vestigators' salaries would be borne by the colleges and universities and where now a research foundation is giving to scientific investigation the services of one man, the same sum would assist a score or more of investigators.

In my own laboratories approximately half of the time of the investigators' laboratory work must of necessity be devoted to the preparation of essential starting-materials, pure amino acids, proteins, organic compounds, etc., in order to later use these for investigational purposes. These compounds are not available on the market except at exorbitant prices, tyrosine, for example, being quoted at $5.00 a gram (when obtainable), a price utterly out of proportion with the cost of preparation.

When one considers the limited funds available for research apparatus and chemicals in our colleges and the excessive cost of these materials, it is not surprising that no more research work is done; the surprising thing is that so much is done. The chemistry budget for our smaller colleges is usually $350–$600 per year and will probably not exceed $3,000 in many of our larger institutions. From this sum is first purchased the necessary equipment of apparatus and chemicals for the undergraduate laboratory courses and *if any funds remain* research chemicals or apparatus are secured. Unfortunately in many instances no funds remain for research work, the instructor can not prepare the compounds needed, for his time is too largely taken up by teaching, with the result that his research aspirations slowly die, for they have no soil upon which to grow. The question may arise: "Why does not such a man prepare his basic materials even if his time is limited?" In the first place there is no glamor in such work. In the second place, there are often eight or ten synthetic steps from raw products to finished material, and the necessary chemicals and apparatus for certain of these steps are not available. The rarer chemicals of which I am thinking represent in themselves end products of research (already published) and many of our college laboratories are not equipped for these steps, although they may be equipped to use the final product as the starting material for another investigation. It may be that the production of an intermediate product depends on a distillation in a vacuum of 0.01 mm. and no high-vacuum pump is available, etc.

Such an endowed laboratory as I have in mind would be in charge of an organic research chemist and would prepare and keep in stock all sorts of organic compounds for research workers. If an investigator desired a certain compound he could obtain this without cost or for a nominal cost providing that he first convinced the director of the laboratory that there was an actual need for the compound and that it would be used in bona fide research work, acknowledgment of such a grant to be appropriately made in the published results. If, on the other hand, an industrial demand for the chemical should arise (such as that which did arise due to the depleted supplies of dimethylglyoxime after the war began), the laboratory should charge a fee at least large enough to cover the cost of preparation. This would prevent the possibility of exploitation and in any event it should be definitely specified that there should be no resale of the article in question and any supply remaining after the completion of the approved research should revert to the endowed laboratory.

The above plan is probably not perfect, but I feel that there is in it at least a suggestion worthy of the serious thought of our scientific men or scientific societies, and I only hope that in some manner it may bear fruit. We must not again be dependent upon Germany for our research needs and unless some such endowed laboratory is brought into existence I can see no other alternative.

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SCIENTIFIC BOOKS

Electrical Measurements. By FRANK A. LAWS. New York, McGraw-Hill Book Company, Inc., 1917. xiii + 719 pp. Price $5.00.

During recent years, writers of laboratory manuals have exhibited a constantly increas-

ing tendency to confine themselves to detailed directions for the performance of a number of more or less well selected but highly specialized electrical measurements. Such methods provide an easy introduction to the technique of the electrical laboratory and they are frequently useful in dealing with elementary students provided the underlying principles and their interrelations are clearly emphasized. But, when they become crystallized in book form, the several experiments are apt to occupy watertight compartments, between which the student sees very little relation. He performs the specified manipulations and draws the specified conclusions without obtaining the slightest inkling of their significance in electrical science, because he has been relieved of the study necessary for understanding. Moreover, owing to variations in equipment, even the best of such books are of little use except in the laboratories for which they were written.

Professor Laws's book is a welcome departure from these methods and can not fail to be greatly appreciated by serious students of electrical science. It is a clear and comprehensive treatise on modern methods of electrical measurement and includes sufficient discussion of typical instruments to guide the student in their practical application whatever may be the type of the instruments with which he has to deal. A few methods of purely historical interest are described, but for the most part the methods and instruments discussed are so thoroughly up to date that many of the more recent developments can be found elsewhere only in the original publications of their authors. Numerous references to original sources direct the student to first-hand discussions of the topics treated and to special methods and details beyond the scope of the present work.

The following list of chapter headings gives an idea of the field covered by the book: Measurement of Current; The Ballistic Galvanometer; Resistance Devices; Measurement of Resistance; Measurement of Potential Difference and Electromotive Force; Power Measurement; Measurement of Inductance and Capacity; Induction Instruments; Electricity Meters; Phase Meters; Power-factor Indicators; Synchroscopes and Frequency Meters; Graphic Recording and Curve Drawing Instruments; Instrument Transformers; Calibration of Instruments; Determination of Wave Form; Cable Testing.

The theory of methods and instruments is logically developed from fundamental principles and the conditions necessary for accuracy are discussed at some length in connection with practical applications. Galvanometers of various types are treated with the fulness merited by their general use as indicating and measuring instruments. The equation of motion of the suspended system is developed and integrated in its general form. Special cases are then derived by suitable choice of initial conditions and dynamical constants. The results thus obtained are utilized throughout the book in discussing the proper adjustment of resistance, control torque, period, damping factors, deflecting couple and sensitiveness to meet the requirements of the various uses of the galvanometer.

The typography of the book is clear and well arranged. The few misprints, inevitable in a first edition, are apparent and easily corrected. Most of the diagrams and illustrations are clear and well executed but a few of the halftones do not give a very clear idea of the instruments represented. The reader is assumed to be familiar with the fundamental principles of direct and alternating current systems of distribution and with the methods of differential and integral calculus. With this equipment he should find no difficulty in following the author's clear and concise discussions. The book is well adapted for use in senior college laboratories and it should also find a place in the working library of every electrical engineer.

A. deForest Palmer

SPECIAL ARTICLES

A NEW AND IMPROVED METHOD FOR OBTAINING PECTIN FROM FRUITS AND VEGETABLES

For more than two years past the writers have been engaged in the study of methods for