done at any time before the same is sold off the farm on which it is grown, but the proper time for such inspection is when the grain is in head, when even a novice in agronomic or botanical work need make no mistake as to variety and the percentage of possible admixture and the possibility of disease infections, as scab, rust, ergot, smut, etc. A certificate should follow final inspection of the seed in the pure seed laboratory following harvest and threshing. A state list should be published showing the name of the grower, his address, the variety and amount of seed saved for sale as seed and its authorization should be based upon the certificates as issued. Such state laws should specify various grades of improved grain as "bulk seed of sufficient purity for use in special commercial processes, or in general cropping as improved seed, or as pedigreed seed, etc."

Suffice to say that this state listing necessitates official records of pedigrees and makes possible standardization and retention of varietal standards of quality. The whole process tends to form a proper educational basis for seed and crop improvement. Finally, the lists put any man who wishes to use the particular seed in touch with the man who is able to provide it. Thus good seed gets used on the land. The grower and the public is assured against having the work of proper tillage and proper crop rotation destroyed or set aside through the use of false unknown or deteriorated varieties. The whole process tends to insure final crop standardization and is the necessary foundation for final establishment of marketing standards.

In North Dakota the process here outlined is not a matter of theory but has been in operation on a part of the crops since 1909, and quite extensively in operation since 1911. Some hundreds of thousands of bushels of seed have been sold under the state list. We have made a beginning step on the right road looking toward cereal crop improvement. When a farmer or wholesale seed merchant once becomes imbued with the idea of standardized seed of a known quality, sold under certification. and if necessary under lead seal, he at once sees the necessity of following other processes of crop improvement which follow as natural corollaries, thus one will not be apt to put such seed into the lands which are weed infected, disease-infected, or contaminated with other sorts of grains of the same kind, or junk the bulk product with inferior stuff on the commercial market. Improvements in lines of tillage and crop rotation must and will follow upon seed standardization as naturally as day follows sunrise. At present there is no real necessity of much improvement in tillage and crop rotation methods; for the seed used, very often, is of such quality from a sanitary and breeding standpoint, as to thoroughly offset any improvement that might be expected from better tillage methods, and improved methods in soil sanitation.

H. L. Bolley

Agricultural College, N. D.

A PLEA FOR COURSES IN PHYSICAL MEASUREMENTS FOR STUDENTS OF CHEMISTRY AND RELATED SCIENCES

It has been my privilege during the past two years to visit many institutional and industrial research laboratories in various sciences and I have had the opportunity of talking with many workers in these laboratories. Before that time I had spent a number of years in teaching and research in physics. Recollections of that experience, together with observations which I have since been able to make, have forcibly brought to my mind certain convictions which I desire to express, in the hope that such expression may contribute to establishing a basis for definite progress in certain kinds of research.

What is here set down may be common realization, and it may have been expressed before. If so, this will emphasize previous remarks upon the subject; and such emphasis seems to me to be much needed.

It is probably the experience of many scientific workers at some time or other to feel that they are much handicapped by being not sufficiently familiar with the methods and the theories of other sciences which have a direct bearing upon the work in hand. In discussing the subject, I shall confine my attention to the importance of a knowledge of the principles of physics and of methods of physical measurement in their bearing upon work in other fields. No doubt the arguments will apply equally well, in their general aspect, to any science in its relation to the others. My reasons for emphasizing physics are, first, that I want to confine myself to the facts with which I am most familiar, and second, that many of the measurements and experiments made in almost any science are purely physical, involving mechanics, sound, heat, light and electricity with its newest branch, radioactivity.

In engineering, the fact that physics is fundamental has been universally recognized, in some cases by presenting a more intensive, or a longer course in general physics, and in other cases by putting into the curriculum intermediate and advanced courses having a direct bearing upon the problems to be encountered later. Engineering is commonly spoken of as applied physics, and it is therefore to be expected that physics and its applications should occupy a large part of the engineering courses. Workers in those sciences which have more recently become experimental, and in those which, though having long found much of their advancement in experiment, are finding new experimental methods—these have not yet fully recognized the aid they might receive from physics. On the other hand, the physicist himself has failed to recognize the aid which his science might give. Consequently little has been done towards promoting the idea of developing courses in physics with reference to its applications to the chemical, biological and medical sciences.

