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.

NATHAN C. GROVER
UNITED STATES GEOLOGICAL SURVEY

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.*

affect secondary teachers in service. The proposed regulations would become effective for those who receive the provisional college certificates subsequent to September 1, 1942.

We believe recommendation (a) to be of high importance. Under the certification "science" a person may actually be certified to teach the sciences, with as little as three semesters in the science he may be asked to teach, a condition we believe to be indefensible.

Recommendations (b) and (c) are concerned with correcting the present practice of allowing certification in the sciences by groups of sciences which thereby permits certification of inadequately trained persons. If a person is poorly trained in physics and chemistry both, he is no better trained by certifying him in natural science.

Recommendation (e) differs very little from a similar recommendation circulated under date of January 12, 1939, by the Department of Public Instruction and sent to school officials throughout the state. The essential difference is that this committee believes that positive safeguards must be set up to insure that subject-matter training go hand in hand with professional training. It is felt that it is just as important to know what you teach as how to teach it. Particularly it is desired to emphasize that certification in more than one science should occur only upon completion of adequate training in the subject-matter (18 semester hours) in each of the sciences concerned.

This committee believes that now, when the need for more adequate science instruction is so clear, is the time to determine upon new standards. It is true that the scarcity of teaching personnel may force temporary measures under emergency conditions. But a permanent policy may nevertheless be set up now. The undersigned respectfully urge upon you the need for taking constructive action in this connection.

The membership of this committee and the societies represented are as follows: Dr. M. H. Trytten, *Chairman,* National Defense Research Committee—Pennsylvania Conference of College Physics Teachers; W. H. Michener, *Secretary,* Carnegie Institute of Technology —Association of Physics Teachers of Western Pennsylvania and Environs; Dr. E. L. Haenisch, Villanova College—Pennsylvania Chemical Society; Dr. John C. Johnson, Edinboro State Teachers College—Pennsylvania Academy of Science; Dr. C. O. Oakley, Haverford College—Philadelphia Section of the Mathematical Association of America; Dr. F. W. Owens, Pennsylvania State College—Allegheny Mountain Section of the Mathematical Association of America; Dr. F. C. Stewart, Pennsylvania State College—Allegheny Mountain Section of the Society for the Promotion of Engineering Education.

SPECIAL ARTICLES

THE GROWTH-STIMULATING EFFECT OF BIOTIN FOR THE DIPHTHERIA BACILLUS IN THE ABSENCE OF PIMELIC ACID[1, 2]

In a study of the accessory growth factors for the diphtheria bacillus, Mueller[3] discovered that pimelic acid stimulated the growth of the Allen strain and some of the Park 8 strains.[4] Pimelic acid proved to be specific in this effect in so far as the higher and lower homologues of this dicarboxylic acid were inactive. In an attempt to detect pimelic acid in connection with other work in this laboratory, it occurred to us that the effect of pimelic acid on the growth of the diphtheria bacillus might be utilized as the basis of a microbiological assay method for this compound. We have found that cultures of the Allen strain[5] which were recently transferred from Loeffler serum medium to a liquid medium grew very little in the absence of pimelic acid, whereas the addition of increasing amounts of pimelic acid within certain limits resulted in proportional increments of growth. The procedure gives promise as a method for the bio-assay of pimelic acid.[6] The idea of utilizing the diphtheria organism for this purpose has also led us to the recognition of an interesting relationship between pimelic acid and biotin.

Several years ago we tested vitamin H (biotin)

[1] The authors wish to express their appreciation to the S.M.A. Corporation for a research grant which has aided greatly in this work. They also wish to thank Mr. W. O. Frohring and the Research Staff of the S.M.A. Corporation and Dr. R. Major and the Research Staff of Merck and Co., Inc., for supplies of biotin.

[2] After this work had been initiated by us we learned that Dr. E. E. Snell reported at the annual meeting of the Federation of American Societies of Experimental Biology held at Boston that Dr. R. E. Eakin in Professor Roger J. Williams's laboratory had found that a larger amount of biotin was synthesized by *Aspergillus niger* when pimelic acid and cystine were added to the medium.

[3] J. H. Mueller, *Jour. Biol. Chem.*, 119: 121, 1937; and *Jour. Bact.*, 34: 163, 1937.

[4] J. H. Mueller, *Proc. Soc. Exp. Biol. and Med.*, 36: 706, 1937.

[5] This strain was made available through the generosity of Professor J. Howard Mueller.

[6] The liquid medium employed was the same as that employed by Mueller (*Jour. Bact.*, 36: 499, 1938). The culture was transferred from the solid Loeffler medium to the liquid medium, which contains pimelic acid and was incubated at 34–35° C. At the end of 48 hours a loop-full (2 mm loop) of the pellicle was transferred to a second tube of liquid medium. Solutions to be tested together with the pimelic acid-free medium were inoculated with a loop-full of the pellicle which formed in the second tube after incubation for 24 hours at 34–35° C. Micro-Kjeldahl determinations were used to determine the amount of bacterial nitrogen produced in 64-hour cultures incubated at 34–35° C., according to the procedure used by Mueller (*Jour. Bact.*, 29: 383, 1935).