A Life Scientist

Science and Russian Culture in an Age of Revolution. V. I. Vernadsky and His Scientific School, 1863–1945. KENDALL E. BAILES. Indiana University Press, Bloomington, 1990. xiv, 238 pp., illus. $29.50. Indiana-Michigan Series in Russian and East European Studies.

Coined 75 years ago in Tsarist Russia, the word "biosphere" has a quite modern ring. Its author, Vladimir Ivanovich Vernadsky (1863–1945), is increasingly regarded as a prophet for our time. For many alarmed by today's ecological crisis, this theorist of biogeochemistry is the founder of a new, holistic science of life. For many Soviet scientists, this champion of scientific autonomy and opponent of philosophical dogmatism represents a path closed during the Stalin years—one perhaps open again in a period of *glasnost* and *perestroika*.

In this insightful exploration of Vernadsky's legacy, Kendall Bailes unveils a creative scholar-activist whose life and work speak more clearly about his time than our own. Bailes grounds Vernadsky's thought in the values of the liberal intelligentsia that flowered in the last decades of Tsarist rule. The result is the best available biography of any modern Russian scientist and many valuable insights into the history of Russian science.

Bailes's Vernadsky emerges as an archetypical figure of an important and largely neglected generation of Russian scholars. Born in 1863 to a noble family, Vernadsky, like many Russian youth, was exposed to the materialist, politically radical scientism popularized by the "men of the sixties." Yet Bailes demonstrates that Vernadsky and his fellow "men of the eighties" embraced the much different scientism of a professionalizing scientific community. Philosophically and politically eclectic, this close-knit group was united by their noble birth and their belief in gradual social change, the transforming power of rational knowledge, and the autonomy of academic institutions. They reached the height of their influence in the waning years of Tsarist rule, by which time Vernadsky had become a professor at Moscow University, a member of the Academy of Sciences, and a leader of Russia's most powerful liberal political party, the Constitutional Democrats.

Bailes also finds the imprint of Vernadsky's time and circumstances in his scientific ideas. Vernadsky's "broad, synthetic approach" to knowledge was typical of his "transitional generation" of professionalizing Russian scientists committed to broad unifying conceptions yet disdainful of dilettantism. He read widely in metaphysics and a variety of scientific disciplines, incorporating elements of each into his work on mineralogy. For example, his interest in evolutionary theory encouraged him to pose questions not simply about the location of mineral deposits but also about the genesis, development, and interaction of the chemical processes that produced minerals. His readings in the new physics of the early 20th century "prepared Vernadsky to look at life in a new way, from the standpoint of the migration of actions and their particles within living matter and between living and inert matter" (p. 184).

These interests blossomed into his best-known scientific conceptions in the years 1914 to 1922. Bailes suggests that the tumultuous events of these years—World War I, the two revolutions of 1917, and Russia's civil war—encouraged Vernadsky's radical reconceptualization of the relationship between life and non-life: "The collapse of the old regime and the reshaping of social relations, accompanied by a crisis in Russian society's relationship with nature—shortages, famine and disease—focused Vernadsky's attention on the connections between living matter—including humans—and the non-living matter of Earth" (p. 184).

Bailes finds in Vernadsky's scientism a key to his contradictory relations with the Soviet state. As in the Tsarist years, he and many in his circle were confident that "they could pour the new wine of science, secular culture, and economic development into the old wineskin" of a doomed, illiberal regime (p. 161). (Vernadsky fully shared the industrial triumphalism common to his day, Bailes observes, and so leaves an ambiguous legacy to environmentalists who today invoke his name.) Vernadsky polemicized against official dialectical materialist philosophy and resisted Communist Party domination of the scientific community, protected by his international stature and the Party's high regard for scientific expertise. He justified this tolerance by performing important practical tasks, including work on the militarily critical Uranium Commission during World War II.

