of doctoral theses. Now the editor of *Nuclear Science and Engineering* has also asked me to evaluate a thesis! Certainly Dr. Stacey's thesis is a nice scholarly piece of research. It first develops the formation of the general modal approximation in some detail and then makes a few interesting applications, particularly to fast-reactor systems. It should have been abstracted and published as a couple of interesting papers in this (or a similar) journal. A student who wished to delve into the highly specialized subject matter more deeply should have been able to obtain the thesis in some other form, for example, as a microfilm or soft-bound copy. I doubt that there will be enough such students to justify its publication as a book.

Paul F. Zweifel
Department of Physics
Virginia Polytechnic Institute
Blacksburg, Virginia 24061

July 5, 1968

About the Reviewer: Paul Zweifel, who is Professor of Physics at VPI, has contributed to these columns in the past, most recently in 1966. His career, following completion of his graduate studies at Carnegie Tech and Duke, has been divided among laboratories and academic institutions. He has served at KAPL, the Middle East Technical University, and, more recently, at the University of Michigan.

Nuclear Chemistry, Vol. I. Edited by L. Yaffe. Academic Press, New York (1968). 465 pp. $22.00.

A recent elucidation of the term "nuclear chemistry," offered by A. M. Weinberg, suggests that nuclear chemistry began as nuclear physics, ceased to command the interest of physicists, and was taken over by chemists. *Nuclear Chemistry* offers further exposition of the term and is an ambitious attempt to cover, in a series of topical review articles, much of the research that is of interest to nuclear chemists. The topical review articles are written by experts, mostly by nuclear chemists who are actively engaged in these subcategories of nuclear chemistry.

Volume I of the series, which is being reviewed here, treats the study of nuclear reactions extensively. Chapters on experimental nuclear spectroscopy and nuclear models are also included.

Chapter 1, "Nuclear Models" by T. D. Newton, presents the basic assumptions underlying particular nuclear models and develops these assumptions into working form. Although some subjects are treated extensively, e.g., transformation of the collective Hamiltonian from the space-fixed frame to the intrinsic frame, the chapter is extremely brief. The reader could best find this information elsewhere.

"Low Energy Nuclear Reactions" by N. T. Porile, as the second chapter, "discusses those features of low-energy nuclear reactions that are of particular relevance to nuclear chemistry." Accordingly, the compound nucleus and the statistical theory of nuclear reactions are covered well and in great detail. Unfortunately, direct nuclear reactions are not considered to be particularly relevant judging from the space devoted to them. Much emphasis is placed on the Butler plane-wave theory, now out of vogue, instead of the more successful distorted-wave theory, which is mentioned only briefly.

The third chapter, "High Energy Nuclear Reactions" by J. Hudis, discusses a field almost exclusively reserved for nuclear chemists. An excellent discussion of experimental techniques related to the study of high-energy nuclear reactions is presented, as well as a detailed treatment of the calculation of the nucleon cascade and subsequent evaporation path. A well-balanced presentation, outlining the interplay of theoretical predictions with experimental results, mostly those of the Brookhaven group, is given.

J. M. Alexander presents in Chap. 4, "Nuclear Reactions by Recoil Techniques," an extremely comprehensive survey of the field. Recoil ranges and angular distributions are extremely powerful tools in studying nuclear-reaction kinetics and mechanisms, as is shown in this chapter. Innumerable references to original works and relations for use in the analysis of recoil experiments will be useful to the researcher and student alike.

A necessarily brief resume of the techniques used in "Experimental Nuclear Spectroscopy" is offered in the fifth chapter by J. M. Hollander. This chapter effectively summarizes the use of high-resolution semiconductor detectors for electrons, alpha particles, and gamma rays and the use of magnetic spectrometers. The measurement of the properties of the nuclear ground state and excited states via directional correlations and internal conversion electron spectroscopy is also given some consideration.

A. Zucker and K. S. Toth present in the last chapter, "Heavy-Ion Induced Reactions," a complete survey of heavy-ion evaporation and transfer reactions; but, unfortunately, do not cover "in-beam" spectroscopy, an area of great research interest to nuclear chemists. The short subchapter devoted to transuranium element production and identification is particularly timely in light of the clamor for new heavy-ion accelerators and the search for elements 114 and 126.

In summary, *Nuclear Chemistry* contains several scholarly, well-written reviews, the titles of which are perhaps too general for the material presented. The book should prove useful not only to the nuclear chemist but to the student and researchers in other related fields as well.

Curtis E. Bemis, Jr. and Richard L. Hahn

Oak Ridge National Laboratory
Oak Ridge, Tennessee 37830

July 18, 1968

About the Reviewers: Curtis E. Bemis, a nuclear chemist in the Transuranium Research Laboratory at Oak Ridge National Laboratory, is engaged in studies of the nuclear properties of the heavy elements as well as the production and identification of new transuranium element isotopes. He received the BS degree from the University of New Hampshire and the PhD degree from M.I.T. in 1964, and did post-doctoral work at the Research Institute for Physics, Stockholm, in 1965.

Richard L. Hahn is also a nuclear chemist at the Transuranium Research Laboratory of Oak Ridge National Laboratory. He graduated from Brooklyn College and did graduate work at Columbia University, receiving the PhD degree in 1960. Dr. Hahn has had extensive experience in the study of nuclear-reaction mechanisms and in the characterization of alpha-active nuclides.