A Scientific Community on the Edge

International collaborations, competitive grants, e-mail, and freedom to travel are beginning to transform some sectors of Russian science, but its very survival remains in doubt

MOSCOW—By any reckoning, Russian science is in a mess. Since the breakup of the Soviet Union, Russia's downward economic spiral has driven many of the country's research centers to the brink of extinction and many of its best researchers abroad. If these trends are not halted soon, few doubt that Russian science will die. "If this economic situation continues for 2 to 3 years more, we will be destroyed, completely," says Alexander Spirin, director of the Institute of Protein Research in Pushchino, near Moscow.

Yet, as dire as the situation is, some groups are managing to keep their research alive through connections with colleagues abroad and competitive grants from the Russian government and Western organizations. Researchers in some fields are coping better than others: Experimental physics, which enjoyed generous funding from the Communist regime, is floundering in the current cash crisis; biology, which was only just taking off at the end of the Soviet era, is faring better, with some its best groups hanging together with the help of Western aid; and for Russia's earth scientists—whose discipline was one of the most cut off from the outside world during the Communist years—contact with the West is revolutionizing the way they view their discipline. Indeed, the lifting of the Iron Curtain has given some researchers opportunities that previously they could only dream about, such as travel abroad and open communication via electronic mail.

In fact, scientific aid from the West—both grants and collaborations with Western researchers—is not only providing a vital Band-Aid to prevent Russian science from bleeding to death, but is helping change the culture of science as researchers compete for grants for the first time. "[I]t is difficult to overestimate the significance of foreign support," says science minister Boris Saltykov. Scores of researchers interviewed by *Science* echoed Saltykov's views. But the largest aid programs face an uncertain future, and that leaves a major question hanging over Russian science: Can Western aid last until the Russian government is once again able to take care of its own researchers?

The answer will depend in part on how quickly the Russian government itself can implement the kind of tough reforms that most outsiders have urged. Last year, for example, a team of experts assembled by the Organization for Economic Cooperation and Development (OECD) concluded that Russia's research system had become bloated and inefficient during the Communist era. The OECD panel recommended that the country cut its research base in half (*Science*, 19 November 1993, p. 1200) and focus its resources on the best researchers. "[Every institute] has bad scientists," agrees Vladimir Kadyshevsky, director of the Joint Institute for Nuclear Research in Dubna, near Moscow, "and they should find their own way. They are ballast." But if the slump in Russian government science spending cannot be reversed soon, say many researchers, even these tough measures may not be enough to save Russian science.

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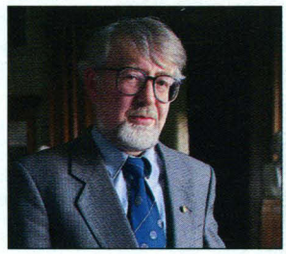

Three vantage points. Soros committee chairman Vladimir Skulachev *(above)*, academy vice president Andrei Gonchar *(top)*, and science minister Boris Saltykov *(right)*.

A struggle for control

The almost universal view *Science* encountered at the lab bench is that the two bodies that are supposed to be looking after the well-being of fundamental science—the Russian Academy of Sciences, which runs more than 300 basic research institutes, and the Ministry of Science and Technological Policy—are doing little to help their plight. Science minister Saltykov has initiated some reforms, but he is widely berated for failing to stave off budget cuts that are greater than those imposed in almost every other area of government spending. And the academy, many charge, has barely begun to remove the networks of patronage that have for decades prevented research funds from being distributed according to merit. In the days when the academy's budget was sufficient to support its researchers, it simply handed block grants to its institutes, which were distributed to individual researchers by institute directors.

