Materia medica and pharmacy : for the use of medical and pharmaceutical students preparing for examination / by W. Handsel Griffiths ; edited, and in part written, by George F. Duffey.

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MATERIA MEDICA AND PHARMACY.

MATERIA MEDICA AND PHARMACY;

FOR THE USE OF

MEDICAL AND PHARMACEUTICAL STUDENTS

PREPARING FOR EXAMINATION.

BY
W. HANDSEL GRIFFITHS,
PH.D., F.C.S., L.R.C.P. EDIN., ETC.

EDITED, AND IN PART WRITTEN, BY
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ETC., ETC.

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1879.

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AUTHOR'S PREFACE.

THERE are few professed teachers of Materia Medica who will not coincide in my opinion that there exists a necessity for reform in the manner of teaching this subject in the medical schools. In a paper "On the Teaching of Materia Medica and Therapeutics," which I communicated to *The Practitioner* in November, 1874, I stated very fully my views on this subject, and advocated very earnestly the dissociation of Therapeutics from the chemical and botanical details constituting Materia Medica, so-called. I suggested that Materia Medica proper and Pharmacy should be taught in the earlier period of the student's curriculum, and that Therapeutics should be taught concurrently with Pathology and the Practice of Medicine. Shortly after the publication of this paper, many eminent lecturers on Materia Medica took action in the matter, and made a representation on the subject to the General Council of Medical Education. The hopeful anticipation that the reform advocated will ere long be effected is one reason for the appearance of the present volume.

I have, however, had another object in this publication—I have had in view the special wants of a numerous class of gentlemen who are now qualifying for the Pharmaceutical profession.

In the comparative exclusion of Therapeutics, in the peculiar mode of arrangement, and in the introduction of tabular matter, this book differs from other works on Materia Medica. The practical value of the tables for educational purposes I have tested by a long experience in teaching. The portion of the book treating of Pharmacy was formerly published as a separate volume, under the title of "Notes on the Pharmacopœial Preparations." Should the same favourable reception be accorded to it in its new garb as when it first appeared, I shall have every reason to be satisfied with the result of my labour.

In conclusion, I would impress on my readers the necessity of studying Materia Medica *practically* as far as possible. A very small outlay, indeed, will enable a student to provide himself with reagents and apparatus for performing most of the tests and processes recorded in these pages. The collections of specimens of the Materia Medica sold by Messrs. Southall Brothers and Barclay, Birmingham, are within the reach of all students, and are highly to be commended.

W. HANDSEL GRIFFITHS.

EDITOR'S PREFACE.

HAVING been asked by the Publishers (shortly after Dr. Handsel Griffiths' untimely and much-lamented death) to take charge of this work in its passage through the press, I willingly undertook the task. The favour with which Dr. Griffiths' former publications on similar subjects had been received was to me a powerful inducement to do so.

Throughout the work, the Author's MS. has been as closely followed as was consistent with accuracy and its original plan; while the results of recent investigations—especially as to chemical processes and the action of drugs—have been freely incorporated with the text. Portions of the manuscript which were missing, and such additions to it as appeared essential, have also been supplied by the Editor, who has endeavoured to make this posthumous work worthy of its Author's reputation.

In addition to the works to which Dr. Griffiths acknowledged his indebtedness in the compilation of his "Notes on the Pharmacopœial Preparations," the treatises of Watts, Muter, Flückiger and Hanbury, Walter G. Smith, and other well-known authorities, have similarly been laid under contribution by both the Author and the Editor of the present volume.

G. F. D.

DUBLIN, *January*, 1879.

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PART I.—MATERIA MEDICA.

PART II.—PHARMACY.

ERRATA.

Page 12, line 3, *for* Arsenosium *read* Arseniosum.
,, 16, ,, 12, ,, kakodyll *read* kakodyl.
,, ,, ,, 17, ,, 2(Na_2HASO_4) *read* 2($Na2HAsO_4$).
,, 24, ,, 36, ,, chloride of lime *read* chloride of calcium.
,, 25, ,, 3, *before* sulphate of lime *insert* solution of.
,, ,, ,, 25, *for* sulphide *read* sulphur.
,, ,, ,, 26, *after* present *insert*, in the form of iron pyrites (FeS_2),
,, ,, ,, ,, *for* becomes *substitute* forms ferrous sulphate and free sulphuric acid, which, acting on the silicate of aluminium, forms
,, 36, ,, 31, *for* 7CO *read* $7CO_2$.
,, 37, ,, 26, *after* carbonates *add*, except those of ammonium, potassium, and sodium.
,, 38, ,, 16, *for* normal nitrate *read* subnitrate again.
,, 45, last line, *for* Fe_2Cl_3 *read* Fe_2Cl_6.
,, 66, ,, ,, magnesia *read* magnesium.
,, 71, line 2, in second col., *for* Trochisi *read* Trochisci.
,, ,, ,, 12, in first col., *for* $KMnO_3$ *read* $KMnO_4$.
,, 76, ,, 16, *for* $K_6Fe_2Cy_2$ *read* $K_6Fe_2Cy_{12}$.
,, 87, ,, 30, ,, K_2SO_4, $Cr_{2}3SO_{4}$, *read* 2(K_2SO_4, $Cr_{2}3SO_{4}$).
,, 93, last line ,, $3Zn_3CO$ *read* $3ZnCO_3$.
,, 142, line 17, ,, Hexyll *read* Hexyl.
,, 159, ,, 27, ,, $C_3H_5C_{16}H_{31}O_2$ *read* $C_3H_{5}3C_{16}H_{31}O_2$.
,, 161, ,, 2, ,, sugar, &c., *read* saccharic and oxalic acids.
,, 167, ,, 5, ,, plus *read* minus.
,, 168, ,, 7, ,, $C_{10}H_{14}O_2$ *read* $C_{10}H_{14}N_2$.
,, 195, ,, 29, ,, C_3H_9O *read* C_3H_9N.
,, 202, ,, 3, ,, $C_{2}4H_4O_5$ *read* $C_{24}H_{40}O_5$.
,, 204, ,, 3 from bottom, in formula, *for* H_{20} *read* H_2O.
,, 207, ,, 31, *for* ($C_{30}H_{61}2C_{16}H_{31}O_2$) *read* ($C_{30}H_{61}C_{16}H_{31}O_2$).
,, 231, ,, 3 from bottom, *for* fourteen *read* nearly twelve and a half.
,, 235, ,, 19, *for* the Inorganic *read* other Metallic
,, 256, ,, 7, ,, $3CO_2$ *read* $2CO_2$.
,, 270, ,, 20, ,, Tincture *read* Lozenge.
,, 282, ,, 7, ,, 2HO *read* $2H_2O$.
,, 286, ,, 18, ,, lime *read* calcium.
,, 288, ,, 12, ,, (C_6H_6O) *read* (C_2H_6O).
,, 291, ,, 29, ,, formula as given, substitute—

$$2KIO_3+5H_2SO_4=K_2SO_4+4H_2SO_4+H_2O+I_2.$$

,, 292, ,, 18, *after* neutral, *add*, and acid.
,, 295, ,, 27, *for* permangante *read* permanganate.
,, 296, ,, 15, ,, oxide *read* cyanide.

PART I.—MATERIA MEDICA.

INORGANIC SUBSTANCES.

CARBON. [C=12]

	B. P. Preps.	Strength	Dose	Action and Use
Carbo Animalis, Animal Charcoal, Bone Black	—	—	—	—
	Carbo Animalis Purificatus	—	20 to 60 grs.	Absorbent. Used in cases of flatulent dyspepsia and fœtid eructations.
Carbo Ligni, Wood Charcoal	—	—	20 to 60 grs.	
	Cataplasma Carbonis	1 in 28	—	Antiseptic and deodorant application to foul ulcers.

Carbo Animalis.

The residue of bones which have been exposed to a red heat *without the access of air*. It consists of about 10 per cent. of charcoal and 90 per cent. of phosphate and carbonate of lime. The residue of bones which have been burned to a white ash *in contact with the air* constitutes *os ustum* or "bone-ash." This consists principally of phosphate of lime, mixed with about 10 per cent. of carbonate of lime and a little fluoride of calcium and phosphate of magnesia.

Carbo Animalis Purificatus is animal charcoal from which the earthy salts have been almost wholly removed. This is effected as follows: Mix hydrochloric acid (10 ozs.) with distilled water (1 pint), and add bone black in powder (16 ozs.), stirring occasionally. Digest at a moderate heat for two days, agitating from time to time; collect the undissolved charcoal on a calico filter, and wash with distilled water till what passes through gives scarcely any precipitate with nitrate of silver, showing absence of chlorides. Dry the charcoal, and then heat it to redness in a closely covered crucible. The animal charcoal thus purified is a black pulverulent substance, inodorous and almost tasteless; it absorbs gases and odours. Tincture of litmus diluted with twenty times its bulk of water, agitated with it and thrown upon a filter, passes through colourless. When burned at a high temperature, with a little red oxide of mercury and free access of air, it leaves only a slight residue, and is thus distinguished from vegetable charcoal and from bone black.

Carbo Ligni.

Wood charred by exposure to a red heat without access of air. Wood yields from 17 to 23 per cent. of charcoal. It is met with in black, brittle, porous masses, odourless and tasteless, very light, and retaining the shape and texture of the wood from which it was obtained. When burned at a high temperature with free access of air, it leaves no more than 2 per cent. of ash. It absorbs gases and odours, and decolourises, but not so energetically as animal charcoal. It is insoluble in water, a bad conductor of heat, but a good one of electricity.

SULPHUR. [S=32]

	B. P. Preps.	Strength	Dose	Action and Use
SULPHUR SUBLIMATUM Sublimed Sulphur, Flowers of Sulphur	—	—	20 to 60 grs.	In small doses, stimulant to skin and mucous membranes. In large doses, laxative. Given in chronic cutaneous diseases, chronic bronchitis, mercurial ptyalism, &c. Externally in scabies and vegetable parasitic diseases. Used in making Emplastrum Ammoniaci cum Hydrargyro, and Empl. Hydrargyri.
	Confectio Sulphuris	4 pts. in 10	1 to 2 drms.	
	Sulphur Præcipitatum	—	20 to 60 grs.	
	Unguentum Sulphuris	1 pt. in 5	—	
SULPHURIS IODIDUM Iodide of Sulphur	—	—	—	—
	Unguentum Sulphuris Iodidi	30 grs. to 1 oz.	—	The ointment is used as an alterative, resolvent, and parasiticide.

Sulphur Sublimatum.

Sulphur prepared from crude or rough sulphur by sublimation. It may also be obtained from metallic sulphides; but it is then liable to contain impurities, as sulphide of arsenic. It is a slightly gritty powder of a fine greenish-yellow colour, without taste, and without odour unless heated; sp. gr. 1·98; burns in open vessels with a blue flame and the evolution of sulphurous acid. Insoluble in water, but soluble in hot oil of turpentine, in bisulphide of carbon, and to a slight extent in oils. It is entirely volatilised by heat, showing absence of fixed impurities, and does not redden moistened litmus paper, showing that it is not oxidised. Solution of ammonia, agitated with it, and filtered, does not on evaporation leave any residue, showing freedom from orpiment (As_2S_3).

Sulphur Præcipitatum.

Heat sublimed sulphur (5 ozs.) and slaked lime (3 ozs.), previously well mixed, in a pint of water, stirring diligently with a wooden spatula; boil for fifteen minutes, and filter. Boil the residue again in half a pint of water, and filter. Let the united filtrates cool; dilute with two pints of water, and, in an open place or under a chimney, add in successive quantities hydrochloric acid (8 ozs.), previously diluted with a pint of water, until effervescence ceases, and the mixture acquires an acid reaction. Allow the precipitate to settle, decant off the supernatant liquid, pour on fresh distilled water and continue the purification by affusion of distilled water and subsidence, until the fluid ceases to have an acid reaction and to precipitate with oxalate of ammonia, showing that all the resulting (soluble) chloride of calcium has been removed. Collect the precipitated sulphur on a calico filter, wash it once with distilled water, and dry it at a temperature not exceeding 120°.

The following reactions occur in this process:—

(1) $3Ca2HO+6S_2=2CaS_5+CaS_2O_3+3H_2O$.

(2) $2CaS_5+CaS_2O_3+6HCl=3CaCl_2+3H_2O+6S_2$.

Precipitated sulphur is a grayish-yellow soft powder, free from grittiness and from the smell of sulphuretted hydrogen. When heated in an open vessel, it burns with a blue flame and the evolution of sulphurous acid. Entirely volatilised by heat. Under the microscope it is seen to consist of opaque globules without any admixture of crystalline matter, also showing the absence of sulphate of calcium which would be present if sulphuric acid were used instead of hydrochloric acid in the preparation. Otherwise it corresponds with sublimed sulphur.

Sulphuris Iodidum.

Rub iodine (4 ozs.) and sublimed sulphur (1 oz.) together in a wedgwood mortar until they are thoroughly mixed. Put the mixture into a flask, close the orifice loosely, and apply a gentle heat so that the colour of the mass shall become gradually darkened. When the colour has become uniformly dark throughout, increase the heat so as to produce liquefaction. Then incline the flask in different directions, in order to return into the liquid any portion of the iodine which may have been condensed on the inner surface of the vessel. Lastly, withdraw the heat, and when the liquid has congealed, remove the mass by breaking the flask, reduce it to pieces, and keep these in a well-stopped bottle.

Subiodide of sulphur is an unstable compound, with a strong odour of iodine; it is grayish-black and crystalline; soluble in glycerine, insoluble in water. If 100 grains be well boiled in water the iodine will pass off in vapour and 20 grains of sulphur will remain.

PHOSPHORUS. [P=31]

	B. P. Preps.	Strength	Dose	Action and Use
PHOSPHORUS Phosphorus	—	—	$\frac{1}{30}$ gr.	Tonic and stimulant. Employed in adynamia, low fevers, neuralgia, and in some chronic diseases of the nervous system and of the skin. Used for making acidum Phosphoricum Dilutum.
	Oleum Phosphoratum	$\frac{1}{32}$ gr. in 5 mins.	5 to 10 mins.	
	Pil. Phosphori	$\frac{1}{18}$ gr. in 5 grs.	3 to 6 grs.	

Phosphorus.

A non-metallic element obtained from bones. The following is an outline of the process:—Digest bone-ash with diluted sulphuric acid; sulphate of lime and superphosphate of calcium are thus formed, the former being precipitated, and the latter held in solution :—

$$Ca_3 2PO_4 + 2H_2SO_4 = 2CaSO_4 + CaH_4 2PO_4.$$

By evaporation, the superphosphate is converted into metaphosphate:—

$$CaH_4 2PO_4 - 2H_2O = Ca2PO_3,$$

and the latter is heated with charcoal:—

$$3Ca2PO_3 + C_{10} = Ca_3 2PO_4 + 10CO + P_4.$$

The crude phosphorus thus obtained is collected in a receiver filled with cold water. It is purified by melting it under water and shaking it with a mixture of sulphuric acid and bichromate of potash, to remove any traces of oxide, &c. It is finally cast into sticks in glass moulds.

Phosphorus is a waxy-looking substance, usually in the form of pipes, from being cast into moulds; almost colourless and transparent when fresh, but gradually becoming coated with a white layer; luminous in the dark, from becoming oxidised and forming phosphorous anhydride (P_2O_3); very inflammable; sp. gr. 1·77; melts at 108°; at 32° it is crystalline and brittle; insoluble in water; soluble in ether, oils, and true naptha; entirely soluble in boiling oil of turpentine and bisulphide of carbon; when burnt forms phosphoric anhydride (P_2O_5). It should be kept in water and in the dark. Phosphorus also exists in a peculiar allotropic condition, known as amorphous or red phosphorus, in the form of a red powder, which may be exposed to the air without giving off any fumes, and may be heated in the open air till the temperature reaches 500°, at which point it takes fire, etc. This variety is not soluble in bisulphide of carbon; when volatilised it reverts to the state of ordinary phosphorus.

IODUM. [I=127]

	B. P. Preps.	Strength	Dose	Action and use
Iodum Iodine	—	—	—	Internally iodine influences the glandular and absorbent system, and is an alterative and resolvent. Given in scrofula, bronchocele, glandular enlargements, indurations; in syphilis, rheumatism, gout, dropsy, skin diseases, etc.
	Linimentum	1¼ in 10	—	
	Liquor	1 in 25	—	
	Tinctura	1 in 40	5 to 20 mins.	
	Unguentum	1 in 31	—	Externally irritant or vesicant, and resolvent.
	Vapor	—	—	To lessen expectoration and allay cough.

Iodum.

A non-metallic element obtained principally from the ashes of sea-weeds. On burning the sea-weeds a dark mass termed "kelp" is obtained; from this the soluble salts, iodides, etc., are obtained by solution in water; the solution is then concentrated and treated with sulphuric acid to form hydriodic acid, and then distilled with black oxide of manganese. Iodine volatilises, and is condensed in receivers. The following is the reaction:—

$$2HI + MnO_2 + H_2SO_4 = MnSO_4 + 2H_2O + I_2.$$

In like manner chlorine and bromine can be obtained from chlorides and bromides.

Iodine occurs in laminar crystals, of a peculiar odour, dark colour, and metallic lustre, which, when heated, yield a beautiful violet-coloured vapour; very sparingly soluble in water, but freely dissolved by alcohol, ether, benzine, chloroform, and by a solution of iodide of potassium. The aqueous solution strikes a deep blue colour with starch. It sublimes without leaving any residue, and the portion that first comes over does not include any slender colourless prisms emitting a pungent odour, showing the absence of cyanide of iodine. It should not moisten bibulous paper, showing its freedom from water. Fixed impurities, as coal, black lead, etc., are detected by sublimation. 12·7 grains dissolved in an ounce of water containing fifteen grains of iodide of potassium, require for complete discoloration 1,000 grain-measures of the volumetric solution of hyposulphite of soda. [For an explanation of this test, see "Volumetric Analysis."]

BROMUM. [Br=80]

	B. P. Preps.	Strength	Dose	Action and Use
Bromum Bromine	—	—	—	Caustic, deodoriser and disinfectant. Used to prepare the bromides of ammonium and of potassium.
	Solution of (App. II.)	2 mins. to 1 oz.	—	Test for detecting iodine in the bromides.

Bromum.

Obtained chiefly from bromide of magnesium, which is found in sea water and certain springs, by heating it with black oxide of manganese and sulphuric acid :—

$$MgBr_2+MnO_2+2H_2SO_4=MgSO_4+MnSO_4+2H_2O+Br_2.$$

Bromine is a dark brownish-red, very volatile liquid, with a strong and disagreeable odour. Its specific gravity is 2·966; with water it forms a crystalline hydrate at 32°. Pure bromine can be frozen. At the common temperature of the air it gives off red vapours, and at a temperature of 117° it boils. Like chlorine, it bleaches in the presence of water. Agitated with solution of soda in such proportion that the fluid remains very slightly alkaline, it forms a colourless liquid, owing to formation of bromide and bromate of soda, which are colourless compounds:—

$$Br_6+6NaHO=5NaBr+NaBrO_3+3H_2O.$$

If this colourless liquid be coloured by the further addition of a small quantity of the bromine, it does not become blue on the subsequent addition of a cold solution of starch, showing the absence of iodine. Bromine is slightly soluble in water, more so in alcohol, and very soluble in ether.

THE ACIDS.

Acid	B. P. Preps.	Strength	Dose	Action and Use
Acidum Aceticum Acetic Acid $HC_2H_3O_2=60$	—	—	—	Used in preparation of the officinal acetates and of the Ext. colch. acet., Lin. Tereb. Acet., Liq. Epispast., and Oxymel.
	Acid. Aceticum Dilutum	1 in 8	1 to 2 drms.	Refrigerant, and allays thirst of fever. Locally astringent, and used in sweating and irritation of skin. Employed in preparation of Acetum Scillæ and Liq. Morphiæ Acetatis.
Acidum Aceticum Glaciale Glacial Acetic Acid $C_4H_6O_3=102$	—	—	—	Caustic, irritant, vesicant and escharotic. Applied to warts, corns, and parasitic skin diseases. Used in preparation of the Acetum Cantharides and the Mistura Creasoti.
Acidum Arseniosum Arsenious Acid or White Arsenic $As_2O_3=198$	—	—	$\frac{1}{60}$ to $\frac{1}{12}$ gr.	Externally escharotic and antiseptic. An alterative in skin diseases; antiperiodic in intermittent fever, and neuralgia; used also in chorea and pulmonary diseases.
	Liquor Arsenicalis	4 grs. in 1 oz.	2 to 8 mins.	Used internally as above.
	Liq. Arsenici Hydrochloricus	4 grs. in 1 oz.	2 to 8 mins.	Ditto.

The Acids—Continued.

Acid	B. P. Preps.	Strength	Dose	Action and Use
Acidum Benzoicum Benzoic Acid $HC_7H_5O_2=122$	—	—	10 to 15 grs.	Stimulating expectorant and diuretic. Used in bronchitis, urinary affections, etc. Contained in Tinct. Camph. Co. and in Tinct. Opii Ammoniata. Is an antiseptic.
	Ammoniæ Benzoas	—	10 to 20 grs.	*Vide* compounds of Ammonium.
Acidum Carbolicum Carbolic or Phenic Acid $HC_6H_5O=94$	—	—	1 to 3 grs.	The pure acid is a powerful caustic. Externally employed as a deodorant, antiseptic and parasiticide. Given in septic diseases, and in flatulent dyspepsia and vomiting.
	Glycerinum Acidi Carbolici	1 pt. in 6 by weight	5 to 10 mins.	
	Suppositoria Acidi Carbol. cum Sapone	1 gr. in each	—	
Acidum Citricum Citric Acid $H_3C_6H_5O_7.H_2O=210$	—	—	10 to 30 grs.	Refrigerant in thirst of fever. Used in the preparation of Vinum Quiniæ and the officinal Citrates.
Acidum Gallicum Gallic Acid $H_3C_7H_3O_5.H_2O=188$	—	—	2 to 10 grs.	Astringent in hæmorrhages, diarrhœa, dysentery, sore throat, etc. It is less astringent topically than tannic acid.
	Giycerinum Acidi Gallici	1 pt. in 6 by weight	10 to 60 mins.	
Acidum Hydrochloricum Hydrochloric or Muriatic Acid $HCL=36{\cdot}5$	—	—	—	The strong acid is caustic. Used in prep. of the officinal chlorides. The dilute acid is refrigerant and tonic, and is given in fevers, dyspepsia, etc.
	Acid. Hydroch. Dilutum	1 min. strong acid in 3¼ mins.	10 to 30 mins.	
	Acid. Nitro-Hydrochlor. Dil.	3 and 4 to 25	5 to 20 mins.	Tonic and alterative. Locally as a bath in certain hepatic affections.
Acidum Hydrocyanicum Dilutum Hydrocyanic or Prussic Acid $HCN=27$	—	2 per cent.	2 to 8 mins.	Sedative in painful alimentary affections, vomiting, cough, certain nervous diseases. Externally allays itching, irritation of skin, neuralgia, etc.
	Vapor Acidi Hydrocyanici	10 to 15 mins. in 1 drm.	—	
Acidum Nitricum Nitric Acid, or Spirit of Nitre $HNO_3=63$	—	—	—	Strong acid used as a caustic in phagedenic sores, nævi, piles, etc., and in preparation of the officinal nitrates. Both dilute acids are refrigerant, tonic, and alterative. Used in fevers, dyspepsia, torpidity of liver, the phosphatic diathesis, in scrofula and certain skin diseases.
	Acid. Nitricum Dilutum	1 min. strong acid in 5 mins.	10 to 30 mins.	
	Acid. Nitro-Hydrochlor. Dil.	1½ and 2 mins. of strong acids in 16 mins.	5 to 20 mins.	
Acidum Phosphoricum Dilutum Phosphoric Acid $H_3PO_4=98$	—	—	10 to 30 mins.	Refrigerant and astringent. Used to allay thirst in diabetes; in sweating, hæmorrhages, and in the phosphatic diathesis. Employed in making the officinal phosphates.
Acidum Sulphuricum Sulphuric Acid, "Oil of Vitriol." $H_2SO_4=98$	—	—	—	The strong acid is a powerful caustic. Used in preparation of the officinal sulphates. The dilute acid is refrigerant, tonic, and astringent, and is used in thirst, in sweating, diarrhœa, mucous discharges, hæmorrhages; in debility, phosphatic diathesis, chronic skin diseases, and low states of the system. It enters into the Inf. Rosæ Acidum.
	Acid. Sulphuric. Aromaticum	—	5 to 30 mins.	
	Acid. Sulph. Dil.	1 min. strong acid in 12 mins.	ditto	

The Acids.—Continued.

Acid	B. P. Preps.	Strength	Dose	Action and Use
ACIDUM SULPHUROSUM Sulphurous Acid $SO_2=64$	—	—	30 to 60 mins.	In dyspepsia and vomiting. Destroys low forms of vegetable life. Locally, is used in parasitic skin diseases, and as a spray in ulcerative stomatitis, and as an antiseptic application.
ACIDUM TANNICUM Tannic Acid $C_{27}H_{22}O_{17}=558$	—	—	2 to 10 grs.	Styptic and astringent in hæmorrhages, diarrhœa, dysentery, and mucous discharges.
	Glycerinum Acidi Tannici	1 pt. in 6 by weight	10 to 40 mins.	
	Suppositoria Acidi Tannici	3 grs. in each	—	Useful in leucorrhœa.
	Suppos. Acidi Tannici cum Sapone	3 grs. in each	—	Ditto.
	Trochisci Acidi Tannici	½ gr. in each	—	Astringent.
ACIDUM TARTARICUM Tartaric Acid $H_2C_4H_4O_6=150$	—	—	10 to 30 grs.	Refrigerant. Enters into formation of the officinal tartrates.

PREPARATION.

In the preparation of seven of the fifteen acids Sulphuric acid is an important factor.

Acidum Sulphuricum.

Is made by burning sulphur, to form sulphurous anhydride; this is passed into leaden chambers, where it meets steam and nitric acid fumes obtained by the action of sulphuric acid on nitre; from the nitric acid fumes the sulphurous anhydride takes up oxygen, becoming converted into sulphuric anhydride, which unites with the water to form sulphuric acid, thus:—

$$3SO_2+2HNO_3+2H_2O=3H_2SO_4+2NO.$$

The nitric oxide (NO) takes up oxygen in its turn from the air, becoming converted into peroxide of nitrogen (NO_2), which is again reduced by fresh sulphurous anhydride to nitric oxide:—

$$SO_2+NO_2+H_2O=H_2SO_4+NO.$$

The nitric oxide thus acts as a carrier of oxygen from the air to the sulphurous anhydride. When the liquid sulphuric acid at the bottom of the chamber attains a density of 1·5, beyond which it absorbs nitrous fumes, it is drawn off and evaporated in shallow leaden pans to a sp. gr. of 1·72; it is finally concentrated in glass or platinum retorts to a sp. gr. of 1·84.

Acidum Sulphurosum.

Is obtained by deoxidising sulphuric acid by distilling it with wood charcoal. Four ounces of sulphuric acid and one ounce of charcoal are put into a glass flask and heated. The resulting sulphurous anhydride is first passed through a wash bottle, to free it from carbonic anhydride and sulphuric acid, and is then conducted into a receiver filled with distilled water, which must be kept cool.

$$C+2H_2SO_4=2H_2O+CO_2+2SO_2.$$

The sulphurous anhydride combines with the water to form the acid (H_2SO_3).

Glacial Acetic acid, Hydrochloric acid, Hydrocyanic acid, and Nitric acid, being volatile, are prepared by distilling one of their salts with the more fixed sulphuric acid.

Acidum Aceticum Glaciale.

Is prepared by carefully heating acetate of soda, so as to drive off the water of crystallisation; the salt is then distilled with sulphuric acid:—

$$2NaC_2H_3O_2+H_2SO_4=Na_2SO_4+H_2O+C_4H_6O_3.$$

Should the product contain sulphurous acid, it must be shaken with bichromate of potash or black oxide of manganese, and redistilled; sulphurous acid is thus converted into sulphuric acid, which combines with the black oxide of manganese.

Acidum Hydrochloricum.

Sulphuric acid (44 ozs.) is slowly added to water (32 ozs.) in a glass flask; the liquid is then allowed to cool before adding chloride of sodium (48 ozs.), to prevent the too rapid evolution of gas. Heat is now applied, and as the gas is given off it is passed through a wash-bottle to remove any trace of sulphuric acid; it is then conducted into a receiver containing distilled water (50 ozs.) This must be kept cool during the whole process, because as the water becomes saturated its temperature increases and its power of absorption lessens. The process is to be continued until the product measures 66 ozs., or the liquid has acquired a sp. gr. of 1·16:—

$$NaCl+H_2SO_4=HCl+NaHSO_4.$$

Acidum Hydrocyanicum Dilutum.

Mix in a retort an ounce of sulphuric acid with four ounces of water; to the mixture when cool add two and a quarter ounces of ferrocyanide of potassium dissolved in half a pint of water; adapt to the retort a receiver containing eight ounces of water, which must be kept cool. Distil with a gentle heat until the fluid in the receiver measures seventeen ounces. Lastly, add as much water as will bring the acid up to the required strength (2 per cent.), so that 100 grains of it precipitated with solution of nitrate of silver shall yield 10 grains of dry cyanide of silver. Ten grains of AgCy (molecular weight=134), derived from 100 grains of HCy (mol. wt.=27, just one-fifth of 134), correspond to 2 grains of the pure liquid acid—*i.e.*, one-fifth the weight of the cyanide. The following is the reaction occurring in the preparation:—

$$2K_4FeCy_6+6H_2SO_4=\underbrace{K_2Fe_2Cy_6}_{\text{Everitt's Salt.}}+6KHSO_4+6HCy.$$

Excess of sulphuric acid should be avoided in the process lest formic acid be produced.

Acidum Nitricum.

Heat equal weights of sulphuric acid and nitrate of potash in a glass retort, and collect the liberated nitric acid by means of a Liebig's condenser.

$$KNO_3+H_2SO_4=HNO_3+KHSO_4.$$

Citric and Tartaric acids are obtained by precipitation as insoluble salts, and then liberated by sulphuric acid.

Acidum Citricum.

Four pints of lemon juice are boiled, so as to coagulate albuminous matter; chalk is then added by degrees until effervescence ceases; citrate of calcium is thus formed and is precipitated:—

$$2H_3C_6H_5O_7+3CaCO_3=Ca_32C_6H_5O_7+3H_2O+3CO_2.$$

Collect the deposit of citrate of calcium on a filter, and wash with hot water until the filtrate is colourless; if cold water was employed the precipitate would be dissolved. The object of the washing is to remove all traces of sugar and malate of lime which may be present. Mix the deposit with one pint of distilled water, and add gradually two and a half ounces of sulphuric acid, previously diluted with a pint and a half of distilled water; boil gently for an hour, constantly stirring. Sulphate of calcium is thus formed and precipitated, and the liberated citric acid is held in solution:—

$$Ca_32C_6H_5O_7+3H_2SO_4=3CaSO_4+2H_3C_6H_5O_7.$$

Filter and wash the insoluble matter with distilled water, and add the washings to the solution. Concentrate the solution to a density of 1·21; allow to cool, and after twenty-four hours decant it from the crystals of sulphate of lime which will have formed; further concentrate the liquor until a film forms on its surface, and set aside to cool and crystallise. Purify, if necessary, by recrystallisation. Good lemon juice yields from 2½ up to 10 per cent. of pure acid. The amount of citric acid in lemons decreases on keeping.

Acidum Tartaricum.

Boil 45 ounces of acid tartrate of potash with 2 gallons of water, and add gradually 12½ ounces of prepared chalk, constantly stirring; part of the acid tartrate of potash is thus converted into neutral tartrate, and tartrate of lime is also formed:—

$$2KHC_4H_4O_6+CaCO_3=CaC_4H_4O_6+K_2C_4H_4O_6+CO_2+H_2O.$$

When effervescence has ceased, add 13½ ounces of chloride of calcium dissolved in 2 pints of water; the neutral tartrate of potash is thus converted into tartrate of lime:—

$$K_2C_4H_4O_6+CaCl_2=CaC_4H_4O_6+2KCl.$$

When the tartrate of lime has subsided, pour off the liquid and wash the tartrate with distilled water until it is rendered tasteless. Pour 13 fluid ounces of sulphuric acid, first diluted with 3 pints of water, on the tartrate of lime; mix thoroughly; boil for half an hour, with repeated stirring, and filter through calico. Sulphate of lime is thus formed, and is precipitated, the liberated acid being held in solution:—

$$CaC_4H_4O_6+H_2SO_4=H_2C_4H_4O_6+CaSO_4.$$

Evaporate the filtrate at a gentle heat until it acquires a sp. gr. of 1·21; allow to cool, and then separate and reject the crystals of sulphate of lime which may form. Again evaporate the clear liquor till a film forms on the surface, and allow it to cool and crystallise. Lastly, purify the crystals by solution, filtration if necessary, and recrystallisation.

Two of the acids—namely, Acetic and Carbolic—are made by a process of destructive distillation.

Acidum Aceticum.

Wood is heated to a low redness in iron retorts, and acetic acid, mixed with wood spirit, tar, and various hydrocarbons, distils over; this crude pyroligneous fluid is then decanted from the tar and redistilled; the wood spirit comes over first and then the acetic acid; the latter is neutralised with carbonate of soda. The resulting acetate of soda is purified by several recrystallisations, and is finally distilled with sulphuric acid and water. Sulphurous acid, if formed, is removed in the same manner as in the case of glacial acetic acid.

Acidum Carbolicum.

Is obtained by fractional distillation from coal-tar, and subsequent purification. The heavier coal-tar oils, boiling between 300° and 450°, are treated by a solution of soda, or by milk of lime. The resulting compounds are then decomposed by a mineral acid, and the oily liquid so obtained is rectified.

Two of the acids—namely, Arsenious and Benzoic, are obtained by sublimation from their natural compounds.

Acidum Arsenosium.

Is collected in flues during the smelting of arseniurets, chiefly arsenical cobalt and mispickel (FeSAs); it is afterwards purified by heating in a thin porcelain capsule, covered with a glass flask filled with cold water; the arsenious acid rises in a vapour and condenses on the bottom of the flask.

Acidum Benzoicum.

Is prepared by heating gum benzoin in a shallow iron pot, surmounted by a wooden or pasteboard box, a piece of muslin being interposed to prevent the sublimed acid from falling back into the pot. Many methods for the artificial preparation of benzoic acid are known.

One acid is prepared by solution from its natural compound, namely—

Acidum Tannicum.

The following is the Pharmacopœial process, and was devised by Leconnet. Expose powdered galls to a damp atmosphere for two or three days, and afterwards add sufficient ether to form a soft paste. Let this stand in a well-closed vessel for twenty-four hours; then, having quickly enveloped it in a linen cloth, submit it to strong pressure in a suitable press, so as to separate the liquid portion. Reduce the pressed cake to powder, mix it with sufficient ether, to which one-sixteenth of its bulk of water has been added, to form again a soft paste, and press this as before. Mix the expressed liquids, and expose the mixture to spontaneous evaporation until, by the aid subsequently of a little heat, it has acquired the consistence of a soft extract; then place it on earthen plates or dishes, and dry it in a hot air chamber at a temperature not exceeding 212°.

The ether, water, and tannic acid seem to unite to form a triple soluble compound, which is decomposed on evaporation and deposits the tannic acid in the amorphous form. Tannic acid is insoluble in pure ether.

The two remaining acids, Gallic and Phosphoric, are prepared by a process of oxidation.

Acidum Gallicum.

Place one pound of powdered galls in a porcelain dish, pour on as much water as will make a thick paste, and keep it in this moist condition for six weeks at a temperature of between 60° and 70°, adding water from time to time to replace that which is lost by evaporation. During this time it is assumed that *Pectase*, which is found in galls and acts as a ferment, gradually transforms the tannic acid of the galls, under the influence of oxygen, into gallic acid and sugar:—

$$C_{27}H_{22}O_{17}+4H_2O=3C_7H_6O_5+C_6H_{12}O_6.$$

The sugar is ultimately oxidised into alcohol and carbonic acid gas, or almost entirely into carbonic acid gas and water:—

$$C_6H_{12}O_6+6O_2=6CO_2+6H_2O.$$

The paste is now boiled for twenty minutes with forty-five ounces of water, strained through calico, and when the fluid has cooled the crystalline deposit which has formed is collected on a filter and drained. It is now pressed strongly between folds of filtering paper, and redissolved in ten ounces of boiling water. When the fluid has cooled to 80° it is poured off from the crystals which have formed; these are then washed with three ounces of ice-cold water, and dried, first by filtering paper, and, finally, at a temperature not exceeding 100°. By boiling the undissolved portion of the galls with forty-five additional ounces of water, filtering into a dish containing the liquor decanted from the crystals in the preceding process, evaporating to the bulk of ten ounces, and cooling to 80°, an additional quantity of the acid may be obtained, which, however, is darker in colour than the product of the previous crystallisation.

Gallic acid can also be produced by the action of acids or alkalies on tannic acid.

Acidum Phosphoricum.

Put six ounces of nitric acid, diluted with eight ounces of distilled water, into a tubulated retort connected with a Liebig's condenser, and having added 413 grains of phosphorus, apply a gentle heat so as slowly to distil five fluid ounces of the liquid. Return this to the retort, and continue the distillation, occasionally returning the distillate, until the phosphorus has entirely disappeared. Transfer the contents of the retort to a porcelain dish of hard, well-enamelled ware, and evaporate the liquid until it is reduced to four fluid ounces; then, transferring it to a platinum vessel, continue the evaporation until it is reduced to about two fluid ounces, and orange-coloured vapours are no longer formed. Mix it now with distilled water until, when cold, it measures one pint.

The following equation represents the reaction occurring in the above process:—

$$3P+5HNO_3+2H_2O=3H_3PO_4+5NO.$$

The nitric acid is first diluted, to avoid the explosive ignition of the phosphorus. If a sufficiency of nitric acid be not employed, phosphorous acid (H_3PO_3) will be produced. If the heat during evaporation be carried too high, pyrophosphoric acid ($H_4P_2O_7$) and metaphosphoric acid (HPO_3) will be formed, owing to the elimination of the elements of water, thus:—

$$2H_3PO_4-H_2O=H_4P_2O_7\text{; and } H_3PO_4-H_2O=HPO_3.$$

The distillate is returned occasionally to the retort to prevent loss, for some of the nitric acid distils over unchanged. The liquid is concentrated by heat to get rid of the nitrous fumes. The latter stage of the evaporation is carried on in platinum vessels, glass or porcelain being corroded by strong phosphoric acid; if the evaporation be continued until dense white fumes of phosphoric anhydride arise, a transparent glassy mass of glacial phosphoric acid will result. The pharmacopœial process stops a little short of this.

CHARACTERS AND TESTS.

Acidum Aceticum.

Contains 28 per cent. of anhydrous acid. It is a colourless liquid, having a strong acid reaction and a pungent agreeable odour; a tarry odour indicates the presence of empyreumatic oil. Sp. gr. 1·044. 182 grains by weight, containing 60 grains of real acetic acid (*i.e.*, one molecule), require for neutralisation 1000 grain-measures of the volumetric solution of soda (*i.e.*, one molecule of $NaHO$), acetic acid being monobasic. It is volatile, and on evaporation should leave no residue, showing the absence of fixed impurities. It should give no precipitate with H_2S (absence of metallic impurities), with $BaCl_2$ (absence of sulphuric acid), or with $AgNO_3$ (absence of hydrochloric acid). If a fluid drachm of it, mixed with half an ounce of distilled water and half a drachm of pure hydrochloric acid, be put into a small flask with a few pieces of granulated zinc, and while effervescence continues a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not be discoloured (absence of sulphurous acid). In this test hydrogen gas is developed by the zinc and hydrochloric acid:—

$$Zn+2HCl=ZnCl_2+H_2.$$

If this meets with sulphurous acid it forms sulphuretted hydrogen:—

$$SO_2+3H_2=2H_2O+H_2S;$$

the latter forms with lead a black sulphide of lead, and hence will discolour lead-paper.

Acidum Aceticum Glaciale.

Contains 84 per cent. of anhydrous acid. It crystallises in colourless prismatic crystals when cooled to 34°, and remains crystalline until the temperature is raised to above 48°. Its sp. gr. is 1·065 to 1·066, and this is increased by adding 10 per cent. of water; hence density cannot be relied on as a test of the strength of glacial acetic acid; further dilution beyond 10 per cent. permanently lowers the sp. gr. At the mean temperature of the air glacial acetic acid is a colourless fluid; it has a pungent acetous odour. 60 grains by weight (one molecule), mixed with one ounce of distilled water, require for neutralisation at least 990 grain-measures of the volumetric solution of soda (one molecule nearly of $NaHO$). Glacial acetic acid is directed to be tested for sulphurous acid in the same way as acetic acid.

Acidum Arseniosum.

When freshly prepared is transparent and vitreous or glass-like; after a time it becomes opaque, and resembles porcelain; its density diminishes, and it becomes more soluble. The medicinal acid occurs as a heavy white powder, or in sublimed masses which usually present a stratified appearance caused by the existence of separate layers differing from each other in degrees of opacity. The sp. gr. of the opaque anhydride is 3·699, that of the vitreous is 3·738. It is tasteless, but leaves a faint sweetish after-impression. When slowly sublimed in a glass tube it forms minute, brilliant, and transparent octahedral crystals; it sometimes crystallises in prisms with a rhombic base, and hence is dimorphous. It is soluble in about 100 parts of cold water, but is much more soluble in boiling water; the solution in boiling water deposits octahedral crystals on cooling. Prolonged boiling converts the opaque into the vitreous variety. Arsenious acid is slightly soluble in alcohol. The aqueous solution, acidified, gives a yellow precipitate with sulphuretted hydrogen; with ammonio-nitrate of silver, it gives a canary yellow precipitate, which is insoluble in water but readily dissolved by ammonia and by nitric acid *(Hume's test);* with ammonio-sulphate of copper, it gives a green precipitate.

Marsh's Test.—Place the solution to be tested in an apparatus for the generation of hydrogen. Generate hydrogen by the action of a hot solution of caustic potash or soda on zinc:—

$$Zn+2KHO=K_2ZnO_2+H_2.$$

Fleitmann has shown that antimony will not combine with this form of hydrogen, but that arsenic will. If arsenic be present it combines with the nascent hydrogen, forming arseniuretted hydrogen:—

$$As_2O_3+6H_2=3H_2O+2AsH_3.$$

On igniting the jet of gas, and holding over the flame a cold porcelain plate, a brown spot of arsenic will be deposited, the hydrogen being burned off into water.

Reinsch's Test.—Boil a strip of pure copper in the solution, acidified with pure hydrochloric acid; arsenic, if present, will be deposited on the copper. Dry the latter, and heat it gently in a long narrow test-tube; the arsenic volatilises, and becomes oxidised to As_2O_3, which condenses on the cool part of the tube in characteristic octahedral crystals.

Arsenious acid has no odour, but when sprinkled on a red-hot coal it emits an alliaceous odour owing to its reduction by the carbon. Arsenious acid is entirely volatilised, without fusing, at a temperature not exceeding 400°, showing the absence of gypsum and chalk. Minute portions heated in a test-tube with a little acetate of soda develop the odour of kakodyll. Four grains of it, dissolved in boiling water with eight grains of bicarbonate of soda, discharge the colour of 808 grain-measures of the volumetric solution of iodine. This discolouration is effected by the formation of colourless iodide and arseniate of sodium, thus:—

$$As_2O_3+4Na_2CO_3+H_2O+I_4=4NaI+4CO_2+2(Na_2HASO_4)$$

As long as by the addition of iodine NaI is formed, the solution is colourless. Any iodine added after that point is accomplished is free and colours the solution. From the above formula it will be observed that one molecule of arsenious acid (As_2O_3) corresponds to four atoms of iodine; accordingly one molecule of As_2O_3 (198 grains) will decolourise four atoms of iodine, *i.e.*, 508 grains (127×4). 1000 grain-measures of the solution of iodine contain one-tenth of an atom of iodine, and will therefore equal one-fortieth of a molecule—*i.e.*, 4·95 grains $\left(\frac{198}{4}\right)$ of arsenious acid; hence four grains of pure arsenious oxide should require 808 grain-measures of the iodine solution:—4·95 : 4 :: 1000 : 808.

Acidum Benzoicum.

Occurs in light, feathery, flexible, crystalline plates and needles, colourless and with a pearly lustre when pure, but sometimes brownish, owing to the presence of oily matter; it has an agreeable odour like benzoin, owing to impregnation with volatile oil, the pure acid being odourless. Sparingly soluble in water, but more soluble in hot than in cold water; the addition of phosphate of soda or of borax increases its solubility. It is readily dissolved by rectified spirit, and it is soluble also in fixed oils. Its aqueous solution reddens litmus, but its acid powers are feeble. It forms soluble benzoates with lime and the alkalies, but any more soluble acid, such as hydrochloric, will precipitate the benzoic acid, except from very dilute solutions. Neutral benzoates give a bulky reddish precipitate of ferric benzoate with persalts of iron.

Benzoic acid melts at 248°, and boils at 462°; when heated to the last-named temperature, it passes off in vapour, leaving only a slight residue, showing the absence of fixed impurities, as lime or asbestos. Its vapours are acrid and suffocating. Kindled in the open air, it burns with a smoky flame.

Acidum Carbolicum.

In colourless acicular crystals, which at a temperature of 95° become an oily liquid, having a strong odour and taste resembling, but more offensive than, creasote, which it also resembles in many of its characters and properties. The crystals gradually change colour, first to a rose-pink (*Rosolic acid*, $C_{12}H_{12}O_3$), and then to a brown tint (*Brunonic acid*). The sp. gr. of carbolic acid is 1·065; boiling point 370°; it is sometimes accompanied by *Cresylic acid* (cresol), a higher homologue, which boils at 397°. The crystals readily absorb moisture on exposure to air, and are thus liquefied; the acid, however, is but slightly soluble in water, but is freely soluble in alcohol, ether, glycerine, and glacial acetic acid. By agitating four parts of carbolic acid with one of water at a low temperature, a hydrate is formed, which crystallises in six-sided prisms. Carbolic acid does not redden litmus paper dipped into it. A slip of deal dipped into it, and afterwards into hydrochloric acid, and then allowed to dry in the air, acquires a greenish-blue colour. It coagulates albumen and collodion. Carbolic acid does not affect the plane of polarisation of a ray of polarised light; wood-creasote, on the other hand, is dextro-gyrate. Carbolic acid belongs to a series of bodies termed *Phenols*, which, though having the composition of alcohols and several properties of acids, differ essentially from these classes of substances. Heated with ammonia in a sealed test-tube, it is converted into water and aniline:—

$$C_6H_6O+NH_3=C_6H_5H_2N+H_2O.$$

Sulphuric acid dissolves it, forming with it sulphocarbolic acid ($HC_6H_5SO_4$), which forms sulphocarbolates with soda, zinc, and other bases. Nitric acid decomposes it with violence, forming *Trinitrophenic* or *Carbazotic acid* ($HC_6H_2(NO_2)_3O$), *Dinitrophenic acid* ($HC_6H_3(NO_2)_2O$), and *Nitrophenic acid* ($HC_6H_4NO_2O$). Dry carbonic anhydride, passed through the dry powder of phenol-sodium, between 212° and 482°, forms among other compounds salicylate of soda, which is decomposed by hydrochloric acid into salicylic acid and chloride of sodium.

Acidum Citricum.

Transparent colourless crystals, of which the right rhombic prism is the primary form. Is decomposed by heat; when heated to 347°, acetone, carbonic oxide, carbonic anhydride, and aqueous vapour are evolved, and *Aconitic acid* ($H_3C_6H_3O_6$), with a little charred matter, are left. Aconitic acid differs from citric in having a molecule less of water, and is isomeric with *Fumaric* and *Maleic acids.* Citric acid crystals dissolve in three-fourths their weight of cold, and in half their weight of boiling water; they are also soluble in glycerine and in rectified spirit, but are insoluble in pure ether. The diluted aqueous solution has an agreeable acid taste. A solution containing 34 grains of the acid to the ounce of water resembles lemon juice in strength; it becomes mouldy by keeping, and decomposes into carbonic and acetic acids. Citric acid dissolves zinc and iron, with evolution of hydrogen. It is very readily oxidised, nitric acids and other agents converting it, at the ordinary temperature, into acetic, oxalic, and carbonic acids. Its aqueous solution is not darkened by sulphuretted hydrogen (absence of metallic impurities, chiefly lead). It gives no precipitate when added in excess to solution of acetate of potash (absence of tartaric acid). It causes no precipitate with any salt of potash except the tartrate, from which it throws down the acid tartrate of that base. It should give no precipitate with solution of chloride of barium (absence of sulphates); and, if sparingly added to cold lime-water, it should not render it turbid (absence of oxalic acid); hot lime water would give with it a precipitate of citrate of lime. Citrate of lime is not dissolved by cold solution of potash, but tartrate of lime is; hence, citrates can thus be separated from tartrates. Crystals of citric acid should leave no ash when burned with free access of air (absence of fixed impurities—*e.g.*, lime). 70 grains of the acid dissolved in distilled water are neutralised by 1000 grain-measures of the volumetric solution of soda (one molecule of $NaHO$). Since one molecule of citric acid (= 210), being tribasic, will saturate three molecules of soda, one-third of a molecule of the acid, *i.e.*, 70 grains ($\frac{210}{3}$), must saturate a single molecule of soda.

Acidum Gallicum.

Crystalline, in acicular prisms or silky needles, sometimes nearly white, but generally of a pale fawn-colour. Taste, sweetish and astringent, but less so than tannic acid, owing to its slight solubility in the saliva. It requires about 100 parts of cold water for its solution, but it dissolves in three parts of boiling water; it is soluble also in rectified spirit, and glycerine makes with it a clear solution miscible with water; ether dissolves it imperfectly. The aqueous solution gives no precipitate with solution of isinglass, unless when mixed with gum, nor does it precipitate albumen or alkaloids, thus differing from tannic acid. It gives a bluish-black precipitate with persalts of iron, and this disappears on heating, owing to the formation of metagallic acid; protosalts of iron are also gradually blackened by gallic acid. The crystalline acid when dried at 212°, loses 9·5 per cent. of its weight (= its molecule of water of crystallisation). It is decomposed by a heat of 410° into *Pyrogallic* *acid* ($C_6H_6O_3$) and carbonic acid. Pyrogallic acid gives a red colour with persalts of iron, and a deep blue with protosalts. If gallic acid be heated rapidly to 482°, it is converted into *Metagallic acid* ($C_6H_4O_2$). Gallic acid should leave no residue when burned with free access of air. The aqueous solution of gallic acid undergoes spontaneous decomposition when exposed to the air, but the addition of a drop of the oil of cloves acts as a preservative.

Acidum Hydrochloricum.

The pure acid is a colourless liquid, but the commercial acid is yellowish, owing to the presence of some organic matter, or of chloride of iron derived from the iron stills in which it is prepared. It is strongly acid, emitting white vapours on exposure, owing to the union of the acid gas with the moisture in the air; it has a pungent odour; sp. gr. 1·16. When evaporated to dryness, it should leave no residue (absence of fixed impurities). It gives with nitrate of silver a curdy white precipitate of chloride of silver, soluble in excess of ammonia, but insoluble in nitric acid, and which turns violet on exposure to light. 114·8 grains by weight, mixed with half an ounce of distilled water, require for neutralisation 1000 grain-measures of the volumetric solution of soda, indicating the percentage of the gas which the acid should include. One molecule of $HCl = 36{\cdot}5$; hence, $114{\cdot}8 : 100 :: 36{\cdot}5 : x = 31{\cdot}8$ per cent. When diluted with four times its volume of distilled water, it should give no precipitate with chloride of barium (absence of sulphates), or with sulphuretted hydrogen (absence of metallic impurities, as iron or lead); it should not tarnish or alter the colour of bright copper when boiled in it (absence of arsenic or antimony). Hydrochloric acid is directed to be tested for sulphurous acid in the same manner as are acetic and glacial acetic acids (p. 14). Hydrochloric acid should have no action on gold leaf, and should not decolourise solution of sulphate of indigo (absence of nitric acid and of free chlorine). Iron is detected by diluting the acid, neutralising with carbonate of soda, and adding ferrocyanide of potassium, when, if it be present, Prussian blue will be precipitated.

Acidum Hydrocyanicum Dilutum.

A colourless liquid, with a taste which is at first cooling and afterwards irritating, and an odour resembling that of laurel water; sp. gr. 0·997. Being volatile and having but a very slight acid reaction, it only transiently reddens litmus paper. A fluid drachm evaporated in a platinum dish leaves no residue. Treated with a minute quantity of a mixed solution of a ferrous and a ferric salt, afterwards with potash, and finally acidulated with hydrochloric acid, it forms Prussian blue. In this test the potash combines with the hydrocyanic acid to form cyanide of potassium (KCy). Hydrated oxide of iron is also precipitated, and this combining with the KCy forms ferro-cyanide of potassium (K_4FeCy_6), with which, on the addition of hydrochloric acid, the iron of the ferric salt combines, and Prussian blue is precipitated:—

$$3(K_4FeCy_6)+2(Fe_2Cl_6)=(Fe_2)_2(FeCy_6)_3+12KCl.$$

Liebig's test for prussic acid consists in adding to it a few drops of yellow sulphide of ammonium, and evaporating to dryness, to form sulpho-cyanide of ammonium. On dissolving this in distilled water and adding a drop of solution of perchloride of iron, a blood-red colour of sulphocyanide of iron forms:—

$$Fe_2Cl_6+6NH_4CyS=Fe_2(CyS)_6+6NH_4Cl.$$

With nitrate of silver, hydrocyanic acid gives a white precipitate of cyanide of silver, which is entirely soluble in boiling concentrated nitric acid. It should give no precipitate with solution of chloride of barium (absence of sulphuric acid). The absence of any foreign acid is determined by the fact of a red colour not being produced on adding iodocyanide of potassium and mercury (Geoghegan's test). It should not be coloured by sulphuretted hydrogen (absence of metallic impurities). 270 grains of prussic acid, rendered alkaline by the addition of solution of soda, require 1000 grain-measures of the volumetric solution of nitrate of silver to be added before a permanent precipitate begins to form, which corresponds to 2 per cent. of the real acid. In this test the nitrate of silver forms with the cyanide of sodium a soluble double cyanide of silver and sodium:—

$$(1.)\ 2NaCy+AgNO_3=AgCyNaCy+NaNO_3.$$

When all the cyanide of sodium is converted into the double cyanide, any further addition of the solution of nitrate of silver will cause a permanent precipitate of cyanide of silver:—

$$(2.)\ AgCyNaCy+AgNO_3=2AgCy+NaNO_3.$$

The molecular weight of hydrocyanic acid $= 27$. According to the first of the above equations, one molecule of nitrate of silver ($= 170$) neutralises two molecules of cyanide of sodium, or two molecules of hydrocyanic acid ($=27\times2=54$). The latter will be equal to 1000 grain-measures of the volumetric solution of nitrate of silver, which, for convenience, contains only one-tenth of an equivalent in grains of nitrate of silver ($\frac{170}{10}=17$). Therefore, 270 grains by weight of the officinal acid contains 2 per cent. of the real acid; for $270 : 54 :: 100 : x = 2$. Scheele's prussic acid contains 4 per cent. of the real acid.

Anhydrous hydrocyanic acid is colourlesss, with a more intense odour than the dilute. Its sp. gr. is 0·697. It is very volatile, and rapidly decomposes into a carbonaceous-like matter. The dilute acid is liable to decomposition on exposure to light, and hence is generally kept in blue glass bottles. The presence of a trace of a mineral acid, sulphuric or nitric, is said to act as a preservative.

Acidum Nitricum.

The pure acid is a colourless liquid, but the commercial acid is reddish or yellowish, owing to its containing some peroxide of nitrogen (NO_2). It has a strong acid taste; exposed to the air, it emits an acrid corrosive vapour, the fumes being caused by the combination of the acid gas with the moisture of the air. Its sp. gr. is 1·42; if denser than this it is unstable and is constantly undergoing decomposition under the influence of light. When poured on copper filings nitric acid forms dense red fumes; but if the acid be mixed with an equal volume of water, and then added to the copper, it gives off a colourless gas (NO), which acquires an orange red vapour (NO_2) as it mixes with the air, and which, if it be introduced into a solution of sulphate of iron, communicates to it a purple or brown colour. The boiling point of the acid is 250°. If submitted to distillation, the product continues uniform throughout the process, indicative of correct percentage of acid present. It leaves no residue on evaporation (absence of fixed impurities). Diluted with six times its volume of distilled water, it should give no precipitate with solution of chloride of barium (absence of sulphuric acid), or with solution of nitrate of silver (absence of hydrochloric acid). Ninety grains by weight of it mixed with half an ounce of distilled water require for neutralisation 1000 grain-measures of the volumetric solution of soda, indicating the presence of 70 per cent. by weight of nitric acid (HNO_3) corresponding to 60 per cent. of anhydrous nitric acid (N_2O_5). Since nitric acid is monobasic, 1000 grain-measures of the soda solution (= one molecule of NaHO) will exactly neutralise one molecule of nitric acid (= 63). Therefore, if 90 grains of the acid require 1,000 measures of the soda solution, there must be 70 per cent. of nitric acid present, for $90 : 100 :: 63 : x = 70$.

Acidum Phosphoricum.

A colourless liquid, with a sour taste and strongly acid reaction. Sp. gr. 1·08. With ammonio-nitrate of silver, it gives a canary-yellow precipitate, which is soluble in ammonia and in dilute nitric acid. All soluble phosphates give with sulphate of magnesia, on adding chloride of ammonium and solution of ammonia, a white crystalline precipitate of ammonio-magnesian phosphate or "triple phosphate" ($MgNH_4PO_4$). When common phosphoric acid is heated it loses water and pyrophosphoric acid is produced:—

$$2H_3PO_4 - H_2O = H_4P_2O_7.$$

By a greater heat more water is driven off, and glacial or metaphosphoric acid is formed (HPO_3). Phosphoric acid should not give a precipitate with sulphuretted hydrogen (absence of metallic impurities), with chloride of barium (absence of sulphuric acid), or with nitrate of silver acidulated with nitric acid (absence of hydrochloric acid). It does not give a precipitate with solution of albumen, showing that metaphosphoric acid is not present. When mixed with an equal volume of pure sulphuric acid, and then introduced into solution of sulphate of iron, it should not communicate to it a dark colour (absence of nitric acid). Mixed with an equal volume of solution of perchloride of mercury and heated, no precipitate is formed, showing the absence of phosphorous acid. If any were present calomel would be deposited:—

$$2\mathrm{HgCl_2}+\mathrm{H_3PO_3}+\mathrm{H_2O}=2\mathrm{HgCl}+2\mathrm{HCl}+\mathrm{H_3PO_4}.$$

The strength of phosphoric acid cannot be tested by the volumetric solution of soda, as the phosphate of soda which is formed, having an alkaline reaction, interferes with the observation of the point of neutralisation as evidenced by litmus paper. It is, therefore, estimated gravimetrically. 355 grains by weight poured upon 180 grains of oxide of lead in fine powder leave, by evaporation, a residue (principally phosphate of lead), which, after it has been heated to dull redness, weighs 215·5 grains (215·5—180=35·5). Six fluid drachms, therefore, correspond to 35·5 grains of anhydrous phosphoric acid, P_2O_5—*i e.*, a quarter of an equivalent. ($P_2O_5=142$, and $\frac{142}{4}=35{\cdot}5$).

Acidum Sulphuricum.

When pure, a colourless, odourless, oily-looking liquid, intensely acid and corrosive. It chars most vegetable substances, and becomes darkened. Some bodies dissolve in sulphuric acid without blackening, as indigo; others are not blackened but are decomposed, as oxalic acid, etc. The sp. gr. of the officinal acid is 1·843. It absorbs water rapidly, and when mixed with it evolves much heat, owing to its condensation. On dilution with an equal measure of water, it generally gives a slight white precipitate of sulphate of lead (derived from the leaden chambers in which it is prepared). Dilute sulphuric acid gives a copious precipitate with chloride of barium, which is insoluble in acids. Evaporated in a platinum dish, it should leave little or no residue (absence of fixed salts). When a solution of sulphate of iron is carefully poured over its surface, there should be no purple colour developed where the two liquids meet (absence of nitrous acid). Diluted with six times its volume of distilled water, it should give no precipitate with sulphuretted hydrogen (absence of arsenic, which is liable to be present when certain varieties of sulphur, as Brazilian, are used in the preparation of the acid). 50·6 grains, by weight, mixed with one ounce of distilled water, require for neutralisation 1000 grain-measures of the volumetric solution of soda (one molecule of NaHO). A molecule of NaHO will neutralise half a molecule of H_2SO_4—*i e.*, 49 grains ($\frac{98}{2}$), the acid being dibasic; but 50·6 grains of the officinal acid should contain exactly 49 grains of the pure acid (*i.e.*, 96·8 per cent.), corresponding to 1000 grain-measures of the volumetric solution of soda. $50·6 : 100 : : 49 : x = 96·8$.

Acidum Sulphurosum.

Water at 65° takes up about 50 volumes of sulphurous acid gas. The officinal acid is a nearly saturated solution of the gas, and is a colourless liquid with a pungent sulphurous odour. The real acid (H_2SO_3) can be obtained in crystals, but is very unstable. Sulphurous acid is a powerful bleaching and deoxidising agent. Its sp. gr. is 1·04. It should give no precipitate, or a very slight one, with chloride of barium (absence of sulphuric acid); but it gives a copious one of sulphate of barium if solution of chlorine be also added, the chlorine converting the sulphurous into sulphuric acid:—

$$SO_2 + 2H_2O + Cl_2 = 2HCl + H_2SO_4.$$

When evaporated, it should leave no residue (absence of fixed impurities). 34·7 grains by weight, mixed with an ounce of distilled water and a little mucilage of starch, do not acquire a permanent blue colour with the volumetric solution of iodine until 1000 grain-measures of the latter have been added:—

$$SO_2 + 2H_2O + I_2 = H_2SO_4 + 2HI.$$

Sulphurous acid being dibasic one equivalent of it (=64) requires two equivalents of iodine ($127 \times 2 = 254$). The volumetric solution contains, for convenience, one-tenth of an equivalent of iodine (=12·7) in 1000 grain-measures, which amount will, consequently, also neutralise one-twentieth of an equivalent of SO_2—*i.e.*, 3·2 grains ($\frac{64}{20}$). Therefore, in the 34.7 grains of the liquid acid directed to be tested, there must be 3·2 grains of SO_2—*i. e.*, 9·2 per cent. $34·7 : 3·2 :: 100 : x = 9·2$.

Acidum Tannicum.

Occurs in pale yellow vesicular masses, or thin glistening scales, and is uncrystallisable. It has a strongly astringent taste, an odour like that of dextrin, and a slightly acid reaction. It is readily soluble in water, rectified spirit, and glycerine, but very sparingly soluble in ether, especially when anhydrous; it is insoluble in fixed and volatile oils. It increases the solubility of iodine in water. The aqueous solution precipitates gelatine yellowish-white, and it is thus distinguished from gallic acid. With the persalts of iron it gives a bluish-black colour of tannate of iron. Some varieties of tannin, however, as that in catechu, give a dark green precipitate with ferric salts, while others, as that in rhatany, give a gray precipitate. With salts of lead and antimony tannic acid gives white insoluble precipitates of tannates of these metals. It decomposes carbonates of the alkali metals with effervescence, forming soluble tannates, which do not precipitate gelatine. The aqueous solution of tannic acid and solutions of the tannates of the alkalies gradually become mouldy and brown, absorbing oxygen, which converts tannic into gallic acid. This is due, according to M. Robiquet, to the presence of a vegetable ferment, pectase, which exists in galls; and it is said that if the solution of tannic acid be boiled for some time so as to coagulate the pectase, it may be kept for an indefinite period without change. Nitric acid converts tannic acid into oxalic and saccharic acids. When boiled with dilute hydrochloric or sulphuric acid, tannic acid unites with water, and is converted into glucose and gallic acid:—

$$C_{27}H_{22}O_{17}+4H_2O=C_6H_{12}O_6+3H_3C_7H_3O_5.$$

A concentrated boiling solution of potash has the same effect. Hence it is termed a glucoside; but Schiff considers tannic to be merely the anhydride of gallic acid. At 620° it is decomposed into pyrogallic ($C_6H_6O_3$) and metagallic acids ($C_6H_4O_2$), water and carbonic acid being evolved. Tannic acid leaves no residue when burned with free access of air.

Acidum Tartaricum.

In colourless crystals, the primary form of which is the oblique rhombic prism; these are pyro-electric, and become luminous in the dark by friction. Tartaric acid has a strongly acid taste, and is readily soluble in water and in rectified spirit. The aqueous solution becomes mouldy on keeping, acetic acid being formed; the addition of a little rectified spirit acts as a preservative. When to a solution of it, not too much diluted, a little acetate of potash is added, a white crystalline precipitate of acid tartrate of potash is formed. Tartaric acid, neutralised by an alkali, gives a white precipitate of tartrate of lime with solution of chloride of lime, which is soluble in cold solution of potash and is reprecipitated on boiling. With nitrate of silver, the acid gives a white precipitate of tartrate of silver, which blackens on boiling, owing to the separation of metallic silver. These three tests serve to distinguish tartaric from citric acid. Seventy-five grains (half an equivalent) of the crystallised tartaric acid dissolved in water require for neutralisation 1000 grain-measures of the volumetric solution of soda (one molecule of NaHO), the acid being dibasic. An aqueous solution of tartaric acid should not be affected by sulphuretted hydrogen (absence of metallic impurities), and should not give a precipitate with sulphate of lime (absence of oxalic acid), or with oxalate of ammonia (absence of lime). It leaves little or no residue when burned with free access of air. When heated with caustic alkalies, an oxalate and an acetate of the base are formed:—

$$H_2C_4H_4O_6+3KHO=K_2C_2O_4+KC_2H_3O_2+3H_2O.$$

Boiled with nitric acid it is converted into oxalic acid. It is converted into succinic acid ($H_2C_4H_4O_4$) by heating it with hydriodic acid for a few hours. Heated to 338°, tartaric acid is converted into meta- and para-tartaric acids. Above 370° it loses water, and is changed into tartralic or ditartaric acid; at 374° the basic water is expelled, and tartaric anhydride remains; this, by the gradual absorption of water, becomes reconverted into the ordinary acid.

COMPOUNDS OF ALUMINIUM. [Al=27·4]

Compound	B. P. Prep.	Strength	Dose	Action and Use
ALUMEN Alum $NH_4Al(SO_4)_2,12H_2O$	—	—	10 to 20 grs.	Astringent, and in large doses emetic and purgative. Used locally as an astringent gargle, lotion, or injection.
	Alumen Exsiccatum	—	—	Dried alum is a slight escharotic and is only used externally.

Alumen.

Usually made by exposing alum schist to the air; the sulphide originally present being thus oxidised becomes sulphate of alumina; this is then dissolved in water, sulphate of ammonia is added, and the ammonia alum thus formed finally crystallised out.

Dried alum is prepared by heating the ordinary alum in a suitable vessel till it fuses, and then raising the heat to not above 400°, so as to drive off the water of crystallisation which forms 47 per cent. of its weight. Above 400° alum is decomposed, and ammonia and sulphuric acid are given off.

Alum occurs in colourless transparent crystalline masses, exhibiting the faces of the regular octahedron, and having an acid sweetish astringent taste. It is slightly efflorescent in dry air, from loss of some of its water of crystallisation. Alum is soluble in about 18 parts of cold water, and in three-fourths of its weight of boiling water. Its aqueous solution gives with caustic potash or soda a white precipitate of hydrate of alumina which is soluble in excess of the reagent (showing absence of lime), and the mixture evolves ammonia, especially when heated. The aqueous solution gives an immediate precipitate with chloride of barium (characteristic of all soluble sulphates). It does not acquire a blue colour on the addition of yellow or red prussiate of potash (absence of per- or proto-salts of iron). When calcined, pure alumina (Al_2O_3) is left behind. The potash alum of commerce is termed "rock alum."

COMPOUNDS OF AMMONIUM. [NH_4=18]

Name	B. P. Preps.	Strength	Dose	Action and Use
AMMONIÆ ACETAS Acetate of Ammonia $NH_4C_2H_3O_2$	Liquor	—	2 to 6 drm.	Diaphoretic, diuretic, and refrigerant.
AMMONIÆ BENZOAS Benzoate of Ammonia $NH_4C_7H_5O_2$	—	—	10 to 20 grs.	Diuretic and slight stimulant. Used in chronic inflammation of bladder with alkaline urine and a tendency to phosphatic deposits.
AMMONIÆ CARBONAS Carbonate of Ammonia $NH_4H_{16}C_3O_8$	—	—	3 to 10 grs.	Stimulant in low states of the system; antacid in dyspepsia with increased secretion of acid, and stimulating expectorant in bronchitis. Seldom used as an emetic.
	Spiritus Ammoniæ Aromaticus	—	½ to 1 drm.	Same as carbonate.
	Solution of (App. II.)	1 in 20	—	Test for purity of bismuth and of zinci carb. and oxid.
AMMONIÆ CITRAS Citrate of Ammonia $(NH_4)_3C_6H_5O_7$	Liquor	—	2 to 6 drm.	Febrifuge, refrigerant, and slightly diuretic.
AMMONIÆ NITRAS Nitrate of Ammonia NH_4NO_3	—	—	—	Used in making nitrous oxide. Not given in medicine.
AMMONIÆ OXALAS Oxalate of Ammonia $(NH_4)_2C_2O_4$	Solution of (App. II.)	1 in 40	—	Test for lime.
AMMONIÆ PHOSPHAS Phosphate of Ammonia $(NH_4)_2HPO_4$	—	—	5 to 20 grs.	Used in urinary diseases with a tendency to uric acid calculi, and in gout.
AMMONII BROMIDUM Bromide of Ammonium NH_4Br.	—	—	2 to 20 grs.	Nerve sedative; used in epilepsy and pertussis; similar to the corresponding potassium salt.
AMMONII CHLORIDUM Chloride of Ammonium or Sal Ammoniac NH_4Cl.	—	—	5 to 20 grs.	Alterative, cholagogue (?) emmenagogue (?). Relieves certain neuralgias. Used as a substitute for mercury in chronic inflammation. Useful in chronic bronchitis with profuse expectoration.
	Solution of (App. II.)	1 in 10	—	Applied externally as a discutient and as a refrigerant lotion.
AMMONII SULPHIDUM Sulphide of Ammonium NH_4HS	Solution of (App. II.)	—	—	Test for copper, lead, cadmium, zinc, &c.

PREPARATION.

Chloride of Ammonium.

Neutralise the ammoniacal liquor of gas works by hydrochloric acid, and purify the crystals by sublimation:—

$$NH_3+HCl=NH_4Cl;$$

or neutralise the ammoniacal liquor by sulphuric acid; mix the resulting sulphate of ammonia with chloride of sodium and sublime; sulphate of soda remains while chloride of ammonium volatilises:—

$$2NaCl+(NH_4)_2SO_4=2NH_4Cl+Na_2SO_4.$$

From the **Chloride** are prepared:—

1. Strong Solution of Ammonia.

Vide, "The Pharmacopœial Preparations." (Part II.).

2. Carbonate of Ammonia.

Heat it with chalk; chloride of calcium and carbonate of ammonia are thus formed; the latter volatilises and is condensed:—

$$6NH_4Cl+3CaCO_3=N_4H_{16}C_3O_8+3CaCl_2+2NH_3+H_2O.$$

From the **Strong Solution of Ammonia** are prepared:—

1. Citrate of Ammonia (Solution of).

Add to a solution of citric acid in distilled water until the liquid is neutral.

2. Phosphate of Ammonia.

Add diluted phosphoric acid to it until the solution is slightly alkaline; then evaporate, adding ammonia from time to time so as to keep it in slight excess in order to prevent the formation of acid phosphate. When crystals are formed on the cooling of the solution, dry them quickly on filtering paper placed on a porous tile:—

$$H_3PO_4+2NH_4HO=(NH_4)_2HPO_4+2H_2O.$$

From the **Solution of Ammonia** (1 pt. Liq. Am. Fort. to 2 pts. distilled water) are prepared:—

1. Benzoate of Ammonia.

Dissolve benzoic acid in slight excess of it, and slowly evaporate

$$NH_4HO+HC_7H_5O_2=NH_4C_7H_5O_2+H_2O.$$

2. Bromide of Ammonium.

Saturate hydrobromic acid with ammonia:—

$$HBr+NH_4HO=NH_4Br+H_2O.$$

3. Sulphide of Ammonium.

Pass sulphuretted hydrogen into solution of ammonia as long as the gas continues to be absorbed, then add more ammonia, and transfer the solution to a well-stoppered green glass bottle:—

$$NH_3+H_2S=NH_4HS. \quad NH_4HS+NH_3=(NH_4)_2S.$$

From the **Carbonate** is prepared:—

1. Acetate of Ammonia (Solution of).

Add acetic acid to it gradually until a neutral solution is formed, then add water.

2. Oxalate of Ammonia.

Neutralise it with solution of oxalic acid.

3. Nitrate of Ammonia.

Saturate dilute nitric acid with it, and evaporate to crystallisation:—

$$N_4H_{16}C_3O_8+4HNO_3=4NH_4NO_3+3CO_2+2H_2O.^*$$

CHARACTERS AND TESTS.

Ammoniæ Benzoas.

In colourless laminar crystals. Soluble in water, thus differing from benzoic acid; soluble also in alcohol. It gives a bulky reddish precipitate with persalts of iron (ferric benzoate). Its aqueous solution when heated with caustic potash evolves ammonia (characteristic of ammonia salts), and, if it be not too dilute, when acidulated with hydrochloric acid gives a deposit of benzoic acid (*vide* p. 16). When heated it sublimes without any residue.

Ammoniæ Carbonas.

The formula of carbonate of ammonia is probably constituted of two molecules of acid carbonate (NH_4HCO_3), and one molecule of carbamate, of ammonium ($NH_4NH_2CO_2$). It occurs in translucent crystalline masses, with a strong ammoniacal odour, an acrid taste, and alkaline reaction. On exposure to air, its odour is dissipated, from the continued volatilisation of the neutral carbonate, a white, opaque powder of acid carbonate being left. The commercial salt is soluble in cold water, but is decomposed by boiling water and alcohol.

In water the carbamate changes into the neutral carbonate:—

$$NH_4NH_2CO_2+H_2O=(NH_4)_2CO_3;$$

hence the aqueous solution will contain both neutral and acid

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* May be also obtained by neutralising the diluted acid with solution of ammonia.

carbonate of ammonium. The neutral carbonate has not yet been isolated in the solid state. Carbonate of ammonia is readily dissolved by acids, with effervescence. If dilute nitric acid be added to it in slight excess, and the solution be boiled, it will give no precipitate with chloride of barium (absence of sulphates), or with nitrate of silver (absence of chlorides). 59 grains of it dissolved in an ounce of distilled water will be neutralised by 1,000 grain-measures of the volumetric solution of oxalic acid. As the carbonate of ammonia may be said to contain four molecules, it follows that 59 grains (*i.e.*, one-fourth of its molecular weight, 236) should neutralise 1,000 grain-measures of the oxalic acid solution (*i.e.*, half a molecule, oxalic acid being a dibasic acid).

20 grains of carbonate of ammonia neutralise 23½ grains of citric acid, 25½ grains of tartaric acid, and 6 drachms of lemon juice.

Ammoniæ Nitras.

A white, deliquescent salt, in confused crystalline masses, having a bitter, acrid taste. Soluble in less than its own weight of water, and sparingly soluble in rectified spirit. A solution of one part in eight of distilled water gives no precipitate with solution of nitrate of silver (absence of chlorides), or with solution of chloride of barium (absence of sulphates). Heated with caustic potash, it evolves ammonia; with sulphuric acid, it emits nitric acid vapour (characteristic of a nitrate). It fuses at a temperature of 320°, and at 350° to 450° it is entirely resolved into nitrous oxide (laughing gas) and aqueous vapour:—

$$NH_4NO_3 = N_2O + 2H_2O.$$

Ammoniæ Oxalas.

Colourless prisms, resembling Epsom salts; heated with caustic potash it evolves ammonia. The aqueous solution gives a copious white precipitate with neutral or alkaline solutions of lime. Completely dissipated by heat.

Ammoniæ Phosphas.

In colourless prisms, which are transparent when recent, but which effloresce and become opaque on exposure, losing both ammonia and water. It is soluble in water, but, unlike the benzoate, insoluble in rectified spirit. Heated with caustic potash, it evolves ammonia. Its aqueous solution gives a yellow precipitate with nitrate of silver, being a salt of tribasic phosphoric acid. If 20 grains of the salt be dissolved in water and solution of ammonio-sulphate of magnesia added, a crystalline precipitate of ammonio-magnesian phosphate falls, which, when well washed upon a filter with solution of ammonia, diluted with an equal volume of water, dried, and heated to redness, forms pyro-phosphate of magnesia ($Mg_2P_2O_7$), leaving 16·8 grains, a little more than four-fifths of the original quantity of the salt operated upon.

Ammonii Bromidum.

In colourless crystals, which become slightly yellow on exposure, from decomposition and liberation of bromine. Has a pungent, saline taste. May be sublimed unchanged by heat. Readily soluble in water; less soluble in spirit. A solution of it in water, mixed with mucilage of starch and a drop of an aqueous solution of chlorine or bromine added, does not develop a blue colour (absence of iodide).

Ammonii Chloridum.

In colourless, inodorous, translucent, tough, fibrous masses, difficult to pulverise. Has a pungent, saline taste, which is best disguised by liquorice. Sp. gr. 1·45. Is soluble in water, less so in spirit, and sparingly soluble in absolute alchohol. It crystallises from its aqueous solution in octahedra. Heated with caustic potash, it evolves ammonia, and when treated with nitrate of silver forms a copious curdy precipitate. When heated it volatilises without decomposition and leaves no residue.

Ammonii Sulphidum.

The solution of sulphide of ammonium is colourless, becoming greenish-yellow on exposure to air and light from formation of disulphide and hyposulphite of ammonia due to the absorption of oxygen. It should be kept in green glass bottles, as it attacks the lead of white glass. It has an intensely disagreeable pungent odour. Sp. gr. 0·999. Chiefly used as a test for certain metals.

COMPOUNDS OF ANTIMONY. [Sb=122]

Name	B. P. Prep.	Strength	Dose	Action and Use
ANTIMONII CHLORIDUM Chloride of Antimony $SbCl_3$	Liquor Antim. Chloridi	—	—	Locally a powerful caustic. Used in the preparation of Antim. Oxidum.
ANTIMONII OXIDUM Oxide of Antimony Sb_2O_3	—	—	1 to 4 grs.	Diaphoretic. In large doses emetic.
	Pulvis Antimonialis	1 pt. in 3	3 to 10 grs.	Ibid.
ANTIMONIUM NIGRUM Black Antimony Sb_2S_3	—	—	—	Used to prepare Antimonium Sulphuratum and Liquor Antimonii Chloridum.

Compounds of Antimony–Continued.

	B. P. Preps.	Strength	Dose	Action and Use
ANTIMONIUM SULPHURATUM Sulphurated, or Golden Sulphide of Antimony Sb_2S_3,Sb_2O_3	—	—	1 to 5 grs.	Alterative and diaphoretic. In large doses emetic.
	Pil. Hydrargyri Subchlor. Co.	1 pt. in 5	5 to 10 grs.	Alterative. Used in syphilis, cutaneous affections, and in chronic rheumatism.
ANTIMONIUM TARTARATUM Tartarated Antimony, or Potassio-tartrate of Antimony, or Tartar Emetic $KSbC_4H_4O_7.H_2O$	—	—	$\frac{1}{16}$ to 1 gr. diaphoretic; 1 to 2 grs. emetic.	In small doses diaphoretic, expectorant, probably cholagogue. In large doses a depressing emetic, sometimes purgative. When tolerance is established, a vascular sedative. Used in acute inflammations, and to relax muscular spasm.
	Unguentum Antim. Tart.	1 pt. in 5	—	Used as a counter-irritant. Produces a papulo-pustular erruption.
	Vinum Antimoniale	2 grs. in 1 oz.	5 min. to 1 drm.	Similar to Antim. Tart.

PREPARATION.

Sulphide of Antimony.

Occurs native; it is purified from silicious matter by fusion, and is afterwards reduced to fine powder.

From the **Sulphide** are prepared:—

1. Antimonii Chloridi Liquor.

Vide "Pharmacopœial Preparations."

2. Sulphurated Antimony.

Mix black antimony (10 ozs.) with solution of soda ($4\frac{1}{2}$ pints), and boil for two hours with frequent stirring, adding distilled water occasionally to maintain the same volume. A double salt, a sulphide of sodium and antimony, and a double oxide of sodium and antimony, both soluble in the hot alkaline solution, are formed:—

$$2Sb_2S_3+6NaHO=2Na_3SbS_3+Sb_2O_3+3H_2O;$$

$$\text{and, } Sb_2O_3+6NaHO=2Na_3SbO_3+3H_2O.$$

The sulphide of sodium combines with and dissolves some of the undecomposed sulphide of antimony, while the oxide of antimony does the same with the undecomposed soda. Strain now through calico, and *before it cools* (as in the hot alkaline solution no precipitate occurs) add to it by degrees diluted sulphuric acid till the latter is slightly in excess The sulphate of sodium is formed in solution, and the sulphide and oxide of antimony are all precipitated as sulphurated antimony:—

$$2Na_3SbS_3+3H_2SO_4=3Na_2SO_4+Sb_2S_3+3H_2S\,;$$
$$2Na_3SbO_3+3H_2SO_4=3Na_2SO_4+Sb_2O_3+3H_2O.$$

Collect the precipitate on a calico filter, wash away the sulphate of soda with distilled water, until the washings no longer give a precipitate with chloride of barium, and finally dry at a temperature not exceeding 212°.

From the **Chloride** is prepared:—

Oxide of Antimony.

Pour solution of chloride of antimony (16 ozs.) into water (two gallons); mix thoroughly; let the precipitate settle; remove the supernatant liquid by a syphon; add distilled water (one gallon); agitate well; let the precipitate subside; again withdraw the fluid, and repeat the processes of affusion of distilled water, agitation, and subsidence. The precipitate formed in the foregoing process consists of oxychloride of antimony:—

$$12SbCl_3+15H_2O=\underbrace{2SbCl_3,5Sb_2O_3}_{\textit{Oxychloride of antimony}}+30HCl.$$

Add now carbonate of soda (6 ozs.) previously dissolved in distilled water (2 pints), to form oxide of antimony and chloride of sodium:—

$$2SbCl_3 5Sb_2O_3+3Na_2CO_3=6Sb_2O_3+6NaCl+3CO_2$$

Leave them in contact for half an hour, stirring frequently; collect the deposit (oxide of antimony) on a calico filter, wash away the chloride of sodium with boiling distilled water, until the washings cease to give a precipitate with solution of nitrate of silver acidulated with nitric acid. Lastly, dry the product at a heat not exceeding 212°, to avoid absorption of oxygen and formation of higher oxides of antimony (Sb_2O_4 and Sb_2O_5).

From the **Oxide** is prepared:—

Tartarated Antimony.

Mix oxide of antimony (5 ozs.) and finely powdered acid tartrate of potash (6 ozs.) with sufficient water to form a paste, and set aside for twenty-four hours. Then add distilled water (nearly 2 pints), and boil for a quarter of an hour, stirring frequently. Filter and set aside to crystallise. Pour off the mother liquor, evaporate to one-third, and set aside that more crystals may form. Dry the crystals on filtering paper at the temperature of the air. In this process the oxide of antimony (Sb_2O_3) merely displaces the acidulous radical H in the acid tartrate of potash:—

$$Sb_2O_3+2KHC_4H_4O_6=2KSbC_4H_4O_7+H_2O.$$

CHARACTERS AND TESTS.

Antimonii Oxidum.

A grayish-white powder, fusible at a low red heat, insoluble in water, but readily dissolved by hydrochloric acid:—

$$Sb_2O_3+6HCl=2SbCl_3+3H_2O.$$

This solution dropped into distilled water gives a white deposit (the oxychloride, or Algarothi's powder), which is at once changed to orange (the golden sulphide, or antimonium sulphuratum) by sulphuretted hydrogen. It is entirely soluble also in acetic and tartaric acids, if the higher oxides of antimony be not present. It is dissolved by solutions of caustic potash and soda. It dissolves entirely when boiled with an excess of acid tartrate of potash, forming tartarated antimony. It should not yield any sublimate when fused in a test-tube (absence of arsenious acid).

Antimonium Nigrum.

A grayish-black crystalline powder. Sp. gr. 4·6. Is insoluble in water, but dissolves almost entirely in boiling hydrochloric acid, evolving sulphuretted hydrogen:—

$$Sb_2S_3+6HCl=2SbCl_3+3H_2S.$$

It fuses below a red heat. It is apt to contain iron, arsenic, lead, or copper.

Antimonium Sulphuratum.

An orange-red powder, odourless, with a slight taste; when heated, it takes fire and burns with a greenish-blue flame, giving off SO_2. Exposure to light and air causes partial decomposition, with separation of sulphur. It is insoluble in water; is readily dissolved by caustic soda, also by hydrochloric acid, with evolution of sulphuretted hydrogen and the separation of a little sulphur. Boiled in water with acid tartrate of potash, the resulting solution is precipitated orange-red with sulphuretted hydrogen, proving the presence of oxide of antimony, which is dissolved by excess of the cream of tartar. 60 grains of this preparation, dissolved in hydrochloric acid and dropped into water, give a white precipitate (the oxychloride), which when washed and dried weighs about 53 grains.

Antimonium Tartaratum.

In colourless transparent crystals exhibiting triangular facets; these become efflorescent and opaque on exposure to air. They have a slight metallic taste; are soluble in about 15 parts of cold water, in 2 parts of boiling water; partially soluble in proof spirit, and insoluble in absolute alcohol. The aqueous solution reddens litmus; it decomposes readily with the formation of algæ (*Sirocrosis tartarica*). Tartar emetic decrepitates and blackens on the application of heat. Its solution in water gives with hydrochloric acid a white precipitate, soluble in excess, and which is not formed if tartaric acid be previously added. Antimonial salts are thus distinguished from salts of bismuth, which also give precipitates with water, but are not dissolved by tartaric acid. Twenty grains dissolve without residue in a fluid ounce of distilled water at 60°, and the solution gives with sulphuretted hydrogen an orange precipitate, which, when washed and dried at 212°, weighs 9·91 grains. Solution of tartar emetic is not precipated by ferrocyanide of potassium, chloride of barium, or nitrate of silver, unless it be concentrated.

COMPOUNDS OF SILVER. [Ag=108]

Name	B. P. Prep.	Strength	Dose	Action and Use.
ARGENTI NITRAS. Nitrate of Silver $AgNO_2$	—	—	1/6 to 1/2 gr.	Externally astringent, irritant, vesicant, and escharotic. Internally astringent, and alterative to alimentary mucous membrane. Used in chronic gastric affections, diarrhœa, &c. Nervine tonic. Given in epilepsy and chorea.
	Volumetric Solution of (App. III.)	17grs.in1,000	—	Used in testing Acid. Hydrocyanic. Dil., Potass. Bromid., and Sodæ Arsenias.
ARGENTI OXIDUM Oxide of Silver Ag_3O	—	—	1/2 gr. to 2 grs.	Similar action to the nitrate, but is less energetic topically.

