Carolyn Bertozzi

CHANGED EXPECTATIONS

CHEMISTS TRAINED IN BIOLOGY WERE ONCE A RARITY— NOW THEY'RE BECOMING THE NORM.

Ramin Rahimian

After Carolyn Bertozzi finished her Ph.D. in organic chemistry in 1993, she did something risky. She accepted a postdoctoral fellowship in a cell biology lab, not a chemistry lab. In the two decades since, chemists have embraced the value of studying biology by total immersion. Bertozzi, an HHMI investigator at the University of California, Berkeley, who uses chemical approaches to tackle biological problems, reflects on this shift.

What was it like in the 1990s for chemists who wanted to tackle biological problems?

A handful of us were in the same boat. We had been trained broadly to design chemical tools for use in biology but didn't know enough biology to identify the problems in urgent need of such tools. We were contemplating doing postdocs in biology labs to gain such insights. But many of us received negative feedback from senior professors. It was considered maverick to leave your field and pursue total immersion in another.

If we left our circle of familiarity and went off into a strange land, the "chemistry establishment" would lose track of us and we'd have a hard time securing jobs. One advisor even went so far as to use the phrase "career suicide."

You went for a biology postdoc anyway. Did their predictions come true?

Not at all. When I applied for faculty jobs in chemistry departments, I'm sure some people wondered how to judge my postdoctoral work. Contrary to the earlier warnings, people valued that I had spent time in a pure biology laboratory. I was hardly an expert, but relative to other bioorganic chemists, I was in a much better position to identify important biological problems that chemistry could uniquely address.

Is it easier today for chemists to follow the path you took?

It wasn't too much later that it became fashionable for chemistry Ph.D.s to postdoc in a biology lab. By the early 2000s, when the first wave of students from my lab graduated, most went on to postdoc in labs that were even more biological than mine. Now, if students interested in working at the chemistry–biology interface do not take that route, they may find themselves at a disadvantage later on. Nonetheless, there are still many scientists who fear that cross-disciplinary training will produce neither the best chemists nor the best biologists. But this opinion is waning.

How are colleges and universities changing their curricula to meet this new expectation that chemists know more biology?

Some schools are doing a phenomenal job of creating programs tailored to training at the juncture of biology and chemistry. Several schools, including Berkeley, support programs that span the life sciences and chemistry departments, and graduate students rotate through labs in both departments. Many medical centers—for example, at the University of California, San Francisco—host chemical biology training programs. Stanford Medical School has renamed its Molecular Pharmacology Department "Chemical and Systems Biology." The basic coursework for a Ph.D. in chemistry hasn't changed much, but students are learning to integrate their chemistry skills with biology systems in research settings.

Is industry also embracing chemists who are trained in biology?

In a big way, but it's a fairly recent trend. Until about 5 years ago, to land a job as a chemist in a big pharma company, you had to do as much hardcore chemical synthesis as possible. I would even venture to say that if a chemist revealed more than a superficial understanding of biology during an interview, it might be considered a bad thing.

That has completely changed. These companies are under considerable pressure to find new and better drug targets. Hiring managers recognize that the people most likely to break out of the tired old mold are the ones with interdisciplinary training. I receive regular e-mails from pharma companies looking for chemical biologists—people who are comfortable engineering proteins, doing chemistry on large molecules in aqueous environments, designing systems far off the typical path of small molecule drug development. This is a very good sign, for the industry and for our trainees.

In what areas are biology-focused chemists making an impact?

Everything from drug development to materials science. A big one is medical diagnostics for developing countries—they need to be portable and cheap and still accurate. That problem will be solved by clever chemical engineering. The interface between physical chemistry and biology has led to all sorts of new ways to image molecules. There is a space for drug discovery—nanoparticles or big molecules—that pharmaceutical companies have been reluctant to pursue because of the difficulty of getting these drugs into the body. But as chemists find ways to engineer new delivery systems, that space is opening up.

INTERVIEW BY SARAH C.P. WILLIAMS. *Carolyn Bertozzi is a distinguished professor of chemistry and a professor of molecular and cell biology at UC Berkeley.*