BIOMEDICAL POLICY

Mammalian Cloning Debate Heats Up

The hubbub over the cloning of Dolly, a Scottish mountain sheep, continued without letup last week. Experts of every type—and nonexperts—offered opinions on how the technique developed at the Roslin Institute in Edinburgh, Scotland, might change the way humans reproduce and, some said, destroy human dignity. Members of Congress rushed forward with bills to outlaw human cloning, state legislators from Alabama to California also proposed new laws, and the National Bioethics Advisory Commission (NBAC) began taking testimony on whether the government should outlaw the cloning of people.

RICK KOZAK

Cloner. Wilmut sees "no good reason" to clone human beings.

President Clinton has asked the NBAC to write an opinion by the end of May to guide the Administration. Until then, he has banned all federally funded human-cloning research. If the NBAC's initial sessions on 13 and 14 March are any guide, NBAC members may have a hard time reaching a consensus. The witnesses, chiefly lawyers and ethicists, offered widely differing views. For example, Leon Kass, an ethicist at the University of Chicago, urged the NBAC to recommend a sweeping ban on human cloning, warning that it "represents something radically new." The NBAC should act, he said "as if the future of humanity may lie in the balance." But another ethicist, Ruth Macklin of Albert Einstein College of Medicine in New York City, suggested that it's not clear that cloning of a person would violate anyone's human rights and so should not be banned reflexively.

While the debate at the NBAC probed such extremes, the Senate subcommittee on public health and safety—chaired by the only physician in the U.S. Senate, heart-transplant surgeon William Frist (R–TN)—took a more moderate and pragmatic approach at a hearing it held on 12 March. The purpose of the hearing, Frist made clear, was to examine the benefits cloning might offer to agriculture, research, and medicine—and to cool down an overheated public discourse.

The star witness at the session was Dolly's "father," Ian Wilmut, the embryologist who headed the cloning team in Edinburgh. At a crowded press conference and later, during his testimony, Wilmut dodged questions about how the new technology ought to be regulated. When pressed by one senator, however, Wilmut said that he could imagine "no good reason" to clone a person. At Frist's invitation, Wilmut and Harold Varmus, director of the National Institutes of Health, concentrated instead on cloning's promise as a technology.

Armed with props—a chart showing the development of an embryo and giant photos of a nucleus being inserted into a mouse egg—Varmus gave the senators what he called a "Bio 101" lesson. He suggested that Wilmut's technique might help reveal how the environment within the cells of the early embryo regulates gene function. Such information, Varmus said, might eventually help in combating genetic diseases by allowing researchers to turn good genes on or bad genes off.

In the near-term, though, Wilmut said, cloning's most likely applications will be in allowing researchers "for the first time to make precise modifications" of the DNA of farm and laboratory animals. The technique used on Dolly might make it possible to create large numbers of custom-designed transgenic animals that secrete medically useful human proteins in their milk, he suggested. Some candidates for this kind of mass production, Wilmut said, are human clotting factor and fibrinogen, which aids in healing wounds. He also suggested that cloning might be used to create model animals for research, such as a sheep designed to replicate the effects of human cystic fibrosis. And he predicted that in 5 to 10 years, cloning techniques may be used to generate tissues for organ replacement.

Both Varmus and Wilmut argued that it is important to make a distinction between the cloning of humans and the cloning of human tissue. In addition, they asked that Congress wait for the results of the NBAC review before rushing to enact new laws.

They have reason to be concerned about that. Already, Representative Vernon Ehlers (R–MI) has introduced two bills—one (HR 922) that would prohibit spending federal funds on "any project of research that involves the use of a human somatic cell for the process of producing a human clone," and another (HR 923) that outlaws the use of such a cell "for the process of producing a human clone." Senator Christopher Bond (R–MO) likewise introduced a bill (S 368) that bans the use of federal funds "for research with respect to the cloning of a human individual."

As a practical matter, every witness at the Senate hearing said, no one is going to clone a human being in the next 90 days, so Congress will take no risks if it waits for the NBAC's advice before acting on these proposals.

–Eliot Marshall

PLANT PATHOLOGY

ATCC Plant-Virus Collection Threatened

In the past few weeks, plant scientists have been trading e-mails and faxes warning that the most diverse collection of plant viruses in the world could be in jeopardy. Their fears were sparked when they learned that in order to cut costs, the American Type Culture Collection (ATCC)—a vast library of microbial cultures that is a vital resource for researchers around the world—has decided, for now, not to include a greenhouse in its new facility, which is being built outside Washington, D.C., near Manassas, Virginia. Moreover, as a further money-saving step, the ATCC, a private, nonprofit organization now headquartered in Rockville, Maryland, recently dismissed the curator of its extensive plant-virus collection. "There is the real possibility that the plant-virus collection will deteriorate and possibly be abandoned," worries Michigan State University plant pathologist Gus de Zoeten.

G. DE ZOETEN

Homeless? Plant viruses, such as this ring spot virus, may lose their home at ATCC.

ATCC officials say that they want to protect and even enlarge the collection but concede that it may be difficult. At risk are isolates of more than 1000 plant viruses and viroids—smaller plant pathogens consisting of small, naked, circular RNAs. While not in as high demand as the ATCC's other products, samples of viral pathogens from these standardized cultures are crucial to understanding—and thwarting—plant diseases, says plant pathologist Anne Vidaver of the University of Nebraska. Without them, she says, "it is not likely that many microbial studies can be replicated by other scientists." The ATCC also produces various diagnostics, such as probes used to screen seeds for viruses before they are planted.

