

After making the difficult decision to turn in their adviser for scientific misconduct, a group of graduate students is trying to recover from the resulting damage to their careers

Truth and Consequences

MADISON, WISCONSIN—In those first disorienting months, as fall last year turned to winter and the sailboats were hauled out of nearby lakes, the graduate students sometimes gathered at the Union Terrace, a popular student hangout. There, they clumped together at one of the brightly colored tables that look north over Lake Mendota, drinking beer and circling endlessly around one agonizing question: What do you do when your professor apparently fakes data, and you are the only ones who know?

Chantal Ly, 32, had already waded through 7 years of a Ph.D. program at the University of Wisconsin (UW), Madison. Turning in her mentor, Ly was certain, meant that “something bad was going to happen to the lab.” Another of the six students felt that their adviser, geneticist Elizabeth Goodwin, deserved a second chance and wasn’t certain the university would provide it. A third was unable for weeks to believe Goodwin had done anything wrong and was so distressed by the possibility that she refused to examine available evidence.

Two days before winter break, as the moral compass of all six swung in the same direction, they shared their concerns with a university administrator. In late May, a UW investigation reported data falsification in Goodwin’s past grant applications and raised questions about some of her papers. The case has since been referred to the federal Office of Research Integrity (ORI) in Washington,

D.C. Goodwin, maintaining her innocence, resigned from the university at the end of February. (Through her attorney, Goodwin declined to comment for this story.)

Although the university handled the case by the book, the graduate students caught in the middle have found that for all the talk about honesty’s place in science, little good

“Here I am, I’ve invested so much time in grad school, and this happens. If we let someone know ...”

—Chantal Ly

has come to them. Three of the students, who had invested a combined 16 years in obtaining their Ph.D.s, have quit school. Two others are starting over, one moving to a lab at the University of Colorado, extending the amount of time it will take them to get their doctorates by years. The five graduate students who spoke with *Science* also described discouraging encounters with other faculty members, whom they say sided with Goodwin before all the facts became available.

Fraud investigators acknowledge that outcomes like these are typical. “My feeling is it’s never a good career move to become a whistleblower,” says Kay Fields, a scientific investigator for ORI, who depends on pre-

cisely this occurrence for misconduct cases to come to light. ORI officials estimate that between a third and half of nonclinical misconduct cases—those involving basic scientific research—are brought by postdoctoral fellows or graduate students like those in Goodwin’s lab. And the ones who come forward, admits ORI’s John Dahlberg, often suffer a “loss of time, loss of prestige, [and a] loss of credibility of your publications.”

Indeed, Goodwin’s graduate students spent long hours debating how a decision to alert administrators might unravel. Sarah LaMartina, 29, who gravitated to biology after its appeal outshone her childhood plan to become a veterinarian, had already spent 6 years in graduate school and worried whether all that time and effort would go to waste. “We kept thinking, ‘Are we just stupid [to turn Goodwin in]?’” says LaMartina, whose midwestern accent reflects her Wisconsin roots. “Sure, it’s the right thing to do, but right for who? ... Who is going to benefit from this? Nobody.”

Shock waves

Goodwin, in her late 40s, had come to the University of Wisconsin in 2000 from Northwestern University in Chicago, Illinois, and was awarded tenure by UW soon after. Landing in Wisconsin was something of a homecoming for her; she had done a postdoc under Judith Kimble, a prominent developmental geneticist in the same department.

Career conundrum. Chantal Ly, in her adviser's now-vacant lab, faced wrenching choices after she and fellow graduate students began questioning the contents of their boss's grant application.

Goodwin studied sex determination in worms during their early development and has published more than 20 papers on that and other subjects in various prominent journals (including, in 2003, *Science*). Goodwin was also the oldest of a crop of female faculty members hired in recent years by genetics department chair Michael Culbertson. "She was the role model," he says.

In the beginning, the Goodwin lab had a spark. Students recall being swept up in its leader's enthusiasm when, seeking a lab in which to settle, they rotated through for a month during their first year of graduate school. Goodwin pushed her students to believe that compelling scientific results were always possible, boosting their spirits during the low points that invariably strike Ph.D. hopefuls. She held annual Christmas parties at her home west of Madison. Once, she took the entire lab on a horseback-riding trip.

