RESEARCH

For a Place at the 'High-Table': The Compelling Case of Indian Women in Science

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DIALOGUE
Science, Scientists, and Society

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Abstract

Much of the existing literature on women in science in India tends to highlight the 'absence' of women, while that is no longer the case. Based on an extensive review of the available evidence, the paper reflects that the number of women in science has been steadily growing, though with significant variations across disciplines. Using Biological Sciences as a reference point, the paper highlights the fact that even when women grow in numbers and begin to knock at the doors of positions in the scientific establishment, they continue to find recalcitrant gatekeepers. Underlying gender frames thus persist and shape the structures of scientific organizations. The paper contends that introducing 'pro-women' affirmative policies without working to alter the existing organizational normative and mindscapes could, in fact, be counter-productive.

Keywords. Gender; Women in Science; Hiring in Science; affirmative action; Indian scientific research and education; Indian scientific research institutions

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As per the World Economic Forum report of 2017, among the 144 countries surveyed, India ranked an abysmal 108 in the global gender gap, dropping from a not-so-impressive 87th rank in the previous year. India was also ranked at an unseemly 141 in health and survival rates and a poor 139 in economic opportunities.[1] Even in terms of education, it was ranked only at 112.

Not surprisingly, the gender gap for women in scientific research is also significantly wide. As per the UNESCO Institute for Statistics (2017),[2] even as the number of personnel engaged in scientific research increased by a healthy 37.8%, the per cent of women researchers dropped marginally, from 14.3% in 2010 to 13.9% in 2015.

The Indian middle-class might wish to connect these numbers to the 'other' India, the marginal and the poor, living in rural hinterlands and urban slums. But, what do these numbers mean to the Indian science community, or the socio-economic middle class and the educated segments? Is the presence of women in Indian scientific research and education truly a cause for concern? If so, is this in any way linked to their access or lack of it to higher education or research training in the Sciences, or do they reflect attrition rates? Are there areas or disciplines where women have better representation and is there a reason for this? Are there structural issues that prevent women from equal participation in scientific research? Are the recognitions commensurate with the women's presence in the science research community? Based on the available primary and secondary sources on the subject, this paper attempts to examine some of these questions.

A brief history and the present context

Soon after India's independence, the Government of India set up a University Education Commission (1948) to examine among other things, 'The aims and objects of university education and research in India.'[3] The emphasis on education as a means for social transformation for the newly formed nation was clear. The Commission in its Report submitted in 1950 had an entire section dedicated to Women's Education.[3] It identified "some fields of work peculiarly appropriate to women…(to) indicate directions which women's education might well take in Indian colleges and universities" as part of its recommendations. These special fields identified were Home Economics, Nursing, Teaching and the Fine Arts. The report espouses more lofty ideals in the introduction to this section, such as:

We have heard frequent suggestions that women's education should run to pretty "accomplishments," such as drawing, painting or the like-skills which will enable well-to-do women to pass the time harmlessly while their husbands do the really important work. This point of view should be obsolete. Women should share with men the life and thought and interests of the times. They are fitted to carry the same academic work as men, with no less thoroughness and

[1] http://www3.weforum.org/docs/WEF_GGGR_2017.pdf
[2] http://uis.unesco.org/en/topic/women-science
[3] http://www.educationforallinindia.com/1949%20Report%20of%20the%20University%20Education%20Commission.pdf(Chapter XII).

quality. The distribution of general ability among women is approximately the same as among men.[4] (The Report of the University Education Commission, 1950, Chapter XII p. 343–344)

However, the thrust during this period was clearly not towards generating competent women scientists. This was also reflected in the enrolments to various courses in those early years. It was only in 1961–62, with the recommendations of the Hansa Mehta Committee (appointed by the National Council for Women's Education) on 'differentiation of curricula for girls and boys,' that the issue of 'common curricula' began to be seriously discussed. The Kothari Commission (1964–66)[5] went a step further, urging that women too should be actively encouraged to study the Sciences.

This is not to suggest that women did not have any presence in higher education or science education in India until this point. A number of studies have examined the history of Indian women in modern scientific research in India starting right from the colonial period. Many of the studies have provided not only excellent biographies detailing the individual struggles of women scientists but have also provided the socio-political milieu of the times. Many of these women, such as Kamala Sohonie, Asima Chatterjee or Janaki Ammal were trailblazers, often breaking the double barrier of caste and gender to venture into laboratories and work under extremely restrictive or even harsh conditions (Sur 2001; Damodaran 2017). However, since the inclusion of women was not an explicit state policy until this point; those who did make it were fighting a much larger battle. For instance, Kamal Sohonie became the first woman to earn a PhD degree in Science (Biochemistry)[6] (Sur 2001). Despite having topped her batch in graduation, she was denied admission to the Indian Institute of Science in Bangalore by none other than the Nobel laureate, C. V. Raman. When Raman did finally relent, he set out stringent and humiliating conditions to her entry: That she would not be considered a regular student for the first year; that she would work whenever her guide asked her to, irrespective of the time of the day, and that she would make sure that her presence did not distract other students. Thus, those who did make it did so under very special circumstances. However, this paper is not about these early achievers, many of whom even refused to acknowledge their own marginalization or refused to see it as gender discrimination.[7] It is not a historical, biographical or even a semi-autobiographical narrative describing the challenges faced by individual women scientists during the course of their journey (for biographical accounts of women scientists in the present day context, see Ramdorai 2017; Vaidya 2017; Dogra and Jayraj 2016; and the TLOS website).[8]

With independence from colonial rule and the adoption of a new Constitution that guaranteed citizenship based on equality to all its citizens, the terms of the game had been fundamentally altered. The Hansa Mehta committee and the Kothari commissions' reports, in this context,

[4] The Report of the University Education Commission, 1950, Chapter XII p.343-344.
[5] https://archive.org/stream/ReportOfTheEducationCommission1964-66D.S.KothariReport/48.Jp-ReportOfTheEducationCommission1964-66d.s.kothari_djvu.txt
[6] https://indianculturalforum.in/2018/07/27/dr-kamala-sohonie-entry-of-women-to-the-indian-institute-of-science/as on 05 Feb 2019
[7] For a more detailed discussion on the caste-class location and gender politics of women scientists of this era see Sur 2001; Damodaran 2017
[8] https://thelifeofscience.com/

laid the grounds for levelling the playing field by recommending common curricula and proposing that women be actively encouraged to study modern Mathematics and the Sciences. How far have we travelled down this road and where does the horizon lie?

A lot has changed since the early days, as this paper attempts to show. Nevertheless, gaps between intentions and actions continue to exist even today. For instance, leading universities/colleges, continue to make the Arts and Humanities more 'accessible' to women than the Sciences at the undergraduate level. Let's consider the example of Delhi University (DU). The university offers undergraduate programs in Sociology and Psychology almost exclusively in 'women-only' colleges affiliated to it, while offering undergraduate programs in Physics in only 5 of the 22 such colleges. In Mumbai, of the many women's colleges available, few offer an undergraduate program in the basic Sciences. Several offer courses in Psychology as well as Sociology. In Chennai, several degree colleges for women offer courses with different combinations of the basic Sciences. Some colleges offer only Mathematics in the science stream (although, it must be said that this subject has somewhat of a double life, and a B. A. degree in Mathematics can be achieved as much as a B.Sc. in Mathematics) along with Psychology and Sociology. Delhi, Mumbai and Chennai have Home Science courses mostly in women's colleges. Exclusive women's colleges for Home Science exist too. This is also true for Nursing and Education, which have also traditionally been seen as 'suitable' for women.

Again, let us consider the issue of discriminatory college/hostel rules and timings that most women students routinely must abide by in colleges and universities across the country. These rules and practices, in the name of women's safety, routinely trample on their rights of equal access to libraries, laboratories, lectures, public spaces and transport. The Jayoti Vidyapeeth Women's University, established by the Government of Rajasthan as recently as 2008, has several strictures laid down for students into its 'Hostel Life' page on its website.[9] This includes constant monitoring of students' movements in and out of campus along with notifications to parents/guardians as well as punitive action if found using a mobile phone or other such devices that possess a SIM card or could connect to the internet. Banasthali Vidyapith, as a rule, does not permit married women to apply for any of its programs, except under 'exceptional circumstances' to its post-graduate programs.[10] Sri Padmavati Mahila Visvavidyalayam at Tirupati, established by the Government of Andhra Pradesh in 1983, informs students that they are expected to wear 'clean and decent dress approved by the Dean'. They are also debarred from organizing any 'meetings for criticizing the policies and actions of the university or college authorities'.[11] In fact, one such case, that of the Mahila Maha Vidyalaya at the Benaras Hindu University (BHU), has even reached the Supreme Court. As per the petition,[12] the hostel regulations do not permit women/residents, to go out after 8 pm, even to attend a program or to use the library within the BHU campus. The hostel regulations also do not permit girls to make/receive telephone/mobile phone calls after 10 pm; free Wi-Fi and Internet in their hostel rooms are not provided either. None of these rules apply to the male students in the hostels in the BHU campus.

[9] https://www.jvwu.ac.in/index.html Accessed on 05 February 2019

Table I Enrolment of students in Masters programs of Physical Sciences and Biological Sciences in 2015–16. The list is only representative and not exhaustive. (Source: AISHE report 2015-16)[16]

SUBJECTS	**M. Sc.**				
	2015–16				
Physical Sciences	**Male**	**Female**	**Total**	**% of Male**	**% of Female**
Mathematics	50081	79523	129604	38.64	61.36
Physics	25540	35349	60889	41.95	58.05
Chemistry	44651	55237	99888	44.70	55.30
Statistics	3691	4618	8309	44.42	55.58
Geo-Physics	633	359	992	63.81	36.19
Electronics	2640	2055	4695	56.23	43.77
Geology	3518	2079	5597	62.86	37.14
Biological Sciences	**Male**	**Female**	**Total**	**% of Male**	**% of Female**
Zoology	13811	27214	41025	33.66	66.34
Botany	12021	24715	36736	32.72	67.28
Biochemistry	2137	4447	6584	32.46	67.54
Biotechnology	4579	9955	14534	31.51	68.49
Microbiology	3457	8607	12064	28.66	71.34
Life Science	2460	4633	7093	34.68	65.32
Genetics	351	487	838	41.89	58.11
Bio-Science	1650	2950	4600	35.87	64.13

Given these circumstances, when we come across newspaper reports that say 'Women outnumber men for PG, M.Phil. courses,'[13] it is certainly worth sitting up and taking note. That this is not only the case in the Social Sciences and Humanities but also in the basic Sciences[14] is worth appreciating. In fact, the number of women per 100 men in M.Sc. courses has risen steadily from 80.1 in 2000–2001 (Manpower profile yearbook 2000–2001) to 113 in 2011–12[15] and further to 157 in 2015–16 (as per the online All India Survey on Higher Education (AISHE), Ministry of Human Resource Development, Government of India initiative; AISHE 2011–12; AISHE 2015–16).[16] These trends persist even when we examine the data across

[10] http://www.banasthali.org/banasthali/admissions/campus.html as accessed on 5th Feb 2019
[11] http://www.spmvv.ac.in/international.html as accessed on 05 Feb 2019
[12] http://www.livelaw.in/gender-discriminatory-hostel-rules-bhu-sc-lens/
[16] http://aishe.nic.in/aishe/reports

disciplines. To comprehend the numbers involved, Table I shows the enrollment of students in Masters programs of the Physical Sciences in comparison to the Biological Sciences across disciplines for the academic year 2015–16. As per the table, women outnumbered men by a significant margin in several disciplines at the post-graduate level. This included not only disciplines related to the Biological Sciences (Zoology, Botany, Genetics, Bio-Science, Life Sciences, Biochemistry, Microbiology and Biotechnology), but also the Physical Sciences (Mathematics, Physics, Chemistry, Statistics, Electronics Geology and Geo-Physics) (Table I). Clearly, advanced level courses in the Physical Sciences are no longer considered out-of-bounds by women despite the many impediments that persist along the way.

Nevertheless, a more careful reading of the data shows that the fraction of women enrolling in the Biological Science disciplines is considerably higher than those enrolling in the Physical Sciences, lending credence to the general perception that women tend to prefer Biological Science related disciplines over the more mathematically oriented science subjects such as Physics or Chemistry.

Let's look at more data to understand the issue further. Enrolment data, as well as pass-out data against each gender for 2015–16 in Physical Sciences disciplines as a whole was collated and compared with that for the Biological Sciences as a group at the post-graduate and higher levels (Table II). Once again, women outnumbered men by a significant margin at the Masters level. When it comes to enrolment for research programs, however, the gender gap persists in the Physical Sciences (Table II). It must be noted that the numbers enrolling for research programs are a very small fraction (one-twentieth to one-tenth) of those who pass out of Masters programs. Thus, theoretically, the available pool of trained candidates is 10–20 times the number of seats being offered. Nevertheless, in M.Phil. and PhD programs as per the AISHE data for 2015–16, there were only ~37% female students to 63% male students in the Physical Sciences disciplines.

In 2011–12, while specific disciplines saw greater gender gaps, on an average approximately 41% of the total students enrolled for an M.Phil. and 33% of those enrolled for a PhD in the Physical Sciences were women. In Biological Sciences disciplines, on the other hand, the gender gap in enrolments has already been reversed: roughly 53% of female students to 47% male students enrolled in M Phil programs and 54% female to 43% male students enrolled in

[13] The Indian Express, December 28, 2015

[14] Science here refers to both basic and applied science courses with the exclusion of courses in Engineering and Technology as well as Medicine.

[15] Although these reports are available from 2010-11 onwards, the year 2011-12 has been chosen to compare with 2015-16 since the percentage of responses from higher education institutions in these two years is comparable.

PhD programs in 2015–16. This was also the case in 2011–12 when approximately 60% of those enrolled for M Phil or PhD programs in the Biological Sciences were women.

Table II Enrolment and pass-out of female students per 100 students in Physical Sciences and Biological Sciences in 2011–12 and 2015–16. Physical Sciences include Mathematics, Physics, Chemistry, Statistics, Electronics, Geology and Geo-Physics while Biological Sciences include Botany, Zoology, Genetics, Bio-Science, Life Science, Biochemistry, Microbiology and Biotechnology. (Source: AISHE reports)[16]

	M. Sc.				M. Phil.				Ph. D.			
	2011-12		2015-16		2011-12		2015-16		2011-12		2015-16	
	Enrol. (%)	Pass-out (%)	Enrol. (%)	Pass-out (%)	Enrol. (%)	Pass-out (%)	Enrol. (%)	Pass-out (%)	Enrol. (%)	Pass-out (%)	Enrol. (%)	Pass-out (%)
Phys. Sci.	50.5	47.4	57.8	56.6	41	54.9	37	55.3	33	33.3	37	29.9
Bio. Sci.	61.3	62.2	67.2	66.7	60	63.6	53	66.44	60	40.7	54	45.8

The greater enrolment numbers also result in more women receiving doctoral degrees as compared to earlier. While data for specific batches of students are not available at the AISHE websites,[9] there is pass-out data available for different years, starting from 2010–11 onwards. In the Biological Sciences, roughly 41% of all the doctorate degrees awarded in 2011–12 went to women (Table II). In 2015–16, roughly 46% of all doctorates awarded in the Biological Sciences went to women (Table II). Not surprisingly, the gender gaps were much larger in the Physical Sciences. In 2011–12, 67% of the doctorates conferred in the Physical Sciences were to men and only 33% were to women on an average. In 2015–16, 70% of those with doctorates in the Physical Sciences were male and 30% were female on an average.

Women employed in research and teaching

Given the narrowing gender gap in doctorates in Biological Sciences, it seemed worth examining how they fared in employment. Statistics regarding faculty recruitment in the Biological Sciences departments across the Indian central universities and research institutes were examined. The choice of the three central universities here was deliberate since they are ‘research universities’ where a significant proportion of faculty are actively involved in scientific research. These universities also have externally-funded research projects, and participate almost exclusively in teaching at the Masters or M.Phil./PhD levels. In fact, PhD programs are a major focus of these universities. Research institutes offer either integrated Masters/PhD programs or PhD programs alone but are mandated to provide classroom

lectures/courses within these programs. Nevertheless, those familiar with the scientific research funding scene in India would be quick to see that here too lies a clear hierarchy, with the research institutes having significantly better infrastructure and being considerably better funded (Poonacha 2005). Thus, the two categories of institutions could provide us with an interesting set of comparisons. The gender ratios in the Biological Sciences-related departments until early 2018 in following institutions were estimated using the available data from their respective websites:

- In JNU,[17] School of Life Sciences (SLS), School of Biotechnology (SBT), Special Centre of Molecular Medicine (SCMM) were included; in HCU,[18] the School of Life Sciences includes Departments of Biochemistry (Biochem.), Plant Sciences (Plant Sci.), Animal Biology (Animal Bio.), Biotechnology and Bioinformatics (Biotech.); in DU,[19] Departments of Biochemistry (Biochem.), Biophysics (Biophys.), Microbiology (Microbiol.), Genetics (Gen.) and Plant Molecular Biology (PMB) were included.
- Indian Institute of Science Education and Research (IISERs)[20] at Pune, Kolkata, Trivandrum and Mohali (School/Department of Biology). Each IISER is autonomous and can award its own degrees as per the NIT Act of 2010, passed by the Indian Parliament.
- Indian Institute of Science (IISc) (Department of Biochemistry (Biochem.),[21] Molecular Biophysics Unit (MBU),[22] Molecular Reproduction, Development and Genetics (MRDG),[23] Department of Microbiology and Cell Biology (MCB)[24] at Bengaluru. IISc is a deemed university as per the UGC Act.
- The Council for Scientific and Industrial Research (CSIR) was the very first of its kind institution, created as an autonomous body for the sole purpose of accelerating research and development in the country. CSIR institutes were at one time expected to be affiliated to universities to award PhD degrees to their students. They are now affiliated to the Academy for Scientific and Innovative Research (AcSIR), created in 2010 by the legislation in the Indian Parliament to award degrees. Research institutes funded by CSIR considered for this study were Indian Institute of Chemical Biology (IICB)[25] at Kolkata, Indian Institute of Microbial Technology (IMTech)[26] at Chandigarh, Centre for Cellular and Molecular Biology (CCMB)[27] at Hyderabad, National Botanical Research Institute (NBRI)[28] at Lucknow and Institute of Genomics and Integrative Biology (IGIB)[29] at Delhi.
- Research institutes funded by DBT considered for this study are National Institute of Immunology (NII)[30] located in Delhi, National Brain Research Institute (NBRC)[31] at Manesar, Haryana). NII is affiliated to JNU for the purpose of awarding degrees, while NBRC is a deemed university.
- Department of Biological Sciences, Tata Institute of Fundamental Research (TIFR)[32] located in Mumbai, and National Centre for Biological Sciences (NCBS),[33] a part of TIFR located in Bengaluru (inStem and CCAMP faculty are not included in this analysis), whose parent body is the Department of Atomic Energy (DAE). TIFR is also considered a deemed university and can award its own degrees.

As can be seen from Table III and Fig 1 below, apart from TIFR and NCBS, the fraction of women in these institutions did not exceed 30%. There are roughly 27% women and 73% men at scientist/faculty level positions in these institutions.

Table III Faculty hiring in Biological Sciences departments/institutes in India. The data collated was taken from individual websites. [17-33]

Institution	Male	Female	% Female
IISc (Biochem. + MCB + MRDG + MBU)	51	12	19.4
IISERs (Biological Sciences)	67	21	23.9
JNU (SLS + SBT + SCMM)	45	16	26.2
DU (Biochem. + Biophys. + Microbiol.+ Gen. + PMB)	28	11	28.2
HCU (School of Life Sciences)	42	15	26.3
CSIR labs (IICB + IMTech + CCMB + NBRI + IGIB)	200	52	20.6
NII (DBT)	25	8	24.2
NBRC (DBT)	12	3	20.0
TIFR (Biological Sciences) (DAE)	5	5	50.0
NCBS (DAE)	23	11	32.3

[17] https://www.jnu.ac.in/node#school_center; and the specific webpages of Schools/Centres thereafter; accessed February 2018
[18] http://www.uohyd.ac.in/index.php/academics/2011-10-27-18-38-04/school-of-life-sciences; accessed February 2018
[19] http://www.du.ac.in/du/index.php?page=list-of-departments and the specific departmental webpages thereafter; accessed February 2018
[20] http://www.iiserpune.ac.in/research/disciplines/biology; http://bio.iiserkol.ac.in/?page_id=1949; http://biology.iisertvm.ac.in/index.php/people/faculty-members/; http://14.139.227.202/dept/dbs/?page_id=40; and the webpages of individual faculty; accessed February 2018
[21] http://biochem.iisc.ernet.in/group_leaders.php and webpages of individual faculty; accessed February 2018
[22] http://mbu.iisc.ac.in/people.htm; https://www.iisc.ac.in/wp-content/uploads/2018/04/IISc_Directory_Planner_2017-2018-Faculty-updated.pdf; accessed February 2018
[23] http://www.mrdg.iisc.ernet.in/people/faculty/; and linked webpages of individual faculty; accessed February 2018
[24] http://mcbl.iisc.ac.in/Faculty-Staff.html; accessed February 2018; accessed February 2018
[25] http://iicb.res.in/faculty-directory/; and the linked webpages of the individual faculty thereafter for their designations; accessed February 2018
[26] https://www.imtech.res.in/research/scientists; and the linked webpages of the individual scientists; accessed February 2018
[27] http://www.ccmb.res.in/index.php?view=researchgroups&mid=0&id=19; and the linked webpage of the research groups accessed February 2018
[28] http://www.nbri.res.in/staff.php#.W2-qHdgzb-Y; and webpages of research groups; accessed February 2018
[29] https://www.igib.res.in/?q=node/22; and the linked webpages of individual scientists; accessed February 2018
[30] http://www.nii.res.in/people/scientific-staff-core-infrastructure-scientists; and the webpages of individual scientists; accessed 08 February 2019.
[31] http://www.nbrc.ac.in/newweb/people/faculty; and http://www.nbrc.ac.in/newweb/wp-content/uploads/2018/12/Annual-Report_17-18.pdf Accessed on 08 Feb 2019.
[32] http://www.tifr.res.in/~dbs/faculty.html; and webpages of individual faculty. Accessed on 05 Feb 2019.
[33] https://www.ncbs.res.in/faculty; https://www.ncbs.res.in/telephone-directory; Accessed on 05 Feb 2019.

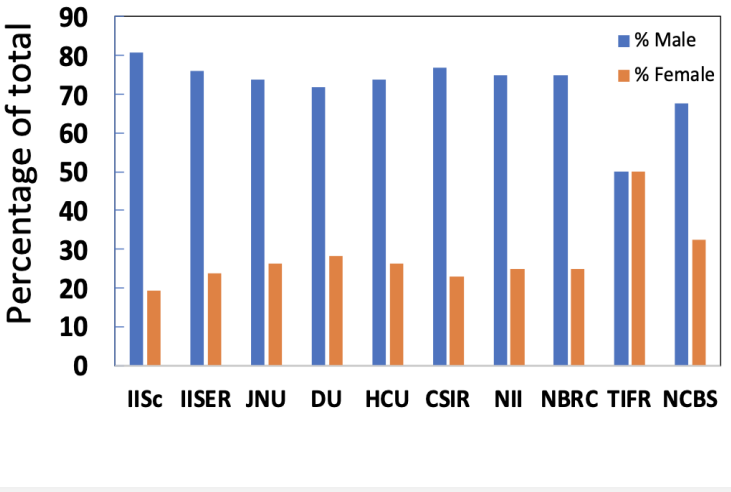

Fig 1 Faculty appointments in Biological Sciences institutes or Biological Sciences departments in different academic institutions in India. The data plotted is based on numbers in Table II and is taken from individual websites.[17-33]

It was important to understand whether there were specific positions at the employment level where the skew varied. Accordingly, an analysis vis-à-vis institutions/departments at different levels of the hierarchy was also done. Given that the enrolments and outcomes have improved over the years, it is expected to be reflected at least at the entry level hiring, even if greater gender gaps appear at senior positions. In the case of CSIR institutes, this implies that we should see less of a skew at Senior Scientist (Sr. Sci.) and Scientist (Sci.) positions as compared to that at the Senior Principal Scientist (Sr. Princi. Sci.) or Chief Scientist (Chief Sci.) positions. J. C. Bose Fellows are generally senior scientists too and may include retired scientists. Since this is a fellowship, not all institutes have them. Emeritus Professors are also retired senior faculty and they are not present in every institute. The DBT-Wellcome Early Career Fellowships (ECF), DST-Inspire, etc. are also fellowships with a fixed tenure and do not represent regular employment. I will return to these fellowships later in this paper.

As can be seen from Fig 2 and Table IV, the presence of women is uniformly low at all levels of the hierarchy in CSIR institutes. Even at the entry-level positions of Scientist or Senior Scientist, their representation remains below 30%.

