merely transformed into an even more intense conflict between basic and applied research.

Then came the war, and the Bomb, and Big Science, and Soft Money. Science and scientists were finally integrated into American life. This, in Daniels's view, was unfortunate, because previously the great strength of American science had been, ironically, its presumed irrelevance to everyday life. Now scientists enjoyed prestige and affluence as never before in American history. But they had bought power at the price of freedom. "Power, in a democratic society, must bring responsibility, and responsibility means an increasing subjection to political, social, and economic forces" (p. 344). Daniels doubts that American science will lose its vigor. What is more likely, he concludes, is that it will lose the last vestiges of its autonomy.

In part because of the very nature of his book, Burnham appears more optimistic. *Science in America: Historical Selections* is a collection of documents designed to augment university courses in the history of American science. Since Burnham's introductory essays total only 35 out of nearly 500 pages, he cannot be expected to elaborate an explicit thesis. Moreover, in the interest of coverage, to make the collection most useful to others, he has selected documents illustrating a whole range of significant issues. He pinpoints several: social conditions which encourage or discourage scientific endeavor; the development of scientific institutions; the justifications for science in a democratic culture; the character and role of the scientist; the argument between pure and applied science; mechanism, materialism, and their critics; and the scientific attitude and its opponents. The documents, selected from three centuries of scientific literature, are well chosen both for scientific content and literary style. Nearly half the selections come from the 20th century.

Although the two volumes have many points of mutual contact (one can frequently support an argument from one with evidence from the other), Daniels and Burnham appear to have fundamentally different casts of mind. Daniels is, in a way, a pure historian tracing, a little sadly, the decline of pure science in America. He is most at home in the earlier period, where he can subject pure science to pure historical analysis. His early chapters are superb, models of the genre. They represent a continuation of his desire, expressed in his earlier study *American Science in the Age of Jackson*, to "recapture a small part of the past as uncontaminated as possible by present judgments as to importance." At the same time Daniels is, like his backslidden scientists, too much involved in contemporary affairs to remain entirely aloof. *Science in American Society* derives its dynamic qualities from the author's divided loyalties to the past and the present.

Burnham is much more in the tradition of progressivist history of science. He sees science (and especially technology) advancing at an ever-accelerating pace, dispelling illusions, solving social problems, contributing to the general welfare. Where Daniels keeps at least one eye on yesterday, Burnham can hardly wait for tomorrow. The really serious problems confronting science are those, like environmental contamination, which confront us all.

Individual readers must decide which of these two approaches is more congenial. But they should read these excellent volumes together. For from them we can gain a much clearer notion of where American science has been, and where it may be going.

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On Ecological Regulation

Concepts of Pest Management. Proceeding of a conference, Raleigh, N.C., March 1970. R. L. RABB and F. E. GUTHRIE, Eds. North Carolina State University, Raleigh, 1970. xii, 242 pp., illus. Paper, $4.

This is a good book. It consists of 15 papers (plus audience discussion) which were presented at a conference having the following objectives: to stimulate and establish guidelines for the initiation of pest management programs, to ascertain the practicality and limitations of the pest management concept, to describe training programs for qualified pest management specialists, and to promote the international exchange of ideas on the subject. Even though the conference evidently failed in all its goals but the last, the proceedings provide much stimulating reading on the theoretical basis and underlying ecological principles of pest management programs.

It is immediately evident that attempts to deal with agricultural pests have grown considerably more sophisticated since the "spray and count" days of two decades ago. Rather than striving for eradication, the science attempts to regulate pest populations at such low levels that they do not become economically important. This regulation is achieved by a variety of methods which include releases of sterile insects, the use of attractants and repellents, the use of all natural mortality factors, and occasional applications of nonpersistent, target-specific pesticides. The ecological expertise of most of the participants in the symposium is evident throughout the book. For example, the opening paper discusses basic ecological subjects such as diversity and stability, growth and invasion rates, and the theoretical relationships between predators and their prey. Later papers discuss somewhat more specialized topics such as the use of systems analysis, bioclimographs, and life tables for understanding the dynamics of both populations of pests and populations of their natural enemies.

The current deemphasis of pesticides is evident, and only one paper deals with their use and limitations in pest management programs. On the other hand, two papers discuss various aspects of genetic manipulations of pest populations and field crops as alternatives to chemical controls. Two chapters grapple with the important questions of economic and practical feasibility of pest management programs, and one discusses the philosophical choices which must be made when the decision is for suppression, management, or eradication of pest populations.

An excellent paper by P. S. Corbet of the Canadian Department of Agriculture focuses on the human population explosion. He points out that if a pattern of increase leading to an estimated population of 7 billion individuals within less than two generations were observed in any other organism no one would hesitate to call it an outbreak of serious proportions. He rightly concludes that the world's chief concern should be the "earthpest" explosion, and that the major problem in pest management lies in stabilizing the human population at a level appropriate to the needs and resources of the biosphere.

