



## Ask Professor Sarah Bellum

*Professor Sarah Bellum answers your questions on navigating the often-uncharted waters of early career development. Professor Bellum is communicated by Patricia L. Clark, Professor of Chemistry & Biochemistry at the University of Notre Dame and member of the Society since 1994. Do you have a question for Professor Bellum? Send it to [sarahbellum@biophysics.org](mailto:sarahbellum@biophysics.org). Your privacy is assured!*

### Your Advisor: Not the Same as a Boss

**Q:** I'm in my fourth year of graduate school, and until recently my research project was proceeding very smoothly. But it now has become clear that a major assumption underlying a lot of my work (and others in the field) is false. This is a huge setback. I feel like I don't have a thesis anymore. I have already had several conversations with my advisor about what to do, but each one has been more frustrating than the last. My advisor keeps telling me not to panic, but he doesn't really tell me what to do. He keeps talking about how there is "still good stuff in here" and "I'm sure we can make a different story out of this," but all I can see is the shambles that was my thesis. Even worse, he doesn't treat the newer graduate students like this—for them, he goes out of his way to explain exactly what he wants them to do. Why won't he do this for me, particularly now that I need his help more than ever before? It seems like since my original thesis collapsed, he has written me off and left me to figure a way out of this mess on my own.

**A:** Watch out: while the synonym 'supervisor' describes both an advisor and a boss, a situation like this highlights a key difference between these types of supervisors. The primary responsibility of your advisor is to help you develop into an independent scientist. In contrast, the primary responsibility of a boss is to help his employees be as productive as possible. Sometimes guiding a student towards independence and increasing

productivity are indistinguishable, such as for the newer graduate students in your lab. But you are no longer a first- or second-year graduate student. After four years of high productivity, your advisor is clearly confident that you know how to design and troubleshoot experiments, interpret your results, and plan the next steps in your project. In your situation, the best move your advisor can make is to help you stretch your wings and move closer to fully independent work by letting you struggle through this mostly on your own, and offering lots of reassurance but few technical insights. This initially might seem (and be) counterproductive in terms of your short-term efficiency in the lab, but it will pay off in the long run in spades, in the form of you taking ownership and primary responsibility for the direction of your thesis project.

It is also important to keep in mind that it is unlikely that your advisor is intentionally withholding helpful ideas from you. After all, most advisors want you to be independent and productive—the more productive you are, the more papers you two will write and the easier it will be for him to renew the research grant that funds your work. But the bald truth is that at this point, you, who have been immersed in this project for several years, likely understand the detailed ins and outs of your thesis project and the relevant literature far better than your advisor. This can be a hard thing for even the most seasoned advisor to admit, but the bottom line is that in many ways you are now better equipped to think up a strategy to climb out of this setback than he is. The major advantage your advisor has in this situation is a broad perspective: it's not his thesis project that has crumbled, and he has probably seen other strong students survive similar crumbings in the past. So it will be much easier for him to stay calm and consider the long view. Do your best to stay calm as well. I know this is hard: you are staring at the shambles that was your thesis and starting to panic. You might feel that the light at the end of the graduate school tunnel, the light

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that you just recently caught sight of, has disappeared or at least moved back another year on the horizon. I know this might be inconceivable right now, but another reason why your advisor is not panicking is because it is unlikely that this setback will delay your defense date very much, if at all. There is an old saying that 90% of the results in a dissertation will be collected in the last six months of graduate school. Like most old sayings, there is a large kernel of truth here, and the reason why is because the bulk of graduate school—the part you have already accomplished—is devoted not to collecting publication-worthy results but to developing your mind and technical skills, and preparing your experimental system. By the time you get where you are, with the end in sight, you and your experiments are both highly tuned. Trust me: you will be able to respond to a challenging change in direction, even a challenge as big as this, more quickly than you think possible.

The key now is to calm down, take a deep breath, and let yourself think about your thesis results, along with the new knowledge gained from the falsified assumption, in the broadest possible way. Most importantly, give yourself permission to

stop thinking about how to re-craft your thesis for a couple days and instead immerse yourself in the best literature in your immediate area. Ask yourself what the most burning issues are in your field now. Make a broad, inclusive list, focusing on the importance of the questions rather than whether they are questions that you personally could answer. Then, and only then, think about what tools you might have to bring to bear to address these questions. Try to make novel connections. A lot of exciting breakthroughs happen at the boundaries between traditional fields. For example, can you apply a tried-and-true approach from one field to a new system? The point is to trust yourself enough to let go of your old thesis direction and explore with confidence the full range of possibilities for going forward. Yes, this will require work, and perhaps more retraining than you were expecting at this stage of graduate school, but the thesis you produce at the end will be stronger for it.

As a whole, graduate school is a period of tremendous growth, both as a person and as a scientist. Like any growth spurt, it comes with some serious growing pains. These growing pains will change as you progress through each stage of graduate school, but they are all somewhat painful. Remember the early pain of year one, feeling lost and having much of what you thought you knew shown to be incomplete (or even worse, wrong)? Or the pain of realizing that you are three long years into graduate school and still cannot see when—if ever—you will finish? The pain you are experiencing right now is certainly different, but as with the others, you will find the strength to overcome it. And in doing so you will learn how to solve your own problems, stretch your wings a little farther, and be that much better prepared to leave the nest upon graduation.

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