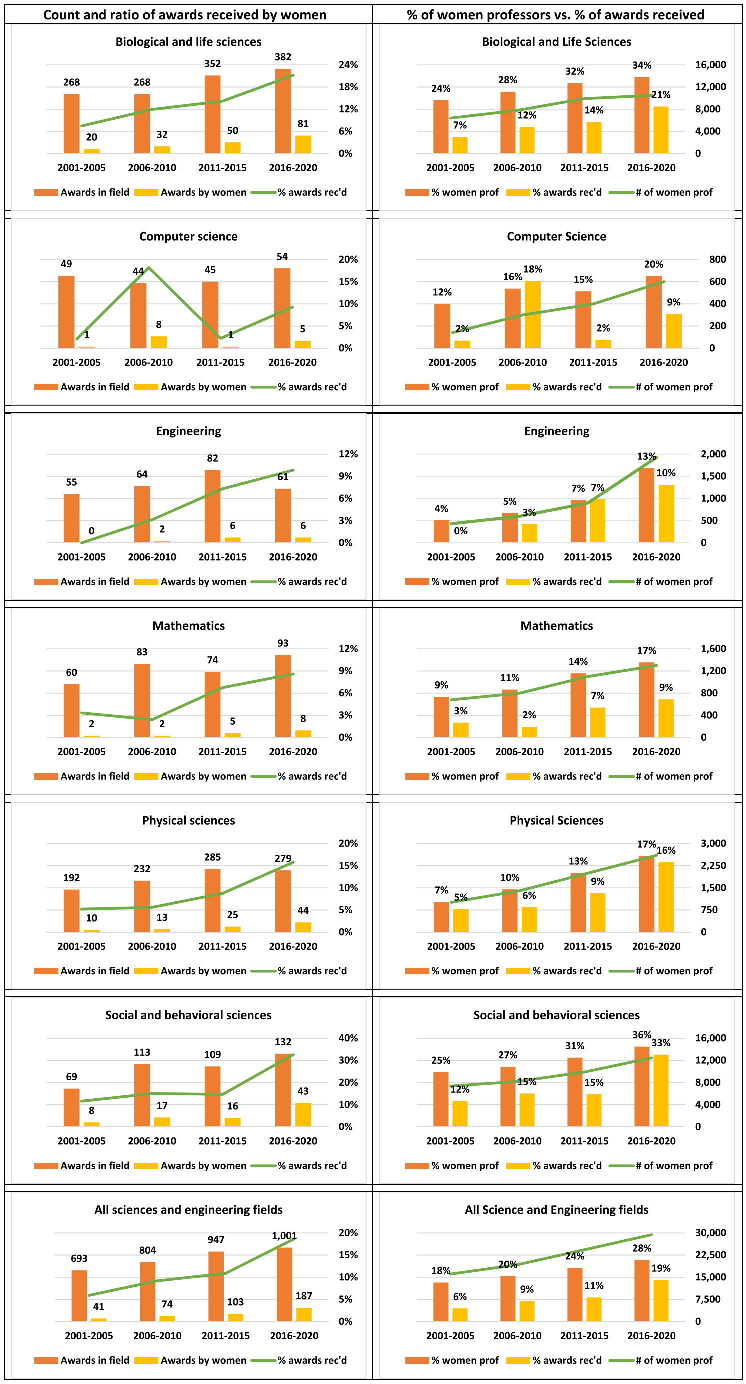

Figure 3. Percentage of awards received by women by field: change over time. Awards in field = total number of awards received by men and women. Awards by women = total number of awards received by women. % awards rec'd = percentage of total awards received by women. % women prof = ratio of professors who are women. # of women prof = number of women with the rank of professor. The data for the number of female professors represent the share of positions held by women during the respective period, using the gender distribution of professors in the United States as a proxy for the worldwide distribution. These data were retrieved from the Institutes of Health (https://www.nsf.gov/statistics/srvydoctoratework/). The figures for each 5-year interval represent the midpoint or the annual average during that period (e.g., the data for the 2016–2020 period are the average of the 2017 and 2019 data). The charts can be read as follows, using the bottom two as examples. Left chart: Women received 41 (or 6%) of all 693 awards given during 2001–2005, 74 (or 9%) of all 804 awards given during 2006–2010, and so on. Right chart: Although women made up 18% of the total population of professors, they received 6% of all awards given during 2001–2005.

the proportion of female professors increased from 12% to 20% during the same period; and (c) the number of available awards in the field remained relatively stable from 2001 to 2015 or increased considerably during 2016–2020. Women received a single computer science award during 2001–2005, followed by eight during 2006–2010, then one award again during 2011–2015, when there was an average of 47 awards (±3) available in each of these 5-year periods. These results suggest that the fluctuation in the number and proportion of awards received by women in computer science is a result of variables other than the count and proportion of female professors and the number of available awards in the field.

