Not Official.

EXALGIN.

METHYLACETANILIDE.

$C_6H_5N(CH_3)CH_3CO$, eq. 148·01.

Long, colourless prismatic needles, or in tabular crystals.

It may be prepared by the action of Acetyl Chloride on Monomethylaniline.

Solubility.—1 in 50 of Water, 1 in 2 of Alcohol (90 p.c.), 1 in 4 of Alcohol (60 p.c.), 1 in 2 of Chloroform, 1 in 10 of Ether.

In hot Water Exalgin is very apt to form supersaturated solutions, which when cold will not separate even when stirred or scratched, but set solid at once on the addition of a fragment of a crystal.

Medicinal Properties.—In small doses it acts as an analgesic without producing ill effects, giving the best results in neuralgia and toothache. It is also slightly antipyretic.—*B.M.J.* '90, i. 344, 558; '90, ii. 735; *P.J.* (3) xix. 781, 861; *T.G.* '89, 339, 534, 746, 797; *L.* '89, i. 658; '90, ii. 845; '92, i. 1174, 1175; '93, i. 785. In large doses it possesses toxic properties.

Severe toxic symptoms in an asthmatic woman after taking one dose of 5 grains.—*L.* '95, i. 1307.

Case of poisoning by large dose (150 grains); recovery. Treatment consisted of 30 grains Salicylic Acid by nasal tube, and of hypodermic injection of $\frac{1}{50}$ grain Atropine, followed by two injections of $\frac{1}{100}$ grain.—*L.* '99, ii. 890.

Dose.—$\frac{1}{2}$ to 1 grain = 0·032 to 0·065 gramme, was found sufficient by Fraser; but larger doses, 4 to 8 grains = 0·26 to 0·52 gramme, have been given in France.

Prescribing Notes.—*May be given in Mixtures, previously dissolving it in a little Alcohol or Tincture before adding the Water. A nice* **pill** *mass is made by adding Glucose q.s. or $\frac{1}{2}$ grain Compound Tragacanth Powder to each 3 grains of Exalgin and Dispensing Syrup q.s. It may also be conveniently given in* **cachets.** *Compressed Tablets are also prepared.*

Foreign Pharmacopœias.—Official in Fr. (Methylacetanilide), Mex. and Span. Not in the others.

Tests.—Exalgin possesses a melting point of 101° C. (213·8° F.) and a boiling point of about 245° C. (473° F.). When boiled with Sodium Hydroxide solution it is decomposed with difficulty, but is completely decomposed by concentrated Hydrochloric Acid with formation of Acetic Acid and Methylaniline. When a small quantity is boiled with Hydrochloric Acid, and the cooled mixture is treated with an excess of Ammonia Solution, no violet coloration should be produced on the addition of Chlorinated Lime Solution. When boiled with a few drops of Chloroform and some Alcoholic Potassium Hydroxide Solution, no odour of Phenyl-isonitrile is evolved. Exalgin dissolves readily in Chloroform, and this fact enables it to be distinguished from Acetanilide and Phenacetin; when 1 gramme of the sample is treated with 2 c.c. of Chloroform, the Exalgin is dissolved. A chloroformic solution of Exalgin remains clear when diluted with 10 times its volume of Petroleum Ether, whereas solutions of Acetanilide and Phenacetin become turbid. 0·5 gramme should leave no weighable residue when heated with free access of air.

MISTURA METHYLACETANILIDI.—Methylacetanilide, 3 grains; Syrup of Orange, 1 fl. drm.; Chloroform Water (*B.P.* '85) to 1 fl. oz.

FEL BOVINUM PURIFICATUM.

PURIFIED OX BILE.

Evaporate 20 fl. oz. of fresh Ox Bile to 5 fl. oz., and mix it with 10 fl. oz. of Alcohol (90 p.c.); separate the precipitate, and reduce the clear fluid to a thick extract.

Solubility.—Soluble in Water and in Alcohol (90 p.c.). Insoluble in Ether.

Medicinal Properties.—Intestinal antiseptic and cholagogue, purgative. Used where there is a deficiency of bile; it assists the emulsification of fats.

Dose.—5 to 15 grains = 0·32 to 1 gramme.

As it is desirable that it should pass into the small intestine unchanged, the pills should be coated with Keratin solution, p. 710, which protects them from the action of the gastric juice.

Foreign Pharmacopœias.—Official in Dutch and Jap. (Fel Tauri Inspissatum); Mex. (Hiel de toro) Port. (Extracto de Fel de Boi), Gall 1, Alcohol 1, Animal Charcoal $\frac{1}{10}$; U.S. (Fel Bovis Purificatum), Ox Gall 3, concentrated to 1, Alcohol 1. Not in the others.

Tests.—Purified Ox Bile is soluble in Water and in Alcohol (90 p.c.), when dissolved in from twenty to thirty times its weight of the former liquid, and mixed with a drop of a fresh syrup prepared by dissolving one part of refined Sugar in four of Water, it yields on the addition of Sulphuric Acid cautiously added so that the precipitate at first formed is redissolved, a cherry-red colour changing through carmine and purple to violet. The reaction is known as Pettenkofer's test, and is the characteristic reaction of Cholalic Acid. It may also be equally well observed by treating a drop of an aqueous solution of the bile on a porcelain surface with a drop of a solution of Cane Sugar, and adding a drop of strong Sulphuric Acid. Owing to a chance of the reaction being obscured by the charring of the Sugar, it has been proposed to employ Furfurol or Glucose in the place of Cane Sugar. Unpurified Ox Bile, if present, is revealed on the addition of Alcohol (90 p.c.) to an aqueous solution, if absent, no precipitate should be produced. The *B.P.* does not state the strength of the aqueous solution to be employed nor the quantity of Alcohol (90 p.c.) to be added; the *U.S.P.* states that an aqueous solution of the purified Ox Gall (presumably 1 in 100) should be clear and should remain transparent upon the addition of an equal volume of Alcohol (94·9 p.c.).

FERRUM.

IRON.

Fe, eq. 55·60.

Fr., Fer; Ger., Gepulvertes Eisen; Ital., Ferro; Span., Hierro.

Annealed Iron wire, having a diameter about 0·005 inch = 0·1 mm. (about No. 35 wire gauge), or wrought iron nails; free from Oxide.

The use of Iron in medicine is of great antiquity; it is said to have been the first mineral used internally, more than 3000 years ago.

Iron salts naturally divide into two groups: the Ferrous or Protosalts, based upon the Oxide FeO; and the Ferric or Sesquisalts (Persalts), based upon the Oxide Fe_2O_3. Ferrous salts have a strong tendency to pass into the Ferric condition by absorption of atmospheric Oxygen, a change which takes place very rapidly in presence of oxidising agents, as Chlorine, Nitric Acid, etc.

Medicinal Properties.—The Iron salts in general are hæmatinic and tonic; the Perchloride and Sulphate are also very astringent and hæmostatic, and are antiseptic. All the Iron salts are stated to be converted into Chloride by the acid of the stomach. The Astringent salts are the most powerful tonics, but as they frequently produce gastric irritation, the Neutral salts are far more generally prescribed. Of these Ferrous Carbonate in its various forms, and the Iron and Ammonium Citrate, are in the greatest demand. The Phosphate preparations are excellent hæmatinics, and are very popular with children. Iron preparations are given after food.

The Iron and Quinine Citrate, Arsenate, and Iodide are given in special cases calling for these combinations.

Iron is useful in most forms of anæmia, and in dyspepsia, debility, chronic cachectic conditions, neuralgia, amenorrhœa and other conditions which so often depend on anæmia; also in convalescence. It is contra-indicated in apoplectic persons and generally in fevers, but has been given with benefit in erysipelas.

When constipation is a symptom, the Iron is combined with some aperient, such as Aloes and Nux Vomica or Cascara; or a mixture containing Magnesium or Sodium Sulphate may be taken separately as required.

Official Preparations.—Of metallic **Iron,** Ferri Sulphas, Liquor Ferri Pernitratis, Liquor Ferri Perchloridi Fortis; of **Iron Wire,** Syrupus Ferri Iodidi, Syrupus Ferri Phosphatis, Syrupus Ferri Phosphatis cum Quinina et Strychnina, Vinum Ferri; of **Ferrous Sulphate,** Ferri Arsenas, Ferri Carbonas Saccharatus, Ferri Phosphas, Ferri Sulphas Exsiccatus, Liquor Ferri Persulphatis, Mistura Ferri Composita; of **Strong Solution of Ferric Chloride,** Liquor Ferri Perchloridi, Tinctura Ferri Perchloridi; of **Solution of Ferric Sulphate,** Ferri et Ammoniæ Citras, Ferri et Quininæ Citras, Ferrum Tartaratum, Liquor Ferri Acetatis; of **Exsiccated Ferrous Sulphate,** Pilula Ferri, Pilula Aloes et Ferri; of **Reduced Iron,** Trochiscus Ferri Redacti; of **Iron and Ammonium Citrate,** Vinum Ferri Citratis.

Not Official.—Mistura Ferri Aromatica, Extractum Ferri Pomati, Iron Malate Wine, Sirupus Ferri Pomati Compositus, Tinctura Ferri Pomati.

Foreign Pharmacopœias.—Official in Austr., Dan., Dutch, Ger., Hung., Ital., Jap., Norw., Swed. and Swiss (Ferrum Pulveratum), Belg. (Ferri Pulvis), Fr. (Fer), Ital. (Limatura de Ferro), also (Ferro Porfirizzato), Port. (Ferro), Mex. (Fierro), Span. (Hierro), and U.S. (Ferrum).

Tests.—Iron when present in solution in the Ferric condition answers the following distinctive tests:—The addition of Ammonia Solution produces a reddish-brown flocculent precipitate, insoluble in excess of the reagent, soluble in Citric or Tartaric Acid; Potassium or Sodium Hydroxide Solution produces a similar precipitate also soluble in Citric or Tartaric Acid; Potassium Ferrocyanide Solution produces a fine blue precipitate insoluble in dilute Hydrochloric Acid, soluble in Oxalic Acid, decomposed by Potassium or Sodium Hydroxide Solution; Potassium Ferricyanide Solution produces a brown or reddish-brown coloration but no precipitate; Ammonium Hydrosulphide Solution produces a black precipitate mixed with Sulphur, on the addition of cold diluted Hydrochloric Acid the black precipitate dissolves, evolving Hydrogen Sulphide gas and leaving a white insoluble precipitate of Sulphur; Ammonium or Potassium

Thiocyanate Solution yields a blood-red coloration readily destroyed by Mercuric Chloride Test-solution, also destroyed by Phosphoric Acid; Tannic Acid Solution produces a black or bluish-black coloration in dilute solutions, a black or bluish-black precipitate in stronger solutions; a solution of the Ferric salt acidified with Hydrochloric Acid liberates Iodine when added to a solution of Potassium Iodide; this reaction has been utilised in the *U.S.P.* as a general method for the determination of Iron in the Ferric condition.

When present in the Ferrous condition its solution yields the following reactions:—Ammonia Solution produces a white flocculent precipitate, rapidly turning to a dirty green colour and ultimately to reddish-brown; it is soluble in diluted mineral acid and in Citric or Tartaric Acid, rapidly becoming brown on exposure to air; Potassium or Sodium Hydroxide Solution yields a similar precipitate which behaves similarly with the reagents mentioned; Potassium Ferrocyanide Solution produces a bluish-white precipitate insoluble in dilute Hydrochloric Acid, the precipitate rapidly changes to dark blue on exposure to air; Potassium Ferricyanide Solution produces a dark blue precipitate, insoluble in dilute Hydrochloric Acid and decomposed by Potassium or Sodium Hydroxide Solution; Ammonium Hydrosulphide Solution yields a black precipitate soluble in cold diluted Hydrochloric Acid with the evolution of Hydrogen Sulphide gas, but no precipitate of Sulphur remains; Hydrogen Sulphide Solution yields no precipitate in an acid solution of a Ferrous salt; Ammonium or Potassium Thiocyanate Solution produces no reaction in solutions containing pure Ferrous salt.

Preparation.

VINUM FERRI. IRON WINE.

Iron, in wire, 1; Sherry 20. Set aside for thirty days in a closed vessel, the Iron wire being almost, but not quite, immersed in the Sherry, the vessel being frequently shaken, and the stopper occasionally removed; filter.

The quantity of Iron dissolved seems to depend almost wholly upon the acidity of the Wine. We found that a good dinner Sherry, containing acids equal to 0·396 p.c. of Acetic Acid, dissolved 0·14 p.c. of Iron, and had its acidity reduced to 0·09 p.c. It was treated as directed in the *B.P.*, and the bottle was about half full.

Of such a Vinum Ferri, 3 fl. drm. would represent the Iron contained in 5 minims of Tinctura Ferri Perchloridi.

Commercial samples seem to lie between 0·2 and 0·3 p.c. of Iron, although occasionally samples are found much weaker.

According to *P.J.* (3) xxi. 641, the Iron strength increases for three weeks and then diminishes. Our experience does not agree with this. A gallon quantity was put on and examined after the first week, and afterwards every month for four months, with the following results: 0·084, 0·114, 0·157, 0·185, 0·204 p.c. of metallic Iron.

N.B.—The old Vinum Ferri, made with Malaga, is much sweeter than that of the *B.P.*, and is sometimes ordered on that account.

Dose.—1 to 4 fl. drm. = 3·6 to 14·2 c.c.

Prescribed for young children and delicate females with irritable stomach.

Not Official.

MISTURA FERRI AROMATICA.—Fine Iron Wire, 2; Red Cinchona Bark, in powder, 4; Calumba, in coarse powder, 2; Cloves, bruised, 1; Compound Tincture of Cardamoms, 12; Tincture of Orange Peel, 2; Peppermint Water, 48. Macerate the first four ingredients in the last one for three days in a closed vessel, agitating occasionally, filter, and make up with Peppermint Water to 50; to this add the Tinctures, and preserve in a well-stoppered bottle.—*B.P.* 1885.

Dose.—1 to 2 fl. oz. = 28·4 to 56·8 c.c.

Much valued, especially in Dublin, as a stomachic tonic and hæmatinic.

This has been incorporated in the *B.P.C.*, slightly modifying the quantities in the transposition to the decimal system.

EXTRACTUM FERRI POMATI.—Sour Apples, 50; convert them into a pulp and express; to the expressed liquid add Iron Wire, 1; heat the mixture on a water-bath until the evolution of gas ceases. Dilute the liquid with Water to make 50 parts, and set it aside for several days; then filter and evaporate to a thick extract. The extract should be a greenish-black, and should form a clear solution with Water.

Dose.—3 to 10 grains = 0·20 to 0·65 gramme.

Foreign Pharmacopœias.—Official in Hung. (Ext. Malatis Ferri), Austr., Dan., Norw. and Swed. (Ext. Pomi Ferratum); Belg. and Ger. (Ext. Ferri Pomati); Jap., Russ. and Swiss (Ext. Ferri Pomatum). Swiss is prepared by dissolving freshly precipitated Peroxide of Iron in Apple Juice; all the others are with metallic Iron and Apple Juice.

SIRUPUS FERRI POMATI COMPOSITUS.—Ferrated Extract of Apples, 1; Cinnamon Water, 4; Syrup of Orange Peel, 20; Simple Syrup, 24; Syrup of Rhubarb, 50; Tincture of Cinnamon, 1.—*Swiss.*

TINCTURA FERRI POMATI.—Ferrated Extract of Apples, 1; Alcohol (90 p.c.), 1; Cinnamon Water, to make 10.

Dose.—30 to 90 minims = 1·8 to 5·4 c.c.

Foreign Pharmacopœias.—Official in Austr., Dan., Hung., Norw. and Swed., 1 and 5; Belg., Ger., Jap., Russ. and Swiss, 1 and 9; Dutch (Solutio Ferri Pomata); and Ital. (Tinctura di Malato di Ferro). Not in the others.

IRON MALATE WINE.—In Devonshire a quantity of Iron Wire or Nails is digested in a bottle of Cider for a week; a wineglassful three times a day is the dose.

FERRI ACETATIS LIQUOR.

SOLUTION OF FERRIC ACETATE.

A dark brownish-red liquid possessing an odour of Acetic Acid and an acid astringent taste.

Medicinal Properties.—Has a diuretic in addition to a hæmatinic and astringent action, and being compatible with Potassium Acetate, is used in some cases of Bright's disease.

In the treatment of either broncho or lobar-pneumonia (*B.M.J.* '05, i. 812), the following prescription has yielded surprisingly good results: Liquor Ferri Perchlor., 15 minims; Liquor Ammon. Acet., 2 drm.; Aqua Chloroformi, to ½ oz.; every four hours when taken alone, or every six hours when alternated with the following Strychnine mixture—Liquor Strychninæ, 5 minims; Chloroform Water, to ½ oz.

Dose.—5 to 15 minims = 0·3 to 0·9 c.c.

Not Official.—Tinctura Ferri Acetici Ætherea.

Incompatibles.—The same as given under Tinctura Ferri Perchloridi.

Foreign Pharmacopœias.—Official in Russ. and Swiss, sp. gr. 1·087 to 1·091. Not in the others.

Solubility.—Miscible in all proportions with Water and Alcohol (90 p.c.).

Tests.—Solution of Ferric Acetate has a specific gravity of 1·031 to 1·035. It is officially required to answer the tests distinctive of Ferric salts, given under strong Ferric Chloride Solution, but it should be noted that this solution will not react with Potassium Sulphocyanide Solution except in the presence of a free mineral acid (not Phosphoric); neither will it liberate Iodine from Potassium Iodide. Tannic Acid Solution yields a bluish-black coloration or precipitate. Ammonium, Potassium or Sodium Hydroxide Solution produces a reddish-brown precipitate, soluble in Citric or Tartaric Acid Solution. When heated with Sulphuric Acid and a little Alcohol (90 p.c.) the characteristic odour of Ethyl-Acetate is evolved. When warmed with Sulphuric Acid alone it evolves a strong acetous odour.

The more generally occurring impurities are Ammonium, Arsenic, Calcium, Copper, Lead, Sodium, Potassium, Zinc, Nitrates, Sulphates, and Ferrous salts. Arsenic may be detected by the modified Gutzeit's test, Copper, Lead and Zinc by Hydrogen Sulphide in either acid or alkaline solution, Ammonium by the evolution of an odour of Ammonia when the liquor is warmed with Potassium or Sodium Hydroxide Solution, Calcium by the precipitate or cloudiness produced by Ammonium Oxalate Solution; Nitrates and Sulphates after the removal of the Iron, the former by the Ferrous Sulphate ring test, the latter by Barium Chloride Solution.

Not Official.

TINCTURA FERRI ACETICI ÆTHEREA (*Swiss*).—Solution of Iron Acetate (sp. gr. 1·087 to 1·091), 8; Alcohol, 1; Acetic Ether, 1. All by weight.

Dose.—10 to 20 minims = 0·6 to 1·2 c.c.

Official in Russ., the proportions being 9, 2, and 1 respectively.

Not Official.

FERRI ALBUMINAS.

A liquor is official in the Dutch Pharmacopœia containing 0·25 p.c. of Ferric Oxide, and several other formulas have been proposed, but it is more convenient to use the commercial scale preparation, which is fairly soluble in Water, and contains 5 p.c. of Ferric Oxide.

Medicinal Properties.—Hæmatinic tonic. Given with success in anæmia, and specially recommended in gastric ulcer.—*T.G.* '86, 399; *L.* '94, ii. 1113; '95, i. 1065; *B.M.J.E.* '94, i. 28, 96; *Pr.* liii. 87.

Dose.—3 to 10 grains = 0·2 to 0·65 gramme.

Foreign Pharmacopœias.—Official in Dan., Dutch, Ger., Jap., Russ. and Swiss (Liquor Ferri Albuminati); Swed. (Liquor Oxydi Ferrici Albuminati). All containing 0·4 p.c. of Iron.

LIQUOR FERRI ALBUMINATI.—Dry Egg Albumen, 4; Solution of Ferric Oxychloride, 13; Alcohol (95 p.c.), 12; Aromatic Elixir (*U.S.P.*), 40;

Solution of Sodium Hydroxide (*U.S.P.*) and Distilled Water, *q.s.* of each to produce 100.—*U.S.N.F.*

This has been incorporated in the *B.P.C.*, employing 12·5 of Alcohol (90 p.c.) in place of 12 of Alcohol (95 p.c.).

FERRATIN.—A brown, tasteless powder, containing 7 p.c. of Iron, prepared from egg Albumen and Tartarated Iron in alkaline solution. Daily dose for children, 5 to 15 grains, and for adults, 20 to 30 grains.—*Pr.* li. 427; *A.J.P.* '94, 500; *B.M.J.* '95, i. 985; *B.M.J.E.* '95, ii. 16; '96, i. 8; *T.G.* '96, 40; *L.* '96, ii. 1820; *B.M.J.E.* '02, ii. 11.

Official in Russ.

Alboferin (Iron Albuminate).—An almost odourless, brown powder, soluble in Water.—*B.M.J.E.* '02, i. 68.

Carniferrin.—A compound of Iron with Phospho-carnic Acid. A brown powder containing about 30 p.c. of Iron.

Fersan (Iron Paranucleo-proteid).—An Iron compound, obtained from red blood corpuscles, soluble in Water.—*B.M.J.E.* '00, ii. 20.