The problem, says ATCC President Raymond Cypess, is that the plant-virus collection runs an annual deficit of about $150,000. Currently, the

U.S. government provides 16% of the ATCC's $18 million budget, with the remainder coming largely from sales of cultures and diagnostics. But unlike some lab cultures, such as human cancer cells, plant viruses, with their relatively low sales, generate little income, and their maintenance costs, especially for greenhouses, are high. Plant-virus collections "can't be run just on sales," agrees Stephan Winter, who operates a smaller service at the University of Braunschweig in Germany. This collection, Winter adds, receives most of its support from German federal and regional governments.

To cut costs while trying to maintain this valuable resource, Cypess says the ATCC has made arrangements to share a greenhouse at neighboring George Mason University after it occupies its new building in March 1998. The organization has also reassigned several biologists to oversee the collection in the absence of the outgoing collection curator, who departs this month.

But plant scientists fear that these measures won't be adequate. "It's not doable to have a generic plant biologist curate a specialized plant-virus collection," says Rutgers University plant biologist Peter Day. Contributions of new and important cultures are unlikely to be made to a collection that is not actively curated, says de Zoeten. He adds that there are also concerns that the agreed-upon greenhouse space might not be sufficient nor available on a timely basis. Many plant viruses have to be transferred to a new batch of plants every few months to survive, which puts heavy demands on greenhouse space.

Cypess responds that the ATCC wants to address these concerns. Among others, the organization is studying the possibility of shifting the plant-sciences program to a land-grant university that supports a lot of plant biology, although no plans have been made yet. But even he concedes that the plant-virus collection might be in jeopardy. "It's never going to develop adequately at the ATCC," he says, "unless additional resources to support it are identified."

In the meantime, the ATCC and plant biologists, together and independently, are exploring various strategies for strengthening the plant-virus collection. One possibility, Cypess says, is for the plant-science community to find new funding to support an endowment for the collection. Where that funding might come from is unclear, however. The National Science Foundation rarely makes the type of long-term commitment needed to maintain a collection. And the obvious agency for long-term support of the plant-virus collection—the U.S. Department of Agriculture—has given nothing. As Vidaver points out, "There is no long-term national policy for supporting the maintenance of culture collections of microorganisms, including viruses."

–Anne Simon Moffat

JAPANESE INDUSTRY

Staying Off Beaten Track Puts LED Researcher a Step Ahead

ANAN, JAPAN—Nichia Chemical Industries Ltd. is an hour's drive from Tokushima airport. But jump in any airport taxi, say "Nichia Chemical," and the driver will speed down Tokushima Prefecture's narrow roads, through miles of rice paddies and sweet-potato fields, past racks of drying seaweed, to your destination in the tiny town of Anan. "Probably every taxi driver in this prefecture knows the way to Nichia," says one cab driver about the prefecture's third-largest employer. "It's famous."

Materials scientists around the world would agree. For them, however, the company's fame rests on the research of one man: Shuji Nakamura, a researcher who is a far cry from the traditional image of a corporate scientist. Holding only a master's degree and working with just one assistant, Nakamura developed the world's first bright blue light-emitting diode (LED). And he is leading the race toward an even bigger prize: the commercialization of a blue laser. He pulled off these feats while working at this small company, far off the beaten high-technology track on Shikoku, the smallest of Japan's four major islands. Even his competitors are generous with their praise: "It's a truly remarkable achievement," says Shigeru Sato, the head of research for Fujitsu Ltd., the giant Japanese electronics firm, about Nakamura's work.

D. NORMILE

"If I get 10 ideas, I try all 10. I just need a target."

—Shuji Nakamura

The challenge of creating more efficient solid-state devices that would emit blue light without burning up in seconds has long stumped legions of scientists at the world's largest electronics companies and leading universities. Nakamura solved the problem in 1993 by taming gallium nitride, one of the few semiconductor materials capable of emitting light at the desired blue wavelength but notoriously difficult to fabricate into working devices.

The commercial stakes are high. With their shorter wavelength, blue lasers promise to quadruple the amount of information stored on music CDs and CD-ROMs. As the last of the primary colors—red, green, and blue—to be available as an LED, the blue LED has also paved the way for the use of these long-lasting, highly efficient light emitters in giant outdoor displays and other high-demand sources, among other applications. What's more, combining red, blue, and green structures in one device produces white light, something that may eventually make the light bulb obsolete. Ramu Ramaswamy, an electrical engineer at the University of Florida who works on optoelectronics, predicts that the developments stemming from Nichia's breakthroughs "will change the world as we know it."

A lighter side. The 42-year-old Nakamura does not have the air of someone who is changing the world. An easygoing, self-described country boy, he laughs easily and often as he tells of his research travails. His first scientific paper, he recalls, was sent back three times. "The English was incomprehensible," he confesses before breaking up. Even more mystifying to those familiar with the buttoned-down norms of industrial research in Japan is the fact that Nakamura never sought nor received corporate permission to publish his results. Indeed, when a company salesperson, contacted by a customer who had read about Nakamura's work, asked what was up, "I told him I didn't know anything about it," Nakamura says, laughing even harder.

But the real punch line of the story is how Nakamura got his research under way. In 1988, after 10 years at Nichia, Nakamura was fed up with working with "near-zero" budgets on themes picked by others. He wanted to choose his own target, and he knew that the first blue LED would be a big prize. He guessed that the founder and chair of the company, Nobuo Ogawa, might be a kindred spirit, so Nakamura bypassed his immediate boss and went straight to Ogawa to request $5 million in equipment. "And,"