the Pharmacopœia, the copper is precipitated as a suboxide, a simple oxymel remaining. Out of five samples obtained from different sources, not one contained the slightest trace of copper. In order to succeed, the temperature must not reach the boiling point; a fine green solution is thus obtained, containing the proper quantity of acetate of copper.—ED.]

2. Cupri Acetas.—Neutral Acetate of Copper.

Formula $CuO,\overline{A},HO$. *Equivalent Weight* 100.

This salt, commonly termed *distilled* or *crystallised verdigris* (*ærugo crystallisata*), and sometimes *flos æruginis*, is met with in the shops crystallised on sticks. It is usually prepared by dissolving common verdigris in acetic acid, and crystallising. The crystals are oblique rhombic prisms. They consist of one equivalent of oxide of copper, one equivalent of acetic acid, and one equivalent of water. This salt is completely soluble in water, by which it is distinguished from common verdigris. In most other properties it agrees with the latter. The bluish white precipitate obtained by adding a solution of the neutral acetate of copper to a solution of albumen consists of *albumen* 90·81, and *di-acetate of copper* 9·19. It is soluble in excess of solution of either acetate of copper or of albumen.[1] It is rarely employed in medicine. Its effects and uses are similar to those of the subacetates. It formerly served for the preparation of concentrated acetic acid. It is used, also, as a pigment.

ORDER XXIX. MERCURY AND ITS COMPOUNDS.

167. HYDRARGYRUM.—MERCURY OR QUICKSILVER.

Symbol Hg. *Equivalent Weight* 100.[2]

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

[1] Lassaigne, *Journal de Chimie Méd.* t. vi. 2de sér. p. 305.

[2] "Considerable difference of opinion has prevailed respecting the equivalent or atomic weight of mercury, arising out of the different views which have been adopted in reference to the constitution of its *oxides*, of which there are two,—a grey and a red, and both of them salifiable. If the grey be considered as a *protoxide*, and the red a *binoxide*, then the number 200 will represent the metal: if, on the other hand, it be assumed that the red oxide be the *protoxide*, and the grey a *suboxide* or *dioxide*, the number 100 must be assumed as the weight of the atom of mercury; and there are strong grounds in favour of the latter view; for the grey oxide is very unstable, and deficient, therefore, in the characters of a true protoxide; whereas the red oxide is comparatively permanent and stable, and it is eminently *basic*, verging even upon alkalinity in its properties; and when, to these considerations, we add the evidence deduced from the connection between the specific heat of mercury and its atomic weight, we are, I think, forced to regard the red oxide of mercury as the protoxide, and notwithstanding the inconvenience that will occasionally ensue in reference to the application of this number to some of the mercurial compounds, to represent the metal by the number 100. (100, Gmelin and Thomson; 101·266, Berzelius; 100·04, Erdmann and Marchand; 101·43, Graham; 202, Gregory)."—Brande's *Manual of Chemistry*.

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.[1] Both Aristotle and Theophrastus[2] mention Ἄργυρος χυτός (*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[3] and Dioscorides[4] 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 ὕδωρ, *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*, ☿, *mercurius*, 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*). Sulphuret 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.[5] Subchloride of mercury (*mercurial horn ore* or *corneous mercury*), iodide of mercury, and seleniuret of mercury, are also found native. Traces of this metal have also been met with in common salt, during distillation with sulphuric acid, by Rouelle, Proust, Westrumb, and Wurzur.[6]

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. The products are sulphuret of calcium, sulphate of lime, and mercury, which distils over. $4HgS + 4CaO = 2CaS + CaO,SO^3 + 4Hg$. At Almaden the ore is roasted, by which the sulphur is converted into sulphurous acid, and the mercury volatilised: $HgS + 2O = Hg + SO^2$. At Idria a modification of this process is followed.[7]

COMMERCE.—Quicksilver is imported in cylindrical wrought-iron bottles (holding from 60 lbs. 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

[1] D'Herbelot, *Bibliothèque Orient.* art. *Moussa.*
[2] *De Lapidibus.*
[3] *Hist. Nat.* lib. xxxiii.
[4] Lib. v. cap. cx.
[5] *Hist. Nat.* xxxiii.
[6] Gmelin, *Handb. d. Chemie*, i. 1282.
[7] Dumas, *Traité de Chimie*, iv. 305.

imported in the years 1827, 1830, and 1840, and the places from which the metal was brought in the two first years, are thus stated in the Parliamentary papers :[1]—

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

[The quantity taken for home consumption in the year 1840 amounted to 328,566 lbs.—ED.]

The iron bottles in which mercury is imported, are sometimes used for the preparation of oxygen gas.

In 1844 a quantity of quicksilver, of good quality, was imported from China in little bamboo bottles or barrels,[2] covered with cemented linen cloth.[3]

[We are indebted to Mr. Faber for the following additional information regarding the commercial history of mercury :—

The gold and silver mines of Central America, which require vast quantities of quicksilver for the purpose of separating the metals, were supplied from time immemorial by Spain, namely, at first by direct commerce, subsequently indirectly through England. This led the Spanish Government, in 1831, to contract for the whole of their produce to one single firm in London, namely Messrs. N. M. Rothschild and Sons, under whose monopoly the price rose from one shilling and tenpence per pound in 1831, to four shillings in 1849. In the latter year, *Californian* quicksilver appeared in commerce, and soon began to supply not only the requirements of Central America and the United States, but consignments were even sent to England to a considerable extent, so as to force the price of four shillings in Feb. 1850, down to two shillings and one penny in Feb. 1854.

The total importation into England, consisting chiefly of Spanish quicksilver, amounted in the ten years, 1833-1842 to 18,051,245 pounds, being an average of 1,805,124 pounds per year. Of this, on the average of the same ten years, 292,199 pounds per year were taken for home consumption.

The importation in 1852 was .....2,113,186 lbs.
" 1853 " .....1,868,120 "

The quality supplied by the mines at present worked both in the Old and the New World seems to be equally pure, a preference being given to neither, excepting in regard to the package; viz. Spanish quicksilver, being the produce of Almaden, and imported from Cadiz and Seville, is packed into cylindrical wrought-iron bottles, the mouth of each being closed by an iron screw, each containing exactly three Spanish arrobas of 23 pounds Spanish, making 76 pounds English per bottle, net. But the weight charged by the importers is on an average only 69 to 70 pounds, arising from the tret of

[1] *Statement of the Imports and Exports* for 1827 and 1830; and *Trade List* for 1840.

[2] *Pharm. Journ.* vol. iii. p. 539, 1844.

[3] [In a former edition it was erroneously stated that each bottle contained about twenty pounds. We have good authority for stating that the contents of twenty-five bottles weighed 1523 pounds. The high price of mercury at that time rendered this importation profitable. None has been received since 1844.—ED.]

4 pounds per 104 pounds, and 1 pound draft being allowed, and the tare being fixed at 18 pounds, while the real tare averages 16 to 17 pounds.

The *Austrian* quicksilver, being the produce of Idria, in Carniola, serves chiefly to supply the German markets, and is but very seldom imported into England, and then by the way of Trieste. It is packed into barrels containing two double goat-skins, each skin containing 50 pounds Vienna weight, the skins being tied by machinery into the shape of bags, by strong cords. This package is both clumsy and dangerous. The yield of Idria is very much less than that of Almadea.[1] The quicksilver mines of Tuscany have only been worked in recent periods, and are situated at Monte Amiato, Val di Castello, and Levigliano. They belong to four companies, and have in the best years produced only about 120,000 pounds, while in 1853, in consequence of the low price of quicksilver, they were only worked to the extent of about 40,000 pounds. China is said to produce much quicksilver, but only one importation from that country is known to have taken place, namely in 1844, the period referred to by the author, when the price of four shillings and sixpence brought it to this market. It consisted of 160 bamboo bottles, or rather boxes, covered with cemented linen cloth, each holding about 60 pounds net. The Californian quicksilver is packed, like the Tuscan, into old Spanish bottles, which are bought up in this and other markets for that purpose. The bulk of the yield is retained for their own gold mines, or shipped to other parts of America.—ED.]

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 pulverulent 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 crystallises in needles and regular octohedrons. In this state it is ductile, malleable, and tenacious; and its density is 13·391. At 662° F. it boils and produces an invisible elastic vapour, whose sp. gr. is 6·976. Mr. Faraday[2] 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 volatilised in considerable quantities. The presence of lead or tin retards the distillation of mercury, while that of platinum appears to accelerate it.

Characteristics.—In its *metallic* or *reguline* 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 *quickening*) 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.

The *mercurial compounds*, when heated with potash or soda, or their carbonates, yield globules of metallic mercury, which may be recognised by the properties already described. If calomel (Hg^2Cl) be the mercurial com-

[1] The yield of Idria varies according to the demand for the article, but it may be stated to be on an annual average of 370,000 pounds English.
[2] *Quarterly Journal of Science*, x. 354.

pound examined, the changes are as follows:—$Hg^2Cl + NaO,CO^2 = NaCl + Hg^2 + O + CO^2$. 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 the copper is heated to redness. With nitrate of the suboxide of mercury the changes are as follows:—$Hg^2O,NO^5 + Cu = Hg^2 + CuO,NO^5$. 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, sulphate and iodide of mercury, may be readily recognised. Sulphuretted hydrogen produces, with mercurial solutions, a black precipitate (*sulphuret of mercury*, HgS).

Solutions of the *protosalts of mercury* yield, with caustic potash or soda, a grey or black precipitate (*oxide of mercury*, Hg^2O); and, with iodide of potassium, a greenish precipitate (*iodide of mercury*, Hg^2I).

Solutions of the *persalts of mercury* yield, with caustic potash or soda, a yellow or reddish precipitate (*binoxide of mercury*, HgO); and, with iodide of potassium, a scarlet one (*biniodide of mercury*, HgI).

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.

Its specific gravity is 13·5. Goes off in vapour by heat. When globules are slowly rolled about on a sheet of paper, not the smallest portion adheres to the paper.—*Ph. Lond.*

Entirely sublimed by heat: a globule moved along a sheet of paper leaves no trail: pure sulphuric acid agitated with it evaporates when heated, without leaving any residuum.—*Ph. Ed.*

PHYSIOLOGICAL EFFECTS. 1. **Of Metallic Mercury.** α. *On Vegetables.*—Mercurial vapours are fatal to plants.[1]

β. *On Animals.*—From the experiments of Moulin,[2] Haighton,[3] Viborg,[4] and Gaspard,[5] 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.

γ. *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[6] states that a patient took for a long

[1] De Candolle, *Phys. Vég.* 1332.
[2] *Philosophical Transactions* for 1691, No. 192.
[3] Beddoes, *On Pulmonary Consumption*, 1799.
[4] Quoted by Wibmer, *Wirkung. d. Arzneim.* iii. 88.
[5] Magendie, *Journ. de Physiol.* i.
[6] *Mém. de la Facult. Méd. d'Emulat.* 4th year, p. 252.

time two pounds daily without injury; and I could refer to the experience of many others who have seen it employed in obstruction 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 oxidised. Thus, Zwinger[1] states that four ounces brought on profuse salivation four days after swallowing it. Laborde[2] 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 leather bag, containing a few drachms of liquid mercury, as a prophylactic for itch and vermin.[3]

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 in confirmed cases 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, fowls, a canary bird,—nay, even the rats, mice, and cockroaches, were destroyed.[4] 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

[1] *Miscell. Curiosa Decur.* 2nda Ann. 6, 1688.
[2] *Journ. de Méd.* i. 3.
[3] Richter, *Ausführ. Arzneim.* Supplem. Bd. 615.
[4] *Edinb. Med. and Surg. Journ.* xxvi. 29.

metal before it is inhaled. I believe, however, with Buchner,[1] Orfila,[2] 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 statement is in the case of the sulphurets of this metal, which, according to Orfila,[3] are inert.

α. *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 corrosive sublimate, and the nitrates) are energetic caustics. The suboxide and calomel are very slightly irritant only: indeed, Mr. Annesley[4] 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.

β. *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; so that mercury seems to promote the excretions generally. The absorbent or lymphatic system seems also to be stimulated to increased activity, for we frequently observe that accumulations of fluids in the shut sacs (as the pleura, the peritoneum, the arachnoid, and synovial membranes) diminish in quantity, and in some cases rapidly disappear, under the use of mercury. At the same time, also, glandular swellings, enlargements, and indurations of various kinds, are dispersed. (For some other observations respecting the *liquefacient* action of mercury, see *ante*, pp. 179 and 188.)

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 is accompanied with more or less tenderness and inflammation of these parts, 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

[1] *Toxicologie.*
[2] *Toxicol. Gén.*
[3] *Arch. Gén. de Méd.* xix. 330.
[4] *Diseases of India.*

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, and the susceptibility of the patient. Formerly salivation was carried to a much greater extent than it is at the present day. Thus Boerhaave[1] considered that a patient should spit three or four pounds in twenty-four hours, and Turner[2] says from two to three quarts are "a good and sufficient discharge." Modern experience has shown 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:[3]—

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 ferrocyanide of potassium and the infusion of galls had no effect on it. Dr. Bostock[4] 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,[5] 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. In Simon's *Animal Chemistry*, several analyses of the saliva from patients under the influence of mercury are given. In all of these there was an increase in the amount of the solid constituents. I have tested the urine of several patients in a profuse state of salivation without having detected a trace of albumen in it.

The effects of mercury hitherto described are such as are frequently 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*, and *cachexia mercurialis*) 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.[6] The following are the ill

[1] *Aphorismi.*
[2] *Practical Dissertation on the Venereal Disease*, 1737.
[3] *Annal. of Phil.* vi. 397.
[4] *Medico-Chirurg. Trans.* xiii. 73.
[5] For some interesting observations on the conversion of albumen into mucus by the action of alkalies and various salts, see Brande, in the *Phil. Trans.* for 1809; Pearson, in ditto, for 1810; Dr. B. G. Babington, in *Guy's Hospital Reports*, vol. ii.; and Dr. G. Bird, in ditto, vol. iii.
[6] See some extraordinary cases of the combined effects of syphilis and mercury, in the *Lancet* for 1832-33, vol. ii. p. 357.

effects which have been ascribed to this metal, and which Dieterich[1] 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 characterised by great restlessness, dryness of the mouth, headache, loss of appetite, nausea, hot and dry skin, quick pulse, red gums, and a swollen tongue : it usually terminates in a critical discharge (as profuse salivation, purging, or sweating), or an eruption makes its appearance. The affection which Mr. Pearson[2] denominated *mercurial erethism* (*erethismus mercurialis*), is regarded by Dieterich as an adynamic mercurial fever (*febris adynamica*). It is characterised 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, very painful, and inflamed (*parotitis mercurialis*), 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 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. I have repeatedly seen inflammation and ulceration of the mouth, and profuse salivation, induced by a few grains of calomel, or some other mercurial.

A very frequent consequence of excessive mercurial salivation, and the attendant ulceration and sloughing, is contraction of the mucous membrane in the neighbourhood of the anterior arches of the palate, whereby the patient is prevented from opening the mouth, except to a very slight extent. I have met with several such cases. In one case (that of a female) it followed the use of a few grains of blue pill, administered for a liver complaint. The patient remains unable to open her mouth wider than half an inch. Several operations have been performed by different surgeons, and the contracted parts freely divided, but the relief was only temporary. In another instance (that of a child, four years of age) it was produced by a few grains of calomel. Though several years have elapsed since, the patient is obliged to suck his food through the spaces left between the jaws by the loss of the alveolar process.

Non-mercurial salivation.—Salivation is occasionally induced by other medicinal agents, as iodine, iodide of potassium, nitric acid, hydrocyanic acid, arsenious acid, emetic tartar, the preparations of gold, and of copper, foxglove, even opium, and castor oil. Moreover, salivation sometimes arises spontaneously. Of this I have seen more than a dozen cases, mostly females. The greater number of them had not (according to their own account) taken medicine of any kind for several months. Several other cases of it are referred to by Dr. Christison[3] and by Dr. Watson.[4] Occasionally the cause of it is obvious : thus pregnancy, decayed teeth, sore throat, decomposing wool in the ears, &c. ; but in many instances the cause cannot be detected.

It is sometimes a matter of considerable importance to distinguish mercurial from non-mercurial ptyalism. The essential symptoms of salivation from mercury are tumefaction, tenderness, and inflammation of the salivary glands ; sponginess, swelling, and inflammation of the gums [a discoloration around the coronæ of the teeth similar to that caused by saturnine preparations has also been observed.—ED.] : copious secretion and

[1] *Die Merkurialkrankheit*, Leipz. 1837.
[2] *Observations on the Effects of various Articles of the Materia Medica*, p. 131, Lond. 1800.
[3] *Treatise on Poisons*, 3d edit. p. 380.
[4] *Lond. Med. Gaz.* Aug. 6, 1841.

excretion of saliva; remarkable fetor of the breath (usually termed mercurial fetor); brassy or coppery taste, and tongue generally swollen. These symptoms may be followed by ulceration and sloughing. But all the same phenomena may exist when no mercury has been taken. Even the so-called mercurial fetor of the breath is not a peculiar effect of this metal.

But the disease which is most likely to be mistaken for the effects of mercury, is gangrene of the mouth, commonly called *cancrum oris*.[1] This usually, but not invariably, occurs in children. It consists of ulceration, followed by gangrene, of the inside of the cheek or lips, and is attended with a copious secretion of offensive saliva. Mercurial ptyalism may sometimes be distinguished from cancrum oris by the peculiar odour of the breath and the salivation preceding the ulceration and sloughing; and by the gums, salivary glands, and tongue, being tumefied and inflamed. But these symptoms are by no means to be relied on, as they may also attend cancrum oris; and it must be admitted, therefore, that the two affections closely resemble each other.[2] The following is a remarkable case of gangrene of the mouth occurring in the adult, and simulating the effects of mercury:—

A man affected with rheumatism sent to a surgeon for advice, who, without seeing him, prescribed some pills, one of which was to be taken thrice daily. At the end of the week, his rheumatism not being relieved, he sent his wife again to the surgeon, who ordered the pills to be repeated. Another week elapsed, when the patient requested Mr. W. H. Coward, surgeon, of the New North Road, Hoxton, to see him; to whom I am indebted for part of the particulars of this case. Mr. Coward found his patient with the following symptoms: fever, great prostration of strength, sore throat, rheumatic pains in the wrist, profuse ptyalism, more than a pint of saliva being discharged per hour, with the breath having the "mercurial" odour; and on the inner side of the right cheek a foul ulcer. He ascribed his present condition to the pills, as he had no sore mouth until after taking them. On cutting one of the pills, it was observed to have a light brown colour, and the odour of opium: hence it was supposed that they were composed of calomel and opium. Purgatives, tonics, and gargles of chloride of soda, were used without avail; and, after some days, Mr. Coward requested me to see the patient. I found him in the following condition: right side of the face swollen and slightly red; gums swollen, red, and ulcerated; breath horribly offensive, its odour not distinguishable from that called mercurial. On the inner side of the cheek, near the orifice of the parotid duct, there was a slough about the size of a sixpenny piece; salivation most profuse,—in fact, the saliva flowed in a continued stream from his mouth; over the body were observed a few petechiæ. Notwithstanding the means employed, the man became worse, the sloughing gradually increased until the whole of the right cheek became involved, and in about a week from my first visiting him he died. A day or two before his death, I ascertained from the surgeon who had prescribed the pills that they contained Dover's powder, and not an atom of any mercurial preparation.

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 fulness 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[3] terms it *ptyalismus pancreaticus mercurialis* (*diarrhœa salivalis, sialorrhœa alvina, ptyalismus abdominalis*).

4. UROPYRHŒA MERCURIALIS.—Excessive secretion of urine, from the use of mercury, is very rare. Two cases are recorded by Schlichting.[4]

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 mer-*

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[1] See an excellent account of this disease, by Dr. H. Green, in Costello's *Cyclopædia of Practical Surgery*, vol. i.

[2] In the *Lond. Med. Gaz.* Aug. 28, 1840, is the report of an inquest held on the body of a child who died of cancrum oris, but whose death was alleged to have been caused by mercury.

