

**Remarks on the inaccuracy and uncertainty of the present method of compounding medicines by drops : together with some hints, which may lead to greater correctness in future : read before the Liverpool Medical Society / by C. Shuttleworth.**

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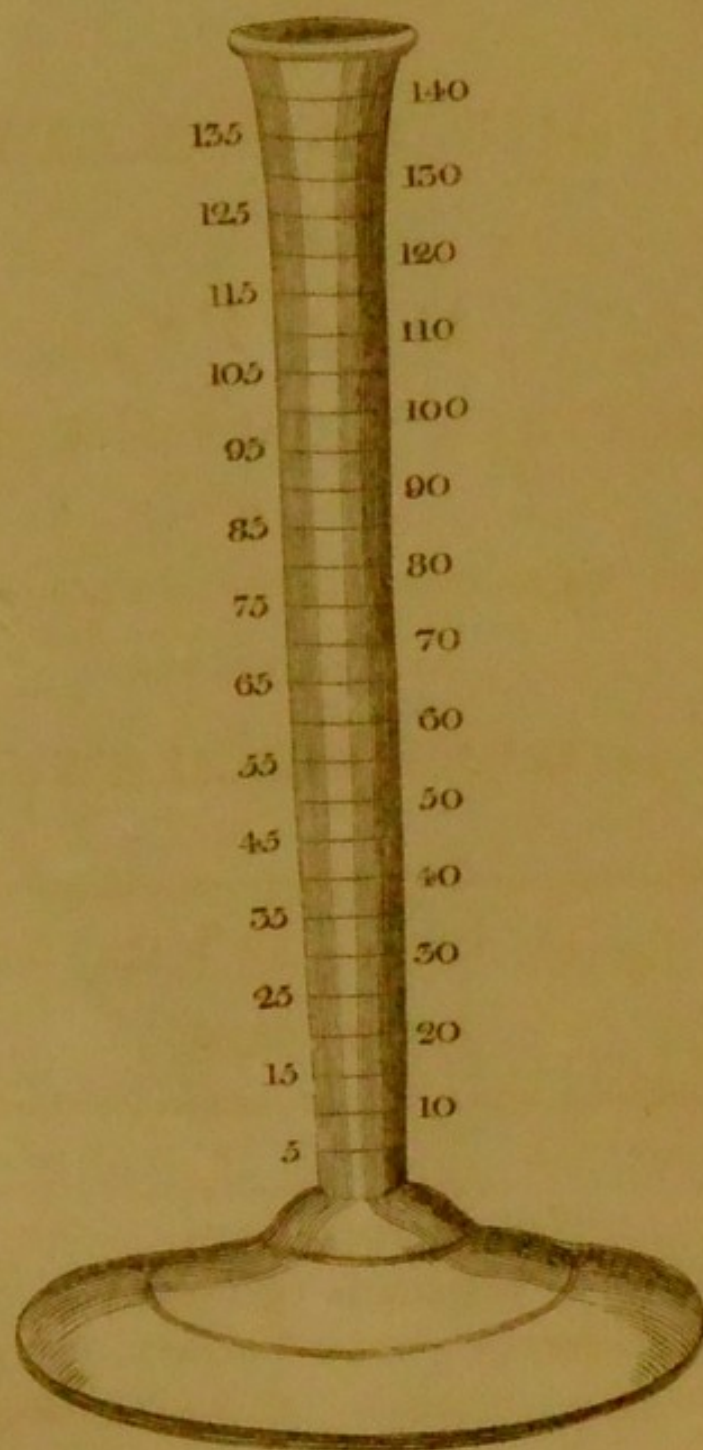
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Tr A. 90

## DROP MEASURE.





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REMARKS  
ON THE  
INACCURACY AND UNCERTAINTY  
OF THE  
PRESENT METHOD  
OF  
COMPOUNDING MEDICINES  
BY  
DROPS;  
TOGETHER WITH SOME HINTS,  
WHICH MAY  
LEAD TO GREATER CORRECTNESS IN FUTURE;  
READ BEFORE THE  
LIVERPOOL MEDICAL SOCIETY.

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By C. SHUTTLEWORTH,  
SURGEON.

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1808.

