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OBSERVATION

The Presence of Female Conveners Correlates with a Higher Proportion of Female Speakers at Scientific Symposia

Arturo Casadevall,^a Jo Handelsman^b

Departments of Microbiology and Immunology and Medicine (Infectious Diseases) of the Albert Einstein College of Medicine, Bronx, New York, USA^a; Department of Molecular, Cellular and Developmental Biology, Yale University, New Haven, Connecticut, USA^b

ABSTRACT We investigated the hypothesis that the gender of conveners at scientific meetings influenced the gender distribution of invited speakers. Analysis of 460 symposia involving 1,845 speakers in two large meetings sponsored by the American Society for Microbiology revealed that having at least one woman member of the convening team correlated with a significantly higher proportion of invited female speakers and reduced the likelihood of an all-male symposium roster. Our results suggest that inclusion of more women as conveners may increase the proportion of women among invited speakers at scientific meetings.

IMPORTANCE The proportion of women entering scientific careers has increased substantially, but women remain underrepresented in academic ranks. Participation in meetings as a speaker is a factor of great importance for academic advancement. We found that having a woman as a convener greatly increased women's participation in symposia, suggesting that one mechanism for achieving gender balance at scientific meetings is to involve more women as conveners.

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Address correspondence to Arturo Casadevall, arturo.casadevall@einstein.yu.edu.

In recent decades, the proportion of women entering scientific careers has increased substantially, but women remain underrepresented in academic ranks. A major problem contributing to the latter is the “leaky pipeline,” whereby women drop from the academic ladder and thus deplete the potential pool of women in senior academic faculty ranks. The leaky pipeline has been attributed to many causes, including discrimination, inadequate mentoring, lack of role models, and the difficulty in balancing academic and family life (1, 2). In this article, we identify a strategy that might encourage more participation of women in science.

In a search for points of leverage that might influence women's success and retention in academic careers, we identified invitations to speak at national meetings as key professional events. Presentations at scientific conferences provide self-evident benefits—they are venues for disseminating research findings, becoming known in science, and networking with colleagues who can enable future professional opportunities. However, the career ramifications extend far beyond those associated directly with the speaking event itself. First, promotion committees typically view invited meeting presentations as evidence for external recognition when considering whether to advance a candidate to a higher academic rank. Second, speaker rosters are often used as a starting point for planning other meetings, amplifying the impact of each event. Third, invited speakers are often provided financial support for travel to the meeting, thereby either making it possible for them to attend or releasing their own travel funds for other uses. In addition to the impact on the speaker herself, speaking at meetings may influence younger women's career choices by providing them female role models. Hence, invitations to speak at scientific

meetings are a critical feature of academic science and thus are important to consider in efforts to increase the participation of women in science.

Several studies have shown that women are underrepresented as speakers in scientific meetings in absolute terms and relative to attendees (2–4). A retrospective analysis of participation at meetings of the American Association of Physical Anthropologists found that symposia organized by men were significantly less likely to include women as first authors in posters, talks, and symposia, despite the fact that women constituted the numerical majority in primatology and were well recognized for their contributions to that field (5). We sought to identify factors that affect the proportion of women among invited speakers.

The American Society for Microbiology (ASM) has hosted its General Meeting (GM) covering all aspects of microbiology for over a century. In addition, ASM runs the Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC), which focuses primarily on the science of antimicrobial drugs and their clinical applications. Historically, the GM was organized by the divisions of the ASM, but beginning in 2011, a new format was instituted whereby a program committee met and designed a meeting composed of plenary sessions and symposia (6). ICAAC is also organized by a program committee. Both program committees provide overall guidance for the scientific programs and assign conveners, but there are differences in how they operate. For the GM, conveners invite speakers, moderate sessions, and shepherd the symposia. Depending on the GM session, the conveners may follow recommendations from the program committee and/or invite speakers themselves in consultation with the pro-

