and certainly is a diffusible stimulant. As such it has been used with benefit in chorea, hysteria, flatulent dyspepsia, and chronic malaria.

CHIMAPHILA, Chimaphila, (*Pipsissewa*),—the leaves of *Chimaphila umbellata*, or Prince's Pine, an evergreen plant of the nat. ord. Ericaceæ, indigenous to all parts of the United States. It contains *Chimaphilin*, a yellowish crystalline principle, *Arbutin*, also crystalline but colorless, with tannic acid, etc.

Fluidextractum Chimaphilæ, *Fluidextract of Chimaphila*,—Dose, ♏x–℥j [av. ♏xxx.]

Chimaphila is a tonic, astringent diuretic, belonging to the same class as Buchu, Uva Ursi, Pareira and Scoparius. It is probably the most active diuretic in this group, stimulating all the excretory organs, especially the kidneys. It is an agreeable tonic, excites the appetite and promotes digestion. The fresh leaves, bruised and applied to the skin, are rubefacient and vesicant, showing the presence of some irritant principle. It is a good diuretic in dropsy, and is efficient in several forms of chronic kidney disease with albuminuria, and in chronic catarrhal affections of the urinary passages, as hematuria, ischuria, dysuria and gonorrhea. It is believed to check the secretion of uric acid, and should prove useful in gout and rheumatism. Externally, it has been applied to ulcers and tumors with benefit.

CHINOLINUM, Chinolin, *Leucolin*, *Quinolin*, C_9H_7N (Unofficial),—is an organic principle and a constituent of coal-tar oil, but may be obtained from quinine or cinchonine by their destructive distillation with potassium hydrate, and is artificially prepared by heating anilin or nitro-benzol with glycerin in the presence of a dehydrating agent. Chemically, it is considered to be formed by a union of benzene and pyridine. (Compare the article CINCHONA.) It is a colorless, oily, strongly refractive liquid, soluble in alcohol, ether and carbon disulphide, sparingly soluble in water. It combines with acids to form crystalline salts; which, except the tartrate, are very deliquescent. The Cinchona alkaloids are derivatives of Chinolin.

Chinolini Tartras, *Chinolin Tartrate* (Unofficial),—a white crystalline powder, of pungent odor, sharp taste, stable in the air and soluble in water. Dose, gr. v–xx.

Derivatives.

Quinalgen (Unofficial),—is the trade name of a complex synthetic derivative of chinolin, and is a re-formed and renamed *Analgen* (see page 60), differing therefrom by having the benzoyl radicle instead of the acetyl one. Dose, gr. vij–xv, not to exceed gr. xlv daily. It acts similarly to Antipyrine, and is said to be devoid of unpleasant symptoms. It has been used with asserted benefit in gout, influenza, migraine, sciatica, neuralgia, hay fever and rheumatic pains.

Thallin, *Tetra-hydro-parachinanisol*,—is a synthetically prepared substance, having also another chemical name, *Tetra-hydro-paramethyl-oxy-chinolin*. It occurs as a colorless powder which is soluble in water, and enters into combination with acids, forming salts, of which the tartrate and sulphate are the most eligible, especially the latter. The dose of Thallin or its Sulphate ranges from gr. ij to gr. xv, a mean average dose being about 5 grains, given in the form of compressed tablets. Thallin is an antipyretic of very great power, doses of 5 to 12 grains lowering the temperature in typhoid fever 4° to 5° in 2 hours' time, the effect lasting nearly 3 hours. In tuberculosis similar results were obtained. Large doses, however, produce very profuse sweating and a dangerous degree of depression; so that this agent is not a favorite remedy for hyperpyrexia.

Kairinum, *Kairin*, *Hydrochlorate of Oxy-ethyl-chinolin-hydride*, $C_{10}H_{13}NO.HCl.H_2O$, —is prepared from Chinolin, belongs to the phenol group of carbon compounds, and is a powerful antipyretic in 8-grain doses hourly. It stains the urine a deep green, and has not proven fatal though 220 doses have been administered in one case. In some cases of typhus it has caused cyanosis and collapse. It produces profuse sweating and vomiting, and the subsequent rise of temperature after its antipyretic influence has worn off is generally ushered in by a severe rigor. It occurs in white crystals, which are freely soluble in water, but is best given in wafer paper, or capsules. Dose, gr. iij–xx.

Chinosol, *Quinosol* (Unofficial),—is the oxy-chinolin sulphonate of potassium, and occurs as a yellow powder which is soluble in water, insoluble in alcohol and in ether. Solutions of 1 in 1000 are used as antiseptic applications in gynecological and obstetrical practice.

Orexin, *Phenyl-dihydro-chinazolin* (Unofficial),—is a complex chinolin derivative, and occurs as a yellowish powder, insoluble in water, but soluble in dilute hydrochloric acid and in the gastric juice. It is incompatible with preparations of Iron. The Hydrochloride and the Tannate are used, the latter being the favorite preparation. Dose, gr. ij-viij, twice daily, before meals, followed by a draught of warm water or beef-tea.

