Continuous spectra are treated in the second contribution, by Wolfgang Finkelnburg and Theo Peters. This article (in German) is well organized, covers the field with admirable completeness, and is a reliable source of information.

The third chapter, on crystal spectra, is written (in German) by Eugen Fick and Georg Joos. It excels throughout in clarity and thoroughness, whether it is dealing with the description of phenomena, the presentation of results, or the exposition of theory.

The Zeeman-effect is the subject of the fourth article (written in English). Its author, J. C. Van Den Bosch, is a member of the staff of the famous Zeeman laboratory in Amsterdam. This chapter covers most of the material which is essential for the experimenter. The theoretical discussions are based upon the vector model. The quantum mechanical treatment is found in volume 35 of this encyclopedia. This rather concise article would have gained by the addition of a detailed list of publications relative to the different elements.

The last chapter (in French), on natural optical activity, is by Jean Paul Mathieu. The presence of this chapter in a volume of spectroscopy is rather peculiar but must be justified by interpreting the term *spectroscopy* in a rather broad sense. This article is a thorough, clear, and attractively presented contribution. Historical remarks and general laws, methods of measurements, and optical activity of isotropic and anisotropic media are the main subject-divisions.

Subject indexes in German-English and English-German and a table of contents, in French for the last article, conclude the volume.

K. W. MEISSNER

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Synthetic Methods of Organic Chemistry. vol. 10. With reaction titles and cumulative index of vols. 6 to 10; vol. 11. W. Theilheimer, Ed. Karger, Basel, Switzerland; Interscience, New York, 1956, 1957. 746 pp.; 494 pp. $25.25; $20.

In volumes 10 and 11 of this series of annual publications, the editor has continued the important compilation of new synthetic methods and of improved old procedures in the field of organic chemistry.

The tenth volume contains a cumulative alphabetical index for volumes 6 to 10 and, in the body of the text, all reaction titles of these volumes. Most of the entries in the tenth volume deal with publications which appeared in the years 1953–1955. Each abstract enumerates starting materials, products, reaction conditions, and yields. In addition, the original literature and, sometimes, supplementary references are given. This pattern is continued in the eleventh volume, which contains abstracts from papers published between 1954 and 1956. A total of 1679 abstracts are published in these two volumes. They should be of great value to chemists who wish to keep up to date on important developments in synthetic organic chemistry.

HENRY FEUER

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The Direction of Research Establishments. Proceedings of a symposium held at the National Physical Laboratory, 26–28 Sept. 1956. National Physical Laboratory. Her Majesty's Stationery Office, London, 1957 (order from British Information Services, 45 Rockefeller Plaza, New York). Four sections. $4.50.

That skillful blend of scientific freedom, wise leadership, and selective allocation of resources which constitutes good research management is a major objective of research directors in industry and government. Many conferences devoted to the problems of research administration have been held in the United States under the sponsorship of various host institutions but without a formal continuing organization. The present book contains the proceedings of the first such conference to be held in Great Britain, one of the series of symposia regularly held by the National Physical Laboratory.

The six sessions included 20 papers by as many authors—14 British, two Canadian, two American, one German, and one Dutch—together with extensive discussion by those in attendance. The first session included papers on the relations between basic and applied research and on the choice and termination of research projects, by J. D. Bernal and Willis Jackson, respectively. The lively discussion ranges from such topics as optimum size of research establishments to the pros and cons of financial awards to individual scientists for particular research successes.

The second session dealt with the problem of creativity, with papers by Morris Stein and D. J. van Lennep. Stein describes a study, carried out by the University of Chicago, of the psychological and sociological factors related to the creativity of American chemists. Creativity, defined as the process resulting in "a novel work that is accepted as tenable or useful or satisfying by a group at some point in time," was determined by the judgment of supervisors, corroborated by that of colleagues and subordinates. Van Lennep studies chemists and physicists from the point of view of applied psychology. In both papers, and in the discussion, creativity seems to be regarded as a quality, probably inherited, which men possess to a greater or lesser degree and which can be brought to its highest expression for a given individual by a suitable environment.

The second session closed with a paper on budgets and administrative controls, by D. R. Willson—a topic which is certainly involved in any consideration of the environment that influences creativity. The author begins by quoting Thomas Jefferson—"The least government is the best government"—an opinion which every research man will heartily endorse. The roles of budgets, project cost accounting, control services, and expenditure controls were debated with as much vigor as in our conferences in the United States.

The third session consisted of four papers on general organization. E. S. Hiscocks describes the growth of scientific research from a craft to a large-scale industry, from the one-man laboratory to team research, and the concomitant necessary changes in organization. He believes, as I do, that "the business of a scientific establishment is to achieve products of scientific thought, and since the spearhead of such an activity lies in the scientists themselves, all other staff are in a sense the tools of the scientists and work to ease their job."

R. Vieweg discusses "Science and the Workshop," coming to the fairly generally accepted conclusion that both a central workshop and small auxiliary shops are required. F. M. Lea and H. A. Snow give advice on the design and provision of buildings in which research is carried out.

The research staff was considered in the fourth session, with five papers: "Selection and Personal Assessment of Staff," by W. S. Bristowe; "Staff Selection and Assessment," by F. T. Rosser; "Superiors and Subordinates in Research," by H. A. Shepard; "Staff Groupings and the Flow of Authority," by C. R. Harington; and "Incentives," by S. Mayne. The first two papers describe the selection and rating procedures in an industrial laboratory (Imperial Chemical Industries) and a governmental laboratory (National Research Council, Canada), respectively. The differences in practice with respect to interviews and weighting of personal factors such as leadership, cooperation and loyalty, power of expression, and personal acceptability are perhaps typical of the two samples rather than representative of characteristic differences between industrial and governmental research laboratories.

