space, and the effect of relativity on the results. It throws light on the monumental work of Newcomb toward the solution of this problem, and also contains appreciative comments upon Newcomb's work.

It is of special interest to note that the entire collection of Newcomb's note-books, manuscripts and letters has been deposited in the Library of Congress and is waiting to be interpreted by some historian of physical astronomy. The position of Simon Newcomb in the history of astronomy is well known, and the collection of manuscripts and letters is, therefore, remarkable especially for its completeness and the extent of the wide range of his correspondence.

Berlin, 15/7/1926

My dear Mrs. Whitney:

Referring to our meeting in the Hall of the League of Nations I shall endeavor to give here the information you desired.

Your father's life-work is of monumental importance to astronomy. It may be characterized as follows. Kepler discovered empirically the laws which would govern the motion of a planet around the sun, if no other planet were present. From these Newton deduced the general laws of motion as well as the law of gravitation which bears his name. Newton's laws assert quite generally how masses must move when acted upon by no other forces than those of mutual gravitation. When there are more than two masses present the calculations of the motion over an extended period of time present great difficulties. However, in our solar system the relations are much less involved, inasmuch as one of the bodies, the sun, is greatly preponderant in mass. In the case of a single planet the calculations lead to results which differ but little from those which would have obtained, were this planet and the sun extant. If it were not for this, Kepler would not have been able to discover his laws and it is hard to conceive what orientation astronomy would have then taken.

There remained, however, the problem to determine the influences which the rest of the planets exert upon each individual planet. This is the astronomical problem of "perturbations"; it engaged the attention of the most outstanding mathematicians and astronomers for the last hundred years. Your father was the last of the great masters who, with this object in view, calculated with painstaking care the motions in the solar system. So gigantic is this problem that there are but few who can confront its solutions with independence and critical judgment.

This work is of great importance for an understanding of the laws of nature, for only thus can we establish the degree of accuracy to which the Newtonian laws are valid. The calculations, when compared with actual facts, showed that theory reflected experience with extraordinary precision. Only in the case of one planet was there found a slight deviation from the calculated orbit, a deviation which exceeded the limits traceable to errors in observation: it was the case of Mercury, the planet nearest the sun. Indeed, observations disclose a slow rotation of the major axis in the plane of the orbit and in the direction of Mercury's motion and this can not be accounted for by perturbations as calculated on the basis of Newton's law. The amount of this rotation is about forty seconds in a century, *i.e.*, it is so slight that it would take not less than thirty thousand years to bring about a complete revolution of the orbital axis. Yet all attempts to explain satisfactorily this deviation in accordance with the Newtonian theory were in the main unsuccessful.

Then, some ten years ago, theoretical investigations in the theory of relativity showed that the Newtonian laws could not be held rigorously true, but are merely true with great approximations. The exact laws, which were obtained through speculative methods, prove that in every planetary motion the major axis of the orbit executes a slow rotation, independent of the perturbations exerted by the other planets. This rotation is for all planets other than Mercury too slight to be observed. And as to Mercury, the calculation furnished exactly the forty seconds per century which heretofore caused so much perplexity.

It was thus that the theory of relativity completed the work of the calculus of perturbations and brought about a full agreement between theory and experience.

With kind regards,

Yours,

A. Einstein

I wish to acknowledge my gratitude to Dr. Tobias Dantzig, professor of mathematics at the University of Maryland, for the exact translation of the above letter.

Frederick E. Brasch,
Secretary of the History of Science Society
Library of Congress,
Washington, D. C.

SCIENTIFIC BOOKS

Moss Flora of North America. By A. J. Grout. Vol. III, Part 1, 62 pp. + 14 pls. 1928. Published by the author.