Dose.—10 to 30 grains = 0·65 to 2 grammes.

Ferri Alginas (Alginoid Iron).—A tasteless, brown powder, containing about 10 p.c. of Iron. Insoluble in Water, soluble in Ammonia. Recommended in anæmia.—*P.J.* '98, ii. 199; *B.M.J.* '02, i. 723.

Claimed (*M.P.* '05, ii. 9) that this drug has two advantages over other compounds of Iron: (1) it does not derange digestion; (2) it does not cause constipation. Alginic Acid is a nitrogenous acid obtained from seaweed. It is best given in powder or cachets.

Dose.—2 to 15 grains = 0·13 to 1 gramme.

Particularly useful in chlorosis with vomiting and pain in the stomach.

FERRI PEPTONAS.—A brown or reddish-brown powder, having a meaty and somewhat disagreeable odour. Readily soluble in Water.

Dose.—5 to 10 grains = 0·32 to 0·65 gramme.

LIQUOR FERRI PEPTONATI.—Peptone, dry, 4; Solution of Ferric Oxychloride, 20; Alcohol, 12; Aromatic Elixir (*U.S.P.*), 40; Solution of Sodium Hydroxide (*U.S.P.*) *q.s.*; Distilled Water, *q.s.* to produce 100.—*U.S.N.F.*

This has been incorporated in the *B.P.C.*

LIQUOR FERRI PEPTONATI CUM MANGANO.—Ferric Peptonate, 4·5; Soluble Manganese Citrate, 0·8; Ammonia Water (*U.S.P.*), 1·3; Aromatic Elixir, 5·0; Alcohol (95 p.c.), 15·00; Distilled Water, *q.s.* to produce 100.—*U.S.N.F.*

Manganese Chloride, 0·35; Solution of Iron Peptonate, *q.s.* to produce 100.—*B.P.C.*

FERRI ARSENAS.

IRON ARSENATE.

Arseniate of Iron.—*B.P.* '85.

Fr., Arséniate de Fer; Ger., Arsensaures Eisenoxydul; Span., Arseniato de Hierro.

A tasteless, olive-green, amorphous powder, consisting of Ferrous Arsenate, $Fe_3(AsO_4)_2$, $6H_2O$, eq. 550·12, Ferric Arsenate and some Iron Oxide, and containing not less than 12½ p.c. of hydrous, equivalent to 10 p.c. of anhydrous Ferrous Arsenate.

Medicinal Properties.—Similar to those of Arsenious Acid; the quantity of Iron in the dose is extremely small.

Dose.—$\frac{1}{16}$ to $\frac{1}{4}$ grain = 0·004 to 0·016 gramme.

Prescribing Note.—*Best given in* **pill** *well triturated with Milk Sugar, and massed with a little Glucose.*

Antidotes.—*See* Acidum Arseniosum.

Not Official.—Mistura Ferri Arsenicalis, Pilula Ferri Arsenicalis, Ferri Arsenio-Citras Ammoniata, Injectio Ferri Arsenatis Solubilis.

Foreign Pharmacopœias.—Official in Fr., Mex. (Arseniato de Fierro) and Span. Not in the others.

Tests.—Iron Arsenate dissolves in Hydrochloric Acid, and the solution answers the tests distinctive of both Ferrous and Ferric salts given under Ferrum. After separation of the Iron, the neutralised filtrate should yield a reddish-brown precipitate with Silver Ammonio-nitrate Solution, and a white crystalline precipitate with Magnesium Ammonio-sulphate. It is officially required to indicate 10 p.c. of anhydrous or nearly 12½ p.c. of hydrous Ferrous Arsenate as determined by titration with Volumetric Potassium Bichromate Solution, using Potassium Ferricyanide Solution as an indicator, 1 gramme requiring at least 6·7 c.c. The solution in Hydrochloric Acid should yield no decided turbidity with Barium Chloride Solution, indicating the absence of more than a trace of Sulphates.

Not Official.

MISTURA FERRI ARSENICALIS.—Arsenical Solution, 2 minims; Iron and Ammonium Citrate, 5 grains; Tincture of Calumba, 10 minims; Water, to 1 fl. oz.—*St. Thomas's.*

This has been incorporated in the *B.P.C.*

Citrate of Iron and Ammonium, 8 grains; Arsenical Solution, 5 minims; Tincture of Calumba, 30 minims; Water, to 1 fl. oz.—*University.*

Arsenical Solution, 5 minims; Iron and Ammonium Citrate, 6 grains; Infusion of Quassia, to 1 fl. oz.—*Guy's.*

PILULA FERRI ARSENICALIS.—Arsenious Anhydride, $\frac{1}{60}$ grain; Exsiccated Ferrous Sulphate, 3 grains; Excipient, *q.s.* for one pill.—*University.*

Arsenious Acid, $\frac{1}{60}$ grain; Exsiccated Ferrous Sulphate, 3 grains; Milk Sugar and Syrup of Glucose, *q.s.* for one pill.—*B.P.C.*

FERRI ARSENIO-CITRAS AMMONIATA.—Green or yellowish-green deliquescent scales, containing 1·4 p.c. Arsenious Acid and 15 to 18 p.c. of Iron. Readily soluble in Water. A valuable antiperiodic. Best administered by subcutaneous injection.

INJECTIO FERRI ARSENATIS.—A neutral, sterilised solution, containing 2·5 p.c. of the above salt, specially prepared for hypodermic administration. The dose, which is 1 c.c., contains 0·00035 gramme Arsenious Acid and from 0·00375 to 0·0045 gramme of Iron.

FERRI CACODYLAS.—*See* under Sodii Cacodylas.

Not Official.

FERRI BROMIDUM.

The commercial salt is in greyish-white crystalline masses, coated with red insoluble Oxybromide, which amounts to about 0·5 p.c.

It generally contains about 18 p.c. of Water, corresponding nearly with the formula $FeBr_2,3H_2O$, eq. 347·29. When this is not allowed for, a Syrup or Liquor made from the solid Bromide, and calculated as if anhydrous, will be proportionately weaker than when made from Iron Wire.

Foreign Pharmacopœias.—Not in any.

LIQUOR FERRI BROMIDI FORTIS.—A clear green liquid. Sp. gr. 1·554.

Each fl. drm. contains 36 grains of Iron Bromide ($FeBr_2$, eq. 214·3).

This solution keeps well in a corked bottle, with bright Iron Wire immersed in it, and on filtration gives a clear green liquid.

With the addition of a small quantity of Hypophosphorous Acid, the Liquor will keep very well.

Foreign Pharmacopœias.—Official in Mex. (Bromuro Ferroso) and Port. (Brometo Ferroso), both solid, no solution. Not in the others.

SYRUPUS FERRI BROMIDI.—Strong Solution of Iron Bromide (filtered), 1; Simple Syrup, 7; mix.

Contains $4\frac{1}{2}$ grains of Iron Bromide in each fl. drm.

Medicinal Properties.—A tonic in anæmia and amenorrhœa.

Syrupus Ferri Bromidi.—Iron Wire free from oxide, 2·5; Bromine, 6; Refined Sugar, 70; Distilled Water, *q.s.* to yield 100.—*B.P.C.*

It is not stated in the *B.P.C.* whether the Bromine is by weight or measure, but as it is taken from the *Conference* formula, it is most probably by weight, and rather less Bromine is used in the *B.P.C.* It was subsequently stated to be by weight.

Each fl. drm. contains about $4\frac{1}{2}$ grains of Ferrous Bromide.

Dose.—30 to 60 minims = 1·8 to 3·6 c.c.

SYRUPUS FERRI BROMIDI CUM QUININA.—Acid Quinine Hydrobromide, $\frac{1}{2}$ oz.; Diluted Hydrobromic Acid, 2 fl. drm.; Distilled Water, 1 fl. oz.; dissolve the Quinine salt in the Acid and Water mixed; then add Syrup of Ferrous Bromide, *q.s.* to yield $12\frac{1}{2}$ fl. oz.—*B.P.C.*

Dose.—30 to 60 minims = 1·8 to 3·6 c.c.

1 fl. drm. contains about $1\frac{1}{10}$ grains of Acid Quinine Hydrobromide, and about 4 grains Ferrous Bromide.

It is rather stronger in Quinine than the *Conference* formula.

SYRUPUS FERRI BROMIDI CUM STRYCHNINA.—Strychnine 1 grain; Diluted Hydrobromic Acid, 70 minims; Syrup Ferrous Bromide, to 8 fl. oz.

60 minims contains $\frac{1}{64}$ grain of Strychnine.

SYRUPUS FERRI BROMIDI CUM QUININA ET STRYCHNINA.—Dissolve 1 grain of Strychnine, in powder, in 8 fl. oz. of the Syrup of Ferrous Bromide with Quinine given above.—*B.P.C.*

1 fl. drm. contains about $\frac{1}{64}$ grain Strychnine, about $1\frac{1}{10}$ grains Quinine Acid Hydrobromide and about 4 grains Ferrous Bromide.

Dose.—30 to 60 minims = 1·8 to 3·6 c.c.

FERRI CARBONAS SACCHARATUS.

SACCHARATED IRON CARBONATE.

Fr., Saccharure de Carbonate Ferreux; Ger., Zuckerhaltiges Ferro carbonat.

Dull, greyish-brown, amorphous, odourless powder, having at first a sweet and subsequently a ferruginous taste. It is officially stated to consist of Ferrous Oxycarbonate, $x\mathbf{FeCO_3}, y\ \mathbf{Fe(OH)_2}$, in a greater or less degree of oxidation, mixed with Sugar; the Ferrous salt, if reckoned as Ferrous Carbonate, $\mathbf{FeCO_3}$, eq. 115·15, constituting about $33\frac{1}{3}$ p.c. of the mixture.

A new method of preparing Saccharated Carbonate of Iron is recommended by Mr. J. H. Franklin; he proposes the use of liquid Glucose instead of Sugar; the percentage of ferrous carbonate obtained is about double that obtained by the official process, and keeps perfectly in a well-closed bottle. It is useful in the preparation of pills, tablets and capsules.—*P.J.* '07, ii. 114, 155.

Medicinal Properties.—An excellent chalybeate; readily taken and well borne. Not astringent. Useful in anæmia, and in anæmic forms of amenorrhœa, neuralgia and sciatica. Ferrous Carbonate, in the form of 'Blaud's Pills,' is a very popular medicine.

Dose.—10 to 30 grains = 0·65 to 2 grammes.

The above dose is equivalent to 3⅓ to 10 grains = 0·216 to 0·65 gramme of Ferrous Carbonate.

Prescribing Notes.—*Given in* **cachets, lozenges,** *or* **pills.** *Sometimes ordered in the form of Powders to be taken on bread and butter. A good pill can be made by adding Dispensing Syrup q.s. It can also be taken as an* **effervescent granule.**

Incompatibles.—Acids and Acidulous salts; all Vegetable astringents.

Official Preparations.—Mistura Ferri Composita and Pilula Ferri. Although not actually prepared from the Saccharated Iron Carbonate, they are here grouped for comparison.

Not Official.—Massa Ferri Carbonatis, Pilulæ Ferri Carbonatis, Trochisci Ferri Carbonatis Saccharati, Ferri Oxidum Saccharatum.

Foreign Pharmacopœias.—Official in Austr. and Swiss (Ferrum Carbonicum Saccharatum), contains about 20 p.c. of Carbonate; Belg. (Carbonas Ferri Saccharatus), 20 p.c.; U.S. contains 15 p.c.; Ger., Jap. and Russ., 9·5 to 10 p.c. of Iron equal to about 20 p.c. of Carbonate; Norw. (Hydratocarbonas Ferrosus Saccharatus). No Sugar: Jap. (Ferrum Subcarbonicum); and Mex. (Carbonato de Fierro). Not in the others.

Tests.—Saccharated Iron Carbonate dissolves with effervescence in diluted Hydrochloric Acid, and the solution yields with Potassium Ferrocyanide or Potassium Ferricyanide Solution a blue precipitate. It is officially required to contain about 33⅓ p.c. of the Ferrous Salt if reckoned as Ferrous Carbonate; the *U.S.P.* preparation is required to contain not less than 15 p.c. of Ferrous Carbonate, and the *P.G.* from 9·5 to 10 p.c. of Iron, corresponding to 19·7 to 20·7 p.c. of Ferrous Carbonate. The *B.P.* employs Volumetric Potassium Bichromate Solution for the determination, and Potassium Ferricyanide Solution as an indicator, dissolving the Carbonate in warm concentrated Phosphoric Acid, notwithstanding it having been shown that warming on a water-bath even for 10 minutes introduced an error of 25 p.c. The *U.S.P.* dissolves the Carbonate in Diluted Sulphuric Acid and performs the titration with Tenth-normal Volumetric Potassium Dichromate Solution. The *P.G.* converts the whole of Ferrous salt into the Ferric condition, and determines the total Ferric Iron with Potassium Iodide Solution, titrating the liberated Iodine with Tenth-normal Volumetric Sodium Thiosulphate Solution.

A 2 p.c. solution of the Carbonate in sufficient Hydrochloric Acid to effect solution and ensure a slight excess of acid should yield no pronounced turbidity with Barium Chloride Test Solution.

Barium Nitrate (or Chloride).—A solution of Saccharated Iron Carbonate prepared as above should not give more than a slight cloudiness with T S. of Barium Chloride, *U.S.P.* The *P.G.* requires that a solution of the Saccharated Iron Carbonate in Water (1–50) obtained by means of the least possible quantity of Hydrochloric should only be rendered slightly turbid by T.S. of Barium Nitrate, *P.G.*

Volumetric Determination.—The solution of 1 gramme of Saccharated Iron Carbonate in excess of warm concentrated Phosphoric Acid diluted with Water should require at least 29 c.c. of the Volumetric of Potassium Bichromate Solution, using Potassium Ferricyanide Solution as an indicator, *B.P.*; the solution obtained by dissolving 1·15 gramme in 10 c.c. of dilute Sulphuric Acid, diluted to about 100 c.c. with Water should require not less than 15 c.c. of Tenth-normal Volumetric Solution of Potassium Dichromate for complete oxidation, using Potassium Ferricyanide Solution as an indicator, *U.S.P.*; the *P.G.* directs that 1 gramme be dissolved in 10 c.c. of dilute Sulphuric Acid without heat. To this is added solution of Potassium Permanganate (5–1000) until the faint transitory reddening just becomes permanent, then 2 grammes Potassium Iodide. The mixture is allowed to stand for one hour in a closed vessel at ordinary temperatures, and then titrated with Tenth-normal Volumetric Solution of Sodium Thiosulphate; for combination with the free Iodine 17 to 17·8 c.c. of Tenth-normal Volumetric Solution of Sodium Thiosulphate should be necessary.

Preparations.

MISTURA FERRI COMPOSITA. Compound Mixture of Iron. *N.O.Syn.*—Griffith's Mixture.

Reduce 60 grains of Myrrh to powder, and mix it with 30 grains of Potassium Carbonate and 60 grains of Refined Sugar; form this into a smooth thin paste, by rubbing with a small quantity of Rose Water. Gradually add more Rose Water and 50 minims of Spirit of Nutmeg until the product measures 7 fl. oz. Dissolve 25 grains of Ferrous Sulphate in 3 fl. oz. of Rose Water, and mix with the above.

It is convenient to keep the first part of the mixture ready made, and to add the Ferrous Sulphate solution when required for use.

Dose.—½ to 1 fl. oz. = 14·2 to 28·4 c.c.

The following modification has been suggested by Mr. J. H. Franklin:—Saccharated Carbonate of Iron (with Glucose), 16 grains; Syrup of Glucose, 3 fl. drm.; Gum Acacia (in powder), 20 grains; Tincture of Myrrh, 4 fl. drm.; Spirit of Nutmeg, 50 minims; Rose Water to produce 10 fl. oz. Reduce the Saccharated Carbonate of Iron to a fine powder, triturate with the Syrup of Glucose and continue the trituration with a few drops of Rose Water to form a smooth thin paste, gradually add more of the Rose Water, and add the Acacia diffused in the Tincture of Myrrh and Spirit of Nutmeg, finally making the product measure 10 fl. oz. with Rose Water.—*P.J.* '07, ii. 155; *C.D.* '07, ii. 180.

This has been incorporated in the *B.P.C.* under the title **Mistura Ferri Carbonatis Composita.**

Foreign Pharmacopœias.—Official in Dan., similar to Brit., but with three times as much Sugar, and without Nutmeg; Norw., without Nutmeg, with Peppermint Water; Swed., Emulsio Myrrhæ Ferrata, with Peppermint Water and Tincture of Lavender in the place of Rose Water and Nutmeg; U.S. similar to Brit., but with Spirit of Lavender in the place of Nutmeg. Not in the others.

PILULA FERRI. Iron Pill.

Mix 150 grains of Syrup, 10 grains of Glycerin and 20 grains of Distilled Water; with this incorporate 150 grains of Exsiccated Ferrous Sulphate; add 95 grains of Exsiccated Sodium Carbonate,

and mix quickly. Allow 15 minutes for the salts to react, and make into a pill mass by the addition of 50 grains of powdered Gum Acacia and 15 grains of powdered Tragacanth.

If divided into 5-grain pills, each pill will contain about 1 grain of Ferrous Carbonate.

Dose.—5 to 15 grains = 0·32 to 1 gramme.

Pilula Ferri Carbonatis (*B.P.* '85).—Made with Saccharated Iron Carbonate, 4; Confection of Roses, 1; contains rather more Ferrous Carbonate than Pilula Ferri (*B.P.* '98).

The following modification has been suggested by Mr. J. H. Franklin:—Saccharated Carbonate of Iron (with Glucose), 648 grains; Liquorice Root (in powder), 162 grains; Liquid Glucose, 216 grains; Water, 54 grains. Make a mass, and divide into pills weighing 2½, 5 and 7½ grains each.—*P.J.* '07, ii. 115.

This has been incorporated in the *B.P.C.*

Vallet's mass is made by precipitating and washing the Iron Carbonate, and mixing it with Honey and Milk Sugar to form a mass. *See* below.

Blaud's Pills are made by mixing (in the pill mass) dried Ferrous Sulphate and dried Potassium or Sodium Carbonate. *See* below.

Foreign Pharmacopœias.—Official in Belg. and Dutch (Pilulæ Blaud), Dan. and Norw. (Pilulæ Blaudii) also (Pilulæ Ferri Compositæ), Fr. (Pilules de Carbonate Ferreux, formule de Vallet, and Pilules de Carbonate de Fer composées, Pilule de Blaud, Ger. and Jap. (Pilulæ Ferri Carbonici Blaudii), Austr. (Pilulæ Ferri Carbonici), Ital. (Pillole di Carbonato Ferroso) (Pillole di Blaud) also (Pillole di Vallet), Mex. (Pildoras de Blaud and Pildoras de Vallet), Port. (Pilulas de Carbonato Ferroso), Span. (Pildoras de Blaud), Swed. (Pilulæ Ferratæ Blaudii and Pilulæ Myrrhæ Ferratæ), Swiss (Pilulæ Ferratæ Blaudii and Pilulæ Ferri Carbonici) (Pil. Valleti); U.S. (Pilulæ Ferri Carbonatis) (Blaud's Pills), also (Massa Ferri Carbonatis) (Vallet's Mass). Not in the others.

Not Official.

MASSA FERRI CARBONATIS (Vallet's Mass).—Dissolve 100 of Ferrous Sulphate and 46 of Monohydrated Sodium Carbonate, each separately, in 200 of boiling Distilled Water, and, having added 20 of Syrup to the solution of the Iron salt, filter both solutions and allow them to become cold; gradually add the Iron solution to the Sodium solution in a 500 bottle, rotating it until Carbonic Acid gas no longer escapes. Add Distilled Water, *q.s.* to fill the bottle; then cork it and set aside so that the Ferrous Carbonate may subside. Pour off the supernatant liquid, and wash the precipitate with a mixture of Syrup 1, Water 19, by decantation until the washings no longer have a saline taste. Drain and press; mix the precipitate at once with 38 of Clarified Honey and 25 of Sugar, and evaporate the mixture in a tared dish on a water-bath, with constant stirring, until it is reduced to 100.—*U.S.*

PILULÆ FERRI CARBONATIS (Blaud's Pills).—Rub 8 grammes of Potassium Carbonate in a mortar with about 10 drops each of Glycerin and Water, then add 16 grammes of Ferrous Sulphate and 4 grammes of Sugar, previously triturated together to a uniform powder, and rub the mass thoroughly until it assumes a greenish colour. When the reaction has terminated incorporate 1 gramme of Tragacanth and 1 gramme of Althæa, and, if necessary, a little more Water, so as to obtain a mass of pilular consistence. Divide this into 100 pills. —*U.S.*

TROCHISCI FERRI CARBONATIS SACCHARATI.—Containing 3 grains of Saccharated Carbonate in each.

Dose.—1 to 3 lozenges.

FERRUM OXIDUM SACCHARATUM (*Ger.* and *Austr.*).—A reddish-brown powder, with a sweet, slightly ferruginous taste; a mixture of Hydrated Ferric Oxide and Sugar, containing the equivalent of 2·8 p.c. of Iron.

Dose.—5 to 15 grains = 0·32 to 1 gramme.

