with which a student performs his daily work and of his permanent acquisition of medical knowledge fitting him to practise his profession.

If I have clothed these conclusions in the language of prophecy it is because the title of my discourse has laid this necessity upon me. In forecasting the immediate future, I have borne in mind the history of the immediate past and, if I have failed to read aright the indications of the lines on which our medical schools are to advance, it must be remembered that the development of a biological science and of its dependent arts not infrequently takes place in totally unexpected directions, thus introducing into the path of educational progress perturbations which may well defy prediction.

H. P. Bowditch.
Harvard Medical School.

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*NATIONAL STANDARDIZING BUREAU.**

Treasury Department,
Office of the Secretary,
Washington, April 18, 1900.

Sir: I have the honor to submit herewith the following draft of an amendment to the sundry civil bill, now pending in the Committee on Appropriations, and to recommend that the necessary appropriation to carry the same into operation and effect may be included therein:

That the Office of Standard Weights and Measures shall hereafter be known as the National Standardizing Bureau, and shall remain under the control of the Secretary of the Treasury.

The functions of the bureau shall consist in the custody of the standards; the comparison of the standards used in scientific investigations, engineering, manufacturing, commerce, and educational institutions with the standards adopted or recognized by the Government; the construction when necessary of standards, their multiples, and subdivisions; the testing and calibration of standard measuring apparatus; the solution of problems which arise in connection with standards; the determination of physical constants, and the properties of materials when such data are of great importance to scientific or manufacturing interests and are not to be obtained of sufficient accuracy elsewhere.

The bureau shall exercise its functions for the Government of the United States; for any State or municipal government within the United States, or for any scientific society, educational institution, firm, corporation, or individual within the United States engaged in manufacturing or other pursuits requiring the use of standards or standard measuring instruments. All requests for the services of the Bureau shall be made in accordance with the rules and regulations herein established.

The officers and employees of the bureau shall consist of a director, at an annual salary of six thousand dollars; one physicist, at an annual salary of thirty-five hundred dollars; one chemist, at an annual salary of thirty-five hundred dollars; two assistant physicists or chemists, each at an annual salary of twenty-two hundred dollars; two laboratory assistants, each at an annual salary of fourteen hundred dollars; two laboratory assistants, each at an annual salary of twelve hundred dollars; one secretary, at an annual salary of two thousand dollars; one clerk, at an annual salary of twelve hundred dollars; one clerk, at an annual salary of one thousand dollars; one messenger, at an annual salary of seven hundred and twenty dollars; one engineer, at an annual salary of fifteen hundred dollars; one fireman, at an annual salary of seven hundred and twenty dollars; one mechanician, at an annual salary of fourteen hundred dollars; one mechanician, at an annual salary of one thousand dollars; one mechanician, at an annual salary of eight hundred and forty dollars; one watchman, at an annual salary of seven hundred and twenty dollars, and two laborers, each at an annual salary of six hundred dollars.

The director shall be appointed by the Presi-

* Letter from the Secretary of the Treasury, transmitting, with accompanying communications, a draft of a bill for the establishment of a National Standardizing Bureau.

dent, by and with the advice and consent of the Senate. He shall have the general supervision of the bureau, its equipment, and the exercise of its functions. He shall make an annual report to the Secretary of the Treasury, including an abstract of the work done during the year, and a financial statement. He may issue, when necessary, bulletins for public distribution, containing such information as may be of value to the public or facilitate the bureau in the exercise of its functions.

The officers and employees provided for by this act, except the director, shall be appointed by the Secretary of the Treasury, at such time as their respective services may become necessary.

The following sums of money are hereby appropriated: For the payment of salaries provided for by this act, the sum of thirty-four thousand nine hundred dollars, or so much thereof as may be necessary; for the erection of a suitable laboratory, of fireproof construction, for the use and occupation of said bureau, including all permanent fixtures, such as plumbing, piping, wiring, heating, lighting, and ventilation, the sum of two hundred and fifty thousand dollars; for equipment of said laboratory, the sum of twenty-five thousand dollars; for a site for said laboratory, to be approved by the visiting committee hereinafter provided for and purchased by the Secretary of the Treasury, the sum of twenty-five thousand dollars, or so much thereof as may be necessary; for the payment of the general expenses of said bureau, including books and periodicals, furniture, office expenses, stationery and printing, heating and lighting, expenses of the visiting committee, and contingencies of all kinds, the sum of ten thousand dollars, or so much thereof as may be necessary, to be expended under the supervision of the Secretary of the Treasury.

