

A Different Kind of Medicinal Chemistry Toolbox

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ABSTRACT: To attract and retain women in medicinal chemistry, a toolbox of resources and opportunities is suggested. Scientific meetings, books, affinity groups, training courses, and networks all can provide support and strategies to help increase the percentage of women in the field.



KEYWORDS: Medicinal chemistry, women in science, women in chemistry, women in science technology, engineering, and math (STEM)

In 2017 a Viewpoint in this journal asked the question, Where are all the women in medicinal chemistry?¹ The goals of that manuscript were to raise awareness about the lack of women in the field, to bring attention to the leaky pipeline, and to suggest some actions that would encourage women not only to join our discipline but also to stay in this exciting and rewarding field of research. While we are not convinced that in the relatively short 2+ year-span since the article was published the percentages ($\leq 20\%$) have significantly changed, we are encouraged by some recent concrete actions, including the special issues of *ACS Medicinal Chemistry Letters*² and *Journal of Medicinal Chemistry*³ dedicated to Women in Medicinal Chemistry. To further encourage women to enter and stay in our discipline, in this Viewpoint we suggest a toolbox of resources and opportunities that can be used to assist, enable, and support women's careers in medicinal chemistry.

Given the constraints of this Viewpoint, we realize that such a compilation cannot be comprehensive. Therefore, we decided to highlight a few resources and opportunities ("tools") that we found particularly valuable, and include specific examples of each. Some may be more appropriate for those early in their careers, and some are geared to midcareer scientists. Many are inexpensive or free; a few may be a considerable investment. While in some cases we describe resources that are specific to an organization or a region, it is very likely that similar opportunities can be found in every scientific community. We also appreciate that a set of tools is highly personal and needs to be tailored to the individual and to the specific job/goal. Therefore, some of these tools may be useful to some, but some may not be relevant to everyone; and a completely different set of tools may be needed for others.

■ A DIFFERENT KIND OF MEDICINAL CHEMISTRY TOOLBOX

Scientific Meetings. On the surface, scientific meetings all offer the same thing to attendees—an opportunity to learn cutting-edge science. However, some scientific meetings offer much more: opportunities to network, to share your own work, to acquire some specialized skills, to gain new perspectives and fresh ideas, and to develop professionally and personally. For these reasons, it is important to carefully choose which meeting(s) to attend in order to maximize the investment of time and expense. A few specific meetings that we have found valuable are described below.

One direct result of the "Where are All the Women" article¹ was the establishment of the *Empowering Women in Organic Chemistry (EWOC)* (<http://ewochem.org>) meeting, which broadly promotes and supports women in organic chemistry.⁴ The inaugural 2019 meeting consisted of a full day of scientific talks, a poster-session, and breakout sessions/workshops on subjects such as practical strategies for creating confidence; creating, building, and leveraging your network; and cultural change to enable diversity and inclusion.⁵ Several of these workshops were led by scientists in industry (Bristol-Myers Squibb and Merck), offering opportunities for younger scientists to get a glimpse of the corporate world. What distinguishes this meeting from many other scientific meetings is the focus on empowering women: not only women doing cutting-edge science, but the appreciation that sometimes there are unique hurdles that have to be overcome to do so. The other unique

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aspect of the 2019 meeting was that the gender ratio was reversed compared to most meetings—the majority of speakers, poster presenters and attendees were women. While most of us are used to being in the ~20% minority, meetings such as this can be a valuable reminder that there are role models and peers in our field. The 2020 EWOC meeting will be held in August in South San Francisco at the Genentech site. Local EWOC chapters have been established (Greater Boston area: <https://www.linkedin.com/groups/12295218/>), and an EWOC Europe meeting is scheduled for June 2020 in Cheshire UK. EWOC is very affordable and is suitable for all career levels and all employment sectors.

