cent developments in molecular orbital theory" (27 pages), H. C. Longuet-Higgins; "Intermolecular forces and equation of state of gases" (31 pages), Taro Kihara; "On statistical mechanics and electromagnetic properties of matter" (52 pages), P. Mazur; and "The application of the theory of stochastic processes to chemical kinetics" (38 pages), Elliott W. Montroll and Kurt E. Shuler.

PAUL C. CROSS
Department of Chemistry,
University of Washington

Flavor Research and Food Acceptance. A survey of the scope of flavor and associated research, compiled from papers presented in a series of symposia sponsored by Arthur D. Little, Inc. Reinhold, New York; Chapman and Hall, London, 1958. vi + 391 pp. Illus. $10.

This book, based on a series of four symposia organized by Arthur D. Little, Inc., in 1956–1957, integrates the related aspects of food flavor revealed by sensory testing, consumer testing, psychology, physiology, and chemistry. The topics are presented by leading authorities among research consultants, universities, government research laboratories, and the food industry. The physiological basis of flavor is described as the adsorption of certain characteristic chemical components on the surface of the taste receptor cells on the tongue, which results in electrical depolarization of these "chemoreceptor" surfaces. This in turn induces electrical impulses in the nerve fiber; the frequency of these impulses is directly related to the strength of the chemical taste stimulus. Electrophysiological tests on single nerve fibers of the rat show that most of these fibers respond in varying degrees to more than one of the salt, sour, bitter, and sweet categories. These sensations, therefore, do not correspond to individual basic receptor types.

Organoleptic testing by laboratory panels is described in terms of techniques for detecting difference from a standard. The statistical significance of the findings is shown to be dependent on panel size, degree of difference sought, and design of the test. Descriptive testing of complex flavors can be accomplished by the flavor-profile method originated by Arthur D. Little, Inc. This is a method of subjective analysis by trained panels, which considers total flavor amplitude plus independently recognizable aroma and flavor components, according to type, intensity, and order of perception. Methods of scoring and ranking flavors are discussed, both generally and specifically, in relation to dairy products. Suggestions are offered with respect to selection of experimental media to use in evaluating separate flavor components, methods for separating odor samples and presenting them to test subjects, and adequate design and control of the test environment (the physical setting, handling of samples, and selection, training, and motivation of judges).

A chapter devoted to the importance of new-product development from management's point of view emphasizes the need for business-economic appraisals of market and profit opportunity to guide research. Consumer testing serves to reduce the risks attendant on product development.

Some classifications of tests are presented, including the following: (i) blind paired comparisons; (ii) paired comparisons of identified products, in which identification allows for the effects of the package or the product image in the consumer's mind; (iii) monadic testing, in which standard, experimental, and competitive products are randomly sampled in identical packages (one to each tester), and in which a later survey is used to determine the acceptance of experimental samples relative to the total market; (iv) scaling tests, useful when there are several contending experimental products; (v) continued-use tests to establish the duration of an initial acceptance or rejection; and (vi) multiple-paired comparisons, in which a number of variables may be appraised in a statistical design; this test provides more information than is available from stepwise paired comparisons without requiring an increase in the number of testers.

A chapter devoted to the Nielsen method of market analysis shows how sales trends can be used to measure the effects of new-product promotion and to study the vulnerability of established products.

A section of seven chapters gives in detail the experiences of six food manufacturers and one oil refiner in their applications of organoleptic product-acceptance testing.

The final section covers analytical investigations of complex natural flavors by physicochemical separation of their important components. Some of the tools employed for these purposes are described—for example, distillation, selective solvent extraction, liquid and vapor phase chromatography, countercurrent distribution between immiscible solvents, mass spectrometry, and infrared spectroscopy. A recent approach to flavor development in processed foods is described, which employs postprocessing treatment with specific enzymes designed to react with surviving flavor precursors. The chromatographic separation of strawberry oil derivatives in the Swiss laboratories of Firmenich is described, with experimental details. A parallel study made in the U.S. Department of Agriculture laboratories, which employed vapor phase chromatography, is also presented.

Investigations of flavor in dairy products emphasized the usefulness of the 2,4-dinitrophenylhydrazine derivatives in identifying flavor components. The odor of Cheddar cheese has been related to beta-methylmercaptopropionaldehyde. Following a chapter on the analytical separations of limonene sulfides, analytical details and extensive data on the composition of citrus oils are reported, from the U.S. Department of Agriculture laboratories in California.

A summation chapter by A. J. Haagen-Smit draws a rather tenuous thread of continuity through the otherwise loosely related separate chapters. Several chapters carry extensive bibliographies, and an alphabetical subject index is provided.

L. W. ELDER
Research Center,
General Foods Corporation

International Directory of Psychologists Exclusive of the U.S.A. Prepared for the National Academy of Sciences-National Research Council by the Committee on an International Directory of Psychologists, Division of Anthropology and Psychology. Publication 520. Eugene H. Jacobson, Ed. H. C. J. Duijker, European Co-Editor. National Academy of Sciences-National Research Council, Washington, D.C., 1958. xii + 527 pp. $5.

This book contains information about psychologists in all countries outside the United States. Plans for this directory were prepared by a committee of the National Academy of Sciences–National Research Council; Edwin G. Boring served as chairman of the committee. Since the American Psychological Association publishes a directory of psychologists in the United States, it was decided that the *International Directory* should not duplicate that effort.

The arrangement of the directory is alphabetical by country and by name under each country. The following information is supplied for each entry: Name and title; preferred mailing address; date of birth; place of birth; highest earned academic degree; university granting degree and year in which degree was granted; membership in professional societies; editorial responsibilities; current occupation; primary fields of interest in psychology; and sex.

An index of names adds to the usefulness of this compilation.