

Montpellier (*Journ. de Chim. Méd.* 2nde Ser. iii. 408) gave it in syphilitic maladies, in doses of one-tenth and even of one-eighth of a grain, without the least inconvenience. It has been introduced into the London Pharmacopœia, at the suggestion of Mr. Everitt, as a source of hydrocyanic acid (*vide* p. 237.)

ORDER 20. MERCURY AND ITS COMPOUNDS.

Hydrar'gyrum.—*Mer'cury* or *Quick'silver*.

HISTORY.—No mention is made of quicksilver in the Old Testament; nor does Herodotus allude to it. From this we might infer that both the ancient Hebrews and Egyptians were unacquainted with it. But we are told on the authority of an Oriental writer, that the Egyptian magicians, in their attempts to imitate the miracles of Moses, employed wands and cords containing mercury, which under the influence of the solar heat, imitated the motion of serpents (D'Herbelot, *Bibliothèque Orient.* art. *Moussa*). Both Aristotle and Theophrastus (*De Lapidibus*) mention ἄργυρος χυρὸς, (*argentum liquidum*): and the first of these naturalists says that Dædalus (who is supposed to have lived about 1300 years before Christ) communicated a power of motion to a wooden Venus by pouring quicksilver into it. We are also told that Dædalus was taught this art by the priests of Memphis. Pliny (*Hist. Nat.* lib. xxxiii.) and Dioscorides (lib. v. cap. cx.) also speak of mercury, and the latter writer describes the method of obtaining it from cinnabar.

Mercury was first employed medicinally by the Arabian physicians Avicenna and Rhazes; but they only ventured to use it externally against vermin and cutaneous diseases. We are indebted to that renowned empiric Paracelsus for its administration internally.

SYNONYMES.—The names by which this metal has been distinguished are numerous. Some have reference to its silvery appearance and liquid form; as ὑδράργυρος, *hydrargyrus* and *hydrargyrum*, (from ὑδωρ, *aqua*, and ἄργυρος, *silver*); others to its mobility and liquidity, as well as its similarity to silver, such as *argentum vivum*, *aqua argentea*, *aqua metallorum*, and *quicksilver*. It has been called *Mercury*, after the messenger of the gods, on account of its volatility.

NATURAL HISTORY.—Mercury is comparatively a rare substance. It is found in the metallic state, either pure (*native* or *virgin mercury*), in the form of globules, in the cavities of the other ores of this metal, or combined with silver (*native amalgam*). Bisulphuret of mercury (*native cinnabar*) is the most important of the quicksilver ores, since the metal of commerce is chiefly obtained from it. The principal mines of it are those of Idria in Carniola, and Almaden in Spain. The latter yielded 10,000 lbs. of cinnabar annually to Rome in the time of Pliny (*Hist. Nat.* xxxiii.) Protochloride of mercury (*mercurial horn ore* or *corneous mercury*) is another of the ores of mercury. Traces of this metal have also been met with in common salt, during its distillation with sulphuric acid, by Rouelle, Proust, Westrumb, and Wurzer (Gmelin, *Handb. d. Chemie*, i. 1282).

PREPARATION.—The extraction of quicksilver is very simple. In some places (as in the Palatinate and the duchy of Deux-Ponts) the native cinnabar is mixed with caustic lime, and distilled in iron retorts. In

this process the lime abstracts the sulphur (forming sulphuret of calcium), and the disengaged mercury distils over. At Almaden the ore is roasted, by which the sulphur is converted into sulphurous acid, and the mercury volatilized. At Idria a modification of this process is followed (Dumas, *Traité de Chimie*, iv. 305).

COMMERCE. — Quicksilver is imported in cylindrical, wrought-iron bottles (holding from 60lbs. to 1 cwt.), the mouth of each being closed by an iron screw; and also in goat-skins, two or three times doubled. The quantities imported in the years 1827 and 1830, and the places from which the metal was brought, are thus stated in the parliamentary papers (*Statement of Imports and Exports*, for 1827 and 1830).

	1827.	1830.
Spain and the Balearic Islands	653,374	1,675,652
Gibraltar	121,320	—
Italy and the Italian Islands	108,567	331,416
	<hr/> 883,261	<hr/> 2,007,068

PROPERTIES.—At ordinary temperatures quicksilver is an odourless, tasteless, liquid metal, having a whitish colour, like silver or tin. Its sp. gr. is 13·5 or 13·6. When intimately mixed with pulverent or fatty bodies, it loses its liquid character, and it is then said to be *killed*, *extinguished*, or *mortified*. When cooled down to 38·66° F. it freezes, and crystallizes in needles and regular octahedrons. In this state it is ductile, malleable, and tenacious. At 656° F. it boils, and produces an invisible elastic vapour, whose sp. gr. is 6·976. Mr. Faraday (*Quart. Journ. of Science*, x. 354) has shown, that at common temperatures, and even when the air is present, mercury is always surrounded by a mercurial atmosphere; and, according to Stromeyer, at from 140° F. to 160° F. mercury, when mixed with water, is volatilized in considerable quantities. Chemists are not agreed as to the equivalent or atomic weight of this metal. Thus Dr. Thomson assumes 100; Gmelin, 101; Berzelius, 101·43; Brande, 200; Turner and Phillips, 202. I shall adopt the latter.

CHARACTERISTICS. (a.) *Of metallic mercury.*—In its metallic state mercury is distinguished by its liquidity at common temperatures, and by its volatility. When invisible to the naked eye, and in a finely divided state, it may be readily detected by the white stain (called by workmen *quickenings*) communicated to gold and silver. Mercurial vapour may be detected by exposing gold or silver to its influence. If mercury be in combination with other metals, and the tests now mentioned be not applicable, we may dissolve the suspected substance in nitric acid, and proceed as for the mercurial salts.

(b.) *Of mercurial compounds.*—When heated with potash or soda, or their carbonates, globules of metallic mercury are obtained, which may be recognised by the properties already described. Solutions of the mercurial salts, placed for some time in contact with a piece of bright copper, and afterwards rubbed off with paper, leave a silvery stain behind, which disappears when heated to redness. Those compounds which are of themselves insoluble in water may be dissolved by digesting them with nitric acid; and the copper test may then be applied. In this way the mercury contained in calomel, vermilion, subsulphate and iodide

of mercury, may be readily recognised. Sulphuretted hydrogen produces, with mercurial solutions, a black precipitate.

Solutions of the protosalts of mercury yield, with caustic potash or soda, a grey or black precipitate; and, with iodide of potassium, a greenish or yellow precipitate.

Solutions of the persalts yield, with caustic potash or soda, a yellow or reddish precipitate; and, with iodide of potassium, a scarlet one.

PURITY.—The purity of this metal is ascertained by its brilliancy and great mobility. Mechanical impurities—such as adhering dirt or dust—are instantly detected, and may be separated by straining through flannel, or by filtering through a small hole in the apex of an inverted cone of paper. The presence of lead, tin, zinc, or bismuth, may be suspected by the rapidity with which the metal tarnishes in the air, and by its small parts *tailing*, instead of preserving a spherical form. These impurities may be got rid of by distillation in an earthen retort.

PHYSIOLOGICAL EFFECTS. 1. *OF METALLIC MERCURY.* (a.) *On vegetables.*—Mercurial vapours are fatal to plants (Decandolle, *Phys. Vég.* 1332).

(b.) *On animals.*—From the experiments of Moulin (*Phil. Trans.* for 1691, No. 192), Haighton (Beddoes, *On Pulmonary Consumption*, 1799), Viborg (quoted by Wibmer, *Wirkung d. Arzneim.*, iii. 88), and Gaspard (Magendie, *Journ. de Physiol.* i.), it appears that when *injected into the veins*, mercury collects in the small vessels of the neighbouring organs, and acts as a mechanical irritant. Thus, if thrown into the jugular vein, peripneumonia is excited; and, on examination after death, little abscesses and tubercles have been found in the lungs, in each of which was a globule of quicksilver as the nucleus.

(c.) *On man.*—Some difference of opinion exists as to the *effects of liquid mercury when swallowed*; one party asserting that it is poisonous, another that it is innocuous. The truth I believe to be this: so long as it retains the metallic state it is inert; but it sometimes combines with oxygen in the alimentary canal, and in this way acquires activity. Avicenna, Fallopius, and Brasavola, declared it harmless; Sue (*Mém. de la Facult. Méd. d'Emulat.* 4th year, p. 252) states that a patient took for a long time two pounds daily without injury; and I could refer to the experience of many others who have seen it employed in obstructions of the bowels, without proving noxious; but the fact is so generally known and admitted, as to require no further notice. In some instances, however, it has acted powerfully, more especially where it has been retained in the bowels for a considerable time; no doubt from becoming oxidized. Thus Zwinger (*Miscell. Curiosa Decur.* 2nd. Ann. 6, 1688) states that four ounces brought on profuse salivation four days after swallowing it. Laborde (*Journ. de Méd.* i. 3) also tells us, that a man who retained seven ounces in his body for fourteen days, was attacked with profuse salivation, ulceration of the mouth, and paralysis of the extremities; and other cases of a similar kind might be quoted.

Dr. Christison considers the question set at rest by the Berlin College of Physicians, and that the metal is innocuous.

Applied externally, liquid mercury has sometimes produced bad effects. Dr. Scheel has related a fatal case, attended with salivation, brought on from wearing at the breast during six years a leathern bag, containing a

few drachms of liquid mercury, as a prophylactic for itch and vermin (Richter, *Ausführ. Arzneim.* Supplem. Bd. 615).

The injurious effects of *mercurial vapours*, when inhaled or otherwise applied to the body, have been long known. They are observed in water gilders, looking-glass silverers, barometer-makers, workmen employed in quicksilver mines, and in others exposed to mercurial emanations. In most instances an affection of the nervous system is brought on, and which is indicated by the *shaking palsy* or *tremblement mercuriel* (*tremor mercurialis*), which is sometimes attended with stammering (*psellismus metallicus*), vertigo, loss of memory, and other cerebral disorders, which frequently terminate fatally. The first symptom of shaking palsy is unsteadiness of the arm, succeeded by a kind of quivering of the muscles, which increases until the movements become of a convulsive character. In all the cases (about five or six in number) which have fallen under my notice, the shaking ceased during sleep. I have not seen the least benefit obtained by remedial means, although various modes of treatment were tried. This is not in accordance with the experience of Dr. Christison, who says the tremors "are cured easily though slowly." If the individual continue his business, other more dangerous symptoms come on, such as delirium or epilepsy, or apoplexy (*apoplexia mercurialis*); and ultimately death takes place.

In some instances salivation, ulceration of the mouth, and hæmoptysis, are produced by the vapour of mercury. The following remarkable case is an instance in point. In 1810, the *Triumph* man-of-war, and *Phipps* schooner, received on board several tons of quicksilver, saved from the wreck of a vessel near Cadiz. In consequence of the rotting of the bags the mercury escaped, and the whole of the crews became more or less affected. In the space of three weeks 200 men were salivated, two died, and all the animals, cats, dogs, sheep, goats, fowls, a canary bird,—nay, even the rats, mice, and cock-roaches, were destroyed (*Ed. Med. and Surg. Journ.* xxvi. 29).

As metallic mercury in the liquid state is not active, it has been thought that mercurial vapour must also be inactive. Thus Dr. Christison thinks that the activity of the emanations arises from the oxidation of the metal before it is inhaled. I believe, however, with Buchner (*Toxicologie*), Orfila (*Toxicol. Gén.*), and others, that metallic mercury, in the finely divided state in which it must exist as vapour, is itself poisonous.

2. OF MERCURIAL COMPOUNDS.—Probably all the mercurial compounds are more or less noxious. The only doubtful exception to this is in the case of the sulphurets of this metal, which, according to Orfila (*Arch. Gén. de Méd.* xix. 330), are inert.

(a.) *Local effects.*—For the most part, the local action of the mercurial compounds may be regarded as alterative, and more or less irritant. Many of the preparations (as the bichloide, the nitrates, &c.) are energetic caustics. The protoxide and protochloride (calomel) are very slightly irritant only: indeed, Mr. Annesley (*Diseases of India*) asserts, from his experiments on dogs, and his experience with it in the human subject, that the latter substance is the reverse of an irritant; in other words, that when applied to the gastro-intestinal membrane it diminishes its vascularity. But I suspect some error of observation here.

(b.) *Remote effects.*—In *small and repeated doses*, the first obvious effect of mercurials is an increased activity in the secreting and exhaling

apparatus. This is particularly observed in the digestive organs; the quantity of intestinal mucus, of bile, of saliva, of mucus of the mouth, and probably of pancreatic liquid, being augmented. The alvine discharges become more liquid, and contain a larger proportion of bile. The operation of the medicine does not stop here: the pulmonary, urino-genital, and conjunctival membranes, become moister, the urine is increased in quantity, the catamenial discharge is sometimes brought on, the skin becomes damper and at the same time warmer. The absorbent or lymphatic system seems also to be stimulated to increased activity; for we frequently observe that the accumulations of fluid in the shut sacs (as the pleura, the peritoneum, the arachnoid, and synovial membranes) diminish in quantity, and in some cases rapidly disappear. At the same time, also, glandular swellings and indurations of various kinds are dispersed. These are the cases in which the mercurials are called *alteratives*—that is, they indirectly induce healthy action in a very slow, gradual, and incomprehensible manner.

When our object is to obtain the *sialogogue* operation of mercurials, we give them in *somewhat larger doses*. To a certain extent the effects are the same as those already mentioned, but more intense. Of all the secretions, none are so uniformly and remarkably augmented as those of the mucous follicles of the mouth and the salivary glands; and the increased secretion of these parts is accompanied with more or less tenderness and inflammation, the whole constituting what is termed *salivation* or *ptyalism* (*salivatio*, *ptyalismus*, *sialismus*). The first symptoms of this affection are slight tenderness and tumefaction of the gums, which acquire a pale rose colour, except at the edges surrounding the teeth, where they are deep red. Gradually the mouth becomes exceedingly sore, and the tongue much swollen; a coppery taste is perceived, and the breath acquires a remarkable fetidity. The salivary glands soon become tender and swollen; the saliva and mucus of the mouth flow abundantly, sometimes to the extent of several pints in the twenty-four hours. During this state, the fat is rapidly absorbed, and the patient becomes exceedingly emaciated. The blood when drawn from a vein puts on the same appearance as it does in inflammatory diseases.

The quantity of saliva and buccal mucus discharged by patients under the influence of mercury, varies according to the quantity of the medicine employed, the susceptibility of the patient, &c. Formerly salivation was carried to a much greater extent than it is at the present day. Thus Boerhaave (*Aphorismi*) considers a patient should spit three or four pounds in twenty-four hours; and Turner (*Pract. Dissert. on the Ven. Disease*, 1737) says from two to three quarts are “a good and sufficient discharge.” Modern experience has shewn that all the good effects of mercurials may be gained by a very slight affection of the mouth. Several analyses have been made of saliva from patients under the influence of mercury. Fourcroy, Thomson, Bostock, and Devergie, failed to detect the least trace of mercury in it. But some other persons have been more successful, as will be hereafter mentioned. The following are the constituents of saliva during mercurial ptyalism, according to Dr. Thomson (*Annal. of Phil.* vi. 397):—

Coagulated Albumen	0·257
Mucus, with a little Albumen	0·367
Chloride of Sodium	0·090
Water	99·286

100·000

It was an opal fluid, having a sp. gr. of 1·0038, and by standing deposited flakes of coagulated albumen. The nitrates of lead and mercury produced copious precipitates with it; but the ferrocyanuret of potassium and infusion of galls had no effect on it. Dr. Bostock (*Medico-Chirurg. Trans.* xiii. 73) found the saliva discharged under the influence of mercury to differ from that of the healthy state, in being less viscid, and in containing a substance analogous to coagulated albumen, such as it exists in the serum of the blood; so that it would seem the mercurial action alters the secretion of the salivary glands, and makes it more analogous to the exhaled fluids of the serous membranes.

The effects of mercury hitherto described are such as are occasionally produced for the cure of diseases; but occasionally other phenomena present themselves in individuals who have been subjected to the influence of this metal, and which have been considered as constituting a peculiar malady, to which the name of *mercurial disease* (*morbus mercurialis*, *hydrargyriasis* seu *hydrargyrosis*, *cachexia mercurialis*, &c.) has been given. The *pseudo-syphilis*, or *cachexia syphiloidea* of some writers, is supposed to be syphilis, more or less modified by the mercurial disease. The following are the ill effects which have been ascribed to this metal, and which Dieterich (*Die Merkurialkrankheit*, 1837) regards as so many forms of the mercurial disease:—

1. *Mercurial fever* (*febris mercurialis*, Dieter.)—Under this name Dieterich has included two febrile states. One of these (*febris erethica*; *f. salivosa*) comes on a few days after the use of large doses of mercury, and is characterized by great restlessness, dryness of the mouth, headache, loss of appetite, nausea, hot and dry skin, quick pulse, red gums, swollen tongue, &c.: it usually terminates in a critical discharge (as profuse salivation, purging, or sweating), or an eruption makes its appearance. The affection which Mr. Pearson (*Observ. on the Effects of various Articles of the Mat. Med.* p. 131) denominated *mercurial erethism* (*erethismus mercurialis*), is regarded by Dieterich as an adynamic mercurial fever (*febris adynamica*). It is characterized by great depression of strength, a sense of anxiety about the præcordia, frequent sighing, trembling, partial or universal, a small quick pulse, sometimes vomiting, a pale contracted countenance, a sense of coldness; but the tongue is seldom furred, nor are the vital or natural functions much disordered. When these symptoms are present, a sudden and violent exertion of the animal power will occasionally prove fatal.

2. *Excessive salivation* (*ptyalismus stomachalis mercurialis*, Dieter. *stomatitis*).—I have already noticed mercurial salivation as far as it is ever purposely induced for the cure of diseases. But it sometimes happens, either from the inordinate employment of mercury, or from some peculiarity in the constitution of the patient, that the mouth becomes violently affected: the gums are tumefied and ulcerated; the tongue is swollen to such an extent, that it hangs out of the mouth, incapacitating the patient from either eating or speaking; the salivary glands are enlarged and most painful, and the saliva flows most copiously from the mouth. In one instance sixteen pounds are said to have been evacuated in twenty-four hours. In some cases (Dieterich, *op. cit.*) the gums slough, the teeth loosen and drop out, and occasionally necrosis of the alveolar process takes place. During this time the system becomes extremely debilitated and emaciated; and, if no intermission be given to the use of mercury, involuntary actions of the muscular system come on, and the patient ultimately dies of exhaustion.

In some cases, active inflammation, succeeded by ulceration and sloughing of the fauces takes place (*angina mercurialis*). In one instance, which fell under my notice, this condition was brought on by the use of a few grains of blue pill, taken for a liver complaint. Recovery took place, but the contraction of the mucous membrane in the neighbourhood of the anterior arches of the palate was so great, that the patient was

unable to open her mouth wider than half an inch. Several operations were performed, by different surgeons, to remedy this, but the relief was only temporary.

Salivation is occasionally induced by other substances (hydrocyanic, nitric, or arsenious acids, emetic tartar, foxglove, iodine, &c.), and sometimes occurs spontaneously. The peculiar odour of the breath, the brassy or coppery taste, and the sponginess of the gums, are usually considered to be characteristic of mercurial salivation. But in some cases these symptoms are insufficient to enable us to distinguish it. I have seen about a dozen instances of apparently spontaneous salivation, yet presenting the characters of ptyalism from mercury. They occurred in Dispensary patients, and mostly in females. The greater part of them had not (according to their own account) taken medicine of any kind for months. Sloughing phagedena of the mouth (*stomacace gangrænosa*) cannot, in some cases, be distinguished from the sloughing produced by mercury (*stomacace mercurialis*). A remarkable case, in proof, I have recorded in the *London Medical Gazette* (vol. xviii. 389).

3. *Mercurial purging* (*diarrhœa mercurialis*).—Violent purging is a very frequent consequence of the use of mercury. It is frequently attended with griping, and sometimes with sanguineous evacuations. In some cases there is fullness of the left hypochondrium, burning pain and tenderness of the region of the pancreas, and the evacuations are frothy, whitish, tough, and often greenish, at least in the commencement, from the intermixed bile. These symptoms may fairly be referred to an affection of the pancreas, analogous to that of the salivary glands. Dieterich (*op. cit.*) terms it *ptyalismus pancreaticus mercurialis* (*diarrhœa salivalis, sialorrhœa alvina, ptyalismus abdominalis*).

4. *Uorrhœa mercurialis*.—Excessive secretion of urine, from the use of mercury, is very rare. Two cases only are recorded, both by Schlichting (*Ephemerid. A.C.L. Nurembergæ, 1748, tom. viii. Obs. viii. p. 25, quoted by Dieterich, op. cit.*)

5. *Hidrosis mercurialis*.—Profuse sweating is another occasional effect of mercury. 6. *Skin diseases*.—Several forms of skin diseases, both acute and chronic, have been regarded as part of the ill effects of mercury.

(a.) *Eczema mercuriale*, Pearson; (*erythema mercuriale*, Spens and Mullins; *lepra mercurialis*, Stokes and Moriarty; *hydrargyria*, Alley, Rayer; *erysipelas mercuriale*, Cullerier, Lagneau; *spilosis mercurialis*, Schmalz).—This disease appears occasionally during the progress of a mercurial course. Some writers have frequently met with it:—thus, Alley (*Observ. on the Hydrargyria, 1810*) saw forty-three cases in ten years, and of this number eight terminated fatally. Rayer confesses, that in twenty years he never saw but three instances of it. During the ten years that I was connected with the General Dispensary, I saw only two cases of it. The disease consists of innumerable, minute, and pellucid vesicles, which have been mistaken for papulæ. These give the appearance of a diffused redness to the skin, and a sensation of roughness to the touch. Sometimes it is preceded, and attended by febrile disorder. In two or three days the vesicles attain the size of a pin's head, and the included serum becomes opaque and milky. It soon extends over the body, and is accompanied by tumefaction, tenderness, and itching. It usually terminates by desquamation: but in some cases a copious discharge takes place from the excoriated and tender surface; and when this ceases, the epidermis comes off in large flakes: in some instances the hair and nails fall off, and the eyes and eyebrows become entirely denuded. There is usually some affection of the respiratory organs, indicated by dry cough and tightness of the præcordia.

