

Observations on the Edinburgh pharmacopoeia, and on the dispensaries of Dr. Christison and Dr. A.T. Thomson : to which are added, illustrations of the present state of pharmacy in England / by Richard Phillips.

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OBSERVATIONS
ON THE
EDINBURGH PHARMACOPŒIA,
AND ON
THE DISPENSATORIES
OF
DR. CHRISTISON AND DR. A. T. THOMSON;
TO WHICH ARE ADDED,
ILLUSTRATIONS
OF THE
Present State of Pharmacy in England.

BY RICHARD PHILLIPS, F.R.S., L. & E., &c.

AND HONORARY MEMBER OF THE PHARMACEUTICAL SOCIETY.

(From the Medical Gazette, Pharmaceutical Journal, and Medico-Chirurgical Review.)

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INDEX.

N.B.—The first 36 pages are distinguished by an asterisk.

Acetate of Copper	19*
Acetum Britannicum	1,* 16*
Acetum Destillatum	2,* 8,* 23,*
Acetum Gallicum	2*
Acidum Aceticum	8,* 24,* 53
Acidum Citricum.. .. .	27*
Acidum Hydrocyanicum	29*
Acidum Muriaticum	3,* 31,* 40
Acidum Muriaticum dilutum	34*
Acidum Muriaticum purum	31,* 33*
Acidum Nitricum	34,* 39
Acidum Nitricum dilutum	11,* 35* 39
Acidum Nitricum purum	11,* 34*
Acidum Pyroligneum	3*
Acidum Sulphuricum	3*
Acidum Sulphuricum purum	36*
Acidum Tartaricum	3,* 3
Æther Sulphuricus	53, 54
Ammoniaë Acetatis Aqua	6
Ammoniaë Carbonas	4*
Ammoniaë Oxalas	34
Ammoniaë Spiritus	4,* 9
Antimonii Oxidum	9
Antimonii Sulphuretum	18*
Antimonium	18*
Antimonium Tartarizatum	10
Aqua Ammoniaë.. .. .	4*
Aqua Ammoniaë fortior	4*
Aqua Destillata	51
Argenti Nitras	4,* 52
Barytæ Carbonas.. .. .	4*
Barytæ Murias	4*
Barytæ Muriatis Solutio	13
Barytæ Nitras	34
Bismuthum Album	13
Calcis Murias	14
Corrosivus Sublimatus	22
Creta Preparata	5,* 14
Elaterin	21*
Emplastrum Hydrargyri	20*
Ferri Ammonio-chloridum.. .. .	50
Ferri Oxidum Nigrum	14
Ferri Sulphas	19
Ferri Sulphuretum	17
Ferrugo	18
Ferrum Tartarizatum	22
Hydrargyri Binioididum	19*
Hydrargyri Iodidum	19*
Hydrargyri Oxydum	19*

Hydrargyri Precipitatum Album	19*
Hydrargyrum	19*
Hydrargyrum cum Creta	20*
Liquor Ammoniae	45
Liquor Ammoniae fortior	18*
Liquor Arsenicalis	12
Liquor Potassæ	43
Liquor Potassæ Arsenitis	13
Liquor Potassæ Carbonatis.. .. .	42
Magnesiæ Sulphas	6,* 20*
Morphia	21*
Morphia, Citrate	21*
Morphia, Hydriodate	22*
Morphia, Nitrate.. .. .	22*
Morphia, Phosphate	22*
Morphia, Sulphate	21*
Morphia, Tartrate	21*
Narceia	23*
Narcotina	23*
Pilulæ Hydrargyri Chloridi Compositæ	20*
Plumbi Acetas	13,* 26
Plumbi Carbonas.. .. .	23*
Plumbi Nitras	13,* 26
Plumbum	23*
Potassæ Acetas	27
Potassæ Aqua	28
Potassæ Carbonas	29, 42
Potassæ Carbonas purum	29
Potassæ Hydras	50
Potassæ et Sodæ Tartras	29
Potassæ Tartras	55
Potassii Sulphuretum	31
Pulvis Antimonialis	6*
Pulvis Cretæ Opiatus	20*
Quinæ Sulphas	6*
Sodæ Carbonas	31
Sodæ Carbonas exsiccata	55
Sodæ Nitras in common Salt	32*
Sodæ Phosphas	32
Sodæ Sulphas	46
Spiritus Ætheris Nitrici	46
Spiritus Ammoniae Aromaticus.. .. .	48
Sublimatus Corrosivus	22
Sulphuretum Hydrargyri Nigrum	19*
Tinctura Ferri Sesquichloridi	49
Unguentum Citrinum.. .. .	23
Unguentum Hydrargyri Mitius	20*
Vinum Opii	20*
Weights and Measures	17*

OBSERVATIONS,

§c. §c.

I HAVE participated in what I believe to have been the anxiety of the medical and chemical world for the appearance of this work. It has been in preparation for no inconsiderable time, and common report has attributed its progress and completion to the labours of Dr. Christison. That this opinion has been correctly formed is confirmed by the following passage in the last number of the *Edin. Med. and Surg. Journal* (July 1839): "Whilst we give the Edinburgh College of Physicians full credit for the excellence of the work which bears their name, it would be unfair in us, possessing the local information which we do, not to express our conviction that a great part of its value is due to the labours and exertions of its accomplished President, Dr. Christison. It is, indeed, fitting that the President of a College of Physicians should be a man of scientific eminence; and especially that, when the body over which he presides publishes a new Pharmacopœia, he should be both competent and ready to take a principal share in its formation. We are certain that we do not in any respect depreciate the merits of other members of the Edinburgh Pharmacopœia Committee, when we say, that we believe the greater part of its excellence is owing to Dr. Christison's scientific knowledge, laborious manipulations, and indefatigable research into the books of British and foreign pharmacologists."

Were it not perfectly superfluous, I would willingly add my testimony to the great scientific acquirements of Dr. Christison: his name is almost sufficient to set criticism at defiance; but, as chemical facts do not differ from others in being "stubborn things," I shall freely and fully state what I believe to be facts respecting this Pharmacopœia. I shall do so plainly, but, I trust, without giving offence either to the Royal College of Physicians as a body, or to their learned and scientific President as an individual.

The first article that requires notice is the second in the *Materia Medica*; it is

ACETUM BRITANNICUM. *British vinegar.* Of this it is stated that its density is from 1006 to 1012. "In four fluidounces complete precipitation takes place with 30 minims of solution of nitrate of baryta." This means, I presume, that the sulphuric acid which vinegar contains is perfectly thrown down by the assigned quantity of the barytic solution. Vinegar-makers are permitted to add to vinegar 1-1000dth of its weight of sulphuric acid; and it can hardly be supposed that they do not avail themselves of this privilege to its full extent. Let us, therefore, see what quantity of sulphuric acid four fluidounces may contain. The density of vinegar being taken at 1006, four fluidounces weigh 1760 grains, and the sulphuric acid which

it contains amounts to 1.76 grain; as 49 of this acid decompose 130 of nitrate of barytes, 1.76 will require 4.66 for that purpose.

The College test solution of nitrate of barytes is prepared by dissolving 40 grains of the salt in 800 grains of water; and assuming, what may be admitted without sensible error, that the bulk of the solution does not materially differ from that of the water, the question to be determined is, how much nitrate of barytes is contained in 30 minims of the test solution.

A fluidounce, or 437.5 grains of water = 480 minims, 800, therefore, = 877, holding 40 grains of the barytic salt in solution; consequently, 30 minims contain 1.36 grain only, instead of 4.66 grains, as required; so that more than 100 minims of the solution are necessary to produce an effect which, according to the College, is complete with 30.

Being unwilling to trust entirely to calculation, especially when experiment is so easy as in the present case, I procured some vinegar from a source which I knew to be respectable: its density was 1019, which exceeds the greater specific gravity stated by the College. With four fluidounces of this I mixed 30 minims of the test barytic solution; the precipitate formed was separated by filtration, and 60 minims more were added to the clear vinegar: this occasioned much more abundant precipitation than the 30 minims, and after again filtering the vinegar, nitrate of barytes being added, it occasioned the formation of more sulphate.

Four fluidounces of this vinegar gave a quantity of sulphate of barytes which indicated an excess of 1.3 of a grain of sulphuric acid: this may be attributed to the error of experimenting, and the sulphates contained in the water used in preparing the vinegar.

I found, also, that the saturating power of this vinegar is accurately stated in the London Pharmacopœia: one fluidounce saturated a drachm of crystals of carbonate of soda.

ACETUM DESTILLATUM. *Distilled vinegar.* "Density 1005." "One hundred minims neutralize 8 grains of crystallized carbonate of soda." One hundred minims of a liquid whose density is 1005 weigh 91.6 grains, and this quantity of distilled vinegar saturates 8 grains of carbonate of soda; 100 therefore = 8.7 grains. Now, 144 of crystals of carbonate of soda = 51 real acetic acid; and consequently $8.7 = 3.07$, which is the per centage of acetic acid contained in the distilled vinegar: this quantity amounts to only about 3-5ths of that which the undistilled vinegar contains; and no inconsiderable portion of the loss of 2-5ths is occasioned by the College needlessly directing only 6-8ths of the vinegar to be distilled.

ACETUM GALLICUM. *French vinegar.* The introduction of this seems needless. It appears, however, from the College statement, that the quantity of sulphuric acid added to vinegar in France is precisely the same as that in England; for of the foreign article it is also stated, that "in four fluidounces complete precipitation takes place with 30 minims of solution of nitrate of baryta." Having obtained some French vinegar, I found its density was 1016; I added the proper quantity of the test solution to a portion of it, and I certainly found that sulphate of barytes was precipitated. After filtering the vinegar, I added dilute sulphuric acid to it, which

occasioned the formation of much more sulphate than had been occasioned by the sulphuric acid in the vinegar.

To determine, within certain limits, how little sulphuric acid this vinegar actually contained, I added the test in the proportion of 15, instead of 30 minims, and I found, when the vinegar had been filtered, not only that nitrate of barytes occasioned no precipitation in it, but that dilute sulphuric acid did. It is, therefore, evident that the vinegar did not contain half enough sulphuric acid to occasion "complete precipitation" of the nitrate of barytes. Of the French vinegar which I employed, 100 minims saturated nearly 14 grains of crystallized carbonate of soda, while an equal quantity of English vinegar, exclusive of the sulphuric acid which it contains, saturated little more than 12 grains; consequently the French is stronger than the English vinegar by nearly one-sixth.

ACIDUM MURIATICUM. *Hydrochloric Acid of commerce.* "Density at least 1180." I have never met with it so strong, and suspect that any thus dense must contain a large quantity of sulphuric acid. "It always contains a little sulphuric acid, oxide of iron, chlorine, and bromine." I should like to see the evidence of its containing the last-mentioned element. Why is so usual an impurity as sulphurous acid omitted?

ACIDUM PYROLIGNEUM. "*Diluted acetic acid obtained by the destructive distillation of wood.*" If this acid be, as admitted, acetic acid, for what purpose is the name of pyroligneous acid now introduced? It is merely making a distinction without a difference.

ACIDUM SULPHURICUM. *Sulphuric Acid of commerce.* "Density 1840, or near it." I have seldom found it less than 1844. "When diluted with its own volume of water, only a scanty muddiness arises, and no orange fumes escape." The muddiness that *arises* is, I presume, sulphate of lead, which is *thrown down*.

ACIDUM TARTARICUM. *Tartaric Acid.* The formula for preparing this acid was, I presume, intended to be similar to that of the London Pharmacopœia; but, by an oversight of no small moment, the process has been deteriorated. The London College directs 7 pints and 17 fluidounces of diluted sulphuric acid to decompose a given quantity of tartrate of lime, and the Edinburgh College orders precisely the same quantity. They have, however, forgotten that their diluted sulphuric acid is different from that of the London Pharmacopœia, although the directions for preparing it immediately precede those for the tartaric acid, and in the very same page.

The London diluted sulphuric acid is prepared by mixing $1\frac{1}{2}$ fluidounce of the strong acid with $14\frac{1}{2}$ fluidounces of water; while the Edinburgh Pharmacopœia directs 1 fluidounce of acid to 13 fluidounces of water: their comparative strengths by weight are about as 100 to 78, and by volume the difference is still greater; the Edinburgh College should have directed more than 10 pints of dilute sulphuric acid, instead of less than eight.

Under the head of *Acidum Citricum*, a corresponding error is committed, and with an appearance of precision that renders the mistake more remark-

able. In preparing this acid the London College directs four pints of lemon-juice, four and a half ounces of chalk, and twenty-seven fluidounces and a half of diluted sulphuric acid: the Edinburgh Pharmacopœia orders the same quantities, except that the diluted sulphuric acid is reduced by half an ounce. "Diluted sulphuric acid, twenty-seven fluidounces, or in proportion to the chalk required." So that the sulphuric acid is reduced by half an ounce, when it ought to have been increased by nearly eight ounces.

AMMONIÆ CARBONAS. *Sesquicarbonate of ammonia.* "Heat sublimes it entirely: a solution in water, when treated with nitric acid in excess, does not precipitate with solution of nitrate of baryta or silver." Now, these are not the peculiar properties of sesquicarbonate of ammonia; they belong equally to the carbonate and bicarbonate.