In engineering, women have received very few of the highly prestigious awards in the field. However, their share was relatively in line with their numbers among engineers and engineering professors. For example, during 2006–2010, women received only two (or 3% of all 64) awards presented in this period, but this was at a time when women constituted only 5% of all professors. During 2011–2016, women received 7% of all awards in engineering while making up 7% of all professors. In short, the number of highly prestigious research awards women are expected to receive in engineering is relatively driven by their numbers among full professors in the field.

In mathematics, the number and proportion of awards received by women increased steadily over the years; however, their share remained considerably below the number of awards they are eligible for considering the number of female professors in the field. At the rate of awards received during 2016–2020 and considering their numbers among professors, women would need to increase their share of awards in mathematics by 89% (or go up from 9% to 17% share) to achieve parity with men. In the physical sciences, the number and proportion of awards received by women grew consistently after 2001–2005 and by 2016–2020 there was no longer a gap between men and women; it remains to be seen whether women will maintain their relative share of awards in the field.

In the social and behavioral sciences, women's share of highly prestigious awards ranged from 12% to 15% from 2001 to 2015 only to jump to 33% (or 43 of all 132) awards given during the 2016–2020 period; this sudden substantial increase was largely a result of five awards that women received 19 times (out of a total of 37) during 2016–2020 in comparison to seven times (out of a total of 75) during the previous 15 years: the Berggruen Prize for Philosophy and Culture (first awarded in 2016), Dan David Prize (2002–), Holberg Prize (2004–), John von Neumann Award (2001–), and the John W. Kluge Prize for Achievement in the Study of Humanity (2003–). Apart from the Berggruen Prize, which started in 2016 and conferred its prize on women three out of five times through 2020, we could not find any information on the websites of the other four awards or in the literature that could explain the reasons for the shift in the number and percentage of awards going to women.

Geographically, from 2001 to 2020, women affiliated with institutions located in the United States received nearly twice as many awards (n = 272) as their counterparts in other high-income countries (n = 140) and considerably more than the rest of the world (n = 15) (Figure 4). During these 20 years, women in the United States always received a higher proportion of all awards received by scientists affiliated with institutions located in the country compared to women in other high-income countries; however, women in the latter group substantially increased their share of all awards in their respective countries during 2016–2020, bringing them closer to achieving parity with their women colleagues in the United States (Heinze, Jappe, & Pithan, 2019). Although women in the rest of the world enjoyed a better success rate during 2016–2020 compared to women in the United States and other high-income countries (21% vs. 18% and 17%, respectively), they received only nine of the 187 awards given to women worldwide during these 5 years. Overall, as mentioned earlier,

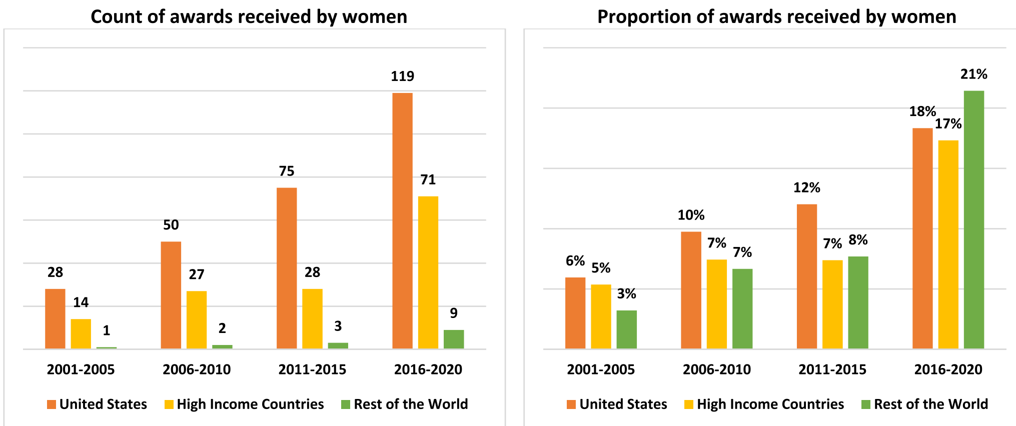

Figure 4. Count and proportion of awards received by women (by country/country groups).

women everywhere continue to face the challenge of achieving parity with men that is comparable with their numbers within the elite scientific community.