(b.) *Miliaria mercurialis*.—A miliary eruption has been observed by both Peter Frank and Dieterich, apparently as a consequence of the use of mercury.

(c.) *Chronic skin diseases* (*herpes, psudracia, and impetigo*).—These are doubtful consequences of the use of mercury. They have occurred after the employment of this metal; but considerable doubt exists, as to whether they ought to be regarded as the effect of the remedy, or of the disease for which they have been exhibited, or of some other condition of system. *Herpes præputialis* has been ascribed, by Mr. Pearson, to the previous use of mercury (Bateman, *Pract. Synopsis of Cutaneous Diseases, 6th ed.*), and his opinion has been adopted by Dieterich (*op. cit.*); but it certainly now and then occurs, when no mercury has been exhibited. The *psudracia mercurialis* and *impetigo mercurialis* of Dieterich (*op. cit.*) are still more doubtful effects of mercury.

7. *Inflammation of the eye, fauces, and periosteum*, have been ascribed by some writers to the use of mercury; but by others the power of this agent to produce these diseases is denied. That they have followed the use of mercury cannot be doubted, but *post hoc* is not *ergo propter hoc*. Dieterich regards the maladies referred to as states of congestion, not of inflammation, and therefore calls them *symphoreses* (from *συνφύρεσις, an*

accumulation). The inflammation of the conjunctiva (*conjunctivitis mercurialis*; *symphoresis conjunctivæ oculi mercurialis*, Dieter.), ascribed by Von Ammon (*Rust's Magazin*, 1830) to the use of mercury, should probably be referred to some other cause. He says it is characterized by a lilac tint around the cornea; that it sometimes precedes salivation, disappearing when this is established, and is commonly regarded as a catarrhal symptom. The mercurial iritis (*iritis mercurialis*; *symphoresis ireos mercurialis*, Dieter.; *iritis rheumatico-mercurialis*, Jaeger), described by Mr. Travers (*Surgical Essays*, i. 59), was, in all probability, an iritis arising from some other cause than mercury (Mackenzie, *On Diseases of the Eye*, 2d edit. p. 496). The so-called mercurial retinitis (*symphoresis retinæ oculi mercurialis*, Dieter.) may be explained in the same way. An inflammation of the fauces sometimes occurs after the use of mercury (*angina mercurialis*; *symphoresis faucium mercurialis*, Dieter.) It may come on in five or six days after the use of mercury, and assume an acute form, with a tendency to slough (Colles, *Pract. Observ. on the Vener. Disease*, p. 45); or it may appear after the employment of mercury for five or six weeks, and take on a chronic form (Dieterich, *op. cit.* p. 273). Inflammation of the bone or periosteum, and the consequent production of nodes (*symphoresis periosteî mercurialis*, Dieter.), has been ascribed to mercury. But the disease is rarely or never seen after the use of this mineral, except when it has been given for the cure of a venereal affection, to which, in fact, it ought with more propriety to be referred (Mr. Lawrence, *Lect. on Surg. in Med. Gaz.* v. 805; Colles, *op. cit.* p. 189).

8. *Hypertrophies* (*Hypertrophie*, Dieter.).—Enlargement of the inguinal, axillary, and mesenteric absorbent glands (*adenophyma inguinale mercuriale*; *ad. axillare merc.*; *ad. meseraicum merc.* Dieter.), as well as of some of the secreting glands, viz. the parotid glands, the pancreas, the testicles, and liver (*adenophyma parotideum merc.*; *ad. pancreaticum merc.*; *ad. testiculi merc.*; *hepatophyma merc.*), and condyloma and ganglion (*condyloma et ganglion mercuriale*, Dieter.), have been ascribed by some (Mathias, *op. cit.* and Dieterich, *op. cit.*) to the use of mercury, but, as I believe, on insufficient grounds.

9. *Ulceration and sloughing*.—Ulceration of the mouth is a well-known effect of mercury. Ulceration of the throat is likewise a consequence of the use of this mineral (*mercurial ulcerated throat*, Mathias; *mercurial sore throat*, Bacot, in *Med. Gaz.* iii. 312). Sloughing of the same parts may also be induced. It is well known that venereal sores (especially those called phagedenic) at times assume a sloughing disposition, in consequence of the improper use of mercury (Sir A. Cooper, *Lectures on Surgery*, in *Lancet*, iv. 42; Carmichael, *On Venereal Diseases*, p. 165, et seq. 2nd ed.) Ulceration of the fibrous membranes (*ulcus membranæ fibrosæ mercuriale*), and ulceration of the absorbent glands (*ulcus glandularum mercuriale*), has been ascribed to the use of mercury (Dieterich, *op. cit.* p. 376).

10. *Neuroses mercuriales*.—Various symptoms indicating a disordered condition of the nervous system, are met with in persons who have been exposed to the baneful influence of mercury: such as wandering pains (*neuralgia mercurialis*); a tremulous condition of the muscular system (*tremor mercurialis*), sometimes accompanied with stammering (*psellismus metallicus*), and occasionally terminating in paralysis (*paralysis mercurialis*), epilepsy or apoplexy (*apoplexia mercurialis*). To these, Dieterich (*op. cit.*) adds asthma (*asthma mercurialis*), of which he only saw one case, amaurosis (*amaurosis mercurialis*), and hypochondriasis (*hypochondriasis mercurialis*).

Of these, the best known is the shaking palsy (*tremor mercurialis*; *tremblement mercuriel*), a remarkable affection which occurs among workmen exposed to the action of the vapour of mercury, such as miners, gilders, barometer-makers, looking-glass silverers, &c. The first symptom of it is unsteadiness of the arm, succeeded by a kind of quivering of the muscles, which increases until the movements become of a convulsive character. In all the cases which I have seen, the movements were suspended during sleep.

11. *Cachexia* (*cachexia mercurialis*).—This condition is characterized by disorder of the digestive organs, loss of appetite, wasting, incapability of much exertion, with increased secretion from all the organs, especially from the salivary glands.

The foregoing are the most important of the ill effects ascribed to the use of mercury. As I have already stated, some of them ought probably to be referred to other causes, and not to the use of this mineral; but as doubt must necessarily be entertained on this point, I have thought it more advisable to mention them. The student will find some pertinent observations concerning them, in a paper by Dr. Musgrave (*Edin. Med.*

and *Surg. Journ.* vol. xxviii.), and in Dr. Currie's pamphlet (*Examination of the Prejudice commonly entertained against Mercury*).

In excessive doses: acute poisoning.—When large doses of some of the soluble salts of mercury have been swallowed, *gastro-enteritis* is observed. The patient complains of an acrid styptic taste in the mouth, and of a feeling of burning and tightness in the throat; the face is usually flushed and sometimes swelled, violent vomiting and purging (frequently of bloody matters) soon come on, the vomiting being increased by every thing taken into the stomach; oftentimes there is irritation of the urinary passages, and sometimes even suppression of urine; the pulse is small, frequent, and contracted; the respiration difficult; the extremities cold. In some cases *salivation* is produced: this seldom comes on during the first 24 hours; and in those instances in which it does occur, is seldom delayed beyond the fourth day. Towards the termination of the case, some indications of *disorder of the cerebro-spinal system* come on, such as slight drowsiness or stupor, or even coma; tremors and twitchings of the muscles, and sometimes even violent convulsions; in some cases paraplegia. These symptoms terminate in death. Post-mortem examination discovers inflammation, and its consequences, of the gastro-intestinal membrane.

THEORY OF THE ACTION OF MERCURY.—There are many disputed points connected with the action of mercurials, which it will be convenient to examine under this head.

1. *Absorption of mercury.*—By the external or internal use of mercury, this metal becomes absorbed (in what state has not been ascertained), and is subsequently either deposited in some of the solids of the body, or thrown out of the system by some of the excretories.

The accuracy of this statement is proved by the following facts:—

(a.) *Mercury has been detected in the blood* by Zeller, Buchner, Schubarth (quoted by Dr. Christison, *On Poisons*, 3^d. ed. p. 366), Colson (*Arch. Gén.* xii. 68), and Dieterich (*op. cit.*). It appears to be in such intimate combination with this vital fluid that it cannot be recognised by the ordinary tests. Destructive distillation is in most cases necessary for its detection.

(b.) *Mercury has been found in the secretions*, viz. in the perspiration, the saliva, the gastro-intestinal secretion, the bile, the urine, and the fluid of ulcers (Christison, Colson, and Dieterich, *op. cit.*) The blackening of the skin, mentioned both by Harrold (*Meckel's Archiv.* iii. 532) and Rigby (*Lond. Med. Rep.* April 1837), as having occurred in consequence of the use of mercury subsequent to the employment of sulphur, establishes the existence of mercury in the cutaneous transpiration. The sulphur and the mercury were thrown out of the system by the skin, and immediately they were out of the sphere of the vital powers, they entered into union and formed the black sulphuret of mercury, which was deposited on the integument in a pulverent form.

(c.) *Mercury has been found in the reguline state in the organic solids*, viz. in the bones, brain, synovial capsules, the pleura, the humours of the eye, the cellular tissue, the lungs, &c. (Christison, *op. cit.*; Wibmer, *Wirkung d. Arzneim.* iii. 85; Colson and Dieterich, *op. cit.*) In what part of the system reduction is effected, has not been made out.

2. *The constitutional effects of mercury are consequences of its absorption.* For, in the first place, mercurials affect the general system to

whatever part of the body they be applied, whether to the mucous membranes, the cutaneous system, or the cellular tissue, or injected into the veins. *Secondly*, the action of mercurials on the system is assisted by the use of bloodletting and emetics;—agents which promote absorption. *Thirdly*, when mercurials are administered by the stomach, and excite purging, they rarely affect the general system, apparently in consequence of the function of absorption being suspended.

3. *After absorption, mercury effects changes in the qualities of the blood, and in the action of the whole organism, but especially the apparatus of organic life.*—Soon after salivation has been established, the blood exhibits an inflammatory crust. At a later period its colour deepens, and its coagulability is diminished: the proportion of clot, and therefore of fibrin, to serum becomes smaller. “The formation of albumen and mucus,” says Dieterich (*op. cit.* 80), “sinks to that of serum; the whole organic formation of the patient is less consistent and cohesive.” The same authority also tells us, that under the influence of mercury the electrical condition of the blood changes from the negative (healthy) state to that of positive. The evacuations from all the secreting and exhaling organs, especially from the mucous follicles and salivary glands, is much increased. The secretion of bile is also promoted. Dr. Wilson Philip (*On the Influence of Minute Doses of Mercury*, p. 14) says, “mercury has a specific operation on the liver,—a power not merely of exciting its functions, but of correcting the various derangements of that function in a way which it does not possess with respect to any other organ, and which no other medicine possesses with respect to the liver.” I confess I am not acquainted with any facts warranting this assertion. The purgative effects of mercury arise partly from the increased secretion of bile, and partly from the stimulus given to the mucous lining of the alimentary tube; more particularly to its follicular apparatus. The *nervous system* appears also to be specifically affected by mercurials. This is to be inferred partly from the effects produced in those who are subjected to the vapours of this metal, such as the shaking palsy, &c. and partly from the effects of the soluble salts, when given in enormous doses. The *heart and lungs* are, in some cases, remarkably affected. This was particularly observed by Sir Benjamin Brodie (*Phil. Trans.* for 1812) in his experiments on animals with corrosive sublimate; as also by Smith, Orfila, and Gaspard. The affection of the *urinary organs* in poisoning by corrosive sublimate is also not to be forgotten.

4. *The nature of the influence exercised by mercury over the organism* has been a fertile source of discussion. One class of writers has regarded it as mechanical, a second as chemical, a third as dynamical.

(a.) *Mechanical hypothesis.*—Astruc (*De Morb. Ven.* ii. 149) and Barry (*Med. Trans.* i. 25) fancied that mercury acted by its weight, its divisibility, and its mobility; and thus getting into the blood separated its globules, rendered it more fluid and fit for secretion, made the lymph thinner, and overcame any existing obstructions.

(b.) *Chemical hypotheses.*—Some have advocated the chemical operation of mercurials, and have endeavoured to explain their curative powers in the venereal disease by reference to their chemical properties, but without success. Thus Mitié, Pressavin (quoted by Richter, *Ausführ. Arzneim.* iv. 305), and Swediaur (*Prac. Observ. on Venereal Complaints*), assumed that mercury acted chemically on the syphilitic poison, as acids

and alkaliés do on each other; while Girtanner (*Abhandl. ü. d. Vener. Krankh.*) supposed that the efficacy of mercurials depended on the oxygen they contain. To both hypotheses the same objection applies: if they were true, the larger the quantity of mercury used, the more effectually would the venereal disease be cured. Now this is not found to be the case. Dr. Cullen (*Treat. of the Mat. Med.* ii. 446) endeavoured to account for the action of mercury on the salivary glands, in preference to other organs, by assuming that it has a particular disposition to unite with ammoniacal salts, with which it passes off by the various excretions; and as the saliva was supposed to contain more of these salts than other secretions, he thus accounted for the larger quantity of mercury which passed off by these glands, and which being in this way applied to the excretories, occasioned salivation. But the whole hypothesis falls to the ground, when it is known that mercury has no "particular disposition" to unite with the ammoniacal salts; and that, even if it had, other secretions are as abundantly supplied with these salts as the saliva. Dr. John Murray substituted another hypothesis, but equally objectionable:—mercury, says he, cannot pass off by the urine, because of the phosphoric acid contained in this fluid, and which would form, with the mercury, an insoluble compound. It must, therefore, be thrown out of the system by other secretions, particularly by the saliva, which facilitates this transmission by the affinity which the muriatic acid, the soda, and the ammonia of the secretion, have for the oxide of mercury, and by which a compound soluble in water is formed. The answer to this hypothesis is, that mercury is thrown out of the system by the urine, and probably in larger quantity than by the saliva; secondly, the saliva also contains phosphatic salts, according to Tiedemann and Gmelin.

(c.) *Dynamical hypotheses.*—Some writers have principally directed their attention to the quality of the effects induced by mercury, and have termed this mineral stimulant, sedative, both stimulant and sedative, tonic or alterative. Those who assume mercury to be a *stimulant* or *excitant* are not agreed as to whether particular parts or the whole system are stimulated, and, if particular parts, what these are. Thus Hecker fixes on the lymphatic system, Schöne on the arterial capillary system, Reil on the nerves (Richter, *op. cit.* v. 306). The simple answer to all of them is, that other stimulants are not capable of producing the same effects on the constitution as mercury; nay, are frequently hurtful in the very cases in which this metal is beneficial.

On the other hand, Conradi, Bertele, and Horn (quoted by Richter, *op. cit.* v. 307), considered it to be a *weakening agent*, or *sedative*. Hence those who adopt this hypothesis must assume that the diseases in which mercury is beneficial are of a phlogistic or hypersthenic character; and that syphilis, therefore, is of this kind,—an explanation not at all satisfactory, nor consistent with facts. Of late years, the sedative operation of some of the mercurial preparations (calomel and mercurial ointment) has been assumed (particularly by our countrymen practising in the East), from the circumstance that these agents allay vomiting and diarrhœa in yellow fever, cholera, and other dangerous diseases. But even admitting that mercurials do produce these effects, this is hardly a sufficient ground for denominating them sedatives.

Some think that mercurials, in *small* or moderate doses, are *stimulants*, but in *excessive* doses, *sedatives*; and that this sedative operation is

common to all substances when employed in large quantities. This is the opinion of Dr. Wilson Philip (*op. cit.*)

Dr. Murray (*Syst. of Mat. Med.*) calls mercury a tonic; Vogt (*Phar-kodynamik*) terms it an alterative resolvent; Sundelin (*Heilmittellehre*) places it among the resolvent alteratives, under the designation of lique-facient (*verflüssigende*). Mr. Hunter (*Treatise on the Venereal Disease*) accounts for its beneficial effects in syphilis, by saying it produces an irritation of a different kind from that caused by the venereal disease, and that it counteracts the latter by destroying the diseased action of the living parts.

USES. 1. *OF METALLIC MERCURY*.—Liquid mercury has been used as a *chemical* agent, to dissolve silver coin which may have been ac-cidentally swallowed; *secondly*, as a *mechanical* agent, to remove ob-structions of the bowels; for example, intus-susception, or intestinal invagination. But neither theory nor experience seem favourable to its use; for in the greater number of cases the intus-susception is progres-sive—that is, the superior portion of the gut is insinuated into the lower portion, and, therefore, the pressure of the metal on the sides of the intes-tine cannot give relief; and even in cases of retrograde intus-susception,—that is where the lower portion of the bowels passes into the upper, mercury, instead of pressing the intus-suscepted portion back, might push it further on, by getting into the angle of reflection between the containing and inverted gut (Hunter, *Trans. of a Society for the Improve-ment of Med. and Chir. Knowledge*, i. 103). *Lastly*, water, which had been boiled with mercury (*agua mercurialis cocta*), was at one time used as an anthelmintic; but if the metal be pure, the water takes up no appreciable quantity of it. Moreover, it would appear that mercury has no particular anthelmintic powers; for persons who were salivated have not been freed from their worms, and Scopoli very frequently found ascarides in the workers of the quicksilver mines of Idria (Bremser, *Sur les Vers. Intest.* 428).

Administration.—When taken internally it has been administered in various doses, from an ounce to a pound or more.

2. *OF THE PREPARATIONS OF MERCURY*.—As *ERRHINES* or *EMETICS*, mercurials are never resorted to now, though formerly the *sub-sulphate* was used for these purposes.

As *ALTERATIVES*, they are given in small doses in various chronic diseases; such, for example, as dyspepsia, gout, chronic skin diseases, scrofula, &c. Calomel is said to be less beneficial as an alterative than blue pill, on account of its more irritating action on the bowels. The *hydra-gyrum cum cretâ* is an excellent alterative, especially for children.

Certain preparations of mercury (as blue pill, calomel, and the *hydra-gyrum cum cretâ*) are employed as *PURGATIVES*. They promote secre-tion from the mucous follicles of the intestines, from the liver, and the pancreas. They are rarely, however, used alone; being, in general, either combined with or followed by other cathartics (as jalap, senna, colocynth, or the saline purgatives). Thus it is a common practice to exhibit a blue or calomel pill at night, and an aperient draught the fol-lowing morning, the object being to allow the pill to remain as long as possible in the bowels, in order that it may the more effectually act on the liver. Mercurial purgatives are administered for various purposes, sometimes as anthelmintics, sometimes to assist in evacuating the con-

tents of the alimentary canal; but more commonly with the view of promoting the secretions, particularly of the liver, or of producing counter-irritation, and thereby to relieve affections of other organs, as the skin or head.

The great value of mercurials is as *SIALOGOGUES*. Formerly it was supposed, that the beneficial effects of mercury were proportionate to the degree of ptyalism, and thus to eradicate particular affections it was thought necessary to cause the evacuation of a given quantity of saliva. "I have heard," says Dr. Wilson Philip (*op. cit.* p. 19), the late Dr. Monro, of Edinburgh, state the quantity of saliva which must be discharged daily, to eradicate particular affections." Modern experience has proved the incorrectness of this notion; and we now rarely find it necessary to excite a high degree of salivation; indeed, frequently it would be prejudicial, but we sometimes find it requisite to keep up this effect for several weeks, particularly in diseases of a chronic character.

Production of sore mouth and salivation.—One of the most efficacious methods of putting the system under the influence of mercury is *friction* with the *unguentum hydrargyri*; but the troublesome and unpleasant nature of the process is a strong objection to it in practice, more especially in venereal diseases, in which patients usually desire secresy. Full directions for its employment will be given hereafter (vide *Ung. Hydrargyri*). In the year 1779, Mr. Clare (*Essay on the Cure of Abscesses by Caustic, also a New Method of introducing Mercury into the Circulation*, 1779) proposed a new method of causing salivation by friction, and which consists in rubbing two or three grains of calomel, or of the protoxide of mercury, on the inner surface of the cheeks and gums. It is said that the metal quickly becomes absorbed, and causes salivation, and if care be taken not to swallow the saliva, diarrhœa does not occur. Notwithstanding that Hunter, Cruikshank, and others, have tried this plan, and reported favourably of it, and that it is free from the objections made to the use of mercurial ointment, it has never been a popular remedy. *Fumigation*, as a means of affecting the general system, is an old method of treating venereal diseases. Turner (*On the Venereal Disease*) employed for this purpose cinnabar; Lalouette (*Nouv. Method. de traiter les Malad. Vénér.* 1776) calomel; and the late Mr. Abernethy (*Surgical and Phys. Essays*) the protoxide. Mr. Colles (*op. cit.* p. 58) has frequently seen fumigation fail in exciting salivation. He says, an easy mode of fumigating any part is by using mercurial candles (composed of cinnabar or oxide of mercury mixed with melted wax, with a wick, and burnt under a curved glass funnel). Baumé used *mercurial pediluvia* to excite salivation, composed of half a grain of corrosive sublimate dissolved in a pint of distilled water, and in a solution of this strength the patient immersed his feet for the space of two hours; several objections, however, exist to the practice, which has been rarely followed. Upon the whole, the most convenient method of producing salivation is by the *internal use of mercurials*, particularly of those preparations which are mild in their local action, as blue pill, calomel, and the *hydrargyrum cum cretâ*.

Treatment before and during salivation.—Formerly the use of mercurials was preceded by antiphlogistic measures, such as blood-letting, purging, warm bathing, and low diet, but they are now rarely resorted to, though useful, by facilitating absorption. Mr. Colles (*Practical*

Observations on the Venereal Disease, p. 28) thinks that these preparatory measures have been improperly omitted, and that the want of them has, of late years, contributed to bring this valuable remedy into much disrepute—in which opinion I am disposed to join him. Occasionally great difficulty is experienced in affecting the mouth, a circumstance which may arise from the irritable condition of the bowels; and when this is the case, inunction should be resorted to, or opium or vegetable astringents conjoined. Sometimes, however, the system appears insusceptible to the influence of mercury, and this may arise from idiosyncrasy, or from the presence of some disease, particularly fever. Emetics and blood-letting are useful in these cases, as they promote absorption; and as the influence of the former depends on the state of nausea produced, tartar emetic will be the best vomit, since it is the most powerful nauseant. Varying the mode of administering the mercury will also sometimes facilitate its operation on the system: thus, if it have been employed internally, inunction should be tried, and *vice versa*.

