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## How to make undergraduate research worthwhile

*Practices might differ from country to country, but undergraduate students can be better served in research, says Shaun Khoo.*

One of the things that excited me about taking up a Canadian postdoctoral position was that, for the first time, I would get a chance to work with and mentor enthusiastic undergraduate researchers. I looked forward to the chance to [gain mentorship skills](#) while helping out future scientists, and maybe, eventually, freeing up some of my own time.

As an Australian, I had never pressured to volunteer in a lab – most Australian students don't do any undergraduate research unless they enroll in an extra honours year, because the law prohibits unpaid student placements [that are not a course requirement](#). It hasn't held back [overall research productivity](#) in Australia, but it is a stark contrast to the North American environment, where many undergraduates feel pressure to get research experience as soon as they begin university. Most graduate [medical students](#), for example, have previous research experience, and North American graduate schools have come to [expect this](#) from applicants. In Canada, nearly 90% of graduate medical students have [past research experience](#).

[Numerous articles extol](#) the virtues of undergraduate research experience, but, unfortunately, evidence supporting the [benefits of undergraduate research experience is limited](#). Most studies on the topic rely exclusively on self-reports that are corroborated less than 10% of the time by studies using more-direct measurements. For example, [surveys](#) find that undergraduate student researchers say that they have developed data-analysis skills – something that would normally involve lots of practical work – yet, when interviewed, most of them admit to never having done any data analysis.

Like many postdoctoral researchers and graduate students, I spend most of my time with undergraduate students working on technical skills that they might need to work in the lab, but that don't necessarily improve their conceptual understanding. For example, if I teach a student how to use a cryostat, they might become proficient in slicing brains, but they won't necessarily learn how synaptic transmission works. Even if we manage to [instil excitement](#) for the intricacies of research in our undergraduate students, it's hard to avoid the conclusion that for the vast majority that continue in academic research, there will be [no permanent jobs](#) – we might just be saddling our undergraduates with unrealistic expectations.

So how do we avoid wasting our time as mentors and our students' time as learners and researchers? Here are my suggestions.

### Consider long term goals

Undergraduate students should reflect on how their undergraduate research experiences will prepare them for professional success. Should they be aiming for research experiences that are based on their courses, because it will better improve their [understanding of scientific concepts](#)? Will a given opportunity help them reach their career goals by getting into a professional graduate program? Can they commit to staying with a research programme long enough to become effective and potentially be a co-author?

### **Acknowledge and offset opportunity cost**

Undergraduate research requires significant time investments from both students and research supervisors. Undertaking such research might mean forgoing paid employment or other experiences, such as student societies, sport, performing arts or campus journalism and politics. Mentors can help undergraduate students by facilitating summer-scholarship applications or finding ways for students to get course credit for their work.

### **Training for diverse careers**

Most undergraduate students will pursue non-research careers or join professional graduate programmes. Those who try to continue in academia will eventually face a bleak post-PhD academic job market. Just as PhD students need preparation for a wide range of careers, so do undergraduate students need to build a [transferable skill set](#). Mentors can encourage undergraduate students to build communication skills by, for example, encouraging them to present in lab meetings, or facilitating teamwork by having groups of undergraduate students complete a project together.

### **Undergraduate research experiences can be better**

There's limited non-anecdotal evidence that undergraduate research improves a given lab's [research productivity](#), or even [student learning](#), but such research isn't necessarily a waste of time. Before undergraduate students pad their CVs with research experience, they should reflect on what they will achieve by conducting research, and they should seek out meaningful projects to work on and develop relevant skills for their future career.

For mentors, we have an obligation to consider the career development of undergraduate students and, for the sake of our publication records, we should aim to work with students who can commit at least a year to our projects. And, as much as possible, we should try to take the pressure off undergraduate students to do research, so that it can be an enjoyable learning experience rather than a box they need to check.

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