Worse still, rather than presenting a united front to lobby for higher funding, the ministry and academy have spent most of the past 2 years at each other's throats in a power struggle for control over science. Last December, for example, as President Boris Yeltsin reshuffled his government in the wake of the victory of Vladimir Zhirinovsky's extreme nationalists in the parliamentary elections, the academy's governing presidium called for the science ministry's abolition (*Science*, 14 January, p. 166). Academy officials have called for a slower pace of reform all along. But their critics charge that this view is motivated by self-interest, as the new funding mechanisms introduced by Saltykov have squeezed the academy's budget.

The most important of these mechanisms is the Foundation for Basic Research (FBR), Russia's first Western-style granting agency, which was established in 1992 and aims to distribute funds according to peer review rather than patronage. The FBR is now supporting some 6000 research projects, providing an average of $5500 a year to each. But the agency's funding is unpredictable: Last year, FBR received just 60% of the money it was promised.

Saltykov is also trying to concentrate his scarce resources in a new elite network of State Scientific Centers. Last year, 33 centers were selected from among those formerly run by the Soviet Union's numerous sectoral industry ministries. Some have since split into several institutes, making a total of 42 centers. But most basic research centers were denied access to the scheme because the Academy of Sciences refused to put any candidates forward, arguing that the ministry was trying to usurp control over its institutes.

The academy swallowed its pride earlier this year and proposed several of its institutes with large expensive facilities for the second round of awards—now in the process of being made. Furthermore, this spring most of the centers selected last year were still waiting for many of the privileges that Saltykov promised: So far they are getting only a limited selection of tax breaks, and money to conduct specific state-funded research projects.

The sputtering nature of these reforms has drawn a barb from mathematician Andrei Gonchar, the academy's first vice president. In an interview with *Science*, he accused Saltykov of being too quick to try to dismantle the old Soviet research system before new funding mechanisms are fully up and running. "If you want [merely] to destroy, you can do it quickly," he says.

PHOTOS BY GEORGE DE KEERLE/SYGMA

Gold-plated ivory tower. Russian Academy of Sciences' new building, spurned by senior officials who prefer to remain in their old headquarters in a prerevolutionary mansion.

Funding strangulation

Even if Saltykov can identify Russia's best research groups, however, he faces a big problem: Many of them work in institutes that are under threat of closure, strangled by salary costs and electricity bills. Indeed, the entire research system is now in danger of a collapse that could drag down world-class centers along with the makeweights.

The science ministry is trying to help. Earlier this year, Saltykov won an agreement that will provide electricity at less than half the market price for some 50 leading research institutes. But these centers expect little lasting benefit. "It only delays the problem, because prices are growing exponentially," says Alexander Rumyantsev, research and development director at Moscow's Kurchatov Institute of Atomic Energy.

To most scientists, these difficulties underline the problem of trying to implement reforms while funding is plummeting. Many researchers are clinging to the hope that the changes in government since last December's parliamentary elections, which have removed the radical economic reformers who had ordered deep cuts in government spending, will bring more generous funding for science. As yet, there is scant evidence of this, but leading science policy makers are optimistic. "Now, I feel there is more careful and more serious attention from the government," says FBR chairman Vladimir Fortov, whose agency's share of the science budget was upped in February from 3% to 4%.

International connections

In view of this grim financial picture, you might think it would be difficult to find some light amidst the gloom. Yet, in many of the labs *Science* visited, there was a smattering of optimism. The recent political changes have brought long-sought freedoms—in particular the opportunity to travel to the West, a privilege previously denied many researchers who lacked a powerful patron able to pull the strings necessary to obtain an exit visa. And the past few years have also seen the introduction of electronic-mail networks allowing easy communication with foreign scientists. The result? "A complete revolution," says paleontologist Andrei Sher of the Severtsov Institute of Evolutionary Animal Morphology and Ecology in Moscow. In the Soviet era, Sher communicated with Western colleagues by regular mail—which would be delayed while it was scrutinized by government censors. "For scientific cooperation, it was impossible," he says.