AMMONIÆ SPIRITUS. *Solution of ammonia in rectified spirit.* "It does not effervesce with muriatic acid." This is a mistake, for effervescence does occur, as in liquor ammoniæ, if the acid be strong.

AQUA AMMONIÆ. *Diluted aqueous solution of ammonia.* "Density 960; nitric acid occasions no effervescence." Whether nitric acid occasions effervescence or not, may depend entirely on the strength of the acid employed; for if it be not diluted, the effervescence of ammoniacal gas is extremely violent, owing to the heat occasioned by chemical action. Carbonic acid is, I presume, the admixture that the nitric acid is intended to detect; lime water, or a solution of chloride of calcium, are much better tests of the presence of this acid than nitric acid, even when properly diluted.

AQUA AMMONIÆ FORTIOR. *Concentrated aqueous solution of ammonia.* "Density 880: one fluidounce with three of water makes Aqua Ammoniæ," meaning, of the density of 960, as above directed. This statement, however, is erroneous, for when a solution of ammonia is mixed with water, the density of the mixture is nearly the mean; so that one volume of solution of ammonia, of density 880, and three volumes of water, will have a density of 970 instead of 960: two, instead of three, fluidounces of water should have been directed to be added to one fluidounce of the stronger solution of ammonia.

ARGENTI NITRAS. *Nitrate of silver.* "Soluble in distilled water, with the exception of a very scanty black powder," which, however, does not occur when the salt has been properly prepared from pure silver.

BARYTÆ CARBONAS. *Carbonate of baryta.* "One hundred grains dissolved in an excess of nitric acid are not entirely precipitated with sixty-one grains of sulphate of magnesia." If, by sulphate of magnesia, the anhydrous salt be intended, then this statement is correct; but there is no indication of this, and it requires either calculation or experiment to discover a meaning which there are no grounds for suspecting to be hidden.

BARYTÆ MURIAS. *Chloride of barium.* "Ninety-nine grains in solu-

tion, acidulated with nitric acid, are not entirely precipitated by 49 grains of sulphate of magnesia."

I have just shewn that "sulphate of magnesia" means *anhydrous* sulphate, and I shall presently prove that "sulphate of magnesia" also means *crystallized* sulphate: hence, when crystallizable salts are mentioned, we are under the necessity of determining, by calculation or by previous trial, with what materials an experiment is to be performed. In this instance, the muriate of barytes and the sulphate of magnesia may be crystallized or anhydrous, and it may require four calculations, or as many experiments, to discover the state in which the salts are intended to be employed: thus—

1st.	The muriate may be	crystallized	and the sulphate	crystallized.
2d.	"	anhydrous	"	crystallized.
3d.	"	anhydrous	"	anhydrous.
4th.	"	crystallized	"	anhydrous.

In these four cases the quantity of each salt required is, in the

	Muriate of Barytes.		Sulphate of Magnesia.
1st. . . .	crystallized, 99 grains . . .	crystallized, 99·8 grains.	
2d. . . .	anhydrous, 99 " . . .	crystallized, 117 " "	
3d. . . .	anhydrous, 99 " . . .	anhydrous, 57 " "	
4th. . . .	crystallized, 99 " . . .	anhydrous, 48·6 " "	

Making, therefore, a slight allowance for the difference between the weights of the equivalents which the College appear to adopt, and those used by me, it is evident that, by the aid of repeated calculations or experiments, the enquirer may arrive at a correct conclusion as to the meaning which the College attach to the words "muriate of barytes" and "sulphate of magnesia."

It follows also, that, in this case, two meanings may be conveyed by the same term; whereas, under acetum destillatum and acidum aceticum, "crystallized carbonate of soda" and "carbonate of soda" have both the same meaning: whether to give the same name to two different substances, or two different names to the same substance, has the merit of being the less ambiguous, I shall not stop to inquire.

CRETA PREPARATA [PRÆPARATA]. *Chalk, finely pulverized by levigation.* "A solution of 25 grains in ten fluidrachms of pyroligneous acid, when neutralized by carbonate of soda, and precipitated by 32 grains of oxalate of ammonia, continues precipitable after filtration by more of the test." Under the head of acidum pyroligneum (this name being given to pure acetic acid) it is stated, that one hundred minims neutralize at least fifty-three grains of carbonate of soda, meaning, as I believe, in the state of crystals; ten fluidrachms, or six hundred minims, therefore, saturate 318 grains of the carbonate, equivalent to 110 grains of carbonate of lime: hence it follows that the acetic acid directed for dissolving twenty-five grains of chalk is capable of dissolving more than four times that quantity, and the excess requires 244 grains of carbonate of soda for saturation; so that before the lime of twenty-five grains of chalk can be precipitated from solution by oxalate of ammonia, nearly ten times its weight of carbonate of soda is used to saturate the excess of acid employed in dissolving it.

MAGNESIÆ SULPHAS. *Sulphate of magnesia.* "Ten grains dissolved in a fluidounce of water and treated with solution of carbonate of ammonia, are not entirely precipitated by 280 minims of solution of phosphate of soda." I have shown in two cases that sulphate of magnesia means the anhydrous salt; it might therefore be very naturally concluded that the same meaning would in this instance attach to the same words; on making the experiment, however, with the crystallized sulphate, I found that the precipitation occasioned by the phosphate of soda when added a second time, was not nearly so considerable as it would have been if the anhydrous salt had been used. In this instance, therefore, sulphate of magnesia means the crystallized salt, as it must also do in the directions for preparing the carbonate of magnesia.

PULVIS ANTIMONIALIS. *A mixture chiefly of sesquioxide of antimony and phosphate of lime, with a little antimoniate of lime.* "Distilled water, boiled with it and filtered, gives with sulphuretted hydrogen an orange precipitate; muriatic acid digested with the residue becomes yellow, does not become turbid by dilution, but gives a copious orange precipitate with sulphuretted hydrogen." Not only is antimonial powder *not* chiefly sesquioxide of antimony and phosphate of lime, but it frequently contains not a particle of the former; the antimony is mostly in the state of deutoxide or antimonious acid. A proof that it contains very little sesquioxide, if any, is indeed given by the College in stating that the muriatic solution "does not become turbid by dilution." If this preparation contained sesquioxide chiefly, it would be almost entirely soluble in muriatic acid, for this oxide and phosphate of lime are very readily taken up by it.

It appears to me more probable that it is antimonite than antimoniate of lime, which the powder contains.

QUINAE SULPHAS. *Sulphate of Quina.* "A solution of ten grains in a fluidounce of distilled water, and two or three drops of sulphuric acid, if decomposed by a solution of half an ounce of carbonate of soda in two waters, and heated till the precipitate shrinks and fuses, yields on cooling a solid mass, which when dry weighs 7.4 grains."

Supposing that the sulphuric acid added amounts to six grains, and the sulphate to contain two grains, less than twenty-four grains of the carbonate would be sufficient to precipitate all the quina, instead of the 240 grains ordered.

I made the experiment with ten grains of the sulphate of quina, 25 grains of the carbonate of soda, and three drops of sulphuric acid; I found that there was more of the alkaline salt than was required; the quina was readily separated by the filter, and it weighed when dry 7.1 grains.

The following list exhibits, as it appears to me, instances of the omission of capital letters, in cases in which they ought, according to the best authorities, to have been employed:—

Acorus calamus

instead of Acorus Calamus.

Carum carui

Carum Carui.

Cinnamomum cassia

Cinnamomum Cassia.

Anamirta cocculus
Citrus limonum
Humulus lupulus
Daphne mezereon
Strychnos nux-vomica
Juniperus sabina
Polygala senega
Aristolochia serpentaria
Taraxacum dens-leonis
Arctostaphylos uva-ursi
amygdalus communis
Acacia catechu
Areca catechu

Anamirta Cocculus.
Citrus Limonum.
Humulus Lupulus.
Daphne Mezereon.
Strychnos Nux-vomica.
Juniperus Sabina.
Polygala Senega.
Aristolochia Serpentaria.
Taraxacum Dens-leonis.
Arctostaphylos Uva-ursi.
Amygdalus communis.
Acacia Catechu.
Areca Catechu.

In the following instances the College have varied their practice, in some cases employing capitals, and in similar ones neglecting them :—

Aurantii oleum
Hydrochloric acid
Carbo ligni
Antimonium Tartarizatum
Cinnamomum Zeylanicum
Maranta indica
Rosæ Fructus
Calamina preparata [præparata]

Bergamotæ Oleum.
Hydrochloric Acid.
Carbo Animalis.
Ferrum tartarizatum.
Cinnamomum zeylanicum.
Cetraria Islandica
Juniperi fructus
Creta Preparata [Præparata].

The inaccuracies in the natural-history part of the *Materia Medica*, are, however, of a much graver description than those which I have just pointed out.

“ *CASTOREUM.* *Castor* : a peculiar secretion from the præputial follicles of *Castor fiber*.” *Castoreum*, or *castor* of the shops, is the præputial follicles, with their contained secretion, of the *Castor Fiber*. According to the definition of it given by the College, apothecaries ought, of course, to use the secretion only, in making tincture of castor, throwing away the follicles themselves.

“ *CINCHONA CORONAE*, *Crown-Bark*.”

“ *CINCHONA CINEREA*, *Gray-Bark*.”

“ *CINCHONA PALLIDA*, *Pale-Bark*.”

Much confusion has been here introduced. It might be naturally supposed that *crown*, *gray*, and *pale* barks were different kinds of *Cinchona* bark ; whereas the fact is, that crown and gray barks are pale barks. The only other kind of pale bark known in English commerce, is ash bark, an inferior kind, of little value. Surely the College did not mean this ? But if not, what is meant ? Again, the College have translated the terms *gray* or *silver Cinchona* by *Cinchona cinerea*, which means literally, *ash-coloured Cinchona*, and which for shortness may be termed *ash Cinchona*. Now ash *Cinchona* of commerce is a very distinct and inferior kind of bark to that

called "gray or silver *Cinchona*." Further, why is the hyphen (-) put between the words *Crown*, &c., and *Bark*?

"*ALOE INDICA*." What is meant here? Aloes produced in India? If so, none is found in English commerce. Does it mean aloes brought from some part of the world by way of India? If so, "*Aloe socotrina*" is "*Aloe indica*."

"*CALAMUS AROMATICUS*" is obtained from *Andropogon Calamus aromaticus* (Royle, *Hist. of Hindoo Med.* p. 33.) The rhizoma of *Acorus Calamus* is a very different substance.

"*ERGOTA*. *An undetermined fungus developed in place of the seed upon Secale cereale*." Decandolle's opinion here adopted by the Edinburgh College has been satisfactorily disproved by the investigations of Phillipar, Phœbus, Smith, Quekett, and others. Both Fries and Berkeley evidently doubted its correctness.

"*HORDEUM*. *Decorticated seeds of Hordeum distichon (L. W. Spr.); Barley*." The decorticated grains of *Hordeum distichon* form *Scotch* or *Pearl Barley*, but not "*Barley*" as so called in England.

"*GLYCIRRHIZÆ RADIX*." The substance meant is a *rhizoma*, not a *root*.

Having now concluded my observations on the *Materia Medica* of the first edition of the *Edinburgh Pharmacopœia*, I proceed to consider the *Preparations* of the same, beginning with—

Acetum destillatum.—I have already had occasion to show (p. 2) that by the College process a considerable quantity of vinegar is wasted, owing to their directing too small a portion to be distilled; the amount of this loss I have since ascertained. From f $\bar{3}$ 40 of English vinegar I distilled, as ordered, f $\bar{3}$ 30; its density was 1006. I afterwards obtained f $\bar{3}$ 5 more, and its density was 1009.3; the former contains about 3.53 per cent. of acetic acid, and the latter 5.4, consequently the acetic acid contained in the f $\bar{3}$ 30 amounted to 466 grains, and that in the f $\bar{3}$ 5 to 120 grains; so that, owing to the directions for distilling only f $\bar{3}$ 30 instead of f $\bar{3}$ 35, scarcely four-fifths of the vinegar which might be obtained are actually procured, and for this very considerable loss no adequate reason can be assigned. I also distilled f $\bar{3}$ 30 and f $\bar{3}$ 5 from f $\bar{3}$ 40 of French vinegar; the results corresponded so exactly with those above stated, that it is needless to describe them.

Acidum Aceticum.—The directions for preparing this acid are as follows:—

"Take of acetate of lead any convenient quantity: heat it gradually in a porcelain basin by means of a bath of oil or fusible metal (8 tin, 4 lead, 3 bismuth) to 320° F.; and stir till the fused mass concretes again: pulverise this when cold, and heat the powder again to 320°, with frequent stirring, till the particles

cease to accrete. Add six ounces of the powder to nine fluid drachms and a half of pure sulphuric acid contained in a glass matrass : attach a proper tube and refrigeratory ; and distil from a fusible metal bath with a heat of 320° to complete dryness. Agitate the distilled liquid with a grain or two of red oxide of lead to remove a little sulphurous acid, allow the vessel to rest a few minutes, pour off the clear liquor, and redistil it. The density should not be above 1065."

I have attempted to follow this process, and if (which I very much doubt) any one else ever did, he must, I think, have found that it is much more easy to fail than to succeed in it. The College evidently intend to procure glacial, or the strongest acetic acid ; for what medicinal use it can be required, I shall not enquire ; I may perhaps make another attempt to prepare it. In the mean time, I will state, as the results of experiments which I have already performed, some of the more glaring imperfections (to use a gentle expression) of the directions issued by the College.