For more than forty years the Lesquereux and James "Manual" has been the standard work on the mosses of North America: this, supplemented in 1896 by the Barnes and Heald "Keys." During this time several books have been written on the mosses of eastern North America, but nothing which has even pretended to cover the country west of the Mississippi. American bryologists have been compelled to depend, in no small degree, upon Dixon's "Handbook of British Mosses" and other European works for a knowledge of the mosses of their own country. It was hoped, when the first moss section of "North American Flora" was issued, that this gap would soon be bridged; but fifteen years have elapsed and only two instalments have appeared. Even as far as it has gone, this latter work loses much of its usefulness to the general moss student in the complete absence of illustrations.

The present work aims to describe all known species of mosses occurring in North America, north of Mexico, together with any well-marked varieties or forms. In a measure, it is in the nature of a supplement to the author's justly popular "Mosses with Hand-lens and Microscope," but only to the extent that illustrations are here confined to species not already figured in that book. It will be issued in parts, of which the first (in order of publication) has just appeared. This deals with the Climacieae, Porotricheae and Brachythecieae, and describes sixteen genera and about one hundred species. Two new genera are distinguished, namely Pseudothecium (formerly included under Isothecium Brid.) and Chamberlainia (formerly included under Brachythecium Br. and Sch.), and there are numerous new nomenclatorial combinations. In addition to adequate technical descriptions for each species, there are citations of exsiccati and important illustrations, together with notes on distribution and habitat, and, in many cases, comparative notes. It is to be hoped that not only American bryologists but botanists in general will give this enterprise the support which its importance merits and upon which its completion depends.

G. E. NICHOLS

YALE UNIVERSITY

Special Cytology. The form and functions of the cell in health and disease. A text-book for students of biology and medicine. Edited by E. V. COWDRY. Paul B. Hoeber, Inc. New York, 1928.

THIS interesting and important book of 1,348 pages is the product of thirty-five distinguished American biologists, leaders in anatomy, histology, physiology, pathology, neurology, medicine and surgery. Each one has contributed a chapter on the subject which his investigations have helped to clarify. With such diversity of background of authorship and the marked inequalities in the extent of our existing knowledge of the cytology of different types of cells one would expect and does indeed find quite different modes of treatment of the subject-matter of the various chapters. This enhances the value of the book and is of particular interest where differences of opinion crop out in chapters with overlapping fields.

One is somewhat puzzled after reading the various chapters as to just what is meant by cytology. "The purpose of cytology," according to the introduction, "is not only to gain an accurate morphological knowledge of the cell, but also to learn its chemical constitution, the nature of its organs, the functions of its nucleus and cytoplasmic structures, etc." Twelve of the thirty-seven sections are concerned much more with microscopic anatomy, histology, embryology, comparative anatomy, physiology and pathology than with cytology. This is partly because comparatively little is known of the finer structure and functions of the individual cells and partly because the chapters seem to indicate that the authors are not cytologically minded: the treatment is not in terms of cell structure and cell function. The remaining twenty-five sections contain more or less cytology and in addition varying amounts of histology, physiology, embryology, pathology, etc. Each section is provided with a valuable bibliography.

The book emphasizes the fact that we know very little about the special cytology of the several hundred types of cells which make up the tissues and organs of the body. In spite of the somewhat misleading title of the book the editor and the contributors are to be congratulated on the excellent quality of the text, which will be very useful to students and teachers.

WARREN H. LEWIS

DEPARTMENT OF EMBRYOLOGY,
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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN IMPROVED METHOD OF PALM-PRINTING[1]

THE usual method of obtaining palm-prints for the study of epidermal ridges involves the use of a hard surface, either plane or curved, for transferring by pressure a film of printers' ink to the palm, and again for receiving the imprint of the inked palm. Some investigators prefer to ink the palm directly by means of the roller.

Owing to the uneven contact between the irregularly curved palmar surface and the unyielding surface of the plate or slab used in inking and printing, the impression is often imperfect. Usually the prints show interruption of the epidermal ridge lines where the hollow of the palm makes imperfect contact with the inked slab or with the paper, or else there is blurring of the ridge patterns along the bases of the fingers.

[1] From the Department of Medicine, College of Physicians and Surgeons, Columbia University, and the Presbyterian Hospital, New York City.