much-neglected field. One of the greatest triumphs of modern industrial chemistry is the fixation of atmospheric nitrogen, yet, for almost numberless ages, atmospheric nitrogen has been quietly fixed and utilized in the root nodules of the clover, pea, bean and other leguminous plants. We can prove that nitrogen is fixed there but of the chemistry of this unobtrusive underground process we have almost no information.

Future advancement in the knowledge of the cotton plant and of other crops will best be accomplished by the most active kind of scientific cooperation. Chemistry is the basis which underlies the existence of soils and crops and animals. Eliminate the elements and processes of chemistry and nothing material is left. Yet, agricultural research demands not only the aid of chemistry but of physics, biology, physiology, meteorology, bacteriology, geology and many other sciences. The chemist who works alone will accomplish but little, but if he collaborates with other investigators in the exploration of the borderland where chemistry and the other sciences overlap he will make discoveries of lasting benefit and importance.

BUREAU OF CHEMISTRY, U. S. DEPT. AGRIC.
WASHINGTON, D. C.

COÖPERATIVE WORK OF THE BUREAU OF STANDARDS[1]

BY N. F. HARRIMAN
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Immediately following the World War the growing demands for highly trained technical men to meet the increasing demand for industrial research, threatened the Bureau of Standards with a depletion of its staff and thereby a curtailment of its research activities. This situation led to the establishment by the Bureau of a Research Associate Plan, whereby a manufacturer or association of manufacturers might place a graduate physicist, chemist or engineer, at the Bureau for a period of one or more years to carry on investigation in some particular line.

This plan has proved valuable, both in the training of additional research specialists by association with the Bureau staff and in maintaining the research output of the Bureau in lines which are of special industrial importance.

The Bureau of Standards coöperates, wherever feasible, with the industries in the development and promotion of higher standards and minimum production waste in the commodities of commerce. In effect, therefore, the research associate plan is a plan for coöperative investigation to such ends. The work undertaken under this plan is such that it would be done by the Bureau alone if its funds were sufficient. The co-

[1] Presented at the 16th Annual Convention of The Am. Oil Chem. Soc'y, New Orleans, May, 1925.

operative method may be, however, somewhat more certain of practical results and these results thereby likely of quicker adoption. Coöperative work is not encouraged except in fields where the Bureau has rather complete equipment and highly specialized personnel to give advice and assistance.

In line with this policy of closer coöperation, a system of research associates has been worked out, and several of the most important industries are maintaining such associates at the bureau for carrying out particular investigations in which they are interested. In nearly every case these research associates are supported not by a single manufacturer but by a group through their trade association; and the results, which are published by the bureau, are available to the public at large. In this way the facilities of the bureau's laboratories and the experience of its scientific staff are made of benefit to the maximum number of people throughout the country, and incidentally men are trained for the industries in research methods... There are at present stationed at the bureau 46 associates, representing 24 industries. A list of these research associates, together with the divisions to which they are assigned, the problems on which they are working, and the industrial associations represented by them, is given below:

It is particularly gratifying to note the closer relations which are growing each year between the bureau and the industries of the country. Not long ago it was a matter of considerable difficulty to obtain the coöperation of industrial groups in the small amount of research work then carried on by the Government. Now problems are presented to us by almost every industry, and their successful solution depends very largely on the degree of coöperation between those presenting the problem and the bureau. The former are the best judges of the commercial aspects of the question and can give invaluable advice on the practicability of suggested processes, while the latter is best qualified to lay the sound foundation of scientific and technical data upon which the solution of such questions depends.

Mr. P. H. Walker and Mr. F. W. Smither, of the Chemistry Division of the Bureau of Standards are members of your detergents committee. They report that this committee is as yet in the formative stage, but they expect to coöperate with your Society in industrial and technical work on fats and oils for uses other than food.

