

Observations on medical weights and measures.

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Part First.

ORIGINAL COMMUNICATIONS.

ARTICLE I.—*Observations on Medical Weights and Measures, with the Method for their Adjustment in the New British Pharmacopœia.*
By CHARLES WILSON, M.D., Fellow of the Royal College of Physicians, Edinburgh.

No one will question the importance of a well-arranged system of Weights and Measures in Pharmacy, though many may look with little interest on the history of their use, in different ages and in different countries. Without altogether neglecting the latter department of the subject, I shall enter no further upon it, during the following remarks, than may appear necessary for purposes of illustration, in so far as a knowledge of the past condition of any arrangement is desirable or requisite for a just appreciation of its future changes. To attempt more would demand the scope of an ample treatise: for, so far from the topic of medical weights and measures being a simple and easy one, the history of their origin, of their various relations, and of their changes, to and fro, at different periods, is one of great intricacy, and demanding proportionate labour. My leading object will be to indicate briefly the present state of medical metrology in this country, and to point to its improvement.

But what might, at other times, be received merely as a question of great, though not of any special or immediate interest, must be admitted as having peculiarly direct claims on attention at the present conjuncture. The fact that, under the recent Act for registering the qualifications of medical practitioners, there is a clause authorising the General Medical Council to frame, or cause to be framed, a new British Pharmacopœia, and to fix the proper weights and measures by which its formulæ are to be compounded, with the knowledge that, accordingly, such a Pharmacopœia is already in progress under the auspices of that body, gives a singular opportune-

ness to the consideration of the topic before us. Manifestly, if any change be discovered to be necessary, in any single department of pharmacy, such a change can be best accomplished now, when the various other alterations requisite to bring into harmony the different pharmacopœias of the three United Kingdoms, and to adapt the whole to the existing state of medical knowledge, and to the more thoroughly ascertained of the exigencies of medical practice, must inevitably introduce much that is novel and break up or modify much that is old; facilitating, therefore, the simultaneous introduction of every other description of change found to be advisable, and presenting the occasion for moulding the united labour demanded into one effort to be made by the compilers and one lesson to be mastered by the druggist and the practitioner. And this must be especially true of any department so thoroughly pervading the rest as that of the weights and measures. If a change in them be really necessary, that change should be made now, when it will obviously glide easily into use with all the rest. Defer it, however, and the bulk of the recently advanced labour will be proportionately rolled back, to be commenced anew so soon as the clamour for the removal of defects has become too strong to be disregarded; and then as a task the more ungrateful, that it will be felt that it might have been rationally anticipated and avoided. Such an alternative once determined, and it is that which is really in prospect, it cannot be difficult to discern the part likely to be taken by the eminent men who constitute the Medical Council.

All are aware, that the standard originally authorised for pharmaceutical uses in this country, after the period of the constitution of the London College of Physicians, and more particularly at the time of the issue of the first Pharmacopœia of that body, was that modification of the troy weight, which, from certain peculiarities in its lower sub-divisions, has been especially designated as the apothecaries' weight; and that this was thenceforward appointed to be held as appropriated for exclusive use in medicine, and in the laboratories of the druggists. But there was, probably, even at this early period, an element already at work, which shook the security of the exclusive sanction designed to be thus given to the troy standard; and this lay in the habit of the wholesale druggists with reference to their sales, which were made to the retailers by the avoirdupois weights. Thus the apothecary was at once placed in the predicament of having to purchase most of his wares by one description of weight, imposed upon him from beyond the profession, and to compound, sell, and dispense them by another, which a legitimate authority had enjoined within the profession; and therefore, in the latter case, with what ought to have been all the influence of a direct and natural claim upon his implicit compliance. The embarrassment thus occasioned soon led to a partial infringement of what had been fixed upon as the rule; and this was glided into the more readily, that the universal adoption of the avoirdupois system, by all

the common departments of trade and commerce throughout the country, increased obviously the convenience of retailing those medicines, the precise quantities of which were not prescribed by the physician, according to the popular, and therefore the generally understood standard, where that was also the standard by which the wares had been at first purchased. At what date the practice of retailing, as contradistinguished from dispensing, medicines, by other than the troy weights became fully established, it would now be difficult to determine; but we have evidence that towards a century and a half ago, when the excellent treatises on Weights and Measures by Bishop Hooper and Dr Arbuthnot¹ were published, it was the prevailing usage to sell and buy all drugs in the gross by the avoirdupois weights only. The arrangement which subsists now, more definite in its expression, and undeviatingly adopted, of retailing all quantities of medicines, amounting to, or exceeding, a quarter of an ounce by the latter weights solely, is probably not of much later origin. But this practice, old and universal as it is, is by no means equally unfailingly understood by medical practitioners, of whom it is still easy to meet a majority who are not aware that their patient, who purchases an ounce of medicine, receives less by forty grains if he do not carry with him the warrant of a written prescription: while the practitioner himself, requiring a drug which he intends to mete out in his practice, is regarded in the same light, and is supplied only with the smaller avoirdupois ounce; though reasonably believing, because taught by his pharmacopœia, that the troy ounce is that which is alone sanctioned in his dealings with the druggist.

The practice thus introduced was one which naturally secured its own extension. The habit of retailing by the avoirdupois weights soon led even to the disappearance of the larger descriptions of troy weights from by far the greater number of the druggists' counters; and with this arose the pretext for a further encroachment upon the regulations of the pharmacopœia. Instead of compounding the various galenical preparations directly by the troy weights, as enjoined by the Colleges, a custom ensued of commuting the proportions of these into the avoirdupois weights, which were now alone in their possession. But a difficulty was created here, in the conflicting and alternating values of weights which were identical in their denominations in the two standards thus simultaneously brought into use; and there could be no ready means or security of computation, where a larger avoirdupois pound was to be substituted, at one time, for a smaller troy pound, while, at another time, a smaller avoirdupois ounce was to take the place of a larger ounce in troy. The process, therefore, lost all pretensions to certainty, and it became henceforward one, the degree of success in effecting which rested on the care and accuracy of the individual druggist, joined to what chanced

¹ *Tables of Ancient Coins, Weights, and Measures*, 1727, p. 53.

to be his capacity for a description of calculation an assured facility in which is not to all minds equally easily attainable, and an effort at which the less scrupulous may have often altogether avoided. In the meantime, the requirements of medical practitioners still compelled a continuance of the preparation of medicines according to the authorised troy or apothecaries' weight, which was therefore still in requisition for all minor subdivisions, such as the drachm, scruple, and grain. Thus, that which had commenced with just pretensions to the credit of the uniformity and accuracy of a scientific system, had degenerated, under the force of circumstances, into a state of discreditable confusion, which was the more remarkably inappropriate, that it existed in a department the precision and certainty of which, considering its objects and its relations, should have been of the most thoroughly exemplary description. If we analyse our brief survey, it shows us already the extraordinary medley of three different modes of procedure, thenceforward contemporaneously established in the laboratories of the druggists. By the first, they made all their purchases, and retailed all their wares, when amounting to a quarter of an ounce in quantity, and upwards, according to the avoirdupois scale: by the second, they dispensed prescriptions, of course merely a restricted form of sale, not in conformity with the weights by which they had made their purchases, but according to the troy or apothecaries' standard: and by the third, they mingled the two, receiving their directions in troy, and transmuting them for execution into avoirdupois. In all this, however, it would be unfair to forget, that our present race of druggists are certainly at least entitled to all the justification which Quatrocchus, an authority on the subject, concedes under like circumstances to his cotemporaries in Venice, when he admits for them¹ the right of pleading as their excuse that they had inherited their usages from their predecessors, and had been imbued with them as a part of their earliest notions.

