as an admirable solution of the difficult problem faced by the author: namely, to present an introduction to a vast theory with deep roots in both pure and applied mathematics, that would be intelligible to readers without great mathematical sophistication. A proper balance between formal applications and rigorous analysis has been maintained, and the approach in general has the clarity and elegance that one has come to expect from this particular author. For those who wish to begin the study of the field in question or for those who wish to prepare an introductory course on the subject, the book is equally useful. And we may add that the more sophisticated readers interested in the field will also find many items worthy of their attention, and many important unifications.

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HYDROLOGY

Hydrology. Edited by OSCAR E. MEINZER. xi + 712 pp. New York: McGraw-Hill Book Company.

THIS book, which is the latest addition to a series of monographs sponsored by the National Research Council, eight of which have been previously issued, each treating of a particular phase of the physics of the earth, treats of water as it comes from the atmosphere to the surface of the earth in the form of rain and snow, passes over and through the crust of the earth as surface water and ground water and returns again by evaporation and transpiration to the atmosphere in a never-ending cycle, now commonly known as the hydrologic cycle. On the enormous and continuous exchange of water and water vapor between the land and water surfaces of the earth and its atmosphere, which constitutes that cycle and which is comparable in average magnitude with the combined flood discharges of 200 rivers of the size of the Mississippi, man is absolutely dependent for vital supplies of fresh water. Although he is interested in that portion of the cycle related to the ocean which is invaluable to him for purposes of transportation, which furnishes much of the water of evaporation that is later precipitated on the land and which affects in other ways the climates of the land surfaces and, therefore, his comfort and happiness, his greatest interest in the water of the hydrologic cycle relates to that portion of it which falls on the land and is used by vegetation or is possibly available for many human uses as it flows over and through the crust of the earth in the form of surface water and ground water. That portion, which is replenished by precipitation and depleted by evaporation, is complicated by diversities in topography and vegetation of the earth's surface, by variations in porosity of soils and rocks and by the activities and works of man. It is to that complicated portion of the cycle that the major part of the book is devoted, and properly so, since man's interest in the hydrologic cycle and the science of hydrology will continue to be excited, as it has been in the past, by their relation to the practical problems associated with the use of water rather than by the theories related to an abstract science.

In the introductory chapter, Dr. Meinzer defines the science of hydrology, outlines the phases of the hydrologic cycle and its relation to the problems of human life and traces the history of that science from its birth in the false concepts of the ancients, through the gradual development of the present rational and practical science, as a progressive growth resulting from the work of many students of the last 300 years. With his characteristic modesty, Dr. Meinzer has failed to mention, except casually, his own important contributions to those phases of the science that relate especially to the measurement, recharge and recovery of the water that is stored in or flows through the ground—a phase of the hydrologic cycle that is of relatively minor magnitude but is of major value to man.

Each subsequent chapter has been prepared by an expert in the phase that he discusses. Precipitation is presented by Merrill Bernard; the reverse processes of evaporation and transpiration are presented by Sidney T. Harding and Charles H. Lee. The courses and progress of flow of water over and through the crust of the earth are presented under several topics: snow, ice and glaciers are discussed by James E. Church and François E. Matthes; characteristics of surface runoff, by Adolph F. Meyer, Charles H. Pierce, LeRoy K. Sherman, William G. Hoyt, Royal W. Davenport, Clarence S. Jarvis and Walter B. Langbein; storage and control of water, by William G. Hoyt; prediction of runoff, by Royal W. Davenport; ground water and its movement, by Oscar E. Meinzer and Leland K. Wenzel; infiltration, by LeRoy K. Sherman and George W. Musgrave; soil moisture, by Karl v. Terzaghi and Leonard D. Baver; physical changes produced in and by water, by William H. Twenhofel, Harry R. Leach, Lorenz G. Straub, Charles S. Howard and Margaret D. Foster; and special conditions produced in limestone, by Allyn C. Swinnerton, and in lava rock, by Harold T. Stearns.