PREPARATION.

Nitrate of Silver.

Add nitric acid (2½ ozs.) and water (5 ozs) to refined silver (3 ozs.) in a flask, and apply a gentle heat till the metal is dissolved:—

$$3Ag + 4HNO_3 = 3AgNO_3 + NO + 2H_2O.$$

Decant the clear liquor from any black powder (trace of gold or of sulphide of silver) which may be present, into a porcelain dish; evaporate, and set aside to crystallise. Let the crystals drain in a glass funnel, and dry them by exposure to the air, carefully avoiding the contact of all organic substances. To obtain the nitrate of silver in rods, fuse the crystals in a capsule of platinum or thin porcelain, and pour the melted salt into proper moulds.

From the **Nitrate** is prepared:—

Oxide of Silver.

Dissolve nitrate of silver (½oz.) in distilled water (4 ozs.), and having poured the solution into a bottle containing solution of lime (3½ pints), shake the mixture well and set aside to allow the deposit to settle:—

$$2AgNO_3 + Ca2HO = Ca2NO_3 + Ag_2O + H_2O.$$

Draw off the supernatant liquid, collect the deposit on a filter, wash it with distilled water, and dry it at a heat not exceeding 212°.

CHARACTERS AND TESTS.

Argenti Nitras.

In colourless tabular crystals, the primary form of which is the right rhombic prism; or in white cylindrical rods, "lunar caustic." Soluble in its own weight of distilled water at 60°; soluble also in rectified spirit. The solution gives with hydrochloric acid a curdy white precipitate ($AgCl$), which darkens on exposure to light, chlorine being set free and a subchloride of silver being formed. This precipitate is soluble in ammonia, but not in nitric acid. A small fragment of nitrate of silver, heated on charcoal with the blowpipe, first melts and then, like all other nitrates, deflagrates, leaving behind a dull white metallic coating (metallic silver). Crystals of nitrate of silver are apt to contain copper and lead; in the fused form, nitre may be present, being occasionally added to render the sticks less brittle, and to moderate the caustic action. Ten grains of the salt, dissolved in two fluid drachms of distilled water, give with hydrochloric acid a precipitate, which, when washed and thoroughly dried, weighs 8·44 grains. The filtrate, when evaporated by a water bath, should leave no residue (absence of copper, lead, and nitrates of soda or potash).

Stains of nitrate of silver may be removed by solution of cyanide of potassium; or by moistening them with solution of iodide of potassium, and subsequently washing with hyposulphite of sodium.

Argenti Oxidum.

An olive-brown powder, becoming black by age, and undergoing partial reduction. At a low red heat it gives off oxygen, and is reduced to the metallic state. It is insoluble in water, feebly soluble in ammonia, and the solution on exposures deposits an explosive black powder known as fulminating silver. It dissolves completely in nitric acid, without evolution of any gas (absence of carbonate of silver, which is sometimes present from the precipitant used in its preparation containing some carbonic acid). The solution in nitric acid presents the characters of nitrate of silver. Twenty-nine grains of the oxide of silver heated to redness leave 27 grains of metallic silver. The molecular equivalent of the oxide is 232, and that of silver is 216; and 232 is to 216 as 29 is to 27.

Salts of silver, especially the oxide, decompose in contact with organic matter, especially with creasote, carbolic acid, or any of the essential oils. Hence, in their preparation their solutions are decanted, not filtered. Combustion or explosion may result from this decomposition; and care must consequently be taken in compounding them.

COMPOUNDS OF BISMUTH. [Bi=210]

	B. P. Preps.	Strength	Dose	Action and Use
BISMUTHI CARBONAS Carbonate of Bismuth $2(Bi_2CO_5),H_2O$	—	—	5 to 20 grs.	Astringent, and sedative to alimentary mucous membrane. Used in irritative dyspepsia, gastralgia, chronic vomiting, and diarrhœa of phthisis. Applied locally as a sedative and absorbent in skin affections, leucorrhœa, and gleet.
BISMUTHI OXIDUM Oxide of Bismuth Bi_2O_3	—	—	5 to 15 grs.	Same as the carbonate.
BISMUTHI SUBNITRAS Subnitrate of Bismuth or White Bismuth $BiNO_4,H_2O$	— Trochisci Bismuthi	— 2 grs. in each	5 to 20 grs. 1 to 6	Same as the carbonate.

PREPARATION.

Carbonate of Bismuth.

Mix nitric acid (4 ozs.) with distilled water (3 ozs.), and add purified bismuth (2 ozs.) by degrees, to form the normal nitrate ($Bi+4HNO_3=Bi3NO_3+NO+2H_2O$). When effervescence, due to escape of nitric oxide gas, has ceased, apply for ten minutes a heat approaching that of ebullition, and afterwards decant the solution from any insoluble matter that may be present. Evaporate the solution so as to remove excess of acid and concentrate it until it is reduced to two fluid ounces, and add this in small quantities at a time to a cold filtered solution of carbonate of ammonia (6 ozs.) in distilled water (2 pints) constantly stirring the mixture:—

$$4Bi3NO_3+3N_4H_{16}C_3O_8=12NH_4NO_3+2Bi_2CO_5+7CO.$$

Collect the precipitate of hydrated oxycarbonate on a calico filter; wash it with distilled water until the washings pass tasteless. Remove now as much of the adhering water as can be separated from the precipitate by slight pressure, and finally dry the product at a temperature not exceeding 150°, to avoid decomposition.

Subnitrate of Bismuth.

Mix nitric acid (4 ozs.) with distilled water (3 ozs.), and add purified bismuth (2 ozs.) by degrees to form the normal nitrate ($Bi+4HNO_3=Bi3NO_3+NO+2H_2O$). When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluid ounces, and pour it into half a gallon of distilled water; the subnitrate is thus precipitated, while supernitrate of bismuth remains in solution:—

$$5Bi3NO_3+8H_2O=4BiNO_4, H_2O+Bi3NO_3, 8HNO_3.$$

When the precipitate has subsided, decant the supernatant liquid, containing the supernitrate of bismuth, add half a gallon of distilled water to the precipitate, stir well, and after two hours decant off the liquid, collect and drain the precipitate in a calico filter, press it, and dry it at a temperature not exceeding 150°, to avoid decomposition.

From the **Subnitrate** is prepared:—

Oxide of Bismuth.

Mix subnitrate of bismuth (1 pound) with solution of soda (4 pints), and boil for five minutes—

$$2BiNO_4+2NaHO=Bi_2O_3,H_2O+2NaNO_3;$$

then having allowed the mixture to cool, and the precipitated oxide to subside, decant the supernatant liquid, and wash the precipitate thoroughly with distilled water, to remove the nitrate of soda, and finally dry the oxide by the heat of a water bath.

In this process excess of soda is necessary for the complete removal of the nitric acid.

[The *Liquor Bismuthi et Ammoniæ Citratis* is prepared by adding to a concentrated solution of nitrate of bismuth a solution of citric acid, and subsequently solution of ammonia, until the precipitate formed is re-dissolved and the solution becomes neutral. Each drachm of the diluted solution contains three grains of Bi_2O_3.]

CHARACTERS AND TESTS.

Bismuthi Carbonas.

A white powder blackened by sulphuretted hydrogen (black sulphide, Bi_2S_3). Like all neutral and basic carbonates, it is insoluble in water, but soluble with effervescence (CO_2) in nitric acid. When added to sulphuric acid coloured with sulphate of indigo, the colour of the latter is not discharged (absence of any nitrate). If to nitric acid mixed with half its volume of distilled water as much carbonate of bismuth be added as the acid will dissolve, one volume of the solution poured into twenty volumes of water will yield a white precipitate (test for presence of a bismuth salt). The nitric acid solution gives no precipitate with dilute sulphuric acid (absence of lead), or with solution of nitrate of silver (absence of chlorides).

Bismuthi Oxidum.

A dull lemon-yellow powder. Heated to incipient redness it is not diminished in weight, being anhydrous. (The hydrate Bi_2O_3, H_2O is formed if ammonia be used instead of soda in precipitating the oxide from the nitrate). It is insoluble in water, but soluble in nitric acid mixed with half its volume of water, forming a neutral nitrate; if it be thus dissolved to saturation, the solution poured into twenty times its volume of water yields a precipitate of subnitrate of bismuth. The nitric acid solution gives no precipitate with diluted sulphuric acid (absence of lead), nor with solution of nitrate of silver dropped into it (absence of chlorides). Solution of chloride of ammonium added to the nitric acid solution gives a white precipitate of oxychloride of bismuth, $2(BiCl_3, Bi_2O_3), H_2O$; if this be treated with excess of solution of ammonia, then filtered, and the clear filtrate neutralised with hydrochloric acid, it should not become turbid (absence of silver).

Bismuthi Subnitras.

A tasteless heavy white powder in minute crystalline scales. Blackened by sulphuretted hydrogen (Bi_2S_3). Insoluble in water, but soluble in nitric acid mixed with half its volume of distilled water, forming a solution which, poured into water, gives a white crystalline precipitate of the normal nitrate. It forms with sulphuric acid, diluted with an equal bulk of water, a solution which is blackened with sulphate of iron (characteristic of the presence of a nitrate). The nitric acid solution gives no precipitate with dilute sulphuric acid (absence of lead), or with solution of nitrate of silver (absence of chlorides).

COMPOUND OF CADMIUM. [Cd=112]

	B. P. Preps.	Strength	Dose	Action and Use
Cadmii Iodidum Iodide of Cadmium CdI_2	— Unguentum Cadmii Iodidi	— 1 pt. in 8	— —	Not given internally. Used externally in the same cases as iodide of lead is, but does not stain the skin.

PREPARATION.

Iodide of Cadmium.

By direct combination of iodine and cadmium in the presence of water; or by decomposing sulphate of cadmium by iodide of barium.

CHARACTERS AND TESTS.

Cadmii Iodidum.

In flat micaceous crystals, white, of a pearly lustre, which melt when heated to about 600°, forming an amber-coloured fluid. At a dull red heat violet-coloured vapours of iodine are given off. It is anhydrous and permanent in the air; freely soluble in water and in rectified spirit, and the solution reddens litmus. The aqueous solution gives a yellow precipitate, CdS, with sulphuretted hydrogen or sulphide of ammonium, which is insoluble in excess of the latter; the solution also gives a white gelatinous precipitate, Cd2HO, with excess of solution of potash, the filtrate from which is unaffected by sulphide of ammonium (absence of zinc). 10 grains dissolved in water and nitrate of silver added in excess, give a precipitate which—when washed with water and afterwards with half an ounce of solution of ammonia, to dissolve any adhering cadmium, and dried—weighs 12·5 grains.

COMPOUNDS OF CALCIUM. [Ca=40]

	B. P. Preps.	Strength	Dose	Action and Use
CALCII CHLORIDUM Chloride of Calcium $CaCl_2$	—	—	10 to 20 grs. —	Acts on glandular system: formerly used in scrofula. Allays certain forms of vomiting.
	Solution of (App. II.)	1 in 10	—	Test for Potassæ citras.
	Saturated Do. (App. II.)	4 in 5	—	Used in estimating strength of Sp. Æther. Nitrosi.
CALCIS CARBONAS PRÆCIPITATA Precipitated Carbonate of Lime $CaCO_3$	—	—	10 to 60 grs.	Antacid and astringent; given in acidity with diarrhœa. Contained in Troch. Bismuthi; 4 grains in each lozenge.
CALCIS HYDRAS Slaked Lime CaH_2O_2	Liquor Calcis	11¼ grs. to 1 pt.	1 to 4 ozs.	Antacid and slightly astringent; given in acidity with diarrhœa.
	Liq. Calcis Saccharatus	8 grs. to 1 oz.	15 to 60 mins.	Ditto.
CALCIS HYPOPHOSPHIS Hypophosphite of Lime $Ca2PH_2O_2$	—	—	5 to 10 grs.	Stimulant, alterative, and tonic, like Phosphorus, but less objectionable. Used in pulmonary phthisis, nervous depression, etc.
CALCIS PHOSPHAS Phosphate of Lime $Ca_3P_2O_8$	—	—	10 to 20 grs.	Used in scrofula, rickets, and osteomalacia; hectic and other wasting diseases. Contained in Pulvis Antimonialis.
CALX Lime CaO	—	—	—	Used externally as a caustic, and for making Calcis Hydras.
	Calcis Hydras	—	—	
CALX CHLORATA Chlorinated Lime $CaOCl_2$ (?)	—	—	—	Disinfectant.
	Liq. Calcis Chloratæ	1 in 10	—	Used as a disinfectant and stimulant application to various foul ulcers, and in cases of fœtid discharges.
	Vapor Chlori	—	—	Stimulant, antiseptic, and disinfectant inhalation in gangrene of the lungs, phthisis, chronic bronchitis, etc.
CRETA Chalk $CaCO_3$	—	—	—	Used for making Creta Præparata and carbonic acid gas.
CRETA PRÆPARATA Prepared Chalk	—	—	10 to 60 grs.	Antacid and astringent; used in acidity with diarrhœa.
	Hydrarg. cum Creta	2 pts. in 3	3 to 8 grs.	Alterative and laxative.
	Mist. Cretæ	1 pt. in 32	1 to 2 ozs.	Same as Cretæ Præparata.
	Pulv. Cretæ Aromat.	1 pt. in 4	10 to 60 grs.	Antacid and aromatic astringent.
	Pulv. Cretæ Ar. cum Opio	1 pt. in 4 nearly	10 to 40 grs.	Antacid, aromatic astringent and sedative.

PREPARATION.

Chalk.

Is native friable carbonate of lime.

Prepared Chalk.

Chalk freed from most of its impurities by elutriation and afterwards dried in small cone-shaped masses.

From **Chalk** are prepared:—

1. Lime.

By calcination, to expel the carbonic acid ($CaCO_3 = CaO + CO_2$).

2. Chloride of Calcium.

By neutralising it with hydrochloric acid ($2HCl + CaCO_3 = CaCl_2 + H_2O + CO_2$). A little solution of chlorinated lime and slaked lime are added to the solution in order to peroxidise, and so precipitate, any iron which may be present. The solution is then filtered to remove the insoluble peroxide of iron, evaporated until it becomes solid, and the salt finally dried at about 400°, to obtain it anhydrous.

From the **Chloride** is prepared:—

Precipitated Carbonate of Lime.

Dissolve chloride of calcium (5 ozs.) and carbonate of soda (13 ozs.) in boiling distilled water (2 pints each), ($CaCl_2 + Na_2CO_3 = CaCO_3 + 2NaCl$); collect the precipitate of carbonate of lime, which results on mixing these solutions, on a calico filter, and wash away the chloride of sodium with boiling distilled water until the washings cease to give a precipitate with nitrate of silver (showing its complete removal); dry the product at a temperature of 212°.

From **Lime** is prepared:—

Slaked Lime.

Place lime (2 pounds) in a metal vessel, pour distilled water (1 pint) upon it, and when vapour ceases to be disengaged, cover the vessel and set it aside to cool. When the temperature has fallen to that of the atmosphere, sift the product, and preserve it in well-stoppered bottles.

From **Slaked Lime** are prepared:—

1. Chlorinated Lime.

By exposing it to the action of chlorine gas as long as the latter is absorbed—

$$CaH_2O_2 + Cl_2 = H_2O + CaOCl_2.$$

2. Hypophosphite of Lime.

By heating it with phosphorus and water until phosphuretted hydrogen ceases to be evolved—

$$3Ca2HO + P_8 + 6H_2O = 3(Ca2PH_2O_2) + 2PH_3,$$

then filtering the liquid, separating uncombined lime with carbonic acid gas, and evaporating the remaining solution until the salt separates in a crystalline condition.

From **Bone-ash** is prepared :—

Phosphate of Lime.

Digest it (4 ozs.) in hydrochloric acid (6 ozs.) diluted with water (1 pint) until it is dissolved; the carbonate of lime is thus converted into chloride of calcium, and the phosphate into superphosphate ($Ca_32PO_4+4HCl=CaH_42PO_4+2CaCl_2$). Filter the solution if necessary; add water (1 pint), and afterwards solution of ammonia (12 ozs.), until the mixture becomes alkaline; tribasic phosphate of lime is thus precipitated—

$$CaH_42PO_4+2CaCl_2+4NH_4HO=Ca_32PO_4+4NH_4Cl+4H_2O.$$

Having collected the precipitate on a calico filter, wash it, in order to remove the chloride of ammonium, with boiling distilled water as long as the liquid which passes through occasions a precipitate when dropped into solution of nitrate of silver acidulated with nitric acid. Dry the washed product at a temperature not exceeding 212°.

CHARACTERS AND TESTS.

Calcii Chloridum.

In white semi-transparent agglutinated masses, dry, but very deliquescent, with a bitter acrid saline taste. Evolves no chlorine or hypochlorous acid on addition of hydrochloric acid, and is thus distinguished from calx chlorata. It is entirely soluble in twice its weight of water, from which it can be crystallised in prisms; it is soluble also in alcohol. The aqueous solution does not yield a precipitate on addition of lime-water (absence of carbonic acid, and freedom from iron, alumina, &c.).

Calcis Carbonas Precipitata.

A white crystalline powder, insoluble in water, dissolving in hydrochloric acid with effervescence, and thus distinguished from the sulphate of lime, which has been sold for it. The solution, when neutralised by ammonia, lets fall on the addition of oxalate of ammonia a copious white precipitate of calcic oxalate ($CaC_2O_4,2H_2O$). With dilute nitric acid it gives a clear solution which, if perfectly neutral and deprived of carbonic acid by boiling, is not precipitated by saccharated solution of lime (absence of phosphates), or by solution of nitrate of silver (absence of chlorides).

Calcis Hydras.

Is whiter than quicklime. It may be obtained in crystals from its aqueous solution. [*Vide* "CALX"]

Calcis Hypophosphis.

A white crystalline salt, with a pearly lustre and a bitter nauseous taste. Insoluble in rectified spirit. Soluble in six parts of cold water, and only slightly more soluble in hot water. The crystals do not lose water when heated to 300°. Heated to redness it is decomposed, evolving spontaneously inflammable phosphuretted hydrogen, and leaving a reddish coloured residue, calcic pyrophosphate, amounting to about 80 per cent. of the salt:—

$$2(Ca2PH_2O_2)=Ca_2P_2O_7+2PH_3+H_2O.$$

Calcis Phosphas.

A light white amorphous powder, insoluble in water, but soluble without effervescence (absence of carbonic acid) in dilute nitric acid. The solution continues clear when an excess of acetate of soda is added to it, but lets fall a white precipitate on the subsequent addition either of a little oxalate of ammonia (presence of lime), or of perchloride of iron (presence of phosphoric acid). In this test the acetate of soda is added to neutralise the nitric acid, in which oxalate of lime and phosphate of iron are soluble. 10 grains dissolve perfectly and without effervescence in dilute hydrochloric acid, and the solution yields with ammonia a white precipitate (tricalcic phosphate), insoluble in boiling solution of potash, and weighing 10 grains when washed and dried. If alumina were present, it would be dissolved by the potash solution, and there would be a corresponding loss of weight in the residue.

Calx.

In compact masses of a whitish colour and of a caustic taste, which readily absorb water, and which, when rather less than their weight of water is added, crack and fall into powder (CaH_2O_2= Calcis Hydras, slaked lime), with development of much heat. About 11 grains are dissolved by a pint of water at 60°; it is less soluble in boiling water; at 32° water takes up twice as much lime as at 212°. Sugar and glycerine both increase the solubility of lime. The powder obtained by the process of slaking, when agitated with distilled water, gives after filtration a clear solution, which has an alkaline reaction, and yields a white precipitate with oxalate of ammonia. The powder obtained by slaking dissolves, without much residue, and without effervescence (absence of carbonic acid), in diluted hydrochloric acid; and if the solution thus formed be evaporated to dryness, and the residue redissolved in water, only a very scanty precipitate forms on the addition of saccharated solution of lime, showing the absence of all but traces of magnesia, alumina, or of phosphates.

Calx Chlorata.

A dull white powder, with a feeble odour of chlorine and an acrid bitter taste. On exposure to air it gives off chlorine, and is converted into chloride and carbonate of calcium. It is partially soluble in water. The solution evolves chlorine copiously on the addition of oxalic acid, and deposits at the same time oxalate of lime ($CaOCl_2+H_2C_2O_4=CaC_2O_4+H_2O+Cl_2$). The bleaching properties of calx chlorata depend on the evolution of chlorine, and the test for its purity consists in determining the amount of chlorine which can be set free by acids from a given weight of it. The test is as follows:—10 grains, mixed with 30 grains of iodide of potassium, and dissolved in four fluid ounces of water, produce, when acidulated with two fluid drachms of hydrochloric acid, a reddish solution, which requires for the discharge of its colour at least 850 grain-measures of the volumetric solution of hyposulphite of soda, corresponding to 30 per cent. of chlorine liberated by hydrochloric acid. In this test chlorine is liberated by hydrochloric acid ($CaOCl_2+2HCl=CaCl_2+H_2O+Cl_2$). The free chlorine in contact with the iodide of potassium liberates an equivalent amount of iodine, which dissolves in the excess of iodide of potassium, forming a red solution. The amount of free iodine is now determined by ascertaining how much hyposulphite of soda is required to discharge the red colour—colourless iodide and tetrathionate of sodium being formed ($2Na_2S_2H_2O_4+I_2=2NaI+Na_2S_4O_6+2H_2O$).

Creta Præparata.

A white minutely crystalline powder, effervescing with acids (carbonic acid), and dissolving with only a slight residue (silica) in dilute hydrochloric acid. The solution, when supersaturated with solution of ammonia, gives, upon the addition of oxalate of ammonia, a copious white precipitate of oxalate of ammonia. The salt ($CaCl_2$) formed by dissolving the prepared chalk in hydrochloric acid, if rendered neutral by evaporation to dryness, and redissolved in water, gives only a very scanty precipitate on the addition of saccharated solution of lime (absence of all but traces of magnesia, alumina, or of phosphates).

COMPOUND OF CERIUM. [Ce=92]

	Strength	B. P. Preps.	Dose	Action and Use
CERII OXALAS. Oxalate of Cerium, $CeC_2O_4.3H_2O$.	—	—	1 to 2 grs.	Local sedative; nervine tonic. Used in irritable condition of stomach, in vomiting of pregnancy, &c. Given also in chorea, epilepsy, nervous cough, and nervous palpitation of heart.

PREPARATION.

Oxalate of Cerium.

May be obtained as a precipitate by adding solution of oxalate of ammonia to a soluble salt of cerium, as the chloride.

CHARACTERS AND TESTS.

Cerii Oxalas.

A white granular powder, insoluble in water, decomposed at a dull red heat into a reddish-brown powder, consisting of the oxides of cerium (CeO and Ce_2O_3); this residue dissolves completely in boiling hydrochloric acid, without effervescence (absence of earthy oxalates and of carbonates), and the resulting solution gives with solution of sulphate of potash, a white crystalline precipitate of double sulphate of potash and cerium (K_2Ce2SO_4). If the salt be boiled with solution of potash, and filtered, the filtrate is not affected by solution of chloride of ammonium (absence of alumina, lead or silver); but when supersaturated with acetic acid it gives with chloride of calcium a white precipitate of oxalate of lime, which is soluble in hydrochloric acid (test for oxalic acid). 10 grains, when incinerated, lose 5·2 grains in weight.

COMPOUND OF COPPER. [$Cu=63·5$]

Compound	B. P. Prep.	Strength	Dose	Action and Use
CUPRI SULPHAS Sulphate of Copper; Blue Stone or Blue Vitriol $CuSO_4.5H_2O$	—	—	¼ to 2 grs. astringent and tonic; 5 to 10 grs. emetic	In small doses astringent to alimentary canal, and after absorption a nervine tonic; used in diarrhœa, dysentery, chorea and epilepsy. In large doses, acts as emetic, and is given as such in narcotic poisoning. Externally applied to ulcers, and as a lotion to diminish mucous secretions.

PREPARATION.

Sulphate of Copper.

By heating sulphuric acid and copper together, dissolving the product in water, and evaporating till crystals form on cooling ($Cu+2H_2SO_4=CuSO_4+2H_2O+SO_2$). On a large scale, it is prepared by roasting copper pyrites.

CHARACTERS AND TESTS.

Cupri Sulphas.

In oblique prismatic crystals of a clear blue colour, soluble in water, and reddening litmus. Has a strong styptic metallic taste. Effloresces slightly in dry air. At 212° it loses four molecules of water, and at 400° it loses all its water of crystallisation. Anhydrous sulphate of copper is white, but immediately becomes blue on meeting with moisture; hence its use as a test for the presence of water in absolute alcohol. Solution of sulphate of copper gives with chloride of barium a white precipitate of barium sulphate, insoluble in hydrochloric acid, and a maroon-red precipitate of cupric ferro-cyanide with yellow prussiate of potash. If an aqueous solution of the salt be mixed with twice its volume of solution of chlorine, and solution of ammonia be added, the precipitate formed by the first addition of the ammonia will be dissolved by a further and sufficient addition of the alkali, and a violet-blue solution will be produced, leaving nothing undissolved. The foregoing is a test for the presence of iron; the chlorine peroxidises iron, if it be present, and the ammonia in excess dissolves the cupric hydrate, which is at first thrown down; but if any iron, ferric oxide, be present, a reddish-brown precipitate is left undissolved. Fixed alkalies precipitate cupric hydrate, which is insoluble in excess of the precipitant.

IRON AND ITS COMPOUNDS. [Fe=56]

	B. P. Preps.	Strength	Dose	Action and Use
Ferri Acetas Acetate of Iron $Fe_26C_2H_3O_2$	Tinctura Ferri Acetatis	—	5 to 30 mins.	Tonic.
Ferri Arsenias Arseniate of Iron $Fe_3As_2O_8$	—	—	$\frac{1}{16}$ to ½ gr.	Therapeutically identical with arsenious acid.
Ferri Carbonas Saccharata Saccharated Carbonate of Iron $FeCO_3$	— Pil. Ferri Carbonatis.	— 1 pt. in 1¼	5 to 20 grs. 5 to 20 grs.	A mild, non-astringent hæmatinic. Used in anæmic amenorrhœa, and in neuralgia.
Ferri et Ammoniæ Citras Citrate of Iron and Ammonia	— Vinum Ferri Citratis	— 8 grs. in 1 oz.	5 to 10 grs. 1 to 4 drms.	Very slightly astringent hæmatinic.
Ferri et Quiniæ Citras Citrate of Iron and Quinia	—	—	5 to 10 grs.	Possesses the properties of iron with those of quinia.
Ferri Iodidum Iodide of Iron FeI_2	— Pil. Ferri Iodidi Syrup. Ferri Iodidi	— 1 pt. in 3. 4½ grs. in 1 drm.	1 to 5 grs. 3 to 8 grs. ½ to 1 drm.	Used in scrofulous diseases, phthisis, rheumatoid arthritis, and in secondary and tertiary syphilis in cachectic subjects.
Ferri Oxidum Magneticum Magnetic, or Black Oxide of Iron Fe_3O_4	—	—	5 to 10 grs.	Non-astringent hæmatinic.
Ferri Perchloridum Perchloride of Iron Fe_2Cl_3	Liquor Fortior Liquor Tinctura	— 1 in 4 1 in 4	— 10 to 30 mins. 10 to 30 mins.	Used locally as a caustic and powerful styptic. General tonic and hæmatinic, and also astringent and styptic.

Iron and its Compounds—Continued.

	B. P. Preps.	Strength	Dose	Action and Use
FERRI PERNITRAS Pernitrate of Iron $Fe_2 6NO_3$	Liquor Ferri Pernitratis	—	10 to 40 mins.	Astringent and tonic; useful in chronic diarrhœa and chronic mucous discharge.
FERRI PEROXIDUM HUMIDUM Moist Peroxide of Iron Fe_2O_3 (with about 86 per cent. of uncombined water)	—	—	¼ to ½ oz.	Given internally as an antidote in arsenical poisoning; it converts arsenious acid into an insoluble arseniate of iron.
FERRI PEROXIDUM HYDRATUM Hydrated Peroxide, or Sesquioxide, or Red Oxide of Iron $Fe_2O_3.H_2O$	—	—	5 to 30 grs.	Non-irritating; useful when it is desired to continue iron for a long period. Much used in neuralgias.
	Emplastrum Ferri	1 pt. in 11	—	Used as a mechanical support.
FERRI PERSULPHAS Persulphate of Iron $Fe_2 3SO_4$	Liquor Ferri Persulphatis	—	—	Used for making several Pharmacopœial preparations of Iron.
FERRI PHOSPHAS Phosphate of Iron $Fe_3P_2O_8$	—	—	5 to 10 grs.	Given in diabetes and in rickets, &c.
	Syrupus Ferri Phosphatis	1 gr. in 1 drm.	1 drm.	
FERRI SULPHAS Sulphate of Iron, or Green Vitriol $FeSO_4.7H_2O$	—	—	1 to 5 grs.	Locally styptic, astringent, and irritant. Internally tonic, astringent and hæmatinic. Contained in Pil. Aloes et Ferri, and used in making Mist. Ferri Co.
	Ferri Sulphas Exsiccata	—	½ gr. to 3 grs.	Similar to the sulphate.
	Ferri Sulphas Granulata	—	1 to 5 grs.	Ditto.
	Solution of (App. II.)	10 grs. to 1 oz.	—	Test for nitric acid, etc.
FERRI SULPHIDUM Sulphide of Iron FeS	—	—	—	Used for production of sulphuretted hydrogen (App. I)
FERRUM REDACTUM Reduced Iron	—	—	1 to 5 grs.	Non-astringent hæmatinic.
	Trochisci	1 gr. in each	1 to 6	Ditto. Adapted for children.
FERRUM TARTARATUM Tartarated Iron, or Potassio-tartrate of Iron	—	—	5 to 10 grs.	Very slightly astringent hæmatinic.

PREPARATION.

From wrought-iron wire (**Ferrum**) are prepared:—

1. Iodide of Iron.

Put iron (1½ ozs.), iodine (3 ozs.), and distilled water (12 ozs.) into a flask, and having heated the mixture gently for about ten minutes, raise the heat and boil until the froth becomes white, showing that all the iodine has been taken up. Pass the solution as quickly as possible through a wetted calico filter into a dish of polished iron, wash the filter with distilled water (3 ozs.), and boil down until a drop of the solution taken out on the end of an iron wire solidifies on cooling. The liquid should now be poured out on a porcelain dish, and as soon as it solidifies it should be broken into fragments and preserved in a stoppered bottle.

2. Sulphate of Iron.

Pour distilled water (1½ pints) on iron wire (4 ozs.), placed in a porcelain capsule; add sulphuric acid (4 ozs.), and when the disengagement of hydrogen gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filtering paper placed on porous bricks, and preserved in a stoppered bottle ($Fe + H_2SO_4 = FeSO_4 + H_2$). When cold, dilute sulphuric acid acts on metals, hydrogen is liberated; but when the hot or strong acid is used, sulphurous anhydride is disengaged.

Dried Sulphate of Iron is prepared by exposing sulphate of iron to a heat commencing at 212°, and finally raised to 400°, until aqueous vapour is no longer given off. The residue is pulverised and preserved in stoppered bottles:—

$$FeSO_4,7H_2O = FeSO_4,H_2O + 6H_2O.$$

At a higher temperature sulphuric acid is given off.

Granulated Sulphate of Iron is made by filtering a boiling solution of sulphate of iron, prepared as above, into rectified spirit (8 ozs.), stirring the mixture so that the salt shall separate in minute granular crystals. These being deprived of adhering liquid by decantation, are transferred on filtering paper to porous tiles, and dried by exposure to air.

3. Perchloride of Iron. [*Vide* "LIQUORS."]

4. Pernitrate of Iron. [*Vide* "LIQUORS."]

From the **Sulphate** are prepared:—

1. Carbonate of Iron (Saccharated).

Dissolve sulphate of iron (2 ozs.) and carbonate of ammonia (1¼ ozs.) in boiling distilled water (½ gallon each), and mix the two solutions, with brisk stirring, in a deep cylindrical vessel, which is then to be covered as accurately as possible. Set the mixture by for twenty-four hours, and from the precipitate (carbonate of iron) which has subsided, separate the supernatant solution (sulphate of ammonia) by a syphon. Pour on more boiling distilled water (1 gallon), stir well, and, after subsidence, again remove the clear solution. Collect the precipitate on a calico filter, and having first subjected it to expression, rub it with sugar (1 oz.) in a porcelain mortar. Finally, dry at a temperature not exceeding 212°:—

$$FeSO_4 + (NH_4)_2CO_3 = FeCO_3 + (NH_4)_2SO_4.$$

Boiling water is used in this process to exclude air. Notwithstanding all precautions a little peroxide of iron is unavoidably formed. The object of the sugar is as a preservative against atmospheric oxidation.

2. Arseniate of Iron.

Dissolve sulphate of iron (9 ozs.) in boiling distilled water (3 pints), and dissolve arseniate of soda, dried at 300° (4 ozs.), and acetate of soda (3 ozs.) in boiling distilled water (2 pints); mix the two solutions; collect the white precipitate (arseniate of iron) which forms, on a calico filter, and wash until the washings cease to be affected by a dilute solution of chloride of barium, showing complete removal of the sulphate of sodium. Squeeze the washed precipitate between folds of strong linen in a screw press, and dry it on porous bricks in a warm air-chamber whose temperature shall not exceed 100°, in order to avoid oxidation as much as possible:—

$$2Na_2HAsO_4 + 2NaC_2H_3O_2 + 3FeSO_4 = \\ Fe_3 2AsO_4 + 3Na_2SO_4 + 2HC_2H_3O_2.$$

The object of the acetate of soda in this process is to prevent the liberation of free sulphuric acid, in which ferrous arseniate is soluble; it is insoluble in free acetic acid.

3. Phosphate of Iron.

Dissolve sulphate of iron (3 ozs.) in boiling distilled water (2 pints), and dissolve phosphate of soda ($2\frac{1}{2}$ ozs.) and acetate of soda (1 oz.) in boiling distilled water (2 pints). Mix the two solutions, and, after careful stirring, transfer the precipitate (phosphate of iron) to a calico filter, and wash it with hot distilled water till the filtrate ceases to give a precipitate with chloride of barium. Finally, dry the precipitate at a temperature not exceeding 120°, to avoid oxidation as much as possible:—

$$3FeSO_4 + 2Na_2HPO_4 + 2NaC_2H_3O_2 = \\ Fe_3 2PO_4 + 3Na_2SO_4 + 2HC_2H_3O_2.$$

The process is analogous to that for the preparation of arseniate of iron, the object of the acetate of soda being to prevent the liberation of free sulphuric acid, in which ferrous phosphate is soluble.

4. Persulphate of Iron. [*Vide* "LIQUORS."]

From the **Persulphate** is prepared:—

Peroxide of Iron (Moist).

Mix solution of persulphate of iron (4 ozs.) with distilled water (1 pint), and add this gradually to solution of soda (33 ozs.), stirring constantly and briskly. Let the mixture stand for two hours, stirring it occasionally; then put it on a calico filter, and, when the liquid has drained away, wash the precipitate (peroxide of iron) with distilled water until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, enclose the precipitate, without drying it, in a stoppered bottle. This preparation, when used, should be recently made:—

$$Fe_2 3SO_4 + 6NaHO = Fe_2O_3,3H_2O + 3Na_2SO_4.$$

If the solutions were mixed in the reverse order to that given above, an oxysulphate would result.

Hydrated Peroxide of Iron is made by drying the moist peroxide at a temperature not exceeding 212°, until it ceases to lose weight ($Fe_2O_3,3H_2O = Fe_2O_3,H_2O + 2H_2O$).

From the mixed **Sulphate** and **Persulphate** is prepared:—

Magnetic Oxide of Iron.

Dissolve sulphate of iron (2 ozs.) in distilled water (2 pints), and add to it solution of persulphate of iron (5½ ozs.); then mix this with solution of soda (4 pints), stirring them well together. Boil the mixture; let it stand for two hours, stirring it occasionally; then put it on a calico filter, and, when the liquid has drained away, wash the precipitate (magnetic oxide of iron) with distilled water until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, dry the precipitate at a temperature not exceeding 120°, as it absorbs oxygen at a higher temperature and forms ferric oxide:—

$$FeSO_4 + Fe_2 3SO_4 + 8NaHO = FeO,Fe_2O_3(Fe_3O_4),4H_2O + 4Na_2SO_4.$$

From the **Peroxide** are prepared:—

1. Citrate of Iron and Ammonia.

In the preparation of this substance, moist peroxide of iron is first prepared as follows:—Mix solution of ammonia (14 ozs.) with distilled water (2 pints), and to this add gradually solution of persulphate of iron (8 ozs.) previously diluted with distilled water (2 pints), stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally; then put it on a calico filter, and when the liquid has drained away, wash the precipitate (peroxide of iron) with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium, indicating complete removal of the sulphate of ammonia. Dissolve now citric acid (4 ozs.) in distilled water (8 ozs.), and having applied the heat of a water-bath add the peroxide of iron, previously well drained, and stir them together until the whole or nearly the whole of the oxide has dissolved, acid citrate of peroxide of iron being thus formed. Let the solution cool; then add solution of ammonia (5½ ozs.) Filter through flannel; evaporate to the consistence of syrup, and dry it in thin layers on flat porcelain or glass plates at a temperature not exceeding 100°, to avoid decomposition. Remove the dry salt in flakes and keep in a stoppered bottle.

2. Citrate of Iron and Quinia.

The first stage in the process is the formation of moist peroxide of iron, as above (using, however, 8 ozs. of solution of ammonia and 4½ ozs. of solution of persulphate of iron). Quinia is then precipitated from its sulphate by mixing the latter (1 oz.) with distilled water (8 ozs.), adding diluted sulphuric acid (12 drms.), and, when the salt is dissolved, precipitating the quinia with slight excess of solution of ammonia. Collect the precipitate in a filter, and wash it with distilled water (1½ pint). Dissolve now citric acid (3 ozs.) in distilled water (5 ozs.), and, having applied the heat of a water-bath, add the oxide of iron, previously well drained; stir them together, and when the oxide has dissolved, add the precipitated quinia, continuing the agitation until this also has dissolved. Let the solution cool, then add in small quantities at a time solution of ammonia (12 drms.) diluted with distilled water (2 ozs.) stirring the solution briskly, and allowing the quinia which separates with each addition of ammonia to dissolve before the next addition is made. Filter the solution, evaporate it to the consistence of a thin syrup, then dry it in thin layers on flat porcelain or glass plates at a temperature of 100°. Remove the dry salt in flakes, and keep it in a stoppered bottle.

The produce is a triple citrate of iron, quinia, and ammonia, the iron existing in both a ferrous and ferric state.

3. Tartarated Iron.

The first stage in the process is the formation of moist peroxide of iron as in the previous two other "scale" preparations of iron (using, however, 10 ozs. of solution of ammonia and 5½ ozs. of solution of persulphate of iron). Mix the washed and drained precipitate intimately with acid tartrate of potash (2 ozs.) in a porcelain dish, and let the mixture stand for twenty-four hours; then, having applied a gentle heat not exceeding 140°, add gradually distilled water (1 pint), and stir constantly until nothing more will dissolve; filter; evaporate at a temperature not exceeding 140° to the consistence of a syrup, and dry it in thin layers on flat porcelain or glass plates in a drying closet at 100°. Remove the dry salt in flakes, and keep it in stoppered bottles.

In this process the acid tartrate of potash is converted into a neutral dibasic salt by the combination of an equivalent of peroxide of iron.

4. Reduced Iron.

Introduce peroxide of iron (1 oz.) into a gun-barrel, confining it to the middle part of the tube by plugs of asbestos. Pass the gun-barrel through a furnace, and when it has been raised to a strong red heat, cause it to be traversed by a stream of hydrogen gas developed by the action on zinc of some sulphuric acid diluted with eight times its volume of water. The gas, before entering the gun-barrel, must be rendered quite dry by being made to pass first through some more sulphuric acid, and then through a tube eighteen inches long, packed with minute fragments of the chloride of calcium. The farther end of the gun-barrel is to be connected by a cork with a bent tube dipping under water; and when the hydrogen is observed to pass through the water at the same rate that it bubbles through the sulphuric acid, the furnace is to be allowed to cool down to the temperature of the atmosphere, the current of hydrogen being still continued. The reduced iron is then to be withdrawn, and enclosed in a dry stoppered bottle.

$$Fe_2O_3 + 3H_2 = Fe_2 + 3H_2O.$$

In this process some magnetic oxide is also formed:—

$$3Fe_2O_3 + H_2 = H_2O + 2Fe_3O_4.$$

The hot metal is very prone to oxidation while in a state of minute division; hence the necessity for keeping up the stream of hydrogen gas while the metal is cooling. The temperature during the process should not be too high; otherwise the product will be in agglutinated masses.

CHARACTERS AND TESTS.

Ferri Arsenias.

At the moment of its precipitation is white, but rapidly changes to a gray or greenish colour, owing to oxidation and formation of a mixed arseniate. It is a tasteless amorphous powder, insoluble in water, but soluble in hydrochloric acid. This solution gives a copious light-blue precipitate with yellow prussiate of potash (persalt of iron), and a still more abundant one of a deeper colour with red prussiate of potash (protosalt of iron) showing the presence of both ferrous and ferric salts. A small quantity boiled with an excess of caustic soda, and filtered, forms oxide of iron, which gives, when exactly neutralised by nitric acid, a characteristic brick-red precipitate (arseniate of silver, Ag_3AsO_4) on the addition of solution of nitrate of silver. When thrown on live coals, it emits the garlic-like odour of arsenic. The solution in hydrochloric acid, when diluted, gives no precipitate with chloride of barium (absence of sulphate). Twenty grains, dissolved in an excess of hydrochloric acid diluted with water, continue to give a blue precipitate with red prussiate of potash, until at least 170 grain-measures of the volumetric solution of bichromate of potash have been added; indicating 2·85 grains of iron in the ferrous state in the arseniate = 14·25 per cent.

Ferri Carbonas Saccharata.

Consists of carbonate of protoxide of iron mixed with peroxide of iron and sugar, the carbonate forming at least 37 per cent. of the mixture; the proportion of carbonate varies greatly in commercial specimens. There is no carbonate of peroxide of iron. When first precipitated carbonate of iron is white, but it rapidly darkens in colour owing to oxidation; it is met with in small coherent lumps of a gray-brown colour with a sweet, very feeble, chalybeate taste. Dissolves with effervescence in warm hydrochloric acid diluted with half its volume of water, and the solution gives a slight precipitate with chloride of barium (the sulphate of ammonia not being completely washed away in its preparation). Twenty grains, dissolved in excess of hydrochloric acid and diluted with water, continue to give a blue precipitate with red prussiate of potash, until at least 208 grain-measures of the volumetric solution of bichromate of potash have been added.

Ferri et Ammoniæ Citras.

In thin transparent scales of a deep red colour, slightly sweetish and astringent in taste; feebly reddens litmus paper; is soluble in water, almost insoluble in spirit, except when greatly diluted. Gives a copious blue precipitate with yellow prussiate of potash (presence of peroxide), but no precipitate with the red prussiate (absence of protoxide). Heated with solution of soda it evolves ammonia and deposits peroxide of iron. The alkaline solution from which the iron has separated does not, when slightly supersaturated with acetic acid, give any crystalline deposit; thus distinguishing it from tartarated iron. When incinerated with exposure to air, it leaves not less than 27 per cent. of peroxide of iron, which is not alkaline to litmus. Tartarated iron, when incinerated, leaves a mixture of peroxide of iron, carbon, and carbonate of potash.

Ferri et Quiniæ Citras.

In thin scales of a greenish golden-yellow colour, somewhat deliquescent, and entirely soluble in cold water. The solution is very slightly acid, and is precipitated reddish-brown by solution of soda, the precipitate consisting of hydrated peroxide of iron mixed with quinia; with solution of ammonia it gives a white precipitate of quinia; it gives a blue precipitate with both yellow and red prussiate of potash, showing the presence of both per- and proto-salts of iron; with tannic acid it gives a grayish-black precipitate of tannate of iron with quinia. Its taste is bitter as well as chalybeate. When burned with exposure to air, it leaves a residue which when moistened with water is not alkaline to test-paper, showing absence of potash. 50 grains dissolved in an ounce of water and treated with a slight excess of ammonia give a white precipitate of quinia, which, when collected on a filter and dried, should weigh 8 grains. The precipitate is almost entirely soluble in pure ether, showing the absence of cinchonia and quinidia, and when burned leaves but a minute residue. The proportion of quinine present in commercial samples is liable to vary considerably. It spoils by long exposure to light and becomes less soluble.

Ferri Iodidum.

Crystalline, green with a tinge of brown, inodorous, deliquescent, excessively prone to oxidation, soluble in alcohol, soluble also in water, forming a slightly green solution, which gradually deposits a rust-coloured sediment of peroxide of iron, and acquires a red colour from the separation of the iodine. Its solution gives a copious blue precipitate with red prussiate of potash, indicating the presence of a protosalt of iron. Mixed with mucilage of starch, it acquires a blue colour on the addition of a minute quantity of solution of chlorine, showing the presence of iodine.

Ferri Oxidum Magneticum.

It exists combined with about 20 per cent. of water of hydration, and contains some peroxide of iron. It is brownish-black, tasteless, strongly magnetic. It dissolves without effervescence in hydrochloric acid diluted with half its bulk of water, showing the absence of metallic iron, which if present would give rise to evolution of bubbles of hydrogen. The hydrochloric acid solution gives blue precipitates with both yellow and red prussiates of potash, indicating the presence of per- and proto-chlorides of iron. When a small quantity is heated in a dry test-tube by the flame of a lamp, a deposit of moisture takes place in the cool part of the tube; heated in the open air, it is converted into peroxide of iron. 20 grains dissolved in hydrochloric acid continue to give a blue precipitate with red prussiate of potash, until 230 grain-measures of the volumetric solution of bichromate of potash have been added; indicating 24·8 per cent. of ferrous oxide.

Ferri Peroxidum Humidum.

Is hydrated peroxide of iron, with about 86 per cent. of uncombined water. A soft, moist, pasty mass, of a reddish-brown colour. Dissolves readily in dilute hydrochloric acid, without the aid of heat, forming a solution which gives a copious blue precipitate with yellow, but not with red prussiate of potash, proving the presence of peroxide and absence of protoxide of iron. A little of it dried at 212° until it ceases to lose weight, gives off moisture when further heated in a test-tube, proving the presence of a hydrate.

Ferri Peroxidum Hydratum.

A reddish-brown powder, tasteless, not magnetic; dissolves completely, though slowly, with the aid of heat, in hydrochloric acid diluted with half its volume of water, forming a solution which gives a copious blue precipitate with yellow, but not with red prussiate of potash, proving the presence of peroxide and absence of protoxide of iron. Heated to dull redness in a test-tube, it gives off moisture, and is converted into the anhydrous form.

Ferri Phosphas.

A slate-blue amorphous powder, insoluble in water; soluble in hydrochloric acid. The solution yields a precipitate with both yellow and red prussiate of potash, that afforded by the latter being more abundant, indicating more protosalt than persalt. When its solution is treated with tartaric acid and an excess of ammonia, and subsequently with ammonio-sulphate of magnesia, it lets fall a crystalline precipitate of triple phosphate ($MgNH_4PO_4,6H_2O$). The solution must be rendered alkaline, else the triple phosphate would not be formed. The tartaric acid prevents the precipitation of oxide of iron by the ammonia. If it is digested in hydrochloric acid with a lamina of pure copper, a dark deposit (arsenicum) does not form on the metal; thus distinguishing it from arseniate of iron. 20 grains dissolved in hydrochloric acid continue to give a blue precipitate with red prussiate of potash, until at least 250 grain-measures of the volumetric solution of bichromate of potash have been added.

Ferri Sulphas.

In oblique rhombic prisms, which are of a pale greenish-blue colour when free from persulphate, but which are of a rich green colour when the latter salt is present. The crystals are slightly efflorescent; at 400° they lose six equivalents of water (*Ferri Sulphas Exsiccata*), and at a red heat they are decomposed. Sulphate of iron has a styptic taste; it is soluble in water, but insoluble in rectified spirit if free from persulphate. This insolubility in spirit is utilised for the preparation of the *Ferri Sulphas Granulata*. On exposure to air, the crystals absorb oxygen and become brown, from formation of persulphate; their aqueous solution readily absorbs oxygen, and deposits a rust-coloured sediment of basic sulphate ($Fe_4O_5SO_4$). Solution of sulphate of iron gives a white precipitate with chloride of barium, being the test for a sulphate; with red prussiate of potash it gives a blue precipitate, and with yellow prussiate of potash it gives an almost white or light blue precipitate, if it is nearly free from persulphate. It gives no precipitate with sulphuretted hydrogen, showing the absence of copper. *Granulated Sulphate of Iron* occurs in small, pale greenish-blue granular crystals. In other respects it corresponds to the characters and tests for sulphate of iron.

Ferrum Redactum.

Is metallic iron with a variable amount of magnetic oxide of iron. It occurs as a fine, grayish-black powder, strongly magnetic, and exhibiting metallic streaks when rubbed with firm pressure in a mortar. It dissolves in hydrochloric acid with the evolution of hydrogen, and the solution gives a light blue precipitate with yellow prussiate of potash, showing the absence of peroxide. 10 grains added to an aqueous solution of 50 grains of iodine and 50 grains of iodide of potassium, and digested with them in a small flask at a gentle heat, leave not more than 5 grains undissolved, which should be entirely soluble in hydrochloric acid. In this test the metallic iron alone is dissolved, the magnetic oxide being insoluble in the iodine solution; the solubility of the magnetic oxide in hydrochloric acid shows the absence of silica and mechanical impurities. Reduced iron may contain some sulphide of iron.

Ferrum Tartaratum.

Thin, transparent scales, of a deep garnet colour, slightly deliquescent, somewhat sweet, and rather astringent; soluble in water, and, although a persalt, sparingly soluble in spirit. The aqueous solution, when acidulated with hydrochloric acid, gives a copious blue precipitate with yellow prussiate of potash, but no precipitate with red prussiate of potash, indicating the presence of a persalt and absence of a protosalt. When the salt is boiled with solution of soda, peroxide of iron separates, but no ammonia is evolved, by which it is distinguished from the citrate of iron and ammonia; the filtered solution, which contains tartrate of potash and soda, when slightly acidulated by acetic acid, gives as it cools a crystalline deposit of acid tartrate of potash, thus:—

$$KNaC_4H_4O_6+HC_2H_3O_2=KHC_4H_4O_6+NaC_2H_3O_2.$$

By incinerating 50 grains of tartarated iron at a red heat, washing what is left with distilled water, and again incinerating, a residue of peroxide of iron is obtained, weighing 15 grains.

MERCURY AND ITS COMPOUNDS. [Hg=200]

Mercury or "Quicksilver" is occasionally met with in nature in its metallic state, but more frequently combined with chlorine as "horn mercury," or with silver, forming a native amalgam; and still more abundantly combined with sulphur as sulphide of mercury, or "Cinnabar."

It is chiefly obtained from the latter by distilling it with iron; a sulphide of iron is formed, and the mercury distils over and is condensed. Commercial mercury is purified by redistillation and washing with dilute hydrochloric acid. When pure, it is a brilliant white metallic liquid; it tarnishes slightly on exposure; becomes solid (freezes) at —39°; boils at 662°; above 40° a slight vapour arises from it, and at a heat a little below that of visible redness, it entirely volatilises. Its specific heat is low, and it is a good conductor of heat; hence its adaptability in the construction of thermometers. When small globules of it are rolled on a sheet of paper, they should remain spherical and not adhere, thus showing freedom from metallic impurities. Mercury dissolves and forms "amalgams" with many metals—as tin, bismuth, silver, gold, &c. It is not attacked by hydrochloric acid, or by cold sulphuric acid; but boiling sulphuric acid and cold or boiling nitric acid dissolve it, and convert it into their respective salts. It forms two classes of salts—*Mercuric*, or persalts, and *Mercurous*, or protosalts. The following table shows the distinctive tests between these:—

Test	With *Mercuric Salts*	With *Mercurous Salts*
Hydrochloric acid	No precipitate.	White precipitate.
Solution of potash	Yellow „	Black „
Iodide of potassium	Red „	Yellowish-green precipitate.
Solution of ammonia	White „	Black precipitate.

Preparations containing Mercury chiefly uncombined.

Hydrargyrum cum Creta,	1 part in 3
Emplastrum Ammoniaci cum Hydrargyro,	1 „ in 5
„ Hydrargyri,	1 „ in 3
Linimentum Hydrargyri,	1 „ in 6
Pilula Hydrargyri,	1 „ in 3
Suppositoria Hydrargyri,	1 „ in 6
Unguentum Hydrargyri,	1 „ in 2
„ „ Compositum,	1 „ in 4½

Compounds of Mercury.

	B. P. Preps.	Strength	Dose	Action and Use
HYDRARGYRI IODIDUM RUBRUM Red Iodide or Biniodide of Mercury HgI_2	— Unguentum Hyd. Iodidi Rubri	— 1 pt. in 28	gr. $\frac{1}{16}$—$\frac{1}{4}$	Resembles corrosive sublimate in its action, and is given in the same cases. Is much more irritating than the green iodide. Chiefly used externally to enlarged glands, syphilitic periosteal nodes, and in goitre, &c.
HYDRARGYRI IODIDUM VIRIDE Green Iodide of Mercury HgI	—	—	1 to 3 grs.	Acts similarly to calomel, but is less purgative, and more readily affects the system. Used externally in chronic skin diseases.
HYDRARGYRI NITRAS Nitrate of Mercury $Hg2NO_3$	Liq. Hydrarg. Nitratis Acidus Unguentum Hyd. Nitratis	— 1 in 15½	— —	Caustic; applied to acne, lupus, warts, cancerous and other spreading ulcers, &c. Alterative, stimulant, and parasiticide. Beneficial in many cutaneous diseases, and (diluted) in ophthalmia tarsi, &c.
HYDRARGYRI OXIDUM FLAVUM Yellow Oxide of Mercury HgO	—	—	—	Used, as in Marshall's oleate of mercury, as a local application in chronic inflammation of joints, in skin diseases; also for inunction in syphilis. Is the active ingredient in "yellow wash."
HYDRARGYRI OXIDUM RUBRUM Red Oxide or Nitric Oxide of Mercury, Red Precipitate HgO	— Unguentum Hyd. Oxidi Rubri	— 1 pt. in 8	— —	Used externally as an irritant and escharotic to excrescences, chancres, fungous ulcers, &c.
HYDRARGYRI PERCHLORIDUM Perchloride or Bichloride of Mercury, Corrosive Sublimate $HgCl_2$	— Liq. Hyd. Perchloridi Lotio Hyd. Flava	— ½ gr. in 1 oz. 18 grs. in 10 ozs.	gr. $\frac{1}{16}$—$\frac{1}{8}$ ½ to 2 drms.	Powerful irritant. In small doses, used as an alterative, in syphilis, scaly skin diseases, periosteal affections, &c. Employed locally as a parasiticide in chronic skin diseases, in chronic mucous discharges, and as a gargle in ulcerated sore throat.
HYDRARGYRI SUBCHLORIDUM Subchloride or Chloride of Mercury, Calomel $HgCl$	— Lotio Hyd. Nigra Pil. Hyd. Subchloridi Co. Unguentum Hyd. Subchloridi	— 3 grs. in 1 oz. 1 pt. in 5 1 pt. in 6½	½ to 5 grs. 5 to 10 grs. — —	Produces but little local irritation. Is an alterative and purgative. The compound pill is used as an alterative in chronic skin diseases, and the ointment is used externally in such cases.
HYDRARGYRI SULPHAS Sulphate of Mercury $HgSO_4$	—	—	—	Not employed medicinally. Used in preparation of Hyd. Perchloridum and Hyd. Subchloridum.
HYDRARGYRUM AMMONIATUM Ammoniated Mercury, Ammonio-chloride of Mercury, White Precipitate NH_2HgCl	— Unguentum Hyd. Ammoniati	— 1 pt. in 8	— —	Not used internally. Externally used to destroy pediculi, and in chronic skin diseases.

PREPARATION.

From **Mercury** are prepared:—

1. Green Iodide of Mercury.

Rub iodine (278 grs.) and mercury (1 oz.) in a porcelain mortar, occasionally moistening the mixture with a few drops of rectified spirit, and continue the trituration until metallic globules are no longer visible, and the whole assumes a green colour. Dry the product in a dark room on filtering paper, by exposure to the air. Preserve in an opaque bottle ($Hg+I=HgI$). In this process the spirit dissolves the iodine, and by its evaporation moderates the temperature.

2. Nitrate of Mercury.

Vide "LIQUORES."

3. Sulphate of Mercury.

Heat mercury (20 ozs.) with sulphuric acid (12 ozs.) in a porcelain vessel, stirring constantly until the metal disappears, then continue the heat until a dry white salt remains. During the process abundant fumes of sulphurous acid gas are given off:—

$$Hg+2H_2SO_4=HgSO_4+SO_2+2H_2O.$$

Heat is necessary, as cold sulphuric acid does not act on mercury.

From the **Nitrate** is prepared:—

Red Oxide of Mercury.

Dissolve mercury (4 ozs.) in nitric acid (4½ ozs.) diluted with water (2 ozs.), evaporate the solution to dryness ($3Hg+8HNO_3=3Hg2NO_3+2NO+4H_2O$). With the dry salt (nitrate of mercury) thus obtained triturate mercury (4 ozs.) until the two are uniformly blended together. Heat the mixture in a porcelain dish with repeated stirring, until acid vapours cease to be evolved ($Hg2NO_3+Hg=2HgO+2NO_2$).

If nitrate of mercury were heated by itself, red oxide of mercury would be formed, but some oxygen would be wasted thus:—

$$Hg2NO_3=HgO+2NO_2+O.$$

From the **Sulphate** are prepared:—

1. Perchloride of Mercury.

Reduce sulphate of mercury (20 ozs.) and dried chloride of sodium (16 ozs.) to fine powder, and having mixed them with black oxide of manganese (1 oz.) by trituration in a mortar, subject the mixture to sublimation ($HgSO_4+2NaCl=HgCl_2+Na_2SO_4$). The object of using black oxide of manganese is to prevent the formation of any calomel; this it does by liberating some chlorine from the chloride of sodium.

2. Subchloride of Mercury.

Moisten sulphate of mercury (10 ozs.) with some water, and rub it with mercury (7 ozs.) until globules are no longer visible. The sulphate of mercury is thus converted into subsulphate ($HgSO_4 + Hg = Hg_2SO_4$). Add dried chloride of sodium (5 ozs.), and thoroughly mix the whole by continued trituration ($Hg_2SO_4 + 2NaCl = Na_2SO_4 + 2HgCl$). Sublime into a large chamber, so as to produce a fine powder; wash the sublimate with boiling distilled water until the washings cease to be darkened by a drop of sulphide of ammonium, showing the absence of corrosive sublimate. Finally, dry at a heat not exceeding 212°, and preserve in an opaque bottle.

From the **Perchloride** are prepared:—

1. Red Iodide of Mercury.

Dissolve perchloride of mercury (4 ozs.) and iodide of potassium (5 ozs.), each in boiling distilled water (the former in 3 pints, the latter in 1), and mix the solutions. When the temperature of the mixture has fallen to that of the atmosphere, decant the supernatant liquor from the precipitate, and having collected the latter on a filter, wash it twice with cold distilled water, and dry it at a temperature not exceeding 212° ($HgCl_2 + 2KI = 2KCl + HgI_2$). As the precipitate is soluble in excess either of bichloride of mercury or of iodide of potassium, excess of either of these salts must be avoided in the process.

2. Yellow Oxide of Mercury.

Dissolve perchloride of mercury (4 ozs.) in distilled water (4 pints) by the aid of heat; add this to solution of soda (2 pints). Stir them together; allow the precipitate to subside; remove the supernatant liquid by decantation; wash the precipitate thoroughly on a calico filter with distilled water, and finally dry it by the heat of a water-bath ($HgCl_2 + 2NaHO = 2NaCl + HgO + H_2O$). In this process the caustic soda must be in excess, hence the mercurial solution is to be added to it, else an oxychloride of mercury would be formed.

3. Ammoniated Mercury.

Dissolve perchloride of mercury (3 ozs.) in distilled water (3 pints) by the aid of a moderate heat. Mix the solution with solution of ammonia (4 ozs.), constantly stirring; collect the precipitate on a filter, and wash it with cold distilled water until the liquid which passes through ceases to give a precipitate when dropped into a solution of nitrate of silver acidulated with nitric acid (absence of chloride of ammonium). Lastly, dry the product at a temperature not exceeding 212° ($HgCl_2+2NH_3=NH_2HgCl+NH_4Cl$). If the order of mixing the solutions be reversed, a compound having the composition $NH_2HgCl, HgCl_2$ would be formed.

CHARACTERS AND TESTS.

Hydrargyri Iodidum Rubrum.

A crystalline powder of a vermilion colour, becoming yellow when gently heated over a lamp on a sheet of paper, and becoming red again on friction or after cooling. It is dimorphous, the crystals being rhomboidal prisms in the yellow form, and octahedral in the red form. Sp. gr. 6·3. Almost insoluble in water, sparingly soluble in alcohol, but freely soluble in ether, or in an aqueous solution of iodide of potassium; it is soluble also without change in solutions of alkaline chlorides. With corrosive sublimate it forms a soluble crystallisable double salt, $HgI_2 2HgCl_2$. When digested with solution of soda, it assumes a reddish-brown colour, oxide of mercury being separated, and iodide of sodium being formed in solution ($HgI_2+2NaHO=HgO+H_2O+2NaI$); when the fluid is cleared by filtration and mixed with solution of starch, it gives a blue precipitate on being acidulated with nitric acid, iodine being set free ($3NaI+4HNO_3=3NaNO_3+2H_2O+NO+I_3$). Red iodide of mercury is entirely volatilised by a heat under redness; sulphide of mercury has been used to adulterate it, but it may be detected by solution of iodide of potassium, which dissolves the iodide, but leaves the sulphide.

Hydrargyri Iodidum Viride.

A dull green powder, which darkens on exposure to light, being decomposed into mercury and red iodide; pure mercurous iodide is yellow. It is insoluble in water, alcohol, or ether, hence when shaken with the latter nothing is dissolved, showing the absence of red iodide, with which it is very apt to be contaminated. Gradually heated in a test-tube, it yields a yellow sublimate (HgI_2), which upon friction or on cooling becomes red, while globules of metallic mercury are left in the bottom of the tube. If rapidly heated, green iodide of mercury may be sublimed unchanged.

Hydrargyri Oxidum Flavum.

Differs only physically from the red oxide. It is a yellow powder, readily dissolved by hydrochloric acid, yielding a solution which with solution of ammonia gives a white precipitate (ammoniated mercury). A cold solution of oxalic acid converts it into oxalate of mercury. It is entirely volatilised when heated to incipient redness, oxygen gas and vapour of mercury being given off. Water boiled with it gives no precipitate with ammonia, or with solution of nitrate of silver, showing the absence of corrosive sublimate. By long exposure to light it acquires a grayish colour, owing probably to its partial reduction to the metallic state.

Hydrargyri Oxidum Rubrum.

An orange-red crystalline powder. Sp. gr. 10·68. Readily dissolved by hydrochloric acid, yielding a solution which, with caustic potash added in excess, gives a yellow precipitate (HgO), and with solution of ammonia a white precipitate (NH_2HgCl). It is readily soluble in nitric, hydrocyanic, and acetic acids, but is unaffected by a cold solution of oxalic acid; it is very slightly soluble in water, alcohol, or ether. Is entirely volatilised by a heat below redness, oxygen gas and vapour of mercury being given off; if it be heated in a test-tube, no orange vapours of NO_2 are perceived, showing the absence of undecomposed subnitrate. By long exposure to light it undergoes partial reduction.

Hydrargyri Perchloridum.

In heavy colourless masses of prismatic crystals, possessing a highly acrid metallic taste. Sp. gr. 5·2. More soluble in alcohol, and still more so in ether (1 in 3) than in water; more soluble in boiling water (1 in 3) than in cold (1 in 16); sal ammoniac greatly increases its solubility in water, and forms with it a stable double salt, *sal alembroth*, $2NH_4Cl, HgCl_2, H_2O$. The simple aqueous solution is liable to decomposition, calomel being deposited, and oxygen being evolved. Nitric, sulphuric, and hydrochloric acids dissolve it without decomposition. Its aqueous solution reddens litmus, and gives a yellow precipitate with caustic potash (HgO), a white precipitate with solution of ammonia (NH_2HgCl), and a curdy white precipitate with nitrate of silver ($AgCl$). When heated it sublimes without decomposition, and without leaving any residue (absence of fixed impurities). It is decomposed by most vegetable decoctions and infusions, by many oils, and when boiled with sugar. With albumen it forms albuminate of mercury ($HgC_{72}H_{110}N_{18}SO_{22}, H_2O$), which is insoluble in water, but soluble in solution of chloride of sodium; it is thus a powerful antiseptic.

Hydrargyri Subchloridum.

A dull, white, heavy and nearly tasteless powder. Sp. gr. 9·2. Is rendered yellow by trituration in a mortar. Is insoluble in water, spirit, or ether. Digested with solution of potash, it becomes black from formation of suboxide of mercury ($2HgCl+2KHO=Hg_2O+2KCl+H_2O$); it is thus distinguished from white precipitate; the clear solution, acidulated with nitric acid, gives a copious white precipitate with nitrate of silver. Contact with prussic acid darkens its colour, owing to the separation of metallic mercury ($2HgCl+2HCy=HgCy_2+2HCl+Hg$). It is entirely volatilised by heat. Warm ether, which has been shaken up with it in a bottle, leaves on evaporation no residue, showing the absence of perchloride and red oxide of mercury, both of which are soluble in ether.

Hydrargyri Sulphas.

A white crystalline heavy powder. Sp. gr. 6·46. Rendered yellow by affusion of water, being thus converted into an insoluble basic sulphate ($HgSO_4.2HgO$), called "Turpeth mineral," and a soluble acid salt. Sulphate of mercury is soluble in solution of chloride of sodium; it is entirely volatilised by heat.

Hydrargyrum Ammoniatum.

An opaque white powder with an unpleasant metallic taste. Cold water, alcohol, or ether have no action on it. It is readily soluble in nitric, hydrochloric, and acetic acids, and is thus distinguished from calomel. Digested with caustic potash, it does not blacken, but evolves ammonia, and acquires a yellow colour ($NH_2HgCl+KHO=NH_3+HgO+KCl$); the fluid, filtered and acidulated with nitric acid, gives a white precipitate with nitrate of silver (presence of chlorine). Boiled with an acid solution of chloride of tin, it becomes gray, and affords globules of metallic mercury ($NH_2HgCl+SnCl_2+2HCl=NH_4Cl+SnCl_4+Hg$). It is entirely volatilised, without fusion, at a heat under redness, showing the absence of fixed impurities. What is known as "fusible white precipitate" (NH_2HgCl, NH_4Cl) contains 14 per cent. less of mercury.

In composition ammoniated mercury corresponds to chloride of ammonium in which two equivalents of hydrogen are replaced by one of dyad mercury. It is therefore a chloride of mercur-ammonium.

COMPOUNDS OF LITHIUM. [L=7]

	B. P. Preps.	Strength	Dose	Action and Use
LITHIÆ CARBONAS Carbonate of Lithia L_2CO_3	—	—	3 to 6 grs.	Antacid, diuretic. Given in gout, uric-acid gravel, and renal calculus. Externally as a lotion to gouty joints, gouty ulcers, and chalk-stones.
	Liq. Lithiæ Effervescens	10 grs. in 1 pint	5 to 10 ozs.	
LITHIÆ CITRAS Citrate of Lithia $L_3C_6H_5O_7$	—	—	5 to 10 grs	Same action and uses as the carbonates, except that it is not a remote antacid, and is more soluble.

PREPARATION.

Carbonate of Lithia.

May be prepared by the action of sulphate or chloride of lithia on carbonate of ammonium.

Citrate of Lithia.

Dissolve citric acid (90 grs.) in warm distilled water (1 oz.); add carbonate of lithia (50 grs.) in successive portions; apply heat until effervescence ceases and a perfect solution is obtained; evaporate by a steam or sand bath till water ceases to escape, and the residue is converted into a viscid liquid. This should be dried in an oven or air-chamber, at a temperature of about 240°, then rapidly pulverised, and enclosed in a stoppered bottle—

$$3L_2CO_3+2H_3C_6H_5O_7=2L_3C_6H_5O_7+3H_2O+3CO_2.$$

CHARACTERS AND TESTS.

Lithiæ Carbonas.

In white powder, or in minute crystalline grains, alkaline in reaction, soluble in 100 parts of cold water, its solubility being increased by the presence of carbonic acid. Like other carbonates, it is insoluble in alcohol. It dissolves with effervescence in hydrochloric acid; and the solution, evaporated to dryness, leaves a residue of chloride of lithium, which communicates a red colour to the flame of a spirit lamp, and, redissolved in water, yields with phosphate of soda a precipitate of phosphate of lithia In this way lithia is distinguished from other alkalies. 10 grains of the salt neutralised with sulphuric acid and afterwards heated to redness, leave 14·86 grains of dry sulphate of lithia, which, when redissolved in distilled water, yields no precipitate with oxalate of ammonia or lime-water, showing the absence of lime and magnesia.

Lithiæ Citras.

A white amorphous powder, deliquescent and soluble in water, without leaving any residue. Heated to redness it blackens, evolving inflammable gases, evidencing the presence of an organic acid; and the residue, neutralised by hydrochloric acid, yields with rectified spirit a solution which burns with a crimson flame. When its solution is boiled with lime-water, it becomes turbid, and clears again on cooling, showing the presence of a citrate. 20 grains of the salt burned at a low red heat, with free access of air, leave 10·6 grains of white residue, consisting of carbonate of lithia.

COMPOUNDS OF MAGNESIUM. [Mg=12]

	B. P. Preps.	Strength	Dose	Action and Use
MAGNESIA Magnesia MgO	—	—	10 to 60 grs.	Antacid and laxative. Given in acidity of stomach with a tendency to constipation; in gouty affections, &c.
MAGNESIA LEVIS Light Magnesia MgO	—	—	10 to 60 grs.	Same action and use as Magnesia. Enters into composition of Pulv. Rhei. Co. (6 pts. in 9).
MAGNESIÆ CARBONAS Carbonate of Magnesia $(MgCO_3)_3\ MgO.5H_2O$	— LiquorMagnesiæ Carbonatis	— 13grs. in 1 oz.	10 to 60 grs. 1 to 2 ozs.	Same action and use as Magnesia. Used in preparation of the Trochisci Bismuthi (2½ grs. in each).
MAGNESIÆ CARBONAS LEVIS Light Carbonate of Magnesia $(MgCO_3)_3.MgO.5H_2O$	—	—	10 to 60 grs.	Same action and use as Magnesia.
MAGNESIÆ CITRAS Citrate of Magnesia $Mg_32C_6H_5O_7$	LiquorMagnesiæ Citratis	—	5 to 10 ozs.	Mild saline cathartic.
MAGNESIÆ SULPHAS Sulphate of Magnesia or Epsom Salts $MgSO_4.7H_2O$	— Enema Magnesiæ Sulphatis	— 1 oz. in 16	1 to 4 drms. —	Saline purgative. In small doses diuretic. Given in febrile affections, portal congestion, &c. Contained in Mist. Sennæ Co.

PREPARATION.

From **Dolomite** (Magnesian Limestone) is prepared:—

Sulphate of Magnesia.

Treat the Dolomite, which consists of carbonates of lime and magnesia with sulphuric acid; a soluble sulphate of magnesia and an insoluble sulphate of lime are thus formed and are separated. It was formerly prepared from "bittern," the liquor left when chloride of sodium is crystallised from sea-water.

From **Sulphate of Magnesia** are prepared:—

1. Carbonate of Magnesia.

Dissolve sulphate of magnesia (10 ozs.) and carbonate of soda (12 ozs.) each in 1 pint of boiling distilled water; mix the two solutions, and evaporate the whole to perfect dryness by means of a sand-bath. Digest the residue for half an hour with boiling distilled water (2 pints), and having collected the insoluble matter (carbonate of magnesia) on a calico filter, wash it separately with distilled water until the washings cease to give a precipitate with chloride of barium, showing that the sulphate of soda is completely removed. Finally dry at a temperature not exceeding 212°, to avoid driving off carbonic acid,

$$4MgSO_4+4Na_2CO_3+5H_2O=3MgCO_3.MgO.5H_2O+\\4Na_2SO_4+CO_2.$$

2. Light Carbonate of Magnesia.

Dissolve sulphate of magnesia (10 ozs.) and carbonate of soda (12 ozs.) in distilled water ($\frac{1}{2}$ gallon each); mix the two solutions cold, and boil the mixture in a porcelain dish for fifteen minutes. Transfer the precipitate to a calico filter, and pour upon it repeatedly boiling distilled water, until the washings cease to give a precipitate with chloride of barium. Lastly, dry by a heat not exceeding 212°. The same reaction takes place as in the preparation of the other carbonate. The difference in the aggregation of the two carbonates depend on the heat employed in their preparation, and on the amount of dilution of the solutions; in the preparation of the light carbonate less heat and a greater degree of dilution are made use of.

From the **Carbonate of Magnesia** are prepared:—

1. Magnesia.

Put carbonate of magnesia (4 ozs.) into a Hessian crucible, closed loosely by a lid, and expose it to a low red heat until a small quantity taken from the centre of the crucible, when it has cooled, and dropped into diluted sulphuric acid, causes no effervescence, showing that all the carbonic acid has been driven off.

$$3MgCO_3,Mg2HO=4MgO+H_2O+3CO_2.$$

2. Citrate of Magnesia (Solution of).

Dissolve citric acid (200 grains) in two ounces of water, and add carbonate of magnesia (100 grains). Stir until dissolved, and filter the solution into a strong half-pint bottle; add syrup of lemons ($\frac{1}{2}$ oz.) and sufficient water to nearly fill the bottle, then introduce crystals of bicarbonate of potash (40 grains), and immediately close the bottle with a cork which should be secured with wire. Afterwards shake the bottle until the crystals are dissolved.

From the **Light Carbonate of Magnesia** is prepared:—

Light Magnesia.

In the same manner as magnesia is obtained from the carbonate.

CHARACTERS AND TESTS.

Magnesia.

A white powder, almost tasteless; very sparingly soluble in water, but more soluble in cold than in hot water; is readily dissolved by acids, without effervescence, showing the absence of carbonate. Sp. gr. 2·3. Its solution in hydrochloric acid, when neutralised by a mixed solution of ammonia and chloride of ammonium, gives a copious crystalline precipitate when phosphate of soda is added to it, the precipitate being the triple, or ammonio-magnesian, phosphate, $MgNH_4PO_46H_2O$. Placed on moist turmeric paper, magnesia turns it brown. With water it forms a hydrate ($Mg2HO$) without the evolution of heat. Dissolved in nitric acid, and neutralised with a mixture of solution of ammonia and chloride of ammonium, it does not give a precipitate with oxalate of ammonia or chloride of barium, showing the absence of lime or sulphates.

Magnesia Levis.

A bulky white powder, differing from magnesia only in its greater levity, the volumes corresponding to the same weight being to each other in the ratio of three and a-half to one.

Magnesiæ Carbonas.

A white granular powder; very sparingly soluble in water, but more soluble in cold water than in hot. It dissolves with effervescence in the dilute mineral acids, yielding solutions which, when first treated with chloride of ammonium, are not disturbed by the addition of an excess of solution of ammonia (showing the absence of lime), but yield a copious crystalline precipitate of triple phosphate upon the addition of phosphate of soda. With excess of hydrochloric acid it forms a clear solution, in which chloride of barium causes no precipitate, showing the absence of sulphate. Another portion of the solution, supersaturated with ammonia, gives no precipitate with oxalic acid or with sulphuretted hydrogen, indicating the absence of lime and of metals generally. 50 grains calcined at a red heat are reduced to 22.

Magnesiæ Carbonas Levis.

A very light powder, which, when examined under the microscope, is found to be partly amorphous, with numerous slender prisms intermixed; the partially crystalline form being due to the slowness of its precipitation. The other characters and tests are the same as those for carbonate of magnesia.

Magnesiæ Sulphas.

In minute, colourless, transparent, rhombic prisms, isomorphous with sulphate of zinc, from which they are distinguished by their intensely bitter taste, by the precipitate produced with potash being insoluble in excess of the reagent, and by not affording a precipitate with sulphide of ammonium. The crystals slowly effloresce in the air; deliquescence indicates the presence of chloride of magnesia, which may also be detected by yielding a white precipitate with nitrate of silver. Sulphate of magnesia is insoluble in alcohol, but readily dissolves in water, and the solution gives copious white precipitates with chloride of barium and with a mixed solution of ammonia, chloride of ammonium, and phosphate of soda (triple phosphate). The aqueous solution of sulphate of magnesia, at ordinary temperatures, should not give a precipitate with oxalate of ammonia, showing the absence of lime; nor should it give a brown precipitate with chlorinated lime or soda, indicating the absence of iron, which would also be detected by giving a blue precipitate with ferrocyanide of potassium. The precipitate of carbonate and hydrate of magnesia given by carbonate of soda, when obtained from a boiling solution of 100 grains of the salt, should, when well washed, dried, and heated to redness, weigh 16·26 grains.

COMPOUNDS OF LEAD. [Pb=207]

	B. P. Preps.	Strength	Dose	Action and Use
PLUMBI ACETAS Acetate of Lead, Sugar of Lead $Pb(C_2H_3O_2)_2.3H_2O$	—	—	1 to 4 grs.	Astringent and sedative; used in hæmorrhages, chronic diarrhœa, and dysentery; to check sweating and expectoration in phthisis. Externally, applied over inflamed parts. Used in making Liquor Plumbi Subacetatis.
	Pil. Plumbi c. Opio	3 pts. in 4	3 to 5 grs.	
	Suppositoria Plumbi Co.	1 pt. in 5	—	
	Unguentum Plumbi Acetatis	12 grs. in 1 oz	—	
PLUMBI CARBONAS Carbonate of Lead $2PbCO_3,PbO,H_2O$	—	—	—	Not used internally. Externally, astringent and sedative to inflamed and excoriated surfaces.
	Unguentum Plumbi Carbonatis	1 pt. in 8	—	
PLUMBI IODIDUM Iodide of Lead PbI_2	—	—	—	Used externally as a mild stimulant to enlarged scrofulous joints, etc. Seldom given internally.
	Emplastrum Plumbi Iodidum	1 pt. in 9	—	
	Unguentum Plumbi Iodidum	1 pt in 8	—	
PLUMBI NITRAS Nitrate of Lead $Pb(NO_3)_2$	—	—	—	Used as a topical application in onychia maligna. In solution, deodorant. Employed in preparation of Plumbi Iodidum.
PLUMBI OXIDUM Oxide of Lead, Litharge PbO	—	—	—	Not given internally. Used in the preparation of the Emplastrum Cerati Saponis, and both of the Acetates.
	Emplastrum Plumbi	—	—	
PLUMBI SUBACETAS Subacetate of Lead $Pb_2O2C_2H_3O_2$, or $Pb_2C_4H_6O_5$	Liq. Plumbi Subacetatis	5 oz. to 1 pt.	—	Astringent and sedative local application.
	Liq. Plumbi Subacet. Dilutus	2 drs. to 1 pt.	—	Ditto.
	Unguentum Plumbi Subacetatis Co.	1 pt. in 5¾	—	Ditto.

PREPARATION.

From **Lead** are prepared:—

1. Carbonate of Lead.

By exposing lead to the fumes of acetic and carbonic acids from decaying organic matter, tan, vinegar, &c.

2. Oxide of Lead.

By roasting lead in a current of air.

From the **Oxide of Lead** are prepared:—

1. Acetate of Lead.

Mix acetic acid (2 pints) with distilled water (1 pint), add oxide of lead (24 ozs.), and dissolve with the aid of a gentle heat. Filter, evaporate till a pellicle forms, and set aside to crystallise, first adding a little acetic acid should the fluid not have a distinctly acid reaction. The addition of acetic acid in slight excess is necessary in order to avoid the formation of basic acetate. The crystals are finally dried on filtering paper, without heat:—

$$2HC_2H_3O_2+PbO=Pb2C_2H_3O_2+H_2O.$$

2. Nitrate of Lead.

Dissolve oxide of lead ($4\frac{1}{2}$ ozs.) in dilute nitric acid (1 pint) by the aid of a gentle heat; filter and crystallise:—

$$PbO+2HNO_3=Pb(NO_3)_2+H_2O.$$

Instead of oxide of lead, metallic lead, or the carbonate of lead, may be used.

From the **Nitrate of Lead** is prepared:—

Iodide of Lead.

Dissolve nitrate of lead (4 ozs.), by the aid of a gentle heat, in distilled water ($\frac{1}{2}$ pint); dissolve iodide of potassium (4 ozs.) in distilled water ($\frac{1}{2}$ pint); mix the solutions. Collect the precipitate of iodide of lead on a filter, and wash away the nitrate of potash with distilled water; dry the precipitate at a gentle heat:—

$$Pb(NO_3)_2+2KI=PbI_2+2KNO_3.$$

From the **Acetate of Lead** is prepared:—

Subacetate of Lead (Solution of).

Boil acetate of lead (5 ozs.) and oxide of lead ($3\frac{1}{2}$ ozs.) in water for half an hour, constantly stirring. Filter, and keep the clear solution in stoppered bottles:—

$$Pb2C_2H_3O_2+PbO=Pb_2O2C_2H_3O_2.$$

CHARACTERS AND TESTS.

Plumbi Acetas.

In white, crystalline masses, slightly efflorescent, having an acetous odour and a sweet, astringent taste. It may be obtained in large, flat, four-sided crystals. Is soluble in water and alcohol. Its aqueous solution slightly reddens litmus; gives a yellow precipitate of iodide of lead with iodide of potassium; a white precipitate of sulphate of lead with sulphuric acid, acetic acid being set free; and a black precipitate of sulphide of lead with sulphuretted hydrogen. Its solution in distilled water is clear, or has only a slight milkiness, which disappears on the addition of acetic acid. It is distinguished from solution of subacetate of lead by the latter forming an opaque white jelly with mucilage of gum arabic. 38 grains ($\frac{1}{10}$ of a molecule) dissolved in water require for complete precipitation 200 grain-measures ($\frac{1}{10}$ of a molecule) of the volumetric solution of oxalic acid.

Plumbi Carbonas.

Commonly called "white lead" (ceruse). Occurs as a soft, heavy, white powder, blackened by sulphuretted hydrogen (PbS), insoluble in water; soluble, with effervescence, in diluted acetic acid, leaving no residue (absence of sulphates), and forming a solution which gives a yellow precipitate of iodide of lead with iodide of potassium, and a white precipitate of sulphate of lead with sulphuric acid. The acetic solution, when treated with excess of sulphuretted hydrogen, boiled and filtered, gives no precipitate with oxalate of ammonia, showing the absence of chalk or whiting.

Plumbi Iodidum.

A bright yellow powder, tasteless and odourless; sp. gr. 6·384. Is sparingly soluble in cold water, but is entirely soluble in boiling water, from which it is deposited, on cooling, in golden crystalline scales. It is soluble in alcohol, acetic acid, solution of potash, and solutions of the alkaline iodides. Fuses at a moderate heat, but is decomposed at a high temperature, violet vapours being evolved. If 100 grains be dissolved in nitric acid diluted with twice its weight of boiling water, and, after the iodine is expelled, sulphate of soda be added, 66 grains of sulphate of lead are thrown down.

Plumbi Nitras.

In colourless octahedral crystals, which are nearly opaque, permanent in the air, of a sweetish astringent taste, soluble in water and alcohol. The aqueous solution gives a black precipitate of sulphide of lead with sulphuretted hydrogen, a white precipitate of sulphate of lead with sulphuric acid, and a yellow precipitate of iodide of lead with iodide of potassium. Added to a solution of sulphate of indigo it discharges its colour (characteristic of a nitrate).

Plumbi Oxidum.

In heavy scales of a pale brick-red colour, completely soluble without effervescence (absence of carbonic acid, which it slowly absorbs from the air) in diluted nitric and acetic acids, either solution, when neutral, giving a copious yellow precipitate of iodide of lead with iodide of potassium. Its solution in diluted nitric acid when supersaturated with ammonia and then cleared by filtration does not exhibit a blue colour, indicating the absence of copper. Oxide of lead decomposes the neutral fats, like the caustic alkalies, forming with them insoluble soaps. It is soluble in lime-water and in solutions of caustic potash and soda.

COMPOUNDS OF POTASSIUM. [K=39]

	B. P. Preps.	Strength	Dose	Action and Use
POTASSA CAUSTICA Caustic Potash, or Hydrate of Potash KHO	— Liquor Potassæ	— 27 grs. to 1 oz.	— 15 to 60 mins.	A powerful caustic; used for making issues. Liquor Potassæ is given internally as an antacid and stomachic sedative in dyspepsia. Acts as an alterative to the glandular system. Employed to diminish viscidity of secretion in chronic bronchitis. Also given in obesity, lithiasis, scrofula, syphilis, and in chronic rheumatism. Used as a stimulant and antipruritic local application in certain chronic skin diseases, and as an escharotic in poisoned wounds.
POTASSA SULPHURATA Sulphurated Potash, Hepar Sulphuris	— Unguentum Potassæ Sulphuratæ	— —	3 to 6 grs. —	Stimulating diaphoretic and expectorant. Used in chronic skin diseases and in chronic rheumatism. Used externally also in the latter cases. Destroys fungi and parasites.
POTASSÆ ACETAS Acetate of Potash $KC_2H_3O_2$	—	—	10 to 60 grs. —	Diuretic and purgative. Given in dropsies; also in acute rheumatism, skin diseases, and chronic enlargement of glands. Acts as an antilithic.
	Solution of (App. II.)	1 in 10	—	Test for Tartaric Acid.
POTASSÆ BICARBONAS Bicarbonate of Potash $KHCO_3$	— Liq. Potassæ Effervescens.	— 30 grs. in 1 pt.	10 to 40 grs. 5 to 10 ozs.	A direct antacid and alterative. Given in dyspepsia, in lithiasis, and in acute rheumatism, etc.
POTASSÆ BICHROMAS Bichromate of Potash $K_2Cr_2O_7$	— Volumetric solution of (App. III.)	— —	— —	Used in the preparation of Valerianate of Soda, and for the quantitative determination of the protoxide in preparations of iron.
POTASSÆ CARBONAS Carbonate of Potash K_2CO_3	—	—	10 to 30 grs.	Almost the same action and uses as potash, but less caustic.

Compounds of Potassium—Continued.

