groups that are small," he says.

Swiss social science and humanities researchers have their own beef with the program. Of the 18 projects recommended by the SNSF to the SRG, three were in the social sciences. None of these was funded, despite the government's previous declaration of social sciences and humanities as one of four priority areas. On 21 December, more than 300 university students, postdocs, and professors sent a letter of protest to Kleiber and his boss, Home Affairs Minister Ruth Dreifuss. The next day, the general secretary of the Swiss Academy of Humanities and Social Sciences, Beat Sitter-Liver, joined two other leaders of Swiss social science organizations in sending another protest letter to Dreifuss. "Social sciences has been relegated to second-class citizenship," contends Keith Krause, a political scientist at the University of Geneva.

Kleiber, also a political scientist by training, says he hopes that parliament will correct that situation this summer by funding four additional centers, one of which is in social sciences. A second (and probably final) call for proposals is expected next year, but some social scientists may pass unless "we are assured that the process will be fair," says University of Geneva sociologist Christian Lalive d'Epinay.

The next time around, Kleiber would like to see a more focused call for proposals and a shorter review process. SNSF Secretary General Hans Peter Hertig acknowledges that there is "certainly room for improvement" in the evaluation procedure, but he disagrees with Schatz's assertion that NCCR will weaken the foundation's support for individual researchers. Individual grants still account for 80% of SNSF's funding.

For Duboule and others involved with the new centers, the program is not just about allocating resources. It's also part of an ongoing effort to improve Swiss science. "We just have to try it and see how it works," Duboule says. "We have to do something; we can't just do nothing." —**MIN KU**

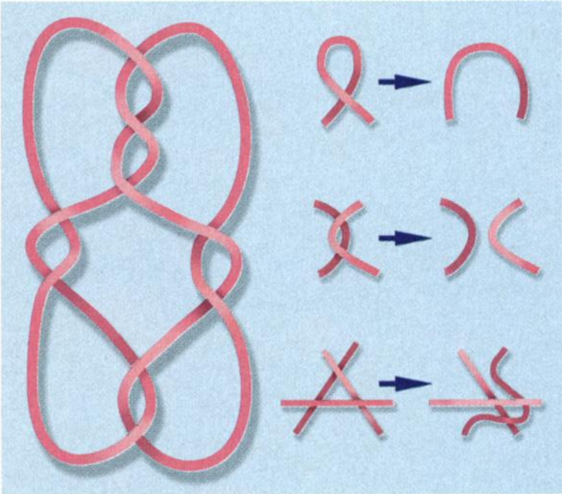
Min Ku is a science writer based in Bern. With reporting by Robert Koenig.

KNOT THEORY

Loopy Solution Brings Infinite Relief

Alexander the Great would sneer. Twenty-three centuries after he slashed through the Gordian knot, mathematicians have finally made their first stab at figuring out how long it takes to untangle a tangle. The unheroic answer, for one key class of knots, is "not forever"—and even that comes with a huge string attached. Still, knot researchers are delighted.

ILLUSTRATION: A. STONEBRAKER



Circle game. In time, three basic maneuvers will reduce a tangle like the one at left to a simple loop.

"People have always wondered if [the unknotting process] was unbounded, and people now know that it is bounded," says Joan Birman, a knot theorist at Barnard College in New York City. "It was a very big problem."

For years, knot theory itself has been in such a tangle that even the most fundamental problems in the field still loom large. "If I hand you a knot, you would hope for some method of identifying it," says William Menasco, a knot theorist at the State University of New York, Buffalo. "The classical problem in knots is to have a complete, nonredundant list of knots, and if you give me a knot, I can standardize it and pick out where in the list it lives." Unfortunately, mathematicians aren't certain that they can do that even for the simplest knot of all: a mere loop of string, also known as the unknot.

This isn't to say that knot theorists have made no progress. For instance, as far back as the 1920s, they had figured out that only three types of motion—the so-called Reidemeister moves—are needed to untangle any knot into a standard, recognizable form. But even with that armamentarium, mathematicians didn't see an obvious way to do the untangling; sometimes the Reidemeister moves made things worse. "They were hoping that the set of moves would make the knot simpler at every step," says Jeffrey Lagarias, a mathematician at AT&T Labs in Florham Park, New Jersey. "The Reidemeister moves do not." As a result, there is no easy way to tell how many moves it would take to untangle a given loop of string—or even whether any finite number could do the job.

Lagarias and Joel Hass of the University of California, Davis, sought to guarantee that unknotting the unknot, at least, does not take forever. Instead of looking at an unknot as a twisted-up loop of string, they treated it as the boundary of a crumpled and distorted disk. They then performed the disk equivalents of Reidemeister moves and translated the results back into the mathematical language of knots. Their conclusion: The number of Reidemeister moves required to untangle any given twisted-up unknot is finite.

Finite numbers, however, can still be ridiculously large. All Lagarias and Hass guarantee is that if a knot crosses itself *n* times, you can untangle it in no more than $2^{100,000,000,000n}$ Reidemeister moves. In other words, if every atom in the universe were performing a googol googol googol Reidemeister moves a second from the beginning of the universe to the end of the universe, that wouldn't even *approach* the number you need to guarantee unknotting a single twist in a rubber band.

"The [bound] is, of course, enormous and hopeless," Lagarias acknowledges. Still, he says, just showing that a limit exists may inspire future researchers to whittle it down to a reasonable size. (Macedonian swordsmen need not apply.) —**CHARLES SEIFE**

ECOLOGY

Scientists Begin Taming Killer Lake

CAMBRIDGE, U.K.—In an unprecedented and potentially risky experiment, scientists this week began venting carbon dioxide–laden water from the bottom of Lake Nyos in Cameroon. The apparatus is intended to prevent a recurrence of a 1986 eruption that claimed 1800 lives.

The carbon dioxide is released from surrounding volcanic sediment and underground springs. Experts say that about 300 million cubic meters of the gas have accumulated in the waters near the lake's bottom, about 200 meters below the surface. In 1986, an estimated 80 million cubic meters of gas escaped from the lake and flowed down the hillside, smothering residents and livestock in what's known as a "limnic eruption."

Hoping to prevent future such disasters, a team headed by Michel Halbwachs of Savoie University in Chambéry, France, has floated a 3-meter-wide raft in the middle of the lake with a 200-meter-long polyethylene pipe running to the lake bottom. As the water travels upward toward the surface, the carbon dioxide comes out of solution. At the surface, 10 liters of carbon dioxide are released for every liter of water. The result is "a jet 40 meters in height, which can continue without any further input of energy," says team member