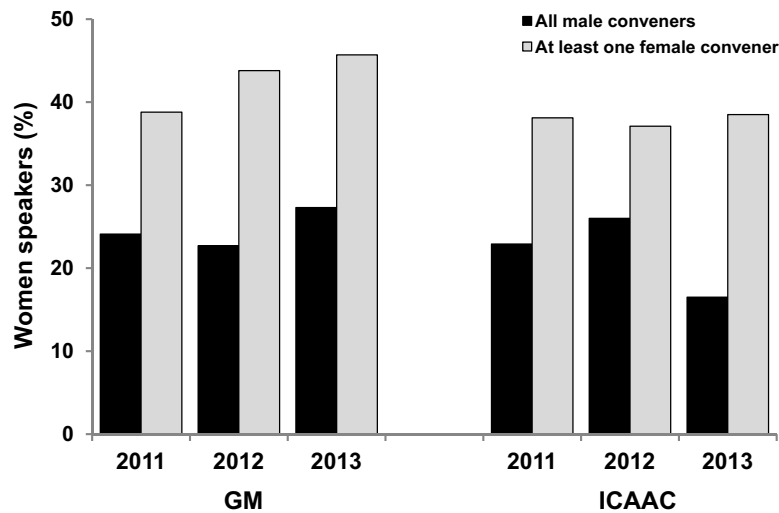


FIG 1 Proportion of women speakers as a function of convener gender composition for the years 2011, 2012, and 2013 at the GM and ICAAC meeting. All comparisons were significant at $P < 0.05$ by Student's *t* test.

gram committee. In contrast, the ICAAC Program Committee is composed of categories that are represented by committee members who select topics for symposia and identify speakers. ICAAC symposium conveners are selected to represent topics of discussion by the program committee members in each category, generally after the symposium is approved by the entire program committee. Thus, conveners are selected by program committee members, rather than the whole committee. Conveners are selected for their expertise and are often, but not always, speakers in the symposium that they convene. The GM and ICAAC symposium take place in the spring and fall, respectively. The size and demographics of these meetings and the ASM membership are shown in Fig. 1.

We examined the gender representation among speakers for plenary sessions and symposia for both the GM and ICAAC as a function of the gender composition of the session conveners. The gender of invited speakers was inferred from the first name, and in cases in which the name was ambiguous, the speaker's sex was determined by examining a picture of them. Sessions were classified as to whether they had been convened by two men, a man and woman, or two women. Data were assembled by calculating percentages of female speakers and/or comparing the absolute ratios of male and female speakers.

Analysis of 216 sessions from 3 GMs held in 2011, 2012, and

2013 revealed that 104 were convened by male-only convener teams, and 112 had at least one female in the convener team. Too few sessions were organized by female-only convener teams to analyze independently, and consequently, we focused only on convener teams that were all male versus those that included at least one female convener. In sessions convened by all men, invited female speakers comprised 22 to 27% (Fig. 1; see Table 2) and averaged 25%. In sessions in which the convener team included at least one woman, woman speakers represented 39 to 46% (Fig. 1 and Table 1) and averaged 43%. Inclusion of at least one woman among the conveners increased the proportion of female speakers by 72% compared with those convened by men alone. Irrespective of whether the session was analyzed on a yearly basis or combined, the presence of a female in the convener team resulted in significantly more women among invited speakers (Table 2).

We also examined the impact of the conveners' gender on the likelihood of a session containing only male speakers. This analysis is important, because all-male rosters send a subtle message, especially to junior scientists, that a field has few women. At the GM over 3 years, 23 to 36% (average 30%) of the sessions were comprised of all-male speakers if the convener team contained only men (Fig. 2 and Table 3), whereas 8 to 10% (average of 8.9%) of the sessions had all-male rosters among those organized by

TABLE 1 Gender numbers and percentages of GM and ICAAC attendees from 2011 through 2013

