of efficient physicians residing in the vicinity of the store, and, in recommending them, a system of rotation and alternation is employed. Having recommended one doctor, the clerk crosses off that physician's name, and when the next request for a good physician is made, he selects the doctor whose name appears next on the list."

It appears that the drug seller feels proud of his Paris-like judgment and the drug journal apparently believed that physicians were devoutly thankful for the recommendation thus given. This much may be said of this seller of drugs: His advice is on a par with that which he gives when he recommends a "patent medicine," the composition of which he is ignorant, for a disease that he does not understand.

The plan proposed by this druggist is, of course, an insult to the medical profession, and it is evident that this has been generally appreciated, for the scheme does not appear to have found favor.

I am convinced that physicians fully appreciate the help which pharmacists can give them, and it only remains for the individual pharmacist to go to the individual physician and demonstrate that he is the one that may be relied on. This plan of procedure, I am sure, promises much good both for the pharmacist and the physician, and is my excuse for presenting this thought at this time.

PHYSICAL CONSTANTS OF THE U. S. P.*

G. H. MEEKER, PH. D., LL. D.

The historical and other introductory matter of the eighth revision of the U. S. P., together with the current federal and state pure food and drug legislation and the miscellaneous evidences of collaboration between the federal government and the revision committee, permit us to perceive how the pharmacopoeia has grown from the modest empiric beginning of 1820, then representing the more progressive pharmacologists of the Atlantic seaboard states, to its present position as the official scientific definer of the drug standards for the whole American public.

The present Pharmacopoeia bears internal evidence that the revision committee has spared no pains in endeavoring to produce scientific accuracy throughout; yet improvements can be, and no doubt will be, made in the ninth revision. It is the purpose of the present paper to point out certain important general improvements and some minor specific improvements which, in the author's opinion, should be made with reference to the physico-chemic data of the ninth revision as compared with the eighth revision.

A treatment of the subject, "The Physical Constants of the U. S. P.," would directly or indirectly require the consideration of:

1. The fundamental unit of length.
2. The fundamental unit of mass.
3. Other units related to 1 and 2—especially of volume and mass.

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4. The standard scale of temperature.
5. Normal temperature and pressure.
6. Official temperature and pressure.
7. The crith.
8. The official coefficient of thermal expansion of gases.
9. Official specific gravity.
10. The density of water at 25° C.
11. The table of relative atomic masses.
12. The official data for solubilities.
13. The official data for melting points.
14. The official data for boiling points.
15. The official data for optical rotatory power.
16. Data for weights in vacuo.
17. Water of crystallization.
18. Normal "air-dry" moisture.
19. Chemic formulae—especially structural.
20. The certification of weights, volume measures, thermometers and polarimeters.
21. Recalculation of stoichiometric data for preparations and assays.
22. Methods for fixing the exact strengths of volumetric solutions, especially alkalies and acids.
23. Miscellaneous topics, such as normal impurities in vegetable oils, iodine number, saponification value, etc.
24. Methods for making determinations of temperature, melting point (or freezing point), boiling point and optical rotatory power.
25. Improvement and amplification of the tables of the Pharmacopoeia.

The labor involved in a thorough examination into all of the points concerned in the foregoing tabulation is so great that for the purposes of this paper it has not been attempted. However, a painstaking examination of the U. S. P., combined with the lessons taught by experience with the Pharmacopoeia in its treat ment of the points at issue, carries the conviction that on the whole the physicochemic data of the U. S. P. are satisfactory in scope and trustworthy in accuracy. Nevertheless, one can observe shortcomings; and some of these are noted below.

I. IMPORTANT IMPROVEMENTS.

Needed reforms in the premises may be tabulated and discussed as follows:

(a) The complete and unequivocal adoption of the principle that the standards of the United States Bureau of Standards shall be, in so far as they are applicable, the official standards of the U. S. Pharmacopoeia; and that all sets of weights, volume measures, thermometers and polarimetric apparatus authorized by the U. S. Pharmacopoeia shall only be official when they have been certified by the U. S. Bureau of Standards.

(b) The eighth revision is particularly delinquent in the looseness of its provisions for temperature measurements. Anyone who has had to do with temperature measurements knows how easily these measures may go astray; and since the determinations of melting points, specific gravities, etc., are exceedingly important provisions of the Pharmacopoeia, the question of temperature should be

handled in a strictly scientific manner. We find the following definition of temperature on page LIII of the Pharmacopoeia:

"When there is occasion to indicate the degree of temperature, the scale of the centigrade mercurial thermometer, or in its absence that of Fahrenheit's thermometer, is employed.