The gradual aggravation of disorder thus initiated was neither unmarked nor unresisted by the Colleges of Physicians, as the bodies in whom was legally vested the duty to superintend and control the proceedings of the apothecaries. They could not witness, without regret, what was actually for them a retrogression from uniformity to diversity; and what was the more a defect, because it was not only, under their circumstances, so peculiarly unbecoming in itself, but because it was glaringly opposed also to what had been for long, if not an achieved success, at least a leading aspiration in our general civil polity, as in that of every other civilised community. It constitutes, indeed, a curious subject of inquiry, and one not uninteresting either in its accessory circumstances or its results, to glance back at what has been the earnest straining of all cultivated nations, and throughout all times, for uniformity of weights and measures within their several communities; and, most of all, in each individual department

¹ *De Officinæ Pharmaceuticæ veris et legitimis ponderibus*, 1617, p. 47.

of their trade or commerce. This prominent longing after what has appeared everywhere as a simple and necessary element of justice, evinces itself at an early era in the command of the Jewish lawgiver, enjoining that "thou shalt not have in thy bag divers weights, a great and a small;"¹ and we point to this form of its origin in the sacred volume, because we trace to it its frequent occurrence afterwards during the middle ages. Charlemagne, in 789, ordains² that there shall be everywhere just and equal weights in his territories, whether for buying or selling: "sicut in lege Domini præceptum habemus." The rule thus enunciated was never altogether lost sight of under his successors; but it soon became liable to many arbitrary infringements, such as it has required ten centuries of effort, terminating with the adoption of the metrical system, finally to dispel. In 1321, for example, Philippe-le-Long issued an ordinance, renewing the appointment of a uniform standard for weights and measures throughout the kingdom; a decree which may be here made the subject of special reference with the greater opportuneness, because the distinct grounds assigned for it are the frauds and injury to which the existing diversities had been found to give rise.

But our interest, on this point, naturally fixes itself more upon what has taken place in our own country. In 1197, we have evidence, in an Assize of Richard I., of an attempt to secure uniformity of weights, in, at least, the several different classes of commodities, if not generally throughout the kingdom.³ It was a more decided advance which was made in the demand of the Barons of England, when they stipulated, eighteen years afterwards, as part of our Magna Charta, that there should be only one measure of wine, of corn, and of cloth for the whole realm, and that "it should be with the weights as with the measures;" a provision which was confirmed by the Charter of Henry III. granted in 1216, as well as by subsequent charters, and which was renewed in identical terms by Edward I., in 1297. Still more apposite for our purpose, is a clause in a Statute of Edward III.,⁴ which ordains, or renews the ordinance, that, as it appeared that certain merchants were in the practice of purchasing wares by one weight, and vending them by another, and as this want of assimilation had given rise to glaring abuses, there should be only one weight permitted for the whole country, and that all contravening this law should be liable to heavy fines and to a year's imprisonment. The Assize of David I. of

¹ Deuteron. c. xxv. 13.

² *Capit. Reg. Fr.*, tom. i., col. 238: Paucton, *Métrologie*, p. 12.

³ "Pondera etiam libræ, et cæteræ peisæ sint ejusdem quantitatis in toto regno secundum diversitates mercaturarum." *Assisa de Mensuris facta per Richardum Regem Angliæ apud Westm.*, A.D. 1197: Wilkins, *Leges Anglo-Saxonicæ*, p. 349.

⁴ 27 Edw. III., St. 2, c. 10. "Item pur ceo que nous avoms entendu, que ascuns marchauntz achatent avoir de pois leynz et autres marchandises per un pois, et vendent per un autre," etc. The clause is interesting, besides, from the occurrence of the phrase "avoir de pois," and the way in which this is applied.

Scotland¹ attaches a fine of eight cows to the offence of using divers or unequal weights; or, in the words of the old Scots translation, of probably the end of the fourteenth century: "Gif ony man aganis this decrete of goddis law haldis unlele and unevyn wechtis he sal geyff to the kyngis amendis viii ky." In the same spirit, and at a later period, another Scottish Act "statutes and ordains,"² that "na Burgh have ane weicht to bye with and ane uther to sell, different in weicht therefra, bot that all Burrowes have ane universal weicht of the stane, baith for byeing and selling of all stuffe in time to cum." It was in no sense, therefore, what had been for long deemed a light transgression, or one against which serious warnings had not been raised in matters of greater indifference than those relating to the guardianship of health and life, into which we have seen that the druggists had glided.

The irregularities which had crept in were obviously, however, not of a nature to be easily reached or controlled by the Colleges of Physicians. They were rooted too deeply in the general relations of commerce, and had spread over too wide and congenial a field, to admit of being readily extirpated; still, as was incumbent upon those on whom rested the responsibility, the effort was made, and was frequently renewed as occasion presented itself. In a document prepared by a Committee of the London Royal College in 1742, and then printed, it is urged, for example,³ that the pound troy being much less than the avoirdupois, while the troy ounce is the heavier, yet "as the druggists and grocers sell by the avoirdupois weight, the apothecaries do not generally use the troy weight for pounds and ounces; whereby it happens, that, when ingredients are some prescribed in pounds and others in ounces, they are not in their practice proportioned according to the intention of the prescription; and when an ingredient is prescribed by any subdivision of the ounce, their small weights being adapted to a greater ounce than the avoirdupois, those ingredients are also used in a wrong proportion." So strong, actually, had been the proclivity to the source of error thus complained against, that the Pharmacopœia itself had not been able to escape its influence; and it is further stated that, "though the troy weights only are described at the beginning, yet many of the compositions are prescribed according to the proportions of the avoirdupois." Having amended, however, this fault on their own parts, by replacing everywhere the troy standard, the committee finally recommended the total abolition of this "confused use of the two weights," and desired meanwhile to leave the rest to the vigilance of the College censors over the shops of the apothecaries. Again, in a plan for a new Pharmacopœia, issued in 1745, the London College reverts to this subject, describing the irregularities which had now intruded

¹ *Acts of Parliaments of Scotland: Assise Regis David I.*, c. xxxi.

² 7 James V. (1540), c. 114: *Laws and Acts of Parliament of Scotland*, part i., p. 253.

³ *Draught for the Reformation of the London Pharmacopœia*, p. xxv.

themselves into the practice of pharmacy as peculiar to ourselves, owing to the custom in this country of appropriating different species of weights to different commodities: and it advances, in special terms, the statement that already then, as the druggists and grocers sell by the avoirdupois weights, so¹ “few apothecaries keep weights adjusted to the troy pound greater than two drams, but for all above use averdepois weights;” a practice of which it once more enjoins the discontinuance, as leading to mischievous error. The College seems to have even then contemplated the possible advantage or necessity of itself passing over to the avoirdupois system, as a politic concession; yet only, apparently, to be startled from this idea upon grounds which it was in its own power to render inadequate, and to conclude once more by maintaining an exclusive adherence to the troy standard.

Those who examine into the spirit of our medical literature, and remark the prevailing conscientiousness by which it is characterised, will not be surprised that men of eminence, not only for special acquaintance with the subject of pharmacy, but for general learning and high character, should not have been slow afterwards in repeating these charges, and in showing their sense of the importance of the malversations to which they pointed. Dr Healde, among the rest, in his translation of the London Pharmacopœia, published first in 1786, while commenting upon the faults liable to be introduced by the prevailing irregularities, laments, as was natural for him at the period, “that the avoirdupois weights are not banished entirely from the shops of apothecaries.” In 1789, Dr Duncan, of Edinburgh, while editing the Dispensatory of Dr Lewis, complains of the prevailing differences of weights as having occasioned great confusion in the practice of pharmacy. In 1822, on the publication of the tenth edition of the Edinburgh New Dispensatory, his eminent son, Dr Duncan, jun., than whom there was then no higher authority in this department of medicine, and no more conscientious writer and observer, renews the challenge of the want of uniformity of weights and measures as attended with many inconveniences, and charges it, besides, with its fitness for engendering numerous and culpable errors. Dr Christison, with a like title to attention, in his Dispensatory published in 1842, brings a similar accusation against the current system. Many druggists and apothecaries have themselves had candour enough to admit, as their own experience, that the irregularities introduced had proved to them a continually recurring source of confusion and inconvenience, and had added a perpetual excuse or occasion for carelessness in young dispensers. Nor, independently of a more general reprobation, are these regrets and confessions, the instances of which might have been multiplied indefinitely from within the different departments of the profession, unattended with something like the taunts of others beyond its limits. The Parlia-

