Since the objectives of the symposium were not stated, the reader can assume them. The volume, in any case, does provide a considerable amount of interesting and new material and some more recent approaches to concentration of radionuclides in biological systems. It should prove to be a useful reference to studies in this field carried out in many parts of the world. A nuclide index is included which may be helpful to many.

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Light on a Clouded Hypothesis

Set Theory and the Continuum Hypothesis. PAUL J. COHEN. Benjamin, New York, 1966. 160 pp., illus. Cloth, $8; paper, $3.95.

In 1939 K. Gödel showed that the Zermelo-Fraenkel axioms of set theory were not strong enough to refute Cantor's continuum hypothesis. Gödel's attack on set theory had the startling feature that it made essential use of the properties of language: it was the nature of the language of the axioms of set theory, rather than the intended meaning of those axioms, that made it impossible for them to refute various hypotheses of set theory. In 1963 P. J. Cohen completed Gödel's linguistic attack on set theory by introducing the immensely valuable, syntactic notion of forcing, and by using it to demonstrate that the axioms of set theory were not powerful enough to prove Cantor's continuum hypothesis. Thus the presently existing axioms of set theory leave the most celebrated hypothesis of set theory shrouded in uncertainty.

This book, as its jacket indicates, is intended for those who are not specialists in mathematical logic. I believe that specialists too would benefit from a perusal of it, for it avoids the dense clouds of dirty details that fog up most books on mathematical logic and thereby obscure all the shining ideas. Mathematical logicians, as a class, seem more afraid than most other kinds of mathematicians of making mistakes. Cohen seems to have no such fear, and consequently he succeeds in presenting in the first two-thirds of his book a delightfully clear and intuitive account of Gödel's work on undecidable sentences of formal number theory and on the irrefutability of the continuum hypothesis, an account that can be readily comprehended by nonlogicians. It is true that the beginner will experience difficulty in filling in details, but he can, if he wishes, extract them from other books and, more important, he can take comfort in the fact that a truly modern mathematician does not require a detailed understanding of the ideas he uses before he uses them.

Section 3 of chapter 3 contains the most penetrating exposition of Gödel's notion of absoluteness that I have seen in print. It is also good to see (section 4 of chapter 3) in print at long last a precise version of the well-known observation that the power set axiom can be proved to hold in L without using the full power of the replacement axiom. Incidentally, line 9 of section 4 of chapter 3 demonstrates that the author, despite the solemnity of his undertaking, is not without humor.

The final section of the book touches, as is fitting, on philosophical matters connected with the continuum hypothesis. The author conjectures that the mathematicians of the future will see clearly that the continuum hypothesis is false. He seems to base his conjecture on the idea that the iterative principle needed to form aleph-one is less "bold" and less "rich" than the iterative principle needed to form the power set of aleph-null. Before he states his conjecture and the grounds on which it rests, he notes, quite rightfully, that most mathematicians hold the idealist view concerning the existence of sets, and that as a consequence they regard discussions of the truth or falsity of the continuum hypothesis as meaningful. One must wonder if mathematicians of the future will regard such discussions as meaningful. After all, there was a time when most deep thinkers regarded the following kind of talk as sensible: "Now being is predicated absolutely and primarily of substances; it is predicated secondarily and as in a qualified sense of accidents. For this reason essence is truly and properly in substances. . . ." I conjecture that the number of present-day mathematicians who find Aquinas's discussion of being and essence meaningful will equal the number of mathematicians of the future who will find discussions of the truth-value of the continuum hypothesis meaningful.

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A Challenge to Those Who Would Avert Starvation

Famine—1975! America's Decision: Who Will Survive? WILLIAM PADDOCK and PAUL PADDOCK. Little, Brown, Boston, 1967. 286 pp., illus. $6.50.

From its title, one might infer that this book is an attention-seeking potboiler, on one of today's ever more gripping and therefore popular subjects. It is not. It is deadly serious, a solemn analysis of things to come in the food domain, together with a proposed plan for action in a field where others have none. The brothers William and Paul Paddock are unusually qualified to write on the subject of food, population, and related problems in underdeveloped countries. Paul Paddock has served in the U.S. Foreign Service for over 20 years, almost entirely in underdeveloped countries. William Paddock is an agronomist, and has spent most of his professional life in the underdeveloped countries of Latin America. They have written one earlier book—*Hungry Nations* (1964)—devoted to the analysis of how food production might be increased in underdeveloped countries. The present volume is incomparably better—sparkling and gripping in style, closely reasoned, inexorably logical. It is to be recommended to all those interested in the shape of our world in the next ten years.

The basic thesis of the brothers Paddock is that famine must inevitably come to the underdeveloped nations, beset as they are and have been in recent years by unprecedentedly rapid rise in population and unforeseenly slow rate of increase in food production. All serious students of the plight of the underdeveloped nations agree that famine among the peoples of the underdeveloped nations is inevitable. The U.S. Department of Agriculture, for example, sees 1985 as the beginning of the years of hunger. I have guessed publicly that the interval 1977–1985 will bring the moment of truth, will bring a dividing point at which the human race will split into the rich and the poor, the well-fed and the hungry—two cultures,

the affluent and the miserable, one of which must inevitably exterminate the other. The Paddocks are both more pessimistic and more realistic. They pinpoint 1974 as the year of onset of general, widespread famine, and round the date off to 1975 for convenience. Their book both documents convincingly the basis for their conclusion and supplies, as no one else has done, a realistic suggestion for American action during the years of food crisis.

