of the four classes of lattices met in solid bodies; a discussion of effects called radiation damage (in solids); a "burner versus breeder" argument from the longer-range view of applying nuclear energy; and historical notes on the first pile and on the plutonium project.

Amidst all this beautiful physics there is one remark in this book which, it seems to me, is not true to Wigner's style. It is this one. "It is true that many of the young men are attracted by the big machines of big science and that it is difficult to resist the easy success which these machines promise." Surely, some of Wigner's brilliant younger Princeton colleagues in experimental physics would have no difficulty in conveying to the author that the success-to-heartbreak ratio in big-machine work is not so much different from what it is in other parts of physics and that no big-machine experimentalist who respects himself and his pupils will promise them easy going.

The book contains two moving biographical notes with noble passages on the struggle of von Neumann and the stoicism of Fermi in the face of death. Nor will the attentive reader fail to note Wigner's own view of the role of death in life.

"The promise of future science is to furnish a unifying goal to mankind rather than merely the means to an easy life, to provide some of what the human soul needs in addition to bread alone," the author says. With this volume he has provided.

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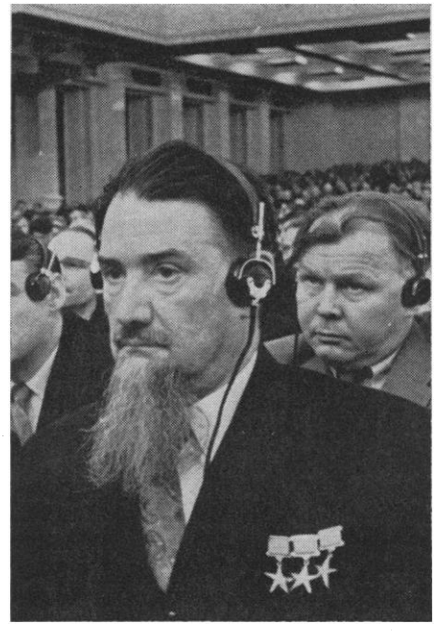
Developer of Russia's Bomb

I. V. Kurchatov. I. N. GOLOVIN. (In Russian.) Atomizdat, Moscow, 1967. 110 pp., illus. Paper, 22 kopecks.

This year, just over two decades after the Soviets achieved their first nuclear chain reaction, they have released their closest approximation to a Smyth report. It is in the form of a biography of Igor Vasilievich Kurchatov. The author, Igor Nikolaevich Golovin, is highly respected for his own researches on controlled thermonuclear reactions and worked closely with Kurchatov in the Soviet nuclear program after it was renewed in the middle of World War II. His is a warm, affectionate portrait of the man who accomplished for the Soviet government essentially what Vannevar Bush, Enrico Fermi, and Robert Oppenheimer did for the United States. A tall statement? Not at all, for Kurchatov directed almost every phase of the Soviet project from materials fabrication, reactor construction, and isotope separation to final detonation of the nuclear devices.



I. V. Kurchatov at the 21st (Extraordinary) Congress of the Communist Party of the Soviet Union, February 1959. [Photograph by V. Yegorov and V. Savostyanov, Fotokhronika, TASS. Courtesy Sovfoto]

The man who was to engineer the splitting of the atom for Stalin was born in the metallurgical factory town of Simsky Zavod in the southern Urals. The year was 1903, a fateful year, for in London the Russian Social Democratic Party itself split into two groups of bitter rivals, the Mensheviks and the Bolsheviks. A few years after the revolution, Kurchatov entered Tavrichesky University in the Crimea, where his association with the greats of Soviet physics, among them Frenkel, Tamm, and Ioffe, began. Developing Kurchatov's career, Golovin effectively conveys the galvanic atmosphere of the laboratories in Leningrad and Kharkov paralleling the excitement being generated by the unfolding knowledge of the atom in Copenhagen, Paris, Cambridge, and elsewhere.

The story of the bomb begins with the letter that Georgy Flerov (co-discoverer of spontaneous fission) sent to the State Defense Committee in May 1942 urging a "uranium bomb" program. Flerov, like Kurchatov, had been engaged since the German invasion on more urgent military tasks, but the priority of nuclear research began to reassert itself. By February 1943 Kurchatov was selected as leader of the project and was back in Moscow organizing people and laboratories. The most important research establishment was Laboratory No. 2 of the Academy of Sciences, in the suburbs of Moscow. (Laboratory No. 1, in Kharkov, was directed by Kurchatov's brother-in-law, Kyrill Sinelnikov.) Today Laboratory No. 2 is the Kurchatov Institute of Atomic Energy, a major research establishment. Christmas Eve 1946 is the date given for divergence of the first Soviet reactor in the "Assembly Shop" of Laboratory No. 2. Kurchatov took it to 100 watts and in the early morning of Christmas day closed it down. The assurance the Soviet government required from their "navigator" was now theirs. Golovin traces the leadership of Kurchatov and his associates at the construction and bomb test sites. The stories are reminiscent of those concerning General Groves and Robert Oppenheimer; for the first time, apparently, in Soviet print General Boris Vannikov, Stalin's General Groves, is given a measure of recognition. So also is Colonel General Avraamy Zavenyagin, the NKVD representative, who was particularly active in the preparation of the first bomb test.