# REVIEWS

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TO  
THE MEMBERS  
OF THE  
LIVERPOOL MEDICAL SOCIETY,  
THESE REMARKS,  
WHICH  
WERE HONOURED WITH THEIR APPROBATION,  
ARE DEDICATED,  
BY THEIR OBEDIENT SERVANT,  
THE AUTHOR.

LIVERPOOL,  
*Clayton-square, January 1, 1808.*

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## REMARKS, &c.

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GENTLEMEN,

IN our occasional conversations, on the subject of administering medicines by drops, a difference of opinion appeared to prevail amongst us, respecting the number contained in a drachm-measure. The inquiry being interesting and important, since, on the result of it, must depend an accurate application of the most active medicinal articles, which are destined to mitigate the sufferings of a disordered frame, I determined to enter on a series of experiments,



in order to attain more correct information, and, if possible, to arrive at some indubitable conclusions. I therefore lost no time in procuring, from Apothecary's Hall, a drop-measure, sanctioned by their seal and signature, and which is now adopted in various parts of the kingdom. Being thus provided, I did not apprehend that any difficulty could occur on a subject apparently so simple; yet the inquiry has unfolded circumstances of considerable importance, and led me to some unexpected results, which I think it my duty to lay before you.

It is a fact familiar to you all, that the size of a drop of any fluid is materially altered by the lip of the vessel from which it falls; but I confess that, for a short time, I was puzzled at the different results which



were obtained by some of my friends in my presence, though they employed the same phial and fluid which I myself had used. The difference in an equal number of drops amounted to a fifth, a fourth, and even, in some instances, to a third part of a drachm by measure.

In order to discover the cause of a difference so extraordinary, we marked the points of the lip of the phial from which the fluid was dropped, and each of us dropping the fluid from the same point of the lip, it appeared that our results were the same. It further appeared, that a variation in the size of a drop, too considerable to be overlooked, may be occasioned by the greater or less thickness, or by a difference in the shape of the lip of even the same vessel,



independently of either the nature of the fluid or the size of the phial in which it may be contained. But as it became necessary to adopt some standard, we endeavoured to discover a point in the lip of a bottle, which should produce drops of water of such a magnitude, that sixty would be exactly equal to the drachm-measure. After various trials, we found that the mouth of a measure, already in my possession, was precisely what we wished to procure; and that it would enable us to perform our experiments with peculiar exactness, admitting of no deception, since its form would prevent us from varying the exact point whence the drop would issue. We had next to provide ourselves with a pair of scales, and we made choice of those which are contained in Dr. W. HENRY's test-box, and which are well known to be constructed



with the nicest accuracy of beam. The result of our inquiries was invariably as follows:

		GRANA.	GTTS.
Aq. distillat. ....	3 mensura eqt.	60 eqt.	60
Solut. Arsenici, Dr. F. ....	3 —————	$60\frac{1}{4}$ ———	60
Vini albi .....	3 —————	$58\frac{1}{4}$ ———	94
Ipecac. ....	3 —————	$59\frac{1}{4}$ ———	84
Antimon. ....	3 —————	$59\frac{1}{4}$ ———	84
Sp. Vini rect. ....	3 —————	$51\frac{1}{2}$ ———	$151\frac{1}{2}$
ten. ....	3 —————	$55\frac{1}{4}$ ———	140
Tinct. Opii .....	3 —————	$59\frac{1}{2}$ ———	134
Digital. ....	3 —————	58 ———	144

## TABLE TRANSLATED.

		GRAINS.	DROPS.
One drachm by measure of	Distilled Water .....	weighed 60	equal 60
	Solution of Arsenic, Dr. F.'s .....	$60\frac{1}{4}$ ———	60
	White Wine .....	$58\frac{1}{4}$ ———	94
	Ipecacuanha Wine .....	$59\frac{1}{4}$ ———	84
	Antimonial Wine .....	$59\frac{1}{4}$ ———	84
	Rectified Spirits of Wine .....	$51\frac{1}{2}$ ———	$151\frac{1}{2}$
	Proof Spirit .....	$55\frac{1}{4}$ ———	140
	Laudanum .....	$59\frac{1}{2}$ ———	134
	Tincture of Foxglove .....	58 ———	144