In the first place, that the acetate of lead may be rendered anhydrous, it is to be heated to 320° of Fahrenheit, stirred till the mass concretes, to be pulverized when cold, again heated to 320° till the particles cease to accrete ;* no *accretion*, however, occurs after *concretion* and pulverization, so that one-half of these directions is needless.

In the second place, doubting whether so high a temperature as 320° , and the troublesome means of applying it, were requisite to deprive acetate of lead of its water of crystallization, I heated ten ounces of this salt in a porcelain vessel over boiling water, occasionally stirring it. When it had ceased to lose water, there were left 8 ounces and 264 grains, which is within a few grains of what the salt ought to have weighed if perfectly anhydrous, taking the equivalent of it when crystallized at 190, and as containing three equivalents of water.

Thus, then, it is evident that the heat of boiling water, and occasional stirring, are capable of effecting what is directed to be performed with constant stirring at 320° , by a fusible metal bath, the use of which is inconvenient and expensive ; or by an oil bath, which has the additional demerits of being disagreeable and dangerous. In both these methods, and especially the former, it is difficult to keep the matrass immersed in the heated fluid ; the use of a thermometer is required, and it must be constantly watched lest the temperature should rise too high, which in the fusible metal bath it must have a great tendency rapidly to do.

In the third place, I shall consider whether acetate of lead is the salt best calculated for yielding acetic acid. My first objection is, that it is an extremely inconvenient substance to mix with the sulphuric acid required to decompose it, for they form a most tenacious compound. As a preliminary trial, on a very small scale, of the mode in which these substances would act upon each other, I added 30 minims of the acid to 140 grains of the acetate, and mixed them with a glass stirrer, which was suffered to remain in the mixture, and was retained by it with such force, that it required a weight equal to several ounces to separate them ; this

* I have not been able to find this word in any dictionary which I have consulted.

renders it difficult to mix the ingredients by agitation, and to do so by stirring in the matrass is impossible. Such indeed is the tenacity of this mixture, that cases may arise in which it may be usefully employed as a cement.

In the fourth place, the use of acetate of lead is highly objectionable on account of the extreme insolubility of the residual sulphate of lead, and the consequent difficulty in clearing the matrass for a second operation. Another objection is its cost compared with that of acetate of soda, a salt which may be advantageously used for preparing glacial acetic acid; its original cost is, indeed, the same as that of acetate of lead, but then 100 parts of this contain only 26.84 of acetic acid, whereas 100 of the soda salt contain 37.22. I find that it also may be rendered anhydrous at 212° . In an economical point of view, therefore, the use of acetate of soda is more advantageous than that of acetate of lead, in the proportion nearly of 14 to 10, and there is the great contingent benefit of the easy removal of the residual sulphate of soda from the matrass, and this is a salt of some little value, whereas the sulphate of lead obtained by the College process is of no use whatever.

Acetate of lead was probably selected by the College in consequence of the statement of Despretz (*Ann. de Chim. et de Phys.* t. 43, p. 223) that he had procured crystallizable acetic acid from it; this information is accompanied with the assertion that the process for preparing the acid of this strength is kept a secret. That it may have been so in France is probable, but it was published in England 20 years since by Messrs. J. and P. Taylor, in the sixth volume of the *Royal Institution Journal*; they obtained the glacial acid by using fused acetate of soda, oil of vitriol, and glass retorts, and most probably a common sand heat, for they make no mention of metal or oil baths as requisite to the success of the operation. I may here mention a curious distinction made by the College, on the subject of modes of heating: when the acetate of lead is to be deprived of its water of crystallization by exposure to a heat of 320° , we may perform the operation "by means of a bath of oil or fusible metal," but when the acetate of lead is to be decomposed at the same temperature, we are directed to "distil from a fusible metal bath;" so that in the first part of the operation we are at liberty to use the better of two bad methods, while in the second, we are restricted to the employment of the worse.

The necessity for having recourse to sulphuric acid purer than that of commerce I cannot discover; if it be merely on account of its greater strength, the acid might be obtained of equal density by simple concentration, which is an operation of much less risk than that of rectification. Messrs. Taylor appear to have used common commercial acid.

Any sulphurous acid which the acetic acid may contain, the College have directed to be removed by agitating it with a grain or two of red oxide of lead, and then redistilling it. Messrs. Taylor used acetate of lead for this purpose, and so, in point of fact, do the College; for when the red oxide is put into acetic acid, it is immediately separated into protoxide and binoxide, and the acetate which the former yields is instantly decomposed by sulphurous acid, whereas the action of sulphurous acid upon deutoxide of lead, so as to become sulphuric acid, is comparatively slow.

As the College have thus limited the quantity of red oxide of lead to be used, let us enquire what must have been the greatest amount of impurity which they supposed the acetic acid to contain; for I know not what other consideration could have induced the limitation of its employment to two grains, when a considerably larger quantity of the acetate of lead than absolutely required would have occasioned but little loss, and no inconvenience.

Two grains of red oxide of lead are equivalent to 1.3 gr. of protoxide, and 0.7 gr. of binoxide; the protoxide is capable of combining with 0.37 gr. of sulphurous acid, and the excess of oxygen in the binoxide is sufficient to convert 0.18 grain of sulphurous into sulphuric acid; the quantity of sulphurous acid therefore, which the College suppose the product to contain, cannot exceed 0.55 of a grain.

Now it will appear by a calculation, which it is not necessary to state, that the ingredients used by the College ought to produce more than 1000 grains of glacial acetic acid, and it is a provoking circumstance, if it be well founded, that this product should require the wasteful operation of being redistilled on account of its containing only about 1-2000dth of its weight of impurity; or, indeed, if the smaller quantity of deutoxide of lead mentioned by the College be sufficient to purify the acetic acid, the sulphurous acid cannot exceed about 1-4000dth of the weight of the acid obtained.

Until more leisure than I have lately had will permit me again to attempt the preparation of this acid according to the directions of the College, I shall quit the subject with remarking, that whether the product be more or less pure than the College suspect, or whether it has a "density not above 1068.5," as stated at p. 2 of the Pharmacopœia, or "not above 1065," as directed at p. 44, the process is to be strongly condemned for its inconvenience and expense.

Acidum Nitricum purum.—The formula of the London College is adopted, and is a great improvement on the former process.

Acidum Nitricum dilutum.—The directions for preparing this are as follow:—

"Mix together three fluidounces of nitric acid (commercial), and four fluidounces of water. If pure nitric acid be used, four fluidounces of it must be mixed with six fluidounces of water. The density of this preparation is 1290."

As the College state the sp. gr. of the dilute acid is 1290, I conclude that they intended, and very properly so, that its strength should be similar to that of their former Pharmacopœia, or that it should contain about 40 per cent. of real nitric acid; for it appears by Dr. Ure's table that dilute nitric acid, of density 1291, contains 39.45 per cent; whether this accuracy, on the part of the College, was the result of calculation or of experiment, it is unnecessary to inquire; unfortunately, however, it attaches to one only of the two modes of preparation directed, or that in which the pure acid is used; I found the sp. gr. of the diluted and thus prepared, to be 1292.

The directions for using commercial nitric acid and water were probably

the result of calculation, and that a wrong one; for experiment tells a very different tale from that of—"the density of *this* preparation is 1290."

It is stated by the College that commercial nitric acid has a density of "at least 1380;" that which I employed was of 1381 density. According to Dr. Ure, acid of 1380 contains, as nearly as possible, 53 per cent. of real acid; and let us try, by calculation, what ought to be the density of a mixture of three fluidounces of nitric acid of 1380, and four fluidounces of water. A fluidounce of a liquid, of density 1380, weighs 603.75 grains; three fluidounces, therefore, weigh 1811.25 grs., and, as it contains 53 per cent. of real acid, the three fluidounces contain 960 grains, within a small fraction, and the four fluidounces of water weigh 1750 grains. The weight of the mixture is, therefore, 3561.25 grains; and, as it contains 960 of real acid, it amounts to 26.9 per cent.

Not trusting, however, to calculation, I prepared the diluted acid by mixing three fluidounces of nitric acid, of density 1381, with four fluidounces of water, and I found the sp. gr. of the mixture was 1189.7 instead of 1290, as stated by the College, and, according to Dr. Ure, it contains, as nearly as possible, 26.3 per cent. of real acid, differing only 0.6 per cent. from the above calculation.

Having thus proved my assertion that if the proportions of acid and water above used were the result of calculation, that it must have been an erroneous one, I proceeded to compare the strength of the two dilute acids by experiment.

First, I added a small quantity of water to a fluidounce of that variety of the College dilute nitric acid which is prepared with nitric acid of density 1500; its sp. gr. as already mentioned, I found to be 1292 instead of 1290, as stated by the College; the difference is quite immaterial. Into this mixture I put a piece of marble, and found, when the action was over, that 209 grains of it had been dissolved. An ounce of the dilute acid weighed 565.25 grains, and as this dissolved 209 grs., 100, of course, dissolved 36.97 grs., and as 50 of carbonate of lime = 54 of nitric acid, $36.97 = 39.72$, the per centage of real nitric acid contained in the nitric acid thus prepared, agreeing almost precisely with the results of calculation.

Secondly, I added a little water to a fluidounce of the College dilute acid, which had been prepared with acid of sp. gr. 1381; its density, as already stated, was 1189.7, and the weight of a fluidounce 520.5 grains; it dissolved 127.3 grains of marble. Then $520.5 : 127.3 :: 100 : 24.45$, and as 50 of the carbonate = 54 nitric acid, $24.45 = 26.40$, exceeding by only 0.1 grain the strength as indicated by calculation. It is, therefore, evident, both from calculation and experiment, that the strengths of these varieties of dilute nitric are, by weight, to each other as 100 to 66, and by volume as 100 to 60.

Thus it appears there is a difference of 40 per cent. in the dilute nitric acids prepared according to the two modes directed. In addition to this, I may remark that, at p. 104, in the formula for Hydrargyri Oxidum rubrum, the dilute nitric acid is directed to be of sp. gr. 1280; this, however, is most probably a mere misprint.

I shall now exhibit an example of the knowledge which the College

possess of the power of the dilute nitric acid, by examining their mode of using it in the preparation of

Nitrate of Lead.—The formula is as follows:—

“Take of lead, six ounces; diluted nitric acid, six fluidounces; water, six fluidounces. Mix the acid and water, and dissolve the lead with the aid of a gentle heat; concentrate the solution, and set it aside to cool and crystallize.”

Six ounces contain 2880 grains, and this quantity of lead combines with 221 of oxygen to form 3101 grains of protoxide. When a metal is oxidized by nitric acid, and converted into protoxide, an equivalent of the acid, 54, is decomposed into three equivalents of oxygen, 24, which combine with the metal, and one equivalent of nitric oxide, which is evolved in the gaseous state. As then 24 of oxygen require 54 of nitric acid for their production, 221 of oxygen, the quantity necessary to convert 2880 of lead into protoxide, will require 497 grains.

One equivalent (or 112) of oxide of lead takes for its conversion into nitrate, 54 of nitric acid, therefore 3101 grains will require 1495 of the acid for the same purpose, making the whole quantity requisite for oxidizing and combining with the lead 1992 of real nitric acid. I have just shewn that the College have given such directions for the preparation of dilute nitric acid as to yield it of the density either of 1292 or 1189·7. Supposing, therefore, the operator, in making nitrate of lead, may have chanced to prepare his dilute nitric acid with commercial nitric acid, and consequently, to have obtained the dilute acid of sp. gr. 1189·7, let us examine how this would have answered his purpose in the quantity directed. I have stated that a fluidounce dissolves 127·3 grains of carbonate of lime = 137·5 of real acid; six fluidounces, therefore, contain 825, of which 497 being required for the oxidizement of the lead, there will remain 328 to convert it into nitrate, instead of 1495 necessary to produce the effect.

It might indeed be supposed, that it is intended by the College merely that the acid should be saturated with the lead, and that the excess of metal should be rejected; this interpretation cannot, however, for a moment be admitted, for the directions are to “*dissolve*” the lead in the acid, not to *saturate* the acid with the lead.

Indeed, it will be seen, which I could hardly have suspected would have turned out to be the case before making the calculation, that even supposing the whole quantity of the lead to be in the state of oxide when the acid is added, it could not be formed into nitrate, for we should have 3101 of oxide, and only 825 of acid, instead of 1495 as required.

The operator being thus disappointed in using the more economical diluted nitric acid, I will suppose that he afterwards employed the more expensive and stronger preparation, obtained by mixing, according to the directions quoted, four fluidounces of nitric acid of density 1500, with six fluidounces of water; with this diluted acid he might reasonably expect to fulfil the mandate of the College; for no one without examination would be justified in arriving at the monstrous conclusion, that though the College had directed diluted nitric acid to be so obtained, as to yield preparations of two very different degrees of strength, neither of them was sufficiently

strong to answer the purpose. But let us see how this matter stands: it has been mentioned that the stronger dilute nitric acid of the College has a density of 1292, which agrees very nearly with their statement or 1290, and I will give them the benefit of the difference. Six ounces of lead, it has been already proved, require 497 of real acid for oxidizement and 1495 for combination after it, = 1992 of real nitric acid. A fluidounce of nitric acid of 1292, dissolves, as already mentioned, 209 of carbonate of lime, equivalent to 225.7 of real acid, which, multiplied by 6, gives 1354 as the whole quantity of acid contained in the diluted acid employed; so that in this more favourable case it appears that the acid is deficient by no less than 638 out of 1992, or nearly one-third.

