central issue of our time. Public judgments arrived at through traditional democratic processes are as pertinent as ever. While "science does broaden and secure the ground on which men can make their choice," he says, it "offers no absolutes and no blueprints . . . to tell us what we want to live for."

Piel offers a provocative theory on the success of Russian science under the rigid monolith of a Marxist totalitarian society. The creative intellect craves freedom and dies without it. The nationalization of science in America since World War II has increasingly restricted the freedom of American science. On the other hand, the intellectual tradition of Russia, bred for generations in an atmosphere of repression and terrorism, has developed some immunity and "is perhaps . . . more cunning and clever in the way it resists and eludes the inquisitor." He is quick, however, to point out that "the things that are wrong with American science are the same things that are wrong with Soviet science."

In a sense, the basic issue raised by Piel and by the delegates of the emerging nations may be the same: Whether men will pursue the illusory symbols of scientific progress, or its real substance: the service of man. Both of these volumes are absorbing and disquieting. In place of the false optimism fostered by the Cult of Science, they point back to the inescapable hard problems of contemporary life. For the solution of these problems, science can do much, but it offers no quick and easy way.

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Students and Teachers

The American High School and the Talented Student. Frank O. Copley. University of Michigan Press, Ann Arbor, 1961. $3.95.

Here are two essays of interest to those who work with superior students in secondary schools. The first essay begins with and justifies general statements such as these: "Knowledge must precede criticism" and "conversation is not education." It then enumerates types of acceleration and enrichment and gives examples of each. The second essay describes (and praises) the advanced placement program, its meaning and organization, and various ways for schools to provide this program for students.

The tone of the whole discussion is practical but not detailed. On the other hand, a detailed treatment might have lost the clear thread of the argument. A reader must bring a background of teaching to this book; he will then find the generalizations very rewarding. The author shows a complete understanding of the problems that actually appear in schools.

One point will be debated by many: English study is for all, but mathematics only for those with special aptitude. It must be noted that the author, Frank Copley, teaches Latin. Also, one might question his statement: "There are few schools, public or independent, large or small, urban or rural, that could not institute Advanced Placement in one form or another and in at least one subject."

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A Historical Puzzle

Lavoisier. The crucial year. The background and origin of his first experiments on combustion in 1772. Henry Guerlac. Cornell University Press, Ithaca, N.Y., 1961. xix + 240 pp. Illus. $4.50.

Lavoisier belongs to that small and lucky band of scientists who effected a revolution in science by the introduction of new concepts. Small wonder, then, that he has attracted so much attention from scholars. Yet hitherto there has been no general agreement about what started Lavoisier on that important series of experiments on combustion, which led to his appreciation of Priestley's discovery of oxygen and to his own totally new idea that a gaseous constituent of air entered into chemical reactions. Here a distinguished historian of science undertakes to unravel what he rightly calls "this important historical puzzle." Henry Guerlac is a master at recounting a scholarly detective story in a manner at once entertaining and profound. One does not need to be a Lavoisier expert to enjoy this elegantly written book. Lavoisier scholars will find the documentation impeccable and the reasoning cogent.

Why did Lavoisier undertake the critical experiments which determined his career? It has been assumed that he was influenced by the work of Black on "fixed air" (CO_2), of Priestley on gases, of Cigna on sulfur and phosphorus, and of French chemists on the combustion of diamonds. It is here shown that the work of Black, Priestley, and Cigna was little known in France, especially to Lavoisier, and that the experiments on the diamond did not strike Lavoisier as combustion. Rather, he saw these experiments as examples of effervescence, a phenomenon with which he busied himself in connection with the reduction of metallic calxes, a phenomenon perhaps connected with the production of "fixed air" as described by Stephen Hales. Guerlac believes that Lavoisier's announced intention of studying the calcination of metals stemmed from Guyton de Morveau's elaborate experiments which showed that all metals gained weight on calcination in air. (But his argument that this was not generally known is weak, as his quotations show: the fact was known to Lavoisier's colleagues; it was the *explanation* that remained in doubt.) In 1772 Lavoisier actually undertook, instead, brilliantly revealing experiments on sulfur and phosphorus; he did so as the result of a series of accidents, skillfully detailed here. And, as a useful appendix, the relevant documents, many previously unpublished, are given in full.