[3] *Op. cit.*

[4] *Ephemerid*, A. C. L., Nuremburgæ, 1748, t. viii. Obs. viii. p. 25, quoted by Dieterich, *op. cit.*

curialis, 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[1] 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. I have seen 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.

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

γ. *Chronic skin diseases* (*Herpes*, *Psydracia*, 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,[2] and his opinion has been adopted by Dieterich;[3] but it certainly now and then occurs when no mercury has been exhibited. The *Psydracia mercurialis* and *Impetigo mercurialis* of Dieterich are still more doubtful effects of mercury.

7. INFLAMMATION OR CONGESTION OF THE EYE, FAUCES, AND PERIOSTEUM, has 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 συμφόρησις, *an accumulation*, or *bringing together*).

The inflammation of the conjunctiva (*conjunctivitis mercurialis*; *symphoresis conjunctivæ oculi mercurialis*, Dieterich), ascribed by Von Ammon[4] to the use of mercury, should probably be referred to some other cause. He says it is characterised 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*, Dieterich; *iritis rheumatico-mercurialis*, Jaeger), described by Mr. Travers,[5] was, in all probability, an iritis arising from some other cause than mercury.[6] The so-called mercurial retinitis (*symphoresis retinæ oculi mercurialis*, Dieterich) may be explained in the same way.

An inflammation of the fauces sometimes occurs after the use of mercury (*angina mercurialis*; *symphoresis faucium mercurialis*, Dieterich). It may come on in five or six days after the use of mercury, and assume an acute form, with a tendency to slough;[7] or it may appear after the employment of mercury for five or six weeks, and take on a chronic form.[8]

Inflammation of the bone or periosteum, and the consequent production of nodes (*symphoresis periostei mercurialis*, Dieterich), 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.[9]

8. HYPERTROPHIES (*Hypertrophiæ*, Dieterich).—Enlargement of the inguinal, axillary,

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[1] *Observ. on the Hydrargyria*, 1810.
[2] Bateman, *Pract. Synopsis of Cutaneous Diseases*, 6th edit.
[3] *Op. cit.*
[4] Rust's *Magazin*, 1830.
[5] *Surgical Essays*, i. 59.
[6] Mackenzie, *On Diseases of the Eye*, 2d edit. p. 496.
[7] Colles, *Pract. Observ. on the Venereal Disease*, p. 45.
[8] Dieterich, *op. cit.* 273.
[9] Mr. Lawrence, *Lectures on Surgery*, in *Lond. Med. Gaz.* v. 805; Colles, *op. cit.* p. 189.

and mesenteric glands (*adenophyma inguinale, mercuriale; ad. axillare merc.; ad. miserai-cum merc.* Dieterich), as well as 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*, Dieterich), have been ascribed by some[1] 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[2]). 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.[3] Ulceration of the fibrous membranes (*ulcus membranæ fibrosæ mercuriale* and absorbent glands (*ulcus glandulorum mercuriale*) has been ascribed to the use of mercury.[4]

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 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 has been already noticed.

11. CACHEXIA (*Cachexia mercurialis*).—This condition is characterised 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.[5]

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,[6] and in Dr. Currie's pamphlet.[7]

In excessive doses: acute poisoning.—When *large doses* of some of the soluble salts of mercury have been swallowed, *gastro-enteritis* is produced. The patient complains of an acrid styptic taste in the mouth, a feeling of burning and tightness in the throat; the face is usually flushed and sometimes swollen, violent vomiting and purging (frequently of bloody matters) soon come on, the vomiting being increased by everything taken into the stomach; oftentimes there is irritation of the urinary passages, and sometimes even suppression of the 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 is seldom delayed beyond the fourth day. Towards the termination of the case, some *disorder of the cerebro-spinal system* supervenes, such as slight drowsiness

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[1] Mathias, *op. cit.*; and Dieterich, *op. cit.*
[2] *Lond. Med. Gaz.* iii. 312.
[3] Sir A. Cooper, *Lectures on Surgery*, in *Lancet*, iv. 42; Carmichael, *On Venereal Diseases*, p. 165, *et seq.* 2d edit.
[4] Dieterich, *op. cit.* p. 376.
[5] Mr. Travers (*Further Inquiry concerning Constitutional Irritation*, p. 87) says, mercurial cachexia is characterised "by irritable circulation, extreme pallor and emaciation, an acute and rapid hectic, and an almost invariable termination in phthisis."
[6] *Edinb. Med. and Surg. Journal*, vol. xxviii.
[7] *Examination of the Prejudice commonly entertained against Mercury.*

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, and is subsequently either deposited in some of the solids of the body, or thrown out of the system by some of the excretories.[1]

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

α. *Mercury has been detected in the blood* by Zeller, Buchner, Schubarth,[2] Colson,[3] and Dieterich. 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.

β. *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.[4] The blackening of the skin, mentioned both by Harrold[5] and Rigby,[6] 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 pulverulent form.

γ. *Mercury has been found in the reguline state in the organic solids*, viz. in the bones, brain, liver, synovial capsules, the pleura, the humours of the eye, the cellular tissue, the lungs, &c.[7] 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 may 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 promoted by agents which augment absorption, and is checked by those which diminish absorption.

3. *After absorption, mercury effects changes in the qualities of the blood, and in the action of the whole organisation, 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,[8] "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

[1] Oesterlen has shown that the globules of mercury contained in mercurial ointment become absorbed, and he has detected them in the viscera and secretions. He also detected globules of the metal in the secretions after the use of calomel (Wunderlich und Roser's *Archiv*, ii. 4. Quoted by Dr. Buchheim).

[2] Quoted by Dr. Christison, *On Poisons*, 3d edit. p. 366.

[3] *Arch. Gén.* xii. 68.

[4] Christison, Colson, and Dieterich, *op. cit.*

[5] Meckel's *Archiv*, iii. 532.

[6] *Lond. Med. Rep.* April 1837.

[7] Christison, *op. cit.*; Wibmer, *Wirkung d. Arzneim.* iii. 85; Colson and Dieterich, *op. cit.*

[8] *Op. cit.* 80.

changes from the negative (healthy) state to that of positive. According to Dr. Farre,[1] it diminishes the number of red globules of the blood. The evacuations from all the secreting and exhaling organs, especially from the mucous follicles and salivary glands, are much increased. The secretion of bile is also promoted. Dr. Wilson Philip[2] 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 broad 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[3] 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 overlooked.

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.

α. *Mechanical hypothesis.*—Astruc[4] and Barry[5] 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.

β. *Chemical hypothesis.*—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, Pressevin,[6] and Swediaur,[7] assumed that mercury acted chemically on the syphilitic poison, as acids and alkalies do on each other; while Girtanner[8] 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[9] 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

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[1] Ferguson's *Essays on the Diseases of Women*, part i. p. 216.—"A full plethoric woman, of a purple red complexion, consulted me," says Dr. Farre, "for hemorrhage from the stomach depending on engorgement, without organic disease. I gave her mercury, and in six weeks blanched her as white as a lily."

[2] *On the Influence of Minute Doses of Mercury*, p. 14.

[3] *Phil. Trans.* for 1812.

[4] *De Morb. Ven.* ii. 149.

[5] *Medical Transactions*, i. 25.

[6] Quoted by Richter, *Ausf. Arzneim.* iv. 305.

[7] *Practical Observations on Venereal Complaints.*

[8] *Abhandl. ü. d. Vener. Krankh.*

[9] *Treat. of the Mat. Med.* ii. 446.

that mercury has no "particular disposition" to unite with 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.

γ. *Dynamical hypothesis.*—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 one or more parts or the whole system are stimulated, and if particular parts, what these are. Thus Hecker fixes on the lymphatic system, Schone on the arterial capillary system, Reil on the nerves.[1] 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,[2] consider 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.[3] Dr. Murray[4] calls mercury a tonic; Vogt[5] terms it an alterative resolvent; Sundelin[6] places it among the resolvent alteratives under the designation of liquefacient (*verflüssigende*). Mr. Hunter accounts for its beneficial effects in syphilis, by saying it produces an irritation of a different kind to that caused by the venereal disease, and that it counteracts the latter by the diseased action of the living parts.

In my opinion mercury is an alterative, and a liquefacient spanæmic (see *ante*, p. 179).

USES. 1. **Of Metallic Mercury.**—Liquid mercury has been used as a *chemical* agent to dissolve silver coins which have been swallowed; and as a *mechanical* agent to remove obstructions of the bowels: for example, intussusception, or intestinal invagination. But neither theory nor experience seems favourable to its use in the latter case; for in the greater number of cases the intussusception is progressive—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 intestine cannot give relief; and even in cases of retrograde intussusception—that is, where the lower portion of the bowels passes into the upper, mercury, instead of pressing the intussuscepted portion back, might push it farther on, by getting into the angle of reflection between the containing and

[1] Richter, *op. cit.* v. 306.
[2] Quoted by Richter, *op. cit.* v. 307.
[3] *Op. cit.*
[4] *Syst. of Mat. Med.*
[5] *Pharmakodynamik.*
[6] *Heilmittellehre.*
[7] *Treatise on the Venereal Disease.*

inverted gut.[1] *Lastly*, water, which had been boiled with mercury (*aqua 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.[2]

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 *subsulphate* 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, and scrofula. Calomel is said to be less beneficial as an alterative than blue pill, on account of its more irritating action on the bowels. The *hydrargyrum cum cretâ* is an excellent alterative, especially for children.

Certain preparations of mercury (as blue pill, calomel, and the *hydrargyrum cum cretâ*) are employed as *purgatives*. They promote secretion 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 pill or calomel at night, and an aperient draught the following 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 contents 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 of relieving affections of other organs, as the skin or head.

The great value of mercurials is experienced when they are given 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,[3] "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.

a. 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 secrecy.

[1] Hunter, *Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge*, i. 103.
[2] Brenser, *Sur les Vers Intest.* 428.
[3] *Op. cit.* p. 19.

Full directions for its employment will be given hereafter (vide *Ung. Hydrargyri*). In the year 1779, Mr. Clare[1] proposed a new method of causing salivation by friction, and which consists in rubbing two or three grains of calomel, or the suboxide 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[2] employed for this purpose cinnabar; Lalouette[3] calomel; and the late Mr. Abernethy[4] the suboxide. Mr. Colles[5] has frequently seen fumigation fail in exciting salivation. He says, an easy method 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 mode 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*.

β. *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[6] 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 upon the system: thus, if it have been employed internally, inunction should be tried, and *vice versâ*.

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[7] 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 cold 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. Dr. Watson[8] observes that "when the flow of saliva, and the soreness of the gums, form the chief part of the grievance, I have found nothing so generally useful as a gargle made of brandy and water; in the proportion of one part of brandy to four or five of water." 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,

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[1] *Essay on the Cure of Abscesses by Caustic; also, a New Method of Introducing Mercury into the Circulation*, 1799.
[2] *On the Venereal Disease.*
[3] *Nouvelle Méthode de traiter les Malad. Vénér.* 1776.
[4] *Surgical and Physiological Essays.*
[5] *Op. cit.* p. 58.
[6] *Practical Observations on the Venereal Disease*, p. 28.
[7] *Op. cit.* p. 34.
[8] *Lond. Med. Gaz.* Dec. 25, 1840.

have been strongly recommended. Sometimes sulphate of quina is administered with advantage.

γ. *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, 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*, the *mercurial erethysm* of Pearson, 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.

δ. *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.

Having offered these general remarks on salivation as a remedial agent, I proceed to notice its use in particular diseases.[2]

α. *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.*

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[1] On this subject consult Colles, *op. cit.* p. 31.

[2] The following are Dr. Farre's rules for the exhibition of mercury (Ferguson, *op. supra cit.* p. 220):—

"1. Never to give mercury when there is an idiosyncrasy against it." The following case is illustrative of the danger of neglecting this advice:—

"A patient of Mr. G.'s, of the Borough, desired him never to give her any mercury, as that drug was a poison to her whole family, to which he, without arguing the point, at once assented. In Mr. G.'s absence, the late Mr. C. was consulted as to some trifling disorder of the bowels, and, not knowing the peculiarity of his patient's constitution, prescribed two grains of calomel. The next morning the lady showed the prescription to Mr. C., saying that she was sure she had taken mercury, as she felt it in her mouth. In a few hours ptyalism ensued; in consequence of which she lost her teeth, her jaw exfoliated, and she ultimately, after a succession of ailments, died, in about two years."

"2. Mercury should be used in all active congestions—pyrexia, phlogosis, phlegmon, ophthalmia, strabismus, cynanche laryngea, cynanche trachealis, pneumonia, and in all inflammatory diseases. In the adhesive stages of dysentery, in the phlegmasiæ, where there is inflammation with power, in tetanus, hemiplegia, paraplegia, neuralgia, in their states of active congestion.

"3. Mercury is hurtful, or doubtful—in the malignant or asthenic forms of pyrexia, where there is low delirium; but in phrenitis, and in that peculiar form of it, the *coup de soleil*, it is most effectual. It is hurtful in tetanus from punctured wound, and in all cases of irritable disease.

"In idiopathic iritis, it is as effectual as bark in ague; but in the traumatic it is injurious, as it interferes with the closing of the vessels by adhesive inflammation: hence, in all hemorrhages, where the orifices of vessels require to be closed, it is hurtful.

"In the hemiplegia of lesion, in asthenic paraplegia, in the neuralgia of irritation, it is bad. Poor Pemberton was three times salivated for tic douloureux, and three times the worse for it.

"It is hurtful in the inveterate forms of scrofulous ophthalmia, though useful in the early stage. It is bad in the amaurosis of depletion.

"It is useful in puerperal peritonitis, and hurtful in the typhoid form of it; as also in the ulcerative stage of dysentery.

"In general, it is doubtful in the suppurative stages of inflammation, and in all erysipelatous and erythematous inflammations, or those tending to gangrene. It is hurtful in all cases of pure asthenia from deficiency of red blood."

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 several 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,[1] 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[2] and Dr. Graves[3] assert, cannot be positively proved, though I think the first more probable. Dr. Graves[4] declares the use of mercury in fever to be both injudicious and unnecessary, unless inflammation of some organ be set up. Dr. Macartney,[5] 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 characterised 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,[6] 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.[7] It has been said by several writers,[8] that in the yellow fever of the West Indies its beneficial effects are not equally evident.

β. 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,[9] Dr. Yeats,[10] Dr. Wright,[11] and Rambach,[12] for its introduction into use in this form of disease. It is principally valuable in adhesive inflammation, to stop, control, or prevent the effusion of coagulable lymph. On the other hand, it may prove injurious in erythematous, scrofulous, malignant, and gangrenous inflammation, as well as in inflammation accompanied with debility or great irritability of the nervous system. Its curative power is not satisfactorily accounted for by the equalization of the circulation, the augmentation of the

[1] *Dict. of Pract. Med.* i. 929.
[2] *On Yellow Fever.*
[3] *Lond. Med. Gaz.* xx. 147.
[4] *Op. cit.*
[5] *Treatise on Inflammation*, p. 162.
[6] *Pract. Observ. on Diseases of the Army of Jamaica.*
[7] Johnson, *On Diseases of Tropical Climates*, pp. 32, 96, 97, 122, &c. &c. 3d edit.; Annesley, *On the Diseases of India*, p. 391, 2d edit.
[8] Johnson, *op. cit.* p. 37; Bancroft, *On Yellow Fever*; Musgrave, *Edinb. Med. and Surg. Journ.* xxviii. 40.
[9] Duncan's *Med. Comm.* vol. ix.
[10] Duncan's *Ann. of Med.* vol. vii.
[11] *Med. Facts and Observ.* vol. vii.
[12] *Dissert. Usus Mercurii in Morb. Inflam.* 1794.

secretions, or the increased activity of the absorbents caused by mercury. It is not equally serviceable in all inflammations. 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 bloodletting) 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.[1] 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, Ballingall, 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.[2] 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[3] recommends the use of blue pill and opium. In acute cases I prefer calomel 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,[4] and has found many supporters;[5] and, undoubtedly, when

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[1] Lawrence, *Lectures on Diseases of the Eye*, in *Lancet*, vol. x. p. 198; Mackenzie, *On Diseases of the Eye*, 2d edit. pp. 389, 394, and 503.

[2] Sir James M'Grigor, *Medical Sketches*; Johnson, *On Tropical Climates*; Annesley, *On Diseases of India*.

[3] *Lectures on Diseases of the Lungs*, &c. p. 191.

[4] *Op. cit.*

[5] *Vide* Dr. Hope, *Lond. Med. Gaz.* xix. 815.

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.[1] 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 cancers and fungoid diseases), mercurials are highly objectionable.

γ. *Venereal diseases.*—It was formerly the opinion of surgeons that the symptoms of the venereal disease 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,[2] Hennen,[3] and Bacot,[4] and to Dr. Thomson[5]—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 the possibility, admit that in some cases this mineral, given so as to excite moderate salivation, is advisable. One fact is, I think, tolerably well established, namely, that the cure of venereal diseases, without the aid of mercury, is much slower and less secure against relapses than by a mercurial treatment.[6] 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[7] 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 contraindicate the use of

[1] Dr. Macleod, *Lond. Med. Gaz.* xxi. 361.
[2] *Med.-Chirurg. Trans.* vols. iv. and viii.
[3] *Military Surgery.*
[4] *On Syphilis*, 1821.
[5] *Ed. Med. and Surg. Journ.* xiv.
[6] *Vide* Colles, *Practical Observations on the Venereal Disease*, p. 318.
[7] *On Venereal Diseases*, 2d edit. 1825.

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:—

αα. Scrofula.—Some of the worst and most intractable forms of 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,[1] 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.

ββ. 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.

γγ. Extreme debility with hectic fever.—This condition is usually believed to contra-indicate the employment of mercury. But Mr. Colles[2] 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."

δ. 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 Hamett, and of Messrs. Annesley, Orton, and Searle, and more recently to the writings of Dr. Ayre, of Hull, 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 in small, others in large doses; some as a purgative, others as a sedative, in combination with opium; others, again, using it as a sialogogue. It is deserving of especial notice, that, when salivation takes place, the patient in general recovers. Dr. Griffin,[3] however, has shewn that this is not invariably the case. (For further information on the use of mercurials in cholera, see *Calomel*).

ε. 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. In granular degeneration of the kidney, characterised by an albuminous condition of the urine, its use is

[1] *Op. cit.* p. 236.
[2] *Op. cit.* p. 206.
[3] *Lond. Med. Gaz.* xxi. p. 882.

highly objectionable. It is of no service to the primary disorder, while its effect on the mouth is often very violent and uncontrollable. 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.

ζ. *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. In diseased spleen they are usually injurious.

η. *In chronic diseases of the nervous system.*—Mercury has been recommended in paralysis, and on some occasions has proved exceedingly efficacious. I have repeatedly seen hemiplegia, with impaired vision and hearing, headache, and cramps of the extremities, recover under the use of mercury, after blood-letting and purgatives had failed. In one case the patient (a young man) was kept under the influence of the medicine for two months. Mr. Colles[1] has likewise found it more 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 most important diseases against which mercurials have been successfully administered as sialogogues.

HYDRARGYRUM PURUM, D.; *Pure Mercury*. (Take of Quicksilver of Commerce, lbs. iij.; Pure Muriatic Acid, f℥ss.; Distilled Water, ℥ij.: having introduced the Quicksilver into a small glass retort, over the body of which a hood of sheet iron is supported, let the heat of a gas-lamp be applied until two-thirds of the metal has distilled over. Boil this for a few minutes with the acid and water, and having by repeated affusion of distilled water and decantation removed the entire of the acid, let the metal be poured into a capsule, and dried by the application of heat.)—The characters of pure mercury have been already stated. As found in commerce, mercury is usually very pure, and therefore the process of purification directed by the Dublin College is unnecessary. By means of a common fire, mercury may be readily distilled in an earthen retort, to which a curved earthen tube, dipping into water, is adapted. A wash-hand basin, containing water, answers as a receiver. The whole of the mercury may be drawn over. The object of the process of distillation is to separate this metal from lead, tin, zinc, and other metals with which it may be contaminated.

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[1] *Op. cit.* p. 327.

168. HYDRARGYRUM CUM CRETA.—MERCURY WITH CHALK.

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

Preparation.—All the British Colleges give directions for its preparation.