Gordon Research Conferences (GRCs) can be found on virtually any topic (<https://www.grc.org>) ranging from medicinal chemistry and various types of organic chemistry to pharmacology and therapeutic area biology. The settings (usually remote), the size of the meetings (small), and the schedule of talks, poster sessions, and free time that fosters interaction among the attendees is such that one can learn new areas of science, share your own exciting science, be comfortable asking questions in an intimate setting, and get to know others in your field. It is important to find a GRC that aligns not only with your specific scientific interest but also has a culture where one feels comfortable (individual GRCs seem to have their own personality). Early in your career, regularly attending a GRC can help you establish a valuable network of professional contacts and give you opportunities to present your work at the poster sessions and get constructive feedback, sometimes leading to your first invitations to speak or be invited to act as a session/discussion leader. In 2016, GRCs initiated the GRC Power Hour, an informal session open to all attendees, to discuss issues of diversity and inclusion, and challenges that women face (<https://www.grc.org/the-power-hour/>).

Another conference that provides a unique way to meet new people in your field and start building your own network is the *European Federation for Medicinal Chemistry (EFMC) Young Medicinal Chemist Symposium* (<https://www.efmc-ymcs.org>). It has been developed by the EFMC with the aim of creating a network, stimulating scientists to share their work with peers and leaders in the field, and creating and recognizing excellence in the field of medicinal chemistry within Europe. In addition to the great science, there is a level of intimacy established between the attendees and the more established organizers.

Books. Women in science are not alone in some of the career challenges they face. There is considerable research on gender differences, and there are multiple books on strategies to succeed in the workplace as a woman. As for scientific meetings, one book does not fit all. Two that we have found useful (or at least parts of them useful) are listed here.

Hardball for Women: Winning at the Game of Business by Pat Heim, Tammy Hughes and Susan K. Golant⁶ was one book that one of us found particularly valuable. Based on research suggesting men and women behave according to different sets of cultural rules, it explains how these differences can lead to significant misunderstandings in the workplace. One specific example involves the concept of teamwork. According to the authors, men are comfortable with a concept of teamwork that relies on a hierarchical structure best modeled on sports play where everyone has a defined role: e.g., a coach, a quarterback, a benchwarmer, a waterboy, etc. Women's version of teamwork, according to the authors, is often based on traditional girls' play: dolls, where there is no formal hierarchy or structure. You might imagine the challenges and misunderstanding that arise when

women, striving to be team players and playing by the flat version of the rulebook, are accusing of not being team players, which others define by a very different (hierarchical) set of rules for teamwork. According to the authors, women will ask questions of anyone on the team in order to get the information needed to complete the task, but this is often viewed negatively, and as questioning their superiors. (It has not gone unnoticed that the impact of Title IX goes well beyond the sports playing field.) This is just one example that the book describes where invisible rules/assumptions, perhaps based on gender differences, can lead to misunderstandings.

Lean In: Women, Work and the Will to Lead by Sheryl Sandberg⁷ garnered considerable attention when it was first published in 2013. Chapters such as "Success and Likeability" and "It is a Jungle Gym Not a Ladder" speak directly to challenges women face in their careers. While some of the advice is controversial, much of it resonates with many women.

Affinity Groups. The establishment of women's groups in academic and industrial settings has become increasingly common. Some provide specific training, access to leaders in the organization, career guidance and development, as well as networking opportunities and social events. In industry, these groups are valuable as they help to develop and retain talent. In academia, they can also offer a support system for women who may be in research groups or departments where there are few other women. Almost all pharmaceutical companies (Genentech, Merck, GSK, BMS, among many others) have formal Women in Chemistry or Women in Science/STEM groups, as do most academic science departments. Importantly, the activities are not restricted to women. There are also nationwide organizations such as the Association for Women in Science (AWIS, <https://www.awis.org>), devoted to advancing women in STEM, with 80 chapters and affiliates who hold regular meetings. The mission of the ACS Women Chemists Committee (WCC; <https://acsbcc.org>) is to "attract, retain, develop, promote, and advocate for women...in the society and profession." In addition to programming at national meetings, they also sponsor a number of awards for women. If your institution has a Women in Science affinity group, search it out; if it does not, create one. It will contribute to your overall success.