After these statements it may be thought quite superfluous to add another word in demonstration of the true nature of the formula for preparing nitrate of lead; but I have not yet done with it. It is well known that lead is oxidized more cheaply and conveniently by the action of heat and air, than that of nitric acid; and knowing this, I am utterly at a loss to conjecture what freak of fancy induced the College to direct the use of the metal instead of litharge. It is employed by them in preparing the acetate and diacetate of lead; and, if properly directed in these cases, no objection could possibly arise to it in that of the nitrate.

The expense of the nitric acid is increased by one-third, the operation is much more tedious, and is attended with the formation of a highly disagreeable vapour, which does not occur when litharge is used.

It is ordered that six fluidounces of water should be added to the six fluidounces of dilute nitric acid; and when the lead is dissolved, we are directed to "concentrate the solution, and set it aside to cool and crystallize."

Now as the College direct the whole of the six ounces of lead to be converted into nitrate, we must suppose that there would be formed, in their opinion, 4596 grains of nitrate of lead; and, as according to Berzelius, this salt requires 7.5 times its weight of cold water for solution, 4596 would require 34470 grains.

Let us, then, examine into the necessity for the concentration of the solution directed by the College. The six fluidounces of dilute nitric acid, of sp. gr. 1292, weigh 3391 grains, of which 1354 are acid and 2037 water; and this added to the 2625, the weight of the six fluidounces, give 4662 grains as the whole quantity of water present at the commencement of the operation; so that, without making any allowance whatever for the loss of water during the digestion, we are directed to concentrate a solution already containing more than seven times as much nitrate of lead as the water is capable of dissolving when cold.

Not trusting, however, to calculation, I put six ounces of lead into the quantities of the stronger dilute nitric acid and water, directed by the College, and heated them in a porcelain vessel for about two hours; of the 2880 grains of lead, 910 remained unacted upon, and consequently 1970 were dissolved. On referring back to what I have stated respecting the solvent power of the dilute nitric acid employed, it will be seen that calculation is confirmed by experiment, quite as nearly as could be reasonably anticipated. I have stated that 1992 of real acid are theoretically required

to convert 2880 of lead into nitrate, and I have shown that six fluidounces of nitric acid, of density 1292, contain only 1354 of real acid. As then, $1992 : 2880 :: 1354 : 1957$, the quantity of lead which by theory ought to be dissolved; whereas, as above stated, it was 1970 by experiment.

I did not "concentrate" the solution as ordered, but set it aside to crystallize without it, and I readily obtained 1620 grains of the crystallized nitrate, which it will be seen by the quantity of lead dissolved is rather more than one-half of the whole quantity formed, for $104 : 166 :: 1970 : 3144$, the nitrate actually produced.

In concluding my remarks on this preparation, I think that I am justified in repeating my opinion, that if these directions for preparing nitrate of lead were given theoretically, the calculation was erroneously made; and this is the most favourable supposition that can be offered in excuse for the egregious mistakes which I have exposed; for it is not credible that the College would have ordered lead to be dissolved by a menstruum which experiment had shown them was insufficient to effect it, or that they would have directed evaporation to produce crystallization, if they had found by experiment it would occur without it.

I had prepared the foregoing remarks, and expressed my intention of continuing them, when I was accidentally informed that the President of the Royal College of Physicians of Edinburgh was engaged in editing a Dispensatory. Under these circumstances, I discontinued my observations, trusting that some difficulties which had occurred to me, but which I had not had time to put to the test of experiment, might receive such explanations in the work alluded to, as would render unnecessary any further interference on my part. Before, however, Dr. Christison's work appeared, another edition of the Edinburgh Pharmacopœia was required and published.

In the Preface to this the College observe, that "few additions have been called for," and, consistently with this statement, I find that Canna, only, has been added to the *Materia Medica*; and to the preparations, *Acidum Aceticum aromaticum*, *Infusum Senegæ*, *Iodinei Liquor compositus*, and *Ferri Iodidi Syrupus*; on the other hand, there have been omitted *Decoctum Senegæ*, *Ferri Iodidi Solutio*, and *Tinctura Veratri*.

"We have," say the College, "rectified several errors, which have occurred to ourselves, or have been pointed out by various critics;" and, on examination, I actually find that in the *Materia Medica* alone, about seventy-five alterations have been made, besides about one-third of this number of corrections of the wrong use or neglect of capital letters, which were pointed out by me.

It is further observed by the College, "we have made some extensive changes, particularly in the formulas for pills and tinctures," and, it is added, that "in general little alteration is made in their composition, and scarcely any in their strength."

I was curious to discover how "extensive changes" could be effected in the mode of preparing medicines without considerably altering their composition or strength. On examination, I find the case to be, with respect

to pills, that whereas, in the first edition, of the twenty-three formulas for pills, the ingredients of twenty were apportioned by *weights*, they are now to be taken by *parts*; with regard to the tinctures, of the fifty-six contained in the work, the ingredients of fifty-four are now apportioned to two pints of the solvent, eighteen only being so before, and two tinctures remain unchanged. These alterations afford ample evidence of the difference between extent and importance.

I admit, however, that no harm has accrued to the pills, and that uniformity with the London College has arisen from the alterations in the preparation of the tinctures.

In the methods of preparing some medicines, greater and more important alterations than those just noticed have been effected, and these, except in two cases, are in a great degree in accordance with my suggestions. Indeed, I shall show in the sequel, that, with few exceptions, where I ceased to detect errors, the College ceased to correct them.

I cannot say that the anticipation which I entertained and expressed, regarding the publication of Dr. Christison's work, as to the removal of difficulties, has been realized by its appearance; for, except in the solitary instance of the formula for Acidum Hydrocyanicum, I am not aware that a single improvement has been effected, which I had not shown to be requisite.

Under these circumstances I renew my observations on the Edinburgh Pharmacopœia, and include with them such as may arise from Dr. Christison's defence of it, or may be suggested by his criticisms on the London Pharmacopœia, or on my translation of that work. I shall pay similar attention to the new edition of Dr. A. T. Thomson's Dispensatory, which also has been published since the appearance of the second edition of the Edinburgh Pharmacopœia.

I shall commence with the *Materia Medica*, the first article of which, requiring notice, is *Acetum Britannicum*; in the first edition it was stated, that its density varied from 1006 to 1012; I showed that it is as high as 1019, and the College have corrected the statement accordingly; Dr. Christison, by a mere misprint, has 10019, instead of 1019. I mentioned also, that British vinegar may legally contain about three times as much sulphuric acid, as would be indicated by the test of the Edinburgh Pharmacopœia, for the extreme admissible quantity. Dr. Christison now asserts, that having examined "twelve different specimens of French and British manufacture, less [nitrate of barytes] is sometimes sufficient; but more is never required."

I have already admitted this to be the case with respect to French vinegar, and it may be so with the Scotch vinegar, provided the manufacturers are more scrupulous than the English; but "the College has excluded these vinegars intentionally." Now, whether four ounces of vinegar contain one grain and three-quarters of sulphuric acid, as permitted by the London College and the excise laws, or half-a-grain, as allowed by the Edinburgh College, is a matter of no consequence whatever, for the latter College do not employ it in any preparation without distilling it; and if they did it would do no harm.

Dr. Christison remarks (p. 12), that the method of the London College

"of ascertaining the absence of an undue proportion of sulphuric acid, in which the operator has to collect and weigh a precipitate amounting to 1.14 grain, is much too tedious and refined for practical use."

Under the head of *Cinchona flava*, p. 16 of the Edinburgh Pharmacopœia, the following are the directions for ascertaining its quality: "A filtered decoction of 100 grains in two fluidounces of distilled water gives, with a fluidounce of concentrated solution of carbonate of soda, a precipitate, which when heated in the fluid becomes a fused mass, weighing when cold 2 grains or more, and easily soluble in solution of oxalic acid." Now, let us compare the *tediousness* of these operations of the two Colleges. In the London process we have, 1st, To prepare a solution of chloride of barium; 2dly, To add it to an ounce of vinegar; 3dly, To collect the precipitated sulphate of barytes; 4thly, To dry it; 5thly, To weigh it. According to the Edinburgh Pharmacopœia, there is, 1st, To boil 100 grains of bark in two ounces of water; 2dly, To filter the decoction; 3dly, To prepare the solution of carbonate of soda; 4thly, To heat it, and the decoction of bark together; 5thly, To separate the fused mass; 6thly, To weigh it; 7thly, To prepare a solution of oxalic acid; 8thly, To ascertain the solubility of the two grains of the fused mass therein.

With respect, then, to tediousness, it is greater in the process of the Edinburgh College than that of the London, in the proportion of eight to five; and the degrees of refinement are, as far as I can discover, not very different. If the bark should be of bad quality, it must be evident that the operator may have to weigh even less than a grain; and if he will employ two ounces of vinegar instead of one, then the precipitate of sulphate of barytes will exceed in weight the fused mass obtained from 100 grains even of good bark.

Under these circumstances I think that the charges brought by Dr. Christison come with a bad grace from him; at the same time I readily admit, that the principle of the Edinburgh College, if correctly carried out, is more easy of application in the testing of vinegar than that of the London College.

Having now concluded my observations on the *Materia Medica* of the Edinburgh Pharmacopœia and on Dr. Christison's remarks, I proceed to notice the similar portion of Dr. Thomson's work, and some of his statements with respect to weights and measures, &c.

In page 83, Dr. Thomson states that "drugs are bought in the gross by *avoirdupois*, or, as it is now termed, *imperial weight*." This alteration of name, I believe, has never taken place, and in the Act of Parliament establishing the Imperial gallon, it is distinctly stated that the Imperial gallon shall contain "ten pounds *avoirdupois* weight of distilled water"—not ten pounds *imperial* weight. We are afterwards told by Dr. T. that a ton contains 100 stone of 14 pounds each instead of 160 stone,—that an ounce *avoirdupois* contains 487.5 grains instead of 437.5,—that a gallon contains 76.800 or $76\frac{8}{10}$ minims instead of 76800, and that 8 fluidrachms contain 450 instead of 480 minims. We have then "a table of the proportions of the wine-gallon used by the London and Edinburgh Colleges." Now these Colleges have adopted the Imperial gallon, and this Dr. Thomson has actually given, though, by mistake, he describes it as the *wine* gallon.

In the *Materia Medica* (p. 176) it is mentioned that the sulphate of potash and sulphate of lead, by which sulphuric acid is rendered impure, are precipitated by the addition of water; this is true only of the sulphate of lead, for sulphate of potash is well known to be very readily soluble in dilute sulphuric acid. Some additional mistakes occur respecting this acid, thus (p. 177) it is stated that "its specific gravity at a temperature of 60 Fahr. is 1.835—1.845, and one fluidounce weighs fourteen drachms;" the fact is, that even when of the greater density mentioned, a fluidounce weighs only 13.45 drachms; it is also observed, that acid of the last described density "consists of 1 anhydrous acid + 9 water." If the statement had been 1 anhydrous acid + 1 water, *equivalents* might have been understood; or of 40 acid + 9 water *parts by weight* might have been supposed to be meant; but Dr. Thomson's statement can lead only to the incorrect conclusion, that strong sulphuric acid consists of 1 part of anhydrous acid + 9 parts of water. Hydrochlorate of ammonia (p. 202) is stated to be composed of 31.5 ammonia and 68.5 acid, "independent of the water of crystallization." It however does not contain any, and Dr. T. afterwards correctly states that it is "an anhydrous salt."

Liquor Ammonia fortior, according to Dr. Thomson (p. 203), is prepared by passing the ammonia arising from the decomposition of a given weight of hydrochlorate of ammonia into an equal weight of water; he also states, and almost correctly, that solution of ammonia of specific gravity 0.880 contains 30.5 per cent. of the alkali. It is evident that Dr. Thomson must have been misinformed on this subject, for 100 parts of the hydrochlorate yield 31.5 of ammonia, and supposing it to be condensed, without any loss by 100 parts of water, the solution would contain rather less than 24 per cent. of the alkali instead of 30.5, and the density of the solution must be about 0.905 instead of 0.880. It is further stated, that a mixture of one fluidounce of solution of ammonia of 0.880, and three fluidounces of water is equal in strength to liquor ammonia of sp. gr. 0.960; but the Doctor soon after states, that a solution of the last-mentioned density is prepared by mixing one fluidounce of solution of 0.880 with two fluidounces of water; the latter statement is the correct one.

Antimonium.—Dr. Thomson, in p. 218, states correctly that sesqui-sulphuret of antimony is composed of 72.8 metal and 27.2 sulphur in 100 parts, "or according to the atomic doctrine, 2 atoms of antimony = 125.2, and 3 atoms of sulphur = 43.3 = eq. 168.5." This latter statement is entirely erroneous, for 2 atoms of antimony = 129.2, and 3 atoms of sulphur = 48.3, give 177.5 as the equivalent of the sesqui-sulphuret instead of 168.5.