The *London College* directs us to take—Of Mercury, ℥iij.; Prepared Chalk, ℥v. Rub them together until globules are no longer visible. The directions of the *Edinburgh College* are similar.

The *Dublin College* orders it to be thus prepared:—Take of Pure Mercury, ℥j.; Prepared Chalk, ℥ij. Rub the mercury and chalk in a porcelain mortar, until the metallic globules cease to be visible, and the mixture acquires an uniform grey colour.

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 it is not in the state of suboxide. 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 mechanically divided only.

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 volatilised, leaving the chalk.

Part is evaporated by heat; what remains is colourless, and corresponds in properties to prepared chalk.—*Ph. Lond.*

Composition.—It is a mechanical mixture of three parts of finely divided *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. It should be given in the form of powder. Pills made of it, and allowed to become hard, present internally large globules of mercury. This arises from the contraction of the substance used to form the pill mass, by which the minute globules are squeezed out and coalesce. 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.

169. HYDRARGYRUM CUM MAGNESIA.—MERCURY WITH MAGNESIA.

The Dublin Pharmacopœia gives the following directions for the preparation of this compound:—

Take of Pure Mercury, ℥j.; Carbonate of Magnesia, ℥ij. The method of preparation is the same as for *hydrargyrum cum cretâ*.

The effects, uses, and doses of this preparation, are similar to those of *hydrargyrum cum cretâ*.

170. PILULÆ HYDRARGYRI.—PILLS OF MERCURY.

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

PREPARATION.—The following are the directions of the British Colleges for the preparation of these pills:—

The *London College* orders of Mercury, ℥ss.; Confection of Red Rose, ʒvj.; Liquorice (root), powdered, ʒij. Rub the mercury with the confection until globules can no longer be seen; then, the liquorice being added, beat the whole together to form a mass.

The *Edinburgh College* orders of Mercury, two parts; Conserve of Red Roses, three parts; Liquorice Root, in powder, one part. Beat the mercury and conserve into a uniform mass until globules of mercury can no longer be detected; then add the liquorice powder, and heat the whole again into a proper mass, which is to be divided into five-grain pills.

The *Dublin College* gives the following formula:—Take of Pure Mercury, ℥ij.; Confection of Red Roses, ℥iij.; Liquorice Root, in fine powder, ℥j. Rub the mercury with the confection until the metallic globules are no longer visible; then add the liquorice powder, and mix the whole well together.

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.

In a circular issued by the College of Pharmacy of New York,[1] it is stated that the following mixture was imported from a manufactory in a provincial town in England, and sold as blue pill:—*Mercury* 7·5, *earthy clay* 27·0, *Prussian blue*, used in colouring, 1·5, *sand*, in combination with the clay, 2·0, *soluble saccharine matters* 34·0, *insoluble organic matters* 12, and *water* 16·0 = 100·0.

[1] *Pharmaceutical Journal*, vol. vii. p. 251, 1847.

PHYSIOLOGICAL EFFECTS.—In full doses (as from five to 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 form 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.

171. UNGUENTUM HYDRARGYRI.—OINTMENT OF MERCURY.

HISTORY.—Mercurial ointment was known to, and employed by, the ancient Arabian physicians,—for example, Abenguefit, 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.—The following are the directions for preparing the *unguentum hydrargyri*, L. E. D.

Take of Mercury, lb. j.; Lard, ℥xiss.; Suet, ℥ss. *L.* [Take of Mercury, lb. iij.; Lard, ℥xxiij.; Suet, ℥j. *E.*] First rub the mercury with the suet and a little of the lard until globules can no longer be seen; then add that which is left, to the lard, and mix, *L. E.*—The *Dublin College* uses equal parts of Purified Mercury and prepared Hog's Lard.—The *Edinburgh College* observes, that "This ointment is not well prepared so long as metallic globules may be seen in it with a magnifier of four powers."

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. The mercury in this ointment is in a finely-divided metallic state. Guibourt[1] 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. 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

[1] *Pharm. Raisonnée*, ii. 140.

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 magnifier of four powers; but when rubbed on gold it quickens it. When examined by a powerful microscope, innumerable globules are observed. In well-made mercurial ointment, these globules are not discernible by the naked eye, being from 1-500th to 1-1000th of a line in diameter.[1] I found the sp. gr. of a sample obtained from Apothecaries' Hall to be 1·7813 at 60° F. Two other samples, procured from two respectable houses, had respectively a sp. gr. of 1·6602 and 1·7603. Mercurial ointment should be kept in a moderately warm situation during the winter season, for, when exposed to great cold, the mercury separates in a liquid form by the crystallisation, I presume, of the fatty matter.

Composition.—This compound consists of equal weights of *fatty matter* and finely divided *mercury*.

Strength and Purity.—Mercurial ointment is frequently prepared with a smaller proportion of mercury than that directed to be used in the Pharmacopœias; and, in order to communicate to it the requisite shade of colour, tersulphuret of antimony, indigo, or Prussian blue, is sometimes intermixed.

In order to ascertain the strength and purity of a given sample, it is desirable to obtain a standard by way of comparison. I have always used for this purpose the ointment prepared at Apothecaries' Hall, London.

The qualities which should be attended to, in order to judge of a suspected sample, are its colour, and its appearance under a magnifier of four powers, as well as under a powerful microscope. By the latter we judge of the size of the globules, their number, and the presence of foreign particles. Its sp. gr. should then be observed. The fatty matter should afterwards be separated from the mercury, and the latter carefully weighed. This is to be effected by means of ether or turpentine. To separate completely the fatty matter, Mr. C. Watt[2] gives the following directions:—Having first melted the fatty matter with boiling water, and allowed it to stand till the greater part of it floated on the surface, pour off the fluid fat, and then boil this mercury in a dilute solution of soap [or caustic alkali] until the metal collects in one globule.

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, it 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 skin, it is capable of producing the before-mentioned constitutional effects of mercurials: and if the lard which it contains be not rancid, no obvious local effect is usually produced. Applied to ulcerated surfaces, mercurial ointment is a

[1] Ehrenberg, in Poggendorff's *Annalen*, xxiv. 40.
[2] *The Chemist*, No. xiv. Feb. 1840.

stimulant, and in syphilitic sores is oftentimes a very useful and beneficial application. [Dr. F. von Bœrensprung[1] has performed some experiments on dead and living animal membranes, to ascertain in what manner mercury enters the system when rubbed on externally in the form of ointment; and he has come to the conclusion, that the metallic mercury, as such, does not pass into the body. By analytical examination, it was found that mercurial ointment consists of peroxide of mercury, metallic mercury, and fatty matter, as asserted by Donovan and Christison, although doubted by Mitscherlich. This oxide, it is suggested by Dr. Bœrensprung, is dissolved by the free acid of the cutaneous secretion. The uncertain action of mercurial ointment is explained by the varying proportions of peroxide of the metal. In order, therefore, to obtain uniform effects, an ointment containing the peroxide should be used. Mercurial vapour, according to the same author's experiments on rabbits, proves injurious by becoming condensed and oxidised in the lungs, where absorption and symptoms of mercurialism commence.—ED.]

USES.—It is rarely or never administered *internally* in this country, but has been much used on the continent, and with great success. 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, and is rubbed into tumours of various kinds (not those of a malignant nature, as cancer and fungus hæmatodes), with the view of causing their resolution. 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 prefer 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 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.[2] Mercurial frictions 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 layer offers an impediment to absorption in proportion to its thickness). The internal parts

[1] *Pharmaceutical Journal*, 1850–51, p. 554.
[2] Colles, *op. cit.* p. 42.

of the thighs are usually, therefore, selected. However, in liver complaints, the inunctions are made in the regions of the organ affected. The occasional use of the warm bath promotes absorption when the ointment is applied to the skin.

1. CERATUM HYDRARGYRI COMPOSITUM, L.; *Compound Cerate of Mercury.* (Take of Ointment of Mercury, Soap Cerate, each ℥vj.; Camphor, ℥iss. Rub them together.)—Employed as a resolvent application to enlarged joints and indolent tumours. This preparation was introduced into the Pharmacopœia on the recommendation of the late Mr. Scott.[1]

2. LINIMENTUM HYDRARGYRI, D.; *Compound Liniment of Mercury.* (Stronger Ointment of Mercury, Lard, each ℥iv.; Camphor, ℥j.; Rectified Spirit, f℥j.; Solution of Ammonia, f℥iv. Rub the camphor first with the spirit, then with the lard and ointment of mercury; lastly, the solution of ammonia being gradually poured in, mix them all.)—It is used (by way of friction) in chronic tumours, and in chronic affections of the joints, where the object is to excite absorption. It is said to excite salivation more readily than the common mercurial ointment, owing to the camphor and ammonia.

172. EMPLASTRUM HYDRARGYRI.—PLASTER OF MERCURY.

Both the London and Edinburgh Colleges give formulæ for the preparation of this plaster.

The *London College* orders of Mercury, ℥iij.; Plaster of Lead, lb. j.; Olive Oil, f℥j.; Sulphur, grs. viij. To the heated oil add the sulphur gradually, stirring constantly with a spatula until they incorporate; afterwards rub the mercury with them until globules are no longer visible; then gradually add the plaster of lead, melted with a slow fire, and mix them all.

In this process the sulphur of the sulphurated oil unites with part of the mercury. The remainder of the metal becomes mechanically divided.

The *Edinburgh College* orders of Mercury, ℥iij.; Olive Oil, f℥ix.; Resin, ℥j.; Litharge Plaster, ℥vj. Liquefy together the oil and resin, let them cool, add the mercury, and triturate till its globules disappear; then add to the mixture the plaster previously liquefied; and mix the whole thoroughly.

The *Dublin College* gives the following formula:—Take of Pure Mercury, ℥vj.; Resin, ℥ij.; Oil of Turpentine, f℥j.; Litharge Plaster, ℥xij. Dissolve the resin in the turpentine with the aid of heat, add the mercury, and rub them together until metallic globules cease to be visible, and the mixture assumes a dark grey colour; then add the litharge plaster, previously melted, and stir the mixture constantly until it stiffens on cooling.

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[2] has seen it induce salivation.

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[1] *Surgical Observations on the Treatment of Chronic Inflammation in various Structures, particularly as exemplified in Diseases of the Joints*, Lond. 1828.

[2] *Op. cit.*

EMPLASTRUM AMMONIACI CUM HYDRARGYRO, L. D.; *Emplastrum Ammoniaci et Hydrargyri*, E.; *Plaster of Ammoniacum with Mercury.* (Ammoniacum, lb. j.; Mercury, ℥iij.; Olive Oil, f℥j.; Sulphur, grs. viij. To the heated oil gradually add the sulphur, stirring constantly with a spatula until they incorporate; then rub the mercury with them until globules are no longer visible; lastly, gradually add the ammoniacum, melted, and mix them all. *L. E.*—The *Dublin College* orders of Ammoniac Plaster, ℥iv.; Mercurial Plaster, ℥viij. Melt them together by means of a steam or water-bath, and stir constantly until the mixture stiffens on cooling.) —This compound, like the preceding, is employed especially to disperse venereal buboes. It frequently excites an eczematous eruption.

173. HYDRARGYRI SUBOXYDUM.—SUBOXIDE OF MERCURY.

Formula Hg^2O. *Equivalent Weight* 208.

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

PREPARATION.—This compound is not met with in any of the British Pharmacopœias. It may be prepared in decomposing calomel by lime water, or by solution of potash.

In both processes double decomposition takes place: 1, chloride of calcium is formed in solution, while suboxide of mercury precipitates ($Hg^2Cl + CaO = Hg^2O + CaCl$); and 2, as potash is used instead of lime, the products are chloride of potassium in solution, and suboxide of mercury precipitated ($Hg^2Cl + KO = Hg^2O, KCl$).

PROPERTIES.—Pure suboxide 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 red oxide. It is odourless, tasteless, insoluble in water and alkalies, but is soluble in nitric and acetic acids. 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 diluted nitric acid it forms a protomercurial salt, known by the before-mentioned characters for these substances.

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

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Sefström.*	*Thénard.*
Mercury	2	200	96·15	96·2	96·16
Oxygen	1	8	3·85	3·8	3·84
Suboxide of Mercury	1	208	100·00	100·0	100·00

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 red oxide had been dissolved, the potash would throw it down as a reddish or yellowish hydrate. If any carbonate of lime

had been present, the oxalate would detect the presence of lime in the solution.

Physiological Effects.—Pure suboxide 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 round 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.

Suboxide 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* (composed of one part of oxide and three parts of lard), 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.

LOTIO NIGRA; *Black Wash; Aqua Mercurialis Nigra; Aqua Phagedænica 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. Suboxide of mercury is precipitated, and chloride of calcium remains in solution. As the efficacy of the wash depends on the suboxide, the bottle must be well shaken each time that it is used. This compound is a favourite application to venereal sores of almost all kinds,—in most being serviceable, in few or none being hurtful.

174. HYDRARGYRI OXYDUM RUBRUM.—RED OXIDE OF MERCURY.

Formula HgO. *Equivalent Weight* 108.

History.—This is the *peroxide* or *binoxide of mercury* of some writers. Geber[1] describes the method of making that variety of it which is prepared by calcination, and which was formerly called *red precipitate per se* (*mercurius præcipitatus ruber per se*), or *calcined mercury* (*hydrargyrum calcinatum*). He calls it *coagulated mercury*.

Preparation.—This compound may be prepared either by precipitation or by calcination.

The *London College* gives no formula for its preparation.

The *Dublin College*, under the name of *Hydrargyri Oxydum Rubrum*, gives a formula which produces the compound usually known as *Hydrargyri Nitrico-Oxydum*. This will be presently described.

[1] *Sum of Perfection*, book i. part iv. ch. 16.

The old process consisted in keeping mercury heated to 600° in a convenient vessel for a considerable time.

The heat vapourised the mercury, which in this state attracted oxygen from the air, and formed this red or peroxide. The long neck of the vessel prevented the escape of the vapours of the newly-formed oxide.

The process was 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, it 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 very slightly soluble in water,[1] but readily soluble in both nitric and hydrochloric acids. They are decomposed and reduced by heat and solar light; the precipitated variety is more readily acted upon 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 corrosive sublimate, which may be known by the tests hereafter to be mentioned for this substance.

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

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Sefström.*	*Donovan.*
Mercury	1	100	92·59	92·68	92·75
Oxygen	1	8	7·41	7·32	7·25
Red Oxide of Mercury	1	108	100·00	100·00	100·00

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

PURITY.—Red 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 Soubeiran,[2] of $HgCl,3HgO$).

PHYSIOLOGICAL EFFECTS.—Red oxide of mercury is a powerful irritant, and, when taken internally, even in small doses, readily excites vomiting and purging: large doses excite gastro-enteritis. Orfila[3] found that the red oxide, obtained by precipitation from four grains of corrosive sublimate, killed a dog in eighteen minutes. The constitutional effects of this preparation are the same as those of mercurials generally.

USES.—Red 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 cyanide of mercury.

[1] *Journ. de Pharm.* t. xxiv. p. 252.
[2] Dumas, *Traité de Chimie*, iii. 615.
[3] *Toxicol. Gén.*

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

LOTIO FLAVA; *Lotio* (seu *Aqua*) *Phagedænica*; *Yellow* or *Phagedenic Wash*.—This compound, which was formerly in frequent use, is prepared by adding corrosive sublimate to lime-water. The proportions vary in different formulæ. The quantity of sublimate should not, I think, exceed two grains to an ounce of lime-water: the usual proportions are thirty grains to sixteen ounces of lime-water. The preparation, then, consists of the hydrated red oxide of mercury (which is precipitated), chloride of calcium, and caustic lime; the two latter being in solution. But if the quantity of corrosive sublimate exceed $3\frac{7}{10}$ grains to an ounce of lime-water, the precipitate is brown or brickdust 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 corrosive sublimate the acid.[1] Yellow or phagedenic wash is applied, by means of lint, to venereal and scrofulous ulcers. Dr. Hintze[2] used it with advantage in chronic ulcers which succeed to burns. It should be well shaken, and used in the turbid state.

175. HYDRARGYRI NITRICO-OXYDUM.—NITRIC OXIDE 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*.

Preparation.—All the British Colleges give directions for the preparation of it.

The *London College* orders of Mercury, lb. iij.; Nitric Acid, f℥xviij.; Distilled Water, Oij. Mix, and apply a gentle heat until the mercury is dissolved. Boil down the solution, and rub the residue into a powder. Put this into another very shallow vessel; then apply a slow fire, and gradually increase it until red vapour ceases to arise, *L.*

The *Edinburgh College* directs of Mercury, ℥viij.; Diluted Nitric Acid (sp. gr. 1280), f℥v. Dissolve half of the mercury in the acid, with the aid of a moderate heat; and continue the heat till a dry salt is formed. Triturate the rest of the mercury with the salt till a fine uniform powder be obtained; heat the powder in a porcelain vessel, and constantly stir it till acid fumes cease to be discharged.

The *Dublin College* orders of Pure Mercury, ℥viij.; Pure Nitric Acid, f℥iij.; Distilled Water, ℥vj. In the acid, diluted with the water, digest the mercury, using at first a very gentle heat, but, when the action has ceased, finally boiling for a few minutes; and, having decanted the solution, evaporate to dryness. Let the residuum, first reduced to powder, be transferred to a shallow cast-iron pot with a flat bottom, and loosely covered by a fire-tile lid; and in this let it be exposed to the heat of a slow fire until red vapours cease to be given off. The heat must now be withdrawn, and, when the pot has cooled, its contents should be transferred to bottles.

[The Dublin College no longer calls this the *Hydrargyri Oxydum Nitricum*, but describes it as the Hydrargyri Oxydum Rubrum, making no distinction between this oxide and that which is procured directly by keeping metallic mercury heated to near its boiling point in contact with air or oxygen.—Ed.]

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[1] Guibourt, *Journ. Chim. Méd.* iii. 377; also *Pharm. Raisonneé*, i. 563; and Soubeiran, *Nouv. Traité de Pharm.* ii. 529.

[2] *Brit. and For. Med. Rev.* April 1836.

This compound is best prepared on a 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. The reduction of the nitrate to powder is objectionable, as it diminishes the crystalline appearance of the oxide. Mr. Brande[1] 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.[2]

When quicksilver and the diluted nitric acid are digested together, the metal is oxidised at the expense of part of the acid, while binoxide of nitrogen escapes, and, combining with the oxygen of the air, becomes nitrous acid. The oxidised metal unites to some undecomposed nitric acid to form a nitrate of the suboxide. $6Hg+4NO^5=NO^2+3(Hg^2O,NO^5)$. When this nitrate is heated, decomposition takes place: the nitric acid yields oxygen to the suboxide of mercury, which thereby becomes red oxide of mercury, while nitrous acid (or its elements) escapes. $Hg^2O,NO^5=2HgO+NO^4$. Some pernitrate of mercury usually remains undecomposed, but the quantity is small. Mr. Brande states, that 100 pounds of mercury and 48 pounds of nitric acid (sp. gr. 1·48) yielded 112 pounds of nitric oxide of mercury. Hence three 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. Dr. Barker[3] 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 (see *hydrargyri oxydum rubrum*).

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.

It consists of shining red crystalline scales. Heated to full redness it evolves no nitric vapours. It is soluble in hydrochloric and in nitric acid.—*Ph. Lond.*

Entirely soluble in muriatic acid: heat decomposes it and sublimes it entirely in metallic globules, without any discharge of nitrous fumes.—*Ph. Ed.*

PHYSIOLOGICAL EFFECTS.—Its local action is that of a powerful irritant (vide *hydrargyri oxydum rubrum*). But the presence of nitrate of mercury in the nitric oxide renders its topical action more energetic. Its constitutional effects are the same as those of other mercurials.

