# Choices in GRAY

**Science is not a morally neutral endeavor, and undergraduates are learning that ethical decisions are rarely a matter of black and white.**

BY FRAN SMITH

Illustrations by Brad Yeo

Peggy wants to use a few genetically engineered mice developed by her colleague Jim, but this won't be so simple to arrange. She refuses to sign an agreement required by a drug company, Jim's sponsor, on the grounds it would restrict her use of the resulting data. Jim knows that Peggy needs the mice to complete her protocol. He appeals to a company executive, who will not bend.

Last summer, 39 undergraduates and their faculty mentors at Santa Clara University watched a videotape of these fictitious scientists' dilemma, then debated what Jim should do. Just say no? That might jeopardize a valued colleague's research, as well as their relationship. Should he leave Peggy alone with the mice, giving her a chance to "borrow" them? That might not be ethical, or even legal.

The discussion was part of the university's Ethics in Science program. Supported by an HHMI grant, it reflects a nationwide trend to incorporate such issues into curricula. At Santa Clara, a Jesuit school in Silicon Valley, all undergraduates are required to take an ethics course. Thus, students receive more than just hard-core training in their fields; they learn some of the rules of professional conduct and start developing the ability to make ethical decisions.

The summer ethics class encourages students—and faculty—to think beyond public controversies such as stem cell research and consider the day-to-day dilemmas that scientists face. "Ethics isn't always those big-headline issues," says Margaret R. McLean, director of biotechnol-


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ogy and healthcare ethics at the university's Markkula Center for Applied Ethics. "Most of the time, it's the little decisions we make every day."

One afternoon a week, the undergraduates gather with their mentors to role-play and debate ethical choices that range from the profound to the mundane. For example, Should I sign a restrictive agreement, as Jim did? What should I do if I discover that a colleague fudged data? If I overslept Saturday morning and didn't feed the rats until noon, must I record the delay? Why bother, if it won't affect my data? (Then again, maybe it will.)

Making ethical decisions requires sensitivity, judgment and the ability to identify the stakeholders as well as the benefits, costs and consequences of any action. Moral imagination helps, as does compassion.

Perhaps compassion cannot be taught, but bioethicists believe that judgment can. Besides, learning to recognize and think about ethical questions may be as important as coming to consensus on answers. Leading scientific organizations, such as the National Institutes of Health, have recommended broad instruction in proper research conduct.

Traditionally, formal education about the ethics of science did not begin until graduate school—if then. A growing number of educators, however, believe it needs to start earlier, before students develop deep-rooted research styles and standards. "College is where many young people abandon earlier habits, ways of thinking and aspirations, and acquire new ones. So it is an especially fertile environment for teaching ethics," says Elizabeth Kiss, director of the Kenan Institute for Ethics at Duke University. As part of the liberal arts curriculum, Duke requires every undergraduate to complete two courses in ethical inquiry.

This can be a real challenge, teachers report. Students—especially science majors—often feel uncomfortable discussing deeply felt values and analyzing motivations and consequences. "We're not talking about memorizing a chemical cascade," Santa Clara's McLean observes, "we're talking about the kind of person you are."

Another barrier is that undergraduates often assume science is a morally neutral endeavor, says Jeremy Sugarman, a professor of medicine and philosophy at Duke. "They need to see that science is not value-free. There are norms and standards that need to be learned."

In Sugarman's course on ethics in the process and application of science, students are paired with mentors from the medical center's Institutional Review Board. Each pair reviews protocols actually under consideration by the board and attends a board meeting together. Then students write papers about what it is like to judge another scientist's protocol and how the board's deliberations compare with the ideal standards and procedures discussed in class.