All the above fluids being kept in the same room, had probably nearly the same temperature with the water, viz.  $55^{\circ}$  of Fahrenheit. I think it right to observe, that a frequent repetition of these experiments entitles me to affirm that the foregoing Table possesses sufficient accuracy in a practical view. In these experiments, the weights which were used did not go below the eighth of a grain. If smaller weights had been used, perhaps greater precision might have been obtained; yet the want of perfect accuracy, occasioned in part by not using smaller weights, was increased, through the difficulty of determining by the eye, whether, by the addition or subtraction of a single drop of spirit, the surface of the fluid in the measure was raised above, or depressed below the line which marks a drachm,—although an instrument was used,



in every experiment, to preserve an exact level. With respect to the Tinctures which were made use of, it may be proper to observe that, by evaporation,

## GRANA.

Tinct. Opii .....	3	habebat	$3\frac{1}{4}$	ext. sicci.
Digitalis .....	3	———	$4\frac{1}{2}$	—— mollis,
Vin. Ipecac. ....	3	———	$2\frac{1}{2}$	———

## GRAINS.

1 drachm {	Of Laudanum .....	contained	$3\frac{1}{4}$	of solid extract.
	— Tincture of Foxglove .....	———	$4\frac{1}{2}$	— softish ditto.
	— Ipecacuanha Wine ....	———	$2\frac{1}{2}$	— ditto, ditto.

Therefore, nine drops of Tinct. Opii, contain one-fourth of a grain of the extract; and eight drops of Tinct. Digitalis\* contain one-fourth of a grain of soft extract.—Mr.

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\* The Tincture of Digitalis was made in the proportion of one part of the leaf, by weight, to four of proof spirit.



LANE's drachm-measure appearing to be an exact medical drachm, we made use of it in all our experiments; but you will not be a little surprised to find, that this measure is so graduated, that it is adapted for the measurement of aqueous fluids only, and is, consequently, limited in its use to FOWLER'S solution of arsenic. If a prescription, therefore, be made by this measure, the space marked by the scale as containing thirty drops, really contains seventy-two, of the tincture of digitalis; sixty-seven of laudanum; and forty-two of antimonial and ipecacuanha wines. — Yet, Gentlemen, that these are facts, I appeal to two of our Members, one of whom\* assisted me through the whole of the investigation, and the other † made experiments

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\* Dr. Lewin.

† Dr. Bostock.



totally unconnected with ours, yet very nearly coinciding in their results. We were, however, enabled to account for the trifling difference which appeared between the results of his experiments and ours, by discovering that his standard drop was not of the exact size which we thought fit to select. I cannot but observe, that the use of Mr. LANE's measure must produce dangerous consequences, as it is impossible to suppose, that it was designed only to ascertain, whether a drop more or less of water should be contained in any mixture. I leave you to judge in what errors, this measure, under the sanction of such high authority as that by which it is recommended, may have involved Druggists, to whom a large share of the composition of medicines is entrusted, as well as men of more scientific information.



Allow me here to state a fact, which we\* were not able satisfactorily to explain. After the commencement of the frost, which was accompanied with snow, we were induced to try whether a drachm of distilled rain or spring water differed as to the number and specific gravity of their drops, when, after repeated trials, we found that neither the one nor the other would produce above forty-five or fifty-two drops to the drachm. The temperature of these fluids was similar to that of the water first used, and differed in no quality that could be ascertained. I leave it to the Society to conjecture, whether any electric or galvanic influence could have occasioned results so different from those of our previous experiments.—Hence

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\* Dr. Lewin and the Author.



arises a new and important objection to the use of drops as a measure of quantity.

