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Storm clouds and a small ray of sunshine over St. Basil's Cathedral in Red Square, Moscow, could be a metaphor for the state of science in Russia—the focus of this year's special issue on Science in Europe. Six scientific fields, each of which is facing a different range of problems, are examined in News reports beginning on page 1259. International funding is discussed in Policy Forums on pages 1280 and 1281, and reviews of books on Russian science begin on page 1346. [Photo: Rick Kozak]
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Science in Russia

Science, in common with most aspects of life in the former Soviet Union, is in the center of a maestral, buffeted by changing currents of political, cultural, and economic forces in the several newly created countries. Science and scientists are caught between two opposing forces. Political freedoms brought by the lifting of the Iron Curtain have suddenly propelled the region's scientists into the world community. Freedom to travel, electronic mail, and the ability to work in the West have enabled some of the better scientists to forge unprecedented collaborations with colleagues abroad. Economic turmoil, however, has brought the area's research systems to the brink of collapse, and the threat of political instability hangs like the sword of Damocles over the future of science in the region.

Our previous special issues on Science in Europe concentrated on the western and central parts of the continent. In this issue, we stretch Europe's borders eastward to focus on science in Russia. We concentrate on Russia because after the breakup of the Soviet Union, Russia retained the lion's share of the science. The problems that now beset science in the other newly independent states are in most cases even more severe than those faced by Russian science. (For a view of the situation in Ukraine, see Science, 2 October 1992, p. 24.)

A series of news reports, coordinated by European News Editor Daniel Clery and European Correspondent Peter Aldhous, examines what is happening to six separate scientific disciplines: molecular biology, physics, space science, mathematics, astronomy, and earth sciences. Science selected these particular disciplines because each one tells a different story. Molecular biology, which was just beginning to flourish at the end of the Soviet era, is struggling, but some of the best groups are managing to remain productive. Molecular biology has the advantage that it does not require major capital investments or huge running costs for large instruments. Experimental physics, which has a long and proud tradition in Russia, does not have those advantages; it has been hit hard by budget cuts and some leading institutes are now barely able to pay salaries and electricity bills. International collaborations are the key to the survival of some of Russia's ambitious space science projects, and in this field new cooperative arrangements are being forged. For Russian astronomers, the difficulties caused by shrinking budgets are compounded by a unique problem: Many of the former Soviet Union's telescopes are in independent states that are in economic or political turmoil. Mathematics, widely regarded as one of the strongest disciplines in the former Soviet Union, has been badly weakened by the emigration of leading researchers. And earth sciences, which were isolated to a greater extent than most disciplines during the Soviet era, are being transformed as scores of Western groups, eager for access to prime research sites, strike up collaborations with Russian scientists.

A consistent theme that runs through the articles on each discipline is that international connections—both collaborations with groups abroad and grants from international organizations—are playing a pivotal role in enabling the best groups to continue doing science. Two Policy Forums emphasize this point. James D. Watson and Gerson S. Sher and Valery N. Soyfer, who are all associated with funding organizations established by financier George Soros, describe efforts to channel funds to the best researchers and science educators throughout the former Soviet Union.

Grants from outsiders, such as the Soros funds and the European Union–backed INTAS program, are, at best, stopgap measures. The future of science in Russia and the other independent states will only be assured when the governments of the region can themselves provide adequate support to the best groups.

In the interim the stopgap funds are providing a lifeline to keep the link between the past and a better future. The past was a mixture of first-class and third-rate science. Some areas of Soviet science were crippled by ideological barriers such as Lysenkoism in genetics and anti-plate tectonics in geology, and a top-down bureaucracy often stifled creativity. The outside money can be helpful not only in supporting science and scientists but also in introducing a democratic and investigator-initiated philosophy into the infrastructure. It is to be hoped that the newfound freedoms can be matched by the funds to welcome the new republics to the international community of science.

Colin Norman and Daniel E. Koshland Jr.
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Women in Science: Cultural Comparisons

In the article by Marcia Bartinaga "Surprises across the cultural divide" in the Women in Science '94 special section (11 Mar., p. 1468) as well as in the Policy Forum "Interventions to increase the participation of women in physics" (11 Mar., p. 1392), statistics originated by W. J. Megaw are presented about women's share in physics degrees and faculty positions. My native country, Hungary, seems to have a positive record of 50% and 47% for bachelor's degrees and faculty members, respectively. These numbers are the highest among the countries investigated. The statistics shown for various countries are used to rationalize existing gender differences by cultural tradition and then, indirectly, to suggest policies for overcoming barriers. Therefore, the accuracy of the data is essential.

