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Fleming, Alexander, 1823-1875.
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Publication/Creation

Dublin : Hodges and Smith, 1852.

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ON THE

CLASSIFICATION OF MEDICINES

ACCORDING TO

THEIR ACTION ON THE HEALTHY BODY.

BY

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“Une collection de faits isolés et sans liaison ne forme point une science.”—

DE CANDOLLE.

FROM THE DUBLIN QUARTERLY JOURNAL OF MEDICAL SCIENCE, NOV., 1852.

DUBLIN:

HODGES AND SMITH, GRAFTON-STREET,

BOOKSELLERS TO THE UNIVERSITY.

1852.

DUBLIN :

Printed at the University Press.

BY M. H. GILL.

ON THE
CLASSIFICATION OF MEDICINES,
&c. &c.

“ *Une collection de faits isolés et sans liaison ne forme point une science.*”

DE CANDOLLE.

THERAPEUTICAL agents are of three kinds, surgical, hygienic, and medicinal. The present paper refers to the last only.

In the science of *Materia Medica*, treating as it does of the properties of a large number of bodies, classification is important as a help to the memory, but it has much higher purposes.

Besides furnishing useful knowledge on the action of a medicine known to us only by its place therein, a *scientific* arrangement enables us to think of and to compare together those drugs which have the greatest number of common and *practically* important properties,—assists us in detecting where our knowledge is deficient, whether in the facts or in our mode of interpreting them,—indicates the way by which the deficiencies are to be supplied,—and is eminently useful in suggesting new methods and fields of observation. Our knowledge of the operation of allied drugs is mutually corrected and explained by their being grouped together, and in thus favouring the progress of the science, a sound classification develops the means of its own rectification and improvement. Lastly, it is only the student of a scientific arrangement who can acquire the knowledge which enables him to practise on general

principles, and so to avail himself with facility, on all sides, of the rapid advancement of the medical sciences.

We are surprised that many able writers on the *Materia Medica* have been indifferent to these important advantages, and that so little care has been devoted to the scientific arrangement of drugs^a. Many of the existing classifications are unscientific and bad, and are consequently fertile sources of error, both in fact and in generalization. We allude to the so-called therapeutic arrangements, and not to those founded on the natural-historical, sensible, or chemical properties of drugs, which are not without their value in relation to certain ends, but, as commonly employed to avoid the supposed insuperable difficulties of a physiological classification, present no claim to our notice. With them we have no more concern than the natural philosopher has with the arrangement of bodies in chemistry, or the chemist with the natural arrangement of plants. The bodies examined by all are the same, but it is the duty of each science to arrange them with reference to the properties (and their practical application, if they have such) which it is the object of the science to investigate.

Most recent authorities have sought rather to indicate the differences presented by the action of drugs when compared together than to trace the resemblances, more or less intimate, which link them into groups,—a task which, however difficult, must be performed if we hope to attain to general views and scientific treatment. To declare its performance impossible is virtually to deny the application of induction to therapeutics, and to reject its claim to the rank of science. The study of the differences of action is most instructive, but the most efficient means of making them apparent is presented by the previous arrangement of the medicines according to their physiological analogies.

^a Amongst the exceptions to this remark we must place in the first rank the distinguished authors of the "Pharmacologia," and of the "Elements of Materia Medica and Therapeutics."

It is objected that the whole range of what are termed facts in the science is so involved in controversy, doubt, and obscurity, that an attempt to arrange them systematically is useless, and has the pernicious result of giving precision and an air of truth to error. We maintain, however, that our knowledge of the physiological action of drugs—which, as will be seen in the sequel, should form the basis of a scientific arrangement—is sufficiently accurate, and embraces an ample number of undoubted truths for our purpose. Thus, the facts indicated in describing the action of a stimulant, sedative, tonic, or narcotic, are sufficiently precise to form the basis of a highly useful classification. A physiological arrangement may be pushed too far, or beyond the limits of ascertained truth; and attempts may be made to found classes and orders on phenomena still involved in obscurity. This is the abuse of a true principle, and is no argument against its proper application. The “controversy, doubt, and obscurity,” complained of, exist much less in our knowledge of the physiological action of drugs than in our knowledge of the practical application of this action to the treatment of disease, where their existence does not prejudice the scientific value of an arrangement founded on the effects of medicines on the healthy body. It is alleged that the framers of physiological arrangements have found the facts hitherto determined insufficient for their purpose, and have in consequence been obliged to resort to speculation. Hypothesis was employed, not, however, because of the insufficiency of the facts, but because of the incompetency of the *soi-disant* philosophers in this department of medicine to make a proper use of them. Therapeutics is eminently an empirical science, and every step in the discovery of truth and in the development of classification must be made by close induction. Unfortunately, several writers, as Brown, Rasori, and Broussais, thought otherwise, and, indulging in speculations independently of observation, attempted to predict facts in place of carefully generalizing those already

discovered. That previous authors have made a bad use of the facts of the science should be to us a strong reason for endeavouring to employ them better, and to confine ourselves rigidly to the positive.

A scientific arrangement of drugs should be founded on the principle of placing those together whose properties present the greatest number of important points of resemblance,—the relative importance of the properties being determined by their value as guides in the application of the medicines to the treatment of disease.

The properties of drugs are numerous and of very different kinds, but a little reflection enables us easily to fix their relative importance in a system of classification. The physiological, chemical, and other properties of a medicine are examined not for their own sake, but to promote the discovery and explanation of its applications in the treatment of disease. *The discovery, therefore, of the therapeutic application, which is the grand object of the science, should be the presiding principle of its classification*; and of the several kinds of properties which a drug possesses, viz., physiological, chemical, botanical, and sensible, it is beyond question, that the first are a long way before the others in their importance in guiding and suggesting its practical application. Indeed, our object in studying the other properties is to improve and give exactitude to our knowledge of the first. *The physiological action of drugs should form, consequently, the basis of their scientific arrangement.* Yet the other properties are sometimes usefully employed to separate the minor divisions of the physiological classes, but they should only be had recourse to for this purpose when the physiological action fails to afford better elements of distinction. The chemical, botanical, and sensible properties are now enumerated in, we believe, the order of their value as contributing to the knowledge of physiological action.

