Soviet Science: Practitioners' Reports

Soviet Science on the Edge of Reform. HARLEY D. BALZER. Westview, Boulder, CO, 1989. xxii, 290 pp. Paper, $32.50. Westview Special Studies on the Soviet Union and Eastern Europe.

Harley Balzer's book provides an informative account of the condition of Soviet science in the 1980s. His study is based in large measure on a survey of 202 emigre scientists conducted in the early 1980s. All of these people had worked recently as scientists or science administrators in the Soviet Union, and the survey asked them about their education, working conditions, and attitudes to science and technology.

This kind of study was particularly important before *glasnost*, when free discussions with Soviet scientists were difficult and the Soviet press was given more to boasting than to reporting. But Gorbachev's policies have not made Balzer's book redundant, for Balzer has integrated his survey results into a broad analysis. He makes excellent use of the secondary literature on Soviet science, of the revelations of the Soviet press in the age of *glasnost*, and of conversations with Soviet scientists. The result is a nuanced picture of Soviet science "on the edge of reform."

Soviet science is a vast enterprise, embracing more than a quarter of the world's researchers. The state has placed a high value on science and technology and has made abundant resources available for research and development. Soviet surveys show that science enjoys high prestige in the society at large. But Soviet science has not done as well as might have been expected, in terms either of scientific discovery or of technical achievement.

Performance has been best in theoretical fields such as mathematics that do not require expensive equipment, as well as in those areas to which the state has given priority. Balzer's respondents evaluated the level of Soviet technology in much the same way as Western studies have done: high ratings in the military sphere, middle ratings in industrial technologies, and low ratings in consumer technologies. Soviet computers and electronics were ranked very low.

In spite of this general picture, however, what emerges from Balzer's study is an impression of great unevenness across the whole R&D system. It is not that some types of institution—Academy institutes or military establishments, for example—are strong and others weak. Rather, within each type of structure and each field of science Balzer finds evidence of the coexistence of high quality with mediocrity. Balzer is able to assess the similarities and differences between the various institutions in the overall system, and the similarities are greater than one might have expected.

This emerges most strikingly in the chapter on military R&D. Here there are privileged institutions with special conditions, but the very size of the military R&D effort argues against the proposition that it is uniformly better than civilian R&D. "Most of the military's performance," writes Balzer, "derives from its being the first claimant on all research and production no matter where it is carried out." Moreover, the factors that account for the relatively successful performance of military R&D—priority, better quality control, more resources—can be created only in a limited number of cases. Not everything can be given top priority.

By committing massive resources the Soviet Union has achieved major results in high-priority areas of technology. But the R&D system, in its day-to-day operation, poses serious obstacles in the way of science and technology. Secretiveness inhibits the flow of scientific information; rampant departmentalism inhibits innovation and diffusion; the inadequate infrastructure puts a brake on scientific research; weak computing capability also hampers research; political interference has had a dire effect on some disciplines, notably biology.

Much of this has been clear for a long time. What Balzer adds is an impression of how the system looks to those who have worked in it: what hindered their research and helped it; how they used informal ties to overcome bureaucratic rigidities; what they see as the strengths and weaknesses of Soviet science. Our overall picture is not, I think, changed in any fundamental way, but we get a more subtle and differentiated sense of how the broad structures affect those who actually do the research and engineering.

For anyone wanting to understand the state of Soviet science on the eve of Gorbachev's reforms, this is an excellent guide. Balzer notes that the condition of Soviet science grew worse in the Brezhnev years, in line with the overall demoralization of society. He also makes the point that the old system of R&D has come under increasing criticism, especially now that there is more readiness to count the cost of the resources devoted to science and other government activities. He is not particularly sanguine about the prospect of reform and thinks that some false starts have been made. The most obvious effect of reform has been greater contact between Soviet and foreign scientists. This is very much to the good, but Balzer makes it clear that more needs to be done if Soviet science is to flourish.

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Evolution of Life Histories

Alternative Life-History Styles of Animals. MICHAEL N. BRUTON, Ed. Kluwer, Norwell, MA, 1989. xviii, 617 pp., illus. $215. Perspectives in Vertebrate Science, vol. 6. From a conference, Grahamstown, South Africa, 1987.

The morphological diversity of animals is exceeded by the diversity of their life histories. Naturalists describing variation in life histories have always followed closely on the heels of taxonomists, who traditionally have used only morphological differences to recognize species and to infer relationships among them. Frogs, for example, are morphologically rather conservative, but they display life histories that range from no parental care of aquatic eggs and larvae to paternal or maternal care with direct development or brooding of eggs in foam nests, on dorsal pits, in the vocal sac, or even in the stomach. Some species are explosive breeders in response to heavy rains; others have prolonged breeding seasons and are highly territorial.

The Darwinian view of natural selection is based on the differential survival and fecundity of genetically different phenotypes. This interplay between the phenotype as the external product of the genotype and fitness as the result of ecological factors acting on the phenotype has made the study of life-history evolution the modern way to do natural history. The recent renaissance of life-history studies has involved two rather separate approaches. One uses the statistical methods of quantitative genetics to uncover the deterministic genetic component to life-history variation. Central to this approach is the notion of phenotypic plasticity, by