The Bureau of Standards (see bulletin of the Bureau of Standards, Vol. III, 663 et seq., 1907), has the following to say concerning the definition of temperature:

Resolution of the International Committee on Weights and Measures, adopted October 15, 1887:

"The International Committee on Weights and Measures adopts as the standard thermometric scale for the international service of weights and measures, the centigrade scale of the hydrogen thermometer, having as fixed points the temperature of melting ice (0°) and of the vapor of distilled water boiling (100°) at standard atmospheric pressure, the hydrogen being taken at an initial thermometric pressure of one meter of mercury—that is to say, 1000÷760=1.3158 times the standard atmospheric pressure."

The scale adopted in this resolution refers to the scale defined by a certain standard hydrogen gas thermometer in the possession of the International Bureau of Weights and Measures at Sevres. This scale was compared with the scale defined by certain mercurial thermometers of French hard glass (verre dur), eight of which were sent to the United States to accompany the American prototype kilograms and meters. The scale defined by a mercurial thermometer is the temperature found after correcting the observed readings for various sources of error inherent in the mercurial thermometer. The values of these corrections have been accurately determined for the above standard mercurial thermometers of the United States Bureau of Standards, which thus serve as the working standards of the United States for fixing temperatures on the international hydrogen scale.

It is recommended that the revision committee employ the above definition for temperature, and avail themselves freely of the information contained in Circular No. 8 of the U. S. Bureau of Standards.

(c) Since the determination of melting points, boiling points, temperatures generally, and optical rotatory power are so important in the Pharmacopoeia, it is believed that the Pharmacopoeia should state official methods for making these observations. Everyone who has had to do with these tests knows the great desirability of specified procedure in the premises.

(d) The Pharmacopoeia should follow the custom universally adopted in scientific publications by citations of the original sources for its data. This necessity cannot be too strongly urged. If one examines physico-chemic tables such as the Smithsonian and those of Landolt, Castell-Evans and Beilstein, and the many tables as well as the original papers of investigators scattered through the various journals, one is impressed by the variation in the values given for melting points, solubilities and optical rotatory power. While it is believed that throughout the Pharmacopoeia authorities should be stated for all of the data included—with respect to melting points, boiling points, solubilities and optical rotatory power, it would appear to be particularly necessary for the Pharma-

copoeia to state the authority which it has accepted for each of its stated values. Melting and boiling points and optical rotatory power being particularly relied upon as tests for purity and identity of various substances of the Pharmacopoeia, it is only just and proper that an intelligent profession should not be compelled blindly to accept the present arbitrarily stated values. The remarks which have been made upon the subject of melting points, boiling points, solubilities and optical rotatory power apply also to miscellaneous special data such as physico-chemic constants of oils and other semi-controversial matters.

Obviously the purity rubric plays an important role here; and it is suggested that two sets of data should be given—one pertaining to the pure substance, and the other showing the permissible limits of the physical constants. The eighth revision appears to have at times stated melting and boiling points applicable to the pure substances only, whereas intending (as the purity rubric shows) to permit tolerable impurity. The intent of the Pharmacopoeia is thus brought into conflict with its provisions. It is here further suggested that freezing points might often be substituted for melting points with great advantage. This is already done in the eighth revision in the case of Phenol.

II. MINOR IMPROVEMENTS.

(e) With respect to the fundamental unit of length, the statement on page LIV of the Pharmacopœia that "the value of the United States National Prototype Standard Meter is identical with that of the International Standard Meter derived from the Métre des Archives" is not strictly accurate. In the first place, the inference would be drawn that there is but one United States National Prototype Standard Meter; whereas, of the prototype meters which were distributed to the governments contributing to the International Bureau of Weights and Measures, the United States received Nos. 27 and 21. No. 27 was the first received, and is the one which has been in actual use by the United States Government—No. 21 being held as a reserve. When the group of International Prototype Meters were prepared, the International Bureau selected No. 26 as being most nearly identical with the Métre des Archives from which all of the prototype standards were derived; and this No. 26 is preserved at Sévres as the real international standard meter. When compared in 1888 with the United States Prototype Standards Nos. 27 and 21, the value of No. 27 was given as 1 m.—1.55 microns @0°C.