¹ *Plan of a New London Pharmacopœia*, 1745, p. xxxii.

mentary Commissioners, reporting on the standards in 1841, speak of the confusion caused by two scales of weight as "undoubtedly an evil," the bad effects of which, they state,¹ "are greatly increased by the identity of the names used in the different scales for describing weights of very different values." Mr Drinkwater Bethune, in a separate letter to the Chancellor of the Exchequer, while advocating, like his fellow-commissioners, an exclusive resort to the avoirdupois pound, but desiring a different scale for its subdivisions, and referring to the mixed use of troy weight for our gold and silver and of avoirdupois for our copper coinage, states that² "it is difficult to conceive a system more thoroughly contrived in every part to cause intricacy and confusion;" and demands an alteration, "if it were only for the sake of helping to extirpate troy weight," the subdivisions of which are thus perpetuated. A writer in the *Encyclopædia Britannica*, a work well known to be in very extensive circulation, even directly charges the College of Physicians³ with having prevented the completion of an equalization of the weights in this country, under the Acts of 1824 and 1835; and of having been the cause of the very needless retention of two, and in some respects three different standards as applied to medicine, from the use of which, it is added, arises a tendency to create confusion, with the opportunity for fraudulent transactions. Foreigners, also, have not hesitated to express their surprise, that anomalies so unjustifiable, whether in a scientific or legal sense, should have been able to intrude, and still more to establish themselves, within a domain which deserved to be so carefully guarded.

It remained not the less true, meanwhile, that neither the persistent remonstrances of individual physicians, nor of the London College, could avail against an irregularity which, we have seen, had been so naturally fostered, and had found so congenial a support in the prevailing usages of commerce. The Acts of Parliament, however, which we have just referred to, suggested a new opportunity, and gave a new direction to the efforts of many, for the rescue of the practice of Pharmacy from this source of discredit and embarrassment. Although all the prepossessions of the physicians of this country must naturally have been in favour of the troy weights, to which they had originally given their sanction, and any disuse of which could not fail to be regarded, and, we have shown, was regarded, as an interference with what was the just prerogative of their body, still there was now a large and fast increasing number of thinking men, who were willing on this matter to surrender to the dispensers of medicine the authority and rights of its prescribers, in so far as this seemed necessary to secure a public benefit which experience had sufficiently proved to be otherwise unattainable. As the druggists persisted in their adherence to the avoirdupois weights, in so large a portion of their transactions, many physicians

¹ *Report of Commissioners for Restoration of Standards*, 1841, p. 12.

² *Letter of J. E. D. Bethune, Esq., to Chancellor of Exchequer*, 1841, p. 6.

³ Vol. xxi., p. 489.

became inclined to approach those who had been so perseveringly retreating from them. By throwing aside their own chosen troy standard, and adopting the avoirdupois standard, as that towards which there existed elsewhere a universal leaning, now also more immediately sanctioned by law, they sought to obtain through a concession, thus in apparent harmony with the tendencies of the times otherwise, freedom from that confusion and intermingling of weights which had for so long brought doubt and tarnish on the functions of pharmacy, in the eyes of those who were at once the most deeply interested and the most deeply versed in its proceedings.

The first, and, in some degree, perhaps the unconscious step in this direction, was that made by the Royal College of Physicians of London, in 1836, when it adopted the imperial measure, expressly based on the avoirdupois standard by the then recent enactment, as its rule for the dispensing of liquids. There might have been, and there doubtless were, other grounds for this innovation, in the circumstance that there already existed, with regard to our liquid measures, other anomalies of a nature in great part independent of those to which we have as yet alluded. Though the pint hitherto in use had been long called the pound, and this had been rated at 16 oz., there was not, in fact, any known liquor a pint measure of which answered to that weight. If we took rectified spirit as our standard, a pint of it exceeded a troy pound by above half an ounce: if we took water, the excess was upwards of three ounces. Then, as this pound could not, manifestly, be the equivalent of the troy pound, containing only 12 oz., so, alike manifestly, neither could the ounce be the equivalent of the troy ounce.¹ The former pint of the London Pharmacopœia was computed to measure 28.875 cubic inches; and the troy ounce has been estimated at 1.900945 cubic inches. But 16 troy ounces would thus occupy 30.415120 cubic inches, instead of the smaller volume just mentioned. The avoirdupois ounce of water, on the other hand, measuring 1.73298 cubic inches, would, in like number, make up only 27.72768 cubic inches, or more than a cubic inch less than the alleged just quantity. Yet it appears from this clearly, that it was the avoirdupois ounce which approached the nearer, as the basis of this arbitrary pound, or pint, in the former fluid measure. This arose, probably, because the pint in question was undoubtedly

¹ According to Bishop Hooper (*An Inquiry into the State of Ancient Measures*, 1721), "a pound's weight of it (*troy*) in wine or water filled up the primary vessel we call a pint," p. 459. At another place he adds:—"Such was the pint of old, and the upper measures from it. And for the under parts of it, they are still measured with the apothecaries by troy ounces, drachms, etc.; but when a whole pint is appointed, it is (it seems) commonly dispensed by a pound Avoirdupoise: and this wants not much of our present wine pint, as it has been changed from its first appointment," p. 463. Setting aside the discreditable confusion, in other respects, noted here by this eminent authority, it seems questionable, nevertheless, whether the pint ever actually corresponded to our present pound Troy.

an inheritance from the uses in medicine of the Greeks and Romans, and because the ancient Roman ounce was almost the exact equivalent of the present avoirdupois ounce. There was, therefore, an evident warrant for its employment here of a different kind from that which had led to the adoption of the troy standard; and there had thus been already an inconsistency introduced, yet really at first in relation to the solids, into what ought to have been the single fundamental basis of our weights and measures in pharmacy. It was thus, in every sense, a step of the description we have indicated, when the avoirdupois standard became explicitly recognised by the London College, as well as apparently more accurately defined, as that upon which the fluid measures of the Pharmacopœia rested.

Within three years afterwards, when the Royal College of Physicians of Edinburgh next issued an edition of its Pharmacopœia, it followed the English College in adopting the imperial standard of measure. This was the more to be regarded as a concession to the prevailing usages of the times, that the Scottish College, in consideration of the errors which it held as prone to arise from a promiscuous use of weights and measures, had for long directed that the quantity of every fluid, as well as solid, should be determined by weight solely, adhering scrupulously to the troy standard with reference to both. But the concession was still more marked, when it added its further, and now wholly explicit, declaration,¹ that it could not admit the force of the objections which had hitherto prevented the introduction also of the imperial or avoirdupois system of weights into the practice of medicine and pharmacy. The like views, as to the expediency of throwing aside the troy weights, and of resorting exclusively, and for all purposes, to the avoirdupois standard, were afterwards supported by Dr Christison, with his usual solidity of reasoning, in the valuable work already referred to. The Dublin College of Physicians was not without warrant, therefore, when, forsaking its own system of measures, which had besides certain peculiar discrepancies from those of the other divisions of the country, it not only joined the other Colleges in the acceptance of the imperial measures, but took another and still more decided step in advance; and,² reiterating the often urged complaint, not less justly grounded in Ireland than elsewhere, of the frequent errors and inconveniences caused by the existing medley, determined that the avoirdupois pound and ounce, associated with a corresponding drachm and scruple, yet retaining the troy grain, should be henceforward the rule within its jurisdiction. The change thus instituted, however, even had it met with a more general acceptance, continued still insufficient to remove the whole of the causes of complaint; and it was manifest that something more remained yet to be effected, as well for the credit of science, as for the convenience of art, and for the public safety.

¹ *Edinburgh Pharmacopœia*, 1839, *Preface*, p. xii.

² *Dublin Pharmacopœia*, 1850, *Preface*, p. xxii.