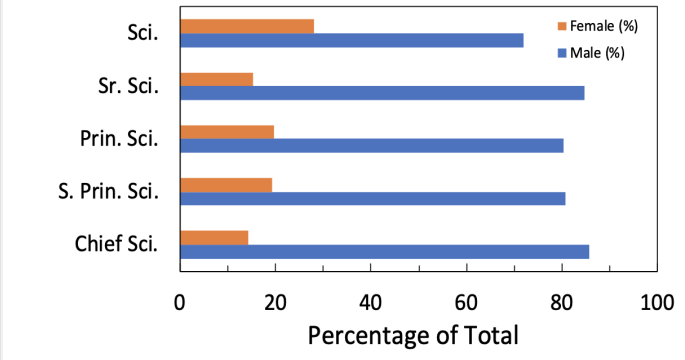

Fig 2 Post-wise combined data of the percentage of male and female scientists in CSIR labs.

Table IV Gender-wise data of scientists in CSIR labs. M: Male; F: Female

POSTS	CSIR Institutes										Total		F (% of Total)
	IICB		IMTech		CCMB		NBRI		IGIB		M	F	
	M	F	M	F	M	F	M	F	M	F			
Chief Sci.	2	0	7	0	5	3	3	0	1	0	18	3	14.3
S. Prin. Sci.	3	2	4	1	7	2	10	1	1	0	25	6	19.4
Prin. Sci.	13	5	11	1	12	5	16	2	1	0	53	13	19.7
Sr. Sci.	13	0	14	4	8	0	14	4	1	1	50	9	15.3
Sci.	2	0	10	0	1	2	6	3	35	16	54	21	28.0

Was this any different for DST/DBT funded institutions? A similar analysis for two of these institutes, NII and NBRC, are shown in Fig 3 and Table V. Again, not surprisingly, senior levels positions (Scientists VI-VII) had more male than female scientists. But Scientist IV-V levels too had a large skew in favour of men.

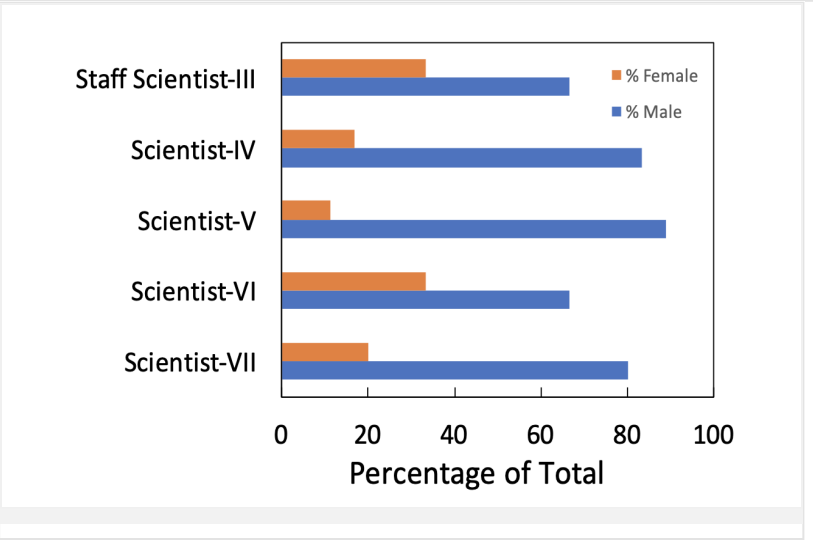

Fig 3 Post-wise hiring of scientists in NBRC and NII combined and segregated based on their gender.

Table V The gender-wise data of scientists in DST/DBT funded institutes.

POSTS	NBRC		NII		Total		F (% of Total)
	M	F	M	F	M	F	
Scientist-VII	2	0	10	3	12	3	20.0
Scientist-VI	5	3	5	2	10	5	33.3
Scientist-V	2*	0	6	1	8	1	11.1
Scientist-IV	3	0	2	1	5	1	16.7
Staff Scientist-III	-	-	2	1	2	1	33.3

Note *One is on deputation from UNESCO-MGIEP, New Delhi

As also noted earlier, the DAE sponsored TIFR and NCBS were different. They showed a clear trend of improved hiring rates for women at the entry/middle level positions (Fig 4; Table VI).

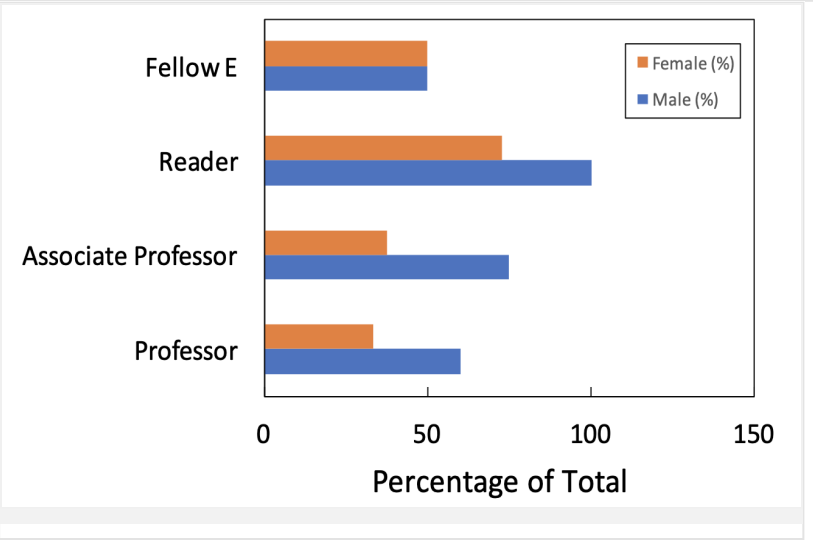

Fig 4 Gender-wise data of scientists in Biological Sciences at TIFR and NCBS combined. Professor includes Distinguished Professor (J), Senior Professor (I) and Professor (H) of NCBS. Fellows were not present in TIFR.

Table VI Gender-wise data of scientists in Biological Sciences at TIFR and NCBS

POSTS	TIFR		NCBS		Total		F (% of Total)
	M	F	M	F	M	F	
Professor	1	2	8	3	9	5	35.7
Associate Professor	1	2	5	1	6	3	33.3
Reader	2	2	9	6	11	8	42.1
Fellow E	-	-	1	1	1	1	50.0

Among institutions that offer Masters as well as PhD programs and, are therefore teaching/ research departments, is the skew any different? This is also interesting to look at, given that teaching was one of the areas initially identified as being 'suitable' for women. The following analysis includes not only the older institutes/departments like the Department of Biochemistry at IISc or the Central Universities of DU, JNU and HCU but also newer ones like IISERs. The recruitments in the new institutes, even if at the senior positions, would give us an idea of the current trends in hiring. The fact that the self-image of IISc and IISERs are those of research institutes and not that of universities is to be noted before we proceed further. Their salary structures, faculty autonomy and work ambience are very different from that of the central universities.

In IISc, women were less than 20% of the total faculty strength in departments related to Biological Sciences. As expected, the gender gap is large at the Professor and Associate Professor levels. But this is even more so at the entry-level, Assistant Professor, positions (Fig 5; Table VII).

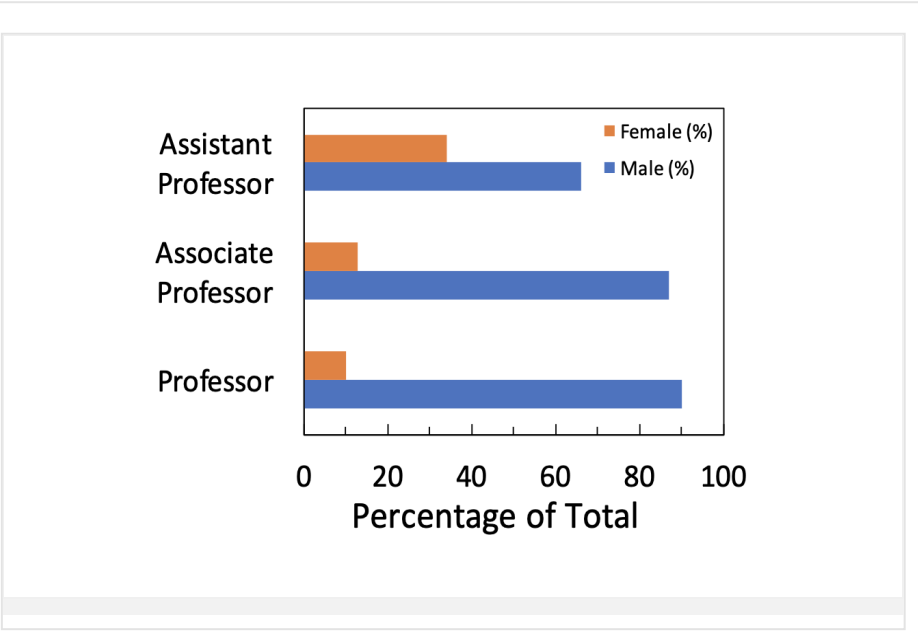

Fig 5 Post-wise hiring of faculty in Biological Science departments at IIScsegregated on the basis of gender.