About 1904 the United States Government made a recomparison of No. 27 with No. 26, and the value then determined was 1 m.—2.00 microns @0°C. However, the 1888 value has been retained as the official value of United States Prototype Standard Meter No. 27, and the Pharmacopoeia should so state.

On April 5, 1893, by executive action, the international meter and kilogram were declared the fundamental standards of length and mass for the United States for both metric and customary weights and measures; and the official relationship then established between the yard and meter is as stated on page LIV of the U. S. Pharmacopoeia. On this page the Pharmacopoeia says, rather loosely, concerning the kilogram that "the United States National Prototype Kilogram, like the International Standard Kilogram, is derived from the Kilogramme des Archives." The complete statement would be that the United States is in possession of Nos. 20 and 4 International Prototype Standard Kilograms.

Of these two No. 20 has not been used, No. 4 being the active standard. No. 4 is not exactly 1 kilogram, but is 1 kg.—0.75 mg. The publications of the United States Bureau of Standards give as the relationship between the pound avoirdupois and the kilogram, the following:

1 lb. avoirdupois=0.453592477 kg.

which would seem to be a better method of statement than that employed in the Pharmacopoeia, viz., 700000000/1543235639 kilogramme.

Authoritative information on the above points concerning the fundamental standards of length and mass are to be found in the publications of the United States Bureau of Standards, but particularly in the Bulletin of Standards, Vol. 1, page 19 et seq., 1904, and in Circulars Nos. 1 and 17 of the Bureau of Standards.

(f) Under the topic of Gasometric Estimations, in the Pharmacopoeia, certain official values should be stated. Normal temperature and pressure should be clearly defined, and an official value for the crith should be stated, so as to relieve the ambiguities which now exist in this portion of the Pharmacopoeia. Also at any portion of the Pharmacopoeia where gas calculations are involved in the assays, the factors employed should be clearly specified. To illustrate the present ambiguity of the pharmacopoeial gas calculations, it may be mentioned that under assay of solution of hydrogen dioxide the calculations concerning the volumes of available oxygen is made really at normal temperature and pressure and not at the official pharmacopoeial temperature, 25° C. This truth, however, only appears by inference when one checks the calculation. Furthermore, in the calculations upon the assay of spirit of nitrous ether, one does not find, except inferentially, any statement for the value of the crith. It is believed that the Pharmacopoeia should adopt for the value of the crith 9/100 of a gram, which is not only a convenient value, but also the value accepted by the Smithsonian Institution (see page 89 of Smithsonian Physical Tables, 3d edition). It is further recommended that in general, when the Bureau of Standards has no official data, the Smithsonian data shall be the guide in determining the official pharmacopoeial data. In this connection, since there is so much doubt as to the exact value to be assigned to the coefficient of thermal expansion of gases, it is suggested that the most convenient official coefficient would be .00367 for each degree centigrade, unless it be desired to state a special coefficient for each kind of gas upon which pharmacopoial calculations are made.

(g) In so far as we have examined those calculations of the Pharmacopoeia involving the determination of mass from stated volumes and specific gravity, the loose assumption is made that the pharmacopoeial specific gravity gives the mass of 1 cc. of the official liquid. The Pharmacopoeia should state a rule for determining mass in this connection, which rule should be based upon the statement that 1 cc. of water at 25° C has a mass of .997 grams. (See Smithsonian Physical Tables, 3rd edition, page 92.) The rule would read substantially, "The mass, in grams, of 1 cc. of any pharmacopoeial liquid is found by multiplying the officially stated specific gravity by .997." Perhaps it would be wise to add a table of masses of unit volumes of official liquids.

(h) With regard to the vexed question of the values to be assigned in a table of atomic masses of the elements, it is believed that a table based upon oxygen=16

would be much more convenient than the present table in the Pharmacopoia, and that the Pharmacopoeia should further declare that the official table of atomic masses shall be the last revised table issued by the International Committee on Atomic Weights. So much time elapses between the successive issues of the Pharmacopoeia that noticeable changes may have occurred in the table of atomic masses; and thus, in 1912 we still find ourselves using the table adopted by the International Committee for 1904.

(i) Rarely one finds discrepancies in statements concerning water of crystallization. For example, one may note the various statements encountered in the Pharmacopoeia with respect to the water of crystallization in mercurous nitrate (pages 530 and 589).

