applications of linear equations. In the work on the Laplace transform the subject of the Heaviside function and impulse function are mentioned, but the authors miss a golden opportunity to bring in the superposition integral. Series solutions are given adequate attention, but the special functions are treated in a very cursory manner. The chapter on graphic and numerical equations contains a brief but welcome treatment of Van der Pol's equation. The last portion of the book contains a fairly standard introduction to partial differential equations and boundary value problems.

The main criticism I have is that the authors in their efforts to keep the work elementary and understandable to the applied scientist, have not been too careful in their statements of definitions and restrictions. A good example of this is the introductory chapter where, following the bad tradition of many others, the authors use "fuzzy" expressions like "general solution," "number of distinct arbitrary constants," and the like.

On the whole the book is a good one and should find wide use in first courses for engineers and scientists.

NICHOLAS J. ROSE

Department of Mathematics,
Stevens Institute of Technology

Psychomotor Aspects of Mental Disease. An experimental study. H. E. King. Harvard Univ. Press, Cambridge, Mass., 1954 (for the Commonwealth Fund). xiv + 185 pp. Illus. $3.50.

In the early days of experimental psychology Kraepelin applied its methods to the study of abnormal states. King points out that the experimental study of simple processes that thus began was not really proved useless but rather was lost to view in the appearance of the more spectacular teachings of the psychoanalysts.

Encouraged by the outcome of his previous work on brain-operated patients, King undertook a comparison of several abnormal and normal groups with regard to what are called the fine psychomotor functions. Experiments of this sort require the subject to perform some simple movement or manipulation not requiring much strength on the occasion of the appropriate stimulus. It is well established that such performances, measured for speed and accuracy, do not correlate well with test intelligence in a normal group, nor indeed do they show great correlation with one another. It is usually stated that there is no general psychomotor ability, but it is possible to discern certain groupings of similar tasks from their correlations. By his choice of tasks, King has sampled three of these groupings: "Speed of single reactions," "finger, hand, and forearm speed in restricted oscillating movement," and, "precision." His subject groups are chronic schizophrenes, pseudoneurotic schizophrenes, neurotics, and normals, with the chronic schizophrenes further divided into three groups on the basis of severity of disorder.

His results show a clear, downward progression of average performance in all tasks from the normal through the most disturbed schizophrenes. The differences are quite apparent, ranging up to a 65-percent loss, and their statistical significance is demonstrated by a simple t-test. The tests discriminate well enough between groups to be useful, especially in combination, as diagnostic indicators, and, easy as they are to apply, they might be a standard aid to the clinician.

All the performances tested turn out to vary in a similar way with the severity of behavior disorder. Psychologically it is important that under such a powerful influence the discreteness of psychomotor functions is lost: fundamentally they must have much in common.

As King observes, his results generally agree with and extend the conclusions of a series of experimenters since Kraepelin. One reason that such results have received scant attention is their isolation. It is hard to see how deficiencies in simple reactions are related to the gross behavior disorders of the psychiatric patient. King has a suggestion to offer. He quotes Sperry's proposition:

> The entire output of our thinking machine consists of nothing but patterns of motor coordination. Cerebration essentially serves to bring into motor behavior additional refinement.

Such a unified view of behavior would be a bold solution, but King seems unwilling to venture quite so far. His view is that for the lower organisms all behavior is motor behavior and that for human beings motor behavior remains important, although they have, in addition, something called "mentation." This persisting Cartesian division still leaves our theory in a state of schizophrenia. With good reason, therefore, King favors study of the relationship of psychomotor functions to other kinds of behavior, and his work offers proof that it would be fruitful.

R. C. DAVIS

Department of Psychology, Indiana University

The Elementary Chemical Composition of Marine Organisms. Memoir No. 2. A. P. Vinogradov. Trans. by Julia Efron and Jane K. Setlow. Sears Foundation, Yale Univ. Press, New Haven, Conn., 1953. xiv + 647 pp. $17.

In this monumental work, Vinogradov intended to provide a factual and theoretical basis for and to stimulate interest in the development of marine geochemistry from Vernadsky's biogeochemical point of view. In addition to surveys of the analytical data available for nonplanktonic marine algae, marine plankton, marine bacteria, marine flowering plants, and the marine representatives of each of the major invertebrate phyla, the lower chordates, and fishes, he has included separate discussions of the metal-containing respiratory pigments, of the mineralogical composition of skeletons of marine organisms, of the regulating influence of ocean salt on the chemical

composition of marine organisms, and of the fundamental changes in elementary composition of marine organisms during geological time. Based on the most extensive bibliography of analyses of marine organisms so far assembled, this study also includes much unpublished work from the files of the Vernadsky Laboratory for Geochemical Problems. A work of such scope is of inestimable value to marine biologists, geochemists, sedimentary geologists, comparative physiologists, and students in many other fields, and especially so since it can be assumed that Vinogradov summarized the basic assumptions and the theoretical approaches common to workers at the Vernadsky Laboratory, certainly the major world center of biogeochemical research.

