The spring semester was almost over when the instructor distributed our last assignment for the "Graduate Seminar in Teaching Biology." The class was offered by our department to equip graduate students with more-effective teaching skills and to prepare us for the academic job market. Despite the departmental support, no faculty member was willing to teach the course, so Paula, a postdoc in our department who had recently started job hunting, volunteered. The workload was light, the classes were congenial, and Paula made sure that we always had snacks. However, this last assignment was the toughest of the course: to write a statement about our philosophy of teaching.

The difficulty was that, even after many teaching assistantships, nobody had ever asked us why we wanted to teach. Yet here was the assignment, and Paula explained that not only teaching institutions, but even research universities, now request such a teaching statement from applicants. We had one week.

I racked my brain for inspiration. Why do I want to teach? When did I decide that I wanted to teach? I couldn't remember. This was even harder than I had anticipated. If I was having trouble just writing a short paper about teaching, did that mean I wasn't cut out to be a professor? Were there any exceptional learning experiences that had inspired me to teach? I was at a loss for answers and it was getting depressing.
The truth is, I felt miserable anyway. My mother had passed away a few months earlier at the age of 53, due to a brain tumor. Her illness had progressed very quickly, so there was not enough time for me to say all of the things that needed to be said, to ask her all of the questions I needed to ask. My inability to do this assignment just added to my despondency. I missed class and didn't turn in the assignment. The course was not graded so it didn't count against me, but my type-A personality and matching type-A ego would not let me give up. Paula said she would read my statement whenever I finished it.

I thought about my mother, about why I wanted to teach biology, and about whether graduate school was a pointless endeavor. I also spent a lot of time thinking about my childhood, my early learning experiences, and what my mother looked like when she smiled as she answered one of my many questions. Slowly, I realized that much of my enthusiasm for biology could be traced back to my first biology teacher, my mother.

She had a bachelor's degree in biology and worked for the Department of Public Health in New York City, investigating cases of food poisoning. Even when I was little, she helped me learn the names of the birds that came to our backyard feeder, to understand why marigolds in the vegetable garden kept the bugs away, and to discover the red-striped salamanders that lived under the logs at the edge of the woods. She and my father took me regularly to the Bronx Zoo, the New York Botanical Gardens, and the American Museum of Natural History. We used to spend part of every summer on a dairy farm, where I learned how to milk cows and hauled bales of hay up to the loft for storage. My mother encouraged me to read Stephen Jay Gould's articles in Natural History magazine when I was 10 and encouraged me to take all of the hardest science classes at school.

Yet despite her obvious interest and enthusiasm for biology, my mother was fond of saying, "Ninety percent of all biology courses is just vocabulary."
My mother's opinions were influenced by the fact that she was part of the baby boom, which overwhelmed the resources of her university's biology department. She told stories about professors who wrote textbooks, and proceeded to read the relevant pages to auditoriums full of students. In one large course, none of the exams were ever graded, and students were evaluated solely on the basis of their class standing: Seniors got A's, and freshmen received D's. More typical exams, which were graded, stressed the recollection of facts, definitions, and jargon, but did not really require students to understand the fundamental concepts underlying the material. Above all, my mother was disappointed by the lack of mechanisms to help students come to appreciate the beauty and wonder of living things.

Biology instruction has progressed since my mother was in school. I never had a course in which the teacher read to me from the textbook, but in many ways my learning experiences have been similar to hers. I took many courses that were almost entirely devoid of general principles, underlying themes, or problem-solving skills.

In my undergraduate biochemistry course, I was expected to know, among other things, the entire chemical pathways for aerobic respiration and photosynthesis, including the names and structures of all of the chemical intermediates and cofactors, the names and cellular locations of all of the enzymes, and the mechanisms of their catalysis. The course was so focused on memorization that it included no lectures at all. There were no labs, either. We purchased a textbook and a "reader's guide," and were expected to learn the material on our own, coming to a test center periodically to be quizzed on our progress.

This approach to teaching has nothing in common with what I enjoy or value about biology, but many of my classmates loved it because they didn't really have to understand anything. It was only an exercise in mnemonics.
The classes that I value the most were experiential, like the rambling walks I used to take with my mother and younger brother. There was always a goal in mind, but also room for improvisation, and you never knew what you might discover along the way. Unfortunately, the list of classes like that is very short: The ecology courses in which we took long field trips to strange habitats just a few miles from campus; the molecular-genetics class in which students worked for months on independent projects; and the marine-invertebrates course in which students were forced to seriously engage the primary literature to write term papers. Yet these classes always suffered from low enrollments or were not offered at all, because few students were willing to commit the time they required, or do work that involved more than memorization.

I see an essential ambivalence about teaching in science departments at research universities. A lot of lip service is devoted to providing high-quality teaching, while the undergraduates demand good professors. However, what gets rewarded is excellence in research, and most students seem to think that the best professors are the ones who teach the easiest classes. As a result, undergraduate courses are designed so that they require minimal effort from both the professors and the students.

All along, my mother knew something that I have only just realized -- scientific discovery is essentially an experiential process. Scientists discover new things by doing experiments, making observations, and immersing themselves in their subject. If we hope to inspire students to become scientists or even to respect what scientists do, we have to find a way to show them the excitement of discovering something new, of experiencing the acquisition of new scientific knowledge.

I aspire to challenge students to truly engage with the subject matter and give them firsthand experience with the magnificence of life on earth. Maybe enrollments in my courses will be small, maybe it will demand a lot of my time and effort, but I now
have a mission and a teaching philosophy: By using experiential learning, I hope to prove my mother wrong and create courses that are not just 90-percent vocabulary. I think my Mom would be proud.

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