Having been educated as a physicist between 1978 and 1983 at the L. Eötvös University of Science in Budapest and having kept a close association with the university afterwards, I cannot verify the figures presented for Hungary. My recollection is that the number of women among the roughly 30 students starting each year to become researchers in physics never exceeded 4; female faculty members at the five physics departments were even scarcer (no woman was giving lectures to my class). I remember similar situations at the other two science universities. Women staff members at the research institutes of physics of the Hungarian Academy were again extremely few. The situation can hardly be much better today.

One possible explanation for the discrepancy between the presented numbers and my experience may lie in the (nowadays softening) rigid university system of Hungary. While researchers (also teachers for the secondary schools, for ages 14 to 18) were educated at the elite science universities, specialized colleges (often with a large number of female students) produced the teachers for primary schools (for ages 6 to 14). A strong gender segregation might be hidden if the numbers were averaged over these different institutions.

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Response: I am grateful for Fúró's interest in the survey of the world's physics departments that I did in 1990. I wrote to the five Hungarian universities that appeared (from The World of Learning) to have a separate department of physics. Unfortunately, the two largest (L. Eötvös University of Science, with 11,000 students, and the Technical University of Science, with 8,400 students) did not respond. Of the three that did reply, which had a total of about 12,000 students, one did not complete the question on gender distribution of faculty, the second reported 15% women faculty, and the third reported 53% women faculty. It is, of course, possible that the last misinterpreted the question "Number of physics faculty members, M...F..."

Nevertheless, the answers to the other questions in which there does not seem to be room for misunderstanding indicate that, of the students graduating with the equivalent of a bachelor's degree in physics in 1990, 52% were women; for master's degrees, 25% were women; and for Ph.D. degrees, 27% were women. Of the students entering graduate work in 1989–1990, 39% were women. These figures suggest that Hungary is doing rather better than many other countries as far as the proportion of women studying physics is concerned.

W. J. Megaw
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I appreciate the effort and skill of Science's team in building the excellent "Women in Science '94" around the hard core provided by W. J. Megaw's data. While enhancing the reader's interest, the anthropological approach may, however, be somewhat vulnerable. Surprise is expressed about the high number of female researchers found in some of the "less advanced" countries. But shadows are found (under headings like "pay," "rank," and "status") that darken the picture. Yes, the climate seems to be women-friendly, but the status of science in these countries is low and so are academic salaries. The field is open to women only because it is undesirable to men. And being a scientist in these countries has a different meaning; it is more like a "cultural activity." Women are hitting the glass ceiling, and there are few full professors and almost no top university administrators or policy-makers.

As the article implies, it is meaningless
Correction

29 April (p. 734) and 13 May (p. 911) issues of Science

The talk being given by Dr. Harold Varmus at the Science/HUGO Human Genome 1994 meeting on Monday, 3 October, in Washington, D.C., is entitled “Manipulating Cancer Genes in the Mouse.”

...to speak about “rank” in those eastern European countries where the pyramidal system of the university kept women, as well as men, away from the top. The same considerations are valid for other criteria, like “status” and “pay.” Pay should be considered within a system of reference. Is it low compared with that of men or with that in other professions, or is it low compared with that in other countries?

The meanings our profession could have in different societies is one of the important issues to be debated in the future, and “Women in science ’94: Comparisons across cultures” is an excellent opening to a new and fascinating topic. Meanwhile, I can only hope that what my colleagues and I have been doing over the years has been science and not some kind of “cultural activity.”

Simona Badilescu
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Barinaga questions the extent to which “the Protestant work ethic” is predicated on the service of women behind the working men. She quotes Judith Perry as saying

A lot of northern Europeans say the Latins... don't do as much, but is that true if we look at the whole society and not just individuals? One of the reasons women are more integrated may be that they are leading a healthier life as a society.

Taking this argument a step further leads one to question whether science can progress as well as it does in the United States without Nobel Prize winners and famous individuals running large laboratories (and their wives taking care of their daily necessities). Is it possible to have some kind of less hierarchal structure in which each individual perhaps devotes less time and energy to science (and more time to household and child care, for example), but the laboratory as a whole produces just as good (or better) science? Perhaps women's advancement can proceed only at the expense of individual fame and fortune. Or is it too dangerous for us to question such basic tenets of our society and the scientific establishment?

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I take strong exception to the contention in the editorial by Daniel E. Koshland Jr. (11 Mar., p. 1355) that a society in which
women “stay home and mind the children” is underutilizing the abilities of half of its citizens. It is true that women have a variety of abilities to offer to society, a variety at least as great as men, but it does not follow that women or men who choose to use their talents in raising children are being underutilized. If I had chosen to stay home and mind the children instead of being the more traditional breadwinner, I would not say that my abilities were being underutilized.