These new communication channels have opened the way for many collaborations with Western labs. And it is these, together with the promise of Western grants, that explain why able Russian scientists are not yet in total despair. Western aid has been slow to start flowing (*Science*, 10 September 1993, p. 1380), but the two largest players—U.S. financier George Soros' International Science Foundation (ISF) and the European Union–backed International Association for the Promotion of Cooperation with Scientists from the Independent States of the former Soviet Union (INTAS)—both announced their first large round of project grants in the spring.

For scientists used to a rigidly hierarchical system in which there was no opportunity to appeal directly to a funding agency for support, the chance to compete for Western grants was a revelation. And Russia's best researchers are adapting rapidly to this unfamiliar procedure. "Now they become more flexible and more aggressive," says Eugene Grishin, deputy director of the Shemyakin and Ovchinnikov Institute of Bioorganic Chemistry in Moscow. Enthuses deputy science minister Andrey Fonotov: "[The grant system] means that you become master of your own destiny."

Indeed, with the Russian science budget insufficient even to meet institutes' salary and energy costs, grants from ISF, INTAS, and other Western bodies are becoming the major source of funding for actual research. So far, 1733 Russian groups have been awarded ISF grants, which average $15,000 over 18 months. INTAS has announced 509 East-West collaborations: On average, each project grant will provide $30,000 over 1 to 2 years for the former Soviet participants, which include 861 Russian groups.

The hope is that holders of Western grants will provide a nucleus from which to rebuild Russian science once government funding picks up. But researchers worry that more grants are needed, either from Western or Russian sources, to sustain a critical mass. "It's certainly important, but far from being enough," says deputy minister Fonotov.

It is not just the number of grants that is causing concern. Because the dollar-to-ruble exchange rate is staying relatively steady while Russia is suffering rampant inflation, the value of the dollar in Russia is plummeting. The entire Western aid effort was predicated on the superior purchasing power of hard currency, says Russian science policy expert Harley Balzer of Georgetown University in Washington, D.C., so if the dollar's value continues to tumble, aid efforts will struggle. And although Western grants can buy a fair amount of research in some disciplines, such as molecular biology, they are by no means a panacea. "[ISF] helps a lot," says plasma physicist Lev Zelenyi of Moscow's Institute of Space Research, "but it cannot support a space mission."

The future of aid

Western aid has always been viewed as a stopgap, a means of preserving the best of Russian science until domestic funding picks up. But Russia's continuing economic crisis means that big increases are still a way off. And that, says Georgetown's Balzer, means that Western assistance will be needed for the foreseeable future. The problem, however, is that both ISF and INTAS are in danger of having to wind up their grant programs. Soros, in fact, has long threatened to do this unless Western governments contribute funds to supplement his original $100-

million donation. While Soros promises to continue ISF's support for libraries and telecommunication links, he intends to bankroll further research grants only if funds are found from other sources.

So far, the sole response to this threat has come from the Russian government, which in March promised $12.5 million. Together with a matching sum from Soros, this will allow for a 6-month extension to existing ISF grants, seeing their holders through to the end of 1995. Beyond this period, Soros told *Science* that he wants to provide around $12.5 million a year for ISF, but only if Western and former Soviet governments chip in to raise the foundation's overall annual budget to between $50 million and $60 million. Former U.S. genome project head James Watson, ISF's executive chairman, has been placed in charge of the fund-raising effort. Now that ISF has proved itself capable of managing a grant round, he says, "this is the time to try and raise additional money."

While Watson attempts to win support for ISF, the Brussels-based managers of INTAS are lobbying to save their program. The original idea was to bankroll INTAS with funds from the European Union's own research budget and direct support from the governments of the union's 12 member nations, explains Rainer Gerold, director of international scientific cooperation at the European Commission, the union's executive body. But so far, 95% of INTAS' budget has come from the union's central coffers. And with Gerold's budget for international collaboration slated for major cuts after 1995 (*Science*, 25 March, p. 1675), INTAS could find its budget slashed in half. If individual European nations do not begin to contribute soon, says Gerold, INTAS may be forced to stop funding grants and concentrate on cheaper activities such as workshops.

