

known, that it is impossible at present to assign to it its proper chemical name. Its active principle is probably oxide of gold. There are several methods of preparing it: the simplest is to add a solution of protochloride of tin to a solution of chloride of gold, until a precipitate is no longer produced. Filter and dry the precipitate.

The purple of Cassius is soluble in ammonia, and does not form an amalgam with mercury: hence it does not appear to contain any metallic gold. Its composition varies according to the mode of procuring it. Gold, oxygen, and tin, are its essential constituents.

This preparation is used in the same cases as the other preparations of gold.

Au'ri Io'didum.—Io'dide of Gold.

This is ordered to be prepared, in the French Codex, by adding a solution of iodide of potassium to a solution of chloride of gold. Double decomposition takes place, and iodide of gold falls down. This is to be collected on a filter, and washed with alcohol, to remove the excess of iodine which precipitates with it.

Iodide of gold is of a greenish yellow colour, insoluble in cold water, but slightly soluble in boiling water. Heated in a crucible it evolves iodine vapour, and is converted into metallic gold. It is probably composed of 1 eq. iodine = 126, and 1 eq. gold = 200.

It has been employed internally, in venereal affections, in doses of from one-fifteenth to one-tenth of a grain. Externally it has been applied in the form of ointment to venereal ulcers (*Pierquin, Journ. de Progrès.*)

Au'ri Tercyan'idum.—Tercy'anide of Gold.

The directions for preparing this salt, in the French Codex, are somewhat diffuse. The process consists essentially in very carefully adding a solution of pure cyanide of potassium to a solution of chloride of gold, until a precipitate (cyanide of gold) ceases to be formed. The chloride of gold, prior to solution, should be deprived of all excess of acid by heating it in a salt-water bath.

Cyanide of gold is a yellow powder, which is insoluble in water. It consists, probably, of 3 eqs. cyanogen = 78, and 1 eq. gold 200. It has been used in venereal and scrofulous affections, both externally and internally. The dose is from one-fifteenth to one-tenth of a grain, made into a pill, with some inert powder.

ORDER 19. SILVER AND ITS COMPOUNDS.

Argen'tum.—Silver.

HISTORY.—Silver, like gold, has been known from the most remote periods of antiquity, being mentioned in the earliest books of the Old Testament (*Genesis, xlv. 2; Job, xxii. 25*). It was termed by the alchemists and astrologers, *Diana* or *Luna*.

NATURAL HISTORY.—It is found in the mineral kingdom in various states; sometimes nