

Title: Mentoring Early Career Researchers

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Abstract

The Curious Future Insight Conference is a platform that brings together scientists from around the world every 2-4 years to discuss the latest advances and innovations in science and technology with the aim of 'uniting through science for a better tomorrow'. Over the 2-day gathering, a number of themes are covered relating to Energy, Healthy Lives, the Human Mind, Life Reimagined, Materials & Solutions, Nutrition and Vibrant Digital. In the 2024 conference, the importance of mentoring and supporting Early Career Researchers within the wider science ecosystem was a prominent feature of a panel session hosted by AAAS/Science and moderated by Dr Rachel Bernstein of Science, deputy news editor focusing on careers and community. In this panel session that also included Dr Senka Holzer, Medical University of Graz and Professor Ulrike Fasbender, University of Hohenheim in Germany, we explored the importance of the mentor/mentee relationship from a scientific and professional perspective, how the relationship can help individuals in navigating challenges within a science career and strategies and approaches for fostering the relationship. This chapter will address some of these main themes around mentoring relationships, bringing in our insights and personal perspectives.

Body

Introduction to Mentoring

The word Mentor first appears in Greek Mythology in *The Odyssey*. Mentor, a trusted friend of Ulysses - the epic hero of the Trojan War, is entrusted with the protection and guidance of his son before Ulysses departs to Troy [1]. In a similar vein, mentoring refers to the process of sharing knowledge, skills, and experience between a mentor and a mentee with the goal to help the mentee progress in both their professional and personal life. Compared to an apprenticeship, mentoring has a broader focus and is not limited to specific skills learning.

Mentors play an important role in helping mentees in the process of developing a scientific research career, and nowadays, in the era of information overload, this support is essential. Navigating too many options (study opportunities, research directions, career paths, etc.) or apparently no options at all (failures in securing very competitive academic positions, unsuccessful grant applications) requires training and advice to help one be in the position to make the best decisions for what comes next.

Mentoring is however not only a process helping one make decisions but also a supportive element in identifying best directions to grow professionally and personally and finding the right balance between personal and professional lives. There are many examples of mentoring directed to students from underprivileged backgrounds or countries with less developed scientific ecosystems. Also, mentoring relationships that are directed towards work/life balance, parenting, etc.

Mentoring relationships can be short or life-long, start with a long and arduous search or through a serendipitous meeting. In this chapter, we will describe our own mentoring journey and highlights from the Mentoring panel during the Curious 2024 Future Insight Conference.

Our experiences of mentoring

Theresa:

Theresa Mercer is a Senior Lecturer in Environmental Sustainability. Her research focuses on two main areas; environmental systems change and collaborative education approaches for environmental sustainability. She is also the Sustainability and Environmental Management Programme Director, acting as a Champion for

ten MSc level courses at Cranfield University. Theresa is particularly passionate about advocating for support aimed at extended leavers within the academic and research communities, having been one herself, and exploring the development of formal support frameworks with HE institutions and research groups that provides support before, during and after periods of extended leave.

My experience with mentoring goes back around 10 years ago. I was an early career researcher on an amazing research project exploring the biodiversity and ecosystem service provision in urban areas. There was a lot of field and lab work involved and I thoroughly enjoyed the practical aspects of the work. Three months into the three year project I became pregnant and eventually took my maternity leave. During this time, I moved from England where my project was based at Cranfield University to Cardiff, Wales where my husband was based at the time. As I got to the end of my maternity leave of one year, I realised that cross-country commuting with a baby in tow just wouldn't be possible. On top of that, my baby daughter didn't take to nursery. She went on sleep strike and hunger strike. I remember ringing my project PI at the time who was also my mentor and telling him I couldn't carry on with the project because of these compounding factors. I was in floods of tears and at the time thought that this would mark the end of my academic career [2].

Two to three days later my PI rung me back and said to me 'look Theresa, don't worry, we can find a way for you to work through this.' 'We can support you for however long you plan to take out of academia.' This time out of academia turned out to be five years. During that time I had both informal and formal support from two of my mentors at Cranfield University. Now I've rejoined academia and returned to Cranfield after a posting at the University of Lincoln. My two mentors continue to support me now in my career since returning to academia. My takeaway message is that as a mentor, you can have transformative, life-changing impacts on the mentees that you are mentoring and can play a huge role in their career trajectories, particularly for those of us that haven't followed a standard route through academia or research careers.