Fabricius Hildanus, Bartholinus, Langius, and Jacobs,[4] have reported cases

[1] *Manual of Chemistry.*
[2] Dr. Barker, *Observ. on the Dublin Pharmacopœia.*
[3] *Op. cit.*
[4] Quoted by Wibmer, *Wirkung d. Arzneim.* iii. 69.

in which the external use of this agent gave rise to salivation and other constitutional effects of mercury. In the case mentioned by Jacobs, death resulted from the application of it to a wart on the face. Frederic Hoffman, Ploucquet, Girtanner,[1] and Dr. Brett,[2] 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, and indolent fungous ulcers. Mixed with eight parts of finely-powdered white sugar, it may be blown into the eye with a quill in opacity of the cornea.[3]

UNGUENTUM HYDRARGYRI NITRICO-OXYDI, L.; *Unguentum Oxidi Hydrargyri*, E.; *Unguentum Hydrargyri Oxydi Rubri*, D. (Finely-powdered Nitric Oxide of Mercury, ℥j.; White Wax, ℥ij.; Lard, ℥vj. Mix. *L.* The *Edinburgh College* employs Nitric Oxide of Mercury, ℥j.; Lard, ℥viij. The *Dublin College*—Red Oxide of Mercury, ʒj.; Ointment of White Wax, ʒvij. Reduce the oxide to a very fine powder and mix it intimately with the ointment by trituration, *D.*)—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[4] 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 eyelids (*ophthalmia tarsi*), and chronic conjunctivitis.

176. HYDRARGYRI SULPHURETUM.—SULPHURET OF MERCURY.

Formula HgS. *Equivalent Weight* 116.

Two forms of this compound are used in medicine, one crystallised or red, the other amorphous or black.

1. Hydrargyri Sulphuretum Crystallisatum vel Rubrum.—Crystallised or Red Sulphuret of Mercury.

HISTORY.—Crystallised or red sulphuret of mercury was known in the most ancient times. *Vermilion* is mentioned twice in the Old Testament;[5] Theophrastus[6] states that there are two kinds of cinnabar (κιννάβαρι, *cinnabaris*), one native, the other factitious: the first was sulphuret of mercury; the second, he says, was a scarlet sand.

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[1] Wibmer, *op. cit.*
[2] *Lond. Med. Gaz.* xiii. 117. A case of poisoning with it is also recorded in the *Lancet* for 1836–37, vol. i. p. 401.
[3] Mackenzie, *On Diseases of the Eye*, 2d edit. p. 584.
[4] *Edinb. Dispensatory.*
[5] *Jeremiah*, xxii. 14; *Ezekiel*, xxiii. 14.
[6] *De Lapidibus*, p. 399, ed. Heins. 1613; Hill's translation, 2d edit. p. 227, 1774.

Geiger[1] found it in the colouring matter of the old Egyptian tombs. It was formerly called *minium*.[2] It is sometimes termed *bisulphuret of mercury* (*hydrargyri bisulphuretum*, Ph. L.)

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

PREPARATION.—Two of the British Colleges give directions for the preparation of this compound.

The *London College* orders of Mercury, lb. ij.; Sulphur, ℥v. Melt the sulphur, add the mercury, and continue the heat until the mixture begins to swell up. Then remove the vessel, and cover it closely to prevent the mixture taking fire. When the material is cold, reduce it [the mass] to powder, and sublime it.

The process of the *Edinburgh College* is similar.

The *Dublin College* gives no process.

In this process the heat enables the mercury and sulphur to combine and form black or amorphous sulphuret of mercury. When large quantities of sulphur and mercury are heated together, a slight explosion and flame are produced. By sublimation, the black sulphuret is converted into *cinnabar*, or the red or crystallised sulphuret.[3]

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 carbonate of soda, it evolves mercurial vapour, which condenses into liquid globules of this metal. The residue, which is sulphuret of sodium, 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:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Guibourt.*	*Sefström.*	*Erdmann and Marchand.*
Mercury	1	100	86·21	86·21	86·29	86·211
Sulphur	1	16	13·79	13·79	13·71	13·789
Sulphuret of Mercury	1	116	100·00	100·00	100·00	100·004

PURITY.—Pure cinnabar is totally volatilised 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

[1] *Handb. d. Pharm.* by Liebig.
[2] Pliny, *Hist. Nat.* lib. xxxiii. cap. 38, ed. Valp.
[3] Full details respecting the Dutch method of manufacturing cinnabar are given in the *Ann. de Chim.* iv. 25; and in Aikin's *Dict. of Chemistry*, vol. ii. p. 87.

hydrosulphuric acid through it, by which a yellow precipitate (AsS^3) is obtained. Earthy impurities are not volatile.

Totally evaporated by heat; and on potash being added to it, runs into globules of mercury.—*Ph. Lond.*

"It is sublimed entirely by heat, and without any metallic globules being formed."—*Ph. Ed.*

PHYSIOLOGICAL EFFECTS.—According to Orfila[1] 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 opposed to those obtained by Smith[2] 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 sulphuret of mercury, but a mixture of the vapour of mercury (either in the metallic or oxidised state) and of sulphurous acid gas. Schenkius[3] has related the case of a young man who died from the use of this vapour, and Hill[4] saw cough, violent salivation and diarrhœa, 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 sulphuret 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 fumigation.

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.

2. Hydrargyri Sulphuretum Nigrum vel Amorphum.—Amorphous or Black Sulphuret of Mercury.

HISTORY.—Amorphous sulphuret of mercury with excess of sulphur (*hydrargyri sulphuretum cum sulphure*) is commonly called *æthiops mineral* (*æthiops mineralis*), and is usually known in the shops as the *black sulphuret of mercury* (*hydrargyri sulphuretum nigrum*).

It is stated that the Chinese used it long before it was known to Europeans. Harris, in 1689, first taught the method of preparing it by trituration.[5]

PREPARATION.—The British Colleges give no directions for the preparation of this compound. It is no longer an article of the Materia Medica.

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

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[1] *Archiv. Gén. de Méd.* xix. 330.
[2] Christison, *Treat. on Poisons*, 3d edit. 395.
[3] *Observ.* L. vii.
[4] *Edinb. Med. Essays*, iv.
[5] [Instead of rubbing the sulphur and mercury together in a mortar, it has been lately recommended to prepare this compound by shaking the materials together in a bottle (*Pharmaceutical Journal* for 1849, p. 492).—ED.]

Characteristics.—By boiling in caustic potash liquor, we obtain a solution of sulphuret of potassium. The residue is black, but possesses all the before-mentioned chemical characteristics of cinnabar.

COMPOSITION.—If this compound be, as Mr. Brande[1] supposes, a mixture of sulphuret of mercury and sulphur, the proportions must be—

	Per Cent.
Sulphuret of mercury	58
Sulphur	42
Hydrargyri Sulphuretum cum Sulphure	100

PURITY.—Free mercury may be detected by its communicating a white stain to gold. Charcoal may be detected by its not volatilising by heat. Animal charcoal, by this character, as well as by the presence of phosphate of lime in the residue. Tersulphuret of antimony may be recognised by boiling in hydrochloric acid, and applying the before-mentioned tests for terchloride of antimony.

PHYSIOLOGICAL EFFECTS.—According to the experiments of Orfila, this preparation, like the last, possesses, little or no activity. The late Dr. Duncan[2] 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.

177. HYDRARGYRI SULPHATES.—SULPHATES OF MERCURY.

There are probably four compounds of sulphuric acid with the oxides of mercury.

Sulphate of the Suboxide of Mercury	Hg^2O,SO^3
Tribasic Sulphate of the Oxide of Mercury	$3HgO,+SO^3$
Sulphate of the Oxide of Mercury	HgO,SO^3
Supersulphate of the Oxide of Mercury	HgO,xSO^3 (?)

Of these, two only will require separate notice here—namely, the second and third.

1. Hydrargyri Subsulphas Flavus.—Yellow Subsulphate of Mercury.

Formula $3HgO,SO^3$. *Equivalent Weight* 364.

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 or action to the root of the *Ipomœa Turpethum*. It has been known by various other names; as the *tribasic sulphate of the oxide* (or peroxide) *of mercury*, the *subpersulphate of mercury*, or the *hydrargyri oxydum sulphuricum*.

[1] *Manual of Pharmacy*, 3d edit. 329.
[2] *Edinburgh Dispensatory*.

By the action of warm water on the persulphate of mercury there are obtained a soluble supersulphate and difficultly-soluble subsulphate of mercury.

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 or peroxide of mercury is precipitated, and a solution of sulphate of potash is obtained, known to be a sulphate by chloride of barium.

COMPOSITION.—Its composition is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Kane.*	*Geiseler.*
Oxide (or Peroxide) of Mercury	3	324	89·01	88·90	88·41
Sulphuric Acid	1	40	10·99	10·95	11·34
Yellow Subsulphate of Mercury	1	364	100·00	99·85	99·75

PHYSIOLOGICAL EFFECTS.—In small quantities it occasions nausea, vomiting, and ptyalism. Taken into the nostrils, it excites sneezing, and sometimes salivation. Stenzel[1] 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.[2] 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).

ADMINISTRATION.—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.

2. Hydrargyri Persulphas.—Persulphate of Mercury.

Formula HgO,SO^3. *Equivalent Weight* 148.

Sulphate of the Peroxide of Mercury; Bipersulphate of Mercury; Hydrargyri Sulphas, D.—This preparation is not used in medicine either as an internal or external remedy; but in pharmacy it serves for the preparation of several other mercurial compounds; as calomel, corrosive sublimate, and subsulphate of mercury.

The *Dublin College* gives the following formula for its preparation:—Take of Quicksilver of commerce, ℥x.; Sulphuric Acid, f℥vj. Place the quicksilver and oil of vitriol in a porcelain capsule, and apply heat until effervescence ceases, and nothing remains but a white and dry salt.

The *London* and *Edinburgh Colleges* give directions for the preparation of this compound, in the processes for the manufacture of calomel and corrosive sublimate.

This salt is an opaque, white solid. It becomes orange-coloured at a dull red heat, but white on cooling: at a full red heat it is decomposed. It is decomposed by water, which resolves it into a basic salt (turpeth mineral) and a supersalt.

[1] Wibmer, *Wirk. d. Arzneim.* iii. 66.
[2] Barker, *Observ. on the Dublin Pharmacopœia.*

178. HYDRARGYRI SUBCHLORIDUM.—SUBCHLORIDE OF MERCURY OR CALOMEL.

Formula Hg^2,Cl. *Equivalent Weight* 235·5.

HISTORY.—Beguin in 1608, and Oswald Croll in 1609, are the first Europeans who mention this compound. Mr. Hatchett[1] 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 καλὸς, *good*, and μέλας, *black*) was first used by Sir Theodore Turquet de Mayenne[2] (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 *chloride, subchloride*, or *protochloride of mercury*, are some of the more modern synonymes of it.

One of the inconveniences attending the alteration of the atomic weight is, that the name (*chloride of mercury*), formerly applied to calomel, is now transferred to corrosive sublimate. This is one of the evils necessarily attendant on the adoption of scientific language in pharmacy.

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

PREPARATION.—All the British Colleges give directions for the preparation of this salt (*Hydrargyri Chloridum*, L.; *Calomelas*, D.)

The *London College* orders of Mercury, lb. iv.; Sulphuric Acid, ℥xxiss.; Chloride of Sodium, lb. iss.; Distilled Water, as much as may be sufficient. Boil two pounds of the mercury with the sulphuric acid in a proper vessel, until the bipersulphate of mercury remains dry; rub this when it is cold with (the remaining) two pounds of mercury in an earthen mortar, that they may be perfectly mixed. Afterwards add the chloride of sodium, and rub them together until globules are no longer visible; then sublime. Rub the sublimate to very fine powder, and wash it carefully with boiling distilled water, and dry it.

The *Edinburgh College* directs of Mercury, ℥viij.; Sulphuric Acid (commercial), f℥ij. and f℥iij.; Pure Nitric Acid, f℥ss.; Muriate of Soda, ℥iij. Mix the acids, add four ounces of the mercury, and dissolve it with the aid of a moderate heat. Raise the heat so as to obtain a dry salt. Triturate this with the muriate of soda and the rest of the mercury till the globules entirely disappear. Heat the mixture by means of a sand-bath in a proper subliming apparatus. Reduce the sublimate to fine powder; wash the powder with boiling distilled water until the water ceases to precipitate with solution of iodide of potassium; and then dry it.

The *Dublin College* gives the following formula:—Take of Sulphate of Mercury, lb. x.; Mercury of commerce, lb. vij.; Dried Chloride of Sodium, lb. v. Incorporate as completely as possible the sulphate and the metallic mercury by prolonged trituration, and, having then added the chloride of sodium, previously reduced to a fine powder, rub all well together until a perfectly equable mixture is obtained. Heat this through the medium of sand, in a shallow iron pot with a flat bottom, lined with clay, and covered with a lid of cast iron, until the sublimate, which attaches itself to a circular plug in the centre of the lid (which admits of being removed and cleaned from time to time), neither exhibits minute globules of mercury, nor is rendered yellow by being touched with a solution of

[1] Brande's *Manual of Pharmacy*, 2d edit. 328.

[2] *Annals of Philosophy*, vol. ii. N. S. p. 427. See also the old series of this journal, vol. xvi. pp. 309, 394, and 426.

caustic potash. The whole being now permitted to cool down to the temperature of the air, the contents of the pot are to be transferred to a small hot hearth or oven, whose door is made tight by a clay lute, and a regulated heat is to be applied so as to cause the vapourised calomel to pass into an adjacent chamber of considerable size, on the floor of which it will accumulate in the form of a fine white powder.

The London College directs the persulphate to be prepared by the action of oil of vitriol on mercury. One equivalent of mercury decomposes an equivalent of sulphuric acid, and abstracts an equivalent of oxygen, to form one equivalent of oxide of mercury, disengaging an equivalent of sulphurous acid. The oxide combines with an equivalent of undecomposed sulphuric acid, and forms one equivalent of persulphate of mercury. $Hg + 2SO^3 = HgO,SO^3 + SO^2$. When one equivalent of persulphate of mercury, one of metallic mercury, and one of chloride of sodium, are intimately mixed and sublimed, the products are one equivalent of sulphate of soda and one of calomel. $HgO,SO^3 + Hg + NaCl = Hg^2Cl + NaO,SO^3$.

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, and from 95 to 100 lbs. of sublimed calomel are obtained. 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 a 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,[1] 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 requires only 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.

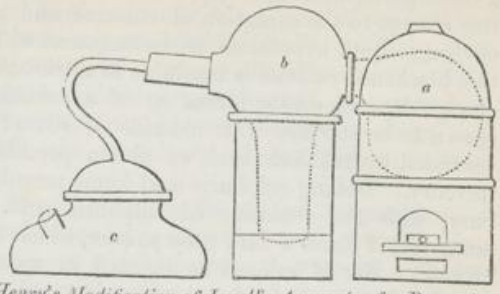
"The above circumstances, too, account for the various appearances under which calomel occasionally presents itself in commerce: it may be added, that the buff aspect of this substance indicates the absence of corrosive sublimate, though it by no means follows as a consequence that when snow-white it 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."[2]

Mr. Jewell's process[3] for preparing calomel consists in keeping the receiving vessel filled with steam, so that the vaporous calomel is condensed in it, and takes

[1] Brooke, *Annals of Philosophy*.
[2] *Manual of Chemistry*, 4th edit. p. 788.
[3] *Repert. of Arts*, xiii. 79, 2d series.

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. 144).

FIG. 144.



Henry's Modification of Jewell's Apparatus for Preparing Calomel by Steam (hydrosublimate of mercury).

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 communicating with the retort, a second dipping into water in an earthen jar, and a third connected to a steam-pipe.
c. Steam-boiler.

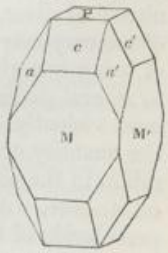
Soubeiran[1] has proposed to modify this process, by substituting a current of air for the vapour of water; a modification which Mr. Calvert[2] states is identical with that already in use in some manufacturing houses in England. The apparatus is an iron cylinder closed at one extremity by a door through which the materials are introduced: the other extremity has a kind of neck attached to it.

2. Another method of preparing calomel is by precipitation. Thus when solutions of nitrate of suboxide of mercury and of chloride of sodium are mixed, double decomposition takes place; nitrate of soda is formed in solution, while dichloride of mercury, or calomel, is precipitated. "If this process be carefully performed, and the precipitate thoroughly edulcorated, the calomel is said to be sufficiently pure; but a small portion of chloride of sodium is apt to remain combined with it, which might affect its medical uses." (Brande.)

3. The late Dr. A. T. Thomson[3] took out a patent for the formation of both calomel and corrosive sublimate, by the direct union of chlorine gas and the vapour of mercury.

PROPERTIES.—The crystals of calomel are square prisms. 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 and tasteless powder, whose specific gravity is 7·140 (Boullay), 7·156 (Pelouze and Fremy). When prepared by Jewell's process, it is perfectly white, but when obtained in the ordinary way, it has a light buff or ivory tint. It volatilises by heat, and, under pressure, fuses. It is insoluble in cold water and alcohol. According to Donovan[4] and others,[5] calomel suffers partial decomposition by long boiling in water, and a solution is obtained which contains mercury and chlorine (corrosive sublimate?).

FIG. 145.



Crystal of Calomel.

By exposure to light, calomel becomes dark coloured, in consequence, according to Dumas,[6] of the transformation of

[1] *Chemical Gazette*, vol. i. p. 210, 1843.
[2] *Ibid.* vol. i. p. 270, 1843.
[3] *Ibid.* vol. i. p. 223, 1843.
[4] *Ann. Phil.* xiv. 323.
[5] Gmelin, *Hanb. d. Chemie*, i. 1299; Geiger's *Handb. d. Pharm.* by Liebig, i. 561.
[6] *Traité de Chimie*, iii. 605.

a small portion into mercury and corrosive sublimate. 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,[1] that this blackened calomel is insoluble in nitric acid. Is it not probable that the change depends on the formation of a subchloride (Hg^4Cl?), as Wetzlar has shown to be the case with chloride of silver? By digestion in hot and concentrated hydrochloric acid, we obtain perchloride of mercury and reguline mercury. Boiling sulphuric acid forms persulphate and perchloride of mercury, with the evolution of sulphuric acid. When calomel absorbs dry ammonia, it forms a dark grey powder, which is $2Hg^2Cl,NH^3 = 2Hg^2Cl,HAd$. (Kane.) But if calomel be digested in water of ammonia, one-half of its chlorine is converted into sal ammoniac, and a dark grey powder (called by Kane *black precipitate*) results, which is a compound of subchloride and subamidide of mercury; $Hg^2Cl + Hg^2Ad$.

Characteristics.—Heated in a glass tube by a spirit lamp it is volatilised, and yields a white sublimate. Mixed with soda-flux, and heated, it yields a sublimate of metallic liquid globules: thus showing it to be a mercurial compound. By the action of lime-water it yields a blackish-grey precipitate (Hg^2O): if to the supernatant liquor an excess of nitric acid be added, there is obtained, on the addition of nitrate of silver, a white precipitate ($AgCl$). Protochloride of tin decomposes it: the products are bichloride of tin and globules of metallic mercury. [It is insoluble in water, alcohol, and ether.—ED.]

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

	Atoms.	Eq. Wt.	Per Cent.	Turner, Davy, Zabouda.		Vols.	Sp. Gr.
Mercury	2	200·0	84·92	85	Mercurial Vapour	1	6·976
Chlorine	1	35·5	15·08	15	Chlorine Gas	½	1·237
Subchloride of Mercury	1	235·5	100·00	100	Vapour of Calomel	1	8·213

PURITY.—When pure, calomel is completely vaporised by heat. Water or alcohol which has been digested on it, should give 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 perchloride of mercury may be inferred. I have met with calomel which, in consequence of being imperfectly washed, contained corrosive sublimate 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 sublimate 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 perchloride of mercury.

A whitish powder, which is volatile by heat. On the addition of potash it becomes black, and then, when heated, runs into globules of mercury. The distilled water with which it has been washed, or in which it has been boiled, gives no precipitate with nitrate of silver, lime-water, nor hydrosulphuric acid.—*Ph. Lond.*

Heat sublimes it without any residuum: sulphuric ether agitated with it, filtered, and then evaporated to dryness, leaves no crystalline residuum, and what residuum may be left is not turned yellow with aqua potassæ.—*Ph. Ed.*

[1] Langrebe, *Ueber das Licht*, 87.