To determine whether women received their awards under similar conditions as men, we compared their research records from 1996 to 2020. Our results—summarized in Table 1—showed great similarities between men and women in terms of the average number of journal articles per author, the average number of authors per article, work in large research groups, the proportion of articles in top 10% and top 25% journals, citations per article, and proportion of publications with international collaboration (i.e., papers coauthored with individuals affiliated with institutions in another country). The only notable difference between male and female award recipients was in international mobility (proportion of authors changing their primary affiliation from one institution in one country to another institution in another country). The results show that only 11% of the female award recipients had changed their primary affiliations

Table 1. Summary of scientific output of award recipients, 1996–2020

	Men	Women	Gap
Average number of articles per year per award recipient	5.2	4.6	13%
Average number of coauthors per article*	7.0	7.5	−7%
Articles with more than 30 coauthors	3.2%	3.6%	−11%
Articles with more than 100 coauthors	1.4%	1.7%	−18%
Articles in top 25% journals per CiteScore (world av. = 50%)	86%	88%	−2%
Articles in top 10% journals per CiteScore (world av. = 27%)	63%	64%	−2%
Single-author articles	6%	6%	0%
Citations per article (world av. = 21)	112	108	4%
International collaboration (world av. = 19%)	45%	44%	2%
International mobility	15%	11%	36%

* Among articles with fewer than 100 coauthors.

Table 2. Average age of professors and award recipients at the time of receiving the award

	Average age of professors			Average age of award recipients		
	Men	Women	Difference	Men	Women	Difference
2001–2005	55.6	53.8	−1.8	63.6	65.5	+1.9
2006–2010	56.4	54.8	−1.6	64.0	62.0	−2.0
2011–2015	57.0	56.4	−0.6	65.4	60.0	−5.4
2016–2020	57.6	57.0	−0.6	66.7	63.0	−3.7
2001–2020	56.7	55.5	−1.2	65.0	62.3	−2.7

For this table, we used the average age of male and female professors in Canada as a proxy for the world (Statistics Canada, 2021).

from one country to another compared to 15% among men[11]. To determine whether the difference between 11% and 15% is statistically significant, we performed an independent samples *t* test. Our results showed no significant difference in the average number of awards received by the 29 internationally mobile female scientists (M = 1.6, SD = 2.61) compared to the 307 internationally mobile male scientists (M = 1.5, SD = 1.24); t = 2.048, p = 0.756. These results suggest that international mobility has a negligible impact on the number of awards received by elite scientists. We further verified this outcome by comparing the population of internationally mobile award recipients with noninternationally mobile award recipients. Here, too, our results showed no significant difference in the average number of awards received by the 336 internationally mobile scientists (M = 1.50, SD = 1.40) versus the 1,937 noninternationally mobile scientists (M = 1.5, SD = 1.21); t = 1.965, p = 0.767 (see also Netz, Hampel, & Aman, 2020).

To determine whether the gender gap in awards may be explained by the age gap between male and female professors, we examined their average ages during 2001–2020. Because we do not have access to the average age of male and female professors in the United States, we used those of Canada as a proxy for the world (Statistics Canada, 2021). The results show that the difference in the average age between male and female professors has decreased from 1.8 years during 2001–2005 to only 0.6 years during 2016–2020. For the average age of award recipients at the time of receiving the awards, the results show fluctuations from one 5-year period to another. Overall, men received their highly prestigious awards at an average age of 65.0 compared to 62.3 for women (see Table 2 for more details)[12]. These results suggest that female professors are not only, on average, younger than their male counterparts, but they receive highly prestigious awards at a younger age, too. The increase in the average age of female professors (moving from 53.8 during 2001–2005 to 57.0 during 2016–2020) may have been a factor in the increase in the number and proportion of awards they received as we progress in time during 2001–2020; however, this suggestion could not be verified from our data. Note here that the average age of male professors also increased over time, yet men received fewer awards as time progressed: The share of awards received by men declined from 89% during 2011–2015 to 81% during 2016–2020 and the count of awards from 844 to 814 during the same period (see Figures 2 and 3).

[11] Approximately 45% of the internationally mobile award recipients left the United States for other countries (or returned to their countries after residing in the United States for several years) and 55% of the award recipients left their countries or returned to the United States after spending several years abroad.

[12] The average ages of men and women when receiving the Nobel Prize is 71 for chemistry, 67 for economics, 68 for physics, and 68 for physiology or medicine during 2010–2019 (Bjørk, 2019).