The handicap of insufficient familiarity with physical measurements and technique, in the case of so many workers in the sciences, is no doubt due to the fact that the great majority of students in these sciences become so absorbed in their own problems, and see in their own fields so many immediate things to be undertaken that they are led to pay but scant attention to any others. Or, on the other hand, students follow a prescribed course of study, which may have been laid out without sufficient consideration having been given to the value of including in that course the sort of training which later might prove extremely useful if not indispensable.

It is true that some recognition has been given physics in all undergraduate courses looking towards graduate work in chemistry, biology, medicine, and in some cases, psychology. The future chemist or bacteriologist "gets" one year of physics, consisting of three or four hours a week of classroom, lecture and laboratory work, and this during his freshmen or sophomore year. An extra year may be added, perhaps, in individual cases, for more or less advanced laboratory work, upon the planning of which the instructor has unfortunately often spent too little thought to bring out fully its possibilities from the student's point of view.

Those who plan such a prescribed course of study may justly argue that the year of physics to which their students are now "exposed," even in classes made up wholly of chemical or premedical students, is too frequently "just physics," and that no emphasis is placed upon the relation of physics to the science in which the student is interested. To a certain extent, this is true. The physics instructor's failing must be traced back to the same cause, however, as an effect of which his knowledge of the other sciences is insufficient to enable him to apply his physics in the manner expected. But aside from this, there is so much ground to be covered in a single year that, regardless of the text used, the class must be carried along at a terrific pace, following the text as closely as it may, in order to cover the ground in the allotted time. *After such a course, it can not be expected that a student should retain much in the way of ability to apply physics to anything else when, at the end of the semester, the sum total of physics which he can successfully apply to the impending examination is so small!* Besides, most of the courses properly include physics in the freshman or sophomore year, and the interval of two or three years until research is begun blots out much of what was actually learned. Consequently, when the student has arrived at the research stage he must, with much loss of time and with much effort, rediscover methods and devise artifices which perhaps are well known in physical technique.

We must conclude that if the physicist has realized the fact that so many measurements are essentially physical, and that it would mean much for progress in all branches of science if those engaged in scientific research of any kind had at their command more physics, he has been at fault in not sufficiently emphasizing these facts and in not offering such a sequence of courses in physics as would recognize them.

Bearing in mind that the time which could be apportioned to such work would probably at best be limited, I should say that, in addition to the regular course in general physics, there should be offered a course, preferably during the senior year, which might be designated "chemical and biological physics." Such a course should be planned to give the student who contemplates graduate work, as well as the student going out into industrial work after his graduation, those principles and measurements which are known to be fundamental in the kinds of work that might be expected to follow. I should plan to have such a course occupy at least the equivalent of three two-hour periods for one semester of sixteen weeks. The following general topics might be taken as representing the essential things from which as many might be selected as were considered advisable, according to circumstances. (1) The accurate measurement of long and short time intervals. (2) Measurement of temperatures by methods other than the mercury thermometer. Principles of pyrometry. (3) Temperature regulation and temperature regulators and controllers. (4) Principles of precision calorimetry. (5) The microscope; its theory, and application to the measurement of small lengths. (6) The reading telescope and its application to the measurement of small angles. (7) Measurement of refractive index; spectrometer and refractometer. (8) The spectroscope, and spectroscopic analysis. (9) Color and colorimetry; intensity of light and photometry. (10) The polariscope and polarimeter. (11) The galvanometer; its use as a deflection and as a null instrument. (12) Ohm's law; measurement of current and potential differences. (13) Electric power and heating. (14) Resistance measurement; Wheatstone's bridge, with application to measurement of electrolytic conductivity. The alternating current galvanometer as applied to conductivity measurements. (15) The potentiometer; application to measurement of thermoelectric forces, electrode potentials, ionic concentrations. (16) Electrometers and electroscopes; applications to measurements in radioactivity. (17) Principles of X-ray measurements.

Fortified with the essentials of such a course, the student would be well grounded for the physics of almost any problem of research he might meet. Certainly the "general physics" course would fall short of giving him anything more than a somewhat hazy idea of the instruments mentioned in the above list, and of the purpose for which they are used.