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Radon Risk Estimates

We are writing in reference to the article by Richard Stone “EPA analysis of radon in water is hard to swallow” (News & Comment, 17 Sept. 1993, p. 1514), and his more recent remark on the same topic in another News & Comment article “Can Carol Browner reform EPA?” (21 Jan., p. 312). Stone attributes much of the debate over regulation of radon in drinking water to the scientific merit of Environmental Protection Agency’s (EPA’s) risk assessment for radon. The purpose of this letter is to clarify several issues related to that assessment.

Although Stone emphasizes that there are “uncertainties in the science underlying the risk analysis” for radon in drinking water, he does not report that EPA itself conducted a quantitative uncertainty analysis of the radon risks (1). In that analysis, inhalation and ingestion risk estimates were characterized in terms of median values and credible ranges that were based on uncertainties of various parameters used in the risk calculations. The analysis was reviewed and generally well received by the Radiation Advisory Committee of EPA’s Science Advisory Board (SAB) (2).

In discussing EPA’s estimate “that radon in drinking water causes 192 excess cancer deaths,” Stone states that this figure was based “primarily on an unpublished study...on...xenon.” The xenon study is an EPA-funded project to improve the dosimetric estimates of ingested radon (3). This report has been available to the public since July 1991, when EPA published the proposed national primary drinking water regulations for radionuclides (4). More important, the findings of the uncertainty analysis indicate that the inhalation risk of decay products from waterborne radon actually dominates ingestion risk of radon in water. The median value of estimated cancer deaths per year (113 cases) from inhalation is 2.5 times higher than the 46 cases from ingestion (1, 5). Furthermore, the inhalation risk estimate is based on strong epidemiological evidence from studies of underground miners and is supported by animal studies (6).

Stone quotes the SAB Executive Committee’s letter (7) to the effect that (in absence of direct human or animal data) “it is not possible to exclude the possibility of zero risk from ingested radon.” Although there are no human or animal data that directly demonstrate risks attributable to ingestion of radon, ingested radon irradiates tissues of the body with alpha particles and can lead to cancer risk (1, 8, 9). EPA’s estimate of risk is derived from information on (i) the biokinetics of radon in the body; (ii) the radiocarcegenic effects of ionizing radiation in humans, primarily the information on effects of gamma rays from atomic bomb studies; and (iii) the relative biological effectiveness of alpha particles compared with gamma rays, inferred mostly from animal studies (1). While EPA has followed the recommendations of the National Academy of Sciences committees in estimating the risks from internally deposited alpha emitters (6, 8, 10), we recognize that there is not universal agreement with this approach. To the extent possible, EPA quantified the uncertainties in its estimates and discussed in qualitative terms uncertainties that could not be quantified (1, 5).

Risk assessment is a continuing process that evolves as new data becomes available. There is always room for scientific debate over radon risk estimates and their associated uncertainties. However, in our opinion, most of the controversy surrounding the regulation of radon in water is really about whether EPA should examine the risks of radon in greater context and focus its efforts on the problem of radon in indoor air (2, 7). EPA’s risk assessment shows that the magnitude of population risk attributable to waterborne radon is relatively small compared with that attributable to radon entering homes from soil. Whether or not a well-characterized estimate of 192 annual excess cancer deaths from waterborne radon indicates a major threat to public health, and whether or not waterborne radon risk should be balanced against indoor air radon risk are legitimate topics for public debate. We believe that it is incorrect, however, to imply that the basic issue is a scientific one.

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Office of Regulatory Management and Evaluation, EPA
Jerome Puskin
Neal Nelson
Office of Radiation and Indoor Air, EPA

SCIENCE • VOL. 264 • 27 MAY 1994
References

Corrections and Clarifications
The enzyme shown in the photo on page 1363 accompanying the 11 March ScienceScope item "Lobbying backfires on LBL, Berkeley" was not a "designed enzyme" or an engineered protein, nor was it human glutathione S-transferase. It is a representation of the mu 3-3 isozyme of rat liver glutathione S-transferase with an inhibitor, 9-(S-glutathionyl)-10-hydroxy-9,10-dihydrophenanthrene. The structure was determined at the Center for Advanced Research in Biotechnology as a result of collaborative work between the laboratory of Gary L. Gilliland and that of Richard Armstrong in the Department of Chemistry and Biochemistry at the University of Maryland, College Park (X. Ji et al., Biochemistry 33, 1043 (1994)).
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Dr. Mary Claire King, University of California, School of Public Health

"Manipulating Cancer Genes in the Mouse"
Dr. Harold Varmus, National Institutes of Health

"Intellectual Property: DNA and its Offspring"
Dr. Kate Murashige, Morrison & Foerster

"Presymptomatic Diagnosis of Self and Progeny"
Dr. C. Thomas Caskey, HUGO

Concurrent Sessions

M1 "New Methods of DNA-Based Diagnosis"
Dr. Stephen P.A. Fodor, Affymetrix, Inc.

