

THE APPROACHING REVISION
OF
THE BRITISH PHARMACOPEIA.

THE WEIGHTS AND MEASURES OF THE
BRITISH PHARMACOPEIA.

By WILLIAM KIRKBY,

Pharmaceutical Chemist; Lecturer on Pharmacognosy in the Owens
College.

THE BEGINNING OF THE CONFUSION.

It is now over thirty years since the first edition of the *British Pharmacopœia* was published, in which the imperial pound and ounce were made official for the compounding of medicines. Previous to that time it was customary to use the apothecaries' ounce for this purpose. As the latter contained 480 standard grains and the former 437.5, the change was not only a very considerable one, but a very confusing one, because the imperial ounce cannot be divided into aliquot parts containing an integral number of grains. In consequence of this difficulty the editors recommended that prescribers and dispensers should discontinue the use of the drachm and scruple—in other words, that all quantities less than an ounce should be expressed in grains. Imperial measures were likewise adopted for denominations of one ounce and upwards, but for lesser denominations the old apothecaries' measures were retained, notwithstanding that the unit of measure—the minim—bears no simple relation to the unit of weight—the grain.

In the next edition, published in 1867, the same systems were directed to be used for the preparation of medicines; but instead of reaffirming the desirability of prescribers abandoning the drachm and scruple weights, the use of them was made optional. In deference to the general custom of using metrical weights and measures for chemical analysis, the metric system was introduced as an alternative in the processes for the volumetric estimations in this edition. After a lapse of eighteen years the present edition appeared. As I intend to consider with some little detail the weights and measures specified for use in compounding its formulæ, I venture to quote at length the short paragraph of the preface which deals with this matter:

"An attempt has been made to introduce a method of setting out the relative quantities of ingredients used in some of the processes by supplementing the respective weights and measures by proportional parts. It was at first proposed that the use of parts should altogether supersede that of weights and measures, but it was thought better, at least for the present, merely to supplement weights and measures by parts when the context permits, and where this can be made more clearly to show the proportion which the several parts bear to each other. Wherever this method is employed the term 'parts' signifies parts by weight, and the term 'fluid parts' signifies the volume of an equal number of parts of water."

AMBIGUITY.

Although the editors appear to have fully recognised the difficulties incident to the use of the imperial ounce of 437.5 grains, it is extremely disappointing to find such frequent evidence of their indecision as to the value in grains of the eighth part and the half of an ounce. From the lists setting forth the strengths of the Galenical preparations it appears that sometimes the eighth of an ounce is $54\frac{1}{2}$ grains (tinct. sumbul, etc.), and sometimes 55 grains (infus. gentian. comp.). The same lack of decision is shown in the various ways the same fact is expressed. Thus the infusions of valerian, rhubarb, and roses are all directed to be made with a quarter of an ounce of the drug to 10 ounces of water. In the lists of preparations given under the respective drugs, three different ways of expressing the strength are made use of: infusion of valerian is 220 grains to a pint, infusion of rhubarb 11 grains to an ounce, and infusion of roses half an ounce to a pint. In the case of tinctures sometimes the strength is given as $2\frac{1}{2}$ ounces to one pint, and sometimes as $54\frac{1}{2}$ grains to one ounce. Instead of forming a useful feature

of the *Pharmacopœia* the lists of preparations given under the drugs and chemicals are liable to give rise to considerable confusion. Ambiguity is not confined to the expression of the quantities, but is imported into the inoffensive little prepositions "in" and "to." In common speech and in pharmaceutical terminology they have meanings which are certainly not identical, but in the *Pharmacopœia* they are frequently used in precisely the same sense. Under extract of socotrine aloes it is stated that the compound decoction of aloes contains "4.3 grains in one fluid ounce," and under myrrh it is said that there are "2.2 grains to one fluid ounce" of the compound decoction. The same mistake is made with regard to linimentum sinapis compositum, which contains one fluid drachm of castor oil to one fluid ounce, and 8 grains of the ethereal extract of mezereon in one fluid ounce. "To" connotes the idea of addition, an idea which is foreign to both the examples mentioned.

The principal difficulty in the use of the weights and measures adopted by the *Pharmacopœia* authorities lies in the fact of the ounce of water having a weight of 437.5 grains and a measure of 480 minims. The result of this is that a solution containing 1 part of a solid in 10 parts, if compounded in weights and measures of denominations above an ounce, will not contain 1 grain in 10 minims, but 1 grain in 11 minims, and 10 minims will only contain 0.91 grain.

A TRANSITIONAL PERIOD.

