

## **ADVANCE Program at Brown University: Space Allocation Study**

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### **Purpose**

The MIT *Report on Women Faculty in Science* (1999) highlighted the “hidden” sources of gender bias in academia. One such “hidden” source of inequality experienced by women faculty in science, technology, engineering, and mathematics (STEM) is office and lab space allocation. According to the report, the availability of adequate space – in terms of both quantity and quality – has the ability to affect researchers’ productivity and the quality of work life. As part of the requirements of the NSF ADVANCE grant, this report examines the gender distribution of space for faculty members in the STEM fields at Brown University during fiscal year 2010.

### **Methodology**

Data used for this report come directly from information collected by the Department of Facilities Management (DFM) and the Controller’s Office at Brown University during the spring of 2010. Brown University was required to conduct a Space Inventory and Functional Usage Study as part of the preparation for the Facilities and Administrative (F&A) Cost Proposal and to comply with the federal regulatory requirement under OMB Circular A-21 “Cost Principles for Educational Institutions.” The results of this space inventory were used to calculate the percentage of space that is used to support both direct and indirect functions and support the allocation of space related to costs to those activities.

On March 29, 2010, DFM and the Controller’s Office began collecting data from designated academic department administrators across campus via an online application available on the DFM website. Academic department administrators were chosen because they generally have first-hand knowledge of space occupants and activities being performed in each space. Academic department administrators completed the survey for space usage for each room in their department as it was being used during the fiscal year of 2010 (July 1, 2009 through June 30, 2010). Information collected included: (1) validation of each room, (2) identification of personnel where sponsored activities are taking place (e.g. faculty, research staff, post-doctoral, technicians, graduate students, undergraduate students, visiting scholars, etc.), and (3) documentation the functional usage of each room. Information proximity to electrical power, years since last renovation, services (e.g. wireless, internet, windows, etc.), as well as satisfaction with quality of space was not collected.<sup>1</sup> All collected information entered into the online application was complete by April 23, 2010.

When the space inventory was complete, ADVANCE at Brown contacted Karen Zaharee, the Space Inventory Manager of the Department of Facilities Management, to gain access to this newly created dataset. ADVANCE at Brown provided Ms. Zaharee with a list of all full-time STEM faculty during FY2010. Ms. Zaharee merged this data with the newly constructed space inventory data to create a final dataset that included faculty name, primary department, rank, gender, race, and total square footage

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<sup>1</sup> Information on quality and satisfaction with space was collected in a Climate Study conducted by the Dean of the Faculty’s Office in Winter 2011.

occupied by the faculty member. This total square footage includes all office and laboratory space occupied by faculty members and their grants (e.g. space for graduate students, post-doctoral students, etc.). This final dataset was used to analyze the gender distribution of space for faculty members in the STEM fields at Brown University during FY2010.

