A supplement to the London, Edinburgh, and Dublin pharmacopoeias : contining a concise view of the doctrine of definite proportions, and its application to pharmacy. An account of the new French medicines, with observations on the modus operandi of medicinal substances in general, on their physiological effects, and therapeutical employment.

Contributors

Spillan, D. -1854.
Harvey Cushing/John Hay Whitney Medical Library

Publication/Creation

Dublin : Hodges and Smith, 1830.

Persistent URL

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Lewis Heermann
M.D.

1833.

A SUPPLEMENT

TO THE

LONDON, EDINBURGH, AND DUBLIN

PHARMACOPŒIAS,

CONTAINING A CONCISE VIEW

OF THE

DOCTRINE OF DEFINITE PROPORTIONS,

AND ITS APPLICATION TO PHARMACY.

AN ACCOUNT OF

THE NEW FRENCH MEDICINES:

WITH OBSERVATIONS

ON THE MODUS OPERANDI OF MEDICINAL SUBSTANCES IN GENERAL,

ON THEIR PHYSIOLOGICAL EFFECTS, AND THERAPEUTICAL EMPLOYMENT.

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DUBLIN:

PRINTED FOR HODGES AND SMITH,

21, COLLEGE-GREEN.

1830.

Printed by R. Graisberry.

PREFACE.

WHEN this work was first undertaken, the author contemplated merely a Supplement to the Pharmacopœias, intending that it should contain a concise view of the Atomic Theory, and of the Doctrine of Definite Proportions, with the application of that doctrine to pharmaceutical purposes, and an epitome of the last French edition of Majendie's Formulary for the preparation of the New Medicines. Having been engaged however for some time in compiling a system of general Therapeutics, he considered, that by presenting the outlines of that system in the present work, he might perform a service not altogether unacceptable to the Medical Student, at the same time that he himself may be regulated by the judgment which shall be passed

on the condensed view of the system herein given, as to the future publication of the entire work. At the end the student will find rules and directions to assist him in that very important department of medical education, viz. the art of prescribing: with a Table of Incompatibles.

In compiling the work, the first authorities have been consulted, more particularly the valuable and scientific articles on Therapeutics by Mr. Barbier, contained in the Dictionnaire des Sciences Medicales.

AN EXPOSITION,

&c. &c.

In the chemical combination of bodies with each other, the four following circumstances may be remarked with regard to the *proportions* in which these combinations take place.

1st. Some bodies combine in all proportions, as water and alcohol, water and any of the liquid acids.

2d. In other cases a given quantity of one substance can combine with any quantity of another to a certain extent; thus, four pounds of water can dissolve any quantity of the bicarbonate of soda not exceeding a pound; a hundred grains of water will dissolve any quantity of sea salt not exceeding forty grains, at which point its dissolving power ceases, the cohesion of the solid becoming comparatively too powerful for the force of affinity. In this as well as in the first case, it may be remarked that the substances so combining have but a weak affinity for each other, and that the characteristic properties of each constituent are still discernible in the compound; thus when sugar or sea salt is dissolved in water, the taste of the solution is still similar to that of the substance dissolved.

3d. In some cases substances combine in only one proportion; as chlorine and hydrogen, zinc and oxygen.

4th. In other cases substances are observed to combine in several proportions: thus there are two distinct compounds of copper and oxygen; as also of oxygen and hydrogen.—100 parts of manganese combine with 14, 28, 42 or 56 parts of oxygen. The most interesting and important class of compounds are those comprehended under this and the preceding head, and it may also be remarked that the substances so combining have a strong and energetic affinity for each other, and that the properties which characterised them in the simple state are no longer discoverable in the compound; of this we have an example in sea salt, which formed of two very caustic bodies, has a saline and agreeable taste. These combinations so formed have been observed to obey certain laws, remarkable as well for their generality, as for the simplicity of the relations which they establish between the respective quantities of the principles of the compounds. The first of these laws is, that all chemical compounds, so long as they retain their characteristic properties, contain the same constant proportion of constituents with the most rigid accuracy, no variation ever taking place; thus nitrate of potash, under all circumstances, and in all situations, consists invariably of 54 parts of nitric acid and 48 of potash. Water consists of one part by weight of hydrogen and eight of oxygen. Carbonate of lime, whether as found in nature, or formed by art, always contains 43.2 carbonic acid and 56.8 lime; and were these elements to unite in any other proportions,

some new compound different from carbonate of lime would be formed. The truth of this law is universally admitted. In fact, without such a law to determine and preserve those fixed proportions in the constituents of bodies, there could not be that regularity and uniformity in their composition which we invariably find to exist. These cond law is, that, when two bodies combine in different proportions, these proportions are always the product of the multiplication by $1\frac{1}{2}$, 2, 3, 4, &c. of the smallest quantity of one of the bodies, the quantity of the other remaining the same: thus supposing there exist four compounds of oxygen and manganese, and that the least oxygenated of these compounds is formed of 100 parts of manganese and 14 of oxygen; another compound will consist of 100 parts of manganese and 14 × 2 of oxygen; the third compound of 100 parts of manganese, and 14 × 3, &c. There are three compounds of lead and oxygen; the first consists of 104 lead + 8 oxygen; the second of 104 lead + 12 oxygen; the third of 104 lead + 16 oxygen: here the quantity of lead being given, the quantities of oxygen are as the numbers 1, $1\frac{1}{2}$, 2. This law is often called the *law of multiples*. The same may be thus expressed; when any two substances, A and B, unite chemically in two or more proportions, the numbers representing the quantities of B combined with the same quantity of A, are in the ratio of 1, 2, 3, 4, &c.; that is, they are multiples of the smallest quantity of B with which A can unite. With respect to this law we may observe, that when any compound

such as A + B, containing several proportions of A combined with a given quantity of B, is decomposed, if the entire of A is not separated, only a definite proportion of it is removed at a time; nor are we to suppose that the portion of A, so removed, is derived from the entire compound A + B, but only from a part of it. This same *law of multiples* has been proved by M. Gay Lussac to hold good also in gaseous combinations, which he has clearly pointed out to take place in simple ratios of volume, and in such a manner as that their condensation also bears a simple ratio to their original volume; this may be illustrated by the following table:

200	vols.	hydr. gas	unite	with	100	vols.	oxygen	and forms water.
300	do.	-	-	-	100	azote	-	200 ammoniacal gas.
100	do.	-	-	-	100	chlorine		200 hydr. chlor. acid.
100	azote	-	-	-	50	oxygen	-	100 protox. azote.
100	do.	-	-	-	100	do.	-	200 deutox. azote.
100	do.	-	-	-	150	do.	-	- hypo-nitrous acid.
100	do.	-	-	-	200	do.	-	- nitrous acid.
100	do.	-	-	-	250	do.	-	- nitric acid.

Thus if we suppose that two gases unite in different proportions, and that the quantity of the one is constant, the quantities of the other will be such, that the smallest, which may be considered as the first, will be contained a certain integral number of times, whether in volume or weight, in the following: The combinations of azote with oxygen, five in number, may serve as an example, by taking the quantity of azote

as constant: all contain 100 parts of azote, but the first contains 50 of oxygen; the second 100; the third 150; the fourth 200; the fifth 250; so that the quantity of oxygen in the first is half that in the second; one-third of that in thet hird; one-fourth of that in the fourth, &c. whether in volume or in weight. Now as several liquids and solids may be converted into gases, and as this may be done by the application of a sufficiently intense heat, it is quite natural to suppose that these laws of combination are also applicable to bodies of this kind: a fact which several experiments tend to prove: thus, when two bodies, A and B, combine together to form the two bodies C and D, it generally happens that the quantity of A being the same in C and D, that of B in C is to that of B in D as 1 to 2, or to 3, or to 4. It is, however, important to remark, that though there exist relations between the weights of the several proportions of any gaseous body, as oxygen, which may unite with any solid, as manganese, there exists no relation between the weight of the oxygen and that of the metal: thus it cannot be said that 10, 14, 16, &c. grains of oxygen must combine with 100 grains of manganese; the law is restricted to express that 100 grains of metal combining with 14 grains of oxygen, if it be possible to form other combinations between these two bodies, 100 grains of manganese will unite with a quantity of oxygen which will be $1\frac{1}{2}$, 2, 3, 4, 5, or six times as much as the 14 grains. The case is different when instead of establishing a relation between the *weights* of bodies, we

establish it between their *volumes*; for then it is observed, not only that there are simple relations between the different volumes of the body A, which combine with a volume of the body B, but also that there exist relations between the respective volumes of A and B. This we may illustrate by an example. 100 cubic inches of azote unite with 50 of oxygen to form a new body; here the oxygen is one half the azote. 100 azote unite with 100 oxygen to form another body; here we have a ratio not only between the respective volumes of the azote and oxygen, (a ratio of equality,) but also between the proportions of oxygen in the two compounds, the latter containing twice as much oxygen as the other. Again, 100 azote combine with 150 of oxygen (three times as much as the first) to form a third compound. 100 azote combine with 200 of oxygen to form a fourth, and so on. M. Gay Lussac, to whom we owe the discovery of this law, has also demonstrated that when, in consequence of combination, the volume of the gases is condensed, the condensation bears a simple ratio to the volumes of the gases, or rather to the volume of one of them. Thus,

100 vols. oxygen	with	200 vols.	of hydrogen	form 200 vols. water.
100 vols. azote	-	300 vols.	do.	200 ammoniacal gas.
100 vols. do.	-	50 vols.	oxygen	100 protox. azote.
100 vols. do.	-	100 vols.	do.	200 deut. azote.

One or two examples may serve to illustrate the application which may be made of these laws of gaseous combinations.

1st, If we desire to know the specific gravity of a compound gas, suppose ammoniacal gas, we know by analysis that 200 vols. ammoniacal gas result from the combination of 300 vols. of hydrogen and 100 vols. of azote. Then, by adding the specific gravity of azote 0.9722 to three times the specific gravity of hydrogen $0.0694 \times 3 = 0.2082$, and dividing the sum 1.1804 by 2,* we have the specific gravity of the compound gas.

Again, we can determine what are the proportions by weight of the elements which constitute a compound gas; it is sufficient for this to take the weight of the vols. of the simple gases, which enter into the composition of the compound gas: for example, the weight of ammoniacal gas will be equal to 0,9722 (sp. gr. of azote) $+0{,}0694 \times 3 = 0{,}2082$ (3 times the sp. gr. of hydrogen):—if we would reduce these numbers to others more simple, we may institute the following proportion: 9722 : 2082 :: 100 : x . . . $x = \frac{208200}{9722}$; *i. e.* if 9722 of azote combine with 2082 of hydrogen, 100 azote will combine with 21,41 hydrogen.

If we wish to ascertain the composition of a gas formed of a gaseous element and of a solid body, we shall speedily arrive at it, by taking into account the

* The process may be rendered clearer thus: specific gravity of the compound would be equal $0.9722+0.0694\times3=1.1804$ divided by $4=0.2951$, did the component gases suffer no contraction; but as they contract to one half, the real specific gravity is double what it otherwise would be, or 0.5902.

specific gravity of the compound gas, that of the elementary gas entering into its composition, and the condensation which the latter gas has experienced in combining with the solid body. For example, if we wish to know the quantity of hydrogen and of sulphur entering into the composition of 100 grains of hydro-sulphuric acid gas, we can ascertain it thus; we know beforehand, that the volume of hydrogen gas contained in the 100 grains of hydro-sulphuric acid gas is equal to that of this gas; we know also the specific weights of hydrogen gas and of hydro-sulphuric acid gas; we then establish the following proportion, if we desire to find the quantity of hydrogen which it contains:

1,1805 : 0,0694 : : 100 : x = the quantity of hydrogen in the gas; that is, the specific gravity of the compound gas, 1,805, is to the specific gravity of hydrogen, 0,0694 as the absolute weight of said compound gas, scil. 100 grs. is to the absolute weight of the quantity of hydrogen contained in the 100 grains of the hydro-sulphuric acid gas.* Therefore, by mul-

* The principle on which this process depends is, that the bulk of any two bodies being given, their absolute weights are as their specific gravities; in the present instance it was stated, that the bulk or volume of the hydrogen contained in 100 grains of hydro-sulphuric acid gas was equal to the bulk or volume of the 100 grains of hydrosulphuric acid gas itself; therefore, as the specific gravity of hydrosulphuric acid gas 1,1805, is to the specific gravity of hydrogen 0,0694, so will 100 grains of hydrosulphuric acid gas be to the absolute weight of a volume of hydrogen equal to the volume of said 100 grains, which is the precise quantity of hydrogen contained in the 100 grains of hydro sulphuric acid gas.

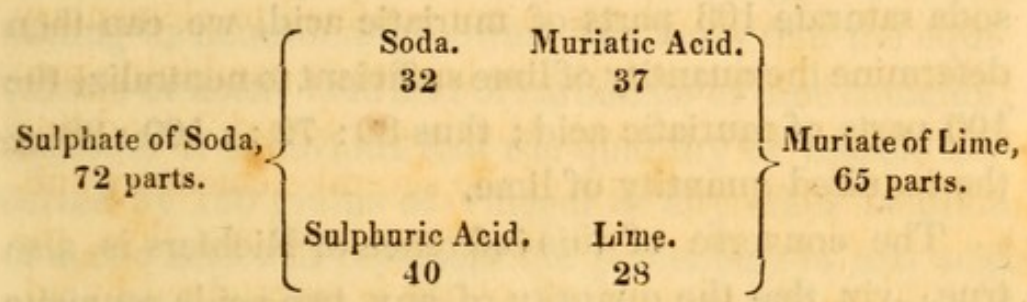
tiplying the means and dividing by the first term, we shall have the weight of the hydrogen contained in the 100 grs. of the hydro-sulphuric acid gas, and consequently the weight of the sulphur.

Having now considered the doctrine of definite proportions, we come to a subject not less important, and one which is intimately connected with that doctrine, viz. the consideration of *Chemical Equivalents*. The nature of Chemical Equivalents will be best illustrated by comparing the relative quantities of different bodies which combine together. Thus, 8 parts by weight of oxygen unite with 1 of hydrogen, 6 of carbon, 16 of sulphur, 36 of chlorine, 200 mercury. Such are the quantities of these bodies, which are found to combine with 8 parts of oxygen ; and when any of these bodies combine with each other, they are found to combine either in the proportion expressed by these numbers, or in multiples of them. Thus sulphuretted hydrogen consists of 1 part of hydrogen and 16 of sulphur ; 36 of chlorine combine with 1 of hydrogen to form muriatic acid. Protosulphuret of mercury consists of 200 parts of mercury and 16 parts of sulphur ; the bisulphuret of mercury of 200 parts of mercury and 32 parts of sulphur. Carbonic oxide consists of 6 parts of carbon and 8 parts of oxygen ; carbonic acid of 6 parts of carbon and 16 of oxygen. Thus, hydrogen being taken as the standard, the combining proportions or *Chemical Equivalents* of the several substances just mentioned are :

Hydrogen - - -	1
Carbon - - -	6
Oxygen - - -	8
Sulphur - - -	16
Chlorine - - -	36
Mercury - - -	200

This law of equivalents is not confined to elementary substances; compounds also have their combining proportions, or equivalents, which are found by adding together the equivalents of the several elementary substances which enter into their composition; thus, the equivalent of sulphate of potass is ascertained by adding together the equivalents of sulphuric acid 40 (16 sulphur + 8 × 3 = 24 = 40) and that of potass 48 (= potassium 40 + oxygen 8 = 48,) so that its equivalent is 88. The equivalent of muriate of soda is 69, as being composed of muriatic acid, 37 + soda 32. This law of the combining proportions of bodies may be thus expressed: If two bodies combine together in definite proportions, the proportion in which they enter into combination will have a relation to the proportions in which they combine with all other bodies; thus, if 1 part of hydrogen combine with 8 of oxygen, the same quantities of hydrogen and oxygen will each combine with the same quantity of any other substance, as 16 of sulphur. This law was inferred by Richter from a fact first observed by himself; viz. that when two neutral salts decompose each other, the resulting salts are likewise neutral. Thus, sulphate

of soda being added to muriate of lime will give perfectly neutral sulphate of lime aud muriate of soda. The reason of this will immediately appear, on considering the equivalents of these substances ; thus, if we take 72 parts of sulphate of soda and 65 parts of muriate of lime, the following decompositions take place :



Here the 40 parts of sulphuric acid combine with the 28 parts of lime, and the 37 of muriatic acid with the 32 of soda, no part either of the acid or alkali remaining in an uncombined state. The neutrality will not be at all affected by our taking more or less than 72 parts of sulphate of soda ; for if we take more, some of the sulphate of soda will remain undecomposed ; if less, we shall have some of the muriate of lime remaining. From this observation Richter inferred, that the quantities of two alkaline bases, sufficient to neutralize equal weights of any one acid are proportional to the quantities of the same bases requisite to neutralize the same weights of every other acid. For instance, 6 parts of potass and 4 of soda neutralize 5 of sulphuric acid ; and 4.4 of potass are sufficient to saturate 5 of nitric acid. Therefore, to find the quantity of soda sufficient to saturate this weight of nitric acid, we in-

stitute the following proportion: as the potass equivalent to the sulphuric acid is to the potass equivalent to the nitric acid, so is the soda equivalent to the first, to the soda equivalent to the second; or in numbers thus: as 6 : 4.4 : : 4 : 2.93 = the required quantity of soda. In a similar manner, if 80 parts of soda and 72 of lime saturate 100 parts of sulphuric acid, and if 109 parts of soda saturate 103 parts of muriatic acid, we can then determine the quantity of lime sufficient to neutralize the 100 parts of muriatic acid; thus 80: 72 : : 109 : 98 = the required quantity of lime.

The converse of this inference of Richters is also true; viz. that the quantity of any two acids requisite to neutralize equal weights of any one base are proportional to the quantities of the same acids requisite to neutralize equal weights of any other base; thus, 126 parts of sulphuric acid and 87 of muriatic acid neutralize 100 parts of soda, and 138 of sulphuric acid neutralize 100 parts of lime, how much muriatic acid will produce the same effect? This may be determined by the following proportion: as 126 : 87 : : 138 : 95.3 = required quantity of muriatic acid.

The advantages to be derived from an acquaintance with these principles of chemical combination in proportional quantities, are too manifest from the examples already given to require further comment. By their aid calculations which otherwise would be tedious and difficult, may be made with ease and certainty; and the precise quantities of substances necessary to produce any required effect at once determined, a mat-

ter of considerable importance to the success of chemical manipulations in general, as well as to the conducting of pharmaceutical operations with certainty and despatch. A few instances may be adduced from the Pharmacopœia by way of illustration.

If we want to test the strength of distilled vinegar, we have an easy and sure mode of doing it by ascertaining its neutralizing power. We know that the equivalents of acetic acid and of carbonate of lime coincide; therefore it is obvious that the quantity of marble dissolved by 100 grains of vinegar or any other solution of acetic acid will represent the percentage of real acid in such a sample. For example, let 500 grains of such a solution of acetic acid be put into a basin or flask with 100 grains of marble in fragments, and after the first effervescence is over, warmed, and the neutrality ascertained; the solution is then to be poured off and the remaining pieces of marble washed, dried, and weighed; if 60 grains have disappeared, 60 grains of dry acetic acid were present in the 500 grains of the solution employed. Again, suppose we wish to test the strength of any solution of hydrocyanic acid, we proceed as follows: to 100 grains, or any other convenient quantity of the acid, contained in a phial, small quantities of the peroxide of mercury in fine powder are successively added, till it ceases to be dissolved. The weight of the oxide, divided by 4, gives the quantity of real acid present. The rationale of this test is: the equivalent of the peroxide of mercury (216) happens to be just eight times that of hydrocyanic acid

(27). Now, as the prussiate of mercury consists of two proportionals of acid to one of base, it is manifest that the quantities of acid and of base in the salt are in the ratio of 1 to 4. Again, in the preparation of carbonate of magnesia, for example, the ingredients prescribed are sulphate of magnesia and carbonate of potass; and the quantity of the sulphate of magnesia directed being 25 parts, we may ascertain *a priori* the necessary proportion of the carbonate of potass, having recourse to their respective equivalents; thus the equivalent of sulphate of magnesia is 123, and that of carbonate of potass is 70. Now, 123 : 70 : : 25 : 14 q. p. the proportion of carbonate of potass required. For other instances of the useful application of the doctrine of equivalents to pharmaceutical purposes, see my Translation of the New Dublin Pharmacopœia, where I have pointed out in the notes the advantage of this doctrine in determining *a priori* the requisite proportion of the several ingredients. The method of determining the proportional numbers will be considered, when we have come to the subject of the Atomic Theory.

ATOMIC THEORY.

HAVING now considered the laws which regulate the chemical combination of bodies in definite proportions, and having seen that these laws were inferred from experiment and induction, and were totally independent of, and unconnected with any speculation

whatever, we shall now enter on the subject of the atomic theory of Mr. Dalton, a theory happily adapted to the purpose of explaining those laws, and accounting for the regularity and uniformity with which they have been observed to influence and preside over chemical combinations. With regard to the ultimate elements of matter, two opposite opinions have been held. Some suppose, that every particle of matter, however minute, is still capable of further division, whilst others, on the contrary maintain, that matter is composed of certain atoms so minute as not to admit of further division. In favour of the atomic constitution of bodies, strong arguments have been deduced from the phenomena of chemical combinations, in which the substances combined are dispersed every where through the whole mass. Thus chalk is a compound of lime and carbonic acid, and how minute a portion soever of chalk we may take, we shall find it to contain a portion of each of these constituents. How small a portion soever of nitre we may take, we shall find it to contain nitric acid and potash; now, it is clear that this could not be the case unless these elements combined atom to atom. The permanency of chemical compounds, which we have already adverted to, when considering the laws of chemical combination, and which can be attributed to nothing else than to the union of a certain determinate number of the atoms of one constituent with a certain determinate number of the atoms of another, may be adduced as a powerful argument in support of the same doctrine. Dr.

Wollaston, however, in his Essay on the finite Extent of the Atmosphere, has supported the atomic constitution of bodies on a principle wholly independent of chemistry. He has inferred from observations made by himself and others, that there is no solar atmosphere; whence it would follow, that the atmosphere was limited to our earth; for this limitation he accounts, by supposing that the air, after attaining a certain degree of rarefaction, possesses so feeble an elasticity, that the tendency of its particles to separate from each other is counteracted by gravity. The unknown height at which this equilibrium between the two forces of elasticity and gravitation takes place, is the outermost boundary of the atmosphere. Now this mode of reasoning will not apply unless the air be supposed to consist of ultimate atoms; hence, in order to account for the limited extent of the atmosphere, on this principle, the air is inferred to consist of atoms; and if the inference be granted, it is fair to presume that matter in general has a similar constitution. For more ample details on this curious subject, see Dr. Wollaston's Essay in the Philosophical Transactions for 1822; and also Dr. Turner's Chemistry, page 207. Another and very cogent argument in favour of this doctrine has been adduced by Professor Mitscherlich, from the peculiar connexion noticed by him between the form and composition of certain substances; for which see Turner's Chemistry, pp. 558, 559.

Mr. Dalton having observed a remarkable coinci-

dence in the proportions of the elements contained in some chemical compounds, was led to believe that such coincidence was not partial or accidental, but that it might form part of a general system, comprehending every chemical combination. Under this impression, he examined and compared with great ingenuity of research, a vast number of compounds, and has published a valuable collection of facts, established by others as well as by himself, throughout the whole of which this same principle of composition was found to prevail. A few examples will suffice to explain the nature of this principle:

Water	consists	of	hydrogen	1 part	+	8 oxygen
Olefiant gas		of	hydrogen	1 do.	+	6 carbon.
Carbonic oxide		of	oxygen	8 do.	+	6 carbon.
Carbonic acid		of	carbon	6 do.	+	16 oxygen.

What is here remarkable is, that the last terms in the first and second of these combinations are precisely the same as the first and second terms representing the proportions of the same elements in the third compound. In the fourth combination we may observe a further coincidence of a different kind, in which the second term is precisely double the first term of the preceding combination. Supposing this coincidence to be something more than accidental, Mr. Dalton had recourse to the atomic constitution of bodies in order to explain it, and advanced the opinion that combination takes place between the atoms of bodies only. For instance, 1 part by weight of hydrogen combines

with 8 of oxygen; now, in this quantity of hydrogen he conceives that there are as many atoms, as there are in 8 times that weight of oxygen, and that each atom of hydrogen combines with an atom of oxygen; hence then, the weight of 1 atom of oxygen is 8 times as great as the weight of an atom of hydrogen.

Mr. Dalton thus assuming, that combinations take place only between the particles, or the atoms, or the molecules of bodies; he lays it down as a principle that when two bodies *a* and *b* can unite, their union is made in the following manner:

1 atom *a* and 1 atom of *b* = 1 atom of *c* binary.
1 atom *a* and 2 atoms of *b* = 1 atom of *d* ternary.
2 atoms *a* and 1 atom of *b* = 1 atom of *e* ternary.
1 atom *a* and 3 atoms of *b* = 1 atom of *f* quaternary.
3 atoms *a* and 1 atom of *b* = 1 atom of *g* quaternary.

He next assumes, that in the case where two bodies can form but one combination, it must be binary; that in the case where they may form two, the one must be binary and the other ternary; that when they may form three, there must be one binary and two ternary; that when they may form four, two are ternary, one binary, and one quaternary; that the atomic theory embraces not only the combinations of simple bodies, but also those which may take place between simple bodies and compound bodies, or between compound and other compounds; that if, for example, a neutral salt results from the combination of an atom of base and an atom of acid; the same salt,

with excess of acid, will result from an atom of the same base and two atoms of acid.

These principles being laid down, he thence deduces the relative weights of the atoms. Thus, let there be 2 bodies, *a* and *b*, capable of forming a compound resulting from an atom of the one with an atom of the other; it is evident that there will be between the weight of these 2 atoms the same relation as between the weight of the quantities of the same bodies *a* and *b*, which shall be combined. If then we find by experiment, that in the compound *ab*, the body *a* enters as 4, and the body *b* as 3, these numbers 4 and 3 will necessarily express the relative weights of the atoms of *a* and *b*.

Mr. Dalton takes as unity in the relative weight of the atoms, the weight of the atom of the lightest body, which is hydrogen; and as he assumes that water is formed of 1 atom of this body, and 1 atom of oxygen; and as analysis shews, that in water these two bodies are in the ratio by weight of 1 to 8, it thence follows, that designating the weight of the atom of hydrogen by 1, he must designate that of the atom of oxygen by 8. Considering then other binary combinations, the proportion of whose elements he knows, and the relative weight of one of the atoms, he infers the relative weight of the other, and so forms a table of the relative weights of a great number of atoms. Instead of taking the atom of hydrogen as unity, Mr. Dalton might have taken any other atom, for example, oxygen; then the relative weight of the atom of hydrogen, will be ^{1}, or, 0.125.

Mr. Dalton has taken hydrogen as unity, as being the lightest of all bodies, and consequently combining in the smallest proportions. Others, however, have assumed oxygen as the unit, in consequence of its entering into the composition of a greater number of substances. However, it is quite immaterial what figures are employed to express the weight of the atoms, provided the relation be strictly observed. Dr. Thomson makes oxygen 1, so that hydrogen, which is eight times less, is to be expressed by the decimals .125. Dr. Wollaston, in his scale of chemical equivalents, fixes oxygen at 10, by which hydrogen will be 1.25. According to Berzelius oxygen is 100.

Besides the atoms of simple bodies, of which we have hitherto spoken, Mr. Dalton has also admitted the existence of atoms in compound bodies. The weight of these compound atoms is found by taking the sum of the weights of the constituent atoms. Thus, an atom of copper unites to an atom of oxygen to form the protoxide of copper; the atom of copper weighs 64, and that of oxygen weighs 8; then the weight of an atom of protoxide of copper will be 72.

When 2 compound bodies unite together to form others more compound, the combination takes place equally between their atoms, and in the same manner as if the bodies were simple; thus let us suppose a neutral salt formed of an atom of acid (a compound body) and of an atom of base (compound body); if, with the same acid and the same base, we can procure

an acid salt, this salt will be formed of an atom of base and of two atoms of acid.

In consequence of the very satisfactory explanation which the laws of chemical combination receive from the atomic theory, it has been usual to employ the term atom in the same sense as combining proportion or equivalent. Thus, instead of saying that water is composed of one equivalent of oxygen and one equivalent of hydrogen, it is often said to consist of one atom of each constituent. Hence, then, the method of determining the combining proportions or equivalents of substances is precisely the same as that for determining their atomic weights.

Among the objections that have been urged against the Atomic Theory, that arising from the occurrence of half a proportion may be remarked; for as the idea of half an atom is inconsistent with the Atomic Theory, and is, in fact, a contradiction in terms, such an arrangement of the atoms must be adopted, as may enable us to avoid the inconvenience. We find the different oxides of lead to be constituted as follows:

	Lead.	Oxygen.
Protoxide	104	8 or 1 proportion.
Deutoxide	104	12 or 1½ ditto.
Peroxide	104	16 or 2 ditto.

Now, in order to avoid the fraction in the deutoxide, the different oxides of lead may either be regarded as composed, the protoxide of one atom of lead to one atom of oxygen; the deutoxide of two atoms of lead

to three atoms of oxygen, and the peroxide of one atom of lead to two atoms of oxygen ; or they may be considered as compounds, the protoxide of one atom of lead to two atoms of oxygen, the deutoxide of one atom of lead to three atoms of oxygen, and the peroxide of one atom of lead to four atoms of oxygen. In the same way, the oxides of iron are either composed, the protoxide of one atom of iron and one atom of oxygen, and the peroxide of two atoms of iron to three of oxygen ; or the protoxide of one atom of iron to two atoms of oxygen, and the peroxide of one atom of iron to three atoms of oxygen.

It may not be thought uninteresting to glance at the researches of Berzelius on the subject of the Atomic Theory, and then to consider the laws which that chemist has founded on these researches. Berzelius admits, with Mr. Dalton, the existence of ultimate atoms, to the combination of which with one another, the laws of chemical proportions are owing. According to him, the union of bodies consists in the juxta-position of their atoms, which depends on a force, which, between heterogeneous bodies, produces chemical combination, and between homogeneous atoms, mechanical cohesion. When the atoms of two different bodies are combined, there results a compound atom, in which case we suppose that the force which produces the combination infinitely surpasses the effect of all those circumstances, which may have a tendency mechanically to separate the united atoms. This com-

pound atom is to be considered as mechanically indivisible as the elementary atom.