4. DISCUSSION AND CONCLUSION

As in other areas in academia (e.g., grants, research productivity, length of research careers, salaries, progress through senior and leadership positions, and senior authorship positions), the gender gap in highly prestigious awards is a result of numerous factors. While this study did not specifically address the causes of the gender gap in awards, it should be emphasized that the number of female professors was very low in the past, when they were competing for highly prestigious awards, reflecting "demographic inertia" (Shaw & Stanton, 2012; Silver, Bank et al., 2018). In the early 1990s, only 7,000 (or 10%) of all professors in science and engineering in the United States were women, increasing to 16,000 (or 18%) during 2001–2005 and 29,400 (or 28%) during 2016–2020 (Figure 3). Male professors, on the other hand, increased by a mere 1,300 over the past 20 years (from 75,300 during 2001–2005 to 76,600 during 2016–2020). So, as time was passing, many more women were competing and receiving highly prestigious awards, a trend that will continue in the future until the increase in professor positions reaches equilibrium between men and women, where both are expected to compete for awards on equal footing. It should be emphasized here that while the proportion of female professors increased by 56% from the period 2001–2005 to 2016–2020 (going up from 18% to 28%, respectively), their share of highly prestigious awards more than tripled (going up from 6% to 19%). Similarly, while the number of awards to men and women increased by 44% in total (going up from 693 to 1,001), women's share more than quadrupled—increasing from 41 during 2001–2005 to 187 during 2016–2020. Given the increasing number of female professors in all fields, their increasing recognition by peers, and perhaps their increasing age, one could conclude that it is just a matter of time for women to close the gap with men in highly prestigious awards.

Demographic inertia, however, can only partly explain the present gender gap in research awards, as evidenced by the field of computer science, where despite the significant increase of female professors in the field, their share of awards fluctuated considerably from one period to another. Charlesworth and Banaji (2019) and Lincoln et al. (2012) highlight the role of explicit and implicit biases in the assessment of otherwise similar careers, indicating that women tend to get less recognition than men for similar performance and record. Holmes et al. (2020) pointed at women's underrepresentation on selection committees as an additional cause for receiving fewer awards than they duly deserve. The World Economic Forum (2020) emphasizes the lack of effective efforts and initiatives as reasons for gender inequities overall (and by extension awards). The data in this study raise questions that may support these findings and claims. For example, why as recently as 2016–2020, were over one-third (or 49 of the 141) of the awards examined in this study never received by women, even though the data suggest the presence of many qualified women (see Figure 1 and Table 1)? Holmes et al. (2020) and Silver et al. (2018) emphasized problems in the process rather than qualifications, questioning the methods used in selecting awardees, selection committee structures, and the supervision and training provided to selection committee members. The U.S. National Academies of Science, Engineering, and Medicine years ago concluded that the deficit of women in science and technology is not because too few women enter the field or because women are less committed to their careers, but rather because assumptions and stereotypes about gender operate in personal interactions, evaluative processes and departmental cultures that systematically impede women's career advancement in academic medicine, science, and engineering (Institute of Medicine, 2007). A telling example comes from the Nobel Prizes. Despite the many calls for gender equality within the scientific community over the past decades, until 2020 less than 12% of all Nobel Prizes in chemistry, economics, physiology/medicine, and physics have gone to women—this holds whether we examine the 2016–2020 period or the previous 115 years (see the Nobel Prize website and Lunnemann et al., 2019).

Lincoln et al. (2012), Cadwalader et al. (2014), and Holmes et al. (2020) have identified several methods to alleviate the gender gap and reduce gender bias in research awards. They mentioned that while implicit bias is difficult to eliminate, members of the scientific community should become aware of these biases to reduce their impact on evaluation. They additionally recommended providing implicit bias training, that selection committees focus on the criteria for the awards (rather than nonpertinent, often personal, information), that award committees be more diverse, and that awarding institutions regularly evaluate and revise their nomination process and procedures as well as the selection criteria and mechanisms. Where possible, names and gender identity information should be removed from or avoided in application and nomination packets to ensure a fair evaluation. These changes would give women a better chance of having their work evaluated based on its merits rather than the gender of the author.

Improving our understanding and addressing the causes of gender disparities in awards is crucial to bring often-biased behaviors and decisions in line with values of equality and fairness (Charlesworth & Banaji, 2019). Ensuring the full participation and recognition of the highest-quality award candidates (men and women in high-, middle-, and low-income countries) guarantees improvement in research and innovation that ultimately improves societies (Andersen, Schneider et al., 2019; Chan & Torgler, 2020; Cheryan, Ziegler et al., 2017; Holman et al., 2018; Huang et al., 2020; Nielsen, 2017).

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COMPETING INTERESTS

The author has no competing interests.

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DATA AVAILABILITY

https://scholarworks.aub.edu.lb/handle/10938/22921.

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