Chinolin is antiseptic and powerfully antipyretic, and closely resembles quinine in its chemical construction and its physiological action. It has been extensively used as an antipyretic in pneumonia and other febrile disorders, but proving dangerous from its liability to cause collapse, it and its derivatives (kairin, thallin, etc.) have been superseded by antipyrine, phenacetin and acetanilide. The Tartrate has been employed with benefit in neuralgia and whooping-cough, also as an antiperiodic in intermittents.

Chinosol is claimed to have antiseptic power nearly equal to that of mercuric chloride, a solution of 1 in 40,000 preventing bacterial development. It does not coagulate albumin and is said to be non-toxic. The powder is irritant to wounds when applied dry, but not when in solution. Some observers say that its germicidal power is feeble, and that it impairs the functional activity of the kidneys. It is somewhat astringent and styptic.

Orexin is a remarkable stomachic tonic, a true physiological appetizer, and a promoter of digestion. The Hydrochloride causes some gastric distress, but the Tannate and the base itself are free from this objection. The Tannate has been extensively used in the anorexia of many affections, and has proved remarkably efficient in increasing the appetite and promoting constructive metamorphosis in convalescence from acute disease and in wasting disorders when the requisite amount of aliment is taken with difficulty. It has proved beneficial in sea-sickness, in the nausea and vomiting of anesthesia, the vomiting of pregnancy, chronic gastric catarrh, nervous dyspepsia, neurasthenia, and other affections in which anorexia is a prominent symptom. It is reported to be contraindicated in acute inflammation and ulceration of the stomach, also in hyperacidity, and excessive gastric secretion.

CHIRATA, Chirata, (*Chiretta*),—is the Indian plant *Swertia Chirayita*, nat. order Gentianaceæ, occurring in bundles, composed of all but the coarser woody stems. It is inodorous, but intensely bitter, and contains two amorphous bitter principles, named *Chiratin* and *Ophelic Acid*, but no tannin. Dose of the powdered plant, gr. x–xx [av. gr. xv.]

Fluidextractum Chiratæ, *Fluidextract of Chirata*,—made with diluted alcohol. Dose, ♏x–xx [av. ♏xv.]

The action of this plant is that of a simple bitter, like its congener Gentian. It is an excellent tonic, in this respect rivalling Cinchona, and is used in India as a substitute for the latter. It is laxative and stomachic, diminishes flatulency and acidity, and is particularly serviceable in the dyspepsia of gouty subjects. As it contains no tannin, it may be administered with preparations of Iron.

CHLORALUM HYDRATUM, Hydrated Chloral, (*Chloral Hydrate*) $C_2HCl_3O + H_2O$,—is a crystalline solid, composed of trichloraldehyde (chloral) with

one molecule of water. It occurs in colorless, transparent, rhomboidal crystals, slowly volatilizing when exposed to the air; of aromatic, penetrating and slightly acrid odor, bitterish, caustic taste, and neutral reaction. It is freely soluble in water, alcohol, ether, chloroform, oils, etc.; liquefies when triturated with about an equal quantity of camphor, menthol, thymol or phenol; and is decomposed by alkalies into chloroform and a formate of the base. Its aqueous solution becomes acid, but the alcoholic solution remains neutral. Dose, gr. x–xxx [av. gr. xv.]

Chloral itself, (Trichloraldehyde, C_2HCl_3O), is an unstable, oily, colorless fluid, formed by the action of chlorine upon alcohol, whence its name, Chlor-al.

The Dose varies much with individual susceptibility and with the presence or absence of cardiac and pulmonary disease. Death has been caused in several instances by gr. xxx, in one case by gr. x, and in another gr. vijss produced alarming symptoms, all being in adults. On the other hand, recovery has occurred after the ingestion of an ounce, several hundred grains have been taken at a time in more than one instance without fatal results, and where tolerance has been established by habitual use ʒij–ʒiij are frequently taken without poisonous symptoms. An average dose for a healthy adult is gr. xx, for a child gr. j for each year of age up to gr. vj. It is best given in Syrup of Tolu, or in Peppermint water.

Incompatibles.

Incompatible with *Hydrated Chloral* are: Acetanilide, Alcohol, Alkalies, Ammonium salts, Benzamide, Borax, Borneol, Camphor, Camphora Monobromata, Diuretin, Euphorin, Exalgin, Glycerin (with heat), Lead Acetate, Menthol, Mercuric Nitrate, Mercuric Oxide, Methacetin, Phenacetin, Phenol, Piperazin, Potassium Cyanide, Potassium Permanganate, Potassium Iodide, Pyrocatechin, Quinine Sulphate, Saligenin, Salocoll, Salol, Sodium Phosphate, Thymol, Urea, Urethane. *Physiologically incompatible* are: Ammonium Chloride, Atropine, Brucine, Caffeine, Cocaine, Codeine, Digitalis, Phenol, Physostigmine, Picrotoxin, Strychnine, Thebaine.

Hydrated Chloral should not be prescribed with preparations containing alcohol, as the Chloral is liable to separate as an alcoholate, especially if the Bromide of Potassium or Sodium is used in the same mixture and if the solutions are at all concentrated. In this way great danger is incurred of giving a heavy overdose, as the alcoholate floats on the surface of the mixture, and the entire amount of Chloral contained therein may be taken at a single dose.

Derivatives of Chloral.