These compound atoms combine with other atoms, from whence there result atoms still more compounded. When these combine with others, they produce atoms still more complex. It is important to distinguish these different atoms. They are divided by Berzelius into atoms of the first, second, third order, &c. Those of the first order are composed of simple elementary atoms ; they are of two species ; *organic* and *inorganic :* these never contain but two elements, whilst the others consist of at least three. The compound atoms of the second order arise from compound atoms of the first order ; the atoms of the third from those of the second, &c. For example, sulphurous acid, the protoxide of potassium, alumina and water, are all *compound atoms of the first order,* because they are formed only of oxy gen and another body. Sulphate of potass and sulphate of alumina are *compound atoms of the second order ;* dry alum, which is a combination of these two latter salts, presents an example of an *atom of the third order :* in fine, crystallized alum, containing several atoms of water, combined with an atom of a double sulphate may be cited as an example of a *compound atom of the fourth order.* It is not yet known how far the number of the orders may rise. The case is the same for *compound organic atoms ;* it is not known in how many different orders they may combine, whether among themselves, or with *inorganic compound atoms.*

The manner in which the *elementary* atoms com-

bine is probably as follows: 1°. *An atom of one element combines with one, two, three, &c. atoms of another element.* This is what more frequently happens; so that in most compound atoms, one of the elements enters but as one single atom. 2°. Two atoms of one element combine with three atoms of another element. This combination may take place in all cases where, for example, the quantities of oxygen absorbed by a radical in any two different degrees of oxidation are in the ratio of 1 to $1\frac{1}{2}$, as in sulphur and iron. If the first oxide is composed of an atom of radical, combined with an atom of oxygen, the second must contain two atoms of the one combined with three atoms of the other. This, of course, is necessary in order to avoid the contradiction of half an atom.

With respect to the combination of compound atoms, several laws have been laid down by Berzelius as deduced from experiments, of which the following may be adduced: Compound atoms of the first order, to which the electro-resinous element is common, always combine in such proportion, that the number of the atoms of the electro-resinous element of the one is a multiple by a whole number of this same number in the other; that is to say, for example, in the combinations of oxydized bodies the number of the atoms of oxygen in one of the oxides is a multiple by a whole number of that of the atoms of oxygen in the other. Thus, for example, the hydrate of potassa consists of

Potassa	48	the oxygen of which is	8
Water	9	- - ditto - -	8

In the composition of the salts we see the same law observed. Thus, carbonate of potassa consists of

Carbonic acid	22	the oxygen of which is		16
Potassa	48	- -	ditto - -	8

Carbonate of soda consists of

Carbonic acid	22	the oxygen of which is		16
Soda	32	- -	ditto - -	8

Sulphate of potassa consists of

Sulphuric acid	40	oxygen	24
Potassa	48	- - -	8

In those salts, which contain water of crystallization, a similar relation may be observed between the oxygen of the base and that of the water; thus, sulphate of magnesia consists of

Sulphuric acid	40		
Magnesia -	20	oxygen	8
Water -	63	-	56

The double salts seem to be influenced by the same law; thus, in the double tartrate of soda and potass, the two alkalies contain the same number of atoms of oxygen, and are combined with the same number of atoms of tartaric acid. With respect also to the constitution of the salts, it may be observed, that in each class, the same ratio always holds with respect to the oxygen of the acid and base: thus, in the carbonates, the oxygen of the acid is to that of the base as 2 to 1; in the bicarbonate as 4 to 1, in the neutral sulphates as 3 to 1. We may also observe, that in the

the neutral sulphates, the quantity of the acid is to that of the oxygen of base, as 5 to 1. The reason of this will appear by considering, that as the neutral salts in general are combinations of an atom of protoxide with an atom of an acid, the atoms of oxygen in the acid must in all such salts be multiples of the atom of oxygen in the base, every whole number being a multiple of unity.

In order to illustrate the advantages of an acquaintance with the laws of chemical proportions, and the assistance derivable from them in the process of chemical analysis, we shall now adduce a few examples. Suppose it were required to determine the relative quantities of oxygen and metal in any given quantity of protoxide of lead. In the first place, we know that the neutral sulphates contain 5 times as much sulphuric acid as there is oxygen in the oxide which they saturate: for example, 200 parts of sulphate of copper contain 100 parts of acid, 80 of copper and 20 of oxygen, the oxygen being the one-fifth of the acid. We also know that the sulphate of the protoxide of lead is formed of 100 parts of acid and 279,74 of protoxide: it is then evident that this quantity of protoxide must consist of 259,74 of metal and 20 of oxygen (viz. one-fifth of the acid) then, if 259,74 lead are combined with 20 of oxygen, 100 parts of lead will combine with 7,7 of oxygen.*

* It may not be amiss here to state, that the principle on which this mode of determining the quantity of oxygen depends, is, that in salts of the same class, and in the same state of saturation, the quantities of oxygen contained in the oxides are proportional to the quantities of acid which saturate them.

Suppose, again, we wish to ascertain the proportion of acid and of oxide which constitute the *sulphate of lead:* we know that 100 parts of sulphuric acid must combine with a quantity of protoxide of lead containing 20 parts oxygen, the quantity of acid being 5 times as great as the oxygen of the protoxide. Our object, then, is to determine the quantity of protoxide of lead into which 20 parts of oxygen enter. For this purpose we institute the following proportion: if 7,7 of oxygen change 100 of lead into a protoxide, how much of it will 20 of oxygen change?

$$7{,}7 : 100 :: 20 : x = 259.$$

Hence, then, in the sulphate of lead there will be 100 of acid, 20 of oxygen, and 259 of lead; or what comes to the same thing, 100 of acid and 279 of protoxide.

A TABLE

OF ATOMIC WEIGHTS AND CHEMICAL EQUIVALENTS, HYDROGEN BEING TAKEN AS UNITY.

Acid, acetic.	50
c. 1. w.*	59
arsenic (a 38 + 0.20.)	58
arsenious (a. 38 + 0.12.) ..	50
benzoic.	120
boracic (b. 8 + 0.16.)	24
c. 2. water.	42
bromic (b. 75 + 0.40.)	115
carbonic (c. 6 + 0.16.)	22
chloric (chl. 36 + 0.40.)	76
chloriodic (chl. 72 + iod. 124.) ..	196
chloro-carbonic (chl. 36 + carb. 0.14.)	50
chloro-cyanic (chl. 36 + cyan. 26.)	62
chromic (chr. 28 + 0.24.) ..	52
citric.	58
c. 2. w.	76
columbic.	152

* C. means crystallized, w. water; the numeral before w expresses the number of equivalents of water, which the crystals contain.

Acid,	formic.	37
	gallic.	62
	hydriodic (iod. 124 + hyd. 1.) ..	125
	hydrocyanic (cyan. 26 + hyd. 1.) ..	27
	hypo-sulphurous (s. 32 + 0.8) ..	40
	hypo-sulphuric (s. 32 + 0.40.) ..	72
	malic.	70
	molybdous	64
	molybdic.	72
	muriatic (chl. 36 + hyd. 1.) ..	37
	nitric—dry (nit. 14 + 0.40.) ..	54
	liquid (sp. gr. 1. 5) 2. w.) ..	72
	nitrous (nitr. 14 + 0.32.) ..	46
	oxalic.	36
	c. 4. w.	72
	perchloric (chl. 36 + 0.56.) ..	92
	phosphorous (p. 15.71 + 0.12.) ..	27, 71
	phosphoric (p. 15.71 + 20.) ..	35, 71
	saccholactic.	104
	selenious (sel. 40 + 0.16.) ..	56
	selenic (sel. 40 + 0.24.) ..	64
	succinic.	50
	sulphuric, dry (s. 16 + 0.24.) ..	40
	liquid sp. gr. 1.4838, 1. w.	49
	sulphurous (s. 16 + 0.16.) ..	32
	tartaric.	66
	c. 1. w.	75
	titanic.	48
	tungstic (t. 96 + 0.24.)	120
	uric.	72

Alcohol (olef. gas 14 + aq. vap. 9.) ..	23
alum, anhydrous	262
+ c. 25 w.	487
Alumina.	18
sulphate.	58
Aluminium.	10
Ammonia (nitr. 14 + hyd. 3.) ..	17
Antimony.	44
chloride (ant. 44. + chl. 36.) ..	80
iodide (ant. 44. + iod. 124.) ..	168
oxide (ant. 44. + ox. 8.) ..	52
deutoxide.	56
peroxide.	60
sulphuret.	60
Arsenic.	38
sulphuret.	54
+ sesquisulphuret.	62
persulphuret.	78
Barium	70
chloride (b. 70 + chl. 36.) ..	106
iodide (b. 70 + iod. 124.) ..	194
oxide (baryta.)	78
peroxide.	86
phosphuret.	85, 71
sulphuret.	86
Bismuth.	72
chloride (b. 72 + chl. 36.) ..	108
Bismuth, oxide.	80
iodide (b. 72 + iod. 12.4.) ..	196
sulphuret (b. 72 + s. 16) ..	88

Boron.	8
Bromine.	75
Cadmium.	56
chloride (cad. 56 + chl. 36.) ..	92
oxide.	64
iodide.	180
phosphuret.	71, 71
sulphuret.	72
Calcium, ...	20
chloride (cal. 20 + chl. 36.) ..	56
iodide.	144
oxide (lime.)	28
phosphuret.	35, 71
sulphuret.	36
Carbon.	6
chloride.	42
oxide.	14
Cerium.	50
oxide.	58
peroxide.	62
Chlorine.	36
hydrocarburet (chl. 36 + olef. gas 14.)	50
oxide (chl. 36 + 0.8.)	44
peroxide.	68
Chromium.	32
oxide.	40
Cobalt.	26
chloride (cob. 26 + chl. 36.) ..	62
iodide.	150
oxide.	34

Cobalt, peroxide.	38
phosphuret.	41, 71
sulphuret.	42
Columbium.	144
Copper.	64
chloride (cop. 1 + chl. 1.) ..	100
bichloride.	136
iodide.	188
oxide.	72
peroxide.	80
sulphuret.	80
bisulphuret.	96
Cyanogen (carb. 2 + nitr. 1.)	26
Cyanuret of sulphur (cyan. + 1 sul. 2.) ..	58
Ether. (olef. gas 2 + wat. vap. 1.) ..	37
Fluorine.	18, 86
Glucinium.	18
Glucina.	26
Gold.	200
chloride (g. 1 + chl. 1.) ..	236
bichloride (g. 1 + chl. 2.) ..	272
iodide (g. 1 + iod. 1.)	324
oxide (g. 1 + 0.1.)	208
peroxide (g. 1 + 0.3.)	224
sulphuret (g. 1 + s. 3.)	248
Hydrogen.	1
arseniuretted (a. 1 + h. 1.) ..	39
carburetted (c. 1 + h. 2.) ..	8
Olefiant gas (c. 2 + h. 2.) ..	14
sulphuretted (s. 1 + h. 1.) ..	17
bisulphuretted (s. 2 + h. 1.) ..	33

Iodine.	124
Iron.	28
chloride (I. 1 + chl. 1.) ..	64
perchloride (I. 1 + chl. $1\frac{1}{2}$.) ..	82
iodide (I. 1 + iod. 1.)	152
oxide (I. 1 + 0.1.)	36
peroxide (I. + $0.1\frac{1}{2}$.)	40
sulphuret (I. 1 + s. 1.)	44
bisulphuret (I. 1 + s. 2.) ..	60
Lead.	104
chloride (L. 1. + ch. 1.) ..	140
oxide (L. 1 + 0.1.)	112
deutoxide (L. 1 + $0.1\frac{1}{2}$.) ..	116
peroxide (L. 1. + 0.2)	120
phosphuret (L. 1 + p. 1.) ..	119, 71
sulphuret (L. 1 + s. 1.) ..	120
Lithium.	10
chloride (L. 1 + ch. 1.) ..	46
iodide.	134
oxide (lithia.)	18
sulphuret.	26
Magnesium.	12
chloride.	48
oxide (magnesia.)	20
sulphuret.	28
Manganese.	28
chloride (m. 1 + ch. 1.) ..	64
perchloride, m. 1 + ch. 4.) ..	172
oxide (m. 1 + 0.1.)	36
deutoxide (m. 1 + $0.1\frac{1}{2}$.) ..	40

Manganese, peroxide (m. 1 + 0.2.) ..	44
sulphuret (m. 1 + s. 1.) ..	44
Mercury.	200
chloride, calomel (m. 1 + ch. 1.) ..	236
bichloride (corros. subl.) ..	272
iodide (m. 1. + iod. 1.) ..	324
biniodide (m. 1 + iod. 2.) ..	448
oxide (m. 1 + 0.1.)	208
peroxide (m. 1 + 0.2.) ..	216
sulphuret.	216
bisulphuret.	232
Molybdenum.	48
oxide.	56
deutoxide.	64
Molybdic acid (m. 1 + 0.3.)	72
Nickel.	26
chloride.	62
iodide.	150
oxide.	34
peroxide.	38
Nitrogen.	14
bicarburet (cyanogen.)	26
chloride (n. 1 + c. 4.)	158
iodide (n. 1 + iod. 3.) ..	386
oxide (n. 1 + 0.1.)	22
deutoxide.	30
Oxygen.	8
Palladium.	56
oxide.	64

Phosphorus.	15,71
chloride (p. 1 + ch. 1.)	51,71
bichloride.	87,71
carburet.	21,71
sulphuret.	31,71
Platinum.	96
chloride.	132
bichloride.	168
oxide.	104
deutoxide.	112
sulphuret.	112
bisulphuret.	128
Potassium.	40
chloride.	76
iodide.	164
oxide (potassa.)	48
peroxide (p. 1 + 0.3.)	64
sulphuret.	56
Rhodium, ...	44
oxide.	52
peroxide.	60
Selenium.	40
Silica.	16
Silicium.	8
Silver.	110
chloride.	146
iodide.	234
oxide.	118
sulphuret.	126

Sodium.	24
chloride.	60
iodide.	148
oxide (soda.)	32
peroxide (s. 1 + 0.1½.)	36
phosphuret.	39, 71
sulphuret.	40
Strontium.	44
chloride.	80
oxide (strontia.)	52
sulphuret.	60
Sulphur.	16
chloride.	52
iodide.	140
Sulphuretted hydrogen.	17
Bisulphuretted hydrogen.	33
Tellurium.	32
chloride.	68
oxide.	40
Tin.	58
chloride.	94
oxide.	66
sulphuret.	74
Titanium.	32
oxide.	40
Titanic acid.	48
Tungstin.	96
oxide (brown) (t. 1 + 0.2) ..	112
Tungstic acid (t. 1. + 0.3)	120

Uranium.	208
oxide.	216
peroxide.	224
Water.	9
Yttrium.	34
oxide (yttria.)	42
Zinc.	34
chloride.	70
oxide.	42
phosphuret.	49, 71
sulphuret.	50
Zirconium.	40
Zirconia.	48

SALTS.

Acetate of Alumina (Ac. 1 + Al. 1.) ..	68
c. 1. w.	77
ammonia (Ac. 1 + am. 1.) ..	67
c. 7. w, ...	130
Baryta (Ac. 1 + B. 1.) ..	128
c. 3 w.	155
copper, per oxide (A. 1 + C. 1.)	130
c. 6. w. (com. verdigris.)	184
binacetate.	180
c. 3 w. (distilled verdigris.) ..	207
subacetate (Ac.1 + C. 2.)	210
lead.	162
c. 3. w.	189

Acetate of lime.	..	..	..	78
magnesia.		..	..	70
mercury (protoxide)	c. 4. w.		..	294
potassa.		..	..	98
silver.	..	..	..	168
strontia.	c. 1. w.	..	..	111
Zinc.	..	..	..	92
c. 7. w.		..	..	155
Arseniate of lead (A. 1 + L. 1.)			..	170
lime.	..	..	..	86
magnesia.		..	..	78
potassa.	..	..	..	106
Arseniate of soda.	..	..	..	110
Arseniate of silver.	..	..	..	180
Arsenite of lime (A. 1 + L. 1.)			..	78
potassa.		..	..	98
soda.	..	..	..	82
silver.	..	..	..	168
Carbonate of Ammonia (C. 1 + A. 1.)			..	39
Sesquicarbonate of Ammonia (C. $1\frac{1}{2}$. + A. 1 + w. 1.)				59
Bicarbonate of do. 1 w.		..	..	70
Carbonate of baryta.		..	..	100
copper.		..	..	102
iron (protoxide.)			..	58
lead.		..	..	134
lime.		..	..	50
magnesia.		..	..	42
manganese.		..	..	58
potassa.		..	..	70

Bicarbonate of potassa.	.. ..	92
c. 1. w.	.. ..	101
Carbonate of soda. ..	.. ..	54
c. 10. w. ..	.. ..	144
Bicarbonate of soda. c. 1. w.	.. ..	85
Carbonate of zinc. ..	.. ..	64
Chlorate of lead. ..	.. ..	188
mercury.	.. ..	284
potassa. ..	.. ..	124
Chromate of baryta. ..	.. ..	130
lead. ..	.. ..	164
mercury.	.. ..	260
potassa.	.. ..	100
Bichromate of potassa.	.. ..	152
Muriate of ammonia.	.. ..	54
baryta. c. 1. w.	.. ..	124
lime. c. 6. w.	.. ..	119
magnesia.	.. ..	57
strontia. c. 8. w.	.. ..	161
Nitrate of ammonia.	.. ..	71
baryta. ..	.. ..	132
bismuth. c. 3. w.	.. ..	161
lead. ..	.. ..	166
lime. ..	.. ..	82
magnesia.	.. ..	74
mercury protoxide. c. 2. w.	..	280
potassa.	.. ..	102
silver. ..	.. ..	172
soda. ..	.. ..	86
strontia. ..	.. ..	106

Oxalate of Ammonia, (ox. 1 + am 1.) ..	52
c. 2. w.	70
baryta.	114
Binoxalate of baryta	150
Oxalate of cobalt.	70
lime.	64
potassa.	84
c. 1. w.	93
Binoxalate of potassa	120
c. 2. w.	138
Quadroxalate of potassa, ...	192
c. 7. w.	255
Oxalate of strontia.	88
Phosphate of ammonia. c. 2. w. ..	70.71
baryta.	113.71
lead.	147.71
lime.	63.71
magnesia.	55,71
soda.	67.71
c. 12½ w.	180.21
Sulphate of alumina.	58
ammonia. c. 1. w.	66
baryta.	118
Sulphate of copper (S. 1. + perox. 1.) ..	120
Bisulphate of copper.	160
c. 10. w. (blue vitriol.) ..	250
Sulphate of iron, (protoxide.)	76
c. 7. w. (green vitriol.) ..	139
lead.	152

Sulphate of lime.	68
c. 2. w.	86
lithia. c. 1. w.	67
magnesia. c. 7. w.	123
mercury (S. 1. + perox. 1.) ..	258
Bisulphate of mercury (peroxide.) ..	296
Sulphate of potassa.	88
Bisulphate of potassa. c. 2. w. ..	146
Sulphate of soda.	72
c. 10. w.	162
zinc.	82
c. 7. w.	145
Sulphate of alumina and potassa. ..	262
c. 25. w. (alum.)	487
Nitrate of lead.	178
lime.	94
potassa.	102
Bitartrate of potassa.	180
c. 2. w. (cream of tartar.) ..	198
Tartrate of antimony and potassa. ..	
c. 3. w. (tartar emetic.) ..	363

NEW FRENCH MEDICINES.

ALCOHOLIC EXTRACT OF NUX VOMICA.

Take any quantity of the nux vomica rasped; treat it with alcohol at 40°*, and at the lowest temperature possible. Renew the alcohol, till nothing more is taken up from the raspings; then evaporate slowly to the consistence of an extract.

This extract may be obtained dry by taking the saturated tincture, made with alcohol of 36°, then filtering and evaporating in the usual way.

Effects. Stimulant, and when given in an overdose, it produces tetanic convulsions, and thus destroys life.

Medical uses. Has been found serviceable in paralytic affections of all kinds, general and partial. Mr. Edwards has given it with success in amaurosis with paralysis of the upper eye-lid. Mr. Majendie has seen good effects from its use in weakness of the genital organs, incontinence of urine, debility of the stomach, and in extreme general weakness, accompanied with an irresistible tendency to repose. It has been also

* By the areometer of Baumé.

recommended in partial atrophy of the upper and lower extremities. We must be cautious not to presribe it immediately after the apoplectic attack which may have produced the paralysis, nor can we expect a cure of such consecutive palsies, when there exists any serious organic lesion of the brain.

Mr. Chauffart * has related the cure of paralysis of the rectum by the extract. Doctor Baxter has related, in the eighth volume of the *New York Medical Repository,* a case of hemiplegia which happened to a child three years and half old after measles, successfully treated by the extract of nux vomica. In fine, the efficacy of this extract in all varieties of debility of the nervous system has been vouched for by several medical men.

Form of exhibition and dose. The best form for giving the alcoholic extract of nux vomica is that of pill, each containing one grain of the extract. We commence by one or two, and augment the dose every day till we attain the desired effect. Night is the best time to give the pills, as being the most convenient for observing the phenomena we wish to produce. Sometimes the dose must be raised to 24 or 30 grains a day to obtain tetanic action, but 6 grains usually suffice. When we wish to produce but slight effects, half a grain, or one grain a day will suffice. An alcoholic solution may also be used, of which the following is the formula:

* Journal General de Medicine. Octob. 1824. p. 3.

Tincture of Nux Vomica.

Take of alcohol at 36°. 1 ounce.
Dry extract of nux vomica, 3 grains.

This tincture is administered in drops in any ordinary vehicle in the same circumstances, as the extract in substance. It may also be used in friction on the affected parts.

STRYCHNIA.

The alcoholic extract of nux vomica, nux vomica, St. Ignatius' bean, the famous poison of Java (the upas tieuté,)* the snake-wood, owe their great activity to two vegetable alkalies discovered by M.M. Pelletier and Caventou, the one called *strychnia* and the other *brucia*. These two bases are combined with a vegetable acid ealled *igazuric acid.*†

Mode of preparing strychnia. Make an alcoholic extract of nux vomica; dissolve it in water; add to the solution subacetate of lead in a liquid form, till precipitation ceases. The foreign matter being thus separated, the strychnia remains in solution with a portion of colouring matter, and sometimes an excess of acetate of lead. The lead is separated by sulphuretted hy-

* This must not be confounded with the *Upas Anthiar* of the same island, which kills in a few minutes by vomiting, whilst the upas tieuté destroys life by producing tetanic convulsions.

† Annales de Chimie, etc. tom. x. page 176. 1819.

drogen; then filter and boil with magnesia, which seizes on the acetic acid, and gives a precipitate of strychnia and brucia. This must be washed with cold water, and re-dissolved in alcohol to separate it from the excess of magnesia, and by evaporation of the alcohol we obtain a mixture of strychnia, brucia, and colouring matter. The entire is put to macerate in a small quantity of weak alcohol, which readily dissolves the brucia and the colouring matter, whilst the strychnia remains in the form of powder. The strychnia is again taken up by rectified boiling alcohol, which dissolves it. The alcohol being evaporated, the strychnia is obtained in a crystalline form. By renewing the crystallization, we may obtain it still purer.

Properties. In the form of minute crystals. When repeatedly crystallized it is white and granular; taste intolerably bitter; odour none; scarcely soluble in water: neither fusible nor volatile.

Composition. Oxygen, 6.38. Hydrogen, 6.54. Azote, 8.92. Carbon, 78.22, in 100 parts.

Operation. Similar to that of the alcoholic extract of nux vomica, except that it is much more energetic. One-eighth of a grain is sufficient to kill a large dog. One-fourth of a grain has often produced marked effects on man in a state of health.

Medical uses. The same as of the extract of nux vomica.

Form of exhibition, and dose. Strychnia may be given in pills containing one-twelfth or one-eighth of a grain. The following formula may be adopted:

Pills of Strychnia.

Take of very pure strychnia, 2 grains.
Conserve of roses, half a drachm.

Mix carefully, and divide into 24 equal pills.

Tincture of Strychnia.

Take of alcohol at 36°. 1 ounce.
strychnia, 3 grains.

This is taken in a dose of from 6 to 24 drops, in mixtures or common drinks.

M. Majendie has frequently employed the following mixture:

Take of distilled water, 2 ounces.
very pure strychnia, 1 grain.
white sugar, 2 drachms.
acetic acid, 2 drops.

A tea-spoon full morning and night.

Strychnia, by uniting with acids, forms salts, which are crystallizable, and for the most part soluble; hence the greater activity of the salts of this substance. The sulphate is the most important, and the only one tried by Majendie.

BRUCIA.

Mode of preparation. Brucia is obtained from the inner bark of the *brucea anti-dysenterica,* by a process similar to that directed for the extraction of strychnia, with this difference, that in the present case, we must not wash the magnesian precipitate so much, as the brucia is much more soluble in water than the strychnia, by reason of the great quantity of colouring matter it carries with it. By evaporating the alcoholic liquors employed in treating the magnesian precipitate, we readily obtain the brucia in a resinous form, as not being as yet sufficiently pure to crystallize. In order to purify it we must combine it with oxalic acid, and treat the oxalate with a mixture of alcohol at 40°, and of ether at 60°. We shall thus dissolve the colouring matter, and the oxalate of brucia will remain in the form of a white powder. This oxalate will be decomposed by magnesia, and the brucia taken up by the alcohol. In evaporating the alcoholic solution in the open air, we shall obtain the brucia crystallized. If we evaporate by the aid of heat, we shall have the the brucia fused, but not less pure.

Properties. It has an extremely bitter taste ; is but little soluble in water, though more so than strychnia. It dissolves in 500 times its weight of boiling, and in 850 times its weight of cold water. When regularly crystallized, it presents itself under the form of ob-

lique prisms with a parallelogrammic base. It combines with acids, and forms neutral salts with them.

Operation. Similar to that of strychnia, but less powerful. According to the experiments of Andral, six grains of brucia are required to produce the effects of a quarter of a grain of pure strychnia, so that their relative strength will be as 1 : 24.

Medical uses. Similar to those of strychnia.

Form of exhibition. It may be given in pills, or in tincture, gradually increasing the dose. For medical use the brucia obtained from the bark of the brucea anti-dysenterica should be used, as that obtained from nux vomica is apt to be mixed with strychnia, which increases its power, and prevents us from calculating its effects. In cases of paralysis Andral has given it in doses of from half a grain to 5 grains.

Majendie has given it with success in two cases of atrophy, one of the arm and the other of the leg. The patients took six pills daily of one-eighth of a grain each.

Pills of Brucia.

Take of very pure brucia, 12 grains.
conserve of roses, $\frac{1}{2}$ drachm.
Mix carefully, and divide into 24 equal pills.

Tincture of Brucia.

Take alcohol at 36°. 1 ounce.
brucia, 18 grains.

Dose. From 6 to 24 drops, in any ordinary vehicle.

MORPHIA, AND ITS SALTS.

Mode of preparation. M. Robiquet employs the following method: He boils a highly concentrated solution of opium with a small quantity of magnesia (10 grammes to each pound of opium,) for a quarter of an hour. There is formed a considerable greyish deposit, which he filters, and washes with cold water. After carefully drying the precipitate, he treats it with diluted alcohol, which he allows to macerate for some time at a heat below ebullition. In this way he takes up but very little morphia, and much colouring matter. He then filters and washes it with a little cold alcohol. The deposit is again taken up by a larger quantity of rectified alcohol, well boiled. He again filters the liquor whilst still boiling, and on cooling he obtains the morphia, which he divests of the colouring matter by repeated crystallization.

Properties. Inodorous; colourless or pure white; taste intensely bitter; crystals small, rectangular, four-sided prisms; sparingly soluble in water and cold spirit of wine.

Composition. According to the analysis of Dumas and Pelletier, 100 parts consist of carbon, 72.02. Hydrogen, 7.61. Azote, 5.53. Oxygen, 14.84.

Operation. From the very sparing solubility of morphia, its narcotic effects (which experiment proves it to possess) are not at all so obvious, as when by combining with acids it forms neutral salts, which, from

their greater solubility, evince such marked narcotic powers. The principal salts of morphia are the acetate and sulphate.

Preparation of the Acetate of Morphia.

This salt is formed by directly combining in a capsule the acetic acid and the morphia, and then slowly evaporating to dryness. The difficulty of obtaining it in crystals, by reason of its extreme deliquescence, has led to the adoption of this mode of preparation. The acetate is also obtained by dissolving the morphia in alcohol, filtering the solution, saturating the liquor with acetic acid, and then evaporating, so as to reduce all to dryness; but the acetate thus obtained is not exactly acetate of morphia, but acetate with excess of base, as may be seen by attempting to dissolve it in water; one part of the acetate is undissolved, which is in fact morphia not entirely saturated with acetic acid.

Preparation of Sulphate of Morphia.

The morphia is dissolved in sulphuric acid previously diluted with water. The solution made hot, and evaporated to a certain point, crystallizes on cooling into silk-like tufts. This salt very much resembles the sulphate of quina, with which it might be confounded; but it becomes red when treated with concentrated nitric acid; a phenomenon which the sulphate of quina does not present.

To obtain the sulphate of morphia we may also dissolve the morphia with alcohol, and saturate with sulphuric acid; then by evaporating we obtain the sulphate of morphia crystallized in silky tufts. This sulphate is soluble in double its weight of distilled water.

Operation of the salts of morphia. They are powerfully narcotic and sedative, and used wherever opium is indicated.

Form of exhibition. These salts may be given in pills, electuaries, or draughts, in doses from $\frac{1}{4}$ grain to 2 or 3 grains in the 24 hours. Mr. Majendie has also prescribed them in syrups, according to the following formulæ:

Syrup of the Acetate of Morphia.

Take of simple syrup, 1 pound.
acetate of morphia, 4 grains. *M.*

Dose. A small tea-spoon full every three hours. Sleep has been often procured in a much smaller dose.

Syrup of Sulphate of Morphia.

Take of syrup, 1 pound.
sulphate of morphia, 4 grains.

Make a syrup.

Dose. Same as above.

This syrup is employed by M. Majendie, when the patient has become habituated to the action of the

syrup of the acetate. In general, by varying these salts of the alkaline remedies, their action on the animal economy is kept up for a considerable time, and that without augmenting the dose to too great an extent.

Solution of Morphia.

Take of acetate of morphia, 16 grains.
distilled water, 1 ounce.
acetic acid, 3 or 4 drops.
alcohol, 1 drachm.
The two latter are added to keep the salt in solution.

This solution is employed as a substitute for the liquid laudanum, Rousseau's drops, tincture of opium, &c. The dose is from 6 to 24 drops.*

The solution of morphia may be made by employing the sulphate instead of the acetate.

* The BLACK DROP, which it would appear owes its virtues to the acetate of morphia, is prepared as follows, according to the formula given by Dr. Armstrong: "Take half a pound of opium sliced; three pints of good verjuice (juice of the wild crab,) and one and half ounce of nutmegs, and half an ounce of saffron. Boil them to a proper thickness; then add a quarter of a pound of sugar, and two spoons full of yest. Set the whole in a warm place near the fire, for six or eight weeks; then place it in the open air, until it becomes a syrup; lastly decant, filter, and bottle it up, adding a little sugar to each bottle."

Battley's LIQUOR OPII SEDATIVUS also appears to owe its efficacy to the acetate of morphia.