We speak here of physiological action, as obtained by the

exhibition of medicinal doses. When, from the quantity of the drug, life itself is endangered, the phenomena occasionally become more complex, and assume a new character; as when a stimulant (alcohol), and a tonic (quina), occasion narcotism in poisonous doses. Our science does not require that the consideration of the poisonous effects should be included in the physiological arrangement of drugs. It would give rise to complexity, and confer no advantage in therapeutic application. The practical ends of Toxicology and *Materia Medica* are different: poisons are arranged in groups, whose effects require similar treatment; drugs in groups, whose effects have a common application in the treatment of disease. At the same time an examination of the physiological arrangement proposed in this memoir shows the majority of the classes, as the atonics, sedatives, tetanics, narcotics, and irritants, to be as closely allied in their poisonous action as in their medicinal effects.

Having determined that the physiological action in medicinal doses shall form the basis of our arrangement, it remains to ascertain the relative value (with reference to our present subject) of the different effects on the healthy body produced by drugs. Some of these are general, some special, others local. General action is secondary to absorption, and is manifested on the entire frame; special action, also secondary to absorption, is displayed on one system or organ^a; while local action, pre-

^a The words special and specific, now used indiscriminately, might be usefully distinguished, the former being employed in the sense I have attached to it in the text to designate action on one system or organ of the healthy body; the latter, peculiar and unexplained control over disease. Thus employed, special is a physiological, and specific a therapeutic term.

It may not be superfluous to observe here, that while I maintain the scientific accuracy and importance of associating medicines into classes which correspond in action, I believe that scarcely any two produce precisely the same effects. There is resemblance, but not identity. The impressions created may differ both in their force and nature, even among those most nearly allied. This is seen unequivocally in the repeated successful substitution of one drug for another of the same class which has

ceding absorption and independent of it, is confined to the part to which the drug is applied.

The effects designated by the terms tonic, atonic, stimulant, and sedative, are examples of general action. Their manifestation is not confined to one organ or system, but is extended to the whole body. A sedative does not depress the stomach only, or the lungs, or the circulation, or the nervous system, but all of these. We grant that all are not influenced to the same extent, and that, for example, some sedatives act more powerfully on the vascular, and others more obviously on the nervous system; but the *Materia Medica* furnishes no example either of a drug acting as a sedative on one system, and as a stimulant on another, or of a sedative or stimulant, whose power is not displayed more or less distinctly throughout the entire frame. These, then, are illustrations of *general physiological action, on which, in virtue of its universality, the chief classes should be established*. The first, second, third, and fourth classes of my arrangement, or the tonics, atonics, stimulants, and sedatives, are founded on the general action of the drugs they contain. They admit of a greater number of common and important propositions, and their practical applications are more obvious than any other classes into which, upon different principles of arrangement, the drugs could be thrown. The term *special*, as opposed to *general*, I employ to designate the action on a particular organ or system; thus, digitalis is a general sedative, but operates specially on the circulation; opium is a general stimulant, but has a special action on the

lost its remedial efficacy, as in the internal exhibition of stimulants, tonics, narcotics, and the local application of irritants and astringents. Were there indeed identity, we might sweepingly retrench the *Materia Medica*, and introduce into our art that deceptive simplicity which is accompanied by a vast curtailment of its resources. At the same time, when we have more than enough of medicines closely allied in action, a physiological arrangement helps to indicate such of the less useful as may be safely expunged.

brain, suspending its functions and producing sleep; ergot of rye has a special action on the uterus; and belladonna and opium induce special effects on the iris. These are obviously of inferior value to the former, but they are important elements of distinction. As a rule, the rank of a special physiological effect in our system of classification is determined by the double consideration of the absolute importance to life of the organ or system affected, and of the value of the practical applications of the action in the treatment of disease.

Nearly all medicines have some kind of general action, and operate more or less obviously as tonics, atonics, stimulants, or sedatives, and the *Materia Medica* might be arranged under these four classes, in which orders could be established to separate the members having important special actions, as tetanics, narcotics, and evacuants. Thus chloroform might be ranked in an order of the class sedatives, having the name of sedative narcotics; opium, in an order of the class stimulants, having the name of stimulant narcotics; while strychnia, junipers, and cantharides, might take their places among stimulants; the first in an order with the name of stimulant tetanics, and the second and third in an order with the name of stimulant diuretics. An arrangement of this kind, however, is deficient in practical value, for the obvious reason, that many of our medicines are not employed therapeutically in virtue of their general, but on account of their special action, when, as in the examples given, that is of a prominent and important nature, and undoubtedly transcends the general in the value of its practical applications. It is manifestly more useful to make the special actions of the tetanics, narcotics, parturients, evacuants, and astringents, the characteristics of new classes, and to unite together the medicines possessing them, for common consideration and comparison. On this principle are established the fifth, sixth, seventh, eighth, and ninth classes in my arrangement. In these, the general action is usefully employed to form subdivisions, as when the narcotics and eva-

cuants are distinguished according as they are tonic, atonic, stimulant, or sedative^a.

I consider it an essential principle in a physiological classification, that the drugs be arranged separately, according to their *local* and *remote* (general and special) actions, when between these there is no correspondence or necessary connexion. Thus ammonia, tartar emetic, sulphuric acid, and the sulphate of iron, are all *local* irritants, but respectively *remote* stimulants, sedatives, astringents, and tonics. In compliance with this principle are founded the tenth and eleventh classes of my arrangement, or the irritants and emollients.

The divisions should be as nearly as possible mutually exclusive; stimulants should contain no sedatives, and *vice versâ*. The two classes referred to *are* mutually exclusive; but the same perfection is not attainable throughout a physiological arrangement (e. g. stimulants, narcotics, and evacuants), and it is not essential to its scientific character, as some erroneously suppose. The nature of the properties themselves, as well as the circumstance, that in my classification I have regard both to the properties and their practical application, renders the attainment of mutual exclusiveness in all the divisions impracticable. It is certainly desirable, but it would be wrong to secure it by the sacrifice of any practical advantage. When a medicine obtains a place in more than one class, the plan adopted in my Lectures is to give the complete description under the class which recognises its most important action, and to refer the student to this account when the drug comes again under notice. This trifling inconvenience, for there is no repetition, has been needlessly exaggerated.

In my arrangement the distinctive characters are furnished by the prominent or characteristic and well-ascertained physiological effects, and are not sought for in obscure phenomena or in the *modus operandi*. Drugs rarely operate (as some au-

^a These remarks show the error in the forced simplicity of such dichotomic arrangements as the Brunonian *more* and *less*, or the Italian *for* and *against*.

thors have supposed) exclusively as vital, chemical, or mechanical agents, but combine in the total sum of their action two or all three of these elements; and besides, our knowledge generally of the modes in which physiological actions are brought about is altogether too imperfect and uncertain to allow of its safe employment in classification. I have endeavoured to give a more definite meaning to a portion of the language of therapeutic science, but have ventured to introduce only one new term, and throughout have studiously avoided changes in the established nomenclature.