Although the paragraph quoted from the preface of the *Pharmacopœia* does not contain a definite statement of the reasons which led to the adoption of the system of proportional parts, there can be but little doubt that it was because the editors felt the great need there was for a system of weights and measures which would permit of centesimal calculations, and they did not see their way to the introduction of the metric system without first establishing a period of transition. The intention was decidedly good, especially as provision was made for the measuring of liquids in accordance with English practice, and not for the weighing of them according to Continental custom. According to what rules it has been applied in the formulæ of the *Pharmacopœia* I cannot discover. The preface says that it has been employed "when the context permits, and where this can be made more clearly to show the proportion which the several parts bear to each other." This can scarcely have been the only cause for the erratic manner, from the point of view of the preface, in which "parts" formulæ are distributed throughout the *Pharmacopœia*. All the ointments have alternative "parts" formulæ, whereas only one tincture is so treated. The uniform application of this system to the ointments cannot be for the reason given in the preface, because in some cases nothing whatever is gained in clearness. For example, the ointment of oleate of zinc, in which 1 ounce of each of the two ingredients is directed to be taken, what help is rendered by giving as an alternative the directions for 1 part of each?

Some inexplicable inconsistencies are to be found among the ointments in the relation the two sets of formulæ bear to each other. Unguentum belladonnæ and unguentum hydrarg. ammon. are directed to be made with 1 part of the active ingredient and 9 parts of the base; but in the former ointment 1 part equals 50 grains, and 9 parts equal 1 ounce (437.5 grains), and in the latter 1 part equals 50 grains, and 9 parts equal 450 grains. It were a waste of time and space to speculate upon the reasons for such anomalous statements. I shall therefore content myself with giving a few more instances to show what a hopeless muddle has been made of what might have been a real stepping-stone to a metric system of weights and measures suited to British requirements. The one tincture favoured with a formula in "parts" is tinctura podophylli; it is given as resin of podophyllum 1 part, rectified spirit 54.68 fluid parts. One cannot help wondering how this quantity is to be measured without first making an elaborate calculation. Tinctura quinina has precisely the same strength, but no alternative "parts" formula is given; vinum ferri citratis has also the same strength and a "parts" formula, but instead of agreeing with that of tinctura podophylli it appears as 1 part of the active ingredient and "55 fluid parts nearly" of the vehicle. Surely the editors must have unbounded confidence in the skill of the men who compound the recipes of the *Pharmacopœia*;

otherwise they would hardly expect them to successfully measure "55 fluid parts nearly." This cannot be seriously intended for a working formula; it is merely a display of the variety of ways in which the same statement may be expressed. The fear of being monotonous has been a bogey—haunting the compilers with a tiresome persistence. As in the imperial weights and measures, so in the "parts" dull uniformity has been most successfully avoided. Unguent. gallæ, ungu. hydrarg. subchlorid., and ungu. zinci all have a strength of 80 grains to 1 ounce of base; in equivalent parts it is given in the first as 1 part and 5.5 parts, in the second as 1 part and 5.47 parts, and in the third as 2 parts and 11 parts. It is true that these whimsicalities do not interfere with the production of reliable preparations by the discreet pharmacist, but they do detract very considerably from the value of the *Pharmacopœia* as a standard work of reference.

INACCURACIES.

The formulæ of some of the Galenical preparations are open to a much greater objection than those already noticed. They either do not yield preparations of the strength they are stated to have, or the two alternative formulæ give different results. The compound rhubarb pill is directed to contain 90 minims of oil of peppermint in the Pharmacopœial quantity of mass, but according to the "parts" formulæ it will only contain 80 minims. Many instances of errors of this kind are found among the so-called percentage solutions of alkaloids and other poisonous substances. Attention has been so frequently called to these errors that it may seem superfluous to do more than mention them. But at the risk of being considered prolix I venture to particularise a few of the more apparent discrepancies. Liquor arsenicalis should contain 87.5 grains instead of 87 grains of arsenious acid to carry out the intention of the editors. In Donovan's solution the proportion of the active ingredients is given as 90 grains to the pint instead of 87.5. It would seem the easiest thing in the world to make such simple solutions as liquor atropinæ sulph. and liquor sodii arseniatis to at least correspond with one another, and they are both stated to have a strength of 1 in 100. Yet the former has 9 grains dissolved in 16½ fluid drachms of camphor water (1 in 101 fluid grains) and the latter 9 grains in 2 fluid ounces (1 in 98.2 fluid grains).

