appeared in 1931. It is devoted to the subject of dynamics and so contains that part of Hamilton's work which many students estimate as the most important of his amazing contributions to knowledge. With the exception of a few minor notes, occupying less than ten pages of the present volume, Hamilton's work on dynamics was done over one hundred years ago during the decade 1830–40. It is only now after the lapse of a century, largely due to the physical successes of the theory known as wave-mechanics, that it is accorded the general recognition that its importance deserves. It is for the present reviewer a striking and welcome coincidence that Schrödinger, the founder of the theory of wave-mechanics, is now a professor at the Royal Irish Academy of which Hamilton has been the most distinguished president. The interest of the volume under review is much enhanced by the fact that more than half of it (over 300 pages) has not previously been published.

It would be out of place, even if space permitted, to attempt to give any detailed account of the contents of Hamilton's papers on dynamics. However, as in most mathematical theories, the important central idea may be described so as to be understandable by any interested, intelligent scientist. The simplest mechanical system consists of a material particle moving in some field of force (say the gravitational field of the earth) and the problem of its motion may be looked at from two quite different viewpoints. We may regard as given the conditions at the start (*i.e.*, the initial position and the initial magnitude and direction of the velocity) and may ask the conditions at some later time; or we may regard as given the initial position and the position at some later instant and may ask the initial magnitude and direction of the velocity. For convenience of reference we term the first point of view the local or differential view-point and the second point of view the ballistic or distant view-point (it being in fact the point of view of a gunner who wishes to hit a distant object). Hamilton's great merit was the emphasis he laid on the ballistic point of view (which led to his discovery of his Principal Function) as opposed to the local point of view which had dominated his great predecessor Lagrange. Once the importance of the Principal Function (which is determined by the initial and final positions of the particle) is realized, the theory of partial differential equations assumes full sway; and the interplay between this theory and the theory of ordinary differential equations (in which the time is the independent or master variable) which dominates the local point of view constitutes the important core of Hamilton's work (which was later perfected by Jacobi). The subsequent development of the Calculus of Variations (which occupies a central position in physical theories) may be largely attributed to Hamilton's work. It is pleasant to be able to say that credit for the recent important developments in this theory must be assigned to American mathematicians (particularly Bliss and Morse). Indeed, one need only point to Birkhoff's work in dynamics and to Morse's emphasis on the "large" as opposed to the "local" point of view, to justify the statement that Hamilton's mantle has fallen upon American shoulders. In this connection we must not forget the important work of Synge (who assisted in editing the first volume of Hamilton's works) on the subject of Hamilton's optical researches.

The physical appearance of the book leaves nothing to be desired. That it could be produced at all in the present difficult times is a real tribute to its publishers. The world of science owes a great debt to the editors, both for their clarifying appendices and for their intelligent restraint.

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RECENT DEVELOPMENTS IN THE STUDY OF ROCKS

A Handbook of Rocks for Use without the Petrographic Microscope. By JAMES FURMAN KEMP, sixth edition, completely revised and edited by Frank F. Grout. viii + 300 pp. New York: D. Van Nostrand Company. 1940. $3.00.

THIS excellent revision of Kemp's well-known book follows much of the plan of the older editions but has been largely rewritten so as to take account of the recent developments in the study of rocks. One who is familiar with the older editions notices that the rather detailed discussion of the chemistry included in the descriptions of the rocks in the older editions has been wisely abridged and assembled in a separate section. The glossary which was very valuable in the old editions has been omitted. Several such glossaries are now available.

This book gives excellent hand specimen classifications and descriptions of the igneous, sedimentary and metamorphic rocks; good brief discussions of the field occurrence, geological relations, and origin of such rocks; and descriptions of the newer methods of study. It includes a chapter on calculations in rock study, and illustrations of rock descriptions.

Much of the text is devoted to the naming and descriptions of rocks, and the classifications adopted are simple but are very well suited to megascopic work by one who is not a professional petrographer. An experienced petrographer can make finer megascopic distinctions and must do so to carry on precise petrographic field work. The sections on the origins of rocks, the relations of rocks to each other, sedimentation, and metamorphism are brief but clear discus-

sions of the subjects and are very well selected to give the student an elementary knowledge of our present views on them.

The book should be very valuable to mining engineers, geologists, and others who are interested in making careful studies of rocks without using the petrographic microscope. It is an excellent text-book for courses in macroscopic petrography.