Kendall Bailes raced to complete this book as he was dying of AIDS. Those familiar with his splendid *Technology and Society Under Lenin and Stalin* (Princeton University Press, 1978) will notice with sadness the marks of haste. Compared to the excellent account of Vernadsky's life and work under Tsarism, the treatment of his Soviet years is sketchy. Vernadsky's mature scientific conceptions are capably characterized but do not receive the close reading necessary to sustain fully the author's insights into their distinctive origin and character. The account of scientists' reactions to Vernadsky's work is similarly suggestive but incomplete. Finally, one does not expect to find in a work of this quality such a stark factual error as the claim that Sechenov won the Nobel Prize (p. 54).

Vernadsky's legacy is certainly relevant to us today. As Bailes observes in an eloquent conclusion, however, that legacy resides less in specific formulations than in his ability to draw creatively upon a variety of scientific and cultural resources to pose profound questions about life on our planet.

DANIEL P. TODES
Institute of the History of Medicine, Johns Hopkins University Medical School, Baltimore, MD 21205

Sovietological Postmortems

The Legacy of Chernobyl. ZHORES A. MEDVEDEV. Norton, New York, 1990. xiv, 352 pp., illus. $22.95.

The Social Impact of the Chernobyl Disaster. DAVID R. MARPLES. St. Martin's, New York, 1988. xviii, 313 pp. + plates. Paper, $16.95.

As the worst nuclear (and industrial) accident in history, the Chernobyl disaster of 26 April 1986 certainly marks a watershed whose full consequences for the Soviet Union and for the rest of the world are still uncertain.

Both these contributions to what Medvedev refers to as "Chernobylogy" focus upon the broader ramifications of the accident, such as the impact upon the environment, agriculture, health, and the media and arts, drawing their information from a careful sifting of the voluminous amount of Soviet materials now available. In both cases, the essential message is that the true impact of the accident is far greater than the Soviet government has been willing to admit. The authors also argue that much still remains hidden about the factors contributing to the explosion of the reactor and the sequence of events following it. According to Marples, "Chernobyl was the first test of *glasnost* and also the first victim." Medvedev says that he "remains skeptical of the official version" and that "true *glasnost* is only beginning to emerge." Marples is even blunter—in his words, "The Soviet Government has

essentially developed an official line" that is patently untrue. Medvedev has been able to draw upon the revelations in 1989 by some of the officials and scientists involved that this was in fact the case. Marples, writing earlier and drawing his inferences largely from the events and reportage of 1987, clearly demonstrates considerable skill at what might be called "sovietology"—the technique of plumbing and interpreting Soviet reports, newspapers, and interviews and reconstructing situations not only from what is actually said but also from what is not said and from the overall context of the message.

Both books highlight many of the key mistakes or shortcomings that figured prominently in the accident and that the Soviets have been reluctant to publicize. These include such problems as the initial construction of the unit in 1984, when it was licensed for commercial operation without certain crucial safety systems installed; the lack of instruments in the first hours and days to adequately measure the level of radiation in the immediate vicinity; the deliberate initial under-reaction to the accident in an effort to maintain a "business-as-usual" facade; the evacuation fiasco; the mistakes made in taming the reactor fire; and the botched cleanup of the special zone. They invariably trace these problems back to certain longstanding features of the Soviet system.

This is, in fact, an important theme in both books. The authors see certain aspects of what might be termed "the Soviet system," not just the incompetence of the plant operators on the tragic night as the Soviets have charged, as root causes of the accident. They persuasively argue that it was the "system" that placed unqualified operators on the staff of a major nuclear power plant, produced the defective reactor design, was responsible for the poor quality of the initial construction of the station, and established the operating procedures for the plant. And the litany goes on. Medvedev makes this point somewhat more explicitly by stating his belief that open societies deal far more effectively with such high-risk technologies and industrial accidents.

Both authors also quietly excoriate the International Atomic Energy Agency for its role in the cover-up by the Soviets. They both rate the August 1986 IAEA meeting in Vienna as a public relations success for the U.S.S.R. The international forum was used to allay much of the anger of the West about the initial lack of openness and was used to "sell" the Soviets' official line that operator incompetence caused the accident. Both authors conclude that although the Soviets were forced to make considerable concessions and had to present a lot of damning information at the meeting, the official report submitted to the IAEA was for the most part a cover-up. The authors submit that the IAEA really did not press the Soviets because it was not expedient to do so, as Chernobyl threatened the entire global nuclear industry of which the IAEA is a part.