Solution of Citrate of Morphia.

Doctor Porter of Bristol (United States) has introduced a modification of the black drop, of which the following is the formula:

Take of opium 4 ounces; crystals of citric acid 2 ounces; pound the entire well in a porcelain mortar; add a pint of boiling distilled water; mix carefully; macerate for 24 hours, and filter.

This preparation, to which Doctor Porter has given the name of *citrate of morphia*, on the supposition that it consists merely of citric acid and morphia, contains also some narcotine. In order to have it free from the presence of narcotine, pure morphia, or the extract of opium deprived of its narcotine, should be employed.

The American physicians who have employed Porter's preparation with success, state it to be more prompt in its effects, but less permanent than opium in substance or in tincture. They regard it as more active than opium; one part of the solution of the citrate being equivalent to about 3 parts of opium, in cases where a small quantity suffices to produce the desired effect; but when it may be necessary to give it in large doses, a double strength only should be calculated on. Lime water, solution of ammonia, &c., are incompatible with this preparation, as they would decompose the citrate.

Mr. Majendie proposes to substitute for Dr. Porter's formula the following:

Solution of Citrate of Morphia.

Take of pure morphia, 16 grains.
citric acid crystallized, 8 grains.

Dissolve in one ounce of distilled water, and colour the solution with two drachms of the alcoholic tincture of cochineal.

The dose is from 6 to 24 drops in the 24 hours.

Extract of Opium deprived of Morphia.

The process just described under the article MORPHIA does not entirely deprive the opium of this alkali; a certain quantity always remains in the residuum. Mr. Majendie, after several trials, ascertained that this residuum still possessed some narcotic powers, considerably less, however, than the common watery extract. Four grains of this extract do not appear equivalent to one of the common watery extract, or ¼ of a grain of Morphia.

NARCOTINE, OR SALT OF DEROSNE.

Mr. Majendie has not as yet decided on the virtues of this substance as an article of medicine. However, as it is one of the immediate principles of opium, he has given considerable attention to its physiological history. This substance given in the dose of a grain dissolved in oil, produces on dogs a state of stupor, which persons not accustomed to such experiments may easily confound with sleep; this state, however,

evidently differs from sleep : the eyes being open, the respiration not being so profound as in sleep, and it being impossible to arouse the animal from this heavy and stupid state. Death usually comes on in 24 hours. Combined with acetic acid, its effects are entirely different ; animals may bear strong doses of it, even 24 grains, without loss of life ; and whilst they are under its influence, they are agitated with convulsive movements similar to those produced by camphor ; there are the same signs of fright, the same movements backward, the same inability to move forward, in fine, the same frothing at the mouth, and the same agitation of the jaws, &c.

After combining the action of morphia with that of narcotine, Mr. Majendie has seen the two different kinds of effects of these substances take place at one and the same time on the same animal. He has put, for example, into the pleura of a dog, a grain of morphia and a grain of narcotine, dissolved in acetic acid ; the animal soon became drowsy, with intervals of real sleep, from the effects of the morphia ; but, at the same time, the stimulant effects of the narcotine were evident, and seemed to struggle in a very remarkable manner with the effects of the morphia. This struggle lasted for more than half an hour ; but at length the animal fell into a profound sleep, probably under the influence of the morphia.

Mr. Majendie conceives that the variable and seemingly opposite effects so frequently produced by opiates is attributable to the presence of these two principles.

This explanation is rendered still more probable by the circumstance, that persons who take morphia do not experience those stimulant effects caused by the watery extract of the shops, in which both narcotine and morphia co-exist.

The elementary composition of narcotine, according to Messrs. Dumas and Pelletier, is as follows:

Carbon, - -	68.88
Azote, - -	7.21
Hydrogen, - -	5.91
Oxygen, - -	18.00
Narcotine,	100.—

EXTRACT OF OPIUM,

Deprived of the Salt of Derosne.

Experience having proved that narcotine is injurious when not combined with an acid, and that it is excessively stimulant, when combined, Mr. Robiquet conceived the idea of preparing an extract of opium entirely divested of this substance, which possesses a decided advantage over the ordinary watery extract. This he does by treating the ordinary watery extract with ether, which not acting on the meconate of morphia, takes up all the narcotine, and deposits it in acicular crystals by evaporation.

Mode of preparing the Extract of Opium deprived of Narcotine.

Macerate crude opium in cold water; filter and evaporate to the consistence of a thick syrup; treat it in a suitable vessel with rectified ether; shake it frequently before decanting the ethereal tincture; after having separated it, submit it to distillation, in order to remove the ether; repeat this operation till for the residue of the distillation we shall obtain crystals of narcotine. When the ether ceases to act, evaporate the solution of opium to the consistence of pills.

The following modification of this formula has been suggested by M. Dublanc, junior :

Take 300 grammes of extract of opium, prepared in the cold, which are to be dissolved in 150 grammes of distilled water: this solution is to be poured into a retort, and on it 2000 grammes of pure ether; the apparatus is adjusted so as to receive the product of distillation, and a gradual heat is applied. After having drawn off about 500 grammes of ether, the apparatus is taken down, and the ether supernatant on the extract in the retort is to be quickly drawn off. The ether obtained by distillation serves to wash the extract whilst warm, and after these operations, evaporation is to be carried on to a proper consistence. Lest the ether decanted from the extract after the distillation may leave in the mass a little narcotine, the extract is made to dissolve in distilled water, and on filtering there are found in the filter small crystals of narcotine mixed

with a pulverulent extractive matter, insoluble in the small quantity of water employed to take up the extract; evaporation is then employed to restore to the extract its ordinary form. Thus obtained, the extract of opium may be regarded as entirely deprived of narcotine. It attracts powerfully the moisture of the atmosphere. It is easily dissolved in water, which it colours much less than the ordinary extract, without depositing any foreign matter. A digester may equally be employed to obtain by means of ether the extract of opium pure. This extract is employed as the common watery extract.

EMETINE.

Ipecacuanha consists of an oily matter, gum, starch, lignin, and a peculiar vegetable alkaline principle discovered in 1817 by M. Pelletier, called emetine. Of this substance ipecacuanha contains 16 per cent., and to it the emetine properties of the root are attributable. M. Boulay has found emetine in the *viola odorata*, and has called it *violine* or *indigenous emetine*.

Preparation of coloured emetine. The ipecacuanha must be reduced to powder, and treated with ether at 60°, to dissolve the fatty odorous matter; when the substance so pulverized no longer yields any thing to the ether, it is then treated with alcohol: then the alcoholic tinctures are to be placed in a water bath, and the matter to be re-dissolved in cold water. It then parts with some wax and a little of the fatty matter

which it still retained; nothing more then remains than to macerate it on carbonate of magnesia, by which means it loses its gallic acid, to take it up again by alcohol and to evaporate it to dryness.

Emetine thus prepared is not quite pure, though it may answer well enough as a medicine. It presents itself in the form of transparent scales of a reddish brown colour, with scarcely any smell, but a bitter, though not disagreeable taste.

Medical uses. The same as those of ipecacuanha. To procure vomiting, dissolve 4 grains in any proper vehicle, and give it in divided doses. If the entire were given at once, the vomiting excited would expel it entirely from the stomach, without its producing any further effect:

The following formula may be used:

Emetine Mixture.

Take of emetine,	4 grains.
weak infusion of orange,	2 ounces.
syrup of orange flower,	½ ounce.

Five drachms to be taken every half hour.

In chronic pulmonary catarrhs, hooping cough, chronic diarrhœas, the following lozenges may be employed with advantage, as a substitute for the common ipecacuanha lozenges:

Pectoral Lozenges of Ipecacuanha.

Take of sugar, 4 ounces.
coloured emetine, 32 grains.
To be formed into lozenges of nine grains each.

The emetine as above prepared not being pure, the following mode of procuring it is to be adopted :

To obtain pure emetine, we must substitute for the carbonate of magnesia, calcined magnesia, adding a quantity of this base sufficient to take up the free acid which exists in the liquor, and to seize on that which is combined with the emetine. The emetine, separated and rendered less soluble, is precipitated, and mixed with the excess of magnesia. The magnesian precipitate, mixed with a little very cold water, which seizes on the colouring matter not combined with the magnesia, must be carefully dried and treated with alcohol, which dissolves the emetine. This, obtained by the evaporation of the alcohol, must be re-dissolved in diluted acid, and treated with purified animal charcoal. After this operation, which is intended to remove all colouring matter, we are to precipitate by a a salifiable base. The different waters used in washing the magnesian precipitate still retain some emetine, which may be obtained by another series of operations.

Properties. White, pulverulent, permanent in the air ; little soluble in cold water ; much more so in hot water ; readily soluble in alcohol and ether ; taste slightly bitter.

Composition.	Carbon,	64.57
	Azote,	4.06
	Hydrogen,	7.77
	Oxygen,	22.95
	Emetine,	99.22

Medical uses. To produce vomiting, one grain of pure emetine, previously dissolved in a little acetic or sulphuric acid, may be mixed up with some drink: Or the following formula may be employed:

Emetic mixture.

Take of infusion of lime flowers,	3 ounces.
pure emetine dissolved in a sufficient quantity of acetic acid,	1 grain.
syrup of marsh mallow,	1 ounce.

The dose is five grains every quarter of an hour till vomiting is excited.

ALKALIES EXTRACTED FROM THE DIFFERENT SPECIES OF BARK.

The existence of a distinct vegetable principle in cinchona bark was first announced by Dr. Duncan, jun., in 1803, to which he ascribed the febrifuge virtues of that substance. To this he gave the name of *cinchonine.* Dr. Gomes of Lisbon, following up the inquiry, first procured cinchonine in a separate state;

but the discovery of its alkaline nature was made known, in 1820, by M.M. Pelletier and Caventou. These chemists have fully established, that the febrifuge property of bark is possessed by two alkalies, the *cinchonia,* or *cinchonine* of Dr. Duncan, and *quina,* both of which are combined with kinic acid. These principles, though resembling each other in many points, are distinctly different, standing in the same relation to each other as potassa and soda. The former exists in cinchona lancifolia, or pale bark, the latter in cinchona cordifolia, or yellow bark; whilst both are contained in cinchona oblongifolia, or red bark.

Preparation of cinchonia and quina. The cinchona is first deprived of all bitterness by boiling alcohol; then distillation is to be carried on to dryness in a water bath: the alcoholic extract is then entirely dissolved in boiling water strongly impregnated with muriatic acid. Calcined magnesia is to be added in a large quantity, in order to fix the entire of the red colouring matter, and to render the liquor clear, which is attained after some minutes boiling. It is then allowed to cool, thrown on a filter, and the magnesian precipitate washed with cold water; it is then to be dried by means of a stove, and treated for several times with boiling alcohol, until all the bitterness be removed; the alcoholic liquors are then mixed, and the cinchonia crystallises on cooling. The cinchonia thus obtained is still mixed with a green fatty substance, from which it may be freed by solution in a very diluted acid. If the acid were too strong, it would dissolve

a part of the fatty matter, and the end would not be accomplished.

The quina is obtained from the yellow cinchona by the same process as cinchonia from the grey.

Both quina and cinchonia have been found simultaneously in the three species of bark.

Properties of cinchonia. White, translucent, needle-form crystals; soluble in 700 parts of cold water. Dissolved in alcohol, or in an acid, it affords a very bitter taste, altogether like that of the grey bark.

The sulphate and acetate of cinchonia are employed in medicine; the first of these salts is very soluble in water; the second is much less so; but an excess of acid dissolves it easily enough.

Properties of quina. Quina is white: and though it did not appear capable of crystallizing by solution, yet M.M. Dumas and Pelletier succeeded in making it assume a crystalline texture by submitting it to igneous fusion in vacuo, and suffering it to cool gradually. In this case, instead of preserving its resinous aspect and its transparence, it contracts, becomes opake, and there are formed on its surface centres of crystallization, which radiate in all directions. The fracture of the mass is crystalline. Quina is equally insoluble in water as cinchonia; however its taste is much more bitter. Its salts also are, in general, more bitter. It is very soluble in ether, while cinchonia is slightly so, which enables us not only to distinguish those bases, but also to separate them, when united.

The mean composition of quina, according to Dumas and Pelletier, is:

Carbon, - - -	75.38
Azote, - - -	8.72
Hydrogen, - -	6.15
Oxygen, - - -	9.85
Quinine,	100.10

The composition of cinchonia, according to the same chemist, is:

Carbon, - - -	76.97
Azote - - -	9.02
Hydrogen, - -	6.22
Oxygen, - - -	7.97
Cinchonine,	100.18

Preparation of sulphate of quina. M. Henry, jun. has published a ready and cheap process for directly obtaining the sulphate of quina. He treats the bark several times (by the aid of heat) with water acidulated with sulphuric acid, in the proportion of 6 or 8 grammes to each kilogramme of distilled water; he then filters through close linen, blanches the liquors by means of quick-lime, and washes the precipitate for the purpose of separating the excess of lime. This being well drained, is digested repeatedly in alcohol, at 36°. The alcoholic tinctures are collected in the water bath of an alembic: distillation is then performed, for the purpose of collecting the spirit of wine, which serves for new operations; and there re-

mains a brown, viscid, bitter substance, a considerable portion of which is impure quina. This mass, exposed to heat, is treated with water sharpened with sulphuric acid, passed through filtering paper, and the liquor, when cooled, affords crystals formed of sulphate of quina, which a second solution and crystallization will give perfectly pure.

The same mode of preparation has been used to extract from grey bark the sulphate of cinchonia. It has not succeeded so well.

The sulphate of quina thus obtained presents itself under the form of white crystals, completely soluble in water, and more so in boiling water, particularly if slightly acidulated.

Besides the sulphate, a supersulphate of quina has also been obtained in solid transparent prisms, of a flattened quadrangular form, distinctly terminated, and soluble even in the cold.

There is also an *acetate of quina*, remarkable for the facility with which it crystallizes.

Operation and uses. The sulphate of quina acts as a tonic, aud is found the most useful of all the salts of bark, particularly in intermittent fevers. In prescribing this medicine care should be taken not to combine it with substances, that form insoluble compounds with it. Thus the infusion of roses, which is so frequently directed as a vehicle for it, is objectionable, on account of the astringent matter it contains, and which therefore precipitates the quina from its solution.

Dose of the sulphate, from 1 grain to 5.

M. Majendie has given the following formula for the preparation of a *syrup of quina.*

Syrup of Quina.

Take of simple syrup, 2 livres.
sulphate of quina, 64 grains.

Six doses of two spoons full each are commonly sufficient to arrest intermittents.

Quina Wine.

Take of good Madeira wine, 1 litre.
sulphate of quina, 12 grains.

Tincture of Quina.

Take of sulphate of quina, 6 grains.
alcohol at 34°. 1 ounce.

Dose. ʒ i. to ʒvi.

PREPARATIONS OF CINCHONIA.

Syrup of Cinchonia.

Take of simple syrup, 1 livre.
sulphate of cinchonia, 48 grains.

This syrup may be employed in the same dose, and under the same circumstances, as the syrup of quina.

Wine of Cinchonia.

Take of Madeira wine, 1 litre.
sulphate of cinchonia, 24 grains.

Tincture of Cinchonia.

Take of sulphate of cinchonia, 12 grains.
alcohol at 34°. 1 ounce

Several distinguished physicians have recommended the combination of bark with opium in the treatment of obstinate intermittents. This combination is particularly useful when the irritation of the stomach causes the bark to be rejected. Though this combination has become less necessary since the introduction of the sulphate of quina into practice, still there are circumstancs where sulphate of quina may be with advantage joined with opium, or, what is better, with morphia. M. Majendie has seen intermittent fevers, which had resisted the use of the sulphate of quina, cured by its combination with opium. Fifteen or twenty grains of the sulphate of quina has been combined with two or three grains of opium, and divided into doses, and administered during the intermissions, by which treatment intermittent fevers of great severity and long standing have been cured without fail, except in those cases where organic lesion may have existed.

M. Majendie combines the sulphate of morphia with the sulphate of quina, according to the following formula:

Take of sulphate of quina, 2 to 6 grains.
sulphate of morphia, $\frac{1}{2}$ to 1 grain.
Divide this into from two to four doses.

Sulphate of quina has also been combined with tartar emetic in the cure of intermittents, as in the following formula:

Take of tartarized antimony, 3 grains.
sulphate of quina, 10 grains.
Mix carefully, and divide into six equal parts.

M. Gola, who introduced this combination, gives one dose every two hours during the apyrexia. He states, that the first dose sometimes produces vomiting of bitter substances, sometimes alvine evacuations; sometimes no evacuation takes place, but the fever always ceases.

VERATRIA.

For our knowledge of this substance we are indebted to M.M. Pelletier and Caventou, who discovered this new alkali in the *veratrum sabadilla, veratrum album,* or white hellebore, and the *colchicum autumnale,* or meadow saffron.

Mode of preparing veratria. The seeds of the sabadilla are to be treated several times with boiling alcohol. These tinctures, filtered whilst nearly boiling, deposit on cooling whitish flakes of wax: the matter dissolved, being brought to the consistence of extract, is again to be taken up by cold water. There then remains on the filter a small quantity of fatty substance; the solution is then allowed to evaporate slowly. There is formed an orange-yellow precipitate, which presents the character of the colouring matter found in almost all woody vegetables. There is then to be poured into the liquor, which is still highly coloured, a solution of

acetate of lead: there forms immediately a new precipitate of a yellow colour, and very abundant, which is separated by filtration. The liquor, now become nearly colourless, still contains, among other substances, the acetate of lead, which has been added in excess. The lead is separated by means of a current of sulphuretted hydrogen: the liquor is then to be filtered and concentrated by evaporation, then treated with magnesia and filtered anew. The magnesian precipitate is treated with boiling alcohol. The alcoholic liquors give, on evaporation, a pulverulent substance, very acrid, exhibiting all the characters of an alkali. This substance is at first yellowish: by repeated solutions in alcohol, and precipitations effected by pouring water into the alcoholic solution, it is ultimately obtained under the form of a very white and perfectly inodorous powder.

Chemical composition. Carbon, 66.75. Azote, 5.04. Hydrogen, 8.54. Oxygen, 19.60.

Operation and medical uses. This medicine, whose action is chiefly directed to mucous surfaces, exciting violent sneezing, when applied to the membrane of the nose, and excessive vomiting and purging, when taken into the alimentary canal, is particularly indicated in those cases requiring prompt action of the intestines, and has been given with great advantage to old persons, in whose large intestines there were large accumulations of fæces.

Form of exhibition. This medicine may be given in pills according to the following formula:

Take of veratria, ½ grain.

Gum arabic and syrup, sufficient to make six pills.

One of these pills to be taken, and if purgative effects do not follow, they may be given to the extent of three in the course of the day.

Tincture of Veratria.

Take of veratria, 4 grains.
alcohol, 1 ounce. *Mix.*

This solution may be given in the dose of 10, 15, 20, or 25 drops in a cup of any drink: it may be employed with advantage internally instead of the tincture of colchicum, in dropsy, leuco-phlegmasia, and anasarca; externally in frictions, in these same diseases, and in gout.

Solution of Veratria.

Take of sulphate of veratria, 1 grain.
distilled water, 2 ounces.

This may be substituted for the eau medicinale of Husson.

Ointment of Veratria.

Take of veratria, 4 grains.
axunge, 1 ounce.

This ointment may be employed externally in cases of chronic rheumatism, anasarca, and in gout.

PRUSSIC ACID.

Prussic acid was first discovered by Scheele, in 1782. It was first introduced into medical practice by M. Majendie. M. Gay Lussac first procured it in a state of purity, the substance procured by Scheele being but a solution of the acid in water. As this medicine has now obtained a place in the last edition of the Dublin Pharmacopœia, I shall substitute the mode of preparing it as therein given for that in the Formulary of M. Majendie.

Mode of preparing Prussic Acid.

Take of cyanuret of mercury,		1 ounce.
	muriatic acid, *by measure,*	7 drachms.
	water, *by measure,*	8 ounces.

Distil eight ounces *by measure* from a glass retort into a cold receiver. Preserve the acid in a well-stopped vessel, in a cool and dark place.

The specific gravity of this acid is to that of distilled water, as 998 to 1000.

Properties. This acid is colourless, transparent, with the odour of bitter almonds; taste at first bland, then pungent and acrimonious; very volatile; decomposed by high temperature and light. One part of the pure Prussic acid to eight and half times of water constitutes the medicinal Prussic acid of M. Majendie.

Operation and medical uses. Narcotic and sedative, and has been found of great efficacy in spasmodic cough; also in chronic catarrh: likewise in dyspeptic

cases, attended with heart-burn, it has been given for the purpose of diminishing the morbid irritability of the stomach, and thereby causing its juices to be more slowly secreted, and of a more healthy character.

Dose and Form of exhibition. Dose, a quarter of a drop to two drops, in any vehicle, as distilled water, camphor mixture, &c.

The following are the formulæ most generally employed by M. Majendie in administering this medicine:

Pectoral Mixture.

Take of medicinal Prussic acid, 1 drachm.
distilled water, 1 pint.
white sugar, 1½ ounce.

A desert spoonful night and morning.

Care should be taken to shake the mixture well before using it, as the acid floats on the surface of the water.

Pectoral Potion.

Take of infusion of ground ivy, 2 ounces.
medicinal Prussic acid, 15 drops.
syrup of marsh mallows, 1 ounce. *M.*

Dose. A desert spoonful night and morning.

Syrup of Prussic Acid.

Take of simple syrup, 1 pound.
medicinal Prussic acid, 1 drachm. *M.*

This syrup is added to common pectoral drinks, and as a substitute for other syrups.

Mixture for Lotions.

Take of medicinal Prussic acid, 1 to 2 gros.
lettuce water, 1 *pinte.*

The quantity of the acid may be augmented from 2 to 4 *gros.*

This mixture is used as an external application in cases of herpes, cancerous ulcerations, and in preparing injections in cancer of the uterus.

CYANURET OF POTASSIUM.

As a Substitute for Prussic Acid.

M. M. Robiquet and Villerme have proposed the substitution of cyanuret of potassium for Prussic acid, as being more uniform in strength and less prone to decomposition, than the acid.

Mode of preparation. The process given by M. Robiquet consists in exposing to long continued heat ferruginous prussiate of potass. Thus the cyanuret of iron is completely decomposed, and that of potassium remains unaltered. The residue of this intense calcination consists of a solid, blackish, lamellated mass, which is cyanuret of potassium soiled by the iron and charcoal, which belonged to the cyanuret of iron. This mass is to be washed in water : it is allowed to deposit the iron and charcoal, whilst the cyanuret of

potassium is dissolved and changed into hydro-cyanate of potassa.

The cyanuret of potassium, dissolved in 8 times its weight of distilled water, is changed into hydro-cyanate of potass. The cyanuret, mixed with water in this proportion, may be called *medicinal hydrocyanate of potass.*

The dose and use of this substance are precisely the same as of the medicinal Prussic acid.

FORMULÆ.

Pectoral Mixture.

Take of medicinal hydro-cyanate of potassa, 1 gros.
distilled water, 1 livre.
purified sugar, 1½ ounce
Five *gros* to be taken night and morning.

Pectoral Potion.

Take of infusion of ground ivy, 2 ounces.
medicinal hydro-cyanate of potassa, 15 drops.
syrup of marsh mallows, 1 oz. *M.*
Five *grammes* every three hours.

Syrup of Hydrocyanate of Potass.

Take of simple syrup, 1 livre.
medicinal hydro-cyanate of potassa, 1 gros.

This syrup may be added to the common pectoral drinks, and serve as a substitute for other syrups.

CYANURET OF ZINC.

This has been employed in Germany instead of hydro-cyanic acid; it is considered to possess well-marked vermifuge powers. M. Pelletier prepares it by precipitating sulphate of zinc by hydro-cyanate of potass: thus there is formed a triple hydro-cyanate of zinc; which being dried and calcined at a dull red heat, is changed into cyanuret of zinc.

This preparation is to be given in the same doses as the cyanuret of potassium, commencing with one-fourth of a grain, and advancing gradually to a grain and a half. Great caution is necessary in its administration.

It is stated in Dr. Hufeland's Journal for 1823, that Dr. Henning has derived considerable advantage from the cyanuret of zinc, in cases where the hydro-cyanic acid is usually given; and particularly in the worm affections of children, he has given one grain of the cyanuret of zinc mixed with powder of jalap. He has also used it in nervous affections, and particularly in cramps, of the stomach. In these cases he prescribed the following mixture:

Take of cyanuret of zinc, 6 grains.
calcined magnesia, 4 grains.
canella powder, 3 grains.

This dose he directed to be taken every 4 hours.

He has also prescribed it in cases of dyspepsia and difficult menstruation.

SOLANIA.

This is the active principle of the *solanum dulcamara,* or *woody nightshade,* and was procured by Desfosses. It possesses distinct alkaline properties, and is found in the plant, combined with malic acid. Its medicinal powers have not yet been ascertained.

DELPHIA.

This was discovered in the *delphinium staphysagria,* or *stavesacre,* by M. M. Fenueille and Lassaigne; it possesses the general character of the vegetable alkalies. It has not been as yet tried as a medicine.

GENTIANINE.

This alkali was discovered in *gentiana lutea* by M. M. Henry and Caventou. M. Majendie has given the following forms for its exhibition:

Tincture of Gentianine.

Take of alcohol at 24°. 1 ounce.
gentianine, 5 grains. *M.*

Dose. From half a drachm to a drachm.

Syrup of Gentianine.

Take of simple syrup, 1 livre.
gentianine, 16 grains.

Dose. From a drachm to three drachms.

M. Majendie considers this one of the best bitters n scrofulous cases.

IODINE.

This principle was discovered in the year 1812, by M. Courtois, a manufacturer of saltpetre at Paris, in the mother-waters of the soda of sea-weed. It may be obtained from most of the fuci which grow on the sea-coast, and, according to Fife, from sponge.

Mode of preparing it. It exists in the mother-waters of soda, prepared from sea-weed, where it is found combined with hydriodic acid. These waters are obtained by burning the fuci growing on the sea-coast of Normandy, draining the ashes and concentrating the liquor. To obtain the iodine, an excess of concentrated sulphuric acid is poured into these waters, and the liquor is brought to a state of boiling, by degrees, in a glass retort furnished with a receiver. The sulphuric acid seizes on the base of the hydriodate, and on the hydrogen of the hydriodic acid, so that the result is sulphate of potass, water, sulphurous acid, and iodine, which rises in the form of violet-coloured vapours, passes into the receiver with a little of the acid, and there condenses in this state. In order to purify it, it must be washed, mixed with water, containing a little potass, and distilled anew.

Properties of iodine. Crystals small; at the ordinary temperature, solid: in colour and general aspect resembles black lead: fuses at 338°. Fahr.: volatilizes at 347°. Fahr. producing a violet-coloured vapour.

Soluble in ether and alcohol. Water dissolves only $\frac{1}{7000}$ of its weight.

Operation and uses. Stimulant, absorbent, and emmenagogue; has been given with marked advantage in bronchocele and other glandular swellings, both in Switzerland and France.

Iodine has likewise been employed with equal success in the treatment of scrofula. In the Report of the Polyclinical Institute of Berlin for the years 1820, 1821, 1822, M.M. Hufeland and Osan, after reporting favourably of the efficacy of the tincture of iodine, and of hydriodate of potassa in the cure of goître, add, that they have employed the same preparations with advantage in scirrhus and cancer of the uterus. We have an account of a white swelling of the knee, where the patient could not walk without crutches, effectually cured by iodine given internally, and rubbed in the form of ointment externally. Dr. Guerdner has recorded cases of scrofulous and tuberculous affections of the thorax and abdomen greatly benefited by this medicine. Dr. Baron appears to have employed this medicine with some success in the treatment of scrofulous phthisis, and with still more decided benefit in a case of encysted dropsy of the ovary. Dr. Coindet praises iodine as a powerful emmenagogue. Professor Brera records several cases of indurated glands, tabes mesenterica, chronic dysentery, and hemoptoe, supervening to suppressed menstruation, laryngeal phthisis, leucorrhœa, syphilitic enlargements, as having been also cured by it.

MEDICINAL EMPLOYMENT OF IODINE.

Tincture of Iodine.

Take of alcohol, 1 ounce.
iodine, 48 grains.

Dose. From 4 to 10 drops three times a day, in a glass of pure water.—20 drops contain about one grain of iodine.

Iodurettted Sulphuric Ether.

Take of sulphuric ether, 1 gros.
pure iodine, 6 grains.

Thirty drops contain one grain of iodine.

Dose, 10 drops.

Solution of Hydriodate of Potass.

Take of hydriodate of potass, 36 grains.
distilled water, 1 ounce. *M.*

Dose. From 10 to 20 drops.

Ointment of Hydriodate of Potass.

Take of hydriodate of potass, $\frac{1}{2}$ gros.
axunge, $1\frac{1}{2}$ ounce.

Mix.

This has been found serviceable, when rubbed to the extent of half a gros twice a day, in cases of glands enlarged from scrofula. Also, in cases of enlarged testicle which had resisted every other means.

Dr. Uré* recommends friction, with the following preparation, as a substitute for the preceding:

Ointment of Iodate of Zinc.

Take of iodate of zinc, 1 gros.
axunge, 1 ounce. *Mix.*
A gros to be rubbed on the tumour twice a day.

IODURETS OF MERCURY.

The proto-ioduret of mercury, which has been employed in syphilis, is prepared by dissolving 100 parts of crystallized proto-nitrate of mercury in 400 parts of water. There is then poured into the filtered solution a solution of hydriodate of potass, which is added, till there is no farther precipitation; a greenish-yellow precipitate is then obtained, which is pulverulent: this is thrown on a filter, then carefully washed with distilled water, until the water which comes from it no longer yields a black precipitate with potass. This is then dried, and kept in a close vessel shaded from the sun's rays. This is a proto-ioduret, yellow, insoluble in water, and exerts no action on it: it is volatile: according to Thomson, 162 parts contain 62 parts of iodine and 100 of mercury.

Mode of preparing the deuto-ioduret of mercury. This is prepared with corrosive sublimate, 70 parts, and 100 parts of hydriodate of potash. Each is dis-

* Dict. of Chemistry, 2d Edition.

solved separately in distilled water. The two liquors are filtered and added together in small quantities; there is immediately precipitated a red powder, which is collected on a filter, and very carefully washed with distilled water, until the water that passes through the filter has no longer any taste. The precipitate is then dried, reduced to powder, and put into a bottle, which is kept from the sun's rays.

MANNER OF EMPLOYING THE IODURET OF MERCURY.

Ointment of the Proto-ioduret of Mercury.

Take of proto-ioduret of mercury, 20 grains.
axunge - - - 1½ ounce. *M.*

This is said to accelerate the cicatrization of inveterate venereal ulcers.

Ointment of the Deuto-ioduret of Mercury.

Take of the deuto-ioduret of mercury, 20 grains.
axunge, - - - 1½ ounce. *M.*

This being more active than the preceding, is to be used in less quantity.

