

## On the Introduction of Metrical Weights and Measures for use in Pharmacy.

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In proposing to submit the subject of weights and measures for discussion, my principal object has been to draw forth the expression of opinion as to the desirability of taking some steps to promote the introduction of the metrical system for use in pharmacy.

The subject has come under the consideration of the Pharmaceutical Society or its members on several previous occasions, and although some difference of opinion has been manifested on those occasions with reference to the practical expediency of attempting a sudden or speedy change from the system at present used in this country to the metrical system, yet the superiority, in many respects, of the latter, and the probability, amounting almost to certainty, that sooner or later it will supersede all other systems, have been generally admitted.

The object of establishing one system of weights and measures for all nations, commends itself so forcibly to the approval of those who are engaged in scientific or commercial pursuits, that the abstract proposition that it is desirable to accomplish such an object meets with ready assent, and any differences of opinion that may arise in connection with it almost exclusively relate to the comparative merits of different systems proposed for adoption, or to the balance between the anticipated gain from the adoption of that which is considered the best system and the loss or inconvenience which must inevitably attend a change while it is being made, or to the means by which, in the event of a change being decided upon, it may be most advantageously effected.

At the present time it seems hardly necessary to consider the question of the comparative merits of competing systems. The greater part of those who have studied the subject, and are capable of appreciating the relative merits of the system in use in this country and of the French system, have decided in favor of the latter; but with the general public the question is not one of comparative merits but of comparative acquaintance or familiarity with these or other means for estimating the measurement of quantities, and as they have daily occasion for the application of such means, they are satisfied to use those with which they are most familiar.

As far as the general public is concerned, I have no doubt the prevailing feeling would be in favor of leaving things as they are, or of mending but not revolutionizing our system; yet there is undoubtedly a growing tendency to aim at a nearer approach to perfection than is attainable by any mere patching of that which is already, but a clumsy piece of patchwork.

I believe the practical requirements of pharmacy present stronger grounds for a thorough reform of our system of weights and measures than can be adduced with relation to any other application of it, and the subject is one, therefore, which has strong claims upon our attention.

The acknowledgment in the Pharmacopœia "that the absence in the present system of any denomination of weight between the grain and the avoirdupois ounce of 437.5 grains, and the fact that the ounce is not a simple multiple of the grain, are grave defects," is

sufficient to establish the necessity for further change, and the only question is, as to the nature of change to be made. Shall we try again to patch up our own system, or shall we adopt an entirely new one?

The only new system that we can hope, or indeed could desire to have substituted for the one with which so much dissatisfaction has been expressed, is the metrical system, which has already received the sanction and approval of scientific and commercial men in almost every part of the civilized world.

In deciding to change our system for the metrical system, however, we do not necessarily imply that we are wholly dissatisfied with the one or entirely approve of the other. It is a great mistake, not unfrequently committed, to endeavor to discredit our system, in the hope of bringing about a speedy change to another, by ascribing to it defects that do not belong to it, and at the same time to extol the advantages of the metrical system by claiming for it more than it is entitled to.

It is sometimes represented that our weights and measures are not accurately defined, that they are liable to variation, and therefore cannot be relied upon, that in fact their construction is not based upon scientific principles, and that they are indefinite and uncertain.

On the other hand, the metrical system is sometimes represented as having a scientific basis, which gives to it in all its details a greater degree of certainty and accuracy than can be claimed for our system.

Now these are entirely erroneous notions, and it is important that no arguments in favor of the metrical system should be founded upon such false assumptions. Originally, it is true, there were no well defined standards to which our weights and measures could be referred for verification, and no scientific means by which they could be reproduced in the event of all existing measures being destroyed. When a troy grain had no better definition than the weight of a grain of wheat, when the inch was defined as having the length of three barleycorns, the foot the length of a man's foot, and the yard that of the king's arm, there was indeed uncertainty enough in these measures. And even when, in course of time, the natural standards originally referred to were superseded and more reliable ones adopted, much still remained requiring further improvement.

In the latter part of the last century, the reformers of the great French Revolution, in reforming the then existing systems of weights and measures, adopted three fundamental propositions on which to base their new system.

1. That some natural object or phenomenon, presenting an unvarying measure of extension, should be taken as the unit from which all their measures should be calculated.
2. That measures of extension, of capacity, and of weight, should bear a definite and simple relationship to each other and to the fundamental unit.
3. That the different denominations of weight and measure should be multiples and submultiples of each other by ten; in fact, that the system should be throughout a decimal system.

In seeking for a natural standard to be used as the unit of measure, they took the metre, not, as it would appear, because it was found or considered to be the most suitable measure that could be fixed upon, but because it was the ten-millionth part of a

quadrant of the earth's meridian. As it has since turned out, no advantage resulted from taking this particular measurement as the initial standard or unit, and in fact the first proposition might have been omitted without any practical disadvantage.

In this country we have pursued a somewhat similar course to that adopted by the French reformers, in reforming our system and framing that which has been established here by law, but we have not acted entirely upon the same principles.

We proposed to take an object representing an unvarying measure of extension, which depending upon a fixed law of nature, could be reproduced at any time and applied for the verification of our standards. But instead of taking the measurement of the earth's circumference, we took the length of a pendulum vibrating seconds of mean time, in the latitude of London, in a vacuum at the level of the sea. This measure scarcely differs from the French metre, but instead of using this measure as our unit, we used it only for indicating the proper length of the yard, from which all other measures of extension, capacity, and weight, according to our system, are calculated.

We have not established the same simple relationship between measures of extension, capacity, and weight, as exist in the French system, but have mostly retained such measures as were previously in use; and as the old measure was not framed in accordance with a decimal division, such a division does not characterize our system.

The essential differences between our system and the metrical system are these, that there is great incongruity between the different parts of our system, which is not the case with the metrical, and that the metrical system is a decimal one, which ours is not.

It may be stated of both systems, and equally of both, that the means originally proposed and provided for verifying the standard by reference to natural objects or phenomena have not proved to be practically available. Both systems in this respect have, to a certain extent, given way under the rigid application of the test of experience, and it is found that the most accurate method of verifying all weights and measures is by comparison with artificial standards carefully kept for that purpose.

Any superiority for which the metrical system may possess of ours must be referred not to the method of determining the fundamental unit from a natural standard, but to the more perfect systematic manner in which all measures are related to the first integer in this system, to the decimal arrangement in it of all measures, and above all to the fact that it presents the only apparent means by which we can reasonably hope to establish one uniform system of weights and measures for all countries.

The advantages which in these respects the metrical system presents would probably ensure a ready assent to its adoption, if those required to use it could be induced so far to master the details of the subject as to acquire definite ideas of the quantities represented by the integral measures. It is with reference to this part of the subject that I wish particularly to invite discussion.

If we are to look to the metrical system as that which is ultimately to replace our present system we must prepare the way for its adoption by making those who are engaged in the practice of pharmacy acquainted with