I now proceed to describe the arrangement which I have adopted in compliance with the foregoing principles. I divide the *Materia Medica* into two divisions:—I. *Physiological*, embracing all drugs employed in virtue of their physiological action; and—II. *Non-physiological*, including those substances employed in the treatment of disease, but not in virtue of their action on the living body. In the latter division is placed the twelfth class, or the anthelmintics proper. The former comprises eleven classes, arranged in the order of their importance. The first, second, third, and fourth are founded on the general action of their members, and justly obtain precedence of the fifth, sixth, seventh, eighth, and ninth, which are characterized by special actions. Priority of place is given to the tonics and atonics as they influence assimilation, the most general and essential property of living beings^a. The fifth, sixth, and seventh classes precede the evacuants and astringents, because they operate on more important organs, and the tetanics come before the narcotics, as the cord is more essential to animal life than the brain. The irritants and emollients recognise local action only, and come last in the order of sequence. The CLASSES are divided into orders, and these again into sub-orders, when further subdivision directs attention to important physiological analogies, or useful practical applications.

^a Vegetables, like animals, have their tonics and atonics, as shown in the effects of different soils and manures.

TABLE OF THE CLASSES AND THEIR DEFINITIONS.

DIVISION I.—PHYSIOLOGICAL.

- CLASS 1. Tonics: increase permanently the strength and weight.
- „ 2. Atonics: diminish permanently the strength and weight, independently of evacuation.
- „ 3. Stimulants: increase temporarily functional activity, independently of local inflammation.
- „ 4. Sedatives: diminish temporarily functional activity, independently of evacuation.
- „ 5. Tetanics: cause spasms of the voluntary muscles.
- „ 6. Narcotics: induce sleep.
- „ 7. Parturients: cause contractions of the uterus.
- „ 8. Evacuants: increase secretions and excretions.
- „ 9. Astringents: constrict the tissues, and diminish secretions and excretions.
10. Irritants: tend to inflame the part to which they are applied.
- „ 11. Emollients: lubricate and soften the part to which they are applied.

Action followed by re-action.

DIVISION II.—NON-PHYSIOLOGICAL.

- CLASS 12. Anthelmintics: destroy worms in the alimentary canal.

In the descriptive definitions of the classes which follow I have purposely noticed such characters only as are absolutely necessary to explain and illustrate the classification. Complete histories, embracing every common proposition that can be made of the drugs, as well in relation to their botany and chemistry as to their action, uses, and exhibition, would more strongly exhibit the principle and practical value of the arrangement, but I reserve their publication for another time.

First Class.—TONICS: *increase permanently the strength and weight.* Their operation is slow, but enduring, and without re-action. They improve the digestion and the appetite, augment the strength and flesh, give colour to the cheeks, and vigour to the animal spirits. The tonicity of the fibre is augmented, as shown by the firm muscle, and tense, unyielding pulse; but it is an error to suppose that the operation of tonics is confined to an increase of this property. They enrich the blood, and promote nutrition, and might be described strictly as medicines which improve assimilation, employing this word in its comprehensive sense to include nutrition; but I have characterized them, like the other classes, by their obvious effects.

All tonics improve assimilation, but in different ways, on which is founded their separation into four orders:—I. COD-LIVER OIL; II. IRON AND ITS COMPOUNDS; III. VEGETABLE BITTER TONICS; and IV. ACID TONICS. The first and second orders act probably by furnishing in themselves materials essential to healthy nutrition. The general tonic action of cod-liver oil is undoubtedly its most important effect. The third and fourth orders operate by invigorating the digestion, so important in the process of assimilation.

All the drugs of the third order contain a bitter principle, to which in some is superadded volatile oil or resin; in others, tannin; and in others, starch or gum; and practical advantage is gained by throwing them into four sub-orders, named:—1. *Pure*; 2. *Stimulant*; 3. *Astringent*; and 4. *Emollient Bitter Tonics*. We could dispense with one or two of these, and make room for a *sedative* bitter tonic, like the *Prunus Virginiana*, or wild-cherry, which is a desideratum in our pharmacopœia: the sedative principle of this valuable medicine is hydrocyanic acid.

Cod-liver oil and iron are connecting links between dietetical and medicinal agents, and form the natural commencement of a list of the *Materia Medica*.

Second Class.—**ATONICS:** *diminish permanently the strength and weight independently of evacuation.* Like tonics, their operation is slow, but enduring, and without re-action. Their general action is an exact counterpart to that of tonics. They weaken digestion and the appetite, and bring on debility, emaciation, paleness of the features, and depression of mind. The tonicity is deeply injured, as shown by the weak, flabby muscle, and soft, compressible pulse. They impoverish the blood, check nutrition, and promote absorption, and might be described as medicines which impair assimilation. In excess they are poisonous, and commonly produce death, more or less purely, by necræmia^a. Some members of the class are powerful irritants, but we refer here only to their remote effects.

Although all atonics impair assimilation, and produce weakness and wasting, they present important differences of action, on which is founded their division into four orders: I. MERCURIALS; II. ARSENICALS; III. IODIDES; and IV. ALKALINES: which excite, respectively, the constitutional states named mercurialism, arsenicalism, iodism, and alkalism.

That the iodide of potassium is a useful remedy in the mercurial disease is not inconsistent with an arrangement which places together mercurials and iodides. Melsens has shown this effect to be chemical, and independent of physiological action. The iodide decomposes and washes out the insoluble compounds of mercury which linger in the system, and occasion the symptoms of its chronic action.

The atonics comprise most of the absorbents, deobstruents, resolvents, alteratives, and spanæmics of other writers. The lowered constitution of the blood, and softening with increased absorption of healthy and morbid structures, indicated by these terms, are all necessary consequences of defective assimilation, and are equally induced by insufficient food, dyspepsia, or other source of impaired nutrition. Alterative, as generally accepted, is a therapeutic term, and should not have a place in

^a Williams' Principles of Medicine, p. 464.

any physiological classification. This word has different meanings attached to it, and is frequently employed obscurely to conceal our ignorance of the true action of a medicine. In its most common signification of a *therapeutic effect without obvious physiological action*, it is applied incorrectly, for when atonics are exhibited, even in small doses, effects of the kind described above may be traced, and similar phenomena, but of higher intensity, are induced by larger doses. The use of the word alterative might be advantageously discontinued.