The greatest deviation from the percentage ideal occurs in the liquor strychninæ hydrochl., in which no allowance has been made for the condensation of the mixture of rectified spirit and water; accordingly the first formula results in a strength of 1 grain in 96.7 fluid grains, and the second in a strength of 1 grain in 97 fluid grains. In these alkaloidal solutions a deliberate attempt was made to approach true percentage solutions as understood by pure chemists. The effort has been anything but successful. Even if it had been successful, I fail to see of what service it would have been either to the medical man or the pharmacist. In devising formulæ for liquid medicines there are two considerations which should be kept in view: first, the convenience of the prescriber in ordering with certainty and ease the exact quantity of a medicament in any proportion he may desire, and in remembering the exact strength of all galenical preparations; secondly, the welfare of the patient in being able to measure exactly the prescribed quantity of a medicament when exhibited in the liquid form. Supposing these alkaloidal solutions do contain 1 grain in 100 fluid grains, the prescriber, if he desires to order a quarter of a grain, must direct the pharmacist to use 27½ minims, because the fluid grain is not a legalised measure. There at once arises the difficulty of measuring the exact quantity, and the prescriber is required not only to remember that these are so-called percentage solutions, but he must also remember the relation of fluid grains to minims. The medical man's difficulty creates that of the patient, who very rarely, if ever, gets in a dose an aliquot part of a grain of these strong remedies. These solutions are not true percentage solutions because the specific gravity of them is altogether ignored. They are, therefore, neither scientifically correct nor practically useful.

THE END TO BE SOUGHT.

As the measuring of liquid medicines by patients is so convenient and so desirable for the ensuring of accuracy of dosage, it cannot be denied that the only practically useful sys-

tem for formulæ for liquid preparations is to have the medication expressed in terms of weight which are integral parts of the terms of measure. All Galenical preparations, standardised or not standardised, should conform to this rule.

In the forthcoming *Pharmacopœia*, the simplest way out of the difficulty with regard to percentage preparations would be to adopt the metric system, but modified according to the American plan by measuring instead of weighing all liquids. The non-legalisation of the metric weights and measures for purposes of trade in this country is, however, a great difficulty, but it may possibly be overcome ere the publication of the next *Pharmacopœia*. If it should only be used in alternative formulæ, confusion and inexactness will be again introduced into all the preparations which are prescribed and dispensed in minim quantities. These articles ought to be compounded and prescribed in terms of the metric system only; but if the imperial weights and measures are used, then they ought to contain an integral number of grains in an integral number of minims.

The charming diversity in expressing the strengths of preparations in the present *Pharmacopœia* has very serious drawbacks which do not even need to be mentioned. In future a uniform system of expressing them should be adopted, and I would suggest that the centesimal proportions should be used—so many units of weight in 100 units of volume. To ensure accuracy, liquid preparations should be made up, after the lapse of an adequate period of time to allow of condensation or cooling, to a given volume with a suitable liquid at a given temperature.

Analytical operations are very rarely carried out with grains and fluid grains, the metric system being almost universally adopted in laboratories. For this reason, if for no other, it is extremely desirable that the quantitative tests of the *Pharmacopœia* should be set forth in terms of the metric system, and that the results should be given as percentages.

THE PUBLIC HEALTH OF LONDON.¹

THE second annual report presented by Mr. Shirley Murphy to the London County Council is even more full of interesting and important matter than its predecessors, and is accompanied by five appendices consisting of reports, etc., in connection with the public health work of the Council.

The annual report itself extends to 67 foolscap pages, and is illustrated by 17 diagrams; it is divided, as the report of last year was, into a portion dealing with statistics and a portion dealing with administrative work. The former relates to the vital statistics of the population of the administrative County of London for the year 1893, and the well executed diagrams graphically depict the variations in the birth-rate, marriage-rate, and death-rate of that population during a period of years, and show the extent to which zymotic disease has prevailed in recent times in the large metropolitan community. The excess and defect above and below the mean death-rate in the case of the principal infectious diseases as manifested in London present themselves clearly to the eye, and suggest the comparison that has been made between these manifestations and those of the rhythmical rise and fall of "waves on the enridged sea."

A table is given in the present report showing the marriages of minors in London registration divisions during the years 1885 to 1892, while another new table deals with the proportion of legitimate and illegitimate births in those divisions. The method employed by the Registrar-General with respect to the thirty-three large towns of England and Wales has been applied for the purposes of correcting for differences of age and sex distribution the death-rates of the forty-one London sanitary districts, and the comparative mortality figures for each of these districts are given (London as a whole being taken as a standard at 1,000). This method of comparison shows how favourably Hampstead, with a comparative mortality figure of 673, and Lewisham with 704, compare with such districts as St. Luke (1,498) and the Strand (1,592). It is clear that the eulogiums which have lately been passed, in connection with the recent weekly returns of

¹ Annual Report of the Medical Officer of Health of the Administrative County of London for the year 1893. Sold by Edward Stanford, Cockspur Street, Charing Cross. 2s. 10d.