In stating the composition of sulphate of barytes (p. 265) an instance occurs of the confusion which Dr. Thomson has created by the indiscriminate use of the words *proportions* and *equivalents*; he states that barytes is composed of barium and oxygen "in equal proportions." He certainly meant that it consists of one equivalent of each of its constituents. He also gives $Ba + H.O$, which means hydrate of barium, as the formula of hydrate of barytes, $Ba O + H.O$. The purity of carbonate of barytes, Dr. Thomson says, "is ascertained by its complete solubility in dilute nitric acid; and by the whole of the baryta being thrown down as a sulphate when sulphate

of magnesia is added to the acid solution." Now the same effect, but with the addition of sulphate of lime, would follow if baryto-calcite were similarly treated, for this consists of about two-thirds carbonate barytes and one-third carbonate of lime. Why sulphate of magnesia is preferred as a precipitant to dilute sulphuric acid or sulphate of soda, I am at a loss to conceive. "Acetate of copper," Dr. Thomson says (p. 403) "consists of 1 eq. of protoxide of copper = $39.6 + 1$ of acid = $51.48 + 9$ of water = 81, making the equivalent = 181.08." It is evident that, after he had written 9 for 1 equivalent, Dr. Thomson mistook it for 9 equivalents, and consequently = 81 water; in the Table of Pharmaceutical equivalents 9 is correctly mentioned as 1 equivalent.

Hydrargyrum.—Referring to a list of the officinal preparations of this metal, which he has introduced, Dr. T. observes (p. 488), "in forming this table, we have been much assisted by the excellent table drawn up by Dr. Duncan, jun. in the Edinburgh New Dispensatory; and we trust our alterations will render it more practically useful." On examining the mode in which Dr. Thomson has executed his task, I cannot congratulate him on having attained his very laudable wish. The following observations will show that the table is in every respect extremely erroneous and incomplete.

In the first place, the Dublin Pharmacopœia is represented as containing Unguentum Hydrargyri nitrico-oxydi, instead of Unguentum Hydrargyri Oxydi nitrici; it is, however, subsequently mentioned. Pilulæ Hydrargyri Chloridi L. should have *compositæ* added. The Hydrargyri Acetas D. is represented as containing suboxide of mercury, a compound the existence of which has not been proved, and is not contained in Dr. Thomson's table of Pharmaceutical Equivalents; and he terms the acetic acid, acetous acid.

Hydrargyri Iodidum L., and Hydrargyri Biniodidum L. E., are classed together under the head of mercury combined with iodine, "by precipitation with earths and alkalies from acid solutions;" this description is totally inaccurate, for neither earths nor alkalies nor acid solutions are at all employed in preparing these iodides in either of the Pharmacopœias mentioned; they are obtained by triturating metallic mercury with iodine.

It is stated that the Hydrargyri Oxydum of the London Pharmacopœia is procured "by lime-water from the solution of the bichloride of mercury," whereas it is obtained from the chloride; it is hardly necessary to state that lime-water precipitates binoxide of mercury from the bichloride. We have then Præcipitatum album E., meaning Hydrargyri Præcipitatum album, obtained "by ammonia from the nitric solution (*suboxidized*)."
The fact is, that no nitric solution is employed in this preparation; it is obtained from solution of the bichloride, and if it contain oxygen at all, it must be in the binoxide and not the suboxide of mercury; indeed, as already remarked, the existence of a suboxide has not been ascertained. Ung. Ammonio-chloridi L. is printed instead of Unguentum Hydrargyri Ammonio-chloridi.

Sulphuretum Hydrargyri nigrum of the Dublin Pharmacopœia is first, and properly, represented as being prepared by trituration; afterwards, Hydrargyri Sulphuretum cum Sulphure is erroneously given as the name

of this preparation in the Dublin Pharmacopœia, whereas it is that of the London, and in both cases it is stated to be *sublimated* instead of prepared by trituration.

I shall now point out certain omissions; those, from the London Pharmacopœia, are *Pilulæ Hydrargyri Iodidi*, *Unguentum Hydrargyri Biniodidi*, *Ceratum Hydrargyri compositum*.

From the Edinburgh Pharmacopœia the omissions are *Cinnabaris*, *Pilulæ Calomelanos compositæ*, *Pilulæ Calomelanos et Opii*, *Unguentum Precipitati albi*. Of the Dublin preparations the annexed are omitted: *Hydrargyri Cyanuretum*, *Hydrargyrum cum Cretâ*, *Hydrargyri Oxydum nitricum*, *Hydrargyri Sulphuretum rubrum*, *Hydrargyri Oxydum rubrum*, *Pilulæ Calomelanos compositæ*.

The table showing the proportion in which Opium and certain Preparations of Iron, &c., are contained in some compound medicines, is replete with inaccuracies.

The *Pulvis Cretæ Opiatus* of the Edinburgh Pharmacopœia contains one grain of opium in 37 grains, and not 40 as stated.

Dr. Thomson has given the proportion of opium contained in the *Syrupus Opii* of the Dublin Pharmacopœia; it contains no such preparation.

Vinum Opii of the London Pharmacopœia is stated to contain one grain of opium in ten minims, while the Edinburgh and Dublin preparations are asserted to contain one grain in seventeen minims. The correct quantities are, London, one grain in 16 minims, Edinburgh, one grain in 13.3 minims, and Dublin, one in 16.6 minims.

Emplastrum Hydrargyri, P. L., is mentioned as containing 15 grains of mercury in one drachm; the correct quantity is 12 grains; of the *Hydrargyrum cum Cretâ*, P. L., 2.67 grains, instead of three grains, contain one grain of mercury; the Dublin *Hydrargyrum cum Cretâ* contains in 5 grains 2 grains of mercury instead of one, as stated. *Pilulæ Hydrargyri Chloridi compositæ* contain one grain of chloride in five grains, instead of four, as mentioned. *Unguentum Hydrargyri mitius* of the Dublin Pharmacopœia is stated to contain half-a-drachm of mercury in two drachms; but, as it is prepared with one part of mercury and two parts of lard, two drachms must contain two-thirds of a drachm, instead of only half, as set down. This error the author has probably borrowed from the Dublin Pharmacopœia.

Dr. Thomson has correctly stated that the *Unguentum Oxidi Hydrargyri*, P. E., which is prepared with eight parts axunge, and one part oxide, contains in each drachm 6 grains $\frac{6}{7}$ ths of oxide. When, however, he mentions the Dublin preparation, which consists of precisely similar quantities of fat and oxide, he says that a drachm contains six grains and a half of oxide instead of two-thirds. It is but proper to state, however, that this error occurs in the Dublin Pharmacopœia.

With respect to crystallized Sulphate of Magnesia, Dr. Thomson remarks, "according to Dr. Henry, the composition of this sulphate is *acid* 38, *magnesia* 18, *water* 44 parts, = 100 of the salt." Dr. Henry thus gives the composition of this salt in the last edition of his work:—

" Magnesia	.. ..	16.	or 1 atom = 20
Sulphuric Acid	.. ..	32.57	or 1 atom = 40
Water	.. ..	51.43	or 7 atoms = 63

100.

123"

It will be observed that this statement differs very considerably from that given in the Dispensatory.

Elaterin.—In p. 551 it is stated, that the formula of this substance is C. 6, H.12, O.5, or 36.9 of carbon, 23.9 hydrogen, 39.2 oxygen = 100.00. As however, 6 equivalents of carbon weigh three times as much as 12 eqs. of hydrogen, this statement of the composition of 100 parts is evidently erroneous; if the formula be right, it should have been 41.4 carbon, 13.5 hydrogen, and 45.1 oxygen. Zwenger's formula, quoted by Liebig, is $C^{20} H^{28} O^5 = 69.170$ carbon, 7.971 hydrogen, 22.859 oxygen in 100.

Citrate of Morphia.—The equivalent of this salt when anhydrous is, according to Dr. Thomson (p. 594), 355.71; the correctness of this number, depends, however, upon which of his conflicting statements respecting the equivalent of citric acid is adopted. In p. 826, he says "it consists of 4 of carbon = 24.48 + 3 of hydrogen = 3 + 5 of oxygen = 40, making the equiv. of the anhydrous acid = 67.48." In the Table of Pharmaceutical Equivalents, the composition is stated to be 4 of carbon = 24.48, 2 of hydrogen = 2, and 4 of oxygen = 32, giving 58.48 as the equivalent. If we subtract 288.23, the equivalent of morphia, from 355.71, the alledged equivalent of the anhydrous citrate, we shall have 67.48, as that of citric acid, agreeing with the former and incorrect statement of the constitution of the acid.

Before I notice various other statements respecting the salts of morphia, I may observe that, on several occasions, Dr. Thomson has employed M alone to represent morphia in some of his formulas, whereas, in others, he has substituted \bar{M} for it; to the use of M simply it is to be objected, that it is not sufficiently descriptive, since other substances commence with this letter, and these are described by the addition of another, as Mg to signify magnesium and Mn for manganese. With respect to \bar{M} it is to be observed, that the horizontal line over a letter is employed to denote an acid, and \bar{M} which is used by Dr. T. to signify morphia an alkali, is employed by chemists to describe malic acid.

Neutral Tartrate of Morphia.—This salt Dr. Thomson finds to contain 3 equivalents of water, and he gives as its formula $(2 M.HO) + \bar{T} + 3 Aq. = 699.94$. I do not understand how a salt containing two equivalents of base can be correctly called a *neutral* salt; and that under consideration must be considered, according to the formula, as a ditartrate. If also we add together 576.46, two eqs. of morphia, 66.48, one equiv. of tartaric acid, and 27, three eqs. of water, we shall have 669.94 as the equiv. of this salt. It is possible that a figure of 6 may have been inverted, and this supposition will explain Dr. Thomson's error; but the water amounts to 4 per cent. instead of 3.5 by the author's experiment, and 3.6 by his calculation.

Sulphate of Morphia is stated by the author to consist of 1 eq. morphia + 1 sulphuric acid + 6 water = 328.33. If we add together the equivalents mentioned, morphia 288.23, sulphuric acid 40.1, and water 54,

we shall have 382.33 as the equivalent of this salt. Having just corrected an error by supposing a figure to be inverted, we may perhaps explain the present one by admitting that, in Dr. Thomson's statement, the figures 2 and 8 have changed places.

Nitrate of Morphia.—We are informed that "ten grains of the nitrate being heated for five hours over a water-bath, lost 0.45 grains [grain] = 4.5 per cent. (*water of crystallization*). By treatment with ammonia, ten grains of the salt yielded 0.82 grains [grain] of precipitate = 8.2 per cent.," and this precipitate it is presumed "is a compound of one equivalent of morphia + two equivalents of water = 302.23."

Dr. Thomson proceeds, "if the composition of the salt be one equivalent of hydrated morphia (one equivalent of morphia + one equivalent of water, the condition in which morphia is supposed always to enter into salts) + one equivalent of nitric acid, and two equivalents of water of crystallization = 374.38, the per centage of the precipitate (one equivalent of morphia + two equivalents of water), which the scale should give, is 82.89, and the two equivalents of water of crystallization are equal to 4.87 per cent.: neither of these sums differ greatly from the quantities found.

	By Experiment.	By Calculation.
Precipitated Morphia . . .	82.00 . . .	82.89
Water of Crystallization. . .	4.50 . . .	4.87."

The first observation which I shall offer respecting the above statements is, that the number of a compound consisting of one equivalent of morphia and two equivalents of water, is 306.23, and not 302.23. Admitting 374.38 to be the equivalent of the nitrate of morphia described (which it is not), the per centage of bihydrate of morphia which it should yield is 81.8 instead of 82.89 as stated; but the correct equivalent of the nitrate described is 369.38 instead of 374.38 as estimated.

The most extraordinary of Dr. Thomson's errors on this subject yet remains to be pointed out; he first states distinctly, that 10 grains of nitrate of morphia yielded 0.82 grain of hydrate of morphia, equal, as he correctly observes, to 8.2 per cent., and yet he afterwards states, in the passage I have quoted, that by experiment it amounted to 82 per cent., or ten times the quantity originally given. The only way of explaining this mistake appears to me to suppose that Dr. Thomson actually obtained 8.2 grains, or 82 per cent. of precipitate, from 10 grains of the salt, instead of 0.82 grain, or 8.2 per cent. as he states.

Phosphate of Morphia.—Dr. Thomson gives the following as the formula of this salt—"two (\bar{M} , HO), HO, $P_2 O_5$, + 10 Aq. = 767.86." This formula is rendered somewhat obscure by using the word *two* instead of the figure 2, and it will be found, on adding together the equivalents which constitute the salt, that its number is 764.86, instead of that above stated, or 1 eq. acid 71.4, 2 eqs. morphia 576.46, 13 eqs. water 117.

Hydriodate of Morphia.—"If we consider," says Dr. Thomson, "the salt to be composed of one equivalent of hydriodic acid, and one equivalent

of morphia, with 4.15 per cent. (two equivalents) of water of crystallization, its formula will be $\bar{M} HI + 2 Aq. = 447.55$." As commonly happens, an error also occurs in this statement; for 1 eq. of morphia = 288.23, 1 eq. of hydriodic acid = 127.30, and 2 eqs. of water = 18, which added together give 433.53 as the equivalent of this salt.

Narceia.—With respect to this substance, also, a similar mistake occurs—C32, H24, N, O16, are stated to be equivalent to 366.99 instead of 361.99.