In the more recently setup IISERs the number of Professors is small. IISER Kolkata had only one female Professor and no men were hired at this position (Fig 6; Table VII). The other three IISERs had only men at this level and no women. Men also dominated the Associate Professor positions in all the IISERs. The gender skew was also evident at the Assistant Professor positions across the three IISERs, except for the one at Kolkata that seemed to have a reasonable gender balance at the entry-level position.

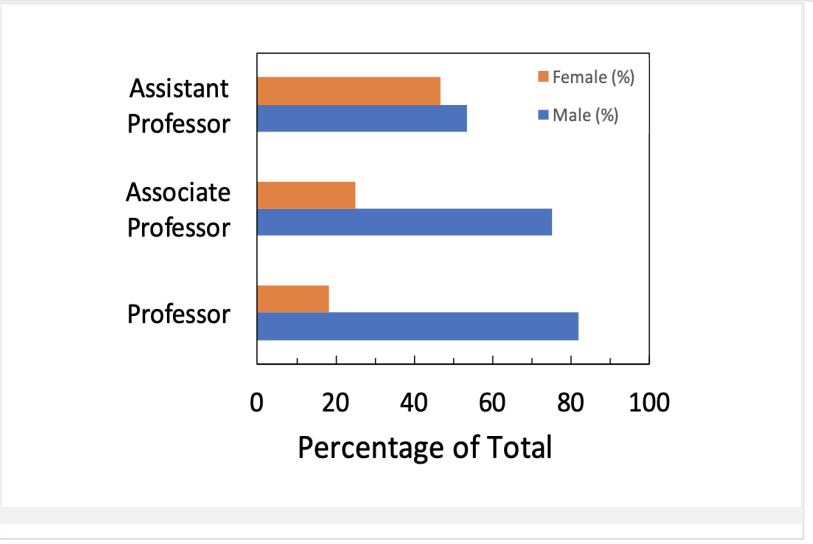

Fig 6 Post-wise data of faculty in Biological Sciences at four of the IISERs combined segregated on the basis of gender.

Table VII Gender-wise data of faculty members in Biological Sciences at four of the IISERs.

	IISER										
POSTS	Mohali		Pune		Trivandrum		Kolkata		Total		F (% of Total)
	M	F	M	F	M	F	M	F	M	F	
Professor	2	0	4	0	3	0	0	1	9	1	10.0
Associate Professor	3	0	13	2	5	1	6	1	27	4	12.9
Assistant Professor	10	6	7	3	7	1	7	6	31	16	34.0

Among the Central Universities, Professor positions in JNU were overwhelmingly skewed in favour of men (Fig 7; Table VIII). A slight skew was also evident in the Assistant Professor positions but this is much less so.

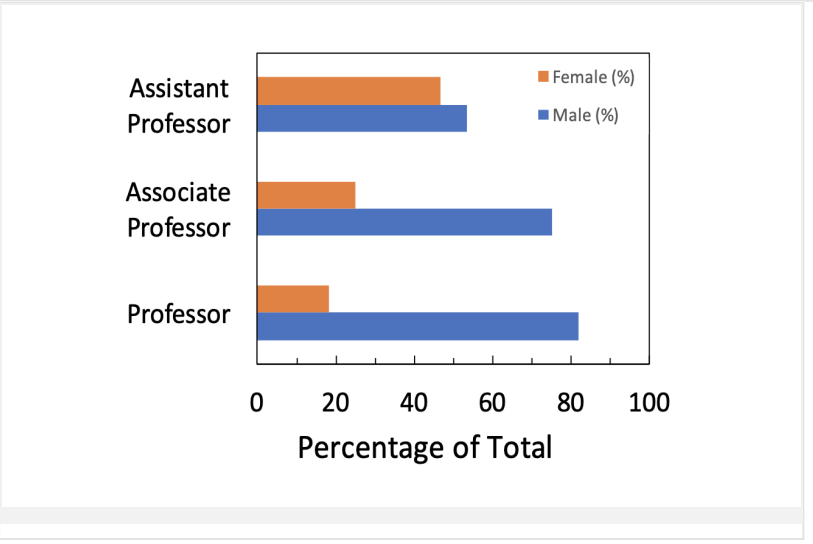

Fig 7 Post-wise data of faculty members in Biological Science-related Schools/Centres of JNU segregated on the basis of gender.

Table VIII Gender-wise data of faculty members in Biological Science-related Schools/Centres of JNU.

JNU									
POSTS	SLS		SBT		SCMM		Total		F (% of Total)
	M	F	M	F	M	F	M	F	
Professor	16	4	6	1	5	1	27	6	18.2
Associate Professor	2	2	6	0	1	1	9	3	25.0
Assistant Professor	3	3	5	3	1	1	9	7	43.8

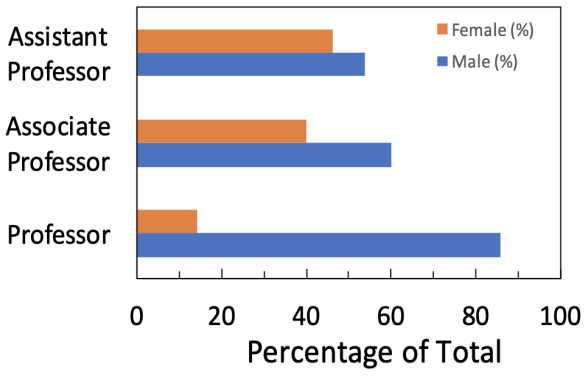

Fig 8 Post-wise data of faculty members in all Biological Science related departments of DU combined and segregated on the basis of gender.

A similar trend is seen in the Life Sciences related departments at DU in both Professor and Associate Professor positions, with the gender skew towards men being clearly evident (Fig 8; Table IX). However, at the Assistant Professor level, a much better representation of women is seen. One notable exception is the Department of Genetics, where the number of women in Assistant Professor positions outnumbers men.

Table IX Gender-wise data of faculty members in Biological Science departments of DU.

DU													
POSTS	Biochem.		Biophys.		Genetics		Microbiol.		PMB		Total		F (% of Total)
	M	F	M	F	M	F	M	F	M	F	M	F	
Professor	6	0	1	0	3	1	2	1	6	1	18	3	14.3
Associate Professor	0	1	0	0	1	0	0	1	2	0	3	2	40.0
Assistant Professor	1	1	1	1	2	3	2	0	1	1	7	6	46.2

In HCU, again, Professor and Associate Professor positions are dominated by men (Fig 9; Table X). With the exception of the Department of Biotechnology and Bioinformatics where Assistant

Professor positions are overwhelmingly occupied by men, the other departments show a better gender balance in appointments at the Assistant Professor positions.

Table X Gender-wise data of faculty members in the School of Life Sciences, HCU.

HCU School of Life Sciences											
POSTS	Biochem.		Plant Sci.		Animal Bio.		Biotech.		Total		F (% of Total)
	M	F	M	F	M	F	M	F	M	F	
Professor	4	2	10	2	4	3	5	1	23	8	25.8
Associate Professor	2	1	1	0	2	0	0	0	5	1	16.7
Assistant Professor	3	1	2	1	2	3	7	1	14	6	30.0

Admittedly, if one were to include the Physical Sciences into this analysis, the gender gap would increase further. Just to provide an estimate of this, such an analysis is provided below for all the Science Departments of HCU (Fig 10).

