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PRACTICAL MATERIA MEDICA
AND
PRESCRIPTION WRITING

W. C. SILLAR

JAMES THIN, EDINBURGH

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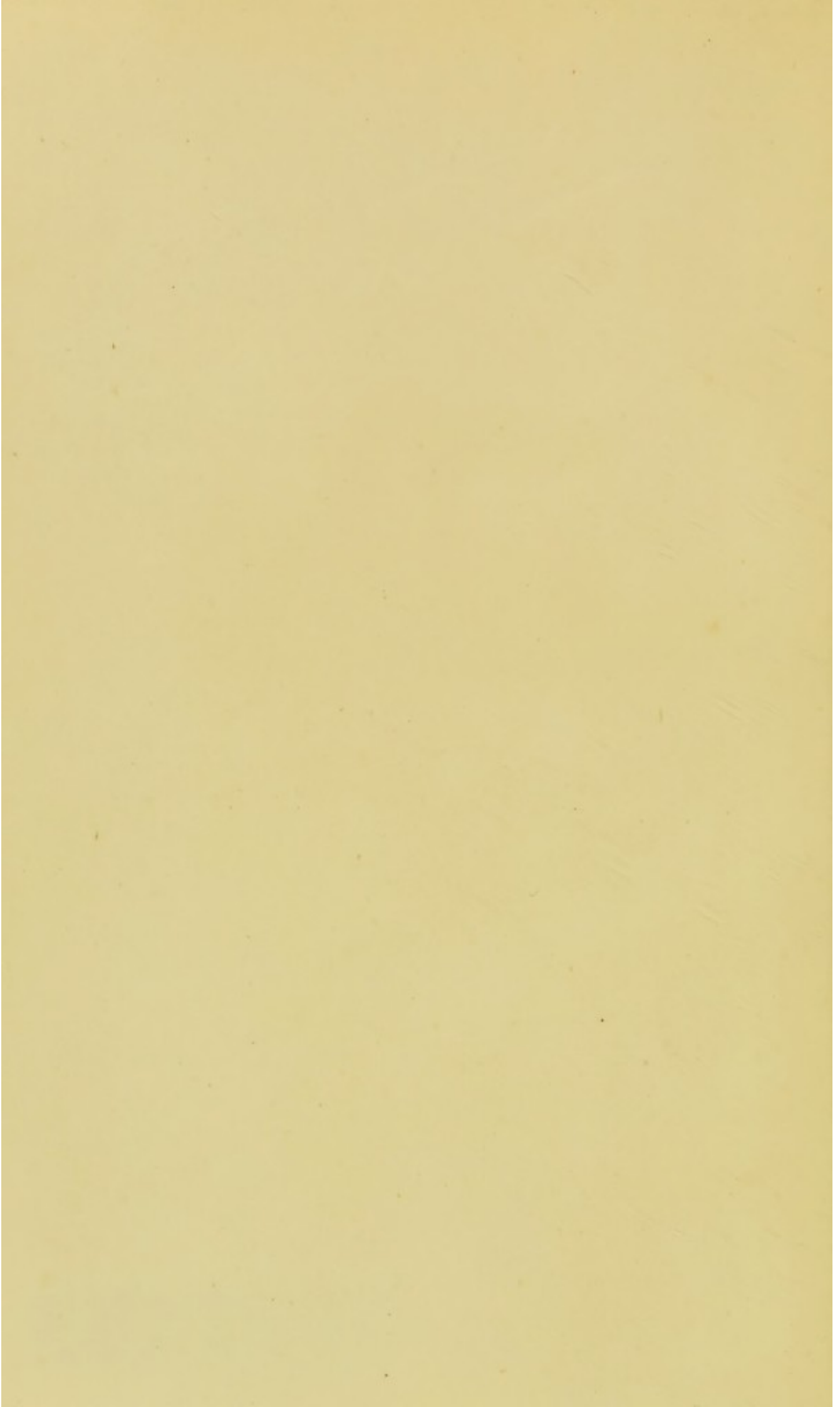
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H. S. Thomas

New College
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PRACTICAL MATERIA MEDICA
AND PRESCRIPTION WRITING



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PRACTICAL MATERIA MEDICA

AND

PRESCRIPTION WRITING

BY

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WITH A PREFACE BY

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SECOND EDITION

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PREFACE

THE Class of Practical Materia Medica was first instituted soon after the present Professor of Materia Medica was appointed. It then embraced a wider field of instruction than the present course overtakes, as it included practical instruction in the physical, sensory, and chemical qualities of the more generally used medicinal substances, as well as such instruction in pharmaceutic processes and in prescribing as was likely to prove useful to medical practitioners. The syllabus was a lengthy one, but the Pharmacopœia was a sufficient guide for so large a proportion of the work that a printed notebook was unnecessary and would have been unsuitable.

Since the qualifying requirements of the course have been limited by the last Universities Commission, probably without sufficient regard to the adequate training of the medical practitioner, to pharmacy, prescribing, and dispensing, the most important facts of the subject-matter admit of being stated with comparative brevity, and as no single existing book overtakes this subject-matter, it has been considered advisable to print a notebook. It is hoped that this notebook will relieve the members of the class from much of the note-taking, which is apt to interfere with the practical work that occupies the greater part of the time of instruction.

Experience gained since the foundation of the class has from year to year led to many modifications in the directions both of curtailment and of amplification, and the notebook represents the last phase of this evolution. I have received much valued assistance in the suggestion of these modifications from former and present assistants, but in so far as the present course is concerned, from no one so much as Dr Sillar, the present senior assistant. Indeed, since the course became limited to its present extent, the remodelling of it has been almost entirely effected by him, and by him also has this notebook been produced.

It will be observed that while pharmaceutic processes receive sufficient attention to allow an intelligent knowledge to be acquired of the special peculiarities of each of them, a large part of the notes is occupied with considerations relating to the dispensing and prescribing of medicines. It has been found possible under these topics to mention many of the facts regarding medicinal substances that are required to guide both the prescriber and the dispenser, and thus to introduce much matter which treats of the sensory, physical, and chemical qualities of medicinal substances. Without this latter knowledge successful prescribing and dispensing are impossible, and the want of it is no doubt accountable for many of the errors which unfortunately occur in the prescriptions of practitioners, and for the difficulties which induce several of them to be guided in their practice by the formulæ of manufacturing druggists.

There is undoubtedly a tendency among many members of the medical profession, and in several schools of medicine, to attach too little importance to the practice of prescribing and dispensing. It is apt to be overlooked that, in a sense, prescribing constitutes one of the great aims and objects of all medical education, and that the prescription of the practitioner is the realisation of his education as applied to the treatment of his patient. Further, it is to be remembered that, under the Medical and Pharmacy Acts, practitioners of medicine have been given the right of dispensing medicines, that this right is largely made use of both in the United Kingdom and in the British Colonies and Possessions, and that a duty and responsibility are thus imposed upon teachers and students of medicine. The object of this notebook may therefore also be stated to be to assist the practitioner in properly discharging some of the most important of his functions. The practical instruction it embodies and typifies qualifies him to apply his knowledge to the treatment of disease, in so far as the application to patients of the selected remedial substances is concerned, and it is doubtful if the prescribing of remedies can properly be done unless sufficient training has been obtained by the student in the making of pharmaceutical preparations and in the practice of dispensing.

THOMAS R. FRASER.

NOTE TO THE SECOND EDITION

AN opportunity occurring owing to the first edition of the notebook being exhausted, I have revised, re-arranged, and added to the notes in some directions which have appeared to be of advantage. In this work I have received as much valued assistance from my present colleague, Dr Gunn, as I received from my former colleague, Dr Carmichael, when the first edition was produced, and I wish to tender my best thanks to them for their help.

I must also acknowledge the assistance I have derived from the two works—*The Art of Dispensing*, edited by M'Ewan, and the *Manual of Prescribing* of Professor Marshall.

W. C. S.

REPORT OF THE COMMISSIONERS OF THE LAND OFFICE

The following is a summary of the land transactions and other matters reported to the Commission during the year ending 31st December 1911.

The total area of land sold during the year was 1,234 acres, valued at £1,234,000. The total area of land purchased was 567 acres, valued at £567,000. The total area of land transferred was 1,701 acres, valued at £1,701,000.

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DEFINITIONS.

Materia Medica includes all information concerning medicinal substances.

Pharmacopœia is a list of such substances in general use in any country, and published by authority.

British Pharmacopœia is that published by the General Medical Council for the British Empire.

Official Substances are those included in the British Pharmacopœia.

Pharmacognosy deals with the sources, physical, chemical, and sensory characters, identification, and purity of medicinal substances.

Pharmacy deals with the processes by which the crude substances are transformed into forms suitable for administration.

Pharmacology is the knowledge of the action of medicinal substances on healthy structures.

Therapeutics is the knowledge of the action of medicinal substances on diseased structures, and the application of such knowledge to the treatment of disease. All treatment of disease is also included under this term.

Dispensing is the practical manipulation of the prescription, so that the patient gets the substances ordered in a suitable form and with suitable directions. It implies a knowledge of pharmacognosy and pharmacy.

Prescribing is the art of ordering one or more medicinal substances in a generally recognised form, with sufficient instructions to the dispenser to enable him to carry them out. It implies a knowledge of pharmacognosy, pharmacy, pharmacology, and therapeutics.

The Prescription is the form in which this order is generally written.

SECTION I.

PHARMACOGNOSY.

THE following list of 200 Articles of the *Materia Medica* is selected only for those beginning the study of *Materia Medica*, and is not to be considered sufficient for the requirements of the medical practitioner.

In this selection there are to be found substances included for various reasons. Many substances are so commonly met with that ignorance with regard to them is not to be excused, *e.g.*, mustard, chloroform, carbolic acid, and oxalic acid. Another class of substances possesses characteristics a knowledge of which is of importance for the prescriber, such as, for example, the odour of paraldehyde and the consistency of oil of theobroma. Of yet another class of substances the prescriber, even though he may not be able to identify them with certainty without applying chemical tests to them, will find it to his advantage to acquaint himself practically with their properties, examples of this class being sulphonal, phenacetin, and subnitrate of bismuth. Also certain examples of official preparations are included, such as liniment of belladonna, spirit of juniper, and iron wine, in order to illustrate the characteristic features of groups of preparations, *viz.*, the alcoholic liniments, the spirits of the volatile oils, and the official wines.

Of the vegetable *materia medica*, some articles are included in order to emphasise the importance of the active constituent which may itself not easily be recognised, *e.g.*, jaborandi leaf, the source of the alkaloid pilocarpine; some because of their general interest, as for instance Haschisch (*Cannabis indica*), and the ordeal beans of Calabar (*Physostigmatis semina*); and some to illustrate the various parts of the plant that may contain the active ingredient (quassia wood and broom tops).

In order to facilitate comparison between the substances, they are arranged in accordance with their more obvious physical characteristics, and attention may be directed to an additional advantage to be gained during the study of pharmacognosy, *viz.*, the mental training requisite in order to

observe accurately and rapidly, and to draw correct inferences from the observations, which training is peculiarly necessary for the medical practitioner.

- | | |
|--------------------------------|-----------------------------|
| Carbo Ligni. | Potassa Caustica. |
| Iodum. | Zinci Chloridum. |
| Potassii Permanganas. | 35 Argenti Nitras. |
| Cupri Sulphas. | Acidum Arseniosum. |
| 5 Ferri Sulphas. | Potassii Cyanidum (N.O.). |
| Ferri Arsenas. | Creta Præparata. |
| Ferri Phosphas. | Hydrargyrum Ammoni- |
| Ferri et Quininæ Citras. | atum. |
| Sulphur Sublimatum. | 40 Hydrargyri Perchloridum. |
| 10 Sulphur Præcipitatum. | Ammonii Chloridum. |
| Sinapis. | Potassii Acetas. |
| Podophylli Resina. | Cetaceum. |
| Iodoformum. | Camphora. |
| Santoninum. | 45 Paraffinum Durum. |
| 15 Calamina Præparata (N.O.). | Cera Alba et Flava. |
| Plumbi Oxidum. | Oleum Theobromatis. |
| Hydrargyri Iodidum Rub- | Adeps Lanæ. |
| rum. | Paraffinum Molle. |
| Hydrargyri Oxidum Rub- | 50 Borax. |
| rum. | Soda Tartarata. |
| Hydrargyri Oxidum Fla- | Alumen. |
| vum. | Sodii Carbonas. |
| 20 Pulvis Rhei Compositus. | Ammonii Carbonas. |
| Pulvis Cretæ Aromaticus. | 55 Sodii Phosphas. |
| Pulvis Cinnamomi Com- | Sodii Chloridum. |
| positus. | Potassii Bromidum. |
| Pulvis Glycyrrhizæ Com- | Potassii Iodidum. |
| positus. | Acidum Tartaricum. |
| Pulvis Ipecacuanhæ Com- | 60 Acidum Citricum. |
| positus. | Thymol. |
| 25 Ferri Carbonas Saccharatus. | Menthol. |
| Acidum Tannicum. | Potassii Chloras. |
| Acidum Chromicum. | Acidum Boricum. |
| Acidum Carbolicum. | 65 Chloral Hydras. |
| Potassii Bichromas. | Butyl Chloral Hydras. |
| 30* Ferri et Ammonii Citras. | Acidum Oxalicum (N.O.). |
| Ferrum Tartaratum. | Potassii Nitras. |
| Phosphorus. | Strychnina. |

- 70 Plumbi Acetas.
Zinci Sulphas.
Magnesii Sulphas.
Quininæ Sulphas.
Caffeina.
- 75 Acidum Salicylicum.
Acidum Benzoicum.
Sodii Bicarbonas.
Potassii Carbonas.
Calx Chlorinata.
- 80 Hydrargyrum cum Creta.
Hydrargyri Subchloridum.
Antimonium Tartaratum.
Bismuthi Subnitras.
Phenazonum.
- 85 Phenacetinum.
Sulphonal.

Fluids.

- Glycerinum.
Paraffinum Liquidum.
Oleum Phosphoratum.
- 90 Oleum Ricini.
Oleum Morrhuæ.
Oleum Amygdalæ.
Copaiba.
Creasotum.
- 95 Oleum Terebinthinæ.
Oleum Copaibæ.
Oleum Eucalypti.
Oleum Anisi.
Oleum Lavandulæ.
- 100 Oleum Menthæ Piperitæ.
Oleum Sabinæ (N.O.).
Oleum Amygdalæ Amaræ
(N.O.).
Acidum Hydrocyanicum
Dilutum.
Acidum Sulphurosum.
- 105 Acidum Aceticum.
Liquor Ammoniaë.

- Spiritus Ammoniaë Aromaticus.
Spiritus Ammoniaë Fetidus.
Liquor Plumbi Subacetatis.
- 110 Spiritus Rectificatus.
Spiritus Juniperi.
Chloroformum.
Æther.
Æther Aceticus.
- 115 Paraldehydum.
Spiritus Ætheris Nitrosi.
Amyl Nitris.
Mistura Cretæ.
Lotio Hydrargyri Flava.
- 120 Lotio Hydrargyri Nigra.
Tinctura Iodi.
Tinctura Ferri Perchloridi.
Linimentum Belladonnæ.
Tinctura Chloroformi et
Morphinæ Composita.
- 125 Tinctura Cardamomi Composita.
Acidum Sulphuricum Aromaticum.
Tinctura Opii.
Tinctura Opii Ammoniata.
Tinctura Camphoræ Composita.
- 130 Vinum Ferri.
Tinctura Benzoini Composita.
Tinctura Gentianæ Composita.
Tinctura Lavandulæ Composita.
Infusum Rosæ Acidum.
- 135 Liquor Arsenicalis.

Dried Juices, Resins, Gums, etc.

- Opium.
Aloe Barbadosensis et Aloe
Socotrina.

- Kino.
 Elaterium.
 140 Asafetida.
 Myrrha.
 Cambogia.
 Benzoinum.
 Balsamum Tolutanum.
 145 Balsamum Peruvianum.
 Scammoniae Resina.
 Guaiaci Resina.
 (Podophylli Resina, v.
ante).
 Tragacantha.
 Acaciae Gummi.
- Plants and Part of Plants.*
- 150 Chirata.
 Cannabis Indica.
 Lobelia.
 Aconiti Radix.
 Podophylli Rhizoma.
 155 Rhei Radix.
 Calumbae Radix.
 Gentianae Radix.
 Zingiber.
 Glycyrrhizae Radix.
 160 Ipecacuanhae Radix.
 Valerianae Rhizoma.
 Senegae Radix.
 Filix Mas.
 Jalapa.
 165 Colchici Cormus.
 Scilla.
 Guaiaci Lignum.
- Quassiae Lignum.
 Haematoxyli Lignum.
 170 Scoparii Cacumina.
 Cinchonae Rubrae Cortex.
 Cascara Sagrada.
 Cinnamomi Cortex.
 Galla.
 175 Jaborandi Folia.
 Laurocerasi Folia.
 Digitalis Folia.
 Hamamelidis Folia.
 Hyoscyami Folia.
 180 Cocae Folia.
 Senna Alexandrina et
 Indica.
 Buchu Folia.
 Conii Fructus.
 Anisi Fructus.
 185 Cubebae Fructus.
 Piper Nigrum.
 Pimenta.
 Coriandri Fructus.
 Aurantii Cortex Siccatus.
 190 Colocynthis Pulpa.
 Physostigmatis Semina.
 Nux Vomica.
 Strophanthi Semina.
 Ricini Semina (N.O.).
 195 Crotonis Semina (N.O.).
 Sinapis Albæ Semina.
 Sinapis Nigræ Semina.
 Colchici Semina.
 Ergota.
 200 Cantharis.

It is advisable, when studying pharmacognosy, to follow one order or method in describing the substances examined. The information required is the following:—Name, definition, source, mode of preparation, physical and sensory characteristics, chemical composition, impurities, pharmaceutical preparations, and doses.

DESCRIPTION OF MEDICINAL SUBSTANCES.

1. **Name.**—By this is meant the official Latin name, with its English equivalent. There are also various synonyms usually applied to commercial specimens which do not necessarily conform to the official tests for purity—*e.g.*, **Cupri Sulphas**; B.P. synonym **Cupric Sulphate**; other synonyms, **Blue Vitriol**, **Copper Vitriol**, or **Blue Stone**.

There are some names of proprietary remedies resembling, but not identical with, official substances, and not controlled as to strength, composition, or purity by any authority except the manufacturer—*e.g.*, **Liquor Potassii Permanganatis**, B.P., is a one per cent. solution of neutral Potassium Permanganate; while **Condy's Fluid** does not necessarily conform to these requirements, and should not be used as a synonym.

No contraction or name should be used about which there is any ambiguity—*e.g.*, **Bismuth** should not be used for *Bismuthi Subnitras*, nor **Pilula Opii** for *Pilula Saponis Composita*, nor **Liquor Strychninæ** for *Liquor Strychninæ Hydrochloridi*.

In using contractions for the individual words of a name, the same care should be taken. Examples: **Hyd. Chlor.** might be intended for *Chloral Hydrate*, *Hydrargyri Subchloridum*, or *Hydrargyri Perchloridum*; **Ac. Sulph.** might mean either *Concentrated Sulphuric Acid* or *Sulphurous Acid*; **Ac. Hydro. Dil.** might be *Acidum Hydrobromicum Dilutum*, *Acidum Hydrochloricum Dilutum*, or *Acidum Hydrocyanicum Dilutum*; **Inf. Sen.** might be either *Infusum Sennæ* or *Infusum Senegæ*.

Some of the More Common Synonyms.

1. Colloquial terms, such as:—

Adhesive plaster	Emplastrum Resinæ
Allspice	Pimenta
Baking soda	Sodii Bicarbonas
Bleaching powder	Calx Chlorinata
Brimstone	Sulphur
Cacao butter	Oleum Theobromatis
Dill water	Aqua Anethi
Fly blister	Emplastrum Cantharidis
Steel drops	Tinctura Ferri Perchloridi
Steel wine	Vinum Ferri
Washing soda	Sodii Carbonas

2. *Names taken from physical characteristics.*

Aromatic powder	Pulvis Cinnamomi Compositus
Black draught	Mistura Sennæ Composita
Black wash	Lotio Hydrargyri Nigra
Blue ointment	Unguentum Hydrargyri
Blue pill	Pilula Hydrargyri
Blue stone	Cupri Sulphas
Camphorated oil	Linimentum Camphoræ
Cold cream	Unguentum Aquæ Rosæ
Citrine ointment	Unguentum Hydrargyri Nitratis
Curd soap	Sapo Animalis
Fluid magnesia	Liquor Magnesii Carbonatis
Grey powder	Hydrargyrum cum Creta
Milk of sulphur	Sulphur Præcipitatum
Red gum	Eucalypti Gummi
Red precipitate	Hydrargyri Oxidum Rubrum
Sal volatile	Ammonii Carbonas
Sugar of lead	Plumbi Acetas
Sweet spirits of nitre	Spiritus Ætheris Nitrosi
White precipitate	Hydrargyrum Ammoniatum
Yellow wash	Lotio Hydrargyri Flava

3. *Old names still sometimes used.*

Blue vitriol	Cupri Sulphas
Basilicon ointment	Unguentum Resinæ
Calamine	Native carbonate of zinc
Calomel	Hydrargyri Subchloridum
Chloric ether	Spiritus Chloroformi
Corrosive sublimate	Hydrargyri Perchloridum
Croton chloral	Butyl-chloral Hydras
Copperas	Ferri Sulphas
Cream of tartar	Potassii Tartras Acidus
Diachylon	Emplastrum Plumbi
Elixir of vitriol	Acidum Sulphuricum Aromaticum
Emplastrum Lyttæ	Emplastrum Cantharidis
Ergotin	Extractum Ergotæ
Flowers of Benjamin	Acidum Benzoicum
Flowers of sulphur	Sulphur Sublimatum
Fusel oil	Alcohol Amylicum
Green vitriol	Ferri Sulphas
Laudanum	Tinctura Opii
Lignum Vitæ	Guaiaci Lignum
Liver of sulphur	Potassa Sulphurata
Litharge	Plumbi Oxidum
Lunar caustic	Argenti Nitras
Muriatic acid	Acidum Hydrochloricum
Oil of salt	Acidum Hydrochloricum
Oil of vitriol	Acidum Sulphuricum

3. *Old names still sometimes used*—continued.

Opodeldoc	Linimentum Saponis
Otto of roses	Oleum Rosæ
Paregoric (English)	Tinctura Camphoræ Composita
Paregoric (Scotch)	Tinctura Opii Ammoniata
Sal ammoniac	Ammonii Chloridum
Sal alembroth	Double chloride of ammonium and mercury
Salts of lemon	Oxalic Acid
Salts of sorrel	Oxalic Acid
Salts of tartar	Potassii Carbonas
Saltpetre	Potassii Nitras
Spirits of wine	Spiritus Rectificatus
Spirits of turpentine	Oleum Terebinthinæ
Tartar emetic	Antimonium Tartaratum
White vitriol	Zinci Sulphas

4. *Names taken from the introducer of the preparation, or from a place.*

Blaud's pill	Pilula Ferri
Burnett's fluid	Liquor Zinci Chloridi
Carron oil	Linimentum Calcis
Castile soap	Sapo Durus
Christison's pill	Pilula Colocynthis cum Hyoscyamo
Donovan's solution	Liquor Arsenii et Hydrargyri Iodidi
Dover's powder	Pulvis Ipecacuanhæ Compositus
Easton's syrup	Syrupus Ferri Phosphatis cum Quinina et Strychnina
Epsom salts	Magnesii Sulphas
Eserine	Physostigmine
Fowler's solution	Liquor Arsenicalis
Friar's balsam	Tinctura Benzoini Composita
Goa powder	Araroba
Goulard's extract	Liquor Plumbi Subacetatis Fortis
Goulard's lotion	Liquor Plumbi Subacetatis Dilutus
Gregory's powder	Pulvis Rhei Compositus
Glauber's salt	Sodii Sulphas
Griffith's mixture	Mistura Ferri Composita
Hoffmann's anodyne	Spiritus Ætheris Compositus
James's powder	Pulvis Antimonialis
Mindererus spirit	Liquor Ammonii Acetatis
Panama bark	Quillaiaæ Cortex
Plummer's pill	Pilula Hydrargyri Subchloridi Composita
Prussic acid	Acidum Hydrocyanicum (dilutum)
Rochelle salts	Soda Tartarata
Spanish fly	Cantharis
Seidlitz powder	Pulvis Sodæ Tartaratæ Effervescens
Scott's ointment	Unguentum Hydrargyri Compositum
Scheele's acid	Acidum Hydrocyanicum, four per cent. solution

5. Names mostly of proprietary substances, some of them having an exact official equivalent.

Antipyrin	Phenazonum
Battley's sedative solution	Extractum Opii Liquidum
Black drop	Four times the strength of Tinctura Opii
Chillie paste (Smedley's)	Unguentum Capsici
Chlorodyne	Tinctura Chloroformi et Morphinae Composita
Condy's fluid	Liquor Potassii Permanganatis
Fuller's earth	Kaolinum
Hazeline	Liquor Hamamelidis
Lanoline	Adeps Lanæ Hydrosus
Red lotion	Zinci Sulphas (a coloured solution)
Nepenthe	Morphine sulphate in sherry
Parrish's food	Syrup of phosphate of iron and alkalies
Saccharin	Glusidum
Vaseline	Paraffinum Molle

The Definition of a Medicinal Substance generally includes its source and method of preparation.

2. Source.—Definite chemical substances may be obtained either from ores—*e.g.*, **Magnesii Sulphas**, from native sulphate of magnesium; or from some salt—*e.g.*, **Potassii Acetas**, from potassium carbonate, or by some synthetical process.

Vegetable products are obtained from definite plants—*e.g.*, **Digitalis Folia** are the dried leaves of *Digitalis Purpurea* (N.O. Scrophulariaceæ); **Elaterium** is the sediment from the juice of the ripe fruit of *Ecballium Elaterium* (N.O. Cucurbitaceæ); **Strychnina** is an alkaloid obtained from the seeds of *Strychnos Nux Vomica* (N.O. Loganiaceæ), and other species of *Strychnos*; **Oleum Ricini** is the fixed oil expressed from the seed of the *Ricinus Communis* (N.O. Euphorbiaceæ).

3. Mode of Preparation.—By the mode of preparation of a medicinal substance is generally meant its production and purification; *e.g.*, **Potassii Acetas** is prepared by the action of acetic acid on potassium carbonate and the drying of the product by fusion; **Chloroformum** is prepared by the distillation of diluted alcohol with lime and chlorinated lime, and is purified first by washing with water and sulphuric acid, and then again distilling with lime and chloride of calcium; **Podophylli Resina** is prepared from the rhizome of *Podophyllum Peltatum*, by making a strong tincture with

alcohol and pouring the tincture into acidified water, which precipitates the resin; this is then collected and washed on a filter, and dried.

4. Physical Characteristics are divided into the **general appearance, colour, odour, taste, weight, and solubility**. Those characteristics which are perceived by the senses are called the **sensory properties**.

(a) **General Appearance**.—Solid, semi-solid, fluid or gaseous.

Solid substances may be divided into **crude vegetable substances** having certain features in common according to the part of the plant from which they are derived, *e.g.*, roots, barks, leaves, seeds, etc.: **Crystalline masses**, *e.g.*, *Ammonii Carbonas* or *Potassii Acetas*: **Separate crystals**, *e.g.*, *Acidum Carbolicum*, which is composed of acicular crystals, while *Potassii Chloras* occurs in rhomboidal crystalline plates: **Crystalline powders**, where the crystals are too small to be easily made out by the unaided eye; *e.g.*, *Salicinum* and *Homatropinæ Hydrobromidum*: **Scales**, *e.g.*, *Ferri et Quininæ Citras*: **Rods**, *e.g.*, *Zinci Chloridum*: **Amorphous masses**, *e.g.*, *Acidum Arseniosum*; *Creta Præparata*: **amorphous masses of an unctuous consistence**, *e.g.*, *Cera Alba*; *Oleum Theobromatis*; *Paraffinum Durum*; and **amorphous powders**, *e.g.*, *Zinci Oxidum*.

Semi-solid, *e.g.*, *Extractum Gentianæ*; *Paraffinum Molle*.

Fluid or Watery, *e.g.*, *Aqua Laurocerasi*. **More mobile than water**, *e.g.*, *Spiritus Rectificatus*; *Æther*. **Syrupy** or **Viscid**, *e.g.*, *Glycerinum*; *Acidum Lacticum*. **Oily**, *e.g.*, *Oleum Ricini*.

Under **general appearance** are also considered such features as are included in the terms **permanent**, *e.g.*, *Potassii Bichromas*; **hygroscopic**, *e.g.*, *Glycerinum*; **deliquescent**, *e.g.*, *Potassii Acetas*; **efflorescent**, *e.g.*, *Sodii Carbonas*; **volatile**, *e.g.*, *Bromum*; *Æther*; and **inflammable**, *e.g.*, *Camphora*; *Æther*.

(b) **Colour**, or absence of colour. **Transparency**. **Translucency**. **Opacity**.—Crystals in the form of a fine powder may have a different colour from that of the unbroken crystals.

Also the colour of a fluid may vary with the thickness of the layer examined. Terms referring to well-known substances are often used, *e.g.*, amber-coloured, straw-coloured, etc. **Clear** denotes absence of suspended matter, not absence of colour.

(*c*) **Odour, or absence of odour.**—Care should be taken to distinguish between irritation produced by a substance and a true odour; *e.g.*, *Ammonia* irritates the nasal mucous membrane, while *Valerian* has a characteristic odour. Also it should be observed that some substances, *e.g.*, the volatile or essential oils in concentration, diminish the sense of smell or paralyse it entirely, so that it becomes difficult or impossible to distinguish slight differences of odour. It is advisable to smell the stopper of a bottle containing such a substance before attempting to smell the solid or fluid directly.

An odour may be strong or faint, persistent or evanescent, characteristic, and penetrating. It may be agreeable or disagreeable. If of the nature of many of the essential oils, the term aromatic is used; if very disagreeable, nauseous; if agreeable, fragrant. The term æthereal or fruity is applied to substances such as *amyl nitris*, and *chloral hydras*.

(*d*) **Taste, or absence of taste.**—Under this heading various sensations in the mouth are described as well as true taste sensations. These may be **strong or faint, characteristic of the substance**, *e.g.*, *Pulvis Rhei*; **agreeable or disagreeable**, or **nauseous**; **persistent or evanescent**.

Among these sensations are **warmth** and **coolness**, *e.g.*, *Oleum Menthe Piperitæ*, which gives first the one and then the other. **Irritation** has several subdivisions, such as **tingling**, *e.g.*, *Aconiti Radix*; **acid**, *e.g.*, *Podophylli Resina*; **pungent**, *e.g.*, *Oleum Sinapis Volatile*; **burning**, *e.g.*, *Acidum Carbolicum*. Other sensations are **numbness**, *e.g.*, *Cocaina*; **astringency**, *e.g.*, *Alumen*; **mucilaginous**, *e.g.*, *Tragacantha*; and **oiliness**, *e.g.*, *Oleum Amygdalæ*.