For all comparisons, calibrations, tests, or investigations, except those performed for the Government of the United States or State governments within the United States, a reasonable fee shall be charged, according to a schedule submitted by the director and approved by the Secretary of the Treasury.

The Secretary of the Treasury shall from time to time make regulations regarding the payment of fees, the limits of tolerance to be attained in standards submitted for verification, the sealing of standards, the disbursement and receipt of moneys, and such other matters as he may deem necessary for carrying this act into effect.

There shall be a visiting committee of five members, to be appointed by the Secretary of the Treasury, to consist of men prominent in the various interests involved, and not in the employ of the Government. This committee shall visit the bureau at least once a year, and report to the Secretary of the Treasury upon the efficiency of its scientific work and the condition of its equipment. The members of this committee shall serve without compensation, but shall be paid the actual expenses incurred in attending its meetings. The period of service of the members of the original committee shall be so arranged that one member shall retire each year, and the appointments thereafter to be for a period of five years. Appointments made to fill vacancies occurring other than in the regular manner are to be made for the remainder of the period in which the vacancy exists.

I transmit herewith a statement of the conditions which call for the establishment of a national standardizing bureau, together with a few of the resolutions adopted by scientific bodies and the opinion of individuals as to the immediate and urgent need of such an institution.

Respectfully,

L. J. GAGE,
Secretary.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

CONDITIONS WHICH NECESSITATE THE ESTABLISHMENT OF A NATIONAL STANDARDIZING BUREAU.

The selection and care of the original standards, and the solution of problems involved in the production, calibration, and distribution of duplicates, constitute one of the most important branches of scientific work any government is called upon to undertake. That such work should in all cases be under the control of the General Government, and that general governments

should co-operate with each other in establishing uniformity of standards, is a fact usually admitted as beyond dispute. Until recent years this work has been confined to problems concerned with the standards of length, mass, capacity and temperature; but the increased order of accuracy demanded in scientific and commercial measurements and the exceedingly rapid progress of pure and applied science have increased the scope of such work until it includes many important branches of physical and chemical research, requiring for its successful performance a complete laboratory, fitted for undertaking the most refined measurements known to modern science.

Germany has established the Physikalische-Technische Reichsanstalt and the Normal-Aichungs-Commission; England, the Standards Department, the Electrical Standardizing Laboratory, and the National Physical Laboratory (but recently established); Austria, the Normal-Aichungs-Commission; and Russia, the Central Chamber of Weights and Measures. These, together with the institutions of other countries and the International Bureau des Poids et Mesures, at St. Cloud, France, are organized for the purpose mentioned and are noted for the very important work they accomplish annually. An examination of the function of these institutions and the sums of money devoted to their maintenance is the most convincing evidence of the importance of problems pertaining to standards and standard-measuring apparatus.

Throughout our country institutions of learning, laboratories, observatories and scientific societies are being established and are growing at a rate never equaled in the history of any nation. The work of original investigation and instruction done by these institutions requires accurate reliable standards, which in nearly every case must be procured from abroad, or can not be procured at all.

The extension of scientific research into the realm of the extremes of length, mass, time, temperature, pressure and other physical quantities necessitates standards of far greater range than can be obtained at present. Frequently the comparison of the same physical quantities vary with the magnitude of the quantity to be measured, and may even introduce entirely new conditions, methods and apparatus, as in the case of high or low temperatures.

The introduction of accurate scientific methods into manufacturing and commercial processes involves the use of a great variety of standards of far greater accuracy than formerly required. An accurate knowledge of the high temperature of a furnace or refinery, or the low temperature of a refrigerating process, is often essential to the economical working of the process.

Enormous commercial transactions are daily based upon the reading of electrical measuring apparatus, inaccuracies of which involve great injustice and financial losses; hence the national bureau should be in a position to calibrate or test electrical standards of all kinds for commercial, as well as the most refined scientific work.

The scientific work carried on by the different departments of the Government involves the use of many standards and instruments of precision, which are too frequently procured from abroad, owing to our own lack of facilities for standardizing.