	B. P. Preps.	Strength	Dose	Action and Use
Potassæ Chloras Chlorate of Potash $KClO_3$	— Trochisi Potassæ Chloratis	— 5 grs. in each	10 to 30 grs. 1 to 6	Refrigerant. Given in low fevers. Useful as a gargle in stomatitis, aphthous and other ulcerations of the gums, mouth, and throat; cancrum oris; ptyalism, etc.
Potassæ Citras Citrate of Potash $K_3C_6H_5O_7$	—	—	20 to 60 grs.	Diaphoretic, diuretic, and mild laxative. Used in uric acid gravel, etc. Acts as an alterative in some chronic affections. Antiscorbutic.
Potassæ Nitras Nitrate of Potash KNO_3	—	—	10 to 30 grs.	Refrigerant, diaphoretic and diuretic. Used to allay irritation in dyspepsia. In large doses, a vascular sedative, and as such used in acute inflammations—*e.g.*, rheumatism, etc.
Potassæ Permanganas Permanganate of Potash $KMnO_3$	— Liquor Potassæ Permanganatis	— 4 grs. to 1 oz.	— 2 to 4 drms.	Disinfectant, antiseptic, deodoriser. Used as an application to foul ulcers, etc., and as an injection, gargle, etc. May be given internally to correct offensive evacuations and fœtid expectoration.
Potassæ Prussias Flava Yellow Prussiate of Potash, Ferrocyanide of Potassium $K_4FeC_6N_6.3H_2O$	—	—	—	Not used medicinally. Test for persalts of iron. Used to prepare Acid. Hydrocyanicum Dil.
Potassæ Prussias Rubra Red Prussiate of Potash, Ferridcyanide of Potassium $K_6Fe_2C_{12}N_{12}$	Solution of (App. II.)	¼ oz. to 5 oz.	—	Test for protosalts of iron.
Potassæ Sulphas Sulphate of Potash K_2SO_4	—	—	15 to 60 grs.	Mild purgative, alterative. Represses secretion of milk. Enters into composition of Pil. Colocynth Co. and Pulv. Ipecac. Co.
Potassæ Tartras Tartrate of Potash, or Soluble Tartar $K_2C_4H_4O_6$	—	—	60 grs. to ½ oz.	Diuretic. In large doses, a mild purgative.
Potassæ Tartras Acida Acid Tartrate of Potash, Bitartrate of Potash, or Cream of Tartar $KHC_4H_4O_6$	—	—	20 to 60 grs.	Refrigerant, diuretic. In large doses, a hydragogue purgative. Used in dropsies. Used in preparation of Tartaric Acid; the officinal Tartrates; Conf. Sulphuris; and Pulv. Jalapæ Co.
Potassii Bromidum Bromide of Potassium KBr	—	—	5 to 30 grs.	Alterative, soporific. Given in sleeplessness, nervous affections, epilepsy, delirium tremens, convulsions, throat affections, etc.
Potassii Iodidum Iodide of Potassium KI	— Lin. Pot. Iodid. cum Sapone Ung. Pot. Iodid.	— 54¾ grs. to 1 oz. 1 pt. in 8¾	2 to 10 grs. — —	Diuretic, alterative. Given internally in scrofula, glandular enlargements, and hypertrophies; in syphilis, dropsy, rheumatism, aneurism, lead-poisoning, etc. Externally used in syphilitic and glandular affections, in skin diseases, etc.
	Solution of (App. II.)	1 pt. in 10	—	Test for lead.

PREPARATION.

From **Pearl-ash** (the product of the lixiviation of wood-ash) is prepared:—

Carbonate of Potash.

Treat pearl-ash with its own weight of distilled water, and evaporate the solution so formed to dryness, while it is kept briskly agitated.

From **Carbonate of Potash** are prepared:—

1. Acetate of Potash.

To acetic acid (2 pints), placed in a thin porcelain basin, add gradually carbonate of potash (20 ozs.); filter, acidulate, if necessary, with a few additional drops of the acid, and, having evaporated to dryness, raise the heat cautiously so as to liquefy the product. Allow the basin to cool, and when the salt has solidified, and while it is still warm, break it into fragments and put it into stoppered bottles ($K_2CO_3+2HC_2H_3O_2=2KC_2H_3O_2+H_2O+CO_2$). In this process an acid reaction is given to the solution, so as to completely neutralise the potash; the presence of a very little carbonate producing, during the liquefaction of the salt, a brown discoloration.

2. Bicarbonate of Potash.

Pass carbonic acid gas (generated from marble and hydrochloric acid) through a strong solution of carbonate of potash for a week. Crystals of the less soluble bicarbonate of potash are gradually deposited ($K_2CO_3+H_2O+CO_2=2KHCO_3$). The following are the details of the process:—

Dissolve carbonate of potash (1 pound) in distilled water (2 pints), and filter the solution into a three-pint bottle, capable of being tightly closed by a cork traversed by a glass tube sufficiently long to pass to the bottom of the fluid. Introduce marble (1 pound) into another bottle, in the bottom of which a few small holes have been drilled, and the mouth of which is closed by a cork also traversed by a glass tube, and place the bottle in a jar of the same height as itself, but of rather larger diameter. Connect the two glass tubes air-tight by a caoutchouc tube. The cork of the bottle containing the carbonate of potash having been placed loosely, and that of the bottle containing the marble tightly, in its mouth, pour into the jar surrounding the latter bottle hydrochloric acid (1½ pint) previously diluted with water (3 pints). When carbonic acid gas has passed through the potash solution for two minutes, so as to expel the whole of the air of the apparatus, fix the cork tightly in the neck of the bottle, and let the process go on for a week. At the end of this time numerous crystals of bicarbonate of potash will have formed, which are to be removed, shaken with twice their bulk of cold distilled water, and, after decantation of the water, drained, and dried on filtering paper by exposure to the air. The mother liquid, filtered if necessary, and concentrated to one-half at a temperature not exceeding 110°, will yield more crystals. The tube immersed in the solution of carbonate of potash, which should have as large a diameter as possible, may require the occasional removal of the crystals formed within it, in order that the process may not be interrupted.

3. Bichromate of Potash.

Roast chrome iron ore (FeO,Cr_2O_3) with a mixture of carbonate of potash and chalk in a furnace through which a current of air passes. Yellow chromate of potash is thus formed ($2FeO,Cr_2O_3+4K_2CO_3+O_7=Fe_2O_3+4K_2CrO_4+4CO_2$). The object of adding the chalk is to keep the mixture in a porous state by diminishing its fusibility. The yellow chromate, when treated with sulphuric acid, yields the red bichromate of potash ($2K_2CrO_4+H_2SO_4=K_2Cr_2O_7+K_2SO_4+H_2O$).

4. Chlorate of Potash.

Pass chlorine gas (generated from black oxide of manganese and hydrochloric acid) over a mixture of carbonate of potash and excess of slaked lime; chlorate of potash, chloride of calcium, and carbonate of lime are thus formed; the latter is removed by filtration, and the chlorate of potash crystallises on evaporation ($K_2CO_3+6CaH_2O_2+6Cl_2=2KClO_3+5CaCl_2+CaCO_3+6H_2O$). The following are the details:—

Mix slaked lime (53 ozs.) with carbonate of potash (20 ozs.) and triturate them with a few ounces of water so as to make the mixture slightly moist. Place oxide of manganese (80 ozs.) in a large retort or flask, and having poured upon it hydrochloric acid (24 pints) diluted with water (6 pints); apply a gentle sand heat, and conduct the chlorine as it comes over, first through a bottle containing six ounces of water, and then into a large carboy containing the mixture of carbonate of potash and slaked lime. When the whole of the chlorine has come over, remove the contents of the carboy, and boil them for twenty minutes with water (7 pints); filter and evaporate till a film forms on the surface, and set aside to cool and crystallise. The crystals thus obtained are to be purified by dissolving them in three times their weight of boiling distilled water, and again allowing the solution to crystallise.

5. Citrate of Potash.

Dissolve crystals of citric acid (6 ozs.) in distilled water (2 pints), add carbonate of potash (8 ozs.) gradually, and, if the solution be not neutral, make it so by the cautious addition of the acid or the carbonate of potash. Then filter, and evaporate to dryness, stirring constantly after a pellicle has begun to form, till the salt granulates. Triturate in a dry warm mortar, and preserve in stoppered bottles:—

$$3K_2CO_3+2H_3C_6H_5O_7=2K_3C_6H_5O_7+3H_2O+CO_2.$$

6. Yellow Prussiate of Potash.

Fuse animal substances, such as the cuttings of horns, hoofs, and skins, with carbonate of potash, in an iron pot; lixiviate the crude product in water, and purify the salt by crystallisation:—

$$6KCN+Fe+2H_2O=K_4FeCy_6+2KHO+H_2O.$$

7. Sulphurated Potash.

Mix carbonate of potash (10 ozs.) and sublimed sulphur (5 ozs.) in a warm mortar, and having introduced them into a crucible, let this be heated, first gradually until effervescence has ceased, and finally to dull redness, so as to produce perfect fusion. Let the liquid contents of the crucible be then poured out on a clean flagstone, and covered quickly with an inverted porcelain basin, so as to exclude the air as completely as possible while solidification is taking place. The solid product thus obtained should, when cold, be broken into fragments, and immediately enclosed in a green-glass bottle, furnished with an air-tight stopper. In this process hyposulphite and sulphide of potassium are formed:—$3K_2CO_3+4S_2=K_2S_2O_3+2K_2S_3+3CO_2$. Too high a heat would decompose the hyposulphite into sulphate and sulphite.

8. Tartrate of Potash.

Dissolve carbonate of potash (9 ozs.) in boiling distilled water (2½ pints); add by degrees acid tartrate of potash (20 ozs.), and if, after a few minutes boiling, the liquid is not neutral to test-paper, make it so by the careful addition of more of the carbonate or of the acid tartrate. Then filter, concentrate till a pellicle forms on the surface, and set it aside to cool and crystallise. More crystals may be obtained by evaporating and cooling the mother liquor. Drain the crystals, dry them by exposure to the air in a warm place, and preserve them in a stoppered bottle:—

$$2KHC_4H_4O_6+K_2CO_3=2K_2C_4H_4O_6+CO_2+H_2O.$$

9. Caustic Potash.

Boil down solution of potash (made by the action of slaked lime on the carbonate) rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which, when removed on a warm glass rod, solidifies on cooling. Pour it now into proper moulds, and when it has solidified, and while it is still warm, put it into stoppered bottles. Neither platinum, glass, nor porcelain vessels can be used in this process, as caustic potash acts injuriously on those materials.

From **Caustic Potash** are prepared:—

1. Bromide of Potassium.

Put solution of potash (2 pints) into a glass or porcelain vessel, and add bromine (4 ozs.) in successive portions, with constant agitation, until the mixture has acquired a permanent brown tint. By this means, bromide and bromate of potash are formed ($6KHO + Br_6 = 5KBr + KBrO_3 + 3H_2O$). Evaporate to dryness; reduce the residue to a fine powder, and mix this intimately with powdered wood charcoal (2 ozs.). Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and when the whole has been brought to a state of fusion, remove the crucible from the fire, and pour out its contents. By this means the bromate of potash is converted into bromide ($KBrO_3 + C_3 = KBr + 3CO$). When the fused mass has cooled, dissolve it in the water, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the mother liquor, and cooling. The salt should be kept in a stoppered bottle.

2. Iodide of Potassium.

Is obtained by a process analogous to that directed for the preparation of the bromide, the substances used being solution of potash (1 gallon), iodine (29 ozs.), and wood charcoal (3 ozs.). The reactions expressing the decomposition are:—

(1.) $6KHO + I_6 = 5KI + KIO_3 + 3H_2O.$
(2.) $KIO_3 + C_3 = KI + 3CO.$

From **Caustic Potash** and **Chlorate of Potash** is prepared:—

Permanganate of Potash.

Reduce chlorate of potash (3½ ozs.) to fine powder, and mix it with oxide of manganese (4 ozs.); put the mixture into a porcelain basin, and add to it caustic potash (5 ozs.), previously dissolved in four ounces of water. Evaporate to dryness on a sand bath, stirring diligently to prevent spurting. Pulverise the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull red heat for an hour, or till it has assumed the condition of a semifused mass. In this stage of the process manganate of potash is formed ($6KHO + 3MnO_2 + KClO_3 = 3K_2MnO_4 + KCl + 3H_2O$). Let the mass cool, pulverise it, and boil with a pint and a half of the water. Let the insoluble matter subside, decant the fluid, boil again with half a pint of the water, again decant, neutralise the united liquors accurately with dilute sulphuric acid, and evaporate till a pellicle forms. By this means the green manganate is converted into the purple permanganate ($3K_2MnO_4+2H_2O=2KMnO_4+4KHO+MnO_2$). Set aside to cool and crystallise. Drain the crystalline mass, boil it in six ounces of the water, and strain through a funnel the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallise, drain the crystals, and dry them by placing them under a bell jar over a vessel containing sulphuric acid. Asbestos is used as the filtering material, as organic matter would decompose the permanganate.

From **Yellow Prussiate of Potash** is prepared:—

Red Prussiate of Potash.

Pass chlorine gas through a solution of yellow prussiate of potash, until it ceases to give a blue precipitate with a persalt of iron. $2K_4FeCy_6+Cl_2=K_6Fe_2Cy_{12}+2KCl$.

From **Argol** (the deposit on inside of wine casks) is prepared:—

Bitartrate of Potash.

During the fermentation of the grape-juice alcohol is formed, and the *argol*, or *red*, or *crude, tartar* (which consists of acid tartrate, tartrate of lime, and colouring matter), being insoluble in the alcohol, is deposited as a crust on the inside of the casks. It is purified from the lime salt and the colouring matter by charcoal and clay, and by re-crystallisation.

From **Nitre-soils** is obtained:—

Nitrate of Potash.

Certain Indian soils contain nitrate of potash united with nitrate of lime. On treating these with wood-ashes or carbonate of potash, an insoluble carbonate of lime is formed, and is separated from the soluble nitrate of potash by solution of the latter. The nitrate of potash is finally crystallised, and may be purified by re-solution and re-crystallisation.

From **Nitrate of Potash** is prepared:—

Sulphate of Potash.

The residuum of the distillation of nitric acid, when made by the action of sulphuric acid on nitre, consists of acid sulphate of potash ($KHSO_4$). From this the neutral sulphate is prepared by dissolving it in water, and neutralising it with carbonate of potash ($2KHSO_4+K_2CO_3=2K_2SO_4+H_2O+CO_2$); the salt is crystallised from the neutral solution.

CHARACTERS AND TESTS.

Potassa Caustica.

In hard white pencils. Sp. gr. 2·2. Very deliquescent, powerfully alkaline and corrosive; is readily soluble in water and in alcohol. Its aqueous solution decomposes most metallic salts, precipitating from solution all metals which form insoluble oxides or hydrates. The precipitates it forms in solution of aluminium, glucinum, chromium, zinc, and lead, are soluble in excess of the alkali, but all others are insoluble; on account of its solvent action on oxide of lead, it should not be kept in white glass bottles. It precipitates from vegetable infusions their alkaloids or neutral principles. It melts below redness, forming an oily fluid, which decomposes even silicates. A watery solution acidulated with nitric acid gives a yellow precipitate with perchloride of platinum—the double chloride of potassium and platinum ($2KCl, PtCl_4$), the general test for potassium—and scanty white precipitates with nitrate of silver and chloride of barium, showing the presence of traces of chlorides and of sulphates. 56 grains (one molecule) dissolved in water leave only a trace of sediment, and require for neutralisation at least 900 grain-measures of the volumetric solution of oxalic acid.

Potassa Sulphurata.

Solid greenish fragments, liver-brown when recently broken; rapidly absorbs oxygen from the air, and becomes dull-white, sulphate of potash being formed; is alkaline, acrid to the taste; forms readily with water a yellow solution, which has the odour of sulphuretted hydrogen, and evolves it freely when excess of hydrochloric acid is dropped into it, sulphur being at the same time deposited ($K_2S_3+2HCl=2KCl+H_2S+S_2$). It strikes black with salts of lead. The acid fluid when boiled and filtered is precipitated yellow by perchloride of platinum, proving presence of a salt of potash; and white by chloride of barium, proving presence of sulphuric acid. About three-fourths of its weight (the sulphide of potassium) are dissolved by rectified spirit. The sulphate of potash, into which it becomes charged by oxidation, is insoluble in spirit.

Potassa Acetas.

White foliaceous satiny masses, very deliquescent. With its aqueous solution tartaric acid gives a crystalline precipitate of acid tartrate of potash. Sulphuric acid causes the disengagement of acetic acid, and a dilute solution of perchloride of iron strikes a blood-red colour with the solution, owing to the formation of peracetate of iron. It is entirely soluble in rectified spirit, showing the absence of carbonate and other salts of potash. It is neutral to test-paper, showing the absence of cream of tartar, which if present would give it an acid reaction; and its solution is unaffected by sulphide of ammonium, proving the absence of metallic impurities.

Potassæ Bicarbonas.

Colourless right rhombic prisms, not deliquescent, of a saline feebly alkaline taste, not corrosive. Insoluble in alcohol, soluble in four parts of cold water and in one part of boiling water; its aqueous solution does not affect turmeric paper. Dilute hydrochloric acid causes strong effervescence (CO_2), forming a solution with which perchloride of platinum gives the yellow precipitate, characteristic of potash salts. From the carbonate it is distinguished by a solution of corrosive sublimate, which gives a brick-red precipitate with the former, and a very slight white precipitate with the bicarbonate; this test fails with the carbonate if chloride of sodium be present. The bicarbonate does not give a precipitate with sulphate of magnesia until the mixture is boiled. 50 grains exposed to a low red heat leave 34½ grains of a white residue of carbonate of potash, which require for exact saturation 500 grain-measures of the volumetric solution of oxalic acid. 20 grains of it neutralise 14 grains of citric or 15 grains of tartaric acid.

Potassæ Bichromas.

In large red, transparent, four-sided tables; anhydrous; fuses below redness; at a higher temperature is decomposed, yielding green oxide of chromium and yellow chromate of potash, which may be separated by dissolving the latter in water. On adding excess of oil of vitriol to a cold saturated solution of bichromate of potash, chromic anhydride is deposited in crimson needles ($K_2Cr_2O_7 + H_2SO_4 = 2CrO_3 + K_2SO_4 + H_2O$). Dissolved in water, bichromate of potash gives with chloride of barium a yellowish-white precipitate ($BaCrO_4$), and with nitrate of silver it gives a purplish-red precipitate (Ag_2CrO_4). Both these precipitates are soluble in diluted nitric acid. The solution also, when digested with sulphuric acid and rectified spirit, acquires an emerald-green colour of chromic sulphate (Cr_23SO_4), the liberated oxygen converting the alcohol into aldehyd.

Potassæ Carbonas.

A white crystalline powder, alkaline and caustic to the taste, very deliquescent, and thus differing from the bicarbonate and from the carbonates of soda; it is readily soluble in water, but insoluble in spirit, showing the absence of hydrate of potash. Effervesces with dilute hydrochloric acid, and forms a solution which gives a yellow precipitate with perchloride of platinum. Loses about sixteen per cent. of its weight (water of crystallisation) when exposed to a red heat. When supersaturated with nitric acid, and evaporated to dryness, the residue is almost entirely soluble in water, only a little silica remaining undissolved; and the solution is precipitated only faintly by chloride of barium and nitrate of silver, indicating the presence of traces of sulphates and chlorides. Unlike the bicarbonate, carbonate of potash gives a white precipitate with sulphate of magnesia. 87 grains require for neutralisation at least 980 grain-measures of the volumetric solution of oxalic acid. 20 grains of it will neutralise 17 grains of citric or 18 grains of tartaric acid.

Potassæ Chloras.

In colourless rhomboidal crystalline plates, with a cool saline taste, sparingly soluble in cold water. It explodes when triturated with sulphur. When a few drops of sulphuric acid are dropped on the crystals, they become orange-red, and give off yellow vapours of peroxide of chlorine. An explosive gas, *euchlorine*, is formed when chlorate of potash is gently heated with hydrochloric acid. Solution of chlorate of potash should not give a precipitate with nitrate of silver or oxalate of ammonia, proving the absence of chlorides and of lime. By heat the salt fuses, gives off oxygen gas, and leaves a white residue of chloride of potassium, which forms with water a neutral solution, which is precipitated white by nitrate of silver ($AgCl$), and yellow by perchloride of platinum ($2KCl, PtCl_4$).

Potassæ Citras.

A white powder of saline feebly-acid taste, deliquescent, and very soluble in water. Heated with sulphuric acid, it forms a brown fluid, gives off an inflammable gas (carburetted hydrogen, CH_4), and evolves the odour of acetic acid. Its solution, mixed with a solution of chloride of calcium, remains clear till it is boiled, when a white precipitate of citrate of lime separates, which is readily soluble in acetic acid. This test proves the absence of tartrate, with which chloride of calcium gives an immediate precipitate in the cold. Solution of citrate of potash, acidulated with hydrochloric acid, gives a yellow precipitate with perchloride of platinum; 102 grains of it ($\frac{1}{3}$ of a molecule of the salt containing one molecule of potash, the acid being tribasic) heated to redness till gases cease to be evolved, leave an alkaline residue of carbonate of potash mixed with carbon, which requires for exact neutralisation 1,000 grain-measures of the volumetric solution of oxalic acid.

Potassæ Nitras.

In white crystalline masses or fragments of striated six-sided prisms, colourless, of a peculiar cool saline taste. Readily soluble in water, sparingly in rectified spirit. Sp. gr. 2·07. Thrown on the fire it deflagrates; heated to redness, it loses oxygen, and is converted into deliquescent nitrite. Warmed in a test-tube with sulphuric acid and copper wire, it evolves ruddy fumes of NO_2, showing the presence of nitric acid. Its solution, acidulated with hydrochloric acid, gives the yellow precipitate with perchloride of platinum. Its solution is not affected by chloride of barium or nitrate of silver, showing the absence of sulphates or chlorides.

Nitre is a powerful oxidising agent. When fused and cast into moulds it forms little bullet-shaped masses, and is known as *sal prunella.*

Potassæ Permanganas.

Dark purple slender prismatic crystals, inodorous, with a sweet astringent taste, soluble in water. A single small crystal suffices to form with an ounce of water a rich purple solution, which, when mixed with a little rectified spirit and heated, becomes yellowish-brown; this is due to the reduction of the permanganic acid to hydrated peroxide, the alcohol being oxidised to acetic acid, which combines with the liberated potash. The crystals, heated to redness, decrepitate, evolve oxygen gas, and leave a black residue, from which water extracts potash, recognised by its alkaline reaction, and by its giving, when acidulated with hydrochloric acid, the characteristic yellow precipitate with perchloride of platinum. Entirely soluble in cold water. 5 grains dissolved in water require for complete decoloration a solution of 44 grains of granulated sulphate of iron acidulated with 2 fluid drachms of diluted sulphuric acid. In this reaction the oxidising power of the permanganate changes the iron from the ferrous to the ferric state, and manganic and potassium sulphates are formed.

Potassæ Prussias Flava.

In large yellow crystals, permanent in the air, soluble in water, insoluble in alcohol. The aqueous solution precipitates deep blue with persulphate of iron, rich-brown with sulphate of copper, and white with acetate of lead. Heated with diluted sulphuric acid, hydrocyanic vapours are evolved. Used as a test for persalts of iron, with which it gives a blue precipitate; with protosalts of iron it gives a white precipitate.

Potassæ Prussias Rubra.

Crystallises in garnet-red crystals, which are soluble in water, forming a green solution. Used as a test for protosalts of iron, with which it gives a deep-blue precipitate, "Turnbull's blue;" with persalts of iron it gives no precipitate.

Potassæ Sulphas.

In colourless hard six-sided prisms terminated by six-sided pyramids; these undergo no change on exposure to air, are sparingly soluble in water, insoluble in alcohol, have a bitterish and saline taste, and decrepitate strongly when heated. The aqueous solution should be neutral to test paper, showing freedom from the acid sulphate of potash, and it should not be affected by oxalate of ammonia, showing absence of lime. When acidulated with hydrochloric acid, it is precipitated white by chloride of barium and yellow by perchloride of platinum.

Potassæ Tartras.

In small colourless four or six-sided prisms. Taste, mildly saline and bitterish. Heated with sulphuric acid it forms a black tarry fluid, evolving inflammable gas and the odour of burned sugar. Acetic acid added sparingly to its solution causes the separation of a white crystalline precipitate of acid tartrate. Entirely dissolved by its own weight of water, hence sometimes called "soluble tartar." 113 grains ($\frac{1}{2}$ a molecule, the salt being a neutral dibasic one) heated to redness till gases cease to be evolved, leave an alkaline residue, which requires for exact neutralisation 1000 grain-measures of the volumetric solution of oxalic acid, corresponding to one molecule of the alkali. Tartrate of potash will be rendered slightly deliquescent if it contain carbonate of potash; and it will have an acid reaction if adulterated with cream of tartar.

Potassæ Tartras Acida.

A gritty white powder, or fragments of cakes crystallised on one surface; of a pleasant acid taste, sparingly soluble in water, insoluble in spirit. Heated in a crucible it evolves inflammable gas and the odour of burned sugar, and leaves a black residue (black-flux). This effervesces with diluted hydrochloric acid, and forms a solution which, when filtered, gives a yellow precipitate with perchloride of platinum, and when neutralised by ammonia is rendered slightly turbid by oxalic acid, indicating presence of a trace of lime. 188 grains (one molecule) heated to redness till gas ceases to be evolved, leave an alkaline residue, which requires for exact neutralisation 1000 grain-measures of the volumetric solution of oxalic acid.

Potassii Bromidum.

In colourless cubical crystals, with no odour, but a pungent saline taste, ready soluble in water, less soluble in spirit. Its aqueous solution gives a white crystalline precipitate of acid tartrate of potash, with tartaric acid. When its solution in water is mixed with a little chlorine, chloroform agitated with it, on falling to the bottom, exhibits a red colour. In this test the chlorine sets free bromine, which is dissolved by the chloroform and colours it. Ten grains require for complete decomposition 840 grain-measures of the volumetric solution of nitrate of silver. If more than 840 grain-measures be required, the presence of a chloride is indicated, the equivalent of chlorine being less than half that of bromine; if less be required, the presence of an iodide is indicated, the equivalent of iodine being nearly double that of bromine. A solution of the salt mixed with mucilage of starch and a drop of an aqueous solution of bromine or chlorine does not exhibit any blue colour, showing the absence of iodine.

Potassii Iodidum.

In colourless, generally opaque, cubic crystals, of a bitterish and acrid saline taste, not deliquescent in dry air; readily soluble in water, less so in alcohol. It usually has a feeble alkaline reaction. Its solution mixed with mucilage of starch gives a blue colour on the addition of a little solution of chlorine. It gives a crystalline precipitate of acid tartrate of potash with tartaric acid. The addition of tartaric acid and mucilage of starch to its aqueous solution should not develop a blue colour, showing the absence of iodate of potash. Were iodate present, the acid would liberate iodic acid from it, and hydriodic acid from the iodide; these acids reacting on each other, set free iodine, which would then colour the starch ($HIO_3 + 5HI = 3H_2O + I_6$). With solution of nitrate of silver it gives a pale yellow precipitate of iodide of silver, which is insoluble in solution of ammonia; the addition to the ammoniacal liquid of nitric acid in excess should not cause turbidity, showing the absence of chlorides, chloride of silver being soluble in ammonia. With saccharated solution of lime, the solution of iodide of potassium would give a precipitate, were carbonates present. Iodide of potassium is a solvent of iodine and insoluble iodides.

COMPOUNDS OF SODIUM. [Na=23]

	B. P. Preps.	Strength	Dose	Action and Use
SODA CAUSTICA Caustic Soda, Hydrate of Soda $NaHO$	—	—	—	Action same as caustic potash (p. 70), but it is less powerful and less deliquescent.
	Liquor Sodæ	18·8 grs. in 1 oz.	—	
	Volumetric Solution of Soda (App. III.)	40 grs. in 1000 grs.	—	Used in estimating the acids volumetrically.
SODA TARTARATA Tartarated Soda, Potassio-tartrate of Soda, or Rochelle Salts $NaKC_4H_4O_6 \cdot 4H_2O$	—	—	¼ to ½ oz.	In large doses, mild saline purgative; in small doses, diuretic. Given in same cases as tartrate of potash.

Compounds of Sodium—Continued.

	B. P. Preps.	Strength	Dose	Action and Use
SODÆ ACETAS Acetate of Soda $NaC_2H_3O_2.3H_2O$	—	—	—	Acts as a mild diuretic. Is rarely used medicinally. Employed in preparation of the Arseniate and Phosphate of Iron, and of Syr. Ferri Phosph.
	Solution of (App. II.)	$\frac{1}{2}$ oz. to 5 ozs.	—	See Calcis Phosphas, p. 42.
SODÆ ARSENIAS Arseniate of Soda $Na_2HAsO_4.7H_2O$	—	—	$\frac{1}{16}$ to $\frac{1}{8}$ gr.	Same action and use as Arsenious acid; but is less liable to produce irritation of mucous membranes.
	Liquor Sodæ Arseniatis	4 grs. in 1 oz.	5 to 10 mins.	
SODÆ BIBORAS Biborate of Soda, Borax $Na_2B_4O_7.10H_2O$	—	—	5 to 40 grs.	Diuretic, antacid, emmenagogue. Used as a topical sedative to ulcerations of mucous membranes, and as a detergent. Is astringent and antipruritic.
	Glycerinum Boracis	1 pt. in 6	—	
	Mel Boracis	56 grs in 1 oz.	—	
SODÆ BICARBONAS Bicarbonate of Soda $NaHCO_3$	—	—	10 to 60 grs.	Similar to bicarbonate of potash, but not so efficacious in uric acid diathesis, and it influences the liver-secretion more.
	Liq. Sodæ Efferv.	30 grs. in 1 pt.	—	
	Sodæ Citro-Tart. Effervescens	17 pts. in 31	60 grs. to $\frac{1}{4}$ oz.	
	Trochisci Sodæ Bicarbonatis	5 grs. in each	1 to 6	
SODÆ CARBONAS Carbonate of Soda $NaCO_3.10H_2O$	—	—	5 to 30 grs.	Similar to carbonate of potash, but is less caustic.
	Sodæ Carbonas Exsiccata	—	3 to 10 grs.	
SODÆ HYPOPHOSPHIS Hypophosphite of Soda $NaPH_2O_2$	—	—	5 to 10 grs.	Similar to Calcis Hypophosphis (p. 39).
SODÆ HYPOSULPHIS Hyposulphite of Soda $Na_2H_2S_2O_4.4H_2O$	Volumetric Solution of (App. III.)	24·8 grs. in 1000	—	Used for estimation of Chlorine and Iodine.
SODÆ NITRAS Nitrate of Soda $NaNO_3$	—	—	—	Not used medicinally. Employed in preparation of Sodæ Arsenias.
SODÆ PHOSPHAS Phosphate of Soda $Na_2HPO_4.12H_2O$	—	—	$\frac{1}{4}$ to 1 oz.	In large doses, a mild saline purgative, and as such given in constipation of children. In small doses, diuretic, and used in uric acid diathesis. Used in preparation of Ferri Phosphas.
	Solution of (App. II.)	1 to 10	—	Test for Magnesia.
SODÆ SULPHAS Sulphate of Soda, Glauber's Salt $Na_2SO_4.10H_2O$	—	—	$\frac{1}{4}$ to 1 oz.	Mild saline purgative, influencing the biliary secretion. In small doses, diuretic.
SODÆ VALERIANAS Valerianate of Soda $NaC_5H_9O_2$	—	—	1 to 5 grs.	Resembles valerian, acting as a powerful stimulant and antispasmodic. Used in preparation of Zinci Valerianas.
SODII CHLORIDUM Chloride of Sodium, Common Salt $NaCl$	—	—	—	A necessary article of food. In large doses, emetic and purgative. Used in preparation of Hydrochloric Acid, Calomel, and Corrosive Sublimate.

PREPARATION.

Caustic Soda.

Boil down solution of soda in the manner directed for the preparation of caustic potash (p. 74).

Tartarated Soda.

Dissolve carbonate of soda (12 ozs.) in boiling distilled water, add gradually acid tartrate of potash (16 ozs.), and, if after being boiled for a few minutes the liquid has an acid or alkaline reaction, add a little carbonate of soda or acid tartrate of potash till a neutral solution is obtained. Boil and filter; concentrate the liquor till a pellicle forms on the surface, and set it aside to crystallise. More crystals may be obtained by again evaporating as before:—

$$2KHC_4H_4O_6+Na_2CO_3=2KNaC_4H_4O_6+H_2O+CO_2.$$

Acetate of Soda.

Add carbonate of soda to acetic acid until effervescence ceases, and evaporate the resulting solution:—

$$Na_2CO_3+2HC_2H_3O_2=2NaC_2H_3O_2+H_2O+CO_2.$$

Arseniate of Soda.

Reduce separately dry arsenious acid (10 ozs.), dry nitrate of soda (8½ ozs.), and dried carbonate of soda (5½ ozs.) to fine powder, and mix them thoroughly in a porcelain mortar. Put the mixture into a large clay crucible, and cover it with the lid. Expose to a full red heat till all effervescence has ceased, and complete fusion has taken place. Pour out the fused salt on a clean flag-stone, and as soon as it has solidified, and while it is still warm, put it into boiling water (35 ozs.), stirring diligently. When the salt has dissolved, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and, having dried them rapidly on filtering paper, enclose them in stoppered bottles. In this process the nitrate of soda yields oxygen to the arsenious acid, and converts it into arsenic acid, which expels the carbonic acid of the carbonate, and unites with all the soda present, forming pyro-arseniate of soda:—$As_2O_3+Na_2CO_3+2NaNO_3=Na_4As_2O_7+CO_2+N_2O_3$. Solution in water converts the pyro-arseniate into the officinal salt:—

$$Na_4As_2O_7+H_2O=2Na_2HAsO_4.$$

Biborate of Soda (Borax).

Is produced by spontaneous evaporation on the shores of some lakes in Thibet, and is imported into this country under the names of "Tincal" and "Crude Borax." It is also obtained by saturating the boracic acid of Tuscany with carbonate of soda.

Bicarbonate of Soda.

Carbonic acid is slowly disengaged by means of the apparatus used in the preparation of bicarbonate of potash, and passed similarly under pressure into a mixture of carbonate of soda (2 pounds) and dried carbonate of soda (3 pounds). When the damp powder has ceased to absorb carbonic acid, it is shaken for half an hour with half its weight of water, the undissolved portion is then drained and dried by exposure to the air on filtering paper placed on porous bricks:—$Na_2CO_3+H_2O+CO_2=2NaHCO_3$. When the crystallised carbonate alone is used the CO_2 disengages enough water from it to dissolve the bicarbonate, and lead to its crystallisation on the apparatus; a due proportion of dried carbonate is therefore mixed with it to prevent this. The powder is finally washed with a little water, in order to remove any undecomposed carbonate.

Carbonate of Soda.

Formerly obtained from "Kelp" or "Barilla," the ashes obtained from burning sea-weeds. It is now obtained from chloride of sodium. This is first converted into sulphate of soda by the action of sulphuric acid:—$2NaCl+H_2SO_4=Na_2SO_4+2HCl$. The sulphate of soda is then mixed with charcoal and chalk, and heated in a reverberatory furnace. The carbon thus reduces the sulphate to sulphide of sodium:—$Na_2SO_4+2C_2=Na_2S+4CO$. The sulphide now reacts on the chalk, forming an insoluble oxy-sulphide of calcium and carbonate of soda:—

$$5Na_2S+7CaCO_3=5Na_2CO_3+5CaS,\ 2CaO+2CO_2.$$

The crude carbonate thus formed is now dissolved out by water, and heated with sawdust, which, by the carbonic acid formed in its combustion, converts into carbonate any caustic soda that may have been produced by the action of quicklime on the sodic carbonate.

Native carbonate of soda is obtained as an efflorescence from the borders of large lakes near Tripoli.

Dried carbonate of soda is obtained by driving off the water of crystallisation from the carbonate by a strong heat.

Effervescent Citro-tartrate of Soda.

Mix thoroughly powdered bicarbonate of soda (17 ozs.), powdered tartaric acid (8 ozs.), and powdered citric acid (6 ozs.); place them in a dish or pan of suitable form heated to between 200° and 220°, and when the particles of the powder begin to aggregate, stir them assiduously until they assume a granular form; then, by means of suitable sieves, separate the granules of uniform and most convenient size, and preserve the preparation in well-closed bottles. In this process the particles of the powder are merely agglutinated by the water of crystallisation, without mutual decomposition, which is only effected by solution in water.

Hypophosphite of Soda.

Add carbonate of soda to solution of hypophosphite of lime as long as a precipitate of carbonate of lime is formed:—

$$Ca2PH_2O_2+Na_2CO_3=2NaPH_2O_2+CaCO_3.$$

The carbonate of lime is then removed by filtration, the solution evaporated to dryness, and the salt solidifies.

Hyposulphite of Soda.

Gently warm a solution of sulphite of sodium with finely powdered sulphur:—

$$Na_2S_2O_3+S+H_2O=Na_2H_2S_2O_4.$$

Nitrate of Soda.

Found native in Peru, Chili, and other parts of South America. Sometimes termed Peruvian or Chilian nitre. It is purified by crystallisation from water.

Phosphate of Soda.

Place bone-ash, which is mainly Ca_32PO_4 (10 pounds), in a capacious earthenware or leaden vessel, pour on sulphuric acid (56 ozs.), and stir with a glass rod until the whole powder is thoroughly moistened. Acid phosphate of calcium and calcic sulphate are thus formed; the former remains in solution and the latter is for the most part precipitated:—

$$Ca_32PO_4+2H_2SO_4=CaH_42PO_4+2CaSO_4.$$

After twenty-four hours, add gradually, with constant stirring, distilled water (1 gallon); digest for forty-eight hours, adding distilled water from time to time to replace what has evaporated. Add now again distilled water (1 gallon), stirring diligently; digest for an hour, filter through calico, and wash what remains on the filter (calcic sulphate) with successive portions of distilled water, till it has almost ceased to have an acid reaction. Concentrate the filtrate (acid phosphate of calcium) to a gallon; let it rest for twenty-four hours, and filter again. Heat the filtrate to near the boiling point, and add carbonate of soda (16 pounds) previously dissolved in distilled water (2 gallons) till it ceases to form a precipitate and the fluid has acquired a feeble alkaline reaction. In this part of the process dibasic phosphate of lime is precipitated, and dibasic phosphate of soda is formed and remains in solution:—

$$CaH_42PO_4+Na_2CO_3=Na_2HPO_4+CaHPO_4+H_2O+CO_2.$$

Filter through calico, evaporate the clear liquor till a film forms on the surface, and set it aside to crystallise. More crystals will be obtained by evaporating the mother liquor, a little carbonate of soda being added if necessary to maintain its alkalinity. Dry the crystals rapidly, and without heat, on filtering paper placed on porous bricks, and preserve them in stoppered bottles.

Sulphate of Soda.

Is obtained in the manufacture of hydrochloric acid from common salt and sulphuric acid:—$NaCl+H_2SO_4=NaHSO_4+HCl$. The acid sulphate of soda thus formed is then neutralised with carbonate of soda, and the resulting neutral sulphate crystallised out:—

$$2NaHSO_4+Na_2CO_3=2Na_2SO_4+H_2O+CO_2.$$

Valerianate of Soda.

Dilute sulphuric acid (6½ ozs.) with water (10 ozs.), and dissolve bichromate of potash (9 ozs.) in water (3½ pints) with the aid of heat. When both liquids are cold, mix them with fusel oil (4 ozs.) in a matrass with occasional brisk agitation, until the temperature of the mixture has fallen to about 90°. Connect the matrass with a condenser, and distil until about half a gallon of liquid has passed over. Saturate the distilled liquid accurately with solution of soda, remove any oil (amylic alcohol) which floats on the surface, evaporate till watery vapour ceases to escape, and then raise the heat cautiously, so as to liquefy the salt. When the product has cooled and solidified, break it into pieces, and immediately put it into a stoppered bottle. By the action of sulphuric acid on the bichromate, chromic acid is liberated. This, being a powerful oxidiser, converts the amylic alcohol ($C_5H_{12}O$) into valerianic acid; and the chromium of the chromic acid and the potassium uniting with the sulphuric acid form a double sulphate of chromium and potash:—$2K_2Cr_2O_7+3C_5H_{12}O+8H_2SO_4=3HC_5H_9O_2+11H_2O+K_2SO_4,Cr_23SO_4$. The valerianic acid acts on an unchanged portion of the amylic alcohol, forming valerianate of amyl, and the latter is converted by the soda into valerianate of soda and amylic alcohol, which is thus regenerated.

Chloride of Sodium.

Abundantly distributed in nature, in the solid condition as "rock salt," and in solution in certain springs and in sea water. Brine, when evaporated, yields "bay salt," or "sea salt."

CHARACTERS AND TESTS.

Soda Caustica.

Hard and grayish-white, very alkaline and corrosive. It imparts a yellow colour to flame (test for sodium), and its solution in water acidulated by nitric acid gives only scanty white precipitates with nitrate of silver and chloride of barium, showing presence of traces of chlorides and sulphates. It has not such an affinity for water as caustic potash. Forty grains (one molecule) dissolved in water leave scarcely any sediment, and require for neutralisation about 900 grain-measures of the volumetric solution of oxalic acid (equivalent to nearly half a molecule, because oxalic is a dibasic acid). If quite pure it should require 1000 grain-measures.

Soda Tartarata.

In colourless transparent prisms, or halves of prisms, of the right rhombic order, generally eight-sided. Very soluble in water, and having a saline and slightly bitter taste. Heated with sulphuric acid it blackens, evolving inflammable gases and the odour of burnt sugar. It imparts a yellow colour to flame. A strong solution gives a crystalline precipitate of acid tartrate of potash on the addition of a small quantity of acetic acid. 141 grains (half a molecule) heated to redness till gases cease to be evolved, leave an alkaline residue of carbonates of potash and soda, which requires for neutralisation 1000 grain-measures (half a molecule) of the volumetric solution of oxalic acid.

Sodæ Acetas.

In transparent, colourless, slowly efflorescent crystals, having a sharp bitter taste, soluble in water, forming a neutral solution. It is charred by heat, and is converted into carbonate of soda. Its solution, when dilute, should not be precipitated by chloride of barium or nitrate of silver, showing the absence of sulphates and chlorides.

Sodæ Arsenias.

In colourless, efflorescent, transparent prisms, soluble in water. The solution is alkaline, giving white precipitates with chloride of barium ($Ba_3 2AsO_4$), chloride of calcium ($Ca_3 2AsO_4$), and sulphate of zinc ($Zn_3 2AsO_4$), and a brick-red precipitate with nitrate of silver ($Ag_3 AsO_4$), all of which are soluble in nitric acid. Heated to 300° it loses 40·38 per cent. of its weight, its water of crystallisation being driven off. A watery solution of 10 grains of the residue, treated with 53 grain-measures of the volumetric solution of soda, continues to give a precipitate with the volumetric solution of nitrate of silver until 1613 grain-measures of the latter have been added, indicating the presence of 10 grains of dry arseniate of soda:—$Na_2 H AsO_4 + 3AgNO_3 = 2NaNO_3 + AgAsO_4 + HNO_3$. The volumetric solution of soda is added in the first instance, in order to neutralise the free nitric acid formed.

Sodæ Biboras.

This, the old name of borax, is incorrect; its probable constitution is $2(NaBO_2), B_2O_3, 10H_2O$, that is, metaborate of soda, boracic anhydride, and water of crystallisation. It occurs in transparent colourless crystals, sometimes slightly effloresced, with a weak alkaline reaction; insoluble in rectified spirit; sparingly soluble in water, but is rendered much more soluble by the presence of cream of tartar, and the mixture inspissates solution of gum-arabic or of Iceland moss. It is soluble in glycerine. Heated, it undergoes aqueous fusion, and at a red heat forms a transparent glass bead, which is used as a flux in blow-pipe operations. A hot saturated solution, when acidulated with any of the mineral acids, lets fall, as it cools, a scaly crystalline deposit (boracic acid), the solution of which in spirit burns with a green flame. 191 grains (half a molecule) dissolved in 10 fluid ounces of distilled water require for saturation 1000 grain-measures of the volumetric solution of oxalic acid.

Sodæ Bicarbonas.

In powder, or small, opaque, irregular scales, white, of a saline, not unpleasant taste. Imparts a yellow colour to flame. Dissolves with much effervescence in diluted hydrochloric acid, forming a solution in which perchloride of platinum causes no precipitate, and which is thus distinguished from bicarbonate of potash. A solution of the salt in cold water gives a white ($HgCO_3$), and not a coloured precipitate (HgO) with solution of perchloride of mercury, showing the absence of carbonate of soda. When supersaturated with nitric acid, its solution scarcely precipitates with chloride of barium or nitrate of silver, showing the presence of mere traces of sulphates and chlorides. 84 grains (1 molecule) exposed to a red heat, leave 53 of an alkaline residue of carbonate of soda (half a molecule), which requires for neutralisation 1000 grain-measures of the volumetric solution of oxalic acid (half a molecule). 20 grains of bicarbonate of soda will neutralise 16·7 grains of citric, or 17·8 grains of tartaric acid.

Sodæ Carbonas.

In transparent, colourless, laminar crystals, of a rhombic shape, efflorescent, with a harsh alkaline taste and strong alkaline reaction. It imparts a yellow colour to flame, and dissolves with effervescence in diluted hydrochloric acid, forming a solution which does not precipitate with perchloride of platinum. It is distinguished from the bicarbonate by giving a yellow precipitate with corrosive sublimate, and a white precipitate with sulphate of magnesia. By heat it undergoes aqueous fusion, and then dries up, losing 63 per cent. of its weight, its water of crystallisation being driven off. When supersaturated with nitric acid, it precipitates only slightly with chloride of barium or nitrate of silver, showing the presence of traces merely of sulphates and chlorides. 143 grains (half a molecule) require for neutralisation at least 960 grain-measures of the volumetric solution of oxalic acid.

Sodæ Hypophosphis.

A white granular salt, having a bitter nauseous taste. It is deliquescent; very soluble in water and in spirit, but insoluble in ether. At a red heat it ignites, emitting spontaneously inflammable phosphuretted hydrogen.

Sodæ Hyposulphis.

Colourless crystals, with a mild saline taste; freely soluble in water. It dissolves insoluble silver salts, especially the chloride, with which it forms a very sweet solution. On the addition to its solution of a few drops of sulphuric acid, sulphur is precipitated, and it is thus distinguished from a solution of sulphite of soda ($NaS_2H_2O_4+H_2SO_4=Na_2SO_4+2H_2O+SO_2+S$). It discharges the red colour of iodine in solution, forming two colourless salts, iodide and tetrathionate of sodium:—

$$I_2+2Na_2H_2S_2O_4=2NaI+Na_2S_4O_6+2H_2O.$$

Sodæ Nitras.

In colourless obtuse rhombohedral crystals, slightly deliquescent, having a cooling saline taste. Thrown on the fire, it deflagrates; warmed in a test tube with sulphuric acid and copper wire, it evolves ruddy fumes (nitric peroxide, NO_2). It is soluble in about two parts of cold distilled water. The solution gives no precipitate with nitrate of silver or chloride of barium, proving absence of chlorides and sulphates.

Sodæ Phosphas.

In large, transparent, colourless, oblique rhombic prisms, terminated by four converging planes, efflorescent, tasting like common salt, sp. gr. 1·58. It imparts a yellow colour to flame. Soluble in water; insoluble in alcohol. Its solution has a faintly alkaline reaction, and, being tribasic, it gives a yellow precipitate with nitrate of silver (Ag_3PO_4), the resulting fluid acquiring an acid reaction:—$Na_2HPO_4+3AgNO_3=2NaNO_3+Ag_3PO_4+HNO_3$. Heated to dull redness, it loses 63 per cent. of its weight, leaving a residue of pyrophosphate, which, when dissolved in water, gives with chloride of barium a precipitate of pyrophosphate of baryta almost entirely soluble in diluted nitric acid, a slight residue indicating the presence of a little sulphuric acid.

Sodæ Sulphas.

In transparent oblique prisms; has a salt and bitter taste; effloresces on exposure to the air. Its solubility in water increases up to 92°, and then diminishes to 215°. It is insoluble in spirit. Exposed to heat in a porcelain crucible it loses 55·9 per cent. of water. Heated with solution of potash no odour of ammonia is evolved, and no precipitate is formed; showing the absence of ammonia, iron and manganese. Imparts the yellow colour characteristic of sodium to flame. 100 grains of it dissolved in distilled water and acidulated with hydrochloric acid, give by the addition of chloride of barium a white precipitate of sulphate of baryta, which, when it has been washed and dried, weighs 72·2 grains.

Sodæ Valerianas.

A white deliquescent salt, very soluble in water and in spirit, without alkaline reaction, and giving out a powerful odour of valerian on the addition of sulphuric acid.

Sodii Chloridum.

In small white crystalline grains, or transparent cubic crystals, usually more or less deliquescent, from the presence of some chloride of magnesium or chloride of calcium, with a purely saline taste, odourless, imparting a yellow colour to flame. Its solubility in water is but little affected by heat. It is insoluble in pure alcohol, but slightly soluble in rectified spirit. The aqueous solution is not precipitated by perchloride of platinum, thus distinguishing it from chloride of potassium. It gives with nitrate of silver a white precipitate ($AgCl$) soluble in ammonia, but insoluble in nitric acid. A solution is not precipitated by one of carbonate of ammonia, followed by solution of phosphate of soda. The former test would detect lime, and the latter, in addition, would indicate magnesia. At a high temperature it is volatilised unchanged.

COMPOUNDS OF ZINC. [Zn=65]

	B. P. Preps.	Strength	Dose	Action and use
ZINCI ACETAS Acetate of Zinc $Zn(C_2H_3O_2)_2.2H_2O$	—	—	1 to 2 grs. (as a tonic) 10 to 20 grs. (as an emetic)	In small doses, tonic and astringent; in large doses, emetic. Topically an astringent, *e.g.*, in ophthalmia and in chronic mucous discharges.
ZINCI CARBONAS Carbonate of Zinc $ZnCO_3(ZnO)_2.3H_2O$	—	—	—	Locally astringent and desiccant. Employed in preparation of the acetate and oxide.
ZINCI CHLORIDUM Chloride of Zinc $ZnCl_2$	— Liquor Zinci Chloridi	— 366grs. to 1oz.	—	Externally escharotic, irritant, and astringent. Is a deodorant and antiseptic.

Compounds of Zinc—Continued.

	B. P. Preps.	Strength	Dose	Action and Use
ZINCI OXIDUM Oxide of Zinc ZnO	— Unguentum Zinci	— 1 pt. in 6½	2 to 10 grs. —	In small doses, tonic, antispasmodic, and astringent. Locally applied as an astringent to excoriated surfaces, and in many cutaneous diseases.
ZINCI SULPHAS Sulphate of Zinc, White Vitriol $ZnSO_4.7H_2O$	—	—	1 to 3 grs. (as a tonic) 10 to 30 grs. (as an emetic)	In small doses, tonic and astringent; in large doses, a direct emetic. Given in chorea, epilepsy, hysteria, etc.; in solution, used as an astringent lotion and injection.
ZINCI VALERIANAS Valerianate of Zinc $Zn(C_5H_9O_2)_2$	—	—	1 to 3 grs.	Nervine tonic and antispasmodic. Said to be an indirect anthelmintic.

PREPARATION.

From **Zinc** are prepared:—

1. Chloride of Zinc.

Put granulated zinc (16 ozs.) into a porcelain basin; add by degrees hydrochloric acid (44 ozs.) previously mixed with distilled water (1 pint), and aid the action by gently warming it on a sand-bath until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow it to stand on a cool part of a sand-bath for twenty-four hours, stirring frequently. Filter the product into a gallon bottle, and pour in solution of chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add carbonate of zinc (½ oz.) in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter through paper into a porcelain basin, and evaporate until a portion of the liquid, withdrawn on the end of a glass rod and cooled, forms an opaque white solid. Pour it out now into proper moulds, and when the salt has solidified, but before it has cooled, place it in closely-stoppered bottles. In this process chloride of zinc is formed by solution of the metal in hydrochloric acid ($Zn+2HCl=ZnCl_2+H_2$). Zinc sometimes contains iron. This is removed by the chlorine solution, by which the ferrous is converted into ferric chloride ($2FeCl_2+Cl_2=Fe_2Cl_6$). By the addition now of carbonate of zinc, ferric oxide is precipitated and chloride of zinc formed:—

$$Fe_2Cl_6+3ZnCO_3=Fe_2O_3+3ZnCl_2+3CO_2.$$

2. Sulphate of Zinc.

Pour sulphuric acid (12 ozs.) previously mixed with distilled water (4 pints) on granulated zinc (16 ozs.) contained in a porcelain basin, and, when effervescence has nearly ceased, aid the action by a gentle heat. Filter the fluid into a gallon bottle, and add gradually, with constant agitation, solution of chlorine until the fluid acquires a permanent odour of chlorine. Add now, with continued agitation, carbonate of zinc (½ oz.) until a brown precipitate (ferric oxide) appears; let it settle, filter the solution, evaporate till a pellicle forms on the surface, and set aside to crystallise. Dry the crystals by exposure to the air on filtering paper placed on porous tiles. More crystals may be obtained by again evaporating the mother liquor. In this process sulphate of zinc is formed by solution of the metal in sulphuric acid ($Zn+H_2SO_4=ZnSO_4+H_2$). The sulphate of zinc is then purified from any ferrous sulphate which may be present by adding chlorine and carbonate of zinc:—

$$2FeSO_4+Cl_2+ZnCO_3,2ZnO=Fe_2O_3+ZnCl_2+2ZnSO_4+CO_2.$$

From **Sulphate of Zinc** are prepared:—

1. Valerianate of Zinc.

Dissolve sulphate of zinc (5½ ozs.) and valerianate of soda (5 ozs.) each in two pints of water; raise both solutions to near the boiling point, mix them, cool, and skim off the crystals which are produced. Evaporate the mother liquor at a heat not exceeding 200°, till it is reduced to 4 ounces; cool again, remove the crystals which have formed, and add them to those which have been already obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold distilled water till the washings give but a very feeble precipitate with chloride of barium. Let them now be again drained, and dried on filtering paper at ordinary temperatures. In the process the following reaction occurs:—

$$ZnSO_4+2NaC_5H_9O_2=Na_2SO_4+Zn2C_5H_9O_2.$$

2. Carbonate of Zinc.

Dissolve carbonate of soda (10½ ozs.) in distilled water (1 pint) in a capacious porcelain vessel, and pour it into a solution of sulphate of zinc in water (1 pint), stirring diligently. Boil for fifteen minutes after effervescence has ceased, and let the precipitate subside. Then wash the precipitate in boiling water until the washings fail to give a precipitate with chloride of barium, showing complete removal of the sulphate of sodium formed. Dry the precipitate by the aid of a gentle heat.

On mixing the solutions in this process, sulphate of soda and carbonate of zinc are formed ($ZnSO_4+Na_2CO_3=Na_2SO_4+ZnCO_3$); but the latter begins to evolve carbonic acid as soon as it is precipitated, and when the effervescence is over, two of every three molecules are converted into hydrated oxide:—

$$3Zn_3CO+3H_2O=ZnCO_3,\ 2ZnO,\ 3H_2O+2CO_2.$$

From **Carbonate of Zinc** are prepared:—

1. Acetate of Zinc.

Add carbonate of zinc (2 ozs.) in successive portions to acetic acid (3 ozs.) previously mixed with water (6 ozs.) in a flask; heat gently, add by degrees more of the acetic acid till the carbonate is dissolved; boil for a few minutes, filter while hot, and set it aside for two days to crystallise. Decant the mother liquor; evaporate to one-half, and again set it aside for two days to crystallise. Place the crystals in a funnel to drain, then spread them on filtering paper on a porous tile, and dry them by exposure to air at ordinary temperatures. The following is the reaction:—

$$ZnCO_3, 2ZnO + 6HC_2H_3O_2 = 3(Zn2C_2H_3O_2) + 3H_2O + CO_2.$$

2. Oxide of Zinc.

Expose the carbonate in a loosely covered Hessian crucible to a dull red heat, until a portion taken from the centre and cooled no longer effervesces when dropped into dilute sulphuric acid:—

$$ZnCO_3, 2ZnO = 3ZnO + CO_2.$$

CHARACTERS AND TESTS.

Zinci Acetas.

Thin translucent and colourless crystalline plates, of a pearly lustre, with a sharp unpleasant taste; evolving acetic acid when decomposed by sulphuric acid; soluble in water, and the solution precipitated pure white (sulphide of zinc) by sulphuretted hydrogen. A dilute watery solution is not affected by chloride of barium or nitrate of silver, showing the absence of sulphates and chlorides; and, when slightly acidulated with hydrochloric acid, is not precipitated by sulphuretted hydrogen, proving the absence of arsenic, copper, lead, and cadmium. After it has been boiled for a few minutes with a little nitric acid, it yields with ammonia a white precipitate of hydrated oxide of zinc (ZnO, H_2O), entirely soluble without colour (absence of iron and copper) in an excess of the re-agent.

Zinci Carbonas.

White, tasteless, inodorous; insoluble in water; soluble, with effervescence and without residue, in diluted nitric acid. This solution is not affected by chloride of barium or nitrate of silver (absence of sulphates and chlorides), and gives with carbonate of ammonia a white precipitate, entirely soluble, without colour, in an excess of the re-agent, forming a solution which is precipitated white by sulphide of ammonium (characteristic of zinc salts).

Zinci Chloridum.

Colourless opaque rods or tablets, very deliquescent and caustic. Almost entirely soluble in water, alcohol, and ether. Its aqueous solution gives with sulphide of ammonium a white precipitate of sulphide of zinc; it also gives a white precipitate with nitrate of silver (AgCl). If first acidulated with hydrochloric acid, it is not affected by sulphuretted hydrogen (distinction from lead and cadmium). Its aqueous solution should not give a precipitate with chloride of barium or oxalate of ammonia, showing the absence of sulphates and of lime; it should not be tinged blue by yellow or red prussiate of potash, proving freedom from iron. Ammonia gives with its solution a white precipitate of hydrated oxide of zinc, which is entirely soluble in excess of the reagent.

Zinci Oxidum.

A soft nearly white tasteless and inodorous powder, becoming pale yellow when heated. Dissolves without effervescence (absence of carbonate) in diluted nitric acid, forming a solution, which is not affected by chloride of barium or nitrate of silver (absence of sulphate or chloride), and gives with carbonate of ammonia a white precipitate of carbonate of zinc, which dissolves entirely, without colour, in an excess of the reagent, forming a solution which is precipitated white by sulphide of ammonium.

Zinci Sulphas.

In colourless transparent prisms, isomorphous with sulphate of magnesia; efflorescent; soluble in water. It is precipitated and again redissolved by ammonia; gives white precipitates with chloride of barium and with sulphide of ammonium. Its solution should not be tinged purple by tincture of galls, showing freedom from iron. When acidulated with hydrochloric or sulphuric acid, it should not be precipitated by sulphuretted hydrogen, showing the absence of arsenic, copper, and lead. Boiled for a few minutes with a little nitric acid, it yields with ammonia a white precipitate (oxide of zinc) entirely soluble (absence of iron), without colour (absence of copper), in excess of the reagent.

Zinci Valerianas.

In brilliant white pearly tabular crystals, with a feeble odour of valerianic acid, and a metallic taste; scarcely soluble in cold water or in ether; soluble in hot water and alcohol. Heated to redness in an open crucible, it leaves a residue of oxide of zinc which, when dissolved in diluted sulphuric acid, yields with ammonia a precipitate which entirely dissolves in an excess of the reagent, and the resulting solution gives a white precipitate with sulphide of ammonium. Its solution in hot water is not precipitated by chloride of barium, showing the absence of sulphate. It gives, when heated with diluted sulphuric acid, a distillate which, when mixed with the solution of acetate of copper, does not immediately affect the transparency of the fluid, but forms after a little time oily drops, which gradually pass into a bluish-white crystalline deposit, showing the absence of butyric acid.

It has been pointed out that commercial valerianate of zinc consists principally of butyrate of zinc; hence the necessity for the latter test.

ORGANIC SUBSTANCES.

VEGETABLE KINGDOM.

RANUNCULACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ACONITUM NAPELLUS	*a.* The fresh leaves and flowering tops	Extract. Aconiti	—	1 to 2 grs.	A cardiac sedative. Lessens the force and rapidity of the circulation. Diaphoretic. Locally relieves rheumatic and neuralgic pain.
Monkshood (*Germany and Britain*)	*b.* The dried root	Linimentum ,,	1 oz. to 1 oz.	—	
		Tinctura ,,	54½ grs. to 1 oz.	5 to 15 min.	
		Aconitia	—	—	
		Ung. Aconitiæ	8 grs. to 1 oz.	—	
PODOPHYLLUM PELTATUM American May-apple or Mandrake (*North America*)	The dried rhizome	Resina Podophylli	—	¼ to 1 gr.	Purgative and cholagogue. Acts chiefly on duodenum. Useful in chronic constipation.

Aconitum.

The fresh leaves and flowering tops are gathered when the flowers are about one-third expanded. The leaves are smooth, palmate, divided with fine deeply-cut wedge-shaped segments, exciting when chewed a tingling sensation. The flowers are numerous, irregular, with a helmet-shaped petaloid calyx; the petals are two, the rest being abortive. The flowers are deep blue, and occur in dense racemes.

The root is collected in winter or early spring, before the leaves have appeared. It is generally from one to three inches long—not thicker than the finger at the crown—tapering, with numerous fibres proceeding from the sides; it is blackish-brown without, and whitish within; it causes tingling and numbness when cautiously chewed.

The root has been mistaken for horseradish and Jerusalem artichoke. The differences between it and horseradish are thus tabulated by Prof. Bentley:—

Aconite.	*Horseradish.*
Form.—Conical, tapering rapidly to a point.	*Form.*—Slightly conical at the crown; then cylindrical, or nearly so, and almost of the same thickness for many inches.
Colour.—Coffee-coloured, or more or less brownish, externally.	*Colour.*—Externally white, or with a yellow tinge.
Odour.—Merely earthy.	*Odour.*—Especially developed on scraping, when it is very pungent and irritating.
Taste.—At first bitter, but afterwards producing a disagreeable tingling and numbness.	*Taste.*—Bitter or sweet, according to circumstances, and very pungent.

Aconite contains an alkaloid, *Aconitia* ($C_{30}H_{47}NO_7$), united with *Aconitic Acid* ($H_3C_6H_3O_6$) and a base, *Aconella*, which resembles *Narcotine* in composition and proportion. A substance named *Napelline* has also been obtained from it. Duquesnel has recently extracted a crystalline alkaloid ($C_{54}H_{40}NO_2$), which he believes to be the active principle.

Aconitia is a white, usually amorphous, solid, soluble in 150 parts of cold water, in 50 of hot water; very soluble in alcohol, and entirely soluble in pure ether. Its solution in ether should leave no residue when burned with free access of air. It is alkaline, neutralises acids, and is precipitated from them by caustic alkalies, but not by carbonate of ammonia, or by bicarbonates of potash or soda. It melts on heating, and burns with a smoky flame. It is sometimes mixed with Delphinia, and sometimes contains Aconella.

Amorphous Aconitia from Germany is very impure, and, comparatively speaking, of little potency. The English Aconitia is much more powerful, and is obtained mostly from *A. ferox*, Nepaul Aconite, or Bikh root, which is three times stronger than A. napellus. It probably owes its potency to *Pseud-aconitia*, which is perhaps a mixture of amorphous and crystalline aconitia.

Podophyllum.

The rhizome occurs in pieces of variable length, about two inches thick, wrinkled longitudinally, jointed, dark reddish-brown externally, whitish within, breaking with a short fracture, giving off from the sides pale brown rootlets. The stem bears a pendant fragrant white flower, and two large peltate palmate-lobed leaves. The fruit is a large oval fleshy berry, sometimes called "wild lemon," from its form and colour. The different parts of the flower have different properties, the fruit being subacid and innocuous, the leaves poisonous, and the rhizome powerfully purgative.

The powdered rhizome resembles jalap in appearance, is yellowish-gray, with a sweetish odour and a bitterish subacid nauseous taste. It contains resinous matters, gum, and other substances soluble in water. *Berberine* ($C_{20}H_{17}NO_4$) is stated to exist in the rhizome, and to be contained in commercial Podophylline. Berberine was first found in Berberis vulgaris, the Common Barberry, and should not be confounded with Beberia, the alkaloid of Bebeeru (Nectandra) bark, N.O. Lauraceæ. It is also contained in large quantities in Hydrastis canadensis and in other Ranunculaceæ, and in Calumba. Podophyllum also contains a non-purgative bitter crystalline alkaloid, an odoriferous principle, which sublimes in colourless scales, and *Saponin* (p. 110).

The resin Podophylline, which constitutes about 3½ to 5 per cent. of the rhizome, is a pale greenish-brown amorphous powder, soluble in rectified spirit and ammonia, and precipitated from the former by water and from the latter by acids. It is almost entirely soluble in pure ether. The pure resin is white, the colour of the ordinary resin being probably due to the presence of berberine. It is said to be a mixture of two resinous substances, the one soluble in ether, the other insoluble. Like jalap resin, podophylline is insoluble in oil of turpentine.

MAGNOLIACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ILLICIUM ANISATUM Star-anise (*China*)	The fruit	Oleum Anisi Essentia ,,	— 1 vol. in 5	— 10 to 20 mins.	Aromatic, stimulant, and carminative. Used to relieve flatulence, and to prevent aperient medicines griping.

The oil yielded by the distillation of the fruit of Illicium anisatum—the Star-anise, distilled in China—resembles true anise oil, which is obtained from the fruit of Pimpinella anisum, an Umbelliferous plant (p. 143).

MENISPERMACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
JATEORRHIZA COLUMBO Calumba (*Eastern Africa*)	The dried root	Pulv. Calumbæ Extractum ,, Infusum ,, Tinctura ,,	— 2½ ozs. from 1 lb. 1 oz. to 1 pt. 2½ ozs. to 1 pt.	5 grs. 2 to 10 grs. 1 to 2 ozs. ½ to 2 drms.	Bitter, stomachic tonic. Contained in Mist. Ferri Aromat.
CISSAMPELOS PAREIRÆ Pareira (*Brazil*)	The dried root	Decoct. Pareiræ Extractum ,, Extr. Liquid. ,,	1½ oz. to 1 pt. — 1 oz. to 1 oz.	1 to 2 ozs. 10 to 20 grs. ½ to 2 drms.	Stimulating diuretic. Useful in catarrh of the bladder, calculous affections, and pyelitis.

Calumba.

The root is cut transversely into flat circular or oval slices, which become concavo-convex in drying; they are about two inches in diameter and from two to four lines thick. They are thinner and softer in the centre, and of a yellow colour, the outer portion being dark green or olive. They have a bitter taste and a slightly aromatic odour. A decoction, when cold, is blackened by solution of iodine, owing to presence of starch, in which the root is particularly rich.

Calumba root contains a neutral crystallisable principle, *Calumbine* ($C_{21}H_{22}O_7$), which is slightly soluble in water or proof spirit, and freely soluble in alkaline solutions and in dilute acetic acid; *Calumbic acid* ($C_{21}H_{21}O_7$), a yellow amorphous substance, feebly soluble in cold water; and an alkaloid, *Berberine* ($C_{20}H_{17}NO_4$), the salts of which are soluble and yellow, and give the colour to the root. Calumbate of berberine is contained in the infusion and tincture. Calumba root also contains a little resinous extract and a trace of volatile oil. It contains neither tannic nor gallic acid, and hence may be given with salts of iron. The infusion, which is made with cold water, does not contain starch, and hence does not strike blue with iodine.

White bryony root tinged with tincture of turmeric, and the root of American calumba (Frasera Walteri), have been substituted for true calumba; they, however, contain but little starch, and when moistened, do not strike blue with tincture of iodine. The latter plant also differs from calumba in not containing tannin. False calumba (Coscinium fenestratum) has also been substituted for calumba, but it likewise contains very little starch.

Pareira.

The root of Pareira brava occurs in cylindrical oval or compressed pieces, entire or split longitudinally, half an inch to four inches in diameter, and from four inches to four feet in length. The bark is grayish-brown, longitudinally wrinkled, crossed transversely by annular elevations; interior is woody, yellowish-gray, porous, with well-marked, often incomplete, concentric rings and medullary rays. Taste is at first sweetish and aromatic, afterwards intensely bitter.

Hanbury thinks that true pareira root is the root of the Chondodendron tormentosum. The root and stem of Cissampelos pareira have no concentric rings.

Pareira root contains a crystalline principle, *Pelosine* or *Cissampeline* ($C_{18}H_{21}NO_3$), a strong base isomeric with *Codeia*, and said to be identical with *Beberia*. It is soluble in alcohol and ether; insoluble in water, but swells up with it, and forms a hydrate, which becomes yellow, and is decomposed, on exposure to air and light. It combines with acids, forming salts, which are soluble in water. Besides this principle, pareira contains resin, a bitter yellow matter, starch, salts, &c.

PAPAVERACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
PAPAVER SOMNIFERUM The White Poppy (Cultivated in *Britain*)	The nearly ripe dried capsules	Decoct. Papaver	2 ozs. to 1 pt.	—	Mild anodyne and soporific.
		Extractum „	1 part from 3	2 to 5 grs.	
		Syrupus „	1 part to 3	1 to 6 drms.	
OPIUM Papaver Somniferum (Grown in *Asia Minor*)	Inspissated juice from incisions in unripe capsules	Pulvis Opii*	—	½ to 2 grs.	Anodyne, soporific, narcotic, sedative, antispasmodic, sudorific, and astringent.
		Confectio „	1 in 40, nearly	5 to 20 grs.	
		Emplastrum „	1 in 10	—	
		Enema „	½ drm. Tinct. to 2 oz.	—	
		Extractum „	About 1 part from 2	½ to 2 grs.	
		Extract. Liquid.	22 grs. Ext. in 1 oz.	10 to 40 mins.	
		Linimentum „	1 vol. Tinct. in 2 vols.	—	
		Pil. Ipecac. cum Scilla	1 part in 2½, nearly	5 to 10 grs.	
		Pil. Plumbi cum Opio	1 part in 8	3 to 5 grs.	
		Pil. Saponis Co.	1 part in 6, nearly	3 to 5 grs.	
		Pulv. Cretæ Ar. cum Opio	1 part in 40	10 to 40 grs.	
		Pulv. Ipecac. Co.	1 part in 10	5 to 15 grs.	
		Pulv. Kino Co.	1 part in 20	5 to 20 grs.	
		Pulv. Opii Co.	1 part in 10	2 to 5 grs.	
		Suppos. Plumbi Co.	1 gr. in each	—	
		Tinct. Camph. Co.	2 grs. to 1 oz.	15 min. to 1 drm.	
		Tinct. Opii	33 grs. to 1 oz., nearly	5 to 40 mins.	
		Tinct. Opii Ammoniata	5 grs. to 1 oz.	½ to 1 drm.	
		Trochisi Opii	$\frac{1}{10}$ gr. Ext. in each	1 to 6	
		Ung. Gallæ cum Opio	32 grs. to 1 oz.	—	
		Vinum Opii	22 grs. Ext. in 1 oz., nearly	10 to 40 mins.	
PAPAVER RHŒAS Red Poppy (*Britain*)	The fresh petals	Syrupus Rhœados	—	1 drm.	Slightly sedative. A colouring agent.

Papaveris Capsulæ.

Are globular, two or three inches in diameter, smooth, pale brownish-yellow, crowned by a sessile stellate stigma. The placentæ are parietal, and bear many small pale brownish reniform seeds. The capsules contain in small quantity the principles found in opium. The seeds contain much bland oil, but are devoid of narcotic properties. When unripe, the capsules contain more opium.

Opium.

Opium is obtained by making incisions into the unripe capsules of the poppy, before the petals have fallen, taking care not to

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* All the preparations containing opium are here grouped together.

penetrate to the interior; the milky juice which exudes soon becomes brown and is inspissated by spontaneous evaporation. It occurs in irregular lumps, weighing from 4 ozs. to 2 pounds, enveloped in the remains of poppy leaves, and generally covered with the chaffy fruits of a species of rumex. When fresh, it is plastic, tearing with an irregular slightly-moist chestnut-brown surface, shining when rubbed smooth with the finger, having a peculiar odour and bitter taste.

The chief varieties of opium are—Turkey, Egyptian, and East-Indian. Persian and European (French, German, and English) opium is also met with.

Turkey Opium is the officinal variety; there are two kinds of it—viz., *Smyrna* opium and *Constantinople* opium. The former occurs in more or less flattened masses, weighing from a quarter of a pound to two pounds; it is covered with rumex capsules; when fresh, it is soft and rich brown internally, and has a heavy narcotic odour and bitter taste. It is made up of agglutinated tears. Good Smyrna opium should yield ten per cent. of morphia; it is sometimes adulterated with salep powder, which causes the tincture to assume a mucilaginous consistence. The Constantinople opium occurs in small lenticular masses, weighing from a quarter to a half a pound, often enclosed in a poppy leaf, of which the midrib is prominent, but according to Pereira, never covered with the rumex capsules.

Egyptian Opium is met with in flat, more or less circular, cakes, about one to three inches in diameter, covered with a leaf, which is probably that of a palm; it is hard and dark brown internally, and emits a musty narcotic odour. It is inferior to Turkey opium, yielding from six to seven per cent. of morphia; it is particularly rich in meconic acid.

East-Indian Opium, also known as Bengal or Benares opium, and sometimes termed Chinese investment opium. Occurs in round balls, weighing about four pounds, covered with a thick coating of poppy leaves; internally, it is blackish and soft. It also occurs in cakes, called Malwa or Garden Patna opium. It is inferior to Turkey opium, yielding on an average from three to eight per cent. of morphia. It is not met with in English commerce.

Opium is extensively adulterated, the chief impurities being moisture, sand, stones, leaves, woody-fibre, seeds, charcoal, dung, &c.; these may be detected by subjecting the opium to a searching physical examination. Flour is sometimes used to adulterate opium, and may be detected by the iodine test; opium so adulterated quickly becomes sour. Juices of various plants, extracts—as of tobacco, Indian hemp, &c., fruit-pulps, &c.—are also met with as impurities of opium.

Alkalies precipitate the alkaloids from opium, but redissolve them in excess; lime, magnesia, and tannic acid also precipitate the opium alkaloids—a fact which should be remembered in prescribing.

The **Acids** derived from opium are:—

Meconic	$H_3C_7HO_7 . 3H_2O$
Thebolactic	$C_3H_6O_3$

Meconic Acid crystallises in pearly scales; is soluble in water; is tribasic, and forms insoluble salts with lead, lime, and barium. With neutral persalts of iron it gives a blood-red colour, which is not bleached by solution of corrosive sublimate, as is the similar red colour of ferric sulphocyanate. In testing for it, solution of acetate of lead is added to the filtered liquor; meconate of lead and acetate of morphia are thus formed; the former is decomposed by sulphuretted hydrogen; the resulting sulphide of lead being precipitated, the meconic acid is set free and can be separated by filtration. Opium yields on an average from six to eight per cent. of meconic acid, which is believed to be an inert substance.

Thebolactic Acid is isomeric, or perhaps identical, with lactic acid. Turkey opium contains two per cent.

The **Alkaloids** of opium are:—

(*a.*) *Primary.*—	Morphia	$C_{17}H_{19}NO_3$
	Codeia	$C_{18}H_{21}NO_3$
	Codamine	$C_{20}H_{25}NO_4$
	Laudanine	$C_{20}H_{25}NO_4$
	Pseudomorphine	$C_{17}H_{19}NO_4$
	Papaverine	$C_{21}H_{21}NO_4$
	Rhœadine	$C_{21}H_{21}NO_6$
	Lanthopine	$C_{23}H_{25}NO_4$
	Cryptopia	$C_{21}H_{23}NO_5$
	Meconidine	$C_{21}H_{23}NO_4$
	Thebaia	$C_{19}H_{21}NO_3$
	Narcotine	$C_{22}H_{23}NO_7$
	Opianine	$C_{66}H_{72}N_4O_{21}$
	Porphyroxine	—
(*b.*) *Derived.*—	Apomorphia	$C_{17}H_{17}NO_2$
	Apocodeia	$C_{18}H_{19}NO_2$
	Rhœagenine	—
	Cotarnine*	$C_{11}H_{10}(CH_3)NO_3$

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* The following bases, viz.:—Hydrocotarnine ($C_{12}H_{15}NO_3$), Protopine ($C_{20}H_{19}NO_5$), and Laudanosine ($C_{21}H_{27}NO_4$), are also found in opium; and two additional bodies have recently been discovered by Messrs. T. and H. Smith in it—viz., an alkaloid, Gnoscopine ($C_{34}H_{36}N_2O_{11}$), and a neutral body (*vide* p. 107), Meconoiosine ($C_8H_{10}O$).—Ed.

Of these, the following preparations of morphia are alone officinal:—

Name of Preparation	Strength	Dose
Morphiæ Acetas	About 1 part from 8 or 10 of Opium	$\frac{1}{8}$ to $\frac{1}{2}$ gr.
Injectio Morphiæ Hypodermica	1 gr. in 12 min.	1 to 6 mins.
Liquor Morphiæ Acetatis	4 grs. in 1 oz.	10 to 40 mins.
Morphiæ Hydrochloras	About 1 part from 8 or 10 of Opium	$\frac{1}{8}$ to $\frac{1}{2}$ gr.
Liquor Morphiæ Hydrochloratis	4 grs. in 1 oz.	10 to 40 mins.
Suppositoria Morphiæ	$\frac{1}{2}$ gr. in each	—
Suppos. Morph. cum Sapone	$\frac{1}{2}$ gr. in each	—
Trochisci Morphiæ	$\frac{1}{36}$ gr. in each	1 to 6
Troch. Morph. et Ipecac.	$\frac{1}{36}$ gr. in each	1 to 6

Morphia.

Is isomeric with *Piperine.* Crystallises in six-sided prisms; it is soluble in alcohol, and is distinguished from other fixed alkaloids by its solubility in alkaline solutions; it is very slightly soluble in ether or water. Morphia is extremely sensitive to the action of oxidising agents. It liberates iodine, and hence blues starch when added to iodic acid. It and its salts give a blue or greenish-blue colour with persalts of iron. Nitric acid converts it into oxalic acid, with development of an orange-red colour which changes to yellow. Fröhde's re-agent (solution of molybdate of soda in strong sulphuric acid—"sulphomolybdic acid") gives a blue colour; and Husemann's test consists in the addition of nitric acid or chlorine to a warmed solution of morphia in sulphuric acid; in this case also a violet or blue colour is developed.

Morphia exists in opium combined with meconic acid; on testing for it, therefore, solution of acetate of lead is added to the filtered liquor to form acetate of morphia and meconate of lead; the latter being insoluble, is filtered off, and to the filtrate, which contains the acetate of morphia, sulphuretted hydrogen is added, to convert any acetate of lead into insoluble sulphide of lead readily separated by filtration. The filtrate is now slightly warmed, to drive off the sulphuretted hydrogen, and the solution is available for the application of tests.

The following is the pharmacopœial test for estimating the quantity of morphia present in opium:—Take of opium 100 grains, slaked lime 100 grains, distilled water 4 ounces. Break down the opium, and steep it in an ounce of the water for twenty-four hours, stirring the mixture frequently. Transfer it to a displacement apparatus, and pour on the remainder of the water in successive portions, so as to exhaust the opium by percolation. To the infusion thus obtained, placed in a flask, add the lime, boil for ten minutes, place the undissolved matter on a filter, and wash it with an ounce of boiling water. Acidulate the filtered fluid slightly with dilute hydrochloric acid, evaporate it to the bulk of half an ounce, and let it cool. Neutralise cautiously with solution of ammonia, carefully avoiding an excess; remove by filtration the brown matter which separates, wash it with an ounce of hot water, mix the washings with the filtrate, concentrate the whole to the bulk of half an ounce, and add now solution of ammonia in slight excess. After twenty-four hours collect the precipitated morphia on a weighed filter, wash it with cold water, and dry it at 212°. It ought to weigh at least from 6 to 8 grains.

Acetate of Morphia.

Crystallises in fine needles; generally occurs as a white powder; is apt to lose part of its acid on keeping; is soluble in water and alcohol, and its aqueous solution gives, with solution of caustic potash, a precipitate which is redissolved with excess. Acetate of morphia is affected by nitric acid and perchloride of iron similarly to the hydrochlorate. It develops an acetous odour on the addition of sulphuric acid. (For mode of preparation of this and the following salt, see Part II.)

Hydrochlorate of Morphia.

Occurs in silky acicular crystals; soluble in about 20 parts of water; soluble also in spirit. When pure, it is entirely dissipated by heat. Its aqueous solution gives a white precipitate with nitrate of silver ($AgCl$) and also with potash, the latter being soluble in excess of the alkali. When moistened with strong nitric acid, it becomes orange-red, and with solution of perchloride of iron it gives a greenish blue. 20 grains dissolved in half an ounce of warm water, with ammonia added in the slightest possible excess, give on cooling a crystalline deposit, which, when washed with a little cold water and dried by exposure to the air, weighs 15·18 grains.

The following are non-officinal:—

Codeia forms colourless rhombic prisms or octahedral crystals; soluble in alcohol and chloroform, but less soluble in ether; soluble in 25 parts of boiling water, and in 50 parts of water at 60° F.; is insoluble in alkaline solutions. Forms crystallised salts with acids. With Fröhde's re-agent, gives a green colour, which turns to royal blue; with nitric acid it gives a reddish, and with a mixture of sulphuric and nitric acids it gives, on heating, a blood-red colour. Opium contains from $\frac{1}{4}$ to 1 per cent.

Codamine.—Soluble in alcohol, ether, and boiling water. Yields a dark-green solution with nitric acid.

Laudanine forms stellate groups of small colourless six-sided prisms. Soluble in chloroform and benzol. Turns orange-red with nitric acid.

Morphia and the three preceding alkaloids form an homologous series.

Pseudomorphine forms a fine white crystalline precipitate; insoluble in alcohol, ether, or water. Gives with nitric acid an orange-red solution, which turns to yellow.

Papaverine occurs in delicate, colourless, tasteless prisms, which have no action on litmus; slightly soluble in water; soluble in dilute hydrochloric and acetic acids. With cold nitric acid, gives a bright orange colour; with sulphuric acid it forms a solution which is colourless at first, but which becomes purple and finally purplish-red on heating. Opium yields about 1 per cent.

Rhœadine.—Small white prisms; nearly insoluble in alcohol, chloroform, ether, and water. Tasteless and non-poisonous.

Lanthopine.—Small white prisms; insoluble in alcohol and water; soluble in chloroform; tasteless; has no action on litmus. Is homologous with papaverine.

Cryptopia.—Colourless six-sided crystals; scarcely soluble in ether or water, but readily soluble in chloroform. Forms neutral and acid salts, which have a bitter taste. With strong sulphuric acid it gives a blue colour which, on the addition of nitre, turns to orange-red.

Meconidine.—A brownish resinoid mass, which readily splits up into laminæ. Tasteless. Soluble in alcohol, chloroform, and ether; insoluble in water. The alcoholic solution blues litmus. Its salts are very unstable.

Thebaia or Paramorphia.—Crystallises in square lustrous plates of an acrid or styptic taste. Soluble in alcohol, chloroform, and ether; insoluble in water. Gives a blood-red colour with cold sulphuric acid, with a mixture of sulphuric and nitric acids, and with Fröhde's re-agent. With nitric acid it gives a yellow.

Narcotine.—Brilliant prisms; soluble in alcohol, ether, and acids; slightly soluble in boiling water; insoluble in cold water or alkalies. Heated with water it splits up into meconine and cotarnine. With nitric acid it gives yellow; with hot sulphuric acid it gives a blue, which changes to red; with a mixture of nitric and sulphuric acids it gives a red, and with Fröhde's re-agent it gives a green colour, which changes to reddish. Opium yields an average per-centage of 6 to 8.

Opianine resembles, and perhaps is identical with, narcotine. It has been found only in Egyptian opium.

Porphyroxine.—Crystalline. Gives a purple colour on heating with dilute hydrochloric acid.

Apomorphia.—Obtained by heating morphia in a closed tube for several hours, at a temperature of 280° to 300° F., with excess of hydrochloric acid. A molecule of water is removed from the morphia:—

$$C_{17}H_{19}NO_3—H_2O=C_{17}H_{17}NO_2.$$

A snow-white substance, unstable, rapidly turning green on exposure to air. The hydrochlorate being more permanent is preferable.

Apocodeia.—Obtained by depriving codeia of a molecule of water.

Rhœageinine.—Obtained by the action of dilute mineral acids on rhœadine.

Cotarnine.—Obtained by heating narcotine with water.

The **Neutral Bodies** yielded by opium are:—

Narceia - - - $C_{23}H_{29}NO_9$
Meconine - - $C_{10}H_{10}O_4$

Narceia.—Four-sided rhombic prisms or fine needles. Soluble in hot alcohol and glycerine; sparingly soluble in water; insoluble in chloroform or ether. Sulphurous acid dissolves it, forming a rich amber-coloured fluid, the colour of which passes rapidly through a greenish-orange to a port-wine hue. Sulphuric acid turns it brown. With nitric acid it gives yellow. Dilute hydrochloric acid colours it azure blue, and strong hydrochloric acid dissolves it without coloration. With Fröhde's re-agent it yields a yellowish brown. Opium contains less than 1 per cent.

Meconine.—Hexagonal prisms, with dihedral summits. Tasteless at first, but subsequently acrid. Freely soluble in chloroform, soluble also in alcohol and ether, sparingly so in water. Gently heated with sulphuric acid it assumes an emerald green colour, which, on increasing the heat passes through a neutral tint to a permanent purple.

Besides the principles enumerated above, opium contains different resins, gummy, extractive, and fatty matters, caoutchouc, a trace of volatile oil, &c.

Rhœados Petala.

These should be collected immediately after expansion. When fresh, they have a bright scarlet colour, which changes to dusky-red on drying; they have a slightly bitter taste and a narcotic poppy-like odour, which is also lost on drying. Chevalier states that they contain *morphia*, but Attfield was unable to find a trace. A crystallisable, colourless, tasteless, non-poisonous alkaloid, *Rhœadin* ($C_{21}H_{21}NO_6$), is present, and is soluble only in acids. The red colouring matter is said by Meier to consist of two amorphous acids, *Rhœdic* and *Papaveric;* it is turned a dark violet or brown by perchloride of iron, is brightened by acids, and rendered dark by alkalies, being thus distinguished from the colouring matter of red cabbage, which is turned green by alkalies.

CRUCIFERÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
SINAPIS NIGRA; SINAPIS ALBA (*Indigenous*)	The seeds of each. Also the seeds reduced to powder and mixed	Cataplasma Sinapis	—	—	Rubefacient. Employed as a counter-irritant. Internally, the powder, in doses of oz. i or more, is emetic.
		Charta Sinapis	—	—	
		Oleum „	—	—	
		Lin. Sinapis Co.	1 pt. oil in 41	—	
COCHLEARIA ARMORACIA Horseradish (*Britain*)	The fresh root	Spirit. Armoraciæ Compositus	—	1 to 2 drms.	Stimulant, sudorific, diuretic.

Sinapis.

Black mustard seeds are small, round, brownish-black, wrinkled on the surface, and yellowish within. They are very likely to be mistaken for colchicum seeds, which, however, are lighter in colour and somewhat larger.

White mustard seeds are larger than the black variety, and are yellow on the surface.