Narcotina.—Dr. Thomson states that "the components of narcotina are, carbon 68.88, nitrogen 7.21, hydrogen 5.91, oxygen 18.00, in 100 parts; or, according to Liebig, of 65 of carbon + 5.5 of hydrogen + 2.51 of nitrogen + 26.99 of oxygen = 100, or C48 H24 N, O15 eq. = 446.91."

By adding together the numbers by which Dr. Thomson represents these equivalents, it will be found that they amount to 451.91 instead of 446.91; and, on reference to Liebig, it will be seen that his formula is $C^{40} H^{40} N^2 O^{12}$, which, reduced to English equivalents, will be $C^{40} H^{20} N O^{12} = 374.95$, instead of 446.91, Dr. Thomson's inaccurate statement, or 451.91 as above corrected, and 100 parts consist of 65.29 carbon, 5.33 hydrogen, 3.78 nitrogen, and 25.60 oxygen.

Lead.—Under this head the red oxide (p. 643) is stated to be a sesquioxide, though its constitution is correctly given as 3 eqs. of metal + 4 eqs. of oxygen; this erroneous nomenclature is repeated in pp. 648 and 649, although its composition is again correctly given in the latter page. Its composition in 100 parts is also erroneously given as 97 lead + 9.3 oxygen, instead 90.7 and 9.3. The adulteration of carbonate of lead with chalk, Dr. Thomson says (p. 645) "may be discovered by pouring distilled vinegar on the suspected carbonate, and then adding oxalic acid, or oxalate of ammonia, to the solution. The formation of a precipitate proves the presence of chalk." Oxalic acid is, however, no test at all of lime when oxide of lead is also present, for an insoluble oxalate of lead is immediately formed and precipitated. I make this remark on the presumption, that Dr. Thomson will not contend that carbonate of lead is totally insoluble in distilled vinegar; in p. 646, phosphate of lime is accidentally mentioned instead of phosphate of soda.

I proceed now to consider the Preparations of the second edition of the Edinburgh Pharmacopœia, with occasional remarks on the statements of Dr. Christison and Dr. Thomson respecting them.

Acetum Destillatum.—In the first edition, the College directed six parts only of vinegar to be distilled from eight parts. I have shown that by this process only about three-fifths of the vinegar were actually procured. The Edinburgh College have now, in accordance with the London, and with the results of my experiments, directed seven parts of product to be distilled, instead of six, and in addition to the consideration of economy urged by me, Dr. Christison has assigned other valid reasons for the alteration effected.

In giving the Edinburgh formula for *Acetum destillatum*, Dr. Thomson has directed only six instead of seven parts of vinegar to be distilled from eight; he soon afterwards, however, correctly states the quantity to be distilled. Among the "Officinal preparations" of distilled vinegar, Dr. Thomson has included the *Potassæ Acetas*, *Liquor Plumbi diacetatis* and *Oxymel* of the London Pharmacopœia; the *Potassæ Acetas* and *Plumbi Acetas* of the Edinburgh, and the *Ferri Acetas* of the Dublin College; the fact is, however, that it does not enter into the composition of any one of these preparations; and I may further remark that the *Acetum Opii* of the Edinburgh and Dublin Pharmacopœias is erroneously termed *Acetas Opii* by Dr. Thomson.

Acidum aceticum.—In page 8 I have given the formula of the first edition of the Edinburgh Pharmacopœia; it is now slightly altered, and is as follows:

"**ACIDUM ACETICUM**.—Take of Acetate of lead any convenient quantity: heat it gradually in a porcelain basin by means of a bath of oil or fusible metal, (8 tin, 4 lead, 3 bismuth) to 320° F.; and stir till the fused mass concretes again: pulverize this when cold, and heat the powder again to 320° , with frequent stirring, till the particles cease to accrete. Add six ounces of the powder to nine fluidrachms and a half of Pure sulphuric acid contained in a glass-mat-rass: attach a proper tube and refrigerator; and distil from a fusible-metal-bath with a heat of 320° to complete dryness. Agitate the distilled liquid with a few grains of red oxide of lead to remove a little sulphurous acid, allow the vessel to rest a few minutes, pour off the clear liquor, and redistil it. The density is commonly from 1063 to 1065, but must not exceed 1068.5."

In page 9, I have made several remarks on the more glaring imperfections of this process, and offered what I believed to be the only possible excuse for its introduction, namely, that it had never been tried. It now appears that this apology is no longer admissible, for, from what Dr. Christison states, the process appears actually to have been attempted, and my wonder is therefore doubled that it should be retained.

After trying to perform the process described, but with very imperfect success, I stated numerous objections to it: *first*, Acetate of lead may be rendered anhydrous by exposure to a heat of 212° , with occasional stirring, instead of requiring, as directed, continual stirring, a temperature of 320° obtained by the inconvenient and expensive method of a fusible metal-bath, or the disagreeable and dangerous one of an oil-bath, *Secondly*, The employment of a thermometer, required when either a metal or oil-bath is used, is extremely troublesome, and it is very difficult, even with constant watching, to keep the fusible metal at the temperature directed, for it is very apt to rise above it; and, at a very few degrees below it, the mixed metals become solid. *Thirdly*, On account of the tenacity of the mixture of the sulphuric acid and acetate of lead, there is great difficulty in effecting a perfect admixture of them. *Fourthly*, The residual sulphate of lead, on account of its insolubility, is with difficulty removed from the matrass. *Fifthly*, Acetate of lead is more costly than acetate of soda, in the proportion of fourteen to ten. *Sixthly*, The last-mentioned salt leaves a residue of sulphate of soda, easily washed out of the matrass. *Seventhly*, In expelling the water from the acetate of lead, the College give the operator the choice of two bad methods of effecting it, while in distilling the acid, they

restrict him to the use of the worse. *Eighthly*, I showed that "a grain or two" of red oxide of lead could remove only $\frac{55}{1000}$ of a grain of sulphurous acid, or from about 1-4000th to 1-2000th of the weight of the product of acetic acid. *Ninthly*, In page 2 of the Pharmacopœia, it is stated that the density of the acid is "not above 1068.5," while at page 44, it is directed that the density should "be not above 1065."

In the second edition the retained process is accompanied with all its principal bad qualities; some of the details are however corrected to a certain extent, not indeed, altogether in agreement with the remarks which I offered, but in avoidance of some of the more tangible errors of the original: for example, for "a grain or two of red oxide of lead," we find now "a few grains;" and at page 2, the acetic acid is directed to have "a density not above 1068.5," as on the former occasion; whereas, at page 48, it is stated that "the density is commonly from 1063 to 1065, but must not exceed 1068.5."

Dr. Christison (p. 7) after stating the composition, and giving the symbols of acetic acid, observes, that the "hydrated acid ($\bar{A} + \text{Aq.}$) contains of course an additional equivalent of hydrogen and oxygen. The density of this when accurately prepared is 1063; but it often reaches 1065, owing to the presence of a little additional water. When of the former density one hundred minims (97 grains) neutralize nearly 242 grains of crystallized carbonate of soda." It follows, therefore, that 100 grains of this acid neutralize 249 grains of carbonate of soda = 89 grains of real acid, adopting the same equivalents for acetic acid and the carbonate as Dr. Christison does. This acid consequently consists of 11 water and 89 real acid, which are nearly in the proportion of 9, one equivalent of water + 73 of real acid, instead of $9 + 51.48$ the strongest known, and mentioned by Dr. Christison as such; the error consequently amounts to above twenty-one parts of real acid.

Nor is this all: in the above quotation we are informed, that acetic acid, when accurately prepared, has a density of 1063; "but it often reaches 1065"; now nothing is here said of acid of sp. gr. 1068.5, which, according to the Pharmacopœia, the product may not improperly possess. Let us, then, compare the strengths of the acids of the various densities which the College must suppose to be nearly similar, with the statement of that of 1063, according to Dr. Christison, and of the stronger of 1068.5, according to the table which he has quoted: the first, I have just shown, must contain eighty-nine per cent., while, for the second, the table gives eighty-two. This difference, amounting to seven per cent., surely cannot be owing, as described by Dr. Christison, "to the presence of a *little* additional water."

This mis-statement of the saturating power of acid of 1063, is repeated so distinctly, that there is no occasion merely to infer it. Dr. Christison says, "between 1063 and 1077.7 the same density may indicate an acid of two very different degrees of strength, the weaker of which is in fact, at 1063, less than half as strong as the stronger; while that of 1077.7 is intermediate,—the neutralizing power of 100 grains of these three acids being about 118, 186, and 250, as determined by the carbonate of soda." Adopting, as before, the same equivalent numbers as Dr. Christison, the

acid saturating 250 must contain 89.73 per cent. of real acid, and consequently consist of one equivalent of acid and about two-thirds of an equivalent of water—a compound which I need hardly say, has never been formed.

Dr. Christison characterizes the tests of the London College for ascertaining the purity of acetic acid, as “unnecessarily minute.” He does not seem to be aware that nitric and hydrochloric acid are occasionally used to adulterate this acid, but I have found both of them. Indeed, he says, that muriatic acid “does not occur as an adulteration.”

There are many observations of Dr. Christison respecting acetic acid, which require correction: for example, he states, with respect to what he, in defiance of all modern and just chemical views, calls pyroligneous acid, that “it varies much in density, and therefore in strength,” it ought of course to follow, that agreement in density should indicate similarity in strength; but it will appear from the table which Dr. Christison has inserted, that acid of 1068 may contain either 97 or 37 per cent. of hydrated acetic acid.

Dr. Christison observes (p. 5), that “the London College does not admit the pure acetic acid; while, with a disregard of correct nomenclature, which suits ill with its professions of accuracy in this respect, the name has been given to a weak acid about the density of 1050, containing not much above a third of its weight of the pure acid of the Edinburgh Pharmacopœia.” Whatever may have been the *professions* of accuracy of the London College, it appears to me that they have at least endeavoured, as fully as the subject will admit of, to employ a consistent nomenclature; at any rate they have not adopted the avowed “patchwork” of the Edinburgh College.

Some critics are extremely difficult to please:—because acetic acid contains more water than is absolutely requisite, we may infer that, according to Dr. Christison, it should have been called *impure* acetic acid; on the other hand, when potash containing only the proper quantity of water is called *hydrate* of potash by the London College, then it is “the newest and most refined” name for that substance, although it has been so called for more than a quarter of a century.

Having extended my observations on this subject to a great length, I shall close them with briefly noticing Dr. Christison’s opinions with respect to rendering acetate of lead and acetate of soda anhydrous, and on one other part of the subject, regarding the different nomenclature adopted by the Colleges of London and Edinburgh.

Of acetate of lead, Dr. Christison says, that “the chief difficulty lies in depriving the salt entirely of its water of crystallization. Spontaneous evaporation is too tedious a method of attaining this end; and the process is not sufficiently accelerated either in a confined space of air kept dry with sulphuric acid, or even by substituting a vapour-bath heat. But in a vacuum, with sulphuric acid to absorb the moisture, the crystallized acetate parts with the whole of its water in thirty-six hours; and this method is obviously applicable on the large scale.”

Acetate of lead is rendered perfectly anhydrous by exposure to the heat of steam. Dr. Christison, indeed, informs us that acetate of soda “is not

so easily reducible as the acetate of lead to the anhydrous state without escape of acid or charring of the residual salt." Again I repeat, what I before asserted, that this salt may be rendered anhydrous, and without either the loss of acid or charring, by exposure to a temperature of 212° . I venture also to state, that the method by sulphuric acid is obviously *inapplicable* on the large scale; and that what is described as "the more convenient method" of using a bath of oil or fusible metal is as inconvenient as possible.

It is, indeed, true that an equivalent of acetate of soda, as it contains more water than an equivalent of acetate of lead, requires longer exposure to heat to render it anhydrous; I found, for example, that 2740 grains of the soda salt, representing twenty equivalents, became anhydrous by exposure to 212° during seventeen hours, while 3800 grains of the salt of lead, also representing twenty equivalents, required only twelve hours to produce the same effect.

Dr. Christison (Dispensatory, p. 6), referring to the method of the London College for obtaining acetic acid, says "the process for the weaker London acetic acid will be noticed under the head of pyroligneous acid, of which it is really a variety. The salt used in that process, the acetate of soda, is preferable to all other acetates in point of cheapness."

I am quite at a loss to conjecture what is meant by terming the acetic acid of the London Pharmacopœia a "variety" of pyroligneous acid; indeed in p. 9 it is stated to be "nothing else than pyroligneous acid," because "it is produced from the acetate of soda, which is prepared from wood by destructive distillation." If this be the case, what then is the "pure acetic acid of the Edinburgh Pharmacopœia," which is produced from the acetate of lead, prepared by express direction from "pyroligneous acid," obtained from wood by destructive distillation? (*Edin. Pharm.* p. 111.)

With respect to the formula for Acidum Aceticum, Dr. Thomson seems to have consulted the first, instead of the second edition of the Edinburgh Pharmacopœia; for he mentions the employment of "a grain or two of red oxide of lead," instead of a few grains; and, also, that "the density should not be above 1065," instead of "the density is commonly from 1063 to 1065, but must not exceed 1068.5."

