

An Anxious Time for Swiss Science

Long a hallmark for quality, Swiss science is now under threat: from stagnant budgets, recession-hit industry, and a referendum that might outlaw transgenic research

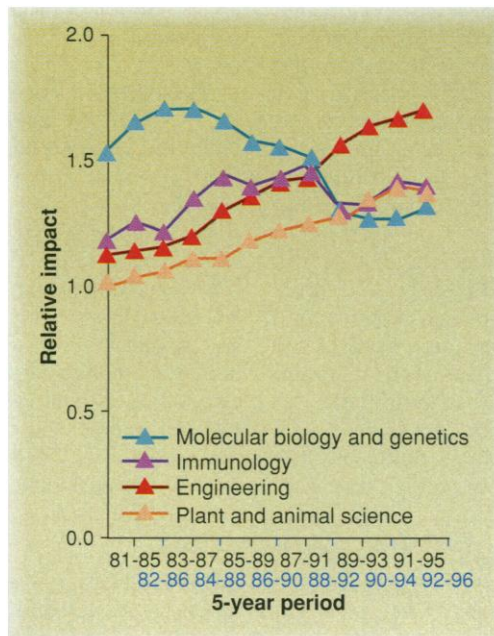
BERN—For a small alpine nation, Switzerland has long had a big impact in the world of science. The 16th century Swiss alchemist Paracelsus was the first to employ chemistry in the practice of medicine; geologist Louis Agassiz's groundbreaking work on glaciers sent tremors through his field in the 19th century; and in 1905 a young Swiss Patent Office employee named Albert Einstein turned physics upside down with his special theory of relativity. And Switzerland continues to put its stamp on 20th century science: More than 20 Swiss or Swiss-educated scientists have won Nobel Prizes in the natural sciences, and in recent years the country has ranked number 1 worldwide in both the number of research papers per capita and the number of citations per capita (*Science*, 7 February 1997, p. 793). "For such a small nation, Swiss science is strong over a remarkably broad spectrum," observes Olaf Kübler, a physicist and electrical engineer who is president of the Zurich branch of the Swiss Federal Institute of Technology (ETH-Zurich), Europe's closest equivalent to the Massachusetts Institute of Technology.

Yet, in spite of all these achievements, there is an almost palpable feeling among researchers here that parts of this dynamic scientific enterprise are under threat. The most immediate danger is a "gene-protection" initiative, a constitutional amendment instigated by public petition, which, if approved in a nationwide vote on 7 June, would ban all research involving transgenic animals, severely restrict research with transgenic plants, and forbid the patenting of genetically modified organisms. Some researchers with international reputations—including Charles Weissmann of the University of Zurich's Molecular Biology Institute and Walter J. Gehring of the University of Basel's Biozentrum—warn that if the amendment is approved they and many other researchers would be compelled to shift their research out of Switzerland.

The referendum is not the only dark cloud on the horizon: In a report issued last year, the government's advisory Science Council warned that the nation's "future capability for innovative and competitive science is not guaranteed." Among the threats to the quality of Swiss science, the report cited relatively flat R&D budgets in Switzerland's

recession-weakened economy, "structural difficulties and financial gaps in university research," and declining research efforts by some industries.

Many researchers and government experts who spoke with *Science* felt that these threats are symptoms of a breakdown in trust between scientists and the Swiss public. "Scientists have to take the concerns of the Swiss people seriously. The biggest mistake would be to dismiss their concerns without fully answering them," argues Franco Cavalli, an oncologist from Bellinzona who is a mem-



Impact. Cites per paper from Switzerland compared to baseline of 1.0 for each field.

ber of the Swiss Parliament.

So, after decades near the summit, is Swiss science now on a slow road down from the heights? "There are warning signs, but I hope that Switzerland will reaffirm its commitment to high-quality science," says Heidi Diggelmann, a University of Lausanne virologist who is president of the Swiss National Science Foundation's Research Council. Observes Charles Kleiber, the nation's top-ranking government science official, "Switzerland has no choice—brainpower is our greatest resource."

Science at the "hub of Europe"

Why has such a small nation fostered such influential research? Swiss scientists can

point to numerous factors that have contributed to their success: national wealth, a host of international institutions, an excellent educational system, and extensive cooperation between industrial and university research. And many Swiss experts point to the fact that their republic of 7.2 million people has very few natural resources—and hence depends on innovation to survive. Kübler believes high-quality education is a major reason for the country's scientific excellence: "When they begin their university studies, Swiss students are often better prepared, and more highly qualified, than their counterparts from other parts of Europe."

Switzerland's location at the "hub of Europe" and the mix of languages—German, French, and Italian are spoken here—have helped ease the way for profitable scientific exchanges. And Switzerland's neutral status drew many prominent scientists from Germany and elsewhere in war-torn Europe during the 1930s and '40s. "The financial means and the political situation allowed us to convince some of the very best scientists worldwide to work in Switzerland," says chemistry Nobel laureate Richard Ernst of ETH-Zurich. Even today, ETH often outbids some of the continent's most prestigious research institutions—including Germany's wealthy Max Planck Society—when hiring top researchers.

Another important factor has been the traditionally strong commitment to basic research, as well as a relatively open granting process that gives young scientists a chance to compete. "It's a bottom-up process," says Diggelmann. "Almost anyone who has good ideas can apply." She says 85% of the National Science Foundation's annual budget of about \$210 million is spent on basic research. The Swiss also invest heavily in their young scientists: In 1996, the government funded 560 Swiss postdocs on fellowship programs outside the country, including 323 in the United States. The National Science Foundation then offers "career awards" to entice promising young postdocs to return home.