Yr	No. of attendees by meeting				Gender % from total membership data ^a											
	GM				ICAAC				Total		Full		Postdoc		Student	
	Total ^b	Full	Postdoc	Student	Total ^b	Full	Postdoc	Student	Male	Female	Male	Female	Male	Female	Male	Female
2011	5,345	3,391	420	1,534	6,840	6,204	312	324	63	38	63	37	49	51	40	60
2012	6,102	3,948	513	1,641	6,049	5,399	325	325	62	46	63	37	45	55	38	62
2013	4,871	3,096	377	1,398	4,470	3,979	263	228	61	47	63	37	44	56	37	63

^a The gender percentage of ASM members was estimated from the subset of membership data for which the gender information was known. These percentages apply to membership of the society and are not the gender percentages of meeting attendees, since that information was not available. However, the gender percentages do give an indication of likely gender percentages for the full, postdoc, and student attendees.

^b The total numbers each at the GM and ICAAC meeting include only the full, postdoc, and student members who attended and do not include emeritus members, one-day attendees, exhibitors, and those who attended only workshops. Not all attendees are necessarily ASM members.

TABLE 2 Effect of including female conveners on the gender composition of scientific sessions

Meeting and yr	No. of sessions (F/M ratio) ^a			P value ^b
	Total	No female conveners	1 or more female conveners	
GM				
2011	65	28 (28/88)	37 (57/90)	0.0121
2012	76	35 (32/109)	41 (77/99)	0.0001
2013	75	41 (44/117)	34 (69/82)	0.0009
Total	216	104 (105/314)	112 (203/271)	<0.0001
ICAAC				
2011	84	55 (50/168)	29 (42/68)	0.0045
2012	85	47 (47/134)	38 (56/95)	0.0324
2013	75	47 (28/142)	32 (47/75)	<0.0001
Total	244	149 (125/444)	99 (145/238)	<0.0001

^a F/M denotes the total number of female (F) and male (M) invited speakers.

^b P value of the comparison of F/M ratios calculated by chi-square test (two tailed) with the Yates correction.

teams that included at least one woman (Fig. 2 and Table 2). The presence of a woman on the convening team was associated with reduced likelihood of an all-male session by about 70%.

Analysis of 244 sessions from three ICAAC meetings held in 2011, 2012, and 2013 revealed that 145 were convened by male-only convenue teams, and 99 had at least one female in the convenue team (Table 2). Paralleling the analysis of the GM, inclusion of at least one woman in the convening team was associated with 74% more female-invited speakers than symposia organized by all-male teams. Inclusion of at least one woman in the convening team significantly reduced the number of sessions with all-male rosters (Fig. 2 and Table 3). In 2013, almost half of the sessions organized by all-male convenue teams included only men in the speaker roster. Hence, the findings from the analysis of GM and ICAAC session gender composition data closely mirrored each other.

Our results show an association between the presence of a woman in the session convening team and significantly greater female participation in the roster of invited speakers. We considered the obvious explanation that the increase in female speakers in sessions with one or more women conveners was a result of the convenue also speaking. Clearly, having a woman convenue who

then chooses to speak at her symposium or selecting a woman from the speaker roster to serve as convenue could account for some of the association observed. Consequently, we also analyzed the prevalence of conveners among the speaker rostrum for all symposia for both sexes. We found that on average for the 3 years studied, 24% of the male conveners and 25% of the female conveners spoke at their sessions at the GM, and 26% and 22% of the male and female conveners, respectively, spoke at their sessions at the ICAAC symposium. Hence, male and female conveners are making comparable contributions to the overall gender ratios of speakers, and the percentage of female conveners who spoke at their sessions was smaller than the increase in female participation associated with inclusion of female conveners, suggesting that female conveners increased the participation of women by other means. Furthermore, the presence of a woman on the convening team was associated with a marked reduction in the percentage of rosters comprised of all-male invited speakers. The findings on gender proportion for the GM and ASM closely paralleled each other despite the differences between the contents of the meetings; the GM is focused primarily on basic microbiology, whereas the ICAAC symposium focuses primarily on antimicrobial agents and their clinical use. We note that the data from both meetings were