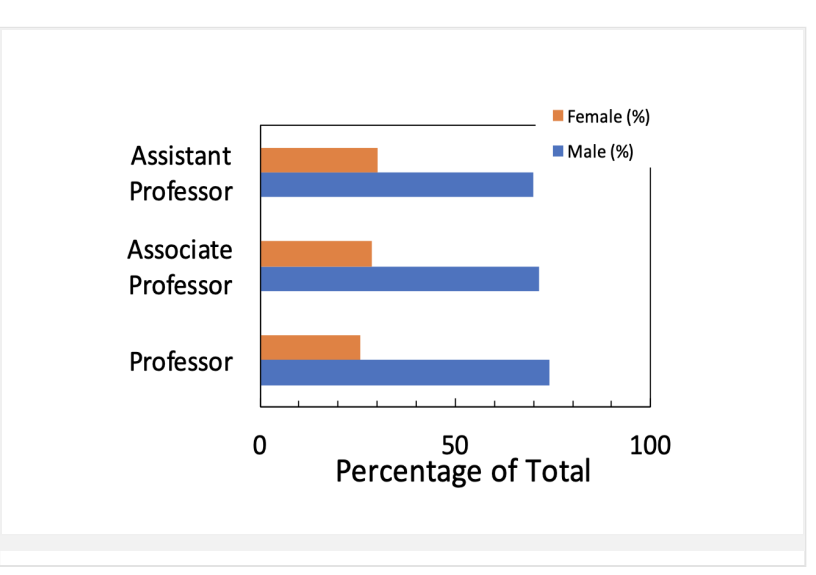

Fig 9 Post-wise data of faculty members in all Biological Science related departments of HCU combined and segregated on the basis of gender.

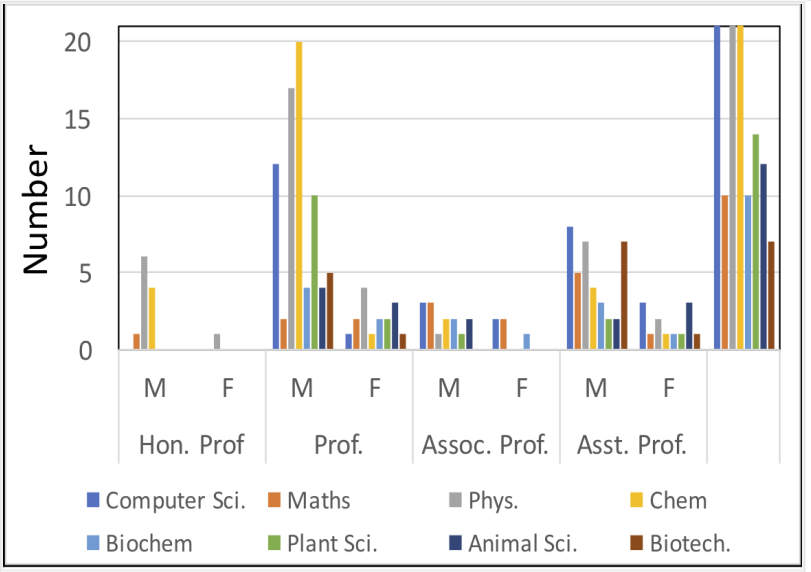

Fig 10 Gender-wise data of faculty members in all Science Schools at HCU. Data for School of Computer and Information Sciences (Computer Sci.), School of Physics (Phys.), School of Mathematics and Statistics (Maths), School of Chemistry (Chem.) and School of Life Sciences (Biochem., Plant Sci., Animal Bio., Biotech.) were collated from their respective websites.[34]

Fig 10 shows that the number of women occupying any of the three levels of faculty positions is low within the Science Schools. In addition, the relative ratio of men to women is significantly higher in the Physical Science disciplines (Computer Science, Mathematics, Physics and Chemistry).

There are several points to be noted from the data presented above for the Biological Sciences faculty in different institutions.

- All research institutes show a marked gender skew at senior positions in their faculty profiles. TIFR and NCBS are notable exceptions.
- The gender skew persists at entry/middle-level positions in the faculty profiles of the research institutes. TIFR and NCBS are again the exceptions here.
- IISc and IISERs show significant gender skew at both senior and entry-level positions. This is true for Biological Sciences departments in an older institution such as the IISc but is also true for those in newer institutions such as the IISERs. As mentioned before, despite being known as organizations with a significant teaching component, the self-image and funding/faculty autonomy of these institutions are similar to that of research institutes. Is it possible that the hiring patterns in these places, therefore, mimic what is seen in most research institutes?
- The Central Universities, in general, showed a much smaller skew at the entry-level positions,

[34] http://www.uohyd.ac.in/index.php/academics/2011-10-27-18-38-04/department-of-computer-information-sciences/faculty; http://mathstat.uohyd.ac.in/people/faculty; accessed February 2018

- although the senior levels were expectedly skewed quite significantly in favour of men. While these are places with a clear mandate to combine research with teaching, their Master's programs are generally very popular and gaining entry to these programs is highly competitive. Hence, teaching remains a major focus in these institutions.

What explains this skew in hiring? Is this really a result of gender bias in the larger society, particularly in the Indian family where the parents do not allow or encourage their daughters to enrol in career-oriented science programmes? Is it that women are just not 'good enough' or are 'less ambitious?' Do they prefer positions that emphasize teaching over positions that mandatorily prioritize research? Or do they encounter gatekeepers and selection processes that tend to favour men for research positions but consider women with less of a bias in teaching positions? Or is it a combination of all of these processes?

The available data may seem complicated but is not difficult to understand. To put this in perspective, the gender profiles of those who receive, arguably, two of the most competitive early career research fellowships, the DST-INSPIRE Faculty Scheme[35] and the India Alliance DBT-Wellcome Early Career Fellowships (ECF)[36] over a period of the last 7 years were examined. These post-doctoral research awards are given for a fixed term of 5 years to begin with. As can be seen from Table XI, from 2013 onwards women awardees begin to perform as well and often better than the men. One possible explanation is that these fellowships do not provide for a regular position and are therefore likely to be less attractive to men. However, this seems like an unlikely explanation, given that receiving these awards adds value to an individual's career profile and enhances their chances of finding regular positions. The other more plausible explanation is that the current generation of women entering the Biological Sciences are actually competent enough and ambitious enough to make it to the top.

Table XI Gender profile of awardees of DST-INSPIRE Faculty Award and DBT-Wellcome Early Career Fellowships in Basic Biomedical Research

Fellowship	2011		2012		2013		2014		2015		2016		2017	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
DST INSPIRE	8	3	28	16	14	10	12	11	5	11	23	24	8	14
DBT-Wellcome ECF	0	2	3	2	0	4	2	3	2	4	1	7	4	3

[35] http://www.inspire-dst.gov.in/faculty_scheme.html; accessed August 2018
[36] https://www.indiaalliance.org/fellowships/early-career-fellowships; since this is the Fellows page, it may only represent those who accepted the fellowship offers and not the total number of fellowships offered.

Peer recognition and Awards

How do women scientists fare when it comes to recognition and awards? This is particularly pertinent to ask given that since the early 2000s, several of the Indian science academies have sponsored studies, held high profile workshops and organized brainstorming sessions on gender inclusivity. How well did women fare in being elected to the science academies, the Indian National Science Academy (INSA), for example? Given below in Table XII are the numbers of women Fellows elected in different disciplines to the INSA.

Table XII Numbers of Women Fellows of INSA in different disciplines. The data for Biological Sciences are provided for a few years from 1990 onwards to show the trends in women getting elected as Fellows to INSA as available at the INSA website.[37] The last two columns provide the data for total numbers of Fellows in the disciplines mentioned in the Table, along with the numbers of women and their percentages with reference to the total.

Subject Areas	Elected in 1990		Elected in 2000		Elected in 2010		Elected in 2016		Elected in 2017		Total Fellows in INSA	Total women Fellows in INSA
	M	F	M	F	M	F	M	F	M	F		
Plant Sciences	1	0	-	-	2	2	2	0	2	1	66	5 (7.6%)
Animal Sciences	2	0	1	0	2	2	0	2	2	0	66	15 (22.7%)
Microbiology and Immunology	-	-	-	-	1	1	2	1	1	1	19	5 (26.3%)
Cell and Biomolecular Sciences	2	0	2	0	2	2	3	0	2	0	99	8 (8.1%)
Health Sciences	1	3	2	0	2	2	2	2	2	1	82	20 (24.4%)
Agriculture Sciences	2	0	1	0	1	1	1	0	1	0	58	2 (3.4%)
Total	8	3	6	0	10	10	10	5	10	3	**390**	**55 (14.1%)**
Mathematics											76	7 (9.2%)
Physics											134	6 (4.5%)
Chemistry											127	2 (1.67%)

[37] http://www.insaindia.res.in/indianfellow.php

As is evident from the trends and data shown in Table XII, in most disciplines, not only is gender parity a distant dream, it is highly unlikely to be ever achieved without active intervention in this direction. Although on a comparative scale, women in the Biological Sciences do seem to be slightly better off than their counterparts in other disciplines. A similar disturbing trend is observed in the conferring of prestigious awards such as the Shanti Swarup Bhatnagar Award (instituted in 1958) awarded in 7 scientific disciplines or the more recently instituted Infosys Award that is awarded in 4 disciplines of science and engineering. Until 2016, of the 525 awardees, only 16 were women (3.04%). This became 16 out of 535 awardees in 2017 (2.99%). Of the 8 awardees who received the Infosys Awards in Engineering and Computer Sciences until 2017, only 1 was a woman; 2 out of the 9 awardees in the Life Sciences were women and 1 of the 9 awardees in the Physical Sciences was a woman.