During the time that the patient's mouth is sore, he should, if possible, confine himself to the house, use warm clothing, avoid exposure to cold, take light but nourishing food, and regulate the state of his stomach and bowels. Mr. Hunter thought that during a mercurial course the manner of living need not be altered: but Mr. Colles (*op. cit.* p. 34) has properly, I think, objected to this. If the discharge become excessive, or ulceration of the gums take place, the further use of mercury is of course to be stopped; and, in order to moderate the effect already produced, the patient should be freely exposed to a cool but dry air, use purgatives and opium, and wash his mouth with some astringent and stimulating liquid. I have generally employed, as a gargle, a solution of the chloride of soda or of lime; but in the absence of these, a solution of alum, or of sulphate of copper, may be used. With regard to internal remedies, I have no confidence in any as having a specific power of stopping salivation, though iodine, sulphur, nitre, and other substances, have been strongly recommended. Sometimes sulphate of quinia is administered with advantage.

Accidents during salivation.—Occasionally, during salivation, certain effects result from mercury, which are in no way necessary or useful in a therapeutical point of view: on the contrary, some of them are highly prejudicial. Thus, sometimes, *excessive salivation, with ulceration of the gums*, takes place, as already noticed: not unfrequently *gastro-intestinal irritation* (or actual inflammation) comes on, and which may require the suspension of the use of mercury, or its employment by way of inunction, or its combination with opium or vegetable astringents. I have already noticed *fever, eczema mercuriale, mercurial erythysm* of Pearson, &c. as other occasional effects. In feeble and irritable habits, mercury sometimes disposes sores to *slough*. Occasionally a kind of *metastasis* of the mercurial irritation is observed: thus, swallowing a large quantity of cold water, or exposing the body to cold and moisture, has caused a temporary cessation of salivation, attended with violent pains or convulsions, or great irritability of stomach.

Curative action of salivation.—Though no surgeon ascribes the curative action of mercury to the salivation, yet, without this effect, the curative influence is not usually observed. Hence, though the one cannot be considered to stand to the other in the relation of cause and effect,

yet the two are usually contemporaneous: so that when we fail to induce some affection of the mouth, we do not observe the beneficial effects of mercury. (On this subject consult Colles, *op. cit.* p. 31).

Diseases for which salivation is employed.—Having offered these general remarks on salivation as a remedial agent, I proceed to notice its use in particular diseases.

(a.) *Fever.*—It has been said that salivation diminishes the susceptibility to the contagion of fever, whether common or specific; but that it is not an absolute preventive is shown by the fact, that patients under the full influence of mercury have caught fever and died of it, as will be found noticed by my friend, Dr. Clutterbuck, in his *Inquiry into the Seat and Nature of Fever*. I have several times used mercurials as sialogogues in fever; I believe, for the most part, with advantage. I have only used them when there was some marked local determination or inflammatory condition. I have seen three fatal cases of fever in which mercurials were used profusely, without having any effect on the mouth; but in other instances, in which the mouth became affected, recovery took place. My experience, therefore, agrees with that of Dr. Copland (*Dict. of Pract. Med.* i. 929), namely, that death, after salivation has been established, is very rare. Whether the recovery was the consequence of the mercurial action, or the salivation the result of the mitigation of the disorder, as Dr. Bancroft (*On Yellow Fever*) and Dr. Graves (*Lond. Med. Gaz.* xx. 147) assert, cannot be positively proved, though I think the first more probable. Dr. Graves (*op. cit.*) declares the use of mercury in fever to be both injudicious and unnecessary, unless inflammation of some organ be set up. In this opinion I cannot agree with him. Dr. Macartney (*Treatise on Inflammation*, p. 162), on the other hand, says, “In no single instance have I known it [mercury] fail in arresting the progress of the disease, provided the fever be not combined with visceral affections, or characterized from the beginning with unusual prostration of strength.” The great indisposition of the system, in fever, to take on the mercurial action, is frequently a most annoying circumstance. It may sometimes be overcome by the employment of mercurials both internally and externally. Mr. Lempriere (*Pract. Observ. on Diseases of the Army of Jamaica*), who practised in Jamaica, finding that calomel was often exhibited in immense quantities, without exciting any apparent action, was induced to employ corrosive sublimate in doses of the eighth part of a grain, with the addition of ten drops of laudanum, and this quantity was repeated every hour until some affection of the mouth was observed, or until the more alarming symptoms had considerably abated.

The beneficial influence of mercurials has been more particularly experienced in the fevers of warm climates, especially those of the East Indies (Johnson, *On Diseases of Tropical Climates*, pp. 32, 96, 97, 122, &c. &c. 3d. ed.; Annesley, *On the Diseases of India*, p. 391, 2d. ed.) It has been said by several writers (Johnson, *op. cit.* p. 37; Bancroft, *On Yellow Fever*; Musgrave, *Edinb. Med. & Surg. Journ.* xxviii. 40), that in the yellow fever of the West Indies its beneficial effects are not equally evident.

(b.) *Inflammation.*—Of late years various forms of inflammation have been most successfully combated by the use of mercury. Hence this mineral is termed an *antiphlogistic*. We are principally indebted to Dr.

Hamilton (Duncan's *Med. Comm.* vol. ix.), Dr. Yeats (Duncan's *Ann. of Med.* vol. vii.), Dr. Wright (*Med. Facts & Observ.* vol. vii.), and Rambach (*Dissert. Usus Mercurii in Morb. Inflamm.* 1794) for its introduction into use in this form of disease. Its influence is that of a profoundly acting alterative (*vide* p. 10). Its curative power is not satisfactorily accounted for by the equalization of the circulation, the augmentation of the secretions, or the increased activity of the absorbents caused by mercury.

Mercury is not equally serviceable in all inflammations, but it is exceedingly difficult to generalize; that is, to point out in what circumstances those inflammations agree which are benefited by it. It appears, however, that the *nature of the tissue*, the *structure of the organ affected*, and the *quality or kind of inflammation*, are points of considerable importance as affecting its use.

Thus it appears that inflammations of *membranous tissues* are those principally benefited by a mercurial plan of treatment; and more especially those in which there is a tendency to the exudation of coagulable lymph or of serous fluid—as meningitis, pleuritis, pericarditis, and peritonitis (particularly of puerperal women). In inflammation of the lining membrane of the air-tube, but more especially in croup, or, as it is sometimes termed, plastic inflammation of the larynx, mercury is one of our most valuable remedies; and as this disease is one which terminates rapidly, no time should be lost in getting a sufficient quantity of mercury into the system. Calomel is usually employed; but when the bowels are very irritable, the *hydrargyrum cum cretâ*, or even mercurial inunction, may be resorted to. In inflammation of the tunics of the eye, particularly iritis, mercury (next to blood-letting) is the only remedy on which much confidence can be placed; and we use it not merely with a view of putting a stop to the inflammatory action, but also in order to cause the absorption of the effused lymph (Lawrence, *Lectures on Diseases of the Eye*, in *Lancet*, vol. x. p. 198; Mackenzie, *On Diseases of the Eye*, 2d. ed. pp. 389, 394, 503). In inflammation of the synovial membranes, mercury has been employed, and in some cases with manifest advantage. In dysentery, mercury has been extensively used, especially in warm climates. By some, calomel has been employed merely as a purgative (Jackson, Ballinghall, Bampfield, and Annesley); by others, to produce its sialogogue effects (Johnson and Cunningham).

The *structure of the organ* influences the effect of mercury: at least it is well known that this mineral is more beneficial in inflammation of certain organs (especially those of a glandular structure, as the liver) than of others; and we refer it to some peculiarity in the structure of the part affected. In hepatitis of either temperate or tropical climates (particularly of the latter), mercury is advantageously employed (Sir James M'Grigor, *Medical Sketches*; Johnson, *On Tropical Climates*; Annesley, *On Diseases of India*). Blood-letting, however, should be premised, particularly in the disease as usually met with in this country. In peripneumonia, more especially when hepatization has taken place, the best effects have sometimes resulted from its use; of course after the employment of blood-letting. When hepatization has taken place, Dr. Davies (*Lect. on the Diseases of the Lungs, &c.* p. 191) recommends the use of blue pill and opium. In inflammation of the substance of the brain, also, mercury may be advantageously resorted to, after the usual depletives.

The nature or quality of the inflammation also influences the effects, and thereby the uses, of mercury. Thus, in syphilitic inflammation, mercurials are of the greatest utility; less so in rheumatic inflammation; still less in scrofulous; and most decidedly objectionable in cancerous or scorbutic diseases. The treatment of rheumatism by calomel and opium was proposed by Dr. Hamilton (*op. cit.*), and has found many supporters (*vide* Dr. Hope, *Lond. Med. Gaz.* xix. 815); and, undoubtedly, when the febrile action does not run too high, or when the pericardium becomes affected, calomel and opium, preceded by blood-letting, will be found serviceable. It appears to be best adapted to the fibrous or diffuse form of the disease, and to fail in the synovial (Dr. Macleod, *Lond. Med. Gaz.* xxi. 361). The scrofulous habit is, for the most part, unfavourable to the use of mercury given as a sialogogue, but there are cases in which it is not only admissible but serviceable—as scrofulous ophthalmia, when of an acute kind. In all maladies of a malignant character (as cancer, fungoid disease, &c.) mercurials are highly objectionable.

(c.) *Veneral diseases.*—It was formerly the opinion of surgeons that the symptoms of venereal diseases were progressive, and never disappeared until mercury was administered; but it has, of late years, been clearly proved that this notion is erroneous: and we are indebted to some of our army surgeons—namely, to Messrs. Ferguson, Rose, Guthrie, (*Med. Chirurg. Trans.* vols. iv. and viii.), Hennen (*Military Surgery*), and Bacot (*On Syphilis*, 1821), and to Dr. Thomson (*Ed. Med. and Surg. Journ.* xiv.)—for showing that the venereal disease, in all its forms, may be cured without an atom of mercury. Moreover, it is fully established by the experience of almost every surgeon, that while in some instances mercury exercises a beneficial influence hardly to be observed with respect to any other disease or any other remedy, yet, that in some cases it acts most injuriously; and it is generally supposed that many of the bad venereal cases formerly met with, arose, in great part, from the improper use of mercury. It is a point, therefore, of considerable importance, to determine what cases are best adapted for a mercurial, and what for a non-mercurial, method of treatment; for in admitting the possibility of a cure without this agent, it is not to be inferred that the method is either eligible or expedient; nay, the very persons who have proved this possibility, admit that in some cases this mineral, given so as to excite moderate salivation, is advisable. One fact is, I think, now tolerably well established—viz. that the cure of venereal diseases without the aid of mercury is much slower and less secure against relapses than by a mercurial treatment (*vide* Colles, *Pract. Observ. on the Vener. Disease*, p. 318). It is not easy to lay down rules to guide us in the selection of the one or the other of these methods of treatment. Mr. Carmichael (*On Venereal Diseases*, 2d ed. 1825) relies principally on the eruption, and, next to this, on the appearance of the primary ulcer; and of the four forms of the venereal disease which he has described, namely, the papular, the pustular, the phagedenic, and the scaly, full courses of mercury are required, he says, in one only—namely, the scaly; in which the primary sore is the Hunterian chancre or callous ulcer, and the eruption partakes of the characters of lepra or psoriasis. But it has been satisfactorily proved by experiments made in the military hospitals, that even this scaly form of the disease may get well without mercury; and, on the other hand, in the pustular and papular forms, mercury is often a

most valuable agent. Hennen, Rose, Guthrie, and Thomson, advise the employment of moderate quantities of mercury whenever the disease does not readily subside under the use of ordinary methods of treatment. But unless some special circumstances contra-indicate the use of mercury, it is, I think, advisable to affect the mouth slightly in most forms of the disease.

The circumstances which deserve attention, as affecting the use of mercury, are numerous. The following are the principal:—

a. Scrofula.—Some of the worst and most intractable forms of the venereal disease occur in scrofulous subjects; and in such, mercury is in general prejudicial. I have seen numerous instances of its injurious effects. One case which fell under my notice was that of a medical student, who, after three years' suffering, died; having been made much worse on two occasions by what I conceived to be the improper use of mercury, once by his own act, and a second time by the advice of the surgeon of his family. Mr. Colles (*op. cit.* p. 236), however, denies the baneful influence of mercury in scrofula, and advises its use for the cure of syphilis in scrofulous subjects; but he admits that the profession generally entertain a contrary opinion.

β. Condition of the primary ulcer.—Another point deserving attention in deciding on the use of mercury, is the condition of the primary sore: if it be much inflamed, or of an irritable nature—if it be of the kind called phagedenic, or at all disposed to slough—mercury must be most carefully avoided, as it increases the disposition to sloughing. In one case that fell under my notice, a gentleman lost his penis by the improper use of mercury, under the circumstances just mentioned.

γ. Extreme debility with hectic fever.—This condition is usually believed to contra-indicate the employment of mercury. But Mr. Colles (*op. cit.* p. 206) asserts, “that a patient affected with secondary symptoms, even though extremely attenuated, and, as it were, melting away under the effects of hectic, can with perfect safety and advantage at once commence a course of mercury; by which not only shall his venereal symptoms be removed, but at the same time his general health be re-established.”

(d.) Cholera.—Writers on the spasmodic cholera, both of this country and of India, speak for the most part favourably of the effects of mercury, especially in the form of calomel. I may refer to the works of Drs. Johnson, Venables, and Hanett, and of Messrs. Annesley, Orton, and Searle, in proof. I have met with no writers who attribute ill effects to it. Unfortunately those who advocate its use are not agreed as to the dose, or frequency of repetition; some advising it as a purgative; some as a sedative, in combination with opium; others, lastly, using it as a sialogogue. It is deserving of especial notice, that when salivation takes place, the patient in general recovers. Dr. Griffin (*Lond. Med. Gaz.* xxi. p. 882), however, has shown that this is not invariably the case. (For further information on the use of mercurials in cholera, vide HYDRARGYRI CHLORIDUM).

(e.) Dropsy.—In this disease, mercurials may do either good or harm. Thus when the dropsical effusion depends on inflammation, they may be employed with the best effects, as when hydrocephalus arises from meningitis, or hydrothorax from pleuritis. When ascites is occasioned by an enlarged liver, which compresses the vena portæ, and thereby gives rise

to effusion, mercurials are sometimes beneficial. On the contrary, when dropsy occurs in old subjects, and when it depends on, or is accompanied by, general debility, salivation is almost always hurtful. Moreover, when the effusion arises from mechanical causes not removable by mercury, as obliteration of any of the venous trunks, or pressure of malignant tumors, salivation is injurious. Occasionally dropsical effusion takes place without any appreciable cause, and then, of course, if mercury be employed, it must be in part on speculation. In such cases calomel is not unfrequently employed in combination with squills or foxglove.

(f.) *In chronic diseases of the viscera*, especially those arising from or connected with inflammation, mercury is frequently serviceable. Thus, in enlargement or induration of the liver, in hepatization of the lungs, &c. In those diseases commonly termed malignant, as cancer and fungus hæmatodes, and also in diseases of a non-malignant character, but occurring in debilitated subjects, mercurials, given so as to excite salivation, are objectionable.

(g.) *In chronic diseases of the nervous system*.—Mercury has been recommended in paralysis, and on some occasions has proved exceedingly efficacious. I have seen hemiplegia, with impaired vision and hearing, headache, and cramps of the extremities, recover under the use of mercury, after blood-letting, purgatives, &c. had failed. The patient (a young man) was kept under the influence of the medicine for two months. Mr. Colles (*op. cit.* p. 327) has likewise found it most efficacious in paralysis. In tetanus, mania, epilepsy, hysteria, tic douloureux, and other affections of the nervous system, mercury has been used with occasional benefit.

The foregoing are some of the more important diseases against which mercurials have been successfully administered as sialogogues.

Hydrar'gyrum cum Cré'tá.—Mer'cury with Chalk.

HISTORY.—This compound (called also *mercurius alcalisatus*, or *æthiops absorbens*) is first mentioned, I believe, by Burton, in 1738.

PREPARATION.—It is prepared by rubbing three ounces of mercury with five ounces of chalk, until globules are no longer visible. On account of the tediousness of the process, the friction is usually effected by steam.

If this powder be digested in acetic acid, the lime of the chalk is dissolved, and the carbonic acid escapes; but the greater part, if not the whole of the mercury, is insoluble in the acid, and hence is not the protoxide. If examined by a lens, the residuum is found to consist of minute separate globules, which readily whiten silver and gold, showing they are in the metallic state. Hence it is probable that the quicksilver is, for the most part, mechanically divided only, but a small portion may perhaps be oxidized.

PROPERTIES AND CHARACTERISTICS.—It is a greyish powder, which effervesces on the addition of acetic acid, yielding a solution of lime, which may be distinguished by the tests for the calcareous salts already mentioned. By digestion in nitric acid, we obtain a solution known to contain mercury by the characters already detailed for the mercurial preparations generally. By heat the mercury is volatilized, leaving the chalk.

COMPOSITION.—It consists of mercury and chalk, with perhaps a little

protoxide of mercury. It contains three parts of mercury and five of chalk.

PHYSIOLOGICAL EFFECTS.—It is an exceedingly mild but valuable mercurial. In full doses it acts as a gentle laxative, promoting the secretion of bile and intestinal mucus, but sometimes creating a little sickness. The chalk renders it antacid. By repeated use it occasions the constitutional effects of mercury already described.

USES.—It is a valuable remedy in *syphilis infantum*. It is frequently employed to promote and improve the secretions of the liver, pancreas, and bowels, in various disordered conditions of the digestive organs, accompanied by clay-coloured stools or purging. In strumous affections of children (especially enlarged mesenteric glands), and other chronic maladies, it is administered with great advantage as an alterative.

ADMINISTRATION.—To adults it is given in doses of from five grains to a scruple, or half a drachm. For children the dose is two or three grains. Rhubarb, carbonate of soda, or, in some cases, Dover's powder, may be conjoined with it.

Hydrar'gyrum cum Magne'siâ.—*Mer'cury with Magne'sia.*

Under this name there is a compound in the Dublin Pharmacopœia, prepared by rubbing two parts of mercury with two parts of manna until the globules disappear, and then washing out the manna with water, and adding eight parts of subcarbonate of magnesia. Its effects and uses are analogous to the preparation just described.

Pilulæ Hydrar'gyri.—*Pills of Mer'cury.*

HISTORY.—The oldest formula for mercurial pills is that of Barbarossa (at one time admiral of the Turkish fleet, and afterwards governor or king of Algiers), and which was communicated by him to Francis the First, king of Franconia, who made it public. The common name for this preparation is *blue pill*, or *pilulæ cæruleæ*.

PREPARATION.—In the London Pharmacopœia it is ordered to be prepared by rubbing two drachms of purified mercury with three drachms of confection of roses, until globules are no longer visible, and then adding a drachm of powdered liquorice-root. In the Dublin Pharmacopœia extract of liquorice is substituted for the root. In the Edinburgh Pharmacopœia one part of mercury, one of confection of roses, and two of starch, are employed. The friction is usually effected by steam power. By trituration the metal is reduced to a finely-divided state, and becomes intimately mixed with the confection and liquorice powder.

PROPERTIES.—It is a soft mass, of a convenient consistence for making into pills, and has a dark blue colour. When rubbed on paper, or glass, it ought to present no globules; but applied to gold it communicates a silvery stain.

COMPOSITION.—Three grains of this pill contain one grain of mercury.

IMPURITY.—If any sulphuric acid should have been added to the confection to brighten its colour, some subsulphate of mercury will be formed—a compound which possesses very energetic properties.

PHYSIOLOGICAL EFFECTS.—In full doses (as fifteen grains) it frequently acts as a purgative. In small doses it is alterative, and, by repetition, produces the before-mentioned constitutional effects of mercurials.

USES.—The practice of giving a blue pill at night, and a senna draught the following morning, has become somewhat popular, in consequence of its being recommended by the late Mr. Abernethy, in various disorders of the chylopoietic viscera. As an alterative, in doses of two or three grains, blue pill is frequently resorted to. Lastly, it is one of the best internal agents for exciting salivation, in the various diseases for which mercury is adapted.

ADMINISTRATION.—The usual mode of exhibiting it is in the form of pill, in the doses already mentioned; but it may also be administered when suspended in a thick mucilaginous liquid. If the object be to excite salivation, we may give five grains in the morning, and from five to ten in the evening; and to prevent purging, opium may be conjoined.

Unguentum Hydrargyri.—Ointment of Mercury.

HISTORY.—Mercurial ointment was known to, and employed by, the ancient Arabian physicians—for example, Abhengueth, Rhazes, and Avicenna: so that it has been in use certainly 1000 years. However, Gilbertus Anglicus, who lived about the commencement of the thirteenth century, was the first who gave a detailed account of the method of extinguishing mercury by fatty matters. Besides its more common appellation of *mercurial ointment*, it was formerly termed *blue* or *Neapolitan ointment*.

PREPARATION.—In the London, Dublin, Edinburgh, and United States Pharmacopœias, the *unguentum hydrargyri fortius* is prepared by rubbing two pounds of mercury with an ounce of suet and twenty-three ounces of lard, until globules are no longer visible. To promote the extinction of the mercury, the metal should be previously triturated with some old mercurial ointment. Rancid lard also assists the extinction of the globules.