Alcoholic solution of Deuto-ioduret of Mercury.

Take of alcohol, 1½ ounce.
deuto-ioduret of mercury, 20 grains. *M.*

Twenty-six drops of this solution correspond nearly to ⅛ grain of the deuto-ioduret of mercury. It is given in the dose of 10, 15, or 20 drops, in a glass of distilled water. It has been extolled in scrofulous affections combined with syphilis.

Pills of the Deuto-ioduret of Mercury.

Take of deuto-ioduret of mercury, 1 grain.
extract of juniper, 12 grains.
liquorice powder, a sufficient quantity. *Mix.*

Divide into 8 pills: to be taken at first two in the morning and two at night. *Dose* to be augmented to four in the morning and four at night.

Pills of Proto-ioduret of Mercury.

Take of proto-ioduret of mercury, 1 grain.
extract of juniper, 12 grains.
liquorice powder, a sufficient quantity. *Mix.*

Divide into 8 pills.

Dose to be regulated as in the preceding.

LUPULINE.

The existence of this substance was first noticed in the *humulus lupulus* by M. Ives of New York. It has been since described in France.

It presents itself in the form of small, shining, yellowish grains, which cover the base of the strobiles of the hop. It is of a golden yellow, pulverulent, and of aromatic odour.

With respect to its action on the system, M. Ives regards it as aromatic, tonic, and narcotic.

MEDICINAL EMPLOYMENT.

Powder of Lupuline.

Take of lupuline, 1 part.
white sugar, powdered, 2 parts.

First bruise the lupuline in a porcelain mortar, and add the sugar gradually. Mix carefully.

Pills of Lupuline.

Take of lupuline any quantity: beat well into a pillular mass, and divide into pills.

Tincture of Lupuline.

Take lupuline, bruised, 1 ounce.
alcohol, 2 ounces.

Digest for 6 days in a close vessel; strain; express it strongly; filter, and add as much alcohol as may give 3 ounces of the tincture.

The dose of lupuline has not as yet been settled with any degree of precision by practitioners.

CROTON OIL.

The mode of preparing this oil in India is not known. It would appear, however, to be obtained by expression or by boiling. By digesting in sulphuric ether 100 parts of the bruised kernels, placing the whole on a filter, carefully covered during the whole continuance of the filtration, and washing the residuum

with a sufficient quantity of ether, Dr. Nimmo of Glasgow found that there remained forty parts, and that sixty had been dissolved. In this way, from 300 grains of the seeds, from which 108 are to be subtracted for the envelope, which will leave 192 grains of the kernels, he procured two drachms of an oil, which had the taste and medicinal properties of common croton oil.*

According to Dr. Nimmo, the activity of croton oil seems to depend on an acrid resinous principle, soluble in ether, alcohol, and the fixed and volatile oils.

From his experiments, 100 parts of the kernels of the *croton tiglium* contain of acrid principle 27 ; fixed oil, 33 ; farinaceous matter, 40. 100 parts of the croton oil contain of acrid principle 45, and of fixed oil 55.

Properties. Colour, pale brownish yellow ; inodorous ; taste, hot, biting, and very permanent.

Operation and uses. Drastic; purgative : its action is very quick, coming on frequently in half an hour. This oil may be employed as an ordinary purgative, when there exist no symptoms of irritation about the stomach or intestinal canal ; it is more particularly indicated, when ordinary purgatives have failed in apoplexy, dropsy, or where mechanical or other obstacles prevent their action. It may be given in doses of one, two, or three drops, in half an ounce of spirit of gum. It may also be given in the form of pill.

* It is now ascertained, that the oil examined by Dr. Nimmo was the oil of *Iatropha curcas*, not croton oil. This error arose from confounding the seeds of the *Iatropha* or *Physic nut* with those of *Croton tiglium*.

Soap of the Oil of Croton.

In consequence of the inconvenience arising from the variation in the size of drops, M. Caventou has prepared a soap with soda as the base, in the following manner: he triturates two parts of oil and one part of liquid caustic soda. When the combination has acquired sufficient consistence, it is poured into paste-board moulds, and, after some days, the soap is taken out in slices, and kept in a well-stopped bottle with a large mouth. This soap is given in doses of from 2 to 3 grains in a little water or sugar, or in pills. The purgative effect is the same as that of the oil of croton.

PIPERINE.

This substance was discovered in black pepper by M. Oerstadt. It is obtained by digesting the grains of black pepper in alcohol raised to ebullition, suffering this to rest and cool, then decanting and repeating the operation with fresh alcohol. The two solutions are then to be mixed; to these are added distilled water, with hydrochloric acid; by this a deposit is formed, on the separation of which very beautiful crystals may be collected on the filter and sides of the vessel; these are the piperine. This is said to have been attended with considerable success in the treatment of intermittent fever. Dr. Meli seem to consider it more certain and more prompt than the sulphate of quina. From its greater activity it must be given in smaller doses.

UREA.

Urea, a proximate principle of the urine of mammiferous animals, was discovered by Rouelle Cadet, and studied in most of its properties by Fourcroy and Vauquelin.

Mode of obtaining it. According to M. Thenard, the following process is the best: Treat urine, evaporated to the consistence of a syrup by its volume of nitric acid at 24°; shake the mixture, and place it in an ice-bath, in order to harden the crystals of the acid nitrate of urea; wash them in water at 0; drain and press them between two sheets of filtering paper; when they are thus separated from foreign matters, dissolve them in water, and add to the solution subcarbonate of potass, which takes up the nitric acid, and sets the urea at liberty. Evaporate this new liquor by a gentle heat nearly to dryness; treat the residue with very pure alcohol, which dissolves only the urea; concentrate the solution, and the urea crystallizes.

Properties. The purest urea that can be obtained presents itself under the form of elongated and brilliant lamellæ; it is colourless, transparent, of a fresh and sharp taste, and of a smell similar to that of urine. It is soluble in water and in alcohol.

Composition. Oxygen, 28.5. Azote, 32.5. Carbon, 14.7. Hydrogen, 11.8.

Mode of action. Diuretic. It may be given in the dose of a scruple in distilled water, sweetened with sugar. The dose may be carried so far as two or three drachms.

OIL OF THE EUPHORBIA LATYRIS.*

The *Euphorbia Latyris,* known by the name of spurge, is an indigenous annual plant. It contains, like all the *Euphorbiæ,* an irritating and caustic juice.

Process for obtaining the oil. When the seeds of the *Euphorbia Latyris* are quite ripe, they are to be dried and separated from the black seeds, which become rancid; the oil is obtained by simple pressure: 14 ounces of seeds give 6 ounces of a very pure oil.

Properties. This oil very much resembles castor oil: it has the same colour; has somewhat less density; it is devoid of odour; is not acrid, nor has it an unpleasant flavour; it is very clear.

Operation and use. This oil is purgative, and is very certain and quick in its effects: The dose is from 4 to 8 drops; water, sweetened with sugar, forms a very good vehicle for it.

THRIDACE,† OR LACTUCARIUM.

The *lactucarium* of Dr. Duncan of Edinburgh, such as is prepared by M. Probart of London, and the

* *Giornale di Farmacia Chimica. Anno* 1824. *f.* 553. Dr. Carlo Calderini has obtained from it an oil which may be substituted with advantage for that of the *Croton tiglium,* and which, as the latter, acts in a very small dose. This oil is derived from the seeds.

† Θριδαξ, *lactuca.*

thridace of Dr. Francois, are nothing more than the white viscous juice of the garden lettuce (*lactuca sativa hortensis,*) extracted without heat at the period when the plant flowers.

Mode of preparing. Dr. Duncan has pointed out, in the Memoirs of the Caledonian Horticultural Society, different modes for obtaining the juice of the lettuce, which he has called *lactucarium:* he advises that it be received on cotton, sponges, or brushes, as it flows when the stem of the plant has been wounded; but M. Probart, chemist in London, has made experiments on a larger scale, the results of which are stated in the Pharmacologia of Dr. Paris, who thus describes the process as communicated to him by M. Probart: "I have," says M. Probart, "the cos lettuce planted about eight inches asunder in rows, between which there is sufficient space to enable persons to pass up and down without injuring the plants. I commence my operations just before the plant is about to flower, by cutting off an inch of the stem: the milky juice immediately exudes, and is collected on pieces of wove cotton about half a yard square. As soon as this becomes charged, it is thrown from time to time into a vessel containing a small quantity of water, which, when sufficiently impregnated, is evaporated at the common temperature of the atmosphere, by exposure in a number of shallow dishes. The *lactucarium,* in a few hours, is found adhering to the vessels in the form of an extract, but differing from every other in all its sensible properties: this method en-

ables me to collect *lactucarium* with great facility and despatch, but it is still attended with considerable expense, as the proportion of milky product is necessarily very small, and the price of the medicine consequently high, and therefore not within the reach of general practice. This consideration led me to make farther experiments, for the purpose of ascertaining whether an extract might not be obtained from the plant, possessing all the properties of *lactucarium*, when administered in large doses, and which could be introduced at a comparatively trifling cost. In prosecuting this inquiry, I found that the plants contain most of the milky juice, when they have flowered, and the leaves are beginning to assume a yellow hue; and I observed, that when cut down, the milky juice assumes, for the most part, a concrete form, having subsided in the bark of the stalk and in the old leaves, a circumstance, which accounts for the extreme bitterness of these parts. I was naturally led, from these circumstances, to choose the above period for my operations, and to select those parts only of the plant for my extract, rejecting the substance of the stalk, and the young sprouts. My method of procuring the extract is as follows: I first macerate the parts in water for twenty-four hours, and then boil them for two, after which I allow the clear decoction to drain through a sieve, without using any pressure; this is then evaporated, as far as it can be done with safety, and the process is finished in shallow dishes, in the manner above described, for obtaining *lactucarium*. This ex-

tract, which I have called "EXTRACTUM LACTUCÆ CONCENTRATUM," is of course less powerful than Lactucarium, but it possesses all the properties in larger doses, and it has been found equally useful in a number and variety of cases: a concentrated tincture is also prepared from the juice of the lettuce."

M. Caventou adopts the following process for the purpose of obtaining thridace: he gathers the lettuce immediately before flowering; he strips off the leaves, bruises the stalks lightly, then presses them for the purpose of extracting the juice. When this has been obtained, it is evaporated at a temperature not exceeding 30 or 35 degrees, to a suitable consistence. This medicine is narcotic and sedative, and has been administered with advantage in cases of rheumatism and phthisis, in doses of from 2 to 4, 6, or even 8 grains a day, divided into 2, 3, or 4 doses. It has an obvious advantage over opium, inasmuch as it is not observed to produce the narcotism, stupor, constipation, and other bad effects so frequently induced by the different preparations of opium.

SALTS OF GOLD.

Dr. Chrestien, of Montpellier, first called the attention of physicians to the preparations of gold, as medicinal agents, in 1810. Since that period, other physicians have used them, but not with the same success. There are four preparations of gold at present employed in medicine: 1. the chloruret or muriate of

gold; 2. the chloruret or muriate of gold and soda; 3. the oxide of gold; 4. the oxide of gold by tin, or *purple of Cassius.*

Mode of preparing the Chloruret of Gold, or Muriate of Gold.

Take one part of fine beaten gold; cut it into small bits, and put them into a white glass phial; pour on it three parts of *aqua regia* (consisting of one part of nitric acid and two parts of hydrochloric acid) and heat the entire on a very small sand bath. The solution of the gold will be soon effected. The liquor is to be evaporated till the odour of chlorine begins to be perceived, which indicates a commencing decomposition of the chloruret formed. Then remove the vessel from the fire and let it cool. The chloruret readily assumes the form of a crystalline mass, presenting a great number of beautiful yellow crystals. In this state the chloruret of gold is as pure as we can desire. It may be preserved in the same phial in which it was prepared, merely covered with paper, without there being any occasion to apprehend its suffering alteration.

Properties. The chloruret of gold is always very acid, nor does it owe this property to a foreign acid, but to itself. Taste, styptic and disagreeable; very soluble in water, to which it imparts a beautiful yellow colour. Two parts of gold ought to afford three parts of chloruret.

The chloruret or muriate of gold and soda is pre-

pared by dissolving four parts of gold in aqua regia, evaporating the solution to dryness; pouring on the product thirty-two parts of water with one part of chloruret of sodium, and concentrating the liquor to one half its weight, there are then obtained, on cooling, crystals composed of 69.3 of chloruret of gold, 14.1 of chloruret of sodium, and 16.6 of water. Similar observations have been made on chloruret of gold and of potassium.

These double salts are of a beautiful yellow colour, presenting the form of long quadrangular prisms: they attract moisture, though in a less degree than the acid chloruret.

Mode of preparing the Oxide of Gold.

Process of the Codex. Take any quantity of chloruret of gold prepared in the way above described; dissolve it in 7 or 8 times its weight of cold distilled water, and put the entire into a white glass phial, or into a matrass, if acting on very large quantities. Then add to the liquor some carbonate of potass crystallized, or dissolved in a little water, until all effervescence shall cease; raise the liquor to a temperature near ebullition; a very abundant precipitate of a gelatinous appearance will form; let the liquor cool and filter; wash the precipitate with water, until the washings no longer afford any sensible precipitate on adding a solution of nitrate of silver; you may then be certain that the precipitate is sufficiently washed. Remove the oxide from the filter, and dry it at the temperature of water raised to

60 or 70° R. and preserve it in a well stopped bottle in a cool dark place.

The liquor in which the precipitate is formed, as well as the washings, still contain much gold; this metal may be precipitated by pouring into it a sufficient quantity of proto-sulphate of iron.

Properties of the oxide of gold. The oxide of gold in the state of *hydrate* is yellow, but when dried, it is of a violet colour, nearly black. Whatever precautions may have been used in drying it, it is never entirely dissolved in the hydro-chloric acid; it always leaves a residue, very weak to be sure, but arising from hence, that in drying it, one part of the oxide of gold is reduced to the metallic state. Sulphuric and nitric acid, whether diluted or not, have no action on the oxide of gold. This property might serve to separate oxides of the same colour, which may have been mixed with it.

Preparation of the Oxide of Gold by Tin.

Dissolve any quantity of the chloruret of gold in sixteen times its weight of cold distilled water; prepare a weak solution of proto-hydrochlorate of tin, *acidulated with hydro-chloric acid.* Add this gradually to the former liquor, until it ceases to throw down any precipitate; filter the liquor, and wash the precipitate well with boiling water, until the washings no longer precipitate the nitrate of silver. Then dry this precipitate at the temperature of boiling water, and this will be the *purple of Cassius.* This appears to be a combination of deutoxide of tin and of metallic gold.

Action of the Salts of Gold on the Animal Economy.

According to the experiments of Orfila, very small quantities of the muriate of gold, (from three-fourths of a grain to two grains), dissolved in a little water, being injected into the jugular veins of several dogs, uniformly produced, in all, the following symptoms: Difficult and sonorous respiration; dyspnœa; suffocation; slight vomiting; all progressively increasing in severity, and ultimately terminating in death. On opening the bodies of these animals, the effects of the salt were found directed to the organs of respiration and circulation. On introducing this substance into the stomach of several dogs, in doses of from 3 to 10 grains, these animals lingered for a few days, and then died. The muriate of gold in these cases was found to have acted in the manner of all corrosive poisons, producing inflammation, ulceration, and, in some cases, suppuration in the mucous membrane of the stomach.

Cases in which the Preparations of Gold have been administered. Before the time of M. Chrestien, the preparations of gold were used in medicine; they had even been recommended, in cases of syphilis, by Gabriel Fallopius: M. Chrestien, however, has extended this medicine to the treatment of diseases of the lymphatic system; he has given it in cases of scrofula, goître, herpetic eruptions, scirrhus, and even tubercular phthisis. Lalouette, in his Treatise on Scrofula, commends the salts of gold. Their efficacy, however, has not been established by the testimony of other physicians. As an anti-syphilitic, this medicine has failed repeatedly.

Manner of employing. In consequence of the deoxidizing effects produced on the different preparations of gold by animal or vegetable substances with which they have been occasionally combined for medical administration, the mode of exhibiting these preparations now most approved of is that of friction on the gums, and the hydrochlorate of gold and of soda is that which is preferred. This is to be reduced to powder, and combined with fifteen, twelve, ten, eight, six, and even four times its weight of excipient; starch, powder of lycopodium, washed in alcohol, are the substances which have appeared best to preserve the salts of gold; decomposition takes place more or less readily with other powders, as those of liquorice, mallow, &c.

Friction with Muriate of Gold and of Soda.

M. Chrestien gives the following formulæ:

Take of muriate of gold and soda crystallized, 1 grain.
powder of lycopodium, - - - 2 grains.
Mix.

This quantity is to be divided at first into fifteen parts; then very gradually raise the dose, so as to give the one-tenth, or even the one-eighth of a grain.

This is to be applied once a day by friction on the tongue and gums.

It seldom happens, according to M. Chrestien, that more than four doses are required to cure the most severe syphilitic diseases.

Pills with Oxide of Gold.

Take of extract of the bark of the root of Daphne mezereon. } 2 *gros.*
oxide of gold by potass, 6 grains.

Mix carefully, and divide into sixty equal pills.

For the six grains of the oxide of gold one grain of the triple muriate may be substituted.

M. Chrestien recommends these pills in cases of scrofula and lymphatic obstructions; he commences by one a day, and gradually augments so as to give seven or eight a day.

Dr. Niel, who has written on the use of the preparations of gold, has recommended a particular method for their employment, when the state of the tongue or of the interior of the mouth does not admit of friction on these parts. The method is this: he removes the cuticle on one side of the neck by means of a small blister, and then dresses this part, night and morning, with the following ointment:

Take of axunge, - - - - half a *gros.*
gold divided by mercury, 1 grain. *Mix.*

He gradually increases the dose of the divided gold to two grains. For this the following ointment may be substituted:

Take of axunge, - - - - - half a *gros.*
muriate of gold and soda, one-tenth of a grain.
Mix.

SALTS OF PLATINA.

The processes for obtaining the salts of platina are precisely the same as those employed for the salts of gold. M. Cullerier, the uncle, has made some experiments with the hydro-chlorate of platina and soda, and the results are the same as those which the same salt has given with the gold base.

BARK OF THE ROOT OF THE PUNICA GRANATUM.

The decoction of the bark of pomegranate root has been much extolled and employed for the cure of tape-worm. The following is the mode of its administration: The evening previous to giving the decoction of the pomegranate root, the patient should take an ounce and half or two ounces of castor oil with equal parts of syrup of lemons. The patient is directed the use of gruel and a spare diet, until the following decoction be given:

Take of the fresh or dry bark of pomegranate root (*punica granatum*) bruised, - - - } 2 ounces.
common water - - - 2 livres.

Mix and macerate without heat for twenty-four hours; then boil gently, till it be reduced to one livre: strain.

This quantity of decoction is to be taken in three doses every half hour, or every three quarters of an hour.

Usually one hour, and seldom so long as two hours after the third dose, the tænia is brought away entire, wound up into a ball, and strongly knotted in many places. Even though the first and second doses should be rejected by vomiting, still the third dose must be taken. If the tænia should not come away entire, the decoction should be repeated the following day.

CHLORURETS OF LIME AND SODA.

Mode of preparation. Though the manner of preparing the chlorurets of soda and of lime has been long known, it may be useful to describe here the manner in which M. Labarraque prepares the chlorurets, in order to obtain uniformly the same compounds.

Chloruret of Soda. Dissolve five livres of pure carbonate of soda in twenty livres of distilled water, so that the liquor may give twelve degrees by the pèse-sel of Baumé. The liquor is put into a flask so large as that about a quarter of it may be empty: place on a sand-bath a glass balloon, containing four pints, having a long neck and a wide mouth, into which introduce 576 grammes of hydro-chlorate of soda, and 448 of peroxide of manganese. Lute to the mouth of the balloon a large curved tube, together with a tube in the form of an S, for the introduction of the weak acid: the first tube is put into a flask, containing a small

quantity of water, for the purpose of washing the gas, and from this flask proceeds a large curved tube, which is plunged into the vessel containing the saline solution.

The apparatus being suitably arranged, and the luting perfectly dry, pour into the tube S the diluted acid cold, and after being mixed for some time with water, in the following proportions: concentrated sulphuric acid 576 grammes, water, 448 grammes. The fire is then applied to the sand-bath, and the heat is continued until the chlorine ceases to be disengaged. The process being terminated, the strength of the product is examined. For this purpose, take a portion of the chloruret, and introduce it into the berthollimêtre, and pour on it some of the solution of the sulphate of indigo, prepared as follows: Of Bengal indigo, pulverised, one part; strong sulphuric acid, six parts; act on them by heat, and then dilute in 993 parts of distilled water. The chloruret ought to bleach 18 parts of sulphate; and in case the liquor should not be sufficiently saturated with chlorine, it is necessary to pass into it a current of this gas to the point which we have just mentioned.

Medical uses of the Chloruret of Soda. This preparation has been found very useful for the removal of general or local infection; thus carbuncle, hospital gangrene, obstinate venereal ulcers, have proceeded rapidly to cicatrization, under the use of the chloruret, diluted in ten or fifteen parts of water. M. Majendie has also prescribed a solution of the chloruret, and with

advantage, as a lotion in cases of cancer of the breast and of the uterus, by which means the fetor of the discharge, as well as the sufferings of the patients, were considerably diminished. In these diseases it has been found useful as a lotion, and in cases of sore throat and ulceration of the mouth as a gargle.

Mode of preparing the Chloruret of Lime. Take any quantity of quick-lime, and slake it by means of a small quantity of water. The moist powder is then mixed with a twentieth of its weight of hydro-chlorate of soda, and put into long earthen vessels, into which the chlorine enters. This gas is evolved from a mixture similar to that employed for the preparation of the chloruret of soda. Several sets of apparatus are placed by each other, according to the occasion, care being taken, however, that the chlorine enters slowly into each of them, in order that the combination may take place successively: this condition is essential to the success of the operation. The hydrate of lime being sufficiently charged with chlorine, becomes moist, and by this phenomenon we judge that the process is drawing to an end.

Use. The chloruret of lime has been employed with advantage as a disinfecting agent, under the same circumstances, and with the same happy results, as the preceding preparation.* For more ample information

* The compiler of these pages has seen the most striking advantages result from the internal use of the chloruret of lime in a case of gangrene of the lung, lately in the Meath Hospital, under the care of Doctor William Stokes.

regarding the use of the chlorurets in medicine, see Mr. Alcock's Essay on these preparations, also the various Medical Journals.

PHOSPHORUS.

Little notice was taken of phosphorus, as a medicine, previous to the year 1748. It was then noticed by Doctor Mentz, in a dissertation, entitled, " De Phosphori loco medicamenti, aliquot casibus singularibus confirmata, auctore J. Gabr. Mentz, Witteberg, 1751." A case is mentioned by this physician, wherein the greatest benefit resulted from the administration of this medicine to an individual, who at the close of a malignant petechial fever was attacked by an obstinate diarrhœa, accompanied with delirium and general prostration of strength; two grains of phosphorus were given, by means of which sleep and a gentle perspiration were produced. By continuing the medicine for a very short time all the functions were re-established, and the disease ceased. Other cases are also given by the same individual, wherein the patients, after an almost hopeless prostration of strength, were re-established in perfect health by the use of the same medicine. *The London Medical Review* for March, 1799, contains a report, made by a society of physicians in London on the medical properties of phosphorus. From this report it would appear, that this substance holds the first place among the alexiteria and alexipharmaca, and that it has been employed with success

in several cases, where the vital powers were nearly extinct. Great caution is at the same time recommended in the use of so active and powerful a medicine. In the *London Medical Repository* for March 1815, two observations are to be found, regarding the efficacy of phosphorus in palsy.

In the same year there appeared a work of Lobstein, intended to determine the diseases in which phosphorus and its preparations have been found useful. According to him, the diseases in which this substance may be administered with advantage, are ataxic and adynamic fevers, attended with great prostration of strength, obstinate intermittent fevers, rheumatic and gouty affections, suppression of the menses, chlorosis, &c.

On the Employment of Phosphoric Acid.

Phosphoric acid has also engaged the attention of several physicians, with regard to its medicinal virtues. Doctor Lentin has submitted to the Royal Society of Gottingen a memoir, entitled, *De Acido Phosphori cariei ossium domitore.* The author observes, that phosphoric acid constitutes the essential part of the bones, inasmuch as it exists in them as long as they preserve the solid form; and because, when they are dissolved by any chemical agent, the residue, after the decomposition, is found saturated with it. Hence he imagines, that this acid may be employed with advantage in caries of the bones. Accordingly, he applied

compresses, moistened with phosphoric acid, diluted with eight parts of distilled water, to ulcers situate over carious bones, renewed the dressings twice a day, and found in several cases marked advantage from the practice. The same physician found advantage from the internal use of the acid in phthisis pulmonalis, in the dose of 20 or 30 drops, in a glass of water, sweetened with sugar. Bertrand Pelletier relates the case of a man who, having been long addicted to excessive indulgence in venereal pleasures, shewed all the symptoms of tabes dorsalis: he commenced the use of a tisan prepared with phosphoric acid and honey, and in a very short time he recovered his strength, and gave himself up anew to the same pleasures and in the same excess as before.

Mode of preparing Phosphorus, and of administering it.

Bertrand Pelletier, who has made very extensive researches concerning phosphorus, gives the following directions for its preparation: he puts six grains of phosphorus, cut into small bits, into an *once* of sulphuric æther; the mixture is to be occasionally shaken for three or four days. The dose of this is from 10 to 15 drops in a glass-full of barley-water, or any proper vehicle, and given, so that from 120 to 150 drops may be taken in the space of three or four days. This quantity generally suffices for a cure.

This solution may be used in the way of friction, in cases which may seem to require it.

Mr. Lescot's process for preparing phosphorised aromatic oil is as follows:

Take of phosphorus, - - - - - 1 once.
oil of olives, or of sweet almonds, 1 livre.

Cut the phosphorus into very small pieces; introduce them into a flask with a ground stopper, and add the oil. Leave them in contact at the ordinary temperature in a dark place for fifteen days; decant and render it aromatic with the essential oil of bergamot; preserve for use in a well stopped flask, removed from the light.

This oil is administered internally in the dose of 25 or 30 drops in the twenty-four hours, in emulsions or mucilaginous drinks, for four or five days.

For external use, an ointment is made of it by mixing with it a proper proportion of axunge. It is employed in this state for four, six, eight or ten days in succession. It is not rare for this to become luminous during friction, if care be not taken to keep it in the dark.

ALKALINE DIGESTIVE LOZENGES, CONTAINING BICARBONATE OF SODA.

The experiments of several chemists have shewn that the gastric juices, poured into the stomach during digestion, are of an acid nature. Tiedeman and Gmelin, Prout, and others, have found this quality to

be owing to the presence of hydro-chloric acid; these acid juices are what commence the solution of the aliments. Moreover, it has been ascertained that the soda contained in the other fluids which assist in digestion, saturates the free acid, and that this saturation is essential to the complete solution of the aliments. Mr. D'Arcet has proved, by experiments on his own person, that the bicarbonate of soda, taken in small doses, facilitates digestion; and also that some mineral waters, found serviceable in painful digestions, chronic affections of stomach, and calculous disorders, &c. contained carbonate of soda. *Soda water* may be employed in similar cases with advantage; thus theory and practice concur in recommending the medicinal properties of bicarbonate of soda.

Mode of preparing the Alkaline Lozenges.

The bicarbonate of soda and sugar are put into a perfectly dry bottle; the bottle is carefully shaken, in order to mix the powders well; the mixture is taken from the bottle; there is then added mucilage of gum tragacanth and essential oil of mint; the entire is to be kneaded on a marble slab; the mass to be converted into lozenges, which are to be dried, either by the air or a stove. Each to weigh about one *gramme*.

Formula of M. D'Arcet.

Take of dry bicarbonate of soda, pure, and in fine powder, -	5 grammes.
white sugar, in fine powder,	95 ditto.
mucilage of gum tragacanth, prepared with water, -	*q. s.*
essential oil of mint, pure and fresh, - - - - - - -	2 or 3 drops.

As these lozenges slightly attract moisture from the air, they should be preserved in well stopped bottles, or in a dry place.

Two or three of these lozenges are considered by M. D'Arcet as sufficient to restore digestion. Their action he considers purely chemical, viz. that they saturate the excess of acid which they meet in the primæ viæ.

CONCERNING THE

ACTION OF MEDICINAL SUBSTANCES

ON THE LIVING SYSTEM.

MEDICINAL substances produce effects on the living system only when placed in contact with some part of that system; and the parts of that system adapted to receive these medicinal substances are always covered either by the skin or by a mucous membrane. The principal parts of the human body to which medicines may be applied, are, 1, The stomach and small intestines. 2. The large intestines. 3. The skin. 4. The surface of the eyes. 5. The pituitary membrane. 6. The interior of the mouth. 7. The vast extent of the air passages. 8. The meatus auditorius. 9. The interior of the urethra and bladder. 10. In the female, the vagina, and, in some cases, the cavity of the uterus.

With respect to the relative importance of all these parts for the reception of medicinal agents, the *gastro-intestinal surface* obviously holds the first place, as well from the vast number of absorbents with which it is supplied, and which take up the medicinal particles

into the system, as also because of the great number of nerves which it receives from the cerebral and ganglionic systems, by which either surface is connected with the brain, spinal cord, heart, and lungs, so that the impressions made on it by medicinal agents are communicated to all these organs.

From the universal sympathies thus established between the stomach and the rest of the system, we need not wonder that it should be affected in almost all diseases.

The practitioner should well consider the state of the stomach when about to administer medicines, as the pathological conditions in which it may be, modify very much their action as well as their effects. Thus, for instance, when the stomach is in a state of irritation,* nothing could be more mischievous than the exhibition of medicines possessing tonic, stimulating, or acrid properties.

The large intestines, though by no means so favourably circumstanced for therapeutic purposes as the stomach and small intestines, still, from the great supply of nervous filaments distributed over their surface, by which they are connected through the great sympathetic, with the rest of the system, and also from their great absorbing powers, great advantages may be derived from the application of medicinal substances

* This gastro-intestinal irritation often exists, in the course of phthisis, in organic diseases of the heart, intermittent and continued fevers ; a circumstance which should modify the treatment to be adopted.

to their surface. By acting on this surface, on the principle of revulsion, great advantage has been derived in affections of the head, lungs, and of the stomach itself. The precaution above alluded to with respect to the stomach, should be observed when the surface of the large intestines becomes the seat of irritation.

The *skin*, amply supplied as it is with absorbing vessels, presents very favourable means for the introduction of medicines into the system, more particularly, when the state of the stomach would not warrant their internal exhibition. Thus, when the gastro-intestinal surface is in a state of irritation, should the practitioner wish to bring the system under the influence of mercury, he introduces that substance through the skin.

With regard to the other surfaces, to which medicinal substances may be applied, they neither possess the same interest, and moreover, the effects to be produced by application to them are merely local.