Then, last October, everything changed. One afternoon, in the conference room down the hall from the lab, Ly told Goodwin she was concerned about her progress: The project she'd been working on, Ly felt, wasn't yielding usable results. Despite months of effort, Ly was unable to replicate earlier observations from the lab.

"At that time, she gave me three pages of a grant [application]," Ly recalled recently. The proposal, which was under review at the National Institutes of Health (NIH), sought to broaden a worm genetics project that another student, third-year Garrett Padilla, had begun. Goodwin, Ly says, told her that the project, on a new, developmentally important worm gene, was "really promising, but there's so many aspects of it there's no way he can work on everything." Goodwin urged Ly to peruse the pages and see whether the gene might interest her as a new project.

Reading the grant application set off alarm bells for Ly. One figure, she quickly noticed, was represented as unpublished data even though it had appeared in a 2004 paper published by Goodwin's lab.

Ly and Padilla sat back to back at desks in the corridor outside the lab. When she showed him the pages from the grant application, he too was shaken. "There was one experiment that I had just not done," as well as several published and unpublished figures that seemed to have been manipulated, he says. Two images apparently identical to those already published were presented as unpublished and as representing proteins different from the published versions. "I remember being overwhelmed and not being able to deal with it at that moment," says Padilla.

A bearish 25-year-old with a closely cropped beard and wire-rimmed glasses, Padilla speaks softly, with deliberation. Bored by bench work, he was considering leaving biology research for law school and had discussed the possibility with Goodwin. She had urged him to "stick it out," he says. "Everybody goes through a phase where

Padilla steeled himself for a confrontation. On Halloween day, he paced nervously outside Goodwin's office, summoning the courage to knock. The conversation did not go well, says Padilla.

In a computer log of events he had begun to keep at Kuersten's urging, which he shared with *Science*, Padilla wrote that Goodwin denied lifting a Western blot image from a published paper and presenting it as unpublished work, although, he added in the log, "She became extremely nervous and repeatedly said, 'I fucked up.'" Padilla also noted: "I left feeling that no issues were resolved." His confusion deepened when Goodwin later that day blamed the problem on a computer file mix-up.

Meanwhile, word was leaking out to others in the lab that something was terribly wrong. Two days later, Padilla called a meeting of all current lab members: six graduate students and the lab technician. To ensure privacy, the group, minus Ly, who had recently had a baby girl, convened in the nearby engineering library. Padilla laid out the grant papers for all to see.

In that meeting, ensconced in the library, the grad students hesitated at the thought of speaking with the administration. "We had no idea what would happen to us, we had no idea what would happen to Betsy, we had no idea how the university would react," says LaMartina, who admits to some distrust of authority and also a belief that people who err deserve a second chance.

Ly felt less charitable toward Goodwin but confesses that at first she considered only her own predicament. In many ways, just reaching graduate school was a triumph for Ly, and she badly wanted that doctorate. In 1981, when Ly was 8 years old, her family fled Cambodia for the Chicago suburbs. Around Ly's neck hangs a gold-plated French coin, a 20-franc piece her curator father had collected before he was killed in his country's civil war.

In Chicago, Ly's mother worked long hours and put her daughter through Wellesley College in Massachusetts. When Ly moved to Madison, so did her husband, now an anesthesia resident, and her mother, who speaks little English and cannot drive. "Here I am, I've invested so much time in grad



Happier times. The lab poses for a group shot, including (front row) Professor Elizabeth Goodwin in blue, Sarah LaMartina in white, Chantal Ly in gray, (back row) Garrett Padilla in red, postdoc Scott Kuersten in black, and Mary Allen in green.

they don't want to be here," he recalls Goodwin telling him.

At a loss after seeing the grant application, Padilla consulted two scientists for advice: his fiancée's adviser, a physiology professor at the university, and Scott Kuersten, a former postdoc in Goodwin's lab who had been dating LaMartina for several years and who happened to be in town. Kuersten and Padilla talked for about an hour and together examined the papers cited in the proposal. Kuersten, now at Ambion, a biotechnology company in Austin, Texas, advised Padilla to ask Goodwin for an explanation, as did the physiologist.

school, and this happens. If we let someone know ...” she says, her voice trailing off.