The volume as a whole constitutes an authoritative presentation of the present knowledge of the science of hydrology and of the hydrologic cycle whose continuity and reasonable uniformity in action at any place are of major importance. Man has been dependent, at all stages of his development, on the availability of supplies of water, first, for domestic use and later, for transportation, irrigation, generation of power, industrial-process uses and, finally, for air conditioning. What future new uses for water may arise, no one can predict in detail. If, however, a reliable

forecast of future needs can be made on the basis of experiences of the past, progress in man's development must be assumed to lead inevitably to increased future uses of and demands for water. This monograph on hydrology has, therefore, not only an interest for students of science but also great practical value to those engineers who must apply science to the changing and growing needs of man.

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REPORTS

THE PENNSYLVANIA COMMITTEE FOR THE PROMOTION OF SCIENCE IN SECONDARY EDUCATION[1]

THERE has been a growing feeling among members of collegiate departments devoted to teaching in the sciences that introductory instruction in secondary schools in the sciences has been below a desirable standard. The present war emergency has suddenly turned the spotlight upon this condition. Were facilities in mathematics and science instruction many times greater than they are, the improved pre-induction training on the part of inductees into the Services would play a tremendous part in increasing effectiveness of our Services and their equipment.

Admittedly the circumstances influential in determining the present status of science instruction in secondary schools are varied and complex. No one factor is probably paramount in importance. But clearly the amount of training possessed by individual teachers of the sciences in the subject-matter taught is a factor of very high importance. It is the feeling of the overwhelming majority of the college science teachers of Pennsylvania that only when adequate training in subject-matter is required will teachers of the sciences in secondary schools be able adequately to build up the quality of high-school work in this field. Furthermore, in a scientific age the need for such building up seems self-evident.

On account of the growing feeling of the inadequacy of science instruction in secondary schools, the various organizations of college teaching scientists in the State of Pennsylvania, whose names are subscribed to this letter, each appointed a committee to consider the problem. Out of these committees, the central coordinating committee whose names appear below was chosen to deliberate upon remedial measures. This latter committee has met frequently over several months and has earnestly considered every phase of the situation from the point of view of the schools, the teachers, and the public welfare. Their considered opinions are herein crystallized.

It seems imperative that requirements for teacher certification in secondary schools in the fields of science be reviewed and changed. The committee, whose names and the names of the organizations they represent are subscribed below, has considered carefully this problem and respectfully request the privilege of submitting the following recommendations:

(a) The certification "science" should be abolished and become ineffective at once.

(b) The certification in "physical science" should be valid only on the provisional-college certificate, and only if at least eight semester hours each in physics and chemistry and a total of 18 semester hours together shall have been earned.

(c) On the permanent college certificate for the secondary field an applicant should be certified to teach in biology, chemistry or physics only on completion of 18 semester hours in the science in which he is certified.

(d) The use of temporary or emergency certification should be carefully restricted.

(e) The certification "General Science" should only be valid for courses in that subject in the ninth grade or lower and should require a minimum of eight semester hours in *each* major component science, physics, chemistry and biology. Any composite courses given at a higher level should require certification in each component science.

(f) The granting of the Permanent College Certificate for the secondary field should be governed by the following:

PERMANENT COLLEGE CERTIFICATE FOR THE SECONDARY FIELD

The issue of this certificate is dependent upon the possession of the qualifications required for the provisional college certificate and in addition thereto, not less than three years of successful teaching experience in the appropriate field in the public schools of the Commonwealth with a satisfactory rating and *either* (a) *the completion of advanced education to the amount of thirty semester hours, or* (b) *the earned master's degree.*

The required preparation is to be completed at a minimum rate of not less than six semester hours every three years.

Such advanced education is to be subsequent to the issuance of the baccalaureate degree and should be related to the subjects or fields in which the candidate is certificated to teach or be in the general field of education, at least half of which or fifteen semester hours however being in the subject-matter of the field of certification.

The provisional college certificate may be renewed for an additional period of three years on a rating of "satisfactory" plus six semester hours or more of advanced education, at least half of which or three hours being in the subject-matter of the field of certification.

The above regulations would not be retroactive nor

[1] Report of the committee to the State Council of Education, signed by W. H. Trytten, *Chairman.*