With respect to the way in which medicines act on the living body, we may set it down as a principle, proved both by clinical observation and physiological experiment, that medicines act on the living body, 1. by a direct impression on the organs which receive them; 2. by their molecules being absorbed into the mass of blood; 3. by the play of sympathies; 4. by contiguity of organs; 5. by revulsion.

In illustration of the *direct* action of medicines, we may instance the different astringents and tonics,

which, when taken into the stomach, cause a contraction in the muscular fibres of that organ, and thereby give it strength to perform its functions. The different collyria, applied to the surface of the eye, may also be quoted as instances of the *direct* action of medicinal agents.

On the Absorption of the Particles of Medicinal Substances.

That the particles of medicinal substances are taken up by *absorption,* carried into the blood, and thence distributed through the system, to the different organized tissues, are points which now appear established by the experiments of several physiologists. Thus the colour of the urine is obviously affected by taking rhubarb or saffron; when nitre has been taken into the stomach, its presence is detected in the same excretion. The pulmonary transpiration contracts the odour of garlic, onion, alcohol, or other such substances. The bitterness of wormwood is detected in the milk of these animals who eat it: it is well known that some of the purgative principles of senna are deposited in the nurse's milk, three or four hours after she has taken any of the preparations of this substance. That all these phenomena take place by the absorption of the molecules of these substances, and their being carried into the blood, and thence conveyed to the several secreting and exhaling organs, are matters too clear and too striking to admit of serious objection. For though

we may suppose certain direct communications, by which the molecules of the several substances were conveyed from the stomach to the breasts and bladder, still we must admit, that in order to arrive at the cutaneous and pulmonary surfaces, these molecules must have traversed the blood vessels.

As medicinal substances are taken into the circulation, the phenomena which they excite in the animal economy must be attributed to the impression made by their molecules on the organic tissues. Some have denied the existence of these particles in the torrent of the circulation, in consequence of not being able to detect their presence therein; this, however, may be explained by the consideration, that these particles, dispersed through the entire mass of blood, cannot be found in any part in a quantity sufficient to be detected by chemical re-agents. The experiments of Magendie, of Tiédemann and Gmelin, have decided the question, these physiologists having detected the odour of alcohol, camphor, musk, and other substances in the blood of animals, to which they had administered these substances.* With regard to the readiness or fa-

* It may not be amiss here to state, that some physiologists deny the entrance of medicinal substances into the circulation; among others, Dr. Chapman, Professor of the Institutes of Medicine in the University of Maryland, in his "Elements of Therapeutics," has advanced several very plausible arguments against the doctrine, considering it a mere relic of the humoral pathology. That medicines enter the circulation, however, and in this way frequently produce their sanative effects, is the opinion of the first pa-

cility with which this absorption takes place, several objects of consideration present themselves. 1. Intimate contact between the medicinal substances and the mouths of the absorbents is necessary. 2. As the absorbents do not act with the same vigour on all surfaces, the practitioner should consider the absorbing power of the surface, to which he applies a medicinal substance. 3. He should consider, whether the surface proper for the application of the medicine be in a morbid state or not. 4. As the contact of the substances with the surface may be painful to the organ receiving it, it may happen that it may be expelled, and so escape absorption: as when a medicine may be rejected from the stomach by vomiting; or when, after arriving at the intestines, it excites the muscular contraction in them, and is then expelled the system, so as to escape absorption. 5. A plethoric state of the system has been found to retard absorption.

thologists of the present day. Mr. Andral, in his recent work on Pathological Anatomy, in describing passive congestion of the lung, succeeding acute pneumonia, which frequently remains stationary, notwithstanding the use of antiphlogistics and revulsives, and yet yields immediately to the use of tonics, such as decoctions of polygala or cinchona, expresses himself thus: "Is it not reasonable to conclude, that those substances, when ABSORBED AND CARRIED INTO THE CIRCULATION, produced the resolution of the pulmonary congestion, either by directly stimulating the coats of the pulmonary vessels in their passage through them, or else by exciting the centres of the nervous system, &c. &c.—See the elegant translation of this work by Dr. Townsend and Dr. West, vol. i. pages 58 and 59.

On the Action of Medicines, as affected by Sympathy.

All medicines do not derive their activity from absorption; the nerves, on some occasions, appear to be the conductors of the action of medicinal substances. We oftentimes see a medicine influence all the functions of life immediately after arriving in the stomach. Medicines acting by sympathy make an impression on the nerves of the surface receiving them; this impression is propagated to the brain, and thence transmitted to the other parts of the system, and thus the brain being in direct correspondence with all the living tissues renders general an impression which was at first isolated and local; thus ipecacuanha or squill being given as expectorants, first acts on the stomach; this impression, by sympathetic action, is transmitted to the pulmonary organs, and thus their expulsive power is awakened. Some medicines appear to act both through the medium of absorption and sympathy; as alcohol, and other stimulants. In the administration of medicines, which we consider to derive their influence from sympathetic action, it is important, 1. to consider the extent of the impression made by this agent on the part of the body receiving it. 2. To consider the relations and connexions subsisting between this part and the principal organic apparatuses. Lastly, the actual state of the surface to which the medicinal substance may be applied; viz. whether its sensibility be greater or less than natural, as in the former case both the physiolo-

gical and therapeutic effects of any given medicine will be much more intense and more strongly marked, and in the latter much less so, than in the natural state of the part.

On the Action of Medicines, as effected by Contiguity.

Experience has proved, that, when a medicinal substance comes in contact with any part of the body, its action is not confined to the mere part, but often propagates itself through the subjacent tissues to deep-seated organs. On this principle, when the liver and bladder, or other internal organs are affected, emollient applications are made to the surface over them. On the same principle, cataplasms, ointments, &c. covering tumours, swelled glands, &c. are found useful. Physiology proves to us, that by irritating the excretory duct of a gland, the secretions of that gland are excited and accelerated. Thus, purgatives, when they enter the duodenum, irritate the ductus choledochus, and thereby cause the liver and pancreas to secrete more abundantly.

On the Action of Medicines by Revulsion.

When a medicinal substance, applied to any part of the body, irritates that part, it causes an afflux of blood to it, and thereby a proportional diminution in the quantity of that fluid contained in the vessels of the contiguous parts. This principle is often taken advan-

tage of in the removal of irritations and inflammations. In this way, sinapisms, blisters, rubefacients, &c.* prove efficacious in removing inflammations of the thoracic or abdominal viscera. On the same principle also, purgatives, by exciting a temporary irritation in the intestines, are found useful in some affections of the head and chest. Diaphoretics, diuretics, and emmenagogues may also be considered as acting on this principle. By exciting the action of the cutaneous vessels, of the urinary and uterine organs, they exercise on the other organs a revulsive influence.

On the power of Habit over the Action of Medicines.

If the same medicinal substance be applied every day without interruption to the same part of the body, it is observed to lose its power by little and little, and to fail in affecting parts in which it had previously excited the most striking effects. As the medicinal substance itself has obviously undergone no change, and as it still retains all its properties, both physical and chemical, it must be the vital state of the living tissues, and the susceptibility of the parts to which the medicine is applied, that has undergone this alteration. This phenomenon, curious as it is in a physiological

* It may be observed here, that blisters should never be applied at the commencement of an inflammation, as, from the irritation they necessarily excite, they would rather augment than diminish the evil. The constitutional symptoms should be first subdued by the proper meeaures.

point of view, is still more important, when considered in reference to therapeutics. We may learn from it, that we should progressively augment the dose of these medicines, whose use we intend to continue for any length of time, if we wish them to retain the same uniformity and extent of action, and also that we should suspend their exhibition from time to time, lest the different organs may, from the power of habit, become insensible to their impression. It may not be amiss here to observe, that narcotic medicines are much more under the influence of habit, than those of a stimulant or irritating property. Whilst the power of habit may thus render one surface insensible to the action of a medicine, it will not necessarily exempt the other parts of the system from its influence, provided its molecules have been taken up by absorption. This independence of the general on the local action does not however hold good with respect to the effects arising from sympathy, which take their origin in the organ immediately receiving the substance. The sentient extremities of the nerves of this organ being no longer affected by the medicine, the nervous communications which transmitted its virtue to distant parts are broken off, and then the sympathetic effects are no longer produced.

On the Effects of Medicines.

The *effects* of medicines are of two kinds: 1st. The *immediate* or *physiological*. 2. The *secondary* or

therapeutical. By the former are meant those changes produced in the movements and functions of the different organs, the direct and immediate consequence of the impression made on the system, whether through the medium of the absorbents, or through the communicating powers of the nerves.

By the *secondary* or *therapeutical* effects are meant those modifications and changes produced in the movements and functions of the several organs, whereby, in a body actually diseased, some important result may be produced, which shall counteract and arrest the efforts of the disease, and excite those of an opposite character, which may prove salutary.

The *immediate* effects of medicinal substances comprise all the changes, which the developement of their activity may produce in the animal economy. Their influence extends to all parts of the system, though the phenomena produced are not so obvious or demonstrable. Thus the modifications which the blood and the organic elements undergo will ever remain concealed from the scrutiny of our senses; it is only by the manner in which the several functions are discharged, that we can appreciate the nature of the impression made on the tissues of our organs by the several medicinal substances. When the body is subjected to the influence of a medicine, the action of the latter may be exerted, 1st, on the fluids of the body; 2d, on its solids; 3d, on the movements of the several organs. With regard to the first, viz. the action of medicines on the fluids of the body, as little

can be advanced that is not conjectural and hypothetical, we shall say nothing.*

The only way in which we can conceive medicinal substances to exert their action on the *solids of the body*, is by their producing a change in the physical disposition, in the length, cohesion, density, &c. of the elementary fibres which constitute the tissue of our organs. As the elementary fibres constitute by their approximation and interlacement the several tissues, so these several tissues form the organs, whose aggregate constitutes the entire living structure. Each of these organs has a determinate function to discharge, a function regulated by fixed laws; wherefore, by observing the variations produced in these several functions we may appreciate the species of impression made on the tissue of the organ by a medicinal substance, the internal operation of such substance being rendered sensible and apparent by the differences which may be observed between the activity of each organ at the period previous to the exhibition of the medicine, and that which it possesses, whilst the system is under the influence of the medicine. The nature of the changes in the functions of any organ leads us to a knowledge of the immediate effects produced on the tissue of the organ: thus, when we observe a

* The principal advantage which the practice of medicine has derived from a knowledge of the action of medicines on the fluids, is in the case of preventing and obviating the *lithic acid diathesis*, viz. by saturating with an alkali the free acid, which precipitates the lithic acid from its combinations.

stimulant produce an agreeable feeling of heat in the epigastric region, excite an appetite and accelerate digestion, is it not obvious that this agent has stimulated the tissue of the stomach, has developed its vitality, and increased its natural powers? whereas, when we observe an opiate to destroy all desire for food, which had previously existed, or to suspend the process of digestion which was already commenced, is it not evident that it must have, as it were, stupified the fibres of the stomach, or at least perverted their proper action? In the same way, when we see an alcoholic medicine accelerate the pulse, does it not prove that the tissue of the heart then receives an impression which stimulates its fibres? It may here be observed, that all the living solids or organic tissues are not equally sensible to the impression of medicinal substances. The parts most susceptible of these impressions are the tissues of the digestive and respiratory organs, those of the heart, arteries, and capillaries, that of the brain, and its appendages, those of mucous and serous membranes and of the secretory organs, whilst on the other hand, the cellular tissue, the lymphatic ganglions, aponeurotic and cartilaginous structures are nearly insensible to all such impressions. It is of great importance, in a therapeutical point of view to remark, that disease modifies very much the susceptibility of all the organic tissues. Thus, in fever and inflammation, the brain and circulatory apparatus, the lungs, stomach and intestines, &c. are much more sensible to the action of medicines, than in the state of health. Nay more, so

great is the difference which disease induces in the operation of medicines, that when any organ is inflamed, it is to it almost exclusively that the entire power of the medicine seems to be directed. Thus, if a tonic be administered in any inflammatory affection, the part so affected feels an increase of heat, pain, and tension, whilst the ordinary tonic effects of the substance so given are not at all perceptible in other parts of the system. Thus a person having an ulcer in any part, experiences in that part lancinating pains, after taking more stimulating food or drink than usual.

From what has been said regarding the action of medicinal substances on the several organic tissues, it is obvious, that the only means for ascertaining the medicinal properties of such substance, is to attend to the changes or modifications made by it in the several functions performed by those organs. The aggregate of these changes constitutes the physiological effects of the substances. The effects are to be ascertained by attending to the several functions of digestion, circulation, respiration, the several secretions, &c. &c. These physiological effects may be either local or general. When a small dose of any medicine is taken, its effects are for the most part local, and confined to the part to which such medicine may be applied : thus, for instance, a small dose of a tonic being taken into the stomach, has its effects confined to that organ, enabling it to discharge its functions more perfectly and with more ease : the action of a collyrium is confined to the eye ; that of an injection into the urethra merely

produces a modification in the secretion of its mucous membrane. With regard to the general physiological effects, that is, the modifications produced by medicinal agents on the functions of the circulation, respiration, &c. the greatest importance should be attached to them, inasmuch as it is on these the therapeutic effects mainly depend. Of these effects some are more important, and deserving particular attention, whilst others are of secondary importance and almost insignificant. Among the former are to be classed the modifications produced by any medicinal substance on the functions of the brain, lungs, heart, stomach, on the secretions, &c. Such are the important effects which should be noted with attention, inasmuch as it is these which give the real character of the medicinal substance. Thus care should be taken to note the occurrence of pain or weight of the head, any change in the mental faculties, any aberration in vision, or in the exercise of the other senses, any irregularity in muscular action. To the subordinate or less important effects may be referred those transitory or indescribable sensations experienced internally during the time the system is under the influence of a medicine, as also the changes produced in the physical qualities of the secretions and exhalations, &c.

In considering the importance of the changes which medicines are capable of determining in the vital functions, though we no longer place that implicit confidence in the omnipotence of medicinal agents, which the followers of the humoral pathology did,

who referring all diseases to alterations in the fluids, directed their exclusive and undivided attention to correcting those morbid changes which they supposed to occur in the blood, expecting that by restoring that fluid to its natural condition they should restore the body to health; still the dominion of the physician over the animal economy in regulating and modifying its various functions, will, on examination, be found of considerable extent. Thus, let us suppose each of the organs of the body in its natural state; should we wish to accelerate the functions of digestion, we may do so by administering a stimulant; should we, on the contrary, wish to retard or suspend that function, this can be accomplished by means of a narcotic. Again, do we wish to strengthen the stomach, and to render it more able to discharge its functions, we can effect this by means of a tonic. Over the circulation of the blood the physician has equal dominion: he can accelerate it by some substances, and retard it by others. We know that animal heat is also under the influence of medicinal substances. The respiration too can be accelerated or retarded by certain medicinal agents. The secretions and exhalations are likewise under the influence of the physician. We know that by the exhibition of a purgative or emetic the liver is stimulated to a more copious secretion of bile; the cutaneous system, as also the action of the kidneys, can be excited at will.

It is, however, with regard to the cerebral apparatus, that the physician should attentively study the ac-

tion of medicines. The impressions made directly by them on the cerebrum, cerebellum, and spinal cord, and also the sympathetic influence propagated to these parts from other organs to which medicinal substances may have been applied, are the sources of numberless phenomena which develope themselves in the mental faculties, in the muscular movements, and even in the circulation, respiration, &c. It is well known how, when the brain, spinal cord, or their membranes are excited, the vitality of other parts is also developed: should the impression thus made be confined to the brain, and be continued too long, its functions become disturbed; if the spinal cord or the greatsym pathetic be the seat of the impression, we observe corresponding alterations in the functions of the parts connected with them; the action of the heart becomes irregular, the pulse unequal, respiration becomes difficult, and the functions of the stomach and intestines are disturbed.

When we thus consider the power which medicinal agents exercise over the animal economy, we have sufficient reason to be surprised both at its extent and importance. By means of it the physician appears to have all the organs of the body, and their respective functions, as it were, under his control. Through it he posseeses manifold and valuable resources, by which, if he cannot always destroy the cause of disease, he can frequently attack morbid lesions with success, combat the prevailing symptoms which threaten to prove fatal, and by opposing a medicinal to a patho-

logical disturbance, arrest the further progress of the disease.

With respect to the secondary effects of medicinal agents, they are, as has been observed, consequences of the primary; they are dependent on them, and both these effects stand to each other in the relation of cause and effect. We have seen these agents, by the properties they possess, submit the animal economy to an operation more or less marked, more or less extensive, the several organs have experienced a temporary change in their state and in their functions; these changes must be attended with some results. In a state of health, this disturbance passes off after a time, and is no longer perceptible after the medicine has ceased to act. But in disease, where the functions of life are disturbed, and the movements of the several organs are deranged, these effects become much more important. It is in the midst of this pathological disturbance that the medicine produces that state of the system which corresponds to its properties. It is impossible that this its action should not influence the developement and progress of the disease; it will alleviate some affections, and exasperate others; this change so effected constitutes the secondary effects. The necessity of carefully distinguishing between the primary and secondary effects of medicinal agents, will appear, if we consider the confusion and seeming contradictions which occur in works on therapeutics, from the want of this distinction. When any medicinal agent is said to have the property of strengthening the tissue

of an organ, or of relaxing it, of accelerating or retarding its functions, of irritating the surfaces to which it is applied, its immediate effects are designated; but when it is said to possess a febrifuge, antiscorbutic or antispasmodic property, a different order of effects is meant, which can be obtained only on those who are affected with fever, scurvy, or spasm; in fact, the secondary effects are thus designated.

When we compare the primary and secondary effects of medicines, the following distinctions present themselves: every medicinal substance contains in it an active force, depending on the chemical principles which constitute it; whilst the secondary or curative effects are not at all connected in this way with the chemical constituents of the substance, and are merely devised to explain the advantages derived from these substances. Again, the primary or immediate effects are always constant and the same, and should any dissimilarity appear in them, this will always be found to regard the *degree* rather than the *kind*. For example, senna acts with different degrees of intensity on different individuals, producing on some but slight, on others excessive purging, whilst in others it excites vomiting. Still its physiological operation is the same, that is, it irritates the gastro-intestinal surface.

Such constancy and uniformity cannot be attributed to the secondary or therapeutical effects which are, for the most part, relative or conditional. It too often happens that the medicine, from which experience has taught us to expect the greatest benefit, produces

an effect diametrically opposite: the same remedy, instead of relieving the patient, will render his state much worse. It was to this instability in the therapeutic effects of medicinal substances that Hoffman alluded, when he said, that the same medicine, employed in the same disease, with the same precautions, in the same dose, and at the same time, is oftentimes serviceable to one individual, useless to another, and pernicious to a third.

To the question whether there are such medicines as absolute tonics, i. e. substances which constantly and uniformly produce an increase of vigour in the animal economy, and a more free and easy discharge of its functions, we would answer no. Such an effect is always conditional, and regard must be had to the state of the system at the time of their administration: it is clear these medicines, classed under the head of tonics, would produce effects entirely opposite, if administered during the existence of inflammation of any organ. The last distinction which we shall here remark between the primary and secondary action of medicinal agents is, that the former is always single, whilst the latter are often observed to be manifold; thus, in the practice of medicine we daily find a substance whose primary action is stimulant, to possess the virtue of a stomachic, antiscorbutic, vermifuge, febrifuge, laxative, &c.

The ancients considered that medicines acted on the *causes* of disease; whilst they are now more properly considered to act on the *organs*. They attended ex-

clusively to their *curative* effects; we shall attend first to the changes which they effect in the movements of the several organs in the exercise of their functions, and from these we shall make their curative effects to flow. These curative effects depend on the immediate effects which they cause, whether their action be local, or general, or at once both local and general. Some medicines are no doubt useful by reason of their possessing a specific influence on the causes of disease. These, however, are few in number, and confined to a very small number of diseases. Vermifuge medicines seem to belong to this class. Sulphur, found so useful in some skin diseases, seems to produce its good effects by acting directly on the cause; perhaps mercury also may derive its beneficial effects in syphilitic affections by acting directly on their cause. We shall confine our attention here, however, to those medicinal agents, which derive their therapeutic properties from the impression they make on our organs, and the changes thereby brought about in the exercise of their functions.

Medicinal Substances possess not any specific Property distinct from their Physiological Action, and to which the curative Effects following their Use can be attributed.

No medicinal substance ever produces an amendment in a disease, without primarily producing an organic operation in the body affected. The primary or immediate, and the secondary or curative effects, are so

closely connected that the former must always precede the latter. Again, when from any cause a medicinal substance has lost its power of acting on the organs, or when, from the force of habit or of idiosyncrasy, the organs are insensible to its action, so that its exhibition causes no change in the system, it becomes useless as a therapeutic agent. We may observe also, that those substances which produce the most extensive changes, and give the greatest shock to the system, are those whose therapeutic powers are best demonstrated and least disputed; we may adduce as instances, tartar emetic, opium, the several preparations of bark, &c. Moreover, medicines sometimes, instead of proving useful, and of putting a stop to the morbid phenomena to which they were opposed, produce a fatal exasperation in the symptoms, which no one hesitates to refer to the unseasonable impression made by them on the seat of disease. Why should we not make their more favourable effects flow from the same source?

All acknowledge that medicinal substances, in order to be useful, must be exhibited at the proper time, inasmuch as a substance which would prove useful at the commencement of a febrile attack, would be of no avail in the middle of it, and even injurious at the termination, which could not be, if those agents possessed positive and absolute virtues, whereby they must cure such or such a disease independent of the address of the physician who prescribes them, and who selects the proper time for their exhibition. As a further proof of

the truth of our position, we often find that external circumstances, which are capable of producing a shock or revolution in the system oftentimes serve as most effectual remedies in disease. Thus, a sudden fright has oftentimes cured an intermittent, by exciting a violent shock in the system, at the moment when the fit was about to commence: we often see a new disease put a stop to one of long standing, which had resisted all the medicinal substances employed for its cure. No one certainly will say that these circumstances possess curative virtues independent of the primary impression they make on the system. From all this we may fairly conclude that medicinal substances derive their property of curing or alleviating disease from their active powers, and that the advantages arising from their use proceeds not from any specific virtue intended to produce them. Thus the words, "febrifuge," "antispasmodic," "antiscorbutic," &c. should be looked on as conventional terms admitted into medical language, not so much to designate any real existence, as to announce a probable or likely result from the use of substances to which these attributes are attached.

The advantage arising from the administration of medicinal agents being dependent on the primary impression made by them on the several organs, when the physician prescribes them, he knows merely whether he shall stimulate the organs; whether he shall retard the rapidity of their movements; whether he shall augment or diminish the tension of the several tissues;

whether he shall irritate a surface, or augment a secretion, &c., but beyond this he knows not; the benefits to be derived from this organic operation is the work of nature. To be sure the experience of the physician, aided by the light of physiology, may enable him to calculate on the probable effects of the medicine, whether it will bring about the desired amendment or not; but farther he cannot go. All his hopes of putting a stop to, or alleviating the morbid affection, must ultimately depend on the workings of that *conservative principle** implanted in animal nature, whereby life is sustained from the beginning to the end of its existence, in opposition to those noxious and destructive causes, which are constantly assailing it. If medicinal substancs were endowed with the virtue of curing certain determinate diseases, it would follow, that the same medicinal substances should be employed for

* The existence of the *restorative principle* here alluded to, called by some the *vis medicatrix naturæ*, is too obvious to be denied; we see wounds heal, and various diseases removed without any interference of art whatever. On this subject hear Sir Gilbert Blane: "Such is the virtue of this self-preserving and presiding energy, that whatever deserves the name of *cure*, is referrible to it as the work of nature; for the operations of art consist merely in regulating it, either by exciting it when languid, restraining it when vehement, in changing morbid action, or in obviating pain, or irritation, when they oppose its salutary course. This, I apprehend, is so well understood among well educated physicians, that the word *cure*, as applied to their own merits, is proscribed as presumptuous." Med. Leg. sect vi. p. 259.

the cure of the same disease; whereas, on the contrary, we know that different practitioners administer different medicinal substances, and pursue different modes of treatment in the same diseases, and all with the same ultimate success; the only mode of accounting for this apparent anomaly is by admitting that it is nature, and not medicine, which restores the diseased organs to their natural state. Medicines are no doubt the occasional cause of this happy result, by exciting salutary modifications in the state of the affected parts, by exciting evacuations from the different emunctories, and by aiding the favourable efforts of nature; but in all this they act but as indirect causes, and the cessation of the pathological affection cannot be set down as the necessary consequence of their inherent principles acting on the several organs. It is from the circumstance that medicinal substances possess not any specific power to cure disease, that their dose and mode of administration always decide their success. It is not sufficient merely that the patient should take the medicine called for by the disease; it is necessary that the physiological change produced by it in the system should be proportioned to the pathological changes caused by the disease. The mode of administering medicinal substances will also claim attention: the practitioner who believes that it is these substances that by their inherent virtues cure disease, feels quite indifferent as to the immediate effects caused by them: it is enough for him that the medicine has been administered; he is totally regardless whether the physio-

logical effects produced are proportioned to the intensity of the disease, whilst he who considers that the advantages to be derived from these substances are consequences of their primary effects on the organs, and of the modifications which they excite in their functions, is careful to watch these effects, and to proportion them to the pathological disturbance.

From what has been said, it appears that in order to be able fully to appreciate the advantages which may be derived from medicinal substances in the practice of medicine, it is absolutely necessary to attend to their primary effects. In every age, however, from the very infancy of the healing art, the contrary course has been pursued, and the *curative effects* alone have been the object of research with medical men; from whence it comes to pass, that the Materia Medica is a collection of false conclusions and absurd misrepresentations, rather than a true science. Thus, the practitioner who believes in the curative virtues of medicinal substances, confines his undivided attention to these, and when he studies the action of any such substance, it is merely to find out what disease it can cure. When he administers a medicine in any disease, he merely attends to the change which will come on in the symptoms, always concluding that the exhibition of the medicine, and the amelioration which may succeed, are closely connected, and stand to each other in the relation of cause and effect: *post hoc, ergo propter hoc.* On such a fragile basis has the science of medicinal substances been founded; hence it is that it has too

often consisted of observations engendered by false experience, and propagated by easy credulity. Did we but reflect on the many cases in which unassisted nature triumphs over disease, and on the spontaneous tendency which the several organs of the body have to resume their healthy functions, and also on those temporary as well as permanent amendments, which must be attributed to the influence of the vital principle, we certainly would not feel so sanguine in our hopes to be able to distinguish, after the exhibition of a medicine, the change which may result from its operation, from that which may be the result of the vis medicatrix naturæ; nor is the conservative principle of nature the only source of error which the physician should avoid in investigating the properties of medicinal substances. Whilst diseases are running through their several periods, how often do we not see amendments take place, which must be attributed to the influence of external causes? The practitioner who refers every amendment to the action of the medicine which may have been used, takes not into account the share which these causes may have had in interrupting the progress of the disease, in alleviating symptoms the most alarming, and even in re-establishing health.

In order, then, to be secure from falling into these errors, and to be able to distinguish the results of the action of a medicine from those which appear during its use, but independently of it, our only method is carefully to note the primary or immediate effects produced, since it is from these the therapeutic advantages

which follow must proceed. Not to be led astray in deciding on the merits of any medicinal substance, we must first attend to its primary action on the several organs, note the changes caused by it in the performance of their functions; then consider the pathological lesions, the cure of which we attribute to it, their character and their extent. Then, on comparing the operation of the remedy, and the disease, we shall see whether there exists a connexion between them. The physiological effects produced by such substances should always explain the cures attributed to them, and there should exist between them the relation of cause and effect. It is this relation that should be established and proved. Such is the ground-work, such the proper object of pharmacology.

With regard to the period when the therapeutic effects of medicinal substances develope themselves, it is to be observed that some produce their effects immediately after exhibition, others not until they have been continued for a considerable length of time; thus, when we give a tonic in weakness of the stomach, the benefit caused by its impression on that organ immediately appears. In the same way, after administering an emetic or a purgative, we can judge whether their operation has been favourable or not. But the evidence of the therapeutic effects of medicines is not always so prompt or so striking. It often happens that these effects are not observable until after their use has been continued for weeks or even months. Such effects are seldom however the simple product of the medi-

cine employed; other causes may have contributed to their production, such as diet, exercise, change of climate, change of season, &c. The additional efficacy imparted to medicinal substances by hygienic means, could not but strike physicians, and inspire them with a desire to avail themselves of such aid in therapeutics. This combination of medicinal and hygienic means, directed to the cure of disease, and regulated so as to produce one common effect, is what forms the *curative method.* This may be distinguished into two parts, one positive, and the other negative; the first including the medicines employed, the hygienic circumstances made to act on the patient, &c. whilst the second includes those habits of living, diet, &c. to which the individual had been previously accustomed, and from which it is necessary that he should now abstain, as being likely to prove injurious.

The therapeutist should study the nature, and know the extent of the lesion which constitutes the disease. These become manifest either by direct signs, such as are seen on the parts affected, as redness, increase or diminution of volume, induration or softening, increase or diminution of temperature, variation in the sensibility, &c., or by indirect signs, as in the change which the functions of the several organs undergo, the increase or diminution of their secretions, &c. These latter signs are in general our only guides in the affections of the organs contained in the different cavities of the body. The symptoms, signs, and morbid phenomena should engage attention, however, only so

far as to enable us to arrive at a knowledge of the lesions which exist in the body, wherein they manifest themselves. The physician who collects them for the purpose of constituting a disease of them, and of finding a place for it in a nosological arrangement, loses sight of the cause of the disease and of that which keeps it up. He, on the contrary, who uses the symptoms as guides to conduct him to the state of the lesion, and to discover to him the character and extent of the disease, at once sees what he has to dread, and to what his attention should be directed. The former asks, *what the disease is?* whilst the latter inquires, *where it is?*

In investigating the seat and nature of a disease, the following order has been recommended. The head should be commenced with, including the cerebrum, cerebellum and their membrances: then proceed to the spinal cord; attentively consider the alterations which the cerebral apparatus may undergo, and which may be inferred from the pain, heat, tension, weight, &c. felt by the patient in different parts of the apparatus; any change also, which the mental faculties may exhibit, as also the organs of sense, and the action of the muscles, will assist in directing our inquiry. From the head we pass on to the chest, and examine the state of the pulmonary and circulatory organs; from thence we proceed to the abdomen, and from the appearance of the tongue and lips, and by the application of the hand, by pressure, and by the number and nature of the alvine evacuations, we inferthe st ate of

the viscera therein contained; nor should we be inattentive to the state of the urinary apparatus, manner in which the functions of the skin are performed, &c. By means of this inquiry we may easily arrive at the seat of the disease, be enabled to judge of the character and nature of the pathological lesions which may exist; and consequently be directed in our choice of the medicinal means, which these lesions call for, and in the degree of strength required in the operation of our remedies, as also in the manner of employing them. Whilst this method will clearly point out to us the indications which the physician should fulfil, it will, at the same time, point out the contra-indications which should be kept in view. An organ, for instance, is the seat of a pathological lesion; this lesion calls for a medicine endowed with a certain virtue; but some other organ, equally the seat of disease, will be injured by this same medicinal agent; consequently its employment is contra-indicated.