The true taste sensations are **sweetness**, *e.g.*, *Glycerinum*; **bitterness**, *e.g.*, *Quininæ Sulphas*; **sourness**, *e.g.*, *Acidum Oxalicum*; **alkalinity**, *e.g.*, *Liquor Calcis*; the **saline** taste, *e.g.*, *Sodii Chloridum*; the **metallic** taste, *e.g.*, *Zinci Sulphas*; and the **chalybeate**, *e.g.*, *Ferri Sulphas*.

Two or more distinct sensations may be produced by a substance, *e.g.*, *Potassii Citras* has an **acid saline** taste, while

Potassii Bicarbonas has an **alkaline saline** taste. Again, *Liquor Ferri Perchloridi* is **acid, astringent, and chalybeate**.

(e) **Weight.**—To appreciate the difference in weight between a heavy and a light powder, if there is very little in a bottle, place one hand at the bottom of the bottle and hold the stopper in with the other hand. Then with a gentle but sudden jerk raise the substance from the bottom of the bottle add allow it to fall back again. The impact will give the information required.

(f) **Solubility.**—The solvents most usually employed are cold or boiling water, alcohol, ether, chloroform, glycerine, and the fixed and volatile oils. For special purposes, benzol, acetic ether, amylic alcohol, and bisulphide of carbon are used. Similarly, iodide of potassium is used to increase the solubility of iodine.

Comparative Solubility in Water.—The following substances are soluble in water to a greater extent than 1 in 10, the figure after the name being the parts of cold solvent necessary to dissolve one part of the substance; but it must also be remembered that a solvent may not be able to dissolve the whole amount of a soluble substance as expressed by its saturation figure (*e.g.*, 1 in 20) if the solvent already holds in solution other salts.

(It is convenient, in prescribing, to remember that five grains in a teaspoonful, *i.e.* one fluid drachm, is of the approximate strength of 1 in 12.)

All potassium salts (4 exceptions).	Ferrous sulphate, 2.
All sodium salts (2 exceptions).	Zinc chloride, 1; sulphate, 1; sulphocarbolate, 3.
All ammonium salts.	Bismuth and ammonium citrate.
All official alkaloidal salts excepting those mentioned below.	Copper sulphate, 4.
Calcium chloride, 1; hypophos- phite, 8.	Silver nitrate, 1.
Lithium citrate, 2.	Lead acetate, 3.
Strontium bromide, 1.	Mercurous nitrate: acetate.
Magnesium sulphate, 1.	Phenazonum, 1.
Iron scale preparations, 1.	Chloral hydrate, 1.
	Tannic acid, 1.
	Chromic acid, 1.
	Saccharum lactis, 7.

Among the **less soluble** substances which are soluble in water between the limits of 1 in 10 and 1 in 100 parts, the following are the most important:—

Potassium bichromate	1 in 10	Salicin	1 in 30
Æther	„ 10	Caffeine citrate	„ 32
Paraldehyde	„ 10	Quinine hydrochloride	„ 35
Morphine tartrate	„ 11	Strychnine hydro-	
Alumen	„ 11	chloride	„ 40
Arsenium iodide	„ 11	Butyl-chloral hydrate	„ 44
Sodium bicarbonate	„ 11	Apomorphine hydro-	
Carbolic acid	„ 12	chloride	„ 50
Potassium chlorate	„ 16	Lithium Carbonate	„ 70
Tartar emetic	„ 17	Codeine	„ 80
Potassium permanganate	„ 18	Caffeine	„ 80
Mercuric chloride	„ 19	Picric acid	„ 90
Morphine hydrochloride	„ 24	Arsenious acid	„ 100
Borax : boracic acid	„ 25	Gallic acid	„ 100

The following important substances have a solubility in water of less than 1 in 100:—

Veronal	1 in 145	Camphor	1 in 700
Chloroform	„ 185	Nitroglycerine	„ 800
Acetanilide	„ 190	Quinine sulphate	„ 800
Potassium acid tar-		Calcium hydrate	„ 900
trate	„ 200	Morphine	„ 1000
Atropine	„ 300	Cocaine	„ 1300
Benzoic acid	„ 390	Phenacetin	„ 1700
Aloin	„ 400	Magnesium carbonate	„ 2500
Saccharin	„ 400	„ oxide	„ 6000
Sulphonal	„ 450	Strychnine	„ 6700
Salicylic acid	„ 550	Iodine	„ 7000

Insolubility in Alcohol of Salts soluble in Water.—

The official salts which are soluble to the extent of at least 1 to 25 parts of water, and which are **insoluble** or sparingly soluble in **ninety per cent. alcohol**, are the following:—

Potassium carbonate, bicarbonate, nitrate, sulphate, tartrate, chlorate.

Sodium carbonate, bicarbonate, phosphate, sulphite, sulphate, borax, and soda tartarata.

Insolubility of Salts in Alcohol—*continued.*

Ammonium phosphate.
 Calcium hypophosphite.
 Lithium citrate.
 Alumen.
 Magnesium salts.
 Scale preparations of iron.
 Ferrous, cupric, and zinc sulphates.
 Salts of bismuth and of antimony.

Solubility in Alcohol.—Organic acids and their salts, organic bases, alcohols, phenols and their compounds, volatile oils and resins, and some fixed oils (castor and croton) are **soluble in ninety per cent. alcohol**; glucosides are less soluble than in water; and gums and sugars are insoluble. The solubility in alcohol of the following substances should be observed:—

Salicylic acid, 3.	Sulphonal, 50.
Phenacetin, 20.	Iodoform, 80.

The **solubility** in **glycerine** of a substance which is soluble both in water and in alcohol is generally intermediate between these two solubilities.

The following substances should, however, be noted as being **more soluble** in glycerine than in water:—Arsenious acid, 5; borax, 1; boracic acid, 2; carbolic acid, 1; alum, and corrosive sublimate, 2.

Classification of Soluble and Insoluble Salts.

It is convenient to group the various soluble and insoluble salts of the alkalies, alkaline earths, alkaloids, and heavy metals as follows:—

Soluble.—All oxides, hydrates, and salts of the **alkalies** are soluble in water, the acid tartrate of potassium, however, being only sparingly soluble.

The **most soluble** salts of the **heavy metals** and of the **alkaline earths** are the acetates, nitrates, chlorates, most of the chlorides, bromides, and iodides, and some of the sulphates.

Insoluble.—Of the **heavy metals** and the **alkaline earths**, the oxides, hydrates, carbonates, phosphates, arsenates, arsenites, borates, sulphides, cyanides, tartrates, citrates, benzoates, and salicylates are insoluble in water.

To these insoluble salts may be added mercurous, silver, and lead chlorides, bromides, and iodides, and mercuric iodide, and the sulphates of barium, strontium, and calcium.

Oxychloride of antimony and oxynitrate of bismuth are insoluble. Mercuric nitrate is decomposed by water.

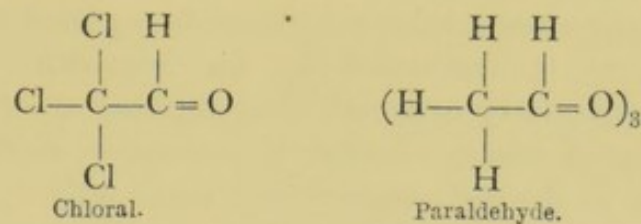
Exceptions.—Calcium oxide, hydrate and carbonate, magnesium oxide, acid carbonate and citrate, and lithium carbonate are somewhat soluble.

The **alkaloids** and the **alkaloidal salts** follow the rule of the heavy metals, thus the alkaloidal bases—carbonates, phosphates, etc.—are sparingly soluble in water, though caffeine and codeine both dissolve in water to the extent of 1 in 80. Thus, also, the acetates, nitrates, chlorates, etc., are soluble. But *quinine acetate* and *sulphate* are very slightly soluble, and the *iodide of quinine* and the *bromide* and *iodide of strychnine* are sparingly soluble, and double iodides of nearly all alkaloids are insoluble.

Alkaloidal tartrates and **citrates** are, however, soluble.

5. Composition.—In the case of a definite chemical substance this is best expressed by its formula, *e.g.*, **Cupri Sulphas**, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.

The structural formulæ of organic compounds is sometimes of assistance in grouping substances with similar action. Thus, for instance, the relation between anhydrous chloral and paraldehyde may be most readily appreciated by comparing their graphic formulæ—



In the case of vegetable substances the most important constituents are the **active principles**. The presence of deleterious substances should also be noted, *e.g.*, hydrocyanic acid in volatile oil of bitter almonds, as well as any excessive quantity of inert matter, *e.g.*, starch in *Calumbæ Radix*.

The reactions by which the various substances are identified should be noted under this heading; and these substances which decompose or precipitate or combine with the substance

under observation. This latter is important in its bearing on the combining of medicines in prescriptions.

6. Impurities and Adulterations.—These in some cases may be important, *e.g.*, arsenic in sulphur, or iodate of potassium in iodide of potassium.

7. Pharmaceutical Preparations.—By this term is meant any form in which the medicinal substance may be administered without the alteration of the essential ingredients, even though the physical forms of the substance and its preparations widely differ from each other. For example, *Tinctura Nucis Vomicae* is a preparation of *Nux Vomica*, and contains the same active principles as *Nux Vomica*, though the tincture is an alcoholic fluid and *Nux Vomica* is a solid. This term *pharmaceutical preparation* is not, however, applied to the different chemical compounds of an element; *e.g.*, *potassii acetas* and *potassii carbonas* are not pharmaceutical preparations of potassium, but independent chemical substances.

These pharmaceutical preparations are made for the convenience of the patient, the prescriber, or the dispenser, or in some cases of all three.

1. Thus a patient can take a substance more readily after its inert constituents have been separated and rejected, as they have been during the preparation of a tincture such as that of orange peel, or after its active constituents have been concentrated, as they have been during the preparation of an extract like that of cascara.

Then again, when a substance is to be applied to the skin, the application is facilitated by the admixture with some slightly adhesive fatty material, thus forming an ointment like that of oxide of zinc; whereas if prolonged contact over a definite area is desired, ingredients more adhesive are used forming a plaster like that of menthol.

When an action on the intestines is desired, a convenient preparation of an irritant substance is a pill, which has the advantage of being easily swallowed without being tasted; while if an irritant action on the mouth or the throat is wanted, in which case the sense of taste will be more or less strongly affected, a pleasantly flavoured lozenge is the more convenient preparation. Thus there are pills containing an active purgative substance like resin of scammony; but there is a

lozenge containing the milder irritant resin of guaiac, which lozenge when swallowed is not sufficiently irritating to cause purgation.

2. There are preparations consisting of several ingredients so often prescribed together in proportions determined by general experience, that the convenience of the prescriber is consulted by giving a short name to the formula. This avoids the necessity of his writing the prescription in full every time he orders this combination. The compound powders and the compound tinctures are examples of these formulæ, as are also the pills, ointments, etc.

3. In order that the dispenser need not always weigh minute quantities of very active substances, there are dilute solutions of them. Again, solutions of the essential oils, viz., the waters and the spirits, are more rapidly dispensed than the equivalent quantities of the undissolved oils can be.

In order to learn and to remember the official preparations, it is of advantage to know the doses, the methods of administration, the localities of application, the composition, and the solubility of the substance under consideration. Thus, for example, nitroglycerine (dose $\frac{1}{200}$ - $\frac{1}{50}$ grain) only slightly soluble in water (1 in 800), very soluble in alcohol, and used for internal administration, has two preparations, the one consisting of small chocolate tablets each containing $\frac{1}{100}$ grain of nitroglycerine, and the other a one per cent. solution in alcohol.

8. Dose.—By the dose is meant the quantity of a medicinal substance given at one time to an average adult man. It is usually expressed within certain limits—a minimum below which too little or no effect may be expected, and a maximum above which undesirable effects may be expected. In the preface to the B.P. it is stated that the doses mentioned in the pharmacopœia are meant for general guidance, but are not authoritatively enjoined. The medical practitioner must act on his own responsibility as to the doses of any therapeutic agents which he administers.

The dose is modified by such conditions as weight, sex, age, repetition, state of health, habits of the patient, idiosyncrasy, etc.

The following selection of some of the more important preparations and their doses has been made with a view to practice in prescription-writing, in which it is necessary to

choose an appropriate preparation and a suitable quantity of it. They should therefore be committed to memory.

Group Doses.

Infusa— $\frac{1}{2}$ to 1 or 2 fluid ounces (except Infusum Digitalis, 2 to 4 fluid drachms).

Decocta— $\frac{1}{2}$ to 2 fluid ounces.

Aquæ— $\frac{1}{2}$ to 2 fluid ounces (except Aqua Laurocerasi, $\frac{1}{2}$ to 2 fluid drachms).

Syrupi— $\frac{1}{2}$ to 1 fluid drachm.

Spiritus—(a) Simple, 5 to 20 minims.

(b) Compound or distilled, 20 to 40 minims for repeated administration.

Do., 60 to 90 minims for single administration.

Tincturæ—usually $\frac{1}{2}$ to 1 fluid drachm.

The most important exceptions are the following:—

Tinctura Belladonnæ	}	5 to 15 minims.
„ Chloroformi et Morphinæ Composita		
„ Digitalis		
„ Ferri Perchloridi		
„ Nucis Vomiceæ		
„ Opii		
„ Strophanthi... 2-5 "	}	2 to 5 minims.
Tinctura Aconiti		
„ Cantharidis		
„ Iodi		

Extracta (solid or semi-solid)— $\frac{1}{4}$ to 1 grain or 2 to 8 grains—

Extractum Belladonnæ Viride	}	$\frac{1}{4}$ to 1 grain.
„ Belladonnæ Alcoholicum		
„ Nucis Vomiceæ		
„ Opii		
„ Strophanthi	}	2 to 8 grains.
Extractum Cascaræ Sagradæ		
„ Ergotæ		

Inorganic Substances Mainly.

Acidum Arseniosum, $\frac{1}{30}$ to $\frac{1}{15}$ grain.

Liquor Arsenicalis
Liquor Arsenici Hydrochloricus } 2 to 8 minims.

Acidum Hydrocyanicum Dilutum, 2 to 6 minims.

Acidum Hydrochloricum Dilutum }
,, Nitricum Dilutum } 5 to 20 minims.
,, Sulphuricum Dilutum }
,, Phosphoricum Dilutum }

Potassii Bromidum, 5 to 30 grains.

,, Iodidum, 5 to 20 grains.

,, Acetas, 10 to 60 grains.

,, Bichromas, $\frac{1}{12}$ to $\frac{1}{6}$ grain.

Ammonii Carbonas, 3 to 10 grains (30 grains, emetic).

Magnesii Sulphas, $\frac{1}{2}$ to 2 drachms, repeated; $\frac{1}{4}$ to $\frac{1}{2}$ ounce for single administration.

Ferri Sulphas, 1 to 5 grains.

Ferri et Quininæ Citras, 5 to 10 grains.

Liquor Ferri Perchloridi, 5 to 15 minims.

Hydrargyri Perchloridum, $\frac{1}{32}$ to $\frac{1}{16}$ grain.

Liquor Hydrargyri Perchloridi, $\frac{1}{2}$ to 1 fluid drachm.

Hydrargyri Subchloridum, $\frac{1}{2}$ to 5 grains.

Argentii Nitras, $\frac{1}{4}$ to $\frac{1}{2}$ grain.

Organic Substances.

Chloral Hydras—5 to 20 grains.

Opium— $\frac{1}{2}$ to 2 grains.

Preparations—

Extractum Opii, $\frac{1}{4}$ to 1 grain.

Pilula Plumbi cum Opio, 2 to 4 grains.

Pilula Saponis Composita, 2 to 4 grains.

Pilula Ipecacuanhæ cum Scillâ, 4 to 8 grains.

Pulvis Opii Compositus, 2 to 10 grains.

Pulvis Ipecacuanhæ Compositus, 5 to 15 grains.

Pulvis Kino Compositus, 5 to 20 grains.

Pulvis Cretæ Aromaticus cum Opio, 10 to 40 grains.

Extractum Opii Liquidum, 5 to 30 minims.

Tinctura Opii, 5 to 15 minims for repeated administration; 20 to 30 minims for a single administration.

Tinctura Camphoræ Composita, $\frac{1}{2}$ to 1 fluid drachm.

Tinctura Opii Ammoniata, $\frac{1}{2}$ to 1 fluid drachm.

Suppositoria Plumbi Composita, 1 grain in each.

Opium—*continued.***Morphinæ Hydrochloridum**— $\frac{1}{8}$ to $\frac{1}{2}$ grain.*Preparations*—

Liquor Morphinæ Hydrochloridi, 10 to 60 minims.

Tinctura Chloroformi et Morphinæ Composita, 5 to 15 minims.

Trochiscus Morphinæ, $\frac{1}{30}$ grain in each.Trochiscus Morphinæ et Ipecacuanhæ, $\frac{1}{30}$ grain in each.Suppositoria Morphinæ, $\frac{1}{4}$ grain in each.**Morphinæ Acetas**— $\frac{1}{8}$ to $\frac{1}{2}$ grain.*Preparation*—

Liquor Morphinæ Acetatis, 10 to 60 minims.

Morphinæ Tartras— $\frac{1}{8}$ to $\frac{1}{2}$ grain.*Preparations*—

Liquor Morphinæ Tartratis, 10 to 60 minims.

Injectio Morphinæ Hypodermica, 2 to 5 minims subcutaneously.

Belladonna.*Preparations of Belladonnae Folia*—Extractum Belladonnæ Viride, $\frac{1}{4}$ to 1 grain.

Succus Belladonnæ, 5 to 15 minims.

Preparations of Belladonnae Radix—Extractum Belladonnæ Alcoholicum, $\frac{1}{4}$ to 1 grain.

Tinctura Belladonnæ, 5 to 15 minims.

Suppositoria Belladonnæ, $\frac{1}{60}$ grain of the alkaloids in each.**Atropina**— $\frac{1}{200}$ to $\frac{1}{100}$ grain.**Atropinæ Sulphas**— $\frac{1}{200}$ to $\frac{1}{100}$ grain.*Preparations*—Liquor Atropinæ Sulphatis, $\frac{1}{2}$ to 1 minim.Lamellæ Atropinæ, $\frac{1}{3000}$ grain in each.**Nux Vomica**—1 to 4 grains.*Preparations*—

Extractum Nucis Vomicae Liquidum, 1 to 3 minims.

Extractum Nucis Vomicae, $\frac{1}{4}$ to 1 grain.

Tinctura Nucis Vomicae, 5 to 15 minims.

Nux Vomica—*continued.***Strychnina**— $\frac{1}{60}$ to $\frac{1}{15}$ grain.*Preparation*—Syrupus Ferri Phosphatis cum Quininā et Strychninā,
 $\frac{1}{2}$ to 1 fluid drachm.**Strychninæ Hydrochloridum**— $\frac{1}{60}$ to $\frac{1}{15}$ grain.*Preparation*—Liquor Strychninæ Hydrochloridi, 2 to 8 minims by
mouth, 1 to 4 minims subcutaneously.**Cinchonæ Rubræ Cortex**—*Preparations*—

Extractum Cinchonæ Liquidum, 5 to 15 minims.

Tinctura Cinchonæ, $\frac{1}{2}$ to 1 fluid drachm.Tinctura Cinchonæ Composita, $\frac{1}{2}$ to 1 fluid drachm.Infusum Cinchonæ Acidum, $\frac{1}{2}$ to 1 fluid ounce.**Quininæ Sulphas**—1 to 10 grains.*Preparations*—

Ferri et Quininæ Citras, 5 to 10 grains.

Pilula Quininæ Sulphatis, 2 to 8 grains.

Syrupus Ferri Phosphatis cum Quininā et Strychninā
 $\frac{1}{2}$ to 1 fluid drachm.Tinctura Quininæ Ammoniata, $\frac{1}{2}$ to 1 fluid drachm.**Quininæ Hydrochloridum**—1 to 10 grains.*Preparations*—Tinctura Quininæ, $\frac{1}{2}$ to 1 fluid drachm.Vinum Quininæ, $\frac{1}{2}$ to 1 fluid ounce.**Quininæ Hydrochloridum Acidum**—1 to 10 grains.**Strophanthi Semina.***Preparations*—Extractum Strophanthi, $\frac{1}{4}$ to 1 grain.

Tinctura Strophanthi, 5 to 15 minims.

Digitalis Folia— $\frac{1}{2}$ to 2 grains.*Preparations*—

Tinctura Digitalis, 5 to 15 minims.

Infusum Digitalis, 2 to 4 fluid drachms.

Cascara Sagrada.*Preparations—*

Extractum Cascaræ Sagradæ, 2 to 8 grains.

Extractum Cascaræ Sagradæ Liquidum, 10 to 20 minims repeated.

Syrupus Cascaræ Sagradæ Aromaticus, $\frac{1}{2}$ to 2 fluid drachms.

Aloe Barbadosis—2 to 5 grains.

Aloinum— $\frac{1}{2}$ to 2 grains.

Ergota—20 to 60 grains.

Preparations—

Extractum Ergotæ, 2 to 8 grains.

Extractum Ergotæ Liquidum, 10 to 30 minims.

Tinctura Ergotæ Ammoniata, $\frac{1}{2}$ to 1 fluid drachm.

Infusum Ergotæ, 1 to 2 fluid ounces.

Injectio Ergotæ Hypodermica, 3 to 10 minims subcutaneously.

Oleum Ricini—1 to 8 fluid drachms.

Oleum Morrhuæ—1 to 4 fluid drachms.

SECTION II.

Weights and Measures of the Imperial System.

Mass.

UNIT is a Grain, or $1/252.456$ of a cubic inch of pure water at 62° F.

437.5 grains = 1 ounce (oz.).

16 ounces = 1 pound.

Observe that there are 16 drachms in this ounce.

In prescribing, the denominations scruple (20 grains) and drachm (60 grains) may be used for convenience. The apothecaries' ounce ($\bar{3}$), weighing 480 grains, is often used, and it should be noted that there are eight 60-grain drachms in the apothecaries' ounce.

Capacity.

Unit is 0.91 of a grain of pure water at 62° F.

60 minims = 1 fluid drachm.

8 drachms = 1 fluid ounce.

20 ounces = 1 pint.

8 pints = 1 gallon.

Relation of Volume to Mass.

0.911 grain of water = 1 minim.

437.5 grains .. = 1 ounce.

70000.0 = 1 gallon.

100 = 110 minims nearly.

1 grain in 100 grains of water, or 110 minims = 1 per cent.

Weights and Measures of the Metric System.

Mass.

Unit, 1 gramme, the weight of 1 millilitre of pure water at 4° C.

1 milligramme = $1/1000$ of a gramme.

1 kilogramme = 1000 grammes.

Capacity.

1 litre = 1000 grammes of pure water at 4° C.

Relation of Imperial to Metric.

1 grain = 0.0648 gramme.

1 gramme = 15.4323564 grains.

1 ounce = 28.35 grammes nearly.

1 pound = 453.6 grammes nearly.

1 kilogramme = 2 lb. 3 oz.

Weights.

Latin Names.		Symbols.
<i>Granum, i</i>	one grain	gr. j.
<i>Scrupulum, i</i>	one scruple	ʒj.
<i>Drachma, ae</i>	one drachm	ʒj.
<i>Uncia (Apothecaries')</i>	one ounce = 480 grains	ʒj.
<i>Uncia, ae (Imperial)</i>	one ounce = 437.5 „	oz. j.
<i>Libra, ae</i>	one pound	lb. j.
<i>Sexta pars grani</i>	a sixth part of a grain	gr. ̄j.
<i>Grani pars quarta</i> } <i>Quadrans grani</i> }	a fourth part of a grain	gr. ̄j.
<i>Grani partes tertiae duae</i>	two-thirds of a grain	gr. ̄j.
<i>Grani partes octavae quinque</i>	five-eighths of a grain	gr. ̄j.
<i>Semigranum</i> } <i>Dimidium grani</i> } <i>Semis grani</i> }	half a grain	gr. ss.
<i>Grana duo cum semisse</i>	two and a half grains	gr. ijss.

Measures of Capacity.

Latin Names.		Symbols.
<i>Minimum</i>	one minim	ʒj.
<i>Drachma fluida</i>	one fluid drachm	fl. ʒj.
<i>Uncia fluida</i>	one fluid ounce	fl. ʒj.
<i>Octarius</i>	one pint	Oj.
<i>Congius</i>	one gallon	Cj.

Domestic Measures.

			Average Equivalent.
<i>Gutta</i>	drop	gtt.	min. ̄j—min. jss.
<i>Cochleare parvum</i>	teaspoonful	coch. parv.	ʒj.
<i>Cochleare medium</i>	dessertspoonful	coch. med.	ʒij.
<i>Cochleare magnum</i>	tablespoonful	coch. mag.	ʒss.
<i>Cyathus vinarius</i>	wineglassful	cy. vinar.	ʒij—ʒijss.
<i>Poculum</i>	teacupful	poc.	ʒiv—ʒvij.
<i>Cyathus magnus</i>	tumblerful	cy. mag.	ʒx—ʒxij.
<i>Pugillus</i>	pinch	pug.	ʒss—ʒj.
<i>Uncia</i>	an inch		

Weighing and Measuring.

Scales of different sizes are used, as may be most convenient for the bulk of the substance to be weighed. For those who are not constantly dispensing, scales which can be held in the hand have certain advantages; they occupy little space, and are inexpensive. Glass scale-pans are more easily cleaned, but are also more easily broken.

Whatever scales are used, it should be seen that the two pans are equally counterpoised, and that the beam swings

freely. If metal pans are used, weigh on a tared watch-glass, or place an equal-sized piece of paper on each pan. This is readily obtained by folding a piece of paper on itself, and cutting out with scissors a circle of about the same size as that of the scale-pans. On separating the paper, two pieces of the same size and weight are obtained.

To see that the Pans are equally Counterbalanced.—

After placing the papers on each scale-pan hold the scales by the hook, in the left hand on a level with the eyes, and allow the beam to oscillate, and observe that the standard makes equal angles on each side of the upright as it swings. If one of the pans be heavier, paper should be cut off the heavier side till equality is obtained.

Weighing.—Place the weight required on the left scale-pan, and hold the scales in the left hand as above, but with the little finger resting against the standard. Take on a spatula more than enough of the powder to be weighed, and hold it over the right scale-pan, and shake off small portions until the requisite amount is obtained. The pressure of the standard against the little finger is removed when the correct amount has been placed on the scale-pan, and the accuracy of the weight taken should be tested by allowing the beam to oscillate again.

It is convenient, when taking a powder from a bottle, to lay the bottle on its side with the mouth towards the worker, and to prevent it rolling by placing the handle of the stopper beneath it. The spatula must be carefully cleaned before putting it into any bottle to remove the contents from it.

Replace the stopper in the bottle, replace the bottle, and replace the weights.

Measuring Fluids.—Hold the measure with the forefinger and thumb of the left hand round its flat base, at such a height that the corresponding lines on the front and back of the measure are both at the level of the eyes. Take the bottle containing the fluid to be measured with the right hand, grasping the side on which the label is, and remove the stopper with the little finger of the left hand. The stopper must not be placed on the table. Pour from the bottle on the side away from the label. Take the measurement of the liquid at the lower limit of the meniscus. Remove the last hanging drops on the lip of the bottle by touching it with the stopper

before replacing the stopper in the bottle. Put back the bottle in its place.

Drain the contents of the measure into the bottle in which the mixture is to be dispensed, and rinse out the measure with small successive quantities of the vehicle, leaving it clean and empty for the next measurement.

Do not measure syrups or glycerines in narrow, conical vessels, because of the difficulty of removing the last portions of such viscous fluids.

Practice.

Weigh twenty grains of oxide of zinc.

Measure sixty minims of dilute hydrochloric acid and dilute it to the bulk of one fluid ounce with water.

SECTION III.

PRESCRIPTION WRITING.

IT is as well to follow the practice of writing prescriptions in a definite order, and to adhere to some plan such as that in the model. To facilitate reference there are certain names given to the various parts of the prescription. Example:—

	<i>Place.</i>	
	<i>Date.</i>	
Mr A. B.		
Recipe,		<i>Superscription.</i>
Ferri Sulphatis grana triginta sex		} <i>Inscription.</i>
Magnesii Sulphatis drachmas octo		
Tincturæ Zingiberis drachmas tres		
Infusi Gentianæ Compositi ad uncias sex		
Solve et misce ut fiat mistura.		<i>Subscription.</i>
Signetur.		
Cochleare magnum ter in die sumendum post cibum.		<i>Signature.</i>
		<i>(Signature of prescriber.)</i>

The use of the numerals is the only point presenting difficulty, and attention should be given to the peculiarities in the declining of **unus**, **duo**, and **tres**. Also distinguish between the use of *unus*, *semel*, *primus*, and *singuli*. Fractions are expressed as "parts of," *e.g.*, four-fifths of a grain, as four-fifth parts of a grain, though the word "part" may be understood and not written.

Observe whether a measured quantity of the vehicle (the compound infusion of gentian in the above prescription) is ordered, or, as in the example, sufficient is ordered to be taken so that the mixture will attain to a definite bulk.

When writing the signature of a prescription, inconvenience will be avoided if the directions to the patient are as complete as possible. They should include answers to the questions **how much? how often? when? and in what manner?** the substance should be taken.

Instructions to Dispenser.

Nouns.

<i>Mistura, ae</i>	a mixture.	<i>Suppositorium, ii</i>	a suppository.
<i>Haustus, ūs</i>	a draught.	<i>Pessarium, ii</i>	a pessary.
<i>Gargarisma, tis</i>	a gargle.	<i>Emplastrum, i</i>	a plaster.
<i>Enema, tis</i>	an enema.	<i>Bougia, ae</i>	a bougie.
<i>Collyrium, ii</i>	an eye-wash.	<i>Injectio, nis</i>	an injection.
<i>Collutorium, ii</i>	a mouth-wash.	<i>Cataplasma, tis</i>	a poultice.
<i>Lotio, nis</i>	a lotion.	<i>Charta, ae</i>	a paper.
<i>Linimentum, i</i>	a liniment.	<i>Phiala, ae</i>	a bottle.
<i>Balneum, i</i>	a bath.	<i>Penicillum</i>	a brush.
<i>Emulsio, nis</i>	an emulsion.	<i>Capsula, ae</i>	a capsule.
<i>Unguentum, i</i>	an ointment.	<i>Pannus, i</i>	cloth.
<i>Confectio, nis</i>	a confection.	<i>Linteam, i</i>	linen.
<i>Pulvis, eris</i>	a powder.	<i>Gossypium, i</i>	cotton.
<i>Pilula, ae</i>	a pill.	<i>Pars, tis</i>	a part.
<i>Massa, ae</i>	a mass.	<i>Paululum, i</i>	a little.
<i>Trochiscus, i</i>	a lozenge.		

Verbs and Phrases.