Chloralformamidum, *Chloraljormamide* (*Chloralamide*) $C_3H_4Cl_3NO_2$—is a crystalline solid, made by the direct union of formamide with anhydrous chloral. It occurs in lustrous crystals, which are soluble in about 20 of water and in 1½ of alcohol, also in glycerin, ether, etc.; and is decomposed in warm or hot solutions, also by alkalies, alkaline carbonates and silver nitrate. Dose, gr. x–xxx [av. gr. xv.], in whisky, brandy, or other alcoholic preparation.

Chloralose, *Anhydro-Gluco-chloral*, $C_8H_{11}Cl_3O_6$ (Unofficial),—is formed by heating together anhydrous Chloral and Glucose. It occurs in small crystals, of bitter taste, freely soluble in hot water, slightly in cold water. Dose, gr. ij–v, in capsule.

Hypnal (Unofficial),—is the trade name of a combination of Chloral and Antipyrine, occurring as tasteless and odorless rhombic crystals, soluble in 6 of water, and credited with simultaneous action as a hypnotic and an analgesic. Dose, gr. xv–xxx in aqueous mixture with some alcohol, flavored with syrup of orange. It is said to cause no gastric disturbance.

Somnal (Unofficial),—is the suggestive name given to a liquid preparation formed by the union of Chloral, Alcohol and Urethane, described as *Ethylirtes Chloral-urethane*, represented by the formula $C_7H_{12}Cl_3O_3N$, and claimed to be a complex body, not a simple mixture of its constituents. It occurs as a colorless liquid, resembling chloroform in its behavior with cold water, with which it forms globules and refuses to mix or dissolve. It is soluble in hot water, in alcoholic solutions, and in alcohol, 3 parts in 1. Dose, ♏xx–ʒj, in whisky or syrup of tolu.

Official Analogue.

Paraldehydum, *Paraldehyde*, $C_6H_1O_3$,—is a polymeric modification (polymer) of acetaldehyde. It occurs as a colorless liquid, of strong and characteristic odor, and a burning and cooling taste; soluble in 8½ of water, miscible in all proportions with alcohol or ether. Dose, ♏xx–ʒij [av. ♏xxx] in simple elixir. The doses usually given are too small for efficiency, ʒj will usually be required, especially in cases of drug-habit. *Incompatibles* are Alkalies, Hydrocyanic Acid, Iodides, Oxidizers.

Sulphonmethane (*Sulphonal*), **Sulphonethylmethane** (*Trional*), **Ethyl Carbamate** (*Urethane*), also the unofficial substances **Veronal** and **Tetronal,** are described under the title SULPHOMETHANUM.

Unofficial Analogues.

Butyl-chloral Hydras, *Butyl chloral Hydrate, Croton-chloral Hydrate* (B.P.),—is a crystalline hydrate obtained by the addition of water to the liquid Butyl-chloral produced by the action of Chlorine gas on Aldehyde. It occurs in white laminæ, of pungent odor, and acrid, nauseous taste, soluble in 50 of water, and in its own weight of glycerin or of alcohol. Dose, gr. v–xx, in syrup or pill; but the best method is to give 5 grains every half hour, until 20 grains have been taken or until relief is afforded. *Incompatibles* are Alkalies, Camphor, Ethyl Carbamate, Exalgin, Menthol, Phenol, Piperazin, Pyrocatechin, Thymol.

Amylene Hydrate, *Dimethyl-ethyl Carbinol*, $C_5H_{12}O$—is a tertiary amylic alcohol, produced by the action of Sulphuric Acid on Amylene. It occurs as a limpid, colorless, oily fluid, of peculiar odor, soluble in 8 of water, miscible in all proportions with alcohol. Dose, ʒss–jss.

Dormio-, *Amylene-chloral,*—is the trade name of a mixture of equal molecules of Chloral and Amylene Hydrate, forming a colorless, oily fluid. Dose, ʒss–j of the 10 per cent. aqueous solution, in which form it is marketed. It is claimed to be a prompt, reliable and safe hypnotic.

Chloretone, *Acetone Chloroform,*—is a Trichlor-tertiary Butyl-alcohol, obtained by the action of Caustic Potash on equal weights of Acetone and Chloroform. It occurs as a white, crystalline powder, of camphoraceous odor, sparingly soluble in water, very soluble in alcohol, in ether, and in chloroform. Dose, gr. v–xxx.

Hedonal,—the esther of methyl-propyl-carbinol-carbamic acid, occurs as a white powder, soluble in alcohol and in ether, insoluble in water. Dose, gr. xv–xxx.

Hypnone, *Phenyl-methyl-ketone,*—a colorless, mobile liquid, soluble in alcohol, insoluble in water. Dose, ♏ij–v, in emulsion or capsule.

Isopral, *Trichloro-isopropyl-alcohol,*—a crystalline powder, soluble in water or alcohol. Dose, gr. viij–xij.

Methylal, *Methylene-dimethyl-ether,*—a product of the oxidation of methylic alcohol, is a volatile, mobile liquid, soluble in water or alcohol. Dose, ♏iij–v, repeated thrice at short intervals.

PHYSIOLOGICAL ACTION.