FERRI ET AMMONII CITRAS.

IRON AND AMMONIUM CITRATE.

Thin, translucent, deep ruby-red, odourless, deliquescent scales, possessing a ferruginous and somewhat astringent taste.

Solubility.—10 in 5 of Water, and measures 10¼; 2 dissolved in 3 of Water measure 4; almost insoluble in Alcohol (90 p.c.).

Medicinal Properties.—As a hæmatinic, it is a very effectual salt, and it possesses scarcely any astringency or tendency to cause gastric irritation or constipation; it may often be given when the stomach will not bear the more astringent preparations of Iron. It becomes moist if kept in paper.

A useful prescription for combating the anæmia which is often a marked feature of neurasthenia is Ferric Ammonium Citrate, 7 grains; Liquor Arsenicalis, 5 minims; Potassium Bromide, 10 grains; Liquor Ammon. Acet., 1 drm.; Chloroform Water, to 1 oz.—*B.M.J.* '06, i. 494.

Dose.—5 to 10 grains = 0·32 to 0·65 gramme.

Prescribing Note.—*Generally prescribed in solution with Tincture of Orange, which covers the taste well.*

An **Aqueous Solution,** 2 fl. oz. representing 480 grains of the scale preparation, is convenient for dispensing, and keeps well.

Incompatibles.—Mineral Acids, Vegetable astringents, and fixed Alkalis.

Official Preparation.—Vinum Ferri Citratis.

Not Official.—Mistura Ferri cum Ammonia.

Foreign Pharmacopœias.—Official in U.S., Jap. and Swiss (Ferrum Citricum Ammoniatum), Belg. (Ferrum Citricum), Fr. (Citrate de Fer Ammoniacal), Ital. (Citrato di Ferro Ammoniacale), Mex. (Citrato de Fierro Amoniacal), Norw. (Citras Ferrico-Ammonicus), Port. (Citrato de Ferro Ammoniacal), Swed. (Citras Ferricus), Swiss (Ferrum Citricum Ammoniatum), Span. (Citrato Ferrico-Amonico). Not in the others. Ger. has Ferrum Citricum Oxydatum.

Tests.—Iron and Ammonium Citrate has a faintly acid reaction towards blue Litmus paper. When incinerated with free access of air it leaves a residue of 31 or 32 p.c. of Ferric Oxide. An aqueous solution when heated with an excess of Potassium Hydroxide Solution evolves the distinctive odour of Ammonia, and yields a brownish-red precipitate, and if this precipitate be filtered off, the filtrate, when neutralised with Acetic Acid, yields on boiling with a little Calcium Chloride Solution a white precipitate.

Over and above the statement that when incinerated with free access of air it leaves 31 or 32 p.c. of Ferric Oxide, the *B.P.* gives no method for the determination of the Iron. The *U.S.P.* employs the Potassium Iodide process mentioned below, titrating the liberated Iodine with Tenth-normal Volumetric Sodium Thiosulphate Solution, using Starch Solution as an indicator. As thus determined, the percentage of metallic Iron should amount to not less than 16 p.c., equivalent to not less than 22·8 p.c. of Ferric Oxide.

The more generally occurring impurities are fixed alkalis, Tartrates and Sulphates. Fixed Alkalis may be detected by the reaction

of the ash towards Litmus paper; it should not show an alkaline reaction towards red Litmus paper. Tartrates are indicated by the appearance of a crystalline precipitate on the addition of an excess of Acetic Acid to the filtrate after removal of the Iron by boiling with Potassium Hydroxide Solution. An aqueous solution should yield no pronounced turbidity with Barium Chloride Solution.

Volumetric Determination.—The *U.S.P.* directs that 0·555 gramme of the salt be dissolved in 15 c.c. of Water and 2 c.c. of Hydrochloric Acid in a glass stoppered flask having a capacity of about 100 c.c., and 1 gramme of Potassium Iodide added. The flask is then securely closed and the mixture kept at a temperature of 40° C. (104° F.) for half an hour and then cooled. When titrated with Tenth-normal Volumetric Solution of Sodium Thiosulphate, using Starch T.S. as indicator, the mixture should require not less than 16 c.c. of the Volumetric Solution to discharge the colour of the liquid.

Preparation.

VINUM FERRI CITRATIS.—Wine of Iron Citrate.

Iron and Ammonium Citrate, 160 grains; Orange Wine, *q.s.* to yield 20 fl. oz. (1 grain in each fl. drm.)

Dose.—1 to 4 fl. drm. = 3·6 to 14·2 c.c.

Official in Jap. (Vinum Ferri), 1 in 50; Mex. (Vino de Fierro), 1 in 150; Span. (Vino Calibeado), 1 and 200 of Malaga.

Vinum Ferri (*U.S.*).—Iron and Ammonium Citrate, 4; Tincture of Sweet Orange Peel, 6; Syrup, 10; White Wine, *q.s.* to produce 100.

Vinum Ferri Amarum, *see* p. 517.

Not Official.

MISTURA FERRI CUM AMMONIA.—Iron and Ammonium Citrate, 10 grains; Aromatic Spirit of Ammonia, 30 minims; Infusion of Quassia, to 1 fl. oz.—*King's.*

Iron and Ammonium Citrate, 5 grains; Aromatic Spirit of Ammonia, 10 minims; Spirit of Chloroform, 5 minims; Infusion of Quassia, to 1 fl. oz.—*Royal Free.*

FERRI ET QUININÆ CITRAS.

IRON AND QUININE CITRATE.

Thin, transparent, pale yellowish-green, deliquescent scales possessing a bitter and ferruginous taste.

It should be kept in well-closed vessels and protected as far as possible from the light.

Solubility.—2 in 1 of Water.

Medicinal Properties.—Bitter stomachic and tonic, combining the properties of both Iron and Quinine.

6¾ grains contain 1 grain of Quinine.

Dose.—5 to 10 grains = 0·32 to 0·65 gramme.

Prescribing Notes.—*Generally given in Mixture with Tincture of Orange and Spirit of Chloroform, or Syrup of Orange; or in Pills made with Alcohol* (90 *p.c.*) *q.s. It is sometimes prescribed with Potassium Citrate or Lithium Citrate, both of which have a tendency to throw out Quinine Citrate. It can be given in the form of Effervescent Granules, dose one teaspoonful.*

For dispensing purposes, it is convenient to keep an aqueous **solution**, 2 *fl. oz.* = 480 *grains of the salt.*

Incompatibles.—Alkalis, their Carbonates and Citrates, Lithium Citrate, Tannic Acid, and vegetable astringents.

Not Official.—Vinum Ferri Amarum, Vinum Ferri et Quininæ, Ferri Quininæ et Strychninæ Citras, Ferri et Strychninæ Citras.

Foreign Pharmacopœias.—Official in Austr. (Ferrum Citricum Chiniatum); Ger., Jap. and Russ. (Chininum Ferro-Citricum); Dan. (Citras Ferricus cum Chinina); Norw. (Citras Ferricus cum Chinino); Port. (Citrato de Ferro e de Quinina); Swed. (Citras Ferrico-Chinicus); Swiss (Chinino-Ferrum Citricum); U.S. Not in the others. U.S. has also Ferri et Quininæ Citras Solubilis.

Tests.—Iron and Quinine Citrate dissolves readily in Water, yielding a solution which is very faintly acid in reaction towards blue Litmus paper. The aqueous solution yields with Potassium Hydroxide Solution a reddish-brown precipitate, and when heated evolves Ammonia (which fact is not noticed in *B.P.*); with Ammonia Solution it yields a white curdy precipitate, with Potassium Ferrocyanide and with Potassium Ferricyanide blue precipitates, with Tannic Acid a bluish-black precipitate.

It is officially required to contain 15 p.c. of Ether-soluble alkaloid, which when neutralised by Sulphuric Acid should answer to the tests for Quinine Sulphate. No standard for the percentage of Iron is given. The *U.S.P.* requires the salt to contain not less than 11·5 p.c. of dried Quinine, and Ferric Citrate corresponding in amount to not less than 13·5 p.c. of metallic Iron. The *P.G.* preparation contains from 9 to 10 p.c. of Quinine, and is required to leave not less than 30 p.c. of Iron Oxide on ignition. An outline of the method adopted by the *B.P.* for the determination of the Quinine is given below. The extracted alkaloid is required to be almost entirely soluble in a little purified Ether, to leave but a minute residue on ignition, and, when neutralised by Sulphuric Acid, to answer the tests distinctive of Quinine Sulphate. The *U.S.P.* employs Chloroform as a solvent for the Quinine, and requires that the dried residue should conform to the reactions and tests for Quinine. The Iodometric method is adopted for the determination of the Iron, the determination being conducted on the liquid remaining after the removal of the Quinine. The *P.G.* employs Ether as a solvent in the Quinine determination. Allen has pointed out that in shaking out with Chloroform or Ether a considerable excess of Ammonia should be present, and the volume of the solvent should equal that of the ammoniacal liquid. The alkaloidal residue should be dried at 110° to 120° C. (230° to 248° F.), a constant weight being difficult to obtain at a water-bath temperature.

The more generally occurring impurities are fixed alkalis, which may be detected by the alkaline reaction of the residue left on ignition, and Tartrates, which yield a crystalline precipitate, when Acetic Acid is added in slight excess to the filtrate after removal of the Iron by precipitation with boiling Potassium Hydroxide Solution.

Gravimetric Determination.—Dissolve a weighed quantity of 5 grammes of the salt in 45 c.c. of Water, add Ammonia Solution in slight excess, extract

the liberated alkaloid by repeated shakings with Ether. Separate the ethereal solutions, mix, evaporate to dryness, and when completely dried at 120° C. (248° F.), cool and weigh. The residue should amount to 0·75 gramme, *B.P.*; a weighed quantity of 1·11 gramme of the salt is dissolved in 20 c.c. of Water, transferred to a separator, rendered alkaline with 5 c.c. of Ammonia Solution, and the mixture shaken out for 1 minute with 10 c.c. of Chloroform. The chloroformic layer is separated and the agitation twice repeated with successive quantities each of 10 c.c. of Chloroform. The Chloroform solutions are mixed, transferred to a tared dish, the Chloroform evaporated spontaneously, the residue dried at 100° C. (212° F.) till constant in weight. It should weigh not less than 0·1276 gramme, which is equivalent to at least 11·5 p.c. of Quinine. The aqueous liquid from the above determination is freed from Chloroform by heating on a water-bath until all ammoniacal and chloroformic odours have disappeared, cooled, and diluted with Water to 50 c.c. A measured quantity of 25 c.c. is transferred to a glass stoppered flask capable of holding about 100 c.c., 3 c.c. of Hydrochloric Acid and 1 gramme of Potassium Iodide added, the flask securely stoppered, and the mixture allowed to stand half an hour at 40° C. (104° F.). When cool not more than 13·5 c.c. of Tenth-normal Volumetric Sodium Thiosulphate shall be required to discharge the colour of the liquid, Starch Solution being employed as an indicator. 1 c.c. of Tenth-normal Volumetric Sodium Thiosulphate Solution indicating 1 p.c. of metallic Iron, *U.S.P.*; a weighed quantity of 1 gramme of the salt is dissolved in 4 c.c. of Water, and sufficient Sodium Hydroxide Solution (15 p.c.) added to ensure a strongly alkaline reaction. The mixture is then shaken out three times in succession with 7 c.c. of Ether. The separated ethereal layers are mixed, evaporated to dryness, and the residue dried at 100° C. (212° F.). It should weigh at least 0·09 gramme, *P.G.*

Not Official.

VINUM FERRI AMARUM.—Soluble Iron and Quinine Citrate, 5; Tincture of Sweet Orange Peel, 6; Syrup, 30; White Wine, *q.s.* to produce 100.—*U.S.P.*

VINUM FERRI ET QUININÆ.—Iron and Quinine Citrate, 2; Detannated Sherry, *q.s.* to produce 100.—*B.P.C.*

Ferri, Quininæ et Strychninæ Citras, resembling the above but containing in addition 1 p.c. of Strychnine, and **Ferri et Strychninæ Citras** (*U.S.*), similar to the above but without Quinine, are both scale preparations, the doses of which are 2 to 5 grains = 0·13 to 0·32 gramme.

Not Official.

FERRI HYPOPHOSPHIS.

There are two Iron Hypophosphites, the Ferrous and the Ferric. The latter is used in most of the American and other proprietary Syrups of the Hypophosphites. The Ferric salt has now replaced the Ferrous salt in the *B.P.C.* preparations.

FERROUS HYPOPHOSPHITE, when freshly prepared, is a greenish crystalline powder, soluble about 1 in 10 of Water, but the commercial salts are so insoluble as to be practically useless for pharmaceutical purposes.

FERRIC HYPOPHOSPHITE.—This compound is obtained as a white precipitate on adding a solution of a soluble Hypophosphite to one of Ferric Chloride containing as little free acid as possible.

It is fairly insoluble in Water, but with the addition of Potassium Citrate it dissolves readily to a green solution, which forms with Sugar a pale yellow *neutral* Syrup, permanent and unalterable by exposure to air, which may be combined with other soluble Hypophosphites, Quinine Hydrochloride, and Strychnine without the addition of acid, and is free from all the pharmaceutical objections attaching to Hypophosphite Syrups containing Iron in the ferrous condition.

Official in U.S.

It is usually sold as **Compound Syrup of Hypophosphites**, and is also made without Quinine to suit those who are peculiarly susceptible to that drug; it is then prescribed 'sine Quinina.'

LIQUOR FERRI HYPOPHOSPHITIS FORTIS. — Solution of Ferric Sulphate, 14·2; Solution of Ammonia, 23; Citric Acid, 7·6; Sodium Hypophosphite, 9·6; Sodium Citrate, 6·6; Distilled Water *q.s.* and Chloroform Water (1 in 200) *q.s.* to produce 100.—*B.P.C.*

This formula was devised (*Y.B.P.* '07, 265) as an improvement on the old *B.P.C.* method.

The solution of Ferric Sulphate is diluted with an equal volume of Water and added to the solution of Ammonia also diluted with an equal volume of Water. After the precipitated Ferric Hydroxide has subsided sufficiently, wash it by decantation with Distilled Water until free from Sulphates, collect the precipitate and drain it; dissolve it in the Citric Acid previously dissolved in 20 of Distilled Water by the aid of a water-bath. When the solution is clear add the Sodium Hypophosphite and continue the heat until a clear greenish solution is produced; add the Sodium Citrate, filter and pass sufficient Chloroform Water through the filter to make up 100 of product.

The *B.P.C. Supplement* replaces the 14·2 of solution of Ferric Sulphate by 12·9 of Ferric Citrate.

LIQUOR HYPOPHOSPHITUM.—Calcium Hypophosphite, 3·5; Sodium Hypophosphite, 2; Potassium Hypophosphite, 1·75; Citric Acid, 1·6; Water, *q.s.* to produce 100; dissolve and filter.—*U.S.N.F.* 1896.

This has been incorporated in the *B.P.C.*

In *U.S.N.F.* 1906 the 1·6 of Citric Acid is replaced by 0·6 of Hypophosphorous Acid, *U.S.P.*

Dose.—10 to 30 minims = 0·6 to 1·8 c.c.

LIQUOR HYPOPHOSPHITUM COMPOSITUS. *Syn.* Liquor Ferri Hypophosphitis Compositus.—Dissolve 320 grains of Calcium Hypophosphite, 320 grains of Sodium Hypophosphite, and 160 grains of Magnesium Hypophosphite in 12 fl. oz. of Distilled Water, add 6 fl. oz. of Strong Solution of Ferric Hypophosphite; filter, and add Distilled Water to make the product 20 fl. oz.—*B.P.C. Formulary* 1901.

Each fl. drm. = 2 grains each of Sodium and Calcium Hypophosphites, 1 grain Magnesium Hypophosphite, and 1½ grains of Ferric Hypophosphite.

Dose.—½ to 2 fl. drm. = 1·8 to 7·1 c.c.

This has been incorporated in the *B.P.C.* as follows:—Calcium Hypophosphite, 3·5; Magnesium Hypophosphite, 1·75; Sodium Hypophosphite, 3·5; Strong Solution of Ferric Hypophosphite, 30; Distilled Water, sufficient to produce 100.

SYRUPUS FERRI HYPOPHOSPHITIS. — Strong Solution of Ferric Hypophosphite, 1; Syrup, 4.—*B.P.C. Formulary* 1901, incorporated in the *B.P.C.*

Each fl. drm. = about 1 grain of Ferric Hypophosphite.

Dose.—½ to 2 fl. drm. = 1·8 to 7·1 c.c.

SYRUPUS HYPOPHOSPHITUM.—Calcium Hypophosphite, 4·5; Potassium Hypophosphite, 1·5; Sodium Hypophosphite, 1·5; Diluted Hypophosphorous Acid, 0·20; Tincture of Fresh Lemon Peel, 0·5; Sugar, 65; Water, *q.s.* to make 100.—*U.S.P.*

Dissolve the Hypophosphites in 45 of the Water, add the Tincture and the Acid; filter, and in the filtrate dissolve the Sugar without heat; make up to 100 with Water.

This has been incorporated in the *B.P.C.*

SYRUPUS HYPOPHOSPHITUM COMPOSITUS. — Calcium Hypophosphite, 80 grains; Manganese Hypophosphite, 40 grains; Potassium Hypophosphite, 40 grains; Quinine Hypophosphite, 20 grains; dissolve in 8 fl. oz. of Chloroform Water; add 1 grain of Strychnine dissolved in 1 fl. drm. of Hypophosphorous Acid; and then 1 fl. oz. of Strong Solution of Ferric Hypophosphite; add 14 oz. of Refined Sugar and dissolve without heat; add sufficient Chloroform Water to make 20 fl. oz. and strain through flannel.—*B.P.C.*

Each fl. drm. contains $\frac{1}{160}$ grain Strychnine, and $\frac{1}{8}$ grain of Quinine Hypophosphite.

Dose.—$\frac{1}{2}$ to 2 fl. drm. = 1·8 to 7·1 c.c.

The employment of Potassium Citrate (1·033 gramme) in the place of Ammonium Citrate for dissolving the precipitated Ferric Hypophosphite, as originally recommended in the *Companion*, is also advocated.—*P.J.* '02, ii. 532.

Syrupus Hypophosphitum Compositus.—Rub 2·25 of Ferric Hypophosphite and 2·25 of Manganese Hypophosphite with 3·75 of Sodium Citrate, add 30 c.c. of Water and warm the mixture for a few minutes, until a clear greenish solution is obtained. Dissolve 35 of Calcium Hypophosphite, 17·5 of Potassium Hypophosphite in a mixture of 450 c.c. of Water, and 5 c.c. of Diluted Hypophosphorous Acid; then dissolve 1·10 of Quinine and 0·115 of Strychnine in a mixture of 30 c.c. of Water and 10 c.c. of Diluted Hypophosphorous Acid; mix the solutions and finally dissolve in them 775 of sugar. Strain the Syrup, if necessary, and add Water *q.s.*, through the strainer, to produce 1000 c.c.—*U.S.*

Not Official.

FERRI IODIDUM.

IRON IODIDE.

FeI_2, eq. 307·40.

In reddish-brown, deliquescent dense masses, easily soluble in Water, leaving only a slight residue, and forming a reddish-yellow solution owing to partial oxidation. The solution may be made green by either hot or cold digestion over bright Iron Wire.

Medicinal Properties.—It combines the properties both of Iodine and Iron, and is a most valuable tonic and alterative in the treatment of scrofulous and syphilitic diseases.

Prescribing Notes.—*Best given in the form of the official Syrup of Ferrous Iodide; it is also given in the form of pills massed with powdered Gum Acacia and Dispensing Syrup, q.s. In some cases Liquorice Powder must be used instead of Dispensing Syrup.*

Official Preparation.—Syrupus Ferri Iodidi.

Foreign Pharmacopœias.—Official in Mex. (Yoduro Ferroso) and Port. Not in the others. Jap. has Ferrum Iodati Saccharatum.

LIQUOR FERRI IODIDI FORTIS.—A clear, greenish liquid.

Each fl. drm. contains 44 grains of Ferrous Iodide (FeI_2 = 307·40). It can be diluted 1 to 7 with Syrup to prepare a Syrup of Iron Iodide, or with Water to make Liquor Ferri Iodidi the same strength as the Syrup.

With the addition of a small quantity of Hypophosphorous Acid, the solution will keep well for a long time; but in this case, when diluting with Syrup, it must be remembered that the official Syrup does not contain Hypophosphorous Acid.

The *B.P.C.* gives a formula for the strong Liquor containing 7·5 p.c. of Diluted Hypophosphorous Acid (*U.S.P.*).

Foreign Pharmacopœias.—Official in Belg., Ger. (Liquor Ferri Iodati), Russ. and Swiss (Ferrum Iodatum Solutum); all contain 50 p.c. of Ferrous Iodide; Mex. (Solucion oficinal de Yoduro ferroso) 20 p.c.

Incompatibles.—Acids, Acid salts, Alkalis and their Carbonates, Lime Water, vegetable astringents.

