By **Gohar Manzar**

Seeing my science clearly

"You are about to witness a thesis implode," I declared to my summer student. As I ran the critical sample through the flow cytometer, my trembling hand betrayed my nervousness that the result would confirm my worst fears: I had been fooling myself. Three years prior, I had been a bright-eyed first-year Ph.D. student. "This is guaranteed to give you data," my mentor had said of the project he wanted me to take over. Preliminary data suggested that a poorly understood protein might trigger immune cells to kill cancer cells. It was an exciting possibility, but I was concerned. The previous rotation student had been unable to replicate the finding and wasn't convinced the protein did anything at all. But I couldn't turn down a project that sounded so promising.

To my relief, a new batch of protein I prepared yielded striking results. The science unfurled into a thrilling jigsaw puzzle. Beautiful flow cytometry plots revealed that our protein induced immune cells to mature. In tissue culture experiments, these cells killed cancer cells with startling ferocity. The debut in vivo study showed that mice treated with the protein had only a fraction of the black melanoma spots we found in controls. I presented the results—collected on Christmas Eve, no less—at our weekly lab meeting with a mother's pride: A causes B causes C, in perfect alignment with our neatly constructed hypotheses.

The results were so astounding, in fact, that they began to make me suspicious. I—along with my thesis committee members and adviser—wondered whether my results could be due to contamination from the bacterial system I used to produce the protein. After all, it seemed logical that a fragment of a pathogen, not our protein, could be what triggered the immune cells. However, I was soon reassured. I tested for contamination, looking for global immune activation, and everything looked clean. Relieved, I carried on.

But about a year later, a reviewer for a grant application identified a flaw in the control I had put my trust in. It was a largely unknown quirk in immunology, heretofore untested because my committee members—like me and my adviser—saw the logical sense of the story I had synthesized. That is what led to the fateful moment at the flow cytometer, where I was testing a commercial sample of my protein certified to be free of any bacterial contaminants—a crucial control that I had previously been too blinded by preconceived expectations to devise.

"I had been spinning a story ... instead of critically examining the facts."

I was aghast when I saw that my protein in this pure state did nothing. My rotation student glanced at me, concerned. I chuckled darkly. I realized that I had been spinning a story from my science, interpreting my results based on my conception of what should be happening instead of critically examining the facts in front of me.

I stepped away from the lab bench for a week and confronted my mistakes with brutal honesty that ended up being cathartic. My adviser did the same. I leaned on generous loved ones as I worked through what felt like the five stages of grief. At first, I lamented the loss of my tidy, compelling story, but I eventually realized that element of my grief was misplaced. As scientists, we seek to understand nature's crooked truth. To simplify it—as tempting as that can be—is contrary to our quest to do meaningful science. It took me 6 months to recover and find closure by taking on a new project. My adviser supported my new direction, and eventually I graduated with my Ph.D.

I was burned, but the scars remind me to be a better scientist. Nowadays, I don't stop at controls. I really ponder my results. Could the cause be something other than what I expect? I am slower to draw easy conclusions and instead make sure to consider every possible variable. I have learned to detach myself from what I want my science to be, and instead allow the science to lead me to understanding what actually is. I listen to my doubts, no matter how much the puzzle fits and "makes sense" at first—or 20th—glance. ■

Gohar Manzar is a resident physician at Memorial Sloan Kettering Cancer Center in New York City. Send your career story to SciCareerEditor@aaas.org.

Science

Seeing my science clearly

Gohar Manzar

Science **365** (6452), 514.
DOI: 10.1126/science.365.6452.514