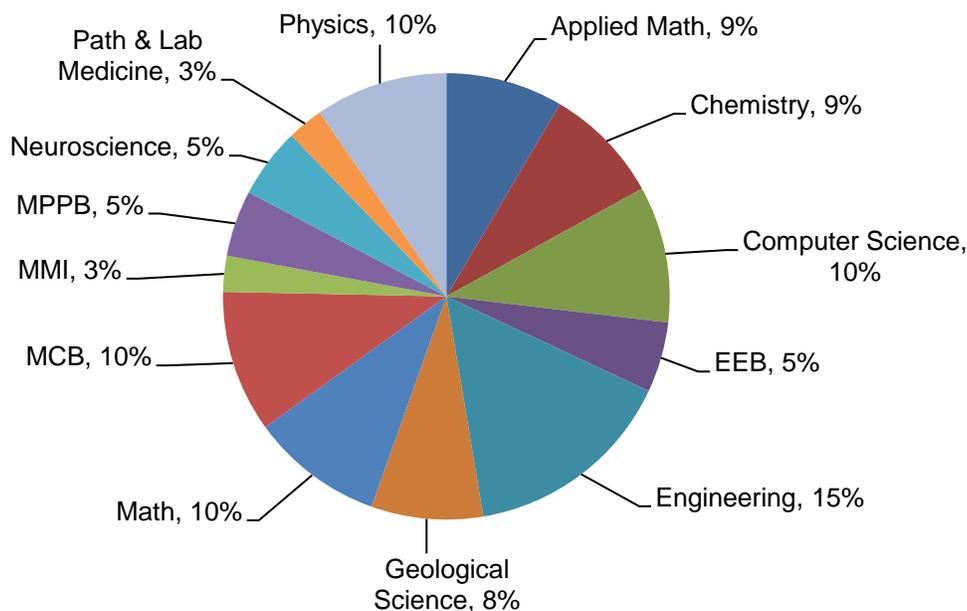
## Results

### Basic Demographics

Space information was analyzed for 272 full-time STEM faculty members at Brown University during fiscal year 2010. In total, thirteen departments make up the STEM fields at Brown University. These include: Applied Mathematics; Chemistry; Computer Science; Ecology & Evolutionary Biology (EEB); Engineering; Geological Science; Mathematics; Molecular Biology, Cell Biology, & Biochemistry (MCB); Molecular Microbiology & Immunology (MMI); Molecular Pharmacology, Physiology, & Biotechnology (MPPB); Neuroscience; Pathology & Laboratory Medicine, and Physics.

Roughly one-quarter of all STEM faculty are from either the School of Engineering (15%) or MCB (10%) (Figure 1). MMI (3%) and Pathology & Laboratory Medicine (3%) have the fewest number of faculty among the STEM fields at Brown. Overall, one-quarter of all STEM faculty are from the life and medical sciences, with the remaining 75% from the physical sciences.

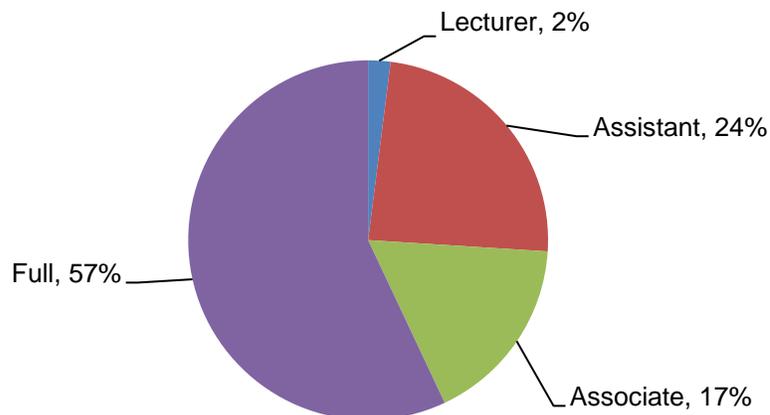
**Figure 1.** Percentage of Full-Time STEM Faculty for FY2010 by Primary Department



A majority of full-time STEM faculty hold the rank of full professor (57%). Almost a quarter of STEM faculty are assistant professors (24%) and another 17% are associate professors. The remaining full-time STEM faculty hold a lectureship position (2%;  $N = 6$ ). See Figure 2. Half of these faculty lecturers are from the Chemistry Department ( $N = 3$ ). Math (69%) and Applied Math (65%) have the greatest numbers of full professors. MMI has the fewest number of full professors (29% of all full-time faculty in this department). Within the remaining departments, the percentage of full professors ranges from 60% to 48%. Most STEM departments have similar percentages of assistant professors (roughly 20 to 30%),