The seeds reduced to powder are the officinal part, and form a greenish-yellow mass, of an acrid, bitterish, oily, pungent taste, scentless when dry, but exhaling a very pungent, penetrating, irritating, odour when moist. A decoction cooled is not made blue by tincture of iodine, showing the absence of starch.

The volatile oil is a colourless or pale-yellow fluid, becoming darker by age, and having the composition of *sulphocyanide of allyl* (C_3H_5CNS). It is one of the four officinal oils (cinnamon, cloves, pimento, and mustard) which are heavier than water, its specific gravity being 1·015. It is readily soluble in alcohol or ether, and to a slight extent in water. Has a very penetrating odour and an acrid burning taste. Applied to the skin, it produces almost instant vesication. It is apt to contain a large proportion of cyanide of allyl (C_3H_5CN), the presence of which may be inferred when the density of the oil is less than that just mentioned. Oil of mustard can be artificially prepared by decomposing iodide of allyl (C_3H_5I) with sulphocyanide of potassium ($KCNS$). When oil of mustard is heated for a few hours in a sealed tube with potassic monosulphide, it is converted into oil of garlic and potassic sulphocyanide.

The black seeds contain *Myronate of Potash* or *Sinigrin* and *Myrosine*, an albuminous ferment resembling diastase, and emulsine or synaptase, and these, in the presence of water at 120° F., yield the volatile oil, which, it must be remembered, does not pre-exist in the seed. Besides the volatile oil, glucose, acid sulphate of potash, free sulphur, and an insoluble organic substance are formed:—

$$\underbrace{KC_{10}H_{18}NS_2O_{10}}_{\text{Sinigrin.}}=\underbrace{C_3H_5CNS}_{\text{Oil of Mustard.}}+KHSO_4+\underbrace{C_6H_{12}O_6}_{\text{Glucose.}}$$

The efficacy of Myrosine as a ferment is destroyed by boiling water, alcohol, acids, &c.; hence the best vehicle for mustard, whether for external or internal use, is water at the ordinary temperature.

White mustard also contains Myrosine, but, instead of the myronate of potash, it contains a glucoside principle, *Sinalbin*. White mustard, therefore, does not yield the volatile oil; but by fermentation it gives rise to an acrid non-volatile principle, containing *sulphocyanide of acrinyl;* sulphate of sinapin, glucose, &c., being also formed:—

$$\underbrace{C_{30}H_{44}N_2S_2O_{16}}_{\text{Sinalbin.}}=\underbrace{C_7H_7O.\ CNS}_{\text{Sulphocyanide of Acrinyl.}}+\underbrace{C_{16}H_{23}NO_5.\ H_2SO_4}_{\text{Sulphate of Sinapin}}+\underbrace{C_6H_{12}O_6}_{\text{Glucose.}}$$

The alkaloid *Sinapin* ($C_{16}H_{23}NO_5$) exists normally in black and white mustard as a sulphocyanide, and has received various names, as *sulpho-sinapisin*, &c. Owing to the presence of this sulphocyanide, infusion of mustard gives a deep red with ferric chloride.

Both the black and white seeds contain from 25 to 35 per cent. of fixed oil. This is a yellowish, tasteless, odourless fluid, composed chiefly of olein and mucilage, and contains *Erucic acid* ($C_{22}H_{42}O_2$).

Flour of mustard is extensively adulterated with common flour, pepper, chilies, turmeric, capsicum powder, &c.

Armoracia.

The fresh root is long, cylindrical, fleshy, from half an inch to an inch in diameter, expanding at the crown into several very short stems. It is white internally, and has a pungent taste and odour when scraped. The characters distinguishing it from Aconite have been already described (p. 97). The volatile oil yielded by horseradish is a *Sulphocyanide of butyl* (C_4H_9CNS); it is allied to that of mustard, and is probably formed in the same way. It is a pale-yellow fluid, heavier than water, readily soluble in alcohol, and slightly in water; applied to the skin, it causes redness and even vesication. Horseradish root also contains a little fat and sugar, but no tannic or gallic acid. With salts of silver or of lead, an aqueous solution of the root gives a black precipitate, indicating the presence in it of sulphur.

POLYGALACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
POLYGALA SENEGA Senega or Snake root (*United States*)	The dried root	Infusum Senegæ Tinctura Senegæ	1 oz. to 1 pt. 2½ozs. to 1 pt.	1 to 2 ozs. ½ to 2 drms.	Stimulating expectorant. Used in chronic bronchitis. Said to be also diuretic and an emmenagogue.
KRAMERIA TRIANDRIA Rhatany root (*Peru*)	The dried root	Extractum Krameriæ Inf. Krameriæ Tinct. Krameriæ	— 1 oz. to 1 pt. 2½ozs. to 1 pt.	5 to 20 grs. 1 to 2 ozs. ½ to 2 drms.	Astringent. Beneficial in chronic diarrhœa, in mucous discharges generally, and passive hæmorrhages. Locally as a gargle, and applied to prolapsus ani, fissures, etc. Is contained in Pulvis Catechu Co.

Senega.

A knobby root-stock, with a branched tap-root of about the thickness of a quill, twisted and keeled; the bark is yellowish-brown, with a sweetish pungent taste, causing salivation; odour is somewhat like that of scammony; the interior is woody, tasteless, and inert.

Senega contains a glucoside called *Senegin* or *Polygalic acid*, which is probably identical with *Saponin* ($C_{32}H_{54}O_{18}$), derived from Saponaria officinalis. Saponin, on boiling with dilute acids, breaks up into *Sapogenin* and glucose ($C_{32}H_{54}O_{18}+2H_2O=C_{14}H_{22}O_2+3C_6H_{12}O_6$). It is an acrid white powder, insoluble in cold water and ether, soluble in boiling water and alcohol. It causes sneezing, and is said to cause local anæsthesia when topically applied to the skin.

By the prolonged action of boiling water on senega root, part of the active principle is formed into an insoluble compound with the colouring matter and albumen, hence an infusion is preferable to a decoction of senega.

Besides *Senegin*, senega also contains tannin, pectin, gum, traces of volatile oil, resin, yellow colouring matter, malic acid, and seven per cent. of sugar.

Gillenia and Ginseng, the root of Panax quinquefolium, are used to adulterate senega, but are recognised by the absence of the line or keel running along the true senega root.

Krameria.

The root is about one inch in diameter, branches numerous, long, brownish-red, and rough externally, reddish-yellow internally. The rough cortex is strongly astringent, tinging the saliva red; the inner wood is almost tasteless. Rhatany root is almost odourless. It contains *Krameric acid*, which gives a dark-green precipitate with perchloride of iron, said to be *Amidic acid*, and *Rhatanin* ($C_{10}H_{13}NO_3$), homologous with tyrosin. Also about 40 per cent. of tannin, existing chiefly in the rough cortex, and a red astringent matter, both of which are soluble in alcohol and water; it does not contain gallic acid. New Granada or Savanilla rhatany, which is sometimes substituted for the officinal Peruvian or Payta rhatany, is yielded by Krameria Ixina or K. tomentosa, and is perhaps superior medicinally to the officinal variety. Parâ or Brazilian rhatany is also found in commerce. The spurious roots do not possess the characteristic red colour of true rhatany.

LINACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
Linum Usitatissimum Linseed (*Britain*)	The seeds	Infusum Lini.	16 grs. to 1 oz.	*Ad lib.*	Emollient and demulcent in irritation of the pulmonary and genito - urinary systems. Locally emollient.
		Oleum Lini.	—	—	
		Lini Farina	—	—	
		Cataplasma Lini.	—	—	

Linum.

The seed is small, about a line long, oval, oblong, and flattened, pointed at one end, dark brown and shining on the surface, and white within, odourless, with an oily mucilaginous taste. Oilcake consists of the seeds ground and deprived of their oil by expression; this reduced to powder constitutes the flour or meal (farina lini—linseed meal). The seeds contain between 20 and 30 per cent. of fixed oil, and about 15 per cent. of mucilage—the oil being found in the kernel and the mucilage in the testa.

The mucilage has the same composition as althea mucilage ($C_{12}H_{20}O_{10}$); it forms with hot water a thick viscid fluid. When mixed with alcohol this throws down white mucilaginous flocks. It gives a precipitate with subacetate of lead, is not affected by infusion of galls or by chlorine, and is not coloured blue by iodine. It reddens litmus, owing to the presence of free acetic acid. Boiling nitric acid converts it into *mucic* and *oxalic acids*, and alkalies convert it into *arabin*.

The oil of linseed is light yellow; sp. gr. 0·93; it has a peculiar taste and odour; is soluble in alcohol, and more so in ether. It rapidly absorbs oxygen, and forms a varnish; hence is termed a drying oil. It contains *palmitin* and perhaps *stearin*, together with a *glyceride of Lineolic acid* ($C_{16}H_{28}O_2$), the latter in great quantity. Linseed oil becomes blood-red from the production of *Linoxyn* ($C_{32}H_{54}O_{11}$), when acted on by acids and alkalies.

Pure linseed oil is not solidified by nitrate of mercury, as rapeseed oil is.

MALVACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
Gossypium Herbaceum Cotton Wool (*United States*)	Hairs of the Seeds (carded)	Pyroxylin	—	—	Protective. Cotton-wool and Collodion are used as a protective to inflamed parts, burns, wounds, &c.
		Collodium	—	—	
		Do. Flexile	—	—	

Gossypium.

Consists of fine filaments or tubular hairs, which become flattened and twisted on drying. They have but few joints, which are indicated by lines passing across nearly at right angles to the margins, and, unlike the fibres of linen, they have not tapering ends and are not aggregated in bundles. Cotton-wool resembles *Cellulin* or *Lignin* in composition ($C_{18}H_{30}O_{15}$), and is isomeric with starch, dextrin, &c. It is yellowish-white, tasteless and odourless; completely insoluble in water, alcohol, ether, oils, and vegetable acids. It is dissolved by strong caustic alkaline solutions. Concentrated hydrochloric acid dissolves it; cold sulphuric acid forms with it a treacly-looking liquid, which, when diluted and boiled, is converted into dextrin first and then into glucose; nitric acid converts it into oxalic acid.

Cellulin is not coloured blue with iodine until after digestion in sulphuric acid, and is thus distinguished from starch. The best cotton is said to be yielded by Gossypium barbadense. None of the malvaceous plants are poisonous; most of them contain an emollient mucilage.

AURANTIACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
Citrus Bigaradia and C. Aurantium The Seville or Bitter Orange, and the Sweet Orange (*South of Europe*)	*a.* The outer part of the rind of the ripe fruit of the bitter orange	Tinct. Aurantii recentis	—	1 to 2 drms.	Aromatic, bitter, stomachic, and flavouring agent.
		Vinum Aurantii	—	—	Ibid. Used in making Vin. Ferri Citratis, and Vin. Quiniæ.
	b. The dried outer part of the rind of the bitter orange	Inf. Aurantii	1 oz. to 1 pt.	5 to 2 ozs.	Same as that of the tincture, as above.
		,, ,, Co.	½ oz. to 1 pt.	1 to 2 ozs.	
		Tinct. Aurantii,	2 ozs. to 1 pt.	1 to 2 drms.	
		Syrup. Aurant.	1 Tinct. in 8	1 drm.	
	c. The flowers of the bitter and of the sweet orange tree	Aqua Aurantii Floris	—	1 to 2 ozs.	Flavouring agent.
		Syrup. Aurant. Floris	—	1 drm.	Ibid.

Aurantiaceæ—Continued.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
Citrus Limonum The Lemon (*Southern Europe*)	*a.* The ripe fruit *b.* The outer part of the rind of the fresh fruit	Succus Limonis, Syrup. Limon. Oleum Limonis Syrupus „ Tinctura „	— 1 pt. to 3¼ lbs. — 1 oz. to 1¾ lbs. 2½ ozs. to 1 pt.	— 1 drm. — 1 drm. 1 to 2 drms.	Refrigerant and antiscorbutic. The oil externally is rubefacient, and contained in Sp. Ammoniæ Aromat. and in Lin. Potass. Iodid. c. Sapone. Preps. chiefly used for flavouring.
Ægle Marmelos Bael Fruit (*Malabar and Coromandel*)	Dried half-ripe fruit	Extractum Belæ Liquidum	1 oz. to 1 oz.	1 to 2 drms.	Astringent. Used in diarrhœa and dysentery.

Aurantii Cortex.

The fruit of the orange is an hesperidium; the rind is thin, of a dark-orange colour, and should be nearly free from the white inner part. It is studded with oil-vesicles, which are concave in the bitter orange and convex in the sweet. The small unripe fruits called orange-berries are used for flavouring curaçoa. The flowers of the bitter orange are large, white, and fragrant; those of the sweet orange are yellowish and not so fragrant. Orange-peel has an aromatic bitter taste and agreeable odour; it contains a volatile oil isomeric with that of turpentine ($C_{10}H_{16}$); a bitter extractive named *Hesperidin* or *Aurantiin;* a glucoside probably identical with *Limonin*, and a little gallic acid. The orange flower contains a little volatile oil (oil of Neroli), differing from that contained in the rind.

Limonis Cortex et Succus.

The fruit is an hesperidium; the rind should have the interior white portion removed; it is lighter in colour than that of orange, and like it is dotted with numerous convex oil-vesicles; it has a fragrant odour and an aromatic slightly bitter taste; a watery infusion of it becomes greenish on the addition of perchloride of iron.

The volatile oil is expressed or distilled; it is pale yellow; that obtained by the latter process is purer but less pleasant in flavour; its sp. gr. is 0·85; it is isomeric with oil of turpentine, oil of orange, &c. ($C_{10}H_{16}$). These oils yield a crystalline substance when saturated with hydrochloric acid gas; that yielded by oil of lemon contains two molecules of the acid, that yielded by oil of turpentine contains but one. Like most volatile oils, oil of lemon is composed of two isomeric oils, *Citrene* and *Citrylene.* After long keeping it deposits a crystalline fat. Besides the oil the rind of the lemon contains *Hesperidin* or *Aurantiin; Limonin* obtained from the seeds is probably identical. The presence of *Hesperidin* in the white portion of the rind is indicated by the development of a yellow colour on moistening it with ammonia. The rind also contains a little gallic acid.

The juice of the lemon is a slightly turbid yellowish liquor, with a sharp acid taste and grateful odour. Its average sp. gr. is 1·039. The quantity of citric acid contained in it is about 32·5 grains to the fluid ounce, but the proportion varies with the age of the fruit; it also contains mucilage, malic and phosphoric acids in small quantity, acid salts, especially those of potash, sugar, &c. To preserve the juice, it may be heated to 150°, filtered, and kept in completely-filled bottles, or one-tenth part of brandy may be added.

Belæ Fructus.

The fruit is roundish, about the size of a large orange, with a hard woody rind; it is usually imported in dried slices, or in fragments consisting of parts of the rind and adherent dried pulp and seeds. The rind is about a line and a half thick, is covered with a smooth pale-brown or grayish epidermis, and internally, as well as the dried pulp, is brownish orange or cherry-red. The moistened pulp is mucilaginous. The ripe fruit is refrigerant. The pulp and seed-coats yield a large quantity of mucilage, some sugar, and a trace of an astringent principle probably allied to tannic acid.

Mangosteen fruit has been substituted for bael fruit, but it is thicker, does not contain the adhering pulp and seeds, and it presents pieces of dark, radiating, wedge-shaped stigmas.

BYTTNERIACÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
THEOBROMA CACAO Cacao Butter (*West Indies and South America*)	Concrete oil from the seeds	—	—	—	Used for making suppositories of Acidum Tannic., Hydrarg., Morphia, and Plumbi Co.

Oleum Theobromæ.

This and the expressed oil of nutmeg are the only two solid vegetable fats. Oil of theobroma is obtained from the ground seeds by expression and heat; it has the consistency of tallow, is of a yellowish colour; its odour resembles that of chocolate, and its taste is bland and agreeable; its fracture is clean, presenting no appearance of foreign matter; it does not become rancid on exposure to air. It melts at about 95°; it is insoluble in water, but soluble in alcohol, ether, and oil of turpentine. It is composed chiefly of stearin with a little oleine. The seeds contain an alkaloid, *Theobromine* ($C_7H_8N_4O_2$), which resembles *Caffeine* or *Theine* chemically and physiologically. It is slightly bitter, sparingly soluble in boiling water, and even less soluble in alcohol and ether.

GUTTIFERÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
GARCINIA MORELLA Gamboge (*Siam*)	Gum-resin	Pulv. Cambogiæ Pil. Cambog. Co.	— 1 pt. in 6	1 to 4 grs. 5 to 10 grs.	Drastic purgative. Given in dropsies and in cerebral disease.

Cambogia.

Occurs in pipes or cylindrical pieces, an inferior variety called cake or lump gamboge being met with in irregular masses. Gamboge is procured by making incisions into the stem, or by cutting away some of the bark and scraping away the juice which exudes; the Siam or pipe gamboge is streaked externally from the impressions of the bamboo reeds in which the juice is collected. Gamboge breaks easily with a smooth conchoidal glistening fracture; colour is tawny, changing to yellow when it is rubbed with water; it is odourless, but the powder causes sneezing and a flow of mucus; it has an acrid taste. An emulsion made with boiling water and cooled does not become green with solution of iodine, showing the absence of starch.

Gamboge consists of about between 75 to 80 per cent. of a yellow resin having acid properties, *Gambogic acid* ($C_{20}H_{23}O_4$), with about 20 to 25 per cent. of a soluble *gum*. The resin which is obtained by evaporating to dryness the ethereal tincture of the gum-resin is soluble in alcohol and ether, and is precipitated from these solutions by water; it is also soluble in solution of potash, forming a deep red liquid gambogiate of potash. This gives with solution of acetate of lead a yellow precipitate of gambogiate of lead, and with solution of sulphate of copper, a brown precipitate of gambogiate of copper; the addition of an acid to it precipitates the resin. When rubbed with water, the gum of gamboge dissolves, forming a yellow emulsion with the suspended resin.

The Ceylon variety of gamboge, which is not officinal, is derived from the Hebradendron gambogioides.

CANELLACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
CANELLA ALBA Laurel-leaved Canella (*West Indies*)	Bark	—	—	—	Aromatic, bitter, stomachic tonic. An ingredient of Vinum Rhei.

Canella Alba.

Is met with in quills, or broken flattened pieces about an inch or so in diameter, and of varying length; these are hard and break with a granular fracture. They are of a very pale yellowish colour, and are somewhat lighter on the internal surface. Canella bark has an aromatic clove-like odour and an acrid peppery taste. It contains a resin, a little volatile oil which resembles cajeput, and oil of cloves, in some of its physical and chemical characters; it also contains some bitter extractive besides starch and mannite. It does not contain tannic or gallic acids, and is thus distinguished from Winter's bark (*Drimys Winteri*, N.O. Magnoliaceæ), for which it is sometimes sold; the inner surface of the latter bark is also dark-coloured.

VITACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
Vitis Vinifera The Grape Vine (*Spain*)	The ripe fruit dried	—	—	—	Used to flavour and sweeten Tinct. Cardamon. Co., and Tinct. Sennæ.

Uvæ.

Raisins contain a considerable amount of grape-sugar ($C_6H_{12}O_6$), acid tartrate of potash, and malic acid. Tartaric acid is derived from the grape, being obtained from "Argol," the deposit on the insides of wine casks. The seeds yield from 15 to 18 per cent. of a tasteless fixed oil, and about the same quantity of tannic acid, which, together with some colouring matter, is also yielded by the skin. "Sultana raisins" are stoneless. Corinthian raisins or "currants" are the produce of a small-sized grape abundant in the Ionian Islands.

ZYGOPHYLLACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
Guaiacum Officinale Guaiacum wood (*St. Domingo and Jamaica*)	*a*. The wood	—	—	—	Diaphoretic, alterative, stimulant, and emmenagogue. Given in Chronic Rheumatism, Quinsy, Amenorrhœa, etc. The wood is contained in the Decoct. Sarsæ Co. and the resin in the Pil. Hydrarg. Subchlor. Co.
	b. The resin	Pulv. Guaiaci	—	10 to 30 grs.	
		Mist. Guaiaci	11 grs. in 1 oz.	½ to 2 ozs.	
		Tinct. Guaiaci Ammoniata	88 grs. in 1 oz.	½ to 1 drm.	

Guaiacum.

Guaiacum wood (*lignum vitæ*) occurs in the form of a coarse powder or chips; it is also met with in the form of large logs, generally denuded of bark and consisting of an outer layer of alburnum or young sap-wood, which is of a pale-yellow colour, the inner portion, the duramen or heart-wood, being of a dark greenish-brown. It is very hard, tough, and heavy, its sp. gr. being 1·33, so that it sinks readily in water. The fibres intersect diagonally and obliquely, giving it a remarkable cross-grained appearance. The powder of guaiacum wood when slightly heated with solution of corrosive sublimate, or when treated with nitric acid, is turned bluish-green; solution of chloride of lime also turns it green.

The resin constitutes 26 per cent. of the wood, and is obtained from the stem by natural exudation (tears), by incisions, or by heat. It occurs in large masses, which are olive-brown when recent but which become brown on exposure to air. It has an aromatic odour and is tasteless at first, but leaves a burning sensation in the throat. Its fractured surface is resinous and translucent at the edges; its sp. gr. is 1·25; it is insoluble in water, but soluble in alcohol, ether, and alkaline solutions. A solution in rectified spirit strikes a clear blue colour when applied to the cut surface of a raw potato, due to the action of Guaiacic acid on the gluten. It is precipitated from alcohol by water and from alkalies by acids. Acted on by nitric acid and chlorine it yields a green colour, which soon becomes green and finally brown. Guaiacum resin contains *Guaiacic acid* ($C_6H_8O_3$), about 10 per cent. of Guaiaretic or Guaiaretinic acid ($C_{20}H_{26}O_4$), and about 70 per cent. of *Guaiaconic acid* ($C_{19}H_{20}O_5$), with other vegetable matter. The resin being mostly acid combines with alkalies as in the ammoniated tincture; it undergoes peculiar changes by oxidation with different re-agents. The simple spirituous solution is coloured blue by nitric acid, nitrous ether, chromic acid (a dilute solution of which is a very delicate test for it), chlorine, alkaline hypochlorites (Schmidt), prussic acid with sulphate of copper (Pagenstecher), gluten, and substances containing it, but not by starch; also by mucilage of gum-arabic, unboiled milk, &c. The ammoniated tincture will not respond to these tests owing to the neutralisation of the resinous acids by the ammonia. The development of the blue colour appears to be due to the oxidation of the free acids, and the original yellowish colour is restored by reducing agents. On destructive distillation, guaiacum resin yields a tar which contains *Guaiacol* ($C_7H_8O_2$) and *Creasol* ($C_8H_{10}O_2$), the two most important ingredients in commercial creasote from wood-tar.

Guaiacum resin is sometimes adulterated with resins of conifers; these may be detected by their terebinthinate odour and solubility in oil of turpentine. Simple tincture of guaiacum resin becomes milky when added to water, but becomes clear on carefully adding solution of potash in excess, if other resins be not present.

The resin of scammony and jalap are sometimes adulterated with guaiacum.

RUTACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
BAROSMA BETULINA, B. CRENULATA, B. SERRATIFOLIA Buchu (*Cape of Good Hope*)	Dried leaves	Infusum Buchu	1 oz. to 1 pnt.	1 to 4 ozs.	Stimulating diuretic, sedative to genito - urinary mucous membrane. Beneficial in Catarrh of bladder, Lithiasis.
		Tinctura Buchu	2¼ ozs. to 1 pnt.	1 to 2 drms.	
GALIPEA CUSPARIA Cusparia or Angustura (*South America*)	Bark	Infusum Cuspariæ	1 oz. to 1 pnt.	1 to 2 ozs.	Aromatic bitter stomachic and tonic. Used in Dyspepsia, Debility.
RUTA GRAVEOLENS Common or Garden Rue (*South of Europe*)	Fresh herb	Oleum Rutæ	—	2 to 6 mins.	Locally irritant. Used internally as a carminative and emmenagogue.

Buchu.

The leaves of buchu are light yellowish- or grayish-green, smooth, and marked with pellucid dots or oil-glands, chiefly at the indentations and apex; they have a powerful odour and a warm, camphoraceous taste.

The leaves of Barosma betulina (short buchu) are about three-quarters of an inch long, coriaceous, obovate, with a recurved truncated apex, and sharp, cartilaginous, spreading teeth. The leaves of Barosma crenulata (medium buchu) are about an inch long, oval-lanceolate, obtuse, minutely crenulated, and five-nerved. The leaves of Barosma serratifolia (long buchu) vary in length from an inch to an inch and a half, are linear-lanceolate, tapering at each end, sharply and finely serrated, and three-nerved.

Buchu, particularly B. betulina, contains about 1½ per cent. of a light brownish-yellow volatile oil, which gives the odour to the leaves; at a low temperature this deposits a small quantity of a crystalline barosma-camphor. Buchu leaves also contain a bitter extractive matter, *Barosmin* or *Diosmin*, which is soluble in water, but insoluble in alcohol or ether. With an aqueous infusion of the leaves, perchloride of iron gives a brownish-green colour, and acetates of lead and copper throw down a yellow precipitate. The leaves of another rutaceous plant, Empleurum serrulatum, have been substituted for B. serratifolia; but they are narrower, terminate in an acute point without a gland, have a bitter taste, and are of a different odour.

Cusparia.

Cusparia bark occurs in straight pieces, more or less incurved at the sides, from half a line to a line thick, and pared away at the edges. The epidermis is mottled brown or yellowish-gray. The inner surface is yellowish-brown and flaky. It breaks with a short fracture; has a peculiar odour, and a bitter, slightly aromatic taste. The cut surface, examined with a lens, usually exhibits numerous white points or minute lines which are raphides of oxalate of lime and liber-fibres. The inner surface of the bark does not become blood-red but is turned bluish-black when touched with nitric acid. Nitric acid applied to the epidermal surface may render it slightly orange-red.

Cusparia contains a trace of volatile oil, some resin, and a neutral bitter principle, *Cusparin* or *Angusturin*. Its composition is not known, but it is obtained in tetrahedral prisms, and is soluble in alcohol, acids, and alkalies. Infusion of cusparia is precipitated by tannin.

The bark of Strychnos nux vomica has been substituted for cusparia bark, and is hence named "false, or East-Indian, angustura bark." This latter is usually in shorter pieces, is more irregularly twisted, is almost odourless, has a much more bitter taste, breaks with a shorter fracture, is not separable into layers; has a whitish epidermis, which is spotted red and is turned greenish or black by nitric acid. Nitric acid applied to the inner surface of the false bark turns it blood-red, owing to the presence of *Brucia*. *Strychnia* is also an ingredient of the false bark.

Rue.

Oil of rue is obtained by distillation with water from the fresh herb. It is of a pale yellow colour, becoming brown by age, of a disagreeable odour, and has a bitter, acrid taste. Its sp. gr. is 0·837. It contains a terpene ($C_{10}H_{16}$) with some rutic aldehyd ($C_{10}H_{20}O$). It has been obtained also artificially.

SIMARUBACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
PICRÆNA EXCELSA Quassia (*Jamaica*)	Wood	Extract. Quassiæ Infusum ,, Tinctura ,,	— 6 grs. to 1 oz. 16½ grs. to 1 oz.	3 to 5 grs. 1 to 2 ozs. ½ to 2 drms.	Bitter stomachic, tonic; beneficial in dyspepsia.

Quassia.

Billets of variable size, seldom thicker than the thigh. The wood is dense, tough, whitish, becoming yellow on exposure; externally it is grayish-brown, and an efflorescence of nitrate of potash is not infrequently found upon it; it is odourless, but has an intensely and purely bitter taste. It is generally sold in chips or raspings.

Quassia yields its bitterness to spirit and to water, but it is curious that the bitterness of the aqueous infusion is immediately removed by permanganate of potash. Quassia contains a neutral crystallisable principle, *Quassine* ($C_{10}H_{12}O_3$); this is readily soluble in alcohol, but slightly so in ether or water, and its solution in the latter menstruum is increased by several salts and vegetable principles. It is devoid of tannic and gallic acids, and hence may be combined with salts of iron.

Surinam bitter-wood is derived from Quassia amara, the original source of quassia.

RHAMNACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
RHAMNUS CATHARTICUS Common Buckthorn (*Britain*)	Recently expressed juice of the ripe berries	Syrupus Rhamni	—	1 drm.	Hydragogue cathartic. Used as a purgative for children.

Rhamni Succus.

The ripe berries of the buckthorn are about the size of a pea, black, smooth, and containing four seeds, by which they are distinguished from the berries of the Alder Buckthorn (Rhamnus frangula), which only contain two. The parenchyma is green and juicy. The odour of buckthorn is rather nauseous. The juice is green and has a nauseous odour; its green colour is intensified on the addition of lime-water or alkalies; it gradually becomes red on exposure to air, owing to the development of acetic acid in it. Evaporated to dryness with lime-water, it forms sap-green. Buckthorn juice contains sugar, mucilage, malic acid, two principles, *Rhamnine* ($C_{18}H_{22}O_{10}$) and *Rhamnegine* ($C_{24}H_{32}O_{14}$), both of which are glucosides and are resolvable into crystalline sugar and *Rhamnetin* ($C_{12}H_{10}O_5$). Besides these it contains a purgative principle which is by some regarded as identical with Rhamine.

ANACARDIACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
PISTACIA LENTISCUS Mastich (*Levant*)	Resinous exudation	—	—	—	Stopping for teeth. Masticatory.

Mastiche.

Mastich is a true resin and is obtained by making incisions into the stem when it exudes. It occurs as small, irregular, yellowish tears, which are often covered with a whitish dust; they are brittle, breaking with a vitreous, shining, transparent fracture; they become soft and ductile when chewed; their odour is faint but agreeable. Mastich is wholly soluble in ether or chloroform but almost insoluble in fixed oils. It consists of *Mastichic acid* ($C_{20}H_{30}O_2$), which is soluble in alcohol, and *Masticin* ($C_{20}H_{31}O$), which is dissolved by ether.

AMYRIDACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use.
BALSAMODENDRON MYRRHA Myrrh (*Arabia and Abyssinia*)	Gum-resin exuding from stem	TincturaMyrrhæ	54¾ grs. to 1 oz.	½ to 1 drm.	Stimulant. Tonic and mild astringent. Contained in Decoct. Aloes Co., Mist. Ferri Co., Pil. Aloes et Myrrh., Pil. Assafœtid. Co., and Pil. Rhei Co.
CANARIUM COMMUNE Elemi (*Manilla*)	Resinous exudation	Unguent. Elemi	1 pt. in 5	—	Topical stimulant to indolent sores and boils.

Myrrha.

Myrrh of the best quality, the so-called Turkey myrrh, is in irregular tears or masses of variable size, somewhat translucent but occasionally covered with powder; it is of a reddish-yellow or reddish-brown colour; the fractured surface is irregular and somewhat oily. Myrrh has an agreeable aromatic odour and an acrid bitter taste. The inferior varieties of Myrrh are in large masses, darker in colour and less translucent. Myrrh is now exclusively imported from the East Indies.

Myrrh contains a volatile oil (*Myrrhol*), gum, resin (*Myrrhin*), and certain salts. The volatile oil is at first colourless, but becomes yellowish on keeping. The gum differs but little from *Arabin;* its solution in water is precipitated by alcohol, salts of lead, silver, protosalts of tin and of mercury. The resin of Myrrh is bitter, is soluble in caustics, in alcohol, and partly soluble in ether; moistened with alcohol and then with hydrochloric acid, it assumes a violet hue which is less brilliant than that assumed by galbanum when similarly treated. Nitric acid dropped on a fragment of myrrh, or on a concentrated tincture, develops a red colour.

With water myrrh forms a milky-white emulsion from the suspension of the resin by the gum which is held in solution. Myrrh is inflammable; it softens but does not melt on heating. Other gum resins, especially gum-bdellium or "false myrrh," probably derived from other species of Balsamodendron, are sometimes met with in samples of myrrh.

Elemi.

A soft unctuous adhesive mass, becoming harder and more resinous by age; is yellowish-white with a rather fragrant fennel-like odour, which is due to the presence of from 10 to 12 per cent. of volatile oil. Elemi is almost entirely soluble in rectified spirit. A crystalline resin, *Elemin* or *Amyrin*, is present in the proportion of 25 per cent.; an uncrystallisable resin in the proportion of about 60 per cent. is also present. Besides these, Elemi contains from 1 to 2 per cent. of *Bryoidin* and *Breidine* crystalline, bitter, neutral principles, which are feebly soluble in cold water, but freely soluble in hot water, in alcohol, and ether.

Elemi is known from olibanum and other resins by its crystalline structure, which is revealed by the microscope; on treating the elemi with cold alcohol a white residuum is formed consisting of acicular crystals of *Amyrin*.

LEGUMINOSÆ.

PAPILIONACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
Glycyrrhiza Glabra Liquorice (*England*)	Rhizome	Extract. Glycyr. Extract. liquid. Pulv. Glycyr. Co.	— — —	— 1 drm. 30 to 60 grs.	Demulcent. The compound powder is purgative. In coughs. Contained in several preparations on account of its sweetening and flavouring properties.
Astragalus Verus Tragacanth (*Asia Minor*)	Gummy exudation from stem	Mucilago Tragacanthæ Pulvis Co.	60 grs. to 10 ozs. 1 pt. in 6	— 20 to 60 grs.	Demulcent. Used to suspend heavy powders. In Conf. Opii & Pulv. Opii Co.
Sarothamnus Scoparii Common Broom (*Europe*)	Fresh and dried tops	Decoctum Scoparii Succus Scoparii	1 oz. to 1 pnt. 3 pts. to 1 spt.	2 to 4 oz. 1 to 2 drms.	Diuretic. Ibid.
Pterocarpus Santalinus Red Sandal-wood (*Coromandel and Ceylon*)	Wood	—	—	—	Used only for colouring Tinct. Lavand. Co.
Pterocarpus Marsupium Kino (*Malabar*)	Inspissated juice exuding from incisions in the stem	Pulvis Kino Pulvis Kino Co. Tinctura Kino	— 3¾ pt. in 5 2 ozs. to 1 pnt.	10 to 30 grs. 5 to 20 grs. ½ to 2 drms.	General and local astringent in diarrhœa, dysentery, relaxed sore throat, etc. Contained in Pulv. Catechu Co.
Myroxylon Pereiræ Balsam of Peru (*Salvador*)	Balsam exuding from the stem after removal of the bark	Balsam. Peru.	—	10 to 15 mins.	Stimulant, expectorant. Locally a stimulant, and applied to bed-sores, ulcers, &c. Given in chronic rheumatism, chronic bronchitis. In gleet, leucorrhœa, &c.

Papilionaceæ—Continued.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
MYROXYLON TOLUIFERUM Balsam of Tolu (*New Granada*)	Balsam exuding from incisions in the bark	Syrupus Tolu Tinctura „	1¼ to 3 pds. 58½ grs. to 1 oz.	1 drm. 20 to 40 mins.	Stimulant, expectorant. Similar to Balsam of Peru. Contained in Tinct. Benzoin. Co.
PHYSOSTIGMA VENENOSUM Calabar Bean (*West Africa*)	The seed	Pulv. Physostig. Extractum Physostigmatis	— —	1 to 4 grs. $\frac{1}{16}$ to ¼ gr.	Contracts pupil; paralyses spinal cord; depresses heart. Employed in chorea, tetanus, general paralysis of the insane, and, locally, to contract pupil.

CÆSALPINEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
HÆMATOXYLON CAMPECHIANUM Logwood (*West Indies*)	Wood	Decoctum Extractum	1 oz. to 1 pnt. —	1 to 2 ozs. 10 to 30 grs.	Astringent in diarrhœa, dysentery.
CASSIA LANCEOLATA AND CASSIA OBOVATA Alexandrian Senna CASSIA ELONGATA Tinnivelly or Indian Senna	Leaflets	Confectio Sennæ Infusum „ Mist. Sennæ Co. Syrupus Sennæ Tinctura „	1 pt. in 11 nearly 2ozs. to 1 pnt. — 1 to 2 ozs. 2½ ozs. to 1 pnt.	60 to 120 grs. 1 to 2 ozs. 1 to 1½ ozs. 1 to 4 drms. 1 to 4 drms.	Purgative. Contained in Pulv. Glycyrr. Co.
CASSIA FISTULA Purging Cassia (*East and West India*)	Pulp of the pods	—	—	—	Laxative. Contained in Confect. Sennæ.
TAMARINDUS INDICA Tamarind (*East and West India*)	Pulp of the fruit	—	—	—	Refrigerant, laxative. Contained in Conf. Sennæ.
COPAIFERA MULTIJUGA Balsam of Copaiva (*West Indies and Valley of Amazon*)	Oleo-resin from incised trunk	Copaiba Oleum Copaibæ	— —	½ to 1 drm. 5 to 20 mins.	Stimulant to mucous membranes. Diuretic. Given in gonorrhœa, cystitis, bronchitis, and dropsy.

MIMOSEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ACACIA Gum Arabic (*Eastern Africa*)	Gummy exudation from stem	Mucilago Acaciæ	1 in 2½	*Ad lib.*	Demulcent. Used to suspend powders and to emulsify oils or resinous tinctures. An ingredient of Mist. Cretæ, Mist. Guaiaci, Pulvis Amygd. Co., Pulv. Tragacanth. Co., and all Trochisci.
INDIGOFERA Indigo (*India*)	The plants fermented	Sol. of Sulphate of Indigo (App. III.)	—	—	Test for free chlorine.

Glycyrrhizæ Radix.

In long cylindrical branched pieces, an inch or less in diameter, tough and pliable; of a grayish-brown colour externally, yellow internally, odourless, with a sweet mucilaginous but slightly acrid taste. Digested with water it yields a solution which gives a precipitate with dilute sulphuric acid.

Liquorice root contains, like several other leguminous rhizomes, a peculiar sweet substance, *Glycyrrhizine* or "liquorice sugar" ($C_{24}H_{36}O_9$); this is yellow, transparent, amorphous, and non-fermentable; is soluble in spirit and in water, and is precipitated from its aqueous solution by dilute acids; when boiled with hydrochloric acid it is resolved into *Glycyrretin*, a bitter resinous matter, and glucose. Liquorice also contains *Asparagine*, gum, mucilage, &c. Heat dissolves out the acrid resinous oil, hence the extract is made with cold water. Liquorice powder is often adulterated on the Continent with a yellow pigment named "French yellow;" this is detected by its effervescing on the addition of hydrochloric acid.

Tragacantha.

This, which is commonly called Gum Dragon, is not the true secretion of the plant, but appears to be the result of a transformation of the cells of the pith and medullary rays. The flaky or Smyrna variety is white or yellowish, occurs in broad shell-like slightly curved plates. Vermiform or Morea tragacanth is rarely met with in this country, but is common on the Continent; it occurs in small twisted filiform spiral pieces. Tragacanth is tough and elastic, but is rendered more pulverisable by a heat of 120° F., at which temperature it loses about 14 per cent. of water; it is almost tasteless; specific gravity is 1·384; is very sparingly soluble in cold water, but swells up into a gelatinous mass which is tinged violet by tincture of iodine. After maceration in cold water the fluid portion is not precipitated by the addition of rectified spirit, showing the absence of gum-acacia.

Tragacanth is usually considered to be a mixture of about 53 per cent. of *Arabin* or *Tragacanthin* and about 33 per cent. of *Bassorin*, together with a little starch. *Tragacanthin* is a soluble gum, and a solution filtered from the insoluble gum *Bassorin* is precipitated by normal acetate of lead, but is not rendered turbid by perchloride of iron, borax, or silicate of potash. *Bassorin*, the insoluble gum, unlike *Arabin*, is devoid of acid properties.

By the action of alkalies and by the prolonged action of boiling water, tragacanth is rendered soluble in water and is converted into true gum. Nitric acid converts it into mucic and oxalic acids, and prolonged boiling with dilute sulphuric acid into sugar.

Tragacanth collected in Asia Minor is frequently mixed with two other gums—Caramania and Moussal gum.

Scoparii Cacumina.

Straight, pentangular, dark-green, smooth, tough twigs, with small oblong leaves, of a bitter nauseous taste, and of a peculiar odour when bruised, but which is lost in drying. They contain a neutral principle, *Scoparine* ($C_{21}H_{22}O_{10}$), on which the diuretic properties of broom depend, and *Spartein* ($C_{15}H_{26}N_2$), a volatile liquid alkaloid which is narcotic, besides extractive matters and salts. *Scoparine* is pale yellow, amorphous, tasteless, odourless, and soluble in alcohol and water. *Spartein*, which is obtained by distillation, is a viscid oil, pale when fresh, but becoming brown on exposure; it forms crystalline salts with perchloride of platinum and corrosive sublimate.

Pterocarpi Lignum.

Dense heavy billets, outwardly dark brown, internally variegated with dark and light red rings if cut transversely. Powder is blood-red. Red sandal-wood also occurs in chips; it has a faint, peculiar, violet-like odour, particularly when rubbed, and it has a slightly astringent taste. Sandal-wood contains a dark-red crystalline principle, *Santalin* or *Santalic acid* ($C_{15}H_{14}O_5$); it also contains *Santal* ($C_8H_6O_3$), which separates from boiling alcohol in colourless, tasteless crystals; a small quantity of *Kino-tannic acid* is also present. The colour of the wood is extracted by alcohol, ether, acetic acid, and alkaline solutions, but not by water; the only volatile oils which dissolve it are those of lavender and rosemary. An infusion of the wood in cold distilled water is of a pale sherry colour, and exhibits a dark blue fluorescence which is destroyed on boiling the infusion, becoming pale red. The colour of the wood is due to the gradual oxidation of an originally colourless principle.

Acids precipitate the *Santalin*, and solutions of metallic salts throw down red or violet precipitates, and are hence incompatible with sandal-wood.

Kino.

Several substances were formerly known under the name of "kino." Thus, there was West Indian or Jamaica kino, South American kino, Butea gum, African kino, Botany Bay kino, &c. The officinal kino is the East Indian or Amboyna kino. It occurs in small, angular, brittle, glistening, reddish-black fragments, translucent and ruby-red on the edges; inodorous, very astringent, tinging the saliva blood-red when chewed. It burns with little flame; is soluble in water and spirit. The aqueous solution gives an intense violet colour when agitated with a little reduced iron or a neutral solution of ferrous sulphate. It is decolourised by acids, and the colour is restored by alkalies.

Besides about 24 per cent. of red gummy matter, kino contains about 75 per cent. of a species of *tannin* called *Mimo-tannic*, or *Kino-tannic*, or *Catechu-tannic acid* ($C_{18}H_{18}O_8$), and another astringent principle, which is also found in catechu, *Catechin* ($C_{20}H_{18}O_8$).

Alkalies increase the solubility of kino in water, but they destroy its astringency. Solutions of kino precipitate iron salts of a green colour; hence these, as well as salts of lead, silver, mercury, antimony, and the mineral acids, are incompatible with kino. Gelatine also gives with solution of kino a greenish precipitate.

Balsamum Peruvianum.

This is a true balsam; that is, a fragrant resinous substance containing either benzoic or cinnamic acid. The other true balsams are Balsam of Tolu, Benzoin, and Storax. These are all solid substances. Balsam of Peru is a reddish-brown or nearly black liquid, translucent and dark red, in thin films. It has the consistence of syrup; sp. gr. 1·15; it is insoluble in water, but yields to it traces of cinnamic and benzoic acids. It is completely soluble in five parts of rectified spirit, showing the absence of fixed oil; it should undergo no diminution in volume when mixed with water, showing the absence of alcohol, or of a solution of balsam of Tolu which is said to be sometimes substituted for it. Balsam of Peru has an acrid, slightly bitter taste, and a balsamic odour, due to the presence of about 60 or 70 per cent. of *Cinnamein*, a neutral volatile oil. This is a cinnamate of benzyl ($C_7H_7,C_9H_7O_2$), and when subjected to fractional distillation yields several distinct products—viz., benzoic alcohol and the cinnamic and benzoic ethers; by caustic alkalies it is resolved into cinnamic acid and benzylic alcohol. Balsam of Peru also contains *Metacinnamein*, a crystallisable solid, isomeric with cinnamein; about 6 or 7 per cent. of *Cinnamic acid* ($C_9H_8O_2$), and *resins*, the latter being probably produced by the oxidation of the oil. Lastly, balsam of Peru contains *Styracin* or cinnamate of cinnyl ($C_9H_9,C_9H_7O_2$), which, by the action of potash, is converted into cinnamate of potash and styrone or cinnylic alcohol. Frémy regards the resins of balsam of Peru as hydrates of the cinnamein; their amount increases with age.

Balsam of Peru is said to be also adulterated with castor oil and copaiba. Freedom from the former impurity is ascertained by adding concentrated sulphuric acid and then water; a little resin is formed if the balsam be pure. Copaiba is detected by distilling a few drops and adding iodine; an explosion results if copaiba be present.

Balsamum Tolutanum.

A reddish or yellowish-brown solid, soft and tenacious at first, becoming hard by age. It has an aromatic taste, and a fragrant balsamic odour, similar to but less powerful than that of balsam of Peru. It is soluble in rectified spirit, ether, and glacial acetic acid, but not in bisulphide of carbon, which dissolves a large portion of balsam of Peru. Balsam of tolu yields cinnamic acid to water; it is similar in composition to balsam of Peru, but contains, moreover, *Tolene* ($C_{10}H_{16}$), a volatile oil, obtained by distilling the balsam with water.

Ulex states that the presence of common resin in it may be inferred, if, on the addition of sulphuric acid to the balsam, it blackens, swells up, and disengages sulphurous acid.

Physostigmatis Faba.

The plant yielding Calabar bean, or the "ordeal" bean of Old Calabar, is large and climbing, sometimes attaining a height of 50 feet; it bears delicate pink flowers, and has a brown pod or legume which contains several seeds. These are about the size of a very large horse-bean, with a very hard, brittle, shining integument, of a brownish red, pale chocolate, or ash-gray colour. Irregularly kidney-shaped, with two flat sides, and a furrow running longitudinally along its convex margin, ending in an aperture near one end of the seed. Within the shell is the kernel, consisting of two cotyledons, weighing on an average about 46 grains; hard, white, and pulverisable, of a taste like that of the ordinary edible leguminous seeds, without bitterness, acrimony, or aromatic flavour. It yields its virtues to alcohol, and imperfectly to water.

The kernel is composed of about 48 per cent. of starch, 23 per cent. of legumin, and $\frac{1}{2}$ to $\frac{1}{3}$ per cent. of fatty oil, together with mucilage, a little sugar, and the active principle, *Physostigmia* or *Eseria* ($C_{30}H_{21}N_3O_4$). This latter is contained only in the cotyledons and may be extracted by alcohol. It has been separated as a yellowish amorphous mass, sparingly soluble in water but moderately so in alcohol, chloroform, benzol, and acids. The aqueous solution is tasteless or slightly alkaline and bitter. The solution in acids becomes red on exposure, owing to decomposition of the alkaloid.

Hæmatoxyli Lignum.

The logs consist only of the heart-wood, and are heavier than water; externally they are of a dark colour, internally they are reddish brown. The chips commonly present a green or greenish-yellow lustre, due to the formation of crystalline hæmatein; they have a sweetish taste and a feeble agreeable odour resembling that of violets; a small portion chewed imparts to the saliva a dark pink colour. The colouring matter of red sandal-wood is not soluble in water, and thus differs from logwood, the colouring and astringent principles of which are soluble in water and alcohol; the solutions are changed to a deep violet colour by alkalies, and are rendered turbid and reddish yellow by acids. Logwood precipitates ferric salts dark brown, alum or acetate of lead blue, and gelatine a reddish colour.

It contains from 9 to 12 per cent. of *Hæmatoxyline* ($C_{16}H_{14}O_6$), which, when quite pure, forms white crystals with either one or three atoms of water of crystallisation; it is sometimes found crystallised in the crevices of the wood. *Hæmatoxyline* is soluble in hot water and alcohol, but sparingly in cold water and ether. There are also present tannin, resin, and the ordinary constituents of wood.

Hæmatoxyline is decomposed into Hæmatein ($C_{16}H_{12}O_6$), a crystalline substance with a green hue, by the combined action of oxygen and ammonia, and this body is again converted into *Hæmatoxyline* by the action of hydrogen and sulphurous acid. When fused with caustic potash *Hæmatoxyline* is converted into *Pyrogallic* acid ($C_6H_6O_3$).

Logwood is sometimes mixed with Brazil-wood, the crystalline colouring matter of which, *Brasilin* ($C_{22}H_{20}O_7$), forms a red solution with alkalies. Unlike logwood, Brazil-wood is not dark on the surface.

Senna.

The senna plants are small undershrubs with yellow flowers, bearing alternate pinnate leaves, with from four to eight leaflets along the leaf-stalk.

The leaflets of Cassia lanceolata and Cassia obovata (Aleppo senna) are lanceolate or obovate, about an inch long, unequally oblique at the base, brittle, grayish-green, of a faint peculiar odour and a mucilaginous sweetish taste. The leaflets are directed to be carefully freed from the flowers, pods, and leaf-stalks. The unequally oblique base and freedom from bitterness distinguish the senna from the leaflets of *Solenostemna Argel*, which, moreover, are paler in colour, thicker, stiffer, finely rugose, and without lateral nerves on the under surface. The leaflets of *Colutea arborescens, of Coriaria myrtifolia*, and of *Lephrosia Apollinea*, are sometimes used to adulterate Alexandrian senna, but they are not met with in English commerce.

The leaflets of Colutea arborescens or "bladder senna" are ovate and equal at the base; those of Coriaria myrtifolia have a strongly marked lateral nerve on each side of the midrib.

The leaflets of Lephrosia Apollinea have parallel transverse veins and are silky on the under-surface.

The leaflets of Cassia elongata are lanceolate, about two inches long, acute, unequally oblique at the base, flexible, green, without any admixture; odour and taste like those of Alexandrian senna.

Indian senna is of two varieties—Tinnivelly senna, and ordinary East Indian, Bombay or Arabian senna. The former alone is officinal; the leaflets of the latter are smaller, browner, often broken, and frequently mixed with pods and stalks.

Tripoli senna consists chiefly of leaflets of Cassia Æthiopica, a variety of Cassia ovata mixed with Cassia obovata.

Senna imparts its virtues to hot or cold water and to alcohol. It contains *Cathartine* or *Cathartic acid* ($C_{180}H_{192}O_{82}N_4S$), a peculiar sulphuretted glucoside; it is yellowish-red, deliquescent, and non-crystallisable; the free acid is almost insoluble in water and cold alcohol, but is soluble in ether, chloroform, and warm dilute alcohol; it is readily soluble when combined with alkaline and earthy bases, and in this form it exists in senna. Alkalies aided by heat act destructively on it; when boiled with alcohol and hydrochloric acid it is resolved into sugar and *Cathartogenic acid.*

Besides *Cathartine*, which is stated by some not to be the active principle, senna contains a yellow colouring matter identical with *Chrysophanic acid*, and, according to some, a crystalline sugar, *Catharto-mannite*, which does not ferment and does not precipitate suboxide of copper. It also contains a trace of volatile oil, tartrate and oxalate of lime and potash, together with the ordinary constituents of leaves.

Senna is incompatible with alcohol and mineral acids, and with lime-water, acetate of lead, tartar emetic, corrosive sublimate, and nitrate of silver.

Cassiæ Pulpa.

The fruit is a cylindrical pod or lomentum, from one to two feet long, about the thickness of the thumb; it has three bands running along its whole length. Internally it is divided into many cells by spurious dissepiments, and each cell contains a single oval shining brown seed, surrounded by pulp. This is blackish-brown, viscid, sweet, with a rather sickly odour; it is almost entirely soluble in alcohol and water; it contains about 60 per cent. of cane sugar, pectin, mucilage, a substance analogous to tannin, and some principle probably similar to that contained in senna. On exposure to the air the pulp becomes acid, in consequence of undergoing acetous fermentation.

West Indian pods contain more pulp, and are hence more valuable than the East Indian variety. Those pods should be selected which are heavy and in which the seeds do not rattle.

Tamarindus.

The plant is a large tree, bearing yellow flowers variegated with red veins. The pods are about four or five inches long, three-quarters of an inch broad, flattened, curved, and enclosed in a dry brittle shell or epicarp. They are divided internally into cells, which contain the seeds. These are brown and shining, are enclosed in a membranous coat, and are surrounded by the pulp; this is preserved in sugar, and is brown, sweetish, subacid, and contains strong fibres and seeds. A piece of bright iron left in contact with the pulp for an hour should not exhibit any deposit of copper—an impurity which may be present when the pulp is prepared in copper vessels.

The pulp of the tamarind contains sugar, gum, pectin, free citric, tartaric, and malic acids, bitartrate of potash, &c. The seeds contain a large quantity of tannin. The East Indian pods, "black tamarinds," are larger and thicker than those from the West Indies; they are, moreover, preserved without sugar. The West Indian pods, "brown or red tamarinds," are prepared by removing the epicarp from the ripe fruit and placing alternate layers of the shelled fruit and powdered sugar in a cask; boiling water or syrup is then poured over them.

Copaiba.

Copaiba is an oleo-resin and not a balsam, as it contains neither benzoic nor cinnamic acids. It is about the consistence of olive oil, and is of a light yellow colour—the Brazilian variety, which is chiefly met with, being much paler than the West Indian. It is transparent, has a peculiar odour, and an acrid aromatic taste. Its sp. gr. is about 0·95. It is insoluble in water, but entirely soluble in absolute alcohol, ether, fixed and volatile oils, and in strong alkaline solutions if much resin be present. It is perfectly soluble in an equal volume of benzol, does not become gelatinous after having been heated to 270°, and is not fluorescent; these last three characters show the absence of East Indian wood-oil, or *gurjun balsam*, the product of several species of Dipterocarpus. It dissolves one-fourth of its weight of carbonate of magnesia by the aid of heat, and remains transparent, showing the absence of castor-oil and other fixed oils. If present, the latter can also be detected by a diffused greasy stain being left when a little of the suspected specimen is heated on paper. Turpentine is sometimes used to adulterate copaiva, and may be detected by its odour on heating the drug on a spatula or on paper.

Copaiva consists of about 52 per cent. of resin and 40 per cent. of volatile oil, but the proportions vary with age and exposure. The resin, *Copaivic acid* ($C_{20}H_{32}O_2$), closely resembles common resin; is yellow, crystalline, and brittle; soluble in alcohol, rectified spirit, ether, and in fixed and volatile oils; it is decomposed by sulphuric and nitric acids. The volatile oil ($C_{10}H_{16}$) is obtained by distillation; it is closely allied to oil of turpentine; is colourless, with the odour and taste of copaiva. Besides these, copaiva contains about 1½ to 2 per cent. of a soft, brown, resinous matter, the nature of which is unknown, but which is supposed by Gerber to be the result of some alteration of the acid resin; its proportion increases with the age of the drug.

Acaciæ Gummi.

Gum Arabic, as it is generally called, occurs in spheroidal tears, usually from half to one inch in length, nearly colourless and opaque from numerous minute cracks, or in fragments with shining surfaces. Senegal or Barbary gum is met with in larger, coloured, and less pure pieces. Gum acacia is brittle; bland and mucilaginous in taste; insoluble in alcohol, but soluble in water. The aqueous solution gives no precipitate with neutral acetate of lead; but with subacetate of lead it forms an opaque white jelly of gummate of lead ($Pb_2O,3C_6H_{10}O_5$). If an aqueous solution of iodine be added to the powder or to a solution formed with boiling water *and cooled*, there is no appearance of a violet or blue colour, showing the absence of starch. The solution must be cooled, as the colour of iodide of starch is discharged at a high temperature.

Gum consists of *Gummic* or *Arabic acid* or *Arabin* ($C_6H_{10}O_5$), in combination with lime, magnesia, and potash, from which it can be separated by dialysis. It is a colourless, odourless, insipid, uncrystallisable solid. A small quantity of alkali renders it soluble in water, and the solution resembles one of ordinary gum; it is allied to the isomeric bodies *Cerasin* and *Prunin*, *Bassorin* or *Tragacanthin*, and vegetable mucus.

Gum contains 17 per cent. of water; at 212° it loses 12 to 16 per cent. of water, equal to about 3 molecules, and at 300° it loses another molecule and becomes insoluble. It also contains a small quantity of malate of calcium, chlorides of calcium and of potassium, and traces of iron, silicon, and phosphate of calcium.

By nitric acid gum is converted into mucic and oxalic acids, and by sulphuric acid into dextrin and sugar. Solution of oxalate of ammonia gives with solution of gum a white precipitate of oxalate of calcium, showing the presence of the latter earth. Alcohol, ether, chloroform, acetate and subacetate of lead, the mercurial nitrates and neutral oxalates, all produce deposits in a solution of gum, and are hence incompatible with it; borax and perchloride of iron render it gelatinous.

Indigo.

Indigo (C_8H_5NO) is a blue pigment prepared from various species of Indigofera, chiefly the I. tinctoria. It usually occurs in cubical cakes of an intensely blue colour; odourless, but possessing a metallic taste. When rubbed with a smooth hard body, indigo assumes a coppery or bronze-like hue. When heated to about 550° it evolves violet vapours, which condense in minute crystals; it is thus distinguished from Prussian blue. The blue colouring matter, *Indigotin*, is not soluble in water or alkaline solutions, but forms several compounds with sulphuric acid. By the action of deoxidising agents blue indigo is changed into white indigo or Indigogen (C_8H_6NO), which is soluble in water; on exposure to air it again becomes converted into blue indigo. According to Schunck the indigo producing constituent is *Indican* ($C_{26}H_{31}NO_{17}$), for this, when heated with sulphuric or hydrochloric acids, is resolved into indigo, indigo-red, and *Indiglucin* ($C_6H_{10}O_6$), a variety of sugar. Indican is a yellow, amorphous, deliquescent body; soluble in water, alcohol, and ether. The aqueous solution is decomposed by heat, and then yields, when boiled with acids, indigo-brown. Indigo-blue is metameric with benzoyl cyanide; by destructive distillation it yields carbonate and cyanide of ammonia and *Aniline.*

Indigo is introduced into the Appendix of the Pharmacopœia for making the solution of the sulphate. 5 grains of dry indigo are dissolved in 1 drachm of sulphuric acid by heat, and the resulting solution is diluted with sulphuric acid until the whole measures 10 ozs. This solution contains Sulphindigotic acid ($C_8H_5NO.\ SO_3$), a peculiar compound of the acid and the colouring matter. It is used as a test for free chlorine in hydrochloric acid and liquor sodæ chloratæ, and for nitric acid in carbonate of bismuth. If free chlorine in the first place, and nitric acid in the second be present, the colour of the sulphindigotic acid will be destroyed.

ROSACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
AMYGDALUS COMMUNIS Bitter and Sweet Almond. (*Bitter variety from Mogadore; Sweet from Malaga*)	Seed	Oleum Amygd. Pulv. Amygd. Co Mist. Amygd.	— 8 pts. in 13 2½ozs. to 1 pnt.	1 drm. to ½ oz. 1 to 2 drms. 1 to 2 ozs.	Demulcent. Vehicles for other medicines. The oil used in preparation of many ointments.
BRAYERA ANTHELMINTICA Kousso (*Abyssinia*)	Flowers and tops	Infusum Cusso	¼ oz. to 4 ozs.	4 to 8 ozs.	Tæniacide.
PRUNUS DOMESTICA Common Plum Tree (*Syria and Southern Europe*)	Dried drupe	—	—	—	Laxative. Employed in preparation of Confection of Senna.

Rosaceæ—Continued.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
PRUNUS LAUROCERSUS Common or Cherry Laurel *(Asia Minor. Cultivated in England)*	Fresh leaves	Aqua Laurocerasi	1 lb. to 1 pt.	5 to 30 mins.	Sedative. Has similar effects to those of Dilute Hydrocyanic Acid.
ROSA CANINA Dog Rose *(Indigenous)*	Fresh fruit	Confectio Rosæ Caninæ	1 pt. in 3	—	Used in making Pil. Quiniæ, and as a basis for other pill masses.
ROSA CENTIFOLIA Cabbage or Hundred-leaved Rose *(Britain)*	Fresh petals fully expanded	Aqua Rosæ	10 lbs. to 1 gallon	—	Used chiefly as a vehicle for lotions and collyria; and in preparing Mist. Ferri Co. and Trochisci Bismuthi.
ROSA GALLICA Red Rose *(Austria and Southern Europe. Cultivated in Britain)*	Fresh and dried unexpanded petals	Confectio Rosæ Gallicæ Infusum Rosæ Acidum Syrupus Rosæ Gallicæ	1 pt. in 4 ½ oz. to 1 pnt. —	— 1 to 2 ozs. 1 drm.	Slightly astringent. The infusion used chiefly as a gargle and as an agreeable vehicle; the syrup as a colouring agent, and the confection as a basis for all the aloetic as well as other pill masses.

Amygdala Amara.

Bitter almonds resemble the sweet variety in appearance, but are broader and shorter, have a bitter taste, and when rubbed with water emit a characteristic odour.

Both varieties of almonds yield on expression about 50 per cent. of Oleum Amygdalæ. This consists almost entirely of olein—and whether obtained from the bitter or sweet variety is the same in composition and properties, being almost odourless, with a bland oleaginous taste; it becomes rancid on exposure to air, but does not dry. Both varieties of almonds also contain *Emulsine* or *Synaptase*, an albuminous principle which is soluble in water; they also contain sugar, gum, woody fibre, and inorganic salts, chiefly phosphates of potash, lime, and magnesia. In addition to these, the bitter almonds contain about 2½ per cent. of a peculiar white crystalline glucoside, Amygdaline ($C_{20}H_{27}NO_{11}+3H_2O$), which is soluble in water and alcohol. On moistening bitter almonds the Amygdaline is acted on by the Emulsine, and a species of fermentation ensues resulting in the formation of *hydrocyanic acid* and *volatile oil of bitter almonds*, or *hydride of benzoyl* (C_7H_5O, H), together with a little glucose and formic acid, thus—

$$C_{20}H_{27}NO_{11}+2H_2O=HCN+C_7H_6O+2C_6H_{12}O_6.$$

17 grains of Amygdaline mixed with 1 oz. of Emulsine furnish

1 grain of pure hydrocyanic acid, which is equivalent to 50 minims of the officinal dilute acid. Cold water should be used, for boiling water coagulates the Emulsine and prevents the fermentation.

The volatile oil of bitter almonds, when deprived of hydrocyanic acid, is not poisonous. On exposure to air it absorbs oxygen and is converted into Benzoic acid ($C_7H_6O_2$). The oil, which is sold in the shops, contains from 4 to 8 per cent. of hydrocyanic acid, and hence is extremely poisonous. The acid may be separated by agitating the oil with a mixture of milk of lime and ferrous chloride, and then distilling.

Amygdala Dulcis.

The sweet or Jordan almonds are above an inch in length, are lanceolate, acute, with a clear cinnamon-brown seed coat; they are odourless, but the kernel has a bland, sweetish nutty flavour. They do not evolve the odour of bitter almonds when bruised with water. Almonds should be entire, dry, white and brittle; when of bad quality or when long kept, they are soft, flexible, and translucent. By soaking in warm water, the seed-coats are removed, and the kernels are then termed "blanched almonds."

Sweet almonds have the same constitution as the bitter variety, but they do not contain *Amygdaline*, and they contain a rather greater quantity of sugar and fixed oil.

Cusso.

The flowers are diœcious, small, reddish brown, on hairy stalks, outer limb of calyx five-parted, the segments oblong or oblong-lanceolate and reticulated. The general colour of kousso, viewed *en masse*, is yellowish green; it has a tea-like odour. Kousso contains a volatile oil, gum, sugar, tannic acid, wax, an acrid bitter resin, and a crystallisable principle, *Koussine* or Kosin ($C_{31}H_{38}O_{10}$). It forms fine yellow rhombic crystals, which are tasteless, insoluble in water, but freely soluble in boiling alcohol, in ether, chloroform, benzol, glacial acetic acid, and in solutions of caustic alkalies and of alkaline carbonates.

The infusion and decoction of kousso are turned a dark-green with persalts of iron.

"Red cusso" consists of the female flowers with a large reddish calyx, and is said to be the most active.

Prunum.

The dried drupe of the plum is about an inch long, ovate, wrinkled, black, and with a sweet, somewhat austere taste. It contains free malic acid, about 25 per cent. of glucose, gum, pectin, oxalate of lime, and a purgative principle of an unknown nature.

Laurocerasi Folia.

The Cherry-laurel has no relation with the true laurel or sweet Bay-tree (Laurus nobilis). The leaves are from four to five inches long and about two broad; they are ovate-lanceolate or elliptical, coriaceous, distinctly toothed, furnished with glands at the base; smooth, shining, and deep green on the upper surface, but dull and of a lighter colour on the under-surface; they are borne on strong, short foot-stalks. Cherry-laurel leaves emit a ratafia odour when bruised. On distillation with water they yield volatile oil and some hydrocyanic acid, neither of which pre-exist in the leaves. The latter, however, contain Amygdaline and Emulsine or analogous substances, by the mutual reaction of which the oil and acid are formed. The volatile oil resembles that of bitter almonds in composition and properties. The leaves also contain sugar, fat, and a little tannic acid. The proportion of hydrocyanic acid yielded varies with the time of year, only half as much being obtained in winter as in July and August.

Rosæ Caninæ Fructus.

The ripe fruit or hips of the Dog-rose are about an inch or more in length—ovate, scarlet, smooth, and shining, with a sweet subacid pleasant taste. In making the confection they are deprived of their hairy "seeds" or achenes (fruit). The pulp contains citric and malic acids, citrates and malates of potash and lime, tannic acid, sugar, gum, and a trace of volatile oil.

Rosæ Centifoliæ Petala.

The fully expanded petals have a sweetish, bitter and faintly astringent taste and roseate odour, both readily imparted to water. They may be preserved fresh for some time by compressing them with alternate layers of common salt in closed vessels. Unlike the petals of Rosa gallica their fragrance is diminished by desiccation.

The odour is due to the presence of about 0·04 per cent. of a volatile oil known as Attar, or Otto, of Roses, which is prepared in the East. It is a bright oil with a faint straw-coloured tinge, having a specific gravity of from ·87 to ·89. It becomes solid when mixed with alcohol, or when heated up to between 60° and 68°, owing to the formation of crystalline lamellæ of Stearoptene ($C_{20}H_{40}$), which is present in the proportion of about 18 per cent. in Turkish oil, and 60 per cent. in inferior English oils. Attar of Roses is adulterated with geranium oil, the volatile oil of Andropogon Schœnanthus.

The petals also contain colouring matter, a slight laxative principle, traces of tannic, gallic, malic, and tartaric acids, fat, resin, and sugar.

Rosæ Gallicæ Petala.

The unexpanded petals of the French rose have a fine purplish-red colour, which is retained after drying, but which is impaired on exposure to light and air; their taste is bitterish, feebly acid and astringent; their odour is roseate and is developed by drying. They contain red colouring matter which has not yet been isolated; they also contain tannic and gallic acids, hence the infusion gives a dark colour with ferruginous salts and a slight precipitate with gelatine; they contain, moreover, a glucoside called *Quercitrin* ($C_{33}H_{30}O_{17}H_2O$), the yellow crystallisable colouring matter in the bark of Quercus tinctoria; this, when boiled with dilute sulphuric acid, is resolved into glucose and *Quercetin* ($C_{27}H_{18}O_{12}$). Besides these, the petals contain a trace of volatile oil, a little fat, and sugar. An infusion of the petals becomes bright red with acids and green with alkalies.

MYRTACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CARYOPHYLLUS AROMATICUS Cloves (*East India Islands, &c.*)	Dried unexpanded flower-buds	Infusum Caryophylli Oleum Caryophylli	½ oz. to 1 pnt. —	1 to 4 ozs. 1 to 5 mins.	Stimulant. Carminative. Oil, locally in toothache, and as an adjunct to purgatives. Contained in Infus Aurant.Co., Mist. Ferri Ar., and Vinum Opii.
EUGENIA PIMENTA Pimento or Allspice (*West India Islands*)	Unripe fruit	Aqua Pimentæ Oleum „	14 ozs. to 1 gall. —	1 to 2 ozs. 1 to 5 mins.	Stimulant. Carminative. An adjunct to purgatives. Contained in Syrup. Rhamni.
MELALEUCA MINOR Cajeput (*Molucca Islands*)	Oil from leaves	Oleum Cajeputi Spiritus „	— 1 of oil in 50	1 to 5 mins. ½ to 1 drm.	Rubefacient, stimulant, antispasmodic, diaphoretic. Used in rheumatism, colic, hysteria, &c.
PUNICA GRANATUM Pomegranate (*South of Europe*)	Dried bark of root	Decoctum Granati Radicis	2 ozs. to 1 pnt.	1 to 2 ozs.	Tæniacide.

Caryophyllum.

Cloves are nail-like in appearance, about six lines long, dark reddish-brown, plump, and heavy, consisting of a nearly cylindrical body or calyx-tube surmounted by four teeth, and a globular head, which is the unopened corolla. They possess a strong fragrant odour and a bitter, spicy, pungent taste; they emit oil when indented with the nail. Inferior cloves are light, wrinkled, yellowish, and of a feeble taste and odour. The best cloves come from Amboyna. Mother cloves are the dried fruits of the clove tree.

Cloves contain about 18 per cent. of a volatile oil, some salicylic acid, resin, a variety of tannin, lignin, and water.

The volatile oil consists of a hydrocarbon ($C_{10}H_{16}$) which is isomeric with oil of turpentine; this holds in solution *Eugenic acid* ($C_{10}H_{12}O_2$); a crystalline body, *Caryophylline* ($C_{10}H_{16}O$), isomeric with camphor; and, lastly, *Eugenine*, which is probably isomeric with Eugenic acid. Volatile oil of cloves is light yellow when fresh, but gradually becomes red-brown from a resinous change in the Eugenic acid; its specific gravity is 1·055 to 1·060, being one of the few volatile oils which are heavier than water; it has the odour and taste of cloves.

Solutions containing cloves strike black with ferruginous salts. The infusion and the oil are reddened by nitric acid, and turned blue by perchloride of iron—giving, in fact, the same colours as morphia. The infusion and oil of pimento are similarly affected.

Pimenta.

The allspice fruit, or "Jamaica pepper," as it is sometimes called, is gathered before it ripens, for, if allowed to ripen, it loses its aromatic warmth and acquires a flavour like that of juniper. It is about the size of a small pea, brown, rough, crowned with the teeth of the calyx, yellowish within, and containing two dark-brown seeds; the odour and taste is aromatic, hot, and peculiar. It contains about from 3 to 4½ per cent. of a volatile oil, which is heavier than water and appears to be identical with that of cloves. Allspice also contains a fixed oil, resin, a large quantity of tannin, starch, &c.

Oleum Cajuputi.

Very mobile, transparent, of a fine pale bluish-green colour. It has a strong, disagreeable odour, and a warm aromatic taste, leaving a sensation of coldness in the mouth; its specific gravity is 0·925. When distilled, a colourless oil comes over which is *Hydrate of Cajuputene* ($C_{10}H_{16}.H_2O$). This constitutes two-thirds of the crude oil.

Copper has been detected as an adulteration of oil of cajuput, probably owing to its having been kept in copper vessels to preserve its colour. Camphor dissolved in oil of rosemary and coloured with copper has been said to have been substituted for the genuine oil.

Granati Radicis Cortex.

Occurs in quills or fragments of a grayish-yellow colour externally and yellow internally. When the inner surface is moistened with water and rubbed on paper it produces a yellow stain which is rendered blue by ferrous sulphate, and rose colour by nitric acid. The bark breaks with a short fracture, has but little odour, and an astringent, very slightly bitter. It contains about 20 per cent. of *Punico-tannic* acid ($C_{20}H_{16}O_{13}$), a little gallic acid, some mannite, and a principle termed *Punicine*.

It is sometimes adulterated with the root-bark of box and the branch-bark of barberry.

The fruit of the pomegranate was formerly officinal; it resembles an orange, but has a coriaceous rind, and is crowned with a toothed calyx. The rind contains about 20 per cent. of tannin, together with extractive and mucilaginous matters.

CUCURBITACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CITRULLUS COLOCYNTHUS Colocynth (*Mediterranean Shores*)	Pulp of fruit	Pil. Colocynth Extr. Coloc. Co. Pil. Colocynth. Co Pil. Colocynth. et Hyoscyami	— 1 in $4\frac{1}{2}$ 1 in 6 1 in 9	2 to 8 grs. 3 to 10 grs. 5 to 10 grs. 5 to 10 grs.	Drastic purgative. In constipation, dropsy, amenorrhœa, cerebral affections.
ECBALIUM OFFICINARUM Squirting or Wild Cucumber (*Southern Europe*)	Nearly ripe fruit	Elaterium Pulv. Elaterii Co.	— —	$\frac{1}{16}$ to $\frac{1}{2}$ gr. $\frac{1}{2}$ to 5 grs.	Hydragogue purgative in dropsies.

Colocynthidis Pulpa.

The wild cucumber is an annual creeping plant, bearing considerable resemblance to the common water-melon. The fruit was formerly imported from Mogador unpeeled, but is now obtained only from the Mediterranean ports peeled. It is a globular pepo, about the size of an orange, with a hard, yellow rind. The pulp is light, spongy, white or yellowish-white, having an intensely bitter taste. The oval, brownish seeds form about 72 per cent. of the weight of the fruit, and are ordered to be removed.

Colocynth pulp contains a crystallisable glucoside, *Colocynthin* ($C_{56}H_{84}O_{23}$), which is soluble in water and alcohol, but not in ether, and is decomposed by boiling with acids into glucose and a resin, *Colocynthein* ($C_{44}H_{64}O_{13}$). Walz has also separated another principle, *Colocynthitin*, a tasteless crystalline powder. The pulp also contains a bitter resin, a bitter principle, mucilaginous matters, lignin, and phosphates of lime and magnesia.

Ecbalii Fructus.

The wild or Squirting cucumber is a monœcious trailing plant like the common cucumber, but without tendrils. The leaves are large, rough, and irregularly cordate, and the yellow flowers spring from their axils. The fruit is a small elliptical pepo, about 1½ inch long, green, covered with soft prickles, and containing the seeds surrounded by a juicy tissue; these, when the fruit is ripe, are expelled forcibly through an opening in the base—hence the name of the plant. The cause of the bursting is the osmose of the thin outer fluid into the thick central fluid, which is surrounded by a delicate membrane. This goes on until at last the fruit yields at its weakest point—namely, at its attachment to the stalk.

Elaterium.

Is prepared by taking a pound of the nearly ripe fruit of the squirting cucumber and cutting it lengthwise; the juice is then lightly pressed out, strained through a hair sieve, and set aside to deposit. The supernatant liquor is then carefully poured off, and the sediment is collected on a linen filter and dried on porous tiles with a gentle heat. The decanted fluid may deposit a second portion of sediment which can be dried in the same way. Elaterium so prepared was formerly termed the extract. About half an ounce of elaterium is yielded by 40 pounds of the fruit.

Elaterium occurs in light, slightly incurved cakes, somewhat resembling vulcanised India-rubber, about one line thick, greenish-gray, acrid and bitter, with a finely granular fracture. It does not effervesce with acids, showing the absence of chalk; and does not give a blue colour with iodine, indicating the absence of starch. It yields half its weight to boiling rectified spirit; this, when concentrated and added to warm solution of potash, should yield, on cooling, not less than 20 per cent. of *Elaterine* in colourless crystals. Inferior elaterium is thicker, darker, less easily broken, and sinks in water; the Maltese is inferior to the English variety.

Elaterine, or *Elatin* or *Momordicine* ($C_{20}H_{28}O_5$), is the active principle. It is soluble in alcohol, but very slightly so in water or ether, and is insoluble in alkaline solutions; hence is precipitated on adding caustic potash to its alcoholic solution. According to Hanbury and Flückiger chloroform is the best solvent of it. Elaterium also contains a green resinous matter, which is soluble in ether, together with woody fibre, &c.

Starch and flour or chalk are used to adulterate elaterium.

UMBELLIFERÆ.

Name and Habitat	Part Used	B.P. Preps.	Strength	Dose	Action and Use
Conium Maculatum Hemlock (*Britain*)	a. Fresh leaves and young branches	Extractum Conii	—	2 to 6 grs.	Causes paralysis by affecting the motor nerves. Locally, destroys nervous conductivity. Is therefore sedative and antispasmodic.
		Pil. Conii Co.	—	5 to 10 grs.	
		Vapor Conii	—	—	
		Succus Conii	—	½ to 1 drm.	
	b. The dried leaves	Pulvis Conii	—	2 to 8 grs.	
		Cataplasma „	—	—	
	c. The dried ripe fruit	Tinctura „	54½ grs. to 1 oz.	20 to 60 mins.	
Narthex Assafœtida Assafœtida (*Persia & Northern India*)	Gum-resin obtained by incisions into the root	Assafœtida	—	5 to 20 grs.	Stimulant, antispasmodic. Useful in hysteria and tympanitis.
		Enema Assafœt.	30 grs. to 4 oz.	—	
		Pil. Aloes et Assafœtidæ	1 pt. in 4	5 to 10 grs.	
		Pil. Assafœt. Co.	1 pt. in 3½	5 to 10 grs.	
		Spt. Ammoniæ Fœtidus	33 grs. to 1 oz.	½ to 1 drm.	
		Tinct. Assafœt.	54½ grs. to 1 oz.	½ to 1 drm.	
Ferula Galbaniflua Galbanum (*India and Levant*)	Gum-resinous exudation	Empl. Galbani	1 pt. in 11	—	Stimulating expectorant. Plaster used to discuss tumours. In Pil. Assafœtid. Co.
Dorema Ammoniacum Ammoniacum (*Persia and India*)	Gum-resinous exudation	Empl. Ammoniaci cum Hyd.	12 pts in 15	—	Stimulating expectorant and local irritant. Enters into Empl. Galbani, Pil. Scillæ Co., and Pil. Ipecac. cum Scilla.
		Mist. Ammoniaci	13½ grs. to 1 oz.	½ to 1 oz.	
Pimpinella Anisum Anise (*Southern Europe*)	Fruit	Oleum Anisi	—	2 to 5 mins.	Aromatic stimulant and carminative. Used to relieve flatulence. Oleum contained in Tinct. Camph. Co. and Tinct. Opii Ammon.
		Essentia „	1 vol. in 5	10 to 20 mins.	
Fœniculum Dulce Sweet Fennel (*Southern Europe*)	Fruit	Aqua Fœniculi	1 ℔. to 1 gall.	1 to 2 ozs.	Aromatic stimulant and carminative. Relieves flatulence.
Coriandrum Sativum Coriander (*Europe*)	Fruit	Oleum Coriandri	—	2 to 5 mins.	Aromatic stimulant and carminative. Used to prevent griping of purgative medicines. In Syrup. and Tinct. Rhei and Confect. and Tinct. Sennæ. The oil is contained in Syr. Sennæ and in Mist. Gentian.
Carum Carui Caraway (*Mid Europe*)	Fruit	Aqua Carui	1 ℔. to 1 gall.	1 to 2 ozs.	Stimulant carminative. Relieves flatulence. The fruit is contained in Conf. Piperis, Pulv. Opii Co., Tinct. Card. Co., and in Tinct. Sennæ; and the oil in Conf. Scammonii and in Pil. Aloes Barb.
		Oleum „	—	2 to 5 mins.	
Anethum Graveolens Dill (*Southern Europe*)	Fruit	Aqua Anethi	1 ℔. to 1 gall.	1 to 2 oz.	Stimulant carminative. Useful in flatulence of children and as an adjunct to purgatives.
		Oleum „	—	2 to 5 mins.	
Euryangium Sumbul Sumbul or Musk-root (*Bokhara*)	Root	Tinctura Sumbulis	54½ grs. to 1 oz.	10 to 30 mins.	Nervine stimulant and antispasmodic.

Conii Folia et Fructus.

The leaves are best gathered when the flowers begin to fade. They are decompound, smooth, arise from a smooth stem, which is not swollen at the nodes, but is marked with dark purple spots. The dried leaves are of a full green colour, and emit a characteristic odour; they should be preserved in cool, closed, opaque and dry vessels. The fruit is about one-tenth of an inch long, dull gray, broadly ovate, compressed laterally, splits readily when ripe into two 5-ribbed half fruits (mericarps), and is distinguished from other umbelliferous fruits by having undulating crenated edges and no vittæ. According to Dr. J. Harley's researches, the dried ripe fruit is almost inert. The leaves and fruit rubbed with solution of potash give out a powerful odour.

Both leaves and fruit contain a non-poisonous volatile oil, to which the characteristic odour is due; they also contain *Conia* or *Cicutine* ($C_8H_{15}N$), a volatile liquid alkaloid which exists in combination with *Conic acid.* An ounce of the fruit yields about 3 grains of the alkaloid. Conia is colourless when pure, and has a peculiar, mouse-like odour; its specific gravity is ·87; it is soluble in ether and alcohol; it is slightly soluble in water, and more so in cold than in hot; it enters into combination with water, forming a *hydrate of Conia.*

Conia is the only alkaloid besides *Aniline* which coagulates albumen. It is strongly alkaline, neutralising strong acids; sulphuric acid turns it purplish-red changing to green; with nitric acid it gives a blood-red colour; warmed gently with hydrochloric acid it forms a bluish-green crystalline mass. When exposed to the air, conia is resolved into ammonia and a bitter non-poisonous extractive. It produces a greasy stain on paper which disappears on heating. Conia is always associated with a variable proportion of *Methyl-conia* ($C_8H_{14}CH_3N$), a base which closely resembles it in physical properties. Hemlock also contains another base, *Conhydrine* ($C_8H_{15}N.H_2O$), which is strongly alkaline and sublimes in colourless needles.

Conia is set free from its combination in the plant by potash, when it may be distilled, and is recognised by its odour and the fumes which it gives with hydrochloric acid; its vapour is inflammable. Conia has been artificially prepared by Schiff by the action of ammonia on butyl-aldehyd with the aid of heat. The dried leaves of Hemlock, even when most carefully prepared, sometimes fail to yield conia; the most efficient preparations are obtained from the green and *nearly* ripe fruit.

The leaves of several species of Chærophyllum, especially C. Anthriscus and those of Æthusa Cynapium, or Fool's Parsley, may be confounded with hemlock leaves. The development of the odour of conia on adding solution of potash is the conclusive distinction between them.

Assafœtida.

This is met with in irregular masses, partly composed of tears; it is moist when recent, but gradually becomes hard and dry. The colour of a freshly-cut or broken piece is opaque white, but it soon becomes purplish-pink and ultimately dull yellowish or pinkish-brown, owing to the action of air and light on the resinous ingredient; its taste is bitter, nauseous, and acrid, and the odour is fœtid, alliaceous, and persistent. Assafœtida dissolves almost entirely in rectified spirit, showing the absence of mechanical impurities, as sand, stones, &c. Pulverisation of it is facilitated by trituration with carbonate of ammonia, or by incorporating with it while warm from 4 to 10 per cent. of magnesia.

Assafœtida contains about 4 per cent. of volatile oil, on which its odour depends, and which consists of a mixture of Sulphide of Allyl [$(C_3H_5)_2S$] and Sulphide of Hexyll [$(C_6H_{11})_2S$]. The volatile oil is at first colourless, but becomes yellowish and rancid on exposure; it is soluble in alcohol and ether, but requires more than 2,000 times its weight of water to dissolve it; the presence of sulphur in it is shown by the formation of sulphuret of mercury on rubbing it with mercury. Silvered pills of assafœtida too become blackened owing to the formation of sulphide of silver.

Assafœtida also contains about 65 per cent. of resin; this yields a crystallisable acid, *Ferulaic acid* ($C_{10}H_{10}O_4$); with caustic potash it yields *Resorcin* ($C_6H_6O_2$), a homologue of *Orcin;* when subjected to dry distillation, it yields greenish and purplish oils and about ¼ per cent. of *Umbelliferone* ($C_9H_6O_3$), which is isomeric with *Quinone.* Assafœtida also contains 25 per cent. of gum, some saline matter, and traces of malic, acetic, formic, and valerianic acids.

Galbanum.

Occurs in irregular tears about the size of a pea, agglutinated into masses of a greenish yellow colour, translucent, having a strong disagreeable odour and an acrid bitter taste. With water it forms an imperfect emulsion, and is almost entirely soluble in proof spirit. It contains about 3·5 per cent. of volatile oil which does not contain sulphur, and which is isomeric with oil of turpentine ($C_{10}H_{16}$); it also contains about 65 per cent. of a dark, yellowish-brown, transparent, brittle, and tasteless resin. This yields *Umbelliferone* ($C_9H_6O_3$), a blue oil ($C_{20}H_{30}O$) which appears to be identical with blue oil of chamomile, and a colourless oil ($C_{20}H_{30}$). When fused with caustic potash the resin yields *Resorcin,* acetic, and volatile fatty acids.

Ammoniacum.

In tears or masses. The tears are from two to eight lines in diameter, pale cinnamon-brown, breaking into a smooth, shining, opaque, white surface. The masses are composed of agglutinated tears. Ammoniacum is hard and brittle when cold, but softens readily with heat; at a red heat it burns with a white flame. It has a faint peculiar odour, and a bitter, acrid, nauseous taste. Its specific gravity is 1·2. Rubbed with water it forms a nearly white emulsion, the resin and oil being suspended by the dissolved gum. It is soluble in ether and alcohol.

Ammoniacum contains about 70 per cent. of resin, which is partly acrid and partly neutral; likewise about 4 per cent. of volatile oil, which does not contain sulphur, and about 20 per cent. of gum. It is destitute of *Umbelliferone*, but yields a little *Resorcin* when fused with potash.

Rubbed up with camphor, ammoniacum forms at once a mass suitable for pills.

Anisi Oleum.

The fruit which is termed Aniseed is not now officinal. The separated mericarps, or so-called seeds, are oblong-ovate, whitish-brown, downy, with five primary ridges (*juga*), which are smooth and not crenulated at the margins; there are three vittæ or oil-ducts in each channel. The fruit of hemlock has been mistaken for that of anise; but it may be at once distinguished by the development of the mouse-like odour from the former on trituration with potash.

The volatile oil of anise is of a light straw colour, with a warm sweetish taste. Its specific gravity is 0·977 to 0·99, but increases with age. It concretes at 50°, and is soluble in all proportions in alcohol. By exposure to air it forms a resin and becomes less disposed to concrete. Oil of anise consists of two portions, one-fifth being constituted of a liquid oil isomeric with oil of turpentine ($C_{10}H_{16}$), and four-fifths consisting of an oil which solidifies below 50°. This latter, Anethol or Anise-Camphor ($C_{10}H_{12}O$), is easily oxidised, and then yields substances which may be regarded as compounds containing the radicle *Anisyl* ($C_8H_7O_2$). Dilute nitric acid converts oil of anise into oxalic and *Anisic* acids ($C_8H_8O_3$), and *Anisyl hydrate* ($C_8H_8O_2$), which is homologous with oil of meadow sweet, and has the odour of new hay.

Oil of anise is sometimes adulterated with spermaceti, which is known to be present by its insolubility in cold alcohol; it is also adulterated with wax, camphor, and alcohol. Oil of Star-Anise (page 99) is sometimes sold for it, and may be distinguished by the fact that it retains its fluidity at 35°.

Fœniculi Fructus.