Michael:

Michael-Bogdan Margineanu is a Postdoctoral fellow in cancer neuroscience at the Francis Crick Institute and has 13 years of research experience at leading institutions from Germany, Saudi Arabia, UK, Ireland, Austria, US, Switzerland and Romania. He is the Founder and President of Biomentorhub, a youth non-profit and non-governmental organization focused on mentoring young scientists and innovators in life sciences from Romania and other countries with very limited R&D professional opportunities in this field. He is also an alumnus of the Lindau Nobel Laureate Meetings (Medicine & Physiology 2018) and co-founder of the Lindau MentoringHub.

I believe mentoring in science does not start when you actually start to study science formally in university. In my case it started in the family; parents stimulated my curiosity through discussions in a way I think maybe they were my first mentors, even for my scientific journey later on, as we always consulted on major decisions.

Then I think throughout progression in school you get to meet some professors which have a strong impact on your development, inspiring you to choose a particular path. And I think this can be seen to some extent as mentoring as well. Of course for each person in particular the experience and interactions they will have will be different.

But in my case, I had amazing professors who pushed me forward and stimulated my curiosity for science, for research since secondary school. Also, during high school. And I think that this continuous encouragement, this continuous support was very important to move forward along the way. And then of course university (both undergrad and master's degree studies) provided me with mentors. However, maybe the most impactful mentoring relation I had was with my PhD advisor and that's not always the case for everyone.

And not everyone has an excellent mentoring relation with their PhD advisors. However, I could say that when I did choose to apply to the respective research group and work with the respective PI, I looked at him as a role model outside his scientific expertise too. It was something I factored into my decision, and it really paid off. And I'm very grateful for that.

Finding the right mentor and developing the best mentoring relationship

- **What are some methods for finding mentors and fostering the relationship?**

Theresa:

Most academic institutions or research institutes will have some sort of formal mentoring scheme in place. I rejoined Cranfield University and have been there for just over a year now and they have an official way of doing that. You are paired with a mentor beyond your research centre so it is an academic or researcher with that external view, which is great in helping you look beyond your discipline and immediate network.

The other approach is through informal networks. This doesn't necessarily just happen and these networks need to be nurtured, particularly if you have been out of academia for a while. If you have been on extended leave, like I had, I continued with support from my formal mentors but I also reached out through my informal networks that I had developed during my PhD and Postdoc times. I found this larger support network from beyond the project I was involved with incredibly supportive as well.

So there is the formal way of doing things through your relevant institutions' mentoring schemes but also the informal route as well. In order to nurture your networks, do reach out regularly and check-in. Most people are happy to be asked to be an informal mentor. I have done this in the past and have a number of external mentors as a result. They can give very useful external perspectives.

Michael:

Apart from formal mentoring schemes, there are other specialized platforms like Biomentorhub or the Lindau Mentoring Hub, accessible to the alumni of the Lindau Nobel Laureate Meetings. Biomentorhub is accessible to anyone looking for mentors in the life sciences sector.

Related to the mentoring relationship, I think in order to benefit most from this relationship, the mentee needs to believe in the mentor's capacity to help and be able to follow the recommendations received.

I think it's a bit similar to the relationship with a medical doctor. When you go to a medical doctor and are consulted and you get a recommendation, part of the healing process will also be based on your belief that what was recommended will work. It might take you some time to find the medical doctor that you trust, with whom you communicate well. Same applies to a mentoring relationship.

At the same time, I think the mentee must offer openness in the relationship with the mentor to benefit most. It's not something easy to achieve initially, but it's something crucial. The most impactful and useful mentoring relations would be the ones in which there is such openness and maybe you reach a level in which you can consider the mentor, even part of your extended family. Your mentor can be a great role model, but if you do not connect well, you will not get the most out of this mentoring experience. Also, I know it can be very difficult to take criticism but do not run away if you are criticised or if you receive critique from the mentor (constructive non-personal criticism). This is something that can help you grow.

- **What are the hallmarks of a good mentor-mentee relationship?**

Theresa:

In order for a mentor-mentee relationship to work well, regular contact and check-ins are essential. These allow the mentee to maintain momentum in their career plans, to discuss and problem solve any challenges and a chance to get feedback. The communication in any meetings should be open and honest with respect, kindness and dignity being the cornerstones of the relationship. What I found really positive in my experience with my current mentors is that you leave a meeting feeling uplifted, so mentors instill that confidence in you and are emotionally intelligent in their support. A good mentor will open their network and provide opportunities to the mentee. At the same time a mentor will foster a safe space to allow the mentee to make mistakes and learn from them. A mentor will help lift mentees up in their career, helping them realise their potential.