Some assert that the mercury is in a finely-divided metallic state, though, if well prepared, there are no appearances of globules when the ointment is examined by a lens. In favour of this view Guibourt (*Pharm. Raisonnée*, ii. 140) states, that by digesting ether on mercurial ointment, the fatty matter may be dissolved and liquid mercury obtained in equal weight to that used in making the ointment. Now it is unlikely, if the mercury had been previously oxidized, that the ether could deoxidize it; and therefore, this experiment (supposing the results to be those mentioned) appears almost decisive that the mercury is in the metallic state; but on repetition of the experiment, I have not obtained the results stated by M. Guibourt. Mr. Donovan, however, thinks that part of the mercury attracts oxygen, and that the oxide thus formed unites with the fatty matter. I have seen no satisfactory explanation of the efficacy of old mercurial ointment in extinguishing the mercury; Guibourt offers the following:—By trituration, both lard and mercury assume oppositely electrical states, the lard becoming negative, the mercury positive; these states, he supposes, determine a more intimate mixture of the particles, and a greater division of the mercury. Now

rancid lard and old mercurial ointment, having attracted oxygen from the air, more readily take on the negative condition, and hence their efficacy in promoting the extinction of the mercurial globules. Guibourt also asserts, that mortars of marble or wood are better adapted for making this ointment than those of metal, on account of their power of conducting electricity being less.

PROPERTIES.—It is an unctuous fatty body of a bluish grey colour, and if properly prepared, gives no traces of globules when rubbed on paper, and examined by a microscope; but when rubbed on gold, it quickens it.

COMPOSITION.—This compound contains half its weight of mercury.

PHYSIOLOGICAL EFFECTS.—Mercurial ointment possesses very little power of irritating the parts to which it is applied; but when either swallowed or rubbed into the integuments, readily produces the constitutional effects of mercury. Thus Cullerier says, that three or four pills, containing each two grains of this ointment, and taken successively, have often sufficed to excite violent salivation. He also tells us, that if the object be to produce ptyalism, in a very short space of time, we may effect it by giving half a drachm of the ointment in the space of twenty-four hours.

When rubbed on the surface of the body, it produces the same constitutional effects as the other preparations of mercury; but if the lard which it contains be not rancid, no obvious local effect is usually produced. Applied to ulcerated surfaces, mercurial ointment is a stimulant, and in syphilitic sores is oftentimes a very useful and beneficial application.

USES.—It is rarely or never administered *internally* in this country, but has been much used on the continent, and with great success. It certainly well deserves a trial where the system appears insusceptible to the influence of mercury; for Cullerier says, the difficulty with him has been rather to check than to excite salivation by it.

Applied *externally*, it is employed either as a local or constitutional remedy. Thus as a *local* agent it is used as a dressing to syphilitic sores, or rubbed into tumors of various kinds (not those of a malignant nature, as cancer and fungus hæmatodes), with the view of exciting the action of the lymphatic vessels. Sometimes, also, it is employed to destroy parasitic animals on the skin. As a *means of affecting the constitution* we use mercurial inunctions in syphilis, in inflammatory diseases, and, in fact, in all the cases (already noticed) in which our object is to set up the mercurial action in the system, more especially when the irritable condition of the digestive organs offers an objection to the internal employment of mercurials. It may be laid down as a general rule, that mercury may be used with more safety by the skin than by the stomach; but reasons of convenience, which I have already alluded to, frequently lead us to its internal use.

ADMINISTRATION.—*Internally*, it is given in doses of from two to five grains, made into pills, with either soap or some mild powder, as liquorice. *Externally*, when the object is to excite very speedy salivation, half a drachm may be rubbed into the skin every hour, washing the part each time, and varying the seat of application. If, however, it be not desirable or necessary to produce such a speedy effect, half a drachm or a drachm, rubbed in night and morning, will be sufficient.

During the whole course of inunction the patient should wear the same drawers night and day.

When the friction is performed by a second person, the hand should be enveloped with soft oiled pig's bladder, turned inside out (Colles, *op. cit.* p. 42). In making use of mercurial frictions, it is to be recollected they ought not to be violent, but long continued, and had better be carried on near a fire, in order to promote the liquefaction and absorption of the ointment. In syphilis, and other diseases in which our sole object is the constitutional affection, it matters little to what part of the body the ointment is applied, provided the cuticle be thin (for this inorganicized layer offers an impediment to absorption in proportion to its thickness). The internal parts of the thighs are usually, therefore, selected. However, in liver complaints, the inunctions are made in the region of the organ affected. The occasional use of the warm bath promotes absorption when the ointment is applied to the skin.

UNGUENTUM HYDRARGYRI MITIUS (Ph. Lond. & Dublin).—This is prepared by mixing a pound of strong mercurial ointment with two pounds of lard. It contains a sixth part of its weight of mercury. This preparation is applied as a dressing to ulcers and cutaneous diseases.

CERATUM HYDRARGYRI COMPOSITUM (Ph. Lond. : stronger ointment of mercury ; soap cerate, \overline{aa} $\frac{3}{4}$ iv. ; camphor, $\frac{3}{4}$ j. M.)—Its uses are similar to those of the following preparation :—

LINIMENTUM HYDRARGYRI COMPOSITUM (Ph. Lond. : stronger ointment of mercury ; lard, of each, $\frac{3}{4}$ iv. ; camphor, $\frac{3}{4}$ j. ; rectified spirit, f. $\frac{3}{4}$ j. ; solution of ammonia, f. $\frac{3}{4}$ iv. M.)—It is used (by way of friction) in chronic tumors, chronic affections of the joints, &c., where the object is to excite the action of the lymphatic vessels. It is stated to cause salivation more readily than the common mercurial ointment, owing to the camphor and ammonia.

Emplas'trum Hydrar'gyri.—*Plas'ter of Mer'cury.*

In the London Pharmacopœia, this is ordered to be prepared by adding eight grains of sulphur to a fluidrachm of heated olive oil, stirring until they unite. Then rub the mercury with the oil until the globules are no longer visible, and add a pound of melted lead plaster. In this process the sulphur of the sulphurated oil forms with the mercury a sulphuret, while the remainder of the metal is mechanically divided. Each drachm of the plaster contains fifteen grains of mercury.

It is supposed to stimulate the lymphatic vessels of the parts to which it is applied, and is used as a discutient in glandular enlargements and other swellings, whether venereal or otherwise, and also to the region of the liver in hepatic complaints. Dr. Wilson Philip (*op. cit.*) has seen it induce salivation.

EMPLASTRUM AMMONIACI CUM HYDRARGYRO (Ph. Lond.)—This is prepared in a similar manner to the last preparation, except that the gum-resin ammoniacum is substituted for the lead plaster. The preparation of the Dublin Pharmacopœia consists of ammoniacum, lb. j. ; purified mercury, $\frac{3}{4}$ ij. ; common turpentine, $\frac{3}{4}$ ij. M. It is a more powerful compound than the last, and is employed in the same cases, especially in venereal buboes.

Hydrargyri Ox'idum.—Ox'ide of Mer'cury.

HISTORY.—The mode of preparing this compound was taught by Moscat in 1797. This oxide is sometimes termed the *protoxide*, *sub-oxide*, *ash*, *grey*, or *black oxide* (*hydrargyri oxydum cinereum*, *hydrargyri oxidum nigrum*).

PREPARATION.—In the London Pharmacopœia it is prepared by adding one ounce of calomel to a gallon of lime water: then frequently shake them, set by, and when the oxide has subsided, pour off the supernatant liquor, and wash the precipitate with distilled water: afterwards dry it (wrapped in bibulous paper) in the air.

In this process double decomposition takes place: chloride of calcium is formed in solution, while oxide of mercury precipitates.

REAGENTS.	RESULTS.
1 eq. Chlor. Merc. = 238	} 1 eq. Chloride Calcium .. 56
1 eq. Mercury .. 202	
1 eq. Lime = 28	} 1 eq. Oxide of Mercury .. 210
1 eq. Calcium .. 20	
1 eq. Oxygen .. 8	

In the Edinburgh Pharmacopœia one-fourth more lime-water is employed, and the mixture boiled for a quarter of an hour. In the Dublin Pharmacopœia, one part of calomel and four of water of caustic potash are employed. In this case chloride of potassium is formed in solution.

PROPERTIES.—Pure oxide of mercury is black, or nearly so. The present preparation, however, is frequently greyish, owing to the presence of some undecomposed calomel. It is readily decomposed by light (especially by the solar rays), becomes olive coloured, and is resolved into metallic mercury and the binoxide. It is odourless, tasteless, insoluble in water and the alkalis, but soluble in nitric acid and acetic acid. By the action of hydrochloric acid it forms water and calomel. When heated it is first decomposed, and then completely dissipated.

CHARACTERISTICS.—Heated in a glass tube it evolves oxygen, while metallic globules are sublimed. Dissolved in nitric acid it forms a proto-mercurial salt, known by the before-mentioned characters for these substances.

COMPOSITION.—The composition of this oxide is as follows:—

	Eq.	Eq. Wt.	Per Cent.	Sefström.
Mercury	1	202	96.19	96.2
Oxygen	1	8	3.81	3.8
Oxide of Mercury ..	1	210	100.00	100.0

PURITY.—Digested, for a short time, in dilute hydrochloric acid, the solution, when filtered, should form no precipitate with either potash or oxalate of ammonia. If any binoxide had been dissolved, the potash would throw it down as a reddish or yellowish hydrate. If any carbonate of lime had been precipitated, the oxalate would recognise it.

PHYSIOLOGICAL EFFECTS.—Pure oxide of mercury is one of the least irritating of the mercurial preparations, and, therefore, when swallowed, does not produce much disorder of the alimentary canal. In small doses it acts as an alterative and purgative. When taken in repeated doses, its constitutional effects are similar to those of other mercurials.

USES.—Mr. Abernethy employed it as a fumigating agent. The following are his directions for using it:—Place the patient in a vapour

bath, in a complete suit of under garments, with a cloth around his chin. Two drachms of the oxide are then to be put on a heated iron within the machine in which the patient is sitting. After continuing in the bath for about fifteen or twenty minutes, the body is found to be covered with a whitish powder. The patient should be placed in bed, and lie in the same clothes till morning, and then go into a tepid bath. By this mode of proceeding, Mr. Abernethy says, he has known salivation induced in forty-eight hours.

Oxide of mercury is rarely employed as an internal remedy; indeed, its varying composition is a strong objection to its use. As an external application it has been used in the form of *ointment*, and also suspended in a weak solution of chloride of calcium, under the name of *black-wash*.

ADMINISTRATION.—For internal use the dose is from half a grain to two or three grains.

UNGUENTUM HYDRARGYRI OXYDI (oxide of mercury, 1 part; lard, 3 parts: mix them thoroughly, Ph. Edinb.)—This is intended to be a substitute (of a fixed strength) for the common mercurial ointment. According to Mr. Donovan, this ointment should be kept at a temperature of 350° F., for the space of two hours, in order that the oxide and the fatty matter may enter into union. It is used as a substitute for mercurial ointment.

LOTIO NIGRA (*black-wash; aqua mercurialis nigra; aqua phagedenica mitis*).—This is prepared by adding calomel to lime-water. The proportions of the ingredients may be varied, but in general one drachm of calomel is used to a pint of lime-water. Oxide of mercury precipitates, and chloride of calcium remains in solution. As the efficacy of the wash depends on the oxide, the bottle must be well shaken every time of using it. This compound is a favourite application to venereal sores of almost all kinds,—in most being serviceable, in few or none being hurtful.

Hydrar'gyri Binox'ydim.—*Binox'ide of Mercury.*

HISTORY.—This is the *peroxide* or *red oxide of mercury* of some writers. Geber (*Sum of Perfection*, book i. part iv. ch. 16) describes the method of making that variety of it which is prepared by calcination, and which was formerly called *red precipitate per se* (*mercurius precipitatus ruber per se*) or *calcined mercury* (*hydrargyrum calcinatum*). He calls it *coagulated mercury*.

PREPARATION. (a.) *By precipitation.*—In the London Pharmacopœia this compound is directed to be prepared by adding 28 fluidounces of solution of potash to four ounces of bichloride of mercury, dissolved in six pints (120 fluid ounces) of distilled water. The precipitated powder is to be washed with distilled water until the latter comes off tasteless, and is then to be dried.

In this process one equivalent or 274 parts of bichloride of mercury are decomposed by two equivalents or 96 parts of potash, and yield one equivalent or 218 parts of binoxide of mercury, and two equivalents or 152 parts of chloride of potassium.

REAGENTS.		RESULTS.	
1 eq. Bichl ^{de} Mercury..	274	{ 2 eq. Chlorine....	72
		{ 1 eq. Mercury..	202
2 eq. Potash	96	{ 2 eq. Potassium..	80
		{ 2 eq. Oxygen	16
			2 eq. Chloride Potassium .. 152
			1 eq. Binoxide of Mercury .. 218

(b.) *By calcination.*—In the Dublin Pharmacopœia, *hydrargyrum oxydum rubrum* is directed to be prepared by exposing mercury to a heat of 600°, in an open glass vessel, with a narrow mouth and broad bottom, until it is converted into red scales. The heat vapourizes the mercury, which in this state attracts oxygen from the air, and forms this red or binoxide. The long neck of the vessel prevents the escape of the vapours or newly-formed oxide.

The process is a very tedious one, occupying several weeks; so that Geber's remark was correct, that "it is a most difficult and laborious work, even with the profoundness of clear-sighted industry." The apparatus which Mr. Boyle contrived for the manufacture of it, was long termed "*Boyle's Hell*," from a notion that the mercury was tortured in it.

PROPERTIES.—When prepared by precipitation it is in the form of an orange-red powder; but when made by calcination, occurs in small brilliant scales of a ruby red colour. Both varieties agree in the following properties:—They are odourless, have an acrid metallic taste, are insoluble in water, but soluble in both nitric and hydrochloric acids. They are decomposed and reduced by heat and solar light: the precipitated variety is more readily acted on by solar light than the variety made by calcination.

CHARACTERISTICS.—When heated in a glass tube by a spirit lamp, it is decomposed into oxygen and mercury: the first may be recognised by a glowing match, the second condenses in small globules. It dissolves completely in hydrochloric acid: the solution contains bichloride of mercury, which may be known by the tests hereafter to be mentioned for this substance (*vide* HYDRARGYRI BICHLORIDUM).

COMPOSITION.—The composition of this substance is as follows:—

	Eq.	Eq. Wt.	Per Cent.	Sefström.	Donovan.
Mercury	1	202	92.66	92.68	92.75
Oxygen	2	16	7.34	7.32	7.25

Bin oxide of Mercury . 1 218 . . . 100.00 100.00 100.00

Bin oxide of mercury prepared by precipitation usually contains some water.

PURITY.—Bin oxide of mercury should be completely dissipated by heat, and be insoluble in water. Its solution in nitric acid should be unaffected by nitrate of silver, by which the absence of any chloride is shown. If an insufficient quantity of potash be employed in the preparation of the precipitated variety, the product is brownish or brick-dust coloured, and contains oxichloride of mercury (composed, according to Souberain, of 1 eq. bichloride of mercury and 3 eqs. of bin oxide: Dumas, *Traité de Chimie*, iii. 615).

PHYSIOLOGICAL EFFECTS.—Bin oxide of mercury is a powerful irritant, and when taken internally, even in small doses, readily excites vomiting and purging; large doses would excite gastro-enteritis. Orfila (*Toxicol. Gén.*) found that bin oxide, obtained by precipitation from four grains of bichloride, killed a dog in eighteen minutes. The constitutional effects of this preparation are the same as those of mercurials generally.

USES.—Bin oxide of mercury is rarely employed as a medicine. It has been applied as an escharotic, either in the form of powder or ointment. Internally it was formerly exhibited to excite salivation in

venereal diseases, but is objectionable, especially where the bowels are morbidly irritable. It is rarely or never used now.

In pharmacy it is employed in the preparation of bichloride of mercury (*vide* HYDRARGYRI BICYANIDUM).

ADMINISTRATION.—The dose of it is from a quarter of a grain to a grain, given in the form of pill, in combination with opium.

LOTIO FLAVA: Lotio (seu aqua) phagedenica: yellow wash.—This compound, which was formerly in frequent use, is prepared by adding bichloride of mercury to lime-water. The proportions vary in different formulæ. The quantity of bichloride should not, I think, exceed two grains to an ounce of lime-water: the usual proportions are thirty grains of bichloride to sixteen ounces of lime-water. The preparation, then, consists of the yellow hydrated binoxide of mercury (which precipitates), chloride of calcium, and caustic lime; the two latter being in solution. But if the quantity of bichloride exceed $3\frac{7}{8}$ grains to an ounce of lime-water, the precipitate is brown or brick-dust coloured, and contains oxichloride of mercury, while the clear liquor holds in solution some hydrargyro-chloride of calcium; that is, a saline combination, in which chloride of calcium is the base, and bichloride of mercury the acid (Guibourt, *Journ. Chim. Méd.* iii. 377; also *Pharm. Raisonnée*, i. 563; and Souberain, *Nouv. Traité de Pharm.* ii. 529). Yellow or phagedenic wash is applied, by means of lint, to venereal and scrofulous ulcers. Dr. Hintze (*Brit. and For. Med. Rev.* April 1836) used it with advantage in chronic ulcers which succeed to burns. It should be well shaken, and used in the turbid state.

Hydrar'gyri-Ni'trico-Ox'ydum.—Ni'tric-ox'ide of Mercury.

HISTORY.—This preparation was known to Raymond Lully in the latter part of the thirteenth century. It is commonly termed *red precipitated mercury* (*mercurius precipitatus ruber*), or, for brevity, *red precipitate*. It is the *oxidum hydrargyrum rubrum per acidum nitricum* of the Edinburgh Pharmacopœia.

PREPARATION.—In the London Pharmacopœia this compound is directed to be prepared by dissolving three pounds of mercury in a mixture of a pound and a half of nitric acid and two pints (3xl.) of distilled water. The solution is to be evaporated to dryness, and the residue reduced to powder; which is to be put in a shallow vessel, and heated by a slow but gradually increased fire, until red vapours cease to arise.

This compound is best prepared on the large scale, for it cannot be so well procured of the bright orange-red colour and crystalline or scaly appearance usually considered desirable, when only small quantities of materials are employed. Some advise a larger quantity of nitric acid to be employed than is directed in the London Pharmacopœia. The reduction of the nitrate to powder is objectionable, as it diminishes the crystalline appearance of the oxide. Mr. Brande (*Manual of Chemistry*) says, “the nitrate requires to be constantly stirred during the process, which is usually performed in a cast-iron pot.” But in general a shallow earthen dish is employed, with a second one inverted over it, and care is taken not to disturb the nitrate during the operation. The heat of the sand-bath is employed. Indeed, some have asserted that the finest

product is obtained when the calcination is performed in the same vessel in which the nitrate was formed, and without stirring, as directed in the Dublin Pharmacopœia (Dr. Barker, *Observ. on the Dubl. Pharm.*)

When quicksilver and the diluted nitric acid are digested together, the metal is oxidized at the expense of part of the acid, while binoxide of nitrogen escapes, and, combining with oxygen of the air, becomes nitrous acid. The oxidized metal unites to some undecomposed acid to form a nitrate. If no heat be applied, a nitrate of the protoxide only is procured; but when heat is employed, a portion of nitrate of the peroxide is also produced. The following diagram will explain the formation of the protonitrate:—

REAGENTS.		RESULTS.	
1 eq. Nitric Acid 54	{ 1 eq. Bin. of Nitrog. 30	—————	1 eq. Bin. Nitrog. 30
	{ 3 eq. Oxygen 24		
3 eq. Mercury	606	{ 3 eq. Oxide Merc. 630	
3 eq. Nitric Acid	162	—————	3 eq. Protonitr. Merc. 792

When nitrate of mercury is heated, decomposition takes place: the nitric acid is resolved into oxygen and nitrous acid, the first of which combines with the protoxide of mercury, forming therewith the binoxide, while the nitrous acid escapes.

REAGENTS.		RESULTS.	
1 eq. Protonitrate	{ 1 eq. Nitric 54	—————	1 eq. Nitrous Acid..... 46
	{ 1 eq. Nitrous Acid 46		
Mercury = 264	{ 1 eq. Oxygen 8		
	{ 1 eq. Protoxide of Mercury.... 210	—————	1 eq. Bin. Oxide Merc. = 218

Some pernitrate of mercury usually remains undecomposed, but the quantity is small. Mr. Brande states that 100 pounds of mercury with 48 lbs. of nitric acid (sp. gr. 1.48) yielded 112 pounds of nitric-oxide of mercury. Hence 3 pounds of nitric acid must have remained in combination with the oxide.

PROPERTIES.—It occurs in bright tile-red or scarlet crystalline grains or scales. When quite free from nitrate of mercury, it is insoluble in water; but owing to the presence of a small quantity of nitrate, the nitric-oxide of mercury of commerce is usually slightly soluble in water. Dr. Barker (*op. cit.*) found that 1000 parts of water took up 0.62 of this oxide. The other properties and characteristics of this compound are the same as those of the last-mentioned preparation (*vide* HYDRARGYRI BINOXYDUM)

PURITY.—The presence of some undecomposed nitrate may be recognised by heating the suspected nitric-oxide of mercury, when nitrous vapours are evolved, and by boiling in water, when a solution is obtained, from which lime-water and hydrosulphuric acid throw down precipitates. The nitric-oxide of mercury is completely dissipated by heat: hence the presence of non-volatile matters (as red-lead) might be readily detected. Heated before the blow-pipe on charcoal, the mercurial oxide is reduced and dissipated, but if red-lead be present, globules of metallic lead will be left behind.

PHYSIOLOGICAL EFFECTS.—Its local action is that of a powerful irritant (*vide* HYDRARGYRI BINOXYDUM). When the nitric-oxide contains nitrate of mercury, its topical influence is rendered more energetic. Its constitutional effects are the same as those of other mercurials.

Fabricius Hildanus, Bartholinus, Langius, and Jacobs (quoted by Wibmer, *Wirkung d. Arzneim.* iii. 69), have reported cases in which the external use of this agent gave rise to salivation and other constitutional

effects of mercury. In the case mentioned by Jacob, death resulted from the application of it to a wart on the face.

Frederic Hoffmann, Ploucquet, Girtanner (Wibmer, *op. cit.*), and more recently Mr. Brett (*Lond. Med. Gaz.* xiii. 117), have related instances of poisoning by its internal employment.

USES.—Internally it has been administered in the form of pill in venereal diseases, but the practice is highly objectionable.