Dr. I. G. Priest of the Bureau has been working on the investigation of the color of cottonseed oil. Because of his absence from his regular duties at the Bureau, the final standardization on a basis for routine testing has been somewhat delayed. However, the work which he has been doing will contribute directly to this standardization for which detailed plans have been made. The complete standardization will be undertaken this summer with the active coöperation of the Munsell Research Laboratory.

RESEARCH ASSOCIATES ASSIGNED TO THE BUREAU OF STANDARDS

Name	Position	Division	Work assigned for	Assigned by
Parkinson, T.	Res. Asso.	I	Radio Fading Phenomena	Henry S. Shaw, Jr.
Coleman, R. L.	Res. Asso.	II	Research Work in Dental Materials	Weinstein Research Laboratory
Poppe, W. A.	Res. Aid	II		
Miller, M. M.	Clerk	II	Secretarial and Clerical Work in Time Section	Horological Institute of America
Campbell, A. J.	Res. Aid	III	Inv. of the Fire Resistance of Hollow Tile	Hollow Tile Association
Foster, H. D.	Res. Asso.	III		
Eisinger, J. O.	Res. Asst.	III		
Sligh, T. S., Jr.	Res. Asso.	III	Coöperative Fuel Research	Society of Automotive Engineers
Thorne, Mrs. M. E.	Res. Asso.	III		
Weikert, D. L.	Res. Asst.	III		
Peterson, C. A.	Res. Asso.	III	Research in Line of Heat Transmission	Armstrong Cork & Insulation Co.
Krehbiel, J. F.	Res. Asso.	III	Standardization of Pyrometric Cones	Edward Orton, Jr., of Stan-Pyrometric Cone Co.
Fabritz, A. C.	Res. Mech.	IV	Research Mechanics	Munsell Color Co.
Munsell, A. E. O.	Res. Asso.	IV	Colorimetry	Munsell Color Co.
Curtiss, L. F.	Res. Asso.	IV	Research in Radium	National Research Council
Ellitt, A.	Res. Asso.	IV	Research in Optics	National Research Council
Berlin, H.	Res. Asso.	IV	Carbohydrates	Corn Products Refining Co.
LaPorte, O.	Res. Fellow	IV	Spectroscopy	International Education Board
Kunz, A.	Res. Asst.	IV	Carbohydrates	International Education Board
Swanger, W. H.	Res. Asso.	V	Study of Chemical Composition of Gold Alloys for Dental Purposes	Weinstein Research Laboratories
Winkler, J. H.	Res. Asso.	V	Study of Problems in Nickel Electrotyping	The International Asso. of Electrotypers
Hunter, R. B.	Res. Asso.	VI	Inv. of Walkway Materials Measurement of Coefficients of Frictions, etc.	National Safe Walkway Surfaces Code of the Am. Engineering Standards Committee
Chrisler, V. L.	Res. Asso.	VI	Res. Work in Measuring Sound Transmission	Lime and Gypsum Industry
Dutton, H. H.	Res. Asso.	VII	Research in Lime Stones	Indiana Lime Stone Association
Faling, Mrs. M. F.	Res. Asst.	VII	Cleaning and Dyeing of Textiles	National Association of Dyers and Cleaners
Hubbard, C. C.	Res. Asso.	VII		
Gottschalk, V. H.	Res. Asso.	VII	Investigation of Coating of Paper	Bureau of Efficiency
Hamlin, C. H.	Res. Asso.	VII	Standardization of Underwear	Asso. Knit Underwear Mfg. of America
Schurecht, H. G.	Sr. Fellow	VII	Architectural Terra Cotta	National Terra Cotta Society
Fuller, D. H.	Res. Asso.	IX	Terra Cotta Research	National Terra Cotta Society
Kessler, D. W.	Res. Asso.	VII	Planning and Conducting Research on Interior Marble, Designing Apparatus	National Marble Mfg. and Dealers Association
Miller, E. A.	Res. Asso.	VII	Research Work in Lime	National Lime Association
Peter, J. P. C.	Res. Asst.	VII	Research Work in Gypsum	Gypsum Industry of Chicago
Palmer, L. A.	Res. Asso.	IX	Prevention of Efflorescence on Brick Walls	American Face Brick Association
Schenke, E. M.	Res. Asso.	VII	Hosiery and Underwear Research	National Association Hosiery and Underwear Mfrs.
Ashton, F. W.	Res. Asso.	VII	Constitution of Cement	
Bogue, R. H.	Res. Director	VII	Research Work in Cement	
Brownmiller, L. T.	Res. Asst.	VII	Inv. on Properties of Portland Cement	
Dillon, Mary M.	Res. Clerk	VII	Stenographer for Dr. Bogue	Portland Cement Association
Hansen, W. C.	Res. Asso.	VII	Research Work in Cement	
Lerch, William	Res. Asso.	VII	Research on Cement	
Morris, R. J.	Res. Asso.	VII	Osnabury and Jute Cement Bags	
Grenell, L. H.	Met. Engr.	VIII	Preparation and Study of Silver Alloys	Bureau of Mines
Kjerrman, B.	Res. Fellow	VIII	Studying Engineering-Fellowship	The Academy of Science for Engrs., Stockholm, Sweden
Cain, J. R.	Res. Asso.	VIII	Metallurgical Research	American Rolling Mill Co., Metal & Thermit Co., and Trent Process Corporation
Nagy, S.	Inst. Maker	Shop	Instrument Making for Gas Section	American Gas Association