Putting this work in the senior or first post-senior year would have the effect of attracting students who have come to realize the importance of these things in relation to their future work. A well-defined motive is much to be desired in any course, and, such a motive existing, the course should prove very successful from the viewpoints of both student and instructor.

Some of the measurements above mentioned are described—not at all adequately—in manuals of physical chemistry; but there the object of the experiment is the *result*, not the *theory* or *technique* of the measurement. The logical place for such a course is in the physics department, by an instructor who has thoroughly familiarized himself with the student's needs, and who knows what applications may later be expected of the kinds of measurements he teaches. Such an instructor, I daresay, would render a valuable service to his colleagues in the other sciences in the capacity of consultant, advising them upon the physical aspects of their research problems. Much satisfaction could be derived from putting one's best efforts into such work; for there would come out of it the consciousness of having rendered a valuable service to the cause of science.

Discussion of the question in these pages seems to me very desirable as an aid to the crystallization of ideas regarding it. It is hoped that eventually sufficient interest may be aroused in the idea of making physics more valuable, to bring about the establishment in our colleges and universities of courses along the line which has been pointed out.

Paul E. Klopsteg
Leeds & Northrup Company,
Philadelphia

PATENT REFORM PROSPECTS

The initial patent reform measures advocated by the Patent Committee of the National Research Council (as noted in Science, April 11, 1919, No. 1267, p. 356) have been introduced by Chairman John I. Nolan, of the House Committee on Patents under the following numbers:

H. R. 5011. Provides for the separation of the Patent Office from the Interior Department and its establishment as an independent bureau. This bill, if made a law, would take the Patent Office out of the position of one of a number of inconspicuous bureaus in a great department, and set it forth in its proper light as one of the really important branches of the government, exercising a vast influence upon the material and industrial prosperity of our people. It is believed this change would greatly extend the activities of the Patent Office with a resultant stimulation of invention in various lines, and that it would open the door to numerous important reforms.

H. R. 5012. Provides for a single Court of Patent Appeals. The purpose of this court is to shorten the processes of patent litigation and to unify the decisions rendered in patent cases.

H. R. 7010. Provides for increases in personnel and in the salaries paid in the Patent Office. This legislaton is shown to be absolutely indispensable, owing to present outside competitive conditions, in order to obtain and retain the services of competently educated men as examiners. Good men are resigning to take positions with big industrial firms paying large salaries. The Patent Office has long been working without a sufficient force of competent men; its work is consequently in arrears, and the work is done too hastily to be reliable. The bill provides for a considerable increase in the working forces, and fixes a range of salaries for examiners, running from an entrance salary of $1,800 up to $4,000 for primary examiners with corresponding increases for higher officers.

Public hearings on the foregoing bill were held, commencing July 9, by the mentioned House Committee. This committee includes at the present time the following Republican members in addition to Mr. Nolan: Florian Lampert (Wis.), Loran E. Wheeler (Ill.), Albert H. Vestal (Ind.), Wm. J. Burke (Pa)., Albert W. Jefferies (Neb.) and John C. McCrate (N. Y.). The Democratic members are: Guy E. Campbell (Pa.), John B. Johnston (N. Y.), John J. Babka (Ohio), Edwin L. Davis (Tenn.) and John McDuffie (Ala.), but not all members mentioned were present at any one session of the committee. Every member that attended participated to a greater or less extent in the asking of questions of the successive speakers, Chairman Nolan and Representative Johnston being especially attentive and active in this regard, frequently giving distinct assistance in the emphasis or qualification of points made.

As secretary of the National Research Council's committee, Mr. E. J. Prindle had perfected the arrangements for these hearings, and by him the successive speakers were introduced. The first of these was Mr. F. P. Fish, referred to as the dean of the American patent bar. The short address of Mr. Fish will long be remembered by those who heard it as a wonderfully candid, comprehensive and convincing general statement of the importance of the patent system, of its decline, and of the utility or intended effect of the remedial measures under immediate consideration.

On the second day of the hearings Mr. Prindle, having interrupted his own remarks on the preceding day in order that Mr. Fish might be heard, completed a general exposition of the bills. He seemed to agree with Mr. Fish in placing a primary emphasis upon