observations, preparing the ground for a future expansion. An expansion in the study of radiation is absolutely necessary, as is clearly revealed, especially by the articles about short- and long-range weather forecasting. Until we have reliable and detailed knowledge of the amounts of energy available to the atmosphere, we shall be unable to solve satisfactorily the theoretical problems of dynamical meteorology, as well as the practical problems of weather forecasting.

Sections on meteorological optics, atmospheric electricity, cloud physics, and the upper atmosphere then follow. In these fields progress has been much more marked than in radiation, which, at least partly, justifies their rather broad presentation.

Is there reason for optimism in scientific and in practical meteorology? The articles of the *Compendium* certainly would lead us to answer yes to the first part of the question, but the answer to the second is much more dubious. Only to the superficial mind is the great progress in present-day meteorology correlated with the almost bewildering increase in meteorological data. Of much greater importance is the fact that the fundamental problems of dynamical meteorology are being attacked by first-class young scientists like Höiland, Fjörtoft, Eady, Charney, and Eliassen, most of whom have contributed articles to the *Compendium*. These articles, however inspiring to the specialists, will not be easily understood by the general meteorologist, who is warned to apply uncritically the results of the theoreticians—e.g., the dynamic instability, to the atmospheric motions, nonsteady and nonzonal, encountered on daily weather maps.

Between the sections on dynamics of the atmosphere and that on weather forecasting, we find articles on the general circulation—as difficult to define as to describe—on the mechanics of pressure systems, and on local circulations. The discussion of these problems meets with special difficulties, since an intimate collaboration between theoretical and practical meteorologists is needed. The results hitherto obtained are interesting and important, and we may venture to state that we begin to understand the internal structure of the large- and small-scale synoptic models (fronts, cyclones, tornadoes, cumulus convections, etc.), intelligent application of which is invaluable to the practical weather forecaster.

Our methods of forecasting the weather present great variations, although, at least in temperate latitudes, air-mass analysis gives the skeleton upon which the weather forecast is built up. What is to be done to improve the forecasts? This problem is touched upon by several of the scientists who contributed to the section on weather forecasting. Some of them stress the importance of introducing high-speed electronic computers. If we really possessed the key to understanding the evolution of the weather, a standardization by means of technique would be the right procedure. But a schematic introduction of such methods might fix into a stiff mold not only our present knowledge, but also our present ignorance. Modern weather forecasting is a curious mixture of science, art, and technique. It may be advantageous to substitute technique for art—but nothing is gained by substituting technique for science!

The remaining 550 pages of the book deal with a large variety of topics, from climatology to radiometeorology. All articles are supplemented by very useful bibliographies, so that the reader obtains not only general surveys of the different branches of our complicated science but also help to further detailed study. Certainly, the *Compendium* will give impetus and inspiration to many readers and will contribute to future attacks on the many unsolved problems.

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Pollen Morphology and Plant Taxonomy—Angiosperms: An Introduction to Palynology, Vol. I. G. Erdtman. Stockholm: Almqvist & Wiksell; Waltham, Mass.: Chronica Botanica, 1952. 539 pp. Illus. $14.00.

Palynology, one of the younger botanical sciences, is concerned with the various phases of the study of pollen and spores. The fertile pen of Gunnar Erdtman has produced many publications to aid this rapidly expanding field of specialization, the latest of which is *Pollen Morphology and Plant Taxonomy*. Some of the interesting features of the book are the chapter on pollen and spore morphology, and the description of pollen from 327 angiosperm families representing 2400 genera and about 10,000 species. There are 261 original groups of palynograms, plus the colored frontispiece. These palynograms are excellent drawings of the pollen, showing equatorial and polar views, surface and optical sections, and details of the sexine and nexine on a larger scale. Each grain is reproduced at a standard magnification of 1000; thus millimeter measurements of an illustration gives the size in microns. These figures illustrate the features for 250 families and some 600 genera. There is an extensive glossary, which not only defines the terms but also cites illustrations to aid in the interpretation of the definition, and a lengthy bibliography of the scattered literature. The index is complete. It is truly a book of world-wide scope, as many species are described from every country.