But we shall best arrive here at a clear conception of what became then, and continues now, the condition of the medical metrology of the United Kingdom, through a brief recapitulation of the leading points which have been elicited in the preceding slight sketch of its more recent history. We have learned that the system of troy or apothecaries' weights, originally established for exclusive use in the sale and compounding of medicines, has been, in spite of injunction and remonstrance, gradually infringed upon, until all quantities reaching, or exceeding, a quarter of an ounce are universally sold by avoirdupois weight, and all galenical preparations are prevalently compounded by means of a commutation of the former into the latter standard: that, through obvious grounds of exception, dependent on the dominant tendencies of commerce, all attempts having failed in retaining the druggists within the rule primarily established, there has been a growing disposition on the part of our leading medical authorities to incline towards them, and to sanction that avoirdupois system as a consistent whole, which has already been intruded in so large a part: and that, finally, the result of this has been an adoption, on the part of the whole Colleges, of the imperial liquid measures, based upon the avoirdupois standard, for general use in medicine; with the partial adoption, limited as yet to one division of the empire, of a plan of weights for solids intermediate between the two standards; and the retention of the troy weights in their homogeneity for the other two divisions, in as far, at least, as prevailing usages permit them. This state must be clearly one of transition; for the changes introduced have increased an intricacy which was formerly sufficiently embarrassing: yet it points as manifestly in the direction towards which the whole system tends, in order that it may be brought into complete harmony, not only with itself, in its several parts, but with the entire arrangements of commerce throughout the country. Meanwhile, it leaves us to regret the position of the druggist, both within his own more peculiar domain and in his relations to medicine, while he is thus constrained to the use of "divers" weights, by his being still compelled to buy in one weight and sell in another; or by his assuming arbitrarily the right to sell sometimes in one weight and sometimes in another, for it is a merely specious and inadmissible distinction which separates dispensing from selling. We deprecate this the more, that he is unique in this predicament; and that, with a singular impropriety, it is that department of trade which is the closest in its relations to science, which has not only had tolerated in it a laxity of procedure so wholly adverse to scientific rule, and such even as the law does not now admit in the shop of the pettiest huckster, but which, dealing as it does with the highest of human interests, has been thus rendered liable to the more momentous charge of inflicting needless risks of error and danger upon the public. The means of escaping from such a position, and from such imputations, even if undeserved, are well worthy of consideration, and of more serious efforts than the

occasion, fortunately, is likely to demand on the part of any of the interests involved.

The exigency, then, being thus apparent, the opportunity obvious, and the fit authority now directly endowed with a fresh sanction, there can be little danger that the occasion for action presented will be suffered to pass over with neglect. What has been stated will have shown, at all events, that it is not too much to assert that there is a duty incumbent here upon those, who, under the Act for regulating the qualifications of medical practitioners, have had entrusted to them the important charge of preparing the new and long-desired British Pharmacopœia. Holding such a power in their hands as that of directing the true weights and measures to be employed for its purposes, the able men constituting the General Medical Council are not likely to encounter the responsibility it carries with it, in any other than a spirit becoming the onerous relations of their position to science and the public interests. It would be contrary, on the one hand, to an honest sense of dignity on the part of the General Council, were they now, thus freshly and specifically authorised, to be expected to repeat that injunction for the exclusive use of troy weight which they know has never hitherto been obeyed, and which it would be even more difficult to render compulsory at the present than at any former period. Yet, as responsible to science, they surely could not continue, on the other hand, to sanction any form of the existing confusion, and thus linger, in a twofold sense, behind the spirit of the times, which not only demands that there shall be no intermingling of weights in a single craft or profession, and, still more, that these weights shall involve no perplexity, through a coincidence in name yet a divergence in value, like those brought into collision by the druggists, but that there shall be ultimately one sole, and uniform and uncomplicated standard, for whatever uses, throughout the country. The public morality would not be respected, if a system were continued which had been charged by grave and experienced authorities with facilitating and procuring the introduction of many errors or malpractices; and those high interests of human health and life, which constitute the peculiar province of the medical profession, would be held as inconsiderately tampered with, if it could be shown, or even plausibly alleged or suspected, that these malpractices had led anywhere to serious risks of uncertainty or injury in medical practice, and yet that the conditions which fostered such dangers continued to be heedlessly tolerated. It would be no answer to this, that an assurance is offered by the heads of some of the principal firms of druggists, that the present arrangements, with the calculations and transpositions they render requisite, are safe in their hands. What care, and ability, and experience may render easy to some, may be singularly the opposite where these are wanting; and the man who walks unshrinking along the edge of a parapet must not wonder if others prefer the safer footpath below. It is such a footpath, plain and obvious, and easy for all, or

at least rendered needlessly difficult for none, which the framers of the Pharmacopœia are bound to take the present opportunity to provide; and physicians will naturally be excused, if, while cheerfully admitting the merits of at least the more accomplished masters of the craft of the apothecary, they may be not the less reminded sometimes of human fallibility, and sometimes, too, of human rashness and presumption. But beyond this, there will exist always a class of minds to whom such calculations never can become easy; while, simple as they may be to others, they still must remain challengeable, as involving a chance of error, without offering a particle of advantage in compensation.

Assuming, therefore, as at least our own, and not unsupported conviction, that a change is necessary, and that a proper time has arrived for effecting it, to neglect which, indeed, would be to aggravate all difficulties, it only remains to determine what should be its precise nature. Many and various suggestions have been offered for consideration. The first in importance of these has been to proceed at once to some modification of a decimal system; but this has by no means been urged with any unanimity of concurrence, as to which special plan was the best recommended for selection. The metrical system of the French has had its warm advocates; but others, like Herschel and his distinguished associates in the Commission of 1841, have desired the projected decimal division to be based upon the avoirdupois pound, as a scheme the least antagonistic to English usages. Most scientific men would be eager to see a decimal system established in this country; though many might reasonably be inclined to doubt whether the gramme, with its multiples and sub-multiples, and the too close resemblance of the terms of some of these, as the *décagramme* and *décigramme*, to each other, were really the form best adapted for employment in medicine; or whether some more convenient, and probably somewhat higher, unit of weight, even if rejecting the avoirdupois pound, should not be devised and preferred. But there was, above all, one grave objection to the instant and isolated introduction of a decimal system of weights, of whatever description, into pharmacy, that, while it would widen, in the meantime, the discrepancy between the standard of the apothecary and the ordinary commercial standard, and so aggravate an inconvenience already felt too extensively, there could be no security that, should a decimal system be subsequently adopted by the nation at large, it would prove identical with the form which had been independently contrived or selected; and we should thus be compelled ultimately to another change, having derived little intermediate advantage from that which we had laboured to introduce so prematurely.

It was necessary, then, to devise such a change as, while it would the least outrage existing usages, would yet satisfy the claims of science and of public justice, by bringing into harmony with each other the weights and measures in current use in medicine, and

equalizing, at the same time, both with the present commercial standards of the country; and this, it was found, could be accomplished by an alteration in the value of the grain, reducing it to 0.91145 of its value in the troy standard, or taking from it a little more than an eleventh, and thus converting it into what can be used as an integral part of the avoirdupois system. With the value of the grain thus modified, we should have the means of adopting the avoirdupois system of weights as that exclusively employed in pharmacy, throughout all its departments. There would now be an avoirdupois scruple, with its long familiar complement of 20 grains, to represent the medical scruple, and take the place of the former one; while, as multiples of these, there would be an associated drachm and ounce, constituted by 60 and 480 grains respectively, as in the old arrangement; and a pound which, instead of 12, would contain 16 ounces, giving for it an aggregate of 7680 grains. Thus, down to a quarter of an ounce, the weights would be in all respects identical with the imperial standard; and, below a quarter of an ounce, they would be integral parts of that standard, perfect in accuracy, and not reasonably challengeable as to convenience, because presenting here a variance from the commercial weights in denomination only, and not in essence, and that as an easy concession to the long and widely established habitudes of the practitioner. The proposed adjustment is shown at a glance in the following tabular view:—

Pound.		Ounces.		Drachms.		Scruples.		Grains.		(Troy grains.)
℔j	=	16	=	128	=	384	=	7680	=	(7000)
		℥j	=	8	=	24	=	480	=	(437.5)
				ʒj	=	3	=	60	=	(54.68750)
						ʒj	=	20	=	(18.22916)

(gr. j avoird. = 0.91145 troy — gr. j troy = 1.09715 avoird.)