Third Class. — **STIMULANTS**: *increase temporarily functional activity, independently of local inflammation, and their action is followed by re-action.* Stimulants heighten the temperature, increase the force and frequency of the circulation, and excite the muscular and nervous systems. This exaltation of the functions is essentially transient, and after a time these gradually subside to their normal level, and finally sink beneath it, when a state of depression or re-action is established, corresponding in degree to the previous excitement, and characterized by chilliness of the surface, languid circulation, and exhaustion of the physical and mental powers. The transient nature of their operation, and the supervention of re-action, constitute important distinctions between stimulants and tonics. The latter give strength, while the former excite functional display, which, as in over-action from other causes, is followed by exhaustion^a.

The tonic may be said to act like the addition of acid to the water of a galvanic battery, giving true increase of power; and the stimulant, like the discharging-rod, which occasions its display; the functional exaltation in the one case, and the spark in the other, being followed by temporary diminution of action, soon, however, to be restored by the continued development and accumulation of the vital and galvanic forces. As medicines, tonics and atonics commonly act on diseases directly, influencing the organization of the frame and of morbid struc-

^a Paris and Billing recognise this distinction.

tures; while stimulants and sedatives are more frequently exhibited to meet their symptoms and avert the tendency to extinction or excess of function.

The substances comprised in the classes of tonics and stimulants are rarely the source of poisonous effects, and when these occur, they arise from new actions, differing in kind, and not in degree only, from their operation as medicines. Thus the tonic mineral acids are irritant, and the tonic quina and the stimulant alcohol are narcotic in poisonous doses.

Stimulants are arranged in five orders, according as their active principle is alcohol, ether, ammonia, volatile oil, or resin, and to these is added a sixth, including the animal excretions, whose constitution is complex. They are named:—I. ALCOHOLIC; II. ETHEREAL; III. AMMONIACAL; IV. MYROLIC; V. RESINOUS; and VI. ANIMAL EXCRETIONS. In a physiological sense these orders are eminently natural, and have besides many common botanical, chemical, and therapeutical properties.

Fourth Class.—SEDATIVES: *diminish temporarily functional activity, independently of evacuation, and their action is followed by re-action.* The medicines of this class lower the temperature and depress directly the circulating, nervous, and muscular systems. Their action is thus an exact counterpart to that of stimulants. The dulness and inaptitude for mental exertion, induced by their moderate operation, is sometimes accompanied by a disposition to sleep; but this is very different from the true hypnotic power of the narcotics. Like stimulants, their operation is transient, and is followed by a period of functional excitement, corresponding in degree to the previous sedation. Of this re-action we have common examples in the secondary effects of cold and blood-letting, and a similar tendency to febrile excitement has been observed after the depression of medicinal sedatives, as digitalis and aconite. They are poisonous in large doses, and commonly prove fatal by failure of the circulation or by paralysis. The extreme vital depression, or deadly faintness of sedatives, must not be

confounded with the coma of a narcotic. Their temporary operation, and the supervention of re-action, with many other characters, distinguish them from atonics.

Some sedatives, as digitalis, are exhibited as drugs, more especially on account of their depressing action on the circulation; others, as belladonna and Prussic acid, on account of their soothing influence on the nervous system; while a third group, as tobacco and lobelia, are most frequently employed to weaken the muscles. Each acts upon all the systems, but may depress one more powerfully than the others, and these varieties of therapeutic application are dependent upon special differences in the physiological action of sedatives. At the same time these practical distinctions are obviously to some extent accidental, and cannot safely determine the subdivision of sedatives.

In reference to their action in medicinal doses, they are most usefully arranged in four orders, named: I. PURE; II. IRRITANT; III. ATONIC AND IRRITANT; and IV. MYDRACEOUS SEDATIVES. The third order combine with their sedative power an atonic action on the blood and system, and the characteristic phenomenon of the fourth order, the members of which are closely allied in all their effects, is dilatation of the pupil. Belladonna, stramonium, and hyoscyamus, cannot strictly be called narcotics, when that word is employed in the sense attached to it in this paper.

I regard the refrigerant effect of nitre simply as a part of its atonic sedative action. The other direct refrigerants of writers on therapeutics are cooling lotions and refreshing drinks, the most efficient and the safest agent for both purposes being cold or iced water. The indirect refrigerants are purgatives and diaphoretics.

Fifth Class.—TETANICS: *cause spasms of the voluntary muscles.* Their action, commencing with rigidity and muscular twitches of the extremities, gradually involves all the voluntary muscles, and terminates in tetanic convulsions and death

by spasmodic asphyxia. These phenomena result from a special and primary influence on the cord. *Nux vomica* augments the general sensibility, but leaves the intellect unimpaired, and has no decided primary effect on the circulation. This is the only tetanic drug in the Dublin Pharmacopœia.

The *Sixth Class induce sleep*. Commencing with lethargy, narcotic^a action gradually suspends sensibility and consciousness, and in excess terminates in death by coma. It is a special and primary influence on the brain, and has no essential dependence on general stimulant action on the one hand, or general sedative action on the other. This is obvious from the fact that the narcotic power is associated with both of these actions. Some narcotics, as alcohol and ether, are general stimulants; some, as chloroform and lactucarium, are general sedatives; while others, as hops and Indian hemp, act so feebly either as stimulants or sedatives, that difference of opinion exists as to the nature of their operation in this respect. The theory which refers narcotic action to the exhaustion resulting from previous stimulation is untenable on other grounds. Were it true, all stimulants should be also narcotics, but many are not, as the ammoniacal, myrolic, and resinous. The operation of alcohol itself affords no support to this view, as in intoxication consciousness is suspended long before the secondary stage of depression, as indicated by the pulse, is established. Lastly, were narcotism a symptom merely of nervous exhaustion, we should expect its development in a high degree from certain sedatives, as hydrocyanic acid, conium, and aconite, which powerfully depress the cerebro-spinal system. But the slight disposition to sleep sometimes induced by these drugs cannot be likened to true narcotic action.