Training Courses. One of the most important criteria for success for women (actually, everyone) in medicinal chemistry is technical excellence. While your formal education (college and graduate school) may give you foundational knowledge, specialized training courses often provide specific, focused expertise needed for continued advancement. In addition, they can provide a network of peers at the same career stage. The *European School of Medicinal Chemistry (ESMEC)*; (<https://eventi.uniurb.it/esmec/>) is one such meeting. Each year in the Renaissance city of Urbino, Italy, ESMEC provides Ph.D. students and junior researchers from academia and industry with the most recent advances in the fields of medicinal and organic chemistry, pharmacology, molecular biology, and analytical/structural chemistry. Similar to the GRCs, what is also valuable is the informal atmosphere and the combination of lectures and practical workshops that allow learning to occur in a truly interactive setting. In Urbino it is possible for younger scientists to sit with renowned scientists willing to share their knowledge and experience, and to give advice, information, and aid in obtaining opportunities for further career development. A very similar course in the US, held annually for the past 30 years, is

the *Drew University Residential School in Medicinal Chemistry* (<https://www.drew.edu/science-research/about-us/resmed/>).

Networks. A secondary benefit of many of the above tools is the opportunity to establish a network of colleagues and peers, regardless of gender. This is especially important since a recent study indicated that being well connected is more highly correlated with success in science for women than men.⁸ In addition to these informal, personal networks, formal networks exist including the EFMC Young Scientists Network (@YoungSciNet; Twitter), which is a gender-inclusive initiative for Masters, Ph.D., postdoc, and early career chemists working in the medicinal chemistry and chemical biology fields. Other networks that have evolved (the “chemtwitterverse”; LinkedIn) can also provide access to peers and connections.

It would be pretentious of us to think that our 2017 article has been the vehicle by which some stakeholders have changed their policy in terms of the gender gap in medicinal chemistry. However, this issue is undoubtedly gaining increasing attention, and we can point to some tangible examples of progress. Over the last two years, for the first time ever, women have been awarded the most prestigious medicinal chemistry awards in both Europe and the US. In 2018, Christa Muller won the Nauta Award, given every second year to highlight important advances in medicinal chemistry and chemical biology, and Gunda Georg received the 2020 Alfred Burger Award in Medicinal Chemistry, administered by the American Chemical Society. However, it remains to be seen if the percentages of women in our field as measured by memberships in professional societies, corresponding authorship in medicinal chemistry journals, and numbers in leadership positions increases past the 20% point over the next five years.

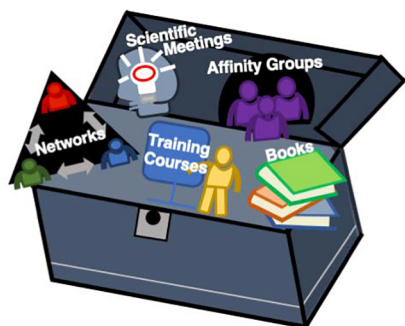


Figure 1. A toolbox of scientific meetings, books, affinity groups, training courses, and networks to support women (and men) in their medicinal chemistry careers. (Image created by Victoria McGovern, which is also used in the TOC.)

With this Viewpoint, we suggest a toolbox (scientific meetings, books, affinity groups, training courses, and networks, **Figure 1**) to support women (and also men) in medicinal chemistry in an effort to increase that percentage. While we feature examples of these tools we have personally found valuable, many others exist, including mentors, as described by Blanco and Audia,⁹ so we do not propose a one-size-fits all solution. The best meeting, book, affinity group, training course, and network for one woman will be different for another. Developing and maintaining a career in medicinal chemistry takes more than scientific knowledge—it takes all the right tools for the job.

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Notes

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■ ABBREVIATIONS

ACS, American Chemical Society; AWIS, Association for Women in Science; EFMC, European Federation of Medicinal Chemistry; ESMEC, European School of Medicinal Chemistry; EWOC, Empowering Women in Organic Chemistry; GRC, Gordon Research Conference; WCC, Women Chemists' Committee

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