M2 "Human Gene Identification"
Dr. Kay E. Davies, Institute of Molecular Medicine, University of Oxford

M3 "Social and Scientific Issues in Genetic Testing"
Dr. Nancy Wexler, Hereditary Disease Foundation

M4 "Gene Therapy"
Dr. Inder M. Verma, The Salk Institute

TUESDAY, OCTOBER 4

Plenary Session II: Development and Signal Transduction

Special Guest: Donna Shalala, U.S. Department of Health and Human Services

"MYOD & Myogenesis"
Dr. Harold Weintraub, Fred Hutchinson Cancer Research Center

"Genome Analysis in the Mouse"
Dr. Shirley M. Tilghman, Princeton University

"FAX: Genes for Mice and Men"
Dr. Peter Gruss, Max Planck Institute of Biophysical Chemistry, Germany

"From an Interferon Clone to the Regulation of Oncogenesis"
Dr. Tadatsugu Taniguchi, Institute for Molecular and Cellular Biology, Osaka University

"C. elegans Genome Project"
Dr. Richard Wilson, Washington University Medical School

"Small GTPases – Switching on Biological Responses"
Dr. Alan Hall, MRC Laboratory for Molecular Cell Biology, U.K.

Concurrent Sessions

T1 "Gene Targeting"
Dr. Elizabeth Robertson, Harvard University

T2 "Sequence to Function"
Dr. Temple F. Smith, Biomolecular Engineering Research Center, Boston University

T3 "Education and the Human Genome Project"
Dr. Paula Gregory, National Center for Human Genome Research, NIH

T4 "Chromatin Structure and the Regulation of Gene Expression"
Dr. Gary Felsenfeld, Laboratory of Molecular Biology, NIH

WEDNESDAY, OCTOBER 5

Plenary Session III: Mapping

"Toward the Ultimate Generation of an Integrated Map of the Human Genome"
Dr. Daniel Cohen, C.E.P.H., France

"Application of High Resolution Genetic Maps to Studies of Common Disorders"
Dr. Jeffrey C. Murray, University of Iowa

"Yeast Genome Project"
Dr. André Goffeau, Université Catholique de Louvain, Unité de Biochimie Physiologique

"The Drosophila Genome Project – a Progress Report"
Dr. Gerald M. Rubin, University of California

"Status and Prospects for the Complete Human Genome Sequence"
Dr. Richard A. Gibbs, Baylor College of Medicine

"High Speed DNA Sequencing: Present and Future Technologies"
Dr. Lloyd M. Smith, University of Wisconsin

"Towards a Complete Set of Human Genes"
Dr. J. Craig Venter, The Institute for Genomic Research

Plenary Session IV: Mapping and Applications

"Vertically Integrated Mapping and Sequencing of Human DNA"
Dr. Maynard Olson, University of Washington School of Medicine

"Interpreting Genes and Genomes"
Dr. David J. Lipman, NIH, National Library of Medicine

"Some Applications of a Genome Library"
Dr. Melvin Simon, California Institute of Technology

"Huntington Disease"
Dr. James F. Gusella, Massachusetts General Hospital

"Ancient DNA"
Dr. Svante Pääbo, Zoologisches Institut, Universität Munchen

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T. Cuyler Young Jr.
Royal Ontario Museum,
Toronto, ON MSS 2C6, Canada

Correction

In the heading of Philip Pauly's review of Robert E. Kohler's Lords of the Fly (15 April, p. 448) the subtitle of the book was listed incorrectly. The correct subtitle is "Drosophila Genetics and the Experimental Life." In "Women in Science: Some Books of the Year" (11 March, p. 1458) the name of the senior editor of second edition of The History of Women and Science, Health, and Technology should have been given as Phyllis Holman Weisbard, and the name of the editor of the first edition should have been given as Susan Searing. Also, the statement that the author of A Matter of Choices: Memoirs of a Female Physicist, Fay Azenberg-Selove, is now retired was incorrect.

Books Received


Vignettes: Chemical Nomenclature

The language of chemistry before Lavoisier was full of mystery and ambiguity. Flowers of zinc, diaphoretic antimony, butter of antimony, powder of algaroth, vitriolated tarth, and ethers per se were among the names no longer familiar to modern chemists.

—Mary Jo Nye, in From Chemical Philosophy to Theoretical Chemistry: Dynamics of Matter and Dynamics of Disciplines, 1800-1950 (University of California Press)

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