The one disappointing aspect of this symposium lies in its failure to concoct a practical plan for implementing pest management programs. This failure was not unnoticed by the organizers of the conference, as it is pointed out

in both the preface and the summary. Central to the problem of implementation is the shortage of pest management personnel who can work effectively with growers. Both a formal presentation and a panel discussion were addressed to the task of training such people, but the only concrete proposal presented was a program designed to produce more specialists with advanced degrees in pest management. An advanced degree should not be a requisite for doing practical work in this field, and there should be no insurmountable problems in training people at the baccalaureate level to be field advisers who can sell pest management programs as effectively as salesmen for agricultural companies sell pesticides. Until such people are trained and working in the field, the pest management movement, at least in this country, will unfortunately remain in its present position as a topic of theoretical research rather than a practical and widely used alternative to broadcast spray programs.

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A Chemical View

Chemistry of Pesticides. N. N. MELNIKOV. Translated from the Russian by Ruth L. Busbey. Frances A. Gunther and Jane Davies Gunther, Eds. Springer-Verlag, New York, 1971. xii, 480 pp., illus. $19.80.

It is evident that Russian and European traditions are similar in one way that differs importantly from the American: they have supported a breed of "pesticide chemists" who are a subculture of the "agricultural chemists." Neither group is common in the United States, where specialization in individual domains such as "insecticides" or "herbicides" is common, and where at the biological end of training specialization is universal: a phytopathologist who understands insecticides is a rare bird indeed. In the American chemical world there is somewhat more catholicity, especially where the needs of industrial chemistry drive individuals to know something of the synthetic aspects of more than one group of pesticides.

For these reasons, the obvious comparison to make (dealing only with the literature in English) is with Hubert Martin's famous book *The Scientific Principles of Crop Protection*. Melnikov's editors say in their preface that the book "represents a thoroughly modern but concise summary of the basic principles of practical pest control by chemical means" and in this way suggest a strong comparison with Martin's book. But Martin (who is a chemist) dealt rather extensively with the actual use of the pesticides in practical agricultural problems, and also gave a great deal of information about the mode of action of the agents. Melnikov's book is uncompromisingly chemical, and its title is highly accurate. For instance, the organization of the book is almost exclusively chemical: 29 of the 31 chapter headings are of the type "Derivatives of urea and thiourea" or "Halogen derivatives of aromatic hydrocarbons," so that DDT is rather humbly relegated to six pages (in a 480-page book) in the latter chapter. The two other chapters are a very general introductory chapter and a good chapter on pesticide formulation.

Because of this stress upon chemistry, the questions of biochemical action and of metabolism are touched on very lightly. Thus in the pages on DDT, its metabolism is not mentioned and nothing is said about the mode of action except that it "has not been determined" (which may be an accurate summary, but which ignores the considerable amount that we do know about the way it acts), but a half page is given to a table of the solubility of DDT in 27 different solvents. Similarly, the many organophosphates described individually (in a 62-page chapter) have their synthesis and physical properties given in detail, but their metabolism mentioned seldom, and then without discussion of the relative importance of the several routes indicated. By contrast, the discussions of the empirically observed variations of potency with structure are often quite extensive and useful. Toxicity data are given with useful frequency, but quite often important facts are omitted, such as the route of administration or the organism employed.

It is very unfortunate that references are omitted entirely except for "general references" following each chapter. Sometimes (as in "Organic mercury compounds") these are all Russian references, of small use to English readers. Happily the subject index is extensive (31 pages) and reliable. The translation is immaculate.

In summary, this really is a book for chemists, and provides a valuable and encyclopedic reference about the chemistry of all the major pesticides used in the world. The coverage is virtually total. It will therefore be an excellent reference book for all chemists dealing with any aspect of pesticides. It is not a book that one sits down to read for general interest, and the translators cannot be serious when they suggest its use for "the beginner who needs a 'comprehensive survey.'"

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Growth and Morphogenesis

Regeneration. Key to Understanding Normal and Abnormal Growth and Development. S. MERYL ROSE. Appleton-Century-Crofts, New York, 1971. xii, 264 pp., illus. $7.95.

"This book is in a sense a synopsis of the science of polarized control of growth and morphogenesis," the author writes. Using as a basis lessons learned from the study of regeneration, he develops several themes relating to the initiation and control of developmental processes. Predominant among these is the concept of a hierarchy of differentiation in which the first structure to appear in a developing system inhibits the subsequent differentiation of like structures along well-defined lines of polarized control. Rose supports this concept with examples of repression of the regeneration of normally dominant or apical structures such as the lens in the newt and hydranth primordia in *Tubularia* by material extracted from the adult structure. Rose has also extended this concept to embryonic development, and along with describing the inhibition of differentiation of specific structures by products taken from their adult homologues, he offers an alternative explanation, based upon inhibition, to the results of Spemann's transplants of the dorsal lip of the blastopore and to much of embryonic induction in general.

Inhibition and the eventual morphogenetic equilibrium must be constantly communicated to the organism as a whole, and throughout the book Rose describes systems in which pathways of inhibitory communication have been demonstrated. In several chapters dealing with regeneration of worms and the amphibian limb and with morphogenesis in Protozoa and plants he points out how the initiation and cessation of sec-