Hydrated Chloral is a powerful hypnotic, also an antispasmodic, an antiseptic, a preventive of the coagulation of fibrin, indirectly an anesthetic, and a direct depressant of the cerebral, medullary and spinal centres and of the cardiac muscle. It is more hypnotic than chloroform but less anesthetic. Applied to the skin or mucous membranes a 1 per cent. solution (gr. v ad ʒj) is antiseptic, but strong solutions are irritant and vesicant, may produce sloughing ulcers, and if taken internally may excite gastritis with nausea and vomiting.

After a brief period of stimulation a medicinal dose depresses the heart, dilates the peripheral vessels and lowers arterial tension, diminishes oxidation and decreases the body-temperature. On the brain cells it has a selective action, producing a deep sopor very like normal sleep, from which the patient may be awakened, but immediately falls asleep again, and which is not followed by headache or depression. This effect is considered by most authorities to

be the result of cerebral anemia produced by the drug. In some persons, instead of sleep it causes headache, insomnia and delirious excitement. It is not an anodyne, as it does not affect the conductivity of the sensory nerves, and does not interrupt the transmission of pain; but by overwhelming the centres it drowns the *consciousness* of pain, and is therefore indirectly anesthetic. A toxic dose produces profound narcotism, abolishment of reflexes and sensibility, complete muscular relaxation, and a great fall of body-temperature. Death may result in the chloral sleep from paralysis of the respiratory centre or the cardiac motor ganglia, or by sudden failure of the heart-muscle in cases of fatty degeneration or in old drunkards.

On the blood its action is to increase the fluidity, to crenate the red corpuscles, and to destroy the leucocytes if used in large quantity. It is rapidly diffused and is excreted by the kidneys partly unchanged, but chiefly as urochloralic acid, producing some diuresis; also by the skin, causing various eruptions if used for any lengthened period. It has been held that the blood, being an alkaline fluid, decomposes it, setting free chloroform, but there are many facts against this theory. Von Mering states that it is decomposed in the blood into trichlor-ethyl alcohol, to which its hypnotic action is due.

The Chloral habit produces a state of marked anemia and muscular weakness, especially of the legs; its subject presenting a weak, irritable, often irregular heart, deranged hepatic functions, jaundice, bileless stools, congestion of the face and the bronchial mucous membrane, perhaps purpura and sloughing of a finger from decreased blood-supply. Its votaries are on the border of insanity, excitable, uncontrollable in speech and action, talking in a silly manner and very volubly, and showing a marked loss of power of the limbs, so much so as to simulate paralysis thereof. Many cases of insanity have their origin in chloralism. In some persons a very few doses of chloral will produce bile-less stools.

Chloral and Atropine, though antagonistic in their action on the spinal cord, both produce motor paralysis, the former by paralyzing the cord, the latter by direct paralysis of the motor nerves.

Therapeutics.

Hydrated Chloral is of great value as a hypnotic and antispasmodic, but must be cautiously used if at all in persons with weak or fatty heart, atheromatous vessels or advanced pulmonary disease. In combination with Potassium Bromide it is much used in asylum and general practice, and equally abused, both drugs being active cardiac poisons. It is by far the best hypnotic in acute mania and in delirium tremens, but has been too incautiously employed therein. The condition of acute alcoholic intoxication seems, however, to antagonize its depressant action on the heart to a great extent, even in old topers, for 30-grain doses, repeated twice within 7 or 8 hours, are commonly used in inebriate asylums and by police surgeons, for the purpose of straightening up a case of acute alcoholism, with no fatal effects resulting from its direct action. Chloral possesses marked power to relax spasmodically contracted unstriated muscle and to dilate the peripheral vessels, properties which govern its employment in many morbid conditions. Associated with Potassium Iodide it is of service in bronchial asthma, and has been used in the form of an enema for checking hemoptysis by the revulsion which it produces in dilating the cutaneous vessels. Chloral is exceedingly efficient as a gastric antiseptic and sedative in the so-called nervous dyspepsia of neurotic persons, characterized by severe pain in the cardiac region of the stomach. It is very serviceable in fevers, when high temperature exists with excitement, restlessness and a sthenic condition, as it lowers temperature and prevents the coagulation of fibrin. In typhoid fever, owing to the marked alkalinity of the tissues, small doses manifest the same effects as those produced only by large doses in other diseases; while in gout even large doses do not cause the desired results, as alkali is lacking in the blood for its decomposition (Liebrich). In the algid stage of cholera and in violent cases of cholera morbus it has been injected hypodermically in 15-grain doses with extraordinary efficacy. In sea-sickness, small doses (gr. v) two or three times a day are generally very efficient. In obstetrics it is used to relieve suffering, relax the os uteri, palliate convulsions and relieve afterpains. For nocturnal epilepsy a full dose at bedtime is a useful palliative. In neuralgia it may be triturated with Camphor and applied over the course of the affected nerve, and the same mixture is efficiently employed as a local application for toothache and earache.