Worldwide trends in peer recognition suggest that the problem is, unfortunately, global. In a paper published in Nature Astronomy, Caplar and others (2017) examined the citations received by papers authored by women versus those authored by men. For this, they analyzed 150,000 articles that were published in 5 major Astronomy journals between 1950 and 2015 using a computational algorithm to control for the non-gender-specific properties of the papers. The authors concluded that papers authored by women, in general, receive 10.4 ± 0.9% fewer citations than would be expected if the papers with the same non-gender-specific properties were written by men. In another study published recently in Plos Biology by Holman and others (2018), the authors examined the authorship of scientific papers and the gender of the senior/communicating authors of the papers as evidence of women heading scientific research teams. For this, they looked at 35.5 million authors from 9.15 million articles (2002–present) in PubMed and 1.1 million authors from 0.5 million arXiv preprints (1991–present) using an algorithm that was trained to specifically identify the gender of the authors. The authors concluded that in Physics, parity would not be achieved for another 258 years and even in Biology this would require over 75 years. Women were also less frequently 'invited' to write a paper as compared to men. Liftstream, a specialist life sciences executive search recruitment company (also reviewed by Elie Dolgin in Nature Biotechnology (Dolgin 2017)) conducted a study and showed that women were underrepresented in biotech management boards simply because of the old-boy networks that kept them out and if they continued to be inducted into these boards at the current rate, gender parity would not be achieved until 2056.

Gender frames, bias and prejudice in science

Gender (as also caste) functions at both the micro and the macro level to influence interpersonal relations as well as organizational structures. Gender frames also bring cultural biases into play in how we respond to or expect others to respond in a given situation (Ridgeway 2009). Institutionalized cultural rules are then also used to penalize or dis-incentivize what is perceived as violating the gender code of behavior.

In a very interesting double-blind study published in the Proceedings of the National Academy of Sciences (PNAS), by Moss-Racusin and others from Yale in 2012, the 'objectivity' of scientists

to gender identity during hiring was tested. The final 127 science faculty (both male and female) who were respondents in this study, received one or the other of two identical applications for the position of a lab manager. The only difference between the two applications was their gender (John vs Jennifer). The scientists were asked to rate the applicants on their competence, hire-ability, salary conferral and mentor-ability. Not only was the male applicant rated higher in all terms of competence, hire-ability and mentor-ability, but the salary offered to the applicant was also significantly higher with $30,238.10 versus $26,507.94 for the female applicant. The gender of the scientists did not affect their choice; female scientists were as likely to rate the male applicant higher than the female applicant as the male scientist. The problem of stereotyping and unintentional implicit gender biases has come to be widely accepted among the students of different genders in science. However, its various modes of working are still being explored. A study, also published in the PNAS, explores how men and women evaluate evidences of gender bias in science differently (Handley *et al* 2015). This group carried out three randomized double-blind studies using two settings from the general public and one from university faculty of both STEM and non-STEM backgrounds. For the purpose of this paper, it would suffice to examine how the 205 STEM and non-STEM faculty responded when asked to evaluate the abstract of the Moss-Racusin *et al.* 2012 study. On an average, no significant difference was observed in the responses between male and female non-STEM faculty in how they evaluated the abstract. However, male STEM faculty were significantly less likely to favourably evaluate the same abstract as compared to the female STEM faculty. The female STEM faculty were not significantly different in their evaluation of the abstract as compared to the non-STEM faculty. This lead the authors to conclude that the results were not a result of overvaluation by female STEM faculty but were actually due to male STEM faculty less likely to accept the likelihood of gender bias in the fields of their own work, and whose acceptance would likely bring into question/challenge their own privileged locations.

Some startling findings were revealed in a survey of trained scientific women power carried out in 2010 by Anitha Kurup and others for the Indian Academy of Sciences in collaboration with the National Institute of Advanced Studies.[38] Of the 794 individuals with PhDs who were registered in this study, roughly 40% were male. The researchers divided them into four categories, women in research (WIR), women not in research (WNR), women not working (WNW) and men not in research (MIR). The study reported that as many as 87% of women with PhDs continued to work in science, with roughly 63% of these being WIR. Not getting jobs was the most prominent reason for WNR not pursuing a career in research. Not finding regular positions or finding only temporary positions were the most prominent reasons for WNW opting out of an active career in science. This was particularly the case for women who also had spouses with PhDs in similar/competing scientific areas or were themselves in scientific research. The temporary nature of the job that these women found then often acted as a further push factor when family emergencies such as caretaking of the elderly or children came up. Interestingly, roughly 14% of WIR were never married as compared to only 2.5% MIR. Significantly greater numbers of WIR reported spending 40–60 hours a week in the lab as compared to men. And significantly larger numbers of men spent fewer than 40 hours a week

in research when their children were growing up. Yet, stereotypes of women not being committed to research or having competing interests of family versus career abound.

Initiatives of Indian science academies and funding agencies

As mentioned earlier, by the turn of the century, several academies of science in India had already flagged the issue of the absence of women in science, their lack of visibility when present and what could be done to change the *status quo*. How effective have these interventions been? Following the Indian National Science Academy's (INSA) report in 2004,[39] the National Academy of Sciences (NASI)[40] and the Indian Academy of Sciences (IAS)[41] conducted workshops and started multiple initiatives on women in science. The Department of Science and Technology (DST) set up a National Task Force for Women in Science in 2005. These concerted efforts brought the issues of Women in Science to the fore, and helped identify gaps between enrollments and hiring, the so-called 'leaky pipe syndrome.'[42] They also highlighted problems in recruitment procedures, the double burden of women in traditional household arrangements and their absence at senior levels or in decision-making positions. They also made recommendations on improving service conditions (flexi-timings, crèches, safe transport, campus accommodation, fellowships, awareness programs) to make a career in science more attractive for women.

The easiest to implement were, of course, the fellowship schemes that did not in any way challenge the *status quo*. Take for instance DST's Women Scientist scheme.[43] This well-intentioned program was meant to help women PhD degree holders return to scientific research after a career break. But without a long-term plan to provide regular employment avenues to beneficiaries, most such schemes merely became post-doctoral fellowships with uncertain futures. Several years earlier, in 1984, UGC had started a Research Scientist Scheme to attract and retain technically trained individuals. Many returned from positions abroad to grab the initiative. By 1999, UGC was reluctant to continue funding the scheme and often the affiliating host institutions were unwilling to absorb these Research Scientists. Many UGC-Research Scientists were able to continue in their positions until retirement with the help of legal interventions, and most faced hostility in the host departments.[44] This is increasingly being seen as the likely fate of the DST-INSPIRE Faculty program (initiated in 2008)[45] or the

[38] https://www.ias.ac.in/public/Resources/Initiatives/Women_in_Science/surveyreport_web.pdf
[39] http://www.iisc.ernet.in/currsci/may102005/1361.pdf; http://www.insaindia.org/scienceservice/science.htm
[40] http://www.nasi.org.in/Report%20-%20Women%20in%20Science%20&%20Technology%20-A%20Vision%20Document.pdf
[41] https://www.ias.ac.in/Initiatives/Women_in_Science/
[42] For a discussion on the leaky pipeline syndrome in the Biological Sciences, see Vaidya 2017.

UGC Faculty Recharge Program (initiated in 2013)[46] too, unless the host institutions find a way to retain the faculty, hired in such a scheme, after the funding ends.

Unfortunately, funding schemes are often announced from the top. There is little cross-talk between organizations or frank assessments of previous initiatives. There is barely any honest discussion with the stakeholders in several of the postdoctoral research schemes that various funding agencies have initiated, and bureaucracy often takes over the control of these programs leaving the awardees themselves with very little say in how the programs are run.