As an external agent it is used in the form of powder (obtained by levigation) or ointment; the latter is officinal. As a caustic, it is sprinkled over spongy excrescences, venereal warts, chancres, indolent fungous ulcers, &c. Mixed with eight parts of finely-powdered white sugar, it is blown into the eye with a quill in opacity of the cornea (Mackenzie, *On Diseases of the Eye*, 2d ed. p. 584).

UNGUENTUM HYDRARGYRI NITRICO-OXYDUM, Ph. Lond. and Dub. (Finely-powdered nitric-oxide of mercury, ʒj.; white wax, ʒij.; lard, ʒvj. Mix. The *unguentum oxidii hydrargyri rubri*, Ph. Ed. consists of nitric oxide of mercury, one part; lard, six parts. Mix.)—This ointment undergoes decomposition by keeping; its colour changing from red to grey, in consequence of the partial deoxidation of the nitric-oxide of mercury. Dr. Duncan (*Edinb. Dispens.*) says the presence of resin quickly causes it to become black. It is a valuable stimulant, and is frequently applied to indolent sores and ulcers, when we require to increase the quantity and improve the quality of the discharge; to inflamed eye-lids (*ophthalmia tarsi*); chronic conjunctivitis, &c.

Hydrar'gyri Chlo'ridum.—*Chlo'ride of Mer'cury.*

HISTORY.—Beguin in 1608, and Oswald Croll in 1609, are the first Europeans who mention this compound. Mr. Hatchett (Brandé's *Manual of Pharmacy*, 2d edit. 328) says it had been long known to the natives of Thibet. Its discoverer is unknown. It has had a great variety of names. The term *calomel* (*calomelas*, from *καλός*, *good*, and *μέλας*, *black*) was first applied to it by Sir Theodore de Mayenne (who died in 1655), in consequence, as some say, of his having had a favourite black servant who prepared it; or according to others, because it was a *good* remedy for the *black bile*. *Drago mitigatus*, *aquila alba*, *manna metallorum*, and *panchymagogum minerale*, are some of the appellations for it. *Mercurius dulcis*, *hydrargyrum muriaticum mite*, *submuriate of mercury*, and *subchloride*, *protochloride*, or *dichloride of mercury*, are some of the more modern synonyms of it.

NATURAL HISTORY.—*Native calomel* or *corneous mercury* occurs in crusts, and also crystallized in four-sided prisms terminated by pyramids. It is found at Deux-Ponts, Carniola, and in Spain.

PREPARATION. (*a.*) *By sublimation.*—Chloride of mercury is prepared by sublimation from a mixture of sulphate of mercury and chloride of sodium.

In the London Pharmacopœia, two pounds of mercury are directed to be boiled with three pounds of sulphuric acid, to dryness, by which bipersulphate of mercury is obtained. When cold, this is mixed, first with two pounds of mercury, then with a pound and a half of chloride of sodium, and afterwards sublimed. The sublimate is to be washed with boiling distilled water, and dried.

In the first stage of this process one equivalent or 202 parts of mercury decompose two equivalents or 80 parts of dry sulphuric acid; and, abstracting two equivalents or 16 parts of oxygen, to form one equivalent or 218 parts of binoxide of mercury, disengage two equivalents or 64 parts of sulphurous acid. The binoxide combines with two equivalents or 80 parts of undecomposed sulphuric acid, forming one equivalent or 298 parts of bipersulphate of mercury.

REAGENTS.	RESULTS.
2 eq. dry Sulphc. { 2 eq. Sulphur 32 } Acid = 80 { 4 eq. Oxygen 32 }	2 eq. Sulphurous Acid .. 64
1 eq. Mercury 202 { 2 eq. Oxygen 16 }	
2 eq. dry Sulphuric Acid 80	1 eq. Bipersulph. Merc. = 298

If one equivalent or 298 parts of bipersulphate, one equivalent or 202 parts of reguline mercury, and two equivalents or 120 parts of chloride of sodium, be intimately mixed and sublimed, reaction takes place, and we obtain two equivalents or 476 parts of chloride of mercury, and two equivalents or 144 parts of sulphate of soda.

REAGENTS.	RESULTS.
2 eq. Chloride Sodm. 120 { 2 eq. Chlorine ... 72 2 eq. Sodium ... 48 }	2 eq. Chloride Merc. = 476
1 eq. Mercury 202	
1 eq. Bipersulphate of Mercury = 298 { 1 eq. Mercury ... 202 2 eq. Oxygen ... 16 2 eq. Sulphuric Acid 80 }	2 eq. Soda 64 2 eq. Sulphate Soda = 144

Mr. Phillips (*Translation of Pharmacopœia*, 1836) explains the process somewhat differently. He assumes that the trituration of bipersulphate with mercury converts this salt into the protosulphate of mercury, and that this yields chloride of mercury by the action of chloride of sodium. But the mere trituration of bipersulphate of mercury with metallic mercury cannot be admitted to be sufficient to convert this salt into protosulphate. It is not improbable that bichloride of mercury is first formed by the mutual reaction of bipersulphate of mercury and chloride of sodium; and that this subsequently combines with mercury, both being in the state of vapour, to form calomel. For some bichloride is always found mixed with the sublimed calomel, and calomel may be readily obtained by subliming bichloride and mercury: as in the process of the Edinburgh Pharmacopœia.

At Apothecaries' Hall, 50 lbs. of mercury are boiled with 70 lbs. of sulphuric acid to dryness in a cast-iron vessel; 62 lbs. of the dry salt are triturated with 40½ lbs. of mercury, until the globules disappear, and 34 lbs. of common salt are then added. The mixture is submitted to heat in earthen vessels, and from 95 to 100 lbs. of calomel are the result. It is washed in large quantities of distilled water, after having been ground to a fine and impalpable powder.

The subliming apparatus varies in different manufactories. In some it consists of a large earthen retort, with short but wide neck, opening into an earthen elliptical receiver, in the bottom of which is water. The retort is placed in sand, contained in an iron pot set in a furnace.

"The form in which calomel sublimes," observes Mr. Brande, "depends much upon the dimensions and temperature of the subliming vessels. In small vessels it generally condenses in a crystalline cake, the interior surface of which is often covered with beautiful quadrangular prismatic crystals (Brooke, *Annals of Philosophy*), transparent, and

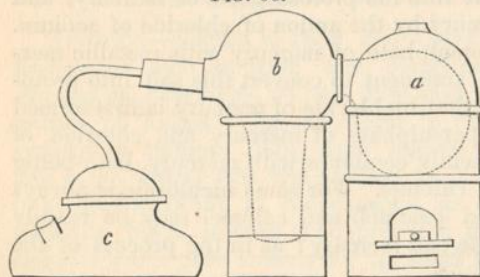
of a texture somewhat elastic or horny: in this state it acquires, by the necessary rubbing into powder, a decidedly yellow or buff colour, more or less deep, according to the degree of trituration which it has undergone. If, on the contrary, the calomel be sublimed into a very capacious and cold receiver, it falls in a most impalpable and perfectly white powder, which only requires one elutriation to fit it for use; it then remains perfectly colourless. By a modification of the process, it may be suffered, as it sublimes, to fall into water, according to Mr. Jewell's patent.

"The above circumstances, too, account for the various appearances under which calomel occasionally presents itself in commerce: it may be added, that the buff aspect of this substance indicates the absence of corrosive sublimate; though it by no means follows as a consequence that when snow-white it contains it. When the surface of massive sublimed calomel is scratched, it always exhibits a buff colour: it also becomes yellow when heated, but loses its tint as it again cools." (*Manual of Chemistry*, 4th ed. p. 788).

Mr. Jewell's process (*Repert. of Arts*, xiii. 79, 2d Series) for preparing calomel consists in keeping the receiving vessel filled with steam, so that the vaporous calomel is condensed in it, and takes the form of a fine powder, which is much finer than can be obtained by levigation and elutriation. This process has been improved by M. O. Henry (fig. 66).

Henry's modification of Jewell's apparatus for preparing calomel by steam (Hydrosublimate of mercury).

FIG. 66.



- (a) Furnace, containing an earthen retort (having a wide and short neck), in which the ingredients for making calomel are placed.
- (b) An earthen receiver, having three tubulures: one connecting with the retort; a second dipping into water in an earthen jar, and a third connected to a steam-pipe.
- (c) Steam-boiler.

(b.) *By precipitation.*—In the Dublin Pharmacopœia, a process is given for procuring precipitated calomel. It consists in mixing seven parts of chloride of sodium, dissolved in 400 parts of boiling water, with 17 parts of purified mercury, dissolved in 15 parts of diluted nitric acid. Double decomposition takes place: one equivalent or 60 parts of chloride of sodium decompose one equivalent or 264 parts of proto-nitrate of mercury, and produce one equivalent or 238 parts of chloride of mercury, and one equivalent or 86 parts of nitrate of soda.

PROPERTIES.—The primary form of the crystals of calomel is the right square prism. The appearance of the crystalline cake of sublimed calomel has been already noticed. As met with in the shops, it is in the form of a fine odourless or tasteless powder, whose sp. gr. is 7.176 (7.2, Brande). When prepared by Jewell's process it is perfectly white, but when obtained in the ordinary way has a light buff or ivory tint. It volatilizes by heat, and, under pressure, fuses. It is insoluble in cold water and alcohol. According to Donovan (*Ann. Phil.* xiv. 323)

and others (Gmelin, *Handb. d. Chemie*, i. 1299; Geiger's *Handb. d. Pharm.* by Liebig, i. 561), calomel suffers partial decomposition by long boiling in water, and a solution is obtained which contains mercury and chlorine (bichloride of mercury?).

By exposure to light, calomel becomes dark coloured, in consequence, according to Dumas (*Traité de Chimie*, iii. 605), of the transformation of a small portion into mercury and bichloride. Others have ascribed this change to the evolution of chlorine and combination of the metal with oxygen. Both hypotheses are inconsistent with the statement of Vogel (Landgrebe, *Ueber das Licht*, 97), that this blackened calomel is insoluble in nitric acid. Is it not probable that the change depends on the formation of a subchloride, as Wetzlar has shown to be the case with chloride of silver? By digestion in hot and concentrated hydrochloric acid, we obtain bichloride of mercury and reguline mercury. Boiling sulphuric acid forms bipersulphate and bichloride of mercury, with the evolution of sulphurous acid.

CHARACTERISTICS.—Iodide of potassium produces at first a greyish, afterwards a greenish-yellow precipitate (iodide of mercury). When heated in nitric acid, calomel is converted into bichloride and bipernitrate of mercury; and on the application of the tests already mentioned for mercurial preparations generally, we readily obtain evidence of the presence of mercury. Having thus shown it to be a mercurial compound, we may easily prove it to be calomel by observing that it is insoluble in water, and that on the addition of lime-water a blackish grey precipitate (protoxide of mercury) is obtained, while the supernatant liquor is found, on the addition of the nitrate of silver, to give evidence of the presence of chlorine in solution. Protochloride of tin, added to calomel, abstracts the chlorine, and becomes bichloride of tin, while globules of metallic mercury are obtained.

COMPOSITION.—The following is the composition of calomel:—

	Eq.	Eq. Wt.	Per Cent.	Turner, Davy, Zabozada.
Mercury	1	202	84·87	85
Chlorine	1	36	15·12	15
Chloride of Mercury	1	238	99·99	100

PURITY.—When pure, calomel is completely vaporized by heat. Water or alcohol which has been digested on it, should occasion no precipitate or change of colour on the addition of lime-water, caustic potash, ammonia, nitrate of silver, or hydrosulphuric acid, by which the absence of bichloride of mercury may be inferred. I have met with calomel which, in consequence of being imperfectly washed, contained bichloride. It had been given to several patients before its purity was suspected, and had operated on them most violently. When mixed with potash it became black, like pure calomel: the quantity of bichloride being insufficient to produce any perceptible alteration in the colour of the precipitate. But water which had been digested on it, gave, with the above-mentioned tests, the characteristic indications of bichloride of mercury.

PHYSIOLOGICAL EFFECTS. (a.) *On animals.*—Wepfer (*Hist. Cicute Aquat.*), Viborg, Flormann (Wibmer, *Wirk. d. Arzn.*), Gaspard (Magendie, *Journ. de Physiol.*), and Annesley (*Diseases of India*), have

examined the effects of calomel on dogs, horses, and pigs, but without any remarkable results. Viborg gave half an ounce, with six pounds of water, to a horse: the effects were cough, heaving of the flanks, quick pulse, enfeebled appetite, and in twenty-four hours loose stools. Annesley asserts, from his experiments on dogs, that large doses of calomel diminish the vascularity of the gastro-intestinal membrane.

(b.) *On man.*—Calomel may be ranked among the mild preparations of mercury; for although, in its local action, it is somewhat more powerful than the oxide, or than those preparations which contain mercury in a finely divided state (as blue pill), yet it is much milder than any of the other salts of mercury. In *small doses*, as a few grains, it occasionally excites no obvious effects, though more commonly it acts as a purgative; and in very susceptible persons, especially females, it sometimes produces nausea, griping, and great faintness. It appears, from the experience of most practitioners, that adults are more susceptible of the influence of calomel than children. When given to the latter, it frequently produces green stools, (the so-called *calomel stools* of Kraus),—an effect which is more frequently observed in suckling infants, and which is usually supposed to arise from the action of calomel on the liver; though Zeller (quoted by Kraus) thinks it depends on alterations produced in the condition of the blood; and Kraus (*Heilmittellehre*, 161) is disposed to refer it to the operation of calomel on the milk contained in the alimentary canal. (*On the Effects of Calomel in producing Slimy Stools*, consult *Lond. Med. and Surg. Journ.* Apr. 1829, 344). Like other mercurials, it increases the action of the secreting organs, and thus promotes the secretion of bile and of intestinal mucus; and we also presume it has a similar influence over the secretion of the pancreatic fluid. Neumann (Gräfe and Walther's *Journal*, Bd. ii. H. 3. S. 432, quoted by G. A. Richter, *Ausführ. Arzneim.* v. 492) states, that a man took two, then three, and subsequently four grains of calomel, daily, for the space of two months, without inducing salivation; but that three months afterwards he became affected with chronic vomiting, the consequence of a scirrhus pancreas, of which he died in four months. From the manner in which the case is related, it is clear the narrator attributed the disease of the pancreas to the use of mercury; whether justly or not, however, is impossible to determine.

The repeated and continued use of calomel, in small doses, is attended with the constitutional effects of mercurial preparations generally, before described.

In *large doses*, it has been regarded as an irritant poison; and, judging from the fatal effects ascribed to it by several writers, not without reason. Thus Hellweg (Wibmer, *op. cit.* iii. 71) has reported a case in which a few grains of calomel, taken as a laxative, caused death; Vagnitius (Wibmer, *op. cit.*) saw fifteen grains prove fatal; and Ledelius (*ibid.*), half an ounce. Fr. Hoffmann has also related two fatal cases (*ibid.*)

“Whytt, Odier, Quin, Wilmer, Leib, and others,” says Gölis (*Treatise on the Hydrocephalus Acutus*, by Dr. Gooch), “gave calomel internally in far larger doses; as two, three, and more grains at a time; and continued its use many days in the same dose, without considering the many evacuations from the alimentary canal, or the violent colic pains; and they affirm that they have never remarked, from the effect of this agent given in these large doses, any bad consequences in the abdomen.

Melancholy experience compels me to contradict them. Many times I saw, under those large and long-continued doses of calomel, the hydrocephalic symptoms suddenly vanish, and inflammation of the intestines arise, which terminated in death. Still oftener I observed this unfavourable accident from an incautious use of calomel in croup: viz. where all the frightful symptoms of this tracheal inflammation, which threatened suffocation, suddenly vanish, and enteritis develop itself, which passed rapidly into gangrene, and destroyed the patients."

In the *Times* newspaper of the 26th April, 1836, there is the report of a coroner's inquest on the body of a Mrs. Corbyn, who was destroyed by swallowing 20 grains of calomel, she having previously taken a moderate dose without its exciting what she considered a sufficient effect; and in the *India Journal of Medical Science* (*Lond. Med. Gaz.* xviii. 484) is a case of a lad, aged 14, a native of Nepal, in whom six grains of calomel apparently produced inflammation and ulceration of the mouth, enormous swelling of the face, mercurial fœtor of the breath, mortification, and death. There was no ptyalism.

In Pierer's *Annalen* for April 1827 (quoted by Wibmer, *op. cit.* 72), is the case of a lady, who by mistake swallowed fourteen drachms of calomel at once. Acute pains in the abdomen came on, accompanied by frequent vomiting and purging. These symptoms were allayed by oleaginous demulcents; but on the second day salivation and ulceration of the mouth took place. In three weeks, however, she was perfectly recovered. Other violent effects are noticed by Wibmer, Gmelin, and others; but the instances adduced are sufficient to show that dangerous and even fatal effects may result from large doses, and therefore that Teichmeyer, Buchner, and others, are justified in ranking it among poisons.

Of late years, however, immense quantities of calomel have been administered medicinally, without giving rise to any symptoms of irritant poisoning,—nay, apparently with the opposite effect; for we have the concurrent testimony of many practitioners, that in yellow fever, cholera, and other dangerous diseases, calomel, in doses of a scruple and upwards, allays vomiting and purging; and on this account has been denominated a *sedative*. So that while in small doses (as from two to five grains) calomel is almost universally admitted to be an irritant to the bowels, it is asserted that larger ones are actually sedative. These statements appear to me to be almost inconsistent, and yet they are fair deductions from the experience of numerous intelligent practitioners. We must, therefore, endeavour to accumulate more facts, in order to illustrate the effects of calomel, and for the present confess we have very imperfect information respecting the nature of its action.

In a case published by Mr. Roberts in the *London Medical Gazette* (xxii. 611), an ounce of calomel was swallowed by mistake, and retained on the stomach for two hours before the error was discovered. The only effects were slight nausea and faintness. Subsequently, emetics, lime-water, and purgatives, were administered; calomel was vomited up, and the day but one afterwards the patient was quite well. Neither salivation nor the slightest affection of the gums occurred.

The largest quantity of calomel given as a medicinal agent, at one dose, is, I believe, three drachms; "and it was followed," says Dr. Christison (*Treatise on Poisons*), from whom I quote the case, which occurred in America, "by only one copious evacuation, and that not till after the use

of an injection." I have now before me reports of eighteen cases of spasmodic cholera, admitted in the year 1832 into the Cholera Hospital at Bethnal Green, in this metropolis, in which enormous quantities of calomel were employed by the house-surgeon, Mr. Charles Bennett (formerly one of my pupils), with very slight physiological effects. When a patient was brought into the hospital, two drachms of calomel were immediately given, and afterwards one drachm every one or two hours, until some effect was produced. In 17 out of 18 cases in which this plan was tried, the vomiting and purging diminished, and the patients recovered. Several of them took from 20 to 30 drachms without the subsequent ptyalism being at all excessive. In one case (a female aged 36 years), 30½ drachms were administered within forty-eight hours, moderate ptyalism took place, and recovery. In the unsuccessful case which I have alluded to, 53 drachms of calomel were administered within forty-two hours, without the least sensible effect.

Dr. Griffin (*Lond. Med. Gaz.* xviii. 880) also tells us, that in several cases of cholera he gave calomel hourly, "in scruple doses, to the amount of two or three drachms or upwards, without eventual salivation; and I recollect," he adds, "one instance in particular, in which I gave two drachms within an hour and a half with perfect success, and without affecting the system."

I do not pretend to reconcile these cases with those recorded by Hellweg, Vagnitius, Ledelius, Hoffman, and Gölis; in fact they appear to me irreconcilable. Dr. Christison, however, suggests that in those cases in which violent effects occurred, the calomel might contain corrosive sublimate.

Mr. Annesley (*Diseases of India*) accounts for the increased quantity of bile found in the stools after the use of calomel, by supposing that the gall-bladder sometimes becomes distended in consequence of the tenacity of the mucous secretion, by which the mouth of the *ductus communis chole-dochus* is closed; and that calomel acts chemically on the mucus, and detaches it. But the hypothesis is, I think, devoid of foundation.

USES.—Calomel is very frequently used as an *alterative*, in glandular affections, chronic skin diseases, and disordered conditions of the digestive organs, more particularly in those cases connected with hepatic derangement. For this purpose it is usually taken in combination with other alteratives, as in the well-known Plummer's pill, which I shall presently notice.

It is very frequently employed as a *purgative*, though, on account of the uncertainty of its cathartic effects, it is seldom given alone; generally in combination with other drastic purgatives—such as jalap, scammony, compound extract of colocynth, &c. whose activity it very much promotes. We employ it for this purpose when we are desirous of making a powerful impression on the alimentary canal, and thereby of relieving affections of other organs, on the principle of counter-irritation, before explained. Thus in threatened apoplexy, in mental disorders (Finch, *Lond. Med. Gaz.* iii. 692), in dropsical affections, and in chronic diseases of the skin. In torpid conditions of the bowels, where it is necessary to use powerful cathartics to produce alvine evacuations, as in paralytic affections, it is advantageously combined with other purgatives. Sometimes we use it to promote the biliary secretion—as in jaundice and other affections of the liver, in chronic skin diseases, and in various disordered

conditions of the alimentary canal not accompanied by inflammation. Moreover, in the various diseases of children requiring the use of purgatives, it is generally considered to be very useful; and its being devoid of taste is of course an advantage.

As a *sedative* it has been administered in yellow fever, spasmodic or malignant cholera, dysentery, and liver affections (vide p. 469). Dr. Griffin (*Lond. Med. Gaz.* xxi. 880) asserts that calomel was a most successful medicine in cholera, controlling or arresting its progress, in 84 cases out of 100, if administered while the pulse was perceptible at the wrist; but, on the contrary, detrimental when given in collapse. The practice was tested in 1448 cases. The dose was from one to two scruples every hour or half-hour.

As a *sialogogue*, it may be used in the cases in which I have already mentioned (p. 448) that mercurials generally are employed: with the view of preventing irritation of the alimentary canal, it is usually given in combination with opium, unless, indeed, the existence of some affection of the nervous system seem to contraindicate the use of narcotics. This combination is employed in peripneumonia, pleuritis, croup, laryngitis, hepatitis, enteritis, and other inflammatory diseases; in fever, syphilis, chronic visceral diseases, &c.