The students decided that Padilla needed to speak with Goodwin a second time, in hope of extracting a clear account of what went wrong or even a retraction of the grant application. Four days after his first nerve-wracking encounter, Padilla was in Goodwin’s office again. This time, the conversation put him at ease. Padilla says Goodwin asked for forgiveness and praised him for, as he wrote in the log, “pushing this issue.” She told him that the grant application was unlikely to be funded—an assertion that turned out to be untrue given that NIH approved it—but offered to e-mail her NIH contact citing some of the problems in the application. Goodwin subsequently sent that e-mail, on which Padilla was copied. He left the encounter relieved.

“At that point, I was pretty content to leave it alone,” he says. “I felt like we had compromised on a resolution.”

A wrenching choice

Another student, however, was finding little peace. Mary Allen, 25 and in her fourth year of graduate school, couldn’t shake a sense of torment about what her mentor might have done. A bookworm who squeezed 3 years of high school into one and entered college at age 15, Allen is guided by unambiguous morals and deep religious convictions, attending a local church regularly and leading a youth group there. She could not fathom that Goodwin had falsified data; at one point, Allen refused even to examine another suspect grant application. But, concerned because Goodwin seemed to have admitted to some wrongdoing, Allen felt she needed to switch labs.

Allen alerted Goodwin that she would likely be moving on. Their mentor then began offering additional explanations for the grant application, say Allen and the others. Goodwin told them that she had mixed up some files and asserted that the files had come to her unlabeled. In a private conversation with Allen, she adamantly denied faking data.

As November wore on, the lab’s atmosphere grew ever more stressful and surreal. When Goodwin was present, she chatted with the students about their worm experiments

“I remember being overwhelmed and not being able to deal with it at that moment.”

—Garett Padilla

and their families—the same conversations they’d always had.

Yet the strain was taking its toll. LaMartina’s appetite declined, and she began losing weight, shedding 15 pounds before the ordeal was over. Padilla called former post-doc Kuersten nearly weekly for advice, and the students talked obsessively with one another. Careful to maintain confidentiality, “the only people we could bounce ideas and



Gathering place. Most students in Madison hit the Union Terrace for fun and food, but the lab’s graduate students had weightier issues on their minds.

solutions off of were each other,” says Padilla. The tension even penetrated Goodwin’s annual Christmas party. For the first time, several lab members didn’t show up.

Deeply worried about how speaking with administrators might impact the more senior students, lab members chose not to alert the university unless the desire to do so was unanimous. Gradually all, including Ly and LaMartina, the most senior among them, agreed that their mentor’s denials left them uncomfortable and concerned that she might falsify data in the future. “My biggest worry was what if we didn’t turn her in ...

and different grad students got stuck in our position,” says Allen.

Two days before exams ended, on 21 December, Ly and Padilla met together with Culbertson and showed him the suspect grant pages. Culbertson didn’t know what to think at first, he says, but “when somebody comes to me with something like that, I have to investigate.”

A surprise resignation

Culbertson quickly referred the matter to two university deans, who launched an informal inquiry to determine whether a more formal investigation was warranted. As is customary, Goodwin remained on staff at the university during this time. She vigorously denied the charges against her, telling Culbertson and the students in a joint meeting that the figures in question were placeholders she had forgotten to swap out. According to Padilla’s log of that meeting, Goodwin explained that she “was juggling too many commitments at once” when the proposal was submitted.

Two biology professors ran the informal inquiry, conducting interviews with Goodwin and her students. One of the two, Irwin Goldman, was also a dean, and he became the students’ unofficial therapist and news source. At their first meeting in January, Goldman reassured the six that their salaries would continue uninterrupted.

The informal inquiry wrapped up a few weeks later, endorsing a more formal investigation. Three university deans, including Goldman, appointed three faculty scientists to the task.

At about this time, says Goldman, the university grew uneasy about possible fraud not only in the first grant application that the students had seen but also in two others that had garnered funding, from NIH and the U.S. Department of Agriculture. The school canceled all three grants. After a panicky 2 weeks during which the lab went unfunded, Goldman drew on money from both the college of agricultural and life sciences and the medical school. (Goodwin had a joint appointment at the two.) The students peppered Goldman regularly with questions, seeking advice on whether to talk to a local reporter or how their funding might shake out.