<i>Adde</i>	add.
<i>Misce</i>	mix.
<i>Solve</i>	dissolve.
<i>Coque</i>	boil.
<i>Filtra</i>	filter.
<i>Cola</i>	strain.
<i>Divide</i>	divide.
<i>Mitte</i>	send.
<i>Quantum sufficiat</i>	as much as is sufficient.
<i>Ad (uncias sex)</i>	up to (six ounces).
<i>Ana (āā)</i>	of each.
<i>Misce (solve, etc.) ut fiat mistura (haustus, etc.)</i>	mix (dissolve, etc.) so that a mixture (draught, etc.) be made.
<i>Fiat secundum artem</i>)	let it be made according to rule.
<i>Fiat lege artis</i>)	
<i>Fiat more solito</i>	let it be made in the usual manner.
<i>Dividatur in partes aequales</i>	let it be divided into equal parts.
<i>Recens, tis</i>	fresh.
<i>Hujus magnitudinis</i>	of this size.
<i>Hujus formae</i>	of this shape.
<i>In argento</i>	coated with silver.
<i>In gelatino</i>	coated with gelatin.
<i>In capsulis amylaceis</i>	in cachets.
<i>Signa</i>	label it.
<i>Signetur</i>	let it be labelled.
<i>Magnus</i>	great.
<i>Parvus</i>	small.
<i>Longus, a, um longe (adv.)</i>	long.
<i>Latus, a, um late (adv.)</i>	wide.

Instructions for Patient (*Æger, Ægra*).

Parts of Body.

Skin.—Cutis (f.) epidermis, capillus (*hair*), barba (*beard*).

Head.—Caput, occiput, tempora (*temples*).

Face.—Facies, frons (*forehead*) supercilium, palpebrum, oculus, nasus, nares, os [oris], labium, lingua, gingiva (*gum*), mentum, gena (*cheek*), auris.

Neck.—Cervix, nucha-ae (*nape*).

Chest.—Pectus [oris], thorax [acis], præcordium, axilla, scapula, latus [eris] (*side*), dorsum (*back*), mamma, mamilla (*nipple*).

Arm.—Humerus, brachium, cubitus (*forearm*), cubitum (*elbow*), carpus, manus-us (f.), digitus, unguis (*nail*).

Abdomen.—Abdomen, venter, epigastrium, umbilicus, inguen [inis] (*groin*), lumbi [orum] (*loins*), tergum (*back*), alvus-i (f.) (*bowels*).

Leg.—Coxa-ae (*hip*), femur, crus, pes, malleolus, planta (*sole*), calx, digitus pedis.

Passages, etc.—Fauces, trachea, rectum, urethra, etc.

Ambo (*both*), dexter (*right*), sinister (*left*), utrinque (*on both sides*), juxta, externus, internus, nudus (*bare*).

Time of Administration.

<i>Annus, i</i>	year.
<i>Mensis, is</i>	month.
<i>Hebdomas, adis</i>	week.
<i>Dies, ei</i>	day.
<i>Hora, ae</i>	hour.
<i>Minutum, i</i>	minute.
<i>Mane</i>	in the morning.
<i>Meridie</i>	at mid-day.
<i>Vespere</i>	in the evening.
<i>Nocte</i>	at night.
<i>Horâ somni</i> } <i>Hora decubitus</i> }	at bedtime.
<i>Hodie</i>	to-day.
<i>Cras</i>	to-morrow.
<i>Hac nocte</i>	this night.
<i>In media nocte</i>	midnight.
<i>Omni die</i> } <i>Quotidie in dies</i> }	every day.
<i>Omni die mane</i>	every morning.
<i>Omni nocte</i>	every evening.
<i>Omni die (nocte), secunda</i>	every second day (night).
<i>Mane omni die secunda</i>	every second morning.
<i>Semel in die</i>	once a day.
<i>Bis in die</i>	twice a day.
<i>Ter in die</i>	thrice daily.

Time of Administration—*continued.*

<i>Saepe in die</i>	often during the day.
<i>Omni hora</i>	every hour.
<i>Omni quadrante horae</i>	every quarter of an hour (fifteen minutes).
<i>Omni semihora</i>	every half-hour.
<i>Omni hora secunda</i>	every two hours.
<i>Alternis horis</i>	every other hour.
<i>De die in diem</i>	from day to day.
<i>Diebus alternis</i>	every other day.
<i>Omni hora tertia</i>	every three hours.
<i>Pro re nata</i>	occasionally.
<i>Subinde</i>	frequently.
<i>Ut opus sit</i>	when necessary.
<i>Ad libitum</i>	at pleasure.
<i>Quoties</i>	as often as.
<i>Primo</i>	the first thing, early.
<i>Deinde</i>	next, thereafter.
<i>Simul</i>	at the same time as.
<i>Donec</i>	until.
<i>Prius</i>	previous to.
<i>Postea</i>	afterwards.
<i>Statim</i>	immediately.
<i>Post cibum</i>	after food.
<i>Ante cibum</i>	before food.
<i>Cum cibo</i>	with food.
<i>Inter cibos</i>	between meals.
<i>Jentaculum, i</i>	breakfast.
<i>Prandium, i</i>	dinner.
<i>Cena, ae</i>	supper.

Manner of Administration.

<i>Phiala prius agitata (P.P. A.)</i>	the bottle being previously shaken.
<i>Ex cyatho aquæ</i>	in a glass of water.
<i>Dosis, is</i>	the dose.
<i>Reliquum</i>	the remainder.
<i>Ex lacte calido</i>	in warm milk.
<i>Ex lacte frigido</i>	in cold milk.
<i>Bulliens</i>	boiling.
<i>Per fistulum vitream</i> }	through a glass tube.
<i>Per cannulam vitream</i> }	
<i>Ligamento</i>	with a bandage.
<i>Lecto</i>	in bed.
<i>Potu</i>	with a drink.
<i>Frictione</i>	with rubbing.
<i>Calore</i>	with heat.
<i>Frigore</i>	with cold.
<i>Ope</i>	by means of.
<i>Caute</i>	carefully.
<i>Leniter</i>	gently.

Manner of Administration—*continued.*

<i>Plene</i>	freely.
<i>More</i> }	in the manner.
<i>Modo</i> }	
<i>Fere</i>	almost, nearly.
<i>Satis</i>	enough.
<i>In aurem (oculum, etc.) instillari</i>	to be dropped into the ear (eye, etc.).
<i>Injiciatur</i>	let it be injected.
<i>Pars affecta fricetur linimento (unguento, etc.)</i>	the affected part to be rubbed with the liniment (ointment, etc.).
<i>Admoveatur ad locum affectum</i>	to be applied to the affected part.
<i>Adhibeatur</i>	let it be given.
<i>Applicetur</i>	let it be applied.
<i>Inhalatur</i>	let it be inhaled.
<i>Pingat</i>	let him paint.
<i>Ponat</i>	let him place.
<i>Imponat</i>	let him place on.
<i>Maneat</i>	let it remain.
<i>Repetatur</i>	let it be repeated.
<i>Bene infricetur</i>	let it be rubbed in thoroughly.
<i>Aspergatur</i>	let it be sprinkled.
<i>Sugat</i>	let him suck.
<i>Capiat</i> }	let him take.
<i>Sumat</i> }	
<i>Capiatur</i> }	let it be taken.
<i>Sumatur</i> }	
<i>Pulvis sumendus est</i>	the powder is to be taken.
<i>Pilula sumenda est</i>	the pill is to be taken.
<i>Oleum sumendum est</i>	the oil is to be taken.
<i>Utatur (with ablative)</i>	let him use.
<i>More dicto</i> }	as directed.
<i>Ut dictum</i> }	
<i>Ubi dolor urgeat</i>	when the pain is violent.
<i>Febre adstante</i>	when the fever is on.
<i>Usque ad vesicationem</i>	continuously until vesication is produced.
<i>Dosi pedetentim crescenti</i>	gradually increasing the dose.
<i>Alvo adstricta</i>	the bowels being confined.
<i>Vacuo ventriculo (vac. vent.)</i>	on an empty stomach.
<i>Donec alvus dejecerit</i>	until the bowels have been moved.
<i>Donec sudor prodeat</i>	until sweat is produced.
<i>Donec somnus obrepat</i>	until sleep comes on.
<i>Donec evanescent symptomata</i>	until the symptoms disappear.
<i>Donec emesis excitetur</i>	until vomiting is produced.
<i>Donec cessaverit</i>	until it has stopped.
<i>Dum tussis persistat</i>	while the cough continues.
<i>Si cephalalgia crescat</i>	if the headache increases.
<i>Donec flatus levatus sit</i>	till flatulence is relieved.
<i>Si vulnere dolens</i>	if suffering from the wound.
<i>Ad tumorem minuendum</i>	to lessen the swelling.

Manner of Administration—continued.

<i>Ad alvi plenam solutionem</i>		till the bowels move freely.
<i>Si accessio invadat</i>		if an attack comes on.
<i>Si aeger inquiet sit</i>		if the patient is restless.
<i>Dejectiones</i>	} <i>liquidæ</i>	loose motions.
<i>Sedes</i>		
<i>Fæces</i>		
<i>Dum contusio dolorosa sit</i>		as long as the bruise is painful.
<i>Pars dolens</i>		a painful part.

Prepositions.*With Accusative.*

<i>Ante</i>	before.	<i>Post</i>	after, behind.
<i>Ad</i>	to.	<i>Prope</i>	near.
<i>Circum</i>	about.	<i>Secundum</i>	according to.
<i>In</i>	into, on.	<i>Supra</i>	above.
<i>Inter</i>	between.	<i>Sub</i>	under.
<i>Infra</i>	below.	<i>Trans</i>	across.
<i>Per</i>	by means of, during.		

With Ablative.

<i>A, ab</i>	from.	<i>In</i>	in.
<i>Cum</i>	with.	<i>Pro</i>	for the purpose of.
<i>De</i>	from.	<i>Sine</i>	without.
<i>E, ex</i>	out of.		

Numerals.

Cardinal.—Unus, duo, tres, quattuor, quinque, sex, septem, octo, novem, decem, undecim, duodecim, tredecim, etc., duo-de-viginti (18), un-de-viginti (19), viginti (20), triginta (30), quadraginta, quinquaginta, sexaginta, septuaginta, octoginta, nonaginta, centum (100), ducenti (200), etc.

Ordinal.—Primus (1st), secundus (2nd), tertius (3rd), quartus, quintus, sextus, septimus, octavus, nonus, decimus, undecimus, duodecimus, tertius-decimus, vicesimus (20th), tricesimus (30th), quadragesimus, quinquagesimus, centesimus (100th), ducentesimus (200th), etc.

Adverbs.—Semel (once), bis (twice), ter (thrice), quater, quinquies, sexiens, septiens, octiens, noviens, deciens, etc.

SECTION IV.

PROCESSES BY WHICH THE PHARMACEUTICAL OR GALENICAL PREPARATIONS ARE MADE.

I. The simplest process is to reduce the drug to a fine state of division forming the *Pulvis* or powder; but this will be further described when the subject of *dispensing* is considered.

II. The active constituents of a plant may be obtained from it by expression.

The **Juice (Succus)**.—The fresh leaves, young branches or flowering tops of the plant, are bruised, the juice squeezed out, collected, and to every three parts of it one part of ninety per cent. alcohol is added; the whole is allowed to stand for seven days, and then filtered.

Advantage : generally an active preparation.

Disadvantage : apt to vary considerably in strength.

Official Succs.

Succus Belladonnæ, five to fifteen minims.

Succus Hyoscyami, one-half to one fl. drachm.

Succi Conii, Scoparii, and Taraxaci, one to two fl. drachms.

Succus Limonis, the freshly expressed juice of the ripe lemon, may be given in doses from one-quarter to one-half fl. ounce. It contains citric acid.

III. The active substance may be dissolved in a suitable solvent. The solvents used are water, alcohol, ether, acetic ether, acetic acid, and glycerine.

WATER AS SOLVENT.

Aqua Destillata should be neutral, free from acids, alkalies, and salts. It is a solvent for many salts, and especially salts of organic acids. It dissolves salts of the

alkaloids freely, and some of the alkaloids sparingly; also several glucosides and neutral principles; albuminous, saccharine, and starchy bodies; colouring matters and gums; and the volatile oils, though only sparingly. Starch is chiefly dissolved above 160° F., and albumins are coagulated at above 212° F. Resins and fixed oils are not dissolved.

The official solutions in water, the **Liquores**, will be considered with the dispensing of mixtures.

Other preparations obtained by using water as a solvent are **Infusa**, **Decocta**, **Aquæ**, **Syrupi**, **Mucilagines**, and some **Extracta** (see p. 49).

The **Infusion (Infusum)** is a solution of the active constituents of a medicinal substance prepared by the action on it of water at a lower temperature than 212° F.

The **Decoction (Decoctum)** is a similar solution, but the water employed is kept for a definite period at 212° F.

Advantages of these preparations: they are easily and cheaply made, and the solvent is pharmacologically inert.

Disadvantages: they decompose when kept, owing to albuminous and starchy constituents. Infusum Calumbæ is made with cold water in order to dissolve less of the starch which it contains. Boiling water is a more energetic solvent than cold, and coagulates albumins, but decomposes some active principles, and drives off volatile constituents.

Group dose: one-half to one or two fluid ounces. Infusum Digitalis, one-quarter to one-half ounce.

The usual quantity of substance taken to make an infusion or a decoction is one-half or one ounce to the pint.

There are twenty-two official infusions, of which I. Rosæ Acidum and I. Cinchonæ Acidum contain free Sulphuric acid. I. Quassia and I. Calumbæ contain no tannin.

The other infusions are:—Inf. Buchu, Chiratae, Cusparia, Ergota, Gentianæ Compositum, Krameria, Lupuli, Rhei, Scoparii, Senegæ, Sennæ, Serpentaria, and Uvæ Ursi.

In addition to these, Inf. Aurantii, Aurantii Compositum (containing orange peel, lemon peel, and cloves) Caryophylli, and Cascariillæ are used mainly as flavouring vehicles.

There are three decoctions; D. Aloes Compositum, containing, in addition to Barbados aloes, liquorice, potassium carbonate, and various aromatic substances; D. Granati Corticis, and D. Hæmatoxyli.

Practice.

Make ten fluid ounces of *Infusum Digitalis*, five fluid ounces of *Infusum Quassiaë*, and five fluid ounces of *Decoctum Hæmatoxyli*.

It is advisable for two workers to work together for this practice in order to complete the three preparations, and to make the infusion of quassia last.

To make five fluid ounces of ***Infusum Digitalis*** :—

Boil a pint of water and place rather less than half a pint of boiling water (measured in a metal vessel) in the earthenware infusion pot in order to raise its temperature. Weigh thirty grains of powdered *Digitalis* leaves in No. 20 powder (see p. 54 for definition of No. 20 powder). Empty out the water which is in the infusion pot, place the weighed *digitalis* in the bottom of the pot, and pour in ten fluid ounces of boiling distilled water. Cover the pot, and note the time accurately. Let it stand for exactly fifteen minutes. Shake occasionally.

During this period wash a small piece of tow under a stream of water, and pack it into the neck of a funnel just so firmly that when the funnel is filled with cold water, the water comes through in single drops. After testing the filter in this way, and when the fifteen minutes have elapsed, pour the infusion gently into the funnel and collect the filtrate in a wide-mouthed bottle in which the funnel is standing. If the filtrate is not quite clear, pour the first portion that has come through back again on to the filter.

To make five fluid ounces of ***Infusum Quassiaë*** :—

Weigh twenty-two grains of finely rasped *Quassia* wood, and place it in a suitable vessel (a wide-mouthed bottle) and add five ounces of cold distilled water; let it infuse for fifteen minutes, and strain as before.

To make five fluid ounces of ***Decoctum Hæmatoxyli*** :—

Place six fluid ounces of cold distilled water in the metal decoction pot, and place it over a lighted Bunsen burner. Weigh 109 grains of logwood in chips, and put it in the water. Note the time at which it begins

to boil. Weigh seventeen grains of bruised cinnamon bark, and add that to the logwood in the decoction pot when it has boiled for eight and a half minutes. Prepare a strainer of tow in the same manner as for the infusion, but pack it rather more tightly as the liquid will be at a higher temperature. Measure five fluid ounces of cold water into a wide-mouthed bottle, and mark the level by means of a strip of gummed paper. Pour away the water, and when the decoction has boiled for exactly ten minutes, *i.e.*, for one and a half minutes after adding the cinnamon, pour it very cautiously on the strainer. When it has all strained through (returning the first portion if it does not come through clear), pour enough cold distilled water over the strainer until the fluid reaches the level of the measured five ounces previously marked.

Observe the colour, odour, and taste of each of these preparations, and place a few drops of each into a test-tube separately, and add to each a drop or two of a solution of perchloride of iron. The black tannate of iron will be formed where tannic acid is present.

For *Liquores Concentrati* see p. 45.

The **Water (Aqua)** is either water itself or the solution of a volatile oil or volatile substance in water. All are prepared by distillation except *Aqua Camphoræ* and *Aqua Chloroformi*, which are made by simple solution. To prepare *Aqua Carui*: take half an ounce of caraway fruit and ten fluid ounces of water, and distil one-half.

Group dose: one-half to two ounces. Exception, **Aqua Laurocerasi** one-half to two drachms, and containing one-tenth per cent. of Hydrocyanic acid.

There are fifteen official *Aquæ*, including Distilled Water itself.

A. *Anethi*, *Anisi*, *Aurantii Floris*, *Carui*, *Cinnamomi*, *Fœniculi*, *Menthæ Piperitæ*, *Menthæ Viridis*, *Pimentæ*, *Rosæ*, and *Sambuci* are used mainly as flavouring agents, as are also *Aqua Camphoræ* and *Aqua Chloroformi*.

Practice.

Prepare **Aqua Chloroformi**; take three minims of Chloroform and two and a half fluid ounces of water, and shake till dissolved. (Nine drops of Chloroform are equivalent to three minims.)

WATER AND SUGAR.

The **Syrup (Syrupus)**.—The syrups are fluid preparations intended for internal administration, and prepared by using as the chief solvent of the active substances **water** with **sugar** dissolved in it. There are twenty-two official syrups, and there is no uniformity in the mode of their manufacture. The greater number are made by dissolving the active constituents in a suitable solvent, and then either dissolving sugar in the resulting solution, or adding syrup. Some are made up to a definite volume, some to a definite weight; *Syrupus* itself and *Syrupus Ferri Iodidi* must be of a definite specific gravity.

Advantages.—A pleasant flavour; the solutions are less liable to decomposition than are watery solutions; and chemical change in the ingredients is lessened. Sugar dissolved in water is a more powerful solvent for some substances (lime, for example) than is water alone, and thus *Liquor Calcis Saccharatus* may be considered as a weak syrup.

Disadvantages.—If there is too little sugar the solution is apt to ferment, and if there is too much sugar, some of it will crystallise out. Also sugar is not an inert pharmacological substance, and in some circumstances is inadmissible. The doses are usually from one-half to one fluid drachm.

The following are used as flavouring agents: *Syrupus, S. Aromaticus, S. Aurantii, S. Aurantii Floris, S. Limonis, S. Rhoeados, S. Rosae, S. Tolutanus*, and *S. Zingiberis*. Observe that *S. Limonis* contains **Citric Acid**.

Syrupus Glucosi is used as a pill excipient.

Those containing active ingredients are the following:—

The more active Official Syrups.

	AMOUNT OF ACTIVE SUBSTANCE IN ONE FLUID DRACHM.	OTHER INGREDIENTS.
<i>S. Chloral,</i>	10 grs. Chloral hydrate.	
<i>S. Codeinæ,</i>	$\frac{1}{2}$ gr. Codeine phosphate.	
<i>S. Ferri Phosphatis,</i>	1 ,, Anhydrous ferrous phosphate.	} Free phosphoric acid.
<i>S. Ferri Phosphatis cum Quininā et Strychninā,</i>	$\frac{1}{2}$,, " " Quinine sulphate. $\frac{1}{32}$,, Strychnine.		} Represents Easton's Syrup.
<i>S. Ferri Iodidi,</i>	$5\frac{1}{2}$,, Ferrous iodide.	
<i>S. Cascaræ Aromaticus,</i>	24 minims of the liquid extract.	
<i>S. Pruni Virginianæ,</i>		} Some hydrocyanic acid.
<i>S. Scillæ,</i>			} Acetic acid.
<i>S. Calcii Lactophosphatis,</i>		} Free acid.
<i>S. Rhei,</i>			} Coriander.
<i>S. Sennæ,</i>		} Coriander.
<i>S. Hemidesmi.</i>		

The **Honey (Mel)** is a thick syrupy preparation, of which honey forms one of the ingredients.

There is **Mel Depuratum**, *i.e.*, honey melted and strained through warm wet flannel. **Mel Boracis** is a mixture of borax, glycerine, and honey; and **Oxymel** is a mixture of honey, acetic acid, and water. **Oxymel Scillæ** is an acetic acid preparation of **Squill** (made by maceration) mixed with honey. Its dose is from one-half to one fluid drachm; and that of Oxymel is one-half to two fluid drachms.

WATER AND GUM.

The **Mucilage (Mucilago)** is a solution or mixture of a gum and water.

There are two official: **Mucilago Acaciæ**, which is a solution of one part of washed gum acacia in one and a half parts of distilled water; and **Mucilago Tragacanthæ**, which is a gelatinous mixture of gum tragacanth with alcohol and water. A strong solution of starch and water is sometimes called Mucilage of starch.

ALCOHOL AS SOLVENT.

Forms of Alcohol itself:—

Alcohol Absolutum is Ethyl Hydroxide, C_2H_5OH , with not more than one per cent. by weight of water; obtained by the removal of water from less strong ethylic alcohol, and by subsequent distillation.

Colourless, transparent, very mobile, volatile, inflammable liquid; hygroscopic at ordinary temperatures, with a characteristic odour, and burning taste; S.G. from 0.794 to 0.796; ninety-nine per cent. by weight. Shaken with from one to two per cent. of anhydrous copper sulphate for two or three hours, the salt does not become blue, showing absence of excess of water. It burns with a blue smokeless flame, leaves no residue when evaporated, nor any disagreeable odour (fusel oil, fixed matter, etc.). Should be free from aldehyde and organic matter, and therefore should not darken on addition of ammonia or caustic potash.

Spiritus Rectificatus contains ninety parts by volume of C_2H_5OH , and ten of water. Obtained by the distillation of fermented saccharine liquids. S.G. 0.834, and contains 86.35 per cent. by weight of ethyl hydroxide. On adding it, or

absolute alcohol, to water, rise of temperature and contraction of volume occur.

Diluted Alcohol :—

Alcohol 70 per cent. by volume, S.G. 0·890.					
„ 60	„	„	„	„	0·913.
„ 45	„	„	„	„	0·943.
„ 20	„	„	„	„	0·976.

Rectified methylated spirit should be Spiritus Rectificatus with some methylic alcohol added. What is sometimes called *methylated spirit* is rectified spirit rendered impure with mineral naphtha, and cannot be diluted with water to any extent without causing a precipitation of the naphtha.

Advantages of alcohol as a solvent: it dissolves alkaloids, glucosides, neutral principles, fixed oils, fats, volatile oils, resins, organic acids, and some salts. It preserves solutions from decomposition; and its preparations being more concentrated than are the corresponding watery preparations, they can be given in smaller doses.

Disadvantages.—It is a reducing agent, is not pharmacologically inert, and is more expensive than water.

The Fluid Preparations made with **Alcohol** as the solvent are **Spiritus**, **Tincturæ**, **Vina**, some **Linimenta**, and some **Liquores Concentrati**.

The **Spirit** (**Spiritus**) is a solution of **ether**, **chloroform**, or a **volatile oil** in rectified spirit. Eleven are prepared by simple solution, and there are five compound spirits prepared by distillation. *Spiritus Vini Gallici* (brandy) is also official.

The spirits are recognised by possessing the physical characters of alcoholic solutions, and the distinctive odour of the dissolved ingredient. The group dose of the simple spirits is five to twenty minims; but the compound or distilled spirits are given in doses of from twenty to forty minims if repeated, or from sixty to ninety minims for one administration.

The eleven spirits prepared by solution are the following :—*Sp. Anisi*, *Cajuputi*, *Cinnamomi*, *Lavandulae*, *Menthae Piperitae*, *Myristicae*, and *Rosmarini*, each containing the volatile oil of the same name, of the strength of one in ten, and given in doses of from five to twenty minims.

Sp. Camphoræ contains camphor of the same strength, and given in the same doses.

Sp. Ætheris contains ether (one in three), dose twenty to forty minims if repeated, sixty to ninety minims for one administration.

Sp. Chloroformi has the strength of one in twenty, and is given in doses of five to twenty minims (thirty to forty for one administration); and *Sp. Juniperi* has a similar strength, but is given in doses of twenty to sixty minims.

The Compound Spirits prepared by distillation are as follows :—

	INGREDIENTS.	STRENGTH.	DOSE.
Sp. Ætheris Compositus.	{ Ether	1 in 3.	20-40 minims repeated; 60-90 minims if only once.
Sp. Ætheris Nitrosi.	{ Ethyl { Sulphate. Sulphite.		
Sp. Ammoniaë Aromaticus.	{ Ethyl nitrite Ammonium carbonate Ammonia. oil of nutmeg. oil of lemon.	About 2½%.	
Sp. Ammoniaë Fetidus.	{ Ammonia asafetida.	About 2½%.	
Sp. Armoraciaë Compositus.	{ Horse-radish root nutmeg. orange peel.		
			60-120 minims.

Practice.

Prepare Spiritus Chloroformi. Measure four minims (twelve drops) of Chloroform, and enough of Spiritus Rectificatus, to make eighty minims of the spirit.

Prepare Spiritus Anisi. Measure four minims (eight drops) of Oleum Anisi, and add sufficient Spiritus Rectificatus to make forty minims.

Test these by adding water to each preparation till precipitation occurs, observing the amount of water which it is necessary to add in each case.

The **Tincture (Tinctura)** is a solution of the active principles of a plant or of the active substance itself in alcohol.

There are five ammoniated tinctures—those of Ergot, Guaiac, Opium, Quinine, and Valerian. There are nine compound tinctures so called—those of Benzoin, Cardamoms, Cinchona, Gentian, Lavander, Rhubarb, Senna, Compound tincture of Camphor (an opium preparation), and Compound tincture of Chloroform and Morphine. The following tinctures, though not called compound, have more than one ingredient: T. of Aloes (*Liquorice*); Catechu (*Cinnamon*); Iodine (*Iodide of Potassium*); Kino (*Glycerine*); Æthereal tincture of Lobelia (*Æther*); and of Quinine (*Orange-peel*).

Doses of tinctures :—

T. Aconiti, Cantharidis, and Iodi, two to five minims. *and strophanthus*

T. Belladonnæ, Cannabis Indicæ, Capsici, Chloroformi et Morphinæ Composita, Cocci, Colchici, Croci, Digitalis, Ferri Perchloridi, Lobeliæ Ætherea, Nucis Vomicae, Opii, Podophylli, Scillæ, Stramonii, ~~Strophanthi~~, in doses of five to fifteen minims.

The others given in doses of from one-half to one fluid drachm are T. Aloes, Asafetidæ, T. Aurantii, Buchu, Calumbæ, Camphoræ Composita, Cardamomi Composita, Cascarillæ, Catechu, Chiratae, Cimicifugæ, Cinchonæ, Cinchonæ Composita, Cinnamomi, Conii, Cubebæ, Ergotæ Ammoniata, Gentianæ Composita, Guaiaci Ammoniata, Hamamelidis, Hydrastis, Hyoseyami, Jaborandi, Jalapæ, Kino, Krameriæ, Lavandulæ Composita, Limonis, Lupuli, Myrrhæ, Opii Ammoniata, Pruni Virginianæ, Quassiæ, Quillaiæ, Quininæ, Quininæ Ammoniata, Rhei Composita, Senegæ, Sennæ Composita, Serpentariæ, Sumbul, Tolutani, Valerianæ Ammoniata, and Zingiberis.

T. Arnicæ and Pyrethri are not given internally.

Tincture Iodi contains $2\frac{1}{2}$ per cent. of iodine, and Tinctura Opii contains about one grain of opium in fifteen minims of the tincture.

OFFICIAL COMPOUND TINCTURES.

	INGREDIENTS.	STRENGTH.	DOSE.
Tinctura Chloroformi et Morphinæ Composita.	Morphinæ hydrochloridum. Acidum hydrocyanicum dilutum. Chloroformum. Oleum menthæ piperitæ. Cannabis indica. Capsicum. Glycerinum.	$\frac{1}{11}$ grain in 10 m. $\frac{1}{2}$ minim .. $\frac{1}{4}$	5 to 15 minims.
Tinctura Camphoræ Composita.	Tinctura opii. Oleum anisi. Acidum benzoicum. Camphora.	Each fl.ʒ contains $\frac{1}{4}$ grain opium = $\frac{1}{30}$ grain Morphine Hydrochloride.	$\frac{1}{2}$ to 1 fl. drachm.
Tinctura Opii Ammoniata.	Tinctura opii. Oleum anisi. Acidum benzoicum. Ammonia.	$\frac{1}{10}$ grain opium in 10 m.	$\frac{1}{2}$ to 1 fl. drachm.
Tinctura Cinchonæ Composita.	Cinchona alkaloids. Orange peel. Saffron. Cochineal. Serpentary.	$\frac{1}{2}$ grain in 110 minims = 0.5%.	$\frac{1}{2}$ to 1 fl. drachm.
Tinctura Gentianæ Composita.	Gentian root. Orange peel. Cardamoms.		
Tinctura Benzoini Composita.	Benzoin. Socotrine aloes. Storax. Balsam of tolu.		

Official Compound Tinctures—*continued.*

	INGREDIENTS.	STRENGTH.	DOSE.
Tinctura Rhei Composita.	Rhubarb. Coriander. Cardamoms. Glycerine.		} $\frac{1}{2}$ to 1 fl. drachm for repeated ad- ministration. 2 to 4 fl. drachms for a single admini- stration.
Tinctura Sennæ Composita.	Senna. Coriander. Caraway. Raisins.		
Tinctura Carda- momi Composita.	Cardamoms. Caraway. Cinnamon. Cochineal. Raisins.		} $\frac{1}{2}$ to 1 fl. drachm.
Tinctura Lavandula Composita.	Lavender. Red sanders wood. Rosemary. Cinnamon. Nutmeg.		

Preparation of Tinctures.—*Tinctura Iodi* and *Tinctura Ferri Perchloridi* are prepared by **simple solution**. Thirty-one tinctures are prepared by the process of maceration, and thirty-three by that of maceration and percolation.

Method of Maceration.—Place the solid materials in the whole of the menstruum in a closed vessel for seven days, frequently shaking. Strain; press out the fluid from the “marc” (the exhausted substance); mix these two liquids, and filter the whole if necessary.

The method of **Maceration and Percolation** may be studied practically.

Practice.

Prepare six fluid ounces of *Tinctura Digitalis*. Weigh three-quarters of an ounce of *Digitalis* leaves in No. 20 powder, and place it in a wide-mouthed stoppered bottle; carefully add enough sixty per cent. alcohol to completely moisten the powder, and let it stand for twenty-four hours.