The value in troy grains, which I have appended for illustration, could have only a temporary interest, and for all merely practical purposes regard to it would speedily become obsolete.

If we have already shown that such a change as we have here suggested has been long desired by many of those the most competent to judge as to its advisability, it is not the less to be anticipated that its idea will prove ungrateful to others, who, so inured to a perverted system as to have become callous to its attendant evils, look upon interference with it, under whatever form, as an unnecessary and troublesome innovation. This question of innovation has sufficient interest in itself, to induce us to make it the subject of a brief consideration: as well to ascertain to what extent, and in what proper sense, it is really an innovation that is proposed, as to determine ultimately, and more precisely, whether, in whatever degree it may be new, its merits, along with its necessity, are intrinsically such as to justify otherwise its introduction. With this purpose, a reference back to an earlier and more general view of the history of medical metrology then we have hitherto found necessary, will not be without its value and curiosity; and we may commence here at the

remotest period which is found to supply us with apposite and trustworthy materials. As the grain and the ounce, the one as hitherto the chief and general basis of all systems of weights in pharmacy, and the other as the highest denomination in predominant use throughout its operations, are naturally the most important objects in such an inquiry, and should be, as they really are, the least variable in their essence, we shall endeavour to keep them before us with the first prominence; the more especially as a relative change in the grain, with the modifications resulting from it, lies at the foundation of our own proposed adjustment. With the Romans, the standard of weight being wisely identical for both medical and commercial uses, the pound was divided into 12 ounces: but, in the minor subdivisions of the latter, they seem for long not to have gone below the obolus, or half scruple; or, at least, we find originally no smaller weights clearly indicated.¹ At this early period, the Roman scruple might be held as the representative of the Greek *gramma*; but the denarius of the former exceeded the drachma of the latter, at least in its ulterior forms, the ounce being divided at first into 7 denarii, which were equivalent to 8 of the later drachmas. Afterwards, however, the newer division into drachmas, or, as they might be designated, into the imperial denarii, became the rule. Pliny, writing a little later than the middle of the first century, describes the obolus as divided into 10 chalci;² thus, the drachm being constituted by 6 oboli, we arrive here at the representative of our grain, yet not, it will be seen, of the troy grain, as might be at first imagined.

All our best inquirers, such as Bernard,³ Hooper,⁴ and Arbuthnot,⁵ agree that the Roman ounce was the almost rigidly exact equivalent of our present avoirdupois ounce; consequently, when it became divided into 8 drachms, and each drachm was reckoned at 60 chalci, we have in these subdivisions, it should be well remarked, the precise equivalents of that drachm and grain which are now proposed for general use in medicine, by assigning to them a place as forming aliquot parts of the avoirdupois system. With the later medical weights of the Greeks, the *mina*, as appears from Dioscorides, Cleopatra, and Galen, but especially the latter, contained 16 Roman ounces, or was exactly equal to our avoirdupois pound. But the 8 drachms in each of these ounces were at first severally divided into only 48 chalci, or *æreoli*; giving, therefore, 6144 of these to this Greek *mina*, or pound. The chalci, again, was sometimes subdivided into 7 *lepta*, though this seems to have been exclusively in monetary computations, and at still later periods. In all ancient civilisations, it is to be remembered, the money standard appears to have been at the basis of, or preserved an identity with, the other standards of weight, for

¹ Celsus, *De Re Medica*, lib. v., c. 17.

² *Historia Naturalis*, lib. xxi., c. 34.

³ Bernardus, *De Mensuris et Ponderibus Antiquis*, 1688, p. 135.

⁴ *Inquiry into State of Ancient Measures*, 1721, p. 10.

⁵ *Tables of Ancient Coins, Weights, and Measures*, 1727, pp. 16, 283.

whatever uses in art or commerce; or, in other words, the system of weights was preserved strictly uniform throughout every department. Setting aside the chalcus, it is in the time of Galen that we have the earliest distinct trace of the use of the grain, properly so designated, in medicine; the scruple being now divided into 24 *sitaria* (σιτάριον: σῖτος, *frumentum*), of which, therefore, 72 were contained in the drachm; while we find, at the same time, associated with the mina, and gradually displacing it, a *litra*, or pound, of 96 drachms, and thus of 12 ounces only,¹ comprehending 6912 of these grains, the kind originally understood being probably wheat. Besides the information thus far derived, and which can only be extricated with some difficulty from amid a number of conflicting statements at these early periods, we learn nothing further as to the employment of the grain, as a weight in pharmacy, from Scribonius Largus, Marcellus, Rufus of Ephesus, or Paul of Ægina, by none of whom is it even alluded to. With the Arabian physicians, as Rhasis and Avicenna, the weights employed were evidently adopted from the Greeks and Romans, and we have with them the *kestuf*, equivalent to $1\frac{1}{2}$ grain, troy, as the representative of the sitarion, or, more precisely, of the chalcus. Shrinking, however, from a task so far beyond our means and our limits as an attempt at a complete harmonisation, or an exposition of the mutual relations, of the ancient standards of weight, it is sufficient to have at least shown in the Greek mina, and in the Roman ounce, together with the chalcus of Pliny, that the equivalents of the avoirdupois pound and ounce, along with the grain now proposed to be associated with both, have a very remote, as well as a singularly close, warrant in the early annals of medicine.

The Roman pound, with its ounce thus corresponding with the present avoirdupois ounce, was retained as the standard by the early French kings;² and appears to have been first swerved from in the time of Charlemagne, whose slightly enlarged ounce suggests the origin of the troy ounce of England. At the close of the ninth century, the Roman ounce was that which remained still in use with our Anglo-Saxon sovereigns. In the eleventh century, the Poids de Marc, the weight of the grain of which only slightly exceeded that of the Greek grain, was introduced into France, or at least was recognised and established in that country, and being gradually multiplied in its forms, unity was lost in the barbarism of the times. But passing at once to the revival of European medicine, and to its studies as first cultivated, with whatever adherent tincture of mediæval darkness, in the school of Salerno, we find a short exposition of the system of medical weights as authorised in the twelfth century, in the *Antidotarium* of Nicolaus Præpositus; a writer whose treatise on pharmacy, thus designated, long served as a principal guide and

¹ Galeni Opera, Ed. Kühn: *De Ponderibus et Mensuris*, cap. iii., vol. xix., pp. 751, 752.

² Paucton, *Métrologie*, p. 638.

rule in a department of medical knowledge,¹ of the present state of which he has been styled the father. According to Nicolaus, the grain of corn being assumed as the basis, the scruple was constituted by 20 such grains, of which the drachm, therefore, contained 60; there being 540 in the ounce, which was now divided into 9 drachms.² The grain of Nicolaus, based upon its natural standard, was thus evidently considerably less than the troy grain, and approached more nearly to the value of the grain now proposed in relation to the avoirdupois system, nearly 527 of which would be required to make up the troy ounce. Saladin of Ascoli, writing probably a century later, defines explicitly the kind of corn as wheat, assigning also 20 grains to the scruple; with the interesting and novel addition that, the better to secure uniformity, middle-sized pickles should be selected, and weights thence adjusted "de plumbo, aut de stanno, vel alio metallo."³ This writer points further to the divergence between the Salernitan ounce of 9 drachms, and the Paduan and Neapolitan, respectively of 8 and 10 drachms. In the little treatise of Apuleius,⁴ the scruple is rated at 24 grains of barley. But the authority of the school of Salerno seems to have been that which preponderated; and we find in the work of a later Nicolaus, probably of the fifteenth century,⁵ and also of long and extensive authority in pharmacy, nearly the same account fundamentally as that given by his namesake and predecessor, though with considerable amplifications, and not without the interlarding of many obscurities and inaccuracies. Descending a century later, we arrive at the first Pharmacopœia issued under the sanction of a public authority, in that of Valerius Cordus, which was published in 1542 by the direction of the Senate of Nuremberg. In the edition of 1556, the grain reported to be at that time in use is given⁶ as the barley-corn: "Ein gren oder gersten Körnlein schwer."

