Fixing the broken graduate education experience

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The current academic culture needs to change its mission, which is narrowly focused on training PhDs to be the next generation of academic tenure-track scientists.

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The life of a scientist can be hard. Some of us find ourselves fighting through graduate school and postdoctoral fellowships, battling for jobs in a saturated job market and then bootstrapping our way through the progression of our career trajectory. Regardless of that, obtaining a PhD is extraordinarily rewarding for the individual and important to society.

Let's focus on the beginning: graduate school. Obtaining a PhD is hard—and it should be. What I found was that graduate school was not impossibly difficult from an intellectual standpoint, but it was painfully hard from an emotional and physical standpoint. I felt as though faculty had the mentality of putting students (and postdocs) through, well, torture—because that's how they went through graduate school and their postdoctoral fellowship. At least, that's my perception. I also found it mentally frustrating that graduate education is narrowly focused on preparing students to eventually become faculty in major universities in which they would be running their own research programs. Looking back, I see the graduate education system as broken, but very fixable.

It is sad that PhD programs continue to focus on training future faculty researchers when, in fact, the majority of PhDs pursue careers outside of academic research[1,2]. I strongly believe that PhD programs are missing opportunities to better prepare PhDs for the different career fields available. I believe that fixing the broken graduate education experience will require at least three main focus areas: (i) culture change, where faculty and administrators must become accepting and supportive of career opportunities outside academic research; (ii) coursework: PhD programs should integrate multidisciplinary coursework into curricula to provide the skills PhDs need to excel outside academia; and (iii) work experience: PhD programs should provide opportunities for students and postdocs to participate in internships and other work activities so that they can obtain paid work experience in their area of interest. One of the biggest complaints that employers have about newly minted PhDs (students and postdocs) who are entering the nonacademic job market is that they have no paid work experience. Our education system should help fix this issue.

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There is some change regarding the graduate education system beginning to occur at the National Institutes of Health (through the Strengthening the Biomedical Research Workforce program) and the National Science Foundation (via the 2013 Innovation in Graduate Education Challenge). Will this be enough? I'm not so sure. The biggest hurdle is the way current faculty and administrators think. Adapting coursework and integrating work experience into PhD programs should be fairly easy, but it is really hard to change the way people think and feel.

I have witnessed extremely negative thinking regarding PhDs seeking careers outside academia. This negative thinking, coupled with my desire to generally enhance the positive atmosphere of the graduate education system, literally led me to dedicate my dissertation "to all those who I will positively influence and encourage." Over the last five years, I've been trying to do just that, writing about these issues in these pages as well as in *The Scientist* and *Biochemistry and Molecular Biology Education*. Current PhD students and recent graduates have responded very well to these initiatives, but not surprisingly, many senior faculty look at these activities as propaganda against graduate education and generally harmful to their academic mission.

Does graduate education need to be revised? What will help improve the system and process of educating and training PhDs? Is change possible? What will it take to change the culture?

Ultimately, graduate education will change. It has to, to keep up with the demands of the job market (most PhDs are already being employed outside academia). Our goal should be to help this change happen sooner and in a way that helps ease the heartache currently experienced by so many graduate students and postdocs around the world.

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