PHYSIOLOGICAL EFFECTS. *α. On Animals.*—Wepfer,[1] Viborg, Flormann,[2] Gaspard,[3] and Annesley,[4] 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.

β. On Man.—Calomel may be ranked among the milder 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 milder than most of the other salts of mercury. Introduced into the stomach through a permanent artificial opening caused by a gun-shot wound, Dr. Beaumont found that twelve grains of calomel caused commotion, slight nausea, and the secretion of a white frothy fluid running at the aperture like fermenting beer from a bottle.[5] Swallowed 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.[6] The green stools (called *calomel stools*) which sometimes follow the administration of calomel to children, are usually supposed to arise from the action of this medicine on the liver; though Zeller (quoted by Kraus) thinks that the colour depends on alterations produced in the condition of the blood; and Kraus[7] is disposed to refer it to the operation of calomel on the milk contained in the alimentary canal.[8] But the same coloured stools are frequently observed when no mercury has been used, and there does not appear to me to be any just ground for ascribing it to calomel.[9] [Dr. Michea,[10] of Paris, has recently endeavoured to ascertain, by chemical analysis, whether the green colour of

[1] *Hist. Cicutæ Aquat.*
[2] Wibmer, *Wirk. d. Arzn.*
[3] Magendie, *Journ. de Physiol.*
[4] *Diseases of India.*
[5] *Experiments and Observations on the Gastric Juice and the Physiology of Digestion*, p. 182. Edinb. 1838.
[6] To this statement exceptions are frequently observed. The following is an instance of the occasional violence of the action of calomel on children. The late Dr. Thomas Davies attended, with the late Mr. Edwin Quekett, a boy of four years old, labouring under peritonitis. One grain of calomel was directed to be administered three times a day; and an aperient dose of calomel and jalap was given. On the fourth day its employment was stopped, in consequence of its violent action. The cheeks were enormously swollen, the gums sloughed, necrosis of the alveolar process of the lower jaw on each side occurred, and portions of bone, with the teeth, came away. The child ultimately recovered in about twelve months; but the jaws cannot be separated, and the patient is now obliged to suck his food through the apertures left by the loss of bone.
[7] *Heitmittellehre*, 161.
[8] See also a paper *On the Effects of Calomel in producing Slimy Stools*, in the *Lond. Med. and Surg. Journ.* April 1829, p. 344.
[9] The so-called *calomel stools* have been analysed both by Simon (*Animal Chemistry*, vol. ii. p. 386) and by Dr. Golding Bird (*Ibid.*; also *Lond. Med. Gaz.* Sept. 5, 1845): the results furnish no evidence of the supposed calomel origin of the stools. No mercury was recognised in them: Simon expressly states, that his attempts to detect mercury proved unsuccessful. These negative results favour the opinion given in the text, that the green colour of the stools is not dependent on the calomel.
[10] *Lancet*, 1849, vol. i. p. 15, quoted from *L'Union Médicale.*

the motions following purgative doses is dependent upon an increased secretion of bile caused by the action of the medicine. On this question there is a great variety of opinion. M. Mialhe considers that the calomel really excites increased secretion of bile. Others, as the late Dr. Golding Bird and Professor Schönbein, think the green colour to be due to an alteration of hæmatosine. M. Michea began a series of analyses upon—1, the spontaneous alvine dejections of healthy men; 2, the dejections of a more or less green colour from men affected with gastro-intestinal inflammation; 3, the same resulting from various doses of calomel; 4, evacuations produced by neutral salts and resinous purgatives. These were tested with strong nitric acid. Dr. Michea concludes, from his experiments and observations, that calomel exerts a special and direct action on the liver, causing an increased secretion of bile. This influence, however, is uncertain. Green evacuations, consisting of the altered bile, are more frequent in men than women, owing, he supposes, to the greater quantity of chlorides generated in the stomachs of men, and which change the chloride into bichloride. Neutral salts and resinous purgatives were not found to increase the quantity of bile.—ED.]

Like other mercurials, calomel 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[1] 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 three months afterwards he became affected by chronic vomiting, the consequence of a scirrhous 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, it 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[2] has reported a case in which a few grains of calomel, taken as a laxative, caused death; Vagnitius[3] saw fifteen grains prove fatal; and Ledelius[4] half an ounce. Fr. Hoffman has also related two fatal cases.[5]

"Whytt, Odier, Quin, Wibmer, Leib, and others," says Gölis,[6] "gave calomel internally in far larger doses; as two, three, or 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 effects 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 these large and long-continued doses of calomel, the hydrocephalic symptoms suddenly vanish, and inflammation of the intestines arise, which

[1] Gräfe and Walther's *Journal*, Bd. ii. H. 3, S. 432, quoted by G. A. Richter, *Ausführ. Arzneim.* v. 492.
[2] Wibmer, *op. cit.* iii. 71.
[3] *Ibid.*
[4] *Ibid.*
[5] *Ibid.*
[6] *Treatise on the Hydrocephalus Acutus*, by Dr. Gooch.

terminated in death. Still oftener I observed this unfavourable accident from an incautious use of calomel in croup: namely, where all the frightful symptoms of this tracheal inflammation, which threatened suffocation, suddenly vanish, and enteritis develope 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 the medicine producing what she considered to be a sufficient effect; and in the *India Journal of Medical Science*[1] is the 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[2] is the case of a lady, who by mistake swallowed 14 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 or 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,[3] 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,[4] 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 Hos-

[1] *Lond. Med. Gaz.* xviii. 484.
[2] Quoted by Wibmer, *op. cit.* 72.
[3] *Lond. Med. Gaz.* xxii. 611.
[4] *Treatise on Poisons.*

pital 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), 30⅓ 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[1] 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 to be irreconcileable. Dr. Christison, however, suggests that in those cases in which violent effects occurred, the calomel might contain corrosive sublimate.

[On the other hand, some practitioners assert that, as the result of their experience, the curative effects of calomel in Asiatic cholera are observed when small doses are given at frequent intervals. Dr. Ayre in 1832, and at each subsequent epidemic appearance of cholera, has strongly urged the use of small and repeated doses of calomel. In a series of letters to the President and College of Physicians,[2] Dr. Ayre repeats his conviction, that, as the result of long experience, his plan is the best yet adopted for the treatment of this disease. Calomel alone is relied upon by him. It is given in the form of pills, containing one or two grains each, at intervals of ten or fifteen minutes, during the stage of collapse. In the premonitory stage of diarrhœa it is given in still smaller doses, with or without the tenth or twelfth part of a grain of opium.—ED.]

Mr. Annesley[3] 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 choledochus* 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 which are 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

[1] *Lond. Med Gaz.* xviii. 880.
[2] *Lancet*, 1854.
[3] *Diseases of India.*

combination with other drastic purgatives—such as jalap, scammony, or compound extract of colocynth, the activity of which it very much promotes. We employ it for this purpose when we are desirous of relieving affections of other organs, on the principle of counter-irritation. Thus in threatened apoplexy, in mental disorders,[1] 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. Sametimes 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. Dr. Griffin[2] asserts that calomel proved a most successful medicine in cholera, controlling or arresting its progress in 84 cases out of 100, when administered while the pulse was perceptible at the wrist; but that, on the contrary, it proved detrimental when given in collapse. The practice was tested in 1,448 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 stated that mercurials generally are employed: with the view of preventing irritation of the alimentary canal, it is usually given in combination with opium, unless the existence of some affection of the nervous system contraindicates the use of narcotics. This combination is employed in peripneumonia, pleuritis, croup, laryngitis, hepatitis, enteritis, and other inflammatory diseases: in fever, syphilis, and chronic visceral diseases.

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[3] 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 blennorrhœa. 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 several forms of chronic skin diseases.

ADMINISTRATION.—When used as an *alterative*, it is given in doses of from half a grain to a grain, frequently combined with oxysulphuret of anti-

[1] *Lond. Med. Gaz.* iii. 692.
[2] *Ibid.* xxi. 880.
[3] *Ibid.* xxii. 397.

mony (as in *Plummer's Pill*) 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 are given usually in combination with, or followed by, the use of other purgatives, especially jalap, senna, scammony, or colocynth. As a *sialogogue*, it is exhibited in doses of one to three or four grains, generally combined with opium or Dover's powder, twice or thrice a day. As a *sedative*, the dose is from a scruple to half a drachm or more. Biett[1] 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 proportionally larger doses than to adults. Salivation is a rare occurrence in them: indeed, Mr. Colles[2] asserts, that mercury *never* produces ptyalism, swelling or ulceration of the gums, in infants; but this is an error.

1. PILULA HYDRARGYRI CHLORIDI COMPOSITA, L.; *Pilulæ Calomelanos compositæ*, E. D.; *Compound Calomel Pills.* (Calomel; Oxysulphuret of Antimony, each ʒij.; Guaiacum, powdered, Treacle, of each ℥ss. Rub the calomel with the oxysulphuret of antimony, afterwards with the guaiacum and the treacle, until incorporated, *L.*—The *Edinburgh College* uses of Calomel, and Golden Sulphuret of Antimony, of each, *one part;* Guaiac, in fine powder, and Treacle, of each *two parts;* the pill-mass is ordered to be divided into six-grain pills.—The *Dublin College* employs of Calomel, Precipitated Sulphuret of Antimony, of each ʒj.; Guaiacum Resin, in powder, ʒij.; Castor Oil, fʒj. Triturate the calomel with the antimony, then add the resin and the oil, and beat the whole into a uniform mass).—This compound is commonly known as *Plummer's pill* (*pilulæ Plummeri*) having been admitted into the Edinburgh Pharmacopœia at his recommendation. Calomel and precipitated tersulphuret of antimony mutually but slowly react on each other; and the ultimate products are sulphuret of mercury and terchloride of antimony. In the dry state, and mixed with other ingredients, this change is retarded. 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. [One grain of calomel is contained in six grains of the London and Edinburgh, and in five grains of the Dublin preparation.—ED.] The dose is from five to ten grains.

2. PILULÆ CALOMELANOS ET OPII, E.; *Calomel and Opium Pills.* (Calomel, *three parts;* Opium, *one part;* Conserve of Red Roses, *a sufficiency.* Beat them into a proper mass, which is to be divided into pills, each containing two grains of calomel).—Each pill contains two-thirds of a grain of opium. It is a valuable compound in rheumatism and various other inflammatory diseases. Dose, one or two pills. If ptyalism be required, one pill may be repeated three times daily.

3. UNGUENTUM HYDRARGYRI CHLORIDI; *Calomel Ointment.* (Calomel,

[1] *Lond. Med. Gaz.* viii. p. 540.
[2] *Pract. Observ.* 281.

ʒj.; Lard, ℥j.)—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.

4. **PILULÆ CATHARTICÆ COMPOSITÆ**, Ph. of the United States. *Compound Cathartic Pills.* (Compound Extract of Colocynth, ℥ss.; Extract of Jalap, in powder; Calomel, of each, ʒiij.; Gamboge, in powder, ℈ij. 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.[1] Each pill contains one grain of calomel. Three pills are a full dose.

179. HYDRARGYRI PERCHLORIDUM.—PERCHLORIDE OF MERCURY.

Formula HgCl. *Equivalent Weight* 135·5.

HISTORY.—We have no account of the discovery of this preparation. Geber[2] 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, bichloride, hydrochlorate, muriate* or *oxymuriate of mercury* (*hydrargyri chloridum, bichloridum*, L., *hydrochloras, murias* vel *oxymurias*), *corrosive sublimate* (*sublimatus corrosivus*, E., *sublimatum corrosivum*, D.), *corrosive muriate of mercury* (*hydrargyri murias corrosivus*), and *acidum chlorohydrargyricum.*

PREPARATION.—There are several methods of obtaining it. Of these two only will require notice.

1. By subliming a mixture of persulphate of mercury and common salt.

The *London College* orders of Mercury, lb. ij.; Sulphuric Acid, f℥xxiss.; Chloride of Sodium, lb. iss. Boil down the mercury with the sulphuric acid in a proper vessel, until dry bipersulphate of mercury remains; rub this when it is cold with the chloride of sodium in an earthen mortar; then sublime with a heat gradually raised.

The *Edinburgh College* directs of Mercury, ℥iv.; Sulphuric Acid (commercial), f℥ij. and f℥iij.; Pure Nitric Acid, f℥ss.; Muriate of Soda, ℥iij. Mix the acids; add the mercury; dissolve it with the aid of a moderate heat; then raise the heat so as to obtain a dry salt. Triturate this thoroughly with the muriate of soda; and sublime in a proper apparatus.

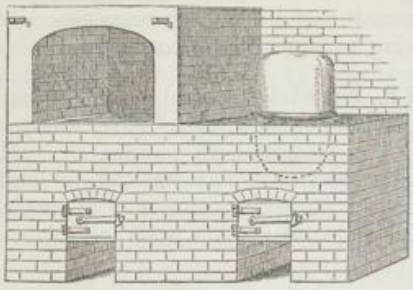
The *Dublin College* gives a separate formula for the preparation of the bipersulphate of mercury (*Hydrargyri Sulphas*, D.) (See *ante, Hydrargyri Persulphas*, p. 918.)

Take of Sulphate of Mercury, lb. x.; Dried Chloride of Sodium, lb. v. Reduce each salt to a fine powder, and, having mixed them carefully by trituration in a mortar, let the mixture be introduced into an iron pot lined with clay, and by a regulated heat, applied through the intervention of sand, let the corrosive sublimate be sublimed into an earthen head placed over the pot, and connected to it by means of lute. The product should be preserved in an opaque bottle.

Sulphate of mercury is usually prepared by submitting the sulphuric acid and mercury to heat in an iron pot, set in brickwork, over a proper fire,

[1] *United States Dispensatory.*
[2] *Inv. of Ver.* viii. 252.

FIG. 146.



Furnaces for the Preparation of Corrosive Sublimate.

a. Furnace for the preparation of the persulphate of mercury. When the operation is going on, an iron plate is suspended in front of the hood, to prevent the escape of vapour.
b. Furnace for the sublimation of the perchloride.

and under a hood or chimney to carry off the vapour of sulphurous acid (fig. 146 *a*).

The mixture of sulphate and common salt is subjected to sublimation in an earthen alembic placed in sand contained in an iron pot; or in an iron pot lined with clay, and covered by an inverted earthen pan (as in fig. 146 *b*). The same pot, with a different head, may be used in the preparation of calomel.

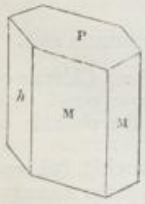
The nature of the changes which occur in the manufacture of persulphate of mercury have been already explained.

When this salt is sublimed with chloride of sodium, double decomposition takes place, and we obtain perchloride of mercury and sulphate of soda, $HgO,SO^3 + NaCl = HgCl + NaO,SO^3$.

2. Perchloride of mercury may also be procured by the direct union of its constituents, chlorine and mercury. The late Dr. A. T. Thomson[1] took out a patent for this process.

PROPERTIES.—As usually met with in commerce, perchloride 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 form is the right rhombic prism. Their specific gravity is about 5·2 (5·14 to 5·42, Liebig). The taste of this salt is acrid, coppery, and persistent. When heated in a tube it fuses, boils, and volatilises: the vapour is very acrid. [If heated on platina foil, or on a slip of mica, it is, if pure, entirely sublimed.—ED.] 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 it is sometimes employed to remove it from organic mixtures.

FIG. 147.



Crystal of Perchloride of Mercury.

An aqueous solution of perchloride 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 perchloride of mercury. This precipitate is slightly soluble in water, and consists, ac-

[1] *Chemical Gazette*, vol. i. p. 223, 1843.

cording to Lassaigne,[1] of albumen, 93·45, and perchloride of mercury, 6·55. But, according to the experiments[2] of Rose, Geoghegan, Mulder, Marchand, and Elsner, it consists of from 10·278 to 11·192 of oxide of mercury, and from 89·722 to 88·808 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.

A solution of perchloride of mercury possesses some of the characters of an acid. Thus its solution reddens litmus, and it unites with the chlor-bases (as chloride of sodium), forming the double salts called *hydrargyro-chlorides*. Litmus which has been reddened by a solution of perchloride of mercury has its blue colour restored by chloride of sodium.

Characteristics.—Perchloride of mercury is recognised by the following characters:—

α. *Heated* in a tube by a spirit lamp, with caustic, or the carbonated fixed alkalies, an alkaline chloride is formed, oxygen, and, if a carbonate be used, carbonic acid gas is evolved, and metallic mercury is sublimed and condensed in the form of globules on the sides of the tube. [The fused residue in the tube, if dry carbonate of soda be used, is chloride of sodium. This may be dissolved in water acidulated with nitric acid, and then tested by nitrate of silver. In this way the presence of chlorine as the combining ingredient of the mercury is established.—ED.]

β. *Lime-water* causes a lemon-yellow precipitate (*hydrated red oxide of mercury*). The supernatant liquid, acidified with nitric acid, yields with nitrate of silver a white precipitate (AgCl) insoluble in excess of nitric acid. If the perchloride be in excess, the precipitate is brick-red (*oxichloride of mercury*, HgCl,3HgO).

γ. *Caustic ammonia*, added to a solution of the perchloride, causes a white precipitate (*chloro-amidide of mercury*, HgCl,HgAd=Hg^2,Cl,NH^2).

δ The *alkaline mono-carbonates* throw down a brick-red precipitate (HgCl,3HgO); the *alkaline bicarbonates* cause opalescence, but no immediate precipitate; in a few minutes, however, a dark-reddish precipitate (HgCl,3HgO) is formed.

ε. *Iodide of potassium* occasions a scarlet precipitate (HgI) soluble in excess, either of iodide of potassium, or of perchloride of mercury; the precipitate frequently appears at first of a yellow colour, though it quickly becomes scarlet.

ζ. *Protochloride of tin* added in excess to perchloride of mercury causes first a white precipitate (*calomel*), and afterwards a greyish powder, composed of reguline mercury, which falls down in a finely divided state. $HgCl+SnCl=Hg+SnCl^2$.

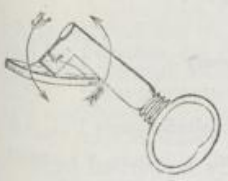
η. *Hydrosulphuric acid* in excess passed through a solution of perchloride of mercury, occasions a black precipitate (HgS). If the perchloride be in excess, a white precipitate (*chloro-sulphuret of mercury*, 2HgS,HgCl) is obtained.

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

ι. *Albumen* causes a white precipitate when added to a solution of corrosive sublimate.

κ. *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 and the solution: an electric current is immediately produced, the perchloride 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. 148, and the arrows point out the direction of the electric current. The silver stain left on the gold is readily removed by heat. [The same result is produced by placing the solution on

FIG. 148.



[1] *Journal de Chim. Méd.* iii. 2e sér. 161.

[2] Sobernheim, *Physiologie der Arzneiwirkungen*, p. 67, 2te Aufl. 1843.

a piece of polished copper foil, slightly acidulating it with dilute hydrochloric acid, and then touching the copper, through the solution, with a slip of zinc. Mercury is instantly deposited.

The tests upon which reliance can be placed for the detection of *mercury* as a poison, in water or organic liquids, are few and simple in their application. If *corrosive sublimate* be dissolved in a liquid, we may mix this liquid in a bottle with its volume of ether; agitate the vessel for a few minutes, then pour the ethereal portion of the liquid into a watch or dial glass, and allow it to evaporate spontaneously. If corrosive sublimate be present, there will be a residue of fine white prismatic crystals on the watch glass. This residue may be examined by the microscope, and also chemically by touching the crystalline deposit with a glass rod dipped in a moderately strong solution of iodide of potassium. The production of a scarlet colour will indicate that the crystals are those of a persalt of mercury; and the presence of chlorine may be readily detected by the processes described in the text.

