


## A generosity of spirit

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To maximize your scientific career, it is essential to establish research networks and build upon a multitude of mentoring relationships. At the heart of these networks, each scientist has the potential to benefit from the influence and satisfaction of being a mentor and a mentee.

You work hard, you are passionate about your research and you want to make a difference. These sentiments are true for researchers in general; however, despite all this drive and commitment, many young researchers are poorly prepared for developing their careers. Two of the most overlooked aspects are the importance of expanding your research network and the significant benefits from being a mentee and mentor. This should not come as a surprise because students are given little guidance or formal training in these crucial areas. This Comment is not an exhaustive list of solutions for successful networking and mentoring, rather it is designed to bring attention to these important issues and to initiate discussions on how the community can better prepare our students. To paraphrase one of my valued colleagues “a rising tide lifts all boats”.

### The power of networking

The simple truth is that all researchers are dependent on professional interactions for career advancement. At no time is this more crucial than at the start of one's career. Most young researchers are not formally taught how to raise their national and international profiles, initiate collaborations, increase their potential for award nominations and receive invitations to prestigious conferences. These skills need to be integrated into an overall career strategy and one of the most important vehicles is your research network. Developing such a network is easier than many students imagine if a few general guidelines are followed. While consensus among researchers is rare, always remember that everyone agrees that helping the next generation of students is essential.

Today, the default research network is the internet. Although online resources are just a starting point, they are important for ideas and best practices. If you search, you will be surprised what can be discovered and subsequently used. Remember, you are not the first to tackle these issues and hence there is no need to reinvent the wheel. In addition, learn from other communities — networking is the same in chemistry as it is in mechanical engineering or molecular biology. However, a small word of caution with respect to using social media to develop your research network and to interact with your mentors and mentees: keep a clear separation between

your professional network and your personal social media presence. Not everyone is interested in your political views or what you did on the weekend.

It is paramount that online resources only supplement your personalized efforts. Searching out networking events and opportunities to interact with your peers is the most effective way to continually grow and expand your network. An increasing number of symposia at national meetings are dedicated to emerging researchers from both academia and industry — ask a senior colleague to nominate you for these symposia or network with the organizers. Many academic organizations can actually learn from industry when it comes to establishing early career research networks and support groups. The latter are a great way to connect with more experienced researchers who share a common background and can help navigate the struggles of establishing your career.

One under-appreciated but very successful strategy for networking is to actually work in the community — ‘work to network’. Volunteering for positions in national and international societies or organizing symposia not only develops your own research network but is an unparalleled way to make lasting connections, introduce yourself to the community and establish collaborations. In the materials arena, service to professional societies such as the American Chemical Society, Materials Research Society or Royal Society of Chemistry is a sure-fire way to supercharge your research network. The small amount of effort required will benefit your career many times over.

Successful development of a research network also often comes down to execution and following through on initial contacts and plans, especially when it may take you out of your comfort zone. I have been to countless professional and social events at which my initial attitude was “this is not going to be fun or useful”. Inevitably, my viewpoint is exactly the opposite. Push yourself to maximize these interactions, even if you are initially hesitant.

### The promise of mentorship

Mentoring is an under-appreciated but vital part of any career. I often consider that the role of mentor crosses the line from career development to career accelerator. Providing support and guidance is important, but equally

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important is being a go-to colleague for award nominations, lectureship invites and student recruitment. Mentorship must be cultivated and as with any investment, a close eye should be given to new opportunities and effective ways to use your valuable time. A sense of engagement with the mentee and identification of mutual benefits often enhances the mentoring relationship.

An additional aspect of mentorship that is discounted is how varied the mentor and mentee relationship can be. Indeed, as a graduate student, I did not appreciate the value of having multiple mentors at all career stages. Your supervisors are obviously central, but it is crucial to have different mentors from within your organization and from industry and academia. Different institutions have different expectations and support structures for mentoring; it is therefore important to diversify and maximize their impact.

### Being a mentor

A good mentor can connect multiple generations of students and also serve as a linchpin connecting different mentoring families. I was the beneficiary of two wonderful mentors: my PhD supervisor, Sir Alan Battersby, and my post-doctoral mentor, Jean Fréchet. After 30 years, Jean is still playing an influential role in my career: opening 'doors,' giving advice and providing great support. A very pleasing and unexpected consequence of Jean's mentoring is how connected I am to all of Jean's students and collaborators. Although I did not realize it at the time, Jean's collaborators and peers were becoming informal mentors and I was becoming part of a much larger research network. As science and technology evolve, these enhanced research networks are becoming an alternative pathway and need to be fully developed.

Some words of caution for both the mentee and mentor. For mentees, please remember that senior colleagues are busy and, as a result, when asking for assistance, you should be as helpful as possible. Take the example of letter writing for award nominations, proactively draft bullet points and research summaries for inclusion. Remember that you are by far the most knowledgeable about your research accomplishments and career highlights. Combining these insights with your letter writer's broader perspective will allow the most effective letter or nomination to be drafted. We all understand the concept of catalysis and decreasing energy barriers, this situation is not any different.

At the beginning of your mentoring career in either academia or industry, a major challenge will be coming to grips with increasing bandwidth pressures. It may sometimes seem easier to take over a project or finish writing a paper by yourself. Try to resist this temptation, as it minimizes the chances for the student or young researcher to learn these important skills through discussions and interactions with you as a mentor.

Coincidentally, it may also curtail your own development in these mentorship areas. Getting better at these soft skills is a career-long and ever changing quest for both mentees and mentors.

### Dual roles of mentor and mentee

Watching your mentees succeed is one of the most rewarding aspects of being a mentor; however, it should not be overlooked how this success can also have a significant impact on the mentor's career. For example, it exposes the mentor to a younger generation of scientists who are often more connected to the latest research directions and characterization techniques. The line between mentee and mentor is actually very fuzzy and although a significant percentage of my own research network may have started off as mentees, it is very satisfying to see that many are now as much mentors to me as I am to them.

### Connecting mentoring with networking

A number of take home messages are woven throughout this Comment article: first, the importance of developing and interacting with your research network as both a mentee and mentor; second, the evolving nature of relationships within your network; and third, the exposure to multiple environments is one of the surest ways to fully understand and appreciate the global nature of your career. For example, industry is for many students an unknown quantity even though this is the career path for most researchers. Proactively looking for networking opportunities and mentors in industry and outside your current institution or company is crucial. In addition, realize that every mentee-mentor relationship is different and by tailoring your style to the individual and modifying the relationship as the younger researcher gains more experience will allow for the greatest impact in both directions. In a similar way to enhancing your research through collaborations, developing a multifaceted strategy for networking and mentoring allows your career to grow in unforeseen and positive directions.

Befitting a Comment article on networking and mentoring, I would like to pay special thanks to the many people who have provided thoughts and comments on the topic. Much can be learned from watching great mentors and mentees in action and it is these lessons that make research fun, inspirational and ultimately truly rewarding.

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