Hydrated Chloral is well borne by children, and is an excellent remedy for infantile convulsions and colic, chorea, whooping-cough, laryngismus stridulus and the first stage of diphtheria, but it should not be used when the first sound of the heart becomes dull and weak. It is highly efficient for the purpose of calming children in scarlet fever. In these affections it may be given with paregoric, as its combination with opium enhances its value and guards the patient against its dangers. Its hypnotic power in adults is much increased by the conjoint administration of laudanum or morphine, and this combination is an excellent remedy in colic, cholera and cholera morbus. Tetanus is well treated by this agent and Potassium Bromide given together in full doses. In strychnine-poisoning Hydrated Chloral is the antagonist. It is generally given by the mouth in very dilute solution with some simple elixir, syrup of tolu, or cinnamon-water, but is well absorbed by the rectum. Its hypodermic administration is liable to result in great local irritation and even sloughing ulcers.

Hydrated Chloral may be applied to the skin as an antipruritic in the eruptive diseases, for which purpose it is well combined with Phenol, ten grains of each to an ounce or two of water or oil. It is said to be the best of all local applications for boils, ʒjss in ʒiv each of glycerin and water, constantly applied to the boil by a tampon of cotton. For ulcers and cancers a 25 per cent. solution is a good antiseptic and anodyne application.

The chief contra-indication to the use of Chloral is the presence of a cardiac affection, although it may be prescribed with much benefit in neurotic palpitation of the heart and in pseudo angina pectoris. Other contra-indications are rosacea, or a tendency to it, and hysteria of grave character. It readily produces congestion of the face, and in hysterical subjects it may excite paroxysms of delirium and hallucinations.

Butyl-chloral Hydrate closely resembles Chloral in action, but is feebler as a hypnotic, less depressant to the heart, and generally less poisonous, but more disagreeable to the taste. It has a specific paralyzant power over the fifth nerve, and over its distribution causes an anesthetic condition long before it produces general anesthesia (Liebreich). It has been used with benefit in various neuralgiæ, especially tic-douloureux, also in sciatica and dysmenorrhea. All statements concerning the action and therapeutics of this drug are to be received with hesitation, as wide differences therein are reported by the best authorities.

Paraldehyde is a reliable hypnotic, almost equal in this respect to Chloral, though its hypnotic action is not so persistent as that of the latter drug, and it requires more frequent repetition to produce sustained sleep. It is also antispasmodic and diuretic but not diaphoretic, and is unquestionably safer than chloral, strengthening and slowing the heart's action, instead of weakening it. Its administration is followed by a well-marked stage of excitement, after which it produces a sound sleep which is described as refreshing. It does not interfere with the appetite or digestion, but occasionally causes an erythematous eruption; and may give rise to salivation, cerebral congestion, and vaso-motor paralysis, if used for any long period of time. A toxic dose paralyzes the medulla and the respiratory centre therein.

Paraldehyde is used as a hypnotic in fevers, rheumatism, acute mania, hysteria and insomnia from various causes, also as an antispasmodic in asthma. Several cases of tetanus have been treated successfully with it, and it has been found useful as a diuretic and hypnotic in a case of senile arterial degeneration with double aortic and mitral regurgitant murmurs, mental depression and very marked insomnia and restlessness.

Cases of Paraldehyde habit are occasionally seen, and exhibit a train of symptoms similar to those observed in delirium tremens. There is great emaciation and anemia, weak and irregular action of the heart, a soft and intermittent pulse, general muscular weakness, tremulousness and restlessness, the gait feeble and unsteady, mental anxiety, agitation and confusion, temporary loss of memory and incoherent speech, also hallucinations of sight and hearing and delusions, all of an unpleasant kind. There is marked gastric derangement, but an abnormally large appetite, excessive flatulence and constipation. The treatment of such a case generally takes about three months, and should be conducted in an inebriate asylum.

Chloralformamide (Chloralamide) is an excellent hypnotic in solution, given about an hour before its action is required, and is usually efficient in simple insomnia, not due to pain, excitement or hallucinations. It does not seem to have cumulative action on repetition, or any tendency to induce a habit. It has given satisfaction as an analgesic in carcinoma of the stomach, dysmenorrhea, and other painful diseases; and is reported as having cured several cases of chorea. The effects of large doses are vertigo, thirst, nausea, vomiting, dryness of the mouth, anorexia, restlessness, slight delirium, and a weak and rapid pulse.

Amylene Hydrate stands between chloral and paraldehyde in hypnotic power, but is more agreeable to the taste and safer in action than these agents. In dose of ℥j it is usually efficient, has no perceptible influence on the heart or respiration, and leaves no unpleasant after-effects. The mixture of this agent and chloral, known as *Dormiol* (see page 215), is said to be an efficient and safe hypnotic, but should be used as carefully as hydrated chloral.

Chloralose is a prompt hypnotic, producing sound sleep in which sensibility is not lost, and leaving no unpleasant after-effects. It depresses the cerebral functions, but excites the spinal cord, so that reflex activity is exalted by it. A dose of 10 grains has produced profound unconsciousness. The maximum dose is 5 grains, in capsule, and this may have to be repeated in not less than an hour.

