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

1. A. Karczmar, in *Psychobiology of Convulsive Therapy*, M. Fink, S. Kety, J. McGaugh, T. Williams, Eds. (Winston, Washington, D.C., 1974), p. 251; M. Fink, *ibid.*, p. 1.
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