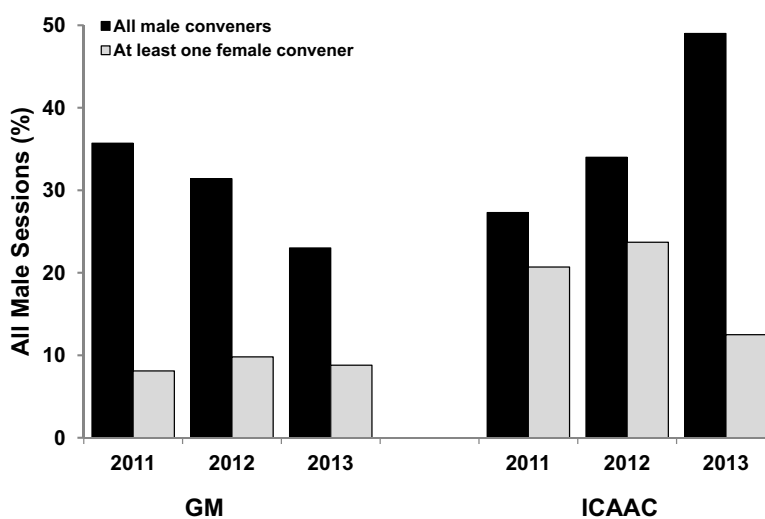


FIG 2 Proportion of sessions containing only a male speaker as a function of the composition of the convening team for 2011, 2012, and 2013 at the GM and ICAAC meeting.

TABLE 3 Effect of including female conveners on the frequency of all-male sessions

Meeting and yr	No. of sessions				P value ^a
	No female conveners		1 or more female conveners		
	All male	Total	All male	Total	
GM					
2011	10	28	3	37	0.0105
2012	11	35	4	41	0.0226
2013	9	41	3	34	0.205
Total	30	104	10	112	0.0002
ICAAC					
2011	15	55	6	29	0.602
2012	16	47	9	38	0.345
2013	23	47	4	32	0.0008
Total	54	149	19	99	0.0042

^a Calculated by chi-square test with the Yates correction or by Fisher's exact test.

remarkably similar despite differences in the operating procedures of the two program committees and differences in both the roles of the conveners and how they were assigned. Furthermore, our results are similar to and consistent with analysis of invited participation in primatology meetings (5), suggesting that the tendency may extend to other fields of science.

Low representation of women among speakers is consistent with the pervasive influence of implicit bias, which is the unintended, typically unconscious, bias toward certain groups that influences evaluation of people and their work (7). However, judgments made by men and women, including academic scientists, are equally influenced by implicit biases (7). If implicit bias were the only influence, we would predict that the gender of the conveners would have no effect on the composition of the speaker roster. We propose that other factors are at play. Perhaps women as conveners more often consider gender and make conscious efforts to find female speakers. Or maybe women are more likely to accept invitations from women or men are less likely to accept invitations from women, leading to an imbalance in the final rosters. Many other hypotheses could explain the results we report here. Because we do not know the mechanism underlying the association, we caution that the data presented here produce only a striking and highly significant correlation, and causation should not be inferred from these findings. At the very least, our findings suggest the need for additional studies to understand how gender choices are made in selecting speakers.

Whatever the mechanism driving the results, practical actions are suggested by the data. The results suggest that an experiment in which at least one woman is included in every team of conveners

might increase the proportional representation of women among the speakers at ASM meetings. An alternative might be to explicitly charge conveners with finding speakers who reflect the diversity of microbiologists. These strategies are worth testing. In the process, we might find that our meetings draw on a fuller arc of talent in microbiology and are enriched by increased gender balance.

This study suggests a simple mechanism for increasing women's participation in a critical part of a scientific life. Further research should determine whether discriminatory behaviors contribute to the outcomes and whether the outcomes contribute to the loss of women from academic science.

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A.C. has served on the GM Program Committee since 2011 and currently is the program chair for the 2014 and 2015 meetings. J.H. is a past president of ASM. ASM has granted the authors permission for use and publication of its data in this article; however, the views and opinions expressed herein are those of the authors and do not necessarily reflect the official position of ASM.

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