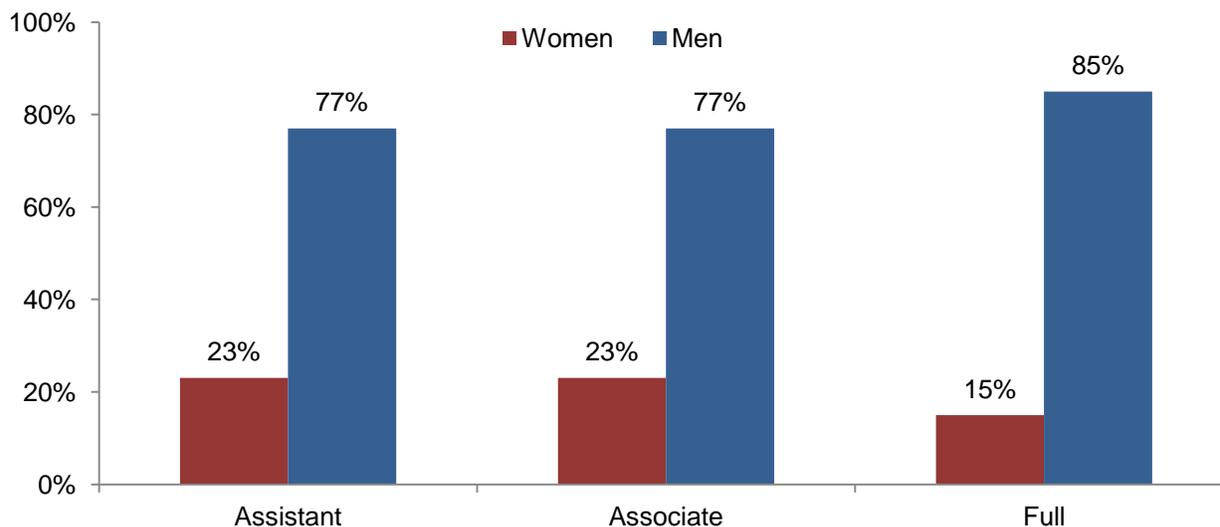
however, almost 40% of MCB faculty are assistant professors and only 14% of Engineering and Neuroscience professors hold the rank of assistant professor.

**Figure 2.** Percentage of Full-Time STEM Faculty by Rank, FY2010



Women represent one-fifth (20%) of full-time STEM faculty at Brown University. More than half of the faculty in Pathology & Laboratory Medicine are women (57%). This is the highest percentage of women in any STEM department. Other departments with relatively high percentages of women include MPPB (46%), EEB (36%), and MCB (32%). The lowest percentage of women in any STEM department is in Applied Math (4%), where only one faculty member is 23 is a woman. Roughly, one-quarter of all assistant professors and associate professors are women (23% for each rank). Only 23 of the 155 (15%) full professors in the STEM fields at Brown University are women. See Figure 3. As would be expected from these results, the association between gender and rank is statistically significant ( $\chi^2(3, N = 272) = 11.74, p = .008$ ).

**Figure 3.** Percentage of Full-Time STEM Faculty by Gender and Rank, FY2010



There is little diversity in terms of race/ethnicity for full-time faculty in the STEM fields at Brown University. Over four-fifths (84%) of faculty are identified as White. The remaining faculty members are Asian/Pacific Islander (12%), Hispanic (3%), or Black (2%). All faculty (100%) in EEB, MCB, and Pathology & Laboratory Medicine are White. The most diverse department is Chemistry (61% are identified as White). The rank of full professor has the least diversity in terms of race/ethnicity, where 88% of all full professors are identified as White. Associate professors are the most diverse with 70% identified as White.

There is little difference between STEM women and men in terms of race. Over four-fifths of all women (85%) and all men (83%) are White. The only slight remarkable difference between gender and race/ethnicity appears among those who are Asian/Pacific Islander. Slightly more STEM faculty males are identified as Asian/Pacific Islander (13%) as compared to women (9%). However, this difference is marginal and not statistically significant.

