loxP sites and chops out the intervening part of the *BRCA1* gene, inactivating it. Sure enough, some of the resulting mice developed breast cancer in at least one of their 10 mammary glands between 10 to 13 months of age.

Deng concedes that there are slight differences between his mice and women with *BRCA1* mutations. Mice at 10 to 13 months of age are analogous to women in their 50s, while *BRCA1*-related breast cancers usually occur before menopause. Also, only 22% of the animals get the cancer, although Deng expects that more will as they age. Still, cancer biologist Bert Vogelstein of The Johns Hopkins University School of Medicine says that the animals provide the first "experimental system to figure out the way the *BRCA1* gene works."

The NIDDK researchers began getting their first hints of how *BRCA1* loss might lead to breast cancer when they looked at the milk ducts in mutant animals that were pregnant or lactating. "The mammary glands were smaller [in the mutants], and there is very sparse and sometimes abnormal branching" of the ducts, Deng says. At the same time the team observed extensive programmed cell death, or apoptosis, in the mammary tissue of mutant mice. "At first glance that looked quite inconsistent" with a gene abnormality that supposedly predisposes to the excessive cell proliferation of cancer, Deng says.

A peek at the chromosomes of tumor cells helped explain this apparent paradox, however. In cells lacking *BRCA1*, the entire genome seemed intrinsically unstable: There were extra copies of individual chromosomes, and some had large deletions or were fused to bits and pieces from other chromosomes. That makes sense, because previous studies had found a connection between *BRCA1*, as well as the other hereditary breast cancer gene, *BRCA2*, and the repair machinery for the chromosome breaks that lead to such instability.

Deng speculates that in the absence of *BRCA1*, cells accumulate enough DNA damage to trigger safeguards that cause them to stop dividing or even undergo apoptosis. That would explain the high cell-death rates seen in the mutant animals. However, the genetic instability also increases the mutation rates of crucial tumor-suppressor genes or cancer-promoting oncogenes—which may eventually overcome the growth controls and spur the development of tumors.

The Deng-Hennighausen team already has evidence connecting the *BRCA1* defect to the loss of *p53*, the well-known tumor suppressor gene that is itself mutated in about 50% of all familial breast cancers. They found that the mouse *p53* gene is either totally silent or severely scrambled in two-thirds of the tumors in their *BRCA1* knockouts. The researchers also found that inactivating one copy of the *p53* gene in the *BRCA1* mutants accelerated tumor formation in the animals and drastically increased the cancer incidence to some 75%.

Hennighausen says he plans a variety of follow-up experiments with the mutant mice. For example, he wants to know whether the tumors spread as frequently as they do in human breast cancer patients and whether their growth is stimulated by the female hormone estrogen, as also happens in some human patients. If so, the animals would be good models for testing therapies.

Other researchers are also eager to get their hands on the long-awaited mice. Says Hennighausen, "We received several phone calls from people requesting the animals."

–MICHAEL HAGMANN

ITALY

University Funding to Be Tied to Performance

MILAN—Italy's reformist minister for universities and research, Ortensio Zecchino, is taking on the country's inefficient university system. A new bill, now awaiting the attention of the relevant parliamentary committee, would force universities to conduct annual assessments of the quality of their teaching and research and tie their level of government funding to the outcome. It would also give professors monetary incentives to get their students to complete their degrees and pass their exams on time. "This bill is a further step on the way to developing a more effective verification of results in the Italian academic world," says Zecchino, who has already pushed through an overhaul of the National Research Council masterminded by his predecessor, Luigi Berlinguer (*Science*, 30 October 1998, p. 855).

> "Any law improving the system of evaluation is certainly welcome."
>
> —Luciano Modica

Previous Italian governments have tried with little success to impose assessments on the country's universities, which are almost exclusively government-funded. In 1993, universities were required to set up internal evaluation panels to assess teaching and research, but the system never worked well. Seven out of the 54 panels across the country never met and about half the panels never presented a report, while many of those that were completed turned out to be of little use. In 1996, a "national observatory" for the assessment of the university system was created, but it also has had little impact.