Still, because privacy rules prevented sharing the details, “we felt isolated up on our floor,” says Padilla. “There were faculty nearby, but they didn’t really know what was going on.” Goodwin, meanwhile, all but disappeared from the lab, appearing only once or twice after the investigation began. The students tried to keep up with their projects as they’d always done. They held lab meetings

alone before being invited to weekly gatherings with geneticist Philip Anderson's lab.

Most faculty members were aware that an investigation had been launched, and some had heard that Goodwin's students were the informers. That led to disheartening exchanges. A faculty member, asked by one of the students whether they'd done the right thing, told her he didn't know. Rumors reached the students that Goodwin had had "to fake something because her students couldn't produce enough data," says Ly.

In late February, Goodwin resigned. The students say they learned of her departure from a biologist who worked in a neighboring lab.

Three months later, the university released its investigation report, which described "evidence of deliberate falsification" in the three applications for the cancelled grants, totaling \$1.8 million in federal funds. In the school's report, which university officials shared with *Science*, investigators also raised questions about three published papers, in *Nature Structural and Molecular Biology*, *Developmental Biology*, and *Molecular Cell*.

None has been retracted or corrected so far. "We are considering the implications" of the university report, said Lynne Herndon, president and CEO of Cell Press, which publishes *Molecular Cell*, in a statement. The editor of *Nature Structural and Molecular Biology* said she was awaiting the results of the ORI investigation, and the other

Questioned. A University of Wisconsin investigation raised concerns about these three papers.

authors of the *Developmental Biology* paper are reviewing the relevant data, says the journal's editor in chief, Robb Krumlauf of the Stowers Institute for Medical Research in Kansas City, Missouri.

The university investigators also noted other problems in the Goodwin lab. "It appears from the testimony of her graduate students that Dr. Goodwin's mentoring of her graduate students included behaviors that could be considered scientific misconduct—namely, pressuring students to conceal



Seeking a new start. The possibility that her mentor had faked data left grad student Mary Allen determined to switch labs.

research results that disagreed with desired outcomes and urging them to over-interpret data that the students themselves considered to be preliminary and weak," they wrote in their report.

Goodwin's lawyer in Madison, Dean Strang, disputes the reliability of the school's report. The investigation was "designed under the applicable UW rules to be an informal screening proceeding," and, because Goodwin resigned, "there was no adjudicative proceeding

at the administrative level or elsewhere," Strang wrote in an e-mail message. He added that "there are no problems with the three published papers cited in the report (or any others)." Strang declined to address whether Goodwin pressed students to

overinterpret data. "Dr. Goodwin will not respond at all to assertions of students in this forum," he wrote.

Uncertain future

Culbertson distributed the investigating committee's report to all department faculty members; it even appeared on Madison's evening news. Still, the rapprochement some of the students had hoped for never material-

ized. "No one ever came up and said, 'I'm sorry,'" Padilla says.

As the graduate students contemplated their futures this spring, they did have one point in their favor: Ironically enough, the sluggish pace of their projects meant that almost none had co-authored papers with Goodwin. But when several of them sat down with their thesis committees to assess their futures, the prognosis was grim. Only one student of the six, who did not reply to *Science*'s request for an interview, was permitted to continue with her original project. She has moved to another Wisconsin lab and hopes to complete her Ph.D. within about a year, according to the others.

Thesis committees and faculty members told Ly, LaMartina, and fourth-year Jacque Baca, 27, that much of their work from Goodwin's lab was not usable and recommended that they start over with a new doctoral project. The reason wasn't necessarily data fraud, the students say, but rather Goodwin's relentless optimism that some now believe kept them clinging to questionable results. Allen, for example, says she sometimes argued but gave in to Goodwin's suggestions that she stick with molecular data Allen considered of dubious quality or steer clear of performing studies that might guard against bias. Ly, on her third, floundering project, says, "I thought I was doing something wrong experimentally that I couldn't repeat these things."

Despite her setback, Baca has chosen to stay at Wisconsin. "It's kind of hard to say" how much time she'll lose, says Baca, who notes that her thesis committee was supportive in helping her find a new lab.