The fruits or so-called seeds are about three lines long and one broad, elliptical, slightly curved, beaked, having eight pale-brown longitudinal ridges—the two lateral being double; the taste and odour are aromatic. The fruits yield from 3 to 4 per cent. of volatile oil, which is of a light yellow colour, and possesses the odour of the seeds; it is the active ingredient, and nearly corresponds in proximate composition to oil of anise. Fennel fruit also contains sugar and about 12 per cent. of fixed oil.

Coriandri Fructus et Oleum.

Coriander fruit is globular, nearly as large as white pepper, beaked, finely ribbed, yellowish-brown; it acquires an aromatic odour and flavour when kept, but all parts of the fresh plant are very fœtid when bruised. It consists of two adherent carpels, which are readily separated The oil ($C_{10}H_{16}.\ H_2O$) is yellowish, and has the odour of the fruit. It consists chiefly of a mixture of two oils, one a volatile oxygenated oil, and the other a less volatile non-oxygenated oil. Its specific gravity is 0·859 to 0·871; it is soluble in alcohol, ether, and glacial acetic acid.

Carui Fructus et Oleum.

The carraway seed, so called, usually separates into two parts (mericarps); they are dark brown, are about two lines long, are slightly curved, and taper at the ends; they have five fine filiform ridges and contain a single vitta in each channel. The longitudinal ridges are of a lighter colour than the intervening interstices; they possess an agreeable aromatic odour and taste.

Carraway fruit contains a volatile oil which is colourless at first but becomes yellowish on keeping; its specific gravity is 0·946. It consists of two portions—one unoxidised, *Carvene* ($C_{10}H_{16}$), and the other oxidised, *Carvol* ($C_{10}H_{14}O$), which is isomeric with *Menthol*, *Myristicol*, and *Thymol*. Oil of Carraway has the characteristic odour and taste of the fruit.

Anethi Fructus et Oleum.

The fruits, or so-called "Dill-seeds," are brown, oval, somewhat flattened, about a line and a half long, convex on one side, concave on the other; the Indian fruit is narrower and more convex. They have five primary ridges and one vitta in each channel. They are surrounded by a pale membranous margin.

The oil is pale yellow, with a pungent odour and an acrid sweetish taste. It resembles oil of carraway, and according to Gladstone it consists of a hydrocarbon, *Anethene*, isomeric with oil of turpentine, and an unoxidised oil ($C_{10}H_{14}O$) identical with *Carvol*.

Sumbul Radix.

The pieces are nearly round, from 2½ to 5 inches in diameter, and from ¾ to 1½ inch thick. They are covered on the outer edge with a dusky-brown rough bark, frequently beset with short bristly fibres. The interior is porous and consists of irregular easily separated fibres. It has a strong musk-like odour. The taste is at first sweetish, becoming after a time bitterish and balsamic. That brought from India differs from the Russian variety in being closer in texture, denser and firmer, and of a reddish tint.

Sumbul root yields about 9 per cent. of a balsamic resin, a little volatile oil, some *Umbelliferone*, about ·75 per cent. of *Angelic acid*, and a trace of *Valerianic acid.* Solution of potash converts the resin into Sumbulic acid, which has a strong odour of musk.

CAPRIFOLIACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
SAMBUCUS NIGRA Elder Flowers *(Indigenous)*	Fresh flowers	Aqua Sambuci	10 lbs. to 1 gal.	1 to 2 oz.	Used as a cosmetic and vehicle for lotions.

Sambuci Flores.

These are small, white, fragrant, crowded in large five-parted cymes. They yield on distillation a volatile oil which is easily altered by exposure to air; it contains a hydrocarbon, *Sambucene* ($C_{10}H_{16}$), and perhaps a camphor. The active ingredients of Elder flowers are soluble in water.

CINCHONACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CINCHONA CALISAYA Cinchona Flava, Yellow Cinchona *(Bolivia and Southern Peru)*	Bark	Pulv.Cinch.Flav.	—	10 to 60 grs.	Tonic, antiperiodic, antipyretic, astringent. Given in fevers, malarious diseases, neuralgias, debility, etc.
		Decoct. „ „	27½ grs. to 1 oz.	1 to 2 ozs.	
		Ext. Cinch. Flav. Liquid.	1 pd. to 4 ozs.	10 to 30 mins.	
		Infus.Cinch.Flav.	22 grs. to 1 oz.	1 to 2 ozs.	
		Tinct. „ „	88 grs. to 1 oz.	½ to 2 drms.	
		Quiniæ Sulphas	—	1 to 10 grs.	
CINCHONA CONDAMINEA Cinchona Pallida Pale Cinchona *(Ecuador, South America)*	Bark	Pulv. Cinch. Pal.	—	10 to 60 grs.	Same as Yellow Bark. Contained in Mist. Ferri Aromatica.
		Tinct. Cinch. Co.	44 grs. to 1 oz.	½ to 2 drms.	
CINCHONA SUCCIRUBRA Cinchona Rubra Red Cinchona *(Chimborazo, South America)*	Bark	Pulv.Cinch.Rubr.	—	10 to 60 grs.	Same as Yellow Bark.

Cinchonaceæ—Continued.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CEPHAELIS IPECACUANHA Ipecacuanha (*Brazil*)	Dried root	Pulv. Ipecac.	—	Expect., ¼ to 2 grs. Emetic, 15 to 20 grs.	Depressing emetic, expectorant, diaphoretic, antidysenteric. Contained in Pil. Conii Co.
		Pil. Ipecac. cum Scillæ	1 pt. in 23 nearly	5 to 10 grs.	
		Pulv. Ipecac. Co.	1 pt. in 10	5 to 15 grs.	
		Troch. Ipecac.	¼ gr. in each	1 to 3	
		Troch. Morph. et Ipecac.	$\frac{1}{12}$ gr. in each	1 to 6	
		Vinum Ipecac.	22 grs. to 1 oz.	Expect., 5 to 20 mins. Emetic, 3 to 6 drms.	
UNCARIA GAMBIR Pale Catechu (*Singapore*)	Extract from leaves and young shoots	Pulv. Catechu	—	10 to 30 grs.	Astringent in diarrhœa, atonic dyspepsia, hæmorrhages, mucous discharges. As a gargle in hoarseness, &c.
		Infusum ,,	16 grs. to 1 oz.	1 to 2 ozs.	
		Pulv. Catech. Co.	1 pt. in 2¼	20 to 40 grs.	
		Tinct. Catechu	54¾ grs. to 1 oz.	½ to 2 drms.	
				1 to 6 drms.	
		Trochisci ,,	1 gr. in each	—	

Cinchonæ Flavæ Cortex, C. Pallidæ Cortex, C. Rubræ Cortex.

Cinchona bark was formerly known as "Jesuits' bark," from its extensive sale and distribution by the Jesuits.

The bark varies in its characters and richness in alkaloids according to the part of the plant from which it is taken and the position of the growth of the plant. Cinchona plantations are now successfully cultivated on the Neilgherry hills and in the valleys of the Himalaya. It has been discovered that covering the trunk of the trees with moss for some time increases the yield of alkaloids, and if the trunk be stripped of some of its bark, and the wound covered with moss, new bark will form which is richer in alkaloids than the original bark. According to De Vrij the root-bark of many Cinchonas is richer in alkaloids than the stem-bark.

The true or YELLOW BARK usually occurs in flat pieces, uncoated or deprived of the periderm, from 6 to 18 inches long, 1 to 3 inches wide, and 2 to 4 lines thick, compact and heavy; outer surface brown, marked by broad, shallow, irregular, longitudinal depressions; inner surface tawny-yellow, fibrous; transverse fracture shortly and finely fibrous. Powder, cinnamon-brown, somewhat aromatic, persistently bitter.

PALE CINCHONA BARK, known as Crown or Loxa bark, occurs always in single or double quills, from 6 to 15 inches long, 2 to 8 lines in diameter, and from ½ a line to 1 line thick, brittle, easily splitting longitudinally, and breaking with a short transverse fracture; outer surface brown and wrinkled, or gray and speckled with adherent lichens, with or without numerous transverse cracks;

inner surface bright orange or cinnamon-brown; powder, pale brown, slightly bitter, very astringent.

RED CINCHONA BARK occurs in flat incurved pieces, less frequently in quills, coated with the periderm, varying in length from a few inches to 2 feet, from 1 to 3 inches wide, and 2 to 6 lines thick, compact and heavy; outer surface brown or reddish-brown, rarely white, from adhering lichens, rugged or wrinkled longitudinally, frequently warty, and crossed by deep transverse cracks; inner surface redder; fractured surface often approaching to brick-red; transverse fracture finely fibrous; powder, red-brown; taste, bitter and astringent.

The following table, taken from Smith's Commentary, well contrasts the characters of the officinal barks:—

YELLOW	PALE	RED
Usually in flat uncoated pieces.	Always in narrow cylindrical quills.	Usually in flat uncoated pieces; thick and compact.
Outer surface brown; inner, tawny-yellow, fibrous.	Outer surface brown, or gray, and speckled with lichens; inner, cinnamon-brown.	Outer surface reddish-brown, frequently warty; inner, redder; fracture, brick-red.
Powder, cinnamon-brown.	Powder, pale-brown.	Powder, red-brown.
Taste, very bitter, slightly astringent.	Taste, slightly bitter, very astringent.	Taste, bitter and astringent.
Infusion is precipitated by sodic sulphate.	Infusion is not precipitated by sodic sulphate.	Infusion is not precipitated by sodic sulphate.
Contains at least 2 *per cent.* of quinia exclusive of other alkaloids.	Contains at least 0·5 *per cent.* of alkaloids, *i.e.*, of quinia and cinchonia.	Contains at least 1·5 per cent. of alkaloids, *i.e.*, of quinia and cinchonia.

Besides the above-named officinal barks there are others which are extensively employed for the extraction of alkaloids; the most important of these are Fibrous Carthegena bark and Gray bark.

Fibrous Carthegena bark, called also Spongy or Orange Carthegena bark, Bogota, and Coquetta bark, is yielded by *Cinchona lancifolia.* It occurs in quills or flat pieces of a yellow or orange colour, often covered on the surface with lichens, and characterised by its spongy or fibrous texture. It yields an abundance of quinidia together with some quinia and cinchonia.

Gray bark, called also Silver or Huanuco bark, is yielded by *Cinchona micrantha* and *Cinchona nitida*, the produce of the latter being superior. It occurs in coarse quills, with a grayish epidermis. It is less wrinkled longitudinally and less crooked transversely than Pale bark. It yields quinia, or quinine, quinidia, and cinchonidia.

Those barks contain the largest amount of quinine which, on fracture, show a homogeneous texture with numerous short fusiform fibres scattered uniformly in the cellular tissue. Barks rich in quinine, as a rule, contain much lime, and hence their infusions are precipitated by sodic sulphate, which is not the case with barks yielding cinchonia; gum is most abundant in barks rich in the latter alkaloid.

Quantitative estimation of the alkaloids in Peruvian Bark (B.P.).

1. *Yellow Bark.*—Boil 100 grains of the bark, reduced to a very fine powder, for a quarter of an hour in a fluid ounce of distilled water acidulated with 10 minims of hydrochloric acid, and allow it to macerate for twenty-four hours. Transfer the whole to a small percolator, and after the fluid has ceased to drop, add at intervals about an ounce and a-half of similarly acidulated water, or until the fluid which passes through is free from colour. Add to the percolated fluid solution of subacetate of lead, until the whole of the colouring matter has been removed, taking care that the fluid remains acid in reaction. Filter and wash with a little distilled water. To the filtrate add about 35 grains of caustic potash, or as much as will cause the precipitate which is at first formed to be nearly redissolved, and afterwards 6 fluid drachms of pure ether. Then shake briskly, and, having removed the ether, repeat the process twice with 3 fluid drachms of ether, or until a drop of the ether employed leaves on evaporation scarcely any perceptible residue. Lastly, evaporate the mixed ethereal solutions in a capsule. The residue, which consists of nearly pure Quinia, when dry, should weigh not less than 2 grains, and should be readily soluble in dilute sulphuric acid.

2. *Pale Bark.*—200 grains of the bark, treated in the manner directed in the test for yellow cinchona bark, with the substitution of chloroform for ether, should yield not less than 1 grain of alkaloids.

3. *Red Bark.*—100 grains of the bark, treated in the manner directed in the test for yellow cinchona bark, with the substitution of chloroform for ether, should yield not less than 1·5 grains of alkaloids.

In the extraction of quinine from yellow bark, ether is used, being the best solvent; while in the case of pale and red bark, chloroform is used in order to extract the cinchonia which is not soluble in ether.

The chief constituents of cinchona barks are:—

Alkaloids:—

Quinia	$C_{20}H_{24}N_2O_2.3H_2O$
Quinidia	$C_{20}H_{24}N_2O_2.2H_2O$
Quinamia	$C_{20}H_{26}N_2O_2$
Cinchonia	$C_{20}H_{24}N_2O$
Cinchonidia	$C_{20}H_{24}N_2O$

Acid principles:—

Quinic or Kinic acid	$C_7H_{12}O_6$
Cincho-tannic acid	$C_{14}H_{12}O_7,H_2O$
Cincho-fulvic acid	$C_{12}H_{14}O_7$
Quinovin	$C_{30}H_{48}O_8$
Quinovic acid	$C_{24}H_{38}O_4$

Quinia. Exists in largest quantity in Calisaya (yellow) bark. It may be obtained from the sulphate by precipitation with ammonia. When pure it is white and the hydrate is crystallisable, although with some difficulty. It is soluble in about 350 parts of cold water, in 60 parts of ether, and is very soluble in alcohol, chloroform, and in fixed and volatile oils. When heated, it fuses into a resinoid mass. It forms crystallisable salts with acids, and solutions of these in excess of the acid pass into a resinoid condition on exposure to sunlight; these solutions are very bitter, and yield a precipitate with tincture of galls, with gallic, tartaric, and oxalic acids, and with mercuric and argentic nitrates. Solutions of quinia exhibit a blue fluorescent appearance; and when treated with fresh strong chlorine-water and ammonia a dark emerald-green colour (*Thalleioquin*) is produced.

With sulphuric acid quinia forms three sulphates:—1. The normal or pharmacopœial sulphate $(C_{20}H_{24}N_2O_2)_2H_2SO_4+8H_2O$ (p. 151), which is sparingly soluble in water; 2. The acid or soluble sulphate $(C_{20}H_{24}N_2O_2,H_2SO_4+7H_2O)$, formed by adding a little dilute sulphuric acid to the officinal sulphate; and, 3. A di-acid sulphate $(C_{20}H_{24}N_2O_2,2H_2SO_4+7H_2O)$.

Cinchonia. Contained chiefly in pale bark. It crystallises from its alcoholic solution in four-sided prisms. It is soluble in about 120 parts of alcohol; is much less soluble in ether, and almost insoluble in water; solutions of the alkalies and alkaline bicarbonates readily dissolve it. With acids it forms soluble salts which have an intensely bitter taste. Solutions of the latter are not fluorescent, and do not give a green coloration with chlorine-water and ammonia; they are precipitated by infusion of galls, and by gallic, tartaric, and oxalic acids.

Quinidia. Is contained in many barks, especially those of New Granada. When pure, occurs in white prisms. It is less soluble in water and in ether than quinia; its sulphate is more soluble than that of quinia, and less so than that of cinchonia. Solutions of quinidia are fluorescent, and when treated with chlorine-water and ammonia give an emerald-green colour.

Cinchonidia. Occurs in striated rhomboidal prisms; forms crystallisable salts; is almost insoluble in ether. Solutions of it are not fluorescent, nor do they give the green coloration on being treated with chlorine and ammonia.

Quinamia is an alkaloid discovered in red bark by Hesse. It forms anhydrous crystals, which are soluble in ether, less so in alcohol, and but slightly soluble in boiling water. Its solutions do not exhibit fluorescence, and do not give a green coloration with chlorine and ammonia.

According to Pasteur, quinine and quinidine when carefully heated in the form of a salt, as the tartrate, are changed into an isomeric and similar but amorphous body, *Quinicine;* cinchonine and cinchonidine under like circumstances are converted into an isomeric substance, *Cinchonicine.*

Quinine and cinchonidine turn a plane of polarised light to the left; cinchonine and quinidine turn it to the right.

The substance termed *Quinoidine* consists of resinous and colouring matters with the cinchona alkaloids changed to a certain extent; it is obtained from the liquors from which sulphate of quinia has been crystallised.

Quinic acid. Crystallises in oblique rhombic prisms resembling tartaric acid in appearance; it is soluble in water, less so in alcohol, and sparingly soluble in ether; when distilled with some oxidising agents it yields a yellow, crystallisable, pungent sublimate, *Quinone* ($C_6H_4O_2$). By destructive distillation it yields benzol, benzoic acid, salicylic acid, carbonic anhydride, and *hydro-quinone* ($C_6H_6O_2$).

Cincho-tannic acid. Differs from ordinary tannic acid in giving a green precipitate with persalts of iron. It is very soluble in water, alcohol, and ether. On destructive distillation it yields *Pyro-catechin.* It is decomposed by alkalies, *Cincho-fulvic acid* being precipitated.

Cincho-fulvic acid or Cinchona-red. Exists naturally in the bark; may be produced by the oxidation of cincho-tannic acid. It is almost insoluble in water, but soluble in alcohol, ether, alkalies, and acids, and the solutions have a deep red colour.

Quinovin. Is an amorphous substance; almost insoluble in water, but soluble in ether and alcohol. By hydrochloric acid it is decomposed into *Quinovic acid* and *Quinova* sugar.

Quinovic acid. A feeble acid; insoluble in water, and sparingly soluble in alcohol, ether, or chloroform.

Besides the acids and alkaloids above mentioned the cinchona barks also contain tannin, starch, colouring matter, a thick volatile oil, a concrete fat gum, ligneous fibre, &c.

The following preparations of quinia are officinal:—

Name of Preparation	Strength	Dose
QUINIÆ SULPHAS	—	1 to 10 grs.
Ferri et Quiniæ Citras	16 pts. in 100	5 to 10 grs.
Pilula Quiniæ	3 pts. in 4	2 to 10 grs.
Tinctura Quiniæ	8 grs. in 1 oz.	½ to 2 drms.
Tinct. Quiniæ Ammoniata	8 grs. in 1 oz.	½ to 2 drms.
Vinum Quiniæ	1 gr. in 1 oz.	½ to 1 oz.

Quiniæ Sulphas.

Occurs in filiform silky snow-white crystals, of a pure intensely bitter taste, sparingly soluble in cold water (1 in 740), yet imparting to it a peculiar bluish tint. The solution gives with chloride of barium a white precipitate ($BaSO_4$) insoluble in nitric acid, and when treated first with solution of chlorine and afterwards with ammonia it becomes of a splendid emerald-green colour. Dissolves in pure sulphuric acid with a feeble yellowish tint, and undergoes no further change of colour when gently warmed (*vide infra*, Salicine). 10 grains with 10 minims of diluted sulphuric acid and half a fluid ounce of water form a perfect solution, from which ammonia throws down a white precipitate (quinia). This redissolves on agitating the whole with half a fluid ounce of pure ether, without the production of any crystalline matter floating on the lower of the two strata, into which the agitated fluid separates on rest. Crystals if present consist of quinidia, which is very slightly soluble in ether. 25 grains of the salt should lose 3·6 grains of water by drying at 212°.

ADULTERATIONS.—(*a*) *Sulphate of lime*, *Chalk*, and *Magnesia;* these are insoluble in alcohol, and when heated on platinum foil leave an ash, the nature of which is ascertained by the ordinary tests.

(*b*) *Cinchonia*, *Cinchonidia*, *and Quinidia;* detected by their different solubilities in water, alcohol, and ether.

(*c*) *Salicine;* gives a blood-red colour with sulphuric acid.

(*d*) *Sugars;* solution of the salt, after precipitation of the alkaloid by an alkali, is sweet.

(*e*) *Starch;* gives a blue colour with iodine.

(*f*) *Stearic acid;* is insoluble in dilute acids.

(*g*) *Boracic acid;* alcoholic solution burns with a green flame.

Ipecacuanha.

The Officinal, or Annulated, or Brazilian root occurs in pieces three or four inches long, about the size of small quills, contorted and irregularly annulated. Colour, brown of various shades. It consists of two parts—the cortical or active portion, which forms about 75 to 80 per cent. of the root, and a slender, tough, almost inert meditullium or woody centre. The powder of ipecacuanha is pale-brown, with a faint nauseous odour, and a somewhat acrid bitter, disagreeable taste, which, according to Dr. Paris, is covered by powdered gum arabic.

Striated or Peruvian Ipecacuanha is the produce of *Psychotria emetica*, N. O. Rubiaceæ, and is occasionally mixed with or substituted for the officinal root; it is of a dark colour and is wrinkled longitudinally. Undulated amylaceous ipecacuanha, yielded by various species of *Richardsonia*, N. O. Rubiaceæ, and also white Brazilian ipecacuanha derived from certain species of *Ionidium*, N. O. Violaceæ, have also been imported and confounded with the true root.

The powder of ipecacuanha is sometimes adulterated with almond-meal, and the imposition is detected by the development of the odour of prussic acid on moistening the powder with water and placing it in a warm place for half an hour.

Ipecacuanha contains about 1 *per cent.* of a feeble alkaloid *Emetine* ($C_{30}H_{44}N_2O_8$) united with *Cephaëlic* or *Ipecacuanic acid;* the former is a whitish amorphous powder with a bitter taste, is soluble in alcohol and sparingly so in water and ether, it is precipitated by tannin; its nitrate is remarkable for its insolubility in water. Cephaëlic acid is a glucoside, and occurs as an amorphous reddish-brown powder, it is allied to *Catechin*, strikes green with persalts of iron, and was formerly thought to be gallic acid. Ipecacuanha root also contains starch, sugar, gum, pectin, albumen, and fatty or oily matter.

Catechu Pallidum.

From its earthy appearance was formerly called Terra Japonica; its native name is *gambir*. It is met with in cubes, or masses formed of coherent cubes; the former are about an inch in diameter, externally brown, internally ochrey-yellow or pale brick-red, of a porous texture, breaking easily with a dull earthy fracture. Sp. gr. 1·390. Taste bitter, very astringent and mucilaginous and succeeded by slight sweetness; its astringency is destroyed by alkalies. It is mostly soluble in cold and entirely soluble in boiling water. A decoction of it when cool is not rendered blue by iodine, showing absence of starchy impurities.

Varieties of catechu are yielded by the Acacia catechu (black catechu or cutch), Areca catechu, or Betel-nut, &c.

Catechu consists chiefly of a variety of tannic acid termed *Catechu-tannic* or *Mimotannic acid*, and *Catechin* or *Catechuic acid* ($C_{13}H_{12}O_5$). The former is soluble in cold water, and, unlike *Gallo-tannic acid*, gives a green precipitate with persalts of iron, does not precipitate tartar emetic, and does not yield pyrogallic acid on heating; on exposure in the moist state it absorbs oxygen, becomes dark red and is rendered insoluble in water.

Catechin crystallises in colourless needles; it is nearly insoluble in cold water, but is soluble in boiling water, alcohol, and ether; its solutions do not precipitate gelatine or vegetable alkaloids except after prolonged boiling, by which it is converted into *Catechu-tannic acid;* it strikes green with persalts of iron; by alkalies and alkaline carbonates it is converted into *Japonic* and *Rubinic* acids.

Besides the constituents above named, catechu also contains extractive matter, mucilage and certain insoluble compounds.

VALERIANACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
VALERIANA OFFICINALIS Valerian (*Britain*)	The dried root	Pulv. Valerianæ	—	10 to 30 grs.	Stimulant, antispasmodic. Given chiefly in hysterical affections.
		Infusum ,,	240 grs. to 1 pnt.	1 to 2 ozs.	
		Tinctura ,,	2½ ozs. to 1 pnt.	1 to 2 drms.	
		Tinct. Valerian. Ammoniata	2½ ozs. to 1 pnt.	½ to 1 drm.	

Valerianæ Radix.

A short yellowish-white rhizome with numerous fibrous roots about two or three inches long; of a bitter camphoraceous taste and penetrating odour, which is agreeable in the recent root but becomes fœtid by keeping. It yields from ½ to 2 per cent. of *Volatile oil,* and about 5 per cent. of *Valerianic acid* when distilled with water; it contains also resinous, extractive, and gummy matters, a little sugar, malic acid, &c.

The volatile oil is greenish and possesses the odour of valerian. Sp. gr. 6·94. It consists of a camphor or stearoptene ($C_{10}H_{18}O$) identical with *Borneol,* the hydrocarbon found in Borneo camphor; of *Valerole* ($C_6H_{10}O$), and *Borneene* or *Valerene* ($C_{10}H_{16}$), which resembles oil of turpentine. *Borneol,* the camphor of Dryobalanops camphora, is a constituent of oil of hops, is crystalline at a low temperature, and forms a blood-red solution with sulphuric acid. On exposure it absorbs oxygen and is converted into valerianic acid, a change which is instantly effected by caustic potash.

Valerianic acid ($HC_5H_9O_2$) can be obtained by distilling the root with sulphuric acid, and also by oxidation of amylic alcohol; it is an oily liquid with a powerful odour of valerian. Sp. gr. 0·9. It forms with bases salts, of which the valerianates of soda and of zinc are officinal.

COMPOSITÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ANACYCLUS PYRETHRUM Pellitory (*The Levant*)	Root	Tinct. Pyrethri	4 ozs. to 1 pnt.	—	Topical irritant, sialagogue. Used in odontalgia, relaxed throat, aphonia, &c.
ARTEMESIA Santonica (*Russia*)	Unexpanded flower-heads	Santonica (Pulv.) Santoninum	— —	10 to 60 grs. 2 to 6 grs.	Anthelmintic in cases of round and thread worms.
ANTHEMIS NOBILIS Chamomile (*England*)	The dried single and double flowers	Inf. Anthemidis Extract. ,, Oleum ,,	½ oz. to 10 ozs. — —	1 to 4 ozs. 2 to 10 grs. —	Aromatic bitter and tonic. In large doses emetic. Prescribed in atonic dyspepsia and as an adjunct to purgatives and emetics.
TARAXACUM DENS LEONIS Dandelion (*Britain*)	*a*. The fresh root *b*. The dried do.	Extr. Taraxaci Succus ,, Decoct. ,,	— — 1 oz. to 1 pnt.	5 to 30 grs. 1 to 2 drms. 2 to 4 ozs.	Cholagogue; tonic. Sometimes diuretic. Given in hepatic congestion.
LACTUCA VIROSA Wild Lettuce (*Britain*)	The flowering herb	Extr. Lactucæ	—	5 to 15 grs.	Soporific; sedative. Relieves cough.
ARNICA MONTANA Arnica (*Middle & Southern Europe*)	The dried rhizome and rootlets	Tinctura Arnicæ	1 oz. to 1 pnt.	1 to 2 drms.	Stimulant to nervous system. Given in adynamia, chronic rheumatism, &c. Externally applied to bruises, sprains, &c.

Pyrethri Radix.

In pieces about the length and thickness of the little finger, covered with a thick brown bark, studded with black shining spots; breaks with a resinous fracture, and presents internally a radiated structure. When chewed, it excites a prickling sensation in the lips and tongue, and a glowing heat. It contains two resins—one, *Pyrethrin* or *Pyrethric acid*, insoluble in solution of caustic potash, the other soluble—as well as a yellow acrid oil, together with inulin, gum, tannin, colouring matter, salts, ligneous fibre, &c. The root of African Pellitory, Anacyclus officinarum, has been substituted for it.

Santonica.

Consists of minute unexpanded flower-heads, which are rather more than a line in length, and nearly half a line in breadth, fusiform, blunt at each end, resembling seeds in appearance, whence its common name "wormseed," but formed of imbricated involucral scales with a green midrib, enclosing four or five tubular flowers. The odour is strong, and the taste bitter and camphoraceous. The fact that the flower-heads are not round and hairy shows non-admixture with flowers of Artemisia vulgaris or of A. Absinthium.

Besides resin, fat, sugar, &c., santonica yields about 1 per cent. of a *volatile oil*, which consists chiefly of *Cinæbene camphor* ($C_{10}H_{18}O$); it boils at 347°, and on heating becomes converted into the dehydrated condition ($C_{10}H_{16}$). The most important constituent of santonica is *Santonin*, which it contains in the proportion of 1½ to 2 per cent. *Santonin* ($C_{15}H_{18}O_3$) is a crystalline neutral principle, occurring in colourless flat rhombic prisms, odourless, with a feebly bitter taste, fusible and sublimable by a moderate heat, but entirely destructible by a red heat with free access of air. It is scarcely soluble in cold water, sparingly soluble in boiling water, but very soluble in chloroform and boiling rectified spirit. It is insoluble in diluted mineral acids, but soluble in solutions of caustic, fixed alkalies forming santonates with them. Sunlight renders santonin yellow, owing to an alteration in its crystalline form. According to Hesse, santonin is the anhydride of *Santoninic acid* ($C_{15}H_{20}O_4$). Heated with alkalies, it is converted into *Santonic acid*, which is isomeric with santoninic acid, but, unlike the latter, is not converted by heat into santonin and water. Prolonged boiling in dilute nitric acid converts santonin into *Succinic acid.* Santonin has been adulterated with gum and with boracic acid; the former is detected by its solubility in water, the latter by its alcoholic solution burning with a green flame.

Anthemidis Flores.

This plant has a strong pleasant odour, and a bitter, slightly aromatic, taste; the flower-heads resemble those of the daisy. The simple variety, "Scotch chamomile," consists of both yellow tubular and white strap-shaped florets. The double variety, "English chamomile," consists of white strap-shaped florets only, all arising from a conical scaly receptacle. Both varieties, but especially the single, are bitter, and very aromatic. By cultivation the single flower-heads are often changed into the double variety. The aromatic qualities of chamomile are due to a *volatile oil* which resides chiefly in the yellow tubular florets; the single flower-heads are therefore preferable. The oil is pale-blue or greenish, becoming yellowish by age. Sp. gr. 0·91. It is regarded by Demarçay as a mixture of *Butylic and amylic angelate and valerate.* When heated with caustic potash, it yields potassic angelate, from which the *Angelic acid* ($HC_5H_7O_2$) may be separated by dilute sulphuric acid. Chamomile also yields a *bitter extractive principle*, soluble in water and alcohol, together with a minute quantity of tannin. Flower-heads of Chrysanthemum Parthenium have been substituted for those of chamomile, but they are distinguished by the flat or nearly convex receptacle; flower-heads of Matricaria chamomilla may be recognised by the naked and hollow receptacle.

Taraxaci Radix.

Tap-shaped roots, smooth and dark brown externally, white within, easily broken, and giving out an inodorous, bitter, milky juice, which becomes brown on exposure, acquires an acid reaction, and, according to Messrs. T. & H. Smith, develops a large quantity of *Mannite.* Taraxacum root should not be wrinkled or pale-coloured externally, and any adherent leaves are runcinate and quite smooth. By this latter character the root of dandelion is distinguished from that of the common hawkbit, Leontodon hispidas. The juice is most abundant in the autumn and winter, and the root should then be collected; in the spring the juice is thin and watery. The juice contains resinous matters, malin, lævulose, sugar, gum, and a bitter extractive from which a crystalline principle, *Taraxacine*, has been obtained. This is soluble in alcohol, ether, and boiling water, but sparingly soluble in cold water. According to Marme, the leaves and stalk of the plant yield *Inosite* ($C_6H_{12}O_62H_2O$) or muscle-sugar.

Lactuca.

The officinal plant, distinguished by its rank odour and red-spotted stem, is preferable to the garden lettuce, in consequence of its yielding a larger quantity of *Lactucarium.* This, the concrete juice of the plant, is obtained by pressing out the juice from the flowering herb, and afterwards inspissating it with a gentle heat. It is met with in small brown lumps, with an opium-like odour and a bitter taste. It is also known as *lettuce-opium* or *thridace.* To alcohol it yields a bitter extractive, and a crystalline substance, *Lactucone*, which is soluble in alcohol and ether, but not in water; it also yields *Lactucic acid* and *Lactucin*, which are soluble in water; the latter substance is crystalline, and resembles mannite. Besides these, Lactucarium contains resin, albumen, sugar, asparagin, succinic and other acids, and some salts.

Arnicæ Radix.

The rhizome is from two to three inches long, and from two to three lines thick, cylindrical, contorted, rough from the scars of the coriaceous leaves, and furnished with numerous long, slender fibres; it has a peppery taste, and a peculiar aromatic odour. It contains a bitter resinous principle, *Arnicin* ($C_{20}H_{30}O_4$), which is an amorphous yellow substance, slightly soluble in water, but freely soluble in alcohol, ether, and alkaline solutions. *Trimethylamine* and a yellowish volatile oil (C_9H_9O) have also been obtained from it. The roots of Geum urbanum, N.O. Rosaceæ, which have been used to adulterate arnica, are distinguished from its rhizomes by their astringency and want of acridity.

LOBELIACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
LOBELIA INFLATA Lobelia Indian Tobacco (*North America*)	The dried flowering herb	Tinct. Lobeliæ Tinct. Lobeliæ Ætherea	54½ grs. to 1 oz. 54½ grs. to 1 oz.	10 mins. to ½ drm. 10 mins. to ½ drm.	Antispasmodic, expectorant, diaphoretic, and emetic. Given in spasmodic asthma.

Lobelia.

Stem angular; leaves alternate, ovate, toothed, somewhat hairy beneath; capsules ovoid, inflated, ten-ribbed; herb acrid. Usually met with in compressed rectangular parcels, somewhat resembling chopped hay. Has a peculiar odour, and a burning taste, which, however, is not observed for some time after it has been chewed. It contains a volatile oil, *Lobelic acid*, and an alkaline active principle, *Lobelina*. This is a yellowish volatile liquid, lighter than water, with a tobacco-like odour; it is soluble in ether and alcohol; forms salts with mineral acids, but is decomposed by alkalies.

ERICACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ARCTOSTAPHYLOS UVA URSI Bearberry (*Indigenous*)	Dried leaves	Infusum Uvæ Ursi	1 oz. to 1 pnt.	1 to 2 ozs.	Astringent, diuretic. In irritation of mucous membrane of bladder and urethra.

Uvæ Ursi Folia.

Obovate, entire, dark-green, shining, about three-fourths of an inch long, reticulated beneath, with a strong astringent taste, by which they may be distinguished from Box-leaves, and a feeble hay-like odour when powdered. The leaves are not dotted beneath, nor toothed on the margin, in this respect differing from the leaves of the Red Whortleberry, Vaccinium Vitis-Idæa. The infusion gives a bluish-black precipitate, with perchloride of iron, showing the presence of gallic and tannic acids, about 36 per cent. of the latter being contained in the leaves; they also contain two crystallisable principles, Arbutin ($C_{12}H_{16}O_7$) and Ursone ($C_{20}H_{32}O_2$), with bitter extractive, &c.

SAPOTACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ISONANDRA GUTTA Gutta-percha (*Bornea, Sumatra, &c.*)	Concrete juice	Liquor Gutta-percha	—	—	Gutta-percha is used for making splints, &c. The Liquor as a protective, and in the preparation of Charta Sinapis.

Gutta-Percha.

Occurs in tough, flexible pieces, of a light brown or chocolate colour, soluble, or nearly so, in chloroform, yielding a more or less turbid solution; it is soluble also in ether, disulphide of carbon, benzol and volatile oils, but insoluble in water, alkaline solutions, dilute acids or fixed oils. Becomes soft and plastic at 212°, and on cooling retains the form that has been given to it when soft. It becomes negatively electric when rubbed, and is an insulator of electricity. The commercial variety consists of about 80 per cent. of pure *Gutta* ($C_{20}H_{32}$), a milk-white solid, and the remainder is composed of two resins—one crystalline ($C_{20}H_{32}O_2$), the other amorphous ($C_{20}H_{32}O$). Pure gutta-percha slowly absorbs oxygen on exposure, and is gradually converted into a brittle resin, devoid of plasticity; it may be preserved under water or in the dark without change for an indefinite period.

STYRACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
STYRAX BENZOIN Benzoin (*Siam & Sumatra*)	Balsamic resin flowing from incised bark	Acid. Benzoicum	—	10 to 15 grs.	Expectorant in chronic bronchitis. Antiseptic. Tincture externally applied to ulcers, wounds, &c. *Vide* p. 7.
		Adeps Benzoatus	10 grs. to 1 oz.	—	
		Tinct. Benzoin. Co.	44 grs. to 1 oz.	½ to 1 drm.	

Benzoinum.

Siam benzoin occurs in lumps consisting of agglutinated tears or of a brownish mottled mass with or without white tears embedded in it; an inferior variety known as Calcutta benzoin, which is much darker in colour, has been met with. Benzoin has little taste, but an agreeable odour; it gives off, when heated, fumes of benzoic acid; being chiefly a resin, it is soluble in rectified spirit, and it is soluble also in solution of potash and in lime water, forming soluble benzoates with its acid. It contains from 10 to 20 per cent. of benzoic acid (p. 16), the remainder consisting of a resin which is partly soluble in ether. Some samples of it yield *Cinnamic acid.* Treated with sulphuric acid, benzoin acquires a maroon-red colour.

OLEACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
OLEA EUROPEA European Olive (*Southern Europe*)	Ripe fruit	Oleum Olivæ	—	—	Demulcent. In large doses slightly laxative. Contained in Charta Epipastica, Cataplasma Lini, Enema Magnesiæ Sulph., and in several Emplastra, Linimenta, and Unguenta.
FRAXINUS ORNUS FRAXINUS ROTUNDIFOLIA Manna (*Calabria & Sicily*)	Concrete saccharine exudation from the stem	Manna	—	60 grs. to 1 oz.	Mild laxative. Used in constipation in children. Adjunct to purgatives.

Oleum Olivæ.

The olive fruit is a smooth, elliptical, single-seeded drupe, about three-fourths of an inch long, and half an inch in diameter, green at first, but afterwards violet-coloured. The oil, called also "sweet oil" or "salad oil," is pale yellow, almost odourless, with a bland mucilaginous taste. Sp. gr. 0·92. It partially congeals at about 36°. It consists of about 72 per cent. of a fluid portion, *Oleine* or *Oleate of glyceryl*, $C_3H_53C_{18}H_{33}O_2$, and 28 per cent. of a solid portion, formerly termed *Margarine*, which is a mixture of *Palmitine*, $C_3H_5C_{16}H_{31}O_2$, and *Stearine*, $C_3H_53C_{18}H_{35}O_2$. It unites with alkalies and other bases, forming soaps. Nitrate of mercury and yellow nitric acid convert it into a solid compound, *Elaidine.*

Glycerine may be separated from ordinary animal or vegetable fixed oils and fats, except spermaceti and wax, by saponification or distillation with superheated steam. It is a slightly yellow or colourless syrupy-looking liquid; sp. gr. 1·260; very sweet, oily to the touch, mixes readily with water and alcohol, but is insoluble in pure ether and chloroform; the watery solution does not ferment with yeast. At the ordinary temperature glycerine does not evaporate, but absorbs moisture on exposure. Glycerine is a triatomic alcohol, a hydrate of glyceryl, having the formula C_3H_53HO or $\left.\begin{matrix}C_3H_5\\H_3\end{matrix}\right\}O_3$. By replacement of three of its atoms of hydrogen by the radicles of the fatty acids, it forms fats and oils. When decomposed by heat, it gives off irritating vapours of *Acrolein* (C_3H_4O); at a red heat it takes fire, and burns with a blue flame. Glycerine possesses remarkable solvent powers, arsenious acid, carbolic acid, borax, many alkaloids, &c., being freely soluble in it; heated with starch it forms a plasma; some bodies, as bichromate and permanganate of potash, are decomposed by it. It cannot be distilled without decomposition, except in the presence of steam, or in a partial vacuum. Acted on by strong nitric acid, it yields *Nitro-glycerine*, $C_3H_5(NO_2)_3O_3$, an explosive, poisonous, oily liquid. Glycerine possesses marked antiseptic properties. It is liable to contain several impurities. If it be diluted with water, its specific gravity will be lower than that stated above; if rancid oils be present, a drop of it rubbed on the hand will develop an unpleasant odour; if glucose be present, it will be turned brown with caustic potash, and when heated with strong sulphuric acid, will give off gases. The presence of gum, dextrin, or glue would cause it to become turbid on mixture with four volumes of alcohol; it will redden litmus if acids be present; the presence of formic acid would be shown by its reducing ammonio-nitrate of silver, and the development of a pine-apple odour, when warmed gently with a little alcohol and strong sulphuric acid, indicates the presence of butyric acid.

Sapo Durus, "Hard soap," is formed by combination of olive oil and *soda*. It is composed of oleate and palmitate of soda. It is grayish-white, horny, easily powdered when kept in dry air, and easily moulded when heated. The presence of a little oxide of iron gives it a red or blue marbled appearance. It is soluble in water, and the solution is precipitated by lime, lead, &c. The ash left after incineration does not deliquesce; it should be entirely soluble in rectified spirit (absence of insoluble ingredients), and should not give an oily stain to paper (absence of unsaponified oil).

Sapo Mollis, "Soft soap," is formed by combination of olive oil and *potash*. It is a yellowish-green, transparent, and gelatinous substance, composed of oleate and palmitate of potash. The ash left after incineration is very deliquescent, showing that potash, not soda, has been employed in its manufacture. Like hard soap it should be entirely soluble in rectified spirit, and should not impart an oily stain to paper.

Manna.

The best manna, or "flake manna," is met with in stalactiform pieces from 1 to 6 inches in length and 1 or 2 inches in width, uneven, porous, and friable, curved on one side, of a yellowish white colour, with a faintly nauseous odour and a sweetish but rather bitter taste. It is soluble in five parts of water and is soluble also in alcohol. Inferior manna is soft and light brown. Manna consists of from 60 to 80 per cent. of *Mannite* ($C_6H_{14}O_6$) together with common sugar and extractive matter; the glaucous colour of manna is due to *Fraxin* ($C_{16}H_{18}O_{10}$), which resembles *æsculin*, and like it forms fluorescent solutions. The mannite may be extracted by means of boiling rectified spirit; it separates on cooling in colourless, shining, four-sided crystals. Mannite requires five parts of cold water for its solution, and this does not undergo vinous fermentation in contact with yeast; nitric acid converts it into sugar with the formation of a little *Racemic acid.* Mannite is widely distributed through the vegetable kingdom.

LOGANIACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
STRYCHNOS NUX VOMICA Nux Vomica (*East Indies*)	The seeds	Extract. Nucis Vomicæ	—	$\frac{1}{2}$ to 2 grs.	Increases reflex excitability of the spinal cord. Nerve tonic. Useful in some cases of chronic paralysis.
		Tinct. Nucis Vom.	44 grs. to 1 oz.	10 to 20 mins.	
		Strychnia	—	$\frac{1}{30}$ to $\frac{1}{12}$ gr.	
		Liq. Strychniæ	4 grs. to 1 oz.	5 to 10 mins.	

Nux Vomica.

The fruit is an orange-like berry, filled when ripe with a jelly-like pulp which contains the seeds; these are nearly circular and flat, about an inch in diameter, umbilicated and slightly convex on one side, externally of an ash-gray colour, thickly covered with short satiny hairs; internally translucent, tough and horny, taste intensely bitter, inodorous. Nux vomica seeds are very difficult to pulverise and must previously be well steamed and rapidly dried.

Nux vomica contains three alkaloids, *Strychnia* ($C_{21}H_{22}N_2O_2$), *Brucia* ($C_{23}H_{26}N_2O_4$), and *Igasuria* united with *Igasuric* or *Strychnic acid.*

Strychnia crystallises in right square octahedrons or prisms, colourless and inodorous; sparingly soluble in water, but communicating to it its intensely bitter taste; soluble in boiling rectified spirit and in chloroform, but not in absolute alcohol or in ether. It forms crystallisable salts with acids. Pure sulphuric acid forms with it a colourless solution, which on the addition of bichromate of potash, or other oxidising agents, acquires an intensely violet hue, speedily passing through red to yellow. Not coloured by nitric acid, showing the absence of Brucia; leaves no ash when burned with free access of air.

Brucia crystallises with four equivalents of water; it is much more soluble in water than strychnia, and is soluble in alcohol. It forms salts with acids; and with nitric acid is coloured red, turning to violet on the addition of stannous chloride.

Igasuric acid is crystallisable; its solution precipitates copper salts bright green.

The bark of Nux vomica, known as false Angustura bark, has been used to adulterate Cusparia, or the true Angustura bark (*vide* p 119).

ASCLEPIADACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
HEMIDESMUS INDICUS Hemidesmus, or Indian Sarsaparilla (*India*)	The dried root	Syrupus Hemidesmi	1oz.to10½ozs.	1 drm.	Alterative, tonic, diaphoretic, diuretic. An agreeable flavouring agent.

Hemidesmi Radix.

Yellowish-brown, cylindrical, tortuous, furrowed, and with annular cracks, having a fragrant odour resembling that of the Tonquin bean, and a very agreeable but rather bitter flavour. It yields its active properties to boiling water, and contains a volatile crystallisable acid substance, *Hemidesmic acid.*

GENTIANACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
GENTIANA LUTEA Yellow Gentian (*Pyrenees*)	Dried root	Extr. Gentianæ	—	2 to 10 grs.	Bitter or stomachic tonic. Given in atonic dyspepsia.
		Infus. Gentian. Co.	120 grs. to 1 pnt.	1 to 2 ozs.	
		Mistura Gentian.	½ oz. to 1 pnt.	½ to 1 oz.	
		Tinct. Gentian. Co.	1½ozs.to1pnt.	½ to 2 drms.	
OPHELIA CHIRATA Chiretta (*Northern India*)	Entire plant	Infus. Chirettæ	½ oz. to 1 pnt.	1 to 2 ozs.	Pure bitter tonic. Given in atonic dyspepsia.
		Tinct. ,,	2½ozs.to1pnt.	½ to 2 drms.	

Gentianæ Radix.

From half an inch to one inch thick, several inches in length, often twisted, much wrinkled or marked with close transverse rings, brownish externally, yellow within, tough and spongy; taste at first sweetish, afterwards very bitter. Gentian root contains a crystalline, tasteless, inert acid, *Gentianic* ($C_{14}H_{10}O_5$), and a crystalline bitter substance, *Gentio-picrin* ($C_{20}H_{30}O_{12}$). By boiling with dilute acids the latter is converted into glucose and a neutral amorphous substance, *Gentio-genin.* Gentian root also contains sugar, gum, pectin, a little volatile oil, and fat. It does not contain starch or tannic acid.

Chirata.

Stems about 3 feet long, of the thickness of a goose-quill, round, smooth, pale brown, branched; branches opposite; flowers small, numerous, panicled; the whole plant is intensely bitter. It contains *Ophelic acid* ($C_{13}H_{20}O_{10}$) and a bitter resinous substance, *Chiratin* ($C_{26}H_{48}O_{15}$); this latter may be precipitated by tannic acid.

CONVOLVULACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CONVOLVULUS SCAMMONIA Scammony (*Syria and Asia Minor*)	*a.* The dried root	Radix Scammonii	—	—	Source of the resin and gum-resin
	b. The resin	Resina Scammonii	—	3 to 8 grs.	Drastic purgative. Contained in Ext. and Pil. Colocynth Co.
		Mist. Scammon.	2 grs. to 1 oz.	½ to 2 ozs.	
		Pil. Scam. Co.	—	5 to 15 grs.	
	c. The gum-resin	Scammonium	—	5 to 10 grs.	Similar to the resin, which may also be prepared from the gum-resin.
		Conf. Scammon.	1 pt. in 3	10 to 30 grs.	
		Pulv. Scam. Co.	1 pt. in 2	10 to 20 grs.	
EXOGONIUM PURGA Jalap (*Mexico*)	Dried Tubercules	Pulv. Jalapæ	—	10 to 30 grs.	Drastic & hydragogue cathartic. Useful purgative in ascites and general dropsies.
		Extract. ,,	—	5 to 15 grs.	
		Pulv. Jalap. Co.	1 pt. in 3.	20 to 60 grs.	
		Resina Jalapæ	—	2 to 5 grs.	
		Tinctura ,,	54½grs. to 1 oz.	½ to 2 drms.	

Scammoniæ Radix, Scammoniæ Resina, Scammonium.

The root is tap-shaped, sometimes three inches in diameter at the top, brown without, white within, slightly odorous, but tasteless, tough and resinous. Ether agitated with the powder, and evaporated, leaves a residue having the properties of scammony resin. 100 parts of the root contain 4·12 of resin, 5·8 of gum, 24·48 of sugar, starch, and extractive, the remainder being cellulin and starch.

Scammony Resin is obtained by exhausting the root or gum-resin with warm rectified spirit, and precipitating it by adding water to the resulting tincture; the spirit is then distilled off, and the residual cake of resin dried. It occurs in brownish translucent pieces, brittle, resinous in fracture, of a sweet fragrant odour if prepared from the root, but having a sour odour if obtained from the gum-resin; it is soluble in alcohol and ether. It cannot form singly an emulsion with water, and is thus distinguished from the gum-resin. Its tincture does not render the freshly-cut surface of a raw potato blue, showing the absence of guaiacum resin. Ether dissolves it entirely, showing that it is not adulterated with resin of jalap. Its chief constituent is a glucoside, *Scammonin*, which is identical with *Jalapin*, and allied in composition and properties to *Convolvulin*. The adulteration of scammony resin with common resin or colophony is detected by the immediate development of a deep-red colour on treating it with sulphuric acid.

The gum-resin is ash-gray and rough externally; fresh fracture is resinous, splintery, shining, black when dry; odour and flavour cheesy; causes, when chewed, a slight prickly sensation in the back of the throat; easily triturated into a dirty-gray powder, and converted with water into a smooth emulsion. It does not effervesce with hydrochloric acid, showing the absence of starch. Boiling water agitated with the powder, cooled and filtered, does not strike a blue colour with tincture of iodine, showing the absence of starch. Ether removes from 80 to 90 per cent. of resin; and what remains is chiefly soluble gum, with a little moisture. Inferior scammony is in dark tenacious masses, not easily powdered, and contains but little resin.

Jalapa, Jalapæ Resina.

Jalap tubercles vary from the size of a nut to that of an orange, are ovoid, and the larger tubercles are frequently incised, the incisions being made to facilitate their drying; they are covered with a thin, brown, wrinkled cuticle, and present, when cut, a yellowish-gray colour, with dark-brown concentric circles. Inferior jalap is light, spongy in texture, and white internally. 100 parts of jalap contain 17·65 of resin, the essential constituent, 20 of sugar, 19 of starch, 20·60 of cellulin, and 10·12 of gum. True jalap is known as "Vera Cruz Jalap." The roots of Ipomæa orizabensis and of I. simularis, "Tampico Jalap," have been substituted for it.

The resin of jalap is in dark-brown opaque fragments, but by filtration through animal charcoal it can be obtained white, and in this form is known in commerce as "Jalapin." The brown fragments are fragrant, translucent at the edges, brittle, breaking with a resinous fracture, readily reduced to a pale-brown powder, sweetish in odour, acrid in the throat, easily soluble in rectified spirit, but only partially so in ether, and thus distinguished from the resin of orizaba and tampico roots; it is insoluble in oil of turpentine, and is thus distinguished from ordinary resin. Jalap resin consists of two portions—one, the active constituent, *Convolvulin* or *Rhodeoretin* ($C_{31}H_{50}O_{16}$), a white acid glucoside, which is insoluble in ether; the other, *Jalapin* or *Jalapic acid* ($C_{34}H_{56}O_{16}$), a strongly acid resin, soluble in ether. Convolvulin readily dissolves in the fixed alkalies, and is by them converted into *Convolvulic acid;* nitric acid converts it into oxalic acid and *Ipomæic acid* ($C_{10}H_{18}O_4$), which is isomeric with *Sebacic acid.* Unlike scammony resin, jalap resin is not readily mixable with milk.

SOLANACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
SOLANUM DULCAMARA Dulcamara, or Bitter-Sweet (*Britain*)	Dried young branches	Infusum Dulcamaræ	2ozs.to1pnt.	1 to 2 ozs.	Alterative, diaphoretic, diuretic(?).
CAPSICUM FASTIGIATUM Capsicum, Guinea- or Pod-Pepper, Chillies (*Zanzibar*)	Dried ripe fruit	Pulvis Capsici Tinctura ,,	— 16⅔grs.to1oz.	½ to 1 gr. 10to20mins.	Stimulant and rubefacient. Given in dyspepsia and in alcoholism. As a gargle in sore throat.

Dulcamara.

The twigs are light, hollow, cylindrical, one or two inches long, about the thickness of a goose-quill, brown externally, pale within, odourless, bitter, and subsequently sweetish to the taste. They should be collected in the autumn when devoid of leaves. Dulcamara contains, in very small quantity, an alkaloid, *Solania* ($C_{43}H_{69}NO_{16}$), which is also found in S. nigrum and S. tuberosum; it crystallises in scales or needles, is soluble in alcohol, but not in water or ether. A bitter sweetish extract, *Dulcamarine* or Picroglycion, also exists in the twigs to the extent of about $\frac{1}{10}$ per cent. The alkaloid is probably combined with malic acid.

Capsici Fructus.

Pod membranous, from five to eight inches long, two lines broad, straight, conical, pointed, smooth, shining, but somewhat corrugated, orange-red, intensely hot in taste. The red colour of powdered capsicum, "Cayenne pepper," gradually fades on exposure to light; it is liable to adulteration with red oxide of lead, coloured sawdust, &c. From an alcoholic extract of capsicum a bright orange-red oily liquid is obtained by ether, and this contains an acrid, volatile, crystalline alkaloid, *Capsicin;* this forms salts with acids; when heated with caustic potash it develops an odour resembling that of conia, and the mixture, on distillation, yields an alkaloid having this odour. Red colouring matter is also contained in the pods.

ATROPACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ATROPA BELLADONNA Belladonna, Deadly Nightshade (*England and Germany*)	*a.* The fresh leaves with the branches	Extr. Belladonnæ	4pts. from 100	¼ to 1 gr.	Dilates pupil, contracts arterioles, lessens pain, diminishes secretion, stimulates respiration and circulation. Antidote to opium, prussic acid, and Calabar bean. It relaxes spasm and is a local sedative.
		Emplast. „	—	—	
		Succus Belladon.	—	5 to 15 mins.	
	b. The leaves dried	Tinct. Belladon.	1 oz. to 1 pnt.	5 to 20 mins.	
	c. The dried root	Lin. Belladon.	1 oz. to 1 oz.	—	
		Atropia	—	—	
		Liquor Atropiæ	4 grs. to 1 oz.	—	
		Atropiæ Sulph.	—	—	
		Liq. Atr. Sulph.	4 grs. to 1 oz.	—	
		Ung. Atropiæ	8 grs. to 1 oz.	—	
DATURA STRAMONIUM Stramonium, or Thorn Apple (*Britain*)	*a.* Dried leaves	Extr. Stramonii	—	¼ to ½ gr.	Resembles belladonna. Chiefly used in asthma, and as an anodyne in gastrodynia, &c.
	b. Ripe seeds	Tinctura „	54½ grs. to 1 oz.	10 to 30 mins.	

Atropaceæ—Continued.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
Hyoscyamus Niger Hyoscyamus, Henbane (*Britain*)	*a.* Fresh leaves and young branches	Extr. Hyoscyami	—	5 to 10 grs.	Resembles belladonna, but is milder in its action. Sedative in nervous excitement. Anodyne, to allay irritation of bladder, to ease cough, to diminish spasm, and to prevent griping of purgatives.
		Succus „	—	½ to 1 drm.	
	b. The dried leaves	Tinctura „	2½ozs. to 1 pnt.	½ to 1 drm.	
Nicotiana Tabacum Virginian Tobacco (*Tropical America*)	Dried leaves	Enema Tabaci	20grs. to 8ozs.	—	Powerful cardiac sedative. Seldom given internally on account of the depression which it produces. Formerly given to produce muscular relaxation in hernia and ileus.

Belladonnæ Folia, Belladonnæ Radix.

The flowers of belladonna are pendant, bell-shaped, of a dingy-purple colour and greenish towards the base. The fruit is a round berry, deep purplish-black when ripe, resting on a broad calyx; it is two-celled and contains many kidney-shaped seeds in a violet-coloured juice.

The leaves are dark-green, alternate, from three to six inches long, ovate, acute, entire, smooth; the uppermost are in pairs and are unequal; they are fœtid when bruised; the expressed juice, or an infusion, dropped into the eye dilates the pupil; they should be collected in June or July.

The root is from one to two feet long and from half an inch to two inches thick; it is branched and wrinkled and is brownish white; an infusion of it dropped into the eye dilates the pupil. It should be collected in the early spring or in the autumn. The uncultivated plant is said to be preferable to the cultivated. The most important alkaloid is *Atropia* ($C_{17}H_{23}NO_3$), which is in combination with malic acid and exists but in small proportion. The leaves also contain, besides ordinary ingredients, *Asparagin* ($C_4H_8N_2O_3,H_2O$), a neutral substance which crystallises in very perfect octahedra and rhombic prisms; by acids or alkalies it is converted into ammonia and *Aspartic acid* ($HC_4H_6NO_4$). The root contains besides *Atropia* an amorphous alkaloid, *Belladonnin*, a red colouring matter, *Atrosin*, and a fluorescent substance.

Atropia occurs in colourless acicular crystals, sparingly soluble in water, more readily in alcohol, in ether, and in chloroform. Its solution in water has an alkaline reaction, gives a citron-yellow precipitate with terchloride of gold, has a bitter taste, and powerfully dilates the pupil. It is an active poison. Leaves no ash when burned with free access of air. By strong hydrochloric acid, or when left for a few hours in contact with caustic alkalies, lime-water or baryta-water, it is decomposed into *Tropic acid* ($C_9H_{10}O_3$) and *Tropine* ($C_8H_{15}NO$); these, plus a molecule of water = Atropia.

Atropiæ Sulphas is a colourless powder, soluble in water, and, unlike Atropia, insoluble in chloroform; its aqueous solution is neutral to test-paper. It leaves no ash when burned with free access of air.

Stramonii Folia, Stramonii Semina.

The fruit is a large, ovoid, four-valved capsule filled with numerous seeds and thickly covered with sharp spines—hence its name "Thorn-apple." The leaves are large, ovate, sinuous, deeply cut, dark-green; of a heavy odour, which is strongest while they are drying; they have a mawkish, faintly-bitter, nauseous taste. They should be gathered when the plant is in flower. The seeds are brownish-black, reniform, flat, rough, of a bitter mawkish taste; inodorous, unless bruised when they emit a peculiar heavy odour. All parts of the plant contain *Daturia* ($C_{17}H_{23}NO_3$), an alkaloid identical with *Atropine,* united with malic acid.

Hyoscyami Folia.

The flowers of henbane are in long one-sided cymes. The fruit—termed a pyxidium—is a spheroidal two-celled capsule containing numerous seeds, and is enclosed in a persistent urn-shaped capsule which opens transversely by a convex lid. The leaves are sinuated, clammy, hairy. The fresh herb has a strong unpleasant odour and a slightly acrid taste which nearly disappears on drying. The fresh juice dropped into the eye dilates the pupil. Plants of the first year are nearly inactive; hence those of the second year alone should be selected; the leaves should be gathered when about two-thirds of the flowers are expanded.

All parts of the plant contain the alkaloid, *Hyoscyamia* ($(C_{15}H_{23}NO)_3$), which is united with malic acid, and is closely allied to atropia. It is an oily liquid which concretes after a time into warty crystals, has a tobacco-like odour, and is soluble in water, alcohol, ether, chloroform, and benzol. By caustic alkalies it is converted into the volatile alkaloid, *Hyoscina* ($C_6H_{13}N$), and *Hyoscinic acid* ($C_9H_{10}O_3$), a crystallisable substance having an odour like that of benzoic acid. The American resinoid substance, Hyoscyamin, should not be confounded with the pure alkaloid.

Tabaci Folia.

Large, mottled-brown, ovate or lanceolate, acuminate, having numerous short glandular hairs; acquire a peculiar heavy odour on drying; have a nauseous, bitter, acrid taste; yield when distilled with solution of potash an alkaline fluid which has the peculiar odour of *Nicotia*, and precipitates perchloride of platinum and tincture of galls. The leaves should not be manufactured, as they undergo in that process considerable chemical changes.

Virginian tobacco contains from 6 to 7 per cent. of *Nicotia* ($C_{10}H_{14}O_2$); this when pure occurs as a colourless volatile oil, but becomes yellow by exposure; its sp. gr. is 1·027; boils at 480°. It is soluble in water, alcohol, ether, and fixed oils; neutralises acids, forming with them very deliquescent salts; it probably exists in the plant united with malic acid. Tobacco also contains a concrete volatile oil, *Nicotianin* or tobacco-camphor.

SCROPHULARIACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
DIGITALIS PURPUREA Digitalis, or Purple Fox-glove (*Indigenous*)	Dried leaf	Pulv. Digitalis	—	½ to 1½ gr.	Cardiac stimulant; contracts arterioles; diuretic and antipyretic. Beneficial in cases of debility or irritability of the heart-muscle, and in cardiac dropsy. Given in delirium tremens and in adynamic fevers.
		Infus. ,,	3 grs. to 1 oz.	2 to 4 drms.	
		Tinct. ,,	54½ grs. to 1 oz.	10 to 30 mins.	
		Digitalinum	—	$\frac{1}{60}$ to $\frac{1}{30}$ gr.	

Digitalis Folia.

The flowers are in long racemes, are purple, and the corolla somewhat resembles the finger of a glove—hence the name of the plant, "folk's-glove" or "fox-glove." The leaves are ovate-lanceolate, shortly petiolate, rugose, downy, pale on the under surface, crenate, almost odourless, but with a bitter acrid taste; they should be collected when about two-thirds of the flowers are expanded. The active constituent of the plant is a bitter, neutral, non-nitrogenised principle, *Digitalin*. The following are the characters of the *Digitalinum* of the Pharmacopœia:—It occurs in porous mammillated masses or small scales, white, inodorous, and intensely bitter; readily soluble in spirit, but almost insoluble in water and ether; it is precipitated by tannic acid; dissolves in acids, but does not form with them neutral compounds; its solution in hydrochloric acid is of a faint yellow colour, but rapidly becomes green. It powerfully irritates the nostrils, and is an active poison. Leaves no residue when burned with free access of air.

Besides Digitalin, digitalis also contains *Digitalein*, an active, amorphous, bitter substance, together with a tasteless, inert, crystallisable substance. Digitalin of commerce is really a mixture of true Digitalin and Digitalein.

The leaves of Symphytum officinale, of Verbascum Thapsus, and of Inula Conyza have been substituted for those of digitalis, but the latter are easily recognised by the characters given above. The leaves of Verbascum nigrum closely resemble those of digitalis, but are smoother and have shorter stalks.

LABIATÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ROSMARINUS OFFICINALIS Rosemary (*South Europe*)	Flowering tops	Oleum Rosmarini Spiritus ,,	— 1 vol. in 50	1 to 5 mins. 10 to 50 mins.	Aromatic stimulant. Used in hysteria and nervous headache. Locally rubefacient and discutient. The oil enters into Lin. Saponis and into Tinct. Lavand. Co.
LAVANDULA VERA Common Lavender (*Britain*)	Flowers	Oleum Lavandulæ Spiritus Lavandulæ Tinct. Lavand. Co.	— 1 vol. in 50 45 mins. in 1 pnt.	1 to 5 mins. ½ to 1 drm. ½ to 2 drms.	Stimulant and carminative. Used in hysteria, hypochondriasis, and in flatulence, etc. Oil contained in Lin. Camph. Co.
MENTHA PIPERITA Peppermint (*Britain*)	Fresh flowering plant	Ol. Menthæ Pip. Aqua ,, ,, Essentia ,, ,, Spiritus ,, ,,	— ½ drm. to 1 gall. 1 vol. in 5 1 vol. in 50	1 to 5 mins. 1 to 2 ozs. 10 to 20 mins. ½ to 1 drm.	Stimulant, carminative. Adjunct to purgatives. Relieves flatulence. Contained in Pil. Rhei Co.
MENTHA VIRIDIS Spearmint (*Britain*)	Fresh herb	Oleum Menth. Virid. Aqua Menth. Virid.	— ½ drm. to 1 gall.	1 to 5 mins. 1 to 2 ozs.	Aromatic stimulant and carminative. Used as an adjunct to purgatives, to correct flatulence and cover taste of nauseous drugs.

Rosmarini Oleum.

Rosemary tops should be collected when coming into flour. They contain a volatile oil, bitter extractive, and tannin. The volatile oil ($C_{10}H_{16}$) is distilled in England; it is colourless, with an odour of the plant and a warm aromatic taste; sp. gr. 0·888; boils at 365°. On standing it deposits a stearoptene analogous to camphor. Its adulteration with oil of turpentine is detected by its sparing solubility in rectified spirit.

Lavandulæ Oleum.

The flowers should be collected in July and August; they yield a volatile oil which is obtained in this country by distillation; it is colourless or pale-yellow, with the odour of the plant and a hot, bitter, aromatic taste; sp. gr. about 0·880; boils at 397°. It contains a hydrocarbon ($C_{10}H_{16}$), and by oxidation yields camphor. The oil is frequently obtained from Lavandula spica.

Menthæ Piperitæ Oleum.

Peppermint contains a volatile oil, a bitter principle, and some tannin. The oil, distilled in Britain, is colourless or pale yellow, with the odour of the plant and a warm aromatic taste which is succeeded by a sensation of cold in the mouth; sp. gr. 0·92; boils at 410°. It consists of a hydrocarbon, *Menthene* ($C_{10}H_{18}$), and *Menthol* or *peppermint-camphor* ($C_{10}H_{20}O$) is deposited on long standing.

Menthæ Viridis Oleum.

The oil, distilled in Britain, is colourless or pale yellow, with the odour and taste of the plant; sp. gr. 0·914; boils at 320°. It consists of a hydrocarbon, identical with oil of turpentine, mixed with an oxidised oil, or stearoptene isomeric with *Carvol* ($C_{10}H_{14}O$).

POLYGONACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
RHEUM Rhubarb (*China, Tartary, and Thibet*)	Dried decorticated root	Extractum Rhei	—	5 to 15 grs.	In small doses stomachic and astringent; in large doses purgative. Beneficial in incipient diarrhœa and in atonic dyspepsia with constipation.
		Infusum „	11 grs. to 1 oz.	1 to 2 ozs.	
		Pil. Rhei Co.	1 pt. in 4	5 to 10 grs.	
		Pulv. Rhei Co.	2 pts. in 9	20 to 60 grs.	
		Syrupus Rhei	—	1 to 4 drms.	
		Tinctura „	44 grs. to 1 oz.	1 to 2 drms. (stomachic) 4 to 8 drms. (purgative)	
		Vinum „	33 grs. to 1 oz.	1 to 2 drms.	

Rhei Radix.

The precise species whence the Asiatic drug is obtained was for some time unknown, but now is referred to Rheum officinale. The root is not collected until the plant is six years old. It occurs in trapezoidal, roundish, cylindrical, or flattish pieces, frequently bored with a hole for suspension during drying, yellow externally, internally marbled with fine waving grayish or reddish lines, finely gritty under the teeth, owing to the presence of raphides (needle-shaped, or acicular, crystals) of insoluble oxalate of calcium; taste bitter, faintly astringent and aromatic; odour peculiar. Inferior rhubarb is decayed and worm-eaten. Boracic acid should not turn the yellow exterior brown, showing the absence of turmeric which is used as an adulterant.

The following table, contrasting the principal commercial varieties of rhubarb, is from Smith's "Commentary:"—

ASIATIC		EUROPEAN
CHINESE	RUSSIAN, The so-called "Turkey rhubarb"	
In cylindrical or rounded pieces, sometimes flattened at one or both sides.	In irregular and angular pieces.	In sticks or cylindrical pieces.
Exterior dull-brownish yellow; reticulated appearance.	Exterior brighter yellow.	Exterior reddish or brownish yellow. Striated or dotted, not reticulated.
Broken surface ragged, uneven, and irregularly variegated. Small stellate circles.	Broken surface similarly variegated. Stellate circles, especially near circumference.	Broken surface radiated in regular lines. No stellate spots.
Generally perforated with small holes.	Pierced with large holes, often reaching only to the centre.	Not pierced.
Gritty when chewed.	Gritty when chewed.	Not gritty under the teeth. Contains more tannin and starch.

English rhubarb is derived from Rheum Rhaponticum and is cultivated near Banbury. The so-called "East-Indian rhubarb" is an inferior kind of the Chinese root; it is imperfectly scraped, is dense, breaks with a comparatively smooth fracture, and presents greenish or blackish stains.

Rhubarb root contains starch, and from 35 to 40 per cent. of crystals of oxalate of calcium; its yellow colour is due to *Chrysophanic acid* ($C_{14}H_8O_4$). This acid occurs in tasteless yellow crystals which are feebly soluble in water but soluble in alcohol, ether, benzol, and alkalies, forming with the latter dark-red solutions; it exists in considerable quantities in "Goa powder." In addition, rhubarb contains some astringent matter in the form of tannic and gallic acids, a bitter substance and various resins; the purgative principle has not yet been isolated.

MYRISTACACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
MYRISTICA OFFICINALIS Nutmeg *(Banda Islands of the Malayan Archipelago)*	Kernel of the seed	Oleum Myristicæ	—	1 to 5 mins.	Aromatic, stimulant, and carminative. Slightly astringent.
		Spirit. Myrist.	1 in 50	½ to 1 drm.	The same. A flavouring agent. Contained in Mistura Ferri Co.
		Ol. Myrist. Expressum	—	—	Topical stimulant. Ingredient of Empl. Calefaciens and of Empl. Picis.

Myristica, Myristicæ Oleum, Myristicæ Oleum Expressum.

The fruit of the nutmeg is about the size and form of a peach, smooth and yellow when ripe. It consists of an outer thick succulent pericarp, which when ripe becomes dry and splits into two or four valves displaying the scarlet membranous net-work, or arillus, known as "mace," enclosing the seed. The kernel constitutes the "nutmeg," and is oval or nearly round, about an inch in length, marked externally with reticulated furrows, internally grayish-red with dark brownish veins. It has a strong peculiar odour and a bitter aromatic taste.

The volatile oil ($C_{10}H_{16}$), which is distilled in Britain, is colourless or straw-yellow, having the odour and taste of nutmeg; sp. gr. about ·930; boils at 329°. It contains an oxygenated oil, *Myristicol*, which is isomeric with *Carvol.*

The concrete or expressed oil, commonly known as "butter of nutmeg," is of an orange colour, firm consistence, and fragrant odour like that of nutmeg. It is soluble in about four parts of warm alcohol. It contains 6 per cent. of the volatile oil and several fatty acids, the most important of which is *Myristicin* ($C_{48}H_{86}O_6$), in combination with glycerine. Myristicin is soluble in ether and benzol, but insoluble in cold alcohol. By saponification it is resolved into *Myristic acid* ($C_{14}H_{28}O_2$). It is also found in spermaceti and in oils of linseed and of poppy.

LAURACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CINNAMOMUM ZEYLANICUM Cinnamon (*Ceylon*)	Inner bark of shoots	AquaCinnamomi Oleum ,, Pulv.Cinnamom. Co. Tinct.Cinnamom.	20 ozs. to 1 gall. — 1 pt. in 3 2½ozs.to 1 pt.	1 to 2 ozs. 1 to 5 mins. 3 to 10 grs. ½ to 2 drms.	Stimulant, aromatic, carminative; slightly astringent. Contained in several astringent preparations.
CAMPHORA OFFICINARUM Camphor (*China and Japan*)	Concrete volatile oil from wood	Aqua Camphoræ Liniment. ,, Lin. Camph. Co. Spirit. Camph. Tinct.Camph.Co.	½ gr. in 1 oz. 1 in 5 nearly 54½ grs. to 1 oz. 1 in 10 1½ gr. in 1 oz.	1 to 2 ozs. — — 10 to 30 mins. 15 mins. to 1 drm.	Diffusible stimulant, antispasmodic, sedative, diaphoretic. Given in adynamic fevers, diarrhœa, antispasmodic diseases. Locally rubefacient and counter-irritant.
SASSAFRAS OFFICINALE Sassafras (*North America*)	Dried root	—	—	—	Stimulant, diaphoretic. Used in making Decoct. Sarsæ Co.
NECTANDRA RODIÆI Bebeeru, or Greenheart Tree (*British Guiana*)	Bark	Beberiæ Sulphas	—	1 to 10 grs.	Tonic and antiperiodic. A substitute for quinine.

Cinnamomi Cortex, Cinnamomi Oleum.

The bark is about one-fifth of a line thick, in closely-rolled quills, which are about four lines in diameter, containing several small quills within them; are light yellowish-brown, with a fragrant odour, and a warm, sweet aromatic taste; breaks with a splintery fracture. Chinese cinnamon, the product of C. aromaticum, is inferior. It is known as "Cassia bark," and occurs in thicker and darker tubes usually single-rolled. With tincture of iodine, a decoction of it gives a blue colour, which is not the case with true cinnamon.

The volatile oil is yellowish when recent, gradually becoming red, owing to oxygenation and formation of a resinous matter mixed with *Cinnamic Acid* ($HC_9H_7O_2$); the oil has the odour and taste of the bark; sp. gr. is from 1·025 to 1·05; it, therefore, sinks in water like oil of cloves, &c. (p. 108). It boils at between 428° and 446°. It is composed of *Cinnamyl hydride* (C_9H_7OH), and a small proportion of a hydrocarbon isomeric with oil of turpentine. Cinnamyl hydride is the aldehyd of Cinnamic alcohol, and, when heated with nitric acid, yields essential oil of almonds and benzoic acid; treated with hydrate of potash, it is resolved into Cinnamic acid and hydrogen. Cinnamic acid is contained in many balsams, especially in storax and balsams of Tolu and Peru; treated with caustic baryta, it is converted into *Cinnamol* or *Styrol* (C_8H_8), with liberation of carbonic anhydride; this may be regarded as the radicle hydrocarbon of the Cinnamic series, as *Benzol* is of the Benzoic series.

Camphora.

A concrete volatile oil or stearoptene obtained by sublimation. It is imported in the crude state in grayish-white grains (China or Formosa camphor), or in granular masses (Japan or Dutch camphor), and is purified in this country by mixing it with lime and resubliming it. So prepared, it is white, translucent, tough, and crystalline; has a powerful penetrating odour, and a pungent taste, followed by a sensation of cold. Sp. gr. 0·985 to 0·996, its density varying with temperature; it floats on water, and is thus distinguished from Borneo or Sumatra camphor, the product of Dryobalanops Camphora. It volatilises slowly at the ordinary temperature, and is deposited in hexagonal plates or prisms; sublimes entirely when heated, showing the absence of fixed impurities; it melts at 300°, boils at 400°, is very inflammable, and burns with a white flame; it is slightly soluble in water (1 in 1000), but is rendered much more soluble by the presence of carbonic acid, sugar, myrrh, carbonate of magnesia, &c.; it is readily soluble in rectified spirit, ether, chloroform, acetic acid, and fixed or volatile oils. It is difficult to pulverise except when a drop or two of rectified spirit or ether is added to it; it may also be obtained in powder by precipitating its tincture with water. The formula of camphor is $C_{10}H_{16}O$. Distilled with phosphoric anhydride, it is resolved into *Cymol* ($C_{10}H_{14}$), a molecule of water being abstracted; heated with nitric acid, it is oxidised into *Camphoric acid* ($C_{10}H_{16}O_4$), which is odourless, and *Camphoretic acid* ($C_{10}H_{14}O_7$). Heated with caustic potash in alcohol, it is converted into Borneo camphor or *Camphol* ($C_{10}H_{18}O$), and *Camphic acid* ($HC_{10}H_{15}O_2$).

It is said to be adulterated sometimes with sal ammoniac, but the presence of the latter is readily detected by shaking the sample with a little water, and testing it with nitrate of silver.

Camphor exists in many plants, and appears to result from the oxidation of a volatile oil.

Sassafras Radix.

Occurs in branched pieces sometimes eight inches in diameter at the crown; the bark externally is grayish-brown, and internally rusty-brown; it is of an agreeable odour, and preserves a peculiar aromatic warm taste. The wood is light, porous, grayish-yellow, more feeble in odour and taste than the bark. It is also met with in chips. Sassafras yields a volatile oil which has the odour and taste of the root, and is the active ingredient; it is heavier than water, having a sp. gr. of 1·09. It consists of a hydrocarbon *Safren* ($C_{10}H_{16}$), sassafras camphor or *Sassafrol* ($C_{10}H_{10}O_2$), and an isomer *Safrol;* the root also contains tannic acid and red colouring matter.

Nectandræ Cortex.

In large, flat, heavy pieces, from one to two feet long, from two to six inches broad, about quarter of an inch thick; grayish-brown externally, and dark cinnamon-brown internally. Its taste is strong, persistently bitter, and astringent. Besides tannic acid, resin, &c., the bark contains two alkaloids, *Nectandria* ($C_{20}H_{23}NO_4$) and *Beberia* ($C_{19}H_{21}NO_3$), a yellow resinous-looking substance, soluble in alcohol, and slightly so in ether. It is regarded by Watz as identical with *Buxine,* a constituent of common box; it forms salts with acids, one of which, the sulphate, is officinal.

Beberiæ Sulphas occurs in dark-brown thin translucent scales, yellow when in powder, with a strong bitter taste, soluble in water and in alcohol. Its watery solution gives a white precipitate with chloride of barium; and with caustic soda a yellowish-white precipitate of beberia, which is dissolved by agitating the mixture with twice its volume of ether. The ethereal solution, separated by a pipette and evaporated, leaves a yellow translucent residue, entirely soluble in dilute acids. Entirely destructible by heat. Water forms with it a clear brown solution.

ARISTOLOCHIÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ARISTOLOCHIA SERPENTARIA Serpentary or Virginian Snake-root (*United States*)	Dried rhizome	Inf. Serpentariæ Tinct. "	½ oz. to 1 pnt. 2½ ozs. to 1 pnt.	1 to 2 ozs. ½ to 2 drms.	Stimulant, tonic, diuretic, diaphoretic. Given in atonic dyspepsia, low febrile states, and in chronic rheumatism. Ingredient of Tinct. Cinchonæ Co.

Serpentariæ Radix.

A small roundish rhizome, with a tuft of numerous slender rootlets about three inches long, yellowish, of an agreeable camphoraceous odour, and a warm bitter camphoraceous taste. Contains a volatile oil, resin, an amorphous bitter extractive matter, together with tannin, sugar, and mucilage.

THYMELACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
DAPHNE MEZEREUM Mezereon (*England*)	Dried bark	Ext. Mezerei Æthereum	—	—	Local irritant and vesicant. In large doses emetic and purgative; in small doses diuretic and diaphoretic. Used in chronic rheumatism, &c. The bark is contained in Decoct. Sarsæ Co., and the Ethereal Extract in the Lin. Sinapis Co.

Mezerei Cortex.

In strips or quilled pieces of various lengths, tough and pliable, olive-brown on the surface, white within, fibrous, odour faintly nauseous, taste hot and acrid. Contains a volatile oil, an acrid resin, and a crystalline non-volatile glucoside, *Daphnin* ($C_{31}H_{34}O_{19}$); this, when boiled with dilute sulphuric acid, yields colourless prisms of *Daphnetin* ($C_{19}H_{14}O_9$). When the root is boiled in water an acrid vapour is given off.

EUPHORBIACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CROTON ELEUTERIA Cascarilla (*Bahamas*)	Bark	Inf. Cascarillæ Tinct. ,,	2ozs. to 1 pnt. 2½ ozs. to 1 pnt.	1 to 2 ozs. ½ to 2 drms.	Aromatic stomachic and tonic. Given in atonic dyspepsia; in convalescence from acute diseases, &c.
CROTON TIGLIUM Croton-oil plant (*East Indies*)	Oil expressed from the seeds	Oleum Crotonis Linim. ,,	— 1 vol. in 8	½ to 1 min. —	Powerful irritant, drastic purgative. Obstinate constipation; externally a counter-irritant.
RICINUS COMMUNIS Castor-oil plant (*East Indies and America*)	Oil expressed from the seeds	Oleum Ricini	—	1 to 8 drms.	Mild quick purgative. Ingredient of Collodium Flexile, Lin. Sinapis Co., and Pil. Hyd. Subchlor. Co.
ROTTLERA TINCTORIA Kamala, Wurrus (*India*)	Powder adhering to the capsules	Kamala	—	30 grs. to ¼ oz.	Anthelmintic in cases of tape-worm.

Cascarillæ Cortex.

In quills two or three inches in length, and from two to five lines in diameter, dull brown, but more or less coated with white crustaceous lichens; breaks with a short resinous fracture; is warm and bitter to the taste, and emits a fragrant odour when burned. It contains a bitter, neutral, crystalline principle, *Cascarillin* ($C_{12}H_{18}O_4$), which is sparingly soluble in water and chloroform, but freely in ether and hot alcohol; it also contains resin, gum, tannin, and a volatile oil which is isomeric with oil of turpentine.

Oleum Crotonis.

Croton oil seeds are about half an inch in length, and quarter of an inch broad; are oblong, a little flattened on the ventral surface, along which is the raised raphe. They are of a dull cinnamon-brown colour, and differ from castor oil seeds in being smaller, rougher, and not polished or speckled. Most of the oil is prepared in England. It is slightly viscid, of a brownish-yellow colour, with an acrid taste and a faintly nauseous odour; it is soluble in ether, oil of turpentine, olive oil, and volatile oils; that prepared in England is much more soluble in rectified spirit than the oil which is imported from India. It is composed of the ordinary fatty acids, together with acetic, butyric, and valerianic acids; it also contains *Tiglinic acid* ($C_5H_8O_2$), which is metameric with Angelic acid, and *Crotonic acid* ($C_4H_6O_2$). The irritant principle has not yet been isolated.

Oleum Ricini.

The leaves of the castor-oil plant, Palma Christi, are palmate, with seven to nine pointed serrate lobes; the flowers are monœcious; the capsule is covered with spines, is three-celled, each cell containing one seed. The seeds are somewhat larger than those of croton oil, are oval, compressed, obtuse at the ends, smooth, shining, and speckled with dark spots and veins; they are very irritant, and contain an acrid purgative principle, which has not been isolated.

The finest oil is that which is obtained by simple expression without the aid of heat, the so-called "cold-drawn" castor oil. Castor oil is viscid, colourless, or pale straw-yellow, having a slightly nauseous odour, and a somewhat acrid taste. It differs from most other fixed oils in being entirely soluble in one volume of alcohol and in two volumes of rectified spirit. Its sp. gr. is 0·964. It does not congeal at zero. On exposure to the air it is apt to become rancid; on saponification it yields *Ricinoleic acid* ($HC_{18}H_{33}O_3$), and *Palmitic acid.* Peroxide of nitrogen converts it into a solid crystalline fat, *Ricinelaidic acid;* by nitrate of mercury and by orange nitric acid it is solidified; treated with ammonia it yields a crystalline amide, *Ricinolamide* ($C_{18}H_{35}NO_2$).

Kamala.

A fine, granular, mobile powder, of a brick-red colour; it is with difficulty mixed with water, but when boiled with alcohol the greater part of it is dissolved, forming a red solution. Ether dissolves most of it, the residue consisting principally of tufted hairs. It should be free from sand or earthy impurities. Under the microscope it is seen to consist of red rounded glands, composed of club-shaped cells mixed with minute stellate hairs. It consists of about 80 per cent. of resin, *Rottlerin* ($C_{22}H_5O_6$), with tannic acid, gum, volatile oil, &c.

PIPERACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
PIPER NIGRUM Black-Pepper (*East Indies*)	Dried unripe berries	ConfectioPiperis	1 pt. in 10	60 to 120 grs.	Stimulant stomachic. Rubefacient. Used in hæmorrhoids and gonorrhœa. Also in dyspepsia, flatulence, &c. Ingredient of Confectio Opii and Pulv. Opii Co.
CUBEBA OFFICINALIS Cubebs (*Java*)	Dried unripe fruit	Pulv. Cubebæ Oleum " Tinct. "	— — 2½ ozs. to 1 pnt.	30 to 120 grs. 5 to 20 mins. ½ to 2 drms.	Stimulant to mucous membranes, especially the urethral and vesical. Given in gonorrhœa, &c.
ARTANTHE ELONGATA or PIPER ANGUSTIFOLIUM Matico	Leaves	Inf. Maticæ	1 oz. to 1 pnt.	1 to 4 ozs.	Leaf is locally a styptic. Stimulant and astringent internally to vesical and urethral mucous membranes.

Piper Nigrum.

A berry about the size of a small pea, roundish, wrinkled tegument, brownish-black, containing a grayish-yellow globular seed. Odour is aromatic, and the taste is pungent and bitterish. When decorticated it forms "white pepper."

Black pepper contains an acrid resin which is the essential ingredient, together with a volatile oil, isomeric with oil of turpentine, a fatty oil, some inorganic matter, and *Piperin* ($C_{17}H_{19}NO_3$). The latter is isomeric with morphia, and is a neutral, tasteless, odourless substance; it is soluble in alcohol and in acetic acid, is less soluble in ether, and is insoluble in water. Nitric acid decomposes it into *Piperic acid* ($HC_{12}H_9O_4$), and the alkaloid, *Piperedia* ($C_5H_{11}N$), which is oily, has the odour of pepper and ammonia, and forms crystalline salts with acids.

Cubeba, Oleum Cubebæ.

The fruit is rather larger than black pepper, is globular, wrinkled, blackish, supported on a stalk; has a warm camphoraceous taste and a characteristic odour. It contains a volatile oil ($C_{30}H_{48}$); an odourless, tasteless, inert, crystalline substance, *Cubebin;* an amorphous resin; *Cubebic acid;* some fixed oil, gum, and inorganic salts.

The volatile oil is distilled in Britain; it is colourless or pale greenish-yellow, having the taste and odour of cubebs. Boils between 430° and 480°. On exposure to cold it deposits crystals of *Hydrate of Cubebene* or *Camphor of Cubebs* ($C_{30}H_{48}2H_2O$).

Maticæ Folia.

From 2 to 8 inches long, pointed, veined and tesselated in the upper surface, downy beneath, with an aromatic slightly astringent warm taste and an agreeable aromatic odour. Contains a volatile oil, a little resin, a crystallisable acid, *Artanthic acid*, and a trace of tannin.

LIQUIDAMBARACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
LIQUIDAMBAR ORIENTALE Storax (*Asia Minor*)	Balsam from the bark	Styrax Præparatus	—	—	Stimulant to mucous membranes, and a stimulating application to ulcers. An ingredient in Tinct. Benzoini Co.

Styrax Præparatus.

The balsam is purified by means of rectified spirit and straining. It is a semi-transparent brownish-yellow semi-fluid resin, of the consistence of thick honey, with a strong agreeable odour and an aromatic bland taste. Heated in a test-tube in a vapour-bath it becomes more liquid, but gives off no moisture; boiled with solution of bichromate of potash and sulphuric acid it evolves the odour of hydride of benzoyle (essence of bitter almonds). When pure it is soluble in alcohol and ether. Solid storax, styrax calmita, is not now officinal; it occurs in friable brownish-red masses which are covered on the surface with an efflorescence of cinnamic acid; it consists of liquid storax mixed with powdered liquid amber bark.