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Scheele's Fluoric Acid Today

Advances in Fluorine Chemistry. vol. 2. M. Stacey, J. C. Tatlow, and A. G. Sharpe, Eds. Butterworth, Washington, D.C., 1961. 220 pp. Illus. $8.

This, the second volume of the series, consists of six reviews covering a very wide range of subject matter. The introductory essay by C. R. Patrick surveys the thermochemistry of organic fluorine compounds; an extensive compilation of the heats of formation is used to deduce bond dissociation energies of various organo-fluorine compounds. C. C. Finger, the American authority, provides a readable description of fluorine resources and utilization. The rapidly increasing application of precision mass spectrometry in organic chemistry makes J. R. Majer's review of the mass spectrometry of

fluorine compounds timely; this chapter includes a detailed description of ionization phenomena in a wide variety of organo-fluorine compounds. J. M. Tedder discusses the fluorination of organic compounds with elementary fluorine; the theoretical aspects are supplemented by an obviously authoritative discussion of the experimental techniques involved. N. Hodge turns to the inorganic chemistry of fluorine and contributes a detailed review of the fluorides of the actinide elements; this chapter summarizes a good deal of the physical chemistry of this class of compounds, and the bibliography provides an excellent key to the literature. Finally, B. P. Saunders contributes a discussion on the physiological action of organic compounds containing fluorine. It is, of course, authoritative and makes interesting reading for both the inorganic chemist and his more biologically oriented colleagues.

The volume is well produced and can be recommended to all chemists concerned with these various aspects of fluorine chemistry.

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A Complete Compilation

Crossed-Field Microwave Devices. vol. 1, *Principal Elements of Crossed-Field Devices*. 648 pp. $22. vol. 2., *Principal Types of Crossed-Field Devices, Analysis of Oscillator System Performance, Regional Progress and Trends*. 520 pp. $18. E. Okress, Editor-in-Chief. Academic Press, New York, 1961. Illus.

One's first reaction to these volumes is one of annoyance. There are over 1200 pages of material, contributed by close to 60 authors and divided into roughly as many sections. Obviously, with different nomenclature, considerable repetition, and the like, such a collection would not constitute a very coherent whole, and the results could hardly fulfill the stated end of "summarizing the progress and state of art of crossed-field microwave devices in theory and practice." Apparently this defect was recognized by the editors, for in the preface they apologize for the inconsistencies in style and level of presentation. However, after one overcomes this initial annoyance, he will find that the quality of many, perhaps most, of the articles is very high. The volumes do include papers by almost everyone who has contributed in an important way to the development of crossed-field devices, and they do cover (sometimes two or three times) the essential characteristics, both theoretical and experimental, of these devices. Obviously, given the number of authors and sections, it is not even possible to quote the table of contents, but it should be pointed out that there is considerable material, some of it not available in as detailed form elsewhere, on many of the new developments, including crossed-field amplifiers, new methods of gun design, recent calculations on large-signal theory, circuits for cross-field devices, cathode problems, and some interesting treatments of the old *bête noire* of crossed-field devices, the instability of the space charge cloud. Thus, despite duplication, nonuniformity, and the like, I must state that these volumes undoubtedly do represent the most complete compilation available of authoritative material on crossed-field devices, including most of the recent developments. Readers will have to overlook the lack of optimum organization and accept these volumes for the riches they contain. It is possible that an attempt to organize the material might have resulted in the books not appearing at all.