MATTHEW J. SAGERS
Center for International Research, U.S. Bureau of the Census, Washington, DC 20233

Prescriptions for Ecology

Ecological Experiments. Purpose, Design, and Execution. NELSON G. HAIRSTON, SR. Cambridge University Press, New York, 1989. xiv, 370 pp., illus. $52.50; paper, $24.95. Cambridge Studies in Ecology.

Ecology as a science has had a successional sequence starting with the early explorer-naturalists who described habitats and organisms. The first half of this century brought rigorous experiments on the mechanics of competition and predation, but the work was confined to laboratory systems. In the '50s and '60s natural history became the raw material for an expanding theory of ecology of the structure of natural communities, but this work was done by the elaborate statistical and mathematical manipulation of quantitative observations. It is always difficult to determine priority, but the first widely cited ecological experiments done in the field to address theoretical issues appear to be Connell's 1961 studies on the distribution of barnacles, Paine's 1966 study on predation by starfish in the rocky intertidal zone, and Eisenberg's 1966 study on population regulation in freshwater snails.

Nelson G. Hairston, Sr., now reviews the status of ecology as an experimental science. The subtitle of his book, *Ecological Experiments: Purpose, Design, and Execution,* suggests a handbook. This book is not a handbook, except in the sense of being a guide to the mind of its author, one of the primary figures in the field for the last 40 years.

Hairston begins with an essay on the big questions and how they have been addressed. The emphasis is on the traditional question of community ecology, What determines the abundance of species in nature?

Field observations are recognized for their value in posing the questions, but their interpretation by cleverness alone is rejected and the use of natural events, such as a landslide or a hurricane, as the basis for a "natural experiment" is abhorred because it "evades the issue of why manipulative experiments are conducted, which is first to test the validity of a specific idea, and second to avoid the charge of a posteriori reasoning" (p. 10). Or, as Hairston more characteristically states, "Nature has no stake in being understood by us" and "Ecologists who are not thoroughly familiar with the organisms involved risk wasting a great deal of time" (p. 31).

Mathematically derived theory is somewhat unfairly relegated to "giving the appearance of scientific rigor to what in principle is a more sophisticated version of the same process of explaining what has been observed" (p. 11).

Laboratory experiments are discounted because of the simplicity of the laboratory environment and the restricted array of species that can be included. Planned experiments in nature are declared to be the way to go. This said, Hairston reviews the elements of a valid experiment: knowledge of initial conditions, inclusion of controls, replication, and dealing with systematic variability by using statistical blocks or stratified samples. A third chapter discusses trade-offs in ecological experimentation: generality versus confidence, realism versus sophistication of experimental design, and sophistication of experimental design versus adequate replication in the field. The discussion is not a lesson in statistics, but rather an exercise in careful thinking. For example, "The duration of an experiment should be determined in advance, because of twin temptations: to stop when the results are pleasing, or to continue until they become so" (p. 31). These first three chapters should be carefully read by anyone planning ecological research or serving as a consulting statistician to ecologists. Even those of us in the choir should listen to the sermon. Others may be outraged.

The next four chapters, about three-fourths of the book, are habitat-by-habitat reviews of the results of experimental field studies. The criterion for inclusion is a planned manipulation to test an a priori hypothesis. These chapters are not a complete review of ecological experiments that have been done in the last three decades, but they cover a remarkably broad selection and are a testament to how much experimentation has contributed to our knowledge of how communities function. Each study is briefly abstracted and then the judgment is handed down. I found myself waiting with joyful anticipation for the word. "To recapitulate, the flaws in this study were as follows" (p. 49); "I have criticized these experiments elsewhere, but the nature of this book requires that I repeat the criticisms" (p. 115); "The experiments represent the sacrifice of realism to rigid adherence to a preconceived design" (p. 117).

One long chapter reviews experiments in forests. Most of this chapter is presented as a