If Zecchino's bill passes, the observatory would be replaced by a new national committee. "It will not be just a change of name," assures Zecchino; "the national committee will have a much more incisive power." The committee will have seven members, some of whom will come from abroad, and it will set general criteria for the universities to carry out their evaluations. Every university will have to set up a new internal evaluation panel with no more than nine members, one-third of whom must come from outside the university. The methods the panels will use to evaluate research and teaching have not yet been spelled out, but in their evaluation of teaching the panels must take into account student assessments of their teachers' performance—a new departure in Italy. According to the bill, assessments will not affect the careers of individual professors; they are for funding purposes only.

The panels will be required to submit their reports to the national committee each year. And from 2000 onward, a portion of the government's funding for universities will be distributed by the committee according to the strength of these evaluations. Those universities that fail to submit an evaluation will receive none of this funding.

The bill also aims to tackle the chronic problem of students not completing their degree courses. Only 13% of Italian students take their exams on time, and only about 30% of those who enroll eventually graduate. Zecchino is proposing to put up $150 million over the next 3 years in incentives for professors to get students through their courses successfully. Universities would bid for this money by proposing projects to improve degree success rates. Zecchino's ministry will provide one-third of a project's funding at the outset and the remainder when it begins to show results.

Luciano Modica, rector of the University of Pisa and president of the Italian Conference of Rectors, says "any law improving the system of evaluation is certainly welcome, but it is not true that in the Italian academic world assessment of quality is completely nonexistent."

Giuseppe Palumbo, deputy of the main opposition party and vice president of the parliamentary committee that will scrutinize the bill, approves of Zecchino's plans in principle. But he believes that they are very ambitious and probably too idealistic. For example, he notes that there are so many students in some Italian university

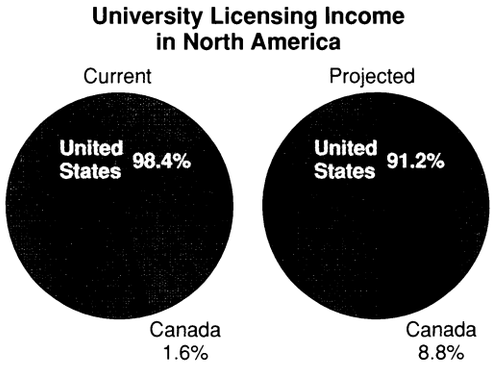
courses that direct contact with the professor is limited and student assessments have little meaning. "In practice, it will be very difficult applying that system without a global reorganization of our academic system," he says. **–CHIARA PALMERINI**

Chiara Palmerini is a writer in Milan.

CANADA

Schools Urged to Boost Technology Transfer

OTTAWA—Canada is losing valuable technology to other countries because of its policies on exploiting the fruits of university research, according to a new report by a high-level government panel. The answer, says the panel, is to give universities rather than individuals the right to commercialize publicly funded discoveries, as well as the money to do the job right. But some academics fear that such a policy, described in a draft report obtained by *Science*, would turn universities into toolboxes for industry and undermine basic science.



Bigger slice. Canadian officials want greater commercial return on academic R&D investment.

The report, "Public Investments in University Research: Reaping the Benefits," is the first product of the prime minister's Advisory Council on Science and Technology, created in 1997. Written by a nine-member subpanel of industry and university officials, it notes that only half of Canada's universities retain ownership of intellectual property (IP) generated by public funds or share it with the researchers; the others turn over full rights to the researchers. The result, says the panel, is that academe has become a "technology supply house for other countries," with faculty members "handsomely rewarded through consulting fees in return for assigning away IP rights" to companies from other countries, notably the United States.