Calomel is frequently combined with other medicines, to increase their effects; as with squills, to produce *diuresis*, in dropsy; or with antimonials, to promote *diaphoresis*.

As an *anthelmintic* it is in frequent use, and forms one of the active ingredients of many of the nostrums sold for worms; though it does not appear to have any specific influence over parasitic animals.

The *local uses* of calomel are numerous. In diseases of the Schneiderian membrane, it is applied as a snuff. It is sometimes blown into the eye, to remove spots on the cornea. Dr. Fricke (*Lond. Med. Gaz.* xxii. 397) has used it with great success in chronic cases of rheumatic, catarrhal, and scrofulous ophthalmia; but in two instances bad consequences resulted from its use. It is sometimes suspended in thick mucilage, and used as a gargle in venereal sore-throat, or injected into the urethra in blenorrhœa. Now and then it is used as a substitute for cinnabar in fumigation. As a local application, in the form of ointment, calomel is one of the most useful remedies we possess for the cure of some forms of skin diseases, as will be presently noticed.

ADMINISTRATION.—When used as an *alterative*, it is given in doses of from half a grain to a grain, frequently combined with oxysulphuret of antimony (as in *Pil. Hydr. Chlor. Co.*) or antimonial powder, and repeated every or every other night; a mild saline laxative being given the following morning; as a *purgative*, from two to five grains, usually in combination with, or followed by, the use of other purgatives, especially jalap, senna, scammony, or colocynth; as a *sialogogue*, in doses of one to three or four grains, generally combined with opium or Dover's powder, twice or thrice a day; and, as a *sedative*, from a scruple to half a drachm, or even more than this, as already mentioned. Biett (*Lond. Med. Gaz.* viii. 540) has sometimes employed it as an *errhine*, in syphilitic eruptions. It is mixed with some inert powder, and given to the extent of from 8 to 20 grains daily. The use of acids with calomel frequently occasions griping. Calomel is most extensively employed in the diseases of children, and may be given to them in as large or larger doses proportionally as to

adults. Salivation is a rare occurrence in them: indeed, Mr. Colles (*Pract. Observ.* p. 281) asserts, that mercury *never* produces ptyalism, or swelling or ulceration of the gums, in infants.

PILULÆ HYDRARGYRI CHLORIDI COMPOSITÆ, Ph. Lond.; *Pilule Calomelanos Compositæ*, Ph. Dubl.; *Pilule Sub-muriatis Hydrargyri Compositæ*, Ph. Edinb.; *Plummer's Pills*, or *Pilule Plummeri* (chloride of mercury; oxysulphuret of antimony, \overline{aa} ʒij.; guaicum resin, powdered, ʒss.; treacle, ʒij. M. The Edinburgh College uses mucilage of gum arabic instead of treacle).—These pills are frequently employed as alteratives in chronic skin diseases, in the papular and pustular forms of the venereal disease, in chronic liver affections, and in various disordered conditions of the digestive organs. The dose is from five to ten grains.

PILULÆ CATHARTICÆ COMPOSITÆ, Ph. U. S. (Compound extract of colocynth, ʒss.; extract of jalap, in powder; calomel, \overline{aa} ʒiij.; gamboge, in powder, ʒij. M. Divide into 180 pills). This pill is intended to combine smallness of bulk with efficiency and comparative mildness of purgative action, and a peculiar tendency to the biliary organs (*United States Dispensatory*). Each pill contains one grain of calomel. Three pills are a full dose.

UNGUENTUM HYDRARGYRI CHLORIDI (calomel, ʒj.: lard, ʒj. M.) This is a most valuable application in porrigo favosa, impetigo, herpes, and the scaly diseases (psoriasis and lepra). Indeed, if I were required to name a local agent pre-eminently useful in skin diseases generally, I should fix on this. It is well deserving a place in the Pharmacopœia.

Hydrar'gyri Bichlo'ridum.—Bichlo'ride of Mer'cury.

HISTORY.—We have no account of the discovery of this preparation. Geber (*Inv. of Ver.* viii. 252) described the method of preparing it; but it is supposed to have been known long anterior to him. Like calomel, it has had various synonymes, of which the principal are the following: *chloride*, *hydrochlorate* or *muriate of mercury* (*hydrargyri chloridum*, *hydrochloras* seu *murias*), *corrosive sublimate* (*mercurius sublimatus corrosivus*), *corrosive muriate of mercury* (*hydrargyri murias corrosivus*), and *acidum chloro-hydrargyricum*.

PREPARATION.—Mercury and sulphuric acid are boiled together, as in the process for making calomel; and the bipersulphate of mercury is sublimed with chloride of sodium, without the addition of metallic mercury. The sublimation is usually effected in an earthen alembic, placed in sand.

The nature of the changes which occur in the manufacture of bipersulphate of mercury have been already explained (p. 465). When this salt is sublimed with chloride of sodium, double decomposition takes place, and we obtain bichloride of mercury and sulphate of soda.

REAGENTS.		RESULTS.	
2 eq. Chloride Sod ^m . 120	} 2 eq. Chlorine 72 2 eq. Sodium 48	} 2 eq. Soda 64	} 1 eq. Bichl ^{de} . Merc. 274
1 eq. Bipersulphate			
Mercury 298	} 2 eq. Sulphuric Acid 80	} 2 eq. Sulphate Soda 144	

PROPERTIES.—As usually met with in commerce, bichloride of mercury is a semi-transparent crystalline mass, in which perfect crystals are rarely found. Occasionally, however, they are obtained either by slow

sublimation, or from a solution of the salt. Their primary form is the right rhombic prism. The sp. gr. of this salt is about 5.2 (5.14 to 5.42, Liebig). The taste is acrid, coppery, and persistent. When heated it fuses, boils, and volatilizes: the vapour is very acrid. It is soluble in about three times its weight of boiling, and in about eighteen or twenty times its weight of cold water: the acids (especially hydrochloric) and the alkaline chlorides increase its solubility. It is soluble in seven parts of cold or three and a half parts of boiling alcohol. Ether dissolves it more readily than alcohol, and will even separate it from its watery solution; and hence is sometimes employed to remove it from organic mixtures.

An aqueous solution of bichloride of mercury readily undergoes decomposition, especially when exposed to solar light; calomel is precipitated, and hydrochloric acid set free. This change is facilitated by the presence of organic substances,—as gum, extractive, or oil; whereas it is checked by the presence of alkaline chlorides.

Albumen forms a white precipitate with an aqueous solution of bichloride of mercury. This precipitate is slightly soluble in water, and consists, according to Lassaigne (*Journ. de Chim. Méd.* iii. 2d series, 161), of albumen, 93.45, and bichloride of mercury, 6.55; so that it is a *hydrargyro-chloride of albumen*. Fibrin forms a similar white compound with corrosive sublimate. When albuminous and fibrinous textures are immersed in a solution of this salt, combination takes place, the tissue contracts, increases in density, becomes whiter, and does not putrefy. Hence it is employed by the anatomist for hardening and preserving certain parts of the body—as the brain.

Bichloride of mercury possesses some of the characters of an acid. Thus it reddens litmus, and unites with the chlor-bases (as chloride of sodium), which in consequence restore the blue tint of litmus, which had been reddened by the mercurial bichloride. The salts which result from the combination of the two chlorides are called *hydrargyro-chlorides*.

CHARACTERISTICS.—Bichloride of mercury is known to be a mercurial compound by the following characters:—

1. *Heated* in a tube by a spirit lamp, with caustic potash, an alkaline chloride is formed, oxygen gas is evolved, and metallic mercury is sublimed and condensed in the form of globules on the sides of the tubes.

2. *Lime-water* causes a lemon-yellow precipitate; an additional quantity of the precipitant water produces a brick-dust red precipitate, while a further quantity restores the yellow colour. The yellow-coloured precipitate is the hydrated binoxide; the reddish-coloured precipitate is the oxychloride.

3. *Caustic ammonia*, added to a solution of bichloride, causes hydrochlorate of ammonia to be formed in solution, while a white powder (*hydrargyri ammonio-chloridum*) is thrown down.

4. The *alkaline carbonates* throw down a brickdust-coloured precipitate: the bicarbonates a white one.

5. *Iodide of potassium* occasions a scarlet precipitate of the biniodide of mercury; but the precipitate frequently appears at first of a yellow colour, though it quickly becomes scarlet. Dumas (*Traité de Chimie*, iii. 619) thinks these yellow and red states of the biniodide depend on some isomeric phenomena requiring farther examination. If an excess of

iodide of potassium be employed, the red precipitate disappears, owing to the formation of a soluble double salt, in which the biniodide of mercury acts the part of an acid, and the iodide of potassium that of a base. This double salt may be called the *hydrargyro-iodide of potassium*. Bichloride of mercury and the biniodide of mercury also form a double salt: hence, if a great excess of the former salt be employed, the red precipitate disappears, owing to the formation of a soluble double salt.

6. *Protochloride of tin* occasions, with bichloride of mercury, a white precipitate of calomel, while perchloride of tin remains in solution. Very shortly this protochloride of mercury is converted into reguline mercury, which falls down in a finely divided state as a greyish powder.

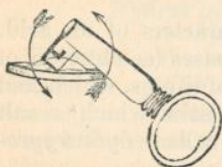
7. *Hydrosulphuric acid* in excess, passed through a solution of bichloride of mercury, occasions a black precipitate of the bisulphuret of mercury: a solution of hydrochloric acid is formed. If the hydrosulphuric acid be not in excess, a white precipitate of the *chloro-sulphuret of mercury* is obtained, and which consists of two atoms bisulphuret of mercury and one of the bichloride.

8. *Ferrocyanide of potassium* causes a white precipitate (ferrocyanide of mercury).

9. *Albumen* is another test for corrosive sublimate, though not one of much value, since it will produce the same white precipitates with many other substances.

10. *Galvanism*.—Drop the suspected solution on a piece of gold, as a sovereign, and apply a key, so that it may touch, simultaneously, the gold

FIG. 67.



and the solution; an electric current is immediately produced, the bichloride is decomposed, the mercury attaches itself to the negative electrode (or pole), namely the gold, while the chlorine unites with the iron of the positive electrode (or pole) to form chloride of iron. The relative position of the gold, the key, and the solution, will be evident from the fig. 67; and the arrows point out the direction of the electric current. The silver stain left on the gold is readily removed by heat. In Dr. Christison's work will be found other methods of applying galvanism; but the one just mentioned is perhaps the most useful, since it can always be readily made use of; whereas a more complicated apparatus is found in the hands of a few persons only. Thus it might be applied at a moment's notice to detect corrosive sublimate in the matters vomited by a patient.

The relative delicacy of some of these tests is thus stated by Devergie (*Méd. Lég.* ii. 676):—

	Degree of Dilution.
Ferrocyanide of potassium	stops at . . 1,500
Lime water	„ . . 4,000
Potash or its carbonate	„ . . 7,000
Iodide of potassium	„ . . 8,000
Ammonia	„ . . 36,000
Hydrosulphuric acid, or hydrosulphate of ammonia	„ . . 60,000
Protochloride of tin, or galvanic pile	„ . . 80,000

The preceding tests have not determined the nature of corrosive sublimate, further than that it is a permercurial salt. To prove that it is a chloride, the simplest method of proceeding is to add to the suspected

solution, lime-water, or carbonate of soda; then filter, and test the clear liquid with *nitrate of silver*, which causes a white precipitate if any chloride be present (*vide* p. 105). If nitrate of silver be added to a solution of bichloride of mercury, we obtain a white precipitate of chloride of silver, but mixed with calomel; and it is to avoid the production of the latter substance that I prefer the method of testing just mentioned.

COMPOSITION.—The composition of this salt is as follows:—

	Eq.	Eq. Wt.	Per Cent.	Turner.
Mercury	1	202	73·72	73·53
Chlorine	2	72	26·27	26·47
Bichloride of Mercury .	1	274	99·99	100·00

PURITY.—Pure bichloride should be white, dry, totally vapourized by heat, and completely soluble in water, alcohol, or ether.

PHYSIOLOGICAL EFFECTS. (a.) *On vegetables.*—The effects of solutions of bichloride of mercury on plants have been examined by Seguin, and subsequently by Marcet and Macaire (*Decandolle, Phys. Vég.* 1332), and from their experiments it appears, that when growing plants are immersed in a solution of this salt, part of the poison is absorbed, a change of colour takes place in the leaves and stems, and death is produced; the effect on the irritable stamina of the *Berberis vulgaris*, and on the leaves of the *Mimosa pudica*, being the same as that produced by arsenic (p. 384). Bichloride of mercury is equally poisonous to cryptogamic plants. Hence vegetable tissues soaked in a solution of it are no longer adapted for the development of the *Merulius lachrymans*, and of other fungi known under the name of the *dry-rot*. This, in fact, is the principle adopted by Mr. Kyan (*Lond. Med. Gaz.* xvi. 630) for the preservation of timber, and which is now practised by the *Anti Dry-rot Company*.—(*Vide* Dr. Dickson's *Lecture on Dry-rot*, 1837.)

(b.) *On animals generally.*—The effects of corrosive sublimate on animals have been examined by Etmuller, Wepfer, Sprægel, Sir Benjamin Brodie (*Phil. Trans.* for 1812), Campbell, Lavort, Smith, Gaspard, Orfila (*Toxicol. Gén.*), Schubarth, and Bostock. An abstract of these will be found in the works of Wibmer (*Wirk. d. Arzn. u. Gifte*), and Christison (*Treat. on Poisons*). Dogs, cats, horses, rabbits, and frogs, are the animals on which the experiments have been tried, and on which sublimate has been found to exercise a poisonous operation, and the same kind of effect is presumed, from analogy, to be produced on all other animals. The results of these experiments have been so briefly yet clearly stated by Dr. Christison, that I cannot do better than quote his words:—"Corrosive sublimate causes, when swallowed, corrosion of the stomach; and in whatever way it obtains entrance into the body, irritation of that organ and of the rectum, inflammation of the lungs, depressed action, and perhaps also inflammation of the heart, oppression of the functions of the brain, and inflammation of the salivary glands." I may add, that mercurial fætor and salivation have been observed in horses, dogs, and rabbits.

(c.) *On man.*—a. *In small or therapeutic doses*, as from one-eighth to one-fourth of a grain, it frequently exerts a beneficial effect on diseases (syphilitic eruptions, for example), without producing any obvious alteration in the actions of the different organs. Occasionally, especially when the

stomach and bowels are in an irritable condition, it gives rise to a sensation of warmth in the epigastrium, and causes nausea, griping, and purging. In such cases it is best to diminish the dose, and conjoin opium. By repetition we frequently observe that the pulse becomes somewhat excited, and if the skin be kept warm, perspiration is oftentimes brought on; at other times the quantity of urine is increased. Continued use of it causes salivation: but it is said, that corrosive sublimate has less tendency to occasion this effect than other preparations of mercury. Maximilian Locher (Van Swieten's *Commentaries upon Boerhaave's Aphorisms*, xvii. 294), who, from the year 1754 to 1762, cured 4,880 patients affected with the venereal disease, at St. Mark's Hospital, Vienna, by the exhibition of this remedy, says, that no person died, or experienced the least painful or dangerous symptoms, in consequence of its use. He was, however, exceedingly cautious and careful in its employment, and always stopped using it on the first appearance of salivation. Van Swieten says, "I am convinced, from repeated experience, that the menstrual evacuation is not disturbed by the use of this remedy."

β. Chronic poisoning.—In somewhat larger doses, or by the long-continued use of the before-mentioned small doses, gastro-enteritis and all the usual constitutional effects of mercury are brought on. Thus heat and griping pain in the alimentary canal (particularly in the stomach and rectum), loss of appetite, nausea, vomiting, purging, and disordered digestion, are the gastro-enteritic symptoms. The pulmonary organs also not unfrequently become affected; the patient complains of dry cough, pain in the chest, disordered respiration, and bloody expectoration. Coupling these symptoms with the specific effects said to be produced on the lungs of animals by the use of corrosive sublimate, we have an important caution not to administer it to patients affected with pulmonary disorders,—a caution, indeed, which Van Swieten gives; "for those," says he, "who have a husky dry breast, are troubled with a cough, whose nervous system is excessively irritable, and are subject to a hæmorrhage, bear not this remedy without detriment."

γ. Acute poisoning.—In very large doses corrosive sublimate acts as a caustic poison, in virtue of its affinity for albumen, fibrin, and other constituents of the tissues. I shall follow Dr. Christison, and admit two varieties of poisoning by it; in one of which "the sole or leading symptoms are those of violent irritation of the alimentary canal. In another variety the symptoms are at first the same as in the former, but subsequently become conjoined with salivation and inflammation of the mouth, or some of the other disorders incident to mercurial erythysm, as it is called."

First variety: Gastro-enteritis.—In this variety the symptoms are analogous to those of other corrosive poisons: namely, violent burning pain in the mouth, throat, œsophagus, and stomach; difficulty of deglutition; sense of suffocation; nausea; violent vomiting (increased by every thing taken into the stomach) of mucous, bilious, or sanguineous matters. The pain soon extends from the stomach over the whole abdomen, which becomes acutely sensible to the slightest impression; violent purging, often of blood; inexpressible anxiety; flushed countenance; restlessness; pulse quick, small, and contracted; cold sweats; burning thirst; short and laborious respiration; urine frequently suppressed; and, lastly, various indications of a disordered condition of the nervous

system, such as a tendency to stupor, or even actual coma; convulsive movements of the muscles of the face and extremities; sometimes diminished sensibility of one of the limbs, or of the whole body; or even paraplegia. Occasionally death appears to result from the powerful effect produced on the nervous system, or from exhaustion, or from mortification of the bowels.

Dr. Christison points out the following characters as serving to distinguish poisoning by bichloride of mercury from that by arsenious acid:—

1. The symptoms begin much sooner.
2. The taste is much more unequivocal and strong.
3. The acidity and irritation in the gullet is much greater.
4. The countenance is flushed, and even swollen; whereas, in poisoning by arsenic, it is usually contracted and ghastly.
5. Blood is more frequently discharged by vomiting and purging.
6. Irritation of the urinary passages is more frequent.
7. Nervous affections are more apt to come on during the first inflammatory stage.
8. The effects are more curable than those of arsenic.
9. Deviations in the symptoms are more rare.

Second variety: Gastro-enteritis, accompanied with or followed by mercurial erythysm.—I here use the term erythysm in the sense in which it is employed by Dr. Christison—namely, to indicate all the secondary effects of mercury. In this variety, the symptoms first observed are those mentioned for the last variety, but they are followed, sooner or later, by those of inflammation of the salivary glands, and of the mouth and its neighbouring parts; profuse salivation, ulceration of the mouth, great fetor of breath, and other symptoms of this kind, already described, (p. 444.)

USES.—*Internally*, it has been employed as a sialogogue, alterative, and diaphoretic.

The celebrated Baron Van Swieten (*op. cit.*) may be regarded as the principal introducer of corrosive sublimate into practice as a remedy for *venereal diseases*. He seems to have been led to its employment from a suspicion that salivation was not requisite for curing this class of diseases; and hence he was desirous of obtaining some mercurial “that could be dilated at will, and so tried in a very small dose.” Now corrosive sublimate possessed these properties, and hence he commenced his experiments with it, and meeting with great success, recommended it to Maximilian Locher, whose results I have already stated. (For further historical details respecting its use, *vide* Pearson’s *Observations on the Effects of various Articles of the Mat. Med.* p. 99, et seq.) The balance of evidence is decidedly favourable to the employment of this medicine as an internal remedy for venereal diseases. By its partizans it has been asserted to be a safe and efficacious mercurial, to remove venereal symptoms in a very short space of time, and without causing salivation, merely by exciting diaphoresis. Its opponents (*vide* Pearson, *op. cit.*) state, on the other hand, that other mercurials are quite as effectual and speedy; that the cure by corrosive sublimate is not permanent; and, lastly, that its corrosive and irritant properties render its employment objectionable. One of the latest advocates for its use is Dzondi, of Halle (*Neue zuverläss. Heilart. d. Lusts. in allen ihren Formen*, &c. 1826, in

in Richter, *Ausf. Arzn.* v. 596), who states, the best mode of using bichloride of mercury is in the form of pills made with crumb of bread; and he gives the following formula for their preparation:— \mathfrak{R} Hydr. Sublim. Corros. gr. xij., solve in Aq. Distill. q. s., adde Micæ Panis Albi, Sacchari Albi, aa. q. s. ut ft. pilulæ numero CXL. Of these pills (each of which contains one-twentieth of a grain of corrosive sublimate), four are to be administered daily, and increased until thirty (containing one grain and a half) are taken at a dose. The best time of exhibiting them is after dinner. In irritable subjects and painful affections, a few drops of the tincture of opium may be taken with each dose. During the time the patient is under their influence, he should adopt a sudorific regimen (as is also recommended by Van Swieten), and take decoction of sarsaparilla.

In *acute diseases* few have ventured to employ bichloride of mercury; however, Schwartz gave it in hepatitis after the fever and pain had subsided; Sauter employed it in an epidemic scarlet fever; and Berends administered it in asthenic malignant fevers (Richter, *Ausführ. Arzneim.* v. 581). I have already noticed (p. 446) Mr. Lempriere's proposal to use it in fever, as a sialogogue.

In various *chronic diseases* it has been given as an *alterative* and *diaphoretic*, with occasional success. Thus in rheumatism, diseases of the bones, periodical pains, skin diseases, scrofulous affections, disorders of the nervous system, &c. In such it should be associated with diaphoretics (as antimony, sarsaparilla, &c.), warm clothing, &c. Not unfrequently opiates should be combined with it.