Graduate the receiving bottle into which the tincture is to percolate, marking the levels of three-quarters of the total bulk and the total bulk; *i.e.*, four and half ounces and six ounces. This may be done by measur-

ing these amounts of water into the receiving bottle, and marking the levels with strips of gummed paper. After this place some of the marc in the percolator, taking it from the bottle on the blade of a spatula. Pack gently but firmly the first portion transferred so as to form a layer half an inch in depth. This is best done with the handle of the spatula. Transfer all the remainder of the marc to the percolator, not packing so firmly, but not leaving any air-spaces, and see that the upper surface is level. Rinse every trace of the marc out of the macerating bottle with sixty per cent. alcohol in small quantities at a time, and pour them gently on to the marc in the percolator. Keep a layer of the alcohol on the surface till four and a half ounces have been collected.

Prepare a filter paper in a funnel, and when the liquid has ceased to percolate, transfer the marc to a straining-cloth by holding this in the palm of the hand, inverting the percolator over it, and dislodging the marc with a gentle tap. Express all the fluid from the marc by as firm pressure as possible, collecting the fluid on the filter which is standing in the receiving bottle; and when the fluid has all filtered through, add more sixty per cent. alcohol till the tincture measures exactly six fluid ounces.

Liquores Concentrati or **Concentrated Solutions** are preparations intermediate in character between infusions and tinctures. They are intended to obviate the necessity of the dispenser making infusions freshly when it is not desired by the prescriber. They are prepared by prolonged maceration, or by maceration and percolation, of vegetable substances in water or dilute alcohol (twenty per cent.).

Example.—To prepare one pint of *Liquor Chiratae Concentratus*, take ten ounces of Chiretta (No. 40 powder) and macerate it for three days in five fluid ounces of twenty per cent. alcohol; percolate it with the same strength of alcohol in ten portions of two ounces each at intervals of twelve hours; and percolate with more of the alcohol until one pint of the concentrated solution is obtained.

Concentrated solutions of the following substances are official:—*Calumba, Chiretta, Cusparia, Krameria, Quassia, Rhubarb, Senna*, and

Senega, which are given in doses of from one-half to one fluid drachm; that of *Serpentary* from one-half to two fluid drachms, and that of *Sarsaparilla* (which is compound, and contains in addition *Sassafras* root, *Guaiac* wood, *Liquorice* root, and *Mezereon* bark) from two to eight fluid drachms.

The **Wine (Vinum)**.—Either sherry or orange wine, or some active substance dissolved in one of these.

Vinum Aurantii is a golden yellow wine, with odour and taste of bitter orange-peel. It should contain ten to twelve per cent. of C_2H_5OH .

From it *V. Ferri Citratis* (dose, one to four drachms) and *V. Quininae* (dose, one-half to one ounce) are prepared.

Vinum Xericum.—Pale yellowish-brown wine, characteristic odour. It should contain at least sixteen per cent. of C_2H_5OH .

From it are prepared *V. Antimoniale* and *V. Ipecacuanhae* (dose, ten to thirty minims as expectorant; the former two to four drachms, the latter four to six drachms as emetic), *V. Colchici* (ten to thirty minims), and *V. Ferri* (dose, one to four drachms), all prepared by maceration for various periods.

Advantages.—The presence of organic acids makes, perhaps, some difference in the solvent action, and the flavour is more agreeable than that of a tincture.

The **Liniment (Linimentum)**.—Liniments are fluid preparations of substances for external application. Some contain oil or soap, and not necessarily alcohol, and are intended to be applied with friction. For these, see p. 86. The others are alcoholic solutions, intended for application without friction.

Of the five liniments in this group, *L. Aconiti*, *Belladonnae*, *Camphorae Ammoniatum*, and *Sinapis* all contain Camphor; *L. Crotonis* contains the volatile oil of Cajuput. Observe that *Linimentum Aconiti* is about thirteen times as strong as *Tinctura Aconiti*, and that *Linimentum Belladonnae* is about seven and a half times as strong as *Tinctura Belladonnae*. The presence of the camphor serves to distinguish the liniment from the tincture.

L. Aconiti is prepared by maceration and percolation; the others by simple solution.

Practice.

Make **Linimentum Sinapis**. Dissolve in a test-tube seven and a half grains of Camphor in two fluid drachms of ninety per cent. alcohol; add five minims of Volatile oil of Mustard, and twenty minims of Castor Oil, and mix.

ALCOHOL AND ETHER AS SOLVENT.

The **Collodion (Collodium)**.—There are three of these preparations, official, including Collodium itself. They are fluids for external application, in which the solvent is a mixture of ether and ninety per cent. alcohol in the proportions of three of the former to one of the latter.

Collodium itself is a solution of **Pyroxylinum** in this solvent.

Pyroxylin is probably a mixture of dinitrate and trinitrate of cellulose, and is prepared by immersing cotton-wool (the hairs of the seeds of *Gossypium Barbadense*, and of other species of *Gossypium*, freed from fatty matter) in a mixture of nitric and sulphuric acids, and soaking it, after it is thoroughly moistened, for three minutes; it is then well washed with water, drained and dried.

Collodion is a colourless, syrupy liquid with an ethereal odour, partly volatile, but leaving a thin, transparent film which contracts rapidly on drying, and which is insoluble in water or in ninety per cent. alcohol. Collodion is very inflammable.

Collodium Flexile consists of Collodion with one-twenty-fourth of its weight of Canada Turpentine, and half that quantity of Castor Oil both dissolved in it. The film left on drying does not contract to the same extent, and therefore does not tend to crack.

ACETIC ETHER AS SOLVENT.

Collodium Vesicans consists of Pyroxylin dissolved in **Blistering Liquid (Liquor Epispasticus)**. This liquor is prepared by macerating and percolating **Cantharides** (a dried beetle—*Cantharis Vesicatoria*) with **Acetic Ether**.

GLYCERINE AS SOLVENT.

The Solvent **Glycerinum** (or glycerol) is a trihydric alcohol $C_3H_5(OH)_3$ with a little water; it is prepared by decomposing fats or fixed oils with alkalies, or with superheated steam. It

is a clear, colourless viscid liquid, hygroscopic, heavier than water (S.G. 1.26); and, when it is decomposed by heat, it emits intensely irritating vapours (acrolein). It is odourless, with a sweet taste, and mixes with water or ninety per cent. alcohol to any extent, but is insoluble in chloroform, ether, and fixed oils. It dissolves many substances, its solvent power being usually between that of alcohol and water. Like other alcohols it can be oxidised, and takes oxygen readily from highly oxidised substances. Its dose is from one to two fluid drachms.

The **Glycerine (Glycerinum)**.—There are ten official glycerines, which consist of various substances dissolved in glycerine.

G. Amyli (starch) is a translucent jelly for external application; and G. Tragacanthæ is a gelatinous paste used as a pill excipient. There are three astringent glycerines, those of *Alum*, *Tannic Acid*, and *Subacetate of Lead*; and there are three more or less antiseptic, those of *Carbolic Acid*, *Boracic Acid*, and *Borax*. These eight are usually applied locally. Glycerinum Pepsini is an acid (hydrochloric) solution of pepsin in glycerine and water (given in one to two drachm doses).

Advantages of Glycerina.—Their sweet taste, viscosity, and stability. The solutions do not decompose. Solid preparations in which it is an ingredient do not become hard owing to its hygroscopic character.

Disadvantages.—It is an irritating substance, and may be oxidised under certain conditions.

The strengths of the glycerina vary from one in three (G. Acidi Borici), one in four (G. Plumbi Subacetatis), one in five (G. Acidi Carbolici, G. Acidi Tannici), to one in six (G. Aluminis, G. Boracis).

ACETIC ACID AS SOLVENT.

The **Vinegar (Acetum)**.—In this preparation the solvent is **Acetic Acid**.

The solvent *Acidum Aceticum* is a product of the destructive distillation of wood, and of the oxidation of ethylic alcohol. It should contain thirty-three per cent. by weight of hydrogen acetate $\text{CH}_3 \cdot \text{COOH}$. It is a clear, colourless liquid, with a pungent characteristic odour and acid taste. *Acidum Aceticum Glaciale* contains ninety-nine per cent. by weight of $\text{CH}_3 \cdot \text{COOH}$, is a liquid at summer temperatures, but crystallises in the cold, and remains crystalline till 60°F . The specific gravity is increased by adding ten per cent. of water. *Acidum Aceticum Dilutum* contains 4.27 per cent. $\text{CH}_3 \cdot \text{COOH}$.

Of the three official Aceta or Vinegars, two are for internal, one for external, administration.

Acetum Ipecacuanhæ is prepared by adding rectified spirit and dilute acetic acid to the liquid extract of *Ipecacuanhæ*. *Acetum Scillæ* is prepared by macerating squill with the dilute acid. The doses of these two last are from ten to twenty minims; and it should be noted that they contain free acid. *Acetum Cantharidis* consists of *Cantharidis* percolated with equal parts of the glacial acid and water, and is used externally.

IV. The active substances may be dissolved by means of solvents, and the solution concentrated by evaporation.

The **Extract** (**Extractum**) is a preparation for internal administration, and prepared by the processes of dissolving out the active constituents of substances by some of the foregoing solvents (or by expressing the juices), and concentrating the resulting products by evaporation. If the evaporation is carried to complete dryness or to a semi-solid consistency, the resulting preparation is called an extract (**Extractum**); but if the evaporation is arrested while the product is still fluid, the name given is that of Liquid Extract (**Extractum Liquidum**). The descriptive names given to the Extracts depend on the solvents originally employed in the preparation: thus, *E. Belladonnae Alcoholicum* is a semi-solid extract standardised to contain one per cent. of alkaloids of the belladonna root, and prepared by evaporating the *E. Belladonnae Liquidum*, which is essentially a strong tincture. *E. Cannabis Indicae* is an alcoholic extract made by percolating powdered Indian Hemp with ninety per cent. alcohol, and evaporating the product to soft consistency. *E. Cascarae Sagradae* is called a watery or aqueous extract because the powdered bark is exhausted with distilled water (by maceration and percolation), even although the extract itself is absolutely dry. *E. Colocynthis Compositum* contains aloes, scammony, soap, and cardamoms in addition to colocynth. Two extracts are called green—*E. Belladonnae Viride* and *E. Hyoscyami Viride*, in which the green colouring-matter of the expressed juice is coagulated by heat, filtered and preserved, and added to the extract when the extract is being finally evaporated, after the albumen has been coagulated by a higher temperature, and removed.

Of the twenty-two official Extracta, it should be observed that the following are **dry**: *E. Aloes Barbadosis*, *E. Cascarae Sagradae*, *E. Euonymi Siccum*, *E. Krameriae*, *E. Rhei*, and *E. Strophanthi*.

Advantages.—A concentrated form of the active substances given in small doses, and of a consistency suitable for the pill form.

Doses.—The most active extracts are given in doses of from one-quarter to one grain, viz., those of Belladonna (both), Cannabis Indica, Colchicum, Nux Vomica, Opium, Physostigma, Stramonium, and Strophanthus. The dry extract of Euonymus may be given in from one to two grain doses, and that of Barbados Aloes (also dry) from one to four grains. Four substances used chiefly for their action on the intestines are given in doses of from two to eight grains, viz., Extracts of Cascara, Colocynth, Jalap, and Rhubarb. Extracts of Chamomile, Ergot, and Hyoscyamus are also given in doses of two to eight grains; and Extracts of Gentian, of Liquorice (Glycyrrhiza), and of Dandelion (Taraxacum) used as pill excipients, may be given in any quantity up to fifteen grains. The dry extract of Krameria may also be given in doses of from five to fifteen grains.

The seventeen official **Extracta Liquida** differ from each other considerably, both in strength and in dosage; they may, however, be arranged conveniently as follows:—

I.

NAME.	STRENGTH—STANDARDISED.		DOSE.
E. Belladonnæ Liquidum	0·75 per cent. of Alkaloids.		
E. Nucis Vomicæ „	1·5	„ Strychnine	1 to 3 m.
E. Opii „	0·75	„ Morphine	5 to 30 m.
E. Ipecacuanhæ „	2 to 2·25	„ Alkaloid	{ ½ to 2 m. Expectorant. 15 to 20 m. Emetic.
E. Cinchonæ „	5·0	„ „	5 to 15 m.

II.

E. Hamamelidis Liquidum	Concentrated and then diluted } till of a strength such that } one fluid ounce contains } the soluble constituents of } one ounce by weight of the } original substance taken. }	5 to 15 m.	
F. Hydrastis „			
E. Jaborandi „			
E. Ergotæ „			10 to 30 m.
E. Cascaræ Sagradæ „			30 to 60 m.
E. Cocæ „			

III.

E. Glycyrrhizæ Liquidum	{ Evaporated till of a definite } specific gravity. }	30 to 60 m.
E. Filicis „	{ An ethereal solution, evapor- } ated till of an oily consistency. }	45 to 90 m.

IV.

E. Cimicifugæ Liquidum	Similar to Group II., with } the exception of Pareira, } in which the solid extract } is estimated. }	5 to 30 m.
E. Taraxaci „		½ to 2 ½.
E. Pareiræ „		
E. Sarsæ „			2 to 4 ½.

Practice.

Make **Extractum Gentianæ**. Infuse Gentian root (one-half ounce) in ten times its weight of distilled water for two hours ; boil it in a decoction pot for fifteen minutes ; pour off the fluid into a capsule ; express the fluid from the marc by means of a straining cloth, collecting it on a filter funnel packed with washed tow ; mix these liquids, and evaporate them on a water-bath (the decoction pot half-filled with water will serve this purpose) to the consistence of a soft extract.

SECTION V.

DISPENSING.

THE remaining official preparations, both solid and fluid, which have many features in common with the products which are dispensed by the pharmacist according to the prescription of the physician, will be considered along with the subject of dispensing such prescriptions.

Such are the powders, pills, lozenges, solutions, mixtures, lotions, injections, suppositories, plasters, etc.

I. (see p. 35).

The **Powder** (**Pulvis**).—One of the simplest forms in which substances may be dispensed so that they may be administered to the patient, is that of the powder. The advantages of this form as compared with the crude substances are that the powdered substances are more rapidly acted upon by solvents either within or outside the body; that they are more readily brought into a condition of intimate admixture with each other, and that they are less liable to produce irritation. When crude vegetable substances are powdered, there is loss not only of water by evaporation, but also of fibrous inert substance, which is rejected when the powder is passed through a sieve. The powder is therefore a rather more active form than the crude substance.

The weight of a powder should not be less than three grains nor more than sixty grains; but if a substance is prescribed in smaller quantities than three grains it should be diluted with sugar of milk, or some flavouring powder, *e.g.*, compound cinnamon powder, or chocolate.

Directions may be given for powders to be taken in solution, suspension, or mixed with some confection or jam. In this last case it should be observed that jam is usually acid in reaction, and will cause effervescence with alkaline carbonates and bicarbonates.

If the ingredients have very disagreeable tastes or odours,

directions should be given that they be taken in gelatin capsules, cachets, or wafer-papers.

Powders may be administered externally and also by "insufflation," *i.e.*, blown on to a surface such as that of the nostrils or of the tonsils.

Some substances should not be prescribed as powders, *viz.*, those which are very volatile, moist, or deliquescent.

Of the sixteen official compound powders—four contain opium, six a purgative, two an astringent, and one contains oxide of antimony; and the last three contain flavouring or suspending substances.

They are as follows:—

OFFICIAL COMPOUND POWDERS.

NAME.	INGREDIENTS.	STRENGTH.	DOSE.	
Pulvis Opii Compositus.	{ Opium . . . pepper, ginger, caraway, tragacanth	1 in 10	2-10 grains.	
Pulvis Ipecacuanhæ Compositus.	{ Opium . . . Ipecacuanha . . . potassium sulphate.	1 in 10 1 in 10		
Pulvis Kino Compositus.	{ Opium . . . Kino . . . cinnamon . . .	1 15 4		1 in 20
P. Cretæ Aromaticus cum Opi.	{ Opium . . . pulvis cretæ aromaticus.	1 in 40		5-20 ..
P. Elaterini Compositus.	{ Elaterin . . . sugar of milk.	1 in 40	10-40 ..	
P. Scammonii Compositus.	{ Scammony Resin Jalap . . . ginger . . .	4 3 1	1 in 2 3 in 8	
P. Jalapæ Compositus.	{ Jalap . . . acid tartrate of potassium ginger . . .	5 9 1	1 in 3 20-60 ..	
P. Rhei Compositus.	{ Rhubarb . . . magnesia . . . ginger . . .	2 6 1	1 in 4½ 20-60 ..	
P. Glycyrrhizæ Compositus.	{ Senna . . . sulphur . . . liquorice . . . fennel, sugar . . .	2 1 2 1, 6	1 in 6 60-120 ..	
P. Sodæ Tartarata Effervescens.	{ Sodium - potassium-tartrate . Sodium bicarbonate . tartaric acid .	120 grs. 40 .. 38 ..	Dissolve the alkaline powder in half a pint of water, and add the acid powder.	
		} alkaline. acid.		

Official Compound Powders—*continued.*

NAME.	INGREDIENTS.	STRENGTH.	DOSE.
P. Catechu Compositus.	{ Catechu 4 Kino, Krameria 2, 2 cinnamon 1 nutmeg 1	{ 4 in 10 2 in 10	10-40 grains.
P. Cretæ Aromaticus	{ Chalk 1 cinnamon, cloves, nutmeg, cardamoms, sugar.	{ 1 in 4		10-60 ..
P. Antimonialis.	{ Antimony oxide calcium phos- phate.	1 in 3	3-6 ..
P. Amygdalæ Compositus.	{ Sweet almonds 8 gum acacia 4 sugar 1	1 in 3	20-60 ..
P. Cinnamomi Compositus.	{ Cinnamon cardamoms 1 ginger 1		
P. Tragacanthæ Compositus.	{ Tragacanth, acacia, starch, sugar 3			Of each, 1 in 6

Size of Powdered Matter.—A sieve with twenty meshes in a linear inch is called a No. 20 sieve, and a powder which will pass through such a sieve but not through a sieve of smaller mesh, is called a No. 20 powder. Substances in large bulk, or tough vegetable matters, are usually powdered in specially constructed apparatus, and afterwards passed through a sieve of the required fineness.

To reduce easily broken or brittle substances to powder in small quantities, a pestle and mortar are required. After breaking the larger particles with direct gentle blows (care being taken not to expel them from the mortar), the stem of the pestle should be grasped firmly by the hand, and rotatory movements from the shoulder carried out, accompanied at the same time by firm pressure; the wrist and elbow, however, being held rigid or nearly so. If the substance adheres to the mortar, it should be detached by means of a spatula, and again ground until quite uniform. Separate particles should be no longer distinguishable.

Where two or more substances are to be powdered, each should be powdered separately and mixed afterwards. Some

substances are more easily powdered if thoroughly dried and warmed, *e.g.*, squill or tragacanth. Some require special treatment, *e.g.*, camphor may be easily powdered when one or two drops of rectified spirit are added—the spirit evaporating during the process.

Mixing two or more Substances.—This may be done on paper by means of a spatula; usually it can be done more rapidly in a mortar by a pestle. The pestle should be held like a pen between the fingers, and the powders mixed with a rapid, light, stirring action, rotating the hand from the wrist, but without the use of force. If the powder adheres to the side of the mortar, it should be detached by the spatula, and the mixing repeated until the product is uniform and the separate ingredients are no longer to be distinguished.

Powders containing volatile oils (*e.g.*, cinnamon bark), when mixed in a mortar with other powders, will not mix afterwards with water so readily as if the mixture had been made on paper.

Dividing.—If the mixed powder is to be divided into separate powders, each of these should be weighed individually and placed each on a piece of paper of suitable size (five inches by four is a convenient size for powders of from five to sixty grains).

Folding.—Lay the paper on the table, with the longer axis parallel with the edge of the table. Place the powder rather nearer to the opposite side than exactly in the centre. With the thumbs, lift the nearer edge of the paper, take it over the powder, and lay it about half an inch on the near side of the further edge. Hold it in its position there with the thumbs, lift the further edge with the two forefingers, and fold it towards you. Let the forefingers meet at the centre, and draw them with pressure to the ends of the paper. Turn this fold again towards you, and press it as before with the forefingers, the edge of this fold now lying along the centre of the packet. The margin of the packet next you should not have been flattened. Shake the powder to the centre of the packet by laying the finger or spatula across the packet half-way between its centre and its end; lift the longer end and dislodge the powder by tapping, and repeat this process at the other end of the packet. Lay the packet with the fold uppermost on the powder-folder, and fold the ends downwards.

The powder-folder is opened to an extent such that the ends of the paper when folded shall meet in the centre. This

extent, ascertained by experiment, is equal to half the length of the powder-paper. Distribute the powder evenly in the packet by smoothing it from the middle to the ends with the flat blade of the spatula. The final packet should measure two and a half inches long and one inch in breadth, and if several are made they should all be uniform in size. They may be dispensed in a box or envelope of suitable size, or wrapped in a paper packet.

To fold such a Packet.—Lay a paper (five by four inches) on the table with the shorter edge parallel with the edge of the table, and place the powder packets on it and fold the first two folds in the same manner as has been described above. When making the second fold, gather the paper tightly round the packet; fold in the ends in the manner in which a book packet is folded, and secure the V-shaped ends by sealing with a little sealing-wax. The label, with the directions to the patient, should be placed on this outer covering. If it be necessary to preserve the powders from the effects of moisture, waxed paper, parchment paper, or tinfoil may be used; or the powders may be dispensed in a stoppered bottle.

To Label.—Write the label, giving its description (mixture, powders, draught, etc.), the directions to the patient (in English), and the patient's name, as in the following example:—

THE POWDERS.
One to be taken thrice daily,
half an hour before meals.
Mr A. B.

Practice.

- (1) Fold an empty paper.
- (2) Dispense the following prescription completely:—

13th May 1903.
Edinburgh University.

Mr A. B.

Recipe,
Calaminæ Præparatæ.
Zinci Oxidi ana semidrachmam.
Miscæ ut fiat pulvis.

Signetur.
Asperge pugillum in partes excoriatas, pro re nata.

Cut paper for scales, weigh each substance, mix them in the

mortar, transfer to powder paper, and fold. Fold in packet and label.

(3) Dispense the following prescription completely :—

Mr C. D.

Recipe,

Cupri Sulphatis grana quatuor
Zinci Sulphatis grana decem
Misce ut fiat pulvis ; mitte tales sex.

Signetur.

Unus statim sumendus ex aquæ calidæ cyatho ; repetendusque omni horæ sextâ ad affectum.

Such a prescription may be written in the following manner :—

Recipe,

Cupri sulphatis grana quatuor et viginti
Zinci sulphatis drachmam
Misce ut fiat pulvis quem divide in partes æquales sex.

Signetur.

Ut supra.

In whichever manner the prescription is written, it must be dispensed as follows :—

Read the prescription carefully, and calculate the dose of each substance. Cut paper for scales, weigh twenty-four grains of copper sulphate, and powder it in the mortar. Transfer it to a paper. Weigh sixty grains of zinc sulphate, and powder it. Add the powdered copper sulphate to the powder in the mortar, and mix the two. Weigh out six fourteen-grain powders from the mass, and place each on a paper. Fold these powders uniformly, wrap them in a packet and label it.

V. There are several preparations for **internal administration**, the ingredients of which are combined with some **adhesive basis**. Such are pills, confections, lozenges, and tablets. The discs (*lamellæ*), though not for internal administration, may be included in this group.

The **Pill (Pilula)**.—A pill is a solid pharmaceutical preparation for internal administration by the mouth, spherical in form, and of from one to five grains in weight. The ingredients must be either themselves adhesive or held together by an adhesive basis or **Excipient**. A well-prepared set of pills

should be uniform in size and shape, and well rounded; each pill must have the same proportion of ingredients; and they must neither be so hard that they pass through the intestines unbroken, nor so soft that they adhere to one another or become flat.

Advantages.—The quantity of the active substance is small in amount, there is little tendency to decomposition of the ingredients, the bulk is convenient, and the pill is therefore very portable. It is easily swallowed and comparatively tasteless. It is a particularly suitable form for the administration of those substances whose action on the intestines is desired, or which are to be absorbed gradually and not very rapidly.

Excipients.—In writing a prescription for pills, the chief difficulty is in the choice of a suitable excipient, and therefore some prescribers prefer to leave this choice, as well as the quantity of the excipient, to the dispenser.

The prescriber can, however, best ensure the efficient application of his remedies by himself choosing those bases or excipients which are appropriate for his purposes, as the action of the ingredients depends in some cases on the rapid disintegration of the pill in the stomach, and in other cases is intended to be exerted very gradually on the intestine, or mainly on its lower portions.

A fluid excipient must be selected if all the other ingredients of the pill are dry, and a smaller amount of it will be required if the fluid is a solvent of some part of the ingredients. For this reason, compound decoction of aloes is often chosen as the excipient for a pill containing aloes or some resinous substance. If the ingredients of a pill are fluid, the excipient must be a solid substance with the properties of an absorbent; and if there is no adhesiveness among any of the ingredients of a pill, this quality must be supplied in the excipient. Excipients may therefore be conveniently divided into those which are fluid, those which are solid, and those which are composed of both classes of substances.

Of the **fluid Excipients** it is not advisable to use **Water** alone, although it is a solvent of many salts; it soon evaporates, and the pill crumbles. The same is true in an even greater degree with regard to **Alcohol**, though its solvent power on resinous substances should be kept in mind. If **Glycerine** is used alone, it, being hygroscopic, causes the pills to become

soft and to lose their shape. It is no longer hygroscopic when mixed with half its weight of water. A mixture of alcohol, glycerine, and water is useful, as it combines the advantages of the separate ingredients. It must not be forgotten that alcohol and glycerine may, under certain circumstances, act as reducing agents. The **Volatile Oils** form good masses with resinous substances, and do not evaporate very rapidly; and the **Fixed Oils**, in small quantities, are good excipients for some insoluble powders, such as, for example, calomel. Special solvents may be employed when necessary; thus bisulphide of carbon may be used to dissolve phosphorus, and when a fluid excipient is required for a mass in which all chemical action must be absent, *e.g.*, one containing potassium permanganate, paraffinum liquidum may be used.

Of the **solid excipients**, a **Fibrous Vegetable Powder**, *e.g.*, powdered liquorice root, may be ordered if the pill is composed either of amorphous or of crystalline substances which are without cohesiveness; but if there is much moisture to be absorbed, a **powder containing mucilaginous matter**, *e.g.*, powdered Marsh-Mallow (*pulvis Althææ*) may be chosen. Other substances, such as starch, flour, and bread-crumbs have been used for similar purposes, but have fallen into disuse because the pills made by means of them are liable to crumble. Where chemical change in the pill is to be prevented or diminished, **Cane Sugar** is sometimes ordered; but it does not, by itself, give permanent cohesion to the mass. Where an **absorbent powder** is required which shall not be acted upon chemically, Kaolin (a silicate of aluminium) or Kieselguhr (a siliceous earth) may be used. **Gum Acacia** and **Tragacanth** have good adhesive properties, but if used in large quantities they tend to make the pills very hard. Various fatty and unctuous substances, such as **Lard**, **Lanolin** (*Adeps Lanæ*), **Cacao Butter** (*Oleum Theobromatis*), and sometimes **Wax**, may be used with success, but the last named may make the pill so indigestible that it may pass through the intestine unchanged. Where chemical change may take place between any of the ingredients of the mass and the excipient, either **Soft** or **Hard Paraffin** may be used, or preferably a mixture of the two, but the disadvantage is the slow disintegration of the pill. **Hard** and **Curd Soaps** form very good masses with resinous substances, **Sapo Animalis** especially; but, being usually alkaline in reaction, care should

be taken to avoid prescribing them with substances which would be injuriously affected by the alkali.

Most use is made of the **semi-solid, gelatinous**, or fluid excipients, which are composed of **more than one** of the substances in the groups mentioned above. These excipients may be conveniently divided into (a) those which contain some form of sugar, (b) those which contain a gum, and (c) vegetable extracts.

(a) Of those which contain a sugar, **Syrup** has the disadvantage of liability to crystallisation of the sugar in the pill as the water evaporates, causing disintegration of the pill. **Honey** has the same disadvantage to a less degree, but **Treacle** has not this tendency. They do not, however, confer a great degree of adhesiveness to a mass composed of non-adhesive substances. **Syrup of Glucose** has much more binding power, and is therefore the most useful member of this class. **Extract of Malt** may be included here, and is rather more adhesive than the other members of the group. **Confection of Roses** (a mixture of sugar and rose petals) forms good masses with many substances, but increases the bulk of the pill unnecessarily.

(b) Of those which contain a gum, the **Mucilages** of **Acacia** and of **Tragacanth**, if used alone, have the same disadvantages as the gums themselves have, *i.e.*, they tend to render the pill unduly hard, and must be used in small quantities only. When mixed with treacle, glycerine, or glucose, however, they form very excellent excipients; and the combinations most frequently employed are **Proctor's excipient** (tragacanth one part, water one and a third parts, glycerine three parts); "**Glucanth**" (liquid glucose seven parts, tragacanth and water each one part, glycerine three parts); and "**Theriacanth**" (treacle sixteen parts, tragacanth one part, rectified spirit two parts). In any one of these there is sufficient adhesiveness to give suitable consistence to a mass of about four times the weight of the excipient, the bulk of the pill is but slightly increased by the excipient, the pill does not tend to become hard, and it is readily disintegrated in the intestinal canal.

(c) If one of the **Vegetable extracts** is preferred as an excipient, and especially if the quantity prescribed is indefinite ("as much as may be necessary"), selection should be made

of one of those which have little pharmacological action, such as the extract of gentian, of liquorice, or of dandelion. They are easily digested, and pills made with them are rapidly disintegrated. If a semi-solid extract is required, care must be taken to avoid prescribing one of the dry extracts.

There are twenty official pills, of which twelve are cathartic, and nine of these contain aloes. There are three which contain opium, and the remaining five contain phosphorus, quinine, squill, asafetida, and ferrous carbonate respectively. They may therefore be conveniently arranged as follows:—

OFFICIAL PILLS.