Far more difficult to implement are programs or solutions that confront well-established power monopolies. In my many years as a student and then as a faculty at multiple institutions across the country, I am yet to come across a gender sensitization program that was carried out for the scientific staff, students or faculty either as a voluntary or mandatory requirement. While I have participated in several programs whose agenda was to attract more women to careers in science, I am yet to see one that seriously introspected on how to make a department or school of study more inclusive, more heterogeneous in composition. I have rarely, if at all, seen recommendations from any workshop adopted in an organization and followed up over the years to assess how successful such interventions have been. The consequence? Most organizations/departments even in the Biological Sciences, where the gender gap in PhD enrolments has been reversed for several years now, have only 25% female faculty on an average even today, as discussed at the beginning of this paper.[47] Few organizations openly advocate policies to recruit women into faculty positions, or announce flexible timings or support preferential housing. Despite this, the survey by Anitha Kurup and others (2010)[48] showed that this does not make women any less committed to their careers. A large majority of these women were married and lived with their families. Caregiving, whether for children or the elderly, continued to be largely their responsibility and very few science institutions had viable supporting structures like quality crèches or safe transport. Much of this remains true even today. Instead of offering flexible timings many organizations in recent times have introduced more market-oriented, profit-maximizing approaches that also quantify productivity by rigid attendance rules, including Aadhar-linked biometrics to further complicate the hostile working conditions that women scientists encounter.

Which also brings us to a larger question - does it matter who makes these policies?[49] Do stakeholders matter? Or is 'location' entirely irrelevant? Let us take the example of a recent policy initiative of the UGC meant to apparently attract more women into scientific research. Clause 4.4 of the UGC Regulations 2016[50] explicitly states that, "The women candidates and Persons with Disability (more than 40% disability) may be allowed a relaxation of one year for

[43] http://www.dst.gov.in/scientific-programmes/scientific-engineering-research/women-scientists-programs
[44] https://indiankanoon.org/doc/170748679/
[45] http://www.inspire-dst.gov.in/faculty_scheme.html
[46] https://www.ugc.ac.in/; https://www.telegraphindia.com/1171009/jsp/frontpage/story_176956.jsp
[47] for a discussion on gender as a narrative emerging in the biological sciences, see Vaidya 2017.
[48] https://www.ias.ac.in/public/Resources/Initiatives/Women_in_Science/surveyreport_web.pdf

M Phil and two years for PhD in the maximum duration. In addition, the women candidates may be provided Maternity Leave/Child Care Leave once in the entire duration of M Phil/PhD for up to 240 days." At first sight, this could be seen as a very generous initiative aimed at ensuring that more women candidates successfully complete their PhD programs and hence we have a greater pool of trained individuals available for hiring. All women, irrespective of their marital status, are entitled to two additional years to finish their PhDs to begin with. If viewing women as equivalent to people with disabilities of about 40% is not sufficiently offensive, those who framed this policy went a step further and put the entire burden of childcare squarely on the women's shoulders. Worse, it puts the burden of marriage and adjustments on the women as well. Clause 6.6 of the UGC Regulations 2016 states that, "In case of relocation of an M Phil/PhD woman scholar due to marriage or otherwise, the research data shall be allowed to be transferred to the university to which the scholar intends to relocate provided all the other conditions in these regulations are followed in letter and spirit and the research work does not pertain to the project secured by the parent institution/ supervisor from any funding agency. The scholar will, however, give due credit to the parent guide and the institution for the part of research already done".[45] Given these rules, is it difficult to guess what would be the likelihood that a research supervisor in science, male or female, would choose a female candidate in preference over a male candidate for a PhD program in their lab?

As already shown above, it is not the absence of trained individuals that prevent women from entering scientific research in large numbers. The hurdles often come later, where skewing of employment opportunities, the lack of infrastructural facilities and the absence of support from institutions come together to keep women out. Policies that do not include the groups for which they are meant often end up producing no real transformation in the lives or experiences of those for whom it is meant. But, as in the case of the UGC Regulations 2016, it would be catastrophic if they end up being detrimental to the interests of those it is meant to serve.

Also, introducing policies without the accompanying changes in the underlying organizational structures can be counter-productive and could result in further reinforcing stereotypes and biases. This is reflected in the apprehensions that many women voice on the idea of introducing gender-based reservations; or the anxiety that many women professionals demonstrate in using flexible work schedules or in working from home while being employed in highly competitive work environments where the workforce is overwhelmingly male. The underlying gender frames inform organizational structures (Ridgeway 2009). Thus, without actively reworking those structures, we run the risk of merely reproducing them. This perhaps explains why newer scientific institutions, such as the IISERs, appear to recreate the gender skew in just the same fashion as the older ones.

[49] For an extensive discussion on the gender politics of science policy making and education, see Poonacha 2005.
[50] https://www.ugc.ac.in/pdfnews/4952604_UGC-(M.PHIL.-PH.D-DEGREES)-REGULATIONS,-2016.pdf

In Conclusion

Much has changed in Indian science scene over the past seven decades. After independence from the colonial rule, the Indian state invested a good proportion of resources in expanding the reach of science education. Increasing gender parity in science has also been one of its concerns since the mid-sixties. Science has also changed otherwise, in response to a variety of forces, both global and national, as well as those processes internal to the scientific establishment. Perhaps the most important positive achievement in this context has been a steady increase in the number of women coming to study and research in the sciences. This is no longer confined merely to certain branches of science education or to a few pockets of the country. Women's presence is growing in every field of higher education with their enrolment and pass out rates consistently exceeding that of men at the Masters and M Phil levels. Given their near complete absence from most disciplines of science up until the sixties, this is no mean feat. As has been widely pointed out, the Indian social reforms of the early twentieth century and the anti-colonial struggle came together to produce a moment in history where education of women took on a positive connotation (Chaudhuri 1999; Sur 2001). Granting though, that this move too was gendered and the purpose of their education was not to enable them to join public life as skilled professionals but to produce able mothers for future generations of citizens, it nevertheless opened up spaces of modern formal education that had thus far remained largely out of bounds for women. This was particularly so for those sections that saw themselves as participating actively in the making of the new nation, its nascent middle classes. Seeing themselves as the custodians of the new nationhood, articulated in terms of its celebrated past and a civilization marked by great spiritual excellence while trying to infuse it with 'modern values,' many of these first and second generation educated Indian elite also equated education with spirituality and penance. Thus, in the Indian cultural context, education as a goal has acquired greater legitimacy over time.

However, women's presence in adequate numbers in the scientific workforce, particularly within the scientific establishment and the higher positions in the professional hierarchy is still a long way off. Lesser still is their presence in the science academies and award lists. The way it is currently structured, this is a catch-up game that women cannot win. Quite like the corporate economy, scientific establishments continue to work within gendered frames of prejudice *via* 'old-boy networks.' It is well known that in the Indian context, hiring, elections, nominations, awards are all helped by such networks that most women do not have easy access to (also see Gupta 2016; Bal 2002; Ramdorai 2017).

More importantly, it is not merely a matter of mobility or recognition for deserving women scientists. Not having enough visible women as role-models for the young researchers entering the world of science, implies that stereotypes of the scientist as 'male' abound providing a negative feedback loop that is self-defeating for women in the sciences. The increased presence of women in the public sphere will make these places more accessible and safer for other women. It will also lead to the increased presence of women at all levels in the scientific establishment including the higher echelons of the profession to make younger

women researchers more comfortable in scientific labs and classrooms and will enhance their motivation as well as scientific capability. However, tokenism should not be the answer. The token minority, whether in a race or a gender context, is often more likely to conform to the majority opinion and has the effect of lulling committees into a false sense of complacency that social biases have been adequately dealt with. Actively encouraging diversity is not merely an issue of social justice, as flagged by the Kothari committee report early on in our independent nation's history, but also an imperative of science and its self-image as a harbinger of progress. Countries and institutions that have actively encouraged diversity have stood to gain from the variety of knowledge, experiences and ideas that come with it.

Why has it been so hard for the scientific establishment to recognize these rather obvious facts? Given the strong association of science with rationality, the scientific establishments perhaps find it hard to take on board the 'gender question' within its own functioning/working. How can scientists be challenged on the issue of 'rationality?' Scientists are supposedly trained to think and function in the realm of the rational, how could they ever be otherwise? Since most subjects that they research on have little to do with gender itself, introducing 'gender' as a subject in their curriculum/training process is often an even bigger challenge. To put it provocatively, 'gender blindness' comes quite naturally to the scientists. Yet as 'scientific evidence' accumulates to the contrary, it is imperative that scientists sit up and examine their own implicit and explicit biases, discuss policy initiatives that are genuinely more inclusive, find better and more transparent ways of hiring more women into faculty positions including getting them into senior and decision-making positions. Enhancing their presence is likely to promote fairness as well as productivity and excellence in science. It is a win-win game!

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