The other four—Ly, LaMartina, Padilla, and Allen—have scattered. Only Allen plans on finishing her Ph.D. Determined to leave Wisconsin behind, she relocated in late March to the University of Colorado, Boulder, where she hopes to start fresh. Members of her church, her husband, and her parents persuaded her to stay in science, which she adores, but she still wonders about the future. “We unintentionally suffer the consequences” of turning Goodwin in, Allen says, noting that it will now take her 8 or 9 years in all to finish graduate school. To her husband’s disappointment, their plans for having children have been deferred, as Allen always wanted to wait until she had completed her degree.

For Padilla, the experience cemented the pull of the law. In late July, a month after his wedding, he and his wife moved to Minneapolis-St. Paul, Minnesota, not far from where Padilla grew up, because his wife’s adviser, the physiologist, had shifted his lab there. Padilla began law school in the city last week.

LaMartina spent 2 months in a different Wisconsin genetics lab, laboring over a new

worm project she’d recently started under Goodwin. That project, however, fell apart in June. She then spent 3 weeks in Seattle and

“Sure it’s the right thing to do, but right for who?”

—Sarah LaMartina

Alaska with Kuersten. During the trip, LaMartina abandoned her Ph.D. plans, and in July, she left Wisconsin for Texas, joining Kuersten at Ambion as a lab technician.

When Ly learned from her thesis committee that her years in the Goodwin lab had come to naught, she left the program and, as a stopgap, joined a cancer lab as a technician. “I decided that I had put my life on hold long enough,” Ly says. She intends to leave science altogether and is considering business school.

For Goldman, the dean who supported the graduate students, the experience was bitter-sweet. Impressed by the students’ profession-

alism and grace under trying circumstances, he came to believe strongly that science needs individuals like them. And although he admits that it’s “horrible” that so many of the students were told to start over, “I don’t see us changing our standards in terms of what a Ph.D. means,” he says.

Still, Goldman does plan to craft formal policies for students who might encounter this situation in the future. The policies, he says, would guarantee that the university protects students from retribution and that their funding remains secure. He hopes that codifying such safeguards will offer potential whistleblowers peace of mind.

In a building with a lobby graced by a fountain shaped like DNA, the Goodwin lab now sits deserted on the second floor. Incubators, pipettes, and empty plastic shoeboxes that once held worms litter its counters. Ly’s original fear months before, that something bad would happen to the lab, had proved more prescient than she had imagined.

—JENNIFER COUZIN

PROFILE: THOMAS KAPLAN

From Making a Killing to Saving a Species

A retired financier turned philanthropist is making an unprecedented investment in conservation science to help save the big cats

Thomas Kaplan was a long way from his usual Wall Street habitat. The wealthy financier spent 4 days last year tracking a 3-year-old leopard named Ngoye in the humid woodlands of northern KwaZulu-Natal Province in South Africa. Along with Luke Hunter, a wildlife biologist for the New York-based Wildlife Conservation Society (WCS), and Guy Balme, a graduate student at the University of KwaZulu-Natal, Durban, Kaplan was silently willing Ngoye to cross from private lands, which were off-limits to the trio, into the Phinda Game Reserve so they could replace her radio collar. Just as they were about to give up and head back to Cape Town, Ngoye finally entered the reserve. Balme quickly tranquilized her and replaced her collar.

The trek turned out to be a pivotal experience—and not just for the 43-year-old Kaplan, who was fulfilling a lifelong

dream to study big cats. After he learned that Balme was struggling to find the money to complete his master’s degree, Kaplan wrote a \$20,000 check to cover Balme’s expenses for 2 years. That philanthropic act was just the start: Kaplan decided there and then to launch a grants program with WCS for graduate students working on cat conservation. So far, he has given \$307,000 to 20 students at institutions all over the world, with a goal of spending \$500,000 a year. Balme says he now plans to pursue a Ph.D. in zoology.

Graduate students aren’t the only beneficiaries of Kaplan’s largess. Since his trek, Kaplan has pledged \$13 million over 10 years for a variety of cat-related conservation efforts, making him quite possibly the largest individual source of research support for such efforts around the world. Conservation scientists say that his long-term philanthropic commitment promises not only to give them more tools with which to save these magnificent beasts but also to nurture the next generation of conservationists. “I don’t think anyone else is in this bracket,” says conservation



On the move. Biologist Alan Rabinowitz searches for tigers in Laos.