Acidum Citricum is the preparation which I shall next notice. I have shown, p. 3, that the Edinburgh College, in the first edition, forgot that their diluted sulphuric acid was weaker than that of the London College, and ordered half a fluidounce less for the decomposition of the citrate of lime, instead of directing, as they should have done, nearly eight fluidounces more. This mistake is now corrected.

Among the tests for ascertaining the purity of citric acid, both Colleges state, that it should be almost entirely dissipated by exposure to the action of heat; and the direction of the Edinburgh College, to incinerate with the addition of a little red oxide of mercury, will probably accelerate the operation, and if so, it is an improvement.

In his remarks on the mode of preparing citric acid, Dr. Christison mentions, that ten parts of chalk are decomposable by nine parts of con-

centrated sulphuric acid. Now, admitting the acid to be of the greatest possible strength, 9.8 parts will be required; and if of the density of 1840 only, as stated in the *Materia Medica*, 10.2 parts of it will be necessary.

With respect to the quantity of citric acid yielded by a given quantity of lemon-juice, Dr. Christison appears to me to have fallen into a great mistake; he says, that "one hundred and sixty pounds of good lemon-juice, yield ten ounces only of pure acid." It is putting the most favourable construction on this assertion to suppose, that the weights mentioned, both with respect to the raw material and the product, are troy weight. Now, taking the specific gravity of lemon-juice, as I have found it, at 1044, 160 troy pounds measure about 100 pints, requiring 112 ounces of chalk for their saturation, and the same weight of sulphuric acid for decomposing the citrate of lime formed: but 112 of chalk are equivalent to 156 of crystallized citric acid, and making a liberal allowance for malic acid, and for loss in the operation, 146 out of 156 ounces is much too large a proportion to be lost; I cannot, therefore, help suspecting, that *ounces* have been accidentally inserted instead of *pounds*, for the sulphuric acid and chalk, low-priced articles as they are, would cost about as much as the citric acid produced would sell for in the market, if ten ounces were the whole quantity obtained.

Dr. Thomson has made the following statements respecting Citric Acid: "Its components, according to Berzelius, are 41.369 carbon, 3.800 hydrogen, and 54.831 of oxygen; according to Dr. Prout, they are 34.28 carbon, 4.76 of hydrogen, and 60.96 of oxygen. In its crystallized state the crystals contain of citric acid 76.32 + water 23.68, = 100 parts; in equivalents it consists of 4 of carbon = 24.48 + 3 of hydrogen = 3 + 5 of oxygen = 40, making the equiv. of the anhydrous acid = 67.48: but the crystallized acid containing $1\frac{1}{2}$ eq. of water = 12.5 its equivalent is, therefore 79.98."

The analysis of Berzelius is of the anhydrous acid, and indicates 4 eqs. carbon, 2 eqs. hydrogen, and 4 eqs. oxygen; whereas Dr. Prout analyzed the crystals, and he states that they consist of carbon 34.38, oxygen 22.37, water 42.85 in 100; in this analysis, however, all the hydrogen with its equivalent of oxygen are estimated as water. It is correctly stated by Dr. Thomson, that my Translation of the *Pharmacopœia* gives 23.68 per cent. of water, if the edition of 1831 be referred to; but, during the last fourteen years, other editions have appeared, in all of which the amount of water is stated to be only 17.16 per cent.

The crystallized acid does not contain $1\frac{1}{2}$ equivalent of water, but $1\frac{1}{3}$, and if it were the former quantity it would amount to $13\frac{1}{3}$, instead of only $12\frac{1}{3}$, as stated; and further, the equivalent of the crystallized acid is stated to be 79.98 instead of 70.

I have just shown that Dr. Thomson mentions 4 eqs. carbon, 3 eqs. hydrogen, and 5 eqs. oxygen = 67.48 as the number for anhydrous citric acid, yet it appears, on referring to his Table of Pharmaceutical Equivalents, that it is composed of 4 eqs. carbon, 2 eqs. hydrogen, and 4 eqs. oxygen, = 58.48, being less by an equivalent each of oxygen and hydrogen than stated in the text; nor is this all:—the crystals are stated in the table to contain 2 eqs. of water instead of $1\frac{1}{2}$ as in the text, and of $1\frac{1}{3}$ as correct;

so that by losing an equivalent of oxygen and hydrogen = 9, and gaining half an equivalent of water = 4.5, the equivalent is reduced from 79.98 to 76.48.

It may be observed that Dr. Thomson has not attended to the statements made by Liebig as to the composition of this acid; nor shall I further notice them than merely remark that, according to his views, the saturating power of this acid, when in crystals, will also be represented by 70.

Acidum Hydrocyanicum.—In a passage already quoted, Dr. Christison observes, that the London College, “with a disregard of correct nomenclature,” have given the name of Acidum Aceticum “to a weak acid, about the density of 1050, containing not much above a third of its weight of the pure acid of the Edinburgh Pharmacopœia.”

If the appellation of acidum aceticum is improperly bestowed on a preparation containing 30 per cent. of acid, where is the propriety of giving the name of Acidum Hydrocyanicum to a solution containing only 3.3 per cent. of that acid? This is the case in the Edinburgh preparation.

The Edinburgh College have adopted the London process for obtaining hydrocyanic acid by decomposing ferrocyanide of potassium with diluted sulphuric acid, with the difference, however, that they have quite needlessly increased the proportion of sulphuric acid. In the first edition, indeed, the relative quantities were 4830 parts of sulphuric acid and 1440 of the ferrocyanide, a quantity of acid sufficient for about 7000 parts, or nearly five times too large; having, however, subsequently learned, what was previously well known to others, that the excess of sulphuric acid “must not be large, otherwise farther decompositions are effected, and, among other products, formic acid is apt to be produced” (Dispensatory, p. 23), the College have reduced the sulphuric acid to 1610 parts, which is still so large that there is yet great risk of the production of formic acid.

“The proportion of sulphuric acid recommended by the Colleges of London and Edinburgh,” Dr. Christison remarks, “is a trifle more than what is sufficient to produce bisulphate of potash in the residuum.” It would be natural to conclude, from this statement, that the Colleges employ nearly similar proportions of sulphuric acid, which, however, is very far from being the case—the London College using an ounce and a half of acid to two ounces of the ferrocyanide; and the Edinburgh, two fluidounces of acid to three ounces of the salt; the quantities of acid for equal quantities of ferrocyanide being to each other about as 108 to 160.

Mr. Everitt has shown, that six equivalents, or 294 parts of sulphuric acid are required to decompose 2 equivalents, or 426 parts, of ferrocyanide of potassium, and, among other substances, there are produced 3 equivalents of bisulphate of potash; the proportions used by the London College are 319 of acid to 426 of ferrocyanide, which certainly are but little more than requisite to produce 3 equivalents of bisulphate; but the proportions of the Edinburgh College are, 476 of sulphuric acid to 426 of ferrocyanide, or sufficient to produce somewhat less than 5 equivalents of bisulphate of potash, instead of only a *trifle more* than three.

After giving Mr. Everitt's view of the nature and results of the decomposition of ferrocyanide of potassium by sulphuric acid, Dr. Christison

states, that "the proportions in the Edinburgh formula ought to yield according to Mr. Everitt's theory 245 grains of pure hydrocyanic acid, or about 16.8 fluidounces of medicinal acid containing a thirtieth of pure acid."

To enable the reader to estimate the quantity of hydrocyanic acid obtainable from ferrocyanide of potassium, we may as well point out its composition, which is

Three equivalents of	Cyanogen..	..	..	78
One	„	Iron..	..	28
Two	„	Potassium	..	80
Three	„	Water	..	27

213

According to Mr. Everitt's statement, admitted both by Dr. Christison and myself to be accurate, one-half of the cyanogen is convertible into hydrocyanic acid, consequently one equivalent of the salt=213, will yield one and a half equivalent of the acid; it follows, therefore, that three ounces, or 1440 grains, the quantity directed in the Edinburgh formula, should afford, theoretically, 274 grains instead of 245, as inferred by Dr. Christison; and when "diluted with about 30 parts of water," should produce more than 19 fluidounces of medicinal acid, instead of 16 only, which Dr. Christison says he has repeatedly obtained, and found to possess the required strength.

I am ready to admit that, although the *theory* of the production of only 16 fluidounces is erroneous, the *fact* of their production may be correctly stated, for, as already mentioned, the excess of sulphuric acid employed may have produced formic acid.

I may as well take this opportunity of pointing out a mistake into which Dr. Christison has fallen, in stating the composition of ferrocyanide of potassium. (Dispensatory, p. 749). He says, "the most generally received doctrine regards it as a compound of two equivalents of cyanide of potassium, and one equivalent of cyanide of iron, with three equivalents of water of crystallization ($2 K Cy + Fe Cy + 3 Aq$), and consequently of 39.15 parts of potassium, 79.17 cyanogen, 28 iron, and 27 water." It is evident 39.15 represent only one equivalent of potassium instead of two equivalents, or 78.30.

With respect to the theory of the production of hydrocyanic acid from bicyanide of mercury, Dr. Christison observes, that when this salt is acted upon by dilute hydrochloric acid, "water is decomposed and oxide of mercury formed, which unites with the muriatic acid to constitute hydrochlorate of peroxide of mercury; while hydrocyanic acid, formed by the disengaged cyanogen and hydrogen of the water, distils over along with watery vapour." In page 516, the terms corrosive sublimate, bichloride of mercury, oxymuriate of mercury, and corrosive muriate of mercury are given as synonymous; but no such name as hydrochlorate of peroxide of mercury is mentioned. Indeed, the correct explanation which Dr. Christison gives of the production of this compound by the action of mercury, common salt, oxide of manganese, and sulphuric acid on each other, excludes both hydrogen and oxygen from its composition, and consequently

proves that it contains neither hydrochloric acid nor peroxide of mercury : he says, "in this process two equivalents of chlorine are disengaged by the action of the sulphuric acid on the salt and oxide of manganese ; and the chlorine in its nascent state coming in contact with the mercury, it unites with one equivalent of the metal, so that bichloride of mercury [not *hydrochlorate of peroxide of mercury*] is at once formed." The true explanation of the production of hydrocyanic acid by the action of hydrochloric acid on bichloride of mercury, and that consistent with the fact of corrosive sublimate being bichloride of mercury is this : when hydrochloric acid and bichloride of mercury are heated together, both are decomposed, the hydrogen of the acid unites with the cyanogen of the mercurial salt to form hydrocyanic acid, while the chlorine and mercury combine and yield bichloride of the metal.

In concluding my remarks on hydrocyanic acid, it is but doing justice to the Edinburgh College to state, that the formula of the first edition of the Pharmacopœia, was not altered in the second, in consequence of any remark of mine. The wonder is, *not* that an alteration should have been made in the formula, but that the error requiring it should have been committed.

Acidum Muriaticum.—This acid is introduced under three forms :—
 "ACIDUM MURIATICUM.—*Hydrochloric acid of commerce.*" "ACIDUM MURIATICUM PURUM.—*Hydrochloric acid ;*" and "ACIDUM MURIATICUM DILUTUM."

The College having adopted the name of Acidum Hydrocyanicum, it would have been more in keeping to have called Acidum Muriaticum, Acidum Hydrochloricum Purum, and to have explained Acidum Hydrochloricum to be Muriatic Acid of commerce, for the term Hydrochloric Acid is not employed in commerce. In the first edition, bromine was stated to be one of the impurities of the commercial acid ; this is now omitted, but sulphurous acid, one of its most common admixtures, is not named as such. Both these subjects were alluded to by me in my remarks on the first edition. The density of commercial muriatic acid is stated to be at least 1180 ; I have never found it nearly so strong, and I repeat, that any muriatic acid of this specific gravity must probably contain a very large admixture of sulphuric acid. After all, as economy must be the only motive for using muriatic acid, containing sulphuric acid, sulphurous acid, chlorine and oxide of iron, what can be the amount of saving when the pure acid may be bought for sixpence per pound ?

Acidum Muriaticum Purum.—The directions for preparing this are as follow : "Purify Muriate of soda by dissolving it in boiling water, concentrating the solution, skimming off the crystals as they form on the surface, draining them from the adhering solution as much as possible, and subsequently washing them with cold water slightly. Take of this salt, previously well dried, of Pure sulphuric acid, and of water, equal weights. Put the salt into a glass retort, and add the acid previously diluted with a third part of the water and allowed to cool. Fit on a receiver containing the rest of the water. Distil with a gentle heat by means of a sand-bath

or naked gas-flame so long as any liquid passes over, preserving the receiver constantly cool by snow or a stream of cold water."

Until Dr. Christison's Dispensatory appeared, I was not aware of the reason for which purified common salt is directed to be used in the above formula; in this work we find it stated, that "all the colleges have a formula for preparing pure muriatic acid; but that of the Edinburgh is the only one which will yield it of perfect purity. Muriate of soda as met with in commerce almost always contains more or less nitrate of soda, and sometimes a considerable proportion." "Another neglect on the part of the London and Dublin Colleges, if their object be to obtain a pure product is, that they do not direct the sulphuric acid to be freed of [from] nitrous acid."