PILULÆ FERRI IODIDI (*U.S.*).—Reduced Iron, 4 grammes; Iodine, 5 grammes; Glycyrrhiza, in No. 60 powder, 4 grammes; Sugar, in fine powder, 4 grammes; Extract of Glycyrrhiza, in fine powder, 1 gramme; Acacia, in fine powder, 1 gramme; Water, a sufficient quantity. To the Reduced Iron, contained in a small mortar, add 6 c.c. of Water, and then gradually the Iodine, constantly

triturating, until the mixture ceases to have a reddish tint. Then add the remaining powders, previously well mixed together, and mix the whole thoroughly. Transfer the mass to a porcelain capsule, and evaporate the excess of moisture, on a water-bath, with constant stirring, until the mass has acquired a pilular consistence. Coat with Balsam of Tolu dissolved in Ether. To make 100 pills.

Pilula Ferri Iodidi was official in *B.P.* '85, but omitted in 1898: it has been incorporated in the *B.P.C.*

Foreign Pharmacopœias.—Official in Belg., Dan., Dutch, Fr., Ital., Mex., Norw., Port., Span., Swed. and Swiss, each pill contains about ¾ grain Iodide of Iron: Hung., about 1 grain; and all coated with Balsam of Tolu dissolved in Ether, except Dutch, which uses Tolu in Chloroform, and Swiss, not coated. Not in the others.

Official Preparation.

SYRUPUS FERRI IODIDI. Syrup of Ferrous Iodide.

Iron Wire, ½ oz.; Iodine, 726 grains; Refined Sugar, 16½ oz.; Distilled Water, *q.s.* to produce 20 fl. oz. of a pale green Syrup containing 3 grains of Ferrous Iodide in 33 minims.

Dose.—30 to 60 minims = 1·8 to 3·6 c.c.

This Syrup is very liable to become discoloured. It may be due to one or other of two causes: (1) Oxidation of Iron, which may be prevented by careful manipulation, or removed by Hypophosphorous Acid. (2) Slight caramelisation of the Sugar by overheating; this cannot be removed by reducing agents.

Foreign Pharmacopœias.—Official in Brit., 9·83 to 10 p.c. of Iron Iodide; Austr., Belg., Dan., Dutch, Ger., Jap., Russ., Span., Swiss and U.S., 5 p.c.; Fr. and Port., 0·5 p.c.; Hung., 12·2 p.c.; Ital., 0·6 p.c.; Mex., 1 p.c.; Norw. and Swed., 10 p.c. All by weight.

The *Brussels Conference* agreed to a strength of 5 p.c. anhydrous Ferrous Iodide.

Tests.—Syrup of Ferrous Iodide has a specific gravity of 1·380 to 1·387; the *U.S.P.* syrup a specific gravity of about 1·349 at 25° C. (77° F.). When diluted with Water it affords with Potassium Ferricyanide Solution a dark blue precipitate. The diluted syrup mixed with Starch Solution yields on the addition of a little Chlorine Water a deep blue coloration. It is officially required to contain not less than 9·83 p.c. w/v, equivalent to 7·1 p.c. w/w, nor more than 10·14 p.c. w/v, equivalent to 7·31 p.c. w/w, of anhydrous Ferrous Iodide, as determined by decomposition of the Ferrous Iodide with Sodium Carbonate and titration of the exactly neutralised solution of Sodium Iodide with Volumetric Silver Nitrate Solution, using Potassium Chromate Solution as an indicator. The *U.S.P.* syrup is required to contain about 5 p.c. w/w, equivalent to 6·74 p.c. w/v of Ferrous Iodide. The Ferrous Iodide is estimated by indirect titration with Tenth-normal Volumetric Silver Nitrate Solution, the excess of Silver being titrated with Tenth-normal Volumetric Potassium Sulphocyanate Solution, Ferric Ammonium Sulphate Solution being used as an indicator. The standard of 5 p.c. w/w of anhydrous Ferrous Iodide is that suggested by the Brussels Conference for the unification of the pharmacopœial formulas for potent drugs. Several processes claiming to be improvements on the official method of determination have been suggested, but do not appear to have been adopted.

The *B.P.C.* in an explanatory footnote to the preparation stated that it contained 1 p.c. of Ferrous Iodide. This was obviously incorrect, and has since been rectified.

Volumetric Determination.—A measured quantity of 10 c.c. (equivalent to 13·87 grammes) of the Syrup is introduced into a flask of 100 c.c. capacity containing 1 gramme of dried Sodium Carbonate dissolved in 10 c.c. of Water. The mixture is shaken until complete interaction has taken place; sufficient Water is added to bring the volume of the liquid to 100 c.c., the whole mixed and filtered. A measured quantity of 25 c.c. of the filtrate is exactly neutralised with diluted Nitric Acid and titrated with Volumetric Silver Nitrate Solution, using Potassium Chromate Solution as an indicator; not less than 16·0 nor more than 16·5 c.c. should be required, *B.P.*; a weighed quantity of 10 grammes should be diluted with Water to 100 c.c. and 15·4 c.c. of the solution be mixed with 15 c.c. of Water, 6 c.c. of Tenth-normal Volumetric Silver Nitrate Solution and 2 c.c. each of diluted Nitric Acid and Ferric Ammonium Sulphate Solution are added and the mixture thoroughly shaken. On titration with Tenth-normal Potassium Sulphocyanate Solution not more than 1 c.c. should be required to produce a permanent reddish-brown tint; 1 c.c. of Tenth-normal Volumetric Silver Nitrate Solution corresponds to 1 p.c. of Ferrous Iodide, *U.S.P.*

FERRI LACTAS.

See under ACIDUM LACTICUM.

Not Official.

FERRI PERCHLORIDUM.

FERRIC CHLORIDE.

N.O.Syn.—CHLORETUM FERRICUM.

The commercial solid, or crystalline, Ferric Perchloride approximates to the formula $Fe_2Cl_6.12H_2O$, eq. 536·90; it occurs in yellow, or yellowish-brown, crystalline masses, deliquescing in air. It is soluble in Water, Alcohol (90 p.c.), Ether and Glycerin.

Medicinal Properties.—A powerful local styptic. 3 grains to an oz. of Water for a **spray**; 60 to 120 grains to an oz. of Water or Diluted Glycerin (Glycerin 1 and Water 1) for a **paint.**

2½ oz. dissolved in 1 oz. of Water makes a solution about the same strength as Liquor Ferri Perchlor. Fort.

For **Incompatibles,** *see* Tinctura Ferri Perchloridi.

The Anhydrous Ferric Chloride (Fe_2Cl_6, eq. 322·34), prepared by sublimation, is in black metallic-looking plates. It deliquesces rapidly on exposure to the air, and then solidifies again to a Hydrate ($Fe_2Cl_6.12H_2O$), containing almost 40 p.c. of Water. Another Hydrate ($Fe_2Cl_6.5H_2O$), containing 21·7 p.c. of Water (official in the Portuguese Pharmacopœia), can be obtained by evaporating an acid solution until syrupy, and then cooling it.

Foreign Pharmacopœias.—Official in Austr. and Hung. (Ferrum Sesquichloratum Crystallisatum); Dan., Dutch, Norw. and Swed. (Chloretum Ferricum); Mex. (Cloruro Ferrico); Port. (Chloreto Ferrico Anhydro), also Crystallisado; Ger., Jap. and Russ. (Ferrum Sesquichloratum); Span. (Chloruro Ferrico) (Anhydrous and the Hydrate); Swiss (Ferrum Sesquichloratum); U.S. (Ferri Chloridum).

FERRI PERCHLORIDI LIQUOR FORTIS.

STRONG SOLUTION OF FERRIC CHLORIDE.

A dark reddish-brown liquid, possessing a powerfully styptic taste; readily miscible with Water, and Alcohol (90 p.c.).

Medicinal Properties.—A powerful local styptic and astringent; escharotic. The more dilute forms are used internally to arrest hæmorrhage in the gastro-intestinal or urinary tracts. *See* also 'Tinctura Ferri Perchloridi,' p. 524.

The liquor (not fortis) in ½ drm. doses thrice daily for hæmorrhagic gastric oozing.—*L.* '06, ii. 1189.

Official Preparations.—Liquor Ferri Perchloridi and Tinctura Ferri Perchloridi.

Not Official.—Glycerinum Ferri Perchloridi, Liquor Ferri Chloroxydi, Liquor Ferri Dialysatus, Liquor Ferri Oxychlorati, Mistura Ferri Amara, Mistura Ferri Aromatica, Mistura Chalybeata, Mistura Ferri cum Magnesii Sulphate, Mistura Ferri Salina, Syrupus Ferri Subchloridi, Tinctura Ferri Chlorati Ætherea, Tinctura Ferri Sesquichloridi, and Tinctura Ferri Muriatis.

Foreign Pharmacopœias.—Official in Austr., sp. gr. 1·280 to 1·290 (10 p.c. of Iron); Belg., sp. gr. 1·28 (29 p.c. Iron Chloride); Dan. and Swed., sp. gr. 1·298 to 1·302 (10 p.c. of Iron); Dutch, sp. gr. 1·470 to 1·482 (75 p.c. of Iron Chloride); Fr., Port. and Span., sp. gr. 1·260 (about 9 p.c. of Iron); Jap. and Norw., sp. gr. 1·280 to 1·282 (10 p.c. of iron); Mex., sp. gr. 1·260 (26 p.c. of anhydrous Iron Chloride); Swiss, sp. gr. 1·280 to 1·290 (about 10 p.c. of Iron); Ger., Hung. and Russ. sp. gr. 1·280 to 1·282 (10 p.c. of Iron); Ital., sp. gr. 1·28 to 1·29 (10 p.c. of Iron, 29 p.c. Iron Chloride); U.S., sp. gr. 1·315 at 25° C. (77° F.) (10 p.c. of Iron, 29 p.c. Iron Chloride).

Tests.—Strong Solution of Ferric Chloride has, according to the *B.P.*, a specific gravity of about 1·42, but there is a discrepancy between the Pharmacopœia figure for Oxide and this figure. The *U.S.P.* Liquor has a specific gravity of 1·280 to 1·290 at 25° C. (77° F.); the *P.G.* Liquor 1·280 to 1·282. The diluted solution answers the tests distinctive of Ferric salts given under Ferrum. Silver Nitrate Solution produces in the diluted solution, acidified with Nitric Acid, a white curdy precipitate, insoluble in Nitric Acid, but readily soluble in Ammonia Solution. It is officially required to indicate 32·0 p.c. w/v of Iron Oxide, which is equivalent to 39·8 p.c. of anhydrous Ferric Chloride. The *U.S.P.* preparation is required to contain not less than 29 p.c. of anhydrous Ferric Chloride, corresponding to 10 p.c. of metallic Iron. The method of determination adopted by the *B.P.* is a gravimetric one. The Iron is precipitated as Hydroxide, ignited and weighed as Oxide; the precipitate obtained by adding an excess of Ammonia Solution to a measured quantity of 5 c.c. diluted with 80 c.c. of Water, when well washed and ignited should leave a residue weighing 1·6 grammes. The *U.S.P.* process is volumetric, and is described below. The amount of Oxide yielded by the *B.P.* process has been shown (*C.D.* '99, ii. 220; '00, ii. 163; *Y.B.P.*, '99, 361; *P.J.*, '99, ii. 44, 63, 133; '00, ii. 106) to be at variance with the specific gravity. A sample made strictly in accordance with the *B.P.* gave 1·604 grammes of Iron Oxide per 5 c.c., but possessed a specific gravity of 1·488 instead of 1·42.

The more generally occurring impurities are Ammonium, Arsenic, Calcium, Copper, Lead, Potassium, Sodium and Zinc; Nitrates and Ferrous salts. Of these the more important are Arsenic, Copper, Lead and Zinc. Arsenic may be detected by Bettendorf's test with Stannous Chloride Solution; Copper and Zinc by Hydrogen Sulphide, using the filtrate after removal of the Iron by Ammonia Solution, or by Potassium Ferrocyanide Solution after removal of the Iron with excess of Ammonia Solution; Lead by precipitation as Sulphate.

Nitrates are examined for by the Ferrous Sulphate test, and Ferrous salts with Potassium Ferricyanide Solution.

A test for Oxychloride with Tenth-normal Volumetric Sodium Thiosulphate Solution is given in the *P.G.* and *U.S.P.* Each of these tests is given in small type below.

Zinc Iodide Starch Solution.—Strips of paper soaked with Zinc Iodide Starch Solution should not be coloured blue when brought near to Liquor Ferri Sesquichlorati, *P.G.*

Potassium Ferrocyanide.—Diluted Solution of Ferric Chloride yields a dark blue precipitate with T.S. of Potassium Ferrocyanide, *P.G.* and *U.S.P.* If 5 c.c. of Ferric Chloride Solution diluted with 20 c.c. of Water be mixed with excess of T.S. of Ammonia and the mixture filtered a colourless filtrate should be obtained, which when supersaturated with Acetic Acid should not be affected by T.S. of Potassium Ferrocyanide, *P.G.*

Potassium Ferricyanide.—Solution of Ferric Chloride diluted with 10 parts of Water and acidulated with Hydrochloric Acid should not produce a blue coloration with T.S. of Potassium Ferricyanide, *P.G.* The *U.S.P.* directs that a few drops of freshly-prepared T.S. of Potassium Ferricyanide be added to a diluted portion of Solution of Ferric Chloride (1–20), a pure brown colour should be produced which should not turn green or greenish-blue at once.—*U.S.P.*

Sodium Thiosulphate.—Three drops of Ferric Chloride Solution heated slowly to boiling with 10 c.c. of Tenth-normal Volumetric Solution of Sodium Thiosulphate should not give a precipitate of Ferric Hydroxide, *U.S.P.* and *P.G.*

Residue.—If to Ferric Chloride Solution (5 c.c. diluted with 20 c.c. of Water, *P.G.*) there be added excess of T.S. of Ammonia, and the mixture filtered, a colourless filtrate should be obtained which should not yield a weighable residue on evaporation and gentle ignition, *U.S.P.* and *P.G.*

Hydrogen Sulphide.—A portion of the filtrate obtained as described in the Residue test above should not yield a precipitate with T.S. of Hydrogen Sulphide, *U.S.P.*

Barium Nitrate.—Another portion of this filtrate should not be affected by T.S. of Barium Nitrate, *P.G.*

Ferrous Sulphate.—A third portion of 2 c.c. of this filtrate, mixed with 2 c.c. of Sulphuric Acid and 1 c.c. of T.S. of Ferrous Sulphate carefully poured over this as a layer, should not give a brown ring, *P.G.* The *U.S.P.* directs that a clear crystal of Ferrous Sulphate be added to a cooled mixture of equal volumes of Sulphuric Acid and a diluted portion of Solution of Ferric Chloride Solution (1–10); the crystal should not become coloured brown, nor should a brownish-black colour develop around it.

Stannous Chloride.—A mixture of 1 c.c. of Ferric Chloride Solution and 3 c.c. of T.S. of Stannous Chloride should not assume a dark colour in the course of an hour, *P.G.*

Volumetric Determination.—The *U.S.P.* gives the following instructions: 10 grammes of the Solution are diluted to measure 100 c.c. and 11·1 c.c. of this mixture are introduced into a glass stoppered bottle of 100 c.c. capacity, together with 10 c.c. of Water and 2 c.c. of Hydrochloric Acid. 1 gramme of

Potassium Iodide is then added and the mixture kept at a temperature of 40° C. (104° F.) for half an hour, then cooled and mixed with a few drops of T.S. of Starch. The mixture when titrated with Tenth-normal Volumetric Solution of Sodium Thiosulphate should require not less than 20 c.c. of the Volumetric Solution to discharge the blue or greenish colour; 1 c.c. of the V.S. is equivalent to 0·5 p.c. of metallic Iron.

Preparations.

LIQUOR FERRI PERCHLORIDI. SOLUTION OF FERRIC CHLORIDE.

Dilute 1 of Strong Solution of Ferric Chloride with Distilled Water to make 4 of a liquid, sp. gr. 1·110. (1 in 4)

Dose.—5 to 15 minims = 0·32 to 1·0 gramme.

This solution and the 'Tincture of Ferric Chloride' contain identical proportions of Ferric Chloride; for 'Prescribing Notes' *see* below.

TINCTURA FERRI PERCHLORIDI.—TINCTURE OF FERRIC CHLORIDE. *N.O.Syn.*—STEEL DROPS. TINCTURE OF STEEL.

Mix 1 of Strong Solution of Ferric Chloride with 1 of Alcohol (90 p.c.), and add Distilled Water to make 4. (1 in 4)

Medicinal Properties.—Astringent, tonic, hæmostatic. Given in passive hæmorrhage and to arrest hæmorrhage in typhoid. As a general tonic during convalescence; highly useful in anæmia; valuable in large doses for faucal and for erysipelatous inflammations. A rectal injection of 60 minims of the Tincture in half a pint of Water kills thread-worms.

Recommended (*L.* '04, ii. 1178, 1248, 1415), not only in puerperal septicæmia, but also in local and general septic infection occurring in gynæcological practice. 15 to 25 minims every two hours strongly recommended in blood poisoning. —*L.* '04, ii. 1313.

If Potassium Iodide be added to an aqueous solution of Potassium Citrate, and Tincture of Ferric Chloride added, a yellowish-green solution is obtained, containing no free Iodine, and remaining permanent for months at least. This is suggested (*C.D.* '05, ii. 971; *P.J.* '05, ii. 861) as a means of overcoming the incompatibility of Potassium Iodide and Ferric Chloride solutions.

Dose.—5 to 15 minims = 0·3 to 0·9 c.c.

Prescribing Notes.—*Preparations of Iron can be given in Infusion of Quassia, or Calumba, but they tinge Infusion of Chiretta and Hops, and change to brown or black those of Cusparia, Gentian, Orange, Cascarilla, Cinchona, Cloves, Digitalis, and all astringent infusions.*

Glycerin is better than an equal quantity of Syrup for masking the unpleasant astringent taste of Ferric Chloride Solutions. Chloroform Water is also useful.

Equal volumes of Liquor Ferri Perchloridi and Glycerin forms a good paint in faucal inflammation.

Styptic Wool, containing Ferric Chloride, is useful for local application.

Incompatibles.—Alkalis and their Carbonates, Lime Water, Calcium Carbonate, Magnesia and its Carbonate, Salicylates, Mucilage of Acacia.

Foreign Pharmacopœias.—Official in Dan., Norw. and Swed. (Solutio Chloreti Ferrici Spirituosa); Dan. and Swed., also (Solutio Chloreti Ferrici Spirituoso-Ætherea); Ger. and Russ. (Tinct. Ferri Chlorati Ætherea); U.S. (Tinctura Ferri Chloridi); Port., from the salt, with Alcohol and Ether; Ital. (Soluzione Alcoolico-Eterea di Cloruro Ferrico), from the Solution with Alcohol and Ether; Swiss (Spiritus Æthereus Ferratus). Not in the others. *See* also 'Tinctura Ferri Chlorati Ætherea.'

Tests.—Tincture of Ferric Chloride has a specific gravity of 1·085 to 1·089; contains about 12 p.c. w/v of total solids and about 22 p.c. w/v of Absolute Alcohol. It yields with Ammonia Solution a reddish brown voluminous precipitate; with Potassium Ferrocyanide Solution a blue precipitate, and with Silver Nitrate Solution a white curdy precipitate, insoluble in Nitric Acid. The *U.S.P.* Tincture has a specific gravity of about 1·005 at 25° C. (77° F.), and contains not less than 13·28 p.c. of anhydrous Ferric Chloride, corresponding to 4·6 p.c. of metallic Iron.

Tinctura Ferri Sesquichloridi P.L.—Tinctura Ferri Muriatis P.E.—There is an idea, which periodically finds its way into print, that a Tincture made according to the formula of the London and Edinburgh Pharmacopœias is more efficacious than the *B.P.*, and can be given in cases where the other is not tolerated. From a chemical point of view the only difference is that *P.L.* is three-fourths the strength of *B.P.*, and when freshly made contains one-fifteenth of the Iron in the Ferrous condition. Alcohol has no reducing action on Ferric Chloride, even after years of contact.

Liquor Ferri Chloroxydi and **Liquor Ferri Dialysatus** have been much used as palatable, non-astringent, and non-irritant hæmatinics, given in cases where the astringent salts would derange the stomach.

Not Official.

LIQUOR FERRI CHLOROXYDI.—A solution in Water of a basic Ferric Chloride, containing 0·8 p.c. of Chlorine for 5 p.c. of Ferric Oxide, approximating to the formula $Fe_2Cl_67Fe_2O_3$. This is the ratio of the Solution made by us many years previous to the use of 'Dialysed Iron.' It was and is still made to contain 7·1 p.c. of Ferric Oxide to correspond with the official Tincture.

Dose.—10 to 30 minims = 0·6 to 1·2 c.c

LIQUOR FERRI DIALYSATUS (Dialysed Iron).—This was formerly official in *B.P.*, but is now omitted. It contains 5 p.c. of Ferric Oxide, and was dialysed until nearly tasteless. It is better to work to a definite percentage of Chlorine; it may be reduced to 0·3 p.c. without interfering with the stability of the solution. It is very doubtful, however, whether there is any advantage in reducing the Chlorine ratio below that of Liquor Ferri Chloroxydi as described above.