A separate class is made of narcotics:—1st, because of the high physiological value of their characteristic effect, and its

^a Toxicologists (with the exception of Copland) and therapeutists commonly attach a wider signification to this word, and include under it all bodies operating on the nervous system.

independence of any general action; and 2nd, because they derive from it all their most important practical applications. As formerly stated, similar reasons have determined the formation into classes of the tetanics, parturients, astringents, and evacuants. The narcotics are few in number. I have not placed alcohol and ether in the list, as these are employed medicinally in virtue only of their stimulant power. Chloroform is the most energetic, and stands alone; opium and lactucarium are allied in action; while Indian hemp and hops are derived from the same natural order, and agree in the important points of not injuring the appetite or causing constipation.

Seventh Class.—PARTURIENTS: *cause contractions of the uterus.* This is a special and direct influence on the uterine contractile tissue, and has no ascertained relation to the general action of parturient drugs. The drastic cathartics induce contractions of the womb indirectly by contiguous sympathy. Ergot of rye is the only certain member of the class, but the parturient power is ascribed also to Indian hemp^a and borax.

Eighth Class.—EVACUANTS: *increase the secretions and excretions.* Their influence is directed to one or more of several organs, as the stomach, bowels, kidneys, skin, lungs, and uterus; whence their division into six orders:—EMETICS, CATHARTICS, DIURETICS, DIAPHORETICS, EXPECTORANTS, and EMMENAGOGUES^b. Their action appears, for the most part, to be essentially of an irritant nature. In the case of many of the emetics and cathartics, the irritation is applied directly to the gastric and intestinal mucous membranes; in the other orders the drug is absorbed and eliminated from the blood chiefly by

^a Dr. A. Christison, in *Monthly Journal* for August, 1851.

^b Applied to the Schneiderian and buccal mucous membranes, irritant bodies increase the pituitary and salivary secretions, and are commonly recognised as orders of evacuants; but the drugs formerly employed as errhines and sialagogues are now scarcely ever used, and have been omitted from the present edition of the *Dublin Pharmacopœia*.

the organ whose secretion it augments, and whose secreting surface it irritates. This remote irritation of a secreting organ or surface is commonly, but erroneously, confounded with general stimulation; for although both properties may reside in the same drug as in the stimulant diuretics, diaphoretics, and expectorants, the former may co-exist also with general tonic, atonic, or sedative action, as in the other medicines of these orders. The irritation, whether local or remote, induces by reflex action an augmented flow of blood to the organ or membrane, and increased secretion, that being a salutary effort of nature to dilute the acrimony of the drug, and protect the living tissue. The flow of tears from snuff in the eye, and of intestinal mucus from an acrid resin in the bowels, are familiar examples of this action; and the same law determines the increase of bile from calomel in the duodenum, and diuresis from cantharis and turpentine, as they escape from the kidney.

Besides their property as evacuants, the medicines of this class possess general actions as tonics, atonics, stimulants, or sedatives, which influence powerfully their special operation, and guide, in an important manner, their application to disease. Hence their general actions are employed as elements of distinction in the subdivision of the orders.

First Order of Evacuants,—EMETICS: *excite vomiting*. They irritate directly the gastric mucous membrane, and induce by reflex action increase of its secretion, and finally, inverted muscular action of the stomach, and expulsion of its contents. Some operate within five, others not for fifteen minutes or half-an-hour; and this difference in the time required to produce emesis is associated with important distinctions in the physiological action and therapeutic applications of emetic drugs, which I have therefore divided into the *quick* and *slow*. The sulphates of zinc and copper are examples of the quick; tartar emetic and ipecacuan of the slow emetics. Their usual division into the direct and indirect is founded on an unproved theory of their mode of operation. The latter term is applied to tartar emetic

and ipecacuan, which are supposed to act on the stomach remotely, or after absorption. Their tardy action is thought to indicate their solution in the stomach and passage into the blood; but it is due as probably to their acquiring acidity only in virtue of chemical changes brought about by their contact for some time with the gastric juice. On the skin their irritant influence is likewise slow of development, and is obviously secondary to some chemical re-action between the drug and the cutaneous secretions. It is also advanced in favour of their indirect operation, that vomiting is produced by their immediate introduction into the circulation; but every experimenter knows that most substances, capable of exciting sufficient disturbance, produce both vomiting and catharsis when thrown into the vessels.

Second Order of Evacuants,—CATHARTICS: *increase the intestinal evacuations*. Several differences are observed in this order. While the majority act uniformly on the entire extent of the canal, some influence especially the duodenum, and others the rectum; some operate speedily, others slowly. One section acts more by increase of the peristaltic movements, and another by augmenting the secretions. But the most material difference relates to their degree of activity: some operating mildly, and others energetically. On this last distinction is founded, if not the most scientific, certainly the most useful arrangement of cathartics into three sub-orders, distinguished as—Laxatives, Purgatives, and Drastics. *Laxatives* gently irritate the mucous membrane, and quicken the intestinal movements, without increasing materially the secretions. *Purgatives* display more power, augmenting in a higher degree the peristaltic action, and exciting copious exhalation from the mucous surface. *Drastics* operate with most energy, causing severe tormina, with frequent watery evacuations; and in large doses proving fatal as irritant poisons. The *Purgatives* are arranged in three groups,—saline, mercurial, and vegetable; the saline ranking immediately after the laxatives by reason of their mild

operation. The first and second of these groups offer for common consideration many points of resemblance in action and uses.

Third Order of Evacuants,—DIURETICS: *increase the urine.* Some augment the fluid portion only; others both the solid and fluid contents of the secretion, and increase it as well in specific gravity as in quantity. Nearly all the diuretics are local irritants, and, when taken into the blood, are eliminated chiefly by the kidneys and irritate the inner surface of the uriniferous canals, ureter, and bladder. This irritation induces, by reflex action, an augmented flow of blood to the kidney, and diuresis. Thus diuretics are special irritants of the urinary mucous membrane; but they have also general actions which influence powerfully their diuretic operation, and determine their division into four sub-orders, named *Tonic, Atonic, Stimulant, and Sedative Diuretics*. The members of the first sub-order are chalybeates, or contain a tonic bitter principle. Those of the second operate on the system as atonics; by impairing assimilation, and increasing interstitial absorption, they charge the blood with a large amount of nitrogenous excrementitious matter, which, escaping by its proper emunctory, the kidney, augments the solid constituents of the urine. The watery element is also increased, but not in the same proportion, and the specific gravity of the urine is consequently raised. The merit of having pointed out the peculiar operation of these diuretics is due to Dr. G. Bird, who named them "depurant." They all belong to the general class of atonics, and their effect on the urine results chiefly from their action on the system; at the same time, like the other diuretics, they are eliminated by the kidneys, but their special action is weak; and it is well known that their full effect as diuretics is best obtained by uniting them with members of the other sub-orders, as in the combinations of mercury with squill or digitalis, and of the acetate of potash with juniper or broom. The general stimulant action of the third sub-order does not influence in any important de-

gree their diuretic effect, except in debility and other morbid conditions. The sedative diuretics act undoubtedly as special irritants of the kidneys, but their general operation contributes to increase the secretion of urine when checked by undue excitement and tension of the renal vessels, and also by the more active absorption which accompanies a relaxed state of the vascular system.

