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OBSERVER

The Economist as Biologist

By PHILIP N. JEFFERSON

That feeling of being inauthentic hit me in the small hours of the night, early this year. It comes on me every now and then, when the gap between what I truly know and what I teach gets too large. Redesigning my econometrics course to incorporate experimental concepts and methods had pushed me over the precipice this time.

I knew I could read more about how to interpret particular social events as quasi-experiments. There are hundreds of papers in economics on that. But further scholastic scrutiny was not the remedy to what ailed me. The problem, while not deep, was fundamental: The precise understanding of what an experiment is had faded from my mind. How was I to get out of that bind?

The answer to my problem came at a faculty lunch in March, when the biologist Amy Cheng Vollmer discussed her concern about the Balkanization of disciplines that often takes place at colleges and universities. She felt that at our institution, Swarthmore College, the natural sciences were seen as somehow different from the humanities or social sciences. She worried that faculty members outside of the natural sciences believed that almost all natural-science majors were headed for medical or graduate school, and thus humanists and social scientists might be advising some students not to take natural-science courses. How could the faculty eliminate the incorrect perceptions that could limit the range of students' intellectual experience at Swarthmore?

Amy concluded her talk with a startling proposal. She would open her microbiology laboratory to any faculty member outside the natural sciences who was willing to spend some time over the summer actually doing biology. The idea was to break down a perceived barrier by having nonscientists do what they would normally keep at a distance.

My first thought upon hearing Amy's proposal was that she was way off the farm. It was easy to understand her concern, but academics are who we are: specialists. We can and probably do read across disciplines, but why would we want to work across disciplines?

But after ruminating on my own conundrum for a couple of days, I thought of Amy and her daring idea. Perhaps working in her microbiology lab was a way to close my authenticity gap.

I met her for lunch, and we clarified our objectives, defined parameters, and set timelines. Luckily for me, another colleague, Cheryl Grood of the mathematics department, was already working in the lab. Cheryl was refreshing her knowledge of biology from courses taken long ago. She and I would form a mini-team.

A great advantage of having a mathematician as a partner is that all of your measurements and calculations are likely to be precise -- even if the conclusions are precisely wrong! I could not have wished for a better partner.

Amy explained that our project was to use established methods of genetic engineering to see if we could make bacteria that were sensitive to ampicillin, an antibiotic, resistant to it instead. We would isolate a plasmid -- a small, self-reproducing element containing DNA but outside the chromosome -- from ampicillin-resistant bacteria. Subsequently, we would manipulate an ampicillin-sensitive strain of the same bacteria so that it would absorb the plasmid. The hope was that the plasmid would transform the recipient's DNA so the bacteria would exhibit resistance to ampicillin.

Was she serious? First, how do you pronounce DNA's full name, deoxyribonucleic acid? Second, what is to prevent me from combining the DNA of the ampicillin-resistant bacteria with my own DNA, thereby rendering me resistant to antibiotics -- and likely to catch all kinds of ailments from my students, who sometimes come into class coughing and wheezing? Third, given that the plasmids, cytoplasm, chromosomes, genes, and all the other stuff inside the bacteria cells are too small for me to see with the naked eye, how will I know if any transformation has taken place? And fourth, don't you need some kind of license to engage in genetic engineering?

Obviously I had some reservations about actually doing microbiology. But it took me only three days of continuous practice to solve the pronunciation problem: dee-ox-ee-RYE-bo-new-clay-ick (the "acid" part was easier).

Because no known pathogens are handled in Amy's lab, the odds of contamination are extremely low. My qualms about absorbing bacterial DNA were thus unwarranted.

Although the transformation we were trying to accomplish could not be seen by the naked eye, the result -- the expression of a gene or trait -- can be confirmed by experimentation. And as a novice, I needed only a mentor, not a license, to make sure that my work in the lab was well within ethical bounds.

The return from doing science hands-on is high. The experiments required care and precision. How do you set up a control? Are you sure that the background conditions -- the medium used to suspend the plasmids, the settings on the spectrophotometer, the size of the pipettes, the agar, etc. -- are exactly the same for the control and the experimental specimens? How do you measure, assess, and interpret your results?

Can an amateur possibly get all that right? More important, can an amateur steeped in a foreign intellectual tradition -- in my case, social science -- possibly comprehend or appreciate the elegance and power of the scientific methods employed?

Amy made everything possible. Taking more time than I could have imagined, explaining every concept, showing how every piece of equipment worked, answering every question (many of them more than once), enduring every mistake, she led Cheryl and me through the processes of plasmid isolation and gel electrophoresis. Not only did we succeed in those feats of genetic engineering, but we also confirmed that the ampicillin-resistant trait was due to the presence of the added plasmid DNA, given that we were able to re-isolate the plasmid from the newly transformed bacteria.

My econometrics course will be different from now on. Not because the material or the text or the statistical software will be new, but because my understanding of one small slice of applied science has been refreshed. I now have new comparisons, examples, interpretations, exercises, and thought

experiments to use with my students in the social sciences.

Experiments in the social sciences will never be as clean as they are in the natural sciences. But I feel much better about teaching quasi-experimental concepts now that I have worked in a real laboratory.

If my professional life allowed it, I would like to spend more time in a lab. That may sound strange coming from a social scientist, and I realize that many faculty members in the humanities and social sciences would not agree with me. Before the desire to refresh my memory of what an experiment was became a pressing matter for me, I thought the idea of my doing science was impractical.

Now, however, I have joined Amy off the farm on the issue of communication and collaboration among the disciplines. You know, the air out here is fresh, the sky is clear, and the company is very good.

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