conditions of culture do influence the protein content. The nutritional quality of cereal proteins tends to be rather low, primarily because the essential amino acid lysine is present in the protein in a rather low concentration, although other essential amino acids also occur in less than ideal quantities. This is significant since protein requirement is an inverse function of protein quality —the lower the quality in the diet, the higher the amount needed. Cereals provide a major source of protein in all populations but particularly in the developing countries. Increased attention has been paid to the quality of cereal proteins since the discovery of various "high lysine corns."

This book consists largely of a compilation of the information available on the protein and amino acid content and estimates of the nutritional quality of the proteins in wheats, ryes, and triticales before and after processing. In general, the various studies reported in the literature are described and the conclusions stated without much critical comment. This is wise at this time.

The major criticism of this book is aimed not at the authors but at the data available. The relationship between protein quality and protein needs is quantitative, but the methodology in common use for evaluating protein quality is completely inadequate for this purpose. More appropriate methods are suggested in chapter 2 of this volume, contributed by McLaughlan and Campbell. It can be accepted that the proteins of wheat and rye and of triticale are of relatively low nutritive value when these cereals are the sole source of protein and that they are limiting in lysine. Rye generally contains somewhat more lysine than wheat, and appropriately selected triticales may approximate, perhaps even exceed, the lysine content of rye. The sum total of the literature tells us little more than this.

It is this reviewer's conviction that the so-called "protein problem" in human nutrition around the world has been overemphasized. It has yet to be shown that improvements in the quantity or quality of protein in the diets now usually consumed will greatly improve nutritional status. Whatever the significance of the problem, it relates to the total mix of proteins consumed. It is clear that the quantity and quality of cereal proteins can be modified by genetic selection. Just what this means for the nutrition of various population groups who consume the cereals is much less clear. There is a protein problem in animal production, however, and improvements in the quantity and quality of cereal proteins can be predicted to minimize the need for protein concentrates of various kinds used in feeds.

Whatever the significance of triticale in human or animal nutrition may eventually prove to be, the current interest in it is another good example of the increasing concern about the nutritional quality of the foods we produce, and, as the authors conclude, these studies serve "as a model of what can be achieved by a scientifically integrated approach to plant breeding."

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Induced Seizures

Neurochemistry of Cerebral Electroshock. WALTER B. ESSMAN. Spectrum, Flushing, N.Y. (distributor, Halsted [Wiley], New York). viii, 182 pp., illus. $12.50. Monographs in Modern Neurobiology.

Cerebral electroshock (ECS) is widely used as a research tactic in studies of memory and seizure mechanisms, as a test of the seizure-inhibiting potential of drugs, and as a therapy for severe psychotic depression. In this small volume, Essman describes some of the biochemical changes that accompany electrically induced seizures, particularly changes in electrolytes, catecholamines, macromolecular cellular elements, and cerebrospinal fluid. Most of his data are derived from rodents, and are presented in sufficient detail to stimulate the reader's interest in their possible relation to associated behavioral changes.

Essman reports inhibition of protein synthesis and a fall in RNA concentration within five minutes of ECS, with the decrease persisting for a number of hours. Acetylcholinesterase activity and acetylcholine levels in the brain first fall after ECS, but rise above the pre-ECS levels within two hours. These changes are reflected in choline levels in the cerebrospinal fluid, which in man and monkey are increased 24 hours after a single seizure and remain elevated for at least a week after multiple seizures. Essman also finds that the degree of protein and cholinergic change with ECS varies with the age of the animal.

Such observations are pertinent to concepts of memory mechanisms, for they provide biochemical correlates of behavioral events. But behavioral observations are lacking in these studies, and the reader is left to make these comparisons from his own experience. As for their pertinence to convulsive therapy, Essman's data are consistent with hypotheses which relate behavioral changes to persistent increases in cholinergic activity (*1*). But the observations presented are inadequate for the critical tests proposed by Kety (*2*) and Ottosson (*3*) for a relation to the convulsive therapy process—biochemical changes must have a time course similar to the behavioral effects, they must be specific and not part of a general bodily defense pattern, and when produced by alternative means they must elicit the same behavioral events—hence judgment about their relevance for the therapy process must be deferred.

The volume is one of the first to examine the biochemical events of ECS, and although premature it is commended to those seeking clues to the biochemistry of memory and the therapy of depression.

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References

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2. S. Kety, *ibid.*, pp. 231, 285.
3. J. O. Ottosson, *ibid.*, p. 209.

Theory of the Solid State

Theoretical Solid State Physics. WILLIAM JONES and NORMAN H. MARCH. Wiley-Interscience, New York, 1973. Two volumes. Vol. 1, Perfect Lattices in Equilibrium. xvi pp. + pp. 1–680, illus. Vol. 2, Non-equilibrium and Disorder. xvi pp. + pp. 681–1302. Each volume, $39.50. Interscience Monographs and Texts in Physics and Astronomy, vol. 27.