I know not on whose authority this statement of the usual existence of nitrate of soda in common salt is made. I have consulted nearly thirty authors, and not one of them mentions it. Nor, as far as I have been able to discover, does any analyst state that nitrate of soda, or any nitrate at all, exists either in rock salt, salt springs, or sea-water; and yet it is from one of these sources that common salt as met with in commerce is procured. Thus, in the *Phil. Trans.* for 1810, Dr. Henry published the analyses of eleven varieties of British and foreign salt: in the 2d Vol. of the *Geological Transactions*, Mr. Horner has given analyses of the salt-springs of Droitwich; Dr. Murray analysed the water of the Firth of Forth, and Dr. Schweitzer that of Brighton, and yet no one of these analysts has mentioned the existence of any nitrate. Dr. Marcet, indeed, expressly says, that sea-water does not contain any nitrate, and he examined fourteen different specimens.

I think it possible, however, that the refuse salt, which remains after the purification of nitre, may have been examined and found to contain a small portion of a nitrate, and thus have given rise to the idea, which is certainly an erroneous one, that nitrate of soda is usually to be found in common salt.

With respect to the purification of sulphuric acid, on account of the nitrous acid which it is supposed usually to contain, I must say, that I never met with it but once; but even supposing it to be a more common admixture than I believe it to be, I am apprehensive that the mode of purification recommended by the College would be apt to introduce more sulphurous acid than it would remove of nitrous.

In concluding I may observe, that I have found no difficulty whatever in obtaining, and I have now by me, hydrochloric acid as colourless as water, by using commercial acid and salt, without any purification being requisite or attempted.

Most particular as the Edinburgh College have been in giving directions for the preparation of pure muriatic acid, it appears as if it might have been as well omitted, and the cheaper commercial acid, impure as it is allowed to be, entirely substituted for it. Dr. Christison, indeed admits that it is sufficiently pure "for all medicinal and most pharmaceutic purposes;" and, consistently with this declaration, I find that it is employed in six of the seven formulas in which this acid is used. Barytæ murias is the only preparation in which pure acid is directed, and it is that in which it is of least consequence to be so.

In giving the directions of the London Pharmacopœia for preparing this acid, *ounces* have been twice substituted for *fluidounces* by Dr. Thomson, and the words, "and when the mixture is cold," have been added by him; but, with respect to the Edinburgh formula, the deviations from the original are so striking and extraordinary, that I shall present the reader with the original and intended copy in opposite columns.

EDINBURGH PHARMACOPŒIA.

Acidum Muriaticum Purum.

"Purify muriate of soda by dissolving it in boiling water, concentrating the solution, skimming off the crystals as they form on the surface, draining from them the *adhering* solution *as much as possible*, and *subsequently* washing them with cold water slightly. Take of this salt, *previously* well dried, of Pure sulphuric acid, and of water, equal weights. Put the salt into a glass retort, and add the acid previously diluted with a third part of the water *and allowed to cool*. Fit on a receiver *containing* the rest of the water. Distil with a gentle heat *by means of* a sand-bath *or naked gas-flame* so long as any liquid passes over, preserving the receiver *constantly* cool by snow or a stream of cold water."

DR. THOMSON'S DISPENSATORY.

Acidum Muriaticum Purum.

"Purify muriate of soda, by dissolving it in boiling water, concentrating the solution, skimming off the crystals as they form on the surface, draining from them the *cohering* solution, * * * * * and * * * * * washing the crystals slightly with cold water. Take of this salt, * * * * * well dried, of pure sulphuric acid, and of water, equal weights. Put the salt into a glass retort, and add the acid, previously diluted with a third part of the water. * * * * * Fit on a receiver *which contains* the rest of the water. Distil with a gentle heat, *or a naked coal-fire flame*, from a sand-bath, as long as any liquid passes over, preserving the receiver * * * * * cool by snow or a stream of cold water, *and allowed to cool*."

"The specific gravity of this acid is, to that of distilled water, as 1.170 to 1.000."

The statement of the specific gravity of the muriatic acid constituted part of the formula of the Pharmacopœia of 1817, but it does not exist in the present. How the other mistakes, to which I have directed attention, either by Italics or asterisks, could have occurred, almost sets conjecture at defiance.

In page 828 Dr. Thomson remarks, with respect to muriatic acid, that "the directions of the London and Edinburgh Colleges, to put part of the water into the receiver, is [are] preferable to mixing the whole with the acid, and pouring it on the chloride." From this statement it might be supposed that the practice of the Dublin College differs from that of the others; the fact is, however, that in the same page, and about 20 lines previously, Dr. Thomson gives the Dublin formula, in which the directions are, "put the remainder of the water in the receiver, that it may absorb the elastic gas as it comes over."

It is further observed, p. 829, "that the residue of the process is sulphate of soda with an excess of acid, or a bisulphate." By which of the three processes bisulphate is produced, Dr. Thomson does not mention; I shall, therefore, consider that most favourable to his statement: this is

the Edinburgh, in which equal weights of acid and salt are used ; and as 60 of the salt require 49 of sulphuric acid to convert it into 72 of sulphate of soda, there will be 11 of acid to convert this quantity into bisulphate, or only 11 instead of the 49 required ; consequently, the residual salt must consist of a mixture of about 56 of neutral sulphate, and only 25 of bisulphate of soda, instead of being entirely bisulphate.

With respect to the " Official Preparations " of hydrochloric acid in the London Pharmacopœia, Dr. Thomson has named five preparations, and omitted six.

Acidum Muriaticum dilutum.—The London and Edinburgh Colleges agree in directing four fluidounces of the strong acid to be diluted with twelve fluidounces of water, which, according to Dr. Christison, are in the proportion of one volume of acid to four volumes of water, instead of one to three. Dr. Thomson represents the Dublin dilute acid to be similar, whereas it consists of 10 measures of strong acid and 11 measures of water ; he has not however given the formula. In p. 832, we have soda for sodium, in p. 838 C. for cyanogen, instead of Cy, and Majendie for Magendie.

Acidum Nitricum.—Of this, as of the muriatic acid, there are three preparations in the Pharmacopœia, "ACIDUM NITRICUM. Nitric acid of commerce." "ACIDUM NITRICUM PURUM. Pure nitric acid." "ACIDUM NITRICUM DILUTUM." With respect to commercial nitric acid, the College, in the first edition, directed it to be of "density at least 1380: colourless, or nearly so: if diluted with distilled water, it precipitates but slightly, or not at all, with solution of nitrate of baryta, or of nitrate of silver." In the second edition, we find "density 1380 to 1390," this alteration is of but little importance, for the difference in strength of acid of these densities amounts to only about 1.5 per cent. of real acid.

Acidum Nitricum Purum.—I have already remarked (page 11) that the formula of the London College is adopted ; this consists in submitting to distillation equal weights of sulphuric acid and nitrate of potash. Dr. Christison observes, that "in order to obtain a pure acid by this process the Edinburgh Pharmacopœia has annexed a condition which the two other Colleges have neglected, but which it is commonly essential to attend to. The nitre of commerce, usually found in the shops, is contaminated with a muriate, probably of potash ; which will cause an impregnation of muriatic acid in nitric acid prepared from it. To prevent this the Edinburgh College directs repeated crystallization, till a solution of the salt no longer indicates the presence of muriatic acid when tested with nitrate of silver." Now, as regards the London College, this statement is incorrect, for under the head of *Notes* it will be seen to be directed, that from a solution of nitrate of potash, neither chloride of barium nor nitrate of silver precipitates any thing.

Acidum Nitricum.—Dr. Thomson has stated the sp. gr. of the Dublin preparation to be 1.400 instead of 1.490 ; and further, that the London and Dublin Colleges direct an acid of sp. gr. 1.502 to 1.504 ; these asser-

tions are both erroneous; the only acid in the London Pharmacopœia is of sp. gr. 1.5, and in the Dublin of 1.490, which latter, as we have just noticed, Dr. Thomson gives as 1.400.

Forty-five years since, Davy published, in his *Researches on Nitrous Oxide*, tables of the composition of nitric acid of different densities; these Dr. Thomson has quoted (p. 843) as if more correct analyses had not long since been performed. To notice only one error in Davy's table—it is stated by him that nitric acid of density 1.5 contains only 8.10 per cent. of water, the real quantity being 20 per cent. In page 845 of Dr. Thomson's work, we find that "the strongest fluid acid, according to Mr. Phillips, contains more than 20 per cent. of water, and 80 of dry acid, or 1 equiv. of dry acid = $54.15 + 2$ of water = 18, making the equivalent 72.15." More errors;—my statement is, that it contains only 20 per cent. or $1\frac{1}{2}$ equiv. of water, instead of 2 equiv., making its equiv. 67.5 instead of 72.15.

Acidum Nitricum Dilutum.—In the first edition of the P. E., the directions were as follows:—"Mix together three fluidounces of Nitric acid (commercial) and four fluidounces of Water. If Pure nitric acid be used, four fluidounces of it must be mixed with six fluidounces of water. The density of this preparation is 1290."

I have shewn that it is by the latter process only, that dilute nitric acid of the required density is obtained: I found its specific gravity to be 1292 instead of 1290, and that it contained about forty per cent. of real acid, while, when the commercial acid was diluted with the quantity of water ordered, its density was scarcely 1190, instead of 1290, and it contained only 26.4 instead of 40 per cent. of real acid, and consequently the difference between the strengths of these preparations, which ought to be of similar power, was as 66 to 100.

The Edinburgh College, in the second edition, have adopted dilute nitric acid of the same density as that of the London College, but prepared according to two formulas, one of which is similar to that of the London College, viz. by mixing a fluidounce of nitric acid of 1.5 with nine fluidounces of water. This mixture is stated to be of density 1077, I have found it to be 1080, the difference is trifling. In the other formula, one fluidounce, five fluidrachms and a half of commercial acid, are mixed with nine fluidounces of water. I have not prepared this mixture, but, from calculation, I find it to be very nearly similar in strength to that obtained with the strong acid. It would, I think, have been better if Dr. Christison had apprized his readers, that the present dilute acid is in strength, to that of the Pharmacopœia of 1817, only about as eleven to forty.

Referring to diluted Nitric Acid, Dr. Thomson observes, that "when prepared according to the directions of the London and Edinburgh Colleges, f $\overline{3}$ j. contains about grs. 72 of nitric acid, of 1.080 specific gravity; and 100 grains, containing 14.3 grains of concentrated acid, will saturate 31 grains of crystallized carbonate of soda; while the same measure of the same acid prepared after the Dublin formula contains grs. 39.05 of the same acid; a difference which may lead to errors in practice, and is therefore to be regretted."

Let me first observe that 1.080 is the sp. gr. of the diluted acid itself,

and it is therefore self-evident that there must be an error with respect to that of the nitric acid which it contains, and from which it is prepared by dilution, and the fact is, that Dr. Thomson has mistaken the density of the diluted acid for that of the concentrated acid employed in its preparation; a fluidounce of the diluted acid contains 67.5 grains of nitric acid of 1.5, instead of 72 grains of 1.080.

As a fluidounce is the only measure which has been mentioned with reference to this subject, I presume it is to be understood, though not perfectly clear, that "the same measure," or a fluidounce of the Dublin dilute acid, contains 39.05 grains of the concentrated acid. Let us examine how this matter stands: the diluted acid of this Pharmacopœia gives such a proportion of nitric acid of 1490 as is equal to 50 per cent. of the acid of 1.5; therefore a fluidounce, which I find by calculation must weigh about 560 grains, will contain 280 grains of acid of 1.5 instead of only 39.05. It is probable, therefore, that Dr. Thomson meant the *same weight*, i. e. 100 grains, instead of the *same measure*, this would give 50 instead of 39.05, a mistake which, after what has been exhibited, is quite within the limits of probability.

Acidum Sulphuricum purum.—The following are the directions of the Edinburgh College for purifying sulphuric acid:—

"If commercial sulphuric acid contain nitrous acid, heat eight fluidounces of it with between ten and fifteen grains of sugar, at a temperature not quite sufficient to boil the acid, till the dark colour at first produced shall have nearly or altogether disappeared. This process removes nitrous acid. Other impurities may be removed by distillation; which on the small scale, is easily managed by boiling the acid with a few platinum chips in a glass retort by means of a sand-bath or gas-flame,—rejecting the first half-ounce."

I have certainly never tried this process, but I must confess that I consider it, even if right in principle, to be liable to considerable uncertainty in practice; for, if 15 grains of sugar should have been employed when 14 grains would have been sufficient, the sulphuric acid must, I think, contain both sulphurous acid and charcoal; for I have found that 1-100dth of a grain of sugar is sufficient to discolour a fluidounce of sulphuric acid, even without the application of heat.

With respect to the preparation of Nordhausen Sulphuric acid, it appears that Dr. Christison is in error when he states that it is "obtained by heating the anhydrous sulphate of iron to redness in a distilling apparatus;" and, from the following statement, also made by Dr. Christison, it is evident that, the sulphate employed must contain water, since it is found in the product, which, he says, "consists essentially, and according to some, of one equivalent of each, of anhydrous acid and the other commercial variety of sulphuric acid, which is in the hydrated condition."

Among the tests proposed by the London College for sulphuric acid we find the following in Dr. Christison's Dispensatory, which I should not have recognized as being such, if it had not been for the prefix of "TESTS. Lond. "Solids not above 2.5 in 1000;" this I presume is intended as a clear explanation of the meaning of "what remains after the acid has been distilled to dryness does not exceed the four-hundredth part of its weight;"—these are the words of the London Pharmacopœia.