(j) From the introductory remarks of the Pharmacopoeia one can infer that of the tolerated innocuous impurities permitted under the various purity rubrics, unless otherwise stated the impurity is taken to be moisture. This, however, is inferential, and the pharmacopoeial statements should be everywhere explicit rather than implicit. It would be an excellent thing if the next revision of the Pharmacopoeia included explicit statements wherever necessary concerning what is considered to be the normal amount of moisture in the respective "air-dry" substances.

(k) Referring to the stoichiometric data underlying the various assays and preparations of the Pharmacopoeia, one occasionally meets with slight inaccuracies or inconsistencies, and it would seem as if this work should all be reparcelled out for recalculation.

(l) The pharmacopoeial methods for adjusting the strengths of volumetric solutions of acids and alkalies appear to be too narrow. Everything is functioned upon the preparation of normal potassium hydroxide solution against purified cream of tartar as a standard substance. This is indeed an excellent method; but it is faulty in that there is no safe check upon the purity of the potassium bitartrate—and, aside from this, any error made in adjusting the normal potassium hydroxide would be perpetuated throughout the series of alkalies and acids. It would appear that a much safer procedure would be to have each alkali and acid made *directly* and *independently*—using for alkalies pure potassium bitartrate and pure potassium tetroxalate as standard substances mutually checking each other, and for acids pure sodium carbonate and colorless, transparent Iceland spar as standard substances; and having in addition the cross-check between the acids and alkalies thus independently prepared. In this way faults in one standard substance would be detected through lack of agreement with the other standard substances; and each standard solution being made independently of the other, manipulative errors in the preparation of one would not be perpetuated through the series. For the standardization of $N/_{10}$ $KMnO_4$ the pure sodium oxalate to be furnished by the U. S. Bureau of Standards (see Bureau Circular No. 26, p. 8) would appear to be the most advantageous standard substance. Pure arsenous oxide is recommended as the standard substance for testing volumetric iodine solutions.

(m) Regarding the question of improvement and amplification of the tables of the Pharmacopoeia, reference should be given to the original sources from which the tables were derived. In the alcohol table a very useful addition would be a

column showing the "proof" of the spirit. Since in the commercial world from which the pharmacist obtains his alcohol the traffic is conducted on the basis of the "proof," it would seem very desirable for the pharmacopoeial alcohol table to contain such a column.

In conclusion it may be said that the foregoing discussion makes no pretense of being complete; but it is hoped that it contains timely suggestions which may prove of value.

MEDICO-CHIRURGICAL COLLEGE, PHILADELPHIA.

IS THE PHARMACIST EQUAL TO THE DEMANDS OF THE AGE?

"Another development of pharmaceutic demand is well illustrated by salvarsan. This is the year 1911. More is required of almost every profession and trade in this year than in 1811, vastly more than in 1711. It ought to be possible to send a prescription for salvarsan, ready for use, to any drug store, in 1911, with the same confidence of its prompt and proper preparation, as for laudanum in 1811. Einhorn's heads and packets for intestinal tests belong in the same category. Salol and keratin coated pills are another example. Suppositories and bougies of gelatin, cocoa butter, etc., are another. The fact that expensive and troublesome apparatus for preparing salvarsan are advertised in medical journals to physicians shows that the pharmacist is blinding his eyes to a proper and ultimately profitable extension of his scope.

"The words pharmacist and chemist used to be almost synonymous. Can the physician telephone to his druggist for a deci-normal solution of sodium hydrate, or a 1 per cent solution of a reagent or drug for local use, and be sure of accuracy? Some time ago, we wrote a prescription for a certain extract, in definite amount. We weighed it in its container, soaked it in alcohol, dried and weighed the box and label, subtracted, and found an error of 25 per cent.

"Has the druggist even weights and scales and graduates of sufficient accuracy for even approximate clinical determinations? Can he analyze urine in a suspected case for arsenic or morphine—fairly simple chemic examinations? Can he prepare extemporaneously, chromic catgut, aseptic dressings, etc.?

"We are writing in no fault-finding mood. We merely wish to impress on the pharmaceutic profession that there is a vast field of usefulness and profit requiring a development of special skill, along logical lines and into which it is practically forcing the medical profession to enter. And, meantime, the former profession is complaining of the non-support of the latter and trying to entice him back by a display of elixirs and 4-ounce mixtures which are almost out of date and which any one with a fairly accurate balance and a 25-cent graduate can compound."—*Buffalo Medical Journal.*