That famine must come to the underdeveloped nations is self-evident, because it is already there. Widespread starvation has been averted in China, India, Egypt, and other countries only by the massive importation during recent years of grain from those few nations which still have surplus, the United States, Canada, Australia, and the Argentine. The first 201 pages of this book are devoted to an extraordinarily detailed analysis of the present famines, their cause, and the possible ways in which they might be mitigated. That to hope for a "technological fix," getting food from the sea, for example, is unrealistic is convincingly demonstrated. The clear-cut, well-documented conclusion is that (i) population growth (now greater than 3 percent a year in many places) cannot be slowed sufficiently before (ii) the present exceedingly slow increase in agricultural productivity (less than 1 percent a year), which also cannot be importantly influenced in the short time available, causes (iii) a decrease in available per capita food supplies in many of the developing nations to levels below those at which the life of their populations can be sustained. I stress again that all responsible investigators agree that the tragedy will occur. They differ only as to whether it will take place in ten years or less, or in ten years or a little more. The underdeveloped world is on a collision course with starvation. No technology short of nuclear warfare can be spread with sufficient speed to avert the catastrophe. The only remaining question for the United States and for the nations of the developed world is how to deal with the starving nations, when starvation comes. The remaining 47 pages of the book are devoted to this matter.

To the problem the Paddocks propose a cold-blooded, but logically realistic solution. Let the developed nations not attempt (it would be logistically impossible anyway) to help all starving peoples equally. Let them instead establish criteria by which the hungry nations may be divided into three categories, to wit, those which given food and technical help may be able to develop into self-sufficient countries; those which cannot so develop, which are hopelessly enmeshed in their own backwardness; and the "walking wounded" which with minimal support may be able to survive. In short, let the developed nations use their food surplus (and we will have to become much more vegetarian than we are at present if we are to have the required surplus) as an instrument of selection, helping and indeed permitting those peoples of the underdeveloped nations who have done best by the standards of our industrial-technical society to survive, and purging the remainder. A grim solution. Does anyone have a better?

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Lectures for Chemists

Nuclear Magnetic Resonance for Organic Chemists. D. W. MATHIESON, Ed. Royal Institute of Chemistry, London; Academic Press, New York, 1967. 297 pp., illus. $10.50.

"The chapters which comprise this book were delivered as a series of lectures at a summer school . . . in 1964. The course . . . was run specifically for Organic Chemists and was primarily concerned with the interpretation of NMR spectra in terms of molecular structure." This quotation from the preface explains, in part, some of the shortcomings of the book. Although each of the contributors is an acknowledged expert, the quality of the chapters shows enormous variation. Jarring discontinuities appear in several places; for example, the A_2B, A_2BX_2 type of designation is introduced without comment, and relaxation times and saturation effects are mentioned without a word of explanation. It also appears that the editor and contributors have been overly condescending in compiling a practical text for the organic chemist. Their desire to be qualitative leads them to omit many important aspects of theory the neglect of which, it seems to me, would seriously hamper the understanding of NMR, even by a practical organic chemist.

The chapter on principles is quite inadequate, not even explaining the origin of the Larmor precession frequency or its relation to the strength of the external magnetic field. The chapters on chemical shift are generally useful. Those on spectral analysis of complex spin systems quote line frequency-intensity tables without ever setting up even the simple quantum mechanical problem of the AB system. It is difficult for me to believe that the reader will fully understand and appreciate such tables and energy diagrams unless he knows their origin. For reasons which escape me the difficult ABC system is discussed before the ABX one. The chapter on the latter is a good, complete, extensive discussion of the practical analysis of ABX systems. Four-spin systems are discussed much less completely than is possible even with a qualitative approach. The AA'XX' system could certainly have been dealt with by consideration of its two AB subspectra. A generally useful section on proton-proton coupling and stereochemistry is followed by one on "other nuclei," which should provide incentive for those used to thinking of only proton work. Problems (and their answers) at the end cover a reasonable range of complexity, with those involving spectral analysis probably being the most useful because of the present abundance of problems of the spectra-structure type in which only chemical shifts and integral data are utilized. The number of errors is modest. An amusing instance is the incorrect statement on page 91 that $D_+ \geqq D_- \geqq 0$ for ABX, whereas a worked problem on page 263 is an example in which $D_+ < D_-$.

In summary, it seems that this text is too late with too little. It does not seem to fill any gap in the presently available reference works.

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17th-Century Atomic Theory

Atomism in England from Hariot to Newton. ROBERT HUGH KARGON. Oxford University Press, New York, 1966. 178 pp. $6.75.

Kargon seeks a reappraisal of the introduction of atomism in 17th-century England. Well aware of the fallacy of chaining the history of science to an internal, technical account, he