The detection of *mercury* in the liquid is readily effected by the following process:—Acidulate the liquid with hydrochloric acid, warm it, and then immerse in it a piece of fine copper gauze, such as is used in Reinsch's process for the separation of arsenic. If the copper gauze be tarnished, it should be washed in water and ether, dried and heated in a small tube, when, should the tarnish have been caused by mercury, silvery globules, white by reflected and opaque by transmitted light, will be apparent. If there be any difficulty, owing to the smallness of the sublimate, in determining whether it consists of globules of mercury or not, the following corroborative test may be resorted to:—Cut off the ring of glass holding the sublimate, break it up, and heat it in a wide tube by the aid of a sand bath in a few drops of nitro-hydrochloric acid. Evaporate to dryness. A crystalline sublimate will appear on the glass (corrosive sublimate), the nature of which may be determined by touching the crystals with a rod dipped in a solution of iodide of potassium. If the crystals be owing to corrosive sublimate produced by the action of the mixed acids on the globules of metallic mercury, the brilliant scarlet colour of iodide of mercury will be immediately apparent.

Another process for the galvanic separation of mercury by gold and zinc is given under AURUM, *post*.

The separation of mercury alone does not prove the presence of corrosive sublimate; but if this poison has been really taken, there will be evidence of the fact in the nature of the symptoms and post-mortem appearances.

Another mode of detecting mercurial salts, whether in substance or solution, has been lately proposed by Mr. Morgan.[1]

If a strong solution of iodide of potassium be added to a minute portion of any of the salts of mercury placed on a clean bright plate of copper, the mercury is immediately deposited in the metallic state, appearing as a silvery stain on the copper, which cannot be mistaken, as no other metal is deposited by the same means. By this method corrosive sublimate may be detected in a solution, unaffected by caustic potash or iodide of potassium. The two-hundredth part of a grain of calomel, or the four-hundredth part of a grain of peroxide of mercury, may be detected by this means.

The advantages of this test are:—1st, its delicacy, inferior only to the galvanic test of zinc and gold; 2nd, its easy application, and its certainty. If applied to a solution the latter must be concentrated; for instance, although it will detect 1000th of a grain in a drop of water, it will not do so in a drachm. We do not find that this process for separating mercury possesses any advantages over that above recommended.—ED.]

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

	At.	*Eq. Wt.*	*Per Ct.*	*Turner.*		*Vols.*	*Sp. Gr.*
Mercury	1	100	73·8	73·53	Vapour of mercury	1	6·97
Chlorine	1	35·5	26·2	26·47	Chlorine Gas	1	2·47
Perchl. of Mercury	1	135·5	100·0	100·00	Vapour of Corrosive Sublimate	1	9·44

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

[1] *Edinburgh Monthly Journal*, vol. xiv. p. 267.

It is crystalline, liquefies by heat, and sublimes. It is soluble in water, rectified spirit and sulphuric ether. Whatever is thrown down from water, either by solution of potash, soda, or lime water, is of a reddish colour: or, if a larger quantity of alkali be added, it is yellow. This substance by heat emits oxygen, and runs into globules of mercury.—*Ph. Lond.*

It sublimes entirely by heat; and its powder is entirely and easily soluble in sulphuric ether.—*Ph. Ed.*

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—The effects of solutions of perchloride of mercury on plants have been examined by Seguin, and subsequently by Marcet and Macaire;[1] 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. It 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[2] for the preservation of timber, and which is now practised by the *Anti Dry Rot Company*.[3]

β. On Animals generally.—The effects of corrosive sublimate on animals have been examined by Ettmuller, Wepfer, Sprœgel, Sir Benjamin Brodie,[4] Campbell, Lavort, Smith, Gaspard, Orfila[5], Schubarth, and Bostock. An abstract of these may be found in the works of Wibmer[6] and Christison.[7] 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 fœtor and salivation have been observed in horses, dogs, and rabbits.

γ. On Man.—αα. 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

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[1] De Candolle, *Phys. Vég.* 1332.

[2] *Lond. Med. Gaz.* xvi. 630. *Vide* also Dr. Dickson's *Lecture on Dry Rot*, Lond. 1837.

[3] See Keraudren, *Des Proprietés du Sublimé Corrosif pour la conservation du bois, et des effets de cette préparation sur la santé des marins*, in the *Mém. Royale Acad. de Méd.* t. v. p. 41, Paris, 1846. I have seen wood which had been prepared by Kyan's process, and which became black on the application of hydrosulphuret of ammonia (showing the presence of mercury), covered with cottony fungi which grew from it. Sir John Barrow, in his *Life of Lord Anson*, says, wood thus prepared is attacked by the Teredo.

[4] *Phil. Trans.* for 1812.

[5] *Toxicol. Gén.*

[6] *Wirk. d. Arzn. u. Gifte.*

[7] *Treatise on Poisons.*

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 (and I am disposed to coincide in this statement) that corrosive sublimate has less tendency to occasion this effect than other preparations of mercury. Maximilian Locher,[1] 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 its administration 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."

ββ. 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 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 hemorrhage, bear not this remedy without detriment."

γγ. 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 erethysm, as it is called."

First variety: Gastro-enteritis.—In this variety the symptoms are analogous to those of other corrosive poisons: namely, violent burning 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 thirsts; short and laborious respiration; urine frequently suppressed; and, lastly, various indications of a disordered conditon of the nervous system, such as 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.

[1] Van Swieten's *Commentaries upon Boerhaave's Aphorisms*, xvii. 294.

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

1. The symptoms begin much sooner.
2. The taste is much more unequivocal and strong.
3. The acridity 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.

To these I may add, that the whitened condition of the epithelium of the mouth distinguishes corrosive sublimate poisoning from poisoning by arsenious acid.[1]

Second variety: Gastro-enteritis, accompanied with or followed by acute erethysm.—I here use the term erethysm 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 fœtor of the breath, and other symptoms of this kind, already described.

Corrosive Sublimate eater.—Pouqueville[2] mentions as a common report that in 1800 there lived at Constantinople a man called "Suleyman yeyen," or "Suleyman the eater of corrosive sublimate." He was 100 years old, and had taken sublimate for 30 years. In 1797 his dose daily exceeded a drachm! Thornton,[3] Hobhouse,[4] and Byron[5] refer to Pouqueville's statement, but no writer that I have met with professes to have seen this extraordinary poison-eater. The story is, doubtless, entirely fabulous, or, if founded on any fact, has been greatly exaggerated. Although use may diminish the effect of agents whose active force is dynamical, there is no evidence that as a result of habit, the affinity of the metallic salts for the organic constituents of the body is lessened. I have no hesitation, therefore, in refusing credence to Pouqueville's story.

USES.—*Internally,* it has been employed as a sialogogue, alterative, and diaphoretic. The celebrated Baron Van Swieten[6] may be regarded as the principal introducer of corrosive sublimate into practice as a remedy for *venereal diseases.*[7] 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 diluted 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.[8] 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 for the removal of venereal symptoms in a very short space of time, and without causing

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[1] [Oxalic acid and sulphuric acid produce, under certain circumstances, this whitened condition of the mucous membrane of the mouth.—ED.]

[2] *Voyage en Morée à Constantinople*, vol. ii. p. 126, Paris, 1805.

[3] *Present State of Turkey*, p. 295, Lond. 1807.

[4] *Journey through Albania*, &c. p. 945, 1813.

[5] *Works*, p. 765, 1837, 8vo. edition.

[6] *Op. cit.*

[7] See also several papers on the use of perchloride in syphilis, in the *Medical Observations and Inquiries*, vols. i. and ii.

[8] 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.*

salivation, merely by exciting diaphoresis. Its opponents,[1] 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,[2] of Halle, who states that the best mode of using it is in the form of pills made with crumb of bread; and he gives the following formula for their preparation: — ℞. Hydr. Sublim. Corros. gr. xij., solve in Aq. Distill. q. s., adde Micæ Panis Albi, Sacchari Albi, aa. q. s. ut ft. pilulæ numero ccxl. 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 recommended by Van Swieten), and take decoction of sarsaparilla.

In *acute diseases*, few have ventured to employ perchloride 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[3] administered it in asthenic malignant fevers. I have already noticed 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, and disorders of the nervous system. In such it should be associated with diaphoretics (as antimony or sarsaparilla,) and warm clothing. Not unfrequently opiates should be combined with it.

Corrosive sublimate is a valuable *sorbefacient* in old dropsical complaints, as those arising from diseased heart, liver, or lungs. From f℥ss. to f℥j. of the liquor hydrargyri bichloridi may be taken every six hours for many days or even weeks without affecting the mouth. Under its use I have repeatedly seen dropsical symptoms disappear.

As an *external* remedy, it has been employed as a *caustic* in substance (either alone or combined with arsenic) to cancerous ulcers, to parts bitten by rabid animals, and to chancres: 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.[4] A *solution* has been employed for various purposes: thus by Baumé, for pediluvia, to produce salivation; as a lotion in chronic skin disease (as lepra, psoriasis, scabies, and rosacea); 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. In

[1] *Vide* Pearson, *op. cit.*
[2] *Neue zuverläss. Heilart. d. Lusts. in allen ihren Formen*, &c. 1826, in Richter, *Ausf. Arzn.* Bd. v. S. 596.
[3] Richter, *Ausf. Arzneim.* v. 581.
[4] *United States Dispensatory.*

obstinate gleet, where the constitution is not very irritable, an injection of a solution of corrosive sublimate frequently proves most effective. A solution is sometimes used as a preventive for the venereal disease. I am informed that a most effective remedy for the contagious porrigo which spreads amongst children in schools, is an ointment composed of from gr. ss. to gr. ij. of corrosive sublimate to an ounce of lard.

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 (see *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. As an injection in gonorrhœa, from gr. $\frac{1}{8}$ to $\frac{1}{4}$ may be dissolved in an ounce of water.

ANTIDOTES.—Several substances which decompose corrosive sublimate have been employed as antidotes. The most important of these are albuminous substances, the hydrated sulphuret of iron, and a mixture of iron filings and zinc.

When corrosive sublimate is mixed with *albumen*, a compound is formed whose chemical action on the tissues is slight as compared with that of perchloride of mercury. Hence the whites and yolks of eggs, milk, and a mixture of wheat-flour, oatmeal (or barley meal), and water, are used as antidotes.

Baron Thénard, the celebrated chemist, 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. Albumen retards, but does not prevent, the absorption of the poison, and consequently does not preclude the production of the constitutional effects of corrosive sublimate.

A mixture of two parts of finely-divided *iron* (iron filings) and one of *zinc* has been recommended by Bouchardat, with the view of reducing corrosive sublimate to the metallic state. [The only efficacious antidotal treatment consists in the free administration of albumen. For this purpose, the yolk as well as the white of egg may be freely given, mixed with water.—ED.]

Meconic acid and the *soluble meconates*, though by some supposed to be antidotes, have been shown by Mr. Allchin[1] not to be so in reality. That *opium* is a valuable agent in poisoning by this mercurial salt cannot be doubted; but its efficacy, though perhaps in part chemical, is chiefly dynamical. Its resinous and colouring matter, as well as, perhaps, to a certain extent, its meconic acid, forms, with corrosive sublimate, difficultly soluble compounds. But its narcotic influence, by deadening the sensibility of living parts to the action of irritants, is the chief source of the utility of opium in poisoning by corrosive sublimate.

LIQUOR HYDRARGYRI BICHLORIDI, L.; *Solution of Bichloride of Mercury*. (Take of Bichloride of Mercury, Hydrochlorate of Ammonia, each, grs. x.; Distilled Water, Oj. Dissolve the bichloride of mercury and

[1] *Pharmaceutical Journal*, vol. viii. p. 264, 1848.

hydrochlorate of ammonia together in water).—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.

180. HYDRARGYRI AMIDO-CHLORIDUM.—AMIDO-CHLORIDE OF MERCURY.

Formula $Hg^2,Cl,N,H^2=HgCl,HgAd$. *Equivalent Weight* 251·5.

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*, E.); 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*), *ammoniated mercury, ammoniacal oxychloruret of mercury*, and *ammonio-chloride of mercury* (*hydrargyri ammonio-chloridum*, L. D.) It is popularly called *white precipitate*, or *white oxide of mercury*.

PREPARATION.—All the British Colleges give formulæ for the preparation of this salt.

The *London College* orders of Bichloride of Mercury, ℥vj.; Distilled Water, Ovj.; Solution of Ammonia, f℥viij. Dissolve the Bichloride of Mercury, with the application of heat, in the water. To this, when it is cold, add the Ammonia, frequently stirring. Wash the powder thrown down until it is free from taste; lastly, dry it.

The *Edinburgh College* directs of Corrosive Sublimate, ℥vj.; Distilled Water, Ovj.; Aqua Ammoniæ, ℥viij. Dissolve the corrosive sublimate with the aid of heat in the distilled water; and when the solution is cold add the aqua ammoniæ; stir the whole well; collect the powder on a calico filter, and wash it thoroughly with cold water.

The *Dublin College* gives the following directions for its preparation:—Take of Corrosive Sublimate, ℥j.; Solution of Ammonia, f℥ix.; Distilled Water, Oj. Dissolve the corrosive sublimate in the water, with the aid of a gentle heat, pour the ammonia into the solution, and, having stirred the mixture well, collect the precipitate on a filter, and wash it with warm distilled water, until the liquid which passes through ceases to give a precipitate when dropped into an acid solution of nitrate of silver. Lastly, dry the product at a temperature not exceeding 212°.

By the addition of ammonia to a solution of perchloride of mercury, a white precipitate of the amido-chloride of mercury is formed, while there remains in solution half the chlorine of the perchloride combined with hydrogen and ammonia, as sal ammoniac. $2HgCl+2NH^3=HgCl,HgAd+NH^3,HCl$.

PROPERTIES.—Amido-chloride of mercury 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 heavy yellow powder ($HgCl,2HgO,HgAd$), which is insoluble in water. It is soluble in sulphuric, nitric, and hydrochloric acids.

Characteristics.—When heated with caustic potash, it gives out ammonia,

and forms a yellow powder (*white precipitated mercury and peroxide of mercury*, KANE). The solution contains chloride of potassium, and with nitrate of silver yields a white precipitate (AgCl), insoluble in nitric acid, but soluble in ammonia. Caustic ammonia does not alter white precipitate. By this it may therefore be distinguished from calomel, which yields a grey powder on the addition of 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, as above mentioned.

COMPOSITION.—Amido-chloride of mercury has the following composition:—

	At.	*Eq.Wt.*	*Per Ct.*	*Kane.*[1]	*Riegel.*
Mercury	2	200	79·522	78·60	78·85
Chlorine	1	35·5	14·115	13·85	13·86
Nitrogen	1	14	5·566	6·37	6·35
Hydrogen	2	2	0·795		
Amido-Chloride of Mercury	1	251·5	99·998	98·82	99·06
			HO	0·58	
				99·40	

Or	*At.*	*Eq.Wt.*	*PerCt.*
Perchloride of Mercury	1	135·5	53·876
Amidide of Mercury	1	116	46·123
Amido-Chlor. of Mercury.	1	251·5	99·99

According to Hennel[2] and Mitscherlich[3] its composition is $2HgCl,NH^3HCl$. Mr. Phillips[4] regards it as a compound of $HgCl,HgO,NH^3$.

PURITY.—This compound is largely adulterated with sulphate of lime. One sample was found to contain one-third of its weight of this substance. Carbonate of lime and of lead are sometimes employed to mix with it.[5] Pure white precipitate, heated on platina or a slip of mica, is dissipated without any residuum; whereas the above impurities remain. The carbonates are recognised by their 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.

A white powder totally sublimed by heat. It is dissolved in hydrochloric acid without effervescence. When heated with solution of potash it becomes yellow, and emits ammonia.—*Ph. Lond.*

Iodide of potassium is sometimes employed to detect lead or starch in the acetic solution. If lime-water or ammonia occasions a black precipitate, or blackens the powder, it indicates the presence of a protosalt of mercury.

PHYSIOLOGICAL EFFECTS.—Its action on the body is very imperfectly known, no recent experiments having been made with it. It is usually considered to be highly poisonous, and somewhat similar in its operation to perchloride of mercury. Palmarius and Naboth[6] have reported fatal cases of its use.[7]

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.

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[1] *Trans. of the Royal Irish Academy*, vii. 423.
[2] *Quarterly Journal of Science*, xviii. 297.
[3] *Ann. Chim.* xxxv. 428
[4] *Translation of the London Pharmacopœia.*
[5] [Mr. G. R. Barnes found a sample of this drug to be adulterated with fifty per cent. of carbonate of lime. *Pharm. Journ.* 1849-50, p. 240.)—ED.]
[6] Wibmer, *Wirk. d. Arzn.* iii. 64.
[7] Vide also Gmelin, *App. Medicam.* ii. 166.

ANTIDOTE.—[Albumen. The speedy expulsion of the poison from the stomach.—ED.]

UNGUENTUM HYDRARGYRI AMMONIO-CHLORIDI, L.; *Unguentum Præcipitati albi*, E.; *Ointment of White Precipitate.* (Ammonio-Chloride of Mercury, ʒij.; Lard, ℥iij.; White Precipitate, ʒij.; Lard, ℥iij. Mix, *E.*) —Stimulant, alterative, and detergent. Used in various skin diseases, as above mentioned.

181. HYDRARGYRI IODIDA.—IODIDES OF MERCURY.

Three compounds of mercury and iodine are known. They are as follows:

Subiodide of Mercury (*protiodide*)	Hg^2I
⅔ Iodide (*sesquiodide*)	Hg^4I^3
Periodide (*biniodide*)	HgI

Of these the first and the third are used in medicine.

1. Hydrargyri Subiodidum.—Subiodide of Mercury.

Formula Hg^2I. *Equivalent Weight* 326.

HISTORY.—This compound is commonly called *protiodide of mercury* (*hydrargyri iodidum*, L.), or simply *iodide of mercury* (*hydrargyri iodidum*). It may be distinguished also as *green subiodide of mercury* (*hydrargyri subiodidum viride*, D.)

PREPARATION.—There are several methods of preparing it.

The *London* and *Dublin Colleges* order of Mercury, ℥j.; Iodine, ʒv.; Rectified Spirit, *as much as may be sufficient.* Rub the mercury and iodine together, adding the alcohol gradually, until globules are no longer visible. Dry the powder immediately, with a gentle heat, (at a temperature not exceeding 100° *D.*), without the access of light, and keep in a well-stoppered vessel.

The *Edinburgh College* gives no formula.

In this process the mercury and iodine enter into combination. The alcohol facilitates the union by dissolving a portion of iodine, and forming with the remainder a pasty mass. Some red or periodide is usually first formed, and is afterwards transformed into the green or subiodide by uniting with mercury.

This process succeeds well when small quantities of iodide are to be prepared; but it is scarcely applicable to the preparation of large quantities, owing to the great heat which is evolved, by which iodine is volatilised, and some red or periodide formed. Soubeiran[1] says that the mass sometimes inflames, and escapes from the mortar with a kind of explosion. To avoid these inconveniences, small quantities only (seven or eight ounces, for example) should be prepared at one time, and the quantity of alcohol should be augmented. Another mode of preparing it is by the addition of solution of iodide of potassium to a solution of the suboxide of mercury, acidified with a very small quantity of nitric acid, as long as a greenish precipitate is produced. There are, however, some difficulties in this mode of proceeding. A sub-

[1] *Nouveau Traité de Pharmacie*, t. ii. p. 513, 2nde édit.

nitrate of mercury is apt to be precipitated with the subiodide, and if, to avoid this, we use excess of nitric acid, this decomposes the iodide of potassium, and sets iodine free, which combines with the subiodide to form the red or periodide. If the solution of protonitrate be added to that of the iodide of potassium, metallic mercury and red or periodide are apt to be formed: the latter is at first dissolved, but is afterwards deposited with the subiodide.

PROPERTIES.—It is a dingy green 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 fumes, and sublimes in red crystals, which become yellow by cooling. Solar light decomposes it, and changes its colour. Heated with potash or soda, it yields iodide of potassium and metallic mercury.