Another method is to add a certain proportion of diluted Ammonia Solution to a solution of Ferric Chloride, so that the precipitate which first forms just redissolves. The Ammonia becomes Ammonium Chloride and the Iron a very basic Oxychloride, from which the Ammonium salt is readily dialysed. Where a saving of expense is an object, as in some large institutions, it would probably be equally efficacious without dialysis.

Dose.—10 to 30 minims = 0·6 to 1·8 c.c.

Foreign Pharmacopœias.—Official in Austr. (Ferrum Hydroxydatum Dialysatum Liquidum); Ger., Hung., Russ. and Swed., when Liquor Ferri Oxidati Dialysati is prescribed, Liquor Ferri Oxychlorati (sp. gr. 1·050) may be dispensed; Belg. and Swiss (Ferrum Oxychloratum Solution), sp. gr. 1·05; Mex. (Oxido de Fierro Dialisado), sp. gr. 1·046. Not in the others.

Liquor Ferri Oxychlorati.—Dilute Ferric Chloride Solution 35, with 160 of Distilled Water, and pour into a mixture of Ammonia Water 35 and Distilled Water 320; wash, press, and dissolve the precipitate in 3 of Hydrochloric Acid, finally warming it to about 40° C. and dilute the solution with Distilled Water until it has a sp. gr. 1·05.—*Ger. Jap.* has the same formula, but employs 2·5 of Hydrochloric acid (30 p.c.), in place of the *P.G.* (25 p.c.).

Liquor Ferri Oxychloridi.—Solution of Ferric Chloride (*U.S.P.*), 35, by weight; Ammonia Water (*U.S.P.*), 35, by weight; Hydrochloric Acid (*U.S.P.*), 2·35, by weight; Water, *q.s.* to produce 100 by weight.—*U.S.N.F.*

Strong Solution of Ferric Chloride (*B.P.*), by weight, 22·50; Solution of Ammonia (*B.P.*), by weight, 35·00; Hydrochloric Acid (*B.P.*), by weight, 2·35; Distilled Water, *q.s.* to produce by weight 100.—*B.P.C.*

Both of the above are stated to correspond in strength with **Liquor Ferri Oxychlorati.**—*P.G.*

GLYCERINUM FERRI PERCHLORIDI.—Solution of Ferric Chloride, 1 fl. oz.; Glycerin, 1 fl. oz.—*Middlesex* and *University.*

Ferric Chloride, 1; Glycerin, 4.—*Guy's.*

MISTURA FERRI AROMATICA.—Solution of Ferric Chloride, 10 minims; Aromatic Spirit of Ammonia, 20 minims; Syrup, 40 minims; Water, to 1 fl. oz.—*St. Thomas's.*

Dose.—1 fl. oz. Mix with the Syrup the Iron Solution, and add the Aromatic Spirit previously diluted with the Water.

This has been incorporated in the *B.P.C.* under the title **Mistura Ferri Ammoniata.**

MISTURA CHALYBEATA.—Solution of Ferric Chloride, 15 minims; Syrup, 30 minims; Infusion of Quassia, to 1 fl. oz.—*St. Thomas's.*

Dose.—1 fl. oz.

This has been incorporated in the *B.P.C.* under the title **Mistura Ferri Amara** with the *syn.* Mistura Chalybeata.

Mistura Ferri Amara.—Solution of Perchloride of Iron, 20 minims; Spirit of Chloroform, 5 minims; Infusion of Quassia, to 1 fl. oz.—*Lock.*

MISTURA FERRI CUM MAGNESII SULPHATE.—Solution of Ferric Chloride, 15 minims; Magnesium Sulphate, 20 grains; Glycerin, 40 minims; Infusion of Quassia, to 1 fl. oz.—*St. Thomas's.*

Dose.—1 fl. oz.

This has been incorporated in the *B.P.C.*

MISTURA FERRI SALINA.—Potassium Citrate, 22 grains; Solution of Ferric Chloride, 24 minims; Chloroform Water, to 1 fl. oz.—*University.*

Dose.—½ to 1 fl. oz.

SYRUPUS FERRI SUBCHLORIDI.—Iron Wire, 300 grains; Hydrochloric Acid, 2 fl. oz.; Citric Acid, 10 grains; Distilled Water, 10 fl. drm.; Syrup, *q.s.* to produce 20 fl. oz.—*B.P.* '85.

Dose.—½ to 1 fl. drm. = 1·8 to 3·6 c.c.

This has been incorporated in the *B.P.C.*

TINCTURA FERRI CHLORATI ÆTHEREA.—Iron Chloride Solution, 1; Ether, 2; Alcohol (90 p.c.), 7. All by weight.—*Ger., Ital.* and *Jap.*

FERRI PERNITRATIS LIQUOR.

SOLUTION OF FERRIC NITRATE.

A reddish-brown liquid, readily miscible with Water. It contains Ferric Nitrate, $Fe_2 6NO_3$, eq. 480·68, in solution.

Medicinal Properties.—Tonic, astringent and escharotic. Like the Ferric Chloride it is useful in hæmatemesis and in hæmorrhage from the bowel, either by the mouth or as an injection with starch mucilage.

Dose.—5 to 15 minims = 0·3 to 0·9 c.c.

110 minims contain 3⅓ grains of Iron; 100 c.c. contain 3·3 grammes.

Foreign Pharmacopœias.—Not in any.

Tests.—Ferric Nitrate Solution has a specific gravity of 1·107 to 1·109. It should answer the tests distinctive of Ferric salts given under Ferrum. The diluted solution, when mixed with an equal volume of Sulphuric Acid, keeping the liquid cool meanwhile, yields a dark-brown ring when a solution of Ferrous Sulphate is gently floated on to the surface of the liquids. It is officially required to yield 4·6 p.c. w/v of Iron Oxide, when a measured quantity of 5 c.c. is precipitated with Ammonia Solution in excess, and the precipitate is washed, dried, ignited, and weighed; the residue amounting to 0·23 gramme. It should be free from the impurities mentioned under Liquor Ferri Perchloridi Fortis, Nitrates excepted.

FERRI PHOSPHAS.

IRON PHOSPHATE.

A dull, greyish-blue, amorphous, odourless powder, which is officially required to contain not less than 47 p.c. of Hydrous Ferrous Phosphate, $Fe_3(PO_4)_2 8H_2O$, eq. 498·48 together with Ferric Phosphate and Iron Oxide.

Solubility.—Insoluble in Water, but soluble in Hydrochloric Acid.

Medicinal Properties.—A valuable hæmatinic tonic. Given in anæmia, in amenorrhœa, some forms of dyspepsia, rachitis and tubercular bone diseases; in nervous depression and exhaustion with tendency to phosphaturia, and during convalescence.

Dose.—5 to 10 grains = 0·32 to 0·65 gramme.

Prescribing Notes.—*Given in* **cachets, pills,** *or* **powders.** *A good pill can be made by adding one-third of its weight of 'Diluted Glucose.'*

Official Preparations.—Syrupus Ferri Phosphatis, Syrupus Ferri Phosphatis cum Quinina et Strychnina.

Not Official.—Syrupus Triplex, Syrupus Tres, Elixir Ferri Quininæ et Strychninæ Phosphatum, Glyceritum Ferri Quininæ et Strychninæ Phosphatum, Pilula Ferri Quininæ et Strychninæ Phosphatum, Liquor Ferri Phosphatis Fortis, Pilula Trium Phosphatum, Syrupus Ferri Phosphatis Compositus, Squire's Chemical Food, Syrupus Ferri Phosphatis c. Manganesio. Ferri Phosphas Solubilis, Ferri Pyrophosphas Solubilis.

Foreign Pharmacopœias.—Official in Span. (Fosfato de Hierro), U.S. (Soluble Ferric Phosphate), Mex. (Fosfato Ferroso-Ferrico). Not in the others.

Tests.—Iron Phosphate dissolves in Hydrochloric Acid, yielding a solution which gives with Potassium Ferrocyanide and with Potassium Ferricyanide Solutions the tests distinctive of Ferric and Ferrous salts given under Ferrum. On the addition of Tartaric Acid and an excess of Ammonia Solution it yields on the subsequent addition of Magnesium Ammonio-sulphate Solution a white granular precipitate. It is officially required to contain not less than 47 p.c. of hydrous Ferrous Phosphate, as determined by the titration of a solution of 1

gramme in Hydrochloric Acid, with Volumetric Potassium Bichromate Solution, using Potassium Ferricyanide Solution as an indicator, at least 28·2 c.c. of the Volumetric Solution should be necessary. Arsenic may be present as an impurity, and may be tested for by the Bettendorf's test.

Preparations.

SYRUPUS FERRI PHOSPHATIS. Syrup of Ferrous Phosphate.

Iron, in Wire, 75 grains; Concentrated Phosphoric Acid, 1¼ fl. oz.; Syrup, 14 fl. oz.; Distilled Water, *q.s.* to make 20 fl. oz. of a pale green syrupy liquid, containing 1 grain of anhydrous Ferrous Phosphate in 60 minims.

Dose.—½ to 1 fl. drm. = 1·8 to 3·6 c.c.

This Syrup can be conveniently made by adding 1 volume of Liquor Ferri Phosphatis Fortis to 5½ vols. of Simple Syrup and 1½ vols. of Distilled Water.

Ferrous Phosphate absorbs Oxygen with great rapidity on exposure to air, and requires such a large excess of Acid to keep it in solution that in framing a formula for Syrupus Ferri Phosphatis a compromise must be made between liability to deposit on the one hand and acidity on the other. We think it is better to use a comparatively small excess, and keep the Syrup in small bottles lying down.

SYRUPUS FERRI PHOSPHATIS CUM QUININA ET STRYCHNINA. Syrup of Phosphate of Iron with Quinine and Strychnine.

Iron, in Wire, 75 grains; Concentrated Phosphoric Acid, 1¼ fl. oz.; Strychnine, in powder, 5 grains; Quinine Sulphate, 130 grains; Syrup, 14 fl. oz.; Distilled Water, *q.s.* to make 20 fl. oz. of a pale yellowish-green syrupy liquid, possessing a very bitter taste, and having a strong fluorescence; it contains 1 grain of anhydrous Ferrous Phosphate, ⅘ grain of Quinine Sulphate, and $\frac{1}{32}$ grain of Strychnine in 60 minims.

Dose.—½ to 1 fl. drm. = 1·8 to 3·6 c.c.

It resembles the compound known as Easton's Syrup.

It can be made extemporaneously by dissolving 2 grains of Strychnine and 51 grains of Quinine Sulphate in 24 minims of Concentrated Phosphoric Acid and Distilled Water to 1½ fl. oz.; Liquor Ferri Phosphatis Fortis, 1 fl. oz.; Syrup, to make 8 fl. oz.

This formula has been incorporated in the *B.P.C.* under the title **Liquor Quininæ et Strychninæ.**

Foreign Pharmacopœias.—Official in U.S. Not in the others.

A mixture of Easton's, Fellows' and Parrish's Syrups is sold as **'Triple Syrup.'**

Syrupus Triplex.—Syrupus Ferri Phosphatis Compositus, 2 fl. oz.; Syrupus Ferri Hypophosphitis Compositus, 1 fl. oz.; Syrupus Eastoni, 1 fl. oz.—*Pharm. Form.* The **Syrupi Tres** of the *Edinburgh Royal Infirmary* is the same.

Martindale (1904) and *B.P.C.* (1907) give the proportions as an equal volume of each.

Not Official.

ELIXIR FERRI QUININÆ ET STRYCHNINÆ PHOSPHATUM.—Soluble Ferric Phosphate, 1·75; Quinine, 0·875; Strychnine, 0·0275; Phosphoric Acid, 0·20; Ammonium Carbonate, 0·90; Alcohol (95 p.c.), 6·00; Acetic Acid,

2·865; Ammonia Water, *q.s.*; Distilled Water, *q.s.*; Aromatic Elixir, *q.s.* of each to produce 100.—*U.S.P.*

Average Dose.—1 fl. drm. = 3·6 c.c.

This has been incorporated in the *B.P.C.* with slight modification.

Soluble Iron Phosphate, 1·75; Quinine, 0·875; Strychnine, 0·0285; Concentrated Phosphoric Acid, 0·25; Ammonium Carbonate, 0·90; Alcohol, 6·25; Acetic Acid, 2·75; Solution of Ammonia, Distilled Water and Aromatic Elixir, *q.s.* of each to produce 100.—*B.P.C.*

In the *B.P.C. Supplement* the 1·75 of Soluble Iron Phosphate is replaced by 1·35 of Ferric Citrate, and sufficient Sodium Phosphate to give the solution a distinctly green coloration.

GLYCERITUM FERRI QUININÆ ET STRYCHNINÆ PHOSPHATUM (*U.S.*).—Soluble Ferric Phosphate, 8; Quinine, 10·4; Strychnine, 0·08; Phosphoric Acid, 20; Glycerin, 50; Water, *q.s.* to make 100.—*U.S.P.*

The **Average Dose,** 15 minims, contains about $1\frac{1}{7}$ grains of Ferric Phosphate, $1\frac{1}{2}$ grains of Quinine, $\frac{1}{87}$ grain of Strychnine.

This has been incorporated in the *B.P.C.*

It is used for preparing Syrupus Ferri Quininæ et Strychninæ Phosphatum, *U.S.P.*, by mixing Glycerite 1 with Syrup 3, but the Syrup so produced is very different from the corresponding preparation in the *B.P.* It contains in each fl. drm. about $1\frac{1}{7}$ grains of Ferric Phosphate, $1\frac{1}{2}$ grains of Quinine, $\frac{1}{87}$ grain of Strychnine.

LIQUOR FERRI PHOSPHATIS FORTIS.—Containing 8 grains per fl. drm. of the Anhydrous Phosphate; is made by dissolving 360 grains of Iron Wire in 6 fl. oz. of Concentrated Phosphoric Acid, with sufficient Water to make 12 fl. oz.

PILULA FERRI QUININÆ ET STRYCHNINÆ PHOSPHATUM.—Ferrous Phosphate, 1 grain; Quinine Sulphate, 1 grain; Strychnine, $\frac{1}{32}$ grain; Milk Sugar, $1\frac{1}{4}$ grains; Concentrated Phosphoric Acid, *q.s.* for one pill.—*Martindale.*

It is also made half this strength, and either may be combined with Arsenious Acid $\frac{1}{60}$ grain.—*Martindale.*

Pilulæ Ferri Phosphatis cum Quinina et Strychnina. *Syn.* Easton's Pills.—In 100 parts, Ferrous Phosphate, 20; Quinine Sulphate, 20; Strychnine, 0·62; Milk Sugar, a sufficient quantity; Concentrated Phosphoric Acid, *q.s.* to form a mass. Divide into pills containing 2 grains each.—*B.P.C.*

Note.—Easton's Pills are sometimes made twice the size specified above; and they may be ordered with the addition of $\frac{1}{64}$ grain of Arsenious Acid.—*B.P.C.*

Although the *B.P.C.* form resembles that of *Martindale*, it is not nearly so definite in strength.

Pilula Trium Phosphatum. Easton's Pill.—Iron Phosphate, 1 grain; Quinine Sulphate, 1 grain; Strychnine, $\frac{1}{32}$ grain; Concentrated Phosphoric Acid, $1\frac{1}{2}$ minims; Liquorice Powder, to 4 grains.—*Guy's.*

SYRUPUS FERRI PHOSPHATIS COMPOSITUS.—Iron Wire, free from Oxide, $37\frac{1}{2}$ grains; Concentrated Phosphoric Acid (sp. gr. 1·5), 1 fl. oz.; Distilled Water, 5 fl. drm.; dissolve by a gentle heat in a flask plugged with Cotton-Wool, the Iron being completely covered by the liquid.

Precipitated Calcium Carbonate, 120 grains; Concentrated Phosphoric Acid, 4 fl. drm.; Distilled Water, 2 fl. oz.; mix, and add Potassium Bicarbonate, 9 grains; Sodium Phosphate, 9 grains, filter, and set aside.

Cochineal, 30 grains; Distilled Water, $7\frac{1}{2}$ fl. oz.; boil for 15 minutes, and when cooled filter, pouring over the filter a sufficient quantity of Distilled Water to produce 7 fl. oz. of filtrate; to this add Refined Sugar, 14 oz.; heat till dissolved, and strain. When cold, add the Iron and Calcium Solutions and sufficient Distilled Water to produce 20 fl. oz.—*B.P.C. Formulary* 1901.

This has been incorporated in the *B.P.C.*, employing 288 minims of Orange Flower Water in place of that quantity of Distilled Water in the quantities given above, but the *B.P.C. Supplement* has since altered the quantity to 480 minims.

Each fl. drm. = ½ grain Ferrous Phosphate and ⅝ grain Calcium Phosphate with small quantities of Potassium and Sodium Phosphates. It should be kept in bottles quite full.

Dose.—½ to 2 fl. drm. = 1·8 to 7·1 c.c.

SYRUPUS FERRI PHOSPHATIS COMPOSITUS, SQUIRE (Squire's Chemical Food).—The preparation, made for many years by Parrish, was imported and subsequently purchased by Squire.

It contains Ferrous Phosphate, Calcium Phosphate, Sodium Phosphate and Potassium Phosphate.

Dose.—½ to 1 teaspoonful, in Water, with meals.

A formula was published many years ago, but how far this has been a success is shown by comparing the Syrups commercially sold, all of them more or less emphatically stated to be made according to the published formula.

In nine samples analysed, the Iron Phosphate ranged from 0·19 to 0·66, the Calcium Phosphate from 0·5 to 1·6, the total Phosphoric Acid from 1·5 to 4·7; these results are expressed in grains per fl. drm.

Medicinal Properties.—A tonic in debility, of whatever origin, and during convalescence from acute diseases. Specially indicated in tuberculosis and rickets, and during pregnancy.

SYRUPUS FERRI PHOSPHATIS C. MANGANESIO.—Dissolve 100 grains Manganese Phosphate in 1½ fl. oz. of Liquor Ferri Phosphatis Fortis and 30 minims of Phosphoric Acid, then dilute to 20 fl. oz. with Simple Syrup.

This Syrup will contain in each fl. drm. ½ grain each of anhydrous Ferrous Phosphate and anhydrous Manganese Phosphate.

Dose.—1 fl. drm. = 3·6 c.c.

This can sometimes be taken when Syrup of Ferrous Phosphate disagrees.

FERRI PHOSPHAS SOLUBILIS. Soluble Ferric Phosphate. (*U.S.*).—Prepared by dissolving Ferric Citrate and Sodium Phosphate in Distilled Water, evaporation and scaling on plates of glass. The scales are transparent and of a bright green colour, freely soluble in Water; they, however, become dark and discoloured on exposure to air. It is used in the preparation of Elixir Ferri Quininæ et Strychninæ Phosphatum (*U.S.*), Glyceritum Ferri Quininæ et Strychninæ Phosphatum (*U.S.*), and Syrupus Ferri Quininæ et Strychninæ Phosphatum (*U.S.*) (from Glycerite).

FERRI PYROPHOSPHAS SOLUBILIS. Soluble Ferric Pyrophosphate (*U.S.*).—Prepared by dissolving Ferric Citrate and Sodium Pyrophosphate in Distilled Water, evaporation and scaling on plates of glass. The scales are transparent and of an apple-green colour, freely soluble in Water.

FERRI SULPHAS.

FERROUS SULPHATE.

Fr., Sulfate de Protoxide de Fer Officinal; Ger., Ferrosulfat; Ital., Solfato Ferroso; Span., Sulfato Ferroso.

$FeSO_4.7H_2O$, eq. 276·10.

Large, translucent, pale green, odourless, monoclinic prisms, having a saline, styptic, ferruginous taste.

Ferrum Sulphuricum Præcipitatum (*Austr.*), resembles the Ferri Sulphas Granulata of *B.P.* '85, omitted in 1898. It is obtained by pouring an aqueous solution of Ferrous Sulphate into Alcohol (90 p.c.).

Solubility.—1 in 1½ of Water; the solution rapidly oxidises on exposure; insoluble in Absolute Alcohol or Alcohol (60 p.c.), hence it cannot be dissolved in Tinctures.

Medicinal Properties.—A powerful astringent and a hæmatinic tonic, but is apt to irritate the stomach. Internally it is given in anæmia, amenorrhœa, and general debility; along with Quinine it promotes the appetite; given with cathartics, such as Magnes. Sulph. and Aloes, to increase their action, but at the same time reduce their dose; externally it is used as a **lotion** for ulceration and erysipelatous surfaces, 3 to 5 grains in an oz. of Water; also as an **injection** for urethral and vaginal inflammations and prolapse of rectum.

Dose.—1 to 5 grains = 0·06 to 0·32 gramme.

Prescribing Notes.—*Given in solution or more generally pill form, to avoid gastric irritation. The* **Dried Sulphate** *is best in pills; 3 grains, which are equal to 5 of the crystallised salt, make a nice pill with 'Diluted Glucose.'*

Liquor Ferri Persulphatis is an excellent **styptic.**

2 grains of Ferrous Sulphate, 30 grains of Magnesium Sulphate, 5 minims of Diluted Sulphuric Acid, Chloroform Water or Peppermint Water to 1 oz.; occurs in Hospital formulas as **Mistura Ferri Aperiens.**

Official Preparations.—Ferri Sulphas Exsiccatus and Liquor Ferri Persulphatis. *See* also 'Ferrum.'