Fourth Order of Evacuants,—*DIAPHORETICS*: *increase the perspiration*. This may be deficient either from undue excitement and tension, or from the opposite condition of undue debility and relaxation of the capillaries of the skin; and observation proves that diaphoresis is brought about at one time by augmenting, and at another by diminishing the activity of the cutaneous circulation. Hence the useful division of this order into *Stimulant* and *Sedative Diaphoretics*. Some of these medicines are eliminated by the skin, and exert upon it a special irritant action; but compared with the general operation of the drugs, this is of subordinate importance in inducing diaphoresis. I have added to the list of diaphoretics—guaiaac, sassafras, meze-reon, sarsaparilla, and dulcamara,—medicines whose action, though obscure, has certainly a close relation to the skin, and is often accompanied by increase of its secretion.

Fifth Order of Evacuants,—*EXPECTORANTS*: *promote the secretion and expulsion of bronchial mucus*. Some are inhaled, and operate as direct irritants; others are taken into the blood, and eliminated by the lungs, increasing the mucus by remote irritation of the secreting membrane. The more important act in another capacity, or as nauseants and emetics, and excite the pulmonary ramifications of the eighth pair through its gastric branches. Their employment renders the sputum more fluid, and promotes its discharge in accordance with the double function of the pneumogastric of presiding over both the secretion and muscular contractions of the bronchi^a. When vomiting is induced, the bronchial contents are shaken and dislodged by

^a Dr. W. T. Gairdner in *Monthly Journal*, 1852.

the succussion of the chest. I have placed in the list of expectorants those medicines only which act as such in a physiological sense, and have arranged them in three sub-orders:—1. *Stimulant*; 2. *Nauseant-sedative*; and 3. *Direct Irritant*. The bronchial secretion is deficient in various morbid conditions of the pulmonary organs, and is restored on their removal by appropriate remedies, which may be atonics, sedatives, or counter-irritants; but the freer expectoration is then a therapeutic effect: nor should the true expectorants be confounded with the astringents and emollients frequently employed in affections of the lungs.

Sixth Order of Evacuants,—EMMENAGOGUES: *promote the menstrual discharge*. Savin and ergot are believed to have a special action on the uterine secretion; but many deny the emmenagogue property of the latter. The cathartic emmenagogues excite the womb sympathetically, while various agents restore the menstrual flow therapeutically, by remedying the constitutional state with which its suppression is connected.

Ninth Class.—ASTRINGENTS: *constrict the tissues, and diminish secretions and excretions*. The medicines of this class determine, primarily, contraction of the living fibre, and especially of the capillaries, to which they are applied, or through which they pass, so as to condense and pale the surface, check exudation, and arrest hemorrhage if present. These effects are promoted in many, if not all, by their tendency to form insoluble combinations with the tissues and organic fluids. Their operation is most obvious on the part to which they are applied; but some act through the circulation on remote organs and surfaces. The astringent power is the result of a *special* influence on the contractile fibre, and may be associated in the drugs possessing it with various general actions. Some astringents are tonic, some atonic, and others sedative, to the system. In a concentrated form many are topical irritants.

Astringent and tonic actions, though frequently united in the same drug, and co-operating in disease, are different in their

nature. Among chalybeates the most active tonics have least astringency. In vegetables, the tonic property is in proportion to the amount of bitter principle, and the astringent to the amount of tannin; and the tonic power is strongest when, as in quina, the bitter principle is entirely free from tannin, the continued exhibition of which does not increase the strength and flesh, but brings on dyspepsia and constipation. It is true, that by checking asthenic fluxes and hemorrhages, astringents improve nutrition and muscular power, and, applied topically, they give contractile vigour to vessels weakened and distended by chronic inflammation; but these are therapeutic results, and should not be confounded with true tonic action.

For practical ends, this class is most usefully divided into the—I. TANNIN-CONTAINING; II. ACID; and III. METALLIC ASTRINGENTS. The operation of the first order is slowly induced, but more enduring than that of the third, in which it is obtained more quickly, and is less persistent. The acids display remote astringent effects more distinctly than the other orders. Of the metallic astringents we know that chalybeates are tonic, and the compounds of lead, atonic and sedative to the general system; but we want precise knowledge of the friendly or unfriendly, tonic or atonic action, on assimilation, of the preparations of zinc, copper, bismuth, and silver. Tonic properties are commonly ascribed to them on account of their successful employment in epilepsy, chorea, and certain periodic disorders. They were more used formerly than at present, and in the older authors improved appetite and increase of strength are frequently stated as results of their continued exhibition in small doses; but these effects were in many cases obviously the indirect consequences of the removal of disease; and, on the other hand, cases are recorded more recently in which the oxide of zinc brought on weakness and emaciation. The curative power in periodic complaints is common to several classes of medicines, and cannot be accepted as proof of tonic action. Matico is a doubtful astringent; it contains no tannin, and produces

no constriction in the mouth. Like copaiba, cubeb, and turpentine, it is a general stimulant and special irritant of the mucous surfaces, the morbid discharges of which it checks by restoring the inflamed membrane to a state of health.

Tenth Class.—IRRITANTS: *tend to inflame the part to which they are applied.* The effect produced varies according to the energy of the drug from simple increase of secretion,—as in lachrymation from dust in the eye,—to congestion and redness, vesication, suppuration, and the formation of an eschar, or complete death of the part. These actions differ chiefly in degree, and the same means, variously applied, will produce all of them. Thus heat, turpentine, and cantharides, according to the method of their employment, excite either redness, vesication, suppuration, or sloughing; and the same irritant which in one man vesicates, in another and more susceptible subject, or in a child, may occasion pustular inflammation, or even gangrene. But though resembling each other, irritants are not identical in action. The effects of turpentine, cantharides, iodine, and arsenic, may be distinguished from analogous actions induced by mustard, ammonia, nitrate of silver, and chloride of zinc. The characteristic features of each are probably due to differences in the influence (whether mechanical or chemical) on the tissue which originates the inflammation,—that being simply an effort of nature to protect the living structure.