From investigating disease by the several organs in the manner now laid down, this advantage will result, that we shall no longer see physicians, when examining the same patient, differ as to the nature of the disease with which he may be affected, inasmuch as they will not set out with preconceived notions, and neglecting symptoms, which they may deem of little importance, direct their exclusive attention to others which may conform more closely to their particular doctrines. By passing in review all the several organic apparatuses, no lesion can escape, facts cannot

be disfigured, nor an arbitrary association of symptoms be any longer admitted.

It would at first view appear, that post mortem examinations, by discovering to us the lesions which caused the disease, should point out the mode of treatment. But the weakness of such a conclusion will at once appear, on considering that the parts, which were the seat of disease, are no longer what they were during life. Those circumstances which formed precise therapeutic indications have now disappeared; those causes which kept up threatening and alarming symptoms, are now effaced by death. A general and uniform coldness has now taken the place of those elevations of temperature once so sensible. In fact, it is not the lesions, such as they are seen in the dead body, that the physician is called on to combat, but such as existed before death, such as the symptoms revealed them. Nor should we forget that post mortem examinations present to our view the product of the disease, rather than the disease itself. The frightful appearances which then present themselves, justify the diagnosis of the physician; they discover what the pathological affection was; they allow us to conjecture the order which it followed, and to represent to our minds the progressive changes which the diseased parts underwent, in order to arrive at the state in which they now are. But the therapeutist should consider that these alterations take place only after a considerable lapse of time, that they have had a beginning and an increase, and that in the

time during which they existed, several periods may be distinguished. These reflexions are of considerable importance; for, on observing the modifications which the tissues experience, the lesions which the viscera undergo, the disorganization of which all the parts of the body are susceptible, one cannot help being surprized at their number and extent, as well as discouraged on comparing with them the power of medicinal agents.

The researches of pathological anatomy seem then to have a tendency to diminish the physician's confidence in medicine, and to inspire him even with a dedermined prejudice against it. But, as has been already said, it is not the lesions, such as they now are seen, that our therapeutic resources are intended to combat. These lesions have then attained their termination : they have passed the point, where their course might have been suspended. These lesions have had a beginning, a development : when they were recent, slight, and before they had penetrated too far, they were by no means above the resources of therapeutics : there was then some proportion between these lesions and the power of medicinal agents. It is no longer difficult then to conceive, that such agents may bring about the cure of affections similar to those, whose anatomical products have been just now stated, by their being attacked at the commencement, and before they could effect all the mischief which post mortem examinations present to our view. The utility of therapeutic means depends on the period of their em-

ployment. Means, which if used to day, would certainly cut short a disease, will be inapplicable or insufficient some days later. In conclusion, we shall add, that it is a living lesion which the therapeutist has to treat; that, in order to ascertain the nature of the remedy called for, he should represent it to himself, such as it is during life, with its colour, temperature, the changes in its sensibility, and that it is necessary to attack it a proper time, before it has destroyed the natural texture of the parts where it has its seat, if he wishes that the operation of medicinal agents should be of any avail.

These principles give to the practice of medicine a solid basis; nor can the art of healing be still considered as all conjecture, first, when it determines the lesions which constitute disease, assigns their seat, measures their extent, and announces the modifications which they cause the several organs to undergo; secondly, when it declares beforehand the physiological effects which medicines produce, and foresees the primary operations of the means to which it has recourse. No doubt, the therapeutic effect of the operation is always uncertain; too often it corresponds not with the expectation of the physician: but can medicine hope to cure all the lesions of which organs are susceptible? Have not limits been put to its power by the Creator himself?

Having concluded the consideration of the modus operandi of medicinal substances, and having said sufficient, if not to satisfy, at least to awaken the curiosity which a subject so interesting and so important must necessarily excite, we shall now proceed to make some observations on the different classes of medicines, with regard to their physiological effects on the different systems and organs of the body in health and disease, and then to consider their therapeutical employment. The classification to be adopted is that of Mr. Barbier, as contained in his Materia Medica, which, having for its basis the primary or physiological operation of medicinal agents, appears to be more permanent than any arrangement founded on their secondary or therapeutical effects. This classification is as follows:

1. Tonics, or medicines which strengthen the tissue of the organs.

2. Excitants: } Medicines which stimulate the
3. Diffusibles: } tissue of the organs.

4. Emollients: Such as relax their tissues.

5. Temperants: Such as moderate the too great activity of the organs.

6. Narcotics: Such as diminish cerebral life.

7. Purgatives: Such as irritate the internal surface of the intestines.

8. Emetics: Such as irritate the gastro-duodenal surface.

9. LAXATIVES : Such as disturb the natural movements of the intestines.

10. MEDICINES, whose mode of action is not well determined, or which cannot be referred to any of the preceding classes.

FIRST CLASS.

TONICS.

The medicinal substances ranked under the class of tonics,* include the several species which have received the name of *corroborants* or strengtheners, *styptics*,† *astringents*, &c. The active property of these substances determines in the several organs a change or modification of their tissue, which shall now be pointed out. In order fully to appreciate the impression which medicines of this class make on the several tissues, it is necessary to see them successively in contact with these tissues : 1. In their natural state. 2. In a state of morbid debility. 3. In a state of irritation or inflammation. If the organ on which we desire to study the action of a tonic is in its natural and healthy state, the influence of this tonic is difficult to be discovered during its action on the body; the organs will not change their mode of action; the several functions will be performed with their usual regularity.

* τόνος, *tone, tension.* † στύφω, *I contract* or *astringe.*

Should the organs on which the force of the tonic is exerted, be in a weakened condition, then the impression made by the medicinal substance will have the effect of producing manifest changes in it. Their movements, before enfeebled and languid, will become stronger, and it may be observed, the greater the debility and languor, the more striking will the effects of the tonic be. When the vital properties of the several organs are more developed than natural, the effects of tonic medicines will still be discoverable. By increasing the already too great activity of the several parts of the system, they excite disturbance, and the pathological state which follows their use, still further proves the nature of their powers, that state being generally of an inflammatory character.

From what has been said on the subject, it will appear, that they may be used with advantage in morbid affections arising from general debility. It is also manifest, why their effects on the animal economy are so little perceptible, their action being directed entirely to the insensible contractility of the organs, the tissues of which become in consequence more firm and more condensed.

A tonic medicine given in a small dose, has merely a local action; whilst if the dose be augmented, and the active principles be absorbed in sufficient quantity, the entire system is subjected to its influence. It may not be uninteresting to run through each of the systems of the body, and to note the changes made in their action by the exhibition of a

tonic. We shall thus be enabled to form a just idea of the importance and extent of the propertics of this class of medicinal substances, and to see what advantage therapeutics may derive from their employment. We shall commence with the DIGESTIVE APPARATUS, and first consider how it may be affected in its healthy or *physiological state.*

Observation demonstrates, that after the exhibition of a tonic medicine, the coats of the stomach experience a fibrillary contraction, whereby they become more firm and more compact, and the stomach in a manner contracts on itself. We are equally warranted in supposing, that according as the substance advances into the interior of the intestinal canal, a similar effect is produced on its coats. The exhalations, and several secretions which ordinarily moisten the mucous membrane of these parts are suspended. The impression made on this membrane is communicated to the muscular tunic, the fibres of which become contracted: in consequence of this change the body of the intestine becomes harder, firmer, and more resisting, whilst its cavity is at the same time diminished. The changes observed in the function of digestion, after the exhibition of a tonic, points out that its influence on the organs subservient to this function is to strengthen their tissue and augment their vigour. We see tonics given in a small dose increase the appetite and bring it on sooner than usual; several individuals find their digestion facilitated and expedited by their employment; a digestion, habitually languid and difficult, by

reason of debility of the digestive organs, is rendered stronger and less distressing after the use of a tonic. It may be observed, that the alvine evacuations acquire an unusual degree of consistence from the employment of tonic medicines, and sometimess appear diminished in quantity. This may be accounted for by the encreased degree of absorption along the intestinal surface, whereby the residue of digestion is deprived of its liquid parts.

When tonic substances are taken in very large quantities into the stomach, they produce considerable disturbance in the functions of the digestive organs. They excite a sensation of heat in the epigastrium, which is diffused over the abdomen, is propagated to the chest and to the head, and is even felt in the limbs. When the substance has entered into the intestines, these become distended and swollen by the exhalation of gas, whilst the muscular fibres are affected with spasmodic contractions, giving rise to colicky pains.

Sometimes however we may perceive tonic medicines produce liquid and even abundant dejections. From having observed this result, Cullen considered himself warranted in placing bitters under the head of purgatives.

Pathological state. When the stomach or any portion of it is in a state of irritation, the exhibition of a tonic substance disturbs the action of this organ, and perverts the regularity of its functions. Irritation of the stomach manifests itself by redness and dryness of the lips and tongue, by the smallness and diminished

appearance of the latter organ, by thirst, sensibility of the epigastrium, &c.: these symptoms are all aggravated by the use of tonic medicines. If the stomach, instead of mere irritation, is actually inflamed, the exhibition of tonics will give rise to phenomena still more striking; their use is followed by a painful sensation of heat in the epigastrium, which the patient compares to a consuming fire, by swelling of this part with great pain on pressure, great thirst, anxiety, oppression, and different other phenomena presented by the organs of circulation, respiration, by the brain, &c.

The coats of the stomach sometimes undergo a morbid change, which gives them a softened appearance, which change causes great debility in the powers of this organ: there is anorexia, a dislike of mucilaginous or fatty aliments; in such cases the use of tonics has the most happy effects; they re-establish the natural functions of this viscus, by inducing a more free and easy digestion.

If the tissues of the stomach are hardened, if scirrhus or cancer occupies any portion of it, the effects of tonic medicines cannot be determined before hand. They vary according as these lesions are situated towards the cardiac or pyloric extremity, near the great or small curvature of the stomach. In such cases tonics have occasionally afforded temporary relief, by retarding the vomiting, and diminishing the frequency of the sour eructations which so often accompany such affections, and by inducing a desire for food, which previously had not existed.

The action of tonics on the intestines in disease merits particular attention. When the mucous membrane is in a state of irritation, the exhibition of tonics will have the effect of exasperating the disease. Should inflammation exist in these parts, the effects of tonics will be still more intense. When blood is exhaled from the mucous surface of the intestines, a tonic may have the effect of arresting the hemorrhage. If this happens to be at the same time the seat of ulcerations, as is seen in dysentery, the effects of tonics will no longer be certain : they will vary with the pathological condition of the intestinal surface.

In wasting of the intestines, which is often observed in the examination of dead bodies, and which is, in general, the result of long protracted disease, in addition to the diminution in substance, there is usually great irritability, and consequently frequent alvine evacuations, whereby the aliment is carried off by stool previous to its complete elaboration. In such cases tonics may be of advantage, by assisting the function of digestion, and rendering the stools more regular.

If ulcerations exist on the surface of the intestines, the effects of tonics will be found to vary according as these are observed to be of an old or recent date, superficial or deep-seated, and according to the state of the ulcerations. If these be recent, tonics may, by developing the vitality of the parts, bring on cicatrization; should inflammation accompany them, tonics may have the effect of exasperating the case. It is necessary to observe, that ulcerations seated on the large

intestines cannot be much influenced by tonics taken by the mouth, inasmuch as their active principles are almost all absorbed in the small intestines, before they can reach the large. The best mode of applying tonics in such cases is by injection.

It often happens that the stomach and intestines are affected only in their vitality without their tissues experiencing any structural or organic lesion. This arises from the increased, diminished, or irregular distribution of nervous influence to these parts. The origin of such affections may be referred either to the brain, whose influence on these tissues of the stomach and intestines is changed, or to the nervous cords received by these parts. If the nervous influence be increased, the digestive organs become more than ordinarily sensible; digestion itself causes the sensation of weight and of painful tension. If it be irregular, there appears a crowd of phenomena, such as spasm, colic, sudden swelling of the intestines, pains communicating with the vertebral column, vomiting, &c. If the nervous influence be diminished, we observe want of appetite, languid or imperfect digestion, diarrhœa, &c. In the two first cases tonics will but exasperate the affection; whilst in the latter they will, if taken in moderate doses, regulate the digestive function; a result, no doubt, depending on the influence of the tonic on the nerves of the stomach and intestines.

Tonic substances, though not coming in immediate or direct contact with the other parts of the digestive apparatus, as the liver, pancreas, and spleen, may however,

act on those organs 1. by that sympathy which the nervous plexuses establish between all these parts; 2. by the entrance of their molecules into the circulation; 3. by the contiguity of the intestinal tissues to the organs. The liver is, more than any other organ, subjected to the action of medicinal substances. In its healthy state the action of tonics has no appreciable effect on it; but when in a state of irritation or inflammation, the exhibition of a tonic never fails to exasperate all the symptoms. Bilious vomiting may be the consequence: the inflammation will often spread to the other parts of the abdominal cavity, particularly to the stomach and intestines. If there be a diminution in the volume of the liver, tonics will excite the action of nutrition, and they will concur in restoring to it its natural or physiological dimensions. This morbid state of the liver is very common; it arises directly from languor in the assimilating functions of this viscus, or may proceed from an inordinate absorption, which carries away the materials belonging to its substance: this change may take place at the end of acute disease, in which the liver has been somewhat inflamed. We sometimes meet with the liver very much enlarged; in such cases the vitality of the organ being inordinately developed, an excess of bile is secreted; a reflux of which into the stomach brings on bilious vomiting. The skin assumes usually a yellowish tint. When such an affection exists, tonics augment it, by increasing the already too great assimilating powers of this organ, and exciting still more the secretion of bile.

CIRCULATION.

Physiological state. Tonics influence the organs of circulation in two ways: When taken into the stomach, the impression made by them on the nerves of that viscus is continued to those of the heart, and this sympathy may change the action of this organ. But it is by the molecules of these substances being taken into the circulation, and thus coming in immediate contact with the substance of the heart and arteries, that the organs subservient to this function are principally influenced. When a dose of a tonic medicine has been taken sufficient for its influence to become general, it is easy to perceive that the contractions of the heart are performed with greater energy, and that this organ propels the blood with greater force into the blood-vessels: the coats of the arteries also become more resisting and more rigid; the pulse becomes more firm and harder, and vessels appear under the finger diminished in size, and at the same time more tense. It is at the same time worthy of remark, that the course of the blood is not quickened, it being one of the characters of a tonic to strengthen the organs without accelerating their action.

It is necessary to distingush the effects of a tonic medicine arising from the impression of its molecules on the tissues of the heart and arteries from those which do not appear until after a long continued use of this substance. Thus, one dose of a tonic will render the

pulse either more full or more frequent, but after the continued exhibition of this substance for some time, it will assume all these characters; these changes will be referrible to the change made in it by the function of nutrition.

Pathological state. When in febrile diseases the pulsations of the heart are become more quick than ordinary, and its contractions stronger and more rapid, and the pulse at the same time is accelerated, it is natural to suppose that these organs are in a state of irritation, whether this irritation arises from the sympathy between the heart and any other part of the system which may be diseased, or from a direct affection of the heart itself. This state of irritation in the organs of circulation presents itself in a great number of diseases. The effects of tonics under such circumstances are sufficiently obvious: when to a patient with a quick, frequent, and hard pulse, burning heat and dryness of the skin, a tonic is given, we uniformly find all the symptoms exasperated after each dose, the pulse is redoubled in force and frequency, the heat becomes more oppressive; presently there comes on anxiety, restlessness, &c. If any organ be in a state of inflammation, observation shews us that the exhibition of a tonic never fails to heighten and extend the disease, the capillaries of the inflamed organ being irritated by its particles. From what has been stated, it is unnecessary to detail the mischief which would result from the administration of tonics, when the

organs of circulation are in a state of actual inflammation.

In hypertrophy of the ventricles, particularly of the left, tonics render the pulse stronger and quicker, and the beating of the heart more violent, and never fail to augment the cerebral disturbance, as well as the other symptoms usually accompanying this affection.

In atrophy of this organ tonics render the pulse stronger for a time, and the pulsations of the heart itself more sensible. This state of the organ is frequently observed in convalescence from fever, during which the tissue of the heart may undergo considerable modifications, its function of nutrition being interfered with during the process of the disease.

The functions of the heart may be perverted independently of any structural lesion. This may be attributable either to the excessive or deficient supply of nervous influence. In the former case there will be violent palpitation of this organ, and great irregularity in the pulse; in the latter the action of this viscus will be slow and weak, as will also the pulse. In the one case tonics will generally exasperate the symptoms, whilst in the other they may prove serviceable.

With respect to the action of tonics on the ORGANS OF RESPIRATION in their *healthy state*, little can be said either interesting or important. But when any part of these organs happen to be the seat of inflammation, whether their mucous membrane, as in bronchitis, or their parenchyma, as in pneumonia, or the pleura, the

exhibition of tonics will be found invariably to exasperate all the symptoms. In hemoptysis tonics may serve to constringe the capillaries of the bronchial membrane, and thereby put a stop to the evacuation; but in such cases the injudicious use of this class of medicines may do much harm.

The action of tonic medicines on the BRAIN and its appendages in their *physiological state* is by no means striking. But when this organ or its membranes are in a state of irritation or inflammation, we invariably find medicines of this class considerably to augment all the symptoms. When the arachnoid is inflamed, the exhibition of a tonic exasperates the acute headach accompanying such a state, as also the restlessness, delirium, intolerance of light and sound, &c. In the course of febrile diseases, the spinal arachnoid is often the seat of irritation, giving rise to symptoms which are developed in the chest, abdomen, and in the limbs. There is pain in the neck, between the shoulders, along the back, in the loins, according as the irritation occupies one or other of these regions. In such cases the use of tonics will do considerable mischief. The cerebral mass itself may be affected either by congestion, effusion, or actual inflammation. The former state is oftentimes induced by the use of tonics in febrile diseases. It is unnecessary to state, that in all such affections medicines of this class are entirely contra-indicated.

The substance of the spinal cord may also experience several sorts of lesions: from its intimate con-

nexion with the system of the ganglionic nerves, or with the trisplanchnique nerve, it becomes impossible to distinguish the affections peculiar to each of these two important parts of the cerebral apparatus. From the circumstance of the spinal cord and ganglionic system of nerves, holding all the viscera under their control, it comes to pass, that lesions of these parts manifest themselves in different parts of the system, by disturbing organs which are perfectly sound. Thus, spasms of the œsophagus, difficulty of deglutition, palpitation of the heart, cramps of the stomach, colics, &c. oftentimes arise by no means from any lesion of the parts where these symptoms are developed, but from a lesion of the spinal cord or ganglionic plexuses. Convulsions, shaking of the limbs, Saint Vitus' dance, oftentimes depend on irritation of the spinal cord or its membranes. Hysteria and epilepsy have their original frequently in the cord.

The substance of the spinal cord may likewise be the seat of disease: there is then manifested great disturbance in the functions of respiration, circulation, and digestion, so that one might refer the disease to the thorax and abdomen, and not to the cord itself. Organic disease of the heart has been frequently suspected, from the disturbed and irregular action of this organ, where the spinal cord was really the seat of disease. It is to be observed, as before, that in all cases of irritation of the cord tonics are contra-indicated.

Besides these structural affections of the cord, it is

also subject to what may be considered vital lesions. Thus weakness in the heart's action, in the functions of the stomach, of the intestines, and of the lungs, may exist without the tissues of these viscera presenting the least alteration, and are to be referred to a diminution in the quantity of the nervous influence distributed to those parts. In such cases tonics will prove serviceable, as well by exciting the vitality of these viscera, as by stimulating the spinal cord to resume its natural influence over the viscera. It is in this way, no doubt, that tonics act when given to remove weakness of the stomach, loss of appetite, slow digestion, weakness of pulse, &c.

As the effects of tonic medicines on the other parts of the system do not possess any considerable interest, we shall now consider the *therapeutical employment* of this class.

The nature of the impression made by tonics on the several tissues, as well as the physiological changes caused by them, should direct physicians in their employment. The immediate effects which they produce, compared with the pathological lesion which they are intended to combat, will point out whether advantage or injury will result from their exhibition. As in the treatment of disease it is to the morbid lesion to which the attention of the therapeutist should be directed, so it is in the several organs that he must seek them. We shall commence with affections of the *digestive apparatus*.

Tonics have been strenuously recommended in

cases of loss of appetite, of indigestion, &c., and their efficacy in these cases appeared so well established as to have procured them the name of stomachics. However, the practitioner will do well to investigate the cause of these affections, and to observe with care the nature of the lesion which disturbs the natural functions of the stomach.

Should this disturbance depend on irritation of the mucous membrane of the stomach, it is obvious that tonics would but increase the mischief, whereas if it depended on debility, or a diminution in the quantity of nervous influence transmitted to this viscus, their use will be productive of much benefit. The same observation may be made regarding the intestinal canal.

In nervous affections of the heart, tonics have been found advantageous; but where there is organic disease of this organ, as hypertrophy of one or both ventricles, their use is contra-indicated.

In pneumonia and pulmonary catarrh, after all inflammatory symptoms have been combated, tonics are frequently found serviceable in assisting expectoration.

In diseases of the lymphatic system, as in scrofula, tonics form the basis of the different methods of cure. By their use the digestion is improved, and the function of nutrition is carried on with more regularity.

EXCITANTS.

Under this head may be ranged all those means which develope the vital forces, accelerate the circulation, and raise the temperature of the body. The distinction which may be made between these and the former class, viz. tonics, is, that excitants develope the contractility of the tissues, whilst tonics augment their tonicity; the former increase the number of the movements of the organ, whilst the latter render them stronger; a tonic, by strengthening the stomach, renders digestion more perfect, whilst the effects of an excitant is to accelerate and expedite the function.

Excitants act in two ways on the *digestive organs;* 1st, by coming in immediate contact, they awaken the vitality of these parts; in this excitation the liver and pancreas, as well as the brain and spinal cord, so closely connected to the gastric organ by sympathy, are observed to participate. 2dly. When the molecules of the excitant are taken into the torrent of the circulation, and with the blood penetrate the several tissues, their influence is again exerted on the stomach, intestines, &c. Excitants have an evident and powerful effect on the digestive organs. When taken internally, the stomach is immediately stimulated; there is a sudden development of vitality in the epigastrium, and a feeling of heat referred by the individual to the stomach. The liver is also stimulated, and its secretions accelerated by medicines of this

class. The physiological effects of excitants however on the digestive apparatus, depend very much on the manner of using them. Small quantities augment the vitality of the stomach, and accelerate and facilitate chymification. This is the effect intended to be produced by the use of aromatics; it is with this view that pepper, mustard, &c. are used in seasoning. Large quantities of these substances are found to have a contrary effect; they disturb and impede, instead of facilitating and expediting, the digestive process.

There is no morbid lesion more common than irritation of the mucous membrane of the stomach. This state is indicated by the following symptoms: lips and tongue red and dry, epigastrium tense and painful, internal heat and thirst, &c. In such a state excitants will but aggravate the mischief, and are therefore contra-indicated. If inflammation be going on in the gastric organ, it is unnecessary to state that they would be still more injurious. What has been said of the stomach itself, is also applicable to the intestines. In debility of the stomach, arising in consequence of the muscular coat of this organ, having lost its natural firmness and thickness, in which case the process of chymification is languidly and slowly performed, excitants are found serviceable by their bringing on appetite, and facilitating and expediting the functions of this organ. When the stomach has become the seat of scirrhus or cancer, the effects of excitants will differ from what they would be in

the natural state of the organ, in proportion as the state of the organ itself is changed. At the commencement they have been found serviceable, by increasing the appetite and rendering chymification more regular and more expeditious. However, these good effects are of no long duration. The same may be said with regard to the intestines. When the nervous influence of the spinal cord or ganglionic plexuses on the stomach and intestines is diminished, these organs are then said to be in a state of atony: the result is, remarkable languor in all the acts of digestion, and obstinate constipation; in such cases, excitants may be found useful, by rendering these organs more active, from their stimulating the gastric nerves.

When the influence of the nerves on the stomach and intestines is irregular and inordinate, it excites spasms, vomiting, hiccup, cramps of stomach, colic, &c. What proves the nervous character of these affections is, that on the one hand the patient has his appetite quite perfect, whilst on the other hand he complains of pains in the back, in the loins, head, &c. Excitants frequently succeed in calming the disorder, and in re-establishing the natural proportion of nervous influence.

The effects of excitants on the organs of circulation are too obvious to require observation in this place. With respect to the respiratory organs, excitants are by no means devoid of influence on their functions. Physisians are constantly in the

habit of giving them for the purpose of assisting expectoration, when in consequence of atony or debility it has become difficult or painful. However, when these organs are in a state of inflammation, nothing could be more unadviseable than the exhibition of an excitant. In the commencement of bronchitis, the use of excitants causes a dry, harassing cough; when the inflammatory stage has subsided, these same agents usually bring on a copious and salutary expectoration.* From what has been said on the subject of excitants, their effects in diseases of the other parts of the system will be readily understood. We shall now proceed to the next† most important class, viz. Emollients.

EMOLLIENTS.

Emollient medicines are those substances which have the property of relaxing the tissues, and diminishing the action of the several organs of the body. They have also gone by the name of *relaxants*; when used for the purpose of combating irritation, they have gone under the name of *demulcents*.

Medicinal substances of this class derived from

* On the effects of the stimulant plan of treatment in catarrh, see Laennec, vol. 1. p. 152.

† No observations have been made on the third class, called Diffusibles, from the great resemblance existing between it and the second.

the vegetable kingdom consist in general of mucilage, a fixed oil, and sometimes sugar.

With respect to the therapeutical application of medicines of this class, it may be observed generally, that they should be given always at a warm temperature: when given hot or cold, their influence on the several organs is considerably modified. In the one case, the medicine, on coming in contact with a living surface, causes a contraction of the fibres of its tissue; this effect, though transient, prevents the proper emollient action which would otherwise follow its exhibition. In the other case, if the substance be given hot, the caloric conveyed into the stomach causes a considerable degree of excitement, which, by the sympathetic connexions of the stomach, is diffused over the system: nor is it until after this first effect the emollient virtue of the medicine is developed.

The occasion where emollients are found serviceable, are in irritation of the mucous membrane of the stomach and intestines, as when ulcerations exist in those parts; in inflammation of the mucous membrane of the bronchia, they are found useful, by calming the cough, and rendering it easier and less painful; they are observed to produce similar good effects in pneumonia and pleuritis.

PURGATIVES.

Purgatives are medicinal substances which possess the property of exciting on the internal surface of the intestines a transient and specific irritation, which is succeeded by alvine dejections. According to this definition, a very considerable diversity will be found to exist among the vegetable substances which have been hitherto classed under the common title of purgatives. With respect to the chemical composition, substances possessing mucilaginous, oily, saccharine and acid qualities, are found classed under the same head, as others possessing resin, extractive, &c. With respect to the sensible qualities, some are inodorous, whilst others exhale a strong nauseating odour; these are distinguished by a sweetish, insipid, or acid taste, whilst others leave on the organ of taste a sensation of extreme bitterness. With respect to the impression on the tissues, i. e. the physiological effects, some are found to strengthen the gastric organs, at the same time that they excite alvine evacuations; whilst others relax and weaken the digestive organs so much, as that their functions are considerably interfered with for some days after the purgation has taken place. Intestinal evacuations may depend on causes altogether distinct. Irritation is here to be considered as the essence of purgation. This irritation, wherever it exists, produces increased sensibility in the part, redness, swelling, fullness of the capillaries, followed

by an abundant exhalation of serum, an increased secretion of mucus and of bile, at the same time that the contractions of the muscular tunic of the intestines become accelerated, whereby their contents are in a short time dislodged by stool.*

The principal immediate effects which purgatives produce on the system are, extinction of all desire for food, oftentimes nausea, and occasionally vomiting, by which, if the purgative is removed from the system, no farther effect is produced from it; the digestive functions are quickly re-established. If vomiting has not occurred some time after the medicine has been taken, pains are felt in the abdomen, which increase gradually, accompanied by a sensation of internal heat; the abdomen also appears swollen. The pulse is at first small and unequal, and there is occasionally a slight feeling of cold. But, in a litttle time, the pulse becomes fuller and more frequent, the animal heat is developed, and the skin appears dry and hot, during the time the alvine evacuations take place, the number and quantity of which are indeterminate. All these effects are very variable, both with respect to their intensity and constancy. In ascending to the causes of these effects, we see that purgatives act principally on the intestinal surface, and that most of the phenomena which they excite are derived from the impression they make on that part. We also observe, however, a certain number of general symptoms, which prove that purgatives extend their influence to the other parts of the

* See Barbier, vol. iii. p. 28.

system. In the operation of these substances we may distinguish a local and a general action. The parts of the body on which purgatives act directly and immediately, are the stomach and the intestines. The internal surface of these parts is lined by a mucous membrane, furnished with a vast number of folds, by which its extent is considerably increased. It also presents a multitude of follicles, which secrete a viscid mucus, which secretion is increased by the action of purgatives. The excretory ducts of the liver and pancreas terminate in the interior of the duodenum. Purgatives, by irritating their extremities, act sympathetically on these glands and increase their secretions. The natural serous exhalations of the intestines are augmented by purgatives. Beneath the mucous membrane is the muscular tunic, by which the vermicular movements of the alimentary canal are performed, and its contents directed onward to the extremity of the rectum. Purgatives excite the contractions of these muscular fibres; the * peristaltic action of the intestines becomes more rapid, and the discharge of their contents is thus accelerated. Thus we see that the part of the body which receives purgatives, and on which they immediately act, is the seat, 1st, of a mucous secretion, which is increased by their use: 2dly, of a serous exhalation which they also augment. 3dly, this part receives the excretory duct of the liver and pancreas, the irritation of whose extremity by purga-

* περιστελλω, contraho.

tives is propagated to the glands whence they proceed, and thus their secretions are increased; and, 4thly, the peristaltic action of the alimentary canal is accelerated.

That the property of purgatives is of an irritating nature is proved by the effects of an over-dose. Those who take purgatives which are too violent, or in excessive quantity, experience all the symptoms of inflammation of the intestinal mucous membrane; of enteritis, peritonitis, bloody stools, tenesmus, cramps in the lower extremities, great sensibility of abdomen, &c.