NAME.	ACTIVE INGREDIENTS.	STRENGTH.	EXCIPIENT.	DOSE.
Pilula Aloes Barbadensis.	Barbados aloes .	1 in 2	Hard soap, oil of caraway, confection of roses.	4 to 8 grns.
P. Aloes et Ferri.	{ Barbados aloes . 1 dried ferrous sulphate . ½ }	in 4½	Comp. cinnamon powder, syrup of glucose.	
P. Aloes et Asafetidæ.	{ Socotrine aloes . 1 asafetida . 1 }	in 4	Hard soap, confection of roses, Syrup of glucose.	
P. Aloes et Myrrhæ.	{ Socotrine aloes . 1 myrrh . ½ }	in 2¼	Syrup of glucose.	
P. Aloes Socotrinæ.	Socotrine aloes .	1 in 2	Hard soap, oil of nutmeg, confection of roses.	
P. Rhei Compositus.	{ Socotrine aloes . ¾ rhubarb root . 1 myrrh . ½ }	in 4	Hard soap, oil of peppermint, syrup of glucose.	
P. Cambogiæ Composita.	{ Barbados aloes . 1 gamboge . 1 }	in 6	Comp. cinnamon powder, hard soap, syrup of glucose.	
P. Colocynthis Composita.	{ Barbados aloes . 1 scammony resin . 1 colocynth pulp . ½ }	in 3	Potassium sulphate, oil of cloves, water.	
P. Colocynthis et Hyoscyami.	{ Comp. pill of colocynth . 2 extract of hyoscyamus . 1 }	in 3		
P. Scammonii Composita.	{ Scammony resin . 1 jalap resin . 1 }	in 6	Curd soap, tincture of ginger.	
P. Hydrargyri.	Mercury .	1 in 3	Liquorice root, confection of roses.	
P. Hydrargyri Subchloridi Composita.	{ Mercurous Chloride . 1 sulphurated antimony . 1 guaiac resin . 2 }	in 4½	Castor oil, rectified spirit.		4 to 8 grns.

Official Pills—continued.

NAME.	ACTIVE INGREDIENTS.	STRENGTH.	EXCIPIENT.	DOSE.
P. Saponis Composita.	Opium	1 in 5	Hard soap, syrup of glucose.	} 2 to 4 grns.
P. Plumbi cum Opio.	{ Opium lead acetate	} $\frac{1}{3}$ in 4	Syrup of glucose.	
P. Ipecacuanhæ cum Scilla.	{ Comp. ipecacu- anha powder squill ammoniacum		} in 6	Syrup of glucose.	} 4 to 8 grns.
P. Phosphori.	Phosphorus	$\frac{1}{50}$ in 1		Acacia gum, wax, lard, kaolin, car- bon bisulphide.		} 1 to 2 grns.
P. Quininæ Sulphas.	Quininæ Sulphate	5 in 6	Tartaric acid, gly- cerine, tragacanth.	} 2 to 8 grns.
P. Scillæ Composita.	{ Squill ginger ammoniacum	} in 5	Hard soap, syrup of glucose.		} 4 to 8 grns.
P. Galbani Composita.	{ Asafetida galbanum myrrh		} in $3\frac{1}{2}$	Syrup of glucose.		} 4 to 8 grns.
P. Ferri.	{ Ferrous carbon- ate (sodium sulphate). . . .	1 in 5		Acacia gum, traga- canth, syrup, glycerine, water.	} 5 to 15 grns.

Practice.

Dispense the following prescription, using the official pill-mass, and observe the consistence of the mass and of the pills. For the ingredients, see p. 61.

Edinburgh University,
May 1903.

Mr A. B.

Recipe.

Pilulæ Aloes Barbadosis . . . grana quatuor et viginti.
Divide in pilulas sex.

Signetur.

Una vespere sumenda vel duæ si necesse sit.

Cut paper for scales; weigh twenty-four grains of the pill-mass, and, if necessary, make the mass uniform in the mortar with the pestle. Remove it by means of the pill-knife, and roll it between the fingers to form a sphere. (A little French chalk will prevent it from adhering to the fingers.) Dust the pill-tile with as minute a quantity of the chalk as possible, and with the pill-knife roll the pill-mass lightly till it assumes the shape of a cylinder, care being taken not to allow the

ends of the cylinder to taper. Roll the cylinder out until it exactly extends to six divisions of the scale; and, with the cutting edge at the end of the pill-knife, cut the cylinder into six portions. Roll each pill between the fingers till nearly spherical, and complete the process by rolling the pills on the tile by means of the boxwood pill-rounder. Compare the size of the pills with each other, and weigh each of them. These pills may be polished by allowing them to rotate rapidly in the rounder with a little French chalk. Dispense in a box, and label it.

If a pill-mass is too hard, it can usually be softened by warming it on a tile previously dipped in boiling water, and dried.

While dispensing the following prescriptions, attention should be given to the effect on the mass of the particular excipient chosen.

Dispense the following prescription for six pills, each weighing about four grains:—

	<i>Edinburgh University,</i> <i>May 1903.</i>
Mr A. B.	
Recipe,	
Aloes Barbadosis	grana sex.
Ferri Sulphatis Exsiccati	grana tria.
Pulveris Cinnamomi Compositi	grana novem.
Syrupi Glucosi	quantum sufficiat ut fiat massa quam divide in pilulas sex.

Signetur.

Una sumenda bis terve in die.

Having calculated the doses, weigh six grains of Barbados aloes and powder it finely; weigh three grains of dried ferrous sulphate and nine grains of compound cinnamon powder, and mix them all intimately in the mortar until the powder is quite uniform. Take six drops of syrup of glucose and place it in the mortar. Rapidly incorporate it with the powder in the mortar, using pressure. For this purpose the pestle should be used as a lever, with the extremity of its handle held in the hollow of the hand, and the edge of the mortar used as the fulcrum. By powerful pressure, combined with a twisting action, the mass is firmly compressed between the end of the pestle and the mortar. Rapidity is

essential, or the mass will become too dry, and it will then crumble. When the mass is formed, detach it from the mortar, make it spherical, transfer it to the pill-tile, and roll it until the cylinder which is formed extends to six divisions. Divide into six pills, and finish them in a manner similar to that in which the former aloes pill was made.

Dispense the following prescription :—

Mr A. B.

Edinburgh University,
May 1903.

Recipe,

Pulveris Digitalis Foliorum	.	.	.	semigranum.
Pulveris Scillæ	.	.	.	granum.
Extracti Gentianæ	.	.	quantum sufficiat ut fiat pilula.	

Mitte tales sex.

Signetur.

Una quāque horā sextā, vel sæpius ut dictum est.

Weigh three grains of powdered digitalis leaves and six grains of squill, and mix them together thoroughly. Take sufficient extract of gentian, incorporate it with the mass in the mortar, and transfer the mass to the pill-tile. Roll and divide into six pills, and finish them. Weigh them, and note their consistence.

Dispense the following prescription :—

Mr A. B.

Edinburgh University,
May 1903.

Recipe,

Quininæ Sulphatis	.	.	.	grana quindecim.
Acidi Tartarici	.	.	.	semigranum.
Tragacanthæ	.	.	.	semigranum.
Glycerini	.	.	.	grana duo.

Misce ut fiat massa et divide in pilulas sex.

Signetur.

Una omni horā sextā, vel sæpius ut dictum est.

Take about half a grain of powdered tragacanth and one drop of glycerine, and mix them in the mortar. Weigh fifteen grains of quinine sulphate, and half a grain of powdered tartaric acid. Mix them well, and place the powder in the mortar, mass rapidly, roll out, and divide into six pills, and finish them. If too much time is spent on this part of the process, the mass becomes elastic, and cannot then be rolled. If the mass has

become too dry, add one or even two drops of water to it, and incorporate again in the mortar.

Dispense the following prescription completely :—

Mr A. B.

Edinburgh University,
May 1903.

Recipe,

Ferri Sulphatis Exsiccati	.	.	.	grana quindecim.
Sodii Carbonatis Exsiccati	.	.	.	grana decem.
Syrupi	.	.	.	minima sex.
Glycerini	.	.	.	minimum.
Aquæ	.	.	.	minima duo.
Acaciæ gummi	.	.	.	grana quinque.
Tragacanthæ	.	.	.	granum.

Misce ut fiat pilularum massa et divide in pilulas decem.

Signetur.

Una vel duæ sumendæ ter in die.

As in this pill ferrous carbonate will be formed, it should be allowed to form in the mass rather than in the individual pills. Place six drops of syrup, one of glycerine, and two of water in the mortar, and mix them. Weigh fifteen grains of exsiccated sulphate of iron and ten grains of exsiccated carbonate of sodium. Add the former to the excipient in the mortar, mix thoroughly, and add the sodium salt quickly. Mix well together, and let it stand till the reaction is complete (about fifteen minutes). During this time weigh five grains of powdered acacia gum and one grain of powdered tragacanth, and mix these two on paper. Add this powder to the mass in the mortar when the reaction is complete, and form the pill-mass as rapidly as possible; then quickly roll, and divide it into ten pills.

If pills are to be made in numbers greater than a dozen, time may be saved by rolling them on a pill machine by means of a long, flat, wooden roller having a handle at each end; and the cylinder thus formed may be rolled on to a set of cutting edges, so that the operation of cutting and rolling the individual pills is much hastened. These machines are of sizes to make pills of various weights, and as it is not easy to roll pills on one of these machines if they are of a size differing from that for which the apparatus has been designed, some machines are made adjustable and with movable parts, to accommodate pills of several sizes.

Pills are usually dispensed in boxes or small bottles, the latter being preferable if the substances are liable to decomposition by moisture. If well made, they should not require powder to prevent them adhering to

one another; if, however, such a powder is required, it must be inert and impalpable. Lycopodium, French chalk, powdered liquorice root, or starch, may be used for this purpose, very little being placed in the box.

Pill Coating.—There are various materials used for the purpose of rendering the pills tasteless, the most frequently employed being silver or gold leaf, sugar, gelatin, collodion and resinous varnishes. Pills may be silvered by covering each pill, which must be well-rounded, with a fine layer of mucilage; they are then transferred, together with a sufficient quantity of silver leaf, to a spherical hollow box, and rotated in it for a short time. One silver leaf of about four inches square should coat about a dozen two-grain pills. It is not advisable to direct pills to be silvered if they contain sulphur, sulphides or sulphur-yielding substances, or mercury.

Sugar (or pearl) coating may be carried out in much the same manner, the pills being rotated in a mixture of sugar and talc in the form of an impalpable powder. It is more satisfactorily done, however, in special apparatus at a raised temperature.

In order to coat with gelatin or collodion, each pill is placed on the point of a fine needle and dipped into a solution of gelatin or of collodion, and dried. The aperture made by the needle is afterwards covered with the coating substance.

Pills may be varnished by rotating them in a dish, which has been previously oiled, with a little of an alcoholic solution of gum mastic and balsam of Tolu. Glycerine should not be used as an ingredient of pills which are to be varnished; and pills with much varnish may pass through the intestine undissolved.

If it is intended that a pill should pass through the stomach undissolved and be broken up in the intestine, the pill may be coated with Keratin, which is a constituent of horny matter, and is prepared by digesting the horny shavings with pepsin, hydrochloric acid, and water, after the fatty matter has been removed by means of ether. The washed residue is collected, dissolved in weak solution of ammonia, and then evaporated to dryness. It may be dissolved for use either by ammonia water or by acetic acid. If a pill is intended to be coated with Keratin a fatty excipient should be chosen, and the pill should be free from moisture.

The Confection (Confectio).—The confections are soft, pasty preparations made with sugar or honey, and contain bulky substances. Besides the confection of roses, which is used only as a pill excipient, there are three others official.

C. Sennæ contains senna, figs, tamarind, prunes, cassia pulp, and extract of liquorice as the active substances; C. Sulphuris contains sublimed sulphur and acid tartrate of potassium; and C. Piperis contains black pepper and caraway fruit. Each is given in doses of from one to two drachms.

The Lozenge (Trochiscus) is a solid, flat disc of from fifteen to twenty grains in weight. The lozenges consist of

active ingredients mixed with a basis of sugar and gum acacia (simple basis), or with the addition of rose water (rose basis), or black currant paste of commerce (fruit basis), or tincture of tolu (tolu basis).

Advantages.—A convenient and pleasant form of administration, especially where a local action on the mouth and throat is desired.

There are seventeen official lozenges.

OFFICIAL LOZENGES.

NAME.	STRENGTH.	BASIS.
Trochiscus Morphinæ.	{ $\frac{1}{3\bar{v}}$ grain of morphine hydrochloride in each . . . }	tolu.
T. Morphinæ et Ipecacuanhæ.	{ $\frac{1}{3\bar{v}}$ grain of morphine hydrochloride in each . . . $\frac{1}{\bar{v}}$ grain of ipecacuanhæ in each . . . }	tolu.
T. Krameriæ et Cocainæ.	{ 1 grain of extract of krameria in each . . . $\frac{1}{2\bar{v}}$ grain of cocaine hydrochloride in each . . . }	fruit.
T. Ipecacuanhæ.	$\frac{1}{4}$ grain in each . . .	"
T. Acidi Tannici.	} $\frac{1}{2}$ " " . . .	"
T. Acidi Benzoici.		"
T. Catechu.	} 1 " " . . .	simple.
T. Ferri Redacti.		"
T. Santonini.		"
T. Eucalypti Gummi.		fruit.
T. Krameriæ.		"
T. Acidi Carbolici.	} 2 grains " . . .	tolu.
T. Bismuthi Compositus.		rose.
T. Potassii Chloratis.	} 3 " " . . .	rose.
T. Sodii Bicarbonatis.		"
T. Guaiaci Resinæ.		fruit.
T. Sulphuris.	5 " " . . .	simple with T. aurantii.

The **Tablet (Tabella)**.—The official tabellæ are tablets made with chocolate as the basis, and of a weight of five grains.

There is only one official, viz., that of nitroglycerine (tabella trinitrini), which contains $\frac{1}{10\bar{v}}$ grain of trinitrolycerin of commerce in each, and of which the dose is one or two.

Compressed Tablets of any substance which can be dispensed in the form of powders may be ordered. They may be made by simple compression by means of a suitable press, or they may require some adhesive substance like sugar in

addition. In some cases, in order to hasten disintegration, there may be added a small quantity of an alkaline bicarbonate together with some tartaric acid. They form a portable and convenient means by which small quantities of powders may be administered. There are none official.

The **Disc (Lamella)**.—These discs are preparations intended for local application to the eye, and consist of a basis of gelatin with some glycerine, together with a salt of an alkaloid.

Lamella atropinae contains $\frac{1}{5000}$ th grain of atropine sulphate; *L. physostigminae* contains $\frac{1}{1000}$ th grain of physostigmine sulphate; and *L. homatropinae* $\frac{1}{100}$ th grain of homatropine hydrobromide. Each of these weighs $\frac{1}{80}$ th of a grain. *Lamella cocainae* weighs $\frac{1}{30}$ th grain, and contains $\frac{1}{60}$ th grain of cocaine hydrochloride.

MIXTURES.

VI. The term *mixture* is used with more than one meaning. It may include fluid preparations such as lotions, liniments, and various kinds of injections; but in its more restricted meaning, it may be defined as a fluid preparation consisting of more than one ingredient, either dissolved or suspended in a sufficiently dilute vehicle, so as to be suitable for internal administration in divided doses. Mixtures may be classified as follows:—

- | | | |
|--|---|---|
| Those composed of fluid substances | { | soluble in each other, (1) |
| | { | insoluble in each other, and therefore requiring special treatment to prevent separation. Emulsions (2) |
| Those composed of fluid and solid substances | { | soluble together, (3) |
| | { | insoluble together, and requiring therefore to be suspended, (4) |

The official *misturæ* belong to one or other of these groups.

General Instructions for Dispensing Mixtures.—Read the prescription carefully, calculate the doses of the various ingredients ordered in order to determine that none of these doses are excessive. The duty of a dispenser when he considers a dose dangerous is to communicate with the prescriber.

In order to calculate the dose of the individual ingredients, first divide the total bulk of the mixture by the *dose of the mixture*. This gives the number of doses. Then divide the quantity of each ingredient by this number.

For example, in the prescription on p. 70 the bulk of the mixture is four ounces and its dose half an ounce.

Therefore, 4 ounces $\div \frac{1}{2}$ ounce = 8; and 80 minims $\div 8 = 10 \text{ m}$, which is the dose of tincture of digitalis ordered.

In the prescription on p. 72 the bulk is three ounces (twenty-four drachms) and the dose one drachm. Therefore, $\frac{24}{1} = 24$ doses. And the quantity of potassium bichromate being three grains, $\therefore \frac{3}{24} = \frac{1}{8}$ grain is the dose of the bichromate.

Having ascertained the nature of the mixture which is to be dispensed, as to whether it is a suspension, emulsion, or solution, determine the order in which the ingredients are to be mixed. In general it is advisable to dilute freely each ingredient before adding the next, and to distribute it equally through the whole mixture. If two substances are ordered which act undesirably on each other, dilute them both as much as possible before mixing them; and if there are any substances ordered which will prevent or lessen such interaction, dispense them before adding the second of the incompatible substances.

When a precipitate is produced in such a mixture, it must not be removed by filtration unless so ordered by the prescriber.

When all the ingredients have been added and diluted, fill the bottle with the vehicle to the previously measured level.

To Wrap the Bottle.—Take a piece of paper of the length of about twice the circumference of the bottle, and of the breadth such that when the bottle is laid transversely on it the paper extends about three-quarters of an inch beyond the bottom and half an inch beyond the cork. Lay the paper with its shorter diameter parallel with the edge of the table, and place the bottle transversely about half-way between the centre and the further margin. Lift the nearer edge of the paper over the bottle to the further side, and fold the lower edge over the upper, in the same manner as described in folding powders. Lift the edges of the paper thus folded together, bring them towards you, and press the upper portion of the paper well under the further side of the bottle by means of the two thumbs. The final fold should lie along the middle line of the upper side of the bottle. Fold the paper at the bottom of the bottle by pressing down the fold or upper portion, then fold laterally the two sides, and lastly bring up the lower flap. Stand the bottle upright to fold the paper over the cork;

begin by pressing the central fold firmly on the top of the cork, holding it in position with the forefinger, lay down the two sides on it with the thumb and second finger respectively, and finally bring down the V-shaped posterior portion. Secure these last portions on the cork and on the bottom of the bottle by touching them with sealing-wax.

Practice.

As an example of the first class of mixtures, all the ingredients of which mix with or are soluble in each other, dispense the following prescription:—

Mr A. B.

Edinburgh University,
June 1903.

Recipe,

Tincturæ Digitalis . . .	minima octoginta.
Liquoris Ferri Perchloridi . . .	drachmam cum semisse.
Glycerini . . .	drachmas duas.
Acidi Hydrochlorici Diluti . . .	minima quadraginta.
Aquæ Destillatæ . . .	ad uncias quattuor.

Misce ut fiat mistura.

Signetur.

Cochleare magnum ter in die post cibum ex aquæ cyatho vinario per vitream cannulam sumendum.

or,

Recipe,

Tincturæ Digitalis . . .	minima octo.
Liquoris Ferri Perchloridi . . .	minima undecim.
Glycerini . . .	minima quindecim.
Acidi Hydrochlorici Diluti . . .	minima quinque.
Aquæ Destillatæ . . .	ad semiunciam.

Misce ut fiat mistura et mitte quattuor uncias.

Signetur.

Ut supra.

First measure four ounces of water into a bottle of suitable size, and observe the level. Empty it, and measure ninety minims of the solution of the ferric chloride and wash it into the measured bottle. Add about one fluid ounce of water. Measure forty minims of the dilute acid and wash it into the bottle. Measure two fluid drachms of glycerine in the larger measure, wash it into the bottle, and shake it well through the mixture till it is quite dissolved. Measure eighty minims of tincture of digitalis, and dilute it in the measure with about one and a half or two drachms of the water, and

then transfer to the bottle; rinse the contents of the measure into the bottle, and if the contents do not reach the measured level of four ounces, add sufficient of the water. Cork the bottle, label it, wrap it up, and address it.

Dispense the prescription again in the order in which the ingredients are prescribed, omitting the dilute acid, and without diluting the ingredients or shaking them after each addition. Compare the results of the two methods.

In a test-tube add the tincture to the solution of ferric chloride, and then add dilute hydrochloric acid until decolorised. Observe the quantity of acid required, and the resulting appearance of the solution.

The mixture should be tasted in order to observe the sweetening power of two drachms of glycerine in such a four-ounce mixture.

Solutions.

Mixtures of the third class, viz., those containing substances in solution, are dispensed almost as readily as those of the first class.

Substances rapidly and easily soluble, such as potassium iodide, may be dissolved in the bottle itself. Some substances, however, dissolve more readily when put into the solvent than when the solvent is poured on them, *e.g.*, the scale preparations of iron.

Solution of crystalline substances is hastened when they are reduced to powder, and the solvent is added, and they are stirred together in the mortar.

Where large amounts of crystalline substances are ordered, the solution when made should be strained or filtered into the bottle, to remove impurities and render the solution clear.

If more of a substance is ordered than will dissolve in the amount of solvent ordered, it must be reduced to powder and dispensed with instructions to shake the bottle.

Where a special solvent is ordered in addition to the vehicle, the solution should be made by means of this solvent, with the addition of some of the vehicle. If an insufficient quantity of solvent has been prescribed, the dispenser must not add more unless the subscription expresses clearly that complete solution is intended. The solution of a slowly dissolving substance may

be hastened by warming the solution, but care must be taken that the maximum solubility of the substance in cold water is not exceeded.

Practice.

As an example of this class of mixture, dispense the following prescription :—

Mr A. B.

Edinburgh University,
June 1903.

Recipe,

Potassii Bichromatis . grana tria.
Glycerini . . . drachmas duas cum semisse.
Aquæ Destillatæ . . ad uncias tres.

Solve et misce ut fiat mistura.

Signetur.

Cochleare parvum omni quarta hora.

Calculate the doses, measure a three-ounce bottle, write the label, weigh three grains of potassium bichromate, powder it in a mortar, add sufficient water to dissolve it, and transfer it to the bottle, washing the contents out of the mortar into the bottle to get the whole quantity. Measure the glycerine as in the last prescription, and finally add the distilled water to the required amount. Cork, label, wrap up, and address.

Suspensions.

Mixtures of the fourth class are a little more difficult to dispense than the foregoing, owing to the necessity of having the suspended substance very finely powdered and the suspending agent uniformly mixed.

The usual suspending agents are the gums, mucilages, starch, syrups, glycerine, and some extracts. The quantity of each required varies with the weight of the powder to be suspended, and the bulk of the mixture. The usual amounts required to suspend from ten to twenty grains of a heavy powder, or ten to thirty grains of a light powder, in one fluid ounce of a mixture are the following :—

Gum tragacanth	2 grains.
Compound tragacanth powder	10 grains.
Starch	10 grains.
Gum acacia	ʒss.
Mucilage of acacia	ʒj.
Mucilage of tragacanth	ʒss.

For suspending purposes, glycerine or syrups are usually prescribed with one or other of these gums, rather than alone, and if alone must be in considerable quantity.

Mucilage of acacia is inadmissible when the mixture contains a large proportion of alcohol, the gum being insoluble in ninety per cent. alcohol.

Very volatile substances should be added to the mixture in the bottle towards the end of the process.

Chemical action among the ingredients if desired or unavoidable, especially if of the nature of effervescence, must be allowed to take place before admixture with the mucilaginous substances.

Mixtures containing **resinous tinctures** with an **aqueous vehicle** should be treated as suspensions. They are well suspended when the mixture contains two drachms of mucilage of acacia in each ounce. After the suspending agent has been made and diluted, and nearly fills the bottle, the tincture should be added and shaken through the mixture.

Gum Resins when mixed with water have barely enough gum to suspend the resin; the addition therefore of a little acacia gum is an advantage. Scammonium—the gum resin—contains enough gum to suspend the resin if milk be taken as the vehicle.

Practice.

As an example of a suspension, dispense the following prescription:—

Edinburgh University,

July 1904.

Mr A. B.

Recipe,

Cretæ Præparatæ	drachmas tres.
Pulveris Tragacanthæ Compositi	grana quadraginta.
Aquæ	uncias tres cum semisse.

Misce ut fiat mistura.

Signetur.

Cochleare magnum sumendum post quamque alvi dejectionem,
phialā prius agitātā.

When dispensing mixtures of which this is an example, *i.e.*, where there is an insoluble solid, a vehicle and a substance which aids in the suspension of this solid, make the suspension first, and dilute it afterwards.

Weigh three drachms of prepared chalk and reduce it in the mortar to a very fine powder. Remove it by the

spatula on to a piece of paper. Weigh forty grains of compound tragacanth powder, place it in the mortar, and add to it from a measured two fluid ounces of water a few drops. Mix thoroughly with the pestle, and add water gradually till about two fluid drachms have been used. There must be no lumps. Add a fourth part of the chalk, mix well together (it may be done quite rapidly), and add more water until a creamy consistence is again produced. Add in the same way the chalk and the water alternately, keeping as far as possible the consistency of a thin cream until all the chalk is added. Add water till the suspension is fluid enough to be poured from the mortar. Take a four-ounce bottle and transfer the mixture to it, rinse the contents from the mortar into the bottle, and, finally, add water till exactly three and a half fluid ounces in all (of water) have been added.

In this instance, an accurate measurement of the vehicle must be kept throughout the process, as the mixture is not directed to be made "to three and a half ounces."

Observe the taste of the mixture and the condition of the chalk—whether any particles are subsiding rapidly. Cork, label, and wrap the bottle.

Emulsions.

The dispensing of the second class of mixtures is the most difficult. The term *emulsion* should be confined to mixtures of this class, consisting mainly of fluids insoluble or but slightly soluble in each other. The chief fluids which do not mix readily with watery vehicles are the fixed oils, oleo-resins, and volatile oils when in excess.

These must be broken up into separate globules and the globules prevented from reuniting by being coated with some soapy, mucilaginous, or albuminous substance. The emulsion, if well made, may be then diluted. In order to elongate the drops until they separate into globules, and thereafter to prevent them from uniting again, it is generally recommended that the stirring should be continuously in one direction, and it should be performed lightly from the wrist with the pestle held between the fingers and thumb like a pen. Emulsification should therefore be continued until all the emulsion has

become opaque, and there are no longer to be seen any clear oil globules.

Emulsifying Agents.—These may be arranged as follows:—

The Alkaline Group.

(a) Alkalies and alkaline salts which form soaps, and soaps themselves. Solution of potash may be chosen when the mixture is to be taken internally; that of lime or of ammonia when it is to be used externally. Potassium carbonate, sodium carbonate, sodium phosphate, and borax may be used also. Potash or soda soap may be used, or a soluble soap prepared by boiling resin in caustic soda. The quantity of liquor potassæ (a six per cent. solution) required to emulsify one ounce of a fixed oil is about two fluid drachms; equivalent to nearly seven grains of potassium hydrate. Liquor ammoniæ is a ten per cent. solution, and liquor calcis a one-tenth per cent. solution of the respective alkaline base. Of potassium carbonate eight or nine grains is required, and of alkaline salts a quantity corresponding to the amount of alkali available for the formation of a soap. Alkaline soaps may be used as emulsifiers, on account of the small proportion of alkali necessary when soap is supplied ready formed. When ordering the alkaline solutions as emulsifiers, the nature of the soap to be produced should be remembered, and the amount of the alkali. Thus in the case of a lime-water emulsion, the soap which is formed (oleate of calcium) is insoluble; in the case of an emulsion with ammonia or potash, the soap is soluble.

The addition of glycerine or of mucilage does not improve an alkaline emulsion; and the addition of acids or of acid salts is carefully to be avoided when prescribing such emulsions.

The Mucilaginous Group.

(b) Mucilages, yelk of egg, gelatine, Irish moss, extract of malt, and casein.

Half an ounce of acacia gum (or an equivalent proportion of mucilage of acacia) will emulsify one fluid ounce of a fixed oil, which may afterwards be diluted with eight ounces of water. Yelk of egg (freed from the albumen) makes equally good emulsions, but must be used freshly prepared. Three fluid ounces of oil may be emulsified by one large yelk, but there is

no disadvantage in using a larger quantity of this emulsifier. Extract of malt makes good emulsions with cod-liver oil, but is employed generally where its medicinal effects are desired.

Mucilage emulsions are destroyed by large quantities of alcohol, owing to the insolubility of gum in this substance. For this reason also small quantities of tinctures in such mixtures should be well diluted and added to the emulsion after it has also been well diluted. The same rule applies to the dispensing of syrups and volatile substances in these emulsions.

The Saponin Group.

(c) Substances containing *Saponin*, a glucoside which when shaken with water produces a frothy lather. Two fluid drachms of a tincture of the bark of *quillaia saponaria* (ten per cent.) will emulsify one fluid ounce of a fixed oil, or its own bulk of a volatile oil. It makes a good emulsion with twice its bulk of the *oily liquid extract of male fern*, which may then be diluted with six or seven times as much water. A saponin emulsion may readily be made by shaking the oil with the emulsifying agent in a bottle till emulsion is complete, and then carefully diluting it until the required amount is obtained.

Choice of Emulsifying Agent.

The members of the alkaline and the saponin groups are most frequently chosen for emulsions which are for external application, while the mucilages, yelk of egg, etc., are most commonly employed where the emulsion is to be administered by the mouth.

The extent to which an emulsion can be diluted, depends partly on the character of the emulsifying agent used, and partly on the skill with which the emulsion has been made and diluted.

Mucilage which has been kept until it has become acid will not emulsify oils well. Powdered gum acacia may itself be used if undecomposed mucilage of acacia is not available; in which case a little water is rubbed with the gum in the mortar to form a mucilage, and an emulsion made by adding the oil. Or the powdered gum and the oil may be rubbed together, and a little water added afterwards to make the emulsion.

Yelk of egg combines most of the advantages of emulsifying

agents, being alkaline and mucilaginous, and being already itself an emulsion.

Practice.

The characters of the **alkaline** or "**chemical**" emulsions, and the order in which the ingredients should be mixed, may be observed while dispensing the three following prescriptions.

Dispense these liniments:—

Mr A. B. *Edinburgh University,*
June 1904.

Recipe,

Olei Lini,
Liquoris Calcis . . . ana unciam.

Misce ut fiat linimentum.

Signetur.

Applicetur ad partes affectas.

Et

Recipe,

Olei Lini . . . unciam.
Liquoris Ammonizæ . drachmas duas.

Misce ut fiat linimentum.

Signetur.

Partes affectæ perfricandæ sunt linimento leniter.

Directions.—Measure one fluid ounce of the oil and place it in a mortar. Measure the alkali and pour it little by little into the oil, stirring lightly but rapidly with the pestle.

In order to observe the effect of diluting such emulsions, pour the completed emulsion into an eight-ounce bottle. Add a drop or two of water, and having corked the bottle shake it well. Continue adding water in the same way, gradually increasing the quantity of each addition until such an amount has been added that the oil or the emulsion separates from the water. Observe the amount of water used. An emulsion is very easily destroyed by diluting too suddenly at the commencement, or too rapidly during the process, of dilution.

Dispense the following prescription completely, and observe that as liquor potassæ contains a very active base, it should be diluted before being used as an emulsifier;

for if undiluted liquor potassæ is added to the oil and stirred for even a comparatively short time, there may be produced such an excessive amount of potash soap that the emulsion can be diluted afterwards only with great difficulty, if at all.

Mr A. B. *Edinburgh University,*
July 1904.

Recipe,

Olei Ricini . . .	. . .	unciam.
Liquoris Potassæ . . .	. . .	drachmas duas.
Aquæ . . . . .	. . .	uncias quatuor.

Misce ut fiat mistura.

Signetur.

Unciæ duæ statim sumendæ et repetendæ primo mane.