Chloretone is hypnotic, antispasmodic, anesthetic, and antiseptic, also narcotic in overdose. It moderate doses it promptly relieves gastric irritability, and prevents the nausea and vomiting due to ether or chloroform inhalation. As a hypnotic it is valuable in insanity and in cases of insomnia unattended with pain, high fever, or much nervous excitement. In epilepsy it has been used with benefit, and it is frequently employed with Cocaine for the production of spinal anesthesia by sub-arachnoid injection, also in a 1 per cent. solution as a local anesthetic application in ulcers and wounds. While large doses, (℥j–℥vj) have been taken without ill effects, it is considered by many authorities to be a dangerous narcotic in doses over 30 grains.

Hedonal is a feeble hypnotic of disagreeable taste, but is considered safer than most other agents of the class. In dose of 15 to 30 grains it acts usually within an hour, and leaves no unpleasant after-effects; but is contraindicated for alcoholics and in diseases producing dyspnea.

Hypnone is a hypnotic of moderate power, but is said to be efficient in the insomnia of alcoholism. It is not dangerous, and has no unpleasant sequelæ except a disagreeable odor of the breath. In very large dose it has induced coma, with paralysis of the heart and respiration.

Isopral is a prompt and efficient hypnotic in doses of 10 grains. It is much less toxic than chloral, and in ordinary dosage is free from depressant action on the heart and respiration.

Methylal is a local anesthetic and an efficient hypnotic, producing a deep sleep of brief duration, with some general anesthesia and lowered reflex excitability. Large doses are depressant to the heart, respiration, and body temperature.

Somnal is an efficient hypnotic in a dose of 30 minims, inducing quiet sleep within half an hour. Doses of 45 and 60 minims have caused no depression of the circulation or respiration. As a sedative it has been used with benefit in asthma, whooping-cough, nervous cough, spasmodic laryngitis, and chorea. It has given satisfaction in melancholia, but is inefficient in mania, delirium tremens, or severe pain, is said to be injurious in general paralysis, and to be contraindicated in cases of impaired digestion.

CHLOROFORMUM, Chloroform, *Trichloro-methane,* $CHCl_3$. Absolute Chloroform is formed by the substitution of 3 atoms of chlorine for 3 of hydrogen in marsh-gas, methyl hydride, CH_4, and is obtained by the action of chlorinated lime on ethylic or methylic alcohol, or by that of an alkaline hydroxide on chloral. If prepared from methylic alcohol (wood-spirit) it is called *Methylic Chloroform*, and is purified with great difficulty. The object of its purification is the removal of the chlorinated pyrogenous oil. The official form is—

Chloroformum, *Chloroform,*—a liquid consisting of 99 to 99.4 per cent. by weight, of absolute Chloroform, and 0.6 to 1 per cent. of alcohol. A heavy

clear, colorless, mobile and diffusible liquid, of characteristic, ethereal odor, a burning, sweet taste, neutral reaction; volatile, not inflammable; soluble in 200 volumes of water, freely so in alcohol and in ether, also in oils, benzol and benzin. Sp. gr. not below 1.490 at 59° F., or 1.476 at 77° F. Dose, internally, ♏ij–x, [av. ♏v], for inhalation ʒss–j, repeated until the desired effect is produced.

Chloroformum Venale, *Commercial Chloroform,* (Unofficial),—is a liquid containing at least 98 per cent. of Chloroform, and having a sp. gr. not lower than 1.470. It contains sundry Hydrocarbons, free Chlorine, Aldehyde and Hydrochloric Acid, and is used only for external applications, or to make the purified article.

Preparations.

Aqua Chloroformi, *Chloroform Water,*—a saturated solution, prepared by agitating an excess of chloroform in distilled water and pouring off the needed quantity of the solution. Dose, ʒj–ʒj [av. ʒiv.]

Emulsum Chloroformi, *Emulsion of Chloroform,*—has of Chloroform 4, Expressed Oil of Almond 6, Tragacanth 1, Water to 100. Dose, ʒj–iv [av. ʒij.]

Spiritus Chloroformi, *Spirit of Chloroform,*—has of Chloroform 6, Alcohol 94. Dose, ♏x–ʒj, [av. ♏xxx], well diluted.

Linimentum Chloroformi, *Chloroform Liniment,*—has of Chloroform 30, Soap Liniment 70.

Linimentum Chloroformi Compositum, *Compound Chloroform Liniment,* (Unofficial),—has of Chloroform ʒj, Oil of Turpentine ʒj, Tincture of Opium ʒss, Tincture of Aconite ʒij, Soap Liniment ʒij.

Tinctura Chloroformi et Morphinæ Composita, *Compound Tincture of Chloroform and Morphine* (B.P.),—contains in each 10-minim dose Chloroform ♏¾, Diluted Hydrocyanic Acid, ♏½, Morphine Hydrochloride, gr. $\frac{1}{11}$. A substitute for Chlorodyne (see below). Dose, ♏v–xv.

Chlorodyne, (Unofficial),—is a celebrated secret mixture, put forth by Dr. J. Collis Browne, of London, and since imitated by many others. It contains Morphine, Chloroform, Ether, Cannabis Indica, Hydrocyanic Acid, Capsicum, etc., and is powerfully anodyne, antispasmodic and narcotic, and therefore highly dangerous in non-professional hands. Of the original preparation each 10-minim dose contains gr. $\frac{1}{8}$ of Morphine Hydrochloride, and the quantity of that alkaloid or its salts in the various imitations varies from gr. $\frac{1}{192}$ to gr. $\frac{1}{6}$ in the same dose. In the *Therapeutic Gazette* for October, 1883, twenty-five different formulæ for Chlorodyne were published.