Medicine Nobel laureate Werner Arber points to "the synergy between university research and private-sector research" as a big plus for Swiss science. Industry contributes an unusually high proportion—about 70%—of total R&D spending and supports the work of many prominent

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scientists. Centers such as the University of Basel's Biozentrum have strong links with the research institutes of Novartis AG and other big pharmaceutical companies. Medicine Nobelist Rolf M. Zinkernagel, whose Institute of Experimental Immunology at the University of Zurich also benefits from such co-operation, says "there have been very productive interactions" between university and pharmaceutical industry researchers.

Opening the ivory towers

Despite Swiss science's present ebullience, some fields face decline in the coming years unless scientists can do a better job of convincing people that research can help improve their lives. "There is a gap between science and society here," says Kleiber, who heads the Interior Department's Swiss Science Agency in Bern. He views the gene-protection initiative as a reflection of that chasm: "If we don't take action now to bridge that gap, we will see similar initiatives in the years to come."

As one of the world's most democratic societies—in which a successful popular vote can directly amend the constitution—Switzerland is vulnerable to public initiatives that might otherwise be diluted by the national Parliament. In the case of the gene-protection amendment, a diverse coalition of environmental, animal-rights, farming, and political groups worked for years to gather the 111,000 signatures that require the Swiss government to put the proposed amendment to a referendum. If the proposal is approved by a majority of Swiss voters and a majority of cantons (states) in June, more than 600 research projects and about 2000 scientists and laboratory workers would be directly affected, and most transgenic research would likely be shut down or transferred to Germany or France. Gehring predicts "an exodus of molecular biologists and geneticists" from Swiss universities. Recent surveys indicate that the vote on the initiative may be close.

Daniel Ammann, a leading proponent of the initiative through SAG—an umbrella organization of more than 30 interested groups—thinks the amendment can win. Ammann contends that the initiative would not hurt

biomedical research in Switzerland because it would still allow the use of gene technology for medical research and gene therapy.

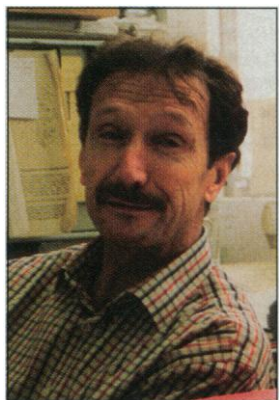


Opening up labs. Virologist Heidi Diggelmann.

Diggelmann, however, says the impact in many fields of research would be "devastating." Noting that about three-quarters of the nation's transgenic research takes place at universities, Diggelmann says the amendment "would hurt Swiss university researchers much more than the pharmaceutical industry."

Swiss biologists are not just sitting back and hoping for the best. Many have been working hard to get out the message that genetic research benefits the public. On Tuesdays, when *Blick*, Switzerland's largest circulation newspaper, hits the newsstands, Zinkernagel's photo sometimes shares a page with a scantily clad "*Blick* girl." His weekly column—"The World of Tomorrow"—aims to convince readers to oppose the gene-protection amendment. "I think people are interested," says Zinkernagel, "and get the message about the importance of research."

In French-speaking Lausanne, Diggelmann has opened her Institute of Microbiology to visitors. "Anyone can call us up and visit the labs—school-kids, sport clubs, ladies' groups," she says. "We try to be humble, to let people know that we don't always have the answers, but that we do understand their concerns." Meanwhile, University of Bern chemokines researcher Marco Baggiolini is preparing to argue the side of science "on



Convincing newspaper readers. Immunologist Rolf M. Zinkernagel.

Italian-speaking TV or radio or newspapers—whatever the venue. It is clear that Swiss scientists have to reach a wider audience to get their message across," he says.

The Swiss pharmaceutical industry is also flooding the country with advertisements opposing the initiative, and the Parliament is now considering a package of proposed new laws, called "Gene-Lex," that would tighten federal controls on transgenic research in a way that is acceptable to most scientists. This week, the Swiss government also created a new dozen-member Federal Ethics Commission for Genetic Technology, headed by a Swiss theologian.

In Basel, Arber speaks out against the initiative, but he says the effort can be "very frustrating. Especially in the German-speaking part of Switzerland, some well-meaning people still feel that geneticists interfere with creation." The National Science Foundation has organized public forums on bioethics, and Diggelmann and fellow researchers regularly hand out leaflets at the farmers' market in Lausanne. "This threat has moved many scientists to get out of their labs and talk to people," Diggelmann says. "That's good—but it should have happened earlier."

The campaigning zeal of Swiss biologists has made many of them realize that longer term efforts are needed to improve the relationship between Swiss science and society. Ernst says he would like to see a "widespread educational effort" to convince the Swiss public that "science and technology are of vital necessity to the future of the Swiss economy." Kleiber agrees, saying he wants to "create a foundation that will be in charge of that effort" to educate the public.



Fixing priorities. Science official Charles Kleiber.

Even if scientists here are successful in helping defeat the gene-protection initiative next month, they still must face other challenges to the quality of Swiss science. Partly because of the nation's lingering economic recession, R&D budgets have been flat in recent years—with R&D expenditures at \$6.7 billion in 1996 (2.76% of gross domestic product). Some industries have transferred research out

of Switzerland, and a growing number of young researchers are leaving for the United States. Meanwhile, the nation's universities are coping with tight budgets and painful restructuring.

Kleiber says that Swiss scientists must learn to be realistic and accept that Switzerland is a small country and "can't do everything." He says they must do a better job of "fixing priorities and focusing more on the areas where we excel." Once the priorities are set—in consultation with the major Swiss industries—Kleiber thinks "we should invest more in science," mainly through the National Science Foundation. He believes the next few years will be crucial in convincing the Swiss people and their government to bolster their support: "We have 2 or 3 years to prove that science and education can bring results."

—Robert Koenig

Robert Koenig is a writer in Bern, Switzerland.