The students also examine real cases with chairs of the Committee on Institutional Animal Care and Use and the group that investigates allegations of research misconduct. They also spend time in labs, teasing out some of the ethical questions that arise in the course of doing research. Visiting the lab of an Alzheimer's disease researcher,

# Theologians Meet Genetics

How do people wrestle with the novel bioethical issues raised by modern genetics? Many turn to their clergy for advice, but find them too uninformed to help. In a new course called God, Adam and Eve: Theology and Science in the Genome Age, theology students in Chicago are exploring the interface of science and religion in order to better address their future congregations' concerns.

The class at Chicago Theological Seminary on the city's South Side is taught by faculty members from both the seminary and neighboring University of Chicago; the collaboration is supported in part by a grant from HHMI. Because the seminary's students include Protestants from various denominations as well as Catholics and Jews, and because they are preparing for a variety of professions—some are ministers or plan to be; others work in helping professions such as social work, and the Ph.D. graduates often become community and denominational leaders—the course is nonsectarian and could have far-reaching effects. The class will publish a Web-based bioethics course for public use.

The syllabus includes some controversial topics: "gay genes," genetics and violence, and genetic determinism and human freedom. Sessions on key concepts in classical genetics and modern issues in genetic research, such as genetic similarities and differences among races, or genetic testing for diseases that can't be treated effectively, provoked lively discussion among the first class's 19 students, most of whom are working toward advanced degrees.

The students are not the only participants to profit from the course. "This class has been a learning process for me too," says Lainie Ross, associate professor of pediatrics at the university and one of the instructors. "The premises of some religions are entirely different from mine, and ethical choices flow from these premises. These premises also help define one's world view." Or as Laurel C. Schneider, associate professor of theology, ethics and culture at the seminary and another course instructor, puts it: "Religion is a lens for viewing the world; science is another lens. The lens you are using helps determine the choices you make."

The University of Chicago already teaches bioethics to life sciences majors (both undergraduate and graduate) and medical students, but that's just scratching the surface as far as the life sciences faculty is concerned. "We wanted to have a broader impact," explains José Quintáns, professor of pathology and director of HHMI programs at the university. "This course is taking the mystery out of science for nonscientists." He wants to develop a similar course for journalism students to help them better communicate bioethical issues to their future audiences.

Susan B. Thistlethwaite, president of the seminary and one of the bioethics course teachers, is as enthusiastic about the experiment as Quintáns. "It's important to break down the literal and figurative walls between science and religion," she says. "We have things to teach each other."

**—JENNIFER BOETH DONOVAN**

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for example, they discovered how deeply the work was influenced by considerations of informed consent. "It's one thing to read a textbook that spells out the ethical issues," Sugarman says. "It's much harder to recognize those questions when they come up as science is actually happening."

Arizona State University and the University of Arizona cohost an annual three-day retreat for science majors, supported by HHMI. The theme is lofty—what makes science ethical?—but the discussions are down-to-earth. In a session on medical ethics, for instance, the students consider the inequitable distribution of organs and end-of-life care. In a genetics workshop, they talk about "designer children."

The closer a problem comes to their own lives, the more excited and engaged the students become, says James Collins, chairman of biology at Arizona State and co-organizer of the retreat. One of the most popular workshops explores questions of laboratory ethics: Who owns the lab notebook? What constitutes plagiarism? What's the relationship between the lab head and postdocs, between postdocs and graduate students, between all of them and undergraduates? "Those questions are real to students," Collins says. "That's when we really begin to see light bulbs go on."

Students respond well to playing the role of ethical decision maker by applying what they've learned in their ethics courses. At the start of Santa Clara's Ethics in Science seminar, Amy Shachter, associate dean of the College of Arts and Sciences, conducts an ethics "inventory" in which students write a short response to several scenarios. For example, "You are a journal editor who learns that a reviewer is disregarding confidentiality guidelines. What do you do?" Shachter scores the essays on sensitivity (how well the student goes beyond facts to express values and weigh benefits and costs to others), judgment (whether the student expresses moral principles and reasoned justifications beyond mere opinion) and commitment (the student's willingness to take action after determining the possible consequences).