From my experience, the very best mentors have been those that don't just support you in your career but support you as a whole person. So your personal life, your values and your choices. If mentors can lean into that and really support you in your whole being, then that's where I feel you have the most fruitful mentorship.

Michael:

I think that also relates to the openness aspect. Sometimes you might not feel so comfortable to open up completely in front of your research advisor, but you will do that in front of someone else who might know you also a bit better. I think one other important aspect that you raised about personal development is also very important. I think one can see this from the perspective of athletes training.

Mentoring should play a very important role in helping you achieve your maximum potential. Give your best and bring the best impact you can in the world. And here, certainly, you need more mentors to be involved. And there are people that can help you basically improve your thinking, improve decision making and build these skills. So it's not about scientific research skills. It's about other soft skills, if you can call them like that, emotional intelligence skills, which I think are more and more important nowadays.

- **What are the responsibilities of a mentor and a mentee in the relationship?**

Theresa:

I think one of the main responsibilities of a mentor is providing honest feedback and helping the mentee identify areas for further development. They also need to be available for regular check-ins. For a mentee, when you have that feedback from your mentor, it is important that you proactively act on it. So understanding that sometimes constructive criticism is there to help guide you and help you grow so to view it and use it in that way. It is also useful to respect the time your mentors give to the relationship as well. Being prepared for meetings can help you get the most out of the time with your mentors so for example having points of conversation or a rough agenda and having any actions prepared that have been met since the previous meeting.

- **Should you develop a mentoring relationship distinct from that with your research advisor?**

Michael:

I think this relates to the openness element I have highlighted before. Especially in the beginning it could be difficult for you to open up and discuss matters related to your personal life and career planning with your research advisor. This is when it is helpful to have a mentor who is not a direct research supervisor but someone who stays with you while you transition through different educational and career phases. I think such a mentor is important and you can see this as a long-term mentoring relationship. At the same time, your current research advisor can become a long-term mentor too.

- **What is a challenge you've faced as a mentee or mentor, and how did you resolve it?**

Michael:

As a mentee, I feel I was shy in the beginning to ask for more help and guidance. I think one should not feel uncomfortable to do so. Expecting that the mentor is not able to provide more support or that the mentor will not be able to answer a particular question can prevent you from asking it and will lead you to reach wrong conclusions.

Theresa:

I think one of the main challenges I've faced as a mentee, has been not realising the power of the mentor-mentee relationship. In my experience as an extended leaver, I thought my time away would signal the end of my academic career and what I really needed to do was reach out and trust in my mentor. In the end I received both the informal and formal support from my mentors during my time away that helped me re-enter academia with experience under my belt in that time away.

- **What is a common pitfall in mentor-mentee relationships and how can it be addressed?**

Michael:

Do not expect that the mentor should take decisions for you. I think you need to be aware that the mentor does not know you and the context better than you do and has limited responsibility when it comes to your decision-making process. You can ask for advice, receive it but assume full responsibility for important career-related decisions that you make.

Theresa:

For those that take a non-traditional academic path (such as extended leavers) there are systemic failures in the academic and research system to support the mentor-mentee relationship during extended leave periods. Oftentimes, the level of support during extended leave is based on the mentor-mentee relationship and as such there are various levels of support available that are relationship-dependent.

This needs to change and as such organisational culture needs to change to ensure that the same level of support is offered to **everyone** during the time away. We need formal support frameworks across institutions that are specific to an individuals' needs, are flexible and innovative. Examples of formal support could include

setting up casual contracts or honorary positions for the mentee. It might include a phased return to work or having protected funding pots for carers to fund childcare support at conferences. Examples of informal support could include setting up parent and carer networks and various platforms to share experiences [3]. My plea to HE and research institutions is to realise the benefits of this approach in retaining talent, provide choice and flexibility in your support and facilitate an open, ongoing and constructive dialogue.

- **What is your view or experience on reverse mentoring?**

Michael: There was a very nice comment from Sir Godfrey at the *Ask Me Anything* session. He pointed out that it's important for experienced researchers to also be mentored by young junior researchers. And I think that addresses quite well this concept of reverse mentoring. I think there are mutual learning benefits, and especially the pace at which science advances nowadays. I feel it's important and it's something that can provide beneficial to mentoring as well. And, apart from that, I think there is always something to learn from each personal interaction that you have.