Directions.—Measure the castor oil and pour it into a mortar. Measure the solution of potash and dilute it in a two-ounce measure to two fluid ounces with water. Add this to the oil a few drops at a time, emulsifying continuously until the emulsion of the oil is complete. Dilute the emulsion in the mortar, at first adding only a drop or two of water (continuously stirring), and gradually adding more water in increasing quantities till the emulsion may be easily poured into the bottle. A six-ounce bottle must be used and the remainder of the four ounces of water ordered must be added to the emulsion in portions, each portion being well shaken through the mixture till the whole is added. Cork and label the bottle.

The characters of the **mucilaginous** or “**mechanical**” emulsions and the order in which their ingredients should be mixed may be observed in the two following prescriptions.

Dispense completely the following mixture :—

Mr A. B. *Edinburgh University,*
July 1904.

Recipe,

Olei Ricini . . .	. . .	unciam.
Mucilaginis Acaciæ . . .	. . .	drachmas tres.
Aquæ . . . . .	. . .	ad uncias quatuor.

Misce ut fiat mistura.

Signetur.

Duo cochlearia magna primo mane in alternis diebus.

In this four-ounce mixture the oil droplets must be prevented from coalescing by being covered with an envelope of mucilage, and the emulsion formed afterwards diluted.

The order of procedure in the case of these "mechanical" emulsions differs from that of the foregoing "chemical" emulsions, in that the mucilaginous emulsifier is placed first in the mortar.

Directions.—Measure the mucilage, place it in a mortar, and add the measured ounce of oil, beginning with one or two drops at a time. It is very important not to add too much at first, and thoroughly to emulsify each portion of oil added. Add the oil, continuously stirring it with the pestle until it is completely emulsified. If the emulsion becomes too stiff and pasty before all the oil is added, it may be diluted with a drop or two of water, but not more. To dilute this emulsion, add the water drop by drop at first, as the oil may separate if too much water is added at the beginning, or it is added too rapidly. Pour the emulsion into a measured four-ounce bottle, and dilute gradually with the remainder of the water, shaking well after each addition. Cork and label the bottle.

Dispense the following mixture :—

Mr A. B. *Edinburgh University,*
June 1904.

Recipe,

Olei Ricini . . .	unciam.
Ovi Vitelli . . .	drachmas duas.
Olei Cassiæ . . .	minima octo.
Aquam . . .	ad uncias sex.

Misce ut fiat mistura secundum artem.

Signetur.

Quarta pars pro dosi. Repetenda ad alvi plenam solutionem.

Directions.—Separate the yolk of an egg from the albumen and rub the yolk in a mortar till smooth. Measure two fluid drachms of it and place it in a mortar. Add the oil, as in the case of the mucilage emulsion, gradually, and with constant stirring, till it is emulsified. Dilute with the same precautions as before until it is sufficiently fluid to be poured into the six-ounce measured bottle.

Add eight drops of the volatile oil of cassia to the mixture, complete the dilution till six fluid ounces are obtained, and cork and label the bottle.

Emulsions of Volatile Oils.—Volatile oils may be emulsified either with saponin, or by a thick mucilage (each minim requiring about ten grains of gum acacia), or by yelk of egg. One yelk will emulsify about two ounces and a half of a volatile oil. Or volatile oils may be mixed with fixed oils and emulsified with them.

The characters of an emulsion of a volatile oil emulsified by means of saponin may be observed in the following prescription.

Practice.

Dispense the following prescription :—

Mr A. B.

Edinburgh University,
June 1904.

Recipe,

Olei Terebinthinæ,	
Tincturæ Quillaiæ	. ana drachmam.
Aquam . . . . .	. ad uncias tres.

Misce ut fiat mistura more solito.

Signetur.

Cochleare magnum sumendum omni semihorā.

Directions.—Measure one drachm of the oil and place it in a three-ounce bottle; measure one drachm of tincture of quillaya and add it to the turpentine. Cork and shake the bottle until emulsification is complete. Add water little by little with repeated shaking until three ounces of the diluted emulsion are obtained.

Mixtures containing *oleo-resins* occupy an intermediate position between emulsions of volatile oils and mixtures containing resins in suspension. Copaiva, for example, or balsam of tolu may be dispensed most successfully with gum acacia.

The official preparations which may be considered here are the **mixtures (Misturæ)**, of which there are nine, viz., two solutions, two emulsions, and five suspensions. (Table, *v.* p. 81.)

The **liquores** and **injectiones** may also be included.

OFFICIAL MISTURÆ.

NAME.	INGREDIENTS.	STRENGTH.	VEHICLE.	DOSE.
Mistura Sennæ Composita.	Magnesium sulphate . . . liq. ext. of liquorice. aromat. sp. of ammonia. comp. tinct. of cardamoms.	1 in 4	infusion of senna.	{ 1 to 2 fl. ℥.
M. Creosoti.	Creosote . . . sp. of juniper. syrup.	1 in 480			distilled water.	{ ½ to 1 fl. ℥.
M. Olei Ricini.	Castor oil . . . mucilage of acacia.	℥ij in ℥j	orange flower water and cinnamon water.	1 to 2 fl. ℥.
M. Spiritus Vini Gallici.	Brandy . . . yolk of egg. sugar.	1 in 2	cinnamon water.	
M. Ammoniaci.	Ammoniacum (a gum resin) . . . syrup of tolu.	1 in 32	distilled water.	{ ½ to 1 fl. ℥.
M. Amygdalæ.	Compound powder of sweet almonds	1 in 8	distilled water.	
M. Cretæ.	Prepared chalk . . . tragacanth. sugar.	1 in 32	cinnamon water.	
M. Guaiaci.	Guaiac resin . . . tragacanth. sugar.	1 in 40	cinnamon water.	
M. Ferri Composita.	Ferrous carbonate. myrrh. sugar. sp. of nutmeg.	...	rose water.	

The **Solution (Liquor)** is a fluid preparation for either external or internal administration, consisting mostly of active substances simply dissolved in water. There are in some cases additional solvents present or substances intended to retard or prevent decomposition.

They are very convenient preparations both for the prescriber and dispenser, and may be classified as follows:—

Eleven of the official solutions are those of very active substances; the strength of these solutions being one per cent., *i.e.*, 1 grain in 110 minims.

Liquor Trinitrini is exceptional in that the solvent is ninety per cent. alcohol with no addition of water.

The active substance is usually expressed in the name of the solution.

1. One per cent. Solutions.

NAME AND ACTIVE INGREDIENT.	OTHER INGREDIENTS BESIDES DISTILLED WATER.	DOSES
Liquor Atropinæ Sulphatis.	salicylic acid . . .	$\frac{1}{2}$ to 1 m.
L. Trinitrini (trinitro-glycerin).	alcohol 90 % alone .	$\frac{1}{2}$ to 2 m.
L. Strychninæ Hydrochloridi.	alcohol 90 % : 1 in 4 .	2 to 8 m.
L. Arsenicalis (arsenious acid).	potassium carbonate	..
L. Arsenici Hydrochloricus (arsenious acid).	dilute hydrochloric acid . . .	..
L. Sodii Arsenatis.	...	..
L. Arsenii et Hydrargyri Iodidi.	...	5 to 20 m.
L. Morphinæ Acetatis.	{ acetic acid. alcohol 90 % : 1 in 4	} 10 to 60 m.
L. Morphinæ Hydrochloridi.	{ dilute hydrochloric acid. alcohol 90 % : 1 in 4	
L. Morphinæ Tartratis.	alcohol 90 % : 1 in 4	..

L. Ethyl Nitritis is a two and a half to three per cent. solution of ethyl nitrite in absolute alcohol, with five per cent. of glycerine added. It should be free from acid and aldehyde, and is given in doses of from twenty to sixty minims.

2. Solutions of Metallic Salts.

There are five solutions of salts of iron, of which the solutions of the perchloride contain free hydrochloric acid in addition to the salt.

NAME.	STRENGTH OF FE.	DOSE.
Liquor Ferri Perchloridi Fortis.	22.5 per cent.	Not given internally.
L. Ferri Persulphatis.	14.5 ..	.. ..
L. Ferri Perchloridi.	5.6 ..	} 5 to 15 m.
L. Ferri Pernitratis.	3.3 ..	
L. Ferri Acetatis.	1.8 ..	

Liquor Hydrargyri Perchloridi is given in doses of from one-half to one drachm, each drachm containing $\frac{1}{10}$ th grain of corrosive sublimate. ($\frac{1}{2}$ gr. in fl. $\bar{5}$ j).

3. Solutions of Salts of Alkalies.

There are eight solutions, the doses of which are rather larger than those of the majority of the preceding.

NAME.	STRENGTH.	DOSES.
Liquor Potassæ.	27 gr. in $\bar{5}$ j.	10 to 30 m.
L. Calcis Saccharatus.	8	20 to 60 m.
L. Calcis.	$\frac{1}{2}$	1 to 4 ounces.
L. Bismuthi et Ammonii Citratis.	3 gr. in $\bar{5}$ j.	$\frac{1}{2}$ to 1 drachm.
L. Potassii Permanganatis.	1 per cent.	2 to 4 ..
L. Ammonii Acetatis.	Indefinite.	2 to 6 ..
L. Ammonii Citratis.	..	2 to 6 ..
L. Magnesii Carbonatis.	10 gr. in $\bar{5}$ j.	1 to 2 ounces.

There are sixteen solutions for external use, three of which are, however, sometimes given internally, namely, Liq. Ammoniaë (10 to 30 m), Liq. Hydrogenii Peroxidi ($\frac{1}{2}$ to 1 $\bar{5}$) and Liq. Sodæ Chlorinatæ (10 to 20 m). They may be conveniently arranged according as they are irritants, antiseptics, or astringents.

4. Irritant Solutions.

NAME.	INGREDIENTS, EXCEPT WATER.	STRENGTH.
L. Sodii Ethylatis.	Ethylate of sodium alcohol (no water).	18 per cent.
L. Hydrargyri Nitratis Acidus.	Mercuric nitrate. nitric acid.	
L. Acidi Chromici.	Chromic anhydrate.	25 per cent.
L. Iodi Fortis.	Iodine potassium iodide alcohol.	nearly 12 per cent. 7 per cent.
L. Ammoniaë Fortis.	Ammonia	32.5 per cent.
L. Ammoniaë.	Ammonia	10 per cent.
L. Epispasticus (blistering liquid).	Cantharides acetic ether (no water).	1 ounce percolated with 2 fluid ounces.

5. Antiseptic Solutions.

L. Calcis Chlorinatæ.	Chlorinated lime	3 per cent. of available chlorine.
L. Sodæ Chlorinatæ.	Chlorinated soda	2½ per cent. of available chlorine.
L. Hydrogenii Peroxidi.	Hydrogen peroxide	9 to 11 vols. of available oxygen.
L. Picis Carbonis.	{ Coal tar	1 in 5.
L. Zinci Chloridi.	{ Tinct. of Quillaya.	1 in 1.2.

6. Astringent Solutions.

L. Plumbi Subacetatis Fortis.	Lead subacetate	1 in 4.
L. Plumbi Subacetatis Dilutus.	{ Lead subacetate	1 in 240.
L. Hamamelidis.	{ alcohol 90 per cent. Distillate from witch-hazel leaves macerated in weak alcohol and water.	

7. Protective Solution and those of Animal Glandular Substances.

L. Caoutchouc.	India-rubber Benzol. Bisulphide of carbon (no water).	1 in 20.
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There are two solutions of animal glandular substances, viz., *Liquor Pancreatis*, a twenty-five per cent. preparation of the pancreas of the pig in dilute alcohol (twenty per cent.); and *Liquor Thyroidei*, a preparation of the thyroid of the sheep, of the strength of one gland to 100 m, and containing glycerine and phenol, and given in doses of from five to fifteen minims.

When a mixture is to be taken in one dose it is called a **draught** (*haustus*).

When it is to be applied to the throat it is called a **gargle** (*gargarisma*), and usually should contain all ingredients in solution. It should have an agreeable flavour, and is generally improved by the addition of a viscid substance such as glycerine.

Solutions of antiseptic and of astringent substances are often prescribed in the form of a wash for the mouth (*collutorium*), which should be pleasantly flavoured.

The various fluid preparations grouped under the general name of mixtures may be administered in other ways than by the mouth. A mixture containing volatile ingredients may be directed to be used as a **vapour** or inhalation (*vapor*), the patient being instructed to inspire air drawn through the fluid. When the fluid is warm, the inhalation of the volatile constituents is more readily accomplished.

Mixtures may also be administered in the form of injections into different part of the body; e.g., beneath the skin (hypodermic injections), into the rectum (enemata), urethra, etc.

For **hypodermic injections** the bulk should be small in amount, in aqueous solution, free from solid particles, aseptic, and as nearly as possible free from acidity or alkalinity.

The official hypodermic injections are four in number:—

NAME AND ACTIVE INGREDIENT.	STRENGTH.	OTHER INGREDIENTS.	DOSE BY SUBCUTANEOUS INJECTION
Inj. Morphinae Hypodermica (morphine tartrate).	2.5 per cent.	...	5-10 2 to 5 m.
Inj. Cocainae Hypo. (cocaine hydrochloride).	5 10 ..	salicylic acid .	5-10 2 to 5 m.
Inj. Ergotae Hypo. (extract of ergot).	33 ..	phenol . . .	5 to 10 m.
Inj. Apomorphinae Hypo. (apomorphine hydrochloride).	1 ..	dil. hydrochloric acid.	5 to 10 m.

Inj. strychninae hypod.
(strychnine hydrochloride) 0.75%

5-10 m.

The **Rectal Injection (Enema)**.—There is no official example of this preparation. It must, therefore, be ordered by prescription. The vehicle usually employed is a cold solution of starch made by boiling two drachms of starch in half a pint of water. If the enema is to be retained until absorbed, its bulk should not exceed two fluid ounces unless it can be injected beyond the sigmoid flexure.

Thus an enema containing opium may consist of half a drachm of tincture of opium and two ounces of the above starch solution.

If the enema is intended to cause expulsion of the contents of the intestines, its bulk should be between ten and fifteen fluid ounces. For example, an ounce of sulphate of magnesium dissolved in fifteen ounces of the starch solution, and mixed with a fluid ounce of olive oil, may be administered in this way. An enema will exert its maximum effect if retained for a considerable time before expulsion. This may be attained if the enema is at the temperature of the body, and is injected slowly without the admixture of air, into the rectum of a patient lying on the left side.

A solution of soap may be used as the vehicle for such substances as castor oil, which may be thus partly emulsified. The soap itself acting as a mild irritant, aids in the desired action.

A **suspension for external use** is termed a **lotion**.

The **Lotion (Lotio)**.—There are two official lotions which are mixtures containing insoluble substances in suspension, and intended for external application. *Lotio Hydrargyri Flava* (yellow wash) consists of mercuric oxide in lime water. Two grains of mercuric chloride are mixed with one fluid ounce of lime water to produce it. *Lotio Hydrargyri Nigra* (black wash) consists of mercurous oxide in lime water, its suspension being aided by mucilage of tragacanth and glycerine. Three grains of mercurous chloride are mixed with glycerine and mucilage of tragacanth, and well shaken with some lime water; more lime water is then added until one fluid ounce is obtained.

The addition of glycerine to a lotion increases the facility of its application and is not as adhesive as gum. Rose water is a usual vehicle for a lotion.

The **Liniment (Linimentum)**.—There are some liniments, fluid preparations for external application not previously con-

sidered (see p. 46), which, in addition to any volatile oil present, contain oily, fatty, or soapy substances in order to diminish friction when they are rubbed on the skin.

They may be arranged according as they contain—

(a) an alkali with a fixed oil.

NAME.	INGREDIENTS.	STRENGTH.
Lin. Calcis	Lime water	1 in 2.
Lin. Ammoniaë.	olive oil. Solution of ammonia . almond oil. olive oil.	1 in 4.

(b) fixed oil with camphor.

Lin. Camphoræ.	Camphor	1 in 4.
Lin. Chloroformi.	olive oil. Chloroform	1 in 2.
Lin. Hydrargyri.	lin. of camphor. Mercury	1 in 6.
Lin. Terebinthinæ Aceticum.	lard, suet. ammonia (strong). lin. of camphor. Oil of Turpentine . . . glacial acetic acid. lin. of camphor.	1 in 2½.

(c) a soap.

Lin. Saponis.	Soft soap camphor. oil of rosemary. water. alcohol 90 per cent.	1 in 10½.
Lin. Opii.		Tinct. of opium lin. of soap . . . . .	1 in 2. = 16 gr. of opium in 3j.
Lin. Potassii Iodidi cum Sapone.	Potassium iodide . . . glycerine. oil of lemon. curd soap.	1 in 9.
Lin. Terebinthinæ.	Oil of turpentine . . . camphor. soft soap. water.	1 in 1½.

VII. Substances intended for external use when there is required application more prolonged than is possible with a liniment or lotion, may be prescribed in the form of ointments, oleates, creams, pastes, plasters, and papers.

OINTMENTS.

The **Ointment (Unguentum)** is a preparation of a soft, solid consistence, intended for external application. The active ingredients are, therefore, incorporated with a basis composed of fatty substances. Different fatty or unctuous substances are chosen in accordance with the purpose the ointment is intended to serve. The basis must be of a suitable consistence, which may be attained by mixing fats or oils having different melting points. If animal fats are used they must be free from rancidity, and decomposition may be delayed by the addition of such an antiseptic substance as, for example, benzoin. The paraffins are preferred where the purpose is to apply a protective covering; the animal fats where absorption is required.

Those substances are more readily absorbed through the skin which are soluble in fats and oils, and are also soluble in water or are readily changed into substances soluble in water. Such a substance is transferred from the sebaceous secretion to the serum.

The **official oily or fatty substances** may be arranged as follows in the order of their melting points:—

	MELTING POINT
Paraffinum Liquidum	(?)
Oleum Amygdalæ	- 4° F.
Oleum Olivæ	32° F. = solid ; 50° F. = pasty.
Acidum Oleicum	41° F. = semi-solid ; 56° to 60° = fluid.
Oleum Theobromatis	88° to 93° F.
Paraffinum Molle	96° to 102° F.
Adeps	100° F.
Adeps Benzoatus	do.
Adeps Lanæ	104° to 112° F.
Adeps Lanæ Hydrosus	do.
Sevum Præparatum	112° to 120° F.
Cetaceum	114° to 122° F.
Paraffinum Durum	130° to 135° F.
Cera Flava and Cera Alba	144° to 147° F.

The **paraffins** are not acted upon by other substances, and are not liable to decomposition as are animal fats. They can take up very little water (soft paraffin only absorbing one-tenth of its weight), and they are not absorbed through the skin. Unguentum paraffini (three parts of hard, and seven of soft, paraffin) is of a more useful consistence than either soft or hard paraffin alone.

Adeps lanæ, the purified cholesterin fat of sheep's wool, is much more readily absorbed through the skin than are other fats. It is very tenacious unless mixed with water. It can take up its own weight of water and when mixed with nearly half its weight of water is called **Adeps lanæ hydrosus**. Adeps lanæ mixed with an equal weight of almond oil and two-thirds of its weight of rose water makes a soft ointment, or cream, which is a much less tenacious basis than the hydrous wool fat alone.

Adeps or purified hog's lard is of suitable consistence, is somewhat absorbable, and is not irritating unless it becomes rancid, which change takes place rapidly in warm weather. When melted with gum benzoin (thirteen grains to the ounce) the change is delayed, but the benzoated lard is rather more irritating than is fresh lard. It will take up rather less than one-fifth part of its weight of water.

Suet, spermaceti, or wax may be added when an ointment is too soft, in order to render its consistence firmer. White wax becomes rancid sooner than yellow wax.

Olive oil and almond oil are bland non-irritating, non-drying, fixed oils, used when the ointment would otherwise be too hard.

Wax and almond oil mixed in similar proportions to those of the paraffins in paraffin ointment, viz., three to seven, will give an ointment of the consistency of lard, and about three or four parts of water can then be taken up by it.

Oleic acid combines with bases (alkaloids and oxides) to form oleates which are easily incorporated with fatty bases.

Oil of theobroma is hard at the ordinary temperatures, fluid at the temperature of the body.

Ointments may be made by simple admixture of the various ingredients; or the fats may be melted together, the solid substances either added in fine impalpable powder, or in solution, and the whole stirred until cool.

When the proportion of a powder to the fatty basis exceeds thirty or forty grains to the ounce (ten per cent.), the ointment has a pasty consistence and is sometimes called a paste (**pasta**). In these "drying pastes" a powder such as zinc oxide may be prescribed in quantities up to five or six drachms in the ounce. An ointment of very soft consistence is called a cream (**cremor**). These render the skin cooler than do ointments,

owing to the evaporation of the watery constituents, which are present in considerable proportion.

Practice.

In order to appreciate the consistence of ointments, dispense the following prescriptions, the first containing powders, the second a fluid. If the substances ordered are not already in a sufficiently fine state of division, they must be very finely powdered before being incorporated with the basis, or added in a state of solution, if soluble. Substances soluble in, or forming compounds with oleic acid, may, with great advantage, be combined with this basis.

Dispense the following prescription :—

Mr A. B.

Edinburgh University,
June 1904.

Recipe,

Zinci Oxidi,
Calaminæ Preparatæ . . . ana grana sedecim.
Adipis ad semiunciam.

Misce ut fiat unguentum.

Signetur.

Admoveatur ad locum affectum nocte manequē.

Directions.—Cut paper for scales, weigh sixteen grains of each of the powders, and mix them intimately together on the slab with the spatula until a uniform powder is obtained. Weigh 186 grains of lard, transfer it to the slab, and incorporate it with the powder by repeatedly spreading and turning over the substances by means of the spatula, until a uniform ointment is prepared. Transfer the completed ointment to the box, and affix a label with the directions.

Dispense the following prescription :—

Mr A. B.

Edinburgh University,
June 1911.

Recipe,

Olei Ricini drachmam cum semisse.
Ceræ Albæ scrupulum cum semisse.
Cetacei scrupulum.
Aquæ Rosæ drachmam.

Fiat unguentum secundum artem.

Signetur.

Applicetur leniter ad mamillas.

Directions.—Boil some water in the decoction pot. Weigh thirty grains of wax and twenty grains of spermaceti. Melt these in a porcelain capsule over hot water. Add ninety minims of castor oil, and stir. Warm a mortar by placing thirty minims of rectified spirit in it and igniting it. Pour the melted fats into the warmed mortar, and add one drachm of rose water (warmed in a test-tube) gradually with constant trituration until the ointment is cold. Transfer the ointment to a box and label it. In cases when the ointment is to be kept for a lengthened period, boxes or pots must be used of a material impermeable by fatty substances.

The forty-four official ointments may be arranged thus—(a) those simply protective or used as bases; (b) those containing very active alkaloids; (c) those containing mercury or its salts; (d) those containing other antiseptic or parasiticide substances, or (e) astringent substances, or (f) more or less irritant substances.

(a) Ointment Bases.

NAME.	INGREDIENTS.	STRENGTH.
Unguentum Aquæ Rosæ.	Rose water, oil of rose, white wax, spermaceti, almond oil.	...
U. Cetacei.	Spermaceti, white wax, benzoin, almond oil.	...
U. Paraffini.	Hard paraffin, 3 pts.; soft paraffin, 7 pts.	...
U. Resinæ.	Resin, yellow wax, olive oil, lard.	...

(b) Ointments containing an Alkaloid.

U. Aconitinæ.	Aconitine . . . oleic acid, lard.	2 per cent.
U. Veratrinæ.	Veratrine . . . oleic acid, lard.	2 ..
U. Atropinæ.	Atropine . . . oleic acid, lard.	2 ..
U. Belladonnæ.	Liq. ext. of bella- donna. benzoated lard.	0·6 per cent. of alkaloids.
U. Cocainæ.	Cocaine . . . oleic acid, lard.	4 per cent.
U. Gallæ cum Opio.	Opium, galls . . . benzoated lard.	7·5 per cent. of opium.
U. Conii.	Juice of conium . . . hydrous wool fat .	2 fl.℥ evaporated. ¾ ounce.

(c) Mercurial Ointments.

NAME.	BASIS.	STRENGTH.
U. Hydrargyri.	Mercury . . . lard. suet.	about 50 per cent.
U. „ Compositum.	Mercury ointment, camphor, yellow wax, olive oil.	about 20 „
U. „ Oleatis.	Mercuric oleate . benzoated lard.	25 per cent.
U. „ Ammoniati.	Ammoniated mercury. paraffin ointment.	10 „
U. „ Subchloridi.	Mercurous chloride benzoated lard.	10 „
U. „ Oxidi Rubri.	Red mercuric oxide paraffin ointment.	10 „
U. „ Oxidi Flavi.	Yellow mercuric oxide . . . soft paraffin.	2 „
U. „ Iodidi Rubri.	Mercuric iodide . benzoated lard.	4 „
U. „ Nitratis.	Mercuric nitrate . lard, olive oil.	6.6 per cent. of Hg.
U. „ Nitratis Dilutum.	Mercuric nitrate . soft paraffin.	1 in 5 = 1.3 per cent. of Hg.

(d) Antiseptic or Parasiticide Ointments.

U. Acidi Salicylici.	paraffin ointment .	2 per cent.
U. Chrysarobini.	benzoated lard .	4 „
U. Acidi Carbolici.	glycerine, paraffin ointment.	4 „
U. Sulphuris Iodidi.	glycerine, benzo- ated lard.	4 „
U. Sulphuris.	benzoated lard .	10 „
U. Acidi Borici.	paraffin ointment .	10 „
U. Creosoti.	hard paraffin, 4 ; soft paraffin, 5.	10 „
U. Eucalypti.	hard paraffin, 4 ; soft paraffin, 5.	10 „
U. Iodoformi.	paraffin ointment .	10 „
U. Staphisagriæ.	yellow wax, benzo- ated lard.	18 „
U. Picis Liquidæ.	yellow wax.	71 „

(e) Astringent Ointments.

U. Gallæ.	benzoated lard .	20 per cent. galls.
U. Gallæ cum Opio.	benzoated lard .	20 „ „
U. Hamamelidis. Liq. Ext. of Hamamelis.	hydrous wool fat .	10 per cent.
U. Plumbi Carbonatis.	paraffin ointment .	10 „
U. „ Iodidi.	paraffin „ .	10 „
U. „ Acetatis.	paraffin „ .	4 „
U. Glycerini Plumbi Sub- acetatis.	paraffin „ .	1 in 6.
U. Zinci. Oxide of Zinc.	benzoated lard .	15 per cent.
U. Zinci Oleatis.	soft paraffin . .	50 „

(f) Irritant Ointments.

NAME.	INGREDIENTS.	STRENGTH.
U. Iodi.	potassium iodide, glycerine, lard	4 per cent.
U. Potassii Iodidi.	potassium carbonate, benzoated lard	10 ..
U. Cantharidis.	benzoated lard	10 ..
U. Capsici.	spermaceti, olive oil . .	20 ..

Oleates of **Mercury** and of **Zinc** are official, and are prepared by double decomposition between a salt of the metal and oleate of soda in solution.

The **Soap (Sapo)**.—There are three official **Sapones** :—

Sapo Durus, made by interaction between sodium hydroxide and olive oil; **Sapo Mollis**, made similarly from potassium hydroxide and olive oil; and **Sapo Animalis**, made from sodium hydroxide and a purified animal fat, consisting mainly of stearin. They all contain some free alkali, but no free oil or fat. They are soluble in ninety per cent. alcohol, and in water except *sapo animalis*, which is sparingly soluble in cold water.

Pastes.—Where fats are unsuitable for skin applications, bases consisting of gelatine, glycerine, and water may be employed. A paste consisting of equal parts of these is of a firm consistence, and may be made softer by diminishing the proportion of gelatine and increasing that of water. Such a paste mixes with water, which is of advantage, for instance, when there is much watery exudation from the skin.

The **Plaster (Emplastrum)** is a preparation intended for external application, consisting of active medicinal substances incorporated with an adhesive basis, composed of various oleates or soaps. Plasters may be spread upon leather, cloth, or other material, being melted by heat when necessary, and should adhere to the skin when applied to it.

The plaster masses are made by melting the various ingredients together, mixing them thoroughly, and allowing the mass to cool.

Resin is an ingredient often employed to increase the adhesiveness, and to produce slight irritation and thereby hasten the absorption or penetration of some active ingredient.

Practice.

In order to appreciate the consistence of a plaster, dispense two plasters, one of which may be spread without the application of heat, and another which requires to be melted before being spread.

The quantity of plaster required to cover each square inch of surface is from ten to twenty grains.

Dispense the following prescription :—

Mr A. B. *Edinburgh University,*
June 1904.

Recipe,

Emplastrum Cantharidis, quantum sufficiat ut fiat emplastrum formæ et magnitudinis ut applicetur post aurem sinistram.

Signetur.

Applicandum ut dictum usque ad vesicationem.

Directions.—Draw accurately, in the middle of a piece of white paper, the shape of the skin which is not covered with hair, behind the left ear, on which it is proposed to apply the blister. This drawing is, of course, made on the prescription by the prescriber. With scissors cut out this central portion, and reject it. Lay the remainder, which gives the size and shape required, on the material on which the plaster is to be spread (sticking plaster, or brown paper, or thin leather). Care must be taken that it is placed in the correct position. By means of the spatula spread a piece of cantharides plaster, of the size of the end of a finger, over the exposed portion. When smoothly spread, strip off the shape. With scissors cut a margin one-eighth of an inch round the plaster. Write the directions.

To spread a plaster by the aid of heat.

Dispense the following prescription :—

Mr A. B. *Edinburgh University,*
June 1904.

Recipe,

Emplastrum Plumbi quatuor uncias longe et tres uncias late.

Signetur.

Applicandum more dicto.

Directions.—Take a piece of white paper (about six inches by four inches), to be used as the shape. Fold it in half along its long diameter, and fold it again in half along the shorter diameter. From the centre point of

the paper measure two inches along the longer, and one inch and a half along the shorter, margin. Complete this rectangle, and cut it out with scissors. Lay the shape so obtained on a sheet of brown paper. Take two drachms of lead plaster (*i.e.* ten grains for each square inch), and lay it as near to the free edge of the plaster tray as possible. Hold this over the plaster paper, and melt the plaster by placing the hot plaster iron upon it. The iron is heated by the flame of the lighted gas which passes through it. When all the melted plaster is on the paper, spread it by means of the plaster iron, being careful to spread from the edges to the centre. When finished, lay the iron on the tray. Remove the shape. Cut the paper, leaving a half inch margin round the plaster.

Where organic substances are contained in the plaster they will be destroyed by too high a temperature.

Of the official plasters, three are used mainly as bases, or for protective purposes—*viz.*, **E. Plumbi**, prepared by boiling together lead oxide and olive oil with water; **E. Resinæ**, containing lead plaster, resin, and hard soap, melted and mixed together; and **E. Saponis**, containing the same ingredients but with less resin and more soap.