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SOCIETIES AND MEETINGS

THE AUTUMN GENERAL MEETING OF THE AMERICAN PHILOSOPHICAL SOCIETY

AN unusual number of important scientific meetings have been scheduled to be held in Philadelphia this fall and winter. Among these were first and foremost the notable Bicentennial Celebration of the University of Pennsylvania with its numerous sections, sessions, lectures and symposia, the semi-annual meeting of the National Academy of Sciences and the annual meeting of the American Association for the Advancement of Science with its many affiliated and associated societies. Under these circumstances, it was feared that the regularly held Autumn Meeting of the American Philosophical Society might not be well attended nor of real importance. But this fear was not justified, for about seventy-five members of the society and one hundred guests, many of them from distant places, were in attendance at the meeting on November 22 and 23. There were three half-day sessions for the reading of papers at which twenty papers were presented, twelve of them by recipients of grants from the research funds of the society. Most of these papers were discussed by persons who were familiar with the subjects presented and the sessions were of correspondingly increased interest. The list of speakers, their topics and the leaders in the discussion of each paper were as follows:

H. P. Robertson, professor of mathematical physics, Princeton University. "Stationary Stellar Systems." Discussed by Dr. Shapley.

K.Aa. Strand,* research associate, Sproul Observatory, Swarthmore College. "The Orbital Motion of Zeta Aquarii." Discussed by Mrs. Gaposchkin.

W. F. G. Swann, director, Bartol Research Foundation of the Franklin Institute. "The Origin of the Secondary Peak in the Rossi Curve for Tin."

S. A. Korff,* research fellow, Bartol Research Foundation of the Franklin Institute; research associate, Carnegie Institution of Washington. "The Production of Neutrons by the Cosmic Radiation." Discussed by Dr. Swann.

Henry A. Boorse,* assistant professor of physics, Columbia University (Barnard College). "Some Problems of Low Temperature Physics." Discussed by Drs. Swann, Aydelotte and Urey.

Oswald Veblen, professor of mathematics, Institute for Advanced Study. "Report on *Mathematical Reviews.*"

Franz Boas, professor emeritus of anthropology, Columbia University. "Relation between Physical and Mental Development." Discussed by Dr. Davenport.

Daniel Sutherland Davidson,* assistant professor of anthropology, University of Pennsylvania. "Rock Paintings and Carvings in Western Australia." Discussed by Dr. Kidder.

Mary Butler,* research associate, University Museum, University of Pennsylvania. "An Archeological Survey of the Alta Verapaz, Guatemala." Discussed by Dr. Kidder.

L. S. Cressman,* professor of anthropology, University of Oregon; John Simon Guggenheim Memorial Foundation Fellow, 1940–41. "Studies on Early Man in South Central Oregon."

Edith von Porada,* research fellow, John Pierpont Morgan Library. "The Collection of Cylinder Seals in the Pierpont Morgan Library."

Nelson Glueck,* professor of bible and biblical archeology, Hebrew Union College. "Ezion-geber: Solomon's Seaport." Discussed by Dr. Albright.

T. Leslie Shear, professor of classical archeology, Princeton University. "Résumé of Results of Ten Years' Excavation in the Athenian Agora." Discussed by Dr. Meritt.

A. P. Coleman, lecturer in East European languages, Columbia University. (Introduced by Dr. Prince.) "Sir John Bowring and Slavonic Poetry." Discussed by Dr. Conklin.

William B. Scott,* professor emeritus of geology and paleontology, Princeton University. "The Mammalian Fauna of the White River Oligocene." (Read by title.)

Glenn L. Jepsen, associate professor of geology, Princeton University. (Introduced by Dr. W. B. Scott.) "The Ancestry of the 'Flying Lemur.'" Discussed by Drs. Shull and Conklin.

William J. Robbins,* professor of botany, Columbia University; director, New York Botanical Garden. "Vitamin B_6 and Growth of Excised Tomato Roots." Discussed by Drs. Bronk and White.

Charles B. Davenport, director (retired), department of genetics, Carnegie Institution of Washington. "Responsive Bone." Discussed by Drs. Weiss and Corner.

Alexander Weinstein,* Zoological Laboratory, Columbia University. "The Geometry and Mechanics of Crossing Over." Discussed by Drs. Whiting and Conklin.

Paul Weiss,* associate professor of zoology, University of Chicago. "Autonomous vs. Reflexogenous Activity of the Central Nervous System." Discussed by Dr. Bronk.

Leonard G. Rowntree,† director, Philadelphia Institute for Medical Research. "The Work of the Philadelphia Institute for Medical Research."

The evening lecture on November 22 was given by Edward S. Corwin, professor of jurisprudence,

* Recipient of grant from the Penrose Fund.

† Recipient of grant from the Deland Fund.