But to make a few observations on the subject before us. The practice of ordering medicines by drops, has probably been a principal reason why medical men find an almost unaccountable difference in the operation of the same quantity or doses of medicines, not only on different constitutions, but on the same individual at different times. A drachm of the tincture of foxglove may contain from one hundred and fourteen to one hundred and forty-four drops, whilst the prescriber has probably considered a still smaller number as equal to a drachm. In the solution of arsenic, a drachm may contain from forty-five to sixty drops, which is in the proportion of three to four. If we, therefore, intend to administer twelve drops



of the smaller size, and the same number of the larger size be given, the dose will amount to sixteen drops; or, if our intention be to order twelve of the larger drops, and the small drop be conveyed into the mixture, the dose will amount to only nine of those designed by the prescriber. Suppose four drops of this solution to be ordered for a child, the variation in the quantity of the dose, may be such as to cause, in the one case, five drops and one-third, as in the other only three to be taken by the patient. I need not remark to you, Gentlemen, that, if danger may have been occasioned to adults from such constant inaccuracy, how fatal may have been the consequences that have arisen to younger patients.

I therefore appeal to you, whether we ought not immediately to abandon a custom



which has so long prevailed in our profession; and whether the following, or some similar practice, ought not to be adopted. The medium number of drops, contained in a drachm of tinctures, may be fairly assumed at one hundred and forty; this is the real number contained in a drachm of proof spirit:\* one hundred and forty drops of proof spirit are equal to sixty of water; therefore, seven drops of spirit are equal to three of water. From this datum, the graduation of a measure becomes simple and easy, if the weather be not frosty. Let, then, a tube be graduated according to this rule; the leading great divisions, being measured by three, six, nine, twelve, fifteen, &c. standard drops of water, must be marked

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\* I am aware, that a late Pharmaceutical publication differs by forty drops from this statement.



seven, fourteen, twenty-one, twenty-eight, thirty-five, &c. for tinctures; the intermediate number can alone be filled up by using proof spirit as a measure of those subdivisions. Or take two grains and one-eighth of water by weight, which equal five drops of spirit, and proceed. Or if mercury, divided in the usual way, be preferred, by the manufacturer, after exactly weighing a measured drachm of it, there can be no objection; but let him be cautious lest he fall into error for want of taking this preliminary step, as the real weight of a measured drachm of mercury will be found to differ widely from the weight given in some popular Tables.

The following method will perhaps be preferred to the preceding ones. Let a cylindric glass tube, open at both extre-



mities, and of equal bore through its whole length, be thus prepared: immerse it in water, so deep as to cause it to hold exactly fifteen drops, and mark the level of the contained fluid. This space, divided into seven equal parts, as it forms a measure of thirty-five drops of spirit, will be separated into spaces holding five spirit drops each. To make use of this instrument, dip it in water up to the first, second, &c. division, and stop its upper end with a finger, that the column of fluid may be supported by the atmospheric pressure from below, then let it empty itself into the measure to be graduated. The level of the water, after it has trickled from the sides of the vessel, must be marked as the first, second, &c. divisions, answering to five, ten, &c. drops. The like mode may be continued with speed and accuracy, till the



number of divisions be completed which any one may require.

The reason why I prefer water to spirit, as a standard by which to graduate the scale, is, that the quick evaporation of spirit, during the above-mentioned experiments, was found to be a source of greater mistakes than at first would have been imagined. For aqueous fluids, the subdivisions of Mr. LANE's measure are tolerably exact. Should a graduated measure for wine be thought necessary, it may easily be formed. For as sixty drops of water are equal to eighty-four of wine, let eighty-four be taken as a standard, and all the intermediate degrees may be easily adjusted.

Thus, Gentlemen, I have, according to my promise, laid before you the remarks



which have occurred to me since our last meeting; and I think you will agree with me, that no conscientious compounder of medicines will be averse from providing himself with a measure graduated by the above regulations, and which I hope to succeed in procuring a manufacturer\* to prepare and sell.

As connected with the present subject, permit me to conclude with observing, that I have lately met with an instance of a six-ounce mixture, which contained very important ingredients, being taken in half the time which had been intended, owing to a difference in the size of modern spoons, both table and tea spoons. To prevent this error from occurring in future,

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\* Mr. Kirk of Liverpool.



