

Seven Actionable Strategies for Advancing Women in Science, Engineering, and Medicine

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Achieving gender equality in science will require devising and implementing strategies to overcome the political, administrative, financial, and cultural challenges that exist in the current environment. In this forum, we propose an initial shortlist of recommendations to promote gender equality in science and stimulate future efforts to level the field.

"You have all made it as women in science. How did you crack the code?" Susan L. Solomon, CEO and co-founder of The New York Stem Cell Foundation (NYSCF), asked the group of women scientists invited to the inaugural meeting of NYSCF's Initiative on Women in Science and Engineering (IWISE). NYSCF convened the meeting in February 2014, which brought together women, representative of multiple career stages, disciplines, and institutions, to identify ways to ensure that women not just enter science, but remain, compete, and truly excel in scientific careers.

Their responses confirmed what research has indicated to be true. Women are paid less (DesRoches et al., 2010) and promoted less (Moss-Racusin et al., 2012). In many fields, they regularly make up a smaller percentage of invited speakers at scientific meetings and conferences (Schroeder et al., 2013). Women also win fewer grants (Ley and Hamilton, 2008) and have higher rates of attrition at every career stage than their male counterparts (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine of the National Academies, 2007).

The responses from the meeting's attendees, however, also indicated that there is a way forward, and that women are making progress. The women in attendance had succeeded, and with the right tools and resources in place, others could, too.

Countless institutions and individuals have committed time, energy, and resources to identify, study, and quantify

exactly what the issues and concerns are. They have laid the groundwork to begin making progress, and there are many others that are ready to join the effort.

NYSCF's IWISE Working Group assembled a selected shortlist of recommendations to promote and ensure gender equality in science, medicine, and engineering, which are outlined below. While many of the ideas, policies, and initiatives proposed are not fundamentally new, and there are other important programs and ideas to consider, the group chose to highlight a selection from its larger, initial list of the most high-impact, actionable strategies. They also sought to promote long-term but promising initiatives that will require significant collaboration among multiple stakeholders with the aim of connecting potential partners.

The group hopes that the strategies proposed will reinvigorate conversations, spur action, and spark new ideas to level the field for women in science.

Direct Financial Support Strategies 1. Implement Flexible Family Care Spending

Under this gender-neutral policy, grant-making organizations would permit grantees to use a certain percentage of grant award funds to pay for childcare, eldercare, or family-related expenses in order to encourage travel to give invited lectures or attend scientific meetings and conferences. The flexible spending would also permit grantees greater freedom to attend workshops and courses, critical for career advancement.

The IWISE Working Group acknowledges that there are significant administrative and legal challenges to implement this type of flexible spending. For example, organizations must consider the complications for investigators and institutions vis-à-vis applicable income tax laws. Flexible family care spending may also result in a diversion of a small amount of grant funds.

Still, the IWISE Working Group believes that the benefits outweigh the costs, and the group calls for biomedical research funders to make flexible childcare spending permissible within the constraints of their grantees' award budgets. Interested grant makers should be encouraged to turn to groups such as the David and Lucile Packard Foundation (<http://www.packard.org/what-we-fund/conservation-and-science/science/packard-fellowships-for-science-and-engineering/>) and the NIH (http://grants.nih.gov/training/faq_childcare.htm) for best practices and lessons learned. NYSCF is in the process of implementing this as a gender-neutral policy.

2. Provide "Extra Hands" Award

The IWISE Working Group suggests that grant-making organizations and institutions prioritize creating gender-neutral award programs for primary caregivers that provide "extra hands" funding opportunities open to all newly independent young investigators. The "extra hands" allow investigators' research to progress seamlessly and without major interruption, increasing productivity in the early and critical years of their independence. The award could be used to hire technicians, administrative assistants, or

postdoctoral fellows or in other creative ways at investigators' discretion in order to make research more efficient when they become primary caregivers. Dean Laurie Glimcher, now at Weill Cornell Medical College, pioneered a version of this award, the Primary Caregiver Technical Assistance Supplements, at the National Institute of Allergy and Infectious Disease during her presidency at The American Association for Immunologists (<http://www.niaid.nih.gov/researchfunding/traincareer/pages/pctas.aspx>). Later, Massachusetts General Hospital (MGH) implemented the Claflin Distinguished Scholar Awards (<http://www2.massgeneral.org/facultydevelopment/cfd/claflin.html>) with promising results (Jagsi et al., 2007). Subsequently, other institutions such as the University of Pittsburgh School of Medicine, the University of Massachusetts School of Medicine (<http://www.umassmed.edu/ofa/Equity-Diversity/Faculty-Scholar-Award>), and Stanford University (<http://med.stanford.edu/diversity/about/mccormick.html>) implemented similar types of award and programs (Munson et al., 2014). In a unique example, the Christiane Nüsslein-Volhard Foundation, based in Germany (<http://www.cnv-stiftung.de/en/goals.html>), devised a program to provide "extra hands" awards to young investigators for financial assistance specifically intended to alleviate household obligations and domestic responsibilities. For example, the funds could be used to hire help in the household, purchase home appliances, or pay for childcare.