Those containing active substances are:—

NAME.	INGREDIENTS.	STRENGTH.
E. Belladonnæ.	Liq. ext. of belladonna resin plaster.	0·5 per cent. alka- loids.
E. Opii.	Opium resin plaster.	1 in 9.
E. Cantharidis.	Cantharides soap plaster, wax, lard, resin.	35 per cent.
E. Calefaciens.	Cantharides soap plaster, wax, resin, and resin plaster.	4 ..
E. Menthol.	Menthol wax, resin.	15 ..
E. Hydrargyri.	Mercury sulphur, olive oil, lead plaster.	33 ..
E. Ammoniaci cum Hydrargyro.	Mercury, ammoniacum . sulphur, olive oil.	20 per cent. Hg.
E. Plumbi Iodidi.	Lead iodide lead plaster, resin.	10 per cent.
E. Picis.	Burgundy pitch, frank- incense, resin, wax, olive oil.	...

The **Paper (Charta)**.—A substance may be mixed with solution of india-rubber and spread on cartridge paper. The only official paper—viz., **charta sinapis** consists of seventy-five grains of powdered mustard (from which the fixed oil has been removed by percolation with benzol) mixed with five drachms of india-rubber solution, spread by means of a suitable brush over thirty square inches of cartridge paper.

VIII. SUPPOSITORIES, PESSARIES, AND BOUGIES.

Substances which are to be inserted into the rectum, vagina, urethra, or ear may be combined with a fatty substance, which must be hard enough, therefore, to withstand considerable pressure at the ordinary temperature, and must melt readily at the body temperature. A suitable basis possessing these properties is **oil of theobroma**; glycerine with gelatine is a softer basis; or a basis consisting of hard soap with glycerine and starch may be used. Other fats having a higher melting point may be added to oil of theobroma, to increase the consistency when the atmospheric temperature is high.

The **Suppository (Suppositorium)** is a solid, conical preparation of a size and shape suitable for insertion into the rectum by the anal orifice. The usual weight of a suppository is fifteen grains; when heavy substances are present, its weight may reach thirty grains. In order to appreciate the size and consistence of suppositories, dispense six fifteen-grain suppositories each containing one grain of phenol.

Practice.

Dispense the following prescription:—

<p>Mr A. B. Recipe,</p> <p style="padding-left: 2em;">Acidi Carbolici . . . granum. Cetacei . . . grana duo. Olei Theobromatis . . . grana duodecim.</p> <p style="padding-left: 2em;">Misce ut fiat suppositorium et mitte talia sex.</p> <p>Signetur. Unum pro re nata.</p>	<p><i>Edinburgh University,</i> <i>July 1902.</i></p>
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Directions.—Boil some water in the decoction pot, and pour the boiling water into the lower chamber of the

suppository bath. In order to allow for the material which cannot be removed from the utensils, weigh out enough of each ingredient for seven suppositories. Weigh fourteen grains of spermaceti, cut it into small pieces, and place it in the upper chamber of the bath. Weigh eighty-four grains of oil of theobroma, cut it into small pieces, and melt it with the spermaceti. Weigh seven grains of carbolic acid and dissolve it in the melted oils. The suppository bath should be, for the next part of the process, at such a temperature that the lower chamber can be held comfortably on the hand. If the melted oils are too fluid, the mixture cannot be well made. If the bath is too hot, it may be cooled by pouring away some of the hot water, or pouring a little cold water into the lower chamber. Take a mould of suitable size, open it, rub the interior of each division with a little soap liniment on the point of the finger, and close it. When the suppository mass is sufficiently cool, pour it in six equal quantities into the six divisions. The suppository will fill a fifteen-grain mould. Allow the suppositories to cool until they are hard, which usually takes about one hour. If the mass solidifies before it is all poured into the mould, it must be melted again by pouring warm water into the lower chamber.

In making suppositories which contain ingredients which would be decomposed by heat, the mass must be divided into the number of suppositories ordered, and these are shaped by compressing them in a suitable mould.

When the ingredient is not soluble completely in the oils, it should be finely powdered and made into an ointment with half of the melted oils. This may then be stirred with the remainder of the oils in the bath until the mass is of suitable consistence to pour into the moulds.

The official suppositories (seven) are made with oil of theobroma, and are of the weight of fifteen or sixteen grains each, with the exception of those of glycerine, which are compounded with gelatine, and may be of the weight of thirty, sixty, or one hundred and twenty grains each.

OFFICIAL SUPPOSITORIES.

NAME.	INGREDIENTS.	STRENGTH.
Suppositoria Belladonnæ.	Alc. Ext. of belladonna oil of theobroma.	$\frac{1}{10}$ gr. of alkaloids in each.
S. Morphinæ.	Morphine Hydro- chloride. oil of theobroma.	$\frac{1}{4}$ gr. in each.
S. Plumbi Composita.	Opium Lead acetate oil of theobroma.	1 gr. ,, 3 gr. ,,
S. Acidi Carbolici.	Phenol white wax. oil of theobroma.	1 gr. ,,
S. Iodoformi.	Iodoform oil of theobroma.	3 gr. ,,
S. Acidi Tannici.	Tannic acid oil of theobroma.	3 gr. ,,
S. Glycerini.	Glycerine gelatine. water.	70 per cent.

Pessaria (Pessus)—Pessaries.—Preparations similar in consistence, but differing in size, may be ordered for vaginal applications, and are prepared by making the mass as above described, and pouring it into moulds constructed to hold one hundred and twenty grains of oil of theobroma.

Bouginaria.—**Bougies** are also similar in consistence, basis, etc., but are from two to three inches in length, and about three-sixteenths of an inch in diameter. They are intended for insertion into the urethra, ear, or nose. There are no official pessaries or bougies.

SECTION VI.

CHOICE OF APPROPRIATE FORMS FOR PRESCRIBING.

WHEN choosing appropriate forms in which to prescribe medicinal substances attention must be paid to the pharmacological action (*e.g.*, the local action, the rapidity of absorption required, etc.), the physical characters, the chemical reactions, and the doses of the substances.

Thus **inorganic salts** and **oxides** may be ordered for internal administration in the form of powders if the salt is permanent and its dose is not too large; in pills when the dose is sufficiently small; in mixtures (in solution or suspension); in lozenges, or in confections.

Inorganic acids are usually prescribed in mixtures; **organic acids** in powders, pills, or mixtures.

Organic substances of the aromatic series (benzene derivatives) and of the fatty series (alcohols, ethers, paraffins, etc.) differ widely from each other in their physical characters. Those resembling inorganic salts must, of course, be prescribed in a manner similar to them. Many of the active principles of animal and vegetable substances are members of these series, and must be treated like them.

Of these active principles of plants the more important are alkaloids, neutral principles, glucosides, resins, fixed and volatile oils, oleo-resins, gum-resins, gums, and oleo-gum-resins.

Alkaloids are weak organic bases, containing nitrogen, belonging to the group of compound ammonias. They are either solid, in which case they are usually crystalline and consist of C, H, N, and O, and belong to the group of *amides*, or they are liquid and volatile, consist of C, H, and N, and are classed with the *amines*. They are insoluble or sparingly soluble in water, but are soluble in alcohol, ether, chloroform, oils, benzene, etc.

termed a **glucoside**. They are not, as a rule, precipitated by the alkaloidal reagents. They may be prescribed in a manner similar to that for alkaloids.

OFFICIAL NEUTRAL PRINCIPLES.

NAME.	DOSE.	NAME.	DOSE.
	Grains.		Grains.
Picrotoxin	$\frac{1}{100}$ to $\frac{1}{25}$	Aloin	$\frac{1}{2}$ to 2
Elaterin	$\frac{1}{40}$ „ $\frac{1}{10}$	Santonin	2 „ 5
Chrysarobin	$\frac{1}{6}$ „ $\frac{1}{2}$	Salicin	5 „ 20

Fixed oils are composed of salts of the higher fatty acids (oleic, palmitic, stearic, etc.) with glyceryl. They are viscid fluids, lighter than water, with little colour, odour, or taste, when pure, insoluble in water, but very soluble in ether, chloroform, benzol, and volatile oils. They are less soluble in alcohol; varying from slight solubility (cod liver oil), to one in one (croton oil).

When placed on paper they leave greasy stains which do not volatilise if heated. They decompose when heated strongly.

When heated with alkalis or their carbonates, or with metallic oxides they form salts (soaps, plasters, *q.v.*), with the liberation of glycerine. Some when exposed to the atmosphere dry, form a transparent varnish (e.g., *linseed oil*); others remain fluid but decompose with liberation of free fatty acids (becoming “rancid”).

They may be prescribed alone, in pills, in capsules, in mixtures (emulsions), ointments, injections, and liniments.

OFFICIAL FIXED OILS.

NAME.	DOSE.
Oleum crotonis	$\frac{1}{2}$ to 1 ℥.
Oleum morrhuæ	1 to 4 dr.
Oleum ricini	1 to 8 dr.
Oleum amygdalæ	} ad libitum
Oleum olivæ	
Oleum lini	} used as bases
Oleum theobromatis	

The **Volatile** or **Essential oils** have very few characteristics in common with fixed oils. They are fluids more viscid than water, some composed of hydrocarbons of the terpene series

($C_{10}H_{16}$), others of oxidised hydrocarbons of the nature of phenols, alcohols, aldehydes, ethers, ketones, etc., while some contain sulphur instead of oxygen.

Nearly colourless when pure, they tend to become darker with age, and in some cases resinify, *i.e.*, form oxidised products of the nature of acids (resins). Each has a characteristic odour and a somewhat burning taste, afterwards leaving a sensation of coolness.

They are sparingly **soluble** in water (but sufficiently so to impart their distinctive odour to it), very soluble in alcohol, ether, chloroform, fixed oils, benzene, etc., and they are inflammable. They are volatile and leave oily stains on paper which disappear when heated unless resin is present; this, however, can be dissolved by alcohol.

As they are not oleates, etc., of glyceryl, they cannot, of course, form soaps with alkalis, nor can they become rancid. Some of them are products of the decomposition brought about by the action of ferments upon glucosides or other substances occurring in plants (*e.g.*, the volatile oil of bitter almonds, and that of mustard).

Volatile oils may be given alone, on sugar, in capsules, in pills, in mixtures (watery or alcoholic solutions or emulsions), inhalations, ointments, or liniments.

The official volatile oils with their doses are:—

Ol. anethi.	Ol. limonis.
Ol. anisi.	Ol. menthæ piperitæ.
Ol. anthemidis.	Ol. menthæ viridis.
Ol. cajuputi.	Ol. myrasticæ.
Ol. carui.	Ol. pimentæ.
Ol. caryophylli.	Ol. pini.
Ol. cinnamomi.	Ol. rosæ.
Ol. coriandri.	Ol. rosmarini.
Ol. eucalypti.	Ol. santali.
Ol. juniperi.	Ol. terebinthinæ.
Ol. lavandulæ.	

The doses of these are from one-half to three minims.

Oleum copaibæ)	5 to 20 minims.	
Oleum cubebæ)		
Oleum santali	5 to 30	„
Oleum terebinthinæ	2 to 10	„
		and 3 to 4 fluid drachms as an anthelmintic.

Oleum sinapis volatile used externally.

Oleum Cadinum—an oily liquid obtained by the destructive

distillation of the wood of *Juniperus Oxycedrus*—may be classed among these oils. It is used chiefly externally.

Stearoptenes.—There are also three concrete or solidified volatile oils called stearoptenes which have most of the characteristics of the group. They all contain oxygen, and are *Menthol* and *Thymol* (given in doses of from one-half to two grains), and *Camphora* (two to five grain doses). They may be prescribed in much the same way as the fluid volatile oils. They become fluid when mixed with phenol, some of its derivatives, or with each other.

Resins are complex oxidised products of the hydrocarbons possessing generally the characteristics of acids or of anhydrides. They are solid substances, brittle, possessing usually a faint but characteristic odour, and having an irritating and acrid or burning taste. They are insoluble in water, very soluble in alcohol and chloroform; some are soluble in ether (*e.g.*, scammony resin), some insoluble (*e.g.*, jalap resin). They are soluble in alkaline solutions, in some cases forming salts, but are precipitated by acids.

They may be prescribed in powders, pills, mixtures (suspended), lozenges, and plasters.

The official resins are :—

Resina podophylli (dose one-quarter to one grain),
 R. jalapæ (two to five grains),
 R. scammonii (three to eight grains),
 R. guaiaci (five to fifteen grains), and
 Resina (from turpentine).

Oleo-resins are composed of resins dissolved in volatile oils, and their physical properties depend on the relative proportion of these ingredients. When the resinous acid is either **benzoic acid** or **cinnamic acid** the oleo-resin is called a **balsam**.

The official oleo-resins are :—

Copaiba (dose one-half to one fluid drachm),
 Balsamum peruvianum (five to fifteen minims),
 Balsamum toltitanum (five to fifteen grains),
 Styra præparatus and Terebinthina canadensis not
 generally given internally (dose five to twenty
 grains).

Gums are of two kinds, the one soluble in water (**arabin**) and composed of arabic acid in combination with calcium, potassium, and magnesium, the other insoluble in water (**bassorin**), which, however, forms a gelatinoid mass with water. They are insoluble in ninety per cent. alcohol.

Tragacantha is mainly composed of bassorin (sixty to seventy per cent.).

Acacia gummi consists mainly of arabin. Arabin in concentration forms insoluble compounds with many of the heavy metals, is decomposed by acids (losing its peculiar adhesive properties), and forms a jelly with some salts—borax for example.

Eucalypti gummi (a red gum) contains eighty to ninety per cent. of soluble gum which is almost entirely soluble in ninety per cent. alcohol. It is given in doses of from two to five grains.

The **Gum-resins** are exudations consisting of gums and resins and differ from the simple resins in their behaviour with water. The gum forms a mucilage which, to a certain extent, suspends the resin. The **Oleo-gum-resins** are combinations of the three substances, gum, resin, and volatile oil.

The official substances belonging to these groups are :—

- Cambogia (dose one-half to two grains),
- Scammonium (five to ten grains),
- Asafetida and Ammoniacum (five to fifteen grains), and
- Myrrha (ten to thirty grains).

These may be prescribed similarly to resins.

COMBINATION IN PRESCRIPTIONS.

It is not always possible or advisable to prescribe single substances unmixed with others; and the ancient instruction that the prescription should be composed in accordance with the formula "**curare, cito, tute et jucunde,**" or, in other words, that it should consist of a "**basis, adjuvant, corrective and vehicle,**" still possesses force.

Two substances often produce a more desirable effect when they are administered together in small doses than would a larger dose of either of them given alone. Thus two hypnotic substances may be preferred to a larger dose of either. Two or more purgative substances, each acting on a different part

or function of the intestine, may be preferable to a larger dose of any one of the ingredients of the prescription.

Again, many substances possess secondary undesirable actions which require to be counteracted by a corrective. Such are the griping pains due to irregular peristaltic contractions of the intestines produced by many purgatives. They may be corrected by the administration of anti-spasmodic remedies such as the volatile oils.

The undesirable action may be an unpleasant taste, which is experienced most strongly when a substance is administered either in concentration or in solution in water. The appropriate corrective in these cases, therefore, is either a diluent or a more viscid solution, or a substance with a stronger and pleasanter flavour.

Flavouring agents.—These are more often of advantage when prescribing powders, mixtures, gargles, and mouth washes, and in those ointments which are intended for application to the head or face.

For flavouring **powders**, sugar or chocolate or compound powder of almonds is useful, and compound cinnamon powder is often employed where a pleasant odour is required. Powdered nutmeg, cloves, and cardamom seeds are also used for the same purpose.

Sugar of milk is a useful diluent, but possesses comparatively little sweetness.

The usual sweetening agents for **mixtures** are *syrup* itself, or one of *official syrups* (v. page 39).

Chloroform water or *glycerine* may be used but are less agreeable.

The liquid extract of liquorice, which contains a sweet principle, *glycyrrhizin*, is largely used to conceal unpleasant tastes. It is, however, precipitated from its solution by acid substances, and by many salts both of metals and of alkaloids, if they are in concentrated solution.

Some of the more agreeable *volatile oils* may be used where an aromatic flavour is wanted. Thus those of *coriander* and of wild cinnamon (*oleum cassiæ*, N.O.) are often used to conceal the taste of fixed oils in emulsions.

The *waters of the volatile oils* (v. page 38) are used where there is required an aromatic substance as well as a diluent.

Preparations of *orange peel* are favourite flavouring agents

for mixtures, either *syrup of orange* or *tincture of orange*, or *aromatic syrup* (orange peel and cinnamon). *Syrup of lemon*, from lemon peel and lemon juice, is also frequently ordered, especially where acidity is required, owing to the citric acid which it contains derived from the juice. *Citric acid* and *tartaric acid* are the acids which are most agreeable.

Sweetness and acidity form a combination pleasanter than sweetness and bitterness, but the viscosity of a syrup has some effect in rendering bitterness less perceptible.

Lotions are generally scented with either *orange flower water*, *elder flower water*, *rose water*, or with *eau-de-Cologne* (*spiritus Coloniensis*, N.O.).

Ointments may be scented with any of the fragrant volatile oils such as those of lavender or of rose; while for ointments applied to the head either *oil of rosemary*, or *oil of bergamot* may be preferred.

Colour may be imparted to **mixtures** by means of either *compound tincture of lavender*, *compound tincture of cardamoms*, *syrup of rose* (petals), *syrup of poppy petals* (*s. rhæados*), *tincture of cochineal* (*t. cocci*), *tincture of saffron* (*t. croci*), or *decoction of logwood* (v. page 37).

The appearance given to a mixture by these preparations is a somewhat bright red colour—darker if alkaline substances are present. Alkaline solutions of logwood are, however, violet, and of poppy petals green.

Lotions and **ointments** containing white substances may be rendered less conspicuous if coloured with either *calamine* or *peroxide of iron*.

SECTION VII.

INCOMPATIBILITY.

INCOMPATIBILITY may be considered as of three kinds : physical, chemical, and pharmacological.

1. **Physical incompatibility** is the condition which occurs when the substances ordered are physically unsuitable to be dispensed in the form of prescription chosen.

2. When substances are prescribed together which act **chemically** on one another, and produce new substances which have a different and undesirable pharmacological action, or are insoluble, or volatile, they are said to be **chemically incompatible**. Of course, a chemical action may take place, producing new substances which are physically incompatible with the form of the prescription chosen.

3. When two substances are prescribed together whose pharmacological actions on the body are opposed to each other, the combination is said to be **pharmacologically incompatible**. Examples : *strychnine* with *bromide of potassium* ; *catechu* with *jalap* ; or *atropine* with *physostigmine*.

The first and second groups only will be dealt with here, and the examples of erroneous prescriptions which follow, many of which have occurred in actual practice, should be rewritten, carrying out the intention of the prescriber, but with the errors corrected.

Physical Incompatibility.

Cases of physical incompatibility may be arranged in the following groups :—

1. Where appropriate preparations of substances are not used.
2. Where an appropriate consistence is not attained ; as :—
 - (a) Where fluid or moist substances are ordered in powders.
 - (b) Where dry substances are ordered as moist excipients in pills.

(c) Where oils or fats of too high or too low melting points are ordered in ointments, suppositories, etc.

3. Where more of a soluble substance is ordered than the amount of solvent will dissolve.

4. Where a soluble substance is precipitated from its solution by the addition of another unsuitable solvent.

5. Where insoluble substances are ordered without a suspending agent; and

6. Where oils are ordered in aqueous mixtures without an emulsifying agent.

The following prescriptions (Nos. 1 to 15) illustrate cases of physical incompatibility :—

1. Recipe,

Tincturæ Ferri Perchloridi	.	ʒij.
Acidi Arseniosi . . . . .	.	ʒj.
Tincturæ Cardamomi Compositæ		ʒj.
Infusi Quassiæ	ad	ʒiij.

Misce ut fiat mistura.

Signetur.

Cochleare parvum sumendum ter in die cum cibo.

2. Recipe,

Ferri et Quininæ Citratis	.	ʒjss.
Nucis Vomicae . . . . .	.	ʒij.
Infusi Calumbæ	ad	ʒiv.

Solve et misce ut fiat mistura.

Signetur.

Drachmæ duæ ter in die sumendæ semihorā ante cibum.

3. Recipe,

Potassii Bromidi . . . . .	.	ʒij.
Extracti Belladonnæ Alcoholici	.	ʒj.
Syrupi Aromatici . . . . .	.	ʒjss.
Aquæ Menthæ Piperitæ	ad	ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Æger capiat cochleare magnum bis in die.

Examples of prescriptions in which the expected consistency is not attained :—

4. Recipe,

Acidi Lactici	gr.	ij.
-------------------------	-----	-----

Fiat pulvis et mitte tales vj.

Signetur.

Unus sumendus ut dictum.

5. Recipe,

Potassii Acetatis ʒss.

Divide in xij pulveres.

Signetur.

Capiat unum ex aquæ cochleari magno quâque quartâ horâ.

6. Recipe,

Jalapæ Resinæ gr. ij.

Podophylli Resinæ gr. ʒ.

Extracti Aloes Barbadosensis . quantum sufficiat
ut fiat pilula. Mitte tales xij.

Signetur.

Capiat unum cras primo mane.

7. Recipe,

Zinci Oxidi,

Acidi Borici ana ʒss.

Ceræ Albæ ad oz. 1.

Misce ut fiat unguentum.

Signetur.

Applicetur ad brachia quater vel quinquies in die ut dictum.

8. Recipe,

Acidi Tannici ʒj.

Olei Theobromatis ʒss.

Cetacei ʒj.

Misce secundum artem et divide in sex suppositoria.

Signetur.

Unum injiciatur si sanguis appareat.

For No. 6, see page 49 ; for Nos. 7 and 8, see page 87.

Examples of prescriptions in which more of a substance is ordered than the solvent will dissolve, or in which a soluble substance is precipitated from its solution by the addition of an unsuitable solvent.

9. Recipe,

Liquoris Trinitrini,

Aquæ Destillatæ ana ʒss.

Misce.

Signetur.

Guttæ duæ ex aquâ omni quartâ horâ.

10. Recipe,

Potassii Chloratis ʒiv.

Glycerini ʒvj.

Aquæ ad ʒvj.

Solve ut fiat gargarisma.

Signetur.

Utatur gargarismatis unciâ post quemque cibum.

11. Recipe,

Potassii Chloratis ̄j.
 Tincturæ Pyrethri ̄j.
 Aquæ Rosæ ad ̄vj.

Solve et misce ut fiat collutorium.

Signetur.

Ut dictum.

*chlorides of the
metals often ve
sol. in ag.
nitrate salts
in ag. Ph
Salts are u*

12. Recipe,

Ferri et Quininæ Citratis ̄j.
 Chloroformi ̄j.
 Infusi Quassiaæ ad ̄vj.

Solve ut fiat mistura.

Signetur.

Cochleare magnum ex aquæ cyatho magno ter in die post cibos.

13. Recipe,

Magnesii Sulphatis ̄jss.
 Tincturæ Zingiberis,
 Tincturæ Aurantii ana ̄j.
 Aquæ ad ̄iij.

Solve et misce ut fiat mistura.

Signetur.

Cochleare medium sumendum primo mane diebus alternis.

For No. 9, see page 81; for Nos. 10, 11, 12, and 13, see page 15.

Examples of prescriptions in which insoluble solids are ordered without a suspending agent, or in which insoluble fluids are ordered without an emulsifying agent.

14. Recipe,

Tincturæ Opii ̄iij.
 Tincturæ Cannabis Indicæ ̄iv.
 Aquæ Destillatæ ad ̄iv.

Misce ut fiat mistura.

Signetur.

Cochleare medium horā somni.

*resin mist.
ag. - misc
ppt out*

15. Recipe,

Copaibæ ̄iij.
 Spiritus Juniperi ̄iv.
 Infusi Caryophylli ̄j.
 Aquæ Menthæ Piperitæ ad ̄vj.

Misce. Fiat mistura.

Signetur.

Semiuncia quartis horis.

16. Recipe,

Olei Terebinthinæ ℥iij.
Aquam ad ℥iv.

Misce. Fiat mistura.

Signetur.

Coch. mag. om. 4tis h.

For No. 14, see page 102; for No. 15, see page 102; and for No. 16, see page 101.

Practice.

In a test-tube take five drops of liquor trinitrini, add five drops of water, and then add more water till the precipitate is dissolved, observing the amount which is necessary.

Weigh five grains of potassium chlorate, place it in a test-tube and add forty minims of water. Heat it until it is dissolved. Divide it into two equal portions. Allow one to cool, and observe the crystallisation. To the other add its own bulk of water, cool it by pouring water over the test-tube, and add rectified spirit until a precipitate is formed. Observe the amount of alcohol added.

In a test-tube dissolve some resin in ninety per cent. alcohol. (1) Pour a drop or two of the tincture thus made into some water in another tube. To this add liquor potassæ or liquor ammoniæ until the precipitate is dissolved. Add dilute hydrochloric acid until the resin is again precipitated. (2) Pour a few drops of the tincture into water containing some mucilage of acacia.

Chemical Incompatibility.

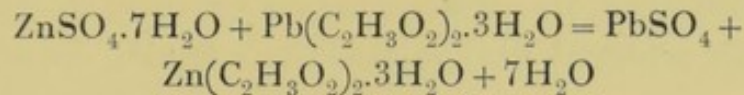
Substances which are prescribed together, and which act chemically on each other, may produce new substances which are physically unsuited to the form of prescription chosen. Two solid substances ordered as a dry powder may interact to produce a moist or fluid substance, or, on the other hand, two soluble substances in solution may produce an insoluble precipitate.

Chemical action, however, may be desired as in the production of ferrous carbonate in *pilula ferri*, or in the production of

effervescence when *tartaric acid* and *bicarbonate of sodium* are ordered to be mixed. Potassium-mercuric-iodide may be ordered by prescribing solutions of *corrosive sublimate* and *potassium iodide*, the latter in sufficient quantity to dissolve the red mercuric iodide which is formed at first.

1. Interaction between Solid Substances.

When two substances containing water of crystallisation are rubbed together, liberation of that water takes place if the new compounds formed have together less water of crystallisation, as may be seen in the following equation :—



If the water of crystallisation be previously driven off, the powders will, of course, remain dry.

Examples :—

17. Recipe,

Zinci Sulphatis	5ijss.
Plumbi Acetatis	5ij.

Misce ut fiat pulvis.

Signetur.

Asperge pulverem in partem affectam.

18. Recipe,

Aluminis	5ij.
Plumbi Acetatis	5ijss.

Misce ut fiat pulvis.

Signetur.

Applicetur more dicto.

Two solid substances which act on each other and produce liquid substances must not be prescribed together to form a dry powder. If ordered in pills they will require an absorbent excipient. Such substances, which being probably in a state of unstable equilibrium, tend to form moist or fluid compounds, are phenol and its derivatives (salol, salicylic acid, resorcin, and some naphthols), acetanilide, phenazonum, phenacetin, exalgin, and chloral hydrate. So also are the concrete volatile oils, camphor, thymol, and menthol.

A convenient form of recording these reactions is provided by the following table, which contains the most important of

these substances, in which L = liquid; DP = damp powder; and P = powder.

	Camphor.	Thymol.	Menthol.		Phenol.	Chloral Hydrate.	Salol.	Thymol.	Camphor.	Menthol.
Camphor	. —	L	L							
Thymol	. L	—	L							
Menthol	. L	L	—							
Phenol	. . —	L	L	L	L	L	L	L	L	L
Chloral Hydrate	L	—	L	L	L	L	L	L	L	L
Salol	. . L	L	—	L	L	L	L	L	L	P
Exalgin	. . L	L	L	L	L	L	L	L	P	L
Phenazone	. . L	P	DP	L	L	L	L	L	P	P
Acetanilide	. . L	DP	P	L	L	L	L	L	P	P
Phenacetin	. . L	L	P	L	L	L	L	L	P	P

Salicylic acid with exalgin produces a liquid.

Examples:—

19. Recipe,

Camphoræ	gr. iij.
Acidi Carbolicæ	gr. jss.
Extracti Gentianæ	gr. ss.

Misce ut fiat pilula, mitte tales vj.

Signetur.

Una quāque quartā horā post cibum.

20. Recipe,

Camphoræ	gr. xxx.
Menthol	gr. xx.

Misce ut fiat pulvis.

Signetur.

Pugillus applicetur ut dictum.

21. Recipe,

Phenazoni	gr. x.
Sodii Salicylatis	gr. xv.

Misce ut fiat pulvis, mitte tales xij.

Signetur.

Unus statim sumendus unusque quāque secundā horā.

In Nos. 19 and 20 a fluid is produced, and in No. 21 sometimes a damp powder.

Practice.

Mix together in a mortar the camphor and phenol of No. 19 and the zinc sulphate and lead acetate of No. 17 in the proportions expressed in the respective prescriptions.

2. Interaction between Substances in Solution.

The greatest number of incompatible prescriptions are produced by neglecting or ignoring chemical actions which may take place between substances in solution.

The following arrangement will be found convenient in classifying such actions :—

- (1) Where **acids** and **bases** are ordered together ;
- (2) Where there are **acids** together with **salts** of **weaker acids** ;
- (3) Where there are **bases** together with **salts** of **weaker bases** ;
- (4) Where **double decomposition** takes place between various **salts** ;
- (5) Where decompositions of greater complexity occur, generally with the liberation of **volatile substances** ;
- (6) Where **oxidation** or **reduction** takes place ; and
- (7) Where substances are formed which are very unstable.

I. Free Acids and Free Bases.

The action desired when free acids or bases are prescribed may be a pharmacological action, or they may be ordered as solvents, or for other pharmaceutical purposes, as, for example, the use of the alkalies as emulsifying agents.

Where the action of **acids** or **bases** is desired, they must not be mixed together if the resulting salt has a different action.

A simple experiment may be performed illustrating such a change in action unaccompanied by obvious physical alteration. Measure thirty minims of liquor potassæ, taste it, and add dilute hydrochloric acid until the solution is neutral to test paper. Observe that the taste has altered, that no visible physical alteration has occurred, but that the pharmacological action as exemplified by the taste of the salt formed differs from that of both the ingredients.

The combination of acids with bases is permissible where the salt formed has a similar action to that of one of the ingredients.

Examples of such permissible combinations :—

22. *Recipe,*

Quininæ	ʒj.
Acidi Hydrochlorici diluti	ʒij.
Aquæ Destillatæ	ad ʒvj.

Solve ut fiat mistura.

Signetur.

Cochleare magnum ter in die ante cibum.

23. *Recipe,*

Liquoris Potassæ	ʒvj.
Acidi Salicylici	ʒij.
Tincturæ Aurantii	ʒj.
Aquæ Cinnamomi	ad ʒiv.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum sumendum omni sesquihorā ex aquā.

No 22 is an acid solution of hydrochloride of quinine; and No. 23 an alkaline solution of salicylate of potassium.

Examples of incompatibility :—

24. *Recipe,*

Tincturæ Guaiaci Ammoniatæ	ʒij.
Quininæ Sulphatis	gr. xxiv.
Acidi Sulphurici Diluti	ʒj.
Aquæ Destillatæ	ad ʒiv.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum quāque sextā horā sumendum.