Storax contains a volatile oil, or *Styrol*, *Cinnamic acid*, *Styracin*, and resin. Styrol (C_8H_8) is an inflammable, volatile, transparent fluid; sp. gr., 0·924; boils at 295°; it has a burning taste, an aromatic odour, and is soluble in alcohol and ether. At 401° it is converted into the odourless and tasteless polymeric solid body, *Metastyrol*. *Cinnamic* acid ($HC_9H_7O_2$) is a powerful crystalline acid. *Styracin* ($C_{18}H_{16}O_2$) is a crystalline solid polymeric with hydride of cinnamyl; it is soluble in ether, less soluble in alcohol, and insoluble in water; by alkalies it is converted into cinnamic acid and *Styrone*, or cinnamic alcohol (HOC_9H_9O); oxidising agents liberate hydride of benzoyle from it.

ULMACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
ULMUS CAMPESTRIS Broad-leaved Elm (*Britain*)	Dried inner bark	Decoct. Ulmi	2½ ozs. to 1 pnt.	2 to 4 ozs.	Demulcent, slightly astringent and tonic. Alterative. In chronic skin diseases—as lepra and psoriasis.

Ulmi Cortex.

A tough brownish-yellow bark about half a line thick, odourless, with a mucilaginous slightly bitter astringent taste. Its decoction is turned green by perchloride of iron and precipitated by gelatine, indicating the presence of tannic acid of which it contains about 3 per cent.; it also contains a little resin and about 20 per cent. of gum and mucilage.

CUPULIFERÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
QUERCUS PEDUNCULATA Common Oak (*Britain*)	Dried bark of small branches.	Decoct. Querci	1¼oz.to 1 pnt.	1 to 2 ozs.	Astringent. Chiefly used in the form of a lotion, gargle, or injection.
QUERCUS INFECTORIA Gall, or Dyer's Oak (*Asia Minor*)	Galls	Tinctura Gallæ	54½ grs. to 1 oz.	½ to 2 drms.	Astringent. Test for Persalts of Iron. Source of Gallic and Tannic acids.
		Unguent. „	80 grs. to 1 oz.	—	
		Ung. Gallæ cum Opio	80 grs. to 1 oz.	—	

Quercus Cortex.

Should be collected in the spring. It is covered with a grayish shining epidermis, cinnamon-coloured on the inner surface, fibrous, brittle, and strongly astringent. It contains a peculiar variety of tannic acid called *Querci-tannic acid.* It differs from tannic acid in not yielding gallic acid when oxidised. Oak-bark also contains an uncrystallisable sugar, pectin, &c.

Galla.

Gall-nuts are excrescences caused by the punctures and deposited ova of the Diplolepis Gallæ tinctoria, a hymenopterous insect. They are hard, heavy, globular bodies, varying in size from half an inch to an inch in diameter, tuberculated on the surface—the tubercles and intervening spaces being smooth. There are two varieties—"blue" and "white;" the former are of a bluish-green colour on the surface, yellowish-white within, with a small central cavity, and intensely astringent. The "white galls" are grayish in colour, are less astringent, and are perforated with a small hole—the passage by which the insect works its escape. English galls are smooth on the surface. Another variety—"large Mecca galls," or "Dead sea apples"—are sometimes imported from Bussorah; they are spherical and are surrounded about the centre by a circle of protuberances.

Galls contain about 35 per cent. of tannic acid, 5 per cent. of gallic acid, together with *Ellagic acid*, gummy and extractive matters, lignin, salts, &c. Tannic and Gallic acids are described under the head of Acids (pp. 18 and 23). Ellagic acid ($C_{14}H_6O_8$) forms a white crystalline powder which is insoluble in water, alcohol, or ether. Starch exists in gall-nuts, but only in the immediate vicinity of the central cavity.

MORACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
Ficus Carica Fig (*Smyrna*)	The dried fruit	—	—	—	Demulcent, nutritive and laxative. An ingredient of Confectio Sennæ.
Morus Nigra Mulberry (*Britain*)	Juice of ripe fruit	Syrupus Mori	—	1 drm.	Refrigerant in fevers. Slightly laxative. A colouring agent.

Ficus.

The so-called fruit is a "Syconus," and consists really of the matured result of an inflorescence, and not of a single flower; it is soft, tough, brown, covered with a saccharine efflorescence; contains numerous small hard seeds, the true fruits in the interior enclosed in a viscid pulp. These are quite closed in, except at the apex, where a small orifice exists. The fig consists chiefly of saccharine and mucilaginous matter.

Mori Succus.

The fruit is a "Sorosis," and consists of numerous small drupelets, each resulting from a separate flower attached to a common receptacle, and each containing a single seed, the fleshy covering of which is formed by the sepals. The juice is of a dark violet colour, with a faint odour and an acidulous sweet taste. It contains sugar, free acid—probably malic—albuminous matter, pectin, gum, salts, cellulin, and insoluble matters.

CANNABINACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CANNABIS SATIVA Indian Hemp (*India*)	Dried flowering tops of female plants	Ext. Cannabis Indicæ	—	¼ to 1 gr.	Anodyne, antispasmodic, and soporific. Given in neuralgia, spasmodic cough, tetanus, hydrophobia, and other spasmodic diseases.
		Tinct. " "	22 grs. of extract. in 1 oz.	5 to 20 mins.	
HUMULUS LUPULUS Hop (*Britain*)	Dried catkins of female plants	Extract. Lupuli	—	5 to 15 grs.	Tonic, stomachic, slightly narcotic. In atonic dyspepsia, nocturnal emissions, chordee, &c.
		Inf. "	½ oz. to 10 ozs.	1 to 2 ozs.	
		Tinct. "	2½ ozs. to 1 pnt.	½ to 2 drms.	

Cannabis Indica.

Tops, consisting of one or more alternate branches, bearing the remains of the flowers and smaller leaves and a few ripe fruits pressed together in masses, which are about 2 inches long, harsh, of a dark-green colour and a characteristic odour. In commerce three forms of Indian hemp are met with—viz., "Churrus," the concreted resinous exudation from the leaves, stems, and flowers; "Gunjah," the dried plant, which has flowered and from which the resin has been removed, packed in long bundles; "Bhang," or "Hashish" of the Arabs, the leaves and capsules without the stalks. The Pharmacopœia directs that, for medical use, the plant which has grown in India, and from which the resin has not been removed, is alone to be employed. The resin, *Cannabin*, is secreted in much larger proportion by the Indian than by the European plant. It is soluble in alcohol and ether, and is separated from its solution in these by the addition of water; it has a bitterish taste and a peculiar odour. A volatile oil is also contained in the plant; this is lighter than water, is amber-coloured, and has an oppressive odour; it has been resolved into a colourless liquid, *Cannabene* ($C_{18}H_{20}$), and a solid hydride of this ($C_{18}H_{22}$).

Lupulus.

The catkin or strobile is composed of thin, semi-transparent membranous scales of a greenish-yellow colour with minute yellow grains (Lupuline) adherent to their base; odour, aromatic; taste, bitter. Lupuline occurs as a golden-yellow powder, having the peculiar flavour of the hops; under the microscope it appears to resemble pollen. Lupuline, in which the active principle of hops chiefly resides, contains a volatile oil, a resin, a nitrogenous substance, a gummy matter, tannic acid, and a bitter principle, *Lupulite* or *Humulin.* The latter is soluble in alcohol, slightly soluble in water, and insoluble in ether. The volatile oil is green, but may be rendered colourless by re-distillation; on exposure to air it is converted into a resinous mass. It contains a hydrocarbon ($C_{10}H_{16}$) with *Valerol* ($C_6H_{10}O$); the latter is converted into valerianic acid by the action of caustic potash. According to Griessmayer, hops contain a minute quantity of *Trimethylamine* and a liquid alkaloid having the odour of conia.

CONIFERÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
PINUS PALUSTRIS, P. TÆDA, P. PINASTER (*America and France*)	The oleo-resin	Oleum Tereb.	—	10 mins. to 4 drms.	Oil of Turpentine is stimulant, antispasmodic, astringent, diuretic. Influences mucous membranes like Copaiba. In large doses purgative and anthelmintic. Given in hysteria, passive urinary and intestinal hæmorrhage. Externally, rubefacient, and as a fomentation in tympanitis.
		Conf. ,,	1 pt. in 4	1 to 2 drms.	
		Enema ,,	1 vol. in 16	—	
		Linim. ,,	16 pts. in 19	—	
		Lin.Tereb.Acet.	1 vol. in 3	—	
		Unguent.Tereb.	1 pt. in 2	—	
PINUS SYLVESTRIS Scotch Fir (*Northern Europe*)	A bituminous liquid from the wood	Pix Liquida Ung. Picis Liq.	—	—	Internal and external stimulant. In skin diseases, bronchial affections, &c.
ABIES EXCELSA Spruce Fir (*Switzerland*)	A resinous exudation from the stem	Pix Burgundica	—	—	External stimulant and Rubefacient. Contained in Emp. Ferri and Emp. Picis.
ABIES BALSAMEA Gilead Fir (*Canada*)	The Turpentine obtained by incision	Terebinthina Canadensis	—	20 to 30 grs.	Like other turpentines; not much used internally. Ingredient of Charta Epispast., Collodium Flexile.
LARIX EUROPEA Larch (*Europe*)	Bark	Tinct. Laricis	2½ ozs. to 1 pnt.	20 to 30 mins.	Stimulant, astringent, and expectorant, Given in intestinal hæmorrhage, purpura. Also in cystitis, chronic bronchitis, &c.

Coniferæ—Continued.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
JUNIPERUS COMMUNIS Common Juniper (*Northern Europe*)	Oil distilled from unripe fruit	Oleum Juniperi	—	—	Stimulant, diuretic.
		Spirit. „	1 vol. in 50	½ to 1 drm.	
JUNIPERUS SABINA Savin (*Britain*)	Fresh & dried tops and oil distilled	Pulv. Sabinæ	—	4 to 10 grs.	Irritant, either externally or internally. Emmenagogue. Externally, to keep up discharge from blisters; internally, in deficient menstruation.
		Oleum „	—	1 to 5 mins.	
		Tinct. „	2¼ oz. to 1 pnt.	20 mins. to 1 drm.	
		Ung. „	8oz.to19ozs.	—	

Oleum Terebinthinæ.

The oleo-resin, as it flows from the trunks of the several species of Pinus, is of a pale-yellow colour, with a characteristic pungent taste and odour; at first its consistence is that of treacle, but this varies with heat and exposure. It consists of resin dissolved in volatile oil, and these are separable by distillation. There are various varieties of turpentine, such as American, French, Chian, Venetian, &c.

Oil or Spirits of Turpentine or Camphine ($C_{10}H_{16}$) is the oil distilled from the oleo-resin. It is limpid and colourless, having the peculiar odour and taste of the oleo-resin. Sp. gr. 0·864; boils at 314°. It is inflammable; miscible with fixed or volatile oils; is soluble in alcohol and ether; shaken with water, a minute quantity of it dissolves, and the solution has no action on blue litmus paper. It is a solvent of many bodies, as of caoutchouc, sulphur, phosphorus, fats, and resins, forming varnishes with the latter. On exposure it partly volatilises, and partly resinifies by oxidation. By the action of strong oxidising agents it is converted into formic acid. With hydrochloric acid it forms two artificial camphors, $C_{10}H_{16}HCl$ and $C_{10}H_{16}2HCl$. Nitric acid acts so violently on it as frequently to inflame it; it converts it into resin, and into oxalic, terebic, and other acids. The oil, when recent, deteriorates on mixing it with iodine. With water oil of turpentine forms three hydrates, *Terpinol* $(C_{10}H_{16})_2H_2O$, *Terpine* $C_{10}H_{16},2H_2O$, and *Terpine hydrate* $C_{10}H_{16},3H_2O$. English and American oil of turpentine is dextro-gyrate; German, French, or Venetian oil is lævo-gyrate.

Resina.

Resin or rosin is the residue of the distillation of the turpentines of various species of Pinus and Abies. It is translucent, yellowish, brittle, pulverisable; breaks with a shining fracture; has a faintly terebinthinate odour and taste; it is easily fusible, and is thus distinguished from gums; burns with a dense yellow flame and much smoke. It is insoluble in water, but soluble in alcohol, ether, fatty and bituminous substances. Sulphuric acid colours it red. Resin consists of three isomeric acids, *Pinic*, *Sylvic*, and *Pimaric* ($HC_{20}H_{29}O_2$); the first of these is soluble in cold alcohol, sylvic acid is soluble in warm alcohol, while pimaric acid requires boiling alcohol for its solution. Turpentine yields from 75 to 90 per cent. of resin; American resin is much purer than English.

Thus Americanum.

Common Frankincense is the concrete turpentine spontaneously exuding from natural fissures in the bark of Pinus Tæda, the Frankincense Pine, and P. palustris, the Swamp Pine. It is a softish, bright yellow, opaque, solid substance; resinous, but tough, having the odour of American turpentine. On keeping it becomes hard. In its recent state it yields about 17 per cent. of volatile oil, and thus differs from resin. True Frankincense, the natural exudation of Abies excelsa, is not now imported into this country.

Pix Liquida.

Tar is a bituminous liquid obtained from the wood of Pinus sylvestris and other pines by destructive distillation; it is thick, viscid, brownish-black, having a peculiar aromatic odour. Water agitated with it acquires a pale-brown colour, a sharp empyreumatic taste, and an acid reaction. The sp. gr. of tar is 1·040. Wood-tar is of a very complex constitution; on distillation, oil of turpentine, creasote, and other hydrocarbons pass over, and a black resin "pitch" remains.

Creasote.

Is a product of the distillation of wood-tar. It consists of two homologous bodies, *Guiacol* ($C_7H_8O_2$) and *Creasol* ($C_8H_{10}O_2$). It is a liquid which is colourless or has a yellowish tinge and a strong empyreumatic odour. It is sparingly soluble in water (1 in 80), but freely soluble in alcohol, ether, and glacial acetic acid; sp. gr., 1·071. Boils at 400°. It coagulates albumen. A slip of deal dipped into it, and afterwards into hydrochloric acid, acquires on exposure for a short time to the air a greenish-blue colour. Dropped on white filtering paper and exposed to a heat of 212° it leaves no translucent stain, showing the absence of fixed oils. It is dextrogyrate; is not solidified by the cold produced by a mixture of hydrochloric acid and sulphate of soda. The presence of carbolic acid, which is the most frequent impurity, may be detected by its giving a violet-blue colour with perchloride of iron in an aqueous solution. True creasote is insoluble in ordinary glycerine which contains some water; carbolic acid, on the other hand, is soluble in it. With nitric acid creasote yields oxalic acid and a resinous mass. It does not yield aniline with ammonia, nor does it gelatinise collodion, as carbolic acid does (p. 17). Its Pharmacopœial preparations are:—*Mistura Creasoti*, *Unguentum Creasoti*, and *Vapor Creasoti*.

Pix Burgundica.

Burgundy pitch is a resinous exudation from the stem of Abies excelsa, the Spruce Fir. It is melted in hot water, and strained through a cloth. It is hard and brittle, yet gradually taking the form of the vessel in which it is contained; opaque, varying in colour, but generally dull reddish-brown; of a peculiar, somewhat empyreumatic, perfumed odour, and aromatic taste, without bitterness; it is free from vesicles, gives off no water when heated; is almost entirely soluble in alcohol and glacial acetic acid. Its composition is the same as that of common resin obtained from turpentine, and it contains a little volatile oil.

Terebinthina Canadensis.

A pale-yellow ductile oleo-resin, of the consistence of thin honey, with a peculiar agreeable odour, and a slightly bitter acrid taste. By exposure it dries very slowly into a transparent adhesive varnish; solidifies when mixed with a sixth of its weight of magnesia, owing to the formation of a fine magnesian soap. It is composed of a volatile oil and resin, and is incorrectly named a balsam, as it contains neither benzoic nor cinnamic acid.

Laricis Cortex.

Occurs in flat pieces from three to six inches long, and from two to four inches wide; the inner surface is yellow and fibrous, and the outer surface, denuded of epidermis, is reddish; the epidermis is grayish, and is spotted with lichens, and beaded with resinous exudation; it has a faintly terebinthinate odour. It contains, besides turpentine, gum, sugar, and tannic acid, a volatile substance termed *Larixin* or Larixinic acid ($C_{10}H_{10}O_5$); this forms crystals like benzoic acid, is sparingly soluble in cold water or ether, but is more soluble in boiling water and alcohol; it is converted by nitric acid into oxalic acid; persalts of iron turn its solution purple.

Oleum Juniperi.

Juniper "berries," as the galbulus or fruit is improperly called, are about the size of black currants, of a dark purple colour, with a glaucous bloom. They are filled with a brownish-yellow pulp, and contain three angular seeds, have an agreeable terebinthinate odour, and, besides the volatile oil, contain resin, wax, gum, grape-sugar, lignin, and salts of lime. In the ripe fruit the volatile oil is converted into resin. Oil of juniper ($C_{10}H_{16}$) is most abundant in the unripe fruit; it is isomeric with oil of turpentine, colourless or pale greenish-yellow, with a sweetish odour and a warm aromatic taste. Sp. gr. 0·855. It is but slightly soluble in alcohol.

Sabinæ Cacumina, Sabinæ Oleum.

The twigs, which are collected in spring, are densely covered with minute imbricated oppressed leaves in four rows; they are of a dark-green colour, have a peculiar, strong, unpleasant odour, and an acrid, bitter, resinous, disagreeable taste. Besides the volatile oil, they contain resin, gallic acid, &c. The oil ($C_{10}H_{16}$) is isomeric with oil of turpentine; it is colourless or pale-yellow; sp. gr. 0·915; has the odour and taste of the plant; it is but slightly soluble in alcohol, but freely soluble in ether.

ZINGIBERACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ZINGIBER OFFICINALE Ginger (*East and West Indies*)	Rhizome scraped and dried	Syrup. Zingiberis	—	1 drm.	Aromatic stimulant and sialagogue. Carminative. Given in atonic dyspepsia with flatulence. To correct griping of purgatives. Contained in several aperient and other preparations.
		Tinct. "	2½ ozs. to 1 pnt.	15 mins. to 1 drm.	
		Tinct. Zingiber. Fortis.	10 ozs. to 1 pnt.	5 to 20 mins.	
CURCUMA LONGA Turmeric (*Ceylon*)	Rhizome	Turmeric Tinct.	1 to 6	—	Test for alkalies. Not used as a remedy.
		Turmeric Paper	—	—	
ELETTARIA CARDAMOMUM Cardamoms (*Malabar*)	The seeds contained in the dried capsules	Tinct. Cardamomi Co.	¼ oz. to 1 pnt.	½ to 2 drms.	Aromatic stimulant, stomachic, and carminative. Similar to ginger. Enters into many preparations.

Zingiber.

The rhizome occurs in irregular, lobed, decorticated pieces, three or four inches long, sub-compressed, yellowish-white but not chalky on the surface, with a short mealy fracture, hot taste, and agreeable aroma. The powder is yellowish-white. Two varieties are met with in commerce—viz., "white" or Jamaica ginger, which is prepared by scraping and scalding the rhizomes, and drying them by exposure to the sun. The other variety is the "black" or East Indian ginger, which is dried without being scraped.

Besides the ordinary constituents of roots, ginger contains a volatile oil, resinous matters, and abundance of starch. The volatile oil (C_5H_8) is the essential ingredient; its sp. gr. is 0·893; it possesses the aroma and taste of the rhizome.

Curcuma.

The best rhizomes are in short pieces, yellow externally, deep orange within, having a peculiar odour. Besides starch and an odorous, acrid, volatile oil, turmeric contains a yellow colouring principle, *Curcumin*, which is insoluble in water, but soluble in alcohol and ether. By the action of alkalies it is turned to a deep brown; but acids, except boracic, produce no change of tint.

Cardamomum.

The fruit is a three-celled capsule, ovate-oblong, triangular, light yellow, coriaceous, ribbed, and containing numerous seeds. The seeds are best kept within their pericarps, from which they should be separated when required for use, the pericarpial coats being rejected. They are obtusely angular, corrugated, reddish-brown, internally white, having a warm, aromatic, agreeable taste and odour. They yield about 4·5 per cent. of volatile oil, which has the taste and odour of the seeds; sp. gr. 0·93; it is a compound of a liquid portion and a crystalline camphor isomeric with turpentine camphor ($C_{10}H_{16}3H_2O$). The seeds also contain a fixed oil, an acrid resin, colouring matter, salts, &c.

IRIDACEÆ.

Name and Habitat	Part Used	B. P. Prep.	Strength	Dose	Action and Use
CROCUS SATIVUS Saffron (*Southern Europe*)	Dried stigma and part of style	Tinctura Croci	1 oz. to 1 pnt.	—	Colouring agent. Contained in Decoct. Aloes Co., Pil. Aloes et Myrrh., Pulv. Cretæ Ar., Tinct. Cinch. Co., Tinct. Opii Am. and Tinct. Rhei.

Crocus.

Consists of thread-like styles, each terminated by three long, orange-brown stigmas, broadest at the summit. It has a powerful odour. Rubbed on the wet finger it leaves an intense orange-yellow tint. When pressed between the folds of white filtering-paper it should leave no oily stain. The finest saffron is dried loosely and is known as "hay-saffron;" an inferior kind, "cake-saffron," is dried under pressure. Saffron contains an orange-red colouring matter, *Polychroit*, a glucoside, which, on decomposition, yields a volatile oil and *Crocin*. This latter, a red colour, is changed blue by sulphuric acid and green by nitric acid.

The *petals* of marigold and of safflower have been used to adulterate saffron; the *stamens* of the saffron have also been found mixed with its styles and stigmas. These adulterations may be detected by steeping in warm water, the form of the thereby expanded crocus stigma and style being characteristic. The weight of saffron is fraudulently increased by coating it with carbonate of lime previously tinged orange-yellow. If a few shreds of such saffron be placed on the surface of water in a wineglass and gently stirred, the water will immediately become turbid and the lime subside as a white powder. When dilute hydrochloric acid is dropped upon saffron thus adulterated, it will freely effervesce (*Pharmacographia*).

SMILACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
SMILAX OFFICINALIS Jamaica Sarsaparilla (*Jamaica*)	Dried root	Decoctum Sarsæ Decoct.Sarsæ Co. Ext.SarsæLiquid.	2½ ozs. to 1 pnt. 2½ ozs. to 1 pnt. 1 pd. to 8ozs.	2 to 10 ozs. 2 to 10 ozs. 2 to 4 drms.	Diaphoretic, tonic, alterative. Given in syphilis, scrofula, chronic rheumatism, gout, skin diseases, &c.

Sarsæ Radix.

Roots not thicker than a goose-quill, generally many feet in length, reddish-brown, covered with rootlets, which are often subdivided and are then said to be "bearded." They are folded in bundles about eighteen inches long, scentless, with a mucilaginous, feebly bitter, faintly acrid taste. The roots consist of a cortex and a ligneous portion or meditullium enclosing the pith. According to the characters of these layers the Sarsaparillas of commerce have been classified into "Mealy" and "Non-mealy." The following description is from "Garrod's Materia Medica":—

"In the *non-mealy* varieties the cortex is deeply coloured and not mealy. Although some starch granules can be detected under the microscope, still the number is comparatively few. The diameter of the meditullium is generally four or five times greater than that of the cortex. Oil of vitriol applied to a transverse section causes both cortex and wood to become of a dark red tint, and iodine shows but a small amount of starch. Under this division are included the *Jamaica*, the *Lima*, and the *true* or *lean Vera Cruz*.

"The *Jamaica*, the only officinal Sarsaparilla, occurs in bundles from a foot to a foot and a half in length, with spirally twisted roots, not thicker than a goose-quill, several feet in length, folded, with numerous rootlets (*bearded*) of a reddish-brown colour. Jamaica Sarsaparilla has a mucilaginous and slightly bitter and acrid taste; it is not mealy, but yields much extractive matter when heated with water.

"*Lima* Sarsaparilla occurs in bundles, about two or three feet long, folded with the chump (or root-stack) in the interior, of a grayish-brown colour. It is derived from Smilax officinalis.

"The *true Vera Cruz* Sarsaparilla is not often found in commerce; it is lean, unfolded, with few rootlets; the chump is present.

"The *mealy* varieties are distinguished by the large amount of starch contained in the inner cortical layers, which are sometimes equal in thickness to the meditullium; they break with a starchy fracture: the cortex is often cracked transversely, and sometimes falls off; they have occasionally a swollen appearance, and are then named gouty. If a drop of sulphuric acid be added to a transverse section, the mealy coat is unchanged, the ligneous zone becomes dark purple, and when a solution of iodine is applied, the starchy layer becomes evident, from the formation of the blue iodide of starch.

"The mealy varieties include the *Honduras*, the *Brazilian*, and the *Caraccas* or gouty Vera Cruz.

"The *Honduras* Sarsaparilla occurs in bundles, about three feet long, composed of the folded roots, secured by a few circular twists; of a dirty brown colour, with many lateral fibres, but no chump; it is very mealy. It is brought from the Bay of Honduras. The botanical origin is doubtful.

"The *Brazilian* or *Lisbon* Sarsaparilla occurs in bundles, from three to five feet long, composed of the unfolded roots, bound together very tightly by a flexible stem; of a reddish brown colour, with few rootlets. It comes from the Brazils, through Lisbon. It is probably derived from Smilax papyracea and Smilax officinalis.

"*Caraccas* or *Gouty Vera Cruz* Sarsaparilla is found in bundles, two feet and a half long, and one foot broad, of a pale yellow colour. The chump is present, and it is very mealy. Derived from Smilax officinalis and syphilitica."

Sarsaparilla spoils by keeping. Its most important constituent is *Sarsaparillin*, *Smilacin*, or *Parillinic acid*, a crystallisable neutral bitter principle which is soluble in hot water, alcohol, and ether, but is almost insoluble in cold water; it turns sulphuric acid red. Sarsaparilla also contains a volatile oil, which is heavier than water, with starch, ligneous fibre, &c.

LILIACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
URGINEA SCILLA Squill (*Mediterranean Coasts*)	Sliced & dried bulb	Pulv. Scillæ	—	1 to 3 grs.	Stimulating expectorant and diuretic. In large doses cathartic and emetic. Given in bronchitis and dropsy.
		Acetum ,,	2½ ozs. to 1 pnt.	15to40 mins.	
		Oxymel ,,	—	½ to 1 drm.	
		Pil. Scillæ Co.	1 pt. in 5	5 to 10 grs.	
		Pil. Ipecac. cum Scilla	1 pt. in 7	5 to 10 grs.	
		Syrup. Scillæ	—	½ to 1 drm.	
		Tinct. ,,	2½ ozs. to 1 pnt.	10to30,mins.	
ALOE VULGARIS *a*. Barbadoes and *b*. Socotrine Aloes (*East and West Indies, Socotra*)	Inspissated juice of cut leaf	*a*. Pulvis Aloes Barbadensis	—	2 to 6 grs.	Purgative. Emmenagogue. Used in dyspepsia, habitual constipation, amenorrhœa. Ingredient of Pil. Cambog. Co., Pil. Coloc. Co., and Pil. Coloc. et Hyos.
		Enema Aloes	4 grs. in 1 oz.	—	
		Extr. Aloes Barb.	8 pts. from 10	2 to 6 grs.	
		Pil. ,, ,,	1 pt. in 2	5 to 10 grs.	
		Pil. Aloes et Ferri	1 pt. in 5½	5 to 10 grs.	
		b. Pulvis Aloes Socotrinæ	—	2 to 6 grs.	Same action. An ingredient of Pil. Rhei Co. and Tinct. Benzoin. Co.; and (the extract) of Ext. Colocynth. Co.
		Decoct. Aloes Co.	4 grs. (*ext.*) in 1 oz.	½ to 2 ozs.	
		Enema Aloes	4 grs. in 1 oz.	—	
		Extr. Aloes Soc.	1 pt. from 2	2 to 6 grs.	
		Pil. Aloes Soc.	1 pt. in 2	5 to 10 grs.	
		Pil. A. et Assaf.	1 pt. in 4	5 to 10 grs.	
		Pil. A. et Myrrh.	1 pt. in 3	5 to 10 grs.	
		Tinct. Aloes	11 grs. in 1 oz.	1 te 2 drms.	
		Vinum ,,	16½ grs. in 1 oz.	1 to 2 drms.	

Scilla.

The squill bulb is pear-shaped, varies greatly in size, and weighs from ½ lb. to 10 lbs. It consists of overlapping scales—the outer ones being membranous, thin, and brownish-red, or white; the inner scales are thick, white, fleshy, and juicy. The taste is mucilaginous, intensely and disagreeably bitter, and somewhat acrid. The dried scales are white, or yellowish-white, slightly translucent and horny, like Tragacanth; they are scentless, disagreeably bitter in taste—easily pulverisable if very dry, but if exposed readily recovering moisture and flexibility. In preparing the scales the inert central ones and the dry outermost ones are rejected. Squill consists of water with gum, uncrystallisable sugar, a trace of tannin, phosphate of lime, and a bitter, resinous, extractive, from which a principle named *Scillitin* has been obtained, together with a peculiar resinous acrid principle. The aqueous infusion of squill is rendered deep-purple by persalts of iron.

Aloe Barbadensis, Aloe Socotrina.

The plant yielding Barbadoes aloes is the Aloe vulgaris; Socotrine aloes is the produce of one or more undetermined species of

Aloe. In the following table the characters of the two officinal varieties of Aloes are contrasted:—

Barbadoes Aloes.	*Socotrine Aloes.*
In yellowish-brown or dark-brown opaque masses.	In reddish-brown masses, opaque or translucent at the edges.
Breaks with a dull conchoidal fracture.	Breaks with an irregular and resinous fracture.
Has a bitter nauseous taste.	Has a bitter taste.
Has a strong disagreeable odour.	Has a strong fragrant odour.
Powder is of a dull olive-green colour.	Powder is of a bright orange-yellow colour.
Is more soluble in water.	Is less soluble in water.
Is usually imported in gourds.	Is usually imported in skins or chests.

Both varieties dissolve almost entirely in proof spirit, and during solution exhibit, under the microscope, numerous minute crystals.

Hepatic or *East Indian Aloes* is non-officinal; it is of a dark reddish-brown or liver colour, opaque or translucent, brittle, having a bitter taste, but not an unpleasant odour; the powder is yellow, and is crystalline.

Cape Aloes, the produce of Aloe spicata, &c., is met with in masses of a greenish-brown colour, having some translucency; it breaks with a conchoidal fracture; its odour is strong but not nauseous; its powder is greenish-yellow, but is non-crystalline. *Caballine Aloes* is an inferior variety of Cape Aloes.

All Aloes yield an active purgative principle, *Aloin* ($C_{34}H_{36}O_{14}$, H_2O); but each of the commercial varieties contains a peculiar aloin of its own. Aloin occurs in a crystalline and an amorphous form—the former is a bright yellow powder, neutral, very bitter, forming yellow solutions which become red on exposure—a change which is immediately effected by nitric acid. Sulphuric acid forms with it a dirty-green solution. The amorphous aloin probably bears the same relation to the crystalline variety that uncrystallised syrup does to cane-sugar; it is very soluble in water. Aloes is also said to yield a resin, so called, which, however, is soluble in boiling water, and is probably merely modified aloin. A volatile oil exists in very small quantity in Aloes. By the action of nitric acid on aloes several crystalline compounds are formed—as *Polychromic*, *Chrysammic*, and *Chrysolepic acids.* An acid named *Aloetic* is found in aloes; it strikes olive-brown with ferric salts.

MELANTHACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
VERATRUM VIRIDE American Swamp or Green Hellebore, or Indian Poke (*North America*)	Rhizome	Tinct. Veratri Viridis	4ozs.to1pnt.	5 to 20 mins.	Topical irritant, emetic, drastic purgative, vascular sedative. Externally in skin diseases; internally in inflammatory diseases.
ASAGRÆA OFFICINALIS Sabadilla, or Cevadilla (*Mexico*)	Dried fruit	Veratria Ung. Veratriæ	— 8 grs. to 1 oz.	— —	Local irritant, emetic, vascular sedative. Ointment used in neuralgia and rheumatism. Given internally in acute febrile affections, acute rheumatism, gout, &c.
COLCHICUM AUTUMNALE Meadow Saffron (*Europe*)	*a.* Fresh and dried corm	Pulv. Colchici Extract. „ Extract. Colchici Aceticum Vinum Colchici	— — — 88 grs. to 1 oz.	2 to 8 grs. ½ to 2 grs. ½ to 2 grs. 10 to 30 mins.	Cholagogue, diuretic, vascular sedative. In large doses purgative and emetic. Given principally in gout and gouty affections, and in rheumatism.
	b. Seeds	Tinctura „	54½ grs. to 1 oz.	10 to 30 mins.	

Veratri Viridis Radix.

The rhizome is collected in autumn and is dried; it is thick and fleshy and gives off numerous pale yellow radicles which are marked with indentations; it has a peculiar acrid taste and produces a sensation of tingling about the fauces. It contains two alkaloids, *Veratria* and *Viridia*, or *Jervine*—the former of these is not identical with the Veratria of cevadilla. Green hellebore root also contains a resin, gallic acid, &c.

Sabadilla.

The dried fruit is about half an inch long, consisting of three light-brown papyraceous follicles, each containing from one to three seeds which are about a quarter of an inch long, blackish-brown, shining, winged, and possessing an intensely bitter taste. Cevadilla owes its virtues to the presence of the alkaloid *Veratria* ($C_{32}H_{52}N_2O_8$), which is probably combined with gallic acids; it also contains a little resin and fatty matter, and two acids—*Veratric* and *Cevadic*—have been obtained from it. The following are the characters and tests of the officinal *Veratria*:—Pale gray, amorphous, without smell, but, even in the most minute quantity, powerfully irritating the nostrils; strongly and persistently bitter, and highly acrid; insoluble in water, sparingly soluble in spirit and ether, but readily in diluted acids, leaving traces of an insoluble brown resinoid matter. An active poison. Heated with access of air it melts into a yellow liquid, and at length burns away, leaving no residue. In contact with sulphuric acid it assumes an intense red colour, and with nitric acid it forms a yellow solution.

The Veratria of commerce contains another principle, *Sabadillina*, which differs from Veratria in being insoluble in ether and in not exciting sneezing.

Colchici Cormus, Colchici Semina.

Colchicum autumnale is indigenous. "In the course of the autumn its elegant lilac-purple flowers emerge from the ground, unaccompanied by leaves (hence its vulgar name of 'naked ladies'); a large portion of the long narrow tube of the corolla being concealed in the ground, and bearing the ovary at its base. In the following spring the leaves come up together with the fruit, which rises on a stalk above the surface in the form of three-lobed and three-celled capsules, which ripen their seeds about midsummer. As the summer passes a bud or new corm begins to form at the base of the old one, and is received into a furrow in its side. Sometimes there is a bud with a corresponding notch on each side. The young corm attains perfection about the middle of next summer, which, accordingly, is the proper time for its collection. The seeds ripen in summer, and should be gathered about August."—Smith.

The fresh corm is about the size of a chestnut, flattened where it has an undeveloped bud; furnished with an outer brown and an inner yellow coat; internally white, solid, and fleshy; yielding when cut a milky, acrid, and bitter juice. The dried corms are prepared by stripping off the outer coat, slicing them transversely, and drying at a temperature not exceeding 150°. The dried slices are about a line thick, moderately indented on one, rarely on both sides; are firm, flat, whitish, amylaceous, and have a bitter acrid taste.

The ripe seeds are about the size of white mustard, are very hard, and of a reddish-brown colour. They are not injured by drying, hence the tincture of them is a more certain preparation than the wine of the corm. Both corm and seeds contain fatty matters, gum, starch, lignin, *Cevadic acid*, and a crystalline principle, *Colchicine* ($C_{17}H_{19}NO_5$). This was formerly considered to be identical with veratria, but it has a less burning taste, is much more soluble in water, and does not excite sneezing; nitric acid turns it a deep violet. It has seldom been isolated.

PALMACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ARECA CATECHU Betel-nut Tree (*East Indies*)	Seed	Pulv. Arecæ	—	½ to ¾ oz.	Tæniacide, astringent.

Areca.

The seeds are contained in a yellowish fruit about the size of a hen's egg. They somewhat resemble horse-chestnuts in size and shape; are of a rusty-gray colour, inodorous, very hard, with a tesselated surface and a well-marked hilum. On section the ruminated albumen is disclosed, the cut surface resembling that of a nutmeg. They contain catechu-tannic and gallic acids, oily matter, gum, and *Areca-red.* This is a reddish-brown substance which is insoluble in cold water or ether, but soluble in boiling water and alkaline solutions; boiled with nitric acid it yields oxalic acid.

GRAMINACEÆ.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
TRITICUM VULGARE Wheat (*Europe*)	The grain, ground and sifted	Farina Tritici Mica Panis Amylum Glycerin. Amyli Mucilago Amyli	— — — 1 pt. in 11 12 grs. in 1 oz.	— — — — —	Nutritive, demulcent. Ingredient of Cataplasma Fermenti.
HORDEUM DISTICHON Pearl Barley (*Britain*)	Husked seeds	Decoct. Hordei	—	—	Nutritive, demulcent.
SECALE CEREALE Common Rye (*Britain*)	Spawn of fungus, Claviceps purpurea, within the paleæ	Ergota Ext. Ergot. Liq. Infus. Ergotæ Tinct. ,,	— 1 oz. to 1 oz. 11 grs. to 1 oz. 109 grs. to 1 oz.	20 to 30 grs. 10 to 30 mins. 10 to 30 mins. 10 ozs. to 1 drm.	Contracts the arterioles, and the uterus. Valuable in hæmorrhages, in tedious labour, purpura, &c.
SACCHARUM OFFICINARUM Cane Sugar (*East and West Indies*)	The juice of the stem	Saccharum Purificatum	—	—	Demulcent. Dietetic. Enters into several preparations.
		Theriaca	—	—	Treacle is slightly laxative. Sweetening agent.

Farina Tritici.

The grain of wheat ground and sifted. Flour consists of starch, about 70 per cent., and gluten, about 10 per cent., together with gum, sugar, mucilage, and water, with phosphates of soda, lime, and magnesia in small quantity. If it be kneaded under a stream of cold water the starch is washed away, and gluten remains as a grayish-white, adhesive, ductile mass. Thus prepared the gluten consists of vegetable fibrine and vegetable albumen, the former being soluble in alcohol, the latter insoluble.

Amylum.

Starch ($C_6H_{10}O_5$) is found in most plants, but very abundantly in the seeds of all grasses, in fleshy seeds such as beans and chestnuts, and in tuberous roots and stems. It occurs in white columnar masses, and under the microscope is seen to consist of small ovoid or angular transparent granules with concentric rings surrounding the central hilum. Its sp. gr. is 1·5. When rubbed in a Wedgwood mortar with a little cold distilled water, it is neither acid nor alkaline to test-paper, and the filtered solution does not become blue on the addition of solution of iodine, showing the absence of potato starch. If starch be kept in a moist state acetic acid is apt to be developed. Mixed with boiling water and cooled, starch gives a deep blue colour with iodine; in this test the decoction must first be cooled, as the blue colour of iodide of starch is discharged by a heat of 200°. When starch is heated with dilute sulphuric acid a soluble isomeric compound, *Dextrin*, is first formed, and this is ultimately converted into *Glucose*. Under the influence of ptyalin or diastase starch is converted into sugar. Strong nitric acid converts it into oxalic acid.

Hordeum Decorticatum.

Pearl Barley is white, rounded, retains a trace of the longitudinal furrow. Contains gluten, starch, gum, saccharine matters, fat, lignin, and salts.

Ergota.

Ergot is the diseased grain of common rye, the cause of the disease being the deposition of the sclerotium (compact mycelium or spawn) of the fungus Claviceps purpurea within the paleæ. The ergot grains are sub-triangular, curved, with a longitudinal furrow on the concave side, obtuse at the ends, from one-third of an inch to an inch and a half in length. They somewhat resemble the spur of a cock—hence the name "spurred rye." They are of violet-brown colour on the surface, pinkish within, solid, frangible, breaking with a short fracture. The odour is faintly-marked, but strong if the powder be triturated with solution of potash, owing to the liberation of a volatile alkaloid, Trimethylia or Secalia (C_3H_9O). Ergot contains two bases, *Ecboline* and *Ergotine*, combined with *Ergotic acid*. Ergotine ($C_{50}H_{52}N_2O_3$) is almost inert, consisting merely of resinous matter. The activity of the drug, which was formerly thought to be due to Ecboline, has lately been ascribed to a principle called *Sclerotic* or *Sclerotinic* acid which is present to the extent of about 4 per cent. Bonjean's "Ergotine" is a watery extract of ergot. Besides the constituents mentioned, ergot also contains about 30 per cent. of a fluid fixed oil, starch, gum, sugar (*Mycose*), and resin.

Ergot deteriorates on exposure to air and moisture; it should be powdered only when required for use. It is liable to be fed on by a species of acarus; camphor, cinnamon, sugar, &c., have been suggested as preservatives. Other varieties of ergot are ergot of wheat, ergot of oat, &c.

Saccharum Purificatum.

There are few plants which do not contain sugar. White sugar occurs in compact crystalline conical loaves, snow-white, dry, scentless, and intensely sweet. Sucrose or cane sugar ($C_{12}H_{22}O_{11}$) is soluble in half its weight of cold water, and is much more soluble in hot water, forming a viscid syrup. The aqueous solution produces a right-handed rotation on a ray of polarised light. Sugar becomes phosphorescent on rubbing pieces of it together. Crystallised from a strong solution, it forms oblique four-sided prisms, constituting "sugar-candy." Heated to 365° it melts, and when cooled suddenly, solidifies into an amorphous transparent substance, known as "barley-sugar." By prolonged boiling it forms uncrystallisable sugar (fruit-sugar, inverted sugar, or Lævulose), and if the boiling be still further continued, it is converted into Glucose or grape sugar ($C_6H_{12}O_6,H_2O$); by weak acids and by fermentation a similar change is readily effected (p. 206). Cane sugar differs from grape sugar in several particulars, as shown in the following table:—

Sucrose.	*Glucose.*
Charred by cold sulphuric acid.	Not charred by cold sulphuric acid.
Does not reduce an alkaline solution of potassio-tartrate of copper on boiling.	Reduces an alkaline solution of potassio-tartrate of copper on boiling.
Not altered when boiled with solution of potash.	Turned brown when boiled with solution of potash.
Crystallises in four or six-sided rhomboidal prisms.	Crystallises in cubes or square tables.
Less soluble in water.	More soluble in water.

Sugars are all carbo-hydrates, the hydrogen and oxygen being in the proportion to form water, and the number of atoms of carbon is six, or a multiple of that number. Gums, starches, and celluloses are also carbo-hydrates.

Theriaca.

Treacle, Sacchari Fæx, is the uncrystallisable residue of the refining of sugar; it is a thick brown syrup, very sweet; sp. gr. about 1·40. It is fermentable with yeast, yielding rum on distillation. It should be free from any empyreumatic odour and flavour.

FILICES.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ASPIDIUM FILIX MAS Male Shield Fern (*Britain*)	Dried rhizome, with part of foot stalks & root fibres	Extract. Filicis Liquid.	—	15 to 30 mins.	Tæniacide.

Filix Mas.

The caudex or central part is thick and cylindrical; it is tufted, scaly, greenish-brown; powder is greenish-brown, with a disagreeable odour, and a nauseous, bitter, somewhat astringent taste.

Male-fern contains, besides tannin, starch, gum, and salts, a volatile oil, a green fixed oil, and resin. The active principle is soluble in ether; the ethereal extract deposits a colourless crystalline substance, *Filicic acid* ($C_{14}H_{18}O_5$); the green liquid portion of the extract consists chiefly of *Glyceride of Filixolyn*, which yields, on saponification, *Filosmylic* and *Filoxylic acids*.

LICHENES.

Name and Habitat	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CETRARIA ISLANDICA Iceland Moss, or Liverwort (*Iceland*)	Entire lichen	Decoct. Cetrariæ	1 oz. to 1 pnt.	1 to 2 ozs.	Demulcent & slightly tonic.
ROCCELLA TINCTORIA, &c. Litmus (*The Azores, &c.*)	Blue colouring matter	Litmus Tincture	—	—	Test for acids and alkalies.
		„ Paper, Blue	—	—	
		„ Paper, Red	—	—	

Cetraria.

Iceland moss occurs as a foliaceous, lobed, crisp, cartilaginous thallus; brownish-white, paler beneath; taste bitter and mucilaginous. A strong decoction gelatinises on cooling, and the gelatinous matter (*Lichenin* or lichen-starch, $C_{12}H_{20}O_{10}$), when dried, forms a semi-transparent mass, which is insoluble in cold water, alcohol, or ether, but is soluble in boiling water, and the solution strikes blue with iodine. Unlike gum or the jelly of Chondrus Crispus—Irish or Carrageen moss—it yields merely a trace of mucic acid on boiling with strong nitric acid; by boiling with dilute acids it is converted into sugar. Iceland moss also contains *Licheno-stearic acid* ($C_{14}H_{34}O_3$), *Fumaric acid*, a little sugar, and a crystallisable bitter principle, *Cetraric acid* ($C_{18}H_{16}O_8$); this latter is soluble in alcohol, ether, and in alkaline solutions, but sparingly in water.

Lacmus.

Litmus is prepared by macerating the lichen in water with ammonia and exposing the mixture to the air for several days. At first it becomes red, and then blue; it is then removed, reduced to a proper consistence, and made up into small cakes with chalk or plaster-of-Paris. It has the odour of violets; yields to water and to alcohol its blue colouring matter. When heated strongly it does not evolve a violet vapour, or afford a sublimate of copper-coloured crystals, showing the absence of indigo. The chief constituent of the blue colouring matter of litmus is *Orcein* ($C_7H_7NO_3$). This is formed by the action of ammonia and the oxygen of the air on *Orcin* ($C_7H_8O_2$), which itself is the product of the decomposition of certain acids existing in the lichens (*Orsellinic acid*, *Erythric acid*, &c.), and is extracted from them by the influence of alkalies.

ORGANIC SUBSTANCES.

ANIMAL KINGDOM.—CLASS MAMMALIA.

RODENTIA.

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CASTOR FIBER The Beaver (*Hudson's Bay*)	The dried preputial follicles and their secretion	Castoreum Tinct. Castorei	— 22 grs. to 1 oz.	5 to 10 grs. ½ to 1 drm.	Feeble stimulant and antispasmodic. Given in hysteria and spasmodic affections.

Castoreum.

The preputial follicles of the Beaver are in pairs, united by their excretory ducts, about three inches long, fig-shaped, firm, and heavy, brown or grayish-black. They contain a dry, resinous, reddish-brown or brown, highly-odorous secretion termed *Castorine*, and a volatile oil. Castorine is a white crystalline fatty principle, soluble in boiling alcohol and in ether. *Salicine* ($C_{13}H_{18}O_7$) is stated to be a constituent of castor; the bark of willow trees, on which beavers feed, containing a large quantity of that substance. Carbolic acid is also found in the volatile oil. Castor is frequently adulterated; but, if genuine, the contents of the follicles are in great part soluble in rectified spirit and in ether.

UNGULATA.

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
MOSCHUS MOSCHIFERA The Musk Deer (*Central Asia*)	The inspissated and dried secretion from the preputial follicles	Moschus	—	5 to 10 grs.	Stimulant and antispasmodic.
OVIS ARIES The Sheep (*Domestic*)	The internal fat of the abdomen	Sevum Præparatum	—	—	Emollient. Used in preparation of Emp. Cantharidis and Ung. Hydrargyri.
BOS TAURUS The Ox and Cow (*Domestic*)	*a.* The fresh milk of the cow	Lac	—	—	Used in making Mist. Scammonii.
		Saccharum Lactis	—	—	Vehicle for powders. In Pulv. Elaterii Co.
	b. Fresh ox-bile	Fel Bovinum Purificatum	—	5 to 10 grs.	Tonic. Slightly aperient and cholagogue.

Ungulata—Continued.

Name and Distribution	Part Used	B. P. Prep.	Strength	Dose	Action and Use
SUS SCROFA The Hog (*Domestic*)	*a.* The purified fat of the abdomen	Adeps Præparatus	—	—	Emollient. An ingredient of the majority of the B. P. Ointments.
		Adeps Benzoatus	10 grs. to 1 oz.	—	Emollient. Enters into 4 suppositories and 4 ointments.
		Sapo Animalis	—	—	Used in making Pil. Scammonii Co., Suppos. Morph. cum Sapone, Sup. Acid. Carbolic. cum Sapone, and Sup. Acid. Tannic. cum Sapone.
	b. A preparation of the mucous lining of the stomach	Pepsin*	—	2 to 5 grs.	Aids digestion of nitrogenous food. Given in atonic dyspepsia.

Moschus.

Musk is procured from the male musk deer, a small graceful animal, about the size of a roe-buck, with no horns. It occurs as irregular, reddish-black, rather unctuous grains, having a strong, peculiar, very diffusible, persistent odour, and a bitter aromatic taste. It is contained in a round or slightly oval membranous sac, about two inches in diameter, situated on the belly of the animal immediately in front of the preputial orifice, and covered on the outer side with stiff grayish hairs arranged in a characteristic concentric manner around its central orifice. Each sac weighs about three-quarters of an ounce, and contains from two to three drachms of musk. Two varieties of musk are imported—China or Thibet musk, and Russian, Siberian, or Kabardine. The latter is an inferior kind.

Musk contains a peculiar odorous principle that has not yet been isolated, as well as ammonia, stearine, elaine, cholesterine, albumen, and different salts. Dried blood and various other substances have been used for the purposes of adulterating it; and artificial pods of musk, made from the skin of the animal, or from that of the musk ox, and stuffed with such substances mixed with a little true musk, have been substituted for the genuine sacs. These false sacs may be recognised by the absence of a central orifice having the characteristic concentric arrangement of the hair round it.

Sevum Præparatum.

Suet is prepared for medicinal purposes by melting the fat and straining it through coarse linen or flannel. Thus purified it is a white, smooth, almost scentless substance. It is nearly exclusively

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* Pepsin may also be prepared from the stomach of the sheep or calf.

composed of stearine ($C_3H_53C_{18}H_{35}O_2$), with a little oleine and palmitine, and is fusible at 103°, being the hardest of the solid fats.

Lac.

Cow's milk consists of casein, butter or fat, milk-sugar, various salts—chiefly chlorides and phosphates—and water. Good milk should yield about 12 per cent. of solid matter, and should afford, at least, about 10 per cent. of cream. *Casein* is the nitrogenous constituent of milk, and gives it its chief nutritive value. Although an albuminoid body, casein differs from albumen in being coagulated by acetic acid, forming what is known as "curds." Other acids, and rennet, produce a similar effect. The residue of milk from which the casein has been removed by coagulation, and the cream by standing, is termed "whey."

Saccharum Lactis.

Sugar of milk, or *Lactose* ($C_{12}H_{24}O_{12}$), is a crystallised sugar obtained from the whey of milk by evaporation. It is seen usually in cylindrical masses, 2 inches in diameter, with a cord or stick in the axis, or in fragments of cakes; grayish-white, crystalline on the surface, and in its texture, translucent, hard, scentless, faintly sweet, and gritty when chewed. It is slowly soluble in six parts of cold water, but slightly soluble in alcohol, and insoluble in ether. When oxidised with nitric acid it yields mucic acid (a product of gum also when similarly treated) and oxalic acid; saccharic, tartaric, and racemic acids are likewise produced in the same way from it. Sugar of milk differs from grape-sugar in yielding *Galactose* when boiled with dilute acids instead of the isomeric substance *Glucose*. But left for some time in contact with yeast, lactose undergoes alcoholic fermentation, and also resembles glucose in reducing cuprous oxide from an alkaline solution.

Fel Bovinum Purificatum.

The gall of the ox is purified from mucus, &c., by mixing fresh bile (1 pint) and rectified spirit (2 pints) by agitation in a bottle, and setting aside for twelve hours until the sediment—which is chiefly mucin coagulated by the spirit—subsides. The clear spirituous solution is then decanted and evaporated in a porcelain dish by the heat of a water bath, until it acquires a suitable consistence for making pills.

Purified Ox-Bile is a yellowish-green substance, having a taste partly sweet and partly bitter; it is soluble in water and in spirit. In addition to mucus and fats, bile consists chiefly of a fatty crystalline substance termed *Cholesterine* ($C_{26}H_{44}O$), certain pigments, a base, *Choline*, and two peculiar conjugate acids called *Glycocholic* and *Taurocholic*, forming crystalline resinous substances resembling soaps, and termed the glycocholate and taurocholate of sodium. *Glycocholic acid* ($C_{26}H_{43}NO_6$) is resolved by the action of sulphuric acid into *Glycocine* ($C_2H_5NO_2$) and *Cholic acid* ($C_24H_4O_5$). *Taurocholic acid* ($C_{26}H_{45}NSO_7$), by boiling with water, yields *Taurine* ($C_2H_7NO_3S$) and cholic acid.

Pettenkofer's test for bile is as follows:—A solution of one or two grains of ox-bile in about a fluid drachm of water—or any fluid containing bile—when treated, first, with a drop of freshly made syrup consisting of one part of sugar and four of water, and then with sulphuric acid, cautiously added until the precipitate at first formed is redissolved, gradually acquires a cherry-red colour, which changes in succession to carmine, purple, and violet. The liberation of the cholic acid gives the change of colours.

The principal colouring matter of the bile is *Bilirubin* ($C_{16}H_{18}N_2O_3$), which, on being oxidised, yields *Biliverdin* ($C_{16}H_{20}N_2O_5$); a third pigment, *Bilifuscin* ($C_{10}H_{20}N_2O_4$), is also described. The presence of these pigments in bile may be demonstrated by adding nitric acid, or other oxidising agents (*e.g.*, tincture of iodine), to a solution containing it. The bilirubin is thus converted into biliverdin, giving a green colour which subsequently changes to blue, violet, red, and finally to yellow. This reaction, consequently, serves for the detection not only of bile-pigment but also of bile itself.

The watery solution of purified ox-bile, if the mucus has been thoroughly removed, gives no precipitate on the addition of rectified spirit.

Adeps Præparatus.

Lard is purified by removing the membranes (peritoneum), washing the broken-up masses of fat thoroughly with a current of running cold water, so that whatever is soluble may be thus dissolved and carried away, and straining, then liquefying at a heat not exceeding 212°, so as to avoid any decomposition, and again straining through flannel.

Prepared lard is a soft white fatty substance melting at about 100°. It should not have a rancid odour, and should dissolve entirely in ether. It is a mixture of oleine ($C_3H_53C_{18}H_{33}O_2$) and stearine, the latter being the chief constituent of hard fats (p. 201). Distilled water in which lard has been boiled should not give a precipitate with nitrate of silver (absence of chloride of sodium), and should not give a blue colour with solution of iodine (absence of starch).

Adeps Benzoatus.

Is made by heating in a warm bath for two hours, prepared lard (1 lb.) and coarsely powdered benzoin (160 grs.), and finally straining. Lard is liable to become rancid by absorption of oxygen, and in such a state would be unfit for use. The addition of benzoin prevents or retards this change, and communicates an agreeable odour to the lard.

Sapo Animalis.

Animal or curd soap is made with soda and a purified animal fat (but not necessarily Adeps Præparatus) consisting principally of stearine. The other pharmacopœial soaps are made with olive oil. Curd soap is white, or with a very light grayish tint, dry, nearly inodorous; horny and pulverisable when kept in dry warm air; easily moulded when heated; soluble in rectified spirit; soluble also in hot water, the solution being neutral or only slightly alkaline to test-paper. It does not impart a greasy stain to paper, and may, with advantage, be substituted for the hard soap made with olive oil in preparing the Linimentum Potassii Iodidi cum Sapone.

Pepsin.

A nitrogenous substance existing in the gastric juice and in the peptic gastric glands. It is prepared from the mucous lining of a fresh and healthy stomach of pig, sheep, or calf, by the following process:—

The stomach of one of these animals recently killed having been cut open and laid on a board with the inner surface upwards, any adhering portions of food, dirt, or other impurity, are to be removed and the exposed surface slightly washed with cold water; the cleansed mucous membrane is then to be scraped with a blunt knife or other suitable instrument, and the viscid pulp thus obtained is to be immediately spread over the surface of glass or glazed earthenware, and quickly dried at a temperature not exceeding 100°, as a higher temperature would destroy its digestive powers. The dried residue is reduced to powder, and preserved in a stoppered bottle.

Pepsin is a light yellowish-brown powder, having a faint, but not disagreeable odour, and a slightly saline taste, without any indication of putrescence; very little soluble in water or spirit. Its efficacy depends upon its solvent powers on albuminous bodies, which, in the presence of dilute hydrochloric acid, it converts into peptones. The quality of a specimen is consequently ascertained by the following test:—Two grains of it with an ounce of distilled water, to which five minims of hydrochloric acid have been added, form a mixture in which 100 grains of hard-boiled white of egg, in thin shavings, will dissolve on their being digested together for about four hours at a temperature of 98°.

Commercial pepsin is often impure; but almost, if not quite, all kinds of pepsin deteriorate by keeping independently of adulteration.

CETACEA.

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
PHYSETER MACROCEPHALUS The Sperm Whale (*Pacific and Indian Oceans*)	Cetine, mixed with oil from the head	Unguent. Cetacei	—	—	An emollient application. Contained in Charta Epispastica.

Cetaceum.

Spermaceti is contained in large quantities from the cavities in the head of the sperm-whale. It is separated from the sperm oil, with which it is mixed, by filtration, and afterwards purified by melting and straining. It is a crystalline, pearly-white, glistening, translucent, fatty substance, with little taste or odour, reducible to powder by the addition of a little rectified spirit; scarcely unctuous to the touch, and should not melt under 100°. If softer fats, such as lard or suet, were present, the melting point would be lower. The latter, like most of the hard or solid fats, consist, as has been shown (pp. 201, 202), chiefly of stearine. Spermaceti consists of nearly pure cetine. Stearine, like oleine, when brought together with a moist alkaline oxide or hydrate, forms, by a simple double decomposition, a soap and glycerine. Cetine, however, which is chemically known as the *palmitate of cetyl* ($C_{16}H_{33}.C_{16}H_{31}O_2$), differs from stearine and oleine in yielding, instead of glycerine, when saponified, a substance called *ethal* ($C_{16}H_{33}.HO$). Ethal is the hydrate of cetyl, and is an alcohol homologous with ordinary alcohol.

Spermaceti is soluble in fixed and volatile oil, and in fats.

CLASS AVES.

RASORES (GALLINÆ).

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
GALLUS BANCKIVA The Common Fowl (*Domestic*)	The egg	Albumen Ovi	—	—	Demulcent.
		Solution of (App. II.)	—	—	Test for freedom of Acid. Phosphoric. Dil, from Metaphosphoric acid: it precipitates the latter.
		Vitellus Ovi	—	—	An ingredient in Mist. Spirit. Vini Gallici. Used for making emulsions.

Albumen Ovi.

Egg Albumen ($C_{72}H_{110}N_{18}SO_{22}$, H_{20}), or the liquid white of the egg, differs from serum (blood) albumen in being coagulable by ether. A solution of albumen in cold water is coagulated by solutions of corrosive sublimate, and many other metallic salts, by nitric, sulphuric, hydrochloric, and tannic acids, and by heating over 180°. It is not precipitated by acetic acid, thus differing from casein.

Vitellus Ovi.

Yolk of egg consists of a mixture of albumen and casein (*Vitelline*), and a yellow oil containing phosphoric acid.

Class Pisces.

TELEOSTEI (ANACANTHINI).

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
ACIPENSER The Sturgeon (*Black Sea and Caspian*)	The swimming-bladder or sound	Isinglass (App. II.)	—	—	Used for making Sol. of Gelatine.
		Solution of Gelatine (App. III.)	10grs.in 1oz.	—	Test for Tannic acid.
GADUS MORRHUA The Cod (*Coasts of Newfoundland, &c.*)	The oil extracted from the fresh liver	Oleum Morrhuæ	—	1 to 8 drms.	Nutritive. Affords an easily assimilated fat. Beneficial in struma, phthisis, defective nutrition, &c.

Isinglass.

The swimming-bladder or sound of various species of sturgeon, prepared, cut into shreds, and dried. It consists almost entirely of pure *gelatine* (9 per cent.); it is soluble in warm water, but gelatinises on cooling; insoluble in alcohol and ether. From its aqueous solution gelatine is precipitated by alcohol, corrosive sublimate, perchloride of platinum, and by tannic acid—the latter forming leather. A solution of gelatine in water is not, like one of albumen, coagulated by heat. By prolonged boiling the gelatinous power on cooling is destroyed.

Oleum Morrhuæ.

Is prepared from the fresh liver of the cod by the application of a heat not exceeding 180°. It contains glycerine, oleic, margaric, butyric, and acetic acids, a peculiar substance called gaduin, various biliary principles due to the hepatic source of the oil, iodine in small quantities, traces of bromine, chlorine, phosphorus, and salts. A volatile alkaloid, *Propylamine* ($NH_2C_3H_7$), can be obtained by distilling the oil with alkalies. It is stated that the fats of this oil are not true glycerides, but are salts of *Propyl* (C_3H_7), and yield *Propyl hydrate* (C_3H_7HO) on saponification instead of glycerine (Muter). The best ("pale") oil is of a pale-yellow colour, with a slight fishy odour, and bland fishy state. The darker-coloured light and dark brown oils are of an inferior quality and have a more nauseous taste. When a drop of sulphuric acid is added to a few drops of the oil on a porcelain plate, the play of colours due to the presence of cholic acid in bile is produced (p. 202). This test shows that the oil must have been made from the *liver*, and hence contain some bile; but it does not prove the genuineness of the oil or demonstrate that it is derived from codfish. Any liver oil would give the same reaction.

CLASS INSECTA.

HYMENOPTERA.

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
APIS MELLIFICA The Hive Bee (*Domestic*)	*a.* Saccharine secretion deposited in the honey-comb	Mel	—	—	Demulcent, slightly laxative.
		Mel Depuratum	—	—	Used in making the confections of pepper, scammony, and turpentine.
		Mel Boracis	64 grs. to 1 oz.	—	Detergent and astringent. Useful application to aphthæ.
		Oxymel	40 pts. in 50	1 to 2 drms.	Demulcent. Chiefly used in gargles for sore throat, and to make oxymel scillæ.
	b. The prepared honey-comb	Cera Flava	—	—	Contained in several ointments and plasters.
		Cera Alba	—	—	Contained in Charta Epispastica, Suppositoria Acid. Tannic., Hydrarg., Morphiæ, and Plumbi Co.; Ung. Cetacei, Plumbi Subacet. Co., and in Ung. Simplex.

Mel, Mel Depuratum.

Honey, when recently separated from the honey-comb, is a viscid translucent liquid, of a brownish-yellow colour, which gradually becomes partially crystalline and opaque, owing to the separation of glucose in crystals. It has a peculiar heavy odour and a very sweet taste. (*Vide* "Mellita," Part II.)

Honey consists of three distinct kinds of sugar—Sucrose, Glucose, and Lævulose—present in varying proportions, mixed with odorous, colouring, gummy, and waxy matters, and water. *Glucose*, dextrose, or grape-sugar ($C_6H_{12}O_6,H_2O$) constitutes the largest proportion, and forms the solid crystalline portion of honey. It is less sweet than cane sugar, and less soluble in water and in alcohol. In common with Lævulose, it is distinguished from cane sugar by at once precipitating red cuprous oxide when boiled with an alkaline solution of a cupric salt (p. 196).

Lævulose or fruit sugar ($C_6H_{12}O_6$) is a mixture of glucose and sucrose in equivalent quantities. It is also known as inverted sugar. Its name is derived from the fact that its solution turns a ray of polarised light to the left. Solutions of cane and grape sugar have an opposite effect. Lævulose is not crystallisable, and in other respects it has the same reactions as glucose.

Honey is adulterated with starch. If boiled with water for five minutes and allowed to cool, it does not, if free from starch, become blue with solution of iodine. Glucose, made from starch, and cane sugar, are also sometimes fraudulently added.

Cera Flava, Cera Alba.

The comb left after the removal of the honey is melted in boiling water, and then cooled. Thus prepared, it constitutes Prepared or Yellow Wax—a firm substance breaking with a granular fracture, yellowish, and having an agreeable honey-like odour. It should not be unctuous to the touch; if it were, its adulteration with suet might be suspected. It does not melt, if pure, under 140°; yields nothing to cold rectified spirit (absence of resin), but is entirely soluble in oil of turpentine (absence of insoluble impurities). Freedom from adulteration with starch is shown by boiling water in which it has been agitated, when cooled, not being rendered blue by the addition of solution of iodine.

White Wax is procured by bleaching yellow wax by exposing it to moisture, air, and light. It is hard, nearly white, and translucent. If too white, adulteration with spermaceti would be indicated. Adulteration with tallow, suet, or lard may be detected by its not being unctuous to the touch, and by the melting point, which is 10° higher than that of yellow wax.

Bee's Wax is a mixture of *Cerotic Acid* or *Cerotin* ($HC_{27}H_{53}O_2$), soluble in boiling alcohol; *Palmitate of Melissyl* or *Myricine* ($C_{30}H_{61}2C_{16}H_{31}O_2$), insoluble in boiling alcohol, but deposited on cooling; and *Ceroleine*, a body to which the colour, odour, and tenacity of wax are due (Attfield).

COLEOPTERA.

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
CANTHARIS VESICATORIA Cantharides or Spanish Fly (*Hungary*)	The Beetle, dried	Acetum Cantharidis	2 ozs. to 1 pt.	—	Externally rubefacient and vesicant. Internally a stimulating diuretic, Emmenagogue, Aphrodisiac (?), and spinal stimulant. Given in cases of chronic paraplegia, incontinence of urine, and in gleet. Ingredient of Empl. Calef.
		Emplastr. Cantharidis	1 part in 3	—	
		Tinct. Cantharidis	5½ grs. to 1 oz.	5 to 20 min.	
		Unguent. Cantharidis	1 pt. to 7	—	
		Charta Epispastica	—	—	
		Liquor Epispasticus	1 oz. to 2½ ozs.	—	

Cantharides.

A small beetle, in the dried state from eight to ten lines long, furnished with two wing-covers (*elytræ*) of a shining metallic-green colour, under which are two membranous transparent wings; odour strong and disagreeable. The powder is grayish-brown, containing shining green particles of the elytræ, and should be free from mites. About May or June the insects swarm upon trees, especially the ash, privet, and lilac, and are collected by shaking the branches and catching them in sheets. They are then killed by being plunged into boiling vinegar, and subsequently dried.

Cantharides contain oil and fatty principles, green and yellow colouring matters, and a solid crystalline body—the active principle—termed *Cantharidine* ($C_5H_6O_2$). This occurs in white, micaceous, fusible scales. It is volatile, inodorous, and tasteless; insoluble in water, and nearly so in cold alcohol and in disulphide of carbon; soluble in ether, chloroform, glacial acetic acid, solution of potash and of soda, and in fixed oils. Pure isolated cantharidine, although insoluble, as above stated, in water and cold alcohol, as it exists in the beetle is partly soluble in these menstrua, perhaps in consequence of its being united with some other constituent of the insect—*e. g.*, the yellow colouring matter. The green colouring matter is said to consist of *chlorophyll*, derived from the plants on which the insects feed.

HEMIPTERA.

Name and Distribution	Part Used	B. P. Preps.	Strength	Dose	Action and Use
COCCUS CACTI The Cochineal Insect (*Mexico and Teneriffe*)	The dried female insect	Tinct. Cocci	2½ ozs. to 1 pt.	—	Colouring agent. The powder is contained in Tinct. Cardamom. Co., and in Tinct. Cinchonæ Co.

Coccus.

The cochineal insects are reared on plantations of the Nopal cactus (Opuntia cochinillifera), and when the female insects become fecundated by the male, the former are swept off the trees, killed by immersion in boiling water, and then dried. The male insects are smaller, and much fewer in proportion numerically, than the female, and are not collected.

The dried insect is ovate, plano-convex, about two lines long, wrinkled, black or grayish-white. It yields, when crushed, a puce-coloured powder. The colouring matter of cochineal is a dibasic acid termed *Carminic Acid* or *Carmine* ($C_{14}H_{14}O_8$). The grayish-white colour of one variety of the insect—silver cochineal—said to be the impregnated female, is due to a whitish powder which quickly becomes black when warmed before the fire. Black cochineal is said to be the female exhausted by propagation.

Various heavy white powders have been found dusted over cochineal, with the view of increasing its weight.

CLASS ANNELIDA.

HIRUDINEA.

Hirudo.

Two species of leeches are particularised in the Pharmacopœia—1. The Speckled Leech, Sanguisuga officinalis; and 2. The Green Leech, S. medicinalis. Leeches are collected in Spain, France, Italy, and Hungary. The body of each variety is elongated, two or three inches long, tapering to a disk or sucker at each end, plano-convex, and, being composed of projecting rings, wrinkled transversely; back olive-green, with six rusty-red longitudinal stripes. The speckled leech is so called from having a greenish-yellow belly spotted with black. The belly of the green leech is of an olive-green colour, and not spotted. The mouth is triradiate, and contains three cartilaginous jaws, each of which is furnished with a double row of numerous sharp cutting teeth. A leech draws from one to two drachms of blood.

PART II.—PHARMACY.

THE PHARMACOPŒIAL PREPARATIONS.

DILUTE ACIDS.

Acidum Aceticum Dilutum.
,, Hydrochloricum Dilutum.
,, Nitricum Dilutum.
,, Nitro-hydrochloricum Dilutum.
,, Sulphuricum Dilutum.
,, Sulphuricum Aromaticum.
,, Phosphoricum Dilutum.
,, Hydrocyanicum Dilutum.

All these preparations, with the exception of the two latter, may be conveniently grouped together as *Dilute Acids, whose neutralising power is measured by the amount of the Volumetric Solution of Soda they are capable of saturating.**

Aromatic Sulphuric Acid is in reality a Dilute Acid, and as such is included in the accompanying table.

The first six members of this group may be contrasted in a tabular form, as follows:—

Acid	Preparation	Neutralisation	Percentage Strength	Sp. Gr.
Acidum Aceticum Dilutum	Dilute 1 part of Acetic Acid with 7 parts of distilled water	One fluid ounce requires 313 grain-measures of the Volumetric Solution of Soda, and therefore corresponds to 16 grains of anhydrous acetic acid ($C_4H_6O_3$)	3·63 per cent. of anhydrous acid	1·006
Acidum Hydrochloricum Dilutum	Dilute 8 parts of Hydrochloric Acid with distilled water until the mixture measures 26½ parts at 60° F.	Six fluid drachms require 1,000 grain-measures of the Volumetric Solution of Soda, and therefore correspond to 36½ grains (or one equivalent) of Hydrochloric Acid	10·58 per cent. of real acid	1·052
Acidum Nitricum Dilutum	Dilute 6 parts of Nitric Acid with distilled water until the mixture measures 31 parts at 60° F.	Six fluid drachms require 1,000 grain-measures of the Volumetric Solution of Soda, and therefore correspond to 54 grains (or half an equivalent) of anhydrous acid (N_2O_5)	14·95 per cent. of anhydrous acid	1·101

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* 1,000 grain-measures of the Volumetric Solution of Soda contain one equivalent in grains (40) of NaHO, and will therefore neutralise an equivalent quantity of any acid. All the dilute mineral acids are prepared so as to be of the same neutralising power—six fluid drachms of each corresponding to one equivalent of the real acid, and hence requiring for neutralisation 1,000 grain-measures of the Volumetric Solution of Soda.

Dilute Acids—Continued.

Acid	Preparation	Neutralisation	Percentage Strength	Sp.Gr.
ACIDUM NITRO-HYDROCHLORICUM DILUTUM	Mix 3 parts of Nitric Acid with 4 of Hydrochloric Acid, and 24 hours afterwards add 25 parts of distilled water in successive portions	Six fluid drachms require 920 grain-measures of the Volumetric Solution of Soda	—	1·074
ACIDUM SULPHURICUM DILUTUM	Dilute 7 parts of Sulphuric Acid gradually with distilled water until the mixture measures 83½ parts at 60° F.	Six fluid drachms require 1,000 grain-measures of the Volumetric Solution of Soda, and therefore correspond to 40 grains (or half an equivalent) of anhydrous acid (SO_3)	10·14 per cent. of anhydrous acid	10·94
ACIDUM SULPHURICUM AROMATICUM	Mix 3 ounces of Sulphuric Acid gradually with 2 pints of rectified spirit, and macerate in this mixture for 7 days, 2 ounces of powdered cinnamon and 1½ ounces of powdered ginger	Six fluid drachms require 830 grain-measures of the Volumetric Solution of Soda, and therefore correspond to 33·2 grains of anhydrous acid	10·91 per cent. of anhydrous acid	0·927

Acidum Hydrocyanicum Dilutum and *Acidum Phosphoricum Dilutum* have been considered in Part I. (pp. 9 and 13).

ACETA (VINEGARS).

These are:—

Acetum.
,, Scillæ.
,, Cantharidis.

Acetum (British Vinegar).

Is now defined as "an acid liquid prepared from malt and unmalted grain by acetous fermentation." The following formula illustrates the theory of *acetification:—*

$$\underbrace{C_2H_6O}_{\text{Alcohol.}} + O_2 = \underbrace{C_2H_4O_2}_{\text{Acetic Acid.}} + H_2O$$

It will thus be seen that the alcohol is converted by the absorption of oxygen from the atmosphere into acetic acid and water. The process of acetification is rapidly effected by allowing the fermenting liquor to trickle slowly through wood-shavings contained in tall vats. A large surface is thus exposed to the air which circulates through small side holes pierced near the bottom of the vessels.

British vinegar contains 4·6 per cent. of anhydrous acetic acid. One fluid ounce (445·4 grains by weight) requires for neutralisation 402 grain-measures of the Volumetric Solution of Soda. Its specific gravity ranges from 1·017 to 1·019.

Sulphuric acid acts as a preservative of vinegar, and hence the presence of $\frac{1}{1000}$ part is legally permitted. The following test indicates that the lawful proportion of sulphuric acid is not exceeded:—The precipitate afforded by the addition of 10 minims of solution of chloride of barium to 1 ounce of vinegar having been removed by filtration, the further addition of solution of chloride of barium will give no precipitate.

The only Pharmacopœial compound in the preparation of which vinegar is employed is the Emplastrum Cerati Saponis.

Acetum Cantharidis.

Preparation.—Digest 2 ounces of powdered cantharides in a mixture of 2 ounces of glacial acetic acid, with 13 ounces of acetic acid, for 2 hours, at 200° F. When cold, place them in a percolator, and when the fluid no longer drops, add 5 ounces of acetic acid to the residuum. When percolation is completed, press and make up the bulk of the liquid to 20 ounces with acetic acid.

Acetum Scillæ.

Preparation.—Macerate 2½ ounces of squills in 20 ounces of dilute acetic acid for seven days, strain with expression, and to the strained fluid add 1½ ounces of proof spirit, and lastly, filter.

It must be borne in mind that these so-called "vinegars" are solutions of the active principles *not in vinegar*, but in very strong acetic acid, in the case of *Acetum Cantharidis*, and in dilute acetic acid, in the case of *Acetum Scillæ.*

Heat is employed in the preparation of Acetum Cantharidis, as it promotes the solution of the active principle, *Cantharidine.*

Acetum Scillæ enters into the composition of Oxymel Scillæ and Syrupus Scillæ.

AQUÆ (WATERS).

The waters are fifteen in number, namely:—

Aqua.
,, Destillata.
,, Camphoræ.
,, Chloroformi.
,, Aurantii Floris.
,, Menthæ Piperitæ.
,, Menthæ Viridis.
,, Rosæ.
,, Sambuci.
,, Laurocerasi.
,, Cinnamomi.
,, Anethi.
,, Carui.
,, Fœniculi.
,, Pimentæ.

Aqua (H_2O).—The purest natural water that can be obtained, cleared, if necessary, from substances *mechanically suspended* in it by filtration. It should be free from taste, odour, and visible impurity.

The most common impurities of natural waters are saline matters, as sulphate of lime, carbonate of lime (held in solution by excess of carbonic acid, and conferring on water the property of "hardness"), &c., besides gases. Water is termed "hard" or "soft" according to its action on soap. In hard waters the contained earth (lime or magnesia) combines with the fatty acid of the soap, forming a substance insoluble in water. Hard waters may be rendered soft by boiling, by which means carbonic acid is driven off, and the carbonate of lime which was held in solution by it is deposited.

The amount of hardness destroyed by boiling is termed "*temporary* hardness," as distinguished from the permanent hardness due to soluble salts of lime and magnesia, which still remain in boiled water.

Professor Clark, the inventor of the soap test for measuring the hardness of water, proposed, as a means for softening water containing carbonate of lime, the addition of sufficient lime-water to unite with the free carbonic acid. The carbonate of lime thus formed, together with that already existing in the water, is deposited, and three-fourths of the hardness of the water is removed.

"Mineral Waters" are those which hold in solution saline or gaseous substances, whence they derive medicinal properties. There are four classes of them, viz.:—*Class* 1. *Carbonated*, containing much carbonic acid, and usually saline carbonates, on which the carbonic acid acts as a solvent (Carlsbad, Seltzer, Ilkstone, &c.). *Class* 2. *Chalybeate*, containing carbonate of iron (Harrogate, Pyrmont, Spa, Tunbridge Wells, &c.), and sulphate of iron (Brighton, &c.). *Class* 3. *Saline*, of which there are several varieties—*calcareous*, containing carbonate and sulphate of lime (Bath, Bristol, &c.); *alkaline*, containing alkaline carbonates (Ems, Vichy, &c.); *purging saline*, containing sulphates of magnesia and soda (Cheltenham, Seidlitz, &c.); and *salt*, containing chlorides, and sometimes traces of iodine and bromine (sea-water, Baden-Baden, Kreutznach, Wiesbaden, &c.). *Class* 4. *Sulphuretted*, containing sulphuretted hydrogen (Aix-la-Chapelle, Cheltenham, Harrogate, &c.).

Aqua Destillata.—Prepared by distilling 10 gallons of water from a copper still. All the volatile impurities come over with the first half gallon, and hence this is to be rejected. On the other hand, the distillation is not to be continued after 8 gallons have passed over, lest empyreumatic matters (resulting from the charring of the organic impurities) might contaminate the product.

The tests for the purity of distilled water are:—

1. No residue on evaporation = absence of fixed impurities.
2. Not affected by *sulphuretted hydrogen* = absence of metallic impurities.
3. Not affected by *oxalate of ammonia* = absence of salts of lime.
4. Not affected by *nitrate of silver* = absence of chlorides.
5. Not affected by *chloride of barium* = absence of sulphates.
6. Not affected by *solution of lime* = absence of carbonic acid.

The remaining Aquæ may be conveniently divided into four classes, according to their method of preparation, as follows:—

CLASS 1.

Prepared by simple solution in distilled water.

Aqua Camphoræ (½ ounce to 1 gallon) was formerly "Mistura Camphoræ."

Aqua Chloroformi (1 drachm to 25 ounces).

CLASS 2.

Prepared by distillation of the flowers.

Aqua Aurantii Floris. Made mostly in France, and apt to contain lead from being imported in leaden vessels; it is hence directed to be tested with sulphuretted hydrogen.

CLASS 3.

Prepared by distillation of the volatile oil with water (1½ drachms of oil to 1½ gallons, distil 1 gallon = 1 of oil in 853).

Aqua Menthæ Piperitæ.
Aqua Menthæ Viridis.

CLASS 4.

Prepared by distillation of part of the plant with water.

160 ounces to 2 gallons, distil 1 gallon = 1 in 1.	*Aqua Rosæ* (fresh petals). *Aqua Sambuci* (fresh flowers).
16 ounces to 2½ pints, distil 1 pint = 1 in 1¼.	*Aqua Laurocerasi* (fresh leaves).
20 ounces to 2 gallons, distil 1 gallon = 1 in 8.	*Aqua Cinnamomi* (bark).
16 ounces to 2 gallons, distil 1 gallon = 1 in 10.	*Aqua Anethi.* *Aqua Carui.* *Aqua Fœniculi* (dried fruit).
14 ounces to 2 gallons, distil 1 gallon = 1 in 11½.	*Aqua Pimentæ* (dried unripe berries).

In the preparation of Aqua Laurocerasi the crushed fresh leaves are directed to be macerated in the water for 24 hours before distilling. It is not a preparation of reliable strength.

The following are the officinal compounds into the composition of which the Aquæ enter:—

Aqua Floris Aurantii in Syrupus Floris Aurantii; *Aqua Cinnamomi* in Mistura Cretæ, Mistura Guaiaci, and Mistura Spiritus Vini Gallici; *Aqua Menthæ Piperitæ* in Mistura Ferri Aromatica; *Aqua Rosæ* in Mistura Ferri Composita and in Trochisci Bismuthi.

CATAPLASMATA (POULTICES).

These are:—

Cataplasma Carbonis.
,, Conii.
,, Fermenti.
,, Lini.
,, Sinapis.
,, Sodæ Chloratæ.

A poultice consists of three parts—namely, the "liquor" (the fluid part), the "corpus" (the basis or bulk of the poultice), and the "accessorium" (the active medicinal ingredient). In the following Table of the Cataplasms the substances which constitute these parts respectively will be seen:—

	"Liquor"	"Corpus"	"Accessorium"	Directions for Preparation
CATAPLASMA FERMENTI	Water at 100° F. (6 ounces)	Flour (14 ounces)	Beer Yeast (6 ounces)	Mix the yeast with the water, and stir in the flour. Place the mass near the fire till it rises.
CATAPLASMA CARBONIS	Boiling Water (10 ounces)	Bread (2 ounces), Linseed Meal (1½ ounces)	Wood Charcoal (½ ounce)	Soak the bread in the water near the fire, and, while stirring, add the linseed meal, and then half the charcoal. Sprinkle the remainder of the charcoal over the surface.
CATAPLASMA CONII	Boiling Water (10 ounces)	Linseed Meal (3 ounces)	Powdered Hemlock leaf (1 ounce)	Mix the hemlock and linseed meal, and add them to the water, constantly stirring.
CATAPLASMA SINAPIS	Boiling Water (10 ounces)	Linseed Meal (2½ ounces)	Mustard (2½ ounces)	Mix the linseed meal gradually with the water, and add the mustard, with constant stirring.
CATAPLASMA LINI	Boiling Water (10 ounces)	Linseed Meal (4 ounces), Olive Oil (½ ounce)	—	Mix the linseed meal gradually with water, and add the remaining ingredient, constantly stirring.
CATAPLASMA SODÆ CHLORATÆ	Boiling Water (8 ounces)	Linseed Meal (4 ounces)	Solution of Chlorinated Soda (2 ounces)	Mix the linseed meal gradually with the water, and add the solution of chlorinated soda, with constant stirring.

On reference to this table it will be noticed that in every case except in that of *C. Fermenti*, boiling water is the "liquor" used. If water at a higher temperature than 100° were employed in the preparation of *C. Fermenti*, the catalytic process which takes place would be materially interfered with. It will also be seen that, except in *C. Fermenti* and *C. Sodæ Chloratæ*, the quantity of water used is 10 ounces.

The "corpus" in the case of *C. Fermenti* is flour; in *C. Carbonis* it is bread and linseed meal; and in every other case it is linseed meal only. In *C. Lini* olive oil is used to replace the natural oil which is lost in the preparation of the meal.

The following are the strengths of the Cataplasms:—

Cataplasma	Fermenti	1 in 4½
,,	Sinapis	1 in 6
,,	Lini	1 in 3½
,,	Sodæ Chloratæ	1 in 7
,,	Conii	1 in 14
,,	Carbonis	1 in 28

It will be observed that the strength of each of the last three poultices is half that of the preceding one.

CHARTÆ (PAPERS.)

There are two of these in the Pharmacopœia, viz.:—

Charta Epispastica.
,, Sinapis.

Charta Epispastica, or "Blistering Paper," is prepared by digesting 4 ozs. of white wax, 1½ ozs. of spermaceti, 2 ozs. of olive oil, ¾ oz. of resin, 1 oz. of cantharides, and 6 ozs. of distilled water, in a water bath for two hours, stirring them constantly, and then straining. Mix ¼ oz. of Canada balsam with the melted plaster, and pass strips of paper over the surface of the hot liquid.

Charta Sinapis.—Mix 1 oz. of powdered black mustard with sufficient gutta-percha solution to form a semi-fluid mixture; pour this into a shallow vessel, and float slips of cartridge-paper over the surface of the fluid, so that they shall receive a thin coating of it on one side; expose them to the air until the coating hardens.

The mustard-paper should be immersed for a few seconds in tepid water before application. This is an imitation of Rigollot's mustard leaves.

CONFECTIONES (CONFECTIONS).

There are eight of these in the Pharmacopœia, viz.:—

Confectio Opii.
„ Piperis.
„ Rosæ Caninæ.
„ Rosæ Gallicæ.
„ Scammonii.
„ Sennæ.
„ Sulphuris.
„ Terebinthinæ.

Confections are preparations of the consistence of a soft solid, in which medicinal substances are incorporated with saccharine matter, with a view either to their preservation or more convenient administration.

The ingredients, strength, and directions for preparation of the officinal Confections are tabulated as follows:—

	Strength	Ingredients	Directions for Preparation
Confectio Opii	1 in 40 nearly	Compound Powder of Opium 192 grs. Syrup - - - 1 ounce	Mix.
Confectio Piperis	1 in 10	Powdered Black Pepper - 2 ounces Powdered Caraway - 3 ounces Clarified Honey - - 15 ounces	Triturate well together in a mortar.
Confectio Rosæ Caninæ	1 in 3	Hips (deprived of seeds) - 1 pound Refined Sugar - - 2 pounds	Beat the hips to a pulp in a stone mortar, rub the pulp through a sieve, add the sugar, and rub well together.
Confectio Rosæ Gallicæ	1 in 4	Red Rose Petals (fresh) - 1 pound Refined Sugar - - 3 pounds	Beat the petals to a pulp in a stone mortar, add the sugar, and rub well together.
Confectio Sulphuris	1 in 2¼	Sublimed Sulphur - 4 ounces Acid Tartrate of Potash - 1 ounce Syrup of Orange Peel - 4 ounces	Triturate well together in a mortar.
Confectio Scammonii	1 in 3	Powdered Scammony - 3 ounces Powdered Ginger - - 1½ ounces Oil of Caraway - - 1 drachm Oil of Cloves - - ½ drachm Syrup - - - 3 ounces Clarified Honey - - 1½ ounces	Rub the powders with the syrup and honey, add the oils, and mix.
Confectio Sennæ	1 in 11 nearly	Powdered Senna - - 7 ounces Powdered Coriander - 3 ounces Figs - - - 12 ounces Prunes - - - 6 ounces Tamarinds - - 9 ounces Cassia Pulp - - 9 ounces Extract of Liquorice - 3¼ ounces Refined Sugar - - 30 ounces Distilled Water - - 24 ounces	Boil the figs and the prunes gently for four hours with 24 ounces of water, add the tamarinds and cassia pulp; digest for two hours, and press the pulp through a hair sieve; dissolve the sugar and liquorice in the pulped product by a gentle heat, and add the senna and coriander. The result should weigh 75 ounces.
Confectio Terebinthinæ	1 in 4	Oil of Turpentine - - 1 ounce Powdered Liquorice Root - 1 ounce Clarified Honey - - 2 ounces	Rub the oil of turpentine with the liquorice root, add the honey, and mix.