In making this material available to non-Russian-speaking scientists, the translators, bibliographers, and editors have performed a heroic task. The entire text has been brought up to date as of about 1946 and much later material has been added, the bibliography has been thoroughly corrected, all text references have been made specific, and in many sections the taxonomy has been unified and revised. A comparison with some of the author's earlier publications in English indicates that his style has been treated with full justice throughout and that his ideas come through unscathed. One suspects that this volume is now as essential to the Russian workers as to any others.

Considering the enormous amount of effort that it represents, this monograph leaves a regrettably unsatisfactory impression. In a work of such scope it must be expected that specialists will be conscious of neglects of emphasis and of superficialities in discussion; an editorial note points out many cases of conclusions not generally accepted by specialists in the appropriate fields or not borne out by more modern investigations. I feel that too much caution was exercised in retaining in the various tables analyses either obviously untrustworthy or certainly superseded by modern techniques. The occurrences in the discussion of conclusions directly contradicted by the pertinent tables of data may perhaps be blamed on the greater ease of revising tabular material; in any case, such contradictions occur frequently.

As evidence of the theoretical approach of the Russian school of biochemists, one can only deplore the general lack of emphasis on the biology of the organisms being analyzed. Especially striking is the omission of mention of the variability of symbiont populations of sponges and corals. Unfortunate, too, is the lack of any thoroughgoing attempt to correlate variations in trace-element content with the available data on enzyme activation. The chemical discussion loses force by omitting any consideration of the physical-chemical states of the trace elements in sea water and of the correlated activities of organisms as ion exchangers or colloid adsorbers. It seems unlikely, for instance, that the uptake, as opposed to the metabolism, of arsenate and vanadate can ever be profitably considered apart from that of phosphate.

Regardless of what appear as its many deficiencies in laying the theoretical groundwork, which was one of its aims, there is a factual basis here for virtually all future investigations into the elementary chemistry of marine organisms and sediments, and we may be sure that the volume will be the major bibliographic starting point for decades to come. As a stimulus to interest, this volume promises to be a success, although the sheer mass of the work may be a major drawback. Gratitude for the elegance and substantiality of the book conflicts in one's mind with horror at the price. Special efforts must be made by librarians to make copies available to the students who should feel and most easily respond to its stimulation.

VAUGHAN T. BOWEN
Woods Hole Oceanographic Institution

Qualitative Inorganic Analysis. A new physico-chemical approach. G. Charlot. Trans. by R. C. Murray. Methuen, London and Wiley, New York, ed. 4, 1954. xi + 354 pp. Illus. $7.

Like many other textbooks on qualitative analysis, this one is suitable for work on a semimicro scale; it is divided into three parts: "Theory," "Chemical properties and the characterization of ions," and "Technique and methods of qualitative analysis." From this point on, however, the differences are more numerous than the resemblances. Few precipitations are made, and the precipitates seldom require washing. The tests are independent of one another and generally do not require separations of ions as a prerequisite. The author believes that a complete analysis can be made in 2 hr or less. The theory studied in part I is required if the procedures for making tests are to be understood.

About 190 pages in part II are devoted to the properties of, and the tests for, more than 100 substances, mostly ions, about equally divided between cationic and anionic groups. About five pages are devoted to directions for analysis. References are made in part III to descriptions of tests in part II. Tests for 27 cations (37 if multiple valences of some ions are counted) are made on separate samples taken from one solution with only occasional removal of interfering ions as prescribed in special cases. Many tests are by, or are similar to, the spot test. For some tests catalysis or controlled *p*H and/or redox are prescribed.

The theory is fully as difficult as that presented in the ordinary textbooks on qualitative analysis. The procedures are simpler in that there are fewer procedures before the final test for an ion is made. In fact, many final tests can be made on a 1-drop sample taken from the original solution. All the theory should be mastered; it is necessary to know it before the reasons for the procedures can be understood. However, with an open book one might make a successful analysis without knowing any of the theory. The introduction states that no special knowledge of physical chemistry is necessary since everything that