25. *Recipe,*

Olei Morrhuæ	ʒjss.
Olei Cassiæ	ʒxij.
Liquoris Potassæ	ʒjss.
Liquoris Ferri Perchloridi	ʒj.
Aquæ Destillatæ	ad ʒvj.

Misce ut fiat emulsio.

Signetur.

Semiuncia ter in die cum cibo sumenda.

26. *Recipe,*

Bismuthi Subnitratis	ʒij.
Liquoris Potassæ	ʒj.
Glycerini Pepsini	ʒxij.
Mucilaginis Acaciæ	ʒiv.
Aquæ Destillatæ	ad ʒvj.

Misce ut fiat mistura.

Signetur.

Capiat cochleare magnum ter in die statim post cibum.

27. Recipe,

Acidi Nitrohydrochlorici Diluti .	̄iij.
Tincturæ Quassiæ	̄vj.
Spiritus Chloroformi	̄iij.
Potassii Bicarbonatis	̄j.
Aquæ Destillatæ	ad ̄vj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum ter in die sumendum semihorā ante cibum.

28. Recipe,

Linimenti Terebinthinæ Acetici .	̄ij.
Linimenti Camphoræ Ammoniaci	̄j.

Misce ut fiat linimentum.

Signetur.

Pro usu externo more dicto.

In No. 24 the acid and the base are present as solvents, which action is destroyed by neutralisation of each by the other. In No. 25 there is free acid with an alkaline emulsifying agent. In No. 26 refer to the composition of the glycerine, see p. 48. In No. 27, though there is no free base, it is convenient to consider the alkaline carbonates and bicarbonates as alkaline bases, as they possess many actions similar in character to those exerted by the alkaline bases. In No. 28 the neutralisation of the acid and the alkaline ingredients in the liniments has rendered them useless for the purpose of producing irritation.

II. Acids with Salts of Weaker Acids.

An acid must not be prescribed along with a salt of a much weaker acid, especially if the weaker acid is so sparingly soluble that it will separate as a precipitate, or is so unstable that it decomposes when liberated in solution, with or without the formation of volatile or insoluble decomposition products.

When an acid is mixed with a salt in solution, the salt is always more or less acted upon, with liberation of its acid; and the extent to which this takes place is greater the stronger the added acid is in comparison with that liberated. If the liberated acid is exceedingly weak, or if it does not remain undecomposed and in solution, the original salt may be entirely changed by the addition of the strong acid.

Organic acids generally are very weak in comparison with

the "mineral acids" (hydrochloric, nitric, sulphuric), and their salts are almost completely decomposed when mixed with these latter acids.

Among those salts which yield volatile or easily decomposable acids are the carbonates and bicarbonates, acetates, sulphites, thiosulphates (hyposulphites), sulphides, nitrites, chlorates, and cyanides.

Salts yielding sparingly soluble acids are salicylates and benzoates.

The addition of an acid to a salt may also give rise to the formation of a sparingly soluble complex salt or acid salt, as in the precipitation of potassium bitartrate from a solution of the normal tartrate.

Official Preparations which contain Free Acid.

In addition to the acids and their preparations, the vinegars and the oxymels, the following also contain free acid:—

Syrupus Scillæ
 Syrupus Ferri Phosphatis
 Syrupus Ferri Phosphatis cum Quininā et Strychninā
 Syrupus Calcii Lactophosphatis
 Succus Limonis
 Liquor Morphinæ Hydrochloridi
 Liquor Morphinæ Acetatis
 Liquor Ferri Perchloridi
 Liquor Ferri Persulphatis
 Liquor Ferri Pernitratidis
 Liquor Ferri Acetatis
 Liquor Arsenici Hydrochloricus
 Liquor Hydrargyri Nitratis Acidus
 Infusum Rosæ Acidum
 Infusum Cinchonæ Acidum
 Glycerinum Pepsini
 Linimentum Terebinthinæ Aceticum
 Spiritus Ætheris Nitrosi
 Liquor Ethyl Nitritis } Unless freshly made

The following also contain free acid, or yield it in presence of water: the effervescing salts, citrate of caffeine, and subnitrate of bismuth.

Examples :—

29. Recipe,

Spiritus Ammoniae Aromatici,		
Syrupi Tolutani . . .	ana	ʒvj.
Syrupi Scillae . . .	.	ʒj.
Infusi Senegae . . .	ad	ʒvj.

Misce ut fiat mistura.

Signetur.

Cochleare magnum ex aquae cyatho vinario ter in die.

30. Recipe,

Sodii Salicylatis . . .	.	ʒij.
Quininæ Sulphatis . . .	.	ʒj.
Acidi Sulphurici Diluti . . .	.	ʒjss.
Aquæ Chloroformi . . .	ad	ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Capiat semiunciam quaque tertiâ horâ donec febris subsidat.

31. Recipe,

Ammonii Benzoatis . . .	.	ʒjss.
Tincturæ Hyoseyami . . .	.	ʒiij.
Infusi Rosæ Acidi . . .	.	ʒij.
Aquæ Destillatæ . . .	ad	ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum horâ decubitus sumendum.

32. Recipe,

Tincturæ Rhei Compositæ . . .	.	ʒiij.
Potassii Bicarbonatis . . .	.	ʒij.
Syrupi Limonis . . .	.	ʒjss.
Aquæ Menthæ Piperitæ . . .	ad	ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare medium ex aquâ ter in die sumendum.

33. Recipe,

Olei Ricini . . .	.	ʒj.
Mucilaginis Acaciæ . . .	.	ʒij.
Infusi Rosæ Acidi . . .	.	ʒj.
Aquæ . . .	ad	ʒiv.

Misce ut fiat emulsio secundum artem.

Signetur.

Cochlearia magna duo hac vespere sumenda.

34. Recipe,

Potassii Acetatis . . .	5ij.
Liquoris Ammonii Acetatis . . .	3ij.
Acidi Sulphurici Aromatici . . .	3j.
Infusi Aurantii . . .	ad 3vij.

Solve et misce ut fiat mistura.

Signetur.

Capiat unciam quāque horā quartā.

35. Recipe,

Bismuthi Subnitratis . . .	3ss.
Sodii Carbonatis . . .	3ijss.
Pulveris Tragacanthæ Compositi . . .	3jss.
Aquæ Anethi . . .	ad 3vij.

Misce ut fiat mistura.

Signetur.

Semiuncia sumenda quater in die ante cibos.

In No. 29 observe the composition of the syrup of squill and that of the spirit (see pp. 39 and 42); in Nos. 31 and 33 that of the acid infusion; in No. 32 that of the syrup. In No. 33 the emulsion is destroyed owing to the decomposition of the mucilage (see p. 103).

In No. 35 there is liberation of carbon dioxide. If an insoluble salt of bismuth is required with an alkali, prescribe bismuth carbonate. If the acid salt of bismuth is required, it should not be combined with an alkali or an alkaline carbonate.

For other prescriptions illustrating similar reactions, see Nos. 40 and 53.

Practice.

In test-tubes add a little dilute sulphuric acid to (*a*) a few particles of prepared chalk; (*b*) to some solution of potassium acetate; (*c*) to some solution of ammonium benzoate. Pour this last (benzoic acid precipitated) into two test-tubes, and add to the one liquor potassæ, and to the other liquor ammoniæ (formation of soluble benzoates).

III. Bases with Salts of Weaker Bases.

A base must not be combined with a salt whose base is weaker chemically than that which is added, especially if the weaker base is liberated as a gas or is precipitated in an

insoluble form. A free base and a salt may also result in the formation of a double basic salt which may be insoluble.

The strongest bases are the alkalies, and of these potash, soda, and lime are stronger than ammonia. Salts possessing an alkaline reaction resemble these bases in their effects, *e.g.*, carbonates and bicarbonates of the alkalies, borax, sodium phosphate, and soaps.

Among the weaker bases it should be observed that all the **oxides** and hydrates of the **heavy metals** are **insoluble**, and the greater number of the free **alkaloids** are also so sparingly soluble as to be often precipitated, when their salts are dispensed with stronger bases.

The alkaloids *caffeine* and *codeine*, being soluble in water (see p. 15), are not precipitated by alkalies; and colchicine, physostigmine and pilocarpine, also soluble in water, are not precipitated but are decomposed by alkalies.

Examples:—

36. Recipe,

Bismuthi Subnitrat̄is	.	.	ʒj.
Ammonii Chloridi	.	.	ʒij.
Liquoris Potassæ	.	.	ʒjss.
Mucilaginis Tragacanthæ	.	.	ʒiv.
Aquæ Cinnamomi	.	ad	ʒvj.

Misce ut fiat mistura.

Signetur.

Cochleare magnum ter in die sumendum.

37. Recipe,

Ferri et Quininæ Citrat̄is	.	.	ʒjss.
Syrupi Aromatici	.	.	ʒj.
Spiritus Ammoniāe Aromatici	.	.	ʒijss.
Aquæ Aurantii Floris	.	ad	ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum quater in die sumendum.

38. Recipe,

Liquoris Hydrargyri Perchloridi	.	.	ʒjss.
Liquoris Strychninæ Hydrochloridi	.	.	ʒij.
Spiritus Ammoniāe Aromatici	.	.	ʒj.
Aquæ Menthæ Piperitæ	.	ad	ʒvj.

Misce ut fiat mistura.

Signetur.

Cochleare medium ter in die sumendum.

39. *Recipe,*

Bismuthi Subnitratis	ʒiv.
Spiritus Ammoniae Aromatici	ʒj.
Chloroformi	ʒjss.
Pulveris Tragacanthae Compositi	ʒss.
Liquoris Strychninae Hydrochloridi	ʒij.
Aquae Menthae Piperitae	ad ʒvj.

Misce ut fiat mistura.

Signetur.

Cochleare medium sumendum omni sextā horā, phiala prius agitata.

40. *Recipe,*

Tincturae Ferri Perchloridi	ʒss.
Liquoris Calcis Saccharati	ʒss.
Misturae Cretae	ad ʒvj.

Misce ut fiat mistura.

Signetur.

Duo cochlearia magna sumenda ut opus sit.

In No. 36 potassium hydrate causes liberation of ammonia; it would also cause formation of oxide of bismuth. In No. 37 ammonia precipitates ferric hydrate as well as quinine. The alkaline carbonate in this prescription would cause somewhat similar precipitates. In No. 38 ammonio-mercuric chloride (white precipitate) is formed; an insoluble double salt of mercury with strychnine is precipitated in a similar manner by the corrosive sublimate, or strychnine may be precipitated by the ammonia. See also note to No. 37. In No. 39 the excess of chloroform dissolves the free strychnine formed, and falls to the bottom after each agitation. There is too little of the suspending agent. In No. 40 ferric hydrate is precipitated by lime, and in this prescription there is also free acid with an alkaline base and an alkaline carbonate. See also prescriptions Nos. 24, 25, and 26, in each of which there is a base and a salt of a weaker base.

Practice.

To illustrate these decompositions mix solutions of the following substances together in test-tubes:—

1. Solution of perchloride of iron; or acetate of lead; or nitrate of silver, with either solution of potash, lime, or ammonia.
2. Solution of an alkaloidal salt (cinchonine sulphate), and either liquor ammoniae or liquor potassae; and

divide this (precipitated cinchonine) into three portions. To one add a few drops of dilute nitric acid, to another add dilute hydrochloric acid, and to the third some dilute sulphuric acid, and compare the solubility therefore of the alkaloid with that of its salts.

3. To some fresh solution of the alkaloidal salt add some mercuric chloride solution.
4. To a solution of mercuric chloride add some solution of potash or of lime, and to another portion add solution of ammonia.

IV. Double Decomposition of Salts.

Two salts should not be prescribed together where double decomposition takes place with the formation of an insoluble salt.

The precipitates occurring most frequently in this group are those of insoluble salts of the heavy metals and those of insoluble salts of the alkaloids; the former are bulky, unsightly, or useless, the latter may be dangerous.

To avoid causing such precipitations the solubility or insolubility of the possible results of chemical combinations should be borne in mind (see pp. 16 and 17).

Examples illustrating the occurrence of insoluble salts of the heavy metals:—

41. Recipe,

Plumbi Acetatis . . .	gr. xxxij.
Tincturæ Opii . . .	ʒ xl.
Acidi Acetici Diluti . . .	ʒj.
Aquæ Destillatæ . . .	ad ʒviij.

Solve et misce ut fiat mistura.

Signetur.

Duo cochlearia magna sumenda omni horā secundā.

42. Recipe,

Tincturæ Ferri Perchloridi . . .	ʒv.
Liquoris Arsenicalis . . .	ʒijss.
Infusi Quassiæ . . .	ad ʒiv.

Misce ut fiat mistura.

Signetur.

Cochleare minimum ex aquæ cyatho vinario omnibus sextis horis.

43. Recipe,
 Liquoris Ferri Perchloridi ʒiij.
 Boracis ʒij.
 Aquæ Destillatæ ad ʒvj.

Solve ut fiat gargarisma.

Signetur.

Gargarisma adhibeatur ut dictum est.

44. Recipe,
 Argenti Nitratis gr. iij.
 Potassii Bichromatis gr. jss.
 Syrupi Aurantii ʒj.
 Aquæ Destillatæ ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum omni horâ sextâ sumendum.

45. Recipe,
 Aluminis ʒiij.
 Boracis ʒj.
 Aquæ Destillatæ ʒiv.

Solve et misce ut fiat lotio.

Signetur,

Lotio applicetur linteo in cervicem utrinque.

46. Recipe,
 Argenti Nitratis gr. j.
 Cocainæ Hydrochloridi gr. vj.
 Sodii Chloridi gr. xij.
 Aquæ Destillatæ ad ʒiv.

Solve et misce ut fiat lotio.

Signetur.

Guttæ. Una in oculum sinistrum instillanda mane ac nocte.

In No. 41 sulphate and meconate of lead are precipitated; in Nos. 42 and 43 insoluble salts of iron are thrown down by carbonate of potassium and borax respectively, and in No. 44 silver bichromate is precipitated; in No. 45 aluminium borate is precipitated, and in No. 46 silver chloride is precipitated.

Magnesium forms many insoluble double salts, and even magnesium sulphate and magnesium carbonate may together combine to form a hard insoluble mass.

Example :—

47. Recipe,

Magnesii Sulphatis . . .	• •	ʒiij.
Sodæ Tartaratæ . . .	• •	ʒjss.
Aquæ	• •	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Uncia sumenda pro dosi.

In this mixture large crystals of a double tartrate of magnesium separate out.

Practice.

In test-tubes mix together the following solutions :—

1. Acetate of lead and iodide of potassium.
2. Nitrate of silver and ferric chloride.
3. Mercuric chloride and dilute sulphuric acid.
4. Ferric chloride and borax.
5. Silver nitrate and potassium bichromate.

Precipitation of Insoluble Salts of Alkaloids.

For the general rules of solubility and insolubility of alkaloidal salts, see p. 17. In addition to these, it should be observed that **double iodides** and double bromides of alkaloids are **insoluble**, with the exception of those of *caffeine*.

It should be observed also that the so-called artificial alkaloids resemble the natural alkaloids in many of their chemical affinities. Some of them which are derivatives of aniline form strongly coloured compounds with oxidising and reducing agents. Thus **phenazonum** becomes red on the addition of ferric chloride or nitric acid to it, and green when nitrous acid or a nitrite is added to it. It, however, differs from alkaloids in being very soluble in water, but resembles them in many of its reactions; thus, for example, its salicylate is easily precipitated from acid solutions.

Examples illustrating the precipitation of insoluble alkaloidal salts :—

48. Recipe,

Liquoris Strychninæ Hydrochloridi .	ʒij.
Ammonii Bromidi	ʒiv.
Infusi Quassiae	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Capiat cochleare medium ter in die.

49. Recipe,

Liquoris Strychninæ Hydrochloridi .	ʒj.
Liquoris Arsenici Hydrochlorici .	ʒj.
Tincturæ Strophanthi	ʒ 48.
Potassii Iodidi	ʒj.
Aquæ Destillatæ	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum sumendum ter in die.

50. Recipe,

Liquoris Strychninæ Hydrochloridi .	ʒj.
Liquoris Arsenici Hydrochlorici .	ʒj.
Tincturæ Strophanthi	ʒ 48.
Potassii Iodidi	ʒj.
Aquæ Destillatæ	ad ʒiij.

Solve et misce ut fiat mistura.

Signetur.

Cochleare medium ter in die.

51. Recipe,

Liquoris Strychninæ Hydrochloridi .	ʒj.
Liquoris Arsenici Hydrochlorici .	ʒj.
Tincturæ Strophanthi	ʒ 48.
Potassii Iodidi	ʒj.
Aquæ Destillatæ	ad ʒjss.

Solve et misce ut fiat mistura.

Signetur.

Cochleare parvum ter in die.

52. Recipe,

Ferri et Quininæ Citratis	ʒj.
Potassii Citratis	ʒij.
Aquæ Cinnamomi	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Capiat semiunciam ter in die.

53. Recipe,

Potassii Acetatis	ʒij.
Quininæ Sulphatis	ʒj.
Acidi Sulphurici Diluti	ʒj.
Aquæ Pimentæ	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magum sumendum quâque quartâ ho ā.

54. Recipe,

Quininæ Sulphatis	ʒj.
Sodii Salicylatis	ʒij.
Tincturæ Aurantii	ʒj.
Aquæ Menthæ Piperitæ	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Semiuncia sumenda ter in die.

55. Recipe,

Liquoris Arsenii et Hydrargyri Iodidi,	
Tincturæ Nucis Vomicæ	ana ʒij.
Infusi Calumbæ	ad ʒvj.

Misce ut fiat mistura.

Signetur.

Cochleare magnum sumendum omni sextâ horâ.

56. Recipe,

Liquoris Hydrargyri Perchloridi	ʒij.
Potassii Iodidi	ʒij.
Infusi Cinchonæ Acidi	ad ʒviiij.

Solve et misce ut fiat mistura.

Signetur.

Semiuncia ter in die sumenda.

57. Recipe,

Cocainæ Hydrochloridi	gr. vj.
Boracis	ʒij.
Aquæ Destillatæ	ad ʒiiij.

Solve et misce ut fiat collyrium.

Signetur.

Paucæ guttæ istillentur in oculos nocte maneque.

In No. 48 bromide of strychnine slowly crystallises out.
In Nos. 49, 50, and 51 the importance of dilution is observed,

the strongest solution depositing iodide of strychnine immediately, the intermediate solution in from two to four hours, and even the most dilute after standing for a month or two and having undergone a little loss by evaporation. In No. 52, if the potassium citrate is alkaline there is precipitation of quinine; if it is acid, an acid citrate of quinine slowly crystallises. In Nos. 53, 54, and 57 acetate and salicylate of quinine and borate of cocaine respectively are precipitated. In Nos. 55 and 56 there is iodine in double combination, and alkaloidal double iodides are insoluble, with the exception of that of caffeine.

For additional examples see prescriptions Nos. 30 and 38.

Practice.

Mix the following solutions together in test-tubes :—

1. Iodide of potassium and quinine sulphate.
2. Iodide of potassium and quinine sulphate and dilute sulphuric acid.
3. Iodide of potassium and cinchonine sulphate.
4. Iodide of potassium and strychnine hydrochloride.
5. Make a solution of iodine in potassium iodide by adding a drop or two of chlorine water to the iodide. Add a drop of this solution to solution of cinchonine sulphate.
6. To two drops of mercuric chloride solution add sufficient potassium iodide solution to dissolve the precipitate formed. Add this solution to solution of cinchonine sulphate.
7. To solution of quinine sulphate add solution of potassium acetate.
8. To solution of cinchonine sulphate add solution of borax.

The **tannates** of the **heavy metals** are usually insoluble, as are those of antimony and of bismuth. Those of most of the **alkaloids** are also insoluble, and in addition tannic acid precipitates albumen and gelatine.

Examples :—

58. Recipe,

Tincturæ Ferri Perchloridi . . . ʒj.
 Liquoris Arsenici Hydrochlorici . . . ʒss.
 Tincturæ Gentianæ Compositæ . . . ʒj.
 Infusi Quassiae ad ʒvj.

Misce ut fiat mistura.

Signetur.

Cochleare magnum ter in die sumendum.

59. Recipe,

Liquoris Bismuthi et Ammonii Citratis,
 Tincturæ Kino ana ʒvj.
 Infusi Chiratae ad ʒvj.

Signetur.

Semiuncia sumenda quāque sextā horā.

60. Recipe,

Quininæ Sulphatis gr. xij.
 Acidi Sulphurici Aromatici ℥xx.
 Infusi Krameriaē ad ʒvij.

Solve et misce ut fiat mistura.

Signetur.

Semiuncia ter in die sumenda.

In No. 58 tannate of iron, in No. 59 kino-tannate of bismuth, and in No. 60 catechu-tannate of quinine is precipitated.

Practice.

To solutions of ferric chloride, lead acetate, corrosive sublimate, cinchonine sulphate, albumen, and gelatine respectively, add solution of tannic acid.

V. Reactions resulting in the Production of Volatile Substances.

The decomposition of salts of volatile acids and the decomposition of ammonium salts have been already considered under headings II. and III.

In addition to these, there are cases of decomposition of iodides and of bromides in solution in the presence of acids and of oxidising agents.

Iodine and bromine respectively are set free. It should be observed that hydriodic acid is easily oxidised; that iodine is

more easily liberated from an **iodate** than from an iodide by an acid; and that the presence of free iodine in a solution of an iodide, or of free bromine in a solution of a bromide, will precipitate any alkaloid (except caffeine) from solution.

There may occasionally occur decompositions of a complex character. Chloral hydrate, for example, is decomposed by alkalies with the formation of chloroform and a formate.

Examples:—

61. Recipe,

Potassii Bromidi	ʒiij.
Tincturæ Calumbæ	ʒij.
Acidi Nitrohydrochlorici Diluti .	ʒijss.
Infusi Quassiæ	ad ʒviij.

Solve et misce ut fiat mistura.

Signetur.

Cochleare medium sumendum ter in die ex aquā.

62. Recipe,

Potassii Chloratis	ʒij.
Syrupi Ferri Iodidi	ʒvj.
Spiritus Chloroformi	ʒij.
Aquæ Destillatæ	ad ʒviij.

Solve et misce ut fiat mistura.

Signetur.

Semiuncia ter in die cum cibo sumenda.

63. Recipe,

Potassii Iodidi	ʒj.
Quininæ Sulphatis	gr. xxxvj.
Acidi Nitrici Diluti	ʒss.
Infusi Calumbæ	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum sumendum omni horā octavā.

64. Recipe,

Potassii Iodidi	ʒjss.
Liquoris Ammonii Acetatis	ʒiij.
Spiritus Ætheris Nitrosi	ʒvj.
Aquæ Destillatæ	ad ʒvj.

Solve et misce ut fiat mistura.

Signetur.

Cochleare magnum ter quotidie.

65. Recipe,

Potassii Iodidi	5jss.
Tincturæ Ferri Perchloridi	5ij.
Tincturæ Quassiæ	5vj.
Aquæ Destillatæ	ad 3vj.

Solve et misce ut fiat mistura.

Signetur.

Semiuncia quater in die.

66. Recipe,

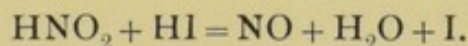
Chloral Hydratis	5ij.
Liquoris Ammoniacæ	℥40.
Syrupi Tolutani	5ij.
Aquæ Destillatæ	ad 3ij.

Solve et misce ut fiat mistura. Non repetenda.

Signetur.

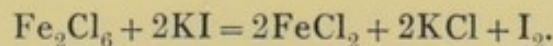
Cochleare medium ex aquæ cyatho vinario horâ decubitus sumendum.

In No. 61 chlorine liberates bromine; in this also, and in No. 63 there is an oxidising acid which liberates bromine and iodine respectively. In No. 62 iodine is set free by the gradual oxidation of the ferrous iodide. In No. 64 potassium iodide and nitrite of ethyl decompose each other, the action being started by free acid in the spirit of nitrous ether.



If the nitrite of ethyl is freshly prepared or is in alkaline solution this decomposition will not occur.

In No. 65 iodine is set free owing to the ferric iodide being unstable.



See also Nos. 49, 50, and 51, where the potassium iodide is gradually decomposed by the hydrochloric acid, especially in the more concentrated solutions.

In No. 66 chloroform is slowly formed.

Practice.

To some solution of potassium iodide add (a) dilute hydrochloric acid, (b) dilute nitric acid, (c) solution of ferric

chloride, (*d*) spirit of nitrous ether. Test the resulting brown solutions with starch solution.

Take some potassium iodide solution and add a drop or two of chlorine water (liberation of free iodine). Add sufficient liquor potassæ to decolorise the solution (formation of iodide and iodate of potassium). To this solution add dilute hydrochloric acid, and compare the result with that which was obtained with the iodide alone (*a*).

(*e*) To a solution of chloral hydrate (1 in 20) add liquor potassæ.

VI. Interactions occurring between Oxidising and Reducing Substances.

Oxidising substances, or those which contain much oxygen, should not be prescribed with those substances which take up oxygen readily.

Many of these substances unite with violence when mixed together in concentration, or with the addition of heat or friction.

Dilution of these substances delays the interaction or, when sufficient, may prevent it altogether. Thus glycerine will reduce potassium bichromate when the two substances are mixed together and remain in contact, whereas if they are diluted before they are brought together (as in the prescription on p. 72) the reduction does not occur.

Among the more active oxidising substances are **nitric acid** and **nitrates**, **picric acid** and **picrates**, **chromic acid** and **chromates**, **chlorates**, **permanganates**, and some **oxides**.

Among the more readily oxidisable substances are **sulphur** and **sulphides**, **phosphorus**, **iodine**, **carbon**, **sugar**, **essential oils**, **alcohol**, **glycerine**, **creosote**, and finely divided organic matter. See also p. 123 for oxidation and reduction of phenazone.

Examples :—

67. Recipe,

Extracti Nucis Vomicae . gr. ʒ.
 Extracti Aloes Barbadensis,
 Potassii Permanganatis ana gr. j.
 Misce ut fiat pilula, et mitte tales vj.

Signetur.

Una sumenda ter in die.

68. Recipe,

Argentii Nitratii . . gr. iv.
 Pulveris Glycyrrhizæ . . ʒij.
 Glycerini ℥ij.
 Extracti Gentianæ . . gr. iv.

Misce ut fiat massa et divide in pilulas xij.

Signetur.

Una quæque horâ sextâ ut dictum.

69. Recipe,

Argentii Oxidi . . . gr. vj.
 Creasoti ℥xv.

Extracti Gentianæ quantum sufficiat ut fiat massa.

Divide in pilulas xij.

Signetur.

Capiat unam omni horâ octavâ.

The potassium permanganate in No. 67 will be reduced by the organic matter ; the silver nitrate in No. 68 will be reduced by glycerine or the organic matter ; and in No. 69 the silver oxide, especially if freshly prepared, will cause the creasote to ignite.

70. Recipe,

Calcii Hypophosphitis,
 Potassii Chloratis . . . ana ʒss.
 Acidi Tannici . . . gr. xij.

Misce ut fiat pulvis, et divide in pulveres vj.

Signetur.

Una ter in die sumenda.

71. Recipe,

Potassii Chloratis . . . gr. v.
 Pulveris Glycyrrhizæ Compositi . ʒss.
 Misce ut fiat pulvis, mitte tales vj.

Signetur.

Unum capiat omni nocte.

72. Recipe,

Sacchari,
 Sulphuris Præcipitati,
 Antimonii Sulphurati . ana gr. iiij.
 Zinci Valerianatis . . gr. j.
 Potassii Chloratis . . gr. ij.

Misce ut fiat pulvis, mitte tales xx.

Signetur.

Unus sumendus ut necesse sit.

In Nos. 70, 71, and 72 the chlorate will be decomposed if rubbed in a mortar with the other ingredients.

73. Recipe,

Potassii Permanganatis . . ʒijss.
 Spiritus Rectificati . . ʒijss.
 Aquæ Destillatæ . . ʒiv.

Misce ut fiat lotio.

Signetur.

Applicanda ut dictum est.

74. Recipe,

Acidi Chromici . . . ʒss.
 Glycerini . . . ʒiv.

Misce.

Signetur.

Applicetur ad tumorem ope penicilli.

While No. 73 was being dispensed with heat, it exploded; in No. 74 reduction of chromic acid takes place with liberation of much heat.

VII. Unstable and Inflammable Substances.

Unstable or inflammable substances must be prescribed with caution, and substances producing a highly unstable compound should not be ordered together.

Chlorate of potassium lozenges have been known to cause a severe accident when carried loose with matches in a pocket; while **erythrol tetranitrate**, **picric acid**, and even **hypophosphites** may be decomposed with violence if subjected to friction or heat.

Inflammable substances such as **ether**, **collodions**, etc., should be prescribed with a caution, to prevent accidents from such substances being handled near a flame.

In the following prescription there is formed a black precipitate of iodide of nitrogen, very explosive when dry :—

75. Recipe,
 Iodi ʒj.
 Linimenti Camphoræ Ammoniati,
 Linimenti Saponis ana ʒj.
 Solve ut fiat linimentum.

Signetur.

Applicetur ad genu dexterum more dicto.

Practice.

Mix a little chlorate of potassium with sugar on paper gently with a spatula, place it on a piece of stone or metal, and touch it with a drop of strong sulphuric acid by means of a long glass rod. Violent combustion ensues. To a little glycerine in a test-tube add one or two crystals of chromic acid; they unite with liberation of much heat. To a few drops of strong solution of iodine add a little ammonia; a black precipitate forms.

Criticism of Prescriptions.

From a consideration of the foregoing examples it will be observed that it is advisable for the prescriber to criticise his prescription before he parts with it.

1. He should check the doses of each ingredient.
2. He should consider the physical characters of each ingredient, to ensure his having chosen the most appropriate preparation.
3. His next consideration should be the method by which the prescription must be dispensed, during which process questions of solubility, consistency, etc., of the various ingredients will probably occur to him.
4. The nature of the completed product should be considered, such as for example the bulk of a powder or of a pill, the concentration and taste of a mixture, or the consistence of an ointment.
5. Finally, he should consider the effects of possible chemical interaction between the ingredients, having regard to the consequent alteration either of the action for which each may have been ordered, or of the condition of solubility. In this latter

case the nature of the insoluble substance should be determined with a view to its removal by filtration if it is not required.

In order to avoid errors, he should not prescribe together with other active substances medicinal preparations (proprietary or otherwise) of whose composition he is in ignorance.

Summary.—In order to be able to prescribe well, it is therefore essential to know the physical and chemical characters of the medicinal substances ordered, and also to know the manipulations which the dispenser must employ to carry out the prescriber's intentions.



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Rs.

Laudani 3j ss. }
Ol. amygd }
Aqua. ana 3ii }

Acid borac gr. x

Ol. menth. pep. ~~ss~~ ʒij ⁱⁱⁱ

Ointment for chapped lips, etc.



Carbide

There



Other soap



bin inside 1:2000



Carbide 1:80



Sulfuric 1:2000

Place on steel & the distended in
sulfuric 1:2000