Experiments have proved, that substances used as purgatives are capable of exciting inflammation of the stomach and intestines in animals to which they have been given in excessive quantities. The effects sought by purgatives consist in a moderate and temporary irritation of the intestines, by which the vital properties of their internal surface are for a time exalted, its capillaries filled with blood, and the membrane itself becomes swollen, redder, and more sensible than in its natural state, whilst the serous exhalations are augmented, and the mucous cryptæ of the membrane are stimulated to a more copious secretion of mucus. As has been said above, the irritation of the ductus choledochus causes the liver to accelerate its functions, whereby a more copious secretion of bile is effected. The products of these several secretions and exhalations is mixed up with the matter previously existing in the canal, and the character of the evacuation will vary according as one or other of these may predominate: it will be bilious if the medicine has determined a copious secretion of

bile; serous, if the intestinal exhalations have been more abundant, &c. It may be observed, that this irritation produced by purgatives does not exist at the same time over all the intestinal surface; it is progressive, and having existed for some time on one part, it proceeds onwards, so that all parts by degrees are made to feel its effects. There are some parts, however, with which the purgative remains longer in contact than with others, and consequently those parts feel its effects much more intensely, while it passes rapidly over others. Experiments made on living animals warrant us in supposing that the duodenum, colon and rectum, are the parts more susceptible of the irritating properties of purgatives. If our object be to obtain copious evacuations, care should be taken, that the impression made on the intestinal surface should not be too violent, and that its mucous follicles and exhalant vessels, as also the hepatic system, should be merely stimulated, and the movements of these parts accelerated, but not disturbed or deranged. If the impression be too violent, the source of the evacuations is soon drained, and the mouths of these organs, furnishing the secretions and exhalations, are spasmodically closed. Hence the utility of administering to those who have taken purgative medicine emollient drinks, which will have the effect of moderating the impression made by the purgative, if that impression has been too violent. For the same reason, it has been recommended to prepare the intestines, previous to the administration of cathartics, by the use of demul-

cent drinks. Such appears to have been the object contemplated by Hippocrates in the following precept: τὰ σώματα χρὴ, ὅκου τὶς βούλεται καθαίρειν, εὔροα ποῖειν. Aphor. 9. sect. 2. The impression made by the purgative on the mucous membrane is transmitted by contiguity to the muscular coat, by which means the vermicular contractions of this tunic are rendered more frequent, and the matter existing in the intestines at the time of the purgative being taken, as also the different secretions and exhalations are made to pass on through the canal more rapidly. Those colicky pains, so often felt after the exhibition of purgatives, are obviously the effect of the irregular contractions of the muscular fibres of the intestines. In the natural state there is a certain harmony between the movements of the longitudinal and circular fibres, and the contractions also of each set of fasciculi are simultaneous. This harmony is disturbed by the action of the purgative, and the abdominal pains are the consequence of this disturbance.

With respect to the general action of purgatives, if we consider attentively what passes in the body, when subject to the operation of a purgative, we shall find important changes produced in parts remote from the intestinal canal. These general effects depend either on the absorption of the molecules of the purgative, or on the sympathetic relations subsisting between the alimentary canal and the other organs of the body.

Purgatives accelerate the pulse, develope the animal heat, and excite thirst; cramps in the legs and thighs

are often experienced; they occasion a diminution of the cutaneous transpiration, and some alteration in the state of the brain and organs of sense. Should wounds, ulcers, &c. exist, they are irritated by the exhibition of purgatives. Their use is followed by lassitude, exhaustion, &c. &c. Several of these symptoms must, no doubt, be attributed to the irritation of the intestines, as the thirst, &c. &c. others, as the cramps, to the impression made on the intestinal nerves, and thence propagated to those of the thighs; the diminished perspiration to the revulsive influence of the purgative, whereby the cutaneous functions are interrupted in consequence of the increased action of the intestines. The other changes, however, produced in the system by purgatives, can be explained in no other way than by supposing their molecules to be absorbed and carried into the circulation. That such absorption takes place, has been satisfactorily proved by numerous experiments.

We shall now consider the *therapeutic* action of purgatives. Purgatives have been in the highest estimation from the very infancy of medicine. The ancients, who considered that the principles or elements of disease existed in the blood and in the other fluids of the body, placed the most implicit reliance on this class of medicines, supposing that those peccant humours which constituted disease were carried off by the action of the purgatives, whilst no other advantage arose from the several secretions and exhalations from the

intestinal surface, than that they served as a vehicle to carry off these humours. To the physiological action of these medicinal agents they attached no importance whatever. If, after their administration, the disease still continued, it was considered that some of the morbific elements still remained in the mass of blood, and it was always to purgatives that recourse was had for the purpose of eliminating them. According to this theory, the exhibition of purgatives was necessarily deemed curative. The progress of physiology, however, has now deprived purgation of a considerable share of this importance, and divested it of these extraordinary powers which the imagination of the humoral pathologists had imputed to it. In order to understand the full extent of the resources which purgatives afford to therapeutics, we have only to consider the physiological influence which they possess over the animal economy. By their use we obtain several well-marked effects calculated to fulfil particular indications: 1st, purgatives serve to unload the intestines of their contents; the importance of this evacuation is acknowledged on all hands: in health its interruption disturbs the exercise of the digestive functions; constipation causes weight of the head and several other disagreeable sensations; in disease it is still more necessary that the intestinal canal should not retain its contents too long, as they would then produce irritation and other injurious effects. 2dly. The action of purgatives increases the secretions of the liver, pancreas, and mucous follicles of the intestines, and augments the

serous exhalations on their surface, thereby diminishing the mass of blood, by which means the abdominal organs are considerably unloaded ; an effect which is found serviceable in a great number of diseases. 3dly. During their operation there is a concentration of the vital forces in the abdomen ; the blood is carried in greater quantities towards these parts, and by these means a derivative or revulsive action is effected, which has been found serviceable in affections of the head and chest. 4thly. The irritation of the nerves distributed over the intestinal surface imparts an unusual degree of influence to the great sympathetic, and modifies the state of the brain and spinal cord, whereby the several organs and systems of the body are excited to increased action. How often do we see a drastic purge given to a dropsical patient rouse the absorbent system, cause the aqueous fluids contained in the cellular tissue or in a serous cavity to enter the circulation, and bring about copious liquid stools, or an abundant flow of urine? Lastly, purgatives exercise considerable influence on the several parts of the system, though their use may not be followed by alvine evacuations, in consequence of their being absorbed and taken into the circulation. In this way the ancients considered them as very effectual alteratives, and with this view they gave them in small doses at considerable intervals.

With respect to the practical application of purgatives, a few observations may now be made.

When the mucous membrane of the intestines is in a state of morbid irritation, the impression made by

purgatives coming in contact with this membrane may be attended with different results: should the irritation be acute and very extensive, the effect of the purgative will be to exasperate it; if this irritation be combined with lesions of any of the other organs of the body, as of the brain, &c., the danger becomes still greater, as by their exasperating the morbid condition of the intestinal surface the sympathetic irritation of the other affected organs is also increased. If, however, the irritation of the intestinal mucous membrane is unattended with fever, and if it be confined to some points of this membrane, it often happens that the purgative plan of treatment will restore the affected parts to health, by changing the mode of action, and opposing a new irritation to that already existing; thus, we often find purgatives prove beneficial in diarrhœa, chronic dysentery,* &c.

In *enteritis* purgative medicines seem calculated to do considerable mischief. If it should appear necessary to empty the intestinal canal, laxatives should then be preferred. When the nervous influence distributed to the intestines is excessive, purgatives, having then too violent an effect on the intestines, are sure to do harm; whereas, when a deficiency of this influence has rendered the alimentary canal torpid, the strongest purgatives are often found to fail in producing any effect.

* The utility of purgative medicines in these affections would probably be considered by some as corroborative of the truth of the homœopathic doctrine of Dr. Hahnemann.

Purgatives are occasionally found useful in some affections of the liver, the irritation which they produce on the duodenal surface stimulating this organ to a more copious secretion of bile; but when the liver is inflamed, the use of purgatives would appear at the commencement of the disease likely to add to the general disturbance, and thus do mischief. Purgatives in small doses, and repeated several times in the day, have been serviceable in cases where there exists induration of any part of the hepatic tissue, when the course of the bile is interrupted, and that the skin has assumed a yellow appearance, &c. In such affections it is that rhubarb, aloes, neutral salts and mineral waters have been found advantageous.

In affections of the mucous membrane of the lungs and bronchiæ, after the inflammatory symptoms have been first subdued, and the secretions of this membrane have been re-established, purgatives have been found of considerable advantage. Huxham, and several other physicians, speak of epidemic coughs, which have disappeared on the appearance of a diarrhœa. Purgatives have been considered by several as injurious in peripneumonia, as soon as expectoration, which appears to be critical, has been established. The irritation then excited in the intestinal canal is considered as likely to interrupt the salutary efforts of nature. However, as cases of this kind are met with, wherein spontaneous alvine evacuations have been found useful, may it not be lawful to imitate, by the use of purgatives, this effort of nature,

and to endeavour to relieve the respiratory organs by establishing a centre of irritation on the internal surface of the intestines, when the state of the latter allows it?

In the treatment of pleuritis,* purgatives have not been found to afford any assistance, until after the inflammation of the pleura has been subdued by the proper means.

In hemoptysis the intestinal irritation excited by purgatives may be useful after blood-letting, by their tendency to diminish the sanguineous congestion to which the pulmonary organs are then subject.

With respect to diseases of the *brain,* it may be observed, that in hemicrania (megrim) purgatives may be of advantage by the revulsion which they cause. When the membranes of the brain are the seat of acute extensive inflammation, which may be combined with

* It may be laid down generally, that in inflammation of serous membranes, purgatives present very little interest. Their general influence must prove injurious, nor can any advantage be expected from them till after the inflammation has been combated by blood-letting, &c. The contrary may be observed with respect to mucous membranes. We often derive the greatest benefit from the administration of purgatives in ophthalmia, otitis, pulmonary catarrh, &c.: the irritation excited by their use on the intestines displacing the pathological irritation which existed on the surface of the eye, in the ear, and in the bronchiæ; these different mucous membranes, as well by their organization as by their functions, possessing over each other a sympathetic influence, of which the therapeutist is careful to avail himself.

other inflammations seated in the organs of circulation, digestion, &c., when, in a word, there exists fever, purgatives no longer promise the same advantages; their use, on the contrary, often excites an exasperation of all the febrile symptoms, and gives additional intensity to the disease. This result principally takes place in the case of fevers, when the intestinal surface is the seat of inflammation, in consequence of the impression made by the purgative on the nerves of the part inflamed, by which the brain and spinal cord being irritated, the innervation of the several organs becomes irregular and inordinate. In cases of inflammation of the cerebrum and cerebellum, purgatives will be found serviceable, when the state of the digestive organs does not contra-indicate their use.

In the treatment of apoplexy, purgatives are of undoubted advantage, both previous to the attack, and during its existence. By their use, aided by the necessary measures, a revulsion may be effected to the intestines, and thus the brain be relieved. In paralysis, by exciting considerable intestinal irritation by means of purging, considerable benefit has often been experienced.

In epilepsy, purgatives have been found beneficial, and there are some cases of the affection said to have been cured by their use. With respect to the use of purgatives in the several species of mania, we may observe, that in idiotcy, which usually depends on serious structural alteration of the brain, little advantage can be expected. As some species, however, may be

owing merely to the pressure of an abundant exhalation in the arachnoid on the surface of the brain, by which the action of this organ may be impeded, advantage may be derived from the daily administration of purgatives, which may tend to relieve the head, as also to promote the absorption of the effused fluid. When the membranes of the cord are the seat of inflammation, giving rise to an extraordinary and irregular innervation, by which all the organs are excited, the exhibition of purgatives would but exasperate the manifold symptoms caused by this lesion, the intestinal tissues being then in such a state of susceptibility, as contra-indicates any thing like an irritating impression. The morbid condition of the membranes of the cord constitutes a prominent lesion in adynamic and typhoid fevers; and from what has been said, it may be inferred what fatal consequences must arise from the indiscriminate exhibition of those drastic purgatives, which are too frequently administered in those fevers. When this inflammation is but partial and limited in its extent, and excites, according to the point where it is situated, spasms of the œsophagus, cough, palpitation of the heart, dyspnœa, or cramps of the stomach, purgatives are not so absolutely contra-indicated. If the upper part of the cord be the seat of the lesion, so that there be no morbid sensibility of the intestines, the exhibition of purgatives may, by exciting intestinal irritation, and thus displacing the inflammation from the part affected, afford relief; but where the inflammation is seated towards the inferior extremity

of the spinal cord, the increased irritability of the stomach, and particularly the intestines, will then contra-indicate the use of purgatives.*

In lesions of the organs of sense, as ophthalmia, otitis, &c., purgatives are found to afford the most striking advantages. In hypochondriacal and hysterical affections, the indiscriminate use of purgatives may cause considerable mischief. In colica pictonum, an affection which appears to be a vital lesion of the intestines, and to have its origin in the nervous apparatus, purgatives are of undoubted advantage. In this affection the intestinal canal is contracted, its sensibility diminished, and its peristaltic movements suspended. Pressure on the abdomen, so far from occasioning pain, is found on the contrary to afford relief; the abdomen appears depressed, with obstinate constipation, and sometimes nausea and vomiting. Other symptoms point out the morbid state of the brain and spinal cord, such as tremors, convulsions, particularly in the upper extremities, wandering pains, paralysis, &c. &c. Experience has pointed out the advantage of making a strong impression on the intestinal surface, under such circumstances, by means of the most active

* The truth of this principle will appear, by considering that vital lesions of long duration may ultimately terminate in structural lesions. A tissue or organ, in consequence of being for any length of time excited by inordinate and excessive innervation, may oftentimes become the seat of inflammation: for this reason, in the case now under consideration, a structural lesion of the digestive organs may succeed to one that originally was but vital.

purgatives.—Medicines of this class have been found serviceable by acting as emmenagogues. With respect to affections of the cutaneous system, those who have been in the habit of considering eruptive diseases as depuratory, strenuously urged the use of purgatives in their treatment. But when it is considered that cutaneous inflammations are frequently combined with other inflammations situate on the principal internal organs of the body, a different line of practice must obviously suggest itself. In small-pox, measles, scarlatina, &c. if the cutaneous eruption be combined with inflammation of any of the digestive organs ; if the tongue is red and dry, the epigastrium very sensible, purgatives are obviously contra-indicated ; and should it be necessary to unload the intestines, laxatives should be had recourse to. Should any of these eruptions be combined, as they occasionally are, with affections of the cerebral and spinal membranes, or of the pulmonary organs, it is then manifest that different means must be adopted for their removal. In other cutaneous affections not attended with febrile disturbance, and in which the digestive organs are not in a state of irritation or inflammation, the exhibition of purgatives has been found very advantageous.

In the various forms of dropsy purgatives have been occasionally employed with success. The advantages arising from their use may be referred to the copious liquid stools which they cause, as also to their power of exciting the absorbent system. However some precaution is necessary in the treatment of

dropsy by purgatives. When the digestive organs are in a state of irritation, their administration would obviously be productive of mischief. When dropsy is the consequence of debility and exhaustion, the free use of purgatives is by no means admissible. In such cases, tonics combined with the more stimulating diuretics are likely to prove much more serviceable.

When purgatives are administered in common fever, regard should be had to the state of the digestive organs. From what has been said, it is manifest that if these were in a state of irritation, the exhibition of purgatives would but exasperate the symptoms, and extend the mischief to other parts. The treatment of fever, by the constant use of purgatives formerly adopted, must of necessity have frequently produced inflammations of the intestines, which were in all probability never taken notice of: nor could we explain why such an effect was not more frequent, but by recollecting that blood-letting was had recourse to along with purgation, by means of which the inflammation caused by the latter may have been oftentimes extinguished. Gentle purgatives or mild laxatives appear more applicable when our object is to obtain the expulsion of those fœtid matters then secreted in the alimentary canal. Having said thus much on the therapeutical employment of purgatives, we shall now proceed to the next most important class of medicines, viz. *Emetics*.

EMETICS.

There is a striking analogy between *Emetics* and *Purgatives*. As purgatives, emetics irritate the *primæ viæ*; as the former, they cause the stomach and intestines to expel their contents, and serve to increase the secretions and exhalations from these organs. Their action is however confined to the gastro-duodenal surface, and the evacuations they give rise to are passed by the mouth. These circumstances entitle them to a distinct place in every pharmacological classification. Emetics are defined, substances which have the power of exciting vomiting. Though vomiting is the most striking phenomenon produced by medicines of this class, still they give rise to other effects whose physiological importance is at least equal to that, and such as concur effectually in the advantages which therapeutics derive from their use.

In the administration of emetics we may consider, 1st, the local action, *i. e.* the irritation produced on the gastric and duodenal surfaces, by which the vitality of these parts undergoes a sudden, but temporary developement; 2dly, the act of vomiting itself; and 3dly, the general influence of the emetic.

The effects of the irritation are, 1. An increase of the natural exhalation of these parts. 2. An increase in the secretion of the mucous follicles of the stomach. 3. The secretions of the liver are augmented, in consequence of the emetic irritating the ductus choledo-

chus; which irritation is thence continued to the gland itself. Nor is this irritation limited to the gastric and duodenal surface; for when the entire of the emetic has not been rejected by vomiting, we find it to pass on into the alimentary canal, and there by its irritating properies to produce all the effects of a purgation.

2. The act of vomiting presents two subjects for consideration: 1st, the shock communicated to the system: 2dly, the quantity and quality of the matter discharged. It was formerly considered, that the vomiting was effected by the sudden, and, as it were, convulsive contraction of the muscular fibres of the stomach itself; but Mr. Majendie has determined by a series of experiments, that the stomach is passive in vomiting, and that its evacuation is effected by the contraction of the diaphragm and of the abdominal muscles. However, it is not so much the act of vomiting itself, as the change it produces on the several functions of life, that should particularly interest us. The first effect experienced after the exhibition of an emetic, is a feeling of uneasiness in the epigastric region, which soon becomes general during the act of vomiting; the diaphragm and abdominal muscles contract convulsively, and the entire machine is agitated, all the viscera suffering repeated and violent concussions. Hence the danger of administering emetics to individuals affected with aneurism, hernia, in the advanced stages of pregnancy, as also in cases of determination of blood to the head or lungs. The pulse is observed to

become small, contracted, and unequal, when the effect of the emetic is about to take place. An abundant diaphoresis usually follows the operation of the emetic. The bronchi are also unloaded of any mucus which they may contain. With respect to the quantity and quality of the matter rejected by vomiting, we shall say nothing in this place.

With respect to the *general action* of emetics, we may observe, that their effects are not confined to the local irritation of the gastro-duodenal surface, and to the mere act of vomiting. The organic phenomena which are developed in parts remote from the digestive apparatus, must also be taken into account. The local irritation of the gastric and duodenal surfaces gives rise to important sympathetic effects. This irritation causes a sudden revulsion of the vital forces, which being concentrated in the abdomen, are considerably diminished in other parts of the system, which diminution, when these parts are in a state of disease, may be attended with beneficial results. Observations appear to sanction physicians in attributing to emetics diaphoretic, diuretic, and emmenagogue properties. These effects may be explained by the shock which it gives to the entire system, and more particularly to the circulatory apparatus.

On the therapeutical employment of emetics. Emetics are employed in medicine, 1. When we wish to evacuate the stomach and duodenum of their contents. 2. When we desire to clear out the intestinal canal, by exciting alvine evacuations; this is best effected by

giving these medicines in small doses and at considerable intervals. 3. They are administered for the purpose of augmenting the secretions and exhalations along the gastro-intestinal surface. 4. They present a sure means for directing the vital forces towards the abdomen, and thereby produce a revulsive movement in affections of the head and chest. 5. Emetics are frequently administered under the title of expectorants, diaphoretics, diuretics, emmenagogues, &c.

Diseases of the digestive apparatus. The stomach and duodenum are occasionally affected with slight irritation of the mucous membrane, which becomes covered with an abundant mucous secretion; the patient complains of loss of appetite; tongue moist, appears increased in volume, covered with a whitish coat; saliva seems thicker than ordinary, and thready; there is observed a sense of fulness in the epigastrium. If the liver participates in the morbid state of the gastro-duodenal surface; if this viscus is in a state of turgescence; if it have a tendency to supply a superabundant secretion of bile, other phenomena are observed; a bitter taste in the mouth; tongue with a yellow coat; disagreeable eructations; vomiting of pure bile. Under such circumstances the exhibition of tartar emetic or ipecacuanha will be attended with most decided advantages. The impression made on the gastro-duodenal surface will change its present mode of action, will give rise to an abundant secretion of mucus, as also to considerable exhalations. This impression is thence propagated to the liver: it causes the immediate

formation of an immense quantity of bile; the hepatic tissue appears to disgorge itself. After the operation of the emetic the patient feels himself relieved; the epigastric region is become quite free; the bad taste in the mouth, the nausea and uneasiness, &c. disappear. If, however, the gastro-duodenal is affected with violent irritation, as may be inferred from the lips assuming a bright red, from the shrunk and pointed appearance of the tongue, which is red at its edges and at the apex, and also dry and chapped, accompanied by thirst and a sensation of heat in the epigastrium, which is painful on pressure, emetics are uncertain, dangerous, and often mischievous.

In *diarrhœa* and *dysentery*, emetics have been found serviceable; the irritation which they excite on the gastric surface having a revulsive influence on that which may exist on the small or large intestines. The advantage to be derived from the exhibition of emetics in cases of *poisoning*, &c. is too obvious to require comment. Emetics constitute a part of the treatment sometimes adopted in the cure of *painter's colic*.

In *croup* emetics are to be administered, more especially at the commencement of the disease, and the best are the antimonial. In this affection it is often difficult to excite vomiting, but whether vomiting be excited or not, we are certain of the counter-stimulant effects of the antimony.* In *hooping cough*, one or two

* For a very successful mode of administering tartar emetic in croup, see Mr. Porter's work on Diseases of the Larynx and Trachea.

emetics may be administered when the disease is forming, and in the latter stages, when the expectoration is difficult, and auscultation shews that the bronchial tubes are loaded with mucus.

In *bronchitis* and *pulmonary affections*, antimonial emetics have been administered with considerable advantage; in these affections they act as counter-stimulants. On the same principle they have been administered in hemoptysis, the irritation of the gastro-duodenal surface diminishing the sanguineous congestion existing in the pulmonary organs. In pneumonia tartar emetic is prescribed in considerable doses, and with the greatest success; not however with any intention of producing either vomiting or purging; on the contrary, for the purpose of preventing these effects, it is usually combined with aromatics and opiates. It may be observed here, that in inflammatory states of the system, tartar emetic is borne in very large doses, without at all exciting vomiting or purging. However, even should it at first produce these effects, by continuing its use the vomiting and purging very often cease to follow from its exhibition.*

* Repeated experiments have proved that when tartar emetic has been taken in such large quantities as to prove poisonous, the pulmonary organs are the first to experience its effects; they are found in a state of violent inflammation; from which it would appear, that tartar emetic possesses a specific influence over these organs. This fact, combined with its efficacy in pulmonary disease, might afford another specious argument to the advocates of the *homœopathic* doctrine.

In affections of the head, as apoplexy, &c., the use of emetics require particular caution, as the most fatal consequences have occasionally resulted from their exhibition,

LAXATIVES.

Purgative and laxative medicines are generally classed under the same head, the latter being supposed to differ from the former only in possessing less of energy. But whether we consider the chemical composition, the sensible qualities, or the physiological action of these two classes, we shall find that no medicinal substances are better entitled to distinct places in the Materia Medica than they are. With respect to chemical composition, the former consist of extractive, resin, a bitter principle, salts, &c., whilst the latter consist of mucilage, a fixed oil, sugar, &c. On examining their sensible qualities, laxatives are inodorous, have a sweetish, insipid, or acid taste, whilst purgatives exhale a nauseating odour, and have a bitter, disagreeable taste. But it is on their different modes of action on the digestive organs that we should principally found the distinction between these substances. Laxatives produce on the digestive organs a state of temporary debility or relaxation, whilst purgatives, as we have already seen, produce a state of irritation. This distinction, though not noticed hitherto in pharmacology, has however been uniformly observed in clinical practice. Practitioners

saw that laxatives, instead of the irritation caused by purgatives, had a tendency to relax the tissues of the stomach and intestines; that instead of the heat, thirst, acceleration of pulse, &c. which purgatives never failed to produce, the exhibition of laxatives was attended with the very opposite results. Hence in irritation of the *primæ viæ,* they hesitated not to prescribe the latter, while they scrupulously abstained from the use of purgatives.

The action of laxatives may be distinguished into that which is local and confined entirely to the alimentary canal, and that which is general, and extended to all parts of the system. The manner of administering the laxative will decide which of these effects shall predominate. If, for instance, it be not much diluted, or be taken in its natural state, the functions of the digestive organs are disturbed, and alvine evacuations soon follow. If, on the contrary, we dilute it very much, the local action will no longer take place while the general effects then become manifest. When laxatives are taken into the stomach, they make on it an impression, as has been already observed, which relaxes its tissue and diminishes its vitality; a feeling of uneasiness is experienced in the epigastric region; the substance passes into the duodenum, without being acted on by the stomach, and in the same state traverses the other intestines: it is every where felt as an inconvenient weight; nature makes an effort to rid itself of it; the peristaltic action of the intestinal canal is accelerated; and thus the substance is made to pass along the tube, bringing

with it whatever matters may already exist there; as also whatever secretions and exhalations it may have caused by the impression which it has made on the intestinal surface.

The local effects of laxatives then arise from a very simple cause, and suppose not the exercise of any specific property in them. This effect proceeds from the impression made by an undigested substance, consisting of mucilage, sugar, or a fixed oil. All substances possessing this chemical composition are capable of producing a laxative effect, provided they be taken in sufficient quantities.

The influence of laxative medicines is not confined to the alimentary canal; they act also on the other organs, and from the changes which they produce in the state of these organs, therapeutics have derived considerable advantages. This general action of laxatives result from their molecules being taken up by absorption, and thus carried into the circulation; and it may be here observed, that in proportion as the alvine evacuations are slow and scanty, this general impression is more energetic and extensive. Nor are we to consider the general action as identical in all laxative medicines. While it is of a temperant or cooling nature in some, as tamarinds, cassia, &c. it is emollient in others, as in the different oils, &c. The advantages arising from the use of the latter in inflammatory affections of the air passages, urinary organs, &c. sufficiently prove them to possess considerable powers, which must evidently arise from the absorption of their molecules, and their coming in direct contact with the

parts affected. In fact, laxatives are emollients possessing the property of disturbing the functions of the intestinal canal, and thereby producing alvine evacuations. From what has been said, it will appear that there is not the slightest analogy between purgatives and laxatives; their local impression, as well as their general influence, being not only of a different, but even of an opposite nature. In administering laxatives their local as well as their general action should be kept in view.

Laxatives are employed in febrile diseases, sometimes on account of their action on the *primæ viæ*, and sometimes by reason of their influence on the system in general, and occasionally for the purpose of procuring the combined advantages of their local and general action. We have already referred to the danger of administering purgatives, when the system is in a state of great irritation, when the tongue is red and parched; when there is thirst, urine scanty, skin dry, &c. In such cases not only are laxatives not contra-indicated, but we often experience the most striking advantages from their use. In the phlegmasiæ also, laxatives are found serviceable, not only by their action on the alimentary canal, but also by the impression they make on the functions of the circulation, respiration, on the skin, &c. In inflammation of mucous membranes we employ laxatives both for their local action on the intestines, and for their general action on the system. In diarrhœa, attended with pain, in inflammation of the intestinal canal, caused by an irri-

tating or corrosive substance, the greatest advantage has been derived from the local as well as general action of this class of medicines. When the digestive functions are impaired in consequence of relaxation of the tunics of the stomach and intestines, laxatives are likely to prove injurious, and to increase the evil. From a particular effect which oily laxatives have on intestinal worms, they are frequently recommended; they first destroy them, and then facilitate their expulsion. In irritation of the urinary organs, the administration of laxatives must appear, from what has been said, likely to be attended with considerable advantages.

Recapitulation of the distinctions made between laxatives and vegetable purgatives.

Chemical Composition.

Laxatives consist of mucilage, sugar, fixed oil, vegetable acids; whilst purgatives consist of bitter principle, extractive, and resinous substances, salts, &c.

Sensible Qualities.

Laxatives are almost inodorous; they have a saccharine, insipid, or acid taste; whilst purgatives, in general, exhale a strong, nauseating odour, and are remarkable for a bitter, acrid taste.

Dose.

Laxatives are usually given in a large dose, when the object is to produce alvine evacuations, whilst a very small quantity of a purgative will generally suffice.

Effect of the Stomach on them.

Laxatives are capable of being acted on by the digestive organs, and of being converted into chyme; purgatives are not digestible.

Action on the Intestinal Surface.

Laxatives relax the tissues of the intestines, whilst purgatives irritate them.

General Action on the System.

Laxatives have an emollient or temperant effect on all the tissues of the body; nor is their use ever followed by an increase in the animal heat, frequency of pulse, thirst, dryness of skin, &c. On the contrary, purgatives act as stimulants; they increase the animal heat, accelerate the circulation, &c. &c.

Therapeutic Employment.

Laxatives are of great advantage in diseases attended with irritation, and in inflammatory affections, whilst they are contra-indicated in affections depending on a state of atony. Purgatives derive their success from their irritating powers, by which they effect the expulsion of the matters contained in the *primæ viæ*, relieve the digestive organs, and cause a useful and salutary revulsion in affections of the head and chest.

ON MEDICAL PRESCRIPTIONS.

The physician in prescribing medicines generally directs several ingredients to be combined in the same formula.

The objects which he proposes to attain by this combination are, 1st, to promote the action of the *basis,* or principal ingredient, by combining it with substances whose physiological action is similar. Thus, in prescribing narcotics, we frequently combine opium, extract of hyoscyamus, and extract of conium, in the same formula. In directing antispasmodics, we combine several medicines of this class, as assafœtida, valerian, and æther. In diuretics, squill, digitalis and calomel are conjoined. In emetics, ipecacuanha and tartar emetic; and in purgatives we constantly combine ingredients of this class, each capable of producing the same ultimate effects.

2dly. To obtain the joint operation of remedies, whose physiological action is different, but which may be required to obviate different morbid symptoms, and to fulfil at the same time several therapeutic indica-

tions. Thus, purgatives are frequently combined with tonics, the latter increasing the tone of the intestines, and thereby rendering them more sensible to the stimulus of the purgative.

In diarrhœa astringents and diaphoretics are often combined; the former exerting its action on the vessels of the intestines, whilst the latter relax the cutaneous exhalants, and thereby produce a salutary revulsion.

In colica pictonum, opium is often combined with purgatives, in consequence of its power of relaxing the spasmodic constriction of the intestinal canal, thereby enabling purgatives to produce their effects.

In dropsy tonics and purgatives are combined; the former, in order to support the strength of the system, and the latter to evacuate the fluid. The same may be said of the combination of tonics and diuretics. Expectorants are advantageously combined with stimulants in pulmonary affections, where the strength of the patient is much exhausted.