At summer's end, Shachter repeats the test. In 1999—the most recent year for which data were analyzed—sensitivity scores started high and remained fairly constant: 75 percent in June, 78 percent in August. Judgment improved dramatically, however—from 44 percent to 78 percent—and commitment also increased measurably, from 67 percent to 78 percent.

"Students and even faculty grow in their ability to say, 'This is wrong and ought not to be done,'" says McLean. This growth is not linear, however, for there is a paradox in ethics education: The more one learns about the relationships among the players, the range of possible actions and the far-reaching consequences, the more difficult it becomes to make a decision. "Many ethical issues appear at first to be black and white," Shachter says, "but when you understand more, everything turns out to be gray."

To guide students through this murkiness, Shachter uses a simplified version of the Ethical Decision-Making Framework, a step-by-step approach to analyzing ethical problems that was designed by the university's Markkula Ethics Center. The tool first helps the user to define the ethical issue at hand; then to identify stakeholders, describe relationships, list possible actions and predict consequences; and, finally, to find ways to resolve problems resulting from the user's chosen action.

At first, the students and their faculty mentors rely heavily on the framework to analyze ethical issues and come up with solutions. But by summer's end, they do it without the framework, which vanishes like a map discarded once the journey becomes familiar.

Ethics in Science began in 1996 with chemistry faculty and students. Last year, Shachter and McLean added HHMI-supported biology students and their mentors, which produced a few surprises.

Chemists and biologists look at issues very differently, McLean discovered. Remember the conflict between Jim and Peggy over the genetically engineered mice? In past summers, the chemists agonized over finding a satisfactory solution: Giving her the mice seemed wrong, but refusing didn't seem right either. The biologists, however, came up with an answer immediately.

"The biologists said, 'All he has to do is sacrifice the mouse and give her the organs. That's all she really needed in this case,'" McLean recalls. This solution, of course, raised other ethical questions for the class to ponder. H

## Bioethics Goes to High School

Ethics education is reshaping high school science. Just ask Carla Calogero, a 10th grade biology teacher at Nathan Hale High School in Seattle.

Calogero used to consider ethics a "tag-along to the curriculum" or "icing on the cake" to capture student attention. Now, ethical inquiry is a substantive part of her five-week unit on genetics.

The class begins by playing a version of the game Scruples. Calogero presents scenarios. For example, a close friend wants to crib your answers on a test. Students must respond to questions such as, Do I help my friend cheat? How do I decide? Who is affected? A heated but enlightening discussion often ensues as they debate their answers.

The teacher then segues into science ethics. Students do assigned exercises that help them make connections between scientific advances—genetic testing, for example—and the dilemmas facing researchers, doctors and families. Finally, teams of students produce "magazines" about topics such as pharmacology or forensics. Each magazine must cover both scientific details and ethical implications, and also present conflicting points of view. "It's easy for students to catch on to the issues," Calogero says, "and as they learn more about the science, the technology and the ethical problems, their understanding really increases."

Calogero began to rethink her curriculum two summers ago, when she took a week-long workshop for teachers at the GENETICS Project, a University of Washington School of Medicine program supported by an HHMI grant. Workshop leaders encouraged the teachers to include bioethics instruction in their classrooms.

Some teachers found this "preposterous," Calogero recalls. "A few objected that bioethics is values-based instruction that has nothing to do with science." Most, however, had already begun discussing ethics informally in class—usually because students brought it up. "I was shooting in the dark, letting the kids take sides and argue," says Paul Ladniak, a biology teacher at Seattle's Chief Sealth High School.

In the workshop, teachers learned a more systematic approach. "They gave us a framework," says Ladniak. "You look at the scientific facts; you identify the stakeholders and their values; you discuss possible outcomes; you keep the discussion narrowly focused." Ladniak thinks that such structured ethics lessons will be more comfortable for him and more valuable to his students than free-wheeling debates. **—FS**

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