Every Russian researcher now leaning heavily on support from ISF and INTAS faces a personal disaster if the two bodies' fund-raising efforts fail. And many Russian scientists see the problems facing these programs as symptomatic of the wider picture of aid to Russia. Now, notes Moscow State University molecular biologist Vladimir Skulachev, Western politicians are having second thoughts about donating money to Russia, fearing a resumption of Cold War hostilities if Zhirinovsky is successful in his planned bid for the presidency in 1996. The danger, says Skulachev, who co-chairs ISF's Russian advisory committee, is that these concerns could become self-fulfilling: If the West now turns its back on Russia, he argues, "for sure we will have Zhirinovsky, or somebody like him."

–Peter Aldhous

With additional reporting by Daniel Clery and Andrey Allakhverdov, a science writer in Moscow.

BIOLOGY

Elite Groups Struggle on With A Little Help From the West

MOSCOW AND PUSHCHINO—In the late 1980s, biologists seemed ready to shake off their reputation as the poor relations of Soviet science, forever overshadowed by their better known colleagues in physics and mathematics. Over the previous quarter of a century, the country's molecular biologists had slowly but surely built up a handful of world-class institutes, and with the advent of Mikhail Gorbachev's *perestroika* reforms, suddenly anything seemed possible. Indeed, in April 1989, when the U.S.-based multinational Monsanto announced a 3-year, $1.5-million deal to set up a joint biotech lab in Moscow with the showpiece Shemyakin Institute of Bioorganic Chemistry, it seemed that Soviet molecular biologists were at last going to emerge from the shadows.

The long-awaited golden age of Soviet biology was, however, cruelly derailed by the disintegration of the Soviet Union and the failure of Russia's nascent market economy to get off the ground. But while these events have left Russian physics, for instance, in a state of near total paralysis, the mood at the country's small cadre of elite biology institutes is somewhat brighter. One reason: Grants from Western bodies such as U.S. financier George Soros' International Science Foundation (ISF) are now allowing the best scientists to continue their experimental work. "It's a hard life. It's a difficult time. But it's possible to do science," says Andrei Mirzabekov, director of the Engelhardt Institute of Molecular Biology in Moscow, which is leading the way in adjusting to the harsh new economic reality (see box).

Survival tactics. One important advantage enjoyed by molecular biologists is that their "small science" experiments do not require huge sums of money. A typical ISF grant of around $15,000, for example, goes some way toward keeping a small team working at the bench. Another factor behind the guarded optimism expressed to *Science* by senior Russian biologists is that they have a long experience of battling through adversity. As many point out, Soviet biology came perilously close to destruction in the 1940s and '50s at the hands of Trofim Lysenko, the infamous president of the Soviet Academy of Agricultural Sciences.

PHOTOS BY GEORGE DE KEERLE/SYGMA

Views from the top. Alexander Spirin *(above)* of the Institute of Protein Research warns of impending crisis; Eugene Sverdlov *(top)* of the Institute of Molecular Genetics favors sending young researchers abroad.

Lysenko promised Joseph Stalin that he could overhaul the country's farm system by applying Lamarckian evolutionary ideas to plant breeding—the premise being that characteristics acquired from environmental conditions could be passed on to subsequent generations. Lysenko's pseudoscience yielded little in the way of better crops, but he filled the gulags with able researchers who opposed his theories, and he drove conventional Mendelian genetics underground.

Given this brutal suppression of the cornerstone of modern biology, it's surprising that Russia now possesses any world-class molecular biology centers. The fact that it does, biologists here agree, is partly due to the covert support provided by their physicist colleagues during the height of Lysenko's power. Take the Institute of Molecular Genetics (IMG) in Moscow, founded in 1959 as the radiobiology department of the Kurchatov Institute of Atomic Energy: "This was just a cover," says