The subdivision of irritants, according to the intensity of their action, into RUBEFACIENTS, VESICANTS, PUSTULANTS, and CAUTERANTS, is the most convenient in practice, although somewhat artificial. The cauterants are commonly described as *local remedies, acting chemically*; but this definition applies only to their use in the removal of a wart or malignant growth, and not to their employment to form an issue, or alter the action of an ulcer, in which cases they owe their therapeutic value not to the primary, chemical, and destructive agency, but to the vital effects which follow, and which are as much a part of the operation of a cauterant as the redness of a sinapism, or the ve-

sication of cantharides. The common division of irritants into vital and chemical is founded on a gratuitous assumption of a difference in their mode of operation.

The irritants are mutually exclusive of the emollients, but they have various remote actions,—there being, as previously stated, no necessary correspondence between the local and remote effects of medicines. The terms irritant and stimulant are sometimes used indiscriminately, but correctly employed, their meanings differ widely, and should be carefully distinguished.

Eleventh Class.—**EMOLLIENTS:** *lubricate and soften the part to which they are applied*, diminishing its physical cohesion and elasticity, and its vital tonicity. They relax the surface, shield it from irritation, and sooth it when inflamed. Their action is strictly local, and is obtained only on the skin and such of the mucous membranes as are within reach of topical medication. They are not conveyed by the circulation to distant parts so as to act upon them in the capacity of emollients; almost all are nutritious, and undergo digestion in the stomach,—a result incompatible with their alleged remote action through the blood. As therapeutic agents, they are believed to influence neighbouring parts sympathetically: thus, in bronchial affections, the softening effect of their application to the top of the larynx is said to extend downwards along the trachea and bronchi; and their soothing action on the alimentary canal is believed to induce a like influence on the kidneys and bladder in renal irritation and vesical catarrh,—an effect chiefly due, however, to the water, taken at the same time, diluting the acrimony of the urine. The poultice and vapour douche are the most efficient means of producing emollient action. The medicinal members of the class divide themselves naturally into five orders:—**MUCILAGINOUS, AMYLACEOUS, SACCHARINE, OILY AND WAXY, AND ALBUMINOUS EMOLLIENTS.**

Twelfth Class.—The non-physiological division contains one class,—the **ANTHELMINTICS**,—comprising those medicines

which *destroy worms in the alimentary canal*. They are brought into immediate contact with the worms, and either poison them, or detach them mechanically from the mucous membrane,—operating external to, and independently of, the vital forces. Thus understood, the class represents the vermicides proper, and does not include the cathartic vermifuges, or the tonics which check indirectly the generation of worms by restoring the healthy state of the digestive tube. The Dublin Pharmacopœia has a poor catalogue of true anthelmintics, and omits the male shield-fern, and other drugs of good repute in the treatment of worms.

Our classification relates exclusively to medicines or the drugs employed in the treatment of disease. Besides these, the Pharmacopœias contain certain articles used either as hygienic agents—as the disinfectants and deodorizers,—or as pharmaceutical agents—as the tests, perfumes, and colour-giving drugs,—the consideration of which belongs, not to medicinal therapeutics, but respectively to hygiene and pharmacy.

The introduction of therapeutical classes was unnecessary as well as incompatible with the principle and object of a physiological arrangement. The physiological action of a medicine, or its operation on the healthy body, is expressed by the names of the classes in the foregoing classification; and the therapeutical action, or its curative power in disease, by the terms—anodyne, antacid, antilithic, antiphlogistic, antispasmodic, &c. While the former is constant, both in health and disease, the latter is uncertain and relative; yet many believe the arrangement of drugs according to their effects in disease to be the most useful in practice. But such an arrangement is, for *practical* ends, most dangerous, as tending to indicate anodynes in all cases of pain, antiphlogistics in all cases of inflammation, and antispasmodics in all cases of spasm; whereas these diseases acknowledge various causes, and occur under such different circumstances as to age, constitution, and period of complaint, as to demand dissimilar and often opposite modes

of treatment. Every step in pathology impresses more strongly the absolute necessity of treating disease on general principles, and of abandoning the empirical folly—fostered by a therapeutical classification—of providing a catalogue of remedies against another catalogue of names of disease. On the other hand, such a system does not respond to a single *scientific* requirement; the only common proposition that can be made of the anodynes, antiphlogistics, or antispasmodics, is, that they are useful in pain, inflammation, or spasm, and that even, as just observed, is open to exception. These classes include medicines having very different effects on the healthy frame. Anodynes are found among sedatives and narcotics; antiphlogistics among tonics, atonics, sedatives, narcotics, evacuants, astringents, irritants, and emollients; antispasmodics among tonics, stimulants, sedatives, and narcotics. Thus employed, as a fundamental element in the classification of medicines, the therapeutical character is bad both in principle and practice; but it is, nevertheless, of service to give the student of the *Materia Medica* a general view of the therapeutical classes, and compare the respective value, special applications, and contraindications of their members in the diseases of which they are curative.

In describing the action and uses of medicines, the employment of physiological terms in a therapeutic sense, and *vice versâ*, is a common source of confusion, and should be avoided.

The following list of medicines is arranged according to the classification proposed in the preceding pages. In preparing it I have confined myself to the medicines officinal in the Dublin Pharmacopœia, and have sought rather to reduce than to multiply the members of the classes and orders, believing that the list would thus be made most useful.

CLASS I.—TONICS.

ORDER I.—COD-LIVER OIL.

ORDER II.—IRON AND ITS COMPOUNDS.

ORDER III.—VEGETABLE BITTER TONICS. *Pure*—quassia and simaruba; gentian and chiretta. *Stimulant*—anthemis and taraxacum; cascarilla. *Astringent*—cinchona. *Emollient*—calumba and pareira; cetraria.

ORDER IV.—ACID TONICS. Sulphuric, nitric, and muriatic acids; lemon-juice.

CLASS II.—ATONICS.

ORDER I.—MERCURIALS. The metal and its mechanical forms; calomel and corrosive sublimate; green and red iodides.

ORDER II.—ARSENICALS. Arsenious acid and liquor arsenicalis.

ORDER III.—IODIDES. Iodine and iodide of potassium.

ORDER IV.—ALKALINES. Potassa, its carbonate, bicarbonate, nitrate, and chlorate; carbonate, bicarbonate, and borate of soda; lime and its carbonate; magnesia and its carbonate.