Not Official.—Liquor Ferri Subsulphatis (Monsel's Solution), Mistura Ferri et Magnesii Sulphatis, Mistura Ferri Aperiens, Monsel's Salt, Gossypium Ferratum, and Ferri et Ammonii Sulphas.

Foreign Pharmacopœias.—Official in Belg., Dan., Dutch, Fr., Ger., Hung., Ital., Jap., Norw., Port., Russ., Span., Swed., Swiss and U.S.; Mex. (Sulfato Ferroso); Fr., Ger., Jap., Russ. and Swiss have a Crude Sulphate; Austr. has a Precipitated Sulphate; U.S. a Granulated Sulphate.

Tests.—Ferrous Sulphate should dissolve to form a clear solution in less than 2 parts of cold Water. The aqueous solution answers the tests distinctive of Ferrous salts given under the heading of Ferrum. Acidified with Hydrochloric Acid its solution yields with Barium Chloride Solution a white precipitate insoluble in Hydrochloric Acid.

It is officially required to contain 99·4 p.c. of crystallised Ferrous Sulphate as determined by titration with Volumetric Potassium Bichromate Solution, using Potassium Ferricyanide Solution as an indicator. The *U.S.P.* salt is required to contain not less than 99·5 p.c. pure Ferrous Sulphate. The processes of determination are compared in the small type below under the heading of Volumetric Determination.

The more generally occurring impurities are Ammonium, Copper, Potassium, Sodium and Zinc, and Ferric salts. They are best detected by oxidising the aqueous solution with Nitric Acid and precipitating the Iron as Ferric Hydroxide with Ammonia Solution. The filtrate should not be blue in colour nor yield a precipitate on the addition of Hydrogen Sulphide, indicating the absence of Copper and Zinc; another portion of the filtrate evaporated to dryness and ignited should not leave a weighable residue, indicating the absence of Potassium and Sodium salts. The *B.P.* uses Hydrogen Sulphide as a test for Ferric salts. It should dissolve 1 in 1½ of Water as stated above, and the solubility of the sample in less than 2 parts of cold Water is officially included as a test for the absence of Oxysulphate.

Hydrogen Sulphide.—If 2 grammes of the salt in aqueous solution be oxidised with Nitric Acid or Bromine Water, and excess of T.S. of Ammonia be added to the solution obtained, the filtrate from this mixture should be colourless and should not be affected by T.S. of Hydrogen Sulphide, *P.G.* This test is also given in the *U.S.P.* 1 gramme of the salt dissolved in 25 c.c. of Water containing 1 c.c. diluted Sulphuric Acid is heated to boiling and oxidised with Nitric Acid. A slight excess of T.S. of Ammonia is then added and the mixture filtered. A colourless filtrate is obtained which should not respond to the time-limit test for heavy metals. The colourless filtrate obtained as in the preceding test should not on evaporation and ignition leave a weighable residue, *P.G.* and *U.S.P.*

Volumetric Determination.—An aqueous solution of 1 gramme of Iron Sulphate acidified with Sulphuric Acid requires at least 36 c.c. of Volumetric Solution of Potassium Bichromate, *B.P.*; the *U.S.P.* directs that 1·38 grammes of the salt in unefflorescd crystals be dissolved in 25 c.c. of dilute Sulphuric Acid and the solution titrated with Tenth-normal Volumetric Solution of Potassium Permanganate; not less than 49·75 c.c. of the Volumetric Solution should be necessary to impart a permanent pink colour to the liquid.

Preparations.

FERRI SULPHAS EXSICCATUS. Exsiccated Ferrous Sulphate. Dried Sulphate of Iron.—*B.P.* '85.

Ferrous Sulphate, submitted to a temperature of 100° C. (212° F.), until it ceases to lose aqueous vapour; reduce to a fine powder and keep in dry, well-stoppered bottles. It should be slowly but completely soluble in Water.

Dose.—½ to 3 grains = 0·032 to 0·20 gramme.

3 grains are equal to 5 grains of Ferrous Sulphate.

Foreign Pharmacopœias.—Official in Dan. and Swed., dried at 104° to 122° F. (40° to 50° C.); Ger., Swiss and U.S., dried at 212° F. (100°C.); Dutch, Fr., Russ. and Span., no temperature given. Not in the others.

Tests.—Dried Ferrous Sulphate dissolves slowly but completely in Water, the solution answers the tests distinctive of Ferrous salts given under Ferrum. The 1 in 20 aqueous solution acidified with Hydrochloric Acid yields with Barium Chloride Solution a white precipitate insoluble in Hydrochloric Acid. It is officially required to contain at least 92·5 p.c. of dried Ferrous Sulphate of the official formula, as determined by titration with Volumetric Potassium Bichromate Solution, using Potassium Ferricyanide Solution as an indicator. The processes of the *B.P.* and *P.G.* are compared below under the heading of Volumetric Determination. It should, of course, be free from the impurities mentioned under Ferrous Sulphate, but *B.P.* does not say so. A standard suggested for Arsenic (*C.D.* '08, i. 796) is 2 parts per million.

Volumetric Determination.—A solution of 1 gramme of the salt in water acidified with Sulphuric Acid requires at least 54·6 c.c. of the Volumetric Solution of the Potassium Bichromate. This corresponds to at least 92·5 p.c. of Exsiccated Ferrous Sulphate $FeSO_4.H_2O$, *B.P.*; the *P.G.* gives the following directions:—Let 0·2 gramme of the salt be dissolved in 10 c.c. of diluted Sulphuric Acid and the solution mixed with Solution of Potassium Permanganate (5–1000) until a faint reddening occurs. After the colour is destroyed, which may be effected if necessary by a few drops of Alcohol, 2 grammes of Potassium Iodide are added and the mixture is allowed to stand for 1 hour at ordinary temperature in a closed vessel. It is then titrated with Tenth-normal

Volumetric Solution of Sodium Thiosulphate, of which at least 10·8 c.c. should be necessary for the combination of the free Iodine, *P.G.*

LIQUOR FERRI PERSULPHATIS. Solution of Ferric Sulphate.

Ferrous Sulphate, 16; Sulphuric Acid, 1½; Nitric Acid, 1½; Distilled Water, *q.s.* to make 22 of a reddish-brown liquid, sp. gr. 1·441, miscible with Water and Alcohol (90 p.c.).

Introduced for making several preparations of Iron, which are enumerated under 'Ferrum,' p. 504.

Foreign Pharmacopœias.—Official in Ital., Jap. and Swiss, sp. gr. 1·428 to 1·430; Russ., sp. gr. 1·426 to 1·430; U.S., sp. gr. 1·420 to 1·450 at 25° C. (77° F.). Not in the others.

Tests.—Ferric Sulphate Solution is officially required to possess a specific gravity of 1·441. Its diluted aqueous solution should answer the tests for Ferric salts given under Ferrum. It should yield when diluted with 10 times its volume of Water a brown but no pronounced blue coloration with Potassium Ferricyanide Solution, indicating the absence of more than a trace of Ferrous salt. It should not decolorise Potassium Permanganate Solution. It is officially required to yield 1·04 grammes of Iron Oxide, as gravimetrically determined by precipitation as Hydroxide with Ammonia Solution, washing, drying and incinerating. The *U.S.P.* Liquor is required to contain 36 p.c. of Normal Ferric Sulphate [$Fe_2(SO_4)_3$ eq. 397·05], corresponding to not less than 10 p.c. of metallic Iron. The *U.S.P.* employs a volumetric Iodometric method for the determination of Iron. The respective processes are compared in small type below under the headings Gravimetric and Volumetric Determinations.

The liquor should be free from the impurities mentioned under Ferrous Sulphate.

Potassium Ferricyanide.—A small portion of the solution diluted with about 10 volumes of Water should yield with a few drops of freshly-prepared T.S. of Potassium Ferricyanide a pure brown colour without a tinge of green or greenish-blue, *U.S.P.*

Sulphuric Acid.—If 2 volumes of the solution be slowly mixed with 1 volume of concentrated Sulphuric Acid in a beaker, no solid white mass should separate, *U.S.P.*

Ferrous Sulphate and Sulphuric Acid.—If a crystal of Ferrous Sulphate be added to a diluted portion of the solution (about 1–10), mixed with an equal volume of concentrated Sulphuric Acid and cooled, the crystal should not become brown nor should a brownish-black colour develop around it, *U.S.P.*

Gravimetric Determination.—The reddish-brown precipitate produced when a measured quantity of 5 c.c. of the Liquor diluted with 80 c.c. of Water is treated with Ammonia Solution in excess, should when washed, dried, ignited, cooled and weighed amount to 1·04 grammes, *B.P.*

Volumetric Determination.—A weighed quantity of 1·11 gramme is introduced into a glass-stoppered bottle of about 100 c.c. capacity together with 15 c.c. of Water and 2 c.c. of Hydrochloric Acid. 1 gramme of Potassium Iodide is added and the mixture kept at a temperature of 40° C. (104° F.) for half an hour, then cooled and titrated with Tenth-normal Volumetric Sodium Thiosulphate Solution, using Starch Solution as an indicator; not less than 20 c.c. shall be required to discharge the blue or greenish colour of the liquid. 1 c.c. of Tenth-normal Thiosulphate = 0·5 p.c. w/w metallic Iron, *U.S.P.*

Not Official.

MISTURA FERRI ET MAGNESII SULPHATIS.—Sulphate of Iron, 3 grains; Magnesium Sulphate, 30 grains; Dilute Sulphuric Acid, 5 minims; Distilled Water, to 1 fl. oz.—*Royal Free.*

Ferrous Sulphate, 2 grains; Magnesium Sulphate, 20 grains; Diluted Sulphuric Acid, 10 minims; Water, to 1 fl. oz.—*King's.*

Mistura Ferri Aperiens.—Ferrous Sulphate, 2 grains; Magnesium Sulphate, 30 grains; Diluted Sulphuric Acid, 2 minims; Peppermint Water, to 1 fl. oz.—*University.*

LIQUOR FERRI SUBSULPHATIS (*U.S.*).—An aqueous solution of basic Ferric Sulphate, corresponding to not less than 13·57 p.c. of Iron. It is known as **Monsel's Solution.**

Monsel's Salt is produced by evaporating and scaling the solution.

GOSSYPIUM FERRATUM.—Moisten Cotton-Wool with Glycerin, then express strongly; steep the damp Wool in a solution of Ferrous Sulphate, 1 part to 2 parts of Water, squeeze out as much as possible of the liquid, and, without drying, pack the prepared wool into a bottle furnished with a glass stopper.

FERRI ET AMMONII SULPHAS. Ammonio-Ferric Alum.—Iron Alum is an Alum in which Iron takes the place of Aluminum. Pale violet octahedral crystals, which are efflorescent. It should contain 99·5 p.c. of pure uneffloresced Ferric Ammonium Sulphate.

Solubility.—Soluble 1 in 3 of Water, insoluble in Alcohol (90 p.c.).

It is used in bleeding from the kidneys; it arrests the hæmorrhage and the anæmia that accompanies it; it is considered more astringent than Alum.

The aqueous solution will, even after filtration, deposit unless slightly acidified with Diluted Sulphuric Acid.

Dose.—5 to 10 grains = 0·32 to 0·65 gramme.

Foreign Pharmacopœias.—Official in U.S.

Tests.—Ferric Ammonium Sulphate dissolved in Water yields a blue precipitate with Potassium Ferrocyanide Solution and a brownish-red precipitate with Potassium Hydroxide Solution, followed by the evolution of Ammonia gas on warming. The aqueous solution gives with Barium Chloride Solution a white precipitate insoluble in Hydrochloric Acid. A weighed quantity of 0·555 gramme of the uneffloresced crystals is dissolved in 15 c.c. of Water and 2 c.c. of Hydrochloric Acid, in a 100 c.c. glass-stoppered flask, 1 gramme of Potassium Iodide is added, the flask securely fastened, the mixture kept for half an hour at 40° C. (104° F.), and then cooled; not less than 11·5 c.c. of Tenth-normal Volumetric Sodium Thiosulphate Solution should be required to discharge the colour. 1 c.c. of Tenth-normal Thiosulphate = 1 p.c. of metallic Iron.

FERRUM REDACTUM.

REDUCED IRON.

Fr., Fer Réduit par l'Hydrogène; Ger., Reduzirtes Eisen; Ital., Ferro Ridotto dall' Idrogeno; Span., Hierro Reducido por el Hidrogeno.

A fine, tasteless powder, possessing a dull iron-grey metallic appearance, and strongly attracted by a magnet. It is officially required to contain at least 75 p.c. of metallic Iron, with a variable amount of Iron Oxide. It is prepared by the reduction of Ferric Hydroxide, at a dull red heat, by dry Hydrogen.

With reference to the keeping qualities of Reduced Iron, it may be noted that, under ordinary atmospheric conditions, a sample containing 91·5 p.c. of Iron, loosely covered with paper to keep out dust, lost only 1 p.c. of metallic Iron in a month.

Medicinal Properties.—Hæmatinic. Given in chlorosis and amenorrhœa.

As Hydrogen is evolved by its contact with the acid gastric secretion, flatulence may be set up.

Dose.—1 to 5 grains = 0·065 to 0·32 gramme.

Prescribing Notes.—*Given in powder, pill, or in lozenges. Pills containing Reduced Iron have a tendency to crack. An excellent pill can be made by mixing Reduced Iron* 24 *grains, Liquorice Powder* 6 *grains, Glycerin of Tragacanth* 6 *grains, and dividing into* 12 *or more pills as desired.*

Official Preparation.—Trochiscus Ferri Redacti.

Foreign Pharmacopœias.—Official in Austr., Belg., Dan., Dutch, Fr., Ger., Hung., Ital., Jap., Mex., Norw., Port., Russ., Span., Swed., Swiss and U.S.

Tests.—Reduced Iron dissolves in Hydrochloric Acid, and Hydrogen gas is at the same time evolved. The solution thus yielded gives the tests distinctive of Ferrous salts given under Ferrum, and on oxidation with Nitric Acid the tests distinctive of Ferric salts also given under Ferrum.

It is officially required to contain at least 75·48 p.c. of metallic Iron as determined by the titration with Volumetric Potassium Bichromate Solution of the Ferrous Sulphate produced when an excess of Copper Sulphate in solution is decomposed by a weighed quantity of Reduced Iron, Potassium Ferricyanide Solution being used as an indicator. The equivalent amount of Copper is precipitated from a hot solution of 1 gramme of Copper Sulphate in 15 c.c. of Water by the addition of a weighed quantity of 0·25 of a gramme of the Reduced Iron, 10 minutes is allowed for the completion of the reaction. The resulting solution of Ferrous Sulphate is filtered with as little exposure to the air as possible and acidified with Sulphuric Acid, it should require at least 33·7 c.c. of Deci-normal Volumetric Bichromate Solution. Both *U.S.P.* and *P.G.* employ Iodometric methods, which are described below in small type under the heading Volumetric Determination. The *B.P.* 1898 raised the percentage of metallic Iron from 50 to at least 75·5 p.c., but there is no difficulty in obtaining Reduced Iron containing over 90 p.c. of metal. It has been pointed out (*C.D.* '99, ii. 214; *P.J.* '99, ii. 109) that the Copper Sulphate method is not satisfactory, and that either one of the other two methods tried is to be preferred (these were the Iodometric process and the 'Mercuric Chloride' process official in the *U.S.* '90, which have now been abandoned in favour of the Iodine method).

The *B.P.* does not include specific tests for impurities, with the exception of Sulphur, which is officially stated to be recognised by an odour of Hydrogen Sulphide during solution; both *U.S.P.* and *P.G.* employ Lead Acetate paper. The more generally occurring impurities, other than the above, are Arsenic, Copper, Silica, Carbon, and alkali Carbonates. Arsenic may be detected by the modified Gutzeit's test, after the preliminary precipitation indicated below, or by the Bettendorf's test. It has been suggested that a limit of Arsenic should be included in the *B.P.* The *U.S.P.* adopts a limit of 1 in 100,000. A limit of 0·05 p.c. has been suggested (*C.D.* '01, ii. 242), and this standard is upheld (*Y.B.P.* '03, 242). It is stated (*C.D.* '08, i. 796)

that a standard of 0·02 p.c. appears to be a sufficiently stringent limit for Arsenic in Reduced Iron. Copper may be detected by Hydrogen Sulphide in a solution rendered faintly acid with Hydrochloric Acid, or it may be detected by oxidising the Ferrous salt to the Ferric condition, precipitating the Iron as Ferric Hydroxide with Ammonia Solution and examining the filtrate. The limit might be fixed at 1 in 5,000. Silica and Carbon may be detected by the residue insoluble in Hydrochloric Acid, which should not amount to more than 1 p.c. Alkali salts may be detected by the reaction towards red Litmus paper of the water with which the sample has been shaken, and by the residue left on evaporation of the same after filtration.

Stannous Chloride.—Let 0·2 gramme of Reduced Iron and 0·2 gramme of Potassium Chlorate be mixed with 2 c.c. of Hydrochloric Acid in a large test glass, and after the reaction ceases the mixture be warmed until free Chlorine is expelled. The solution is then filtered. 1 c.c. of the filtrate so obtained, with the addition of 3 c.c. of T.S. of Stannous Chloride, should not assume a dark colour in the course of an hour, *P.G.*

Modified Gutzeit's Test.—The *U.S.P.* gives the following instructions for treating Reduced Iron before proceeding to test for Arsenic:—'To 0·5 gramme of Reduced Iron contained in a small covered beaker, add 20 c.c. of diluted Sulphuric Acid. After the reaction has somewhat subsided, warm the liquid on a water-bath until the reaction ceases, then collect any minute undissolved residue of impure Iron Arsenide upon a very small filter, rinse the beaker with Water, add the rinsings to the filter, and wash the residue with Water until free from acid reaction. Transfer the residue to the beaker by rinsing it back, and after adding about 0·25 gramme of Potassium Chlorate and 5 c.c. of Hydrochloric Acid evaporate the solution slowly to dryness on a water-bath. Dissolve the residue in sufficient Water to measure 50 c.c., then add 5 c.c. of this solution to 5 c.c. of a saturated Solution of Sulphurous Acid and heat the liquid on a water-bath for fifteen minutes, until all traces of Sulphurous Acid have been removed. The resulting solution should not respond to the modified Gutzeit's test for Arsenic.'

Volumetric Determination.—A weighed quantity of 0·555 gramme of Reduced Iron is introduced into a 100 c.c. flask containing about 2·6 grammes of Iodine, the weight of which is subsequently accurately recorded, 6 c.c. of Water and 2 grammes of Potassium Iodide are added, the flask is securely stoppered and set aside for one hour, sufficient Distilled Water is added to measure exactly 100 c.c., mixed well, and 25 c.c. of this solution removed, and after the addition of a few drops of Starch Test-solution it is titrated with Tenth-normal Volumetric Sodium Thiosulphate Solution. The weight of Iodine taken is divided by 0·02518, the quotient subtracted from twice the number of c.c. of Tenth-normal Volumetric Sodium Thiosulphate Solution used, and the remainder represents the percentage of metallic Iron present in the sample. Instead of employing the official Iodine for the test the percentage of purity of the Iodine may be ascertained by a separate experiment, and the equivalent quantity of pure (100 p.c.) Iodine may be used instead of the 2·6 grammes referred to above, *U.S.P.*

A weighed quantity of 0·3 gramme of finely-powdered Reduced Iron is mixed with 10 c.c. of T.S. of Potassium Iodide, and into this mixture is gradually introduced 1·5 grammes of powdered Iodine, cooling and shaking. As soon as the Iron and Iodine are completely dissolved, the liquid is diluted with Water to 100 c.c., allowed to stand and deposit. A measured quantity of 50 c.c. of the clear Solution is filtrated with Tenth-normal Volumetric Solution of Sodium Thiosulphate, of which not more than 10·3 c.c. should be necessary for combination with the free Iodine, *P.G.*

Preparation.

TROCHISCUS FERRI REDACTI. REDUCED IRON LOZENGE.

1 grain of Reduced Iron in each, with Simple Basis.

Dose.—1 to 6 lozenges.

FERRUM TARTARATUM.

TARTARATED IRON.

Fr., Ferritartrate de Potassium; Ger., Kaliumferritartrat; Ital., Tartrato Ferrico-Potassico; Span., Tartrato Ferrico-Potasico.

Thin, deep ruby-red, translucent, slightly deliquescent scales, having a sweetish, ferruginous and astringent taste.

It should be kept in well-closed vessels, of a dark amber tint, and protected as far as possible from air and light.

Solubility.—1 in 1 of Water (slowly); very sparingly in Alcohol (90 p.c.)

Medicinal Properties.—Chalybeate tonic, and slightly diuretic, suitable in the anæmia of convalescence.

Dose.—5 to 10 grains = 0·32 to 0·65 gramme.

Foreign Pharmacopœias.—Official in Belg. (Tartras Ferrico-Potassicus); Fr. (Ferritartrate de Potassium); Ital. (Tartrato Ferrico-Potassico); Mex. (Tartrato de Potasio y Fierro); Port. (Tartrato de Potassa e de Ferro); Russ. (Ferro-Kalium Tartaricum); Span. (Tartrato Ferrico-Potasico); U.S. (Ferri et Potassii Tartras). Not in the others.

Ferri et Ammonii Tartras is also official in U.S.