As a mature subject theoretical solid state physics is now of such scope that many journals with thousands of pages published annually are necessary to report on the activity in the field. It is not surprising, therefore, that books attempting to survey the whole of the subject have not appeared for some

years. Surely, this book by Jones and March is the first book since Ziman's *Principles of the Theory of Solids* (1960; second edition 1972) that has attempted to treat a large segment of the field at both the professional and the pedagogical level. There are several satisfactory introductory (graduate or advanced undergraduate) texts on solid state; but by and large even the most recent of these do not really "roll up their sleeves" and get into the details of modern calculations as employed in research. These two volumes have set out to do just this, and, somewhat to this reviewer's surprise in view of the magnitude of the task, the authors have produced a very informative compendium of recent activity in theoretical solid state physics.

These two volumes definitely should be bought by any library that hopes to have a reasonably balanced reference text covering the past decade of theoretical solid state. It is not likely that students can afford them, but they would be of great use to someone teaching an advanced graduate course in solid state theory—not necessarily as a text, but as a guide to topics and literature, enriched by spelling out of details, and to snags in calculations. The material is readable by any well-trained student with a year's graduate experience who has had an introductory course in solid state physics.

Volume 1 deals with equilibrium properties (electronic, lattice, and magnetic phenomena). Volume 2 covers transport, defects, superconductivity, and optical properties. Where needed, symmetry theory, many-body theory, Green's functions, and diagrammatic perturbation techniques are introduced. It is these methods that, not having been used extensively in solid state until the past 10 or 15 years, have not found their way into most general surveys of the subject. Here the details of the methods are given, both in the text and in appendices.

A more specific listing of topics, though still abbreviated, is as follows. Volume 1: foundations of symmetry and crystallography; Bloch, Wannier, and other representations, with some examples from calculations; collective properties of the electron gas, with application of many-body methods; the inhomogenous electron gas; phonons, with some discussion of anharmonicity, and phonon Green's functions; magnetism, spin waves, magnetic phase transitions, dynamics of magnetic systems; interaction of particles with a crystal (phonon and neutron scattering). Volume 2: transport theory; optical properties; superconductivity; polarons and excitons; defects and disordered systems. Both volumes have extensive and useful appendices; of particular note to this reviewer are the selection of topics in group theory as applied to solid state and the summary of many-body techniques.

Overall this ambitious project has come off well. As the authors themselves recognize, no single group of theorists at present is in a position to have first-hand knowledge of the whole subject, and they have consulted various well-informed colleagues in an effort to be complete. Nonetheless, the scattered discussion of phase transitions, the absence of discussion of quantum solids and related topics, and the cursory treatment of optical properties (except for metals) are definite deficiencies, in this reviewer's opinion. Another reservation concerns the style of presentation of the material. Although the presentation is extensive it is sometimes uneven, often carrying derivations out in much greater algebraic detail than seems necessary or repeating material that can be found in many introductory texts. This can show a student at least some of the pitfalls which are otherwise hidden, but it makes for a voluminous book.

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The Pyrethroids

Pyrethrum. The Natural Insecticide. Papers from a symposium, St. Paul, Minn., Aug. 1972. JOHN E. CASIDA, Ed. Academic Press, New York, 1973. xviii, 330 pp., illus., + plates. $16.

Pyrethrum is a flower, rather than an insecticide. Specifically it is the generic name of a group of plants from which is extracted "pyrethrin," made up of a mixture of four esters derived from two acids and two alcohols. Pyrethrin is widely used for domestic purposes, because of its very low hazard and rapid action. Synthetic pyrethroids, such as allethrin, have been available for years, but recently a new group of synthetic compounds has leaped into prominence. These are compounds such as resmethrin, first described in 1967. This and its derivatives may usher in a new era of astonishingly potent yet safe compounds, which will have the distinction of a botanical pedigree but which will be produced synthetically.

This book is the outcome of a conference sponsored by the Pyrethrum Board of Kenya. Perhaps as a result, it dwells almost exclusively upon naturally occurring pyrethroids, and it is a disappointment that a book published at this point in time fails to mention the new synthetics even in the section "pyrethrum in the future." This fact and the use of the term "natural insecticide" in the title will tend to reinforce a widely held and absolutely false notion that naturally occurring insecticides are safe and synthetic ones are dangerous. The fallaciousness of this view can be illustrated by pointing to the considerable hazard of the "natural" insecticide nicotine and the remarkable safety of such synthetic compounds as malathion and carbaryl.

The book certainly provides a very comprehensive picture of all aspects of natural pyrethroids. About one-third is devoted to practical considerations, describing the utility of these compounds in controlling a variety of pests. The chapters dealing with control of agricultural and forest insects will be of special interest because use of pyrethroids for these purposes has been very small, owing to their high cost and brief effectiveness. Another third of the book deals with toxicity and mode of action; the brevity of the nine-page chapter on teratogenic, carcinogenic, mutagenic, and allergenic effects bears witness to the amount still to be done in this area, particularly with an insecticide in which human inhalation is probably more common than with any other pesticide. The balance of the book deals primarily with the chemistry and biochemistry of natural pyrethroids, their history, and (briefly) their production.

Within the limitations indicated above, this is an outstanding book. Each chapter is written by an outstanding authority, and the totality of the coverage and the excellence of the book's production make it an extremely satisfying book to read. For the average reader, it may tell more about pyrethrum than he wants to know. But for anybody working seriously with the chemistry, biochemistry, or utilization of insecticides, it will provide plenty of interesting reading, and an invaluable reference source.

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