### *External Funding*

Just under two-thirds (63%) of full-time STEM faculty were awarded external funding during FY2010. Of those faculty who did not receive any grant award money during FY2010 ( $N = 100$ ), over half (56%) were full professors, three-quarters (77%) were male, and 85% were identified as White. Among those faculty members who did receive award money, the average grant amount was over \$500,000 ( $M = 516,443$ ,  $SD = 691,150$ ). As would be expected, award amounts varied by academic rank, gender, and race. Assistant professors in the STEM fields, on average, were awarded the most money during FY2010 ( $M = 658,101$ ,  $SD = 1,008,046$ ) but there is great variation in award amounts within this group. Full professors, on average, were awarded approximately \$500,000 each during FY2010 ( $M = 523,321$ ,  $SD = 617,411$ ) and associate professors, on average, were awarded slightly less ( $M = 351,184$ ,  $SD = 353,838$ ). Women STEM faculty were awarded roughly \$200,000 less ( $M = 362,653$ ,  $SD = 252,054$ ) on average, than men ( $M = 548,934$ ,  $SD = 748,440$ ) in the STEM fields. When considering all STEM faculty who received an award in FY2010, there is no statistically significant difference in award amount by gender ( $t(170) = 1.34$ ,  $p < .18$ ).

The primary variable of interest in this report is total square footage occupied by each full-time faculty member in the STEM fields. Total square footage included both office space and any research space for used for grant activities. This includes both laboratory space and any space used by post-doctoral students, graduate students, or staff members working under a grant which the faculty member is the principle investigator (PI). There are a number of PIs who have shared space. When this occurred, the total square footage for the space in question was divided equally. Most departments have additional general space used by multiple faculty members for research and training purposes. In these cases, it is unknown who uses the space more often and therefore how the square footage of these spaces should be allocated. Therefore, spaces such as these were excluded from the total assigned to each faculty member. The square footage occupied by STEM faculty members ranges from 83 to over 7,000 square feet ( $M = 1,248$ ,  $SD = 1,104$ ).

Overall, the data obtained for total square footage is the best estimate available to conduct the following analyses. There are multiple ways the data could be flawed, but are the only and most reliable data available that allow a study of gender bias in space distribution. While the exact figures presented below

may not be precisely accurate, they do provide valuable insight into hidden gender bias at Brown University.

#### *Space Differences by Academic Rank, FY2010 Awards, and Gender<sup>2</sup>*

As would be expected, there is a clear positive linear relationship between academic rank and space among faculty members in the STEM fields at Brown University. As academic rank increase, so too does the average amount of space occupied. Assistant professors average the smallest square footage of space ( $M = 1,096.0$ ;  $SD = 845.11$ ). Associate professors occupy, on average, slightly more space ( $M = 1,148.6$ ;  $SD = 758.3$ ) and full professors occupy the most space among STEM faculty ( $M = 1,326.7$ ;  $SD = 1,189.2$ ). However, important to note is the greater variation in square footage among full professors, as indicated by the increased standard deviation for this group. When entered into a regression analysis, an increase in academic rank (such as moving from assistant professor to associate professor) is associated with an increase in square footage of 120 feet ( $B = 120.73$ ,  $t(265) = 1.58$ ,  $p < .115$ ). While there is a positive relationship between academic rank and total square footage, these relationship is not statistically significant and academic rank explains very little if any of the variance in space allocation among faculty ( $R^2 = .009$ ,  $F(1, 264) = 2.498$ ,  $p < .115$ ).

The data also indicate a slight difference in average square footage by gender, however, not in the anticipated direction. Women STEM faculty members at Brown University occupy, on average, more space than their male counterparts. The average amount of space occupied by women STEM faculty is 1,287 square feet ( $SD = 871$ ), whereas men occupy, on average, slightly less ( $M = 1,229$ ;  $SD = 1,088$ ). On average, women occupy almost 60 square feet more than men. However, this difference in occupied space between women and men is not statistically significant ( $B = 57.70$ ,  $t(265) = 0.347$ ,  $p < .729$ ;  $R^2 = .000$ ,  $F(1, 264) = 0.120$ ,  $p < .729$ ).