The manufacture of scientific apparatus and instruments of precision has been confined almost exclusively to foreign countries, but at present is growing at a rate which will soon place our own production on a par with that of any other country. In order to secure the requisite degree of uniformity and accuracy it is absolutely essential that American manufacturers of such apparatus have access to a standardizing bureau equivalent to that provided for the manu-

facturers of other countries, notably Germany and England.

The recent acquisition of territory by the United States more than proportionately increases the scope and importance of the proposed institution, since the establishment of a government in these possessions involves the system of weights and measures to be employed. During the near future large public improvements will be undertaken in these countries; schools, factories, and other institutions will be established, all of which require the use of standards and standard measuring apparatus.

Ample facilities should be provided for the investigation of problems which arise in connection with standards and standard measuring apparatus, since it is by the solution of these problems that the standardizing department is enabled to meet the demands of modern and improved methods of measurement.

The work of the Office of Standard Weights and Measures has been of a high order, and as extensive as the appropriation, working force, and quarters would permit; but in view of its great importance to scientific and commercial interests, it is earnestly requested that its functions be enlarged to meet the requirements of existing conditions, and that it be provided with a suitable laboratory, equipment and working force.

NATIONAL ACADEMY OF SCIENCES,
Washington, D. C., April 19, 1900.

SIR: In response to your request and by authority of the National Academy of Sciences I have the honor to communicate the following resolution, adopted by the Academy at its present session:

"Whereas the facilities at the disposal of the Government and of the scientific men of the country for the standardization of apparatus used in scientific research and in the arts are now either absent or entirely inadequate, so that it becomes necessary in most instances to send such apparatus abroad for comparison: Therefore, be it

"*Resolved*, That the National Academy of Sciences approves the movement now on foot for the establishment of a national bureau for the standardization of scientific apparatus."

I am, sir, yours, with great respect,

WOLCOTT GIBBS,
President.

THE SECRETARY OF THE TREASURY,
Washington, D. C.

STATISTICS RELATING TO STANDARDIZING INSTITUTIONS OF FOREIGN GOVERNMENTS.

England.

Standards Department.—Established in 1879, to provide for the custody of the standards; to construct and verify copies of the standards; to verify standards in use by local authorities; to regulate the system of inspection in use in the Empire. Under board of trade. Work directed by a superintendent of weights and measures.

Total annual expenses, including salaries, equipment, and incidental expenses for the year 1897–98..... $15,700

Electrical Standarizing Laboratory.—Established 1890, for general electrical testing and the verification of electrical standards and measuring apparatus. Situated at Old Palace Yard, Westminster. Under board of trade. Work directed by a chief electrician.

Total annual expenses, including salaries, equipment, and incidental expense for the year 1897–98..... $8,600

Kew Observatory.—Established 1871, at Old Deer Park, Richmond, Surrey. Originally founded as an astronomical observatory; then as a meteorological observatory; now as a general testing bureau. Under Royal Society of London. Affairs controlled by the Kew Observatory committee. Work directed by a superintendent. Recently incorporated in the National Physical Laboratory.

Total annual expenses, including salaries, equipments, and incidental expense for the year 1897–98 (almost wholly derived from fees)..... $17,800

National Physical Laboratory.—Established 1899, to be situated at Old Deer Park, Richmond, Surrey. To be a general standardizing laboratory where standards and measuring instruments in use in science or in trade may be verified. Research work may be undertaken when required for the needs of the laboratory or regarded as of distinct value to the public generally. To this institution will be added the buildings, grounds, equipment, and income of the Kew Observatory, thus placing the latter institution under the general head of government institutions. Work to be controlled by a committee of leading scientists, and under immediate control of a director.

Annual appropriation, 1900–1901, for salaries, equipment, and incidental expenses (above the income of Kew Observatory)..... $20,000

Germany.

Die Normal Aichungs Commission.—Established 1868, at Berlin, to regulate the system of inspection of weights and measures throughout the North German Confederation; to construct and provide standards and the necessary measuring apparatus for the local bureaus; to fix regulations in regard to the system of inspection, and to provide for the safe custody of the standards. Under the immediate supervision of a director, aided by the commission, which is composed of scientific men who have been connected directly or indirectly with matters pertaining to weights and measures. Two hundred and fifty thousand dollars was appropriated in 1899 for new buildings and equipment.