Confectio Piperis is intended as a substitute for "Ward's Paste." *Confectio Rosæ Caninæ* enters into the composition of Pilula Quiniæ, and *Confectio Rosæ Gallicæ* into that of the following pill-masses:—Aloes Barbadensis, Aloes Socotrinæ, Aloes et Assafœtidæ, Aloes et Ferri, Aloes et Myrrhæ, Ferri Carbonatis, Hydrargyri, and Plumbi cum Opio.

DECOCTA (DECOCTIONS).

There are fourteen formulæ for the preparation of Decoctions, viz.:—

Decoctum Aloes Compositum.
,, Cetrariæ.
,, Cinchonæ Flavæ.
,, Granati Radicis.
,, Hæmatoxyli.
,, Hordei.
,, Papaveris.
,, Pareiræ.
,, Quercus.
,, Sarsæ.
,, Sarsæ Compositum.
,, Scoparii.
,, Taraxaci.
,, Ulmi.

Decoctions are watery solutions of the active principles of vegetables obtained by boiling.

The process of decoction is unsuitable in the case of vegetables whose active principles are volatile.

The length of time prescribed for boiling (in a covered vessel) varies, and is proportionate to the solubility of the active matter. It is 10 minutes in every case, with the exceptions of *Decoctum Aloes Compositum* (5 minutes), *Decoctum Pareiræ* (15 minutes), and *Decoctum Hordei* (20 minutes). *Decoctum Granati Radicis* is boiled from 2 pints to 1 pint.

Infusion is more effective than decoction as a means of abstracting the principles of sarsaparilla; hence in *Decoctum Sarsæ* and in *Decoctum Sarsæ Compositum* the solid ingredients are directed to be *digested in boiling water* for one hour before being boiled in it.

The majority of the Decoctions are ordered to be *strained while hot*, as a deposit of active matter occasionally takes place when the preparation becomes cold. The exceptions to the rule are *Decoctum Aloes Compositum*, *Decoctum Sarsæ*, and *Decoctum Sarsæ Compositum*, which are to be strained *when cool*, and *Decoctum Cinchonæ Flavæ*, which is to be strained *when cold*.

In every case, except that of *Decoctum Hordei*, after straining, as much distilled water is directed to be poured over the contents of the strainer as will make the strained product measure one pint. In the case of *Decoctum Aloes Compositum* the strained product is made up to 30 fluid ounces.

In *Decoctum Cetrariæ* and *Decoctum Hordei* the moss and the barley, respectively, are directed to be washed with cold water before boiling—in the former case to remove any impurities, and in the latter case to remove any mustiness or disagreeable flavour.

All the Decoctions are simple, excepting *Decoctum Aloes Compositum* and *Decoctum Sarsæ Compositum.* It must, however, be remembered that although *Decoctum Hæmatoxyli* is a simple decoction, 60 grains of powdered cinnamon bark are directed to be used in its preparation.

The following table shows the strengths of the Decoctions:—

2½ ounces to 1½ pints	*D. Sarsæ*	= 1 in 8
	D. Sarsæ Co.	
	D. Ulmi	
2 ounces to 2 pints	*D. Granati Rad.*	= 1 in 10
2 ounces to 1½ pints	*D. Papaveris*	
1½ ounces to 1 pint	*D. Pareiræ*	= 1 in 14
2 ounces to 1½ pints	*D. Hordei*	= 1 in 15
1¼ ounces to 1 pint	*D. Cinchonæ*	= 1 in 16
	D. Quercus	
1 ounce to 1 pint	*D. Scoparii*	= 1 in 20
	D. Cetrariæ	
	D. Taraxaci	
	D. Hæmatoxyli	
	D. Aloes Co.	= 1 in 120

The ingredients of the compound Decoctions are as follows:—

D. Aloes Comp.	*D. Sarsæ Comp.*
Extract of Socotrine Aloes, 120 grs.	Jamaica Sarsaparilla, 2½ ozs.
Myrrh, 90 grs.	Sassafras, ¼ oz.
Saffron, 90 grs.	Guaiacum Wood, ¼ oz.
Carbonate of Potash, 60 grs.	Liquorice Root, ¼ oz.
Extract of Liquorice, 1 oz.	Mezereon Bark, 60 grs.
Compound Tincture of Cardamoms, 8 ozs.	Boiling Distilled Water, 30 ozs.
Distilled Water, q. s.	

The use of the carbonate of potash in the preparation of *Decoctum Aloes Compositum* is to render the aloes and the resin of the myrrh more soluble in water. The extract of liquorice is useful for aiding in the suspension of the undissolved substances, while the compound tincture of cardamoms acts to a certain extent as a preventive of decomposition.

The *Decoctum Sarsæ Compositum* is an imitation of the "Lisbon diet drink."

In the former formula for the preparation of *Decoctum Papaveris* the seeds of the capsules were ordered to be rejected. The seeds are now *retained*, for it is found that their oil, which is suspended in water by the mucilage of the capsules, enhances the medicinal effects of the decoction.

EMPLASTRA (PLASTERS).

There are fourteen officinal Plasters, viz.:—

Emplastrum Ammoniaci cum Hydrargyro.
,, Belladonnæ.
,, Calefaciens.
,, Cantharidis.
,, Cerati Saponis.
,, Ferri.
,, Galbani.
,, Hydrargyri.
,, Opii.
,, Picis.
,, Plumbi.
,, Plumbi Iodidi.
,, Resinæ.
,, Saponis.

Plasters are external applications, adhesive at the temperature of the body, and employed either to afford mechanical support or to convey medicinal effects.

For the directions for the preparation of the individual Plasters, reference must be made to the Pharmacopœia.

The following table shows the constitution of ten of the Emplastra:—

- Oxide of Lead, Olive Oil, Water — *E. Plumbi*
  - *E. Resinæ* (Resin and Hard Soap)
  - *E. Saponis* (Hard Soap and Resin).
    - *E. Belladonnæ* (Extract of Belladonna dissolved in rectified spirits).
    - *E. Opii* (Opium).
    - *E. Calefaciens* (Cantharides, Expressed Oil of Nutmeg, Yellow Wax, Resin, Boiling-water).
    - *E. Plumbi Iodidi* (Iodide of Lead).
  - *E. Ferri* (Hydrated Peroxide of Iron, Burgundy Pitch).
  - *E. Galbani* (Galbanum, Ammoniacum, Yellow Wax).
  - *E. Hydrargyri* (Mercury, Olive Oil, Sublimed Sulphur).

The remaining Plasters are:—

E. Ammoniaci cum Hydrargyro	*E. Cantharidis*	*E. Cerati Saponis*	*E. Picis*
Ammoniacum Mercury Olive Oil Sublimed Sulphur	Cantharides Yellow Wax Prepared Lard Prepared Suet Resin	Hard Soap Yellow Wax Olive Oil Oxide of Lead Vinegar	Burgundy Pitch Frankincense Resin Yellow Wax Expressed Oil of Nutmeg Olive Oil Water

On reference to the above table it will be seen that *Emplastrum Plumbi* forms the basis of no less than *nine* Plasters, and, that of the remaining four, *Emplastrum Cerati Saponis* also contains a compound of olive oil and oxide of lead. *Emplastrum Ammoniaci cum Hydrargyro*, *Emplastrum Cantharidis*, and *Emplastrum Picis*, owe their consistence and adhesiveness to resinous substances, or to a mixture of these with wax and oleaginous matter. *Emplastrum Plumbi* is an *oleo-margarate of lead.* In its preparation the oleic and margaric acids of the oil combine with the lead, forming oleate and margarate of lead, while the glycerine, which is set free, remains dissolved in the water, or mechanically mixed with the Plaster (p. 159).

In *Emplastrum Hydrargyri* and *Emplastrum Ammoniaci cum Hydrargyro* the sublimed sulphur is employed as a means of more minutely dividing the mercury.

It would be waste of time for the student to endeavour to commit to memory the relative proportions of the constituents of every Plaster; it will suffice for him to learn what the ingredients are, and the proportion of active ingredients in the mass.

The following table shows the proportion of the active ingredient in each Plaster:—

E. Belladonnæ (Extract dissolved by Alcohol)	1 in 2
E. Picis	
E. Cantharidis	1 in 3
E. Hydrargyri	1 in $3\frac{2}{3}$
E. Ammoniaci cum Hydrargyro (Mercury)	1 in 5
E. Cerati Saponis (Soap)	1 in $5\frac{1}{2}$
E. Saponis (Soap)	1 in 7
E. Plumbi Iodidi	1 in 8
E. Opii	1 in 10
E. Resinæ	
E. Galbani	1 in 11
E. Ferri (Peroxide)	
E. Calefaciens (Cantharides)	1 in 25

ENEMATA (INJECTIONS, CLYSTERS).

These are substances in a liquid form intended for injection up the rectum, either for the purpose of evacuating the bowel (when the quantity of liquid should be large), or for acting medicinally on the neighbouring parts or on the system (when the bulk of the vehicle should be small). There are six of them in the Pharmacopœia, viz.:—

Enema Aloes.
„ Assafœtidæ.
„ Magnesiæ Sulphatis.

Enema Opii.
,, Tabaci.
,, Terebinthinæ.

Mucilage of starch forms the basis of all the Enemata, with the exceptions of *Enema Assafœtidæ* and *Enema Tabaci.* In the former *cold* water is the basis, and in the latter *boiling* water.

The following are the formulæ:—

	Active Ingredient	Basis	Other Ingredients
E. TABACI	Tobacco Leaf - - 20 grs.	8 ounces	
E. ASSAFŒTIDÆ	Assafœtida - - 30 grs.	4 ounces	
E. ALOES	Aloes - - - 40 grs.	10 ounces	Carbonate of Potash, 15 grains.
E. OPII	Tincture of Opium - ½ drm.	2 ounces	
E. MAGNESIÆ SULPHATIS	Sulphate of Magnesia 1 oz.	15 ounces	Olive Oil, 1 oz.
E. TEREBINTHINÆ	Oil of Turpentine - 1 oz.	15 ounces	

ESSENTIÆ (ESSENCES).

Of these there are only two in the Pharmacopœia, viz.:—

Essentia Anisi.
,, Menthæ Piperitæ.

They are solutions of 1 part of the volatile oil in 4 parts of rectified spirit.

EXTRACTA (EXTRACTS).

These are preparations obtained by evaporating solutions of vegetable principles. They may be conveniently divided into classes according to their method of preparation.

CLASS I.

Fresh or Green Extracts.

Preparation.—The juice pressed out from 112 lbs. of the bruised plant is heated to 130° F. *to coagulate the green colouring matter;* this is then filtered off, and the fluid is heated to 200° F. *to coagulate the albumen*, which is separated by filtration. The fluid is now evaporated, at not above 140°, to a thin syrupy consistence; the green colouring matter, which was separated in an early stage of the process, is added, and the whole evaporated down to the required consistence.

The following are the Extracts thus prepared, with the parts of the plants used:—

Extractum Aconiti (Fresh leaves and flowering tops).
,, Belladonnæ (Fresh leaves and young branches).
,, Conii (Fresh leaves and young branches).
,, Hyoscyami (Fresh leaves and young branches).
,, Lactucæ (Flowering herb).

Another group of Extracts belonging to this class are prepared by heating the juice at once to 212° F. *to coagulate the albumen*, filtering and evaporating to a proper consistence at 160°.

The Extracts thus prepared are:—

Extractum Colchici (Fresh corms without coats).
,, Colchici Aceticum (Ditto).
,, Taraxaci (Fresh root).

In the preparation of *Extractum Colchici Aceticum*, 7 lbs. of the fresh corms deprived of their coats are heated with 6 ozs. of acetic acid before the juice is pressed out. The quantity of taraxacum root used in *Extractum Taraxaci* is 4 lbs.

CLASS II.

Aqueous Extracts.

Prepared from drugs (1 lb. is the quantity directed in each case) by the action of distilled water, cold or boiling, and subsequent evaporation to a proper consistence.

1. Prepared by digestion in *boiling* water:—

Extractum Aloes Barbadensis.
,, Aloes Socotrinæ.
,, Pareiræ.

2. Prepared by infusion in *boiling* water and subsequent boiling:—

Extractum Gentianæ.
,, Hæmatoxyli.

3. Prepared by decoction:—

Extractum Anthemidis.

4. Prepared by maceration in *cold* water:—

Extractum Calumbæ.
,, Glycyrrhizæ.
,, Krameriæ.
,, Quassiæ.
,, Opii.

In all the foregoing Extracts, except those prepared by maceration in cold water, the quantity of water used is 1 gallon. In *Extractum Opii* the opium is macerated with 6 pints of water; in *Extractum Calumbæ* and *Extractum Glycyrrhizæ* the drug is macerated with 4 pints of water; while in *Extractum Krameriæ* and *Extractum Quassiæ* a sufficiency of water is directed. In *Extractum Anthemidis* 15 mins. of oil of chamomile are directed to be added at the end of the process of evaporation.

CLASS III.

Alcoholic Extracts.

Prepared from drugs (1 lb. is the quantity ordered in each case, except in that of *Extractum Colocynthidis Compositum*) by the action of rectified spirit, rectified spirit and water, or proof spirit, and subsequent evaporation to a proper consistence.

1. Prepared with rectified spirit:—

Extractum Cannabis Indicæ.
,, Physostigmatis.
,, Nucis Vomicæ.

In *Extractum Cannabis Indicæ* and *Extractum Physostigmatis* the drug is treated with 4 pints of cold spirit; in the former extract the process is one of maceration, and in the latter percolation is employed as well. In *Extractum Nucis Vomicæ* the drug is steamed, rapidly dried, and pulverised, and then *boiled* with successive portions of spirit until the latter comes off free from bitterness.

2. Prepared with rectified spirit and water:—

Extractum Jalapæ.
,, Rhei.
,, Lupuli.
,, Papaveris.

In the preparation of *Extractum Jalapæ* the drug is macerated in 4 pints of spirit and 1 gallon of water *successively*, as the action of the water is facilitated when the resin is abstracted by the spirit. In *Extractum Rhei* the drug is macerated in a mixture of 10 ozs. of spirit with 5 pints of water. In *Extractum Lupuli*, after maceration in 1½ pints of spirit, the tincture is pressed out, filtered, and the spirit distilled off, leaving a soft extract. The residual hop then is directed to be *boiled* with 1 gallon of water and made into a soft extract. Finally, the two extracts are mixed and evaporated down to a suitable consistence. In the preparation of *Extractum Papaveris* also, *boiling* water is ordered.

3. Prepared with proof spirit:—

Extractum Colocynthidis Compositum.
,, Stramonii.

The student should very carefully distinguish between the *Extractum Colocynthidis Compositum* and the *Pilula Colocynthidis Compositum.* The composition of the latter will hereafter be considered; the following are the ingredients of the former:—Colocynth pulp (6 ozs. macerated in 1 gallon of proof spirit), Extract of Socotrine Aloes (12 ozs.), Resin of Scammony (4 ozs.), Hard Soap (3 ozs.), and Cardamom Seeds (1 oz.) In the preparation of *Extractum Stramonii* the oil of the seeds is removed by the action of washed ether before percolation with the spirit.

Class IV.

Ethereal Extracts.

Extractum Mezerei Æthereum.

Prepared by maceration of 1 lb. of the drug in 8 pints of rectified spirit, and evaporating to form a spirit extract; the latter is then macerated in 1 pint of ether and again evaporated.

Ether is also employed in the preparation of *Extractum Stramonii*, *Extractum Ergotæ Liquidum*, and *Extractum Filicis Liquidum*—in the two former to free the preparation from oil, and in the latter as a solvent of the active matter.

Class V.

Liquid Extracts.

These are fluid preparations, in which the solvent is water, with rectified spirit added as a preservative.

They are:—

	Strength.
Extractum Ergotæ Liquidum	1 in 1
,, Belæ Liquidum	
,, Glycyrrhizæ Liquidum	
,, Pareiræ Liquidum	
,, Sarsæ Liquidum	2 in 1
,, Cinchonæ Flavæ Liquidum	4 in 1
,, Opii Liquidum	1 in 20 (of extract), or 1 grain in 22 minims.
,, Filicis Liquidum.	

These Liquid Extracts may, in general terms, be said to be prepared by maceration of the drug in water, evaporating the aqueous infusion, and adding spirit to prevent decomposition. The *Extractum Opii Liquidum* is prepared by digestion of the extract of opium in water, adding the spirit, and filtering. Cold water is used in all cases except *Extractum Pareiræ Liquidum* (boiling water) and

Extractum Sarsæ Liquidum (water at 160° F.). In the preparation of *Extractum Ergotæ Liquidum*, as has been mentioned, the ergot, before maceration, is directed to be percolated with *washed* ether, the object of which is to remove the oil present. The ether is washed to ensure its freedom from alcohol, which is a solvent of the active principle.

The so-called *Extractum Filicis Liquidum* is rather an Ethereal Extract, and is simply made by percolating 2 pounds of the drug with 4 pints of ether.

GLYCERINA (GLYCERINES).

These are:—

Glycerinum Acidi Carbolici.
,, Acidi Gallici.
,, Acidi Tannici.
,, Amyli.
,, Boracis.

They are solutions of 1 part of the drug in 4 parts of glycerine, except *Glycerinum Amyli*, in which the proportions are 1 of starch to 8 of glycerine.

In the preparation of *Glycerinum Acidi Gallici* and *Glycerinum Acidi Tannici* solution is aided by means of gentle heat; while in *Glycerinum Amyli* heat up to 240° is gradually applied until the starch particles are broken, and a "plasma" or translucent jelly is formed.

INFUSA (INFUSIONS).

These are aqueous solutions of the constituents of vegetables obtained without boiling. They are prepared by digesting the drug (which is to be cut small, sliced, bruised or powdered) in distilled water for a definite period in a covered vessel, and subsequently straining.

Infusion is preferable to decoction, when by the latter process the active principle would be volatilised (Buchu, &c.), or a chemical change induced (Senna, &c.).

The following are the officinal Infusions, with the proportion of the drug ordered. The proportion of water ordered is in each case 10 ozs.:—

Infusum Digitalis, 30 grains.
,, Quassiæ, 60 grains.
,, Caryophylli
,, Chiratæ
,, Ergotæ
,, Rhei
,, Rosæ Acidum
,, Serpentariæ
} ¼ ounce.

Infusum	Valerianæ,	120 grains.
,,	Catechu	160 grains.
,,	Lini	
,,	Anthemidis	½ ounce.
,,	Aurantii	
,,	Buchu	
,,	Calumbæ	
,,	Cinchonæ Flavæ	
,,	Cusso	
,,	Cuspariæ	
,,	Krameriæ	
,,	Lupuli	
,,	Maticæ	
,,	Senegæ	
,,	Uvæ Ursi	
,,	Cascarillæ	1 ounce.
,,	Dulcamaræ	
,,	Sennæ	

Of the above, all are absolutely simple, except *Infusum Rosæ Acidum*, which has 1 drachm of dilute sulphuric acid added; *Infusum Catechu*, which contains 30 grains of cinnamon bark; *Infusum Lini*, which contains 60 grains of liquorice root; and *Infusum Sennæ*, which has 30 grains of ginger.

The *Compound Infusions* are:—

Infusum Gentianæ Compositum.	*Infusum Aurantii Compositum.*
Bitter Orange Peel, 60 grs.	Bitter Orange Peel, ¼ oz.
Fresh Lemon Peel, ¼ oz.	Fresh Lemon Peel, 60 grs.
Gentian Root, 60 grs.	Cloves, 30 grs.
Boiling Distilled Water, 10 ozs.	Boiling Distilled Water, 10 ozs.

In the preparation of *Infusum Lini* the seeds are not to be crushed, as the mucilage is contained in the covering. *Infusum Cusso* is directed *not to be strained.*

Boiling distilled water is used in every case, except *Infusum Chiratæ* and *Infusum Cuspariæ*, in which water at 120° F. is employed; while in *Infusum Calumbæ* and *Infusum Quassiæ*, cold water is ordered, so that the starch may not be dissolved.

The length of time of infusion varies, and is regulated by the solubility of the active ingredients. It is one hour in the majority of cases; fifteen minutes in *I. Anthemidis*, *I. Aurantii*, *I. Aurantii Compositum*, and *I. Cusso;* half an hour in *I. Caryophylli*, *I. Catechu*, *I. Chiratæ*, *I. Ergotæ*, *I. Maticæ*, *I. Quassiæ*, and *I. Rosæ Acidum;* two hours in *I. Cinchonæ Flavæ*, *I. Cuspariæ*, *I. Lupuli*, *I. Serpentariæ*, and *I. Uvæ Ursi;* and four hours in *I. Lini.*

INJECTIO (INJECTION).

There is but one preparation of this class in the Pharmacopœia, viz.:—

Injectio Morphiæ Hypodermica.

This is a solution of acetate of morphia for hypodermic administration, containing 1 grain of the acetate in 12 minims of the injection. It is prepared as follows:—Dissolve hydrochlorate of morphia (88 grs.) in 2 ounces of distilled water, aiding the solution by a gentle heat; then add solution of ammonia so as to precipitate the morphia and render the liquid slightly alkaline; allow it to cool; collect the precipitate on a filter, wash it with distilled water, and allow it to drain; then transfer the morphia to a small porcelain dish with about an ounce of distilled water, apply a gentle heat, and carefully add acetic acid until the morphia is dissolved, and a very slightly acid solution is formed. Add now sufficient distilled water to make the solution measure exactly 2 fluid ounces. Filter and preserve the product in a stoppered bottle excluded from the light.

It is a clear solution, and should be free from any solid particles (fungi). Very slightly acid to test paper. A fluid drachm of it, rendered slightly alkaline by the addition of solution of ammonia, yields a precipitate of morphia which, after being washed and dried, should weigh 4·3 grains, corresponding to 5 grains of acetate of morphia.

LINIMENTA (EMBROCATIONS).

Preparations for external use, applicable to the skin by gentle friction with the hand or by painting.

They all contain either a fixed or volatile oil or soap, camphor being regarded as a concrete volatile oil.

They may be divided into groups according to their method of preparation:—

Class I.

Prepared by macerating and percolating twenty parts of the root with twenty parts of rectified spirit, and then adding one part of camphor.

Linimentum Aconiti ⎫
,, Belladonnæ ⎭ 1 in 1.

Class II.

Those of which olive oil forms the basis.

Linimentum Calcis, 1 in 2.
,, Ammoniæ, 1 in 4.
,, Camphoræ, 1 in 5.

In *Linimentum Calcis* and *Linimentum Ammoniæ*, the officinal solution of the base is respectively employed, and this reacting with the oil forms a soap.

Class III.

Those of which camphor liniment forms the basis.

Linimentum Chloroformi, 1 in 2.
„ Terebinthinæ Aceticum, 1 in 3.
„ Hydrargyri, 1 (of mercury) in 6.

Linimentum Chloroformi is a simple mixture of chloroform and camphor liniment; *Linimentum Terebinthinæ Aceticum* is a mixture of one part each of oil of turpentine, acetic acid, and camphor liniment; while *Linimentum Hydrargyri* is made by gently heating one part each of ointment of mercury and camphor liniment, and then adding gradually one part of solution of ammonia.

Class IV.

Those of which soap liniment forms the basis.

Linimentum Opii, 1 (of tincture) in 2.

This is a simple mixture of equal parts of tincture of opium and soap liniment.

Class V.

Includes the liniments of more complex constitution. The following table will facilitate the recollection of the ingredients of each :—

Liniment	Active Ingredient and Strength	Ordinary Ingredients			Extra Ingredients
L. Potassii Iodidi cum Sapone	Iodide of Potassium and Hard Soap 1 in 9	Oil of Lemon	—	—	Glycerine and Distilled Water
L. Crotonis	Croton Oil 1 in 8	Oil of Cajuput	Rectified Spirit	—	—
L. Saponis	Hard Soap	Oil of Rosemary	Rectified Spirit	Camphor	Distilled Water
L. Camphoræ Compositum	Strong Solution of Ammonia 1 in $4\frac{1}{2}$	Oil of Lavender	Rectified Spirit	Camphor	—
L. Sinapis Compositum	Oil of Mustard 1 in 40	Castor Oil	Rectified Spirit	Camphor	Ethereal Extract of Mezereon and Distilled Water
L. Iodi	Iodine $1\frac{1}{4}$ in 10, and Iodide of Potassium	—	Rectified Spirit	Camphor	—
L. Terebinthinæ	Oil of Turpentine 1 in $1\frac{4}{5}$	—	—	Camphor	Sof So

LIQUORES (SOLUTIONS).

There are thirty-nine formulæ for the preparation of these in the Pharmacopœia. With three exceptions (Liquor Antimonii Chloridi, Liquor Epispasticus, and Liquor Gutta-percha), they may be defined as consisting of substances, sometimes gaseous, dissolved in, or diluted with, water.

They may be conveniently divided into groups as follows:—

CLASS I.

Solutions of the Metalloids.

Liquor Iodi.
,, Chlori.

Liquor Iodi.—Prepared by dissolving 20 grains of iodine in 1 ounce of water by the aid of 30 grains of iodide of potassium. The solubility of iodine in water is greatly increased by the presence of the iodide.

Liquor Chlori.—This is a solution of chlorine gas in half its volume of water. It is prepared by passing the washed gas, made by the action of hydrochloric acid on black oxide of manganese ($4HCl + MnO_2 = 2Cl + 2H_2O + MnCl_2$), into water.

As this solution is liable to be decomposed by light and exposure to air, at first into *hydrochloric* and *hypochlorous acids*, and ultimately into *hydrochloric acid* and *oxygen*, it is directed to be preserved in green glass bottles well stoppered, and to be kept in a cool, dark place.

Liquor Chlori is of a yellowish-green colour, with a strong odour of chlorine; it instantly discharges the colour of a dilute solution of sulphate of indigo. Its specific gravity is 1·003. If no fixed impurities are present there will be no residue on evaporation. The Pharmacopœia directs the following quantitative test, which indicates that the proper amount of chlorine (2·66 grains to the fluid ounce) is present:—When a solution of 20 grains of iodide of potassium in an ounce of water is added to a fluid ounce (439 grains by weight) of the *Liquor Chlori*, the mixed solution acquires a deep red colour, owing to the liberation of iodine, thus:—$2KI + Cl_2 = 2KCl + I_2$. On adding to this coloured solution 750 grain-measures of the volumetric solution of hyposulphite of soda, the colour is discharged, owing to the reaction of the free iodine on the soda salt forming colourless iodide of sodium and tetrathionate of soda, thus:—

$$\underbrace{2\,(Na_2\,H_2\,S_2\,O_4)}_{\text{Hyposulphite of Soda.}} + 2I = 2NaI + \underbrace{Na_2S_4O_6}_{\text{Tetrathionate of Soda.}} + 2H_2O.$$

Class II.

Solutions of Alkalies, or Alkaline Earths, whose neutralising power is estimated by the amount of volumetric solution of oxalic acid which they are capable of saturating.*

Liquor Ammoniæ Fortior.
,, Ammoniæ.
,, Potassæ.
,, Sodæ.
,, Calcis.
,, Calcis Saccharatus.

We will consider consecutively the method of preparation, neutralisation, strength, specific gravity, and tests for purity of the foregoing.

PREPARATION.

Liquor Ammoniæ Fortior is made by passing ammoniacal gas, made by the action of slaked lime on chloride of ammonium—

$$2NH_4Cl + Ca\,2HO = Ca_2Cl + 2NH_3 + 2H_2O,$$

into water contained in a Woulff's bottle, under pressure, until the requisite strength is attained.

Liquor Ammoniæ is simply made by diluting one part of the strong liquor with two parts of water.

Liquor Potassæ and *Liquor Sodæ* are solutions of their respective hydrates in water, made by the action of slaked lime on their carbonates:—

$$K_2CO_3 + Ca\,2HO = Ca\,CO_3 + 2K\,HO.$$

In each the carbonate of lime is deposited, and the supernatant liquor is directed to be decanted or drawn off with a syphon, as filters are acted upon by it.

Liquor Calcis is very simply made by saturating water with slaked lime, and decanting or drawing off with a syphon (for the same reason as in Liquor Potassæ) the clear solution.

Liquor Calcis Saccharatus is made by digesting for some hours a mixture of 1 part of slaked lime and 2 parts of refined sugar in 20 of water.

Slaked lime is very sparingly soluble in water, requiring 732 parts of cold, and 1,500 of boiling water. Sugar greatly increases the solubility of lime, so that the saccharated solution is fourteen times stronger than the simple solution, a fluid ounce of the latter containing only half a grain of lime.

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* 1,000 grain-measures of the Volumetric Solution of Oxalic (a dibasic) Acid contain half an equivalent in grains (63) of Oxalic Acid, and will therefore neutralise an equivalent in grains of an alkali or alkaline carbonate.

Liquor Potassæ, *Liquor Sodæ*, and *Liquor Calcis*, all strongly attract carbonic acid from the atmosphere, and hence they are to be kept in well-stoppered bottles. They are furthermore directed to be kept in *green* glass bottles, in consequence of the solvent power they exert over the oxide of lead contained in white glass.

NEUTRALISATION.*

	Grains Weight.		Grain-measures of Vol. Sol.
Liquor Ammoniæ Fortior	52·3	=	1,000
,, Ammoniæ	85	=	500
,, Potassæ	462·9	=	482
,, Sodæ	458·0	=	470
,, Calcis	4,380·0	=	200
,, Calcis Saccharatus	460·2	=	250

STRENGTH.

Liquor Ammoniæ Fortior.—32·5 (of NH_3) per cent. One fluid drachm contains 15·83 grains.

Liquor Ammoniæ.—10 (of NH_3) per cent. One fluid drachm contains 5·2 grains.

Liquor Potassæ.—5·84 (of KHO) per cent. One fluid ounce contains 27 grains.

Liquor Sodæ.—4·1 (of $NaHO$) per cent. One fluid ounce contains 18·8 grains.

Liquor Calcis.—One fluid ounce contains half a grain of CaO.

Liquor Calcis Saccharatus.—One fluid ounce contains 7·11 grains of CaO.

SPECIFIC GRAVITY.

Liquor Ammoniæ Fortior	0·891
,, Ammoniæ	0·959
,, Potassæ	1·058
,, Sodæ	1·047
,, Calcis Saccharatus	1·052

TESTS FOR PURITY.

Liquor Ammoniæ Fortior:—

1. When diluted with four times its volume of water it gives no precipitate with—

   (*a*) Solution of lime = absence of carbonate;
   (*b*) Oxalate of ammonia = absence of lime;
   (*c*) Sulphide of ammonium = absence of oxide of copper;
   (*d*) Ammonio-sulphate of copper = absence of sulphide of ammonium.

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* *Vide* footnote, preceding page.

2. When treated with excess of nitric acid it is not rendered turbid by—

(*a*) Nitrate of silver = absence of chlorides;
(*b*) Chloride of barium = absence of sulphates.

When "pyrrol" exists as an impurity of the commercial liquor, it may be detected by affording a red colour with nitric or sulphuric acid.

Liquor Potassæ and *Liquor Sodæ*.—The following tests are directed for both of these solutions:—

1. No effervescence with diluted hydrochloric acid=absence of carbonate.

2. Mixed with an equal volume of distilled water there is no precipitate with—

(*a*) Solution of lime = absence of carbonate;
(*b*) Oxalate of ammonia = absence of lime.

3. Treated with excess of diluted nitric acid and evaporated to dryness, the residue forms with water a nearly clear solution, which may be slightly precipitated by—

(*a*) Chloride of barium = trace of sulphates;
(*b*) Nitrate of silver = trace of chlorides;

but is merely rendered turbid (or unaffected in the soda solution) by—

Ammonia = trace of alumina.

Liquor Ammoniæ Fortior is employed in the preparation of Ammoniæ Phosphas, Linimentum Camphoræ Compositum, Liquor Ammoniæ, Liquor Ammoniæ Citratis, Spiritus Ammoniæ Aromaticus, and Tinctura Opii Ammoniata.

Liquor Ammoniæ is used in Linimentum Ammoniæ.

Liquor Calcis enters into the formation of Linimentum Calcis, Lotio Hydrargyri Flava, Lotio Hydrargyri Nigra, and is used in making Argenti Oxidum.

CLASS III.

Effervescing Solutions of Alkalies.

Liquor Lithiæ Effervescens.
,, Potassæ Effervescens.
,, Sodæ Effervescens.

These are made by passing as much carbonic acid gas (generated by the action of sulphuric acid on chalk) as possible, under a pressure of seven atmospheres, into a solution of 30 grains of the bicarbonate (or in the case of Lithia, 10 grains of the carbonate) in

1 pint of water. The solutions must be kept in bottles securely closed. They all effervesce strongly when the containing vessel is opened, owing to the escape of carbonic acid gas.

The following are the tests directed:—

Liquor Lithiæ Effervescens.—10 fluid ounces evaporated to dryness yield 5 grains of a solid white residue, which answers to the tests for carbonate of lithia (p. 63).

Liquor Sodæ Effervescens.—10 fluid ounces boiled for five minutes require for neutralisation 178 grain-measures of the volumetric solution of oxalic acid.

Liquor Potassæ Effervescens.—10 fluid ounces boiled for five minutes require for neutralisation 150 grain-measures of the volumetric solution of oxalic acid.

Five fluid ounces evaporated to one-fifth, and 12 grains of tartaric acid added, yield a crystalline precipitate (of acid tartrate of potash) which, when dried, weighs not less than 12 grains.

Class IV.

Chlorinated Solutions.

Liquor Calcis Chloratæ.
,, Sodæ Chloratæ.

Liquor Calcis Chloratæ is prepared by digesting 1 pound of chlorinated lime in 1 gallon of water. Hypochlorite of lime, chloride of calcium, and a little caustic lime are dissolved; but any carbonate of lime which may be present, and excess of caustic lime, are thrown down and are to be separated by a calico filter.

Liquor Sodæ Chloratæ is a mixed solution of hypochlorite of soda, chloride of sodium, and bicarbonate of soda, and is known as "Labarraque's Disinfecting Fluid." It is made by passing washed chlorine gas (made by the action of hydrochloric acid on black oxide of manganese) into a solution of 12 ounces of carbonate of soda in 36 ounces of water. By the action of chlorine on the solution of the carbonate of soda, chloride of sodium and bicarbonate of soda are formed, thus—

$$2(Na_2CO_3)+2Cl+H_2O=\underbrace{NaClO}_{\text{Hypochlorite of Soda.}}+NaCl+2(NaHCO_3).$$

The following are the tests directed, the explanations of which are given under *Liquor Chlori* (p. 230):—

Liquor Calcis Chloratæ.—One fluid drachm (60 grains by weight) added to a solution of 20 grains of iodide of potassium in 4 ounces of water, and acidulated with 2 drachms of hydrochloric acid, gives a red solution, which requires for the discharge of its colour 500 grain-measures of the volumetric solution of hyposulphite of soda, corresponding to 13 grains of chlorine in a fluid ounce.

Liquor Sodæ Chloratæ.—One fluid drachm (70 grains by weight) added to a solution of 20 grains of iodide of potassium in 4 ounces of water, and acidulated with 2 drachms of hydrochloric acid, gives a brown solution, which requires for the discharge of its colour 500 grain-measures of the volumetric solution of hyposulphite of soda. By the mutual reaction of Liquor Sodæ Chloratæ and iodide of potassium in an acid solution, iodine is liberated; thus—

$$NaClO+NaCl+2KI+2HCl=2NaCl+2KCl+H_2O+2I.$$

Liquor Sodæ Chloratæ has an alkaline reaction, due to the reaction of the bicarbonate; it derives its property of bleaching vegetable colours from the chlorine. On adding hydrochloric acid to it effervescence ensues, owing to the evolution of carbonic acid gas and chlorine, and a solution is formed which gives no precipitate with perchloride of platinum, indicating the absence of potash. It should give no precipitate with oxalate of ammonia, indicating the absence of lime.

Liquor Sodæ Chloratæ is contained in Cataplasma Sodæ Chloratæ.

CLASS V.

Solutions of the Inorganic Salts.

Liquor Ammoniæ Acetatis.
,, Ammoniæ Citratis.
,, Antimonii Chloridi.
,, Arsenicalis.
,, Arsenici Hydrochloricus.
,, Bismuthi et Ammoniæ Citratis.
,, Ferri Perchloridi.
,, Ferri Perchloridi Fortior.
,, Ferri Pernitratis.
,, Ferri Persulphatis.
,, Hydrargyri Nitratis Acidus.
,, Hydrargyri Perchloridi.
,, Magnesiæ Carbonatis.
,, Magnesiæ Citratis.
,, Plumbi Subacetatis.
,, Plumbi Subacetatis Dilutus.
,, Potassæ Permanganatis.
,, Sodæ Arseniatis.
,, Zinci Chloridi.

We will study consecutively the mode and *rationale* of preparation, the strength, specific gravity, character and tests of the foregoing.

PREPARATION.

Liquor Ammoniæ Acetatis.—This is commonly known as "Mindererus' Spirit," and is a solution of acetate of ammonia ($NH_4C_2H_3O_2$) in water. It is made by adding gradually powdered carbonate of ammonia to 10 fluid ounces of acetic acid until a neutral solution is formed, and then adding 2½ pints of water.

The following is the reaction which takes place:—

$$N_4H_{16}C_3O_8+4HC_2H_3O_2=4NH_4C_2H_3O_2+2H_2O+3CO_2.$$

Liquor Ammoniæ Citratis is a solution of citrate of ammonia, $(NH_4)_3C_6H_5O_7$, in water. It is made by adding to a solution of 3 ounces of citric acid in 1 pint of water strong solution of ammonia until the liquid is neutral to test paper. The reaction is expressed thus:—

$$H_3C_6H_5O_7+3(NH_4)HO=(NH_4)_3C_6H_5O_7+3H_2O.$$

Liquor Antimonii Chloridi.—This, which is often known as "Butter of Antimony," is a solution of terchloride of antimony ($SbCl_3$) in hydrochloric acid. It is prepared by dissolving 1 pound of black antimony (Sb_2S_3) by the aid of heat in 4 pints of hydrochloric acid, and boiling down to the bulk of 2 pints.

$$Sb_2S_3+6HCl=2SbCl_3+3H_2S.$$

During the reaction the materials are directed to be placed beneath a flue with a good draught, in order to carry off the sulphuretted hydrogen gas.

Liquor Arsenicalis.—Commonly known as "Fowler's Solution." It is made by dissolving, by the aid of heat, 80 grains each of arsenious acid and carbonate of potash in 10 ounces of water; when cool, adding 5 drachms of compound tincture of lavender, and finally adding distilled water to make up the bulk to 1 pint. The solution of arsenious acid in water is facilitated by the presence of the alkaline carbonate, which is slowly decomposed by it. The officinal solution therefore contains a small quantity of arsenite of potash:—

$$K_2CO_3+As_2O_3=2KAsO_2+CO_2.$$

The compound tincture of lavender is merely added as a colouring and flavouring agent in order to prevent mistakes.

Liquor Arsenici Hydrochloricus.—Made by boiling 80 grains of arsenious acid with 2 drachms of hydrochloric acid and 4 ounces of water until it is dissolved, and then adding water to make up the bulk to 1 pint. Known as "De Valangin's Solution," which originally contained 1½ grs. to the ounce. It is not a chemical compound, but a solution of the arsenious acid in dilute hydrochloric acid.*

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* We may here mention another arsenical liquor which, although not now officinal, was in the *Dublin Pharmacopœia*, and is still so very generally used as to warrant special notice—viz., *Liquor Arsenici et Hydrargyri Hydriodatis*, or "Donovan's Solution." It is made by triturating together 6 grains of arsenic, 16 grains of mercury,

Liquor Bismuthi et Ammoniæ Citratis.—Mix 2 ounces of nitric acid with 1 ounce of water, and add 430 grains of pure bismuth in successive portions. When effervescence ceases, heat moderately for 10 minutes, and then decant. Evaporate to 2 ounces, and add 2 ounces of citric acid dissolved in 4 ounces of water. Add gradually solution of ammonia until the precipitate at first formed is dissolved, and the solution is neutral or slightly alkaline. Dilute with water to 1 pint.

In the above process nitrate of bismuth is first formed; on adding ammonia to this, oxide of bismuth would be precipitated, were it not that, by the previous addition of citric acid, citrate of ammonium is formed, in which oxide of bismuth is freely soluble. The nitric acid, which is set free, is saturated by the excess of ammonia present, and hence the liquor contains nitrate of ammonium, as well as citrate of bismuth and ammonia. It resembles somewhat "Schacht's Solution of Bismuth."

Liquor Ferri Perchloridi Fortior.—An aqueous solution of perchloride of iron (Fe_2Cl_6). Dissolve 2 ounces of iron wire in a mixture of 8 ounces each of hydrochloric acid and water by the aid of a gentle heat. Filter, add 4 ounces of hydrochloric acid and 9 drachms of nitric acid, and heat until red fumes are evolved and the liquid becomes orange-brown. Evaporate down to 10 ounces.

The first stage in the above process is the formation of protochloride of iron by the action of hydrochloric acid on the iron wire.

$$Fe + 2HCl = FeCl_2 + 2H.$$

This protochloride (containing excess of hydrochloric acid) is then converted into perchloride by the action of nitric acid.

$$6FeCl_2 + 6HCl + 2HNO_3 = 3Fe_2Cl_6 + 4H_2O + 2NO.$$

Liquor Ferri Perchloridi.—Made by diluting 1 part of the strong solution with 3 parts of water.

Liquor Ferri Pernitratis.—An aqueous solution of pernitrate of iron (Fe_26NO_3). Dissolve 1 ounce of iron wire in a mixture of 4½ ounces of nitric acid and 16 ounces of water, moderating the action, if necessary, by adding more water. Filter, and add water to 1½ pints. In the reaction which ensues, pernitrate of iron is formed, water is produced, and nitric oxide evolved.

$$2Fe + 8HNO_3 = Fe_26NO_3 + 4H_2O + 2NO.$$

Liquor Ferri Persulphatis.—An aqueous solution of persulphate

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50½ grains of iodine, and ½ drachm of alcohol, until a dry mass is obtained; this is then rubbed with 8 ounces of water in successive portions, and then heated to ebullition; when the solution has cooled it is filtered, and as much water is added as will make up the bulk to 8 ounces and 6 drachms. In this preparation the iodine combines with the arsenic forming the teriodide (AsI_3), and with the mercury forming the red iodide (HgI_2). One fluid drachm of it contains 1-12th grain of arsenic, 1-4th of mercury, and 3-4ths grain of iodine.

of iron (Fe_23SO_4). Dissolve 8 ounces of sulphate of iron in a mixture of 6 drachms of sulphuric acid and 10 ounces of water by the aid of heat. Add 6 drachms of nitric acid diluted with 2 ounces of water. Concentrate by boiling until the mixture changes from black to red. As long as the solution gives a blue precipitate with red prussiate of potash, add a few drops of nitric acid, and renew the boiling in order to convert all the sulphate into persulphate. When cold, add water up to 11 ounces.

When nitric acid is added to a solution of sulphate of iron in sulphuric acid, the proto- is converted into the per-salt, and nitric oxide is developed.

$$6(FeSO_4)+3(H_2SO_4)+2(HNO_3)=3(Fe_23SO_4)+4H_2O+2NO.$$

The nitric oxide is not at once evolved, but is absorbed by, and blackens, any protosulphate which may be present. This black compound is afterwards decomposed.

Liquor Hydrargyri Nitratis Acidus.—A solution of pernitrate of mercury ($Hg2NO_3$). Dissolve 4 ounces of mercury in a mixture of 5 ounces of nitric acid and 1½ ounces of water without heat. Then boil gently for 15 minutes, to ensure the formation of the pernitrate, and to cause the expulsion of the nitric oxide.

The reaction is thus expressed:—

$$3Hg+8HNO_3=3(Hg2NO_3)+4H_2O+2NO.$$

Liquor Hydrargyri Perchloridi.—An aqueous solution of the perchloride of mercury ($HgCl_2$). Dissolve 10 grains each of perchloride of mercury and chloride of ammonium in 1 pint of water.

The chloride of ammonium is to increase the solvent power of the water.

Liquor Magnesiæ Carbonatis.—To a solution of 2 ounces of sulphate of magnesia in ½ pint of water heated to boiling point, add a solution of 2½ ounces of carbonate of soda in ½ pint of water. Boil until carbonic acid is no longer evolved. Collect the precipitated carbonate of magnesia on a filter, and wash until the washings give no precipitate with chloride of barium (absence of a sulphate). Mix the washed precipitate with 1 pint of water, and saturate it with washed carbonic acid gas passed in under slight pressure. Filter the liquid after 24 hours to remove any undissolved carbonate of magnesia, and again pass carbonic acid gas into the filtered solution. Preserve in a well-stoppered bottle.

The following is the reaction:—

$$4(MgSO_4)+4(Na_2CO_3)+4H_2O=$$
$$3MgCO_3Mg2HO3H_2O+4(Na_2SO_4)+CO_2.$$

In this reaction the water decomposes the carbonate of magnesia, some of the carbonic acid of which is given off, and a combination of a hydrate and a carbonate of magnesia results.

This solution resembles " Murray's Fluid Magnesia."

Liquor Magnesiæ Citratis.—Dissolve 200 grains of citric acid in 2 ounces of water, and having added 100 grains of carbonate of magnesia, stir until it is dissolved. Filter the solution into a strong half-pint bottle, add half an ounce of syrup of lemons and sufficient water to nearly fill the bottle, then introduce 40 grains of bicarbonate of potash, and immediately close the bottle with a cork, which should be secured with string or wire. Afterwards shake the bottle until the bicarbonate of potash has dissolved.

In this process the following reaction occurs:—

$$3MgCO_3+2H_3C_6H_5O_7=Mg_32C_6H_5O_7+3H_2O+3CO_2.$$

The addition of the bicarbonate of potash is to generate carbonic anhydride so as to render the solution effervescing. Citrate of potassium is thus also formed in the solution.

Liquor Plumbi Subacetatis, commonly known as "Goulard's Extract." Boil 5 ounces of acetate of lead and 3 ounces of oxide of lead in 1 pint of distilled water for half an hour. Filter, and when cold add water up to 20 ounces. Keep in stoppered bottles. The acetate of lead combines with the oxide of lead to form a mixture of oxyacetates, which is collectively known as the subacetate, thus:—

$$PbO+Pb2C_2H_3O_2=Pb_2O2C_2H_3O_2.$$

Liquor Plumbi Subacetatis Dilutus, commonly known as "Goulard Water." Mix 2 drachms each of solution of subacetate of lead and rectified spirit with 19½ ounces of distilled water; filter and keep in a stoppered bottle.

If this preparation be not made with distilled water it becomes milky from the formation of other salts of lead, as the carbonate and sulphate.

Liquor Potassæ Permanganatis.—Similar to, but half the strength of, "Condy's Disinfecting Fluid." Made by dissolving 80 grains of permanganate of potash ($KMnO_4$) in 1 pint of distilled water.

Liquor Sodæ Arseniatis.—Dissolve 4 grains of arseniate of soda (rendered anhydrous by a heat not exceeding 300°) in 1 ounce of water.

Liquor Zinci Chloridi.—Represents "Sir W. Burnett's Disinfecting Fluid." Dissolve 1 pound of zinc in a mixture of 44 ounces of hydrochloric acid and 1 pint of water, by the aid of gentle heat, until gas is no longer evolved. Boil for half an hour; add water to supply the loss by evaporation; cool; filter. Add solution of chlorine gradually, with frequent agitation, until a permanent odour of chlorine is acquired by the liquid. Add ½ ounce of carbonate of zinc gradually until a brown sediment appears. Filter, and evaporate down to 2 pints.

The following is the reaction:—

$$Zn+2HCl=ZnCl_2+2H.$$

The object of the chlorine is to free the zinc from iron by converting the latter into perchloride, thus—

$$2Cl+2FeCl_2=Fe_2Cl_6.$$

This perchloride is then, by the action of carbonate of zinc, converted into the brown peroxide, and is precipitated as such, thus—

$$Fe_2Cl_6+3ZnCO_3+3H_2O=Fe_26HO+3ZnCl_2+3CO_2.$$

STRENGTH.

Liquor Arsenicalis	1 in 120 (4 grains to the ounce)
,, Arsenici Hydrochloricus	
,, Sodæ Arseniatis	
,, Potassæ Permanganatis	
,, Ferri Perchloridi Fortior	1 in 1
,, Ferri Perchloridi	1 in 4
,, Ferri Pernitratis	1 in 6
,, Magnesiæ Carbonatis	1 in 37
,, Plumbi Subacetatis Dilutus	1 in 80
,, Hydrargyri Perchloridi	1 in 960

Liquor Magnesiæ Carbonatis contains 13 grains of carbonate in the fluid ounce. 1 fluid ounce of *Liquor Bismuthi et Ammoniæ Citratis* contains 24 grains of oxide of bismuth; and 1 fluid ounce of *Liquor Zinci Chloridi* contains 366 grains of chloride of zinc.

SPECIFIC GRAVITY.

The Pharmacopœia mentions the following:—

Liquor Antimonii Chloridi	1·47
,, Arsenicalis	1·009
,, Arsenici Hydrochloricus	1·009
,, Bismuthi et Ammoniæ Citratis	1·122
,, Ferri Perchloridi Fortior	1·338
,, Ferri Pernitratis	1·107
,, Ferri Persulphatis	1·441
,, Hydrargyri Nitratis	2·246
,, Plumbi Subacetatis	1·26

TESTS, ETC.

Liquor Antimonii Chloridi.—A yellowish-red liquid. A little of it dropped into water gives a white precipitate (of oxychloride of antimony, or "Algarothi's Powder," which is a variable mixture of terchloride and teroxide); the solution filtered from this precipitate gives with nitrate of silver a copious precipitate (of chloride of silver). If the white precipitate of oxychloride be treated with sulphuretted hydrogen, it becomes orange-red (by formation of the tersulphide).

One fluid drachm mixed with a solution of ¼ ounce of tartaric acid in 4 ounces of water gives a clear solution, which, when treated with sulphuretted hydrogen, yields an orange precipitate (Sb_2S_3), weighing, when washed and dried at 212°, 22 grains.

Liquor Arsenicalis.—A reddish alkaline liquid. After acidulation with hydrochloric acid, it gives with sulphuretted hydrogen a yellow precipitate (tersulphide). One fluid ounce (441·5 grains by weight), boiled for five minutes with 10 grains of bicarbonate of soda, and, when cold, diluted with 6 ounces of water containing a little mucilage of starch, does not give with the volumetric solution of iodine a permanent blue colour, until 808 grain-measures have been added, corresponding to 4 grains of arsenious acid. In this test, the oxygen of the soda converts the arsenious acid into arsenic acid, and the iodine combines with the sodium to form iodide of sodium. Until all the arsenious acid is converted into arsenic acid, sodium will be free for combination with iodine, which cannot therefore give the characteristic colour with starch.

Liquor Arsenici Hydrochloricus.—A colourless liquid with an acid reaction. The same quantitative test is directed for this solution as for Liquor Arsenicalis, using, however, 20 grains of bicarbonate of soda.

Liquor Bismuthi et Ammoniæ Citratis—Mixes with water without decomposition. Heated with solution of potash, it evolves ammonia and yields a white precipitate. On the addition of hydrochloric acid, it gives a white precipitate (oxide of bismuth), which is soluble in excess.

Three fluid drachms mixed with an ounce of water and treated with excess of sulphuretted hydrogen, give a black precipitate (sulphide of bismuth), which, washed and dried, weighs 9·92 grains.

Liquor Ferri Perchloridi Fortior.—An orange-brown liquid with a strong styptic taste. Diluted with water it gives a white precipitate with nitrate of silver (chloride of silver), and a dark-blue precipitate with ferrocyanide of potassium (characteristic of a persalt of iron), but no precipitate with ferridcyanide of potassium (showing the absence of a protosalt of iron).

One fluid drachm mixed with two ounces of water gives, on adding excess of solution of ammonia, a reddish-brown precipitate (of peroxide of iron), which, washed and incinerated, weighs 15·62 grains.

Liquor Ferri Pernitratis.—A reddish-brown liquid with a slightly astringent taste. It gives a blue precipitate with ferrocyanide of potassium (presence of a persalt), but no precipitate with ferridcyanide of potassium (absence of protosalt). When to a little of it placed in a test-tube, half its volume of pure sulphuric acid is added, and then solution of sulphate of iron is poured on, the whole assumes a dark-brown colour. This colour is due to the absorption by the solution of the sulphate of iron of nitric oxide gas, which is produced by the decomposition of the nitric acid set free by the action of the sulphuric acid.

One fluid drachm treated with excess of solution of ammonia gives a precipitate (of peroxide), which, washed, dried, and incinerated, weighs 2·6 grains.

Liquor Ferri Persulphatis.—A dark-red liquid with a very astringent taste. Diluted with 10 volumes of water it gives a white precipitate with chloride of barium (presence of a sulphate), a blue precipitate with ferrocyanide of potassium (presence of a persalt), but no precipitate with ferridcyanide of potassium (absence of a protosalt).

One fluid drachm diluted with 2 ounces of water and treated with excess of solution of ammonia gives a precipitate (of peroxide), which, washed and incinerated, weighs 11·44 grains.

Liquor Hydrargyri Nitratis Acidus.—Gives a yellow precipitate with excess of solution of potash (indicating mercuric oxide, HgO). If a crystal of sulphate of iron be dropped into it, in a little time the salt of iron and the liquid in its vicinity acquire a dark colour (due to the conversion of a portion of the sulphate of iron into a state of persulphate by nitric acid, and the absorption of the nitric oxide so produced by the remaining portion of the sulphate). It gives no precipitate when a little of it is dropped into hydrochloric acid diluted with twice its volume of water (showing the absence of subnitrate, for if that were present subchloride of mercury would be formed, and this, being insoluble, would be precipitated).

Liquor Magnesiæ Carbonatis.—One fluid ounce evaporated to dryness yields a white solid residue, which, when calcined, weighs not less than 5 grains, is insoluble in water, and answers to the tests for magnesia.

Liquor Magnesiæ Citratis.—The formula for the preparation of this liquor is an imitation of that in the French Codex for "purgative lemonade."

Liquor Plumbi Subacetatis.—A colourless liquid with an alkaline reaction and a sweet astringent taste. It becomes turbid on exposure (by absorption of carbonic acid and consequent formation of carbonate of lead). It forms with mucilage of gum arabic an opaque white jelly. Gives with excess of sulphuric acid a white precipitate (sulphate of lead), acetic acid being set free.

Six fluid drachms (413·3 grains by weight) require for perfect precipitation 810 grain-measures of the volumetric solution of oxalic acid.

Of the foregoing liquors: *Liquor Ferri Perchloridi Fortior* enters into the composition of Liquor Ferri Perchloridi and Tinctura

Ferri Perchloridi; *Liquor Ferri Persulphatis* is used in the preparation of Ferri et Ammoniæ Citras, Ferri et Quiniæ Citras, Ferri Oxidum Magneticum, Ferri Peroxidum Humidum, Ferrum Tartaratum, and Tinctura Ferri Acetatis; *Liquor Plumbi Subacetatis* is contained in Liquor Plumbi Subacetatis Dilutus, and in Unguentum Plumbi Subacetatis Compositum.

CLASS VI.

Solutions of Alkaloids and their Salts.

Liquor Atropiæ.
„ Atropiæ Sulphatis.
„ Morphiæ Acetatis.
„ Morphiæ Hydrochloratis.
„ Strychniæ.

Liquor Atropiæ.—Dissolve 4 grains of atropia in 1 drachm of rectified spirit, and add this gradually to 7 drachms of water.

Liquor Atropiæ Sulphatis.—Dissolve 4 grains of sulphate of atropia in 1 ounce of water.

Liquor Morphiæ Acetatis.—Dissolve 4 grains of acetate of morphia in a mixture of 8 minims of dilute acetic acid, 2 drachms of rectified spirit, and 6 drachms of water.

Liquor Morphiæ Hydrochloratis.—Dissolve 4 grains of hydrochlorate of morphia in a mixture of 8 minims of dilute hydrochloric acid, 2 drachms of rectified spirit, and 6 drachms of water.

Liquor Strychniæ.—Dissolve 4 grains of strychnia in a mixture of 6 minims of dilute hydrochloric acid, and 4 drachms of water by the aid of heat, and then add 2 drachms of rectified spirit and 2 drachms of water.

It will be seen that all the solutions in this group have the same strength—viz., 1 in 120, or 4 grains in the fluid ounce.

The use of the rectified spirit in the last three liquors is to prevent decomposition—that of the acid is to aid solution. *Liquor Strychniæ* is in reality a solution of the hydrochlorate.

The only solutions of which we have not yet spoken, and which are not referable to any of the foregoing groups, are—

Liquor Epispasticus.
„ Gutta-percha.

Liquor Epispasticus, or "Blistering liquid," or, as it was formerly named, Linimentum Cantharides, is prepared by macerating 8 ounces of cantharides in 4 ounces of acetic acid for 24 hours, and then percolating the mixture with ether until 20 ounces are obtained.

Liquor Gutta-percha is a solution of gutta-percha in chloroform. It is thus prepared:—Add 1 oz. of gutta-percha in thin slices to 6 ozs.

of chloroform in a stoppered bottle, and shake them together frequently until solution has been effected. Then add 1 ounce of carbonate of lead previously mixed with 2 ounces of chloroform, and having several times shaken the whole together, set the mixture aside and let it remain at rest until the insoluble matter has subsided. Then decant the clear liquid and keep it in a well-stoppered bottle. The carbonate of lead acts mechanically, uniting with the colouring matter. This preparation is introduced as a vehicle for the powder of black mustard seed in making Charta Sinapis (p. 216).

LOTIONES (LOTIONS).

Of these there are but two, viz.:—

Lotio Hydrargyri Flava.
„ Hydrargyri Nigra.

They are prepared by mixing 18 grains of perchloride of mercury and 30 grains of subchloride of mercury, respectively, with 10 ounces of solution of lime.

In the preparation of *Lotio Flava*, yellow or mercuric oxide (HgO) is precipitated; thus—

$$HgCl_2 + Ca2HO = HgO + CaCl_2 + H_2O;$$

while in *Lotio Nigra*, black or mercurous oxide (Hg_2O) is thrown down—

$$2HgCl + Ca2HO = Hg_2O + CaCl_2 + H_2O.$$

These lotions are commonly known as "yellow wash" and "black wash."

MELLITA (HONEYS).

Including the oxymels there are four formulæ for the preparation of honeys, viz.:—

Mel Depuratum.
„ Boracis.
Oxymel.
„ Scillæ.

Mel Depuratum, clarified honey, is made by melting honey in a water-bath, and straining it while hot through flannel moistened with warm water. The honey is thus rendered less liable to ferment by the removal of the flocculent matters and other impurities.

Mel Boracis is a mixture of 64 grains of powdered borax in 1 ounce of clarified honey.

Oxymel is prepared by mixing 40 ounces of melted clarified honey with 5 ounces each of acetic acid and water.

Oxymel Scillæ is made by evaporating in a water-bath, until the specific gravity of 1·32 is attained, a mixture of 1 pint of vinegar of squill and 2 pounds of clarified honey.

Mel Depuratum, besides forming an ingredient of the foregoing honeys, enters also into the composition of Confectio Piperis, Confectio Scammonii, and Confectio Terebinthinæ.

MISTURÆ (MIXTURES).

The majority of these are preparations containing substances suspended in aqueous fluids by means of sugar, gum arabic, yolk of egg, &c. When the suspended substances are oleaginous, an "emulsion" is formed.

The following are the mixtures of the Pharmacopœia:—

Mistura Ammoniaci.
,, Amygdalæ.
,, Creasoti.
,, Cretæ.
,, Ferri Aromatica.
,, Ferri Composita.
,, Gentianæ.
,, Guaiaci.
,, Scammonii.
,, Sennæ Composita.
,, Spiritus Vini Gallici.

Mistura Ammoniaci.—Triturate ¼ ounce of ammoniacum with 8 ounces of water gradually added, and strain through muslin. The water dissolves the gum of the gum resin, and thus the resin becomes suspended, forming an emulsion of a milky appearance.

Mistura Amygdalæ.—Triturate 2½ ounces of compound powder of Almonds with 1 pint of water, and strain through muslin. The oleaginous matter of the almonds is suspended in the water by their albumen and by the gum and sugar which are contained in the compound powder, and thus a milk-like emulsion is formed.

Mistura Scammonii.—Triturate 4 grains of resin of scammony with 2 fluid ounces of milk gradually added. This is an imitation of "Planche's Purgative Potion."

Mistura Guaiaci.—Triturate ½ ounce of guaiacum resin with ½ ounce of refined sugar and ¼ ounce of gum acacia, add gradually 1 pint of cinnamon water. An emulsion is formed by the suspension of the resin by means of the sugar and gum.

Mistura Cretæ.—Triturate ¼ ounce each of prepared chalk and powdered gum acacia with 7½ ounces of cinnamon water, and add ½ ounce of syrup.

Mistura Spiritus Vini Gallici.—Rub the yolk of two eggs with ½ ounce of refined sugar, and add 4 ounces each of spirit of French wine (brandy) and cinnamon water.

Mistura Creasoti.—Mix 16 minims each of creasote and glacial acetic acid, add 15 ounces of water, and then 1 ounce of syrup and ½ drachm of spirit of juniper. The acetic acid is employed to promote the solubility of the creasote, and the spirit of juniper is to mask the taste. One ounce contains 1 minim of creasote.

Mistura Sennæ Composita.—Dissolve, with the aid of gentle heat, 4 ounces of sulphate of magnesia and ½ ounce of extract of liquorice in 14 ounces of infusion of senna; add 2½ ounces of tincture of senna and 10 drachms of compound tincture of cardamom, and make up the bulk to 1 pint with infusion of senna.

This is intended to resemble "Black Draught."

Mistura Gentianæ.—Macerate ½ ounce of gentian root and 30 grains each of bitter orange peel and bruised coriander fruit in 2 ounces of proof spirit for two hours; add 8 ounces of water, and macerate for two hours more; finally, strain through calico.

Cold water is used, as it dissolves less of the pectin or mucilaginous matter of the gentian, and spirit is used to promote the solubility of the active principle, gentiopicrin.

Mistura Ferri Aromatica.—Macerate 1 ounce of powdered pale cinchona bark, ½ ounce of powdered calumba root, ¼ ounce of bruised cloves, and ½ ounce of fine iron wire, in 12 ounces of peppermint water, for three days; filter, and add as much peppermint water to the filter as will make the product measure 12½ ounces, then add 3 ounces of compound tincture of cardamom and ½ ounce of tincture of orange peel.

This is commonly known as "Heberden's Ink." It contains *tannate* of iron.

Mistura Ferri Composita.—Take 9½ ounces of rose water, triturate with a little of it, so as to form a thin paste, 60 grains each of myrrh and refined sugar, and 30 grains of carbonate of potash; add to this 4 drachms of spirit of nutmeg and more of the rose water until 8 ounces of a milky liquid is formed; then add 25 grains of sulphate of iron dissolved in the remainder of the rose water; mix well, and preserve immediately from the air.

This is an imitation of "Griffiths' Mixture."

The following reaction takes place in the preparation:—

$$FeSO_4 + K_2CO_3 = FeCO_3 + K_2SO_4.$$

More carbonate of potash is employed than is required to effect the decomposition of the sulphate of iron, and the excess forms with the myrrh a saponaceous compound which serves to suspend the carbonate of iron. When first made it is of a greenish colour, owing to the presence of the hydrated ferrous carbonate; but it becomes reddish when exposed, owing to the absorption of oxygen which peroxidises the iron, carbonic acid being evolved. The sugar materially helps in retarding this oxidation.

MUCILAGINES (MUCILAGES).

These are:—

Mucilago Acaciæ.
,, Amyli.
,, Tragacanthæ.

The first is made by dissolving 4 ounces of gum arabic in 6 ounces of water.

Mucilago Amyli is made by triturating 120 grains of starch with 10 ounces of water added gradually, and then boiling for a few minutes with stirring.

Mucilago Tragacanthæ is prepared by shaking up 60 grains of powdered tragacanth with 10 ounces of water.

In order to render oils or resinous tinctures emulsive with aqueous fluids, 3 drachms of mucilage of acacia are required for each ounce, while 10 drachms are required to emulsify one ounce of copaiba (*Squire*).

Mucilago Acaciæ becomes sour on keeping, owing to the formation of acetic acid.

Mucilago Amyli is not strictly a solution, the starch being merely in a "state of excessive hydration."

Mucilage of gum acacia is an ingredient of all the lozenges, except those of opium; mucilage of starch forms the basis of all the enemata, except the enema assafœtida and that of tobacco.

OLEA (OILS).

These are distilled or expressed; they are enumerated in the following table:—

Class I.

Distilled Oils.

(*a*) *From the fresh flowering herb.*
Oleum Menthæ Piperitæ.
,, Menthæ Viridis.
,, Rutæ.

(*b*) *From the fresh tops.*
Oleum Sabinæ.

(*c*) *From the leaves.*
Oleum Cajuputi.

(*d*) *From the bark.*
Oleum Cinnamomi.

(*e*) *From the oleo-resin.*
Oleum Copaibæ.
,, Terebinthinæ.

(*f*) *From the flower.*

Oleum Anthemidis.
,, Caryophylli (unexpanded buds).
,, Lavandulæ.
,, Rosmarini (flowering tops).

(*g*) *From the fruit.*

Oleum Anethi.
,, Anisi.
,, Carui.
,, Coriandri.
,, Cubebæ.
,, Juniperi.
,, Pimentæ.

(*h*) *From the seed-kernel.*

Oleum Myristicæ.

(*i*) *Distilled with water from the seed after expression of the fixed oil.*

Oleum Sinapis.

CLASS II.

Expressed Oils.

(*a*) *From the fresh peel.*

Oleum Limonis.

This oil is sometimes distilled.

(*b*) *From the fruit.*

Oleum Olivæ.

(*c*) *From the seeds.*

Oleum Amygdalæ.
,, Crotonis.
,, Lini.
,, Myristicæ Expressum.
,, Ricini.
,, Theobromæ.

CLASS III.

Phosphorated Oil.

Oleum Phosphoratum.—Heat fixed oil of almonds in a porcelain dish to 300°, and keep it at this temperature for about fifteen minutes, then let it cool, and filter it through paper. Put 4 fluid ounces of this oil into a stoppered bottle capable of holding 4½ fluid ounces, and add to it 12 grains of phosphorus. Immerse the bottle in hot water until the oil has acquired the temperature of 180°, removing the stopper two or three times to allow the escape of expanded air, then shake the oil and phosphorus together until the latter is entirely dissolved. In this process the oil is directed to be previously heated to 300°, in order to expel any water, and to coagulate any trace of albuminous matter present which might cause the precipitation of some of the phosphorus.

Characters.—A clear and colourless or but slightly coloured oil; phosphorescent in the dark. It contains 0·74 per cent. of phosphorus.

Heat is employed in the expression of *Oleum Theobromæ* and *Oleum Myristicæ Expressum*.

Oleum Morrhuæ is extracted from the fresh liver of Gadus Morrhua by a heat not exceeding 180° (p. 205).

The following are the preparations into the composition of which the oils enter:—

Oleum Amygdalæ in Unguentum Cetacei, Unguentum Hydrargyri Oxidi Rubri, Unguentum Plumbi Subacetatis Compositum, and Unguentum Simplex.

Oleum Anisi in Essentia Anisi, Tinctura Camphoræ Compositæ, Tinctura Opii Ammoniata.

Oleum Anthemidis in Extractum Anthemidis.

Oleum Cajuputi in Linimentum Crotonis, and Spiritus Cajuputi.

Oleum Carui in Confectio Scammonii, and Pilula Aloes Barbadensis.

Oleum Caryophylli in Confectio Scammonii, Pilula Colocynthidis Composita, and Pilula Colocynthidis et Hyoscyami.

Oleum Coriandri in Syrupus Sennæ.

Oleum Crotonis in Linimentum Crotonis.

Oleum Juniperi in Spiritus Juniperi.

Oleum Lavandulæ in Linimentum Camphoræ Compositum, Spiritus Lavandulæ, and Tinctura Lavandulæ Composita.

Oleum Limonis in Linimentum Potassii Iodidi cum Sapone, and Spiritus Ammoniæ Aromaticus.

Oleum Menthæ Piperitæ in Aqua Menthæ Piperitæ, Essentia Menthæ Piperitæ, Pilula Rhei Composita, and Spiritus Menthæ Piperitæ.

Oleum Menthæ Viridis in Aqua Menthæ Viridis.

Oleum Myristicæ in Pilula Aloes Socotrinæ, Spiritus Ammoniæ Aromaticus, and Spiritus Myristicæ.

Oleum Myristicæ Expressum in Emplastrum Calefaciens, and Emplastrum Picis.

Oleum Olivæ in Charta Epispastica, Cataplasma Lini, Emplastrum Ammoniaci cum Hydrargyro, Emplastrum Cerati Saponis, Emplastrum Hydrargyri, Emplastrum Picis, Emplastrum Plumbi, Enema Magnesiæ Sulphatis, Linimentum Ammoniæ, Linimentum Calcis, Linimentum Camphoræ, Unguentum Cantharidis, Unguentum Hydrargyri Compositum, Unguentum Hydrargyri Nitratis, and Unguentum Veratriæ.

Oleum Ricini in Collodium Flexile, Linimentum Sinapis Compositum, and Pilula Hydrargyri Subchloridi Composita.

Oleum Rosmarini in Linimentum Saponis, Spiritus Rosmarini, and Tinctura Lavandulæ Composita.

Oleum Sinapis in Linimentum Sinapis Compositum.

Oleum Terebinthinæ in Confectio, Enema, Linimentum, and Unguentum Terebinthinæ, and Linimentum Terebinthinæ Aceticum.

Oleum Theobromæ in all the suppositories.

PILULÆ (PILLS).

There are no less than twenty-three formulæ for the preparation of these, viz.:—

Pilula Aloes Barbadensis.
„ Aloes Socotrinæ.
„ Aloes et Assafœtidæ.
„ Aloes et Ferri.
„ Aloes et Myrrhæ.
„ Assafœtida Composita.
„ Cambogiæ Composita.
„ Colocynthidis Composita.
„ Colocynthidis et Hyoscyami.
„ Conii Composita.
„ Ferri Composita.
„ Ferri Carbonatis.
„ Ferri Iodidi.
„ Hydrargyri.
„ Hydrargyri Subchloridi Composita.
„ Ipecacuanhæ cum Scilla.
„ Phosphori.
„ Plumbi cum Opio.
„ Quiniæ.
„ Rhei Composita.
„ Saponis Composita.
„ Scammonii Composita.
„ Scillæ Composita.

All the pills consist of several ingredients, and yet there is no satisfactory method of classifying them pharmaceutically. We will therefore consider them in alphabetical order, directing the special attention of the student to the ingredients and strength of these important preparations.

Pilula Aloes Barbadensis (1 in 2):

Barbadoes aloes, 2 ozs.; hard soap, 1 oz.; oil of caraway, 1 dr.; confection of roses, 1 oz.

Pilula Aloes Socotrinæ (1 in 2):
Socotrine aloes, 2 ozs.; hard soap, 1 oz.; oil of nutmeg, 1 dr.; confection of roses, 1 oz.

Pilula Aloes et Assafœtidæ (1 of aloes and 1 of assafœtida in 4):
Socotrine aloes, assafœtida, hard soap, and confection of roses, of each 1 oz.

Pilula Aloes et Ferri (1 of aloes and ¾ of iron in 5¼):
Sulphate of iron, 1½ ozs.; Barbadoes aloes, 2 ozs.; compound powder of cinnamon, 3 ozs.; confection of roses, 4 ozs.

Pilula Aloes et Myrrhæ, "Rufus Pill" (1 of aloes and ½ of myrrh in 3):
Socotrine aloes, 2 ozs.; myrrh, 1 oz.; saffron, ½ oz.; confection of roses, 2½ ozs.

Pilula Assafœtidæ Composita (1 of assafœtida, and 1 of galbanum in 3½):
Assafœtida, galbanum, and myrrh, of each 2 ozs.; treacle, 1 oz.

Pilula Cambogiæ Composita (1 in 6):
Gamboge, Barbadoes aloes, and compound powder of cinnamon, of each 1 oz.; hard soap, 2 ozs.; and a sufficiency of syrup.

Pilula Colocynthidis Composita (1 of colocynth, 2 of aloes, and 2 of scammony in 6):
Colocynth, 1 oz.; Barbadoes aloes, 2 ozs.; scammony, 2 ozs.; sulphate of potash, ¼ oz.; oil of cloves, 2 dr.; water, a sufficiency.

Pilula Colocynthidis et Hyoscyami:
Compound pill of colocynth, 2 ozs.; extract of hyoscyamus, 1 oz.

Pilula Conii Composita (2½ of extract and ½ of ipecacuanha in 3):
Extract of hemlock, 2½ ozs.; ipecacuanha, ½ oz.; and a sufficiency of treacle.

Pilula Ferri Carbonatis (1 of saccharo-carbonate in 1¼):
Saccharated carbonate of iron, 1 oz.; confection of roses, ¼ oz.

Pilula Ferri Iodidi (1 of iodide of iron in 3):
Fine iron wire, 40 grs.; iodine, 80 grs.; refined sugar, 70 grs.; liquorice root, 140 grs.; and distilled water, 50 mins.

Pilula Hydrargyri, "Blue Pill" (1 of mercury in 3):
Mercury, 2 ozs.; confection of roses, 3 ozs.; liquorice root, 1 oz.

Pilula Hydrargyri Subchloridi Composita, "Plummer's Pill" (1 of calomel in 5):
Calomel, 1 oz.; sulphuretted antimony, 1 oz.; guaiacum resin, 2 ozs.; castor oil, 1 oz.

Pilula Ipecacuanhæ cum Scilla (3 of Dover's powder in 7):
Compound powder of ipecacuanha, 3 ozs.; squill, 1 oz.; ammoniacum, 1 oz.; and a sufficiency of treacle.

Pilula Phosphori:
Phosphorus, 2 grs.; balsam of Tolu, 120 grs.; yellow wax, 60 grs.

Pilula Plumbi cum Opio (6 of acetate of lead and 1 of opium in 8):
Acetate of lead, 36 grs.; opium, 6 grs.; confection of roses, 6 grs.

Pilula Quiniæ (3 of quinine in 4):
Sulphate of quinine, 60 grs.; confection of hips, 20 grs.

Pilula Rhei Composita (1 of rhubarb, ¾ of aloes in 4½):
Rhubarb, 3 ozs.; socotrine aloes, 2¼ ozs.; myrrh, 1½ ozs.; hard soap, 1½ ozs.; oil of peppermint, 1½ drs.; treacle, 4 ozs.

Pilula Saponis Composita (1 of opium in 5):
Opium, ½ oz.; hard soap, 2 ozs.; water, a sufficiency.

Pilula Scammonii Composita:
Resin of scammony, resin of jalap, and powdered curd soap, of each 1 oz.; strong tincture of ginger, 1 oz.; rectified spirit, 2 ozs.

Pilula Scillæ Composita (1 of squills in 5):
Squill, 1¼ ozs.; ginger, ammoniacum, and hard soap, of each 1 oz.; treacle, 2 ozs.

With regard to the *directions* for the preparation of the foregoing pills, the solid ingredients are to be powdered previously to being mixed, and as a general rule the simple direction is to mix the ingredients thoroughly so as to form a uniform mass. In the preparation of *Pilula Assafœtidæ Composita*, however, the ingredients are to be heated in a water-bath, and the mass stirred until it assumes a uniform consistence. In *Pilula Ferri Iodidi* the iron is to be agitated with the iodine and the water until the froth becomes white, the fluid is then to be poured on the sugar in a mortar, rubbed briskly, and the liquorice gradually added. In the *Pilula Hydrargyri*, the efficacy of the pill depends on the degree of extinction of the mercury, and hence we must be careful to rub the mercury with the confection of roses until the metallic globules are no longer visible; the liquorice is then to be added and well mixed. The following are the directions for the mode of preparing *Pilula Phosphori:*—Put the phosphorus and balsam of Tolu into a Wedgwood mortar about half full of hot water, and when the phosphorus has melted and the balsam has become sufficiently soft, rub them together beneath the surface of the water until no particles of phosphorus are visible, the temperature of the water being maintained at or near to 140°. Add now the wax, and as it softens mix it thoroughly with the other ingredients. Allow the mass to cool without being exposed to the air, and keep it in a bottle immersed in cold water. It may be softened with a few drops of rectified spirit when made into pills.

In making *Pilula Scammonii Composita* add the spirit and tincture to the soap and resins, and dissolve with the aid of a gentle heat; then evaporate the spirit by the heat of a water bath until the mass has acquired a suitable consistence for forming pills. This is the only aperient pill in the Pharmacopœia which does not contain aloes.

Pilula Hydrargyri probably consists of minutely divided metallic mercury combined with mercurous oxide (Hg_2O). It sometimes contains subsulphate of mercury as an adulteration, from the fact of sulphuric acid having been added to the confection of roses to improve its colour; it is detected by rubbing the pill mass with boiling water, and adding solution of nitrate of baryta—a white precipitate, insoluble in nitric acid, resulting.

Pilula Hydrargyri Subchloridi Composita becomes partially decomposed by long keeping, chloride of antimony and sulphuret of mercury resulting.

In *Pilula Plumbi cum Opio*, which is an imitation of "Graves's Pill," a decomposition is also said to take place, acetate of morphia and meconate of lead being formed.

PULVERES (POWDERS).

There are fifteen in the Pharmacopœia, viz.:—

Pulvis Amygdalæ Compositus.
„ Antimonialis.
„ Catechu Compositus.
„ Cinnamomi Compositus.
„ Cretæ Aromaticus.
„ Cretæ Aromaticus cum Opio.
„ Elaterii Compositus.
„ Glycyrrhizæ Compositus.
„ Ipecacuanhæ Compositus.
„ Jalapæ Compositus.
„ Kino Compositus.
„ Opii Compositus.
„ Rhei Compositus.
„ Scammonii Compositus.
„ Tragacanthæ Compositus.

All these are of complex constitution; and as there is no satisfactory method of classifying them pharmaceutically, they had best be considered in alphabetical order.

Pulvis Amygdalæ Compositus (8 in 13).

Blanched Jordan almonds, 8 ozs.; refined sugar, 4 ozs.; gum acacia, 1 oz.

This was formerly the "Confectio Amygdalæ." One oz. of it with 8 ozs. of water forms the *Mistura Amygdalæ* of the present Pharmacopœia.

Pulvis Antimonialis (1 of oxide of antimony in 3):
Oxide of antimony, 1 oz.; precipitated phosphate of lime, 2 ozs.

Intended as a substitute for "James' Powder," of which, however, antimonious acid makes up the bulk.

Pulvis Catechu Compositus (1 in 2½):
Pale catechu, 4 ozs.; kino and rhatany root, of each, 2 ozs.; cinnamon bark and nutmeg, of each, 1 oz.

Pulvis Cinnamomi Compositus (1 in 3):
Cinnamon bark, cardamom seeds, and ginger, of each, 1 oz.

Pulvis Cretæ Aromaticus (1 in 4):
Cinnamon bark, 4 ozs.; nutmeg and saffron, of each, 3 ozs.; cloves, 1½ ozs.; cardamom seeds, 1 oz.; refined sugar, 25 ozs.; prepared chalk, 11 ozs.

Pulvis Cretæ Aromaticus cum Opio (1 of opium in 40):
Aromatic powder of chalk, 9¾ ozs.; opium, ¼ oz.

Pulvis Elaterii Compositus (1 in 10):
Elaterium, 10 grs.; sugar of milk, 90 grs.

Pulvis Glycyrrhizæ Compositus:
Senna, in fine powder, powdered liquorice root, of each, 2 ozs.; refined sugar in powder, 6 ozs. The addition of 1 oz. each of powdered fennel fruit and washed sulphur constitutes the *Pulvis Liquoritiæ Compositus* of the German Pharmacopœia.

Pulvis Ipecacuanhæ Compositus (1 of opium in 10):
Ipecacuanha and opium, of each, ½ oz.; sulphate of potash, 4 ozs.

This is commonly known as "Dover's Powder," of which, however, it is not an exact imitation. The use of the sulphate of potash is to promote the minute division and intermixture of the opium and ipecacuanha. If this powder be kept for any length of time the bottle containing it should be well shaken before dispensing it, as the sulphate of potash is apt to sink to the bottom.

Pulvis Jalapæ Compositus (1 in 3):
Jalap, 5 ozs.; acid tartrate of potash, 9 ozs.; ginger, 1 oz.

The acid tartrate of potash not only assists in the minute division of the jalap, but also promotes the hydragogue effects.

Pulvis Kino Compositus (1 of opium in 20):
Kino, 3¾ ozs.; opium, ¼ oz.; cinnamon bark, 1 oz.

Pulvis Opii Compositus (1 of opium in 10):
Opium, 1½ ozs.; black pepper, 2 ozs.; ginger, 5 ozs.; caraway fruit, 6 ozs.; tragacanth, ½ oz.

Pulvis Rhei Compositus (1 in 4½):
Rhubarb root, 2 ozs.; light magnesia, 6 ozs.; ginger, 1 oz.
Known as "Gregory's Powder."

Pulvis Scammonii Compositus (1 in 2):
Scammony, 4 ozs.; jalap, 3 ozs.; ginger, 1 oz.

Pulvis Tragacanthæ Compositus:
Tragacanth, gum acacia, and starch, of each, 1 oz.; refined sugar, 3 ozs.
Chiefly used as a vehicle for heavy insoluble powders.

The general direction "to mix the ingredients thoroughly, pass the powder through a light sieve, rub it lightly in a mortar, and preserve it in a stoppered bottle," may be said to apply to all the powders. The several ingredients, before mixing, are to be finely powdered.

The following are the preparations into which some of the powders enter:—

Pulvis Amygdalæ Compositus in Mistura Amygdalæ.

Pulvis Cinnamomi Compositus in Pilula Aloes et Ferri, and Pilula Cambogiæ Composita.

Pulvis Ipecacuanhæ Compositus in Pilula Ipecacuanhæ cum Scilla.

Pulvis Opii Compositus in Confectio Opii.

SPIRITUS (SPIRITS).

Including rectified spirit and proof spirit there are sixteen formulæ for use in the Pharmacopœia, viz.:—

Spiritus Ætheris.
" Ætheris Nitrosi.
" Ammoniæ Aromaticus.
" Ammoniæ Fœtidus.
" Armoraciæ Compositus.
" Cajuputi.
" Camphoræ.
" Chloroformi.
" Juniperi.
" Lavandulæ.
" Menthæ Piperitæ.
" Myristicæ.
" Rectificatus.
" Rosmarini.
" Tenuior.
" Vini Gallici.

Spiritus Rectificatus, "Rectified Spirit," or spirit of wine, contains 84 per cent. by weight, or 89 by volume, of absolute alcohol (C_2H_6O), and is obtained by distillation of fermented saccharine fluids. Under the influence of the ferment (*Torula Cerevisiæ*), at between 60° and 80°, the sugar is converted into alcohol and carbonic acid—

$$C_6H_{12}O_6 = 3CO_2 + 2C_2H_6O.$$

Spiritus Tenuior, "Proof Spirit"[*] contains 49 per cent. by weight, or 58 by volume of absolute alcohol, and is made by diluting 5 pints of rectified spirit with 3 pints of water.

The specific gravity of *Spiritus Rectificatus* is 0·838; that of *Spiritus Tenuior* is 0·920.

The Pharmacopœia directs the following tests for the purity of *Spiritus Rectificatus*. It should remain clear on adding to it distilled water. Four fluid ounces of it with thirty grain-measures of the volumetric solution of nitrate of silver exposed for twenty-four hours to bright sunlight and then decanted from the black powder which has formed, should undergo no further change when again exposed to light with more of the test. This test indicates that Amylic Alcohol (Fusel Oil), or Aldehyde, are not present in excess. Rectified spirit, when perfectly pure, does not reduce nitrate of silver.

Absolute alcohol and proof spirit may be similarly tested.

Absolute Anhydrous Alcohol is thus prepared:—

Put 1½ ozs. of carbonate of potash and 1 pint of rectified spirit into a stoppered bottle and allow them to remain in contact for two days, frequently shaking the bottle. Expose 10 ozs. of slaked lime to a red heat in a covered crucible for half an hour, then remove it from the fire, and, when it has cooled, immediately put the lime into a flask or retort, and add to it the spirit from which the denser aqueous solution of carbonate of potash, which will have formed a distinct stratum at the bottom of the bottle, has been carefully and completely separated. Attach a condenser to the apparatus, and allow it to remain without any external application of heat for twenty-four hours; then applying a gentle heat, let the spirit distil until that which has passed over shall measure 1½ fluid ounces; reject this, and continue the distillation into a fresh receiver until nothing more passes at a temperature of 200°. In this process the deliquescent carbonate of potash, which is insoluble in alcohol, absorbs most of the water from it, and the fresh-burnt quick-lime removes the remainder.

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[*] When the specific gravity is ·920 it is said to be "proof;" when the specific gravity is lower than this it is termed "above proof;" and when the specific gravity is higher it is termed "under proof."

Absolute alcohol thus obtained should be colourless and free from empyreumatic odour; sp. gr. 0·795. It is entirely volatile by heat, and is not rendered turbid when mixed with water, showing the absence of essential oil or resin. It should not cause anhydrous sulphate of copper to assume a blue colour when left in contact with it, showing it is free from water. It is a powerful solvent of many substances, but does not dissolve common salt, which is soluble in rectified spirit.

Amylic Alcohol, "Oil of Grain, or Fusel Oil" ($C_5H_{12}O$), is an oily liquid contained in the crude spirit produced by the fermentation of saccharine solutions with yeast, and separated in the rectification or distillation of such crude spirit. It is a colourless liquid with a penetrating and oppressive odour and a burning taste. When pure its sp. gr. is 0·818, and its boiling point 270°. It is sparingly soluble in water, but soluble in all proportions in alcohol, ether, and essential oils. By the action of oxidising agents—*e. g.*, with platinum black—it is converted into valerianic acid, which corresponds to acetic acid in the ethyl series. It is introduced into the Pharmacopœia for the preparation of valerianate of soda.

Spiritus Vini Gallici, "Spirit of French Wine," "Brandy." Spirit distilled from French Wine. It contains about 55 per cent. by measure of alcohol according to Brand, together with some volatile oil and œnanthic ether. When first distilled it is nearly white, but afterwards acquires a brownish colour from the cask in which it is kept.

The remaining spirits may be conveniently divided into SIMPLE and COMPLEX—the former including those which are merely solutions in, or mixture with, rectified spirit.

Simple Spirits.

Spiritus Ætheris is made by mixing 10 ozs. of ether with 20 ozs. of rectified spirit. Its specific gravity should be 0·809.

Spiritus Chloroformi, intended to represent "Chloric Ether," which, however, is much stronger. It is prepared by dissolving 1 oz. chloroform in 19 ozs. of rectified spirit. Its specific gravity should be 0·871. It differs from chloroform in being readily ignited. It yields a green colour with bichromate of potash and sulphuric acid.

Spiritus Camphoræ, the old "Tinctura Camphoræ." Made by dissolving 1 oz. of camphor in 9 ozs. of rectified spirit. It is decomposed by water, the greater part of the camphor separating.