Tests.—Tartarated Iron dissolves slowly in Water. The solution answers the tests distinctive of Ferric salts given under Ferrum. It is stated to yield no dark blue coloration, but only a greenish turbidity with Potassium Ferricyanide Solution, but it always contains Ferrous salt, which precipitates with the Potassium Ferricyanide reagent.

If the precipitate produced by Potassium Hydroxide Solution be removed by filtration and the filtrate be slightly acidulated with Acetic Acid, it yields, as it cools, a crystalline deposit, more particularly if the filtrate is first mixed with a little Alcohol (90 p.c.). It is officially required to yield 30·0 p.c. of Ferric Oxide, as determined by incinerating a weighed quantity at a red heat, cooling, and washing the residue till free from Potassium Carbonate, which operation is not always an easy matter to complete. The *U.S.P.* preparation is required to contain Iron and Potassium Tartrate corresponding in amount to not less than 15 p.c. of metallic Iron. The *U.S.P.* method of determination is an Iodometric one, and is described below. If the Iron be removed from a 1 in 10 aqueous solution by boiling with an excess of Potassium Hydroxide Test-solution, the filtrate, when slightly acidified with Acetic Acid, will gradually deposit a white crystalline precipitate, *U.S.P.*

With Potassium Ferrocyanide Test-solution, the solution should not afford a blue colour or precipitate, unless it be acidulated with Hydrochloric Acid, *U.S.P.*

Ammonia.—The aqueous solution of the salt should not yield any precipitate with T.S. of Ammonia, but is rendered darker, *U.S.P.*

Volumetric Determination.—The *U.S.P.* gives the following instructions:—If 0·555 gramme of the dry salt be dissolved in 15 c.c. of Water and 2 c.c of Hydrochloric Acid, in a glass-stoppered flask having a capacity of about 100 c.c., and if after the addition of 1 gramme of Potassium Iodide, and securely

closing the flask, the mixture be kept for half an hour at 40° C. (104° F.) and then cooled, it should require not less than 15 c.c. of Tenth-normal Volumetric Solution of Sodium Thiosulphate to discharge the colour of the liquid, Starch T.S. being used as indicator (each c.c. of Tenth-normal Volumetric Solution of Sodium Thiosulphate indicating 1 p.c. of metallic Iron).

FICUS.

FIGS.

Fr., Figue; Ger., Feigen; Ital., Fichi; Span., Higos.

The dried fleshy receptacles of *Ficus Carica*, L.

Medicinal Properties.—Nutritious, laxative, and demulcent. Chiefly used medicinally in constipation. Cut open and heated, it forms a convenient cataplasm.

Official Preparation.—Contained in Confectio Sennæ.

Foreign Pharmacopœias.—Official in Port. (Figos Passados); U.S. Not in the others.

Descriptive Notes.—Dried Figs are usually imported in two forms, natural and pulled figs. Natural figs are fruits that have not been made supple by kneading and squeezing; pulled figs are those so treated, and are generally imported in small boxes, in which they have been packed by careful pressure. They are flattened, translucent, and have the characteristic taste of the fig. In dry weather they are covered with a saccharine efflorescence. Greek figs are inferior in quality, containing less pulp, and are smaller.

The fruit is sometimes called a syconus; it is a pyriform receptacle filled with female flowers, each of which contains a minute ovary which, when ripe, forms an achene, often erroneously called a seed. The male flowers are developed sparingly amongst bracts surrounding the minute tubular orifice at the apex.

Compound Syrup of Figs.—Under this title several preparations are made, containing the soluble laxative constituents of Figs and Senna.

FILIX MAS.

MALE FERN.

The Rhizome of *Aspidium Filix-mas*, Sw., carefully dried.

Medicinal Properties.—The powder of the rhizome is slightly tonic and astringent; chiefly used in the form of Liquid Extract as an anthelmintic for tapeworm.

Prescribing Notes.—*The Liquid Extract, which is an Oleo-resin, can be given in Milk, or made into an* **emulsion** *with 1 to 2 fl. drm. of very fresh Mucilage of Gum Acacia, or ½ to 1 drm. of powdered Acacia, and with Peppermint Water or Milk to form a 2 oz. draught; or in* **capsules.** *Best given in the early morning fasting after a purge on the previous day, so that the worm is not protected by food. It is more effective if the dose of Male Fern be divided into three portions*

and given at intervals of half an hour. It should be followed 12 hours afterwards by a brisk purgative (not Castor Oil) to clear away the dead worm.

Under the headings Haustus, and Mistura, Filicis Maris, several formulas are given in the Pharmacopœias of the London Hospitals.

10 minims of Tincture of Senega recommended for each fl. drm. of liquid extract, as an emulsifying agent.—*P.J.* '02, ii. 369.

Official Preparation.—Extractum Filicis Liquidum.

Not Official.—Mistura Filicis.

Foreign Pharmacopœias.—Official in Austr., Belg., Dan., Dutch, Jap., Fr. (Fougère), Ger., Hung., Norw., Ital. (Felce Maschio), Port. (Feto Macho), Russ., Mex., Span. (Helecho Macho), Swed., Swiss, U.S. (Aspidium).

Descriptive Notes.—The rhizome, as met with in English commerce, is sometimes entire and sometimes cut in half longitudinally for facility in drying, and has the scaly bases of the leaf stalks or stipes attached to it, these being angular and about 1 inch long and about $\frac{1}{3}$ inch in diameter. The official description limits the size from 3 to 6 inches (7·5 to 15 cm.) in length, $\frac{3}{4}$ to 1 inch (2 to 2·5 cm.) in diameter. The rhizome should be green internally. It should not be kept more than one year. The *B.P.*, as well as the *P.G.* and *U.S.P.*, requires that the rhizome should not be kept more than a year, as the medicinal activity is decreased on keeping. An indication of its freshness when purchased is the yellowish-green tint of the rhizome and stipes when cut transversely. The *B.P.* requires that it should be collected late in the autumn, and divested of its roots, leaves and dead portions. The *U.S.P.* states that the chaff (*i.e.*, scales), together with the dead portions of the rhizome and stipes, should be removed, and only such portions used as have retained their internal green colour. The distinguishing feature of the rhizome is the presence in the transverse section of 10 large vascular bundles forming a circle, beyond which a number of small ones are scattered, the leaf stalks showing eight only in an irregular circle. In the intercellular spaces near the apex of the rhizome globular stalked glands are found, which do not occur in most of the allied ferns likely to be mistaken for it in this country, such as *A. Oreopteris*, Sw., and *Athyrium Filix-fœmina*, Roth. The scales of *A. Filix-mas*, Sw., have two glands at the base, but that of *A. spinulosum*, Sw., which has been found frequently in Germany mixed with the true rhizome, has them also on the margins of the scales. In S. Africa the root of *Aspidium athamanticum*, Kunze, is used as a tænicide under the name of 'Unkomokomo,' and in Continental commerce as 'Pannum.'

Tests.—The ash of Male Fern varies from 1·5 to 3·0 p.c., the insoluble portion of the ash from 0·1 to 0·5 p.c. A standard of not less than 5 p.c. has been suggested.

Preparation.

EXTRACTUM FILICIS LIQUIDUM. Liquid Extract of Male Fern.

Male Fern exhausted by percolation with Ether, and subsequent evaporation of the Ether.

It is referred to in the *U.S.P.* as Oleoresina Aspidii, and is prepared from Aspidium by percolation with Acetone.

Dose.—45 to 90 minims = 2·7 to 5·4 c.c.

For larger doses than 90 minims, see *L.* '88, ii. 1037; *B.M.J.* '89, i. 319; and particularly as to mode of administration, *L.* '94, ii. 255.

U.S. states that the granular-crystalline substance, which deposits on standing, should be thoroughly mixed with the liquid portion before use.

The activity of the Extract is supposed to be due to **Filicic Acid.**—*P.J.* (3) xxii. 84; and this varies in different samples from 0·71 to 9·59 p.c., reaching in one sample 13·07 p.c.—*P.J.* '97, ii. 85.

Foreign Pharmacopœias.—Official in Austr. and Russ. (Ext. Filicis Maris); Belg., Dan., Dutch, Ger., Jap., Norw., Swed. and Swiss (Ext. Filicis); Fr. (Extrait de Fougère Mâle); Hung. (Extract. Filicis Maris Æthereum); Ital. (Estratto di Felce Maschio Etereo); Port. (Extracto de Feto Macho Ethereo); Span. (Aceite de Helecho Macho); U.S. (Oleoresina Aspidii). All made with Ether.

Test.—Fluid Extract of Male Fern has a specific gravity of 1·008 to 1·010.

Not Official.

MISTURA FILICIS.—Liquid Extract of Male Fern, 1; Powdered Acacia 1; Chloroform Water, to 8.—*University.*

FŒNICULI FRUCTUS.

FENNEL FRUIT.

Fr., Fenouil Doux; Ger., Fenchel; Ital., Finocchio; Span., Hinojo.

The dried ripe Fruit of *Fœniculum capillaceum*, Gilib., from cultivated plants.

Medicinal Properties.—Stimulant, aromatic, and carminative. In action similar to Anise. Antispasmodic in intestinal colic of children.

In infants an infusion (1 to 60) is employed as an enema for the expulsion of flatus.

Official Preparation.—Aqua Fœniculi. Used in the preparation of Pulvis Glycyrrhizæ Compositus.

Not Official.—Oleum Fœniculi.

Foreign Pharmacopœias.—Official in Austr., Belg., Dan., Dutch, Fr. (Fenouil Doux), Ger., Hung., Jap., Norw., Ital. (Finocchio), Port. (Funcho), Russ., Mex. and Span. (Hinojo), Swed., Swiss and U.S.

Descriptive Notes.—A number of different varieties of Fennel fruits are met with in commerce, varying from 3 to 4 mm. (Japanese) to 8 to 10 mm. (Saxon) in length, and from 1·5 mm. (Russian) to 3 mm. (French and Saxon) in diameter. The larger fruits are usually slightly curved, and greenish or greenish-brown in colour, according to age and ripeness when collected. The mericarps are usually united, and taper at the apex, and the longitudinal ridges are prominent with six large vittæ in each mericarp, two being on the flat, and four on the convex side. The different kinds vary in the percentage of Oil and in the relative percentage of Anethol and Fenchone that they

contain. The Indian fruit, which yields the smallest percentage of oil, is referred to, *F. panmorium*, D.C., which, however, is regarded by some botanists as only a variety of *F. capillaceum*.

Fennel fruits, after distillation, are used in cattle foods, and to adulterate powdered Fennel fruits. The directions given in the *B.P.* limit the Fennel fruits to those 5 to 10 mm. long and 3 mm. in diameter; these include the Saxon and the cultivated French varieties, unless the Persian, Indian and Galician, which come within the limits of length, but are rather less in diameter than the official measurement, could be considered to be not excluded by the term 'about' prefixed to the official measurement. So far as flavour is concerned the Saxon, French, Macedonian, Persian, and Japanese are the best. Under the microscope the powder is characterised by the spiral and reticulated thin-walled colourless parenchymatous cells of the mesocarp, and the obliquely arranged thin-walled linear oblong cells, about 3 to 5 times as long as broad, of the inner epidermis, and the absence of striation on the cells of the outer epidermis.

Tests.—The ash of Fennel Fruit should amount to not more than 10 p.c. The ash of four samples determined in the author's laboratory amounted to 8·47, 8·93, 9·75 and 7·70 p.c. The ash of six samples of the Pulvis to 10·85, 12·8, 9·90, 8·91, 13·0 and 9·89 p.c. Good Fennel fruits yield from 3 to 5 p.c. of volatile oil.

Preparation.

AQUA FŒNICULI. Fennel Water.

Fennel Fruit, 1; Water, 20. Distil 10. (1 in 10)

Dose.—1 to 2 fl. oz. = 28·4 to 56·8 c.c.

Foreign Pharmacopœias.—Official in Austr., 1 in 20; Ital., Mex. and Port., 1 in 4; Ger., Jap. and Russ., 1 in 30; Hung. and Swed., 1 in 10; Dutch and Swiss, 1 in 25; Belg., Oil 1, Alcohol 99, Water 3300; Dan., with Oil, 1 in 2000; and U.S., with Oil, 1 in 500. Not in Fr. or Norw.

Not Official.

OLEUM FŒNICULI.—A colourless or slightly yellow liquid, possessing a peculiar characteristic odour and taste. It is distilled from Fennel Fruit, the yield of Oil varying from 4 p.c. to 6 p.c.

The important constituent of this Oil is Anethol. It also contains the ketone, Fenchone, which is isomeric and closely related to Camphor.

The commoner oils contain the Terpenes, Dextro-pinene and Dipentene, together with Phellandrene and Limonene. A good oil contains about 60 p.c. Anethol.

The Oil from Japanese Fennel resembles closely that from the other varieties. —*P.J.* '96, ii. 91; *C.D.* '96, ii. 191.

Commercial varieties of Fennel and their essential oils.—*P.J.* '97, i. 225.

Dose.—5 to 15 minims = 0·3 to 0·9 c.c.

Foreign Pharmacopœias.—Official in Austr., Belg., Dan., Dutch, Ger., Hung., Jap., Norw., Port., Russ., Swed., Swiss and U.S. Not in Fr., Ital. or Mex.

Tests.—Fennel Oil has a specific gravity of 0·965 to 0·980. It is soluble in an equal volume of Alcohol (90 p.c.) and 1 in 10 of Alcohol (80 p.c.). It is dextrogyrate, the rotation being from + 12° to + 20° in a 100 mm. tube. The solidifying point should be between 5° and 10° C. (41° and 50° F.).

The more generally occurring adulterations of Fennel Oil are oils from which the Stearoptene has been removed, Alcohol, Volatile Oils containing Phenols, and Oil of Turpentine. The addition of oils from which the Anethol has been abstracted is rendered evident by the lowering of the solidifying point, Alcohol by the lowering of the specific gravity, whilst Turpentine is also detected by the reduction in the specific gravity, the Alcohol-solubility and Rotation.

Ferric Chloride T.S. is employed to detect volatile oils containing Phenol, the addition of a drop of the solution to an alcoholic solution of the Oil should produce no coloration.

Not Official.

FORMIC ALDEHYDE.

METHANAL. METHYL ALDEHYDE.

Produced by the limited oxidation of Methyl Alcohol. A gas condensable by cold to a clear mobile liquid. The commercial article '**Formol**' or '**Formalin**' is stated to be a 40 p.c. solution.

The Formaldehyde Solution official in the *U.S.P.* is required to contain not less than 37 p.c. w/w, that of the *P.G.* about 35 p.c. w/w, and that of *Fr. Codex*, 35 p.c. w/w. of absolute Formaldehyde.

FORMALDEHYDUM SOLUTUM.—A clear colourless fluid, with an irritating odour, containing from 35 to 40 p.c. of Formaldehyde.

Medicinal Properties.—The strong solution (35 to 40 p.c.) is a powerful antiseptic, disinfectant and deodorant; it is also a powerful caustic, and should be handled with care. The vapour is irritating to the eyes and nose, probably due to traces of Formic Acid. Even in very dilute solution, 1 of Formic Aldehyde in 20,000, or 1 of Formalin in 8000, it possesses considerable antiseptic power, and will preserve liquids otherwise liable to change. The 35 p.c. solution diluted with 50 to 100 of Water, may be used as a general antiseptic in the sick room for washing the hands, spray, etc., and with 400 to 500 of Water as an antiseptic mouth-wash or gargle.

Case of poisoning by drinking 4 oz. of a 4 p.c. solution.—*P.J.* '99, ii. 295.

Formalin (40 p.c.) in 2000 to 3000 of Water used freely to hypopyon ulcers, and septic abrasions of the cornea.—*B.M.J.* '96, i. 144.

2 p.c. solution in ringworm.—*B.M.J.E.* '94, ii. 103; *Y.B.T.* '95, 394.

40 p.c. solution applied to ringworm.—*B.M.J.* '96, ii. 650.

40 p.c. solution sometimes causes suppuration, and is not so useful for ringworm as Carbolic Acid.—*B.M.J.* '97, i. 972.

Stated to be best administered with Sugar of Milk, without a single bad result (*M.P.* '04, ii. 523) in many hundred cases, including scarlet fever, diphtheria, erysipelas and cystitis.

Formic Aldehyde has received considerable attention as a therapeutic agent in pulmonary tuberculosis, and has been employed both intravenously and as an inhalation. Maguire in his Harveian lectures recommends a solution of 1 part Formic Aldehyde Gas in 2000 parts of a sterilised solution of Sodium Chloride.—*Trans. of Brit. Cong. on Tuberculosis*, vol. iii. p. 438; *L.* '00, ii. 1549, 1633, 1709; '01, i. 629, 707; '01, ii. 310; '03, i. 98; '03, ii. 463; *B.M.J.* '00, ii. 1566, 1637, 1695.

Intravascular antisepsis.—Experiments show that at present there is no evidence which would warrant that the course of a septicæmia in animals can be favourably influenced by the intravenous injection of an antiseptic.—*L.* '03, i. 98.

A single intravenous injection of Formaldehyde in physiological solution effected a cure (*L.* '05, i. 1341) in a case of marked oral sepsis, and the cure by intravenous injection in a case of tuberculous abscess of the lung in a patient with acute pulmonary tuberculosis was absolute and rapid. Tubercle bacilli, sputum and cough all disappeared.

Poisons such as Strychnine, Veratrine, Morphine, Atropine and Phosphorus will remain in the organs preserved with a 10 p.c. aqueous solution of Formalin for a very long time.—*L.* '05, i. 1093.

Formaldehyde has been somewhat extensively used by intravenous injection in the treatment of pulmonary phthisis, and a solution of 1 in 2000 is a suitable strength for injection.

As an inhalation, it has been used with good results in tuberculosis, pertussis and diphtheria. 2½ to 6 p.c. solutions of Formalin in pure Water or in 10 to 20 p.c. Glycerin solution are convenient, and should there be more than usual sensitiveness in the air-passages, a little Aromatic Spirit of Ammonia may be added.

A solution of Formalin 1, Chloroform 1, Alcohol (90 p.c.) 2, has also been used; or it may be used as a fine **spray** at a strength of 6 to 10 p.c. solution mixed with Glycerin.—*B.M.J.* '99, i. 202, 772, 1440; '00, i. 139; '00, ii. 1624; '02, ii. 1692; *L.* '01, i. 468; '01, ii. 310; '02, ii. 562, 772; *Trans. of the Brit. Cong. on Tuberculosis*, vol. iii. p. 436.

Severe inflammation of the ends of all the finger nails caused by the prolonged use of a 1 in 500 solution of Formalin as a disinfectant for the hands.—*B.M.J.* '02, i. 54.

Recurrent papillomata of the larynx treated locally by Formalin as a 1 in 1000 increasing up to 1 in 100 spray.—*L.* '01, ii. 487.

A solution of equal parts of Formalin and Glycerin as a paint in lupus.—*B.M.J.* '01, i. 1078; *B.M.J.E.* '01, ii. 48.

10 to 50 p.c. ointment in chilblains if skin be not delicate.—*Pr.* '08, i. 251.

Cases of poisoning from swallowing commercial Formalin.—*B.M.J.E.* '01, i. 9, 72.

A few drops of Liquor Ammoniæ Fort. well diluted with Water, or still better Liquor Ammonii Acetatis, given at frequent intervals as an antidote in cases of Formalin poisoning.—*B.M.J.E.* '01, ii. 7.

Formic Aldehyde as a preservative of foods.—It is generally condemned as a preservative of foods on account of its action on the flesh-forming constituents, rendering them insoluble. The proteids of Milk containing Formalin fail to yield to the digestive action of Pepsin.—*L.* '99, i. 1507; '99, ii. 1282, 1427, 1577; '00, i. 228; *J.C.S. Abs.* '01, ii. 517; *B.M.J.E.* '02, i. 16.

Recommendation of the Departmental Committee appointed to inquire into the use of preservatives in food; that Formaldehyde or any of its preparations be absolutely prohibited in food or drinks.—*L.* '01, ii. 1683; *B.M.J.* '01, ii. 1758; *P.J.* '01, ii. 620; *C.D.* '01, i. 880; *Analyst*, '01, 333.

Formic Aldehyde as a disinfectant.—There is no conflict of evidence as to Formaldehyde being a reliable disinfectant when used in solution, or used in the gaseous state for room disinfection when all objects are freely exposed, but it seems to be the general opinion that for the disinfection of heavy materials and furniture, or where there are many cracks or fissures, or the surfaces are not freely exposed, on account of its non-penetrative properties it is not so suitable as Sulphurous Acid Gas. It has the advantage, however, of being non-injurious to delicate fabrics such as furs, silks, etc.—*L.* '99, i. 1436; '02, i. 759; '03, i. 37; *B.M.J.* '99, i. 1280; '00, i. 1575; '00, ii. 1600; '02, i. 792; *B.M.J.E.* '00, i. 55; *T.G.* '99, 600.

Report of the practical experiments on disinfectants undertaken by the London County Council: both Formic Aldehyde and Sulphur Dioxide failed in the case of wood and cloth charged with spores; in the case of tuberculous sputum dried on linen and paper, Formaldehyde showed to greater advantage than Sulphur Dioxide.—*L.* '02, i. 759; *B.M.J.* '02, i. 792.