Total annual expenses, including salaries, equipment, and incidental expenses for the year 1897–98..... $36,000

Die Physikalische-Technische Reichsanstalt.—Established 1887, at Charlottenburg, as a national physical laboratory and standardizing bureau. Under the control of a president, with an advisory board or council of scientific men. The total appropriations to date for buildings, grounds, and equipment amount to over $1,000,000.

Total annual expenses, including salaries, equipment, and incidental expenses for the year 1897–98..... $80,000

The Reichsanstalt is organized in two sections, as follows:

Section I.—The execution of physical investigations and measurements which aim at the solution of scientific problems of great importance, which require a greater outlay of time, equipment, and materials than are at the disposal of institutions founded primarily for educational purposes. The work of the section also includes the solution of such scientific problems as may arise in connection with the work of Section II.

Section II.—(1) The execution of physical or technical investigations, as required by the Government, or which are of such a character as to further the interests of German manufacturers of instruments of precision, and other branches of technological work, such as the determination of the physical properties of materials, the preparation of materials, the best methods of construction for technical and measuring apparatus.

(2) The verification and calibration of measuring instruments and standards of reference not provided for by the Aichungs Commission.

(3) The construction of instruments, or parts of instruments, and the execution of the mechanical work needed in connection with the equipment and investigations of the institution, and for other bureaus of the Government, so far as such work cannot be afforded by private workshops.

(4) The execution, in special cases, of work similar to that mentioned in (3) for German manufactures.

The Reichsanstalt is reimbursed for work performed in accordance with (3) and (4)

upon the basis of the cost of material and double the time employed.

Austria.

Normal Aichungs Commission.—Established at Vienna in 1871, upon the adoption of the metric system by Austria; to exercise a technical control over the inspection of weights and measures throughout the Empire; to establish regulations regarding inspection; to fix the limits of tolerance; to provide for the custody of the standards; to construct and verify copies of the standards; and to equip the local inspection bureaus with copies of standards and measuring apparatus; to verify, for institutions and individuals, standards and measuring apparatus submitted. The commission is subordinate to the Minister of Commerce, and is composed of a director and a number of co-ordinate members. The director is empowered to appoint a suitable force of technical clerical assistants.

Total annual expenses, including salaries, equipment, and incidental expenses for the year 1897–98..... $46,000

Russia.

Central Chamber of Weights and Measures.—Established 1878, at St. Petersburg, reorganized 1893, to exercise control over all systems of weights and measures in use in the Empire. The work at present is largely preliminary, and comparisons are confined to standards of length, mass, and capacity, but it is the intention of the Government to include the comparison of thermometers, barometers, hydrometers, alcoholometers, etc., and electrical measuring apparatus. Experiments in most of these branches are now being conducted in the laboratories of the chamber, and results of extreme precision are now being obtained, under the minister of finance and the supervision of a director. One hundred and seventy-five thousand dollars was originally appropriated for buildings and grounds.

Total annual expenses, including salaries, equipment, and incidental expenses, for the year 1897–98..... $17,500

The total amounts annually appropriated by different governments for standardizing purposes are as follows:

Germany	$116,000
England	62,100
Austria	46,000
Russia	17,500
United States	10,400

A NEW ENZYME OF GENERAL OCCURRENCE IN ORGANISMS.

A PRELIMINARY NOTE.

WHILE occupied with investigations on the enzymes in the tobacco leaf the writer observed that the clear filtered juice of the fresh leaf, although giving strong reaction for oxidase and peroxidase, yields but a very weak reaction with hydrogen peroxid, *i. e.*, develops mere traces of oxygen upon addition of this substance. The *unfiltered* juice, however, containing in suspension protein matter, chlorophyll bodies, starch granules, etc., yields a very energetic development of oxygen. This behavior caused the writer to doubt the correctness of the now generally adopted teaching that the power of catalyzing hydrogen peroxid is a property of all enzymes. The known enzymes are soluble in water and although they can be retained in a certain measure by some suspended matters, the difference of behavior of the unfiltered and filtered juice in the case just mentioned could hardly be so very marked.

Further tests have shown the writer that the power of catalyzing hydrogen peroxid is found also in manufactured tobacco which had been air-cured, while flue- or fire-cured tobacco was generally indifferent in this regard. Air-cured tobacco that was subjected to a subsequent 'sweating in bulk' shows this power often in a high degree although it is impossible to find the common enzymes. Even oxidase and peroxidase may be destroyed in the sweating process, without the loss of this catalytic power.