Book Reviews

A Soviet View

Science Policy. Problems and Trends. Y. SHEININ. Translated from the Russian. Progress Publishers, Moscow, 1978 (U.S. distributor, Imported Publications, Chicago). 332 pp. $4.80.

Sheinin's book is a fairly typical example of Soviet writing on science policy questions, though its quality is clearly superior in certain respects. The author, who is a senior associate of the Institute of World Economics and International Relations (IMEMO) in Moscow, attempts to identify common problems of science policy in the U.S.S.R. and Western countries and to compare and contrast the tentative solutions that have been adopted; the study focuses on such key issues as the conflict between conformism and creativity in research laboratories, the division of labor within the R & D process, appropriate criteria for project selection, and the mechanisms for implementing national science policies. Explicit East-West comparisons are rare in Soviet writings on science policy, and for this reason alone Sheinin's book is worthy of attention. One suspects, however, that it will appeal more to a Soviet audience than to a Western one. Soviet readers will be less familiar with the Western writings Sheinin summarizes and at the same time will be better able to decode and amplify his discreet remarks about Soviet shortcomings in the light of their everyday experience. Western readers by contrast will already be familiar with their own literature, and here Sheinin's efforts amount to a knowledgeable compilation rather than offer a fundamental critique or novel slant. So far as the Soviet scene is concerned, the Western general reader would require a much more substantive introduction to policy-making institutions and problems. Numerous Western works of this kind now exist, based on extensive coverage of Soviet primary sources; they are by no means hostile to Soviet scientific efforts and achievements and, moreover, take into consideration the relationship between science policy and the operation of the economic planning system. This is a critical relationship that is omitted by Sheinin. One would dearly love to see a frank evaluation of this body of literature by a leading Soviet specialist, but unfortunately no mention is made of it here.

There are two respects, however, in which Sheinin's book will be interesting to Western scientists and specialists in Soviet affairs. These lie not so much in the substance or originality of his analysis as in the dominant attitudes and values that guide his judgments. It seems probable that he is here reflecting views that are widespread among enlightened sections of the Soviet technical intelligentsia and political leadership. The first point to note is the remarkably positive and optimistic evaluation of the impact of science on society that is characteristic of Soviet thinking and differentiates it sharply from the more cautious and critical approach prevalent in the West during the 1970's. Another significant point of interest is those lessons drawn from Western experience that are thought worthy of emphasis by the author and that (by more or less oblique implication) are regarded as offering suitable remedies for present deficiencies in the Soviet system of R & D management. Curiously, the passages in the text where these matters are discussed possess a liveliness and momentum often missing elsewhere in the book.

Given the pervasive optimism of the book it is perhaps inevitable that the author would take issue with Derek Price's contention that by a process of "inner logic" scientific expenditures in all countries will eventually reach a point of saturation. Sheinin argues convincingly that no such trend can be discerned in the rate of growth of Soviet R & D spending and that the cutbacks in the United States in the early 1970's were the result of specific economic circumstances analytically distinct from any internal mechanisms of scientific development; he places great stress on the will of political leaders in continuing to make generous amounts of resources available and on the morale and dedication of the work force in translating these substantial expenditures into increased productivity. If any general pattern of R & D spending can be discerned it is one of "pulsating growth" within five-year cycles; this phenomenon arises because pauses of a few years are required for the productive apparatus in all countries to digest and introduce the new ideas generated during the previous phase of relatively rapid scientific development. Once this is done, the cycle begins again. Needless to say, Western writers such as Forrester who argue that the technological option may not be the most appropriate one for developing countries are seen as arrogant and misguided. If the Soviet rate of economic growth continues to decline in the future as it has done since the late 1950's, despite high levels of R & D spending, it will be interesting to see how perceptions of this complex relationship will change.

Official enthusiasm for science in the U.S.S.R. is reinforced by the attitude of the scientist at the laboratory bench, who is by all accounts highly motivated and, significantly, deeply influenced by traditional scientific norms. These findings are revealed in an extensive opinion survey conducted by the Soviet newspaper *Literaturnaya Gazeta* in July 1970 and confirmed by subsequent surveys. Although there are variations according to academic discipline, age, and sex, it appears that the Soviet scientist regards professional repute as the most acceptable criterion of scientific productivity, is motivated by creative interest rather than material incentives, prefers tranquility to regular contact, and is stimulated by professional colleagues more than by administrative superiors. These results are not entirely as one might have predicted, and since all the conflicting values concerned are to some extent legitimate ones in Soviet circumstances there appear to be no obvious reasons for questioning the objectivity of the survey procedures.

The lessons drawn from Western experience are many and varied. Soviet science policy specialists have long favored the practice of allocating R & D resources to specific projects rather than to institutions and are attracted by organizational arrangements that integrate science and production. Many reforms based on these principles have been introduced into Soviet practice during the past decade. Sheinin is also eloquent in his condemnation of bureaucratism, and

in the Soviet context his apparently general remarks are highly charged; financial flexibility, receptiveness to new ideas, and speed in making the necessary resources available are held to be necessary conditions for successful innovation. A plea for nonconformism in science is also advanced, and the Swedish philosopher Tornebohm's dictum that "little grains of sand are a great irritation to oysters but they help to create the pearls" is quoted with qualified approval. On the foreign front, Sheinin is clearly struck by the successful Japanese strategy of assimilating Western technology on a substantial scale and notes with interest the recent leap forward in Japanese domestic R & D spending. Japanese experience is thus depicted as a model that may contain many relevant features for the U.S.S.R. There is, however, one unresolved contradiction in Sheinin's account. On the one hand he believes that American technological relationships with other advanced capitalist countries are essentially exploitative ones because the most creative brains in these countries are harnessed to American objectives. On the other hand we find that in recent years there has been a growing challenge to the leading position of the United States in world markets for technology-intensive goods. This phenomenon suggests that the benefits of direct U.S. involvement in Western economies are underestimated by the author. It could well be that this form of technology transfer, which is ruled out by the U.S.S.R., is more effective than, for example, formal cooperative links within the Council for Mutual Economic Assistance.