As an *external* remedy it has been applied as a *caustic* in substance (either alone or combined with arsenic) to cancerous ulcers, to parts bitten by rabid animals, to chancres, &c.: used in this way, however, it is mostly objectionable. In onychia maligna it is used with great advantage, mixed with an equal weight of sulphate of zinc, and sprinkled thickly upon the surface of the ulcer, which is then to be covered with a pledget of lint saturated with tincture of myrrh (*United States Dispensatory*). A *solution* has been employed for various purposes: thus by Baumé, as already mentioned (p. 448), for pediluvia, to produce salivation; as a lotion in chronic skin disease (as lepra, psoriasis, scabies, rosacea, &c.); as a wash to ulcers, particularly those of a venereal nature; as an injection in discharges from the urinary organs; as a collyrium in chronic diseases of the eye, especially those of a venereal nature; and as a gargle in ulcers of the tonsils. A solution is sometimes used as a preventive for the venereal disease.

ADMINISTRATION.—It may be used internally, in substance or solution. The dose of it in substance is from one-sixteenth to one-eighth of a grain. Some advise it to be given to the extent of one-fourth of a grain; but in this dose it is very apt to gripe and purge. Dzondi's formula, already given, may be employed when we wish to administer it in substance.

In solution it may be exhibited dissolved in water (vide *liquor hydrargyri bichloridi*), alcohol, or ether.

For *external use*, a watery solution may be employed, containing from half a grain to two or three grains, dissolved in one ounce of water.

LIQUOR HYDRARGYRI BICHLORIDI, Ph. L. (Bichloride of mercury; hydrochlorate of ammonia, aa gr. x; distilled water, \mathfrak{z} xx. Dissolve).—Hydrochlorate of ammonia is used to increase the solvent power

of the water. Each fluidounce contains half a grain of corrosive sublimate. The dose of this solution is from half a fluidrachm to two or three fluidrachms, taken in some bland liquid, as linseed tea.

ANTIDOTES.—Several substances which decompose corrosive sublimate have been employed as antidotes. These are, *albumen*, *gluten of wheat* (as contained in wheaten flour), *milk*, *iron filings*, and *meconic acid*.

I have already alluded to the decomposition of corrosive sublimate by *albumen*. The compound which results from their mutual action appears to be inert, or nearly so. In Dr. Christison's *Treatise on Poisons* will be found several cases noticed, in which albumen has been most effectual: one of the most interesting of which is that of Baron Thenard, the celebrated chemist, who inadvertently swallowed a concentrated solution of corrosive sublimate, but by the immediate use of whites of eggs suffered no material harm. Peschier states, that one egg is required for every four grains of the poison. *Gluten of wheat* has been recommended by Taddei, and may be employed when albumen is not procurable. Wheaten flour (which contains gluten) will probably answer as well as the pure gluten. *Milk*, in the absence of albumen or flour, may be used. *Iron filings* are stated to be useful, by reducing the corrosive sublimate to the metallic state. *Meconic acid* is also said to be an antidote, by forming an insoluble meconate of mercury. But a knowledge of the fact is of little practical value, since the acid is not generally procurable; and tincture of opium, which contains it, cannot be safely used in sufficient quantity; for Dr. Christison finds that five grains of corrosive sublimate require an infusion of 33 grains of opium to precipitate the whole of the mercury.

The other parts of the treatment for acute poisoning by corrosive sublimate are the same as for other irritant poisons, and consist of the usual antiphlogistic system—the warm baths, opiates, &c.

Hydrar'gyri Ammo'nio-Chlo'ridum.—*Ammono'nio-Chlo'ride of Mer'cury.*

HISTORY.—This compound was discovered by Raymond Lully, in the thirteenth century. Lemery pointed out two modes of procuring it, and hence it is sometimes termed *Lemery's white precipitate*, to distinguish it from precipitated calomel, also called on the Continent white precipitate. It has had various other appellations, as *cosmetic mercury* (*mercurius cosmeticus*), *white precipitated mercury* (*hydrargyrum præcipitatum album*); and, according to the view taken of its composition, it has been called *muriate of ammonia and mercury*,—*ammoniated submuriate of mercury* (*hydrargyri submurias ammoniatum*, Ph. Dub.), *ammoniated mercury*, (Ph. U. S.), *ammonio-chloride of mercury* (*hydrargyri ammonio-chloridum*, Ph. Lond.), *ammoniacal oxychloruret of mercury* (Guibourt).

PREPARATION.—It is directed, in the London Pharmacopœia, to be procured by adding eight fluidounces of solution of ammonia to six ounces of chloride of mercury previously dissolved, by the aid of heat, in six parts of distilled water, and allowed to cool. The precipitated powder is to be washed until void of taste, and then dried.

The explanation of the changes which occur in this process varies

according to the view taken of the constitution of the resulting compound. Sal ammoniac (hydrochlorate of ammonia), but no mercury, is certainly left in solution, so that the precipitate cannot contain so much chlorine as bichloride of mercury. It is probable, therefore, that the mercury from which the chlorine has been removed becomes oxidized by the water, though, according to Dr. Kane (*Trans. Royal Irish Acad.* xvii. 423,) this does not take place. The binoxide of mercury, with some mercurial bichloride, and ammonia, precipitate in combination. The following diagram explains the changes according to this view:—

REAGENTS.				RESULTS.	
2 eq. Water.. 18	{ 2 eq. Hydr. 2 2 eq. Oxyg. 16	} 2 eq. Hydroc. Acid. 74	} 2 eq. Ammonia ... 34 2 eq. Ammonia... 34	} 2 eq. Hydrochlre. 108 Ammonia 108	
4 eq. Ammonia.....	68				
1 eq. Bichloride	{ 2 eq. Chlor. 72 Mercury 274	} 1 eq. Binox. My... 218			
1 eq. Bichloride Mercury	202				
				1 eq. Amm. Chlor.	Mercury .. 526

If we suppose two equivalents or 18 parts of water to be given out by one equivalent or 526 parts of ammonio-chloride of mercury, the residue will have the precise elementary composition assigned by Dr. Kane to white precipitated mercury.

PROPERTIES.—It occurs in commerce in masses or in powder. It is white, inodorous, has a taste at first earthy, afterwards metallic. It is decomposed and dissipated by heat, giving out ammonia, nitrogen, calomel, and water. It is insoluble in alcohol. By boiling in water we obtain a solution of hydrochlorate of ammonia, and a yellow powder (white precipitated mercury and binoxide of mercury.—*Kane*.) It is soluble in sulphuric, nitric, or hydrochloric acid.

CHARACTERISTICS.—When heated with caustic potash, it gives out ammonia, and forms a yellow powder (white precipitated mercury and binoxide of mercury,—*Kane*.) The solution contains chloride of potassium, and with nitrate of silver causes a white precipitate (chloride of silver), insoluble in nitric acid, but soluble in ammonia. Protochloride of tin decomposes white precipitated mercury, and separates metallic mercury. To these characters must be added the effect of heat, water, and acids, on it, as above mentioned.

COMPOSITION.—The analyses of Mr. Hennell (*Quart. Journ. of Science*, xviii. 297) and Mitscherlich (*Ann. Chim.* xxxv. 428), agree in showing the constituents of white precipitate to be those of binoxide of mercury and hydrochlorate of ammonia, in the following proportions:—

	Eq.	Eq. Wt.	Per Cent.	Hennell.	Mitscherlich.
Binoxide of Mercury	1	218	80·14	80	82·2
Hydrochloric Acid	1	37	13·60	20	10·7
Ammonia	1	17	6·25		
White Precipitate	1	272	99·99	100	100·0

This composition is adopted by Berzelius. But in explaining the theory of the formation of white precipitate, I have assumed, with Mr. Phillips (*Transl. of the Lond. Pharm.*), a somewhat different view of the subject. Two equivalents of white precipitate, according to Mr.

Hennell, minus two equivalents of water, are equal to one equivalent of the same compound, according to Mr. Phillips.

	Eq.	Eq. Wt.	Per Cent.
Bichloride of Mercury	1	274	52.09
Binoxide of Mercury	1	218	41.44
Ammonia	2	34	6.46
White Precipitate (Phillips)	1	526	99.99

If two more equivalents of water be abstracted, we have the composition of white precipitate, according to Dr. Kane.

	Eq.	Eq. Wt.	Per Cent.
Bichloride of Mercury	1	274	53.93
Binoxide of Mercury	1	234	46.06
White Precipitate (Kane)	1	508	99.99

PURITY.—This compound is largely adulterated with sulphate of lime. I have one sample containing one-third of its weight of this substance. Carbonate of lime and of lead are sometimes employed to adulterate white precipitate. Pure white precipitate, thrown on a red-hot shovel, is dissipated without any residuum: whereas the above impurities remain. The carbonates are recognised by the effervescence on the addition of hydrochloric acid. Sulphate of lime may be detected by boiling the suspected substance in distilled water, and applying the tests for sulphates and calcareous salts, as before directed (pp. 265 and 343).

PHYSIOLOGICAL EFFECTS.—Its action on the body is very imperfectly known, no modern experiments having been made with it. It is usually considered to be highly poisonous, and somewhat similar in its operation to bichloride of mercury. Palmarius and Naboth (Wibmer, *Wirk. d. Arn.* iii. 64) have reported fatal cases of its use (*vide* also Gmelin, *App. Medicam.* ii. 166).

USES.—It is employed as an external agent only; commonly in the form of an ointment. It is an efficacious application in various skin diseases—as porrigo, impetigo, herpes, and even scabies; also in ophthalmia tarsi. Among the lower classes it is commonly used to destroy pediculi.

UNGUENTUM HYDRARGYRI AMMONIO-CHLORIDI, Ph. Lond., Dubl. and U. S. (ammonio-chloride of mercury, ʒj.; lard, ʒiiss. M.)—It is a stimulant, alterative, and detergent.

Hydrar'gyri Io'didum.—*Iodide of Mercury.*

PREPARATION.—This compound, sometimes called *protiodide of mercury*, is directed, in the London Pharmacopœia, to be prepared by rubbing together an ounce of mercury and ten drachms of iodine, adding gradually as much alcohol as may be sufficient, until globules are no longer visible.

In this process the mercury and iodine enter into combination. The alcohol facilitates the union by dissolving the iodine.

PROPERTIES.—It is a greenish-yellow powder, whose sp. gr. is 7.75. It is insoluble in water, alcohol, or an aqueous solution of chloride of sodium; but is soluble in ether, and slightly so in an aqueous solution of iodide of potassium. When heated quickly, it fuses and sublimes in red crystals, which subsequently become yellow. Solar light decomposes it,

and changes its colour. Heated with potash, it yields iodide of potassium and reguline mercury.

COMPOSITION.—It consists of

	Eq.	Eq. Wt.	Per Cent.
Mercury	1	202	61.58
Iodine	1	126	38.41
Iodide of Mercury	1	328	99.99

PHYSIOLOGICAL EFFECTS.—It is a powerfully irritant poison. A scruple killed a rabbit within twenty-four hours, and a drachm destroyed a pointer-dog in five days (Cogswell, *Essay on Iodine and its Compounds*, 160).

In small but repeated doses, it appears to exercise a specific influence over the lymphatic and glandular system. Two grains taken daily caused salivation in two instances (Bielt, *Lancette Française*, Juin 1831).

USES.—It has been used in syphilis and scrofula, especially when they occur in the same individual. Lugol (*Essays on the Effects of Iodine in Scrofulous Disorders*, by Dr. O'Shaughnessy, p. 170) employed an ointment of it in those forms of external scrofulous disease which resemble syphilis. Ricord (*Lancette Franç.* 1834, No. 65) gave it internally with good effect in *syphilis infantum*. Bielt (O'Shaughnessy's *Transl. of Lugol's Essays*, p. 201) has successfully employed it in syphilitic ulceration and venereal eruptions.

ADMINISTRATION.—The dose of it for adults is from one grain gradually increased to three or four. Ricord gave from one-sixth to one-half of a grain to children of six months old. Bielt employed it internally, and also externally, in the form of ointment, to the extent of twelve or fourteen grains daily, by the way of friction.

PILULÆ HYDRARGYRI IODIDI, Ph. Lond. (iodide of mercury, ʒj. ; confection of dog-rose, ʒij. ; ginger, powdered, ʒj. M.)—Five grains of these pills contain one grain of the iodide. The dose, therefore, will be from five grains to a scruple.

UNGUENTUM HYDRARGYRI IODIDI, Ph. Lond. (iodide of mercury, ʒj. ; white wax, ʒij. ; lard, ʒvj. M.)—This is used as a dressing for scrofulous ulcers, or for syphilitic ulcers in scrofulous subjects. It is also employed in tubercular skin diseases, as lupus, rosacea, and sycosis. (Rayer, *Treat. on Skin Diseases*.)

Hydrar'gyri Binio'didum.—*Bini'odide of Mer'cury*.

PREPARATION.—There are two methods of preparing this compound. The process given in the London Pharmacopœia is as follows:—An ounce of mercury and ten drachms of iodine are to be rubbed together, alcohol being gradually added until the globules are no longer visible. The powder is to be dried with a gentle heat, and kept in a well-stopped vessel. The alcohol facilitates the combination of iodine and mercury, as in the process for making the protiodide.

Biniodide of mercury may also be prepared by adding a solution of bichloride of mercury to one of iodide of potassium so long as any precipitate takes place. 274 grains of bichloride will be required to decompose 332 grains of iodide of potassium: these proportions are about 8 of the first to 10 of the second. In this process double decomposition takes place: biniodide of mercury precipitates, while chloride of potassium remains in solution. If excess of iodide of potassium be employed, it

retains some biniodide of mercury in solution. It is better, however, to have a slight excess of iodide of potassium, in order to obtain the mercurial biniodide free from corrosive sublimate.

PROPERTIES.—It is a scarlet red powder, whose sp. gr. is 6.32. It is insoluble in water, but soluble in alcohol, some acids, alkalies, and solutions of iodide of potassium, chloride of sodium, and of many of the mercurial salts. From its solution in boiling rectified spirit it is deposited, on cooling, in rhombic prisms. When heated it fuses, forming a ruby-red liquid, sublimes in crystals, which are at first yellow but afterwards become red, and furnish a scarlet-red powder. It combines with other alkaline iodides (as iodide of potassium) forming a class of double salts, called the *hydrargyro-iodides*.

CHARACTERISTICS.—Heated with potash in a tube it yields metallic mercury, which is volatilized: the residue is iodide of potassium, recognisable by the tests before described (p. 280.) From the protiodide of mercury it is distinguished by its colour and its solubility in a solution of chloride of sodium. The effects of heat on it, and its solubility in iodide of potassium, are other characters which serve to recognise it.

COMPOSITION.—Its composition is as follows:—

	Eq.	Eq. Wt.	Per Cent.
Mercury	1	202	44.5
Iodine	2	252	55.5
Biniodide of Mercury	1	454	100.0

PURITY.—The presence of bisulphuret of mercury in it may be recognised by fusion with caustic potash in a glass tube, by which a mixture of sulphuret and iodide of potassium is obtained: the existence of sulphur may be proved by the evolution of hydrosulphuric acid on the addition of a mineral acid.

PHYSIOLOGICAL EFFECTS. (a.) *On animals.*—A scruple killed a rabbit in twenty-four hours: the stomach was found preternaturally reddened. Ten grains, dissolved in a solution of iodide of potassium, and given to a dog, caused vomiting, pain, tenesmus, and depression: in four or five days the animal was well (Cogswell, *Essay on Iodine*, p. 164). Maillet (*Journ. de Chim. Méd.* iii. 543, 2^{de}. Série) has also made some experiments with it.

(b.) *On man.*—It is a powerful irritant and caustic. It is nearly as powerful as the bichloride of mercury; indeed, Rayer (*Treatise on Skin Diseases*, by Dr. Willis, p. 79) considers it more active than the latter. Applied to ulcers, in the form of ointment, I have known it cause excruciating pain. Left in contact with the skin for a while, it induces, says Rayer, a most intense erysipelatous inflammation. When administered internally, it must be done with great caution. Like other mercurial compounds, its repeated use causes salivation.

USES.—It has been employed in the same cases (*i. e.* syphilis and scrofula) as the protiodide of mercury, than which it is much more energetic. Breschet (O'Shaughnessy's *Transl. of Lugol's Essays*, p. 204) applied it, in the form of ointment, with great success in a case of obstinate ulceration (thought to have been carcinomatous) of the angle of the eye. In the form of a dilute and thin ointment (composed of biniodide of mercury, gr. ii.; cerate, ℞ii.; and almond oil, ℞i.) it has been used in opacity of the cornea (Graefe and Walther's *Journ. f. Chir.* Bd. 13). In

obstinate ophthalmia tarsi, with thickening of the meibomian glands, it has also been successfully employed.

ADMINISTRATION.—It should be given in doses of one-sixteenth of a grain, gradually increased to one-fourth of a grain. It may be exhibited in the form of pills, or dissolved in alcohol or ether.

UNGUENTUM HYDRARGYRI BINIODIDI, Ph. L. (biniiodide of mercury, ʒj.; white wax, ʒij.; lard, ʒvj. M.)

Hydrar'gyri Bisulphure'tum.—*Bisulphuret of Mer'cury.*

HISTORY.—It is mentioned in the Old Testament (*Jerem. xxii. 14*). Theophrastus (*De Lapidibus*) says that *cinnabar* (κιννάβαρι) was accidentally discovered, by Callius, about ninety years before the magistracy of Praxibulus, of Athens—that is, 494 years before Christ. Geiger (*Handb. d. Pharm.*, by Liebig) found it in the colouring matter of the old Egyptian tombs. It was formerly called *minium*. It is commonly termed *red sulphuret of mercury*; and, when in powder, *vermilion*.

NATURAL HISTORY.—The principal repositories of native cinnabar (*cinnabaris nativa*) are Idria, in Carniola, and Almaden, in Spain. It occurs both massive and crystallized; the primary form of its crystals being the acute rhombohedron.

PREPARATION.—Artificial cinnabar (*cinnabaris factitia*) is prepared by mixing two pounds of mercury, with five ounces of melted sulphur, in an iron pot over a fire; and, as soon as the mass begins to swell, it is to be removed from the fire, and covered, to prevent inflammation. When large quantities of sulphur and mercury are heated together, a slight explosion and flame are produced. When cold, it is rubbed to powder and sublimed in earthen pots (*Ann. Chim. iv.*; Aikin's *Dictionary of Chemistry*).

In this process the heat enables the mercury and sulphur to combine, and form the bisulphuret.

PROPERTIES.—Artificial cinnabar has, in the mass, a dark reddish brown crystalline appearance; but, when reduced to a fine powder, is of a beautiful scarlet-red colour, and is then termed *vermilion*. It is tasteless, odourless, insoluble in water or alcohol, and unalterable in the air. It is fusible and volatile. It burns in the air with a blue flame, the sulphur uniting with oxygen to form sulphurous acid, while the mercury is dissipated in a vaporous form.

CHARACTERISTICS.—Heated in a glass tube, with potash, it evolves mercurial vapour, which condenses into liquid globules of this metal. The residue, which is sulphuret of potassium, gives out hydrosulphuric acid on the addition of hydrochloric acid. The colour of cinnabar deepens under the influence of heat.

COMPOSITION.—Its composition is as follows:—

	Eq.	Eq. Wt.	Per Cent.	Guibourt.	Sefström.
Mercury	1	202	86.32	86.21	86.29
Sulphur	2	32	13.67	13.79	13.71
Bisulphuret of Mercury	1	234	99.99	100.00	100.00

PURITY.—Pure cinnabar is totally evaporated by heat, and is insoluble in nitric or hydrochloric acid. If minium or red lead be intermixed, we may recognise it by boiling in acetic acid, by which acetate of lead is

procured in solution: this forms a black precipitate with hydrosulphuric acid,—white with the sulphates,—and yellow with iodide of potassium. Realgar, or sulphuret of arsenicum, may be detected by boiling the suspected cinnabar in solution of caustic potash, supersaturating with nitric acid, and passing a current of hydrosulphuric acid through it, by which a yellow precipitate (orpiment or sesquisulphuret of arsenicum) is obtained. Earthy impurities are not volatile.

PHYSIOLOGICAL EFFECTS.—According to Orfila (*Archiv. Gén. de Méd.* xix. 330), pure cinnabar is inert; for he found no effects were produced on dogs, by half an ounce, when either applied to wounds, or taken into the stomach. These results being opposite to those obtained by Smith (Christison, *Treat. on Poisons*, 3d. ed. 395), it has been presumed that the latter must have employed an impure sulphuret.

The vapour obtained by heating cinnabar in the air is poisonous; but this is not in opposition to Orfila's experiments, since this vapour is not bisulphuret of mercury, but a mixture of the vapour of mercury (either in the metallic or oxidized state) and of sulphurous acid gas. Schenklius (*Observ.* l. vii.) has related the case of a young man who died from the use of this vapour; and Hill (*Edinb. Med. Essays*, iv.) saw cough, violent salivation, diarrhœa, &c. produced by its inhalation.

USES.—Cinnabar is used merely as a fumigating agent, in venereal ulcerations of the nose and throat. The method of using it is this:—About half a drachm is placed on a heated iron, and the fumes inhaled as they arise. In the shops, a copper apparatus, with iron heater, is sold for the purpose. In the absence of this, the bisulphuret is to be placed on a hot iron shovel, and the vapour inhaled by the patient through a funnel. The irritating nature of the sulphurous vapour usually excites coughing, and is injurious in persons disposed to phthisis. Hence the oxide of mercury is to be preferred for fumigating.

ADMINISTRATION.—When employed internally, cinnabar has been given in doses of from ten grains to half a drachm. For the purpose of fumigation, half a drachm may be employed.

Hydrargyri Bisulphuretum cum Sulphure.—*Bisulphuret of Mercury with Sulphur.*

HISTORY.—It is stated that the Chinese used this remedy long before it was known to Europeans. Harris, in 1689, first taught the method of preparing it by trituration. Its most common name is *Æthiops mineralis*; but it is also called *black sulphuret of mercury* (*hydrargyri sulphuretum nigrum*, Ph. Dub., Ed. and U. S.) or *sulphuret of mercury with sulphur* (*hydrargyri sulphuretum cum sulphure*, Ph. Lond.)

PREPARATION.—Equal weights of mercury and sulphur are rubbed together until globules are no longer visible. In this process part of the sulphur enters into chemical combination with the mercury, to form the bisulphuret, which is mechanically mixed with the remaining sulphur.

PROPERTIES.—It is a heavy, black, tasteless, odourless powder, insoluble in water. When heated it fuses, and is completely dissipated.