Anesthetic Mixtures containing Chloroform,—are described under the title ÆTHER, on page 88.

Incompatibles.

Incompatible with *Chloroform* are: Caustic Alkalies, Aqueous fluids. Physiologically incompatible are: Amyl Nitrite, Atropine, Morphine, Oxygen, Strychnine.

Official Chlorinated Compound.

Æthylis Chloridum, *Ethyl Chloride, Monochlor-ethane* (*Kelene*), C_2H_5Cl,—is a haloid derivative prepared by the action of hydrochloric acid gas upon absolute ethyl alcohol. It is a rapid, efficient and safe anesthetic for short operations, if used with exclusion of atmospheric air.

Unofficial Chlorinated Compounds.

Ethylene Bichloride, *Dutch Liquid, Chloric Ether,* $C_2H_4Cl_2$,—is a rapid and powerful anesthetic, probably safer than Chloroform and less so than Ether. It always paralyzes the respiratory centre before the heart, so that its effects may be easily watched and controlled. This is the substance which Guthrie supposed he had obtained when he discovered Chloroform.

Ethylidene Chloride, *Chlorinated Muriatic Ether,* CH_3CHCl_2,—is a mixture of varying sp. gr., and is not inflammable. It closely resembles Chloroform both physically and physiologically, but is less depressant to the heart, consequently safer, and recovery from its effects is very prompt.

Methyl Chloride, CH_3Cl,—a colorless gas, slightly soluble in water, of sweetish odor and taste, inflammable, burning with a greenish flame. Cold liquefies it, and the liquid boils at — 7.6° F. It is used locally in neuralgia to produce intense cold, and with remarkable success.

Methylene Bichloride, *Dichloro-methane,* CH_2Cl_2,—is an effective anesthetic which it was supposed would displace Chloroform as being much safer. Dr. Richardson introduced it and Sir Spencer Wells advocated its use, but though little used as compared with other anesthetics several deaths have occurred from its employment. It kills by paralyzing the heart.

Carbon Tetrachloride, CCl_4,—is less irritant than Chloroform, but for more dangerous to the heart.

Somnoform,—is the trade name of a mixture of Ethyl Chloride 60, Methyl Chloride 35, and Ethyl Bromide 5. It is said to be more rapid in action than ethyl chloride.

Schleich's Narcotic Mixture,—contains Ethyl Chloride 2, Chloroform 3, and Ether 12. Its inhalation is employed for the rapid relief of local pain, as in gastralgia, colic, and uterine spasm, without producing unconsciousness.

PHYSIOLOGICAL ACTION.

The action of Chloroform is similar to that of Ether (see page 88), with several important differences. It is more irritant to the mucous membranes, and if swallowed undiluted it produces violent gastro-enteritis, which becomes apparent after the subsidence of the profound narcotism which at first follows its ingestion in quantity. A dose of ʒj internally may cause death, though recovery has taken place after the ingestion of one, two and even three ounces (Wood). It clots the blood outside the body, converting it into a mass resembling sealing-wax.

The inhalation of Chloroform produces sensations which are rather agreeable than otherwise, and many persons acquire a liking for it. After a few whiffs the patient experiences noises in the ears and flashes of light before the eyes, also a feeling of weight upon the chest; the heart is felt to be beating wildly and a throbbing sensation is experienced in the carotid arteries. In this first stage hysterical symptoms may become manifest, the patient laughing, crying, screaming or swearing. The pulse is at first quite rapid from nervousness, but soon falls in frequency and gains in force. In a short time all sensation of discomfort passes away, the patient becomes quiet, breathes easily, and is evidently comfortable. The consciousness is soon affected, questions being heard but not fully understood, and answered hesitatingly and slowly and in an irrelevant manner. After a brief period of repose there may be another spell of excitement, during which the patient may struggle and endeavor to get up; but this soon passes away, the muscles, which were contracted, become flaccid, and the patient gradually assumes a condition of complete insensibility. In this state all reflex action is abolished and pain is not experienced; the pupils are contracted, and the limbs, when raised and let go, fall heavily. Dangerous symptoms are:—respiration becoming stertorous or shallow, sudden dilatation of the pupils, signs of cardiac failure.

As compared with Ether the inhalation of Chloroform is less stimulating, more irritant to the kidneys, more depressant to the vital functions, and much

more dangerous on account of its direct paralyzant action on the heart. Its vapor is less irritant to the air-passages, non-inflammable, more agreeable, more prompt in action, produces much less subsequent vomiting, a shorter stage of excitement and a more profound degree of narcosis; and should be diluted with 96½ per cent. of air to produce anesthesia with safety, according to the general teaching on this subject. Its mortality is much greater, being about 1 in 3,000, against one in 10,000 for Ether, and fatal cases continue to be reported, though none of these have occurred in obstetrical practice.

