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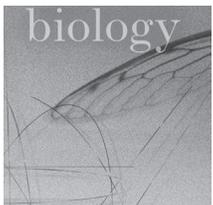
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STEPHANIE FUHR

# Living Biology



Five years ago I began teaching a one credit course for our biology majors entitled *Becoming Biologists: Understanding our Place as Life Scientists*. The story of the development of this course has been the story of my development as a

teacher as well as the story of how I have come to understand the importance of discussing values in the development of a scientist. Creating an introductory course such as this one in any major presents an interesting challenge in backward curriculum design. Knowing the skills, abilities, and dispositions we would like to see in our graduating seniors, the question becomes: which conversations, lessons, and assignments are most relevant to have at the beginning of their development? As a biology teacher, I was asked to step back from the content of my discipline (the sweet comfort zone for many, including myself) and to view the discipline at large in an effort to piece together a story of how “biology” is conducted and what it involves.

Trained as scientists, biology professors instinctively begin with intellectual skills: How can we begin proposing hypotheses? How can we talk about the basics of experimental design? How can we connect learning to theory and physical elements of the brain to encourage metacognition? How can we apply scientific thinking to scientific arguments in order to test claims? But more difficult questions follow: How can we teach students to develop their own questions? How can we prepare them to speak articulately about themselves as learners and biologists? When we think about training our students to emerge as skillful scientists and thinkers, these are the sorts of intellectual acts we want them to practice

throughout our curriculum, beginning in the *Becoming Biologists* course. However, the challenge in a course built from skills alone is that you still have to choose content or stories in order to test the skills.

The introductory course sounds absolutely brilliant from a curriculum design perspective. Yet, the story of the development of this course and my own teaching begins with student distaste for—and kick-back against—“skill lessons” and my subsequent desperate search for meaningful stories and conversations that might engage them. Frustrated by student resistance, I found myself in a state that Robert Pirsig articulates well in *Zen and the Art of Motorcycle Maintenance* as drifting laterally for a while to expand the roots of what I already knew, even though I was determined to expand the branches and move forward (169). I knew what I wanted to teach them, but I didn’t how to get them to embrace this particular kind of learning. The lateral drift sent me in two directions—toward conversations with students and to the college library. I needed to learn which stories the students perceived as missing in their understanding of how “biology” is conducted. I also needed to read more stories from biologists across the many subdisciplines of biology.

The first story I happened upon was an obvious choice given the title of the course I was stumped by, *On Becoming a Biologist*, by John Janovy Jr. The author, a well-known parasitologist and educator at the University of Nebraska-Lincoln, intertwines stories from philosophers, scientists, and educators about the ideals and practical matters of pursuing a professional academic life in the biological sciences. I recommend this book to every student I meet in the classroom. I include readings from it in my course, and have loaned my copy to

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several students to gather their thoughts about it. The roots of what I have known about biology and biologists have expanded greatly thanks to this small book. I hope a book like it exists in every discipline.

In the Spring of 2012, I was fortunate to have an ambitious, capable, and insightful student in my senior inquiry course with a natural curiosity for understanding disease in living systems. He had great potential to thrive as a graduate student and researcher. I loaned him Janovy's book so that he might consider a vocational calling to organismal biology as a researcher and educator. He also agreed to meet again and discuss his thoughts about the book and his own undergraduate experience in biology as a recent alumnus. Returning the book, the student had flagged this passage:

In one critical area—the *reason* biologists study living organisms our whole lives through—education is left largely to chance, and the responsibility for those lessons falls on student shoulders. The idea that science classes must, from bell to bell, deal only with observations, interpretations, and experimental design is a delusion. (Janovy 7)

The student suggested that this passage might guide me in my efforts to generate better purpose and buy-in from students in the *Becoming Biologists* course. Janovy's discussion of values in determining biological research interests and vocational choices had intrigued him. He couldn't recall being asked to consider the values of biologists in our curriculum.

One of Janovy's central arguments is that values are legitimate tools in biology because they allow us to work in areas of thought into which we would otherwise not have access (Janovy 7). Janovy describes a beloved teacher and mentor who often drew upon poetry and art as teaching devices in biology courses to explore abstractions and perceptions in the study of biology. By examining the values and meanings expressed by others in their work, whether of art or science, we can better express the realities conveyed in our observations and interpretations. By being exposed to the values of his teacher and mentor as well as being asked to consider his own values as a student, Janovy was able to expand his intellectual skills and find direction and legitimacy for his own biological interests. Through his personal experiences and story, Janovy challenges biology educators to integrate the life choices of scientists into our teaching of biology so that we might guide students toward answering some fundamental questions about vocational goals: "Should I become a biologist?" Or even: "Am I a biologist without knowing it?" (Janovy 8).