CHARACTERISTICS.—By boiling in caustic potash liquor we obtain a solution of sulphuret of potassium (*vide p. 288*). The residue is black, but possesses all the chemical characteristics of cinnabar (*vide p. 484*); such as being insoluble in nitric acid, volatile, &c.

COMPOSITION.—If this compound be, as Mr. Brande (*Man. of Pharm.* 3d ed. 329) supposes, a mixture of bisulphuret of mercury and sulphur, the proportions must be—

Bisulphuret of Mercury	58
Sulphur	42
Hydrargyri Sulphuretum cum Sulphure, Ph. Lond.	
	100

PURITY.—Free mercury may be detected by its communicating a white stain to gold. Charcoal may be detected by its not volatilizing by heat. Animal charcoal, by this character, as well as by the presence of phosphate of lime in the residue (*vide* p. 359). Sesquisulphuret of antimony may be recognised by boiling in hydrochloric acid, and applying the before-mentioned (p. 400) tests for sesquichloride of antimony.

PHYSIOLOGICAL EFFECTS.—According to the experiments of Orfila, this preparation, like the last, possesses little or no activity. The late Dr. Duncan (*Edinb. Dispensatory*) also tells us, that he has given it in doses of several drachms, for a considerable length of time, with scarcely any effect. It is commonly regarded as alterative.

USES.—It has been used in glandular diseases, especially of children; and also in cutaneous diseases.

ADMINISTRATION.—The dose for adults is from 5 to 30 grains.

Hydrargyri Bicyanidum.—Bicyanide of Mercury.

HISTORY.—This salt was discovered by Scheele. Its real nature was first pointed out by Gay-Lussac in 1815. It has been known by various appellations, as *Prussian mercury* (*hydrargyrum borussicum*), *prussiate*, *hydrocyanate*, *cyanuret*, or *cyanodide of mercury* (*hydrargyri prussias*, *hydrocyanas*, *cyanuretum*, seu *cyanodidum*).

PREPARATION.—Two methods have been adopted for the preparation of it.

(a.) *Proust's process*.—In the Pharmacopœia, eight ounces of ferrosesquicyanide of iron, or Prussian blue (*ferri percyanidum*, Ph. L.) are directed to be boiled with ten ounces of binoxide of mercury and four pints of water. The mixture is to be strained and evaporated, so that it may crystallize. The undissolved residuum is to be washed with boiling distilled water, filtered, and evaporated, so as to yield crystals.

REAGENTS.	RESULTS.
2 eq. Ferrosesquicyan. Iron 430	$\left\{ \begin{array}{l} 3 \text{ eq. Protocyan. Iron. } 162 \\ 4 \text{ eq. Sesquicy. Iron. } 268 \end{array} \right.$
4½ eq. Binoxide of Mercury 981	$\left\{ \begin{array}{l} 3 \text{ eq. Cyan. } 78 \\ 3 \text{ eq. Iron. } 84 \\ 6 \text{ eq. Cyan. } 156 \\ 4 \text{ eq. Iron. } 112 \\ 4½ \text{ eq. Mer. } 909 \\ 3 \text{ eq. Oxyg. } 24 \\ 6 \text{ eq. Oxyg. } 48 \end{array} \right.$
	$\left. \begin{array}{l} 4½ \text{ Bicyan. Merc. } 1143 \\ 3 \text{ eq. Oxide Iron. } 108 \\ 4 \text{ eq. Sesquioxide of Iron. } 160 \end{array} \right\} \text{Residue.}$

The awkwardness of the use of half an equivalent may be easily obviated by doubling all the above numbers; but several reasons have induced me to retain it in the above diagram.

(b.) *Winckler's process*.—Bicyanide of mercury may be obtained more economically, and purer, by adding as much finely-pulverized binoxide of mercury to hydrocyanic acid (obtained by distilling ferrocyanide of potassium with diluted sulphuric acid, *vide* p. 236) as will saturate it,

filter, and crystallize. In this process double decomposition takes place, the resulting products being water and bicyanide of mercury.

REAGENTS.			RESULTS.
2 eq. Hydrocyanic Acid	54	$\left\{ \begin{array}{l} 2 \text{ eq. Hydrogen} \dots 2 \\ 2 \text{ eq. Cyanogen} \dots 52 \end{array} \right.$	2 eq. Water..... 18
1 eq. Binoxide Mercury	218	$\left\{ \begin{array}{l} 2 \text{ eq. Oxygen} \dots 16 \\ 1 \text{ eq. Mercury} \dots 202 \end{array} \right.$	1 eq. Bicyanide of Mercury.. 254

PROPERTIES.—The primary form of the crystals of this salt is the right square prism. The crystals are heavy, white, colourless, transparent or opaque, inodorous, and have a strong metallic taste. They are soluble in water, both hot and cold, and very little, if at all so, in alcohol.

CHARACTERISTICS.—Perfectly dry bicyanide of mercury when heated yields metallic mercury and cyanogen gas. The latter is known by the violet or bluish red colour of its flame. Heated with hydrochloric acid it evolves hydrocyanic acid. It is not decomposed by nitric acid or the alkalis. Its solution throws down a black precipitate with hydrosulphuric acid, and pearly crystalline plates (*hydrargyro-iodo-cyanide of potassium*) with a concentrated solution of iodide of potassium (*vide p. 239*).

COMPOSITION.—Its composition is as follows:—

	Eq.	Eq. Wt.	Per Cent.	Gay-Lussac.
Mercury	1	202	79.52	79.91
Cyanogen	2	52	20.47	20.09
Bicyanide of mercury	1	254	99.99	100.00

PURITY.—When prepared from ferrosesquicyanide of iron (Prussian blue) the crystals are usually yellowish, from the presence of some oxide of iron.

PHYSIOLOGICAL EFFECTS. (a) *On vegetables*.—It acts on plants like bichloride of mercury (Gœppert, in *Decand. Phys. Vég.* 1334).

(b) *On animals*.—Coulon (*Traité sur l'Acide Prussique*, quoted by Wibmer, *Wirk d. Arzneimittel.* iii. 30) found that it acted on dogs, cats, sparrows, frogs, snails, &c. like hydrocyanic acid. After death, inflammation of the stomach was observed. Ollivier d'Angers (*Journ. de Chim. Méd.* i. 269) tried its effects on dogs. Seven grains, dissolved in water, killed a small dog in ten minutes, under attempts to vomit, general convulsions, and exhaustion, manifested alternately; respiration and circulation at first accelerated, afterwards diminished. Similar effects were produced by applying the salt to the cellular tissue, or injecting it into the veins. Tiedemann and Gmelin (*Versuche ü. d. Wege auf welche Subst. aus d. Magen u. Darmk. ins Blut gelang.*) detected mercury in the blood of the splenic vein of a horse to whom the bicyanide had been administered.

(c) *On man*.—Taken in *small doses*, it very readily excites nausea and vomiting. Parent (*Journ. de Chim. Méd.* viii. 473) says it does not produce the epigastric pain which the bichloride of mercury readily occasions. Continued use causes salivation. In one case, one-eighth of a grain twice a day caused ptyalism in three days (Neumann, in *Dierbach's Neueste. Entd. in d. Mat. Med.* ii. 483, 1828). Mendaga (*Decades Medicochirurgicas y Farmaceuticas*, vi. 319, in Richter's *Ausführ. Arzneim.* v. 477) says it acts directly on the skin and bones, and hence it sometimes very speedily allays the pain of and disperses nodes.

In large doses, especially in very susceptible persons, it affects the nervous system, and causes fainting, anxiety, and cramps. Twenty-three and a half grains in one instance (*Journ. de Chim. Méd.* i. 210) caused death in nine days. The most remarkable symptoms were, obstinate vomiting; mercurial ulceration of the mouth and abundant ptyalism; contractions of the heart, which at first were very strong, but became successively slower and more feeble; the abdomen was yielding, and not tender, notwithstanding the constant tenesmus; suppression of urine; semi-erection of the penis, and ecchymosis of this organ, as well as of the scrotum; and, ultimately, convulsive movements.

USES. (a.) *Medicinal*.—It has been employed as an *antivenereal* medicine, and was first used as such by Brera (*Richter, op. cit.*) Parent (*Journ. de Chim. Méd.* viii. 473) administered it as a substitute for the bichloride of mercury, over which it has several advantages. Thus, being more soluble, it ought to be more readily absorbed; it does not give rise to epigastric pain; and, lastly, it is not so readily decomposed; for alkalis, several salts, and many solutions of organic matters, which decompose corrosive sublimate, have no effect on it. It may be applied in the form of aqueous solution or ointment to venereal sores.

It has been employed in induration of the liver, in some chronic skin diseases, in obstinate headache, and in other maladies, as an anti-phlogistic.

(b.) *Pharmaceutical*.—Its principal use in this country is as a source of hydrocyanic acid (*vide p.* 237) and of cyanogen gas.

ADMINISTRATION.—Internally it may be employed in doses of one-sixteenth of a grain gradually increased to one-half of a grain. It may be administered in the form of pills (made with crumb of bread) or alcoholic solution. It will be frequently advisable to conjoin opium, to prevent nausea or vomiting. When used as a *gargle* or *wash*, we may employ ten grains to a pint of water. An *ointment* may be prepared of ten or twelve grains to an ounce of lard.

ANTIDOTE.—I am unacquainted with any antidote for it. Albumen does not decompose it. Perhaps ammonia might be found serviceable, to diminish the effect on the nervous system. Opium relieves the vomiting. Our principal object must be to remove the poison from the stomach, which is to be effected by the stomach-pump, emetics, tickling the throat, &c.

Unguentum Hydrargyri Nitrat̄is.—*Ointment of Nitrate of Mercury.*

HISTORY.—This ointment is sometimes termed *citrine ointment* (*unguentum citrinum*). Another name for it is *mercurial balsam*.

PREPARATION.—It is prepared by dissolving mercury in nitric acid and adding the solution to some kind of fatty matter. The relative quantities of acid and metal employed, as well as the nature of the fatty matter used, are various in different formulæ. The following are the proportions directed to be employed in the British and United States Pharmacopœias.

	London	Dublin	Edinburgh	United States.
Mercury	ʒi.	ʒi.	1 part	ʒi.
Nitric Acid . . .	ʒʒxj.	ʒʒix.	[nitrous acid] 2 parts	ʒʒxi.
Lard	ʒʒvj.	ʒʒiv.	3 parts	ʒʒij.
Olive oil	ʒʒiv.	Oj.	9 parts	Neat's-foot oil ʒʒix.

The London Pharmacopœia directs the solution to be mixed while hot with the lard and oil melted together. The Edinburgh and United States Pharmacopœias order the solution to be added to the mixture of lard and oil when it begins to stiffen.

The *theory* of the process is as follows:—By the mutual action of mercury and strong nitric acid, a nitrate of the binoxide, as well as of the protoxide of mercury, is formed, while binoxide of nitrogen is generated. Part of the latter escapes, and, combining with atmospheric oxygen, forms nitrous acid; the remainder reacts on the free nitric acid, and forms with it hyponitrous or nitrous acid. The liquor then is a mixture of *nitric acid* in excess, probably of *nitrous acid*, of the *nitrate* and *hyponitrite of the binoxide of mercury*, and *nitrate of the protoxide of mercury*.

When this solution is added to the fatty matter (lard and olive oil), the nitrous acid, or the hyponitrous acid which it contains, converts the olive oil into a more consistent and less fusible fatty body, which Boudet (*Journ. de Chim. Méd.* viii. 641) calls *elaïdine*, (from *ελαίς*, *ελαϊδος*, *an olive tree*.) The stearine and elain of the lard also acquire greater consistency in consequence of undergoing an analogous change. There is also a yellow colouring matter produced, and which may be separated by alcohol. By the saponification of a portion of the *elaïdine* a small quantity of mercurial soap (*elaïdate of mercury*) is produced. The hyponitrous acid of the hyponitrite is capable of producing the same effect as the free acid.

Boudet is of opinion that these changes are effected by the *physical* influence of the nitrous acid, for he asserts that the decomposition of the acid is not essential to the formation of the *elaïdine*. In this I suspect he is in error.

By keeping, this ointment is apt to become hard, pulverizable, and thereby unfit for use. This depends principally on the change which the olive oil suffers. Hence in the United States Pharmacopœia neatsfoot oil has been substituted for olive oil. The editors of the *United States Dispensatory* observe, that they had in their “possession, upwards of four months, a pot of ointment made according to the process of the Pharmacopœia, and though it had, at the end of this time, partially assumed a greenish colour, it preserved a uniform, soft, unctuous, consistence.”

The fatty bodies exercise a deoxidizing influence on the acids (free or combined) of the solution, and which is supposed to be independent of the formation of *elaïdine*; and, in consequence of this, nitrogen or binoxide of nitrogen is evolved. They also deoxidize the oxides of mercury, reducing the binoxide to the state of protoxide, and, in time, converting the protoxide into metallic mercury; which, being in a finely-divided state, gives to the mass a greyish colour. This latter change is proved by two facts—first, the change of colour which the ointment undergoes; and secondly, by digesting old citrine ointment in ether, the fatty matters are dissolved, leaving behind metallic mercury.

It is to prevent this change that Guibourt (*Pharm. Raisonnée*, ii. 146)

and Dr. Duncan (*Edinb. Dispensat.*) direct more nitric acid to be used than is contained in the official formulæ.

PROPERTIES.—When fresh prepared this ointment has a fine golden yellow colour, a butyraceous consistence, and a remarkable nitrous odour. It is very apt to become grey when mixed with other ointments, in consequence of their deoxidizing powers. It should be spread with wooden or ivory spatulas.

COMPOSITION.—When fresh prepared this compound contains the following substances:—

Elaidine.
Yellow matter soluble in alcohol.
Elaidate of mercury (mercurial soap).
Nitrate of mercury.

Elaidine is a white saponifiable fat, fusible at 97° F. very soluble in ether, but requiring 200 times its weight of boiling alcohol to dissolve it. When mixed with potash or soda it is converted into glycerin and elaidic acid.

PHYSIOLOGICAL EFFECTS.—It is an irritant and slight caustic. When it has undergone decomposition by keeping, it irritates ulcers exceedingly, and even excites slight erysipelatous inflammation.

USES.—We employ it as a stimulant and alterative in *chronic diseases of the skin*, more particularly those affecting the hairy scalp, as the different forms of porrigo, in which it is exceedingly efficacious. It is also used as a *dressing to ulcers*—to stimulate and cleanse them—as in foul syphilitic sores and phagedænic ulcers. Lastly, it is employed in *ophthalmic diseases*—more particularly ophthalmia tarsi, or psorophthalmia, in which it is applied (mixed with its own weight of almond oil) by means of a camel's-hair pencil to the lids, frequently with such advantage that some have regarded it a specific in this complaint.

Hydrar'gyri Ac'e'tas.—Ac'etate of Mer'cury.

HISTORY.—This compound was known to Lefebure in the 17th century.

PREPARATION.—In the Dublin Pharmacopœia the directions for procuring it are the following:—Add eleven parts of diluted nitric acid to nine parts of mercury, and when the effervescence has ceased let the mixture be digested that the metal may be dissolved. Add this to a boiling solution of nine parts of acetate of potash in a hundred of distilled water acidulated with vinegar; filter through a double hair-cloth, and let it cool, that crystals may form. Wash them with cold distilled water, and dry on paper with a gentle heat. In the Edinburgh Pharmacopœia a larger quantity of nitric acid is used and the vinegar omitted, as well as the directions for filtering through linen.

By the mutual action of diluted nitric acid and mercury we obtain a protonitrate of mercury (*vide p. 463.*) When this is mixed with acetate of potash double decomposition takes place: nitrate of potash and protoacetate of mercury being formed. To prevent precipitation of the yellow subnitrate of mercury, excess of acid (acetic, Ph. Dub., nitric, Ph. Ed.) should be employed: and by filtering, while hot, any which may be formed would be separated before the acetate has deposited.

PROPERTIES.—This salt occurs in white, micaceous, flexible scales, which are inodorous, but have an acrid taste. It blackens by light. When heated it is resolved into carbonic acid, acetic acid, and mercury.

It is very slightly soluble only in water, requiring 300 times its weight of this liquid to dissolve it, according to Dumas. It is insoluble in cold alcohol: boiling alcohol abstracts part of its acid.

CHARACTERISTICS.—Its appearance, its slight solubility in water, and the action of heat on it. Heated with sulphuric acid the vapour of acetic acid is evolved. The fixed alkalies precipitate the black oxide of mercury. Chloride of sodium forms calomel with it.

COMPOSITION.—It has the following composition:—

	Eq.	Eq. Wt.	Per Cent.	Dumas.
Protoxide of Mercury	1	210	80.46	80.66
Acetic Acid	1	51	19.54	19.34
Acetate of Mercury	1	261	100.00	100.00

PHYSIOLOGICAL EFFECTS.—It is one of the mild mercurial preparations. From the reports of Guarin, Colombier, and Vogler (Wibmer, *Wirk. d. Arzneim.* iii. 67) it appears to have acted in some cases with great violence, and to have occasioned violent vomiting, purging, abdominal pain, bloody evacuations, &c. These effects probably arose from the presence of some acetate of the binoxide of mercury.

USES.—It was introduced into practice in consequence of being supposed to be the active ingredient of Keyser's antivenereal pills. But Robiquet has subsequently ascertained that Keyser employed the acetate of the binoxide (Dumas, *Traité de Chimie*, v. 178). It is occasionally used in syphilitic affections.

ADMINISTRATION.—The dose of it is from one to five grains. A solution composed of one grain of the acetate dissolved in an ounce of water, may be used as a *wash*. An *ointment* is prepared by dissolving two or three scruples in an ounce of olive oil.

Hydrar'gyri Subsul'phas Fla'vus.—Yellow Subsulphate of Mer'cury.

HISTORY.—This compound was known to Croll in the sixteenth century. It has been termed *Turpeth* (or *Turbith*) *mineral* (*Turpethum minerale*), from its resemblance in colour to the root of the *Ipomœa Turpethum*.

PREPARATION.—It is prepared by adding one part of persulphate of mercury (the mode of preparing which has been described at p. 464) to twenty parts of warm or boiling water. A supersulphate of mercury is formed in solution, and a subsulphate precipitates.

PROPERTIES.—It is a heavy, lemon-yellow, inodorous powder, having an acrid taste. It requires 2000 parts of water at 60°, or 600 parts at 212°, to dissolve it.

CHARACTERISTICS.—When heated in a tube, sulphurous acid is evolved, and globules of mercury sublimed. Boiled with caustic potash or soda, the red binoxide precipitates, and a solution of sulphate of potash is obtained, known to be a sulphate by chloride of barium (*vide* p. 265).

COMPOSITION.—Its composition is as follows:—

	Eq.	Eq. Wt.	Per Cent.	Braamcamp and Siqueira-Oliva.
Binoxide of Mercury	1	218	84.5	84.7
Sulphuric Acid	1	40	15.5	15
Subsulphate of Mercury	1	258	100.0	99.7

PHYSIOLOGICAL EFFECTS.—In small quantities it occasions nausea, vomiting, and ptyalism. Taken into the nostrils it excites sneezing, and sometimes salivation. Stenzel (Wibmer, *Wirk. d. Arzneim.* iii. 66) mentions a fatal case from its internal use.

USES.—It is sometimes used as an emetic in cases of swelled testicle, to promote absorption by its nauseating and emetic action (*Observ. on the Dublin Pharmacopœia*). It was formerly given at the commencement of a mercurial course. As an errhine it has been administered in chronic ophthalmia and affections of the brain, as incipient hydrocephalus. As an alterative it has been given in the scaly diseases (lepra and psoriasis).

AMINISTRATION.—As an alterative, the dose should not exceed half a grain, or at most a grain. As an emetic it is given to the extent of five grains; in which dose it causes violent vomiting. As an errhine, a grain should be mixed with four or five of some mild powder, as starch or liquorice powder. It is rarely given for any other purposes.

ORDER 21.—COPPER AND ITS COMPOUNDS.

Cu'prum.—*Cop'per.*

HISTORY.—Cuprum, or copper, received its name *κύπρος*, from the island of Cyprus, where it was first discovered, or at least worked to any extent. It seems to have been known in the most remote ages of antiquity, for Moses (*Job*, ch. xxviii.) speaks of brass (an alloy of copper and zinc). The alchemists called it *Venus*.

NATURAL HISTORY.—It is found in both kingdoms of nature.

(a.) *In the inorganic kingdom.*—Copper is found in the metallic or reguline state, combined with oxygen, with sulphur, with selenium, with chlorine, or with oxygen, and an oxyacid (carbonic, arsenic, phosphoric, sulphuric, or silicic).

(b.) *In the organized kingdom.*—It has been discovered in the ashes of most plants, as of stavesacre, rhatany, flax, nux vomica, hemlock, &c. Sarzeau has detected it in the blood of animals (*Ann. de Chim.* xlv. 334).

PREPARATION.—The copper of commerce is usually prepared from copper pyrites or grey copper ore (both sulphurets). These are roasted and then smelted, by which *coarse metal* is procured. This is calcined and again smelted, by which we obtain *fine metal*, or, when cast in sand, *blue metal*. By re-roasting and smelting, *coarse copper* is produced. These processes, of roasting and smelting, effect the expulsion of the sulphur and the oxidization of the iron. The copper thus produced is melted and exposed to the air, to drive off any volatile matters by which *blistered copper* is obtained. It is *refined* or *toughened* by melting it and stirring with a birchpole (J. H. Vivian, *Ann. of Philosophy*, N.S. v. 113).

PROPERTIES.—It is a crystallizable, brilliant, red metal, crystallizable in regular octahedra and cubes, having a specific gravity of 8.86 to 8.89; malleable and ductile; it has a nauseous, styptic taste, and a peculiar and disagreeable smell. It fuses at 1996° F. (*Daniel*); at a higher temperature it may be volatilized. Its equivalent is 32. It is combustible. It is readily oxidated. Acid, alkaline, saline, and fatty bodies, when placed in contact with it in the air, promote its union with oxygen; and, by dissolving a portion of the newly-formed oxide, acquire poisonous properties.