While more quantitative analysis is needed to assess the impact of such programs, the examples are illuminating and encouraging.

Psychological and Cultural Strategies

3. Recruit Gender-Balanced External Review Committees and Speaker Selection Committees

Funders and conveners of symposia should adopt gender-conscious peer review committee and speaker selection committee recruitment policies. A recent study found that the presence of at least one woman on speaker selection committees for scientific symposia correlates with a significantly higher proportion of invited female participants (Casadevall and Handelsman, 2013). Though further

analysis is needed, the IWISE Working Group believes that this may carry over to female candidates winning grant awards in peer-reviewed processes. When a woman declines to sit on a committee, she should be asked to recommend three additional female candidates whom she feels would make exceptional reviewers. Funders and conveners should keep lists of the suggestions for alternate candidates for their future reference and to share with other groups. The IWISE Working Group encourages organizations to share widely with one another names and lists of potential female reviewers and speakers to make it easier for organizations to identify them. For example, the Women in Cell Biology Committee of the American Society for Cell Biology keeps such a list (<http://ascb.org/wicb-committee/>). The IWISE Working Group suggests that at a minimum, females should comprise 20% of all review committees. The group acknowledges that women are often overcommitted in this capacity. However, until there are more women in these fields from whom to choose, some of the burden must unfortunately be placed on the women who have already succeeded. This does not discount the fact that male reviewers should also be encouraged to be as bias conscious as possible, while we work toward equal candidate pools of male and female reviewers.

4. Incorporate Implicit Bias Statements

Studies have demonstrated that subtle and often unconscious gender biases exist throughout society, and specifically, in academic science (Moss-Racusin et al., 2012). To help mitigate the negative impact of such biases, unconscious attitudes, and prejudices, the IWISE Working Group suggests that grant makers incorporate "implicit bias statements" into their external program review processes. These statements describe the concept of implicit bias to reviewers and reiterate the organizations' commitment to gender equality, to equality of opportunity for men and women candidates, and to diversity, in all its forms, throughout their programs. NYSCF uses the following implicit bias statement:

As an institution, The New York Stem Cell Foundation seeks to promote gender equality and increase

diversity, in all of its forms, throughout its programs. Studies have demonstrated that often subtle, unconscious, and implicit biases exist in academic science, which have the potential to negatively impact outcomes in review processes. To that end, please be aware of potential implicit biases when reviewing, scoring and discussing candidates and applications throughout the review process so that we can work together to combat their potential negative impact.

5. Focus on Education as a Tool

Institutions, grant makers, and scientists must commit to education as a tool to combat the issues facing women in science. Academic institutions should make gender awareness training a standard component of their postdoctoral orientations and train principal investigators to proactively take measures in their own labs to mitigate gender disparities. To do their part, grant makers should provide seminars and convene roundtable discussions on gender issues in science for their grantees when possible. For example, NYSCF plans to provide these resources at its annual scientific retreat, which all externally funded scientists are required to attend. Organizations should share educational content and resources as widely as possible.

Major Collaborative and International Initiatives

6. Create an Institutional Report Card for Gender Equality

In what would require significant collaboration and partnership, the IWISE Working Group recommends that a task force be convened to develop a set of quantifiable criteria, which, when taken and analyzed together, will form an Institutional Report Card for Gender Equality to evaluate institutions on these practices. Based on the institutions' scores in each of the established criteria, they will be assigned a gender equality grade. Institutions will be reevaluated on an annual basis.

