Book Reviews

The Nonproliferation Regime

Non-Proliferation. The Why and the Wherefore. JOZEF GOLDBLAT, Ed. Stockholm International Peace Research Institute, Solna, Sweden, and Taylor and Francis, Philadelphia, 1985. xii, 346 pp. $42.

Safeguarding the Atom. A Critical Appraisal. DAVID FISHER and PAUL SZASZ. Jozef Goldblat, Ed. Stockholm International Peace Research Institute, Solna, Sweden, and Taylor and Francis, Philadelphia, 1985. xx, 243 pp. $29.

This year of the third quinquennial review of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) has produced a bumper crop of writings on the treaty as various authors and their sponsors seek to leave their imprint upon the proceedings in Geneva. Two of these new books were sponsored by the Stockholm International Peace Research Institute (SIPRI). Edited by Jozef Goldblat of SIPRI, who has written widely on arms control for many years, their common purpose is to influence the thinking and strengthen the interest of those concerned with controlling nuclear arms and avoiding the further spread of nuclear weapons. In *Non-Proliferation*, SIPRI seeks to bring about a better understanding of why some countries still want nuclear weapons when others able to make them have chosen not to. In *Safeguarding the Atom*, SIPRI hopes both to remove weaknesses of and to gain new support for the international verification function of the International Atomic Energy Agency (IAEA). Both books are directed also at those who can influence public opinion and at scholars and scientists.

In *Non-Proliferation*, Goldblat inquires why seven "threshold" states, those with significant nuclear activities, want nuclear weapons, or at least the option to make them quickly. By way of contrast, he examines three NPT states that have pledged not to acquire nuclear weapons, although when they signed the treaty they had the industrial bases to make them; and three other states that had some nuclear facilities when they signed. Goldblat's analysis rests upon a foundation of invited papers by authors from these states.

Underlying this collection and Goldblat's analysis is the proposition that if the further spread of nuclear weapons is to be avoided it is essential to know the motivations of the countries involved. Goldblat concludes that, although it is not likely that major holdout states will sign the NPT, neither is it likely that additional states will join the nuclear club. He tempers this optimism by warning of a far greater danger to the treaty, namely a mass withdrawal of present members. Goldblat's central message is that arms control and nonproliferation must be connected. The price of nonproliferation for him, and for SIPRI, is nuclear arms control.

The papers on states that are not parties to the NPT cover China and France, which have nuclear weapons, and Argentina, Brazil, India, Israel, Pakistan, South Africa, and Spain, which do not. The papers on states that are parties to the NPT cover Canada, Egypt, South Korea, Sweden, Switzerland, and Taiwan. The authors include a mix of old standbys, with Bertrand Goldschmidt of France, Ashok Kapur and William Epstein of Canada, and Joseph A. Yager and George H. Quester of the United States. Newcomers include Wu Xia Quan of China, Reinhard Drifte of England, Jorge A. Aja Espil of Argentina, José Goldemberg of Brazil, Martin Fehrm of Sweden, and Rodney W. Jones of the United States. All of the papers are good, some are excellent.

Safeguarding the Atom is quite different. Here the authors have notable professional standing and experience with the IAEA.

David Fischer writes from the vantage point of recent experience as the Agency's assistant director for international affairs. He thoroughly and thoughtfully examines the IAEA safeguards system. Sixteen chapters range widely over the overall purpose and form of the safeguards, details of their operations, and the functions of other regional safeguards systems—notably the Euratom system. At a time when many vaguely call for a strengthening of safeguards, Fischer is refreshingly specific. He also lofts as a trial balloon the proposition that "the safeguards systems of the IAEA could be applied forthwith to verify an agreement to stop the production of fissile nuclear weapons or to ban new warheads" (p. 132).

Paul Szasz, a former IAEA legal and safeguards official and now a United Nations legal affairs director, addresses the always troublesome question whether the IAEA has any teeth to enforce its safeguards. Szasz's analysis covers safeguards institutions and practices, actions by states, and safeguards resources and practices. He concludes that the most the Agency can do is cut off nuclear cooperation that it has arranged, suspend membership rights and privileges, and inform the United Nations. In principle, the U.N. could respond through the Security Council and the General Assembly, but, as Szasz is aware, there are limitations to that route. Szasz remains optimistic that "though sanctions in support of safeguards are not very strict, they are probably sufficient for their purpose: to permit the safeguards system to function without destructive obstructions . . . thereby helping to guarantee that the peaceful programmes that the Agency is controlling genuinely do not present any immediate threats to other states" (p. 150).

The volume ends with a chapter of conclusions and recommendations by Goldblat. Those intrigued with the inner workings of the IAEA's safeguards system will find much welcome detail in his outline of alternatives and in his recommendations. His main points are that the chief function of IAEA safeguards is to build confidence between nations by showing that states are keeping their nonproliferation commitments; that the technical improvement of safeguards is feasible, the main problems with such improvements being political, not technical; that safeguards depend critically on the international climate; that the chief priority of the IAEA system is to make safeguards as universal as possible; and that the future of IAEA safeguards is linked to that of the NPT.

Taken together, *Non-Proliferation* and *Safeguarding the Atom* are useful additions to the literature. Each is optimistic that, although no absolute assurance can be given that nuclear weapons will spread no further, today's nonproliferation regime can be improved and strengthened enough to maintain an acceptable balance between the risks and the benefits of nuclear power. Unresolved by either book are the political arguments over what is adequate assur-

ance that civil nuclear power will not be diverted to nuclear weaponry and that its materials will not be stolen by terrorists. Each book looks more to diplomats and politicians than to scientists and engineers to persevere in the search for nonproliferation.