Formaldehyde in the state of vapour is able to destroy the bacilli in '*dried*' sputum, but solutions of 4 to 10 p.c. did not affect '*ordinary*' sputum.—*L.* '03, i. 37.

A paper by Kanthack on the use of Formalin lamps for the disinfection of rooms.—*L.* '98, ii. 1049.

The Aldehyde vapours are non-poisonous, but very irritating to the eyes and throat; they possess marked deodorant and disinfectant properties, and are well suited to the purposes of room disinfection, for they do not affect colours. The use of the reagent in a gaseous form appears to possess the advantages over disinfection by Sulphurous Acid, that it injures nothing except Iron, it diffuses better, and it possesses greater disinfectant power.—*B.M.J.* '98, i. 1542.

Muller's Fluid, containing 10 p.c. of Formol, has been recommended for hardening pathological specimens, but it deposits in 5 days and must be changed; 60 p.c. Alcohol, to which 1 p.c. Formol has been added, is a good preservative fluid after hardening in above.—*B.M.J.E.* '96, i. 88.

The 35 p.c. solution is diluted with 10 to 50 of Water, for fixing and hardening histological and pathological specimens, and for preserving them.

In room disinfection, best results obtained when 50 grammes of Potassium Permanganate are added to 100 c.c. Formaldehyde, or multiples of these quantities, depending on the space to be disinfected.—*T.G.* '07, 460.

Value and selection of disinfectants.—*Pr.* '07, 269.

Foreign Pharmacopœias.—Official in Austr., Belg., Dan., Dutch, Fr., Ger., Ital., Jap., Span., Swed., Swiss and U.S.

Tests.—Formic Aldehyde Solution has a specific gravity of 1·079 to 1·081. The *U.S.P.* has a specific gravity of 1·075 to 1·081 at 25° C. (77° F.); the *P.G.* solution 1·079 to 1·081. It should be neutral or only faintly acid to Litmus paper.

On evaporating 5 c.c. to dryness on a water-bath a white amorphous mass is left, which should leave no weighable residue on ignition.

If the solution be made strongly alkaline with Ammonia Solution and evaporated to dryness on a water-bath, a white crystalline residue readily soluble in Water remains. Formaldehyde Solution readily reduces Silver Ammonio-nitrate Solution, and Potassio-cupric Tartrate Solution, the former yielding a greyish-black deposit of metallic Silver, the latter a deposit of red Cuprous Oxide. 2 c.c. of the Solution mixed with an equal volume of Potassium Hydroxide Solution and about 0·5 gramme of Resorcin gradually yields, when the mixture is heated to boiling, a bright red coloration. 2 drops added to 5 c.c. of Sulphuric Acid containing a little dissolved Salicylic Acid yields, on gently warming, a permanent deep red colour. A brilliant blue colour, varying in intensity with the amount of Formaldehyde present, is produced when about 0·05 gramme of Phenylhydrazine Hydrochloride is added to 1 c.c. of the solution diluted to 5 c.c. with Distilled Water, followed by the addition of 3 drops of a freshly-prepared 5 p.c. Sodium Nitro-prusside Solution, thorough agitation of the liquid, then Sodium Hydroxide Solution drop by drop until an excess has been added. Numerous methods have been proposed for the quantitative determination of Formic Aldehyde. That perhaps most generally used, on account of the ease of manipulation is the Ammonia process, and depends upon its conversion into Hexamethylenetetramine and determination of the amount of Ammonia absorbed. A weighed quantity of 2 grammes of pure neutral Ammonium Chloride is dissolved in 25 c.c. of Water and introduced into a flask provided with a well-fitting stopper. A weighed quantity of 2·5 grammes of the sample is carefully neutralised with Normal Volumetric Potassium Hydroxide Solution and added to the Ammonium Chloride Solution. A measured quantity of 25 c.c. of Normal Volumetric Potassium Hydroxide Solution is then added, the flask securely stoppered and set aside for one hour. A few drops of Rosolic Acid Solution are added, and the excess of Ammonia is titrated with Normal Volumetric Sulphuric Acid Solution, each c.c. of Normal Volumetric Potassium Hydroxide Solution absorbed corresponding to 2 p.c. w/w of Formaldehyde.

The *P.G.* process consists in treating 5 c.c. of the Formic Aldehyde Solution with 20 c.c. of Water and 10 c.c. of Ammonia Solution, allowing the mixture to react for one hour in a well-stoppered flask. A measured quantity of 20 c.c. of Normal Volumetric Hydrochloric Acid Solution is added, a few drops of Rosolic Acid Solution and the excess of acid titrated with Normal Volumetric Potassium Hydroxide Solution. At least 4 c.c. should be necessary to produce a red coloration. The *U.S.P.* process depends upon the oxidation of the Formic Aldehyde to Formic Acid and titration with standard alkali. A measured quantity of 3 c.c. of Formic Aldehyde Solution is placed in a well-stoppered Erlenmeyer flask and accurately weighed. A measured quantity of 50 c.c. of Normal Volumetric Sodium Hydroxide Solution is added, followed immediately by 50 c.c. of Hydrogen Dioxide Solution added slowly through a small funnel, a drop or two of Litmus Solution having been previously added, and the solution previously neutralised with Normal Volumetric Sodium Hydroxide Solution. When the reaction is completed the funnel and sides of the vessel are rinsed with Distilled Water, the whole allowed to stand 30 minutes, and titrated back with Normal Volumetric Sulphuric Acid Solution, using Litmus Solution as an indicator. The number of c.c. of Normal Volumetric Sulphuric Acid consumed are subtracted from 50, the remainder is multiplied by 2·979 and the product divided by the weight of

Solution taken; the quotient indicates the percentage w/w of absolute Formic Aldehyde. Both methods have been tried in the author's laboratory. The Hydrogen Peroxide method is the more accurate of the two and yields higher results, but the ease of manipulation of the Ammonia process and the fact that the results yielded are sufficiently accurate for most practical purposes ensures its more general application. An Iodometric method has been proposed by G. Romijn (*Analyst* '97, 221). A weighed quantity of 2·075 grammes of Formaldehyde Solution is diluted with Water to 500 c.c. A measured quantity of 10 c.c. of this Solution is mixed with 25 c.c. of Deci-normal Volumetric Iodine Solution and sufficient Sodium Hydroxide Solution (15 p.c.) added drop by drop to colour the liquid clear yellow. Allow to stand 10 minutes and add sufficient dilute Hydrochloric Acid to liberate the uncombined Iodine which is titrated with Deci-normal Volumetric Sodium Thiosulphate Solution. 1 c.c. of the Volumetric Iodine Solution is equivalent to 0·001489 gramme of absolute Formic Aldehyde. A method based on the production of a Bisulphite compound by interaction between Formaldehyde Sodium Bisulphite and Normal Volumetric Sulphuric Acid Solution, using Phenolphthalein Solution as an indicator, has also been suggested. The end reaction is, however, somewhat indefinite, and it is therefore difficult to judge when the reaction is complete. The method adopted by the *Fr. Codex* is similar to that of the *U.S.P.*, and depends upon the oxidation of the Formaldehyde to Formic Acid, by means of Hydrogen Peroxide, and determination of the Formic Acid volumetrically.

The more generally occurring impurities are Methyl Alcohol, excess of acid, *e.g.*, Formic Acid, fixed impurities, Iron, Lead, Copper, and Calcium, Chlorides and Sulphates. The presence of Methyl Alcohol or Acetone may be shown by the Iodoform test, no precipitate of Iodoform should be produced when 1 c.c. of the Solution is mixed with 10 c.c. of Iodine Solution, the excess of Iodine decolorised with Sodium or Potassium Hydroxide Solution, and the mixture warmed; excess of acid may be determined by titration with Normal Volumetric Sodium or Potassium Hydroxide Solution, using Phenolphthalein Solution as an indicator of neutrality, the *U.S.P.* and the *P.G.* permit 0·23 w/v of anhydrous Formic Acid; fixed impurities are detected by the residue left on evaporation and ignition; Iron by the Potassium Ferrocyanide test in the diluted solution; Lead, Copper, Calcium, Chlorides and Sulphates by diluting the solution 1 to 3 or 1 to 4 and applying Hydrogen Sulphide Solution, Ammonium Oxalate Solution, Silver Nitrate Solution or Barium Chloride or Nitrate Solution respectively.

PARAFORMIC ALDEHYDE (Paraform. Tri-oxymethylene).—A white micro-crystalline or amorphous powder, insoluble in Water. It is a polymer of Formic Aldehyde; it volatilises at 100° C. (212° F.), and is readily convertible into that substance when heated to the above temperature in the presence of Water. It is used for disinfecting rooms. It is official in *Fr. Codex*.

Sterilisol.—An aqueous solution of Paraform, the solution being effected at 40° to 45° C. (104° to 113° F.) *in vacuo*.—*L.* '05, i. 1075.

HEXAMETHYLENETETRAMINE.—Colourless and odourless lustrous crystals, or as a white crystalline powder, possessing an alkaline reaction.

It is a condensation product, obtained by the action of Ammonia gas on Formic Aldehyde. It should be preserved in well-stoppered bottles.

Commercial varieties of this substance are known under the names of **Aminoform, Cystamine, Formin** and **Urotropine.**

It has been implied, if not actually stated, that all these products are exactly the same and practically interchangeable. This is not borne out by clinical experience, for the different preparations do not always produce the same results in the same patient. This is precisely what we should expect from a body of which the stereographic formula presents so many different possibilities.

Solubility.—Soluble 5 in 6 of Water, 1 in 8 of Alcohol (90 p.c.), sparingly in Ether.

Urinary antiseptic; given in cystitis and phosphaturia.

Dose.—5 to 15 grains = 0·32 to 1 gramme, dissolved in Water or in aerated Water.

Marvellous effects in doses of 10 grains thrice daily in typhoid bacilluria and cystitis, for which conditions it appears to be an almost specific remedy.—*L.* '00, i. 707, 1059, 1876; '01, i. 174; '02, i. 687; *B.M.J.E.* '02, i. 95. 5-grain doses three times a day in cystitis with ammoniacal urine.—*L.* '00, i. 1653.

As an intestinal disinfectant.—*B.M.J.E.* '01, ii. 60.

In daily doses of 20 to 60 grains in diabetic coma.—*B.M.J.E.* '02, i. 72.

Two cases of hæmaturia following the use of from 5 to 10 grains of the salt three times daily.—*B.M.J.* '01, i. 1473, 1617, 1659; *T.G.* '01, 617.

In the pyuria of tabes dorsalis 3 grains daily.—*L.* '03, ii. 1019.

In vesical catarrh accompanying typhoid fever 10-grain doses have been given three times daily with advantage.—*B.M.J.* '04, ii. 1450. Is stated (*L.* '05, i. 83) to be liable to produce irritation of the stomach, diarrhœa, abdominal pain, a measles-like rash, renal irritation, albuminuria, and strangury. It may cause hæmaturia unless well diluted, and the powder should be taken in at least 5 oz. of Water.

In enteric fever, doubtful if it had any influence on the course of the illness itself.—*B.M.J.* '05, i. 414.

In acute but not in tubercular cystitis, in ½-gramme doses.—*T.G.* '07, 311.

A mixture of Urotropine and Iridin has a pronounced effect in causing dissolution of calculi in the treatment of artificially-produced cholelithiasis.—*B.M.J.* '05, ii. 272.

Of value as a prophylactic against the nephritis of scarlatina; suggested that all cases of scarlatina be treated from the beginning with 5 to 7½ grain doses thrice daily, well diluted with Water, to be continued to the 28th day of the disease.—*Edin. Med. Jour.* '07, i. 113.

Foreign Pharmacopœias.—Official in Dan., Jap., Swiss and U.S.

Tests.—Hexamethylenetetramine sublimes at a temperature of 263° C. (505·4° F.). When mixed with a little Salicylic Acid and heated with Sulphuric Acid, it develops a carmine-red coloration. If heated with diluted Sulphuric Acid the characteristic irritating odour of Formaldehyde is evolved, and if a piece of filter paper, moistened with Silver Ammonio-nitrate Solution, be held over the tube, it is immediately darkened. If this Sulphuric Acid Solution be cooled and supersaturated with Sodium Hydroxide Solution, the characteristic odour of Ammonia is evolved; recognised also by its turning a piece of moistened red Litmus paper blue. A 10 p.c. aqueous solution affords a precipitate with Tannic Acid Solution; with Mercuric Chloride Solution, on standing, crystalline needles are produced; with Iodo-potassium Iodide Solution it yields a brown crystalline precipitate.

The more generally occurring impurities are mineral matter, Copper, Iron or Lead, Chlorides or Sulphates, Ammonia salts, and Paraformaldehyde. Mineral matter may be detected by the residue left on ignition; Copper and Lead may be detected by Hydrogen Sulphide Solution; Iron by Potassium Ferrocyanide Solution; Chlorides by Silver Nitrate Solution after acidification with dilute Nitric Acid; Sulphates by Barium Chloride Solution after acidification with diluted Hydrochloric Acid. Ammonium salts and Paraformaldehyde may be detected by Potassio-mercuric Iodide (Nessler's) Solution, the former causing brownish-red colour or precipitate, the latter readily causing a separation of metallic Mercury.

AMYLOFORM.—A white, amorphous, odourless powder, which is a compound of Formaldehyde with Starch. Insoluble in Water, but when brought in contact with moist surfaces it is slowly decomposed, giving off Formaldehyde. Recommended as a dressing or as a dusting powder.—*L.* '97, ii. 40; '00, i. 470; *T.G.* '00, 316.

Dextroform is a white powder, freely soluble in Water, slightly soluble in cold Glycerin, but dissolves 1 in 10 when warmed. It is a compound of Formaldehyde with Dextrine. It has been used internally, and has been given in the form of a 5, 10, or even 20 p.c. solution in gonorrhœa.

Glutol is a yellowish-white powder, insoluble in Water and Glycerin; it is a compound of Formaldehyde with Gelatin, used as an antiseptic dressing.

FORMICIN.—A syrupy liquid, sp. gr. 1·240 to 1·260. Miscible with Water, Alcohol and Chloroform in all proportions. It is produced by the action of Acetamide on Formaldehyde, and has been introduced (*B.M.J.E.* '05, ii. 99; *P.J.* '05, ii. 835) as a powerful antiseptic. Applied in the form of a 2 p.c. tepid solution it has been used as a surgical disinfectant.

HELMITOL (Hexamethylenetetramine Anhydromethylene Citrate).—Colourless crystals, or as a white crystalline powder, soluble 1 in 5 of Water; sparingly soluble in Alcohol (90 p.c.); insoluble in Ether. Has been recommended in chronic posterior urethritis, cystitis and prostatitis.

In acute cystitis the subjective results were good (*B.M.J.E.* '05, ii. 20), but the cystitis reappeared if the drug were discontinued. It is more useful in bacteriuria, the results being permanent.

Dose.—10 to 15 grains = 0·65 to 1 gramme, three times daily.

HETRALIN (Dioxybenzolhexamethylenetetramine).—One of the many derivatives of Hexamethylenetetramine; it forms snow-white crystals, soluble (according to our experiments, *P.J.* [4], xx. 784; *C.D.* '05, i. 783) 1 in 9 of Water; 1 in 17½ of Alcohol (90 p.c.); 1 in 180 of Ether, sp. gr. 0·735; insoluble in Chloroform. It has been introduced as a urinary antiseptic (*B.M.J.* '04, ii. 1468), but (*B.M.J.E.* '04, ii. 64) failed to produce any good effect in seven cases of tuberculous disease of kidneys and bladder.

In doses of 1 grain, given every 3 hours, has been found of value in acute cystitis in an infant.—*B.M.J.* '07, i. 1181.

In cases of cystitis it has proved beneficial in doses of 15 grains twice a day in a tumblerful of cold Water.—*General Practitioner*, Feb. 18, 1907.

INDOFORM.—A white powder, m.p. 108° to 109° C. (226·4° to 228·2° F.), produced by action of Formaldehyde on Acetyl-salicylic Acid. Sparingly soluble in cold Water, and has an acid, astringent taste. Antirheumatic and anti-neuralgic.

Dose.—7½ grains = 0·5 gramme.

SODIUM ANHYDROMETHYLENECITRATE (Citarin).—A white granular, amorphous powder, soluble 1 in 1½ Water; insoluble in Alcohol (90 p.c.), and in Ether. Given in rheumatism and gout, and as a solvent for Uric Acid calculi.

Dose.—15 to 30 grains = 1 to 2 grammes.

URESIN (Hexamethylenetetramine Di-lithium Citrate).—A white, crystalline powder, readily soluble in Water; has been given in gout, and as a solvent for certain urinary deposits.

Dose.—5 grains = 0·32 gramme.

Chinotropine (Quinotropine) is a white powder, readily soluble in Water. It is a combination of Quinic Acid and Hexamethylenetetramine. Is said to lessen formation of Uric Acid.—*B.M.J.E.* '01, ii. 95; *P.J.* '01, i. 666.

Dose.—10 to 15 grains = 0·65 to 1 gramme.

Under the name of **Igazol** a combination of Formic Aldehyde with Chloral, Terpene and Iodoform has been introduced for the treatment of pulmonary consumption, and is used as an inhalation.—*Trans. of Brit. Cong. on Tuberculosis*, iii. 416; *B.M.J.* '00, ii. 662.

Lysoform is a clear, colourless or pale yellowish, soapy liquid. Miscible with Water. Introduced as an antiseptic. A solution 1 to 2 tablespoonfuls to the pint is used to disinfect the hands.—*B.M.J.E.* '01, ii. 88; *L.* '03, ii. 1307.

In the sterilisation of the hands, a 2 p.c. solution in Alcohol gave much superior results to the hot Water-Alcohol method (*B.M.J.* '05, i. 727), but still better results were obtained with Bacillol and Sublamin. Bacillol is a Cresol preparation, non-toxic and non-injurious to the hands. Experiments with a 1 p.c. alcoholic solution gave complete sterility through all tests in a minimum of 60 p.c.

Carbol Lysoform is stated to be a mixture of crude Carbolic Acid and Lysoform, and to be a more active bactericide than either of its components.—*B.M.J.E.* '02, ii. 92; *P.J.* '03, i. 340.

Not Official.

FUCUS VESICULOSUS.

Bladder-wrack collected from rocks by the seaside and dried.

Medicinal Properties.—Given to reduce obesity.
Smelling fresh seaweed is said to relieve hay asthma.

Foreign Pharmacopœias.—Official in Mex. (Encina de Mar); Port. (Bodelha). Not in the others.

Descriptive Notes.—This seaweed is of a blackish colour, flat, forked, about half an inch broad and a foot or more long. From other British species it is distinguished by having a mid-rib, and oval air bladders in the frond, usually in pairs, one on each side of the mid-rib. When dried it has often a white efflorescence of Mannite on the surface. It is said to be most active if collected in September and dried in the shade.

Tests.—Bladder-wrack leaves about 15 p.c. of ash when ignited with free access of air. Two specimens examined in the author's laboratory showed 15·0 and 15·6 p.c. of ash.

EXTRACTUM FUCI VESICULOSI.—Prepared by percolation with Alcohol (45 p.c.), and evaporation to a stiff extract.—*B.P.C. Formulary* '01, incorporated in the *B.P.C.* under the title **Extractum Fuci.**

Dose.—3 to 10 grains = 0·2 to 0·65 gramme, in **pills.**

Test.—It leaves about 18 p.c. of ash on ignition.

EXTRACTUM FUCI VESICULOSI LIQUIDUM.—Dissolve 1 of Extract of Fucus Vesiculosus in Alcohol (45 p.c.) to make 5.—*B.P.C. Formulary* '01, incorporated in the *B.P.C.* under the title **Extractum Fuci Liquidum.**
The fluid extract has been given in *Companion* since 1867, and was included in *B.P.C. Formulary* '01.

Dose.—1 to 2 fl. drm. = 3·6 to 7·1 c.c.

Tests.—Liquid Extract of Fucus Vesiculosus has a specific gravity of about 1·044; contains about 8 p.c. w/v of total solids and about 50 p.c. w/v of Absolute Alcohol.

GALBANUM.

GALBANUM.

Fr., Galbanum; Ger., Galbanum; Ital., Galbano; Span., Galbano.

A Gum-resin obtained from *Ferula galbaniflua*, Boiss. and Buhse, and probably from other species.

Galbanum contains about 9·5 p.c. of ethereal Oil, 63·5 p.c. of Gum-resin soluble in Alcohol, and 27 p.c. of impurities. The pure Gum-resin contains Umbelliferone Galbaresinotannol Ester, 20 p.c.; Galbaresinotannol, about 50 p.c.; and about 0·25 p.c. of free Umbelliferone, 0·5 to 30 p.c. of ash.

Medicinal Properties.—Internally similar to Asafetida, but less energetic; externally as a plaster in chronic inflammatory swellings.

Dose.—5 to 15 grains = 0·32 to 1 gramme.

Official Preparation.—Pilula Galbani Composita.

Not Official.—Emplastrum Galbani and Unguentum Galbani Compositum.

Foreign Pharmacopœias.—Official in Austr., Belg., Dan., Dutch, Fr., Ger., Ital., Jap., Mex., Norw., Port., Russ., Span., Swed. and Swiss. Not in Hung. or U.S.