Reverse mentoring is something I believe becomes integrated into the relationship, it happens through questions asked by the mentee which can bring new perspectives in the mentor's thinking, also through sharing news related to the mentee's learning experience, participation in events and so forth. I don't think having a formal structure for it helps in any way.

Theresa:

You learn something from everyone that you have interactions with. So in my teaching role as a Programme Director and Module Leader, I am involved in teaching management and delivery. Here I am thinking of the interactions I have had with current and previous cohorts of students. We've got these really multi-cultural cohorts with different experiences, age ranges and I learn something new from students and early career researchers every day. To give you an example, when I was a postdoc, we used to use paper-based A-Z maps to get to all our field sites where you use the co-ordinates to find your way around. It took an informal chat with a postdoc recently to say, 'well should I send you a google pin to get to a fieldsite?' I responded with 'what is a google pin?' So it turned into a lesson for me, learning about what google pins are, how they work and what they can be used for. This doesn't always have to be formal and that reverse mentoring happens a lot of the time without me even realising it, from students and early career researchers. It does help to go in with an open mind and to be willing to learn from anyone you interact with.

- **Switching careers/disciplines or approaching highly interdisciplinary research**

Theresa:

I ultimately took five years out of academia and when I returned I went down a teaching route, so I'm slowly getting back into the research over time. I found it quite difficult at the start to get into teaching. I have always been driven by the science and research but I quickly made mentors around teaching in my previous institution. You tend to get communities of practice for example around teaching, similar to having research networks and I found mentors that supported me along the teaching route in that way. So finding people that work in the same sort of area and are passionate about, for example in my case, the teaching and then developing that community. So I didn't have a formal mentor as such. It was more of an informal mentor but they helped guide me through the process of what I needed to do if I was going to follow the teaching route through academia.

Also, for those that have taken extended leave, or considering it, you also pick up really valuable skills in that time out which helps you to become a better mentor and arguably better researcher and/or lecturer when you return. You pick up skills in academia through research and through teaching but similarly you pick up skills in the time away for example project management, resourcefulness, time management, problem-solving and teamwork that can all add to your skills base.

Michael:

It's not only about changing fields, it's about also new fields. We have new interdisciplinary areas such as cancer neuroscience, which is neither typical cancer biology nor typical neuroscience. There is something like environmental neuroscience now being termed and most probably will emerge as a research area by itself. So what happens when you want to jump into an area like this? It's a novel area. Who would you go to talk to now? I think this is a bit, a bit more challenging because there are few experts in general who will take first steps, pioneering steps in developing these areas. So when I looked into cancer neuroscience, there were maybe 6 to 7 research groups around the world, not more than that focusing on this, so, there are in general, a few people you can talk to. I think then it's important to expand your outreach and do not look only

at academics but look also at entrepreneurs for example. They're usually among the first to also take more risky steps into new directions. Possibly some industry departments too.

I also wish to relate my experience taking an independent study course during my PhD studies at KAUST. I told my PI one day that I am really interested to learn more about lactate metabolism in gut microbiota (because the focus of my project was on deciphering the role that lactate plays in signaling in cortical neurons) as I was reading lots of new articles focused on lactic acid bacteria in the context of the gut-brain axis. And that I have considered signing up for an independent study course. The curriculum allowed me to find a second supervisor that coordinated the course together with my PI. So under the guidance of an expert in microbiology and my PI, I designed this independent course focused on lactic acid bacteria metabolism in the gut and brain physiology. It was an amazing learning experience and something I encourage all those who have this opportunity offered by their university to go for it.

Future outlook of mentoring

Theresa:

I would like to stress the importance of mentors and thank all the mentors out there, especially for those supporting mentees that are taking a non-standard route through academia or research. The support that you provide can be completely transformative and life-changing. For mentees out there who are thinking about taking extended leave or are currently taking extended leave, speak to your university or research institute support services about what is available in terms of support. In your time away, continue to nurture your networks and if you are so inclined, keep your hand in with papers and developments in your field as it can really help when you return.

Michael:

Try to always dream big, aim high, and, do not limit yourself by, let's say, the capacity around you or the people around you. You can find the path. You can find the way to achieve what you dream of and what you're capable of. So always push for that, ask for help, connect with like-minded people.

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