Each book is well written, reads well, and includes a welcome abundance of useful documents in its appendixes. Each should have a long, useful life.

WARREN H. DONNELLY
Congressional Research Service, Library of Congress, Washington, D.C. 20540

A Schema of Science

The Intellectual and Social Organization of the Sciences. RICHARD WHITLEY. Clarendon (Oxford University Press), New York, 1985. x, 319 pp. $34.95.

Max Weber prophesied that bureaucracy would pervade social life. Whitley's essay shows, among other things, the bureaucratization of science. The book develops the most systematic analysis yet seen of differences and similarities in the social organization of scientific fields in the mid-20th century, the high-water mark of university-based disciplinary control of scientific work. The final chapter analyzes changes that have set in since World War II, with centralized government funding weakening old university-colleague fiefdoms. The changes are fragmenting disciplines theoretically while homogenizing them methodologically and administratively. A Big-Science physics administrative model is increasingly imposed on research, and other fields imitate the methods of physics. In short, we see bureaucratic rationalization and centralization in science.

Whitley argues convincingly that there is more than one logic of inquiry in science. How scientists work and the kinds of knowledge they create are "contingent upon the social conditions of . . . production and assessment" of knowledge. Differently organized fields develop differently organized knowledge. Most writers have missed this point because they have taken physics as a model of all science. (An exception is Randall Collins, to whose *Conflict Sociology* [Academic Press, New York, 1975] Whitley acknowledges a substantial debt.)

To Whitley, systems of scientists' reputations are the core organizing mechanisms of science. Within fields, scientists compete for recognition—not just as a reward, but to validate claims on future funding. Research is reputed valuable to the extent that it helps others in its field do their work. This has implications. One must not stray too far from the customary ruts, or one's work will not feed into the work of others. Thus the quest for reputations produces a control system that inhibits deviant views and radical innovations. During the 19th and early 20th centuries, reputational systems became solidified in university disciplines.

Sciences differ with respect to two kinds of dependence among researchers. "Functional dependence" grows in tandem with standardized skills and narrowly specialized research topics, which facilitate borrowing of ideas and procedures, as in chemistry and physics. "Strategic dependence" is the extent to which others must be persuaded of the significance of one's work. It is high in fields such as physics and economics, where significance is judged by reference to a systematized theoretical core, and low in less theoretically coherent fields such as chemistry and sociology.

Sciences also differ with respect to two kinds of "task uncertainty." "Technical task uncertainty" has to do with the replicability of procedures and the unambiguity with which results are interpretable. Technical task uncertainty tends to be low in most natural sciences and to be high if lay audiences can influence problem formulation and competence standards, as they can in social sciences and ecology. "Strategic task uncertainty" refers to the extent to which clear intellectual priorities to guide choice of problems and assessment of significance of results are lacking—being low in physics and chemistry and high in biomedical research. Strategic task uncertainty tends to be high when there is a variety of funding agencies and no single prestige hierarchy dominates a field.

From these bare definitions and brief examples, Whitley's concepts seem to overlap. High functional dependence seems a lot like low technical task uncertainty. High strategic dependence resembles low strategic task uncertainty. The distinctions become clearer, mainly by illustration, when Whitley elaborates the analysis in a typology that cross-classifies the two aspects of dependence with the two aspects of uncertainty, each aspect being dichotomized as high or low. Of the 16 possibilities thus generated, seven are empirically stable. These seven are discussed at length by Whitley. The general idea is that the more standardized the techniques and the more monolithic the system of evaluation, the more a unified reputational system controls a field.

Whitley uses the same concepts to analyze the pecking order of fields. When there is functional dependence between fields, one that borrows ideas or techniques from others "may have few distinctive characteristics so that its boundaries and identity become threatened." For example, the old biological disciplines have lost much of their distinctive status because they have adopted procedures from chemistry and physics. When problems are coordinated across fields, as many recently have been, the transfer of ideas is usually one-way. Strategies of high-ranked fields penetrate fields whose theories are seen as less fundamental. A result may be unequal impacts of fields on funders, who take their cues from the most prestigious fields. This process affects styles of research more than it affects the division of money among fields, which is strongly influenced by political concerns such as the desire to cure diseases or reduce crime. Lower-ranking fields are funded, but biologists and sociologists may have to imitate physicists to get the money.

Whitley traces changes that began after World War II and are still continuing, and he locates their processes within his analytical scheme. Disciplines as defined by university departments have lost much of their grip on reputational control, and in biomedical science the disciplines have ceased even to coincide with major fields of research. With government funding of an increasingly hierarchical set of interconnected fields, "fundamental differences between types of knowledge and ways of producing them are neglected in favour of . . . standardization of research skills." The big-project administrative model, which arose in physics because of the immense cost of equipment in that field, has been inappropriately imposed on other fields because of the prestige of physics. (Chemistry, a small-project field that ranks just below physics, has been spared this fate. Whitley tells us why.)

The book keeps repeating itself. It uses too many big words where small ones would do. The distinctions between its concepts are often fuzzy. Its discussions of factors associated with differing organizations of fields generally describe rather than explain: it is not always obvious what is cause, what is effect, and what is tautology. When causal chains