Very extensive data on the spectral transmission of the glasses have already been obtained on the red, yellow and blue glasses for each unit number, from 1 to 20 inclusive.

The objective of his investigations is to put the testing and certification of the glasses on a permanent, secure, and intelligible basis. The equivalent of the various glasses in *dominant wave-length*, *purity* and *transmission* will be established under standard conditions. After that has been done, routine testing can be done in a definite manner.

During the past years the Bureau has accumulated considerable data on the spectral transmission of vegetable oils, including the oils of cottonseed, soya bean, peanut and sesame. Recent approximate analysis of these data indicate that the color variations in the group of vegetable oils studied is due to the variations in concentration of at most four or five different coloring matters: moreover, the data provide an indication as to the exact identity of four of the substances.

Steps have been taken to secure these known coloring matters in pure form, in order that their absorption curves when separately dissolved in the oil base, may be determined. It is then hoped to show definitely the identity and relative amounts of the different coloring matters present in the various oils.

The use of standards enters into almost every activity of the Government, as it does into every industry and into the everyday life of all persons. The work done for the Government is in no wise different from that carried on for Industrial Groups and involves the same problems.

Many bureaus of the Government service are charged with the administration of laws and the establishment of regulations, the intelligent application of which depends very largely on the use of exact standards. This is true to a greater extent than is generally supposed. The Bureau of Standards has coöperated freely with these branches of the Government, and the service rendered has involved every department of physics and chemistry covered by the Bureau's activities. The neglect of such matters in the past has been a frequent source of misunderstanding and litigation between the Government service and the public. Conspicuous examples of bureaus to which assistance has been given are the Customs and Internal Revenue Services, Steamboat Inspection and Coast Guard Services, and the Bureau of Navigation of the Department of Commerce, as well as all bureaus of the War and Navy Departments engaged in construction or development work.

The engineering and building construction in progress at all times by the Government is exceedingly great, both in variety and magnitude. In all of it a knowledge of the materials employed is of fundamental importance from the standpoints of economy, efficiency, and safety. The work of investigating the properties of structural materials was taken up

and is carried on primarily for the purpose of securing the information needed by the Government service in its structural work. This information is necessary to the public in construction work, and every effort is made by the bureau to render its findings available to the public generally. The demands for information of this sort have come from practically all Government bureaus and establishments, but especially in connection with the structural work carried on by the office of the Supervising Architect, the engineering branches of the Army, the Bureau of Construction and Repair of the Navy, the Panama Canal, and the Reclamation Service.