Names, but rarely places, are given in abundance—nor is the book anywhere near as technically complete as the Smyth report. Not a single party leader, past or present, is mentioned. Kurchatov's relationship with Stalin must have been particularly interesting; and Khrushchev, in the spring of 1956, took Kurchatov to Harwell with him and proudly showed him off. This brief visit was the only close glimpse Kurchatov had had of non-Soviet science, or it of him. Golovin's biography helps to correct the latter deficiency. The picture is one of continuous, intense involvement with nuclear problems to the last days of his life, which are chronicled in detail. Kurchatov died on 7 February 1960, while visiting his ailing friend Yuly Khariton, pioneer theorist on chain reactions. The vignettes Golovin presents of an eventful life are as absorbing as any to be found in the multitudinous tales of the Manhattan District.

The declassification officer appears to

have lacked finesse at points. For example, the book dates the first Soviet nuclear explosion as 23 September 1949. Actually, this was the date President Truman announced the explosion, which had occurred a few weeks earlier. But it is likely that only the specialist will be annoyed by such trivia. Some parts of the book have been extracted in the first two issues of *Sputnik*, the new Soviet English-language digest. But the book itself deserves an English edition. Or perhaps some bold soul will attempt a more definitive biography, contrasting and comparing this extraordinary scientist-administrator with his peers elsewhere.

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Viruses and Vectors

Insect Virology. KENNETH M. SMITH. Academic Press, New York, 1967. 270 pp., illus. $11.50.

A great many viruses are associated with insects. Some of the most important diseases of man are transmitted by mosquitoes and ticks, and many destructive plant viruses depend upon insect vectors for survival and dissemination. Many insects are themselves susceptible to specifically infectious viruses, and natural epizootics of such viruses often cause the decimation of host populations. Viruses have been utilized by entomologists in the management of a few pest species, and their potential usefulness as agents for biological control of a large number of important pest insects has stimulated research and interest during the last 20 years.

In this book Smith has reviewed a large proportion of our knowledge of the insect viruses. Most of the viruses, and even the suspected viruses, that are pathogenic for insects are discussed. A section on the relationships between plant viruses and insect vectors is included, but the important associations between mammalian viruses and insects are omitted except for brief mention in the introduction. The first chapters describe the various types of viruses and the diseases they cause. The literature is quite thoroughly reviewed and findings are presented in a lucid manner. It is this part of the book that will make it useful as a reference text.

In the last chapters Smith discusses some of the controversial subjects in the field. The section on the mode of replication is largely a summary of the work done 10 years ago by Smith and his group, and no mention is made of some of the most recent advances in this area. In the section on transmission and spread of insect viruses some very important and basic studies are not discussed. The chapter on inapparent or latent viral infections presents an interpretation that is open to serious question. Throughout the text there are general statements that are not supported by authoritative references, and the reader should be careful in his acceptance of these statements. But the book contains a good deal of useful information about the viruses of insects and when used with critical discretion will be of value to students as well as professionals.

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Radionuclides in the Environment

Radioecological Concentration Processes. Proceedings of an international symposium held in Stockholm, April 1966. BERTIL ÅBERG and FRANK P. HUNGATE, Eds. Pergamon, New York, 1967. 1054 pp., illus. $45.

The proceedings of any international symposium undoubtedly contain information of interest to investigators in the field concerned. The present proceedings contain a great deal of such information. Excellent reviews of several topics are among the hundred-odd papers included in the volume. Papers by such pioneers in the field as Comar and Lengemann and Scott Russell are not infrequent in the literature, but here these workers both provide current knowledge and ideas and indicate subjects needing further study. Other papers, by Hanson, Ekman, and Polikarpov, refer to specific problems in radioecology, in different ways suggesting further research and advocating caution in conducting it.

Unfortunately, summaries of only two sessions are included. One, by Miettinen, is in itself a comprehensive review of unique arctic food chains, supplementing that of Hanson. Hill's summary of the session on the behavior of natural radionuclides in the environment briefly reviews each paper of the session. His general comments could well be applied to the entire symposium, and should be noted by authors and editors. In reference to measurement techniques, their considerable variety and application near their limit of sensitivity, he says that "such a situation places a demand on authors that they should clearly demonstrate the reliability of their methods, and, thus, the validity of their results." Many of the symposium papers fail drastically in this regard, and several papers consist of tables or figures with no text. Others are poorly written, meeting none of the accepted standards for technical publications. In the cursory introduction, the editors point out that time did not permit much editing (none at all is apparent to the reviewer) and say that this should not be necessary since papers are from well-known institutions and scientists! The assumption is false, as most editors and referees of reputable scientific publications could testify. At least adequate proofing and a standard format are expected for a book of such price as this.

There are a sizable number of excellently written and interesting papers in the volume in addition to the introductory and session-summary papers mentioned above. An outstanding example is that of Whicker, Farris, and Dahl on radionuclides in a wild deer population and environment. Among these also are several papers on the behavior of radionuclides in soils by U.S.S.R. investigators (Kwaratskhelia *et al.*, Pavlotskaya *et al.*). Noteworthy, also, is Hawthorne's paper on transfer of ^{137}Cs to milk. In the session concerned with the marine environment, the paper of Phelps on partitioning of stable Fe, Zn, Sc, and Sm in a benthic community indicates a comprehensive study and results of significance. In his paper on the concentration and radiation effects of isotopes of strontium in fish, Townsley describes well-designed experiments and their results. Important also is his remark cautioning that the applicability of many reported findings to the establishment of "safe levels" for disposal of radionuclides in the marine environment is limited because of the complex nature of that environment. A number of other papers could easily provoke useful discussion.