Canadian universities collected a paltry $10 million last year from the marketing of university-based inventions, compared to $700 million in the United States, even though the government spends about one-tenth as much on academic R&D as its southern neighbor. Advisory Council member and expert panel chair Pierre Fortier says the only remedy is to "get some assurances from universities" that commercialization is part of their mission. "We cannot carry on with the laissez-faire approach which has prevailed until now," says Fortier, special adviser to Montreal-based Innovitech Inc. The panel's final report will be submitted 11 May to the full council, which will forward it to the Cabinet in early June. Observers predict it will receive a warm reception from a government eager to promote high-tech industry.

The draft report says that researchers should be obligated to make full disclosure of all IP created from federally funded research. The university, with few exceptions, should own the rights to its commercialization, while the creator should get a "share" in the form of equity or license income. The report proposes legislation similar to the U.S. Bayh-Dole Act of 1980, which gave universities the right to obtain title to inventions developed with federal funds and to grant exclusive licenses to patents based on those discoveries. Such a law would serve to harmonize what is now a hodgepodge of policies and practices.

As an alternative to legislation, the report also proposes that the granting councils adopt a new IP code and prohibit awards to universities that don't follow its guidelines for promoting commercial activity. Fortier says that consultations with 150 academic administrators have recently led the panel to conclude that's a preferable approach. "It's easier to administer," he says. "Legislation could take 2 to 3 years." The panel also recommends that Ottawa spend $30 million a year to hire and train commercialization staff in universities, noting that only 62% of the country's universities have any form of office to foster technology transfer.

While agreeing that universities need to become more attuned to the market, some academics question whether new spending on commercialization is the best solution to the problem of reaping more from Canada's investment in academic research. "Before you can imagine getting a lot of money from industrial applications, you must first invest more in basic research," argues Yves Gingras, professor of the history of science and sociology at the University of Quebec in Montreal.

Others, like Canadian Association of University Teachers executive director Jim Turk, worry that the recommended measures will transform universities from institutions of "open scholarship" to ones in which "commercial benefit" serves as the primary rationale for research. Turk takes issue with virtually every aspect of the report and is particularly incensed by its casting of faculty who assign IP abroad as somehow "treasonous" at a time when the government is allowing Canadian high-tech firms to be bought up by foreign interests. He also faults the panel's emphasis on commercialization rather than on the need to create new knowledge that might have applications, a view he sees as a "bizarre, Orwellian redefinition of innovation." **–WAYNE KONDRO**

Wayne Kondro writes from Ottawa.

JAPAN

Mixed Grades for 5-Year Science Plan

TOKYO—A 1995 law that led to Japan's first-ever 5-year plan for science and technology has helped boost spending and the number of scientists being trained, but it has been less successful in ensuring that the increased funding is well spent. That's the preliminary verdict of a committee of the country's top science policy-makers, in an interim report released last week. "There has been a fairly big effect ... on bringing up the overall level of research activity," says Mitsugu Ishizuka, a former official of the Science and Technology Agency (STA) and a member of the committee that drafted the report. "But there are aspects [of the plan] that haven't progressed as hoped."

A REPORT CARD ON JAPAN'S 5-YEAR PLAN

C or better

- Spending has risen dramatically
- 10,000 postdoc positions created
- Graduate school enrollment up sharply

Just passing

- Spending on facilities spread too thin

Not acceptable

- Negligible increase in lab assistants
- Ineffective evaluation of research programs and results

SOURCES (LEFT TO RIGHT): PRIME MINISTER'S ADVISORY COUNCIL ON SCIENCE AND TECHNOLOGY; COUNCIL FOR SCIENCE AND TECHNOLOGY REPORT

The review is likely to be influential, given its source: the Committee on Policy Matters of the Council for Science and Technology, which is chaired by the prime minister and serves as the nation's highest science advisory body. The panel examined such quantitative measures as the level of funding and the number of lab assistants and interviewed national laboratory heads, researchers, and business leaders.