The medical and the civil, or commercial, ounce were throughout Germany then, as indeed they are now, with the retention of a prudent polity also far in advance of ours, identical in value. The cotemporary Fernelius lays down the system of medical weights in France, as at his period correspondent in its subdivisions, though not in its values, with that of ancient Rome; but, the commercial weight of his country, as well as that of the moneyers, being based upon a different standard, and the civil drachm then in use with both containing, not 60, but 72 grains, like the drachm reported by Galen, the French physician advises the exclusive resort to the civil weight for all purposes whether of science or of traffic;⁷ so

¹ De Renzi, *Storia doc. della Scuola Medica di Salerno*, 1857, p. 284.

² *Antidotarium Nicolai: Supp. in Secund. Lib. Mesues*, Ven. 1623, p. 192.

³ Saladini de Asculo *Compendium Aromatarium*, p. iii.

⁴ *De Ponderibus et Mensuris: Supp. in Sec. Lib. Mes.*, p. 269.

⁵ *Dispensarium Magistri Nicolai prepositi ad Aromatarios*, 1505, f. xxxvi.

⁶ Valerius Cordus, *Dispensatorium*, p. 3.

⁷ Fernelius, *Universa Medicina*, lib. iv., cap. 6. The Greek *gramma*, or

that, though the accuracy of his views on the subject is otherwise not beyond challenge, we have at least to include his distinguished name with those who have preceded as well as followed him, in urging the desirability of a general and safe assimilation and unity throughout the standards for commerce and medicine. But, whatever may have been the precise relations between the civil and pharmaceutical weights in the time of Fernelius, it is certain that, as they were identical at a period long antecedent to his era, so they became once more identical in that subsequent to it. Lemery, for example,¹ states that the ounce of the pound used in medicine was then the equivalent of that used in commerce, though in the former pound there were reckoned 12, and in the latter 16 of such ounces. In the Parisian Pharmacopœia of 1748,² to descend still later, while the scruple is represented at 24 grains of the weight of a barley-corn, the pound, like the civil pound, is rated at 16 ounces; and these, again, were, as they continued till the close of the eighteenth century, the exact equivalents³ of the ordinary weights legalised throughout the country. It is worth noting here, with reference to the recommendation previously quoted from Saladin, that Lemery⁴ finds it still necessary to animadvert upon the use of actual grains of wheat and barley; which he states to be even then employed as weights by many, but which he reprehends on the score of their inequality, enjoining a recourse to those adjusted after them in brass. Wecker,⁵ at an earlier period, uses grains of white pepper, "si alia pondera desunt," and reckons 20 of these to the scruple.

Passing to our own country, if we interpret rightly an early document, we have probably in the reign of Henry III.,⁶ but certainly not later than that of his successor Edward I.,⁷ or at the beginning of the fourteenth century, the grain of corn established as the foundation for the standard of weight in England. The rule was then

scruple, according to this author, was so named because it contained the same number of grains (24) as there were letters (γράμματα) in the alphabet. The earlier authority, however, of Fannius, supposed to be of the time of Constantine, gives a different explanation:—

"Unde putandum
Grammata dicta, quod hæc viginti quatuor in se
Uncia habet."

Rhemnius Fannius Palæmon, *Carmen de Ponderibus et Mensuris*.

¹ *Pharmacopée Universelle*, 1698, p. 57.

² *Codex Medicamentarius Parisiensis*, 1748.

³ Paucton, *Métrologie*, pp. 741, 742.

⁴ *Op. citat.*, p. 58.

⁵ Weckerus, *Antidotarium Speciale*, 1617, p. 203.

⁶ 51 Henry III., § 3.

⁷ 31 Edward I. (1302): *Statutes at Large*, vol. i., p. 148. "Per ordinationem totius regni Angliæ fuit mensura Domini Regis composita, videlicet quod denarius qui vocatus sterlingus rotundus et sine tonsura ponderabit triginta duo grana frumenti in medio spice. Et uncia ponderabit viginti denarios. Et duodecim uncie faciunt libram London."—"Et octo libre frumenti faciunt Galonem."

declared, that 32 grains of wheat, well dried and gathered out of the middle of the ear, should constitute the penny-weight, of which there were to be 20 in the ounce, with 12 ounces to the pound; and eight of such pounds were to make the gallon, the pint, therefore, being equivalent to a pound. In the Assize of King David of Scotland, of "Mesuris and Wechtis,"¹ the sterling penny is also fixed at "xxxii cornys of gude and round quhete;" but the "unce formerly xx, now xxi pennys for ye demynicioune of ye mone," and the "pund xv uncis." We have already seen that in the time of Edward III., there was reference to what were distinguished as avoirdupois merchandises; but the first distinct mention of a troy standard, "la libre de Troy," as a special designation, appears to be in an Act of Henry V.,² passed in 1415 in relation to goldsmiths. A few years later,³ we have mention of a troy pound in Scotland, which is rated at 16 ounces. It is first in the reign of Henry VII.,⁴ however, or nearly at the close of the fifteenth century, that we have the standard weight especially designated as troy weight; yet the pound remains expressly that of Edward I., being ordained, like it, to be founded on the grain of wheat, and to be constituted, through its several sub-multiples, of 7680 of such grains, "according to the old laws of this land." In the succeeding reign we have a distinct statutory recognition of a "Haver-du-pois"⁵ weight; and in 1588, Elizabeth placed an avoirdupois pound as a standard in the Exchequer. In the beginning of the seventeenth century, we meet still with a troy pound in Scotland, containing 16 ounces, and designated⁶ as "French Troyes." When the penny-weight became reduced in England from 32 to 24 grains is not certainly known, but the change possibly connects itself with the confusion introduced through the discreditable debasement of the coinage practised by Henry VIII., a cause of divarication everywhere sufficiently familiar, and of which an indication, with reference, however, to a simple diminution, and not vitiation, of the money, has just been given from the Assize of David.

It is remarkable, meanwhile, that the English troy standard never harmonised truly with that French "Marc de Troyes," from which it has been reputed to be derived; but rather with the Marc of Rochelle, which, indeed, in an early French document quoted by Paucton,⁷ is termed the Marc of England, 12 of its ounces forming the then pound Sterling. To increase this confusion, we learn from

¹ *Scots Acts of Parliament*, vol. i., pp. 309, 310.

² Henry V., Stat. 2, cap. 4.

³ 4 James I., cap. 69. In the same Act, cap. 70, it is ordered that "Ilke pinte sall contene be weicht of clear water of Tay, fourtie ane ounce: That is to saie two pounds and nine ounces Trois."

⁴ 12 Henry VII., cap. 5.

⁵ "Beef, pork, mutton and veal shall be sold by weight called Haver-du-pois."

⁶ Henry VIII. (1532), cap. 4.

⁷ Statute of James VI., 1618: "Sexteine Troyes unces in the Troyes pound."

⁸ *Métrologie*, pp. 639, 643.

the "Pathway of Knowledge," a work of the time of Queen Elizabeth (1596), that the pound avoirdupois was then also of 7680 grains, being "parted into 16 oz.; every oz. is 8 dragmes, every dragme 3 scruples, every scruple 20 grs." Harris, writing long afterwards,¹ confirms this division as far as the scruple, and speaks, it is worth noting, of a foreign avoirdupois² as compared with that of England. With more close regard to our medical weights, these in Scotland, according to Huntar, the author of a treatise of repute,³ were at the commencement of the seventeenth century constituted by a pound of 16 oz., each of 8 "dragmes" containing 3 scruples, but the scruple of 24 grains. If, then, in the first London Pharmacopœia, or, at least, in the first to which I have had access, that of 1627, and in the first Edinburgh Pharmacopœia, that of 1699, the weights appear rated as now, we may charge this arrangement as an innovation, in as far as it was a departure from the older prevailing standards, in this as in other countries, rather than that which, though on wholly different and more substantial grounds of polity than are here in question, is at present proposed for adoption. We have seen, in the midst of the tangled mass through which we have been led, that the pound of 16 ounces is no alien in modern, as it was none in ancient medicine; that the Roman ounce, and the later Greek ounce, are the exact equivalents of the avoirdupois ounce now recommended for exclusive use from present reasons of safety and convenience; that the pound of 7680 grains is not only no innovation among ourselves, but presents the same number and proportion for its lowest sub-multiple as the statute pound of Henry III., the troy pound of Henry VII., and the avoirdupois pound of Queen Elizabeth; and finally, and, under this point of view, most important of all, that, in the midst of all the variations in the ounce and pound, the grain thus reconstituted, rather than invented, approaches more closely than the recent troy grain to the value of the medicinal grain of every

¹ *Lexicon Technicum*, 1704, V. *Weights*.