Shepard compares the traditional theory of industrial organization with organizational traditions in science and with the new industrial organization theory, which introduces more attention to "human relations." In science, he states, "mutual confidence, rather than authority, is the integrative force in organization," and "the supervisor is the agent for maintaining intragroup and intergroup communication, rather than the agent of higher authority." Much the same views are expressed by C. R. Harington. He says, "authority is the wrong word. . . . It is above all important that the scientific staff should feel that the purpose of the administrative machine is to provide the best conditions for their work and that in no sense is it meant to control their professional activities."

In the final paper of the session on incentives, Mayne stresses the great incentive to scientists of career possibilities and of conditions of work such as freedom in research, professional association and recognition, and similar factors. Pay is important as an incentive but by no means the only factor.

The fifth session dealt with the problems of communicating technical information, both within a research establishment and from the establishment to others. C. G. Williams describes the various techniques and lines of communication in a large research laboratory (Shell Research Ltd.), with stress on the value of personal contacts and the value of colloquia and conferences. L. Moss and L. T. Wilkins describe studies in the use of technical information in the smaller industrial establishments. Their paper is supplemented by a survey of industrial technologists and sources of information in seven European countries. While the studies had not been completed at the time of the symposium, some samples of the results are described.

The remaining three papers of this session treated external communications. A. T. Green and A. E. Dodd chose as their subject, "Knowledge: Passing it On—Getting it Used." In this paper they describe the role of the written word and of exhibition, including newspapers, letters, trade literature, the trade press, research reports, popular research magazines, journals of learned societies, abstracts, memoranda, and textbooks; the appeal to the ear through personal contact, telephone communication, lectures and conferences, and radio; and the appeal to both eye and ear through film, television, and personal instruction and demonstration. Arthur Garratt covers much of the same ground in his paper entitled "Extramural Communications," but is bold enough to assign figures of merit to the various methods, personal contact and the written word being equally effective.

The final paper of this session, by M. W. Thistle, emphasizes some fundamental difficulties encountered in efforts to popularize science—for instance, the barriers of the relation between words and things, of scientific language and sophistication of expression, and of factors of security, of printability, and of receptivity.

One additional formal paper, by A. H. Wilson, on the assessment of the work of an industrial research laboratory, and reports of the chairmen of the several sessions complete the volume. Discussions of the papers, which are rather fully reported, constitute one of the most valuable aspects of the report of this symposium. There were 173 persons in attendance, from 16 different countries, but the publication of this volume makes available the major part of the proceedings to all who are willing to read. I found the report very stimulating and useful, and recommend it to all who are concerned with "the direction of research establishments."

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Operations Research for Management. vol. II, *Case Histories, Methods, Information Handling.* Joseph F. McCloskey and John M. Coppinger, Eds. Johns Hopkins Press, Baltimore, 1956. xxxiv + 563 pp. $8.

This volume presents a number of papers given before the Johns Hopkins University Informal Seminar on Operations Research during 1953–54 and 1954–55. Many of the papers have been previously published in various journals in the field of operations research.

The first half of the book is devoted to a presentation of case histories which cover such varied areas as "Traffic Delays at Toll Booths" (by Leslie C. Edie), "Revising New York's Subway Fare Structure" (by W. S. Vickrey), "Operational Research in Underground Mining" (by S. L. Cook), and "Bio-Social Research in Operations Research" (by S. W. Davis).

The second section covers discussions of a number of problem-solving procedures which are available. These include an article on experimental design (by W. J. Youden), a good review of the mathematical complexities of the traveling-salesman problem (by M. M. Flood), and an intriguing but all-too-short chapter on operational gaming (by W. E. Cushen).

The final part of the book deals with "Information Handling in Organized Groups." The subjects discussed include the experimental investigation of the efficiency of various communication patterns in small groups. In one section, J. Macy, Jr., discusses communications among human beings in terms of Shannon-Wiener information theory concepts.

This is a book, then, which illustrates the wide range of interests that "operations analysts" are concerned with.

IRVING ROSHWALB
Audits and Surveys Company, Inc., New York

Radioastronomie. Raymond Coutrez. Edition du Patrimoine de l'Observatoire Royal de Belgique, Uccle, 1956. vii + 383 pp. Illus. + plates. F. 250.

It is difficult to write a technical book of any lasting value on a new and rapidly developing subject. Radio astronomy is such a subject. Its techniques are in a state of continual change, and it is too young to have acquired any large body of well-established results. The author of *Radioastronomie,* Raymond Coutrez, points out these difficulties in his foreword and then proceeds to make a valiant effort to overcome them. According to the foreword, the book was written to provide, in the French language, an outline of the present status (through 1955) of the techniques and results of radio astronomy. In this it succeeds quite admirably. The book is, however, very much an outline in that it covers a large number of topics very briefly, without doing full justice to any. This is rather regrettable in some cases, since much of the material is straightforward astronomy, electronics, and physics, which will be familiar to most readers, or readily obtainable, and might well have been omitted in favor of fuller discussion of those techniques peculiar to radio astronomy. The book is definitely not for the layman, since the author presupposes a fair knowledge of physics and electronics on the part of the reader.

The first five chapters deal with the physics of radiation, general properties of antennas, transmission lines, receivers, and special antenna and receiver techniques used in radio astronomy. As a whole, these chapters provide what is probably the best discussion of the techniques of radio astronomy that is presently available in a single compilation. Chapters VI and VIII give a thumbnail sketch of optical astronomy, which, in my opinion, adds nothing to the book. Chapter VII discusses solar radio astronomy, chapter IX covers galactic and extragalactic radio astronomy, and the final chapter is concerned with meteors, the moon, and the planets.

In general, the book is clearly and concisely written. In only a few places—in the section describing the various defi-