When recently prepared it is yellowish, and when heat is cautiously applied it sublimes in red crystals, which afterwards become yellow, and then by access of light they blacken. It is not soluble in chloride of sodium.—*Ph. Lond.*

COMPOSITION.—It consists of—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Mercury	2	200	61·35
Iodine	1	126	38·65
Iodide of Mercury	1	326	100·00

PHYSIOLOGICAL EFFECTS.—It is a powerful irritant poison. A scruple killed a rabbit within twenty-four hours, and a drachm destroyed a pointer dog in five days.[1] 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.[2]

USES.—It has been used in syphilis and scrofula, especially when they occur in the same individual. Lugol[3] employed an ointment of it in those forms of external scrofulous disease which resemble syphilis. Ricord[4] gave it internally with good effect in *syphilis infantum*. Biett[5] has successfully employed it in syphiltic ulceration and venereal eruptions. [He considered it to be one of the most valuable preparations of mercury in the treatment of syphilis.[6]—ED.]

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. Biett employed it internally, and also externally, in the form of ointment, to the extent of twelve or fourteen grains daily, by way of friction.

1. UNGUENTUM HYDRARGYRI IODIDI, L.; *Ointment of Iodide of Mercury.* (Iodide of Mercury, ℥j.; White Wax, ℥ij.; Lard, ℥vj. 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.[7]

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[1] Cogswell, *Essay on Iodine and its Compounds*, p. 160.
[2] Biett, *Lancette Française*, Juin 1831.
[3] *Essays on the Effects of Iodine in Scrofulous Disorders*, by Dr. O'Shaughnessy, p. 170.
[4] *Lancette Française*, 1835, No. 65.
[5] O'Shaughnessy's *Trans. of Lugol's Essays*, p. 201.
[6] *Medical Times*, vol. xxi. p. 30.
[7] Rayer, *Treat. on Skin Diseases.*

2. Hydrargyri Periodidum.—Periodide of Mercury.

Formula HgI. *Equivalent Weight* 226.

HISTORY.—This compound is usually termed *biniodide of mercury* (*hydrargyri biniodidum*, E.) It is also called the *deutiodide of mercury*, and *red* or *scarlet iodide of mercury* (*hydrargyri iodidum rubrum*, D.)

NATURAL HISTORY.—It is found native in Mexico, in the form of reddish brown particles.

PREPARATION.—Both the Edinburgh and Dublin Colleges give directions for the preparation of this compound. [It is not in the London Pharmacopœia.]

The *Edinburgh College* directs of Mercury, ℥ij.; Iodine, ℥ijss.; Concentrated Solution of Muriate of Soda, *a Gallon*. Triturate the mercury and iodine together, adding occasionally a little rectified spirit till a uniform red powder be obtained. Reduce the product to fine powder, and dissolve it in the solution of muriate of soda with the aid of brisk ebullition. Filter, if necessary, through calico, keeping the funnel hot; wash and dry the crystals which form on cooling.

The process of the *Dublin College* is as follows:—Take of Corrosive Sublimate, ℥j.; Iodide of Potassium, ʒij.; Distilled Water, Oij., or as much as is sufficient. Dissolve the corrosive sublimate with the aid of heat in twenty-five ounces of the water, and, when both solutions are cold, mix them. Decant the supernatant liquor when the precipitate has subsided, and, having collected this latter upon a paper filter, wash it with the remainder of the water. Finally, dry the product at a temperature not exceeding 212°, and preserve it in a close bottle.

In the Edinburgh process the iodine and mercury combine to form the per- or biniodide. The alcohol facilitates the combination by dissolving part of the iodine, and forming a pasty mass with the remainder. The solution of common salt employed serves to separate the per- or biniodide from any subiodide (which is insoluble in that liquid), as well as to obtain the biniodide in a crystalline form. Considerable inconvenience is experienced in obtaining large quantities of the periodide by this process, on account of the great heat evolved when mercury and iodine are rubbed together.

Per- or biniodide of mercury may be readily obtained by mixing solutions of perchloride of mercury and iodide of potassium. [This is the process adopted by the Dublin College.] One equivalent or 135·5 grains of corrosive sublimate are required to decompose one equivalent or 165 parts of iodide of potassium. $HgCl + KI = HgI + KCl$.

In order to obtain a fine-coloured per- or biniodide, and to ensure the absence of perchloride of mercury in the product, a slight excess of iodide of potassium should be employed. This, indeed, holds a little biniodide of mercury in solution, but the quantity is inconsiderable. A large excess of iodide of potassium combines with the biniodide, and forms therewith a soluble double salt (HgI,KI). If the perchloride of mercury be slightly in excess, a pale-red precipitate (composed of biniodide of mercury with a little perchloride) is obtained. A great excess of perchloride of mercury keeps the periodide in solution.

PROPERTIES.—Periodide of mercury is a dimorphous substance; its colour and crystalline form varying with its temperatnre.

α. Red Periodide of Mercury.—At ordinary temperatures, and as usually met with, periodide of mercury is a scarlet-red powder, whose sp. gr. is from

6·2 to 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. When dissolved to saturation in a hot solution of either iodide of potassium or iodide of zinc, it is deposited, on cooling, in the form of square octohedrons. When heated, the red periodide becomes bright yellow, and then fuses, forming a deep ruby-red or amber-coloured liquid, which, by cooling, congeals into a yellow crystalline mass (*var.* β). This, by further cooling, or by mechanical disturbance, or by partial disintegration, suddenly assumes a scarlet colour: the change commencing, in the latter case, at the point ruptured.[1] If the heat be raised sufficiently, the fused periodide is volatilised, and sublimes in the form of yellow right rhombic prisms (*var.* β); but if the temperature be very slowly raised, and the sublimation be carefully conducted, red crystals, having the form of square octohedrons, are obtained.

[Mr. J. B. Barnes[2] finds, by experiment, that *cod liver oil* possesses the property of dissolving biniodide of mercury; and, as both are often administered at the same time, the medical practitioner may find it convenient, when these remedies are required to be given together, to dissolve the biniodide in the oil. Solution is readily effected at the ordinary temperature of the atmosphere, to the extent of half a grain to the fluidounce, by rubbing down the biniodide in a small portion of oil, mixing it with the remainder in a bottle, and shaking for a few moments; at the temperature of 120°, two grains are permanently dissolved by one fluidounce of oil. Mr. Barnes also finds that biniodide of mercury dissolves with the same facility in almond, olive, and castor oils, also in chloroform, pyroxilic spirit, and melted lard and spermaceti cerate.—ED.]

β. *Yellow Periodide of Mercury.*—This is obtained by heating the red periodide; by fusing and partially cooling the red periodide; by subliming the red periodide; and also by precipitation from a solution of a persalt of mercury by iodide of potassium: in the latter case the yellow crystalline grains soon dissolve, and at the same time crystals of the red periodide make their appearance. The citron-yellow crystals of periodide belong to the right prismatic system: they are not permanent, but readily pass into the red state.

Characteristics.—Heated with carbonate of soda or potash in a tube, it yields metallic mercury, which is volatilised: the residue is iodide of sodium and potassium, recognisable by the respective tests. From the subiodide 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:—

	Atoms.	*Eq. Wt.*	*Per Cent.*		*Vols.*
Mercury	1	100	44·25	Vapour of Mercury	1
Iodine	1	126	55·75	Vapour of Iodine	1
Biniodide of Mercury	1	226	100·00	Vapour of Iodide of Mercury	1

PURITY.—The presence of persulphuret of mercury in it may be recognised by fusion with caustic potash in a glass tube, by which a mixture of sulphuret

[1] Warington, *Memoirs of the Chemical Society*, vol. i. p. 85, 1843.
[2] *Pharmaceutical Journal*, Oct. 1853, p. 188.

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.

"Entirely vaporisable: soluble entirely in 40 parts of a concentrated solution of muriate of soda at 212°, and again deposited in fine red crystals on cooling."—*Ph. Ed.*

PHYSIOLOGICAL EFFECTS. *α. 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.[1] Maillet[2] has also made some experiments with it.

β. On Man.—It is a powerful irritant and caustic. It is nearly as powerful as the perchloride of mercury; indeed, Rayer[3] 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. It requires to be administered internally 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 subiodide of mercury, than which it is much more energetic. [It has been employed by M. Cazenave[4] in cases of lupus.—ED.] Breschet[5] 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 periodide of mercury, gr. ij.; cerate, ℈ij.; and almond oil, ℈j.) it has been used in opacity of the cornea.[6] 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.

1. UNGUENTUM HYDRARGYRI IODIDI RUBRI, D.; *Ointment of Red Iodide of Mercury.* (Red Iodide of Mercury, ʒj.; Ointment of White Wax, ʒvij.; M.)—Used in the before-mentioned cases. For ordinary purposes, it will require to be considerably diluted.

2. LIQUOR ARSENICI ET HYDRARGYRI HYDRIODATIS, D.; *Solution of the Iodo-Arsenite of Mercury; Donovan's Solution.*—This solution was introduced into medical use in November 1839, by Mr. Donovan,[7] who gave the following directions for its preparation:—

"Triturate 6·08 grains of finely levigated metallic arsenic, 15·38 grains of mercury, and 50 grains of iodine, with one drachm measure of alcohol, until the mass has become dry, and from being deep brown has become pale red. Pour on eight ounces of distilled water; and after trituration for a few moments, transfer the whole to a flask; add half a drachm of hydriodic acid, prepared by the acidification of two grains of iodine, and boil for a

[1] Cogswell, *Essay on Iodine*, p. 164.
[2] *Journ. de Chim. Méd.* iii. 543, 2de série.
[3] *Treatise on Skin Diseases*, by Dr. Willis, p. 79.
[4] *Bulletin Thérapeutique*, t. xli. p. 226.
[5] O'Shaughnessy's *Trans. of Lugol's Essays*, p. 204.
[6] Gräfe and Walther's *Journ. f. Chir.* Bd. 13.
[7] *Dublin Medical Journal*, vol. xvi. for November 1839; and *Pharmaceutical Journal*, vol. i. p. 425, 1842.

few minutes. When the solution is cold, if there be any deficiency of the original eight ounces make it up exactly to that measure with distilled water. Finally, filter."

The *Dublin* formula is very similar to this. We subjoin it:—Take of Pure Arsenic, in fine powder, grs. vj.; Pure Mercury, grs. xvj.; Pure Iodine, grs. lss.; Alcohol, fʒss.; Distilled Water, ℥ix., or a sufficient quantity. Rub together the arsenic, mercury, iodine, and spirit, until a dry mass is obtained, and, having triturated eight ounces of the water with this in successive portions, let the whole be transferred to a flask, and heated until it begins to boil. When cooled and filtered, let as much distilled water be added to it as will make the bulk of the solution exactly eight fluidounces and six drachms.

When the arsenic, mercury, and iodine, are triturated together with the alcohol, the iodine combines with the metals. The quantity of iodine is about sufficient to convert the arsenic into the teriodide (AsI^3), and the mercury into the periodide (HgI). We may therefore regard this solution as essentially consisting of these two iodides in solution or combination. Mr. Donovan considers that, by solution in water, these two become converted into hydriodates; but there is no evidence of this. Each fluidrachm of this solution contains a quantity of teriodide of arsenic equivalent to one-eighth of a grain of arsenious acid; and of per- or iodide of mercury, equivalent to a quarter of a grain of the peroxide of mercury. In addition, it also contains a minute portion of hydriodic acid, which Mr. Donovan estimates as equal to three-quarters of a grain of iodine.

"The colour of the solution is yellow, with a pale tinge of green; its taste is slightly styptic. It cannot be properly conjoined with the tincture of opium, or with sulphate, muriate, or acetate of morphia; for all these produce immediate and copious precipitates in it. Hence, if opiates are to be used during the exhibition of this arsenico-mercurial liquor, they must be taken at different periods of the day. Tincture of ginger produces no bad effect. The following formula is proper:—℞ Liq. Hydriodatis Arsenici et Hydrargyri, ʒij.; Aquæ Distillatæ, ℥iiiss.; Syrupi Zingiberis, ℥ss. Misce. Divide in haustus quatuor. Sumatur unus mane nocteque." (Donovan.) Each of these draughts contains the equivalent of one-sixteenth of a grain of arsenious acid, and the equivalent of one-fourth of a grain of the peroxide of mercury. "The division into draughts is here necessary; first, to insure accuracy of the dose, so essential in the case of this active medicine; and, next, to prevent injury to the ingredients by the use of a metallic spoon as a measure, the general way in which, unfortunately, the dose of a medicine is determined" (Donovan).

On repeating this process, Soubeiran[1] found that a portion of arsenic remained undissolved; he has therefore proposed the following simple substitute for Donovan's formula:—Teriodide of arsenic, one part; periodide (biniodide) of mercury, one part; water, 98 parts. To make fʒviij. on this principle, take teriodide of arsenic, gr. xxxv.; periodide (biniodide) of mercury, gr. xxxv.; boiling distilled water, ℥viij. Triturate until dissolved, and then filter the solution; and, if necessary, add water to make exactly ℥viij of solution.

Soubeiran's solution is somewhat stronger than Donovan's. The following table shews the comparative quantities of the active ingredients in the two solutions, reduced to French grammes:—

[1] *Journ. de Pharmacie*, t. xxvii. p. 744, 1841.

	Donovan.	*Soubeiran.*
Arsenic	0·158 grammes.	0·165 grammes.
Mercury	0·400 "	0·445 "
Iodine	1·318 "	1·489 "

Soubeiran's solution contains exactly one-hundredth part of each of the iodides. Both Donovan's and Soubeiran's solutions contain the teriodide of arsenic and periodide of mercury, and therefore combine the effects of both of these salts. It sometimes occasions ptyalism. Donovan's solution has been most successfully employed in obstinate skin diseases, such as lupus, lepra, psoriasis, pityriasis, and impetigo. It has proved very effective in chronic cutaneous affections of the scalp and in venereal eruptions, and in some uterine diseases.[1] [For this reason it has been introduced into the last Dublin Pharmacopœia.—ED.]

The dose of it is from ♏x. to ʒss. (see *supra*). When diluted with an equal proportion of water, it has been employed as a wash in the same cases in which it has been administered internally.

182. HYDRARGYRI PERCYANIDUM.—PERCYANIDE OF MERCURY.

Formula HgCy. *Equivalent Weight* 126.

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, Cyanide* or *Bicyanide of Mercury* (*Hydrargyri Prussias, Hydrocyanas, Cyanuretum, Cyanidum* seu *Cyanodidum.*)

PREPARATION.—There are two methods of preparing this salt: one recommended by Proust, the other by Winckler. Proust's process was formerly adopted in two of the British Pharmacopœias.

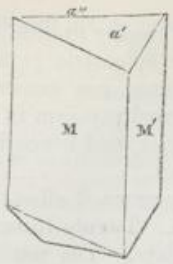
The *London College* formerly ordered, of Percyanide of Iron [*Prussian Blue*], ℥viij.; Binoxide of Mercury, ℥x.; Distilled Water, Oiv. Boil them together for half an hour, and strain. Evaporate the liquor that crystals may be formed. Wash what remains frequently with boiling distilled Water, and again evaporate the mixed liquor that crystals may be formed. The *Dublin College* employed of Prussian Blue, *six parts;* Nitric Oxide of Mercury, *five parts;* Distilled Water, *forty parts.*

In this process the cyanogen of the Prussian blue combines with the mercury of the nitric oxide, while the iron unites with the oxygen of the oxide. Pure percyanide of mercury may be more economically prepared by Winckler's process. This consists in saturating hydrocyanic acid with red oxide of mercury. The solution is to be filtered, and allowed to crystallise. In this process double decomposition takes place, the resulting products being water and percyanide of mercury.

PROPERTIES.—The crystals of this salt are square prisms. They 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.

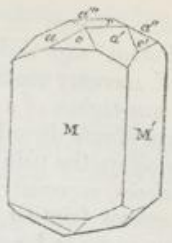
[1] See *Dublin Medical Journal*, vols. xviii. xxi. and xxii.

FIG. 146.



General Form of Crystals of Percyanide of Mercury.

FIG. 147.



Crystals with Modified Planes.

Characteristics.—Perfectly dry percyanide 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 alkalies. Its solution throws down a black precipitate with hydrosulphuric acid, and white pearly crystalline plates (*hydrargyro-iodo-cyanide of potassium*) with a concentrated solution of iodide of potassium.

[COMPOSITION.—Its composition is variously stated, according to the number assumed for the equivalent of mercury. The greater number of British chemists now consider it to be constituted of a single equivalent of each element, and therefore represented by the formula HgCy. The term Percyanide is given to it, in order to keep the nomenclature in conformity with that adopted by the author. There is no other cyanide of mercury known.—ED.]

PURITY.—When prepared from ferrosesquicyanide of iron (Prussian blue), the crystals are usually yellowish, from the presence of some oxide of iron. The following tests of its purity were published in the previous edition of the London Pharmacopœia:—

Transparent and totally soluble in water. The solution, when hydrochloric acid is added, emits hydrocyanic acid, which is known by its peculiar smell; and a glass moistened with a solution of nitrate of silver and placed over it, gives a deposit, which is dissolved by boiling nitric acid. By heat it emits cyanogen, and runs into globules of mercury.

PHYSIOLOGICAL EFFECTS. α. *On Vegetables*—It acts on plants like perchloride of mercury.[1]

β. *On Animals.*—Coulon[2] found that it acted on dogs, cats, sparrows, frogs, and snails, like hydrocyanic acid. After death, inflammation of the stomach was observed. Ollivier d'Angers[3] 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 were at first accelerated, and afterwards diminished. Similar effects were produced by applying the salt to the cellular tissue, or injecting it into the veins. Tiedeman and Gmelin[4] detected mercury in the

[1] Goeppert, in De Candolle, *Phys. Vég.* 1834.
[2] *Traité sur l'Acide Prussique*, quoted by Wibmer, *Wirk. d. Arzneim.* iii. 30.
[3] *Journ. de Chim. Méd.* i. 269.
[4] *Versuche üb. d. Wege auf welch. Subst. aus d. Magen u. Darmk. ins Blut. gelang.*

blood of the splenic vein of a horse to which the percyanide had been administered.

γ. *On Man.*—Taken in *small doses*, it very readily excites nausea and vomiting. Parent[1] says it does not produce the epigastric pain which the perchloride of mercury readily occasions. Continued use causes salivation. In one case, one-eighth of a grain twice a day caused ptyalism in three days.[2] Mendaga[3] 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,[4] 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.—It has been employed as an *antivenereal* medicine, and was first used as such by Brera.[5] Parent[6] administered it as a substitute for the perchloride 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 alkalies, 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 antiphlogistic.

Its principal use in this country is as a source of hydrocyanic acid 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 in 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 of this compound 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, or tickling the throat.

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[1] *Journ. de Chim. Méd.* viii. 473.
[2] Neumann, in Dierbach's *Neuesten Entd. in d. Mat. Med.* ii. 483, 1828.
[3] *Decades Medico-chirurgicas y Farmaceuticas*, vi. 319, in Richter's *Ausführ Arzneim.* v. 477.
[4] *Journ. de Chim. Méd.* i. 210.
[5] Richter, *op. cit.*
[6] *Journ. de Chim. Méd.* viii. 473.

[183. Potassii et Hydrargyri Iodo-cyanidum.—Iodo-cyanide of Potassium and Mercury.]

Formula HgCy,KI. *Equivalent Weight* 291.

[The name of this compound has been introduced into the Appendix of the London Pharmacopœia as an article adapted for the purpose of testing the purity of hydrocyanic acid. It was first proposed by Dr. Geoghegan, of Dublin, as a test for determining the freedom of hydrocyanic acid from any foreign acid.

PREPARATION.—Dissolve in a minimum quantity of warm water equivalent weights of cyanide of mercury and iodide of potassium. If sufficiently saturated, colourless prismatic crystals will be deposited when the liquid has cooled.

PROPERTIES and USES.—The crystals are quite soluble in water, and the solution is decomposed by all acids excepting the hydrocyanic. If the hydrocyanic acid be free from any foreign acid the crystals simply dissolve in it without change of colour (HgCy,KI+HCy). If a hydracid, such as the hydrochloric, be present, the red iodide of mercury is immediately produced:—thus HgCy,KI+HCl=HgI+KCl+HCy, hydrocyanic acid and chloride of potassium being at the same time formed. If an oxacid be present, then water is decomposed, and we have the following changes, HgCy.KI+SO^3HO=HgI+KO,SO^3+HCy. Any vegetable acid which can combine with potash will produce the same effect. Even the carbonic acid of the atmosphere slowly produces this change on the crystals.