The Hyderabad Chloroform Commission's investigations, conducted under the direction of Dr. T. Lauder Brunton, led to the conclusion that Chloroform and Ether act in the same manner upon the heart and respiration, both paralyzing the respiratory centre before the heart, and Chloroform acting more quickly and powerfully than Ether in both directions. Prior to this investigation it was taught that death from Chloroform is almost always sudden and occurs by cardiac paralysis, while from Ether it is slow and usually by paralysis of respiration. The subsequent researches of Gaskell, McWilliam and others tend to sustain the latter view, and show that the verdict of the commission cannot be accepted as conclusive. There is very little doubt but that Chloroform may paralyze the heart without first affecting the respiration; and it is probable that the paralysis of the vaso-motor centre, and the consequent withdrawal of blood from the heart and brain to the dilated splanchnic area, may be an important factor of a fatal result. Another view is that the early action of the anesthetic is to stimulate the cardio-inhibitory centre, causing the sudden death which has frequently occurred in the early stage of Chloroform anesthesia. Chloroform undoubtedly exerts a powerfully depressant action on the heart. Injected into the jugular vein it instantly arrests the cardiac action and destroys its muscular irritability. Its vapor, applied to the exposed heart, paralyzes it, and even when artificial respiration is maintained the effect is very apparent. There can be no doubt but that Chloroform destroys the contractile power of the cardiac muscle (Murrell).

Modes of Dying in Anesthesia are detailed under ÆTHER, on page 89.

THERAPEUTICS.

Besides its use as an anesthetic Chloroform has a large field of therapeutic action. It is frequently employed in liniments as a rubefacient and anodyne application, also to promote the passage of other agents through the epidermis, and to relieve itching. The vapor may be directed onto the raw surface of an ulcer or a superficial burn in order to relieve pain; and that arising from a few drops placed in the hand and held close to the eye will relieve photophobia. Internally it is administered with great benefit in vomiting, colic, dysmenorrhea, and cholera morbus; also in true cholera, in which disease it has probably been more efficient than any other single remedy, and in gastric ulcer, gastralgia and other painful affections of spasmodic character. In three to ten drop doses well diluted it markedly improves all the functions of the stomach, and is a valuable remedy for many gastric disturbances, especially acute dyspepsia. In sciatica, tic-douloureux and other neuralgiæ of important nerves the deep injection of ♏x–xv of pure Chloroform in the vicinity of the nerve is highly recommended, though it may cause dangerous local disturbance. In several cases of severe supra-orbital neuralgia, the writer has injected two or three minims of Chloroform into the vicinity of the supra-orbital nerve just above its foramen of exit, with the most gratifying permanent results, though severe local pain and considerable swelling were experienced for several days.

The vapor of Chloroform inhaled in small quantities from warm water or from a handkerchief is a very useful remedy in many neuroses, as hay-fever, spasmodic asthma and reflex cough. It is one of the best palliatives in the cough of phthisis, as was long ago pointed out by Spencer Wells. It may be used with much benefit as a pulmonary antiseptic in many affections of the air-passages, as acute nasal catarrh, influenza and bronchitis; and has promptly checked a severe case of catarrh extending into the antrum and causing great pain. Carried to the production of muscular relaxation it is often used as an aid to diagnosis, especially in cases of malingering, in suspected disease of the abdominal viscera, and to aid in reducing dislocations and herniæ. It is used with great benefit in parturition, decreasing the sensibility to pain, relaxing the passages, and easing the labor, while it does not interfere with the uterine contractions, nor predispose to inflammation, hemorrhage or convulsions. In such cases the quantity needed is very small, a few whiffs from time to time being quite sufficient. In some cases, as in acute mania, a patient may require to be kept under the influence of chloroform for a long time, for hours, days, or even weeks; and this has been done in the digital treatment of subclavian and other aneurisms. The writer, on one occasion, kept an insane woman continuously under its influence for a period of three weeks, except during the time necessary for taking food.

For the production of complete anesthesia the use of Chloroform is steadily decreasing in favor of Ether, except for young children and in obstetrical practice. Its vapor being four times denser than air, and the rule for its effective use requiring fully 96½ per cent. of air with it, its administration according to the orthodox fashion requires most careful management, and should never be attempted in any but the recumbent posture. An ounce of brandy and a hypodermic injection of morphine, gr. ¼, with atropine, gr. $\frac{1}{120}$, given 20 minutes before commencing the inhalation, are means of great utility in sustaining the heart and respiration and in rendering the anesthesia more profound; but this hypodermic injection should not be employed as a routine practice for all cases. It is contraindicated in weak subjects, in those who are particularly susceptible to the action of morphine, for operations likely to be attended with excessive hemorrhage, and in cases presenting any degree of respiratory insufficiency.

The mortality under chloroform anesthesia, formerly stated at 1 in 5,000, is now placed at about 1 in 3,000; yet Luckett in ten years administered it in 4,263 cases with only one death, and Syme used it in 5,000 cases without a single death. The latter ascribed his excellent record to his adherence to the following rule: "Never mind the pulse, never mind the heart, leave the pupil to itself, but keep your eyes on the breathing, and if it becomes embarrassed to a grave extent, pull the tongue well out with an artery forceps." The Edinburgh rule is practically this: "Watch the respiration, the heart will take care of itself"; but Professor Stewart suggests that a second one should be inculcated, namely—"Watch both the breathing and the pulse; and if the heart threatens