I have obtained a glass measure, divided into the proportions of one drachm, two drachms, half an ounce, one ounce, and one ounce and a half, &c. under the appellation of tea and table spoons,\*—and this I shall recommend every patient to procure, as a safe and clean measure, and to prevent the injury which spoons may receive from being used in administering medicines.†

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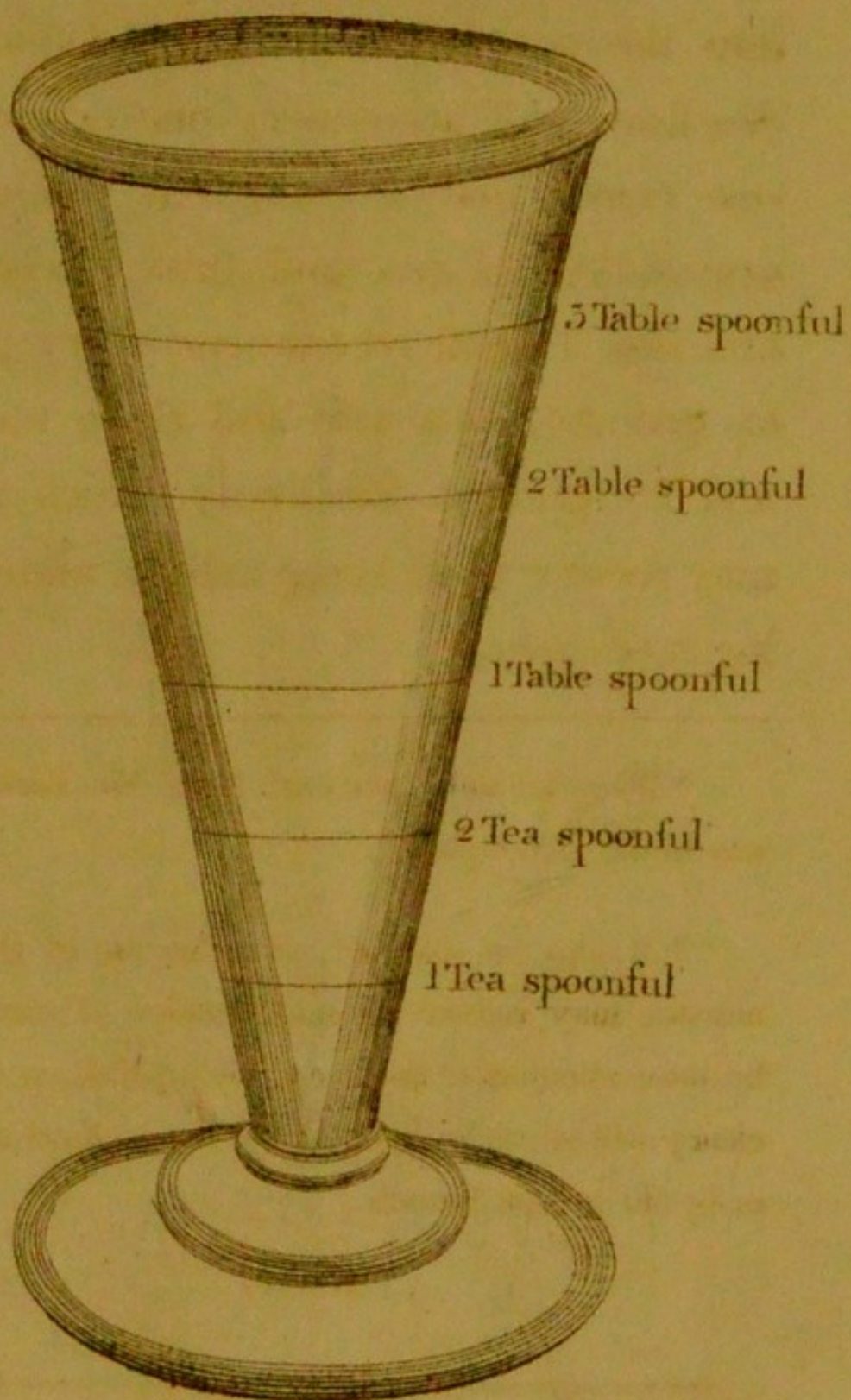
\* They are to be procured from Mr. Kirk's glass-warehouse, Liverpool.

† It may be observed, that the use of the above measure may induce the compounders of medicines to be more attentive to the size of their phials, as any deficiency will be easily detected by the medical attendant, or by the patient himself.

FINIS.



## FAMILY MEASURE.





THE HISTORY OF THE