Spiritus Cajuputi, *Spiritus Juniperi*, *Spiritus Lavandulæ*, *Spiritus Menthæ Piperitæ*, *Spiritus Myristicæ*, and *Spiritus Rosmarini*, are all made by dissolving 1 oz. of the respective volatile oils in 49 ozs. of rectified spirit.

Complex Spirits.

Spiritus Ætheris Nitrosi, "Sweet Spirit of Nitre." A spirituous solution containing nitrous ether ($C_2H_5NO_2$).

Preparation.—Add 1 pint of rectified spirit gradually to 2 ozs. of sulphuric acid, and then add gradually 2½ ozs. of nitric acid. Put the mixture into a retort containing 2 ozs. of fine copper wire, and distil at a temperature of between 170° and 180° until 12 ozs. have passed over. Withdraw the heat now, and when the contents of the retort have cooled, add 2½ ozs. more of nitric acid, and re-distil until the distillate has increased to 15 ozs. Mix this with 2 pints of rectified spirit, or as much as will make the product of the same specific gravity and percentage of ether separated by chloride of calcium.

The following is the *rationale* of the above process, which was proposed by Mr. Redwood:—The sulphuric acid decomposes the alcohol, forming ether, and this is converted into nitrous ether by the nitrous acid which is generated by the action of the copper on the nitric acid. The following equation indicates the decomposition as a whole:—

$$C_2H_5HO+HNO_3+Cu+H_2SO_4=\underbrace{C_2H_5NO_2}_{\textit{Nitrous Ether or Nitrite of Ethyl.}}+CuSO_4+2H_2O.$$

The Pharmacopœia gives the following characters and tests:—

"Transparent and nearly colourless, with a very slight tinge of yellow, mobile, inflammable, of a peculiar, penetrating, apple-like odour, and sweetish, cooling, sharp taste. Specific gravity 0.845. It effervesces feebly or not at all when shaken with a little bicarbonate of soda (showing the absence of free acid). When agitated with solution of sulphate of iron and a few drops of sulphuric acid, it becomes deep olive brown or black (due to the formation of nitric oxide). If it be agitated with twice its volume of saturated solution of chloride of calcium in a closed tube, 2 per cent. of its original volume will separate in the form of nitrous ether, and rise to the surface of the mixture (showing that 10 per cent. of nitrous ether is present, 8 per cent. always remaining unseparated)."

Spiritus Ammoniæ Aromaticus, "Sal Volatile," a spirituous solution of ammonia, neutral carbonate of ammonia, and oils of nutmeg and lemon. It is prepared by distilling 7 pints of a mixture of carbonate of ammonia 8 ozs., strong solution of ammonia 4 ozs., volatile oil of nutmeg 4 drs., oil of lemon 6 drs., rectified spirit 6 pints, and water 3 pints. Its specific gravity is 0·870.

Spiritus Ammoniæ Fœtidus, a spirituous solution of the volatile oil of assafœtida with solution of ammonia. It is prepared by macerating 1½ ozs. of assafœtida in 15 ozs. of rectified spirit for 24 hours, distilling off the spirit, mixing the product with 2 ozs. of strong solution of ammonia, and adding sufficient spirit to make up the bulk to 1 pint.

Spiritus Armoraciæ Compositus (1 in 8):
Made by distilling, with a moderate heat, 1 gallon of a mixture of 20 ozs. each of scraped fresh horseradish-root and bitter orange-peel, ½ oz. of bruised nutmeg, 1 gallon of proof spirit, and 2 pints of water.

The following are the preparations into the composition of which the spirits enter:—

Spiritus Ætheris in Tinctura Lobeliæ Ætherea.
Spiritus Ammoniæ Aromaticus in Tinctura Guaiaci Ammoniata and in Tinctura Valerianæ Ammoniata.
Spiritus Juniperi in Mistura Creasoti.
Spiritus Myristicæ in Mistura Ferri Composita.
Spiritus Vini Gallici in Mistura Spiritus Vini Gallici.
Spiritus Rectificatus and *Spiritus Tenuior* in many tinctures.

SUCCI (JUICES).

Of these there are eight, viz.:—

Succus Belladonnæ.
„ Conii.
„ Hyoscyami.
„ Scoparii.
„ Taraxaci.
„ Limonis.
„ Mori.
„ Rhamni.

The first five are prepared by pressing out the juice from 7 lbs. of the fresh bruised plants, and to every three measures of juice so expressed adding 1 of rectified spirit to preserve from decomposition; the product is then set aside for seven days, filtered, and kept in a cool place.

Succus Limonis, *Succus Mori*, and *Succus Rhamni*, are merely the fresh expressed juices of the ripe fruits. They are more fully considered in Part I.

SUPPOSITORIA (SUPPOSITORIES).

These are solid bodies for introduction into the rectum. There are seven of them in the Pharmacopœia:—

Suppositorium Acidi Carbolici cum Sapone.
„ Acidi Tannici.
„ Acidi Tannici cum Sapone.
„ Hydrargyri.
„ Morphiæ.
„ Morphiæ cum Sapone.
„ Plumbi Compositum.

They may be divided into two groups, one embracing the suppositories of tannic acid, of mercury, of morphia, and the compound suppository of lead. These are made by melting white wax and oil of theobroma by a gentle heat; the active principle and benzoated lard having been rubbed together in a mortar, are then added, and the ingredients thoroughly mixed; the mixture is then poured, while it is fluid, into suitable moulds of the capacity of 15 grains.

The following table gives their composition and strength:—

Suppository	Each contains	Active Ingredients	Benzoated Lard	White Wax	Oil of Theobroma
S. Acid. Tannic.	3 grs. of Tannic Acid	Tannic Acid, 36 grs.	grs. 44	grs. 10	grs. 90
S. Hydrargyri	5 grs. of Mercurial Ointment	Mercurial Ointment, 60 grs.	20	20	80
S. Morphiæ	½ gr. of Hydrochlorate of Morphia	Hydrochlorate of Morphia, 6 grs.	64	20	90
S. Plumbi	3 grs. of Acetate of Lead, and 1 gr. of Opium	Acetate of Lead, 36 grs., Opium, 12 grs.	42	10	80

The other group includes *Suppositoria Acidi Carbolici cum Sapone*, *Suppositoria Morphiæ cum Sapone*, and *Suppositoria Acidi Tannici cum Sapone*. These are made by mixing the active ingredient with glycerine of starch and curd soap, and adding sufficient starch to form a paste of suitable consistence. The mass is then divided into twelve equal parts, each of which is to be made into a conical or other convenient form for a suppository.

Their composition may be thus tabulated:—

Name	Active Ingredient	Curd Soap	Starch	Glycerine of Starch
S. Acidi Carbolici cum Sapone	Carbolic Acid, 12 grs.	180 grs.	q. s.	—
S. Acidi Tannici cum Sapone	Tannic Acid, 36 grs.	100 grs.	q. s.	50 grs.
S. Morphiæ cum Sapone	Hydrochlorate of Morphia, 6 grs.	100 grs.	q. s.	50 grs.

SYRUPI (SYRUPS).

Aqueous solutions of substances saturated with sugar. The following are the eighteen officinal syrups, with the strength of each:—

Syrupus Aurantii (*Tincture*), 1 in 8.
,, Aurantii Floris, 1 in 6¾.
,, Chloral, 10 grs. in each drachm.
,, Ferri Phosphatis, 1 gr. in each drachm.

Syrupus Ferri Iodidi, 4⅓ grs. in each drachm.
,, Hemidesmi, 1 in 8.
,, Limonis (*Juice*), 1 in 2.
,, Mori (*Juice*), 1 in 2.
,, Papaveris (*Capsules*), 1 in 2¼.
,, Rhamni.
,, Rhei (*Root*), 1 in 14.
,, Rhœados (*Petals*), 1 in 3½.
,, Rosæ Gallicæ (*Petals*), 1 in 17¼.
,, Scillæ, 1 in 17.
,, Sennæ, 1 in 2.
,, Tolutanus, 1 in 28⅘.
,, Zingiberis (*Strong Tincture*), 1 in 26.

The following table gives the ingredients, product, and specific gravity of the syrups:—

Syrup	Ingredients	Product		Sp. Gr.
		lbs.	ozs.	
SYRUPUS	Refined sugar, 5 lbs. Distilled water, 2 pints	7½	0	1·330
S. SCILLÆ	Refined sugar, 2½ lbs. Vinegar of squill, 1 pint	—		—
S. LIMONIS	Refined sugar, 2¼ lbs. Fresh lemon peel, 2 ozs. Lemon juice, 1 pint	3½	0	1·34
S. AURANTII FLORIS	Orange-flower water, 8 ozs. Refined sugar, 3 lbs. Distilled water, 16 ozs.	4½	0	1·330
S. TOLUTANUS	Balsam of Tolu, 1¼ ozs. Refined sugar, 2 lbs. Distilled water, 1 pint	3	0	1·330
S. HEMIDESMI	Hemidesmus root, 4 ozs. Refined sugar, 28 ozs. Boiling distilled water, 1 pint	2	10	1·335
S. ROSÆ GALLICÆ	Dried red-rose petals, 2 ozs. Refined sugar, 30 ozs. Boiling distilled water, 1 pint	2	14	1·335
S. CHLORAL	Hydrate of chloral, 80 grs. Distilled water, 4 drms. Simple syrup, 4 drms.	0	1	—
S. FERRI IODIDI	Fine iron wire, 1 oz. Iodine, 2 ozs. Refined sugar, 28 ozs. Distilled water, 13 ozs.	2	11	1·385

Syrupi—Continued.

Syrup	Ingredients	Product		Sp. Gr.
		lbs.	ozs.	
S. Ferri Phosphatis	Granulated sulphate of iron, 224 grs. Phosphate of soda, 200 grs. Acetate of soda, 74 grs. Dilute phosphoric acid, 5½ ozs. Refined sugar, 8 ozs. Distilled water, 8 ozs.	12	0	—
S. Mori	Mulberry juice, 1 pint Refined sugar, 2 lbs. Rectified spirit, 2½ ozs.	3	6	1·33
S. Rhamni	Buckthorn juice, 4 pints Ginger, Pimento, of each, ¾ oz. Refined sugar, 5 lbs. Rectified spirit, 6 ozs.	—		1·32
S. Rhœados	Fresh red-poppy petals, 13 ozs. Refined sugar, 2½ lbs. Distilled water, 1 pint Rectified spirit, 2½ ozs.	3	10	1·330
S. Rhei	Rhubarb root, Coriander fruit, each, 2 ozs. Refined sugar, 24 ozs. Distilled water, 24 ozs. Rectified spirit, 8 ozs.	—		—
S. Sennæ	Senna, 16 ozs. Oil of coriander, 3 mins. Refined sugar, 24 ozs. Distilled water, 5 pints Rectified spirit, 2 pints	2	10	1·310
S. Papaveris	Poppy capsules (dried and freed from seeds), 36 ozs. Refined sugar, 4 lbs. Boiling distilled water, q.s. Rectified spirit, 16 ozs.	6½	0	1·320
S. Aurantii	Tincture of orange peel, 1 oz. Syrup, 7 ozs.	—		—
S. Zingiberis	Strong tincture of ginger, 6 drms. Syrup, 17 ozs.	—		—

For the directions for the preparation of the Syrups reference must be made to the Pharmacopœia. We have not here given the processes, for the details are, in the majority of instances, complicated. The *modus operandi* in the case of *Syrupus Ferri Iodidi* and *Syrupus Ferri Phosphatis*, requires, however, the attention of the student.

In the preparation of *Syrupus Ferri Iodidi* the iron, iodine, and 3 ozs. of the water are to be shaken well together until the froth of the mixture becomes white; a syrup having been made with the sugar and 10 ozs. of the water, the solution of iodide of iron is to be filtered into it while it is still hot. It contains $4\frac{1}{3}$ grains in each drachm.

Syrupus Ferri Phosphatis is a solution of freshly precipitated phosphate of iron in dilute phosphoric acid, converted into a syrup by the addition of sugar which prevents the peroxidation of the iron. Each drachm contains 1 grain of ferrous phosphate.

The following reaction occurs in its preparation:—

$$3FeSO_4+2Na_2HPO_4+2NaC_2H_3O_2= \\ Fe_32PO_4+3Na_2SO_4+2HC_2H_3O_2.$$

Syrups are best kept in full bottles, otherwise the sugar is apt to crystallise from concentration of the syrup. Syrups containing too little sugar are apt to undergo vinous fermentation. This condition may be known by the formation of froth on the surface, a vinous odour, and diminished consistence. The froth is due to the disengagement of carbonic acid gas; the odour is due to the presence of alcohol, and the diminished consistence to the loss of the sugar. According to Macculloch, the presence of chlorate of potash will prevent fermentation in syrups.

Syrupus Papaveris made by the present process is not so liable to ferment as formerly, rectified spirit being now employed to remove the matter which caused fermentation. *Syrupus Sennæ* is also no longer liable to ferment.

Syrupus Limonis when kept too long is apt to deposit grape-sugar.

In *Syrupus Ferri Iodidi* the sugar does *not* effectually prevent decomposition. The best means of preserving the iodide of iron in its integrity is that proposed by Mr. Squire—viz., suspending a coil of iron wire in the bottle containing it.

Syrupus Ferri Phosphatis becomes brown when long kept, and this has been attributed to the production of peracetate of iron from the presence of a small quantity of acetic acid; it is, however, more probably due to the action of phosphoric acid on the sugar.

Syrupus enters into the composition of Mistura Cretæ, Mistura Creasoti, Pilula Cambogiæ Composita, Syrupus Aurantii, and Syrupus Zingiberis.

Syrupus Aurantii is an ingredient of Confectio Sulphuris.

TINCTURA (TINCTURES).

These are spirituous solutions of substances the active principles of which are imperfectly soluble in water, or whose aqueous solutions are not stable. There are no less than 68 tinctures. These are named and classified, according to their strength, in the following table:—

- 1 in 2:—
  - Tinctura Zingiberis Fortior.
- 1 in 3 (?):—
  - Tinctura Aurantii Recentis
- 1 in 4:—
  - Tinctura Ergotæ.
  - ,, Ferri Perchloridi. (*Liquor.*)
- 1 in 8:—
  - Tinctura Aconiti.
  - ,, Assafœtidæ.
  - ,, Buchu.
  - ,, Calumbæ.
  - ,, Cascarillæ.
  - ,, Catechu.
  - ,, Cocci.
  - ,, Colchici Seminum.
  - ,, Conii.
  - ,, Cubebæ.
  - ,, Digitalis.
  - ,, Gallæ.
  - ,, Hyoscyami.
  - ,, Jalapæ.
  - ,, Krameriæ.
  - ,, Laricis.
  - ,, Limonis.
  - ,, Lobeliæ.
  - ,, Lobeliæ Ætherea.
  - ,, Lupuli.
  - ,, Myrrhæ.
  - ,, Sabinæ.
  - ,, Scillæ.
  - ,, Senegæ.
  - ,, Sennæ.
  - ,, Serpentariæ.
  - ,, Stramonii.
  - ,, Sumbuli.
  - ,, Tolutana.
  - ,, Valerianæ.
  - ,, Valerianæ Ammoniata.
  - ,, Zingiberis.
- 1 in 5:—
  - Tinctura Cinchonæ Flavæ.
  - ,, Guaiaci Ammoniata.
  - ,, Pyrethri.
  - ,, Veratri Viridis.

1 in 10:—
Tinctura Aurantii.
,, Benzoini Composita.
,, Chloroformi Composita.
,, Cinchonæ Composita.
,, Kino.
,, Nucis Vomicæ.
,, Rhei.

1 in 20:—
Tinctura Arnicæ.
,, Belladonnæ.
,, Cannabis Indicæ (*Extract*).
,, Castorei.
,, Croci.

1 in 40:—
Tinctura Aloes.
,, Iodi.

1 in 60:—
Tinctura Quiniæ.
,, Quiniæ Ammoniata.

1 in 80:—
Tinctura Cantharidis.
,, Cardamomi Composita.

1 in $13\frac{1}{3}$:—
Tinctura Gentianæ Composita.
,, Opii.

1 in 27:—
Tinctura Capsici.
,, Quassiæ.

1 in 96:—
Tinctura Opii Ammoniata.

1 in 213:—
Tinctura Lavandulæ Composita.

Tinctura Camphoræ Composita has 1 of opium, 1 of benzoic acid, and $\frac{3}{4}$ of camphor in 240.

Different menstrua are used in the preparation of these tinctures:—

Rectified Spirit is used in preparing tinctures of those substances which contain much resin or volatile oil, as in *Tinctura Aconiti, Arnicæ, Assafœtidæ, Benzoini Composita, Cannabis Indicæ, Capsici, Castorei, Cubebæ, Kino, Lavandulæ Composita, Myrrhæ, Nucis Vomicæ, Pyrethri, Tolutana, Veratri Viridis, Zingiberis Fortior.* It is also used in the preparation of *Tinctura Chloroformi Composita, Ferri Acetatis, Ferri Perchloridi, Iodi*, and *Tinctura Opii Ammoniata.*

Proof Spirit is used in the preparation of all the remaining tinctures, except *Tinctura Guaiaci Ammoniata* and *Tinctura Valerianæ Ammoniata*, in which Aromatic Spirit of Ammonia is employed; *Tinctura Opii Ammoniata*, in which strong solution of Ammonia and Rectified Spirit is employed; and *Tinctura Quiniæ Ammoniata*, in which strong solution of Ammonia and Proof Spirit is used; one "Ethereal Tincture," *Tinctura Lobeliæ Ætherea*, in which Spirit of Ether is used; and one in which Tincture of Orange is used—viz., *Tinctura Quiniæ*.

Proof spirit is adapted to make tinctures of such substances as are partly soluble in water and partly in spirit.

The following are the processes according to one or other of which, with the exception of *Tinctura Ferri Acetatis*, all the tinctures are made:—

1st. SIMPLE SOLUTION OR MIXTURE.—*Tinctura Cannabis Indicæ, Chloroformi Composita, Ferri Perchloridi, Iodi.*

2nd. MACERATION.—Macerate the drug in all, or 15 ounces of, the spirit for seven days in a closed vessel, occasionally agitating, filter (in many cases press and strain), and add sufficient spirit to make 1 pint. *Tinctura Aloes, Assafœtidæ, Aurantii, Aurantii Recentis, Benzioni Composita, Camphoræ Composita, Cantharidis, Castorei, Catechu, Cocci, Guaiaci Ammoniata, Kino, Limonis, Lobeliæ Ætherea, Opii, Opii Ammoniata, Quassiæ, Tolutana, Valerianæ Ammoniata.*

The preparation of *Tinctura Lavandulæ Composita* is somewhat exceptional. After macerating the solid ingredients in the spirit, straining and pressing as above, the oils are dissolved in the strained tincture, filtered, and sufficient spirit added to make up to 2 pints. In *Tinctura Tolutana* the balsam of tolu is macerated in 15 ounces of the spirit for six hours only, or until the balsam is dissolved. In *Tinctura Quiniæ* the sulphate of quinia is dissolved in the tincture of orange-peel by aid of a gentle heat. The solution is allowed to remain for three days in a closed vessel, occasionally agitating it, and is finally filtered.

3rd. PERCOLATION.—Pack in a percolator, pour on half a pint of the spirit, two hours after add more spirit, and percolate slowly until 1 pint is collected. *Tinctura Zingiberis Fortior.*

4th. MACERATION AND PERCOLATION.—Macerate the drug for 48 hours in 15 ounces of the spirit in a closed vessel, occasionally agitating; transfer to a percolator, and when the fluid no longer passes, continue the percolation with 5 ounces more of the spirit. Then press the contents of the percolator, filter the products, mix the liquids, and, lastly, add sufficient spirit to make 1 pint.

All the remaining 38 tinctures are made according to this process. It should be mentioned that in *Tinctura Nucis Vomicæ* the drug, before being subjected to the above treatment, is directed to be steamed until it is well softened, then rapidly dried and reduced to a fine powder.

The preparation of *Tinctura Ferri Acetatis* differs from all the foregoing. 2 ounces of acetate of potash are dissolved in 10 ounces of rectified spirit, and 2½ ounces of solution of persulphate of iron are mixed with 8 ounces of rectified spirit; the solutions are then mixed in a bottle, and shaken occasionally during an hour; the mixture is then filtered, and when the liquid has ceased to pass, as much rectified spirit is put on the filter as will make the filtered product measure 1 pint.

The following equation expresses the reaction:—

$$Fe_2 3SO_4 + 6KC_2H_3O_2 = 3K_2SO_4 + \underbrace{Fe_2 6C_2H_3O_2}_{\text{Ferric Acetate}}.$$

In the preparation of most tinctures the drugs are directed to be cut small or bruised, or coarsely powdered, &c.

All the tinctures are simple except those enumerated in the following table, and *Tinctura Aloes*, which has 1½ ounces of extract of liquorice added to hide the taste and to suspend the aloes in the spirit; *Tinctura Catechu*, in the preparation of which 1 ounce of cinnamon bark is used; and *Tinctura Iodi*, which contains ¼ ounce of iodide of potassium to aid in the solution of the iodine.

Tinctura Opii Ammoniata, *Tinctura Rhei*, and *Tinctura Sennæ*, are compound in every sense, and as such are included in the following table:—

TABLE OF INGREDIENTS OF COMPOUND TINCTURES.

Tinctura Opii Ammoniata.

Opium		100 grs.
Saffron Benzoic Acid	each	180 grs.
Oil of Anise		1 drm.
Strong solution of Ammonia		4 ozs.
Rectified Spirit		16 ozs.

Contains 1 gr. of opium in 96 mins.

Tinctura Rhei.

Rhubarb		2 ozs.
Cardamom Seeds (freed from pericarps) Coriander Fruit Saffron	each	¼ oz.
Proof Spirit		1 pint.

Tinctura Sennæ.

Senna	2½ ozs.
Raisins	2 ozs.
Caraway Fruit Coriander Fruit each	½ oz.
Proof Spirit	1 pint.

Tinctura Benzoini Composita.

Benzoin	2 ozs.
Prepared Storax	1½ ozs.
Balsam of Tolu	½ oz.
Socotrine Aloes	160 grs.
Rectified Spirit	1 pint.

Tinctura Camphoræ Composita.

Opium Benzoic Acid each	40 grs.
Camphor	30 grs.
Oil of Anise	½ drm.
Proof Spirit	1 pint.

One gr. of opium is contained in ½ oz.

Tinctura Cardamomi Composita.

Cardamom Seeds (freed from pericarps)	¼ oz.
Caraway fruit	¼ oz.
Raisins	2 ozs.
Cinnamon Bark	½ oz.
Cochineal	60 grs.
Proof Spirit	1 pint.

Tinctura Cinchonæ Composita.

Pale Cinchona Bark	2 ozs.
Bitter Orange Peel	1 oz.
Serpentary Root	½ oz.
Saffron	60 grs.
Cochineal	30 grs.
Proof Spirit	1 pint

Tinctura Chloroformi Composita.

Chloroform	2 ozs.
Compound Tincture of Cardamoms	10 ozs.
Rectified Spirit	8 ozs.

Tinctura Gentianæ Composita.

Gentian Root	1½ ozs.
Bitter Orange Peel	¾ oz.
Cardamom Seeds (freed from pericarps)	¼ oz.
Proof Spirit	1 pint.

Tinctura Lavandulæ Composita.

Oil of Lavender	1½ drms.
Oil of Rosemary	10 mins.
Cinnamon Bark Nutmeg } each	150 grs.
Red Sandal-wood	300 grs.
Rectified Spirit.	2 pints.

Several tinctures become milky when added to aqueous fluids, owing to the precipitation of resinous or oily matters, as *Tinctura Assafœtidæ*, *Benzoini Composita*, *Cannabis Indicæ*, *Castorei*, *Cubebæ*, *Guaiaci Ammoniata*, *Jalapæ*, *Myrrhæ*, and *Tolutana*. If mucilage of gum acacia be rubbed up with the tincture before adding water the insoluble matters will be suspended.

A few of the tinctures spoil by keeping; thus, *Tinctura Kino* and *Tinctura Catechu* gelatinise when kept for a long time; *Tinctura Ferri Acetatis* also gelatinises on keeping, owing to the separation of the insoluble basic acetate, and *Tinctura Gallæ* when long kept becomes useless as a test for gelatine and the vegetable alkaloids, owing to the change of its tannic acid into gallic acid.

Tinctura Colchici made from the seeds is less liable to purge or nauseate than if made from the corm.

Tinctura Assafœtidæ is chiefly used in the form of enema. *Tinctura Digitalis*, if well made, has a greenish colour by transmitted light. *Tinctura Conii* is known to be good if the odour of conia is evolved on adding to it solution of potash.

Several of the tinctures have received popular names; thus, *Tinctura Aconiti* is sometimes called "Fleming's Tincture." It must be remembered, however, that Fleming's tincture is much stronger than the Pharmacopœial one. *Tinctura Benzoini Composita* is termed "Friar's Balsam;" *Tinctura Camphoræ Composita* is known as "Paregoric Elixir;" while *Tinctura Opii Ammoniata* is sometimes called "Scotch Paregoric." *Tinctura Cinchonæ Composita* is occasionally sold as "Huxham's Tincture of Bark." It contains only half as much pale bark as the *Tinctura Cinchonæ Flavæ* does of yellow bark. Lastly, *Tinctura Opii* is known as "Laudanum."

The following are the preparations into the composition of which the tinctures enter:—

Tinctura Aurantii in Mistura Ferri Aromatica, Syrupus Aurantii, and Tinctura Quiniæ.

Tinctura Cardamomi Composita in Decoctum Aloes Compositum, Mistura Ferri Aromatica, Mistura Sennæ Composita, and Tinctura Chloroformi Composita.

Tinctura Iodi in Vapor Iodi.

Tinctura Lavandulæ Composita in Liquor Arsenicalis.

Tinctura Opii in Enema and Linimentum Opii.

Tinctura Sennæ in Mistura Sennæ Composita.
Tinctura Tolutana in Trochisci Acidi Tannici, Trochisci Morphiæ, Trochisci Morphiæ et Ipecacuanhæ, and Trochisci Opii.
Tinctura Zingiberis Fortior in Syrupus Zingiberis.

TROCHISCI (LOZENGES).

This form of administration is adapted to such medicines as may be given in small doses, and which have not a disagreeable flavour.

There are ten formulæ for them, viz.:—

Trochisci Acidi Tannici.
,, Bismuth.
,, Catechu.
,, Ferri Redacti.
,, Ipecacuanhæ.
,, Morphiæ.
,, Morphiæ et Ipecacuanhæ.
,, Opii.
,, Potassæ Chloratis.
,, Sodæ Bicarbonatis.

The following table gives the composition and strength of each:—

Tincture	Each contains	Active Ingredient	Extra	Refined Sugar	Gum Acacia	Mucilage of Gum Acacia	Distilled Water
T. Catechu	1 gr. of Catechu	Pale Catechu, 720 grs.	—	ozs. 25	ozs. 1	ozs. 2	q.s.
T. Ferri Redacti	1 gr. of Reduced Iron	Reduced Iron, 720 grs.	—	25	1	2	q.s.
T. Ipecacuanhæ	¼ gr. of Ipecacuanha	Ipecacuanha, 180 grs.	—	25	1	2	q.s.
T. Potassæ Chloratis	5 grs. of Chlorate of Potash	Chlorate of Potash, 3,600 grs.	—	25	1	2	q.s.
T. Sodæ Bicarbonatis	5 grs. of Bicarbonate of Soda	Bicarbonate of Soda, 3,600 grs.	—	25	1	2	q.s.
T. Acidi Tannici	½ gr. of Tannic Acid	Tannic Acid, 360 grs.	Tinct. of Tolu, ½ oz.	25	1	2	1 oz.
T. Morphiæ	$\frac{1}{36}$ gr. of Hydrochlorate of Morphia	Hydrochlorate of Morphia, 20 grs.	Tinct. of Tolu, ½ oz.	24	1	2	½ oz.
T. Morphiæ et Ipecacuanhæ	$\frac{1}{36}$ gr. of Hydrochlorate of Morphia, and $\frac{1}{12}$ gr. of Ipecacuanha	Hydrochlorate of Morphia, 20 grs.; Ipecacuanha, 60 grs.	Tinct. of Tolu, ½ oz.	24	1	2	½ oz.
T. Opii	$\frac{1}{10}$ gr. of Extract of Opium	Extract of Opium, 72 grs.	Tinct. of Tolu, ½ oz.; Extract of Liquorice, 6 ozs.	16	2	-	q.s.
T. Bismuthi	2 grs. of Subnitrate of Bismuth	Subnitrate of Bismuth, 1,440 grs.	Carbonate of Magnesia, 4 ozs.; Precip. Carb. of Lime, 6 ozs.; Rose water, q.s.	29	1	2	-

It will be noticed that the first five of these lozenges have no extra ingredients, and, moreover, that the proportion of refined sugar, gum acacia, mucilage, and water, is the same in each case. It will also be presently shown that the directions for the preparation of each of these lozenges are the same. The next four lozenges in the table have half an ounce of tincture of tolu as an additional ingredient. Extract of liquorice is used in *Trochisci Opii* in lieu of the mucilage, and rose water is substituted for distilled water in *Trochisci Bismuthi*.

The following direction for preparation applies to all the lozenges except *Trochisci Acidi Tannici*, *Morphiæ*, *Morphiæ et Ipecacuanhæ*, and *Opii* :—

"Mix the dry ingredients, and add the mucilage and water to form a proper mass. Divide into 720 lozenges, and dry them in a hot-air chamber with a moderate heat."

In the preparation of *Trochisci Acidi Tannici* and *Trochisci Morphiæ* the active ingredient is first dissolved in the water, the tincture of tolu and mucilage mixed are then added, and, finally, the gum and sugar, also previously mixed. In *Trochisci Morphiæ et Ipecacuanhæ* the same process is performed, but the ipecacuanha is to be mixed with the gum and sugar. In *Trochisci Opii* the extract of opium is to be moistened with a little water, and added, with the tincture of tolu, to the extract of liquorice heated in a water-bath. When a proper consistence is obtained, the mixture is to be incorporated on a slab with the sugar and gum previously mixed.

UNGUENTA (OINTMENTS).

These may be generally defined as fatty substances adapted to inunction. In the older Pharmacopœias the so-called "cerates" formed a distinct class. Inasmuch as they differ from ointments merely in containing wax (cera), and, consequently, in having a firmer consistence, they are now very properly grouped with the latter preparations.

Many ointments become rancid on keeping—an effect retarded at least by the presence of benzoin. Geisler states that the addition of a few drops of nitric ether will remove the disagreeable fatty odour of ointments.

The great majority of the ointments are prepared by simple trituration of the ingredients, so as to ensure thorough mixture; but when wax, resins, or concrete oils are to be mixed, the aid of gentle heat is necessary. In general terms the following may be said to be the process:—The wax or resins and unctuous matters are to be melted by a gentle heat; they are then removed from the fire, and, while cooling, well and constantly stirred, any dry substances to be added being meanwhile incorporated in a state of fine powder. Stress must be laid on the direction to employ *gentle heat;* too strong a temperature would cause the formation of acrid acids.

There are thirty-four formulæ for ointments in the Pharmacopœia. The following classification, based on the nature of the unctuous ingredient, will be found to simplify the study of these preparations.

Class I.

Ointments—the basis of which is Prepared Lard.

These are tabulated as follows:—

Ointment	Strength	Ingredients	Basis
U. Aconitiæ	1 in 60	Aconitiæ, 8 grs. Rectified Spirit, ½ drm.	Prepared Lard, 1 oz.
U. Atropiæ	1 in 60	Atropiæ, 8 grs. Rectified Spirit, ½ drm.	
U. Iodi	1 in 31	Iodine, 16 grs. Iodide of Potassium, 16 grs. Proof Spirit, ½ drm.	
U. Sulphuris Iodidi	1 in 17	Iodide of Sulphur, 30 grs.	
U. Potassæ Sulphuratæ	1 in 15½	Sulphurated Potash, 30 grs.	
U. Potassii Iodidi	1 in 8¾ (nearly)	Iodide of Potassium, 64 grs. Carbonate of Potash, 4 grs. Distilled Water, 1 drm.	
U. Belladonnæ	1 (of Ex.) in 6½	Extract of Belladonna, 80 grs.	
U. Hydrargyri Subchloridi	1 in 6½	Subchloride of Mercury, 80 grs.	

These are prepared by thoroughly mixing the ingredients by trituration. In the preparation of the first three the solid ingredients, before being incorporated with the lard, are to be well rubbed up with the spirit. In the preparation of *Unguentum Potassii Iodidi* the solid ingredients are dissolved in the water before being added to the lard; and in *Unguentum Belladonnæ* also the extract is directed to be first rubbed smooth with a few drops of water.

The use of the iodide of potassium and spirit in making the *Unguentum Iodidi* is merely to aid in the incorporation of the iodine with the basis.

Unguentum Potassii Iodidi would become yellow-coloured on keeping (owing to the liberation of iodine), if free alkali were not present. It is to prevent this that carbonate of potash is employed.

In applying ointments of powerful alkaloids, as of aconite, the precaution should always be taken of ascertaining that the skin is not abraded.

Class II.

Ointments—the basis of which is Benzoated Lard.

Ointment	Strength	Ingredients	Basis
U. Plumbi Acetatis	1 in 37½	Acetate of Lead, 12 grs.	Benzoated Lard, 1 oz.
U. Gallæ	1 in 6½	Galls, 80 grs.	
U. Gallæ cum Opio	1 (of galls) in 6½, and 1 of opium in 15	Galls, 80 grs. Opium, 30 grs.	
U. Zinci	1 in 6½	Oxide of Zinc, 80 grs.	
U. Sulphuris	1 in 5	Sublimed Sulphur, ¼ oz.	

With the single exception of *Unguentum Zinci*, the simple direction for the preparation of the foregoing ointments is to "mix thoroughly." In the preparation of *Unguentum Zinci* the lard is to be melted before adding to it the oxide of zinc, and the mixture to be stirred while cooling.

Class III.

Ointment—the basis of which is Prepared Lard, and which also contains Prepared Suet.

Ointment	Strength	Ingredients	Basis, &c.
U. Hydrargyri	1 in 2	Mercury, 1 lb.	Prep. Lard, 1 lb. Prep. Suet, 1 oz.

This ointment is prepared by rubbing the ingredients together until metallic globules cease to be visible. The extinction of the mercury is extremely difficult, and is now accomplished by machinery. If a portion of the ointment rubbed on paper shows metallic globules under a magnifier of four powers, it may be concluded that the mercury has not been sufficiently extinguished.

Whether mercury exists in this ointment merely in a state of mechanical division, or in a state of oxidation, is a debated point. The ointment, when first made, is bluish, hence its common name, "Blue Ointment;" but, on keeping, the colour becomes darker—

a change attributable to oxidation. It is very generally believed that the oxide so formed enters into chemical combination with the lard, or one of its fatty acids; indeed some pharmaceutists contend that the efficacy of the ointment depends upon the formation of this compound.

The use of the suet in *Unguentum Hydrargyri* is to prevent the separation of the metal in warm weather.

CLASS IV.

Ointments—the basis of which is Prepared Lard, and which also contain Olive Oil.

Ointment	Strength	Active Ingredients	Basis, &c.
U. HYDRARGYRI NITRATIS	1 in 15½	Mercury, 4 ozs. Nitric Acid, 12 ozs.	Prep. Lard, 15 ozs. Olive Oil, 32 ozs.
U. VERATRIÆ	1 in 60	Veratria, 8 grs.	Prep. Lard, 1 oz. Olive Oil, 1 drm.

The first of these (commonly known as "Citrine Ointment") is made as follows:—Dissolve the mercury in the nitric acid by a gentle heat; melt the lard in the oil by a water-bath in a large porcelain vessel; mix the two mixtures while hot, and if the mixture does not froth up, heat it until it does; finally, stir while cooling.

By the action of the nitric acid on the mercury, pernitrate of mercury is produced, thus:—

$$3Hg+8HNO_3=3(Hg2NO_3)+4H_2O+2NO.$$

When the mercurial solution is mixed with the lard and oil, a reaction also occurs; the nature of this is complicated and has not been hitherto satisfactorily explained.

Unguentum Veratriæ is made by rubbing the oil and the veratria together, and then mixing with the lard.

CLASS V.

Ointments—the basis of which is Prepared Lard, and which also contain Yellow Wax.

Ointment	Strength	Active Ingredients	Basis, &c.
U. SABINÆ	1 in 3⅜ (nearly)	Fresh Savin Tops, 8 ozs.	Prep. Lard, 16 ozs. Yellow Wax, 3 ozs.
U. TEREBINTHINÆ	1 (oil) in 2⅛	Oil of Turp., 1 oz. Resin, 60 grs.	Prep. Lard, ½ oz. Yellow Wax, ½ oz.

The first is made by melting the lard and wax together on a water-bath, adding the savin, digesting for twenty minutes, and finally straining through calico.

Unguentum Terebinthinæ is simply made by melting the ingredients by a water-bath, and stirring the mixture while cooling.

CLASS VI.

Ointments—the basis of which is Simple Ointment.

Unguentum Simplicis is made by melting together by means of a water-bath, and stirring while cooling, prepared lard, 3 ozs.; white wax, 2 ozs.; and almond oil, 3 ozs.

Ointment	Strength	Active Ingredients	Basis
U. HYDRARGYRI IODIDI RUBRI	1 in 28	Red Iodide of Mercury, 16 grs.	Simple Ointment, 1 oz.
U. CREASOTI	1 in 9	Creasote, 1 drm.	
U. CADMII IODIDI	1 in 8	Iodide of Cadmium, 62 grs.	
U. HYDRARGYRI AMMONIATA	1 in 8	Ammoniated Mercury, 62 grs.	
U. PLUMBI CARBONATIS	1 in 8	Carbonate of Lead, 62 grs.	
U. PLUMBI IODIDI	1 in 8	Iodide of Lead, 62 grs.	
U. ANTIMONII TARTARATI	1 in 5	Tartarated Antimony, ¼ oz.	
U. ELEMI	1 in 5	Elemi, ¼ oz.	

With the single exception of *Unguentum Elemi*, the simple direction for the preparation of the ointments of this class is to mix the ingredients thoroughly.

Unguentum Elemi is directed to be prepared by melting the ingredients, straining through flannel, and stirring constantly until the ointment solidifies.

Unguentum Plumbi Carbonatis was the old "Unguentum Cerussæ." *Unguentum Hydrargyri Ammoniata* is commonly known as "White Precipitate Ointment."

CLASS VII.

Ointments—the basis of which is made up of Wax and Oil.

Ointment	Strength	Ingredients	Wax	Oil
U. CANTHARIDIS	1 in 8	Cantharides, 1 oz.	Yellow, 1 oz.	Olive, 6 ozs.
U. HYDRARGYRI COMPOSITUM	1 in 4½	Oint. of Mercury, 6 ozs. Camphor, 1½ ozs.	Yellow, 3 ozs.	Olive, 3 ozs.
U. HYDRARGYRI OXIDI RUBRI	1 in 8	Red Oxide of Mercury, 62 grs.	Yellow, ¼ oz.	Almond, ¾ oz.
U. CETACEI	1 in 5	Spermaceti, 5 ozs.	White, 2 ozs.	Almond, 1 pint
U. PLUMBI SUBACETATIS COMPOSITUM	1 in 5½	Solution of Subacetate of Lead, 6 ozs. Camphor, 60 grs.	White, 8 ozs.	Almond, 1 pint

Unguentum Cantharidis is made by infusing the cantharides in the oil in a covered vessel for 12 hours, placing the vessel in boiling water for 15 minutes, straining through muslin with strong pressure, adding the product to the wax previously melted, and stirring constantly while the mixture cools. Olive oil, being a good solvent of the active principle of cantharides, is now substituted for the boiling water of the older Pharmacopœias.

Unguentum Hydrargyri Compositum and *Unguentum Hydrargyri Oxidi Rubri* are both made by melting the wax with a gentle heat, mixing the oil with it, and, when the mixture is nearly cold, adding the other ingredients and mixing thoroughly.

Unguentum Cetacei is simply prepared by melting the ingredients by a gentle heat and stirring while cooling.

The following are the directions for the preparation of *Unguentum Plumbi Subacetatis Compositum:*—Melt the wax with 16 ozs. of the oil by heat of the water-bath; remove the vessel, and when the mixture begins to thicken, add gradually the solution of subacetate of lead, stirring the mixture while it cools; finally, add the camphor dissolved in the rest of the oil, and mix thoroughly.

Unguentum Hydrargyri Compositum is a substitute for "Scott's Ointment." *Unguentum Hydrargyri Oxidi Rubri* is commonly known as "Red Precipitate Ointment." This ointment loses its red colour on keeping, owing to the conversion of red to black oxide, or reduction to the metallic state.

Unguentum Plumbi Subacetatis Compositum is a modification of "Goulard's Cerate."

UNCLASSED.

Unguentum Picis Liquidæ.—Tar, 5 ozs.; yellow wax, 2 ozs. Melt the wax with a gentle heat; add the tar, and stir while cooling.

VAPORES (INHALATIONS).

There are five of these preparations now officinal. They should be so administered in a suitable apparatus as to enable the patient to breathe without effort the volatile ingredients evolved. They are as follows:—

Vapor Acidi Hydrocyanici.—10 to 15 mins. of acid to 1 drm. of *cold* water.

Vapor Chlori.—2 ozs. of chlorinated lime, and a sufficiency of water to moisten.

Vapor Coniæ.—60 grs. of extract of hemlock, 1 drm. of solution of potash, and 10 drms. of distilled water. 20 mins. of the mixture are to be put on a sponge, and the vapour of hot water passing over it to be inhaled.

Vapor Creasoti.—12 mins. of creasote and 8 ozs. of *boiling* water. Cause air to be passed through the mixture and inhale it.

Vapor Iodi.—1 drm. of tincture of iodine and 1 oz. of water. Apply a gentle heat and inhale the vapour.

The addition of the alkali in *Vapor Coniæ* at once develops the characteristic odour of the hemlock.

VINA (WINES).

Wine, in consequence of the alcohol contained, and in some instances owing to the acidity, is a solvent of many substances insoluble in water. Wines, however, are sometimes objectionable, both from their liability to undergo decomposition and owing to the fact that the proportion of alcohol present is by no means always constant.

Including Vinum Aurantii and Vinum Xericum there are eleven medicinal wines in the Pharmacopœia, viz.:—

Vinum Aurantii (Orange Wine).
,, Xericum (Sherry).
,, Ferri.
,, Colchici, 1 in 5.
,, Rhei, 1 in 15½, or 33 grs. to 1 oz.
,, Ipecacuanhæ, 1 in 20, or 22 grs. to 1 oz.
,, Opii, 1 (*Extract*) in 20.
,, Aloes, 1 in 26½.
,, Ferri Citratis, 1 in 60, or 8 grs. to 1 oz.
,, Antimoniale, 1 in 240, or 2 grs. to 1 oz.
,, Quiniæ, 1 in 480, or 1 gr. to 1 oz.

Orange wine forms the basis of Vinum Ferri Citratis and of Vinum Quiniæ, Sherry that of all the other wines.

The following are the ingredients of the wines:—

Vinum Aloes.

Socotrine Aloes	1½ ozs.
Cardamom Seeds	80 grs.
Ginger, *coarsely powdered*	80 grs.
Sherry	2 pints

Vinum Antimoniale.

Tartarated Antimony	40 grs.
Sherry	1 pint

Vinum Colchici.

Colchicum corm, *sliced, dried, and bruised*	4 ozs.
Sherry	1 pint

Vinum Ferri.

Fine Iron Wire	1 oz.
Sherry	1 pint

Vinum Ferri Citratis.

Citrate of Iron and Ammonia	160 grs.
Orange Wine	1 pint

Vinum Ipecacuanhæ.

Ipecacuanha, *bruised*	1 oz.
Sherry	1 pint

Vinum Opii.

Extract of Opium	1 oz.
Cinnamon Bark, *bruised*	75 grs.
Cloves, *bruised*	75 grs.
Sherry	1 pint

Vinum Quiniæ.

Sulphate of Quinia	20 grs.
Citric Acid	30 grs.
Orange Wine	1 pint

Vinum Rhei.

Rhubarb Root, *coarse powder*	1½ ozs.
Canella Alba Bark, *coarse powder*	60 grs.
Sherry	1 pint

It will be seen on reference to the above that all the wines may be said to be simple except *Vinum Aloes*, *Vinum Opii*, and *Vinum Rhei.*

All the wines are made by maceration (pressing and straining when necessary) and subsequent filtration, except *Vinum Antimoniale*, *Vinum Ferri Citratis*, and *Vinum Quiniæ*, which are made by simple solution and subsequent filtration.

Vinum Xericum contains from 17 to 18 per cent. of alcohol, with colouring matter, œnanthic ether, bitartrate of potash, malates and sugar, &c.

Vinum Aurantii is made by fermenting a saccharine solution to which the fresh peel of bitter orange has been added. It contains about 12 per cent. of alcohol, and is slightly acid.

In *Vinum Antimoniale*, if the tartarated antimony is impure, or the wine of inferior quality, perfect solution is often impossible, and the salt is frequently decomposed. The wine often contains matters which cause precipitation of the *oxide* of antimony.

Vinum Ferri very probably contains *tartrate of potash and iron*, formed by the action on the iron of the bitartrate of potash contained in the sherry.

Vinum Ipecacuanhæ, when long kept, not unfrequently throws down a precipitate of a mixture of bitartrate of potash and cephaelate of emetina.

Vinum Quiniæ is a solution of neutral sulphate and citrate of quinine in orange wine; the citric acid aids materially in the solution of the disulphate.

UNCLASSED PREPARATIONS.

Pyroxylin.

"Gun cotton," prepared by immersing 1 oz. of cotton in a mixture of 5 ozs. each of sulphuric and nitric acids, for three minutes, then washing out the acids well with water, until the washings cease to give a precipitate with chloride of barium, and finally draining on filtering paper, and drying in a water-bath.

It is readily soluble in a mixture of ether and rectified spirit, forming collodion, for the preparation of which it was introduced into the Pharmacopœia. When exploded by heat it leaves no residue.

Collodium.

Collodion, as above stated, is a solution of 1 oz. of pyroxylin in a mixture of 36 ozs. of ether and 12 ozs. of rectified spirit.

It is a colourless liquid with an ethereal odour; highly inflammable, and dries rapidly on exposure to the air, forming a transparent film which is insoluble in water or rectified spirit.

Collodium Flexile.

Is a mixture of 6 ozs. of collodion, 120 grains of Canada balsam, and 1 drm. of castor oil.

Æther.

"Sulphuric ether of Edin. and Dub." is the oxide of ethyl. It contains not less than 92 per cent. by volume of pure ether ($C_4H_{10}O$).

It is unnecessary to detail the complicated process for preparing ether as given in the Pharmacopœia. Suffice it to say, in general terms, that it is made by the action of 10 ozs. of sulphuric acid on 50 ozs. of rectified spirit, added in successive portions. It is purified from any sulphurous or sulphuric acid and water by allowing it to stand on chloride of calcium and slaked lime and redistilling to the sp. gr. of 0·735.

The following is a brief explanation of the process:—By the reaction of sulphuric acid on rectified spirit, *Sulphovinic acid* ($C_2H_6SO_4$) is first formed, thus:—

$$H_2SO_4 + C_2H_6O = C_2H_6SO_4 + H_2O.$$

By the reaction now of alcohol on the sulphovinic acid, the latter is decomposed, forming sulphuric acid and ether, thus:—

$$C_2H_6SO_4 + C_2H_6O = H_2SO_4 + C_4H_{10}O.$$

By the addition of more alcohol sulphovinic acid is again formed; and thus, by the continuous supply of alcohol, the production of ether becomes continuous—sulphovinic acid being an intermediate product.

It is a colourless, volatile, inflammable liquid, with a characteristic odour; boils below 105°. Fifty measures agitated with an equal volume of water are reduced to 45 by an absorption of 10 per cent. It leaves no residue on evaporation.

It enters into the preparation of *Æther Purus*, *Collodium*, *Collodium Flexile*, *Liquor Epispasticus* and *Spiritus Ætheris*.

Æther Purus.

Ether free from either alcohol or water. The process of purification is effected as follows:—Wash the ether well with water (by which the spirit is removed), and when the liquids have been separated, after a couple of minutes, decant the supernatant ether; digest the latter then for 24 hours with recently burned lime and chloride of calcium (to remove the water), and finally distil with the aid of a gentle heat. Its sp. gr. should not exceed 0·720, and it should not coagulate the albumen of the blood; if alcohol were present, the sp. gr. would be exceeded, and it *would* coagulate the albumen of the blood.

Water and sulphurous acids are occasional impurities, the former increasing its specific gravity; the latter imparting to it an acid reaction.

Æther Aceticus.

Acetic ether, or acetate of ethyl ($C_2H_5C_2H_3O_2$) may be obtained by distilling a mixture of eight parts of dry acetate of soda, five parts of rectified spirit, and ten parts of sulphuric acid; adding the distilled product to half its weight of chloride of calcium in a stoppered bottle; letting them remain together for 24 hours, and then decanting and rectifying the ethereal liquid.

In this process the sulphuric acid converts the alcohol into the ether, and liberates acetic acid from the acetate of soda; the ether and the acetic acid combine to form acetic ether which distils with some water; the latter is removed by the chloride of calcium. Two stages occur in the reaction:—

1. $H_2SO_4+C_2H_6O=C_2H_6SO_4+H_2O$.
2. $C_2H_6SO_4+NaC_2H_3O_2=C_2H_5C_2H_3O_2+NaHSO_4$.

Acetic ether is a colourless liquid, with an agreeable ethereal odour; sp. gr., 0·910; boiling point, 166°. Soluble in all proportions in rectified spirit and in ether; 1 part dissolves in 11 or 12 parts of water at 60°. It is a good solvent of essential oils, resins, &c. By alkalies it is decomposed into alcohol and alkaline acetates.

Amyl Nitris.

Nitrite of Amyl ($C_5H_{11}NO_2$) is produced by the action of nitric or nitrous acid on amylic alcohol. To purified amylic alcohol in a glass retort containing some copper foil add one-tenth of its bulk of sulphuric acid; add the same quantity of nitric acid diluted with an equal volume of water; apply a gentle heat, and add more nitric acid gradually until nearly all the amylic alcohol is exhausted; wash the distilled product with solution of soda, to remove hydrocyanic acid, &c., and rectify it over fused caustic potash, to remove any moisture. The following is the reaction:—

$$C_5H_{12}O+Cu+H_2SO_4+HNO_3=C_5H_{11}NO_2+CuSO_4+2H_2O.$$

It is the homologue of nitrite of ethyl (Sp. Æther. Nitr.), and is an ethereal liquid of a yellowish colour and peculiar, not disagreeable, odour; sp. gr., 0·877; boiling point, 205°; insoluble in water; soluble in rectified spirit in all proportions. If it be added, drop by drop, to caustic potash, while fused by the application of heat, valerianate of potash will be formed.

Chloral Hydras.

Hydrate of chloral (C_2HCl_3O,H_2O) is produced by the prolonged action of dry chlorine gas on anhydrous alcohol; the gas being passed through the alcohol for several days, so long as it is absorbed. The resulting liquid is purified by treatment—first with sulphuric acid, which retains water and any unchanged alcohol, and afterwards with a small quantity of lime, which fixes the free hydrochloric acid that is produced. It is finally converted into the solid hydrate by the addition of water. The reactions which take place are complicated; but result primarily in the formation of aldehyd (C_2H_4O) and hydrochloric acid; mono- and subsequently tetra-chlorinated ether, or chloral, being finally obtained. And—

$$2(C_2HCl_3O,H_2O)+Ca2HO=2CHCl_3+Ca2CHO_2+2HO.$$

The latter reaction is utilised in ascertaining the amount of chloroform yielded by acting on a definite quantity of chloral with slaked lime. Thus the value of a specimen may be calculated from the molecular weights. The molecular weight of chloral = 165·5, which multiplied by 2 = 331; the molecular weight of chloroform = 119·5, multiplied by 2 = 239. Therefore, as 331 grains of chloral are equivalent to 239 grains of chloroform, 100 grains of chloral will equal 72·2 grains of chloroform—331 : 100 : : 239 : 72·2.

Chloral hydrate occurs in colourless crystals, which do not deliquesce on exposure to air. It has a pungent, but not an acrid, odour, and a pungent and rather bitter taste. On the application of a gentle heat it fuses to a colourless transparent liquid, which, as it cools, begins to solidify at a temperature of about 120°. It boils in a test-tube, with pieces of broken glass immersed in it, at about 205°, and at a slightly higher temperature it volatilises on platinum foil without residue. Soluble in less than its own weight of distilled water, rectified spirit, or ether, and in four times its weight of chloroform. The aqueous solution is neutral or but slightly acid to test paper. A solution in chloroform, when mixed by agitation with sulphuric acid, does not impart colour to the acid, showing freedom from chlorinated organic impurities (alcoholate of chloral). It is decomposed by alkalies into chloroform and an alkaline formate:—

$$C_2HCl_3O,H_2O+KHO=KCHO_2+H_2O+CHCl_3.$$

100 grains of hydrate of chloral dissolved in an ounce of distilled water and mixed with 30 grains of slaked lime, submitted to careful distillation with a suitable apparatus, should yield not less than 70 grains of chloroform. It enters into the preparation of the *Syrupus Chloral* (p. 260).

Chloroformum.

Terchloride of Formyl ($CHCl_3$).

The following is an abstract of the Pharmacopœial method of preparing chloroform:—3 galls. of water and 30 ozs. of rectified spirit are distilled with a mixture of 10 lbs. of chlorinated lime and 5 lbs. of slaked lime; 50 ozs. of the distillate is well washed with water, and after the mixture separates into two strata, the lower one, which is crude chloroform, is removed, washed repeatedly with successive portions of distilled water, and then shaken with its own volume of sulphuric acid. When the mixture settles, the chloroform is again separated, mixed with 2 ozs. of chloride of calcium and ½ oz. of slaked lime, and again distilled.

The following reactions indicate the probable steps in the process:—

1st. $$\underbrace{2C_2H_6O}_{\text{Alcohol.}} + \underbrace{O_2}_{\text{Oxygen.}} = \underbrace{2C_2H_4O}_{\text{Aldehyd.}} + \underbrace{2H_2O}_{\text{Water.}}$$

2nd. $$\underbrace{C_2H_4O}_{\text{Aldehyd.}} + \underbrace{3Cl_2}_{\text{Chlorine.}} = \underbrace{C_2HCl_3O}_{\text{Chloral.}} + \underbrace{3HCl}_{\substack{\text{Hydrochloric}\\ \text{Acid.}}}$$

3rd. $$\underbrace{2C_2HCl_3O}_{\text{Chloral.}} + \underbrace{Ca2HO}_{\substack{\text{Hydrate of}\\ \text{Calcium.}}} = \underbrace{Ca2CHO_2}_{\substack{\text{Formate of}\\ \text{Calcium.}}} + \underbrace{2CHCl_3}_{\text{Chloroform.}}$$

The process as a whole may be thus expressed:—

$$\underbrace{4C_2H_6O}_{\text{Alcohol.}} + \underbrace{8CaCl_2O_2}_{\substack{\text{Hypochlorite}\\ \text{of Calcium.}}} = \underbrace{2CHCl_3}_{\text{Chloroform.}} + \underbrace{3(Ca2CHO_2)}_{\substack{\text{Formate of}\\ \text{Calcium.}}} + \underbrace{5CaCl_2}_{\substack{\text{Chloride of}\\ \text{Calcium.}}} + \underbrace{8H_2O}_{\text{Water.}}$$

Chloroform is a colourless liquid with a peculiar ethereal odour and sweet taste. Its sp. gr. is 1·49. It is slightly soluble in water, but soluble in all proportions of alcohol and ether. It is neutral in reaction, should not be coloured by sulphuric acid, and should leave no residue or unpleasant odour after evaporation. It is decomposed by fixed alkalies, and, on exposure to air and light, is apt to be decomposed into hydrochloric acid and chlorine. It is a powerful solvent of caoutchouc, gutta-percha, resins, many fats and vegetable alkaloids.

The following are its Pharmacopœial preparations:—*Linimentum Chloroformi*, *Spiritus Chloroformi*, and *Tinctura Chloroformi Composita.*

Cerevisiæ Fermentum.

Beer Yeast, the ferment obtained in brewing beer, is a viscid, semifluid, frothy substance. It is essentially composed of a fungus—the Torula cerevisiæ—exhibiting under the microscope numerous round or oval confervoid cells. It is used in the preparation of the *Cataplasma Fermenti* (p. 215).

ABSTRACT OF THE PROCESSES DIRECTED FOR THE PREPARATION OF THE ALKALOIDS, &c.

Aconitia.

1. Digest the root with rectified spirit to exhaust it of the aconitate of aconitia and resinous matter, and then recover the spirit by distillation and evaporation.

2. Dissolve the alkaloidal salt in water, by which means it is separated from the resinous matter.

3. Add ammonia to the aqueous solution of the aconitate of aconitia; aconitia and some colouring matter are thus precipitated, while aconitate of ammonia is formed and remains in solution.

4. Dissolve the precipitated aconitia by ether, which is afterwards recovered by distillation.

5. Add sulphuric acid to form sulphate of aconitia, and decompose this subsequently by solution of ammonia; aconitia is thus precipitated, while sulphate of ammonia remains in solution.

6. Wash the aconitia so obtained with cold water, and, finally, dry between the folds of blotting-paper.

Atropia.

1. Digest the root with rectified spirit to exhaust it of the malate of atropia.

2. By the addition of lime, malate of lime is formed and atropia set free.

3. Add sulphuric acid to form sulphate of atropia.

4. Separate any resinous matter which may be present by the addition of carbonate of potash in quantity sufficient to produce neutralisation; remove the resinous matter so precipitated by filtration.

5. Again add carbonate of potash, but in sufficient quantity to produce alkalinity; sulphate of potash is thus formed, and atropia is set free and removed by chloroform.

6. Distil off the chloroform, and purify the atropia by solution in spirit, digestion with animal charcoal, filtration, and evaporation.

Atropiæ Sulphas.

Prepared by the action of sulphuric acid on atropia.

Beberiæ Sulphas.

1. Exhaust the bark by sulphuric acid.

2. Concentrate the liquor, and add sufficient lime to precipitate the colouring and vegetable matter, which remove by filtration.

3. Add solution of ammonia to the filtrate, by which means sulphate of ammonia is formed and the beberia is precipitated.

4. Dissolve out the beberia by spirit, which is to be recovered by distillation.

5. Again add sulphuric acid to form sulphate of beberia.

6. The sulphate of beberia so obtained is evaporated to dryness, powdered, and dissolved in water. The aqueous solution is reduced to a syrupy consistence by evaporation, and finally dried in thin layers on glass plates.

Digitalinum.

1. Exhaust the leaves of the digitalinum with rectified spirit, which also takes up colouring matter and extractive.

2. Recover the spirit by distillation, and treat the extract with water, charcoal, and acetic acid—the charcoal being used to decolorise the digitalinum which is dissolved by the acetic acid.

3. Add ammonia to set free the digitalinum from the acetic acid, and then precipitate it by tannic acid.

4. Add oxide of lead, by which means tannate of lead is formed and digitalinum again set free and dissolved in spirit.

5. Again decolorise with animal charcoal, filter to remove the tannate of lead and charcoal, and again recover the spirit by distillation.

6. Finally, wash with ether to remove impurities.

Morphiæ Hydrochloras.

1. Digest opium in water, which dissolves out the meconate and sulphate of morphia and some codeia.

2. Add chloride of calcium, to form meconate and sulphate of lime, which are precipitated, and hydrochlorate of morphia, which is held in solution.

3. Evaporate, to form a solid mass, and then dissolve out the hydrochlorate of morphia with water. Repeat this process several times, using powerful pressure each time to get rid of the colouring matter, and decolorising also with animal charcoal.

4. Add ammonia, by which means morphia is precipitated and separated from any codeia which may be present.

5. Treat the morphia with hydrochloric acid to form hydrochlorate of morphia, which is allowed to crystallise out.

Morphiæ Acetas.

1. Decompose hydrochlorate of morphia by ammonia.

2. Treat the morphia so precipitated with acetic acid to form acetate of morphia, which is obtained as a dry powder by evaporation and drying with a gentle heat.

Quiniæ Sulphas.

1. Exhaust the bark of its alkaloids by hydrochloric acid.

2. Precipitate the alkaloids by adding soda, chloride of sodium being formed and remaining in solution.

3. Add sulphuric acid to the precipitate to form sulphate of quinia and of cinchona.

4. Set aside to crystallise. The sulphate of quinia separates first.

Santoninum.

1. Boil bruised santonica with lime and water to form santonate of lime.

2. Precipitate the santoninum by the action of hydrochloric acid; chloride of lime is thus formed, and is held in solution.

3. Skim off the oily matter and decant the fluid from the precipitate.

4. Wash the precipitate with water and with ammonia to free it from acid.

5. Decolorise by animal charcoal, and then dissolve out the santonin by boiling spirit.

6. Set aside to crystallise in the dark and preserve in bottles protected from the light, lest the crystals should become yellow-coloured.

Strychnia.

1. Exhaust the seeds, by digestion in alcohol and water, of the igasurates of strychnia and brucia.

2. Add acetate of lead to form acetates of strychnia and brucia, igasurate of lead being precipitated.

3. Add ammonia to precipitate the alkaloids, acetate of ammonia being formed and held in solution.

4. Dissolve the precipitated alkaloids in spirit, and evaporate the spirituous solution to deposit the strychnia, which separates first, brucia remaining in solution.

5. Wash the strychnia thus obtained until the washings no longer become red with nitric acid, showing the absence of brucia.

6. Dissolve finally in boiling water and crystallise.

Veratria.

1. Exhaust the ground seeds (separated from the capsules by a preliminary process) with rectified spirit to dissolve out the veratria together with gallic acid and resinous matter.

2. Concentrate the solution and pour it into water to precipitate the resin, which is removed by filtration.

3. Add ammonia, by which means the impure veratria is precipitated, while the gallic acid unites with the ammonia.

4. Wash the precipitated veratria with water on a filter, add hydrochloric acid to it to form hydrochlorate of veratria, and decolorise this with animal charcoal.

5. Add ammonia again, by which means the hydrochlorate of veratria is decomposed, the veratria is precipitated, and hydrochlorate of ammonia formed and held in solution.

6. The precipitated veratria is washed until the washings cease to give a white precipitate on adding nitrate of silver acidulated with nitric acid, showing perfect freedom from hydrochlorate of ammonia.

APPENDIX TO THE PHARMACOPŒIA.

The British Pharmacopœia has an appendix, the contents of which are arranged under three heads as follows:—

I.—Articles Employed in Chemical Testing.
II.—Test Solutions.
III.—Test Solutions for Volumetric Analysis.

I.

ARTICLES EMPLOYED IN CHEMICAL TESTING.

The majority of these articles and their uses having been already referred to, it will suffice to give a nominal list. Most of them are employed for making the "Test Solutions." (See next page.)

Alcohol (C_6H_6O), p. 257.
Benzol, or Benzene (C_6H_6), prepared from coal-tar oil. Test for purity of copaiba, p. 130.
Boracic Acid (H_3BO_3), p. 290.
Chloride of Barium ($BaCl_2$), p. 289.
Copper foil (Cu). Test for nitric acid, p. 21. Used in Reinsch's test for arsenic, pp. 16, 54.
Gold (Au), p. 291.
Hyposulphite of Soda ($Na_2S_2H_2O_4$), pp. 83, 294.
Indigo (C_8H_5NO), pp. 132, 291.
Isinglass, pp. 205, 291.
Litmus, p. 197.
Oxalic Acid ($H_2C_2O_4$), p. 296.
Oxalate of Ammonia, $(NH_4)_2C_2O_4$, pp. 26, 290.
Plaster of Paris ($CaSO_4$), p. 291.
Platinum Black (Pt). Test for fusel oil, p. 257.
Platinum Foil, p. 291.
Red Prussiate of Potash ($K_6Fe_2C_{12}N_{12}$), pp. 71, 80, 289.
Subacetate of Copper of commerce, Verdigris ($Cu2C_2H_3O_2,CuO$), p. 290.
Sulphate of Copper, Anhydrous. Test for freedom of alcohol from water, p. 257.
Sulphide of Iron (FeS), p. 46.
Sulphuretted Hydrogen (H_2S), p. 292.
Tin, Granulated (Sn), p. 291.
Turmeric, p. 186.

II.

TEST SOLUTIONS.

The following seven are made by dissolving ½ ounce of the salt in 5 ounces of water.

SOLUTION OF	USES.
Acetate of Potash	To distinguish between Tartaric and Citric Acids. It gives a precipitate of Bitartrate of Potash with the former.
Acetate of Soda	To indicate the constituents of Phosphate of Lime (p. 42).
Chloride of Ammonium	Test for Magnesia. The solution with some free ammonia is added to the substance to be tested; phosphate of soda is then added, and the magnesia is precipitated as Ammonio-Magnesian Phosphate.
Chloride of Barium	Test for Sulphuric Acid and Sulphates.
Chloride of Calcium	Test for Citric Acid in Citrate of Potash. Citrate of Lime, which is formed, is insoluble in hot water, but soluble in cold: there will be therefore no precipitate until the solution is boiled.
Iodide of Potassium	Test for Lead. Yellow iodide of lead is formed.
Phosphate of Soda	In testing for Magnesia (*v. supra*, Chloride of Ammonium).

The following three solutions are made by dissolving ½ an ounce of the salt in 10 ounces of water:—

SOLUTION OF	USES.
Carbonate of Ammonia	To distinguish zinc from alumina and the alkaline earths. It gives with zinc salts a white precipitate soluble in excess.
Ferridcyanide of Potassium	To distinguish proto- from per-salts of iron. It gives a blue precipitate with a protoxide of iron; no precipitate with a peroxide.
Ferrocyanide of Potassium	Test for many metals. It gives a *blue* precipitate with per-salts of iron, *reddish-brown* with copper, and *white* with proto-salts of iron, and salts of manganese, zinc, tin, cadmium, lead, bismuth, antimony, mercury, and silver.

No general rule can be given for the preparation of the remaining test solutions.

SOLUTION OF	USES.
Oxalate of Ammonia - - - Dissolve ½ oz. of oxalate of ammonia in 20 ozs. of water.	Test for Lime.
Chloride of Calcium (*Saturated*) - - Dissolve 336 grs. in 1 oz. of water.	Test for the purity of Spiritus Ætheris Nitrosi.
Sulphate of Iron - - - - Dissolve 10 grs. of the granulated sulphate in 1 oz. of boiling water.	Test for Nitric Acid, which changes it to a deep olive-green colour.
Acetate of Copper - - - - Digest ½ oz. of subacetate of copper in a mixture of 1 oz. of acetic acid and ½ oz. of water at a temperature not above 212°, stirring until a dry residue is obtained. Dissolve this in sufficient water to measure 5 ozs.	To detect presence of Butyric Acid in valerianate of zinc. The salt is distilled with sulphuric acid, and the solution added to the distillate; if Butyric Acid is present a bluish-white precipitate will result.
Albumen - - - - - Rub up the white of one egg with 4 ozs. of water, and filter through clean moistened tow.	To distinguish Monobasic Phosphoric Acid (with which it gives a precipitate) from the di- and tri-basic varieties (with which it does not afford a precipitate).
Ammonio-Nitrate of Silver - - Dissolve ¼ oz. of nitrate of silver in 8 ozs. of water, and add as much solution of ammonia as will nearly redissolve the precipitate at first formed; filter, and add as much water as will make the solution measure 10 ozs.	Test for Arsenious Acid and Phosphoric Acid, with both of which it gives a yellow precipitate soluble in excess both of ammonia and nitric acid.
Ammonio-Sulphate of Copper - - Dissolve ½ oz. of sulphate of copper in 8 ozs. of water, and add as much solution of ammonia as will nearly redissolve the precipitate at first formed; filter, and add so much water as will make the solution measure 10 ozs.	Test for Arsenious Acid, with which it gives a green precipitate, "Scheele's green," soluble in excess of ammonia.
Ammonio-Sulphate of Magnesia - - Dissolve 1 oz. of sulphate of magnesia and ½ oz. of chloride of ammonium in 8 ozs. of water, add ½ oz. of solution of ammonia, and as much water as will make the solution measure 10 ozs.	Test for Phosphoric Acid and Phosphates.
Boracic Acid - - - - Dissolve 50 grs. of boracic acid in 1 oz. of rectified spirit.	To detect presence of Turmeric (which it turns red) as an adulteration of rhubarb).
Bromine - - - - - Dissolve 10 mins. of bromine in 5 ozs. of water.	To test for presence of Iodine in bromide of potassium; the addition of a few drops sets free the Iodine, which may be detected with mucilage of starch.

SOLUTION OF	USES.
Chloride of Gold Dissolve 60 grs. of fine gold leaf in a mixture of 1 oz. of nitric acid, 6 ozs. of hydrochloric acid, and 4 ozs. of water. Add then another oz. of hydrochloric acid, and evaporate at not above 212° until acid vapours are no longer given off. Dissolve the residue in 5 ozs. of water.	Test for Atropia, with which it gives a citron-yellow precipitate.
Chloride of Tin Dissolve 1 oz. of granulated tin in a mixture of 3 ozs. of hydrochloric acid and 1 oz. of water by the aid of a gentle heat until gas is no longer given off; add as much water as will make the solution measure 5 ozs.	Test for Mercury in ammoniated mercury, and for red oxide of mercury in gray powder.
Gelatine Digest 50 grs. of isinglass and 1 oz. of water for half an hour in a water bath, with frequent shaking; filter through clean moistened tow.	To distinguish between Gallic and Tannic Acids: with the latter it gives a yellowish-white precipitate.
Iodate of Potash Rub 50 grs. of iodine and 50 grs. of chlorate of potash together; place in a Florence flask, and pour upon it ½ oz. of water acidulated with 8 mins. of nitric acid; digest at a gentle heat until the iodine disappears. Boil for one minute. Evaporate to perfect dryness at 212°. Dissolve residue in 10 ozs. of water.	Test for the presence of Sulphurous Acid in acetic acid and glacial acetic acid. When added to acetic acid mixed with mucilage of starch, if Sulphurous Acid be present the iodate is decomposed, iodine set free, and the starch coloured, thus: $KIO_3+3H_2SO_3=KI+3H_2SO_4$
Perchloride of Platinum Pour a mixture of 1 oz. of nitric acid, 4 ozs. of hydrochloric acid, and 2 ozs. of water on ¼ oz. of platinum foil, and digest at a gentle heat, adding, if necessary, more of the acids in the same proportion until the metal is dissolved. Transfer the solution to a porcelain dish, add 1 drm. of hydrochloric acid, and evaporate on a water bath until acid vapours are no longer evolved. Dissolve the residue in 5 ozs. of water.	Test for Potash, with which, in the presence of hydrochloric acid, it forms a sparingly soluble double salt. It is also used as a test for Nicotine, with which it gives a light-yellow precipitate.
Sulphate of Indigo Heat 5 grs. of indigo and ½ drm. of sulphuric acid in a small test-tube over a water-bath for an hour. Pour the solution into 10 ozs. of sulphuric acid, and when the undissolved indigo has subsided decant off the clear liquid.	Test for presence of free Chlorine, which decolorises it.
Sulphate of Lime Rub ¼ oz. of dry sulphate of lime in a mortar with 2 ozs. of water; add this to 18 ozs. of water, and, when the undissolved sulphate of lime has subsided, decant off the clear liquid.	Test for Oxalic Acid.

SOLUTION OF	USES.
Sulphide of Ammonium - - - Pass sulphuretted hydrogen gas into an ounce of solution of ammonia until the gas is no longer absorbed.	Test for various metals, viz.:—Zinc, *white* precipitate; Mercury, Silver, Lead, Copper, Bismuth, Tin, Gold, and Platinum, *brown or black* precipitate. It affords no precipitate in a neutral solution of arsenic, but gives an *orange-red* precipitate in a neutral solution of antimony soluble in excess.
Tartaric Acid - - - - Dissolve 1 oz. of tartaric acid in 8 ozs. of water, and add 2 ozs. of rectified spirit.	Test for Potash

We must here allude to two other important tests—viz., Sulphuretted Hydrogen Gas and Solution of Nitrate of Silver.

Sulphuretted Hydrogen Gas is a test for the metals—thus, it gives, in neutral solutions containing *arsenic*, a yellow precipitate soluble in ammonia and in sulphide of ammonium, but insoluble in excess of hydrochloric acid; it gives, in solutions of *persalts of tin*, a yellow precipitate soluble in hydrochloric acid; it gives, in acid solutions of *proto-* and *per-salts* of *mercury*, salts of *silver*, *lead*, *copper*, *bismuth*, *protoxide of tin*, *gold*, and *platinum*, black or brown precipitates.

Nitrate of Silver is a test for *hydrochloric acid* and *chlorides*, with which it gives a white precipitate soluble in excess of ammonia, but not in nitric acid; for *hydrocyanic acid* and *cyanides*, with which it gives a white precipitate soluble in boiling nitric acid; for *tribasic phosphoric acid*, with which it gives a yellow precipitate soluble in excess of ammonia and nitric acid; and for *arsenic acid*, with which it gives a brick-red precipitate soluble in excess of ammonia and nitric acid.

III.

TEST SOLUTIONS FOR VOLUMETRIC ANALYSIS.

The following is a brief abstract of the method of preparing these solutions, and, in outline, an explanation of their use.

The Pharmacopœia gives the mode of procedure in volumetric estimations according both to the British and Metric systems. We will confine ourselves to the consideration of the former, referring the student to the Pharmacopœia for information with regard to the Metric system.

Apparatus required in the Preparation of the Volumetric Solutions.

1. *A Flask* which, when filled to the mark on the neck, contains exactly 10,000 grains of distilled water, at 60° F.

2. *A Graduated Cylindrical Jar* which, when filled to 0, holds 10,000 grains of distilled water, and is divided into 100 equal parts.

3. *A Burette*, or graduated glass tube, which, when filled to 0, holds 1,000 grs. of distilled water, and is divided into 100 equal parts, each part corresponding to 10 grain-measures.

Volumetric solutions, before being used, should be shaken so as to insure uniformity of strength; they should also be preserved in stoppered bottles.

All measurements are to be made at 60° F.

The quantities of substances to be tested are expressed by grains in weight, while the quantities of the test solution employed are expressed in grain-measures. (A "grain-measure" is the volume of a grain of distilled water.)

I.—VOLUMETRIC SOLUTION OF BICHROMATE OF POTASH.

$(K_2Cr_2O_7=295.)$

Preparation—Dissolve 147·5 ($\frac{1}{2}$ equiv.) in a sufficiency of water to fill the 10,000 grain flask.

1,000 grain-measures of this solution will thus contain 14·75 grains of bichromate ($\frac{1}{20}$ of an equiv. in grains), and when added to a solution of a *proto*salt of iron acidulated with hydrochloric acid, can convert 16·8 grains of iron ($\frac{1}{20}$ of 6Fe in grains) from a state of *proto*salt to that of *per*salt. The molecular weight of $K_2Cr_2O_7$ being 295, $\frac{1}{20}$ of an equivalent = 14·75—the smaller quantity being used for convenience of working. As one molecule of $K_2Cr_2O_7$ can convert six molecules of ferrous into a ferric salt, it follows that 14·75 grains of $K_2Cr_2O_7$ will peroxodise 16·8 grains (= $\frac{1}{20}$ of an equivalent) of 6Fe. (Fe=56; therefore, 6Fe=432, $\frac{1}{20}$ of which = 16·8).

Use.—To determine the amount of protosalt of iron present in a liquid. The conversion of all the protosalt into a state of persalt is known when a little drop of the liquid placed in contact with a drop of solution of ferridcyanide or potassium on a white plate ceases to strike a blue colour.

The solution is used for determining the proportion of protoxide of iron in the following preparations:—

Grains weight.			Gr.-measures of Vol. Sol.
20	of Ferri Oxid. Mag.	will require	230
20	„ Ferri Arsenias	„	170
20	„ Ferri Phosphas	„	250
20	„ Ferri Carb. Sacch.	„	208

Example.—20 grains of magnetic oxide of iron dissolved in hydrochloric acid continue to give a blue precipitate with ferridcyanide of potassium until 230 grain-measures of the volumetric solution have been added:—Thus, 1000 (the number of grain-measures in the solution) : 230 : : 21·6 (= $\frac{1}{20}$ of FeO). The result gives the amount of protoxide of iron in the 20 grains of magnetic oxide experimented on.

The following formula illustrates the nature of the decompositions which occur:—

$$K_2Cr_2O_7+6FeO+8HCl=3(Fe_2O_3)+Cr_2Cl_6+2KCl+4H_2O.$$

II.—VOLUMETRIC SOLUTION OF HYPOSULPHITE OF SODA.

$(Na_2H_2S_2O_4 4H_2O=248.)$

Preparation.—Dissolve 280 grains of hyposulphite of soda in 10,000 grain-measures of water. Fill a burette with this solution, and drop it cautiously into 1,000 grain-measures of the volumetric solution of iodine until the brown colour is discharged. Note the number of grain-measures (n) required to produce this effect; then put 8,000 grain-measures of the same solution into a graduated jar, and augment this quantity by the addition of distilled water until it amounts to $\frac{8{,}000\times1{,}000}{n}$ grain-measures. If, for example, $n=$ 950, the 8,000 grain-measures of solution should be diluted to the bulk of $\frac{8{,}000\times1{,}000}{950}=8{,}421$ grain-measures.

1,000 grain-measures of this solution contain 24·8 grains of hyposulphite of soda, and therefore correspond to 12·7 grains of iodine ($\frac{1}{10}$ of an equivalent).

Use.—To estimate free iodine, which it does by forming, with the iodine, iodide of sodium and tetrathionate of soda, solutions of which are colourless, thus:—

$$2Na_2H_2S_2O_4+2I=\underbrace{Na_2S_4O_6}_{\text{Tetrathionate of Soda.}}+2NaI+2H_2O.$$

The following substances are directed to be tested with this solution:—

Grains weight.			Gr.-measures of Vol. Sol.
60·0	of Liq. Calc. Chloratæ	will require	500
70·0	,, ,, Soda Chloratæ	,,	500
439·0	,, ,, Chlori	,,	750
10·0	,, Calx Chlorata	,,	850
12·7	,, Iodum	,,	1,000

As no iodine is present in the first four of these preparations, the Pharmacopœia directs that solution of iodide of potassium and hydrochloric acid shall be added; so that the free iodine thus liberated in them may be indicated by the solution.

III.—VOLUMETRIC SOLUTION OF IODINE.

$(I=127.)$

Preparation.—Dissolve 127 grains of iodine and 180 grains of iodide of potassium in exactly 10,000 grain-measures of distilled water. 1,000 grain-measures contain 12·7 grains (1-10th of an equiv.) of iodine, and therefore correspond to 1·7 grains of sulphuretted hydrogen, 3·2 grains of sulphurous acid, and 4·95 grains of arsenious acid.

Use.—Quantitative estimation of arsenious acid (*vide* p. 16), sulphurous acid, liquor arsenicalis, liquor arsenici hydrochloricus, and sulphuretted hydrogen. The solution is dropped from the burette into the liquid to be tested, until free iodine begins to appear in the solution.

The following substances are directed to be thus tested:—

Grains weight.			Gr.-measures of Vol. Sol.
4·0	of Acid. Arsenios.	will require	808
441·5	„ Liq. Arsenicalis	„	808
441·6	„ „ Arsen. Hydroch.	„	810
34·7	„ Acid. Sulphurosum	„	1,000

We cannot explain this test better than in the words of Dr. Attfield.* "Any substance which quickly absorbs a definite amount of oxygen may be quantitatively tested by ascertaining how much of an oxidising agent of known power must be added to a given quantity before complete oxidation is effected. The oxidising agents employed for this purpose in the British Pharmacopœia are iodine and the red chromate of potassium; permangante of potassium is often used for the same purpose. Iodine acts indirectly, by taking hydrogen from water, and liberating oxygen; the red chromate of potassium directly, by the facility with which it yields 3-7ths of its oxygen." The following reactions will serve to illustrate the nature of the decomposition:—

$$\underbrace{H_2SO_3}_{\text{Sulphurous Acid.}}+I_2+H_2O=\underbrace{H_2SO_4}_{\text{Sulphuric Acid.}}+2HI.$$

$$\underbrace{As_2O_3}_{\text{Arsenious Acid.}}+2H_2O+2I_2=\underbrace{As_2O_5}_{\text{Arsenic Acid.}}+4HI.$$

IV.—VOLUMETRIC SOLUTION OF NITRATE OF SILVER.

$(AgNO_3=170.)$

Preparation.—Dissolve 170 grains of nitrate of silver in exactly 10,000 grain-measures of distilled water. 1,000 grain-measures will contain 17·0 grains of nitrate of silver (1-10th of an equiv. in grains).

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* "Pharmaceutical Chemistry." Sixth edition, 1875, p. 624.

Use.—Quantitative estimation of hydrocyanic acid, bromide of potassium, and arseniate of soda.

Grains weight.				Gr.-measures of Vol. Sol.
270	of	Acid. Hydrocyan.	will require	1,000
10	,,	Potass. Bromid.	,,	840
10	,,	Sodæ Arsenias (dry)	,,	1,613

Explanation.—The addition of nitrate of silver to hydrocyanic acid with excess of soda causes the formation of a *soluble* double cyanide of silver and sodium ($AgNaCy_2$) until all the hydrocyanic acid is exhausted, thus:—

$$AgNO_3 + 2NaCy = NaNO_3 + NaAgCy_2.$$

When all the hydrocyanic acid is thus expended in the formation of this double cyanide, the further addition of nitrate of silver will cause the precipitation of insoluble oxide of silver. Hence, if we know the amount of nitrate of silver required to produce a permanent precipitate, we can calculate the amount of hydrocyanic acid present. [For full explanation of this test see p. 20.]

V.—VOLUMETRIC SOLUTION OF OXALIC ACID.

$(H_2C_2O_4.\ 2H_2O = 126.)$

Preparation.—Dissolve 630 grains of oxalic acid in exactly 10,000 grain-measures of water.

1,000 grain-measures contain 63 grains ($\frac{1}{2}$ of an equiv.) of oxalic acid, and will therefore neutralise *one* equivalent in grains of an alkali or alkaline carbonate, the oxalic radical being bivalent.

Use in estimating the following substances:—

Grains weight.				Gr.-measures of Vol. Sol.
59·0	of	Ammon. Carb.	will require	1,000
191·0	,,	Borax	,,	1,000
85·0	,,	Liq. Ammon	,,	500
52·3	,,	,, ,, Fort.	,,	1,000
4,380·0	,,	,, Calcis	,,	200
460·2	,,	,, ,, Sacch.	,,	254
413·3	,,	,, Plumbi Subacet.	,,	810
462·9	,,	,, Potassæ	,,	482
4,380·0	,,	,, ,, Efferves.	,,	150
458·0	,,	,, Sodæ	,,	470
4,380·0	,,	,, ,, Efferves.	,,	178
38·0	,,	Plumbi Acetas	,,	200
56·0	,,	Potassa Caustica	,,	900
50·0	,,	,, Bicarb.	,,	500
83·0	,,	,, Carb.	,,	980
102·0	,,	,, Citras.	,,	1,000
113·0	,,	,, Tartras.	,,	1,000
188·0	,,	,, ,, Acida	,,	1,000
40·0	,,	Soda Caustica	,,	900
141·0	,,	,, Tartarata	,,	1,000
84·0	,,	,, Bicarb.	,,	1,000
143·0	,,	,, Carb.	,,	960

Exact neutralisation is ascertained by litmus paper.

VI.—VOLUMETRIC SOLUTION OF SODA.

($NaHO=40.$)

Preparation.—“Fill a burette with the solution of soda, and cautiously drop this into 63 grains of purified oxalic acid dissolved in about 2 ounces of water, until the acid is exactly neutralised. Note the number of grain-measures (n) of the solution used, and having then introduced 9,000 grain-measures of the solution of soda into a graduated jar, augment this quantity by the addition of water until it becomes $\frac{9,000 \times 1,000}{n}$ grain-measures. If, for example, $n=930$, the 9,000 grain-measures should be augmented to $\frac{9,000 \times 1,000}{930}=9{\cdot}677$ grain-measures. 1,000 grain-measures of this solution contain one equivalent in grains (40) of hydrate of soda, and will therefore neutralise one equivalent in grains of any monobasic acid.” [See page 21 and *passim* under the different acids for full explanation.]

Use in testing the following substances:—

Grains weight.			Gr.-measures of Vol. Sol.
445·4	of Acetum	will require	402
182·0	„ Acid. Acet.	„	1,000
440·0	„ „ „ Dil.	„	313
60·0	„ „ „ Glac.	„	990
70·0	„ „ Citric	„	1,000
114·8	„ „ Hydrochlor.	„	1,000
345·0	„ „ „ Dil.	„	1,000
90·0	„ „ Nitric	„	1,000
361·3	„ „ „ Dil.	„	1,000
352·4	„ „ Nitro-Hydroch. Dil.	„	920
50·6	„ „ Sulph.	„	1,000
304·2	„ „ „ Arom.	„	830
359·0	„ „ „ Dil.	„	1,000
75·0	„ „ Tart. Dil.	„	1,000

WEIGHTS AND MEASURES OF THE BRITISH PHARMACOPŒIA.

WEIGHTS.

1 Grain	gr.		
1 Ounce	oz.	=	437·5 grains
1 Pound	lb. = 16 ounces	=	7000 ,,

MEASURES OF CAPACITY.

1 Minim	min.		
1 Fluid Drachm	fl. drm.	=	60 minims
1 Fluid Ounce	fl. oz.	=	8 fluid drachms
1 Pint	O.	=	20 fluid ounces
1 Gallon	C.	=	8 pints

MEASURES OF LENGTH.

1 Line = $\frac{1}{12}$ inch

1 Inch = $\frac{1}{39{\cdot}1393}$ seconds pendulum

12 Inches = 1 foot

36 ,, = 3 feet = 1 yard

Length of pendulum vibrating seconds of mean time in the latitude of London, in a vacuum at the level of the sea } 39·1393 inches

RELATION OF MEASURES TO WEIGHTS.

				Grains of Water.
1 Minim	is the measure of			0·91
1 Fluid Drachm	,,	,,		54·68
1 Fluid Ounce	,,	,,	1 ounce, or	437·5
1 Pint	,,	,,	1·25 pounds, or	8750·0
1 Gallon	,,	,,	10 pounds, or	70,000·0

WEIGHTS AND MEASURES OF THE METRICAL SYSTEM.

WEIGHTS.

1 Milligramme	= the thousandth part of 1 grm., or	0·001	grm.
1 Centigramme	= the hundredth ,,	0·01	,,
1 Decigramme	= the tenth ,,	0·1	,,
1 Gramme	= weight of a cubic centimetre of water at 4° C.	1·0	,,
1 Decagramme	= ten grammes	10·0	grms.
1 Hectogramme	= one hundred grammes	100·0	,,
1 Kilogramme	= one thousand ,,	1000·0	,,

MEASURES OF CAPACITY.

1 Millilitre = 1 cub. centim., or the mea. of 1 gram. of water
1 Centilitre = 10 ,, ,, 10 grams. ,,
1 Decilitre = 100 ,, ,, 100 ,, ,,
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