3dly. To change the effects which the several ingredients are capable of producing in their separate state, and by taking advantage of the power which one may have of modifying the action of the other, to obtain a remedy altogether new. We have numerous examples of this resource in several of our officinal preparations, viz. in the several alkaline, earthy, and metallic salts, where, in consequence of the combinations of the acid with the base, a compound results, calculated to produce effects altogether different from what either of

the components are capable of producing. Sulphate of zinc and acetate of lead being mixed together in solution, an acetate of zinc is produced, which is found more useful in some cases, as a therapeutic agent, than either of the original salts. The "Aqua Chlorinii" of the Dublin Pharmacopœia affords another instance of the same result, as also the "Tinctura Acetatis Ferri." The combination of ipecacuanha and opium of the Pharmacopœias, which goes under the name of Dover's powder, affords a striking instance of the result of *mechanical combination*. Here neither the nauseating effects of the ipecacuanha, nor the narcotic powers of the opium are at all perceived, whilst, by the powers of each over the other, a new remedy is produced, possessing powerful diaphoretic effects.

4thly. To correct the operation of the principal medicine, or obviate some unpleasant effect which it may produce.——We have instances in several of our officinal preparations, where substances are added for the purpose of obviating any disagreeable effects which the principal ingredients may produce. In the compound colocynth pill, the essential oil of cloves is added with this view. In the electuary of scammony, electuary of senna, &c., the essential oils are added for the purpose of obviating the griping or other unpleasant symptoms which the active ingredients are liable to produce. For the same reason, opium is frequently added to mercury, in order to prevent it from passing off by the bowels. The griping properties of senna and resinous purgatives are prevented by the addition of an alkali;

for the same reason, sedatives and aromatics are frequently added to tartarized antimony when it is desired to prevent it from acting as an emetic.

5thly. To communicate an agreeable taste or flavour, and give a convenient form.

Comformably with the above views, four parts are usually distinguished in a formula. The *basis, adjuvans, corrigens,* and *constituens.* From what has been said, the nature and uses of these parts will be readily understood.

The observation of the following directions may enable the inexperienced prescriber to guard against some of the more serious errors to which he is liable in directing the combination of medicinal substances.

1. In prescribing, care should be taken not to combine in the same formula substances which are medicinally, chemically, or mechanically incompatible.

2. He should endeavour to correct the odour and taste of the medicines which may otherwise excite disgust in the patient, at the same time that the substances added for this purpose should not alter the medicinal virtues of the active ingredient.

3. Consider well the *form* in which the medicine may be best administered ; whether it were better given in powder, in pill, in infusion, decoction, &c. ; these different forms can be by no means indifferent, and must depend on the nature of the medicinal substance. Medicines which are nauseous, and which operate in small doses, and are designed to operate slowly, or which have considerable specific gravity, are usually given under the form of pill. Those which are less

ungrateful, or whose operation is immediately required, are given under the form of an electuary or a liquid. It should also be recollected, that the form in which the medicine is given oftentimes influences its action on the system: thus nitre will act as a diuretic only when given in the liquid form. Medicines intended to act on the muscular contractility of the intestines should be given in solution. The same may be said of medicines intended to act on the cutaneous exhalants.

4. He should consider well the *doses*, in which medicines should be administered. There are several substances inert in small quantities, which however become very energetic in larger. The doses also should be raised gradually. In regulating the dose, the age, sex, temperament, habit, idiosyncracy of patient, duration of disease, &c., should be taken into account. The rule proposed by Dr. Young for adjusting the doses of medicines is, that for children under 12 years old, the doses must be diminished in the proportion of the age to the age increased by 12: thus at 2 years old to $\frac{1}{7}$—scil. $\frac{2}{2+12} = \frac{1}{7}$: at 4 years to $\frac{1}{4}$—scil. $\frac{4}{4+12} = \frac{1}{4}$. At 21 the full dose may be given.

5. The prescriber also, previous to writing the prescription, should consider, 1st. The weight or volume of the medicine: 2dly. How long he intends it to last: 3dly. How much of it the patient is to take at a time: 4thly. The proportion of the base at each time of administering it.

Having determined on the dose of the medicine, and the number of times it is to be taken, the quantity

to be directed in the formula will obviously be had by multiplying the dose by the number of doses to be taken. Thus, suppose we wish to give Tartar emetic in half grain doses every hour, and that we determine to continue its use for 12 hours successively, and to administer each dose in a table-spoon full of some liquid vehicle, suppose cinnamon-water, with mucilage of gum arabic, syrup and plain water; first multiply $\frac{1}{2}$ gr. by 12, and that will give the quantity of tartar emetic necessary, scil. 6 grains; whilst the quantity of the vehicle will be $\frac{1}{2}$ oz. multiplied by 12 = 6 oz. of which the cinnamon water may constitute one-half, and the mucilage, syrup, and water, the other.

6. Attend to the particular *season* of the year, when directing any vegetable medicine; for this a knowledge of botany is indispensably necessary.

7. In prescribing a medicine, whether vegetable, mineral, or animal, attention should be paid to the nature of its physical or chemical action on the vessels containing it. The physician should likewise know the consistence, volume, &c. of each medicinal substance, in order that he may select the most suitable form, excipient, vehicle, &c.

8. In drawing up a formula, the different solubility of the several ingredients and the different menstrua in which they are soluble should be attended to; thus some substances are soluble only in alcohol and æther, as camphor, resins, balsams. Others are soluble in diluted alcohol, as gum-resins. Several substances in dissolving combine with water in the state of hydrate, and absorb great quantities of it.

In the following Formulæ the classification of Doctor Murray has been followed with very few exceptions, as being that which is more generally adopted.

NARCOTICS.

1. ℞. Aquæ puræ unciam,
Syrupi simplicis drachmas duas,
Tinct. opii guttas viginti. *M.*
Fiat haustus.

2. ℞. Aquæ puræ unciam cum semisse,
Spir. cinnamomi,
Syr. papaveris, ā. ā. drachmas duas,
Tincturæ opii guttas quindecim. *M.*
Fiat haustus.

3. ℞. Extracti conii.
Extracti hyoscyami ā. ā. grana quinque,
Mucilaginis acaciæ drachmas duas.
Tere simul, donec quam optime misceantur et deinde adde
Liquoris ammoniæ acetatis,
Aquæ puræ, ā. ā, semunciam,
Syrupi rhæados drachmam. *M.*
Fiat haustus, quarta quaque hora sumendus.

PARIS.

In Pulmonary Irritation.

4. ℞. Mist. camphoræ unciam,
Spir. ætheris comp. semidrachmam,
Tinct. opii ♏. decem,
Syrup. papaveris drachmam.
Fiat haustus horâ decubitus sumendus.

5. ℞. Mist. amygdalarum unciam,
Tinct. opii guttas viginti,
Syrupi drachmam. *M.*
Fiat haustus.

6. ℞. Tincturæ opii drachmam,
Infusi lini uncias sex. *M.*
Fiat enema.

7. ℞. Opii puri grana duo,
Saponis duri Hispanici grana quatuor.
Simul contunde ; fiat massa pro suppositorio.

8. ℞. Opii puri grana duo,
Confectionis aromaticæ semidrachmam.
Fiat massa in pilulas octo dividenda, e quibus capiatur una quartis horis.

ARMSTRONG.

9. ℞. Extracti hyoscyami scrupulum,
Camphoræ (alcoholis ope in pulverem redactæ) grana octo.
Fiant pilulæ duodecim, quarum sumantur tres, omni nocte.

DUNCAN.

10. ℞. Opii puri grana quatuor,
Extracti hyoscyami,
Extracti conii ā. ā. grana quindecim.

Fiat massa in pilulas sex dividenda, e quibus sumatur una omni nocte.

DARWIN.

11. ℞. Liquoris ammoniæ acetatis,
Aquæ rosæ, ā. ā. uncias tres,
Vini opii guttas quindecim. *M.*

Fiat collyrium sedativum.

BEER.

In Ophthalmia.

12. ℞. Opii puri grana duo,
Mucilag. acaciæ semunciam,
Lactis tepefacti uncias sex.

Misce pro enemate.

HARTMAN.

13. ℞. Opii puri granum,
Pil. Galb. comp. grana quinque.

Fiat pilula horâ somni sumenda.

14. ℞. Opii purificati unciam.

Tere ad solutionem cum aquæ fontanæ librâ—ut fiat embrocatio anodyna.

SCARPA.

15. ℞. Ceræ flavæ uncias duas,
Ol. oliv. uncias duas. Simul liquefactis adde
Pulveris conii foliorum siccatorum uncias tres.
Fiat emplastrum.

POTT.

In Cancer.

16. ℞. Aquæ cinnam. unciam cum semisse,
Confectionis aromaticæ drachmam,
Tinct. opii minima quindecim. *M.*
Fiat haustus.

LATHAM.

In Gout.

17. ℞. Extracti hyoscyami semiscrupulum,
Pulv. rad. glycyrrhizæ q. s.
Fiant pilulæ duodecim, quarum duæ pluresve ter quotidie sumendæ sunt.

GREGORY.

18. ℞. Pulveris opii semidrachmam,
Camphoræ grana quindecim. Tere simul cum
Unguenti cetacei semidrachmâ.
Ut fiat unguentum.

PEMBERTON.

In Cholic and violent Vomiting.

ANTISPASMODICS.

19. ℞. Mist. camphor. drachmas decem,
Tinct. opii guttas quadraginta,
Spir. ætheris sulphurici drachmam,
Syrup. rhæad. drachmam. *M.*
Fiat haustus.

20. ℞. Mist. assæfœtid. unc. sex,
Tinct. Valer. ammon. semunciam. *M.*
Sumatur pars quarta ter in die.

21. ℞. Moschi scrupulum,
Acaciæ gum. contriti semidrachmam :
Tere optime simul et adde paulatim,
Aquæ ros. unciam,
Æther. sulphur. drachmam.
Fiat haustus.

FRANK.

In Typhus and confluent Small Pox.

22. ℞. Assæfœtid. drachmam,
Aquæ menth. piperit. sesquiunciam.
Tere assamfœtidam cum aquâ paullatim instillatâ, donec quam optime misceantur, et deinde adde,
Tinct. valerian. ammon. drachmas duas,
Tinct. castorei drachm. tres,
Æther. sulphur. drachmam.
Fiat mistura—sumatur cochleare unum amplum secundis horis.

In Hysteria.

23. ℞. Moschi gr. xv,
Camphoræ gr. v,
Spir. rectif. ♏. ij,
Confect. ros. gall. q. s.

Camphoram primum cum spiritu tere, et deinde, secundum artem, fiat bolus.

24. ℞. Tabaci foliorum ℈j,
Aquæ ferventis, unc. viij.

Macera per horam in vase leviter clauso et cola. Fiat pro enemate.

25. ℞. Tinct. opii ♏ vi,
Vini ipecac. f. ʒ i,
Aquæ puræ f. ℥ i,
Syrup. simp. f. ʒ iij,
Sodæ subcarb. gr. xxiv.

Sumat infans sextam partem quartis vel sextis horis.

R. Pearson.

Hooping Cough.

TONICS.

26. ℞. Infus. quassiæ f. ʒx,
Tinct. columbæ f. ʒ i,
Tinct. ferri muriat. ♏ x.

Fiat haustus.

Cline.

27. ℞. Decoct. cinchon. ℥ ij,
Tinct. guaiac. ammon.
Syrup. croci, ā. ā. ʒ i. *M.*
Fiat haustus sextis horis sumendus.

ABERNETHY.

In Chronic Rheumatism.

28. ℞. Decoct. cinchon. ʒ x,
Confect. arom. ℈ i,
Tinct. cinchon. compos. ʒ i. *M.*
Sumat haustum quartis horis.

29 ℞. Infus. cascarillæ f. ℥ iss,
Tinc. cascarillæ, f. ʒ ij,
Tinct zingib. ʒ i. *M.*

30. ℞. Sulphat. quinæ, gr. ij,
Acid. sulphur. dil. ♏ ij,
Aquæ distillatæ. f. ℥ i. *M.*
Fiat haustus bis terve de die sumendus.

31. ℞. Sulphat. quinæ, gr. iij,
Acid. sulphur. dil. gutt. iij,
Infus. aurant. comp. ʒ x,
Tinct. cinchon. comp,
Syrup. zingib. ā. ā. ʒ i. *M.*
Fiat haustus tertiis horis adhibendus.

32. ℞. Carb. ferri gr. xv,
Extr. opii granum,
Sulph. quinæ gr. iij,
Bals. Canad. q. s.
Fiant pilulæ sex—sumat duas ter in die.
Amenorrhœa.

33. ℞. Ferri sulphat. gr. xij,
Extr. gentian. ʒ i,
Pulv. cinnam. comp. ʒ ss. *M.*
Divide in pilulas xviij. Sumat duas ter in die.
Amenorrhœa.

34. ℞. Ferri subcarb. ʒiij,
Syrup. aurant. unciam,
Pulv. cinnamom. comp. ʒ i. *M.*
Fiat electuarium—sumat drachmam bis in die.

STIMULANTS.

35. ℞. Pulv. cinnamom. comp. ʒ i,
Aquæ menth. virid. ℥viiss,
Spirit. lavand. comp. ʒ iii,
Sacchari purific. ʒ ij. *M.*
Sumat ℥ iss. ter quaterve in die.

36. ℞. Confect. aromat. ʒ iss,
Ammoniæ carbonat. ʒ ss,
Aquæ distill. ℥ vi,
Spirit. Myristicæ ℥ i.
Syrup. croci ℥ ss. *M.* FRANK.

37. ℞. Mist. camphor. ʒi,
Spirit. æther. sulphur. ʒij,
Tinct. cardam. comp. ℥ss,
Spirit. anisi ʒvi,
Olei carui ♏.xij,
Syrup. zingib. ʒij,
Aquæ menth. piperit. ℥vss.

Fiat mistura, cujus sumatur cochlearia duo ampla, urgenti flatu.

In Flatulent Cholic.

38. ℞. Ammoniæ carbonatis ʒ ,
Spiritus tenuioris ℥ij,
Decoct. hordei ℥xii. *M.*

Fiat gargarisma.

ASTRINGENTS.

39. ℞. Misturæ Cretæ ℥iss,
Tinct. opii ♏xv,
Tinct catechu ʒi.

Fiat haustus post singulas sedes liquidas sumendus.

In Diarrhœa.

40. ℞. Confect. ros. gall. ʒi,
Infus. ros. fervent. O j.
Macera per horam et cola.
℞. Hujus colaturæ ʒxiij,
Acidi sulphur. diluti ♏x.
Fiat haustus ter in die sumendus.

WARDROP.

In Hæmaturia.

41. ℞. Infus. cuspariæ ʒi,
Tinct. catechu ʒi,
Pulv. ipecac. gr. x.
Fiat haustus.

42. ℞. Lactis vaccini bullientis O j,
Aluminis contriti ʒij.
Ebulliant simul ut fiat coagulum : coletur serum, et sumatur cyathus subinde.

PEARSON.

In Diarrhœa.

43. ℞. Pulv. gallar. ʒi,
Adipis prepar. ʒi.
Fiat unguentum parti affectæ applicandum.

CULLEN.

In Hæmorrhoids.

44. ℞. Tincturæ ferri muriat. ♏x,
Aquæ puræ unciam.
Fiat haustus tertia quaque horâ sumendus.

CLARKE.

In Uterine Hæmorrhage.

45. R. Plumbi acetatis gr. ss,
Confect ros. canin. gr. iv,
Tinct. opii ℥ij.
Fiat pilula una, quarta quaque horâ sumenda.

EMETICS.

46. R. Antimonii tartar. gr. i,
Vini ipecac. drachmas duas,
Aquæ puræ ℥iss.
Fiat haustus.

BAILLIE.

47. R. Sulphat zinci ℈i,
Confect. ros. canin. q. s.
Ut fiat bolus, ex pauxillo infus. anthemid. hauriendus. Post quamlibet vomitionem superbibantur cyathi aliquot infusi ejusdem tepidi.

PURGATIVES.

48. R. Submuriat. hydrargyr. gr. iv,
Extract. colocynth. comp. gr. v,
Capsici granum. *M.*
Fiant pilulæ duæ.

49. R. Pulv. jalap. grana viginti,
Submuriat. Hydrargyr. gr. iv. *M.*
Fiat pulvis.

50. ℞. Submur. hydrargyr. gr. ij,
Pulv. scammon. gr. iv,
Sacchar. purificat. gr. ij. *M.*
Fiat pulvis (*basilicus.*)

51. ℞. Infus. sennæ comp. ℥v,
Tartrat. potass. unciam,
Tinct. jalapæ,
—— sennæ ā. ā. semunciam,
Syrup. rhamni ʒiij. *M.*
Sumat partem quartam pro dosi.

52. ℞. Submur. hydrargyr. gr. x,
Pil. cambog. comp.
Extract. colocynth. comp. ā. ā. gr. xv,
Syrup. zingib. q. s. *M.*
Fiant pilulæ xii.—sumantur duæ pro dosi.

FRANK.

Dropsy.

53. ℞. Infus. sennæ ℥i,
Tinct. sennæ,
Tinct. jalap. ā. ā. ʒi,
Tartrat. potassæ ʒi,
Syrup. sennæ ℥i.
Fiat haustus summo mane sumendus.

54. ℞. Electuar. sennæ ℥iss,
Sulphur. præcipitat. ℥ss,
Syrup. Ros. q. s.

Fiat electuarium, de quo ad nucis moschatæ magnitudinem, capiatur ter vel quater quotidie, donec alvus purgetur.

In Hemorrhoids.

55. ℞. Jalapæ rad. contrit. gr. xv,
Submur. hydrargyr. gr. v,
Confect. ros. canin. q. s.

Fiat bolus.

56. ℞. Sodæ tartarizat. ʒij,
Carbonat. sodæ ℈i,
Aquæ puræ ℥iss.

Fiat haustus, cum cochl. uno amplo succi limonis inter effervescendum sumendus.

LAXATIVES.

57. ℞. Olei ricini semunciam,
Mucilag. acaciæ dr. iij,
Aquæ pimentæ dr. vi,
Syrupi ʒi,
Tinct. opii guttas decem. *M.*

Fiat haustus.

58. R. Olei. ricini ʒi,
Mannæ ʒij.
Pulv. acaciæ, gr. x.
Aquæ ʒx. *M.*
Fiat haustus.

59. R. Olei Ricini, ℥iss,
Vitellum ovi unius:
his rite terendo subactis, adde paulatim,
Aquæ menth. viridis ℥v,
Syrup. aurant. ℥ss.
Fiat mistura aperiens, de qua capiat æger cochlearia tria omni bihorio, donec alvus sit soluta.

EMMENAGOGUES.

60. R. Mist. ferri compos. ℥ss,
Aquæ cinnamom. ℥i. *M.*
Fiat haustus bis in die sumendus.

DENMAN.

61. R. Tinct. ferri muriat,
Tinct. aloes. comp. ā. ā. ℥ss,
Tinct. castor. ʒij. *M.*
Sumatur cochl. unum minimum ex cyatho infus. anthem. flor. ter quotidie.

CLARKE.

Emmenagogue and Antispasmodic.

62. ℞. Ferri tartariz. ʒi,
Extract. anthem. ʒiss,
Balsam. Peruvian. q. s.

Fiat massa in pilulas xxxvi dividenda, e quibus capiat ægra quatuor bis terve in die.

DEWEES.

63. ℞. Tinct. aloes comp. ʒiss,
Tinct. helleb. nigr,
Tinct. castor. ā, ā. ʒij,
Tinct canthar. ʒss. *M.*

CLARKE.

In Menstrual Retentions.

DIURETICS.

64. ℞. Pulv. scillæ gr. iss,
Pulv. cinnam. comp,
Potassæ acetat. ā. ā. gr. viij,
Syrup. zingib. q. s.

Fiat bolus.

65. ℞. Pulv. columb. gr. xv,
Pulv. zingib. gr. x,
Pulv. scillæ, gr. i,
Potass. Bitartrat. ʒi. *M.*

Fiat pulvis ter in die capiendus.

BAILLIE.

Diuretic and Tonic.

66. ℞. Massæ pil. scillæ ʒi,
Submur. hydrargyr. gr. v.

Fiat massa in pilulas xv. dividenda, quarum sumantur duæ singulis noctibus.

67. ℞. Sodæ carbonat. exsiccatæ ʒi,
Saponis duri ℈iv,
Olei juniperi ♏vi,
Syrup. zingib. q. s.

Ut fiat massa in pilulas xxx dividenda, e quibus capiat tres indies.

BEDDOES.

In Gravel and Stone.

68. ℞. Infus. digitalis ℥iv,
Tinct. digit. ʒss,
Acetat. potassæ ʒi,
Tinct. opii ♏v.

Fiat mistura, de qua sumatur coch. unum amplum bis terve in dies.

69. ℞. Infus. gentian. comp. ℥v,
Acetat. Potassæ ʒss.
Spirit. junip. comp.
Spirit. armoraciæ comp. ā. ā. ℥ss,
Æther. nitric. ʒij.

Fiat mistura.

PEARSON.

In Anasarca: Diuretic and Tonic.

70. ℞. Infus. cascarillæ ʒvi,
Spirit. juniperi compos.
——— æther. nitr. ā. ā. ʒi,
Confect. aromat. gr. xv. *M.*
Fiat haustus quinta quaque hora sumendus.

71. ℞. Tinct. Lyttæ ♏x,
Spirit. æther. nitrici ʒi,
Mist. camphor. ʒxij,
Syrup. zingib. ʒi.
Fiat haustus ter in die sumendus,
A highly stimulating Diuretic.

DIAPHORETICS.

72. ℞. Pulv. Dover. gr. xij,
Pulv. antimon. gr. ij.
Fiat pulvis hora decumbendi sumendus, superbibendo haustulum tepidum.

73. ℞. Guaiaci gum-resinæ gr. x,
Pulv. Doveri gr. v,
Confect. rosæ q. s.
Ut fiat bolus, h. s. sumendus.

74. ℞. Pulv. Ipecacuanhæ gr. ij,
Pulv. opii gr. i,
Potassæ nitrat. gr. xvi.
Fiat pulvis hora somni sumendus.

75. R. Mist. camphor. ℥vi,
Spir. æther. compos.
Spir. ammon. aromat.
Syrup. aurant. ā. ā. ʒ iss. *M.*
Capiat æger cochlearia duo ampla in hora.

76. R. Sodæ subcarbonat. ʒi,
Succi limon. recent. ad alkali saturationem q. s.
Mist. camphor. ℥vi,
Potass. nitrat. ℈i,
Syrup. rhœad. ʒiij.
Fiat mistura, cujus capiantur cochlearia tria magna quartis horis.

BAILLIE.

EXPECTORANTS.

77. R. Ammoniaci,
Aquæ cinnamom. ā. ā. ℥iss,
Syrup. tolut. ℥ss,
Tinct. castorei ʒij,
Tinct. opii ♏v.
Fiat mistura, cujus sumatur cochl. unum amplum subinde.

78. R. Mist. Amygdal. ℥i,
Vini Ipecacuan. ♏x,
Carbonat. potass. gr. x.
Sumatur cum succi limon ʒiij, inter effervescendum.

79. R. Emuls. Arabicæ, ℥vij,
Antim. tartar. gr. iss. *M.*
Sumatur cochleare unum amplum 2dis horis.

SIALOGOGUES.

80, R. Acidi Nitrici ʒi,
Aquæ distillatæ ℥xxiv,
Syrup. cujusvis ℥ij.
Mistura fiat. Sumatur partitis vicibus intra nycthemeri spatium.

BEDDOES.

81. R. Hydrarg. oxyd. rubri gr. i,
Opii tertiam grani partem,
Caryophyll. olei ♏i.
Fiat pilula h. s. per hebdomadam sumenda.

HUNTER.

ANTACIDS AED ABSORBENTS.

82. R. Magnes. ʒi,
Spirit. cinnam. ʒiv,
Spir. ammon. Arom. ʒi,
Aquæ puræ ℥v.
Sumatur ℥i. p. r. n.

CLARKE.

In Aphthæ.

83. ℞. Magnes. carbonat. ʒi,
Pulv. rhei gr. xxx,
Aquæ anethi, ℥iij,
Spir. ammon. aromat. ♏xxx. *M.*
ʒij p. r. n. bis terve quotidie.

In the Diarrhœa of Infants.

84. ℞. Pulv. Cretæ comp. cum opio ʒss,
Confect. Aromat. q. s.
Fiant pilulæ octo.

85. ℞. Magnes. ʒss,
Aquæ menthæ piperit. ℥iiss,
Spir. Lavand. comp. ʒss,
Spir. carui ʒiv,
Syrup. zingib. ʒij.
Sumat cochleare unum amplum p. r. n.

86. ℞. Liquor. potass. subcarb. ʒss,
Infus. gentian. comp. ℥i,
Tinct. cascarillæ ʒi.
Fiat haustus pro re nata.

87. ℞. Magnes. ustæ gr. xxx,
Pulv. rhei gr. vi,
Sacchar. albi ʒi,
Olei anisi gutt. iv,
Tinct. opii gutt. iij,
Aquæ fontan. ℥iss. *M.*
Dosis pro infante cochleare parvum.

CHAPMAN.

In the Gripes and Acidities of Infants.

88. R. Carbon. sodæ grana decem,
Infus. gentian. comp.
Aquæ piment. ā. ā. ʒvi,
Tinct. cardam. comp. ʒi. *M.*
Pro haustu.

DEMULCENTS.

89. R. Olei amygd. ʒvi,
Liquor. potass. ♏ L,
Aquæ Ros. ℥viiss. *M.*
Sumantur cochlearia duo ampla ter, quaterve in dies.

90. R. Olei Ricini, ℥ss,
Vitelli ovi q. s.
Aquæ distill. ℥i,
Spir. lavand. comp. ♏ x L.
Syr. Tolut. ℥ss.

GRIFFITHS.

Demulcent and Aperient.

91. R. Vitell. unius ovi,
Ol. amygd. ℥ij,
Syr. althææ ℥i,
Aquæ ros. ℥iij. *M.*
Fiat emulsio.

91. ℞. Lichen. Island. ℥i,
Aqua O iss.

Decoque ad O j et cola. Dosis ℥ iij. to ℥ iv. sæpius.

YOUNG.

92. ℞. Amyli ʒ iij,
Aquæ fervent. ℥iv,
Solve pro enemate, et adde, si opus fuerit,
Tinct. opii ʒss.

A TABLE OF INCOMPATIBLES.

MEDICINAL SUBSTANCES.	INCOMPATIBLES.
Absinthium . . .	Sulphates of iron and zinc. Acetate of lead.
Acid (Citric) . . .	Sulphuric and nitric acid. Acetate of lead. Alkaline, earthy and metallic carbonates. Tartras potassæ.
—— (Nitric) . . .	Salifiable bases. Carbonates. Essential oils.
—— (Sulphuric) . .	Do. do. do. do.
—— (Prussic) . . .	Oxides of mercury and antimony. Nitrate of silver. Tartras ferri et potassæ. Mineral acids. Chlorine.
—— (Tartaric) . .	Alkaline solutions. Magnesia. Acetate of lead.
Alum.	Alkalies and their salts. Magnesia. Lime water. Acetate of lead. Salts of mercury. Vegetable astringents.
Ammoniæ acetatis aqua	Acids. Bichloride of Mercury. Sulphate of magnesia. Sulphates of zinc, copper and iron.
Ammmoniæ carbonas .	Potassa fusa. Liquor potassæ. Magnesia.
Ammoniæ murias . .	Sulphuric and nitric acid. Carbonates of soda and of potassa. Acetate of lead. Lime. Nitrate of silver. Sulphates of magnesia, of zinc and of iron.

MEDICINAL SUBSTANCES.	INCOMPATIBLES.
Calomelas	Kermes mineral. Chlorine. Nitric acid. Alkalies and their carbonates. Lime water. Soap. Alkaline sulphurets. Iron. Lead.
Cinchona	Tartar emetic. Sulphates of iron and of zinc. Bichloride of mercury. Decoction of nut-galls. Lime water. Alkaline carbonates. Bitter infusions.
Colocynthidis pulpa .	Fixed alkalies. Sulphate of iron. Nitrate of silver. Acetate of lead.
Columba	Infusion and decoction of yellow cinchona. Acetate of lead. Corrosive sublimate. Lime water.
Copaiba	Sulphuric and nitric acids.
Digitalis	Sulphate of iron. Acetate of lead. Infusion of cinchona.
Gentian	Acetate of lead.
Guaiacum	Mineral acids.
Gum Arabic . . .	Acetate of lead in solution. Alcohol. Sulphuric æther. Nitric acid.
Gum Kino	Mineral acids. Alkalies. Alkaline carbonates. Acetate of lead. Tartar-emetic. Sulphate of iron.
Hydrarg. mur. corrosiv.	Fixed alkalies. Alkaline carbonates. Tartar emetic. Sulphuret of potass. Soap. Iron. Lead. Metallic mercury. Astringent substances.
Hydriodas potassæ .	Sulphuric and nitric acids. Acetate of lead.
Magnesiæ sulphas . .	Fixed alkalies. Alkaline carbonates. Lime water. Muriate of Barytes. Nitrate of silver. Acetate of lead.

MEDICINAL SUBSTANCES.	INCOMPATIBLES.
Mentha piperita	Acetate of lead. Nitrate of silver. Sulphate of iron.
Moschus	Bichloride of Mercury. Sulphate of iron. Nitrate of silver. Infusion of cinchona.
Murias barytæ . . .	Sulphate of soda. Alum. Nitrate of Potass. Nitrate of silver.
Nitras argenti . . .	Fixed alkalies. Muriatic, sulphuric, and tartaric acids. Soap.
Opium	Alkaline carbonates. Nitrate of silver. Sulphates of zinc, of copper, and of iron. Acetate of lead. Astringent decoctions.
Potassæ bitartras . .	Alkalies. Earths. Mineral acids.
Potassæ acetas . . .	Mineral acids. Decoction of tamarinds. Chloride of mercury. Sulphate of soda and magnesia. Tartrate of potassa. Muriate of ammonia.
Potassæ carbonas . .	Mineral acids. Borax. Muriate of ammonia. Acetate of ammonia. Sulphates of magnesia, and of lime. Alum. Metallic salts.
Potassæ nitras . . .	Sulphuric acid. Sulphates of soda and of magnesia. Metallic sulphates. Alum.
Potassæ sulphas . .	Strong acids. Mercurial salts.
Potassæ tartras . .	Tamarinds. Acid fruits. Acids. Sulphate of soda, potassa and magnesia, muriate of ammonia. Acetate of lead.
Rheum	Gelatine. Infusion of yellow cinchona. Strong acids. Bichloride of mercury. Acetate of lead. Sulphate of iron. Tartar emetic.

MEDICINAL SUBSTANCES.	INCOMPATIBLES.
Sodæ & potassæ tartras	Acids. Tamarinds. Muriate of ammonia. Sulphates of soda, potassa and magnesia. Acetate of lead.
Sodæ phosphas . .	Strong acids.
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* From this the infusion of gentian is to be excepted.

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