Although Sheinin is constrained to present a favorable account of Soviet "reality," the resulting picture does not lack subtlety or objectivity. He sees clearly that, whereas the Soviet Union possesses the advantages of centralized priorities, national planning, and elimination of wasteful duplication, the spontaneity of innovation in Western countries, the responsiveness to consumer demand, and decentralized decision-making are also worthy of serious attention. Between these two extremes performance may be enhanced by pragmatic reforms that do not threaten fundamental principles. These are fair judgments about complex social processes that are not yet fully understood in any country.

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Genetics

Genetic Interaction and Gene Transfer. Papers from a symposium, Upton, N.Y., May 1977. CARL W. ANDERSON, Ed. Brookhaven National Laboratory Biology Department, Upton, N.Y., 1978 (available from the National Technical Information Service, Springfield, Va.). xvi, 378 pp., illus. Paper, $13; microfiche, $3. Brookhaven Symposium in Biology No. 29.

This volume is one of the few recent collections of work on the transfer of foreign genetic information into eukaryotic cells. The editor states in the introduction that it is impossible to give an exhaustive or even an up-to-date treatment of the subject in the symposium format, a disclaimer that is particularly appropriate given the explosion of information on the subject. The published proceedings, therefore, are of more interest for the review material they provide than as a source of current information.

The book is divided into five sections. The first, which deals with natural genetic interactions, includes interesting discussions by Attardi *et al.* of mitochondrial gene control, by Schell and Van Montagu of the important subject of Ti plasmids and their role in crown gall disease, and by Bogorad *et al.* of the regulation of expression of genes for ribosomal proteins and RNA's of the green alga *Chlamydomonas reinhardi*. There is a concise review by Diener of the potato spindle tuber viroid, including a speculative but useful discussion, based on the Britten-Davidson model of gene regulation, of the possible role of viroids as activator RNA's. There is an interesting but somewhat out-of-place discussion by Siddiqui *et al.* of the RNA-dependent induction of heart-specific tissues in the duck blastoderm, demonstrating a probable regulatory role for RNA in this developmental system.

The second and third sections deal with methods of introducing foreign genetic information into eukaryotic cells, beginning with a description by Mintz of the powerful teratocarcinoma system for the introduction of specific mutations into mice. A series of somewhat repetitive papers dealing with chromosome-mediated gene transfer is presented by Ruddle and Fournier, McBride and Athwal, and Degnen *et al.*, and there is a paper by Spandidos and Siminovitch dealing with transfer of dominant markers, consecutive enzymes in the folate pathway, and anchorage independence. Very recent reports from the Spandidos and Siminovitch laboratory indicate that the results may not be reproducible, and all the recently reported results dealing with these systems, including those presented here, are being reevaluated. It does, however, seem clear from reports from a number of laboratories that chromosomal gene transfer results in both unstable (abortive) and stable transformation of cells carrying genetic markers such as hypoxanthine phosphoribosyl transferase or thymidine kinase deficiency.

The use of naked DNA for transformation is discussed by Mishra in the system in *Neurospora* involving inositol-requiring mutants and by Coon and Ho for the transfer of chloramphenicol resistance to 3T3 cells by mitochondrial DNA. These represent the most solid studies of DNA transformation in a field long troubled by irreproducible results. There is a somewhat cursory review by Lacks of DNA uptake by *Diplococcus pneumoniae*, but there is little or no discussion anywhere of the mechanisms of DNA uptake by eukaryotic cells or of the nature of competence in eukaryotic cells.

Graessmann *et al.* give brief glimpses of the use of microinjection into oocytes, fertilized eggs, and cultured cells to study the control of gene expression of the SV40 genome, and Celis describes the intriguing but apparently inefficient use of microinjection of suppressor transfer RNA into cultured cells to screen for nonsense mutations. Upcroft *et al.* describe the use of SV40 containing an *Escherichia coli* DNA fragment carrying the suppressor gene Su^{+}III to transform rat cells and demonstrate that the bacterial fragment remains stably integrated, along with the SV40 sequences, in transformed cells.

The last two sections begin with a brief description by Bukhari of transposable elements and insertion sequences, followed by a description by Laten *et al.* of examples of genetic translocation of the yeast SuP_{1-16} gene, a discussion by Novick of translocation mechanisms in E. *coli*, and a discussion by Reanney of the possible adaptive role of DNA translocation, both between various replicons within a cell and between different cells.

A short but difficult and confusing discussion by Hicks and Strathern deals with the genetic rearrangement occurring during interconversion of mating types in yeast. Carbon *et al.* describe the isolation of *E. coli* plasmids carrying cloned yeast DNA and capable of complementing *E. coli* auxotrophs and show that many of the yeast genes function in the prokaryotic environment. Likewise, Kushner *et al.* describe a plasmid carrying *Neurospora crassa* DNA that can