As would be expected, there is a positive and marginally statistically significant relationship between square footage and whether or not a faculty member was awarded a grant during FY2010. Being awarded a grant during FY2010 is associated with an increase in space of 221 square feet ( $B = 220.76$ ,  $t(265) = 1.66$ ,  $p < .098$ ;  $R^2 = .007$ ,  $F(1, 264) = 2.755$ ,  $p < .098$ ). Additionally, among those who did receive grant monies during FY2010, there is no statistically significant relationship between grants awarded to STEM faculty during FY2010 and total square footage assigned to faculty members ( $B = -82.53$ ,  $t(167) = 1.487$ ,  $p < .224$ ;  $R^2 = .003$ ,  $F(1, 166) = 1.487$ ,  $p < .224$ ).

When gender, academic rank, and grant awards are used to predict square footage simultaneously, there are little differences than when these three variables are examined separately. Overall, approximately one percent of the variation in square footage is explained by gender, academic rank, and whether a grant award was received in FY2010 ( $R^2 = .010$ ,  $F(3, 262) = 1.853$ ,  $p < .138$ ). The positive relationship between academic rank and space remains, but is marginally significant ( $B = 122.707$ ,  $t(265) = 1.601$ ,  $p < .111$ ). Additionally, whether or not the faculty member received a grant during FY2010 is both positive and marginally statistically significant ( $B = 222.55$ ,  $t(265) = 1.02$ ,  $p < .096$ ). There continues to be no statistically significant difference between women and men faculty in the STEM fields at Brown when academic rank and grant award are controlled in the model. Among those faculty who received a grant

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<sup>2</sup> These analyses exclude those faculty members who are lecturers (n=6).

award during FY2010, neither gender, academic rank, or grant amount (entered into the model as computed natural log to normalize the distribution) are statistically significant.

Additional analyses examined the relationship between academic rank, FY2010 grant awards, and space separately for both women and men STEM faculty. However, these separate analyses provided no notable differences from the pooled models. As with the pooled models, the positive relationship between academic rank and square footage remains, and the relationship for both genders remains not statistically significant.

## **Conclusions**

This report examined the gender distribution of space for faculty members in the STEM fields at Brown University during fiscal year 2010 to determine if there is sex discrimination in allocated space. The overall findings show that there does not appear to be a clear pattern of gender discrimination of space at Brown University. The statistical analyses performed show no statistically significant differences in square footage based on gender, rank, or grant awards, either separately or when examined simultaneously.

However, while these results show no statistical differences of space based on gender, general conclusions should be made with caution. The data used to conduct these analyses have some significant limitations. First, information on space was collected from the person in the department most knowledgeable about usage. In most cases, this was the department administrator. It is possible that this person provided inaccurate information. Second, when it was indicated that space was used by more than one PI or faculty member, the space was divided equally among the PIs or faculty members. In many of these cases, the usage may indeed not be equal. Even if more precise measurements of time could be obtained to better estimate percentage of usage, it is likely this estimate would be either under or over estimated. Finally, data on square footage were obtained for FY2010 when the Department of Psychology and the Department of Cognitive & Linguistic Sciences merged (July 2010) into the new Department of Cognitive, Linguistic & Psychological Sciences (CLPS). At this same time, most of the CLPS faculty were preparing to move or had already moved due to pending renovations to Metcalf Hall. This may have been the worst time to complete a study of that department's lab space since they were entirely in transition.

While there are multiple ways the data could be flawed, but are the only and most reliable data available that allow for the investigation of gender discrimination based on space allocation at Brown University. While the exact figures presented may not be precisely accurate, they do offer important insight into possible gender bias. To investigate further any "hidden" gender bias, the focus should shift to the process of allocating space. How do faculty members obtain the space they do? How do department chairs determine space allocation? Other ADVANCE grant recipient institutions (e.g. New Mexico State University) have attempted to uncover this complicated and complex process of gender allocation with little success. Many in the positions of granting space are likely to disclose how they allocate space or in some cases are unaware of how gender bias unconsciously intervenes in the allocation process. In short, improving the accuracy of these data on the square footage of space would provide little in the complete understanding of the complex processes by which gender bias pays out in space allocation and attempts to uncover these processes have proved futile as access to this information is often inaccessible.