With the support of the Doris Duke Charitable Foundation, NYSCF reconvened an expanded IWISE Working Group, which included men, in February 2015 to develop an institutional report card for gender equality. The group decided that

Table 1. Proposed Phase 1 Institutional Report Card for Gender Equality

The proposed Report Card would ask the NYSCF applicant's department chair to answer the following questions:

● What proportion of your department's undergraduates is female?
● What proportion of your department's postgraduate students is female?
● What proportion of your department's faculty (assistant, associate, full professor) is female?
● In the last five years, what proportion of your department's tenured faculty members that were recruited from outside your institution was female?
● In the last five years, what proportion of your department's first time tenure track faculty members that were recruited from outside your institution was female?
● What is your institutional policy regarding paid family leave and pausing the tenure clock? Is there additional support available on top of the recruitment account to fund this?
● What is your institutional policy regarding female representation on internal committees? What is the current percentage of female representation on appointments, promotions, finance, award, and strategy committees?
● In the past 12 months, what proportion of the speakers on your department's external seminar program was female?

it should be rolled out in two phases. The Phase 1 report card should be used specifically by grant-making organizations, like NYSCF, to assess institutions in grant application processes. The group intentionally created a simple, short report card so that department chairs could easily complete it on behalf of investigators applying to grant awards as part of the application process. Table 1 shows the proposed Phase 1 report card.

To increase the impact of the report card, the IWISE Working Group recommends that grant-making organizations join together with NYSCF to use the card. Initially, the group envisions a data-gathering exercise. However, as grant-making organizations accumulate completed cards, they would require institutions to maintain a certain grade or to actively be making progress toward achieving that grade in order for the institutions' researchers to be eligible to apply for funding. The IWISE Working Group believes that institutions will be incentivized to take gender equality seriously once significant funding is attached to their report card grades.

In addition to potentially withholding funding opportunities for poorly performing institutions, the report card will serve as a way to recognize institutions determined to exhibit excellence in gender equality. Highly graded institutions will be awarded "stars" and encouraged to educate other institutions and share best practices.

In Phase 2, an expanded report card targeted at institutions versus departments would be implemented on a wider

scale and in a larger, collaborative effort between biomedical research funders, government organizations, and institutions. The IWISE Working Group began outlining the content of the Phase 2 Report Card at the February 2015 meeting and plans to release the results once finalized.

In both phases of the report card, it will be necessary to obtain relevant benchmarking data in order to assess institutions' gender equality practices, which will be challenging due to the international scope of the report card. It is also important to acknowledge differences in clinical versus non-clinical career paths in the Report Cards and evaluation metrics will need to be adjusted accordingly.

The Athena SWAN award in the United Kingdom (UK) serves as an ambitious model (<http://www.ecu.ac.uk/equality-charter-marks/athena-swan/>) to develop a report card. These awards recognize and celebrate good practices in recruiting, retaining, and promoting women in scientific fields. Institutions that sign up to the Athena Swan Charter can apply for Bronze, Silver, and Gold Awards. They must achieve a number of well-defined goals and metrics to demonstrate that they are promoting best practices for creating women-friendly working environments. For example, institutions that schedule meetings during core working hours to ensure parents can drop off and pick up their children from school are demonstrating best practices.

The Athena SWAN awards have become increasingly influential in the UK

as more data become available on the effectiveness and impact of the award and the evaluations are tied more closely to funding (Munir et al., 2013). Beginning in 2016, the UK's National Institute for Health Research, a major funder of clinical research, does not plan to shortlist any applications from Biomedical Research Centers or Units for funding unless the academic partner institution has achieved at least the Silver Award (http://www.nihr.ac.uk/infrastructure/Pages/infrastructure_biomedical_research_units.asp). This standard provides a strong incentive for institutions to work toward achieving Silver status, and it is helping to raise the profile of women in science in the UK.

It is ironic and concerning, though perhaps not surprising, that there are anecdotal reports that much of the burden for preparing Athena SWAN submissions falls on female faculty. As Phase 1 of the NYSCF report card is rolled out, institutions must avoid the same pitfall.

7. Partner to Expand upon Existing Searchable Databases of Women in Science, Medicine, and Engineering

The IWISE Working Group suggests that funders, academic institutions, and scientific journals collaborate with the European Molecular Biology Organization (<http://www.embo.org/science-policy/women-in-science/wils-database-of-women-in-life-sciences>), the American Society for Cell Biology Science Navigator (<http://ascb.org/science-navigator/>), and other relevant organizations to develop or expand upon existing, searchable databases of women in science, medicine, and engineering. The database will provide assistance to research institutions, political institutions, scientists, universities, search committees, conference organizers, and editors to identify women scientists for positions and activities such as professorships, chairmanships, speaking opportunities at conferences and meetings, selection for advisory groups and committees, participation in manuscript and grant reviews, and serving on the scientific advisory boards of companies, among others, all of which are critical components for career advancement.