Dr. Erdtman has stressed pollen morphology, a study that requires the best of optical equipment and painstaking observations of minutiae. These are often not clearly visible even under oil immersion objectives, but form definite light and dark patterns by differential transmission and absorption of light from which the structure is predicated. The section on pollen morphology will need considerable study, for many new terms have been introduced. These are used to give precision to structural details, which is lacking in many of the older terms in current usage. Also, by means of these terms it is possible to give a com-

plete but concise description of the pollen. The reviewer has had the opportunity to study many of the slides on which this publication is based. Some of the finer details will be seen only in pollen grains that have been prepared by the acetolysis and chlorination techniques introduced by the author.

This book will be a stimulus to systematists because of the numerous observations about pollen types of particular species and genera that are not in harmony with the other members of their respective groups. Possible relationships derived from pollen should be considered in future monographs. Dr. Erdtman found the pollen of *Cneorum pulverulentum* Vent. differed so much from the other species of *Cneorum* that he made a new generic combination (p. 115). This is mentioned because it is the only new combination and could easily be overlooked.

Those who desire to identify pollen for ecological, geological, and climatic interpretations will experience some difficulty, because a key to the pollen groups has not been included. (Imagine trying to identify a plant in *Gray's Manual of Botany* without the aid of an analytical key.) For the experts, however, there is a wealth of information which can be found through the complete index and the citations of pollen of similar structure in other families. A second volume on the gymnosperms, ferns, and mosses is in preparation. Chronica Botanica will act as agent for American sales.

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Polarized Light in Metallography. G. K. T. Conn and F. J. Bradshaw, Eds. New York: Academic Press; London: Butterworths, 1952. 130 pp. $3.80.

For a long time polarized light in transmission microscopy has found wide application in mineralogy and petrography, and, at first glance, one would assume that its use in reflection microscopy should also be of great advantage. However, because of inherent difficulties, the reflection method has been employed in the past only sporadically, and it is only in recent years that it has found wider application by metallographers for the investigation of metallic structures. It has, indeed, proved to be a valuable tool in this field.

The aim of the present book is to acquaint a wider circle with the technique and method of this new development in reflection microscopy by giving a concise treatment of the physical principles involved, by describing the necessary accessories, and by exemplifying the advantages connected with the method. Nine specialists wrote this survey, which was prepared for the Optical Methods Sub-committee of the British Iron and Steel Research Association. The first two chapters describe polarized light, anisotropic materials, and the principles of reflection and absorption. Four further chapters treat the equipment and procedures of reflection microscopy in polarized light, the examination of metal surfaces, the identification of inclusions in metals and alloys, and the use of reflected polarized light in the study of ores. The closing chapter gives a summary of the subject. A glossary of optical terms is attached.

There is no doubt that this book will help to disseminate the knowledge necessary for a further advance in this very promising type of research. It must be stated, however, that the introductory part contains several serious misstatements and that it needs careful revision.

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Experimental Nucleonics. Ernst Bleuler and George J. Goldsmith. New York: Rinehart, 1952. 393 pp. $6.50.

Experimental Nucleonics is a text for a laboratory course for students who have had previous training in nuclear physics and in chemistry. It is divided into four parts: an introduction, and sections on general, chemical, and physical techniques. It includes details of 24 experiments, of which 16 or 17 are considered to comprise the course. These experiments cover a wide variety of techniques involving the measurement of radioactivity, from the determination of the decay scheme of K^{42} by coincidence measurements on the physical side, to separation of chemicals by solvent extraction on the chemical side. Thus, this volume leads to an integration of the sciences of physics and chemistry, so that the physicist who carries out these experiments should be able to perform his own simple chemical purifications, and the chemist who masters the material in this volume should be equipped to perform accurate physical measurements.

Since a separate chapter is devoted to each experiment, there is room for a full description of the physical and chemical principles involved in the measurement. Thus, the experimental details are the smaller part of the total text by a considerable margin. It is this feature which leads to much of the value of the book. Indeed, the introductory material on scintillation counters is the first simple summary that has come to this reviewer's attention, and it appears to be accurate and complete.

The experiments have been wisely chosen to illustrate a great wealth of techniques, and to provide experience in many of the techniques useful in modern radioactivity measurement. They involve, for example, the detection of radiation with photographic plates, measurements in ionization chambers, and absolute β-counting; and they provide experience with many of the garden varieties of Geiger counter. Indeed, if one is to seek a point to criticize, it is that the equipment required to implement the course is quite extensive, and the work required to present the experiments is quite intensive, so that, more's the pity, one might only expect to find such a course given at relatively few universities.

There is one additional use for this volume which the authors do not seem to have had in mind, and that