CLASS III.—STIMULANTS.

ORDER I.—ALCOHOLIC. Spirits, wines, and malt liquors.

ORDER II.—ETHEREAL. Sulphuric ether, spiritus æthereus oleosus and spiritus æthereus nitrosus.

ORDER III.—AMMONIACAL. Liquor, aromatic and fetid spirits; sesquicarbonate, bicarbonate, acetate, and muriate of ammonia.

ORDER IV.—MYROLIC. From the *Labiatae*—peppermint, spearmint, and pennyroyal; lavender and rosemary. *Umbelliferae*—anise, coriander, caraway, and fennel. *Myrtaceae*—cajeput, cloves, and pimento.

Myristicaceæ—nutmeg. *Lauraceæ*—cinnamon, camphor. *Coniferæ*—oil of turpentine. *Valerianaceæ*—valerian. *Meliaceæ*—canella. *Zingiberaceæ*—ginger, cardamoms. *Aristolochiaceæ*, serpentaria.

ORDER V.—RESINOUS. *Oleo-resins*—copaiba, cubebs, matico; black and cayenne peppers. *Gum-resins*—assa-fœtida, ammoniac, galbanum, myrrh.

ORDER VI.—ANIMAL EXCRETIONS. Musk and castor.

CLASS IV.—SEDATIVES.

ORDER I.—PURE. Digitalis; aconite; conium; hydrocyanic acid and cherry laurel; pyroxylic spirit.

ORDER II.—ATONIC AND IRRITANT. Tartar emetic; nitrate of potassa.

ORDER III.—IRRITANT. Tobacco and lobelia; colchicum.

ORDER IV.—MYDRACEOUS. Belladonna, stramonium, and hyoscyamus.

CLASS V.—TETANICS.

Nux vomica.

CLASS VI.—NARCOTICS.

Chloroform; opium and lactucarium; Indian hemp and hops.

CLASS VII.—PARTURIENTS.

Ergot of rye; Indian hemp; borax.

CLASS VIII.—EVACUANTS.

ORDER I.—EMETICS. *Quick*—sulphates of zinc and copper; salt; mustard. *Slow*—tartar emetic; ipecacuan.

ORDER II.—CATHARTICS. (A) *Laxatives*—sulphur; magnesia and its carbonate; manna; tamarinds; prunes; olive oil; honey. (B) *Purgatives*. *Saline*—sul-

phate of magnesia; sulphate and phosphate of soda; tartrate of potassa and soda; sulphate, bisulphate, tartrate, and bitartrate of potassa.

Mercurial—calomel; mercurial pill; mercury with chalk; mercury with magnesia. *Vegetable*—castor oil; senna; rhubarb; aloes; turpentine.

(C) *Drastics*—jalap; scammony; colocynth and elaterium; gamboge; croton oil.

ORDER III.—DIURETICS. *Tonic*—muriate of iron; pareira; pyrola; taraxacum; broom. *Atonic*—mercurials; acetate, bitartrate, and nitrate of potassa; acetate of soda. *Stimulant*—spirit of nitric ether; turpentine; juniper; bucku; and cantharis. *Sedative*—digitalis; squill; colchicum; tobacco.

ORDER IV.—DIAPHORETICS. *Stimulant*—acetate of ammonia; guaiacum, sassafras, and mezereon. *Sedative*—antimonials; opium and ipecacuan; sarsaparilla and dulcamara.

ORDER V.—EXPECTORANTS. *Stimulant*—balsam of Tolu; ben-zoin and its acid; senega. *Nauseant-Sedative*—tartar emetic; ipecacuan; squill. *Direct Irritant*—chlorine; iodine; tar; vinegar.

ORDER VI.—EMMENAGOGUES. Savin; myrrh(?); ergot(?); aloes, and other cathartics.

CLASS IX.—ASTRINGENTS.

ORDER I.—TANNIN-CONTAINING ASTRINGENTS. Tannin; catechu; kino; krameria; galls; oak-bark; logwood; uva-ursi; and French roses.

ORDER II.—ACID ASTRINGENTS. Sulphuric, acetic, and gallic acids.

ORDER III.—METALLIC ASTRINGENTS. Astringent preparations of iron (tonic); lead (atonic and sedative); zinc; bismuth; copper; silver; lime; alum.

Opium; matico(?).

CLASS X.—IRRITANTS.

ORDER I.—RUBEFACIENTS. *Mild*—Tar; resin; Burgundy pitch; elemi; creasote; ammoniac; camphor; oil of amber; iodine; yeast; the alkalis, their carbonates and chlorides; sulphur and its iodide; liver of sulphur; iodide, nitrate, and ammonio-chloride of mercury, &c.: nearly all the drugs applied in the form of ointment, plaster, liniment, and wash, and which are neither astringent, sedative, emollient, nor strongly acrid, may be arranged under this head. *Strong*—cantharis; ammonia; mustard; turpentine; cayenne.

ORDER II.—VESICANTS. Cantharis; ammonia; nitrate of silver.

ORDER III.—PUSTULANTS. Tartar emetic; croton oil; ipecacuan.

ORDER IV.—CAUTERANTS. *Mild*—acetic acid; nitrate of silver; subacetate of copper; red oxide of mercury; savin. *Strong*—nitric and sulphuric acids; arsenious acid; potassa; lime; chloride of zinc; terchloride of antimony; perntrate of mercury.

CLASS XI.—EMOLLIENTS.

ORDER I.—MUCILAGINOUS. Gum Arabic; tragacanth; hemidesmus—(mucilage and oil); linseed; sweet almonds.

ORDER II.—AMYLACEOUS. Wheat starch, and flour; oatmeal; barley; carrot; Iceland moss; arrowroot, tous les mois, sago, tapioca.

ORDER III.—SACCHARINE. Sugar, treacle, liquorice, figs, raisins; glycerine.

ORDER IV.—OILY AND WAXY. Lard, spermaceti, wax; oils of olive, almond, and linseed.

ORDER V.—ALBUMINOUS. Egg.

CLASS XII.—ANTHELMINTICS.

Pomegranate; oil of turpentine; quassia; cowhage; tin powder; male fern; kousso.

No classification of medicines can pretend to freedom from errors and defects, which are unavoidable in the present imperfect state of the science of therapeutics. I hope simply to have founded the foregoing on true principles, of which a good proof will be, its capability of assuming, without violence to its fabric, such corrections as are rendered necessary by the progress of knowledge.

THE END.