Though there are significant political, administrative, financial, and cultural challenges that must be overcome in order to implement these strategies, we must find a way forward and continue working together to change the

landscape for women in science, engineering, and medicine. It is the IWISE Working Group's hope that eventually we will stop talking about women in science and start talking about equality in science, so that in time, excellence, not gender or any other measure of diversity, is the only standard that must be considered.

CONSORTIA

The members of the Initiative on Women in Science and Engineering Working Group are Paola Arlotta, Associate Professor, Harvard University, Massachusetts; Cori Bargmann, Professor, The Rockefeller University, New York; David Berg, Clinical Professor, Yale University, Connecticut; LaTese Briggs, Director, Philanthropy Advisory Services, FasterCures, New York; Moses V. Chao, Professor, Skirball Institute of Biomolecular Medicine, New York University School of Medicine, New York; Giuseppe Maria de Peppo, Principal Investigator, The New York Stem Cell Foundation Research Institute, New York; Catherine Dulac, Professor, Harvard University, Massachusetts; Kevin Egan, Harvard University, Massachusetts; Sindy Escobar-Alvarez, Program Officer, Doris Duke Charitable Foundation, New York; Valentina Fossati, NYSCF-Helmsley Investigator, The New York Stem Cell Foundation Research Institute, New York; Elaine Fuchs, Professor, The Rockefeller University, New York; Laurie H. Glimcher, Dean, Weill Cornell Medical College, New York; Valentina Greco, Assistant Professor, Yale University, Connecticut; Barbara J. Grosz, Professor, Harvard University, Massachusetts; Ya-Chieh Hsu, Assistant Professor, Harvard University, Massachusetts; Mary Hynes, Research Associate Professor, The Rockefeller University, New York; Robert Klitzman, Professor, Columbia University, New York; Sandra Masur, Professor, Icahn School of Medicine at Mount Sinai, New York; Christine Mummery, Editor-in-Chief, Stem Cell Reports, Professor, Leiden University, Leiden, The Netherlands; Betsy Myers, Program Director, Doris Duke Charitable Foundation, New York; Melissa J. Nirenberg, Associate Professor, New York University,

New York; Carolina Pola, Senior Reviews Editor, Nature Medicine, New York; Claire Pomeroy, President, The Lasker Foundation, New York; Vanessa Ruta, Assistant Professor, The Rockefeller University, New York; Beth Schachter, Consultant, Beth Schachter Consulting, New York; Rache Simmons, Chief of Breast Surgery, Weill Cornell Medical College, New York; Kristin A. Smith, Associate Director, External Programs, The New York Stem Cell Foundation, New York; Susan L. Solomon, CEO and co-founder, The New York Stem Cell Foundation, New York; Gordana Vunjak-Novakovic, Professor, Columbia University, New York; and Fiona M. Watt, Professor, King's College London, London, United Kingdom.

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WEB RESOURCES

The URLs presented herein are as follows:

The American Society for Cell Biology Science Navigator, <http://ascb.org/science-navigator/>
Athena SWAN Awards, <http://www.ecu.ac.uk/equality-charter-marks/athena-swan/>
The Christiane Nüsslein-Volhard Foundation, <http://www.cnv-stiftung.de/en/goals.html>
David and Lucile Packard Foundation, <http://www.packard.org/what-we-fund/conservation-and-science/science/packard-fellowships-for-science-and-engineering/>
European Molecular Biology Organization, <http://www.embo.org/science-policy/women-in-science/wils-database-of-women-in-life-sciences>
Massachusetts General Hospital, <http://www2.massgeneral.org/facultydevelopment/cfd/claflin.html>
National Institutes of Health, http://grants.nih.gov/training/faq_childcare.htm
National Institutes of Health Research, http://www.nihr.ac.uk/infrastructure/Pages/infrastructure_biomedical_research_units.asp

Primary Caregiver Technical Assistance Supplements, <http://www.niaid.nih.gov/researchfunding/traincareer/pages/pctas.aspx>
Stanford University, <http://med.stanford.edu/diversity/about/mccormick.html>
University of Massachusetts School of Medicine, <http://www.umassmed.edu/ofa/Equity-Diversity/Faculty-Scholar-Award>
Women in Cell Biology Committee of the American Society for Cell Biology, <http://ascb.org/wicb-committee/>

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