As a footnote comment on the list of authors, I might point out that the list extends approximately from Boot and Buneman through all the rest of the alphabet to Willshaw. Readers who are familiar with the early history of these devices will realize that this encompasses the names of those responsible for developing most of the art of crossed-field devices, including those responsible for the very origins of the field.

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Miscellaneous Publications

(Inquiries concerning these publications should be addressed, not to Science, *but to the publisher or agency sponsoring the publication.)*

Chicago Natural History Museum. *Fieldiana: Zoology*, vol. 39, No. 51, "A new Peruvian race of *Crypturellus obsoletus*," Emmet R. Blake (3 pp. $0.10). vol. 41, "The land snail genus *Amphidromus*, a synoptic catalogue," Frank Fortescue Laidlaw and Alan Solem (275 pp. $4.50). vol. 42, No. 10, Philippine Zoological Expedition, 1946–1947. "New and interesting Odonata from the Philippines," Maurits A. Lieftinck (39 pp. $1). The Museum, Chicago, Ill., 1961.

Geophysics Research Directorate. AFCRL 438, *Research Notes*, No. 36, "Contributions to satellite meteorology," vol. 2, Francis R. Valovcin, Ed. The Directorate, Air Force Cambridge Research Laboratories, Bedford, Mass., 1961 (order from Office of Technical Services, Washington 25)

National Academy of Sciences–National Research Council. *Nuclear Science Series*, NAS–NS 3037, "The radiochemistry of polonium," P. E. Figgins. Office of Technical Services, Washington, D.C., 1961. 71 pp. $0.75.

National Science Foundation. NSF 61-32, *Surveys of Science Resources Series*, "Funds for research and development in industry, 1958." Superintendent of Documents, GPO, Washington 25, 1961. 135 pp. $0.65.

New York Academy of Sciences. *Annals*, vol. 91, art. 3, "Genetic perspective in disease resistance and susceptibility," Richard H. Osborne, Ed., pp. 595–818; vol. 92, art. 1, "Vitamin C," J. J. Burns, Ed., 332 pp.; art. 3, "Pavlovian conference on higher nervous activity," Nathan S. Kline, Ed., pp. 813–1198; vol. 94, art. 1, "Plasma proteins in health and disease," George T. Dimopoullos, 335 pp. New York Academy of Sciences, New York, 1961.

Smithsonian Institution, Bureau of American Ethnology. Bull. 180, *Symposium on Cherokee and Iroquois Culture*. William N. Fenton and John Gulick, Eds. Supt. of Documents, GPO, Washington, D.C., 1961. 292 pp. Illus. $1.25.

U.S. Geological Survey. *Bulletin*, No. 1028-R, pp. 563–81, "Geologic reconnaissance of Kiska Island, Aleutian Islands, Alaska," Robert R. Coats, Willis H. Nelson, Richard Q. Lewis, and Howard A. Powers. *Professional Papers*, No. 316-E, pp. 75–89, "Regional gravity survey along the central and southern Wastch front, Utah," Kenneth L. Cook and Joseph W. Berg, Jr. Superintendent of Documents, GPO, Washington 25, 1961.

U.S. Office of Education. No. OE-53010, "Trends in higher education, planning and management data, 1957–58 to 1959–60," W. Robert Bokelman and Louis A. D'Amico (24 pp. $0.25). No. OE-10005-61-B, "Progress of public education in the United States of America 1960–61" (82 pp.). Superintendent of Documents, GPO, Washington 25, 1961.

U.S. Public Health Service. National Health Survey, Health Statistics, Series B-No. 29, "Disability days, United States, July 1959–June 1960." Superintendent of Documents, GPO, Washington 25, 1961. 50 pp.

University of Wisconsin, College of Agriculture. *Bulletin*, No. 31, "Comprehension of graphs." S. E. Sarbaugh, Richard Powers, Hugh Culbertson, and Thomas Flores. The University, Madison, 1961. 26 pp.