I took away two fundamental lessons from the student's perceptions. First, perhaps the best approach in an introductory biology course with learning goals centered on intellectual skill development is to choose the biological worldview as the overarching theme. Skills, while necessary, are not actually the inspiration for a life's work. Visions and values may very well be. Second, when integrating the stories and content of the introductory course I should always remember to talk about the fundamental curiosities, ideas, and values that have shaped scientists. These lessons helped me envision how I might completely deconstruct my course and rebuild it. I needed to meet students where they are—with their own values and goals—and to scaffold the intellectual skills into their own context. The lessons also made me think more critically and read more extensively about the scientists, philosophers, and educators I was teaching in order to be sure that curiosities and values were always brought to the forefront in our discussions on learning, thinking, and biology.

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The course now begins with discussions and assignments about why students are interested in biology as a discipline of study and the many directions that a professional career within the life sciences may take. We then transition into stories about scientists and science. Before we begin looking at the work of any one scientist, I now spend more time developing the person behind the work. I explain his or her motivations, values, and the ideas and organisms that he or she has been most curious about.

For example, in one case study that we use in the course, we evaluate one of the arguments that Stephen Jay Gould makes in *The Mismeasure of Man*, a widely read popular science book that examines the argument that intelligence can be abstracted as a single number capable of ranking people by intrinsic mental worth (20). In the revised edition of his book, Gould explains his reasons for originally writing *The Mismeasure of Man*, including his family's participation in campaigns for social justice, his own participation, and his strong feelings about fallacious arguments of biological determinism. Gould argues that the best form of objectivity lies in identifying preferences so that their influence can be recognized in the work of a scientist. He acknowledges that preferences often must be identified in order to be eliminated. But such preferences also help us decide what subjects we wish to

pursue in our limited lifespan. Gould claims that “we have a much better chance of accomplishing something significant when we follow our passionate interests and work in areas of deepest personal meaning” (37). He thus advocates the use of values to guide biological research interests in combination with the scrutiny of personal biases to uphold the overall goal of objectivity in science. By presenting both Gould’s motivations and his science through the case study in my course, I now enable students to practice the *skills* of skepticism and critical evaluation while also opening the discussion to the *values* and *worldviews* that shape the lives and contributions of biologists.

Over the past five years, my many conversations with students have led to insights of two general forms. First, they would like to have more conversations about career possibilities in the biological sciences and receive immediate practical advice about the right experiences to prepare them for future work (internships, research experiences, resumes, etc.). Second (and in some tension with the first), students would like to have more philosophical discussions about the nature of science itself. But whether our conversations are philosophical or practical, students (and alumni) and I almost always end up talking about the stories of biologists, about science as a way of knowing the world, and about vocational possibilities in the life sciences. The former student who

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directed my attention to Janovy’s quotation as a guiding idea for the *Becoming Biologists* course is only one example. Most of my personal conversations with students could very easily transfer into formal discussions as the theme of my course: the biological worldview. Furthermore, this theme might be often overlooked by science teachers focused on developing students’ intellectual skills and abilities insofar as those skills and abilities direct us away from passions and stories.

What I have come to realize in rebuilding my course is how discussions of the biological worldview and values were

the obvious thread connecting our students to the study of biology and, potentially, to engagement with the intellectual skills involved in this type of work. My department had designed a course to teach students *how* to study biology, but perhaps we hadn’t given enough thought to the reasons *why* one might study biology. We also needed to train students to make their own choices based on their own values and preferences among the many subdisciplines and career paths

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extending from the study of biology. If our goal in the introductory course was to begin to prepare students in the skills, abilities, and dispositions that would best serve them in the future, we had overlooked some important parts of the *dispositions*. And while values lead to bias in the process of science, they also lead toward the questions we are most interested in asking about the natural world. Values provide the foundation for lifetime engagement in the work of science.

The changes to my course are new enough that I can’t make any grand claims about significant gains, but I can say that this year I have learned more about my students’ personal interests sooner on in the course. They also talked more openly in discussions, and many of them left the course with stronger responses about their understanding of the work of biology than they were able to provide at the beginning. I haven’t had the same level of kick-back that I’d previously experienced. I am hopeful that my students have left the course with some practice at the intellectual skills involved in science as well as an enlarged understanding of *why* they might study biology and what it might offer to their lives.

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