The Bureau of Standards serves as a testing bureau for the various departments of the Government when called upon; and, as such, is assisting to place Government purchases upon an economical and business-like basis. The example of the Government in such matters has a far greater influence upon the public than is generally supposed. The Government can do no greater service to the country than to place its own purchases upon a basis which may be taken as a standard by the public at large. This work involves the specification of a wide range of structural and miscellaneous materials and their testing, when delivered, to ascertain whether or not they comply with the specifications. This is especially important, since such materials are purchased by means of competitive bids, a method resulting in much fraud and injustice unless suitable standards are established and successful bidders held absolutely to this standard in making deliveries. Furthermore, most purchasing officers are realizing the great importance of having such testing done by a disinterested institution equipped with the scientific and other facilities for performing the service in a manner that is fair to both parties concerned in the purchases.

Among the Government bureaus and establishments which have utilized the Bureau of Standards as a testing institution in connection with the purchase of supplies may be mentioned the Government Printing Office, in connection with the purchase of paper, inks, and printing supplies, and the Post Office Department, in connection with the purchase of paper, twine, textiles, etc. A wide range of materials has been tested for the Quartermaster Corps of the Army, the Bureau of Supplies and Accounts of the Navy, and the Panama Canal. The General Supply Committee has called upon the bureau for assistance in the specification of all sorts of supplies and equipment, as well as the testing of samples submitted by bidders of the supplies bid upon. Practically every branch of the Government service, including the District of Columbia, utilizes the Bureau of Standards as a testing bureau. Here, again, as in other fields of the bureau's activities, it gains much useful knowledge, which is given to the public in the form of suitable publications.

In a similar manner, the Bureau collaborates with the Federal Specifica-

tions Board, in the establishment of suitable purchase standards for the use of the Federal Government.

The Bureau experts are members of nearly all of our seventy technical committees; and the chairmanship of twenty-seven of these committees is held by Bureau experts.

These specifications for Government use are adopted only after careful consideration of all pertinent commercial specifications, as it is realized that the selection of a specification or standard without due regard to the manufacturing problems involved would be as serious as for manufacturers to establish them without a careful consideration of the needs of the purchaser. In the selection of specifications for Government use the Federal Specifications Board is coördinating these two interests in a manner which is fair to and understood by both the manufacturer and the user, and will in time base all Government purchases on correct standards of quality and practice. This procedure will, no doubt, serve in time as a model to be followed by large corporations, municipalities, States and the public. In fact, several such cases have already occurred.

In case your society or any group of manufacturers associated therewith, has any problems to the solution of which the Bureau of Standards might be able to contribute, we earnestly invite your attention to the advantages of establishing a research associate at the Bureau.

U. S. BUREAU OF STANDARDS
WASHINGTON, D. C.

CONSTITUENTS OF CRUDE COTTONSEED OIL*

BY GEORGE S. JAMIESON AND WALTER F. BAUGHMAN

This paper reports further progress in the investigation assigned to the Oil, Fat, and Wax Laboratory at the conference of the Basic Research-Committee and the Department of Agriculture, September, 1921.[1]

The authors endeavored to obtain more definite information in regard to the presence of the so-called vegetable mucilage in crude cottonseed oil. For convenience, the "settlings," which separates when the crude oil is permitted to stand several weeks after expression, was examined. The "settlings" from a 5-gallon sample of crude oil was repeatedly extracted with acetone. The insoluble portion of the "settlings" was ground to a powder after the removal of the acetone, and about 125 g. was boiled with 250 cc. of absolute alcohol for several hours in a flask connected with a return condenser. This treatment was repeated with two more 250-cc.

* Presented at the 16th Annual Convention of The Am. Oil Chem. Soc'y, New Orleans, May, 1925.

[1] Previous reports: *The Cotton Oil Press*, **6** (No. 4), 33; **7** (No. 2), 35; **7** (No. 5), 29; THIS JOURNAL, **1**, 30.