The presence of a foreign acid in hydrocyanic acid is therefore indicated by the production of a red colour on the addition of a few of these crystals at the end of a glass rod. It is undoubtedly a delicate test, but we are bound to state as the result of our own experiments that it is less delicate than the ordinary barytic test, so far as sulphuric acid is concerned: for in one sample nitrate of baryta produced a slight cloudy precipitate in which these crystals underwent no change of colour.—ED.]

184. HYDRARGYRI NITRATES.—NITRATES OF MERCURY.

Six solid compounds of nitric acid and the oxides of mercury are known: three are nitrates of the suboxide, and three nitrates of the oxide.

Nitrates of the Suboxide of Mercury	Bibasic Nitrate of the Suboxide of Mercury	$2Hg^2O,NO^5,HO$
	Sesquibasic Nitrate of the Suboxide (crystallised)	$3Hg^2O,2NO^5,3HO$
	Neutral Nitrate of the Suboxide (crystallised)	$Hg^2O,NO^5,2HO$
Nitrates of the Oxide of Mercury	Sexbasic Nitrate of the Oxide of Mercury	$6HgO,NO^5$
	Tribasic Nitrate of the Oxide	$3HgO,NO^5,HO$
	Bibasic Nitrate of the Oxide (crystallised)	$2HgO,NO^5,2HO$

In addition, there are possibly other mercurial nitrates obtained in solution, but they have not hitherto been procured in the solid state.

Of these compounds, it will be necessary to notice two only—namely, the neutral nitrate of the suboxide, and the bibasic nitrate of the oxide.

1. Hydrargyri Protonitras.—Neutral Nitrate of the Suboxide of Mercury.

Formula Hg^2O,NO^5. *Equivalent Weight* 262.

NATURAL HISTORY.—Glocker[1] mentions, on the authority of John, a doubtful minera which he calls *hydrargyronitrites*, composed of suboxide of mercury and nitric acid.

PREPARATION. Neutral nitrate of the suboxide of mercury is obtained by digesting

[1] *Genera et Species Mineralium secundum Ordines Naturales Digestorum Synopsis*, 1847, p. 302.

excess of mercury in cold dilute nitric acid until *short prismatic crystals* ($Hg^2O,NO^5,2HO$) are formed. If these be left in the solution they are gradually dissolved and replaced by large transparent prisms of the sesquibasic nitrate of the suboxide ($3Hg^2O,2NO^5,3HO$).

PROPERTIES.—The neutral salt is soluble without decomposition in a small quantity of water; but in much water its crystals are decomposed into a yellow powder (*bibasic nitrate of suboxide of mercury*, $2Hg^2O,NO^5,HO$, and an acid liquor (*solutio hydrargyri frigide parata*) which contains a soluble supernitrate.

PURITY.—Neutral nitrate of the suboxide of mercury is distinguished from other nitrates in the following way:—If it be rubbed with excess of chloride of sodium, and water subsequently added, the whole of the mercury is thrown down in the form of a white precipitate of calomel, and no perchloride of mercury (corrosive sublimate) can be detected in the filtered liquid. But if any oxide (peroxide) had been present along with the suboxide, some corrosive sublimate would be found in the filtered liquid; and if any basic nitrate of the suboxide had been present a greenish powder (a mixture of calomel and suboxide of mercury) would be formed.

PHYSIOLOGICAL EFFECTS.—The effects of protonitrate may be considered as intermediate between those of calomel and corrosive sublimate. After its ingestion it probably becomes converted into calomel by the action of the alkaline chlorides contained in the alimentary canal. According to Mialhe,[1] if atmospheric oxygen and an excess of alkaline chloride be present, a portion of corrosive sublimate is formed.

USES.—Protonitrate of mercury is rarely used as a medicine. The facility with which it undergoes decomposition by contact with various organic substances is an objection to its internal employment. Its principal medicinal use is, in the form of solution, as a cathæretic or mild caustic in venereal ulcerations or growths. It has also been used in porrigo and in diseases attended with pediculi (Rayer). Biett[2] employed an ointment, composed of 2 parts of protonitrate and 50 parts of lard, in lepra and psoriasis. Dupuytren's *antiherpetic pommade* consisted of two parts of the protonitrate, eight parts of lard, and one part of rose oil. As an internal remedy, the protonitrate may be administered in doses of from $\frac{1}{16}$th to $\frac{1}{8}$th of a grain, in the form of pill made with extract of liquorice.

In pharmacy the protonitrate serves for the preparation of *hydrargyri nitrico-oxydum*, *calomelas præcipitatum*, sometimes for the production of *hydrargyri iodidum*, and also for the preparation of *hydrargyri acetas*. In chemistry its solution is used as a test.

LIQUOR HYDRARGYRI PROTONITRATIS; *Liquor Hydrargyri Nitrici*, Ph. Boruss. 1847; *Liquor Hydrargyri Nitrici Oxydulati*.—Prepared by dissolving one ounce of the crystals of protonitrate of mercury in eight ounces of distilled water to which three and a half scruples of nitric acid have been added; filter the solution, and if necessary add water, so that the sp. gr. of the liquor may be 1·100. Preserve it carefully in a stoppered vessel. The dose of this solution is three drops.

2. Hydrargyri Dipernitras.—Bibasic Nitrate of the Oxide of Mercury.

Formula $2HgO,NO^5$. *Equivalent Weight* 270.

PREPARATION.—By boiling mercury in strong nitric acid, until the liquid, when diluted with water, ceases to yield a white precipitate (calomel) on the addition of a solution of common salt, we obtain a solution of the nitrate of the oxide of mercury (*solutio mercurii calide parata*). By concentration, it acquires the density of 3·47. In this state it has an acid metallic taste, and colours the skin, when exposed to light, purplish-red. The solution probably contains *neutral nitrate of the oxide of mercury*, HgO,NO^5. But by evaporation acid fumes escape, and there are formed crystals of the bibasic nitrate, $2HgO,NO^5,2HO$.

[1] *Traité de l'Art de Formuler*, p. 72, 1845.
[2] Bourchardat, *Nouveau Formulaire Magistral*, p. 321, 1845.

PROPERTIES.—If the crystallised bibasic nitrate be washed with cold water as long as the liquid runs off sour, a heavy yellow powder is obtained, which is the *tribasic nitrate of the oxide of mercury*, $3HgO,NO^5,HO$: this, when boiled in water, yields a brick-red powder, which is the *sexbasic nitrate of the oxide of mercury*, $6HgO,NO^5$.

PURITY.—The presence of nitrate of the suboxide of mercury in a solution of nitrate of the oxide of mercury is known by the production of a white precipitate (calomel) on the addition of a solution of common salt.

PHYSIOLOGICAL EFFECTS.—This nitrate is more acrid and caustic than the protonitrate. Its effects are analogous to those of corrosive sublimate. Indeed, it becomes converted, in the alimentary canal, into the latter salt by the action of the alkaline chlorides it there meets with.

USES.—Internally, it is now never employed. It was formerly given in doses of $\frac{1}{16}$th of a grain. Externally, it is used in two forms,—as an acid solution, and as an ointment.

1. LIQUOR HYDRARGYRI PERNITRATIS, D.; *Solution of Pernitrate of Mercury; Nitras Hydrargyricus Acido Nitrico Solutus; Liquid Acid Deutonitrate of Mercury; Acid Nitrate of Mercury.* (Take of Pure Mercury, ℥ij.; Pure Nitric Acid, f℥iss.; Distilled Water, ℥iss: in the acid, first diluted with the water, dissolve the mercury with the application of heat, and evaporate the solution to the bulk of ℥ijss. *D.*) (Take of Mercury, four parts, by weight; Nitric Acid [sp. gr. 1·32], eight parts, by weight: dissolve the mercury in the nitric acid, and evaporate the solution to nine parts.)—This solution is dense and very caustic. It contains 71 per cent. of pernitrate of mercury, and an excess of nitric acid. It is frequently employed in the Parisian hospitals as a caustic. Biett frequently employed it with success in lupus. It should be applied to the extent of a crown-piece, by means of a brush, to the ulcers, tubercles, and scars which remain soft or purple, and seem on the point of breaking: lint moistened with the solution is then to be applied to the cauterised surface. The parts immediately become white, a kind of erysipelatous inflammation is set up in the surrounding parts, and in a few days a yellow scab gradually falls off.

This solution is also used for the cauterisation of the ulcerated cervix uteri. "When the inflammation is intense, the ulceration large, and the granulations redundant or unhealthy, it exercises a very prompt and beneficial influence, generally cleansing and modifying the sore in one application. In very slight ulcerations, however, I think it is too powerful a remedy, and that the solid nitrate of silver answers the purpose better."[1]

It has been used by Recamier[2] as a caustic in cancerous diseases. He thinks it acts specifically, and modifies the vital actions of the surrounding parts. The acute pain which its application causes is alleviated by a strong solution of opium. Godard[3] employed it in herpes exedens. It has likewise been used with success in a great variety of other cases,—as syphilitic and scrofulous ulcers, condyloma, obstinate lepra and psoriasis, and porrigo favosa.

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[1] *A Practical Treatise on Inflammation, Ulceration, and Induration of the Neck of the Uterus*, by J. H. Bennet, M.D. p. 147, 1845.

[2] *Rech. sur le Traitement du Cancer*, 1829.

[3] *De l'Emploi du Nitrate Acide de Mercury*: Thèse présentée et soutenue à la Faculté de Médecine de Paris, 1826. Also *Archives Générales de Médecine*, t. xi. pp. 203–207.

By the *local* use of this acid nitrate of mercury, the constitutional effects of mercury have been produced. Breschet has seen salivation induced by one application of it to the ulcerated neck of the uterus.[1] In such cases it probably passes into the system in the form of corrosive sublimate, into which salt it is converted by the alkaline chlorides contained in the secretions of the part to which it is applied. To prevent absorption, Mialhe recommends that the cauterised part should be washed immediately after the application of the caustic.

2. UNGUENTUM HYDRARGYRI NITRATIS, L. D.; *Ointment of Nitrate of Mercury; Yellow* or *Citrine Ointment* (*Unguentum Citrinum*, E. D.); *Mercurial Balsam* (*Balsamum Mercuriale*).—It is an imitation of the *golden eye-ointment*. All the British Colleges give directions for its preparation.

The *London College* orders of Mercury, ℥ij.; Nitric Acid, f℥iv.; Lard, lb. j.; Olive Oil, f℥viij. First dissolve the mercury in the acid; then mix the solution while hot with the lard and oil melted together.

The *Edinburgh College* directs of Pure Nitric Acid, sp. gr. 1·380 to 1·390, f℥ixss.; Mercury, ℥iv.; Axunge, ℥xv.; Olive Oil, f℥xxxviiiss. Dissolve the mercury in the acid with the aid of a gentle heat. Melt the axunge in the oil with the aid of a moderate heat in a vessel capable of holding six times the quantity; and while the mixture is hot, add the solution of mercury, also hot, and mix them thoroughly. If the mixture do not froth up, increase the heat a little till this takes place. Keep this ointment in earthenware vessels, or in glass vessels secluded from the light.[2]

The *Dublin College* orders of Pure Mercury, ℥j.; Pure Nitric Acid, f℥j.; Distilled Water, ℥ss.; Prepared Lard, ℥iv.; Olive Oil, f℥viij. Mix the acid with the water, and dissolve the mercury in the mixture, with the aid of a gentle heat. Melt the lard with the oil, and, while the mixture is hot, add to it the solution of mercury, also hot; let the temperature of the mixture next be raised so as to cause effervescence, and, then, withdrawing the heat, stir the mixture with a porcelain spoon until it concretes on cooling.

By the action of concentrated nitric acid on mercury, nitrate of the oxide of mercury is produced ($3Hg + 4NO^5 = 3(HgO,NO^5) + NO^2$). The London, and especially the Edinburgh College, use an excess of nitric acid. When the solution is mixed with the lard and olive oil, a portion of elaïdine[3] is produced, as well as a red viscid oil. Soubeiran[4] says that carbonic acid and binoxide of nitrogen gases are evolved, but Mr. Schacht[5] could not detect them. He obtained only the vapour of nitric acid, having the peculiar smell of the ointment.

By keeping, this ointment is apt to change its colour, and become hard, pulverisable, and therefore unfit for use. The nitrate of the oxide of mercury undergoes deoxidation, and is ultimately reduced to metallic mercury. The grey colour which the ointment acquires by keeping is due to the dissemination of minute globules of metallic mercury through the mass. If old citrine

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[1] Trousseau and Pidoux, quoted by Mialhe, in his *Traité de l'Art de Formuler*, p. 84, 1845. [A case is related by Dr. Lafargue, of Toulouse, in which the acid nitrate of mercury, used as a caustic to the os uteri, produced salivation. See *Lancet*, 1849, ii. 669.—ED.]

[2] There is an error in the Edinburgh Pharmacopœia in the proportion of olive oil and in the density of nitric acid (see Christison's *Dispensatory*, 2d edit. p. 531). In the text I have corrected this error.—J. P.

[3] So called by Boudet (*Journ. de Chim. Méd.* viii. 641) from ἐμαΐς, ἐλαΐδος, *an olive tree*. Boudet ascribes the formation of the elaidine to the action of nitrous or hyponitrous acid.

[4] *Nouv. Traité de Pharmacie*, t. ii. p. 256.

[5] *Pharmaceutical Journal*, vol. iv. p. 451, 1845.

ointment be digested in ether, the fatty matters are dissolved, and metallic mercury left behind. The cause of this change appears to be the use of an insufficient quantity of nitric acid and of too low a temperature. Mr. Duncan, of Edinburgh, first showed, that "by dissolving the metal in an excess of acid with the aid of heat,—using an additional quantity of acid for oxygenating all the fat, and applying a moderate heat at the time of mixing the fat and the metallic solution, so as to ensure complete action between them,—an ointment is obtained not inferior to the quack nostrum [*golden eye-ointment*] in original colour or durability."[1] The present formula of the Edinburgh College (as now corrected) is that of Mr. Duncan. MM. Henry and Guibourt[2] also direct a considerable excess of acid to be employed.

The following are several formulæ for its preparation :—

	United States Dispensatory.	*Paris Codex.*	*Henry and Guibourt.*	*Duncan.*	*Bell and Co.*[3]
Mercury	℥j.	32 parts.	30 parts.	(Avoirdupois Weights). ℥iv.	℥viij.
Nitric Acid	f℥xj. (sp. gr. 1·5).	48 parts (sp. gr. 1·286).	60 parts (sp. gr. 1·321).	℥xij. (Nitrous Acid sp. gr. 1·380 to 1·390) ℥xv.	f℥xiv. (sp. gr. 1·43).
Lard	℥iij.	250 parts.	240 parts.	℥xxxii.	lb. iij.
Olive Oil	0	250 parts.	240 parts.	0	lb. ij.
Neat's-foot Oil...	f℥ix.	0	0		0

The two most important points to attend to in the manufacture of this ointment are—the due regulation of the heat, and the employment of a proper quantity of acid.

"If the mixture be made at a low temperature, no effervescence takes place, and the ointment so produced will become hard in a few days, of a greenish-white colour, and eventually of a consistence that may almost be powdered; but if the oil or fat is heated to a sufficient temperature, or the quantity operated on is large enough to generate the heat required, strong effervescence takes place, much gas is evolved, and a perfect article is produced, of a fine golden colour, and of the consistence of butter" (Alsop). The great success which attends the manufacture of large than of small quantities of this ointment, may be referred to the higher temperature generated by the reaction of larger quantities of the materials. Mr. Alsop says that the proper temperature is between 180° and 212°. A temperature of 190° F. yielded a fine product.

The importance of a sufficient quantity of acid has been already pointed out. Mr. Schacht has shown that ointment spoiled by age or accident, and which has become hard, discoloured, pulverulent, or even blackened, may be restored to its original beauty by heating it with nitric acid; and he has further shown that the use of an excess of nitric acid in the manufacture of the ointment is no disadvantage, for, if the heat be continued long enough, it distils off. Stirring assists the evolution of gas, and is usually believed to

[1] Christison's *Dispensatory*. Mr. Duncan's process was communicated to the late Dr. Duncan (*Supplement to the Edinburgh Dispensatory*, p. 196, 1829).
[2] *Pharmacopée Raisonnée*, p. 448, 3me édit.
[3] Alsop, *Pharmaceutical Transactions*, No. iii. p. 162, 1841.

favour the formation of a fine product; but Mr. Alsop asserts that a long-continued stirring is not required.

When fresh prepared, this ointment has a fine golden yellow colour, a butyraceous consistence, and a peculiar nitrous odour. It is very apt to become grey when mixed with other ointments, in consequence of their deoxidising powers; and to prevent this, an additional quantity of nitric acid should be added. It should be spread with wooden or ivory spatulas.

When fresh prepared, this compound contains the following substances, besides the ordinary constituents of lard and olive oil:—elaïdine, red oil, elaidate of mercury (mercurial soap), and nitrate of mercury.

Elaïdine is a white saponifiable fat, fusible at 97° F. [89·6 F. according to Meyer],[1] very soluble in ether, but requiring 200 times its weight of boiling alcohol to dissolve it. It consists of elaïdic acid and glycerin.

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

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 phagedenic 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 as a specific in this complaint.

3. UNGUENTUM HYDRARGYRI NITRATIS MITIUS, L. (Of Ointment of Nitrate of Mercury, ℥j.; Lard, ℥vij. Rub them together.)—This ointment is to be used recently prepared.

185. HYDRARGYRI ACETAS.—ACETATE OF MERCURY.

Formula $Hg^2O,\overline{A}$. *Equivalent Weight* 259.

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

PREPARATION.—The British pharmacopœias contain no directions for procuring it. The following is the pharmaceutical process by which it was formerly prepared:—

Take of Purified Mercury, Acetate of Potash, of each, nine parts; Diluted Nitric Acid, eleven parts; Boiling Distilled Water, one hundred parts; Distilled Vinegar, as much as may be sufficient. Let the Nitric Acid be added to the mercury, and when the effervescence has ceased, let the mixture be digested that the metal may be dissolved: let the acetate of potash be dissolved in water, and let the distilled vinegar be added until the acid shall predominate in the liquor; to this, whilst boiling, let the solution of mercury in the nitric acid be added, and let the mixture be filtered as quickly as possible through a double linen cloth: let it cool that crystals may form: having washed these with cold distilled water, dry them on paper with a very gentle heat. In every step of this process let glass vessels be employed.

By the mutual action of diluted nitric acid and mercury we obtain a proto-

[1] *Pharmaceutisches Central-Blatt für* 1840, S. 790.

nitrate of mercury. When this is mixed with acetate of potash, double decomposition takes place: nitrate of potash and protoacetate of mercury being formed ($Hg^2O,NO^5+KO,\bar{A}=Hg^2O,\bar{A}+KO,NO^5$). To prevent precipitation of the yellow subnitrate of mercury, excess of acetic acid should be employed; and by filtering, whilst hot, any subnitrate 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 in water, requires 300 times its own 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, are some of its characteristics. 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:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Dumas.*
Suboxide of Mercury	1	208	80·3	80·66
Acetic Acid	1	51	19·7	19·34
Acetate of Mercury	1	259	100·0	100·00

PHYSIOLOGICAL EFFECTS.—It is one of the milder mercurial preparations. From the reports of Guarin, Colombier, and Vogler,[1] it appears to have acted in some cases with great violence, and to have occasioned violent vomiting, purging, abdominal pain, and bloody evacuations. 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 anti-venereal pills. But Robiquet has subsequently ascertained that Keyser employed the acetate of the binoxide.[2] 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.

ORDER XXX. SILVER AND ITS COMPOUNDS.

186. ARGENTUM.—SILVER.

Symbol Ag. *Equivalent Weight* 108.

HISTORY.—Silver, like gold, has been known from the most remote periods of antiquity, being mentioned in the earliest books of the Old Testament.[3] It was termed by the alchemists and astrologers *Diana* or *Luna* ☽.

[1] Wibmer, *Wirkung d. Arzneim.* iii. 647.
[2] Dumas, *Traité de Chim.* v. 178.
[3] *Genesis*, xliv. 2; *Job*, xxii. 25.