² We have several derivations assigned to the term "troy," such as that from *Troy Novant*, a legendary name given to London, from the numeral *trois*, and from the town of *Troyes* in Champagne; and we are reminded of something like the probability of an analogous root in the Tron, and Tron weight of Scotland. The two first etymologies have little to recommend them; but the third, though with the objection that the Rochelle Marc, and not the Marc of Troyes, approached the nearest to the English standard, has much in its favour. Such uses of the term "avoirdupois," however, as that here made by Harris, with the fact that the troy weight of Henry VII. is laid down as identical in the Statute with that ordained as the sole weight by Edward I., and the like, have sometimes inclined me to believe that the French phrase "avoirdupois," on the one hand, merely implied that the due weight, whatever that might be, was had or given: while for the term "troy," on the other hand, we were to look for a similar explanation from a Teutonic source, either in the Anglo-Saxon *treove*, written sometimes *trive* and *tryve* (*fidus*), or, still more nearly, in the old Gothic *troie* (*truth*), or in the later German *treu* (*true*), the latter almost identical with *troy* in pronunciation. In either case, all that would be signified was that the true or just weight, as established by law, should be held as rendered.

³ Huntar, *Treatise of Weights, Mets and Measures of Scotland*, 1624, p. 3.

other European country, with the sole and singular exception, it may be admitted, of that of Austria.

But leaving this kind of investigation, which might have been farther pursued into its more remote and difficult branches, following Budæus,¹ Agricola,² Capellus,³ Eisenschmidt,⁴ and Greaves,⁵ with the other writers quoted in the course of these remarks, and now laying aside the minor, yet not wholly insignificant, question of innovation, to revert to the more serious considerations of prudence and of necessity, let us proceed onwards to a closer view of the relations of these to our subject. The General Medical Council, or those whom it has authorised, will declare, at their own time, their determination on this matter; but it may be permitted to me, meanwhile, as being myself in the position of believing the change in the value of the grain which I have indicated to be the fittest and most expedient under the circumstances, to explain somewhat more fully, yet with conciseness, its nature and its concomitants; considering what would be its results if actually adopted, whether it would be followed by any inconveniences, what would be the weight of these, and in how far they might be obviated, or admitted of compensation. Commencing, then, by again recalling that the present weights or measures for liquids in the Pharmacopœia are based upon the avoirdupois standard, while the troy standard is enjoined for solids, it must be conceded that there is now actually and fundamentally, at least in the London and Edinburgh Pharmacopœias, a mingling of two different standards, the apothecaries' and the imperial, in every formula where liquids and solids are combined. There has thus been here expressly sanctioned something like a renewal of that error, of which the Committee of the London College complained, during their attempt, in 1742, at a reformation of the Pharmacopœia, to which we have already made reference. Yet the anomaly thus introduced was one rather offensive to merely scientific precision than attended by any really practical disadvantages; or, at the most, these could be felt only as complicating the calculations required to determine the proportions between the solids and fluids in any given compound, the quantities constituting which had become conjoined in what had ceased to be a simple and easily ascertainable relation. But it is otherwise with those discrepancies so largely introduced by the druggists into practical pharmacy, as well as into the customary sale of medicines, and the amount, along with the grounds, of reprehension against which we have already illustrated.

It was in so far a well-directed attempt, therefore, which has been alluded to as having been made by the Dublin College in 1850, when it sought to remove this class of discrepancies by a change to

¹ *De Asse et partibus ejus*, 1514.

² *De Mensuris et ponderibus Romanorum atque Græcorum*, 1550.

³ *De ponderibus, nummis et mensuris*, 1606.

⁴ *De ponderibus et mensuris veterum Romanorum*, 1708.

⁵ *Miscellaneous Works*, 1737: *Of the Denarius*.

the avoirdupois system, to the extent that it adopted that system for all denominations of weight above the grain. But, unfortunately, this change lost much of the merit which attached unquestionably to its motive, through the circumstance that it seemed only to vary the difficulty by eluding a part of it; for, in attaching, as a concession to a long-established infraction, a hitherto unrecognised value to the larger denominations of weights, while retaining the troy grain as the real basis of the system, so far from there being a true amalgamation, the actual tendency was to give the appearance of a rule to that practice which was still only arbitrary, and thus to lend the sanction of a new authority to what remained a confused and defective arrangement, resting upon two different, and, in the strict sense, radically and essentially incompatible standards. This is best shown by the fact, that the troy grain could be converted into no aliquot part of the avoirdupois ounce, or of its sub-multiple the drachm; and the expressed value of the former (gr. 437.5), or of the latter (gr. 54.68), or of the associated scruple (gr. 18.22), carried with each so much of an air of unscientific indefiniteness, and of an assurance of practical intricacy and inconvenience, through the compulsory introduction of such fractional numbers into matters which, in ordinary life, must often become the subject of rapid calculation, that the plan, however partially efficient in result, and wholly excellent in intention, seemed little fitted otherwise to invite a general concurrence. But if the result of this intermingling of standards, thus incapable of any perfect blending, with its attendant breaking up into fractional parts of the ounce, drachm, and scruple, evinced the unaptness of the current troy grain for becoming a proper basis for the avoirdupois weight, or for being easily assimilated with that weight, the difficulty becomes at once obviated by reducing the troy grain, in the manner proposed, to 0.91145 of its present value, and by assuming this as the medicinal grain. We now acquire for the system a fundamental unit, fit to take position as an integral part of any of its divisions; and thus it necessarily follows, that what is only an apparently slight change in itself becomes really endowed with virtue enough to remove entirely the existing confusion, imparting to the arrangements everywhere the dignity and consistency of a uniform system, and ensuring a rigid scientific exactness and parallelism to all the operations of pharmaceutical metrology within its own limits, while binding it successfully in equally congruous relations with the ordinary transactions of commerce.

With the adoption, then, of this modified fundamental unit, we complete a system of weights by which the avoirdupois pound, with its statutory division into 16 ounces, is retained for exclusive use in medicine; but the ounce, as we have already indicated, will be divided into 8 drachms, each, therefore, containing two of the former avoirdupois drachms, a denomination of weight so little in use everywhere that it may be almost said to have become obsolete. However, should it still be thought necessary to recognise its existence,

it may be maintained distinct from the new medicinal drachm, by appending to the latter the name of *didrachm*, as signifying the double drachm; a title for which there would be good classical authority, in as far, at least, as an etymology was concerned. The drachm, or didrachm, again, will be subdivided as hitherto into 3 scruples, each of the latter containing the established complement of 20 grains; and thus the pound, as we have stated, 7680 grains of the new value. The obvious effect of this will be, that the different subdivisions of the pound must rank as aliquot parts of each other, while each is an entire multiple of the grain; which, on the other hand, its value once determined, would be as simple an entity as before. But the grain for solids would now be also equal to the computational weight of the grain, or its representative the minim, in the liquid measure, from which it formerly differed; and this newly instituted correspondence between weight and measure would be carried upwards through all the multiples of either, the ponderable value of any measured quantity of a fluid, in relation to distilled water, being easily ascertainable by multiplying the ounce by the specific gravity.

Added to the advantages of this fundamental assimilation of the medicinal weights and measures with each other, so conformable to scientific accuracy, must now be considered that accompanying equalization of both with the ordinary commercial system, which must be regarded as having been the main motive for the introduction of any change. Henceforward, the druggist would sell and compound by the same weight, or by aliquot parts of the same weight, as that by which he made his purchases; and, the troy weight being removed, there would be no longer the risk of that confusion, or the necessity for that calculation, which intervened, as a needless source of possible or of actual error, within the whole tenor of his most ordinary transactions, and which frequently, as we have seen, rendered him liable besides to grave suspicions or to graver charges. On the other hand, as no new denominations of weights, save those below the value of a quarter of an ounce, such as could be procured at the cost of a few shillings, would be required to replace the old troy weights, which might almost instantly be totally and perpetually banished from the laboratory, the question of expense becomes reduced to its lowest significance, and the meagre outlay would be overbalanced to him at once by the consciousness of his security, the simplification of his commercial relations, and the diminution of his labour. Finally, as all changes are the most readily adopted where old denominations are retained to express new quantities, and as all new formulæ in the Pharmacopœia would be adjusted to the new weights, and all new prescriptions to the new formulæ, and as not the oldest practitioner would require to write his prescriptions otherwise than in the mode and with the characters to which long habit had given the force of a predilection, we may almost express surprise that it should be possible to accomplish so much at so

trivial a cost. And if, at what will still, in all probability, be a remote period, the nation should ever be required to advance to a general metrical system, we shall ourselves assuredly accomplish this the more easily and naturally, that we shall proceed simultaneously with the universal interests of the country from the *avoirdupois* to the novel standard, the relations of which will be the more readily mastered by all, that from a common basis we pursue a common object. We revert to yet another cause for congratulation in the circumstance, that the contemplated reduction in the value of the grain will meanwhile bring it nearer to that retained in all other systems of medical weights at present employed in Europe, with the sole exception already noted, or of a projected, but still not established, and an unhappily incongruous,¹ innovation in Prussia; but including that formerly in use in France, and still occupying its place in the older medical literature of that country, as in that of the bulk of civilization everywhere, and throughout all periods. As to the relations of the proposed weights to the existing French metrical system, these, taking the gramme as equal to nearly 16.93 (17) of the new grains, or the new grain as equal to 5.90 (6) centigrammes, may be shortly represented as follows:—

Med. Avoird.		French Grammes.		Approximate Value in Grammes.
1 dr. (<i>didr.</i>)	=	3.54	...	3½
2 —	=	7.08	...	7
4 —	=	14.16	...	14
1 oz.	=	28.32	...	28
2 —	=	56.64	...	56
3 —	=	84.96	...	84
4 —	=	113.28	...	112
8 —	=	226.56	...	224
16 —	=	453.12	...	448

The general error in these approximative values will be found to be about 1-96th part in defect, or below the exact equivalents.

With so much, whether in a scientific, a politic, or in a moral and legal sense, to recommend the adoption of the proposed alteration, the inconveniences attributable to it should be of a very solid and decided character to vindicate any doubt as to its reception. Yet, with every anxiety to discover these, and to attach to them their due significance, whether they relate to the prescriber or to the dispenser, they occur to me as exceedingly few, as concerning, indeed, the latter only, and as of little relative importance to any. One, which has no claim to respect beyond the fact of its existence, is that mere *vis inertiae* which renders all change irksome, unless that into which we glide passively and imperceptibly; when habit reconciles us to difficulties and disorder from which it ceases to be easy to reclaim us to their opposites. But as a large proportion of those interested admit that some description of change is of essential necessity, and as many have advocated the introduction of a metrical system, such as we have

¹ Köhler, *Reform der Medicinalgewichte der deutschen Staaten*, 1858, p. 12.

seen would be wholly inexpedient for the present, those who desire to rest upon the old limits will at least find their nearest satisfaction in acceding to that slighter modification which harmonises so easily with existing usages, yet is so ample in its results, as the alteration of the grain. This would be surely preferable with them to advancing with the others to that more thorough subversion, which would have the double disadvantage of completely breaking up our own internal relations, while separating us still more violently, and for we know not what interval, from the ordinary, and hence the safe rule of commerce.

Another alleged inconvenience, and one which must be as clearly adverse to whatsoever other changes as to that now proposed to be instituted, is, that so long as any prescriptions written before the introduction of the new system continue to be presented, and are to be compounded, therefore, upon the old system of weights, there will be continual risk of error in dispensing them. This is, indeed, to narrow to an extreme limit what is to be received as an opposition to a wide and comprehensive general measure; but as the objection is certainly a tangible one, it is just that it should be answered. Had the former irregularity been itself charged with no promotion of error, in all its parts and through all its duration, a more serious attention might have been conceded to this anticipation of evil with reference to the newly attained regularity, when thus confined to a single category, and one which, as it must be the least extensive of all now, will infallibly become every day smaller. But when we consider how transitory its influence, and how trifling the amount of its capacity for mischief, compared with that which the proposed new arrangement removes, we can assign to it only a very insignificant value. And still more, we must consider whether the change of the weights be the sole, or even the most important, obstacle to be encountered in future, with reference to this class of prescriptions. Unquestionably, the modifications in the strength of the different galenical preparations, such as it will be impossible to avoid in reducing the several existing Pharmacopœias to one harmonious whole, and in accommodating that whole to the progress of medical science, and possibly to the newly perceived exigencies of medical practice, will interfere far more imperiously with the currency of antiquated prescriptions than any reduction of a fractional part of their strength, such as the change in the value of the grain will be fitted to effect; and dispensers will doubtless soon discover, in this way, that the demand made upon their caution by the introduction of the new weights will be the least exigent of what will be still the reasonable duties imposed upon them. Besides, there can be no real hazard, where the difference in dose is a diminution and not an increase: while, should there be anywhere a hankering after an extreme nicety of adjustment, the addition of a tenth, in adapting the new weights to the old prescriptions, will involve a far less intricate, and more

easily familiarised, calculation than druggists have hitherto been in the habit of encountering voluntarily under the existing anomalies. But the honest and experienced physician will remove all pretext for anxiety here by pointing out to them, that there really exists, and can exist, no such level uniformity in age, sex, habits, and physiological or pathological condition, that the practitioner can adjust his ordinary remedies to it to the nicety of the eleventh part of a grain, or, in the case of powerful medicines, such as strychnine for example, to less than the 120th part of that quantity, which would be about the proportions, in either instance, in which the strength of the dose would be altered.

There remains a third inconvenience, affecting, however, a wholly different range of practical and scientific inquiry, which has not escaped notice. In considering the policy of altering the grain, the use of the troy grain by chemists and natural philosophers, including physiologists, was an early object of attention. But these were not seen to be included in any of the proper conditions which affected the practitioner and the druggist, either as to the extent, or the quality, or the practical bearing of their relations; and it was judged, therefore, that they might be reasonably left to alter or continue their present course as they thought best for themselves, and that they would neither cause nor incur any special inconvenience, whether they inclined to adhere to the old standard, which they might render arbitrary for their own purposes, or pass to a new one.

The change, then, which I have proposed appears to me to recommend itself by many and decided advantages. A few of the more important of these I trust have been rendered obvious, without being overrated, and others less essential will readily suggest themselves. It has been my endeavour to show, along with the readiness with which such advantages are attainable, the easy way in which they are capable of being adapted to existing circumstances, while fitted, at the same time, for enabling the profession to proceed the more smoothly onwards to greater changes, should it be afterwards necessary to accomplish these simultaneously with the universal interests of the nation. Had the object of those investigations of which I have presented merely the condensed results not appeared to me to tend to a highly desirable public benefit, I should certainly never have entered upon them; for it required but slight experience to discover that the topic, in other respects, could have little in itself of either prospect of reward or present attraction to stimulate the zeal of the inquirer. A theme may be in the broadest sense for the people, yet only in the narrowest sense popular: and it may lie too much on the debateable ground between the profession and the public to meet the regard of either, though it aim at, or even achieve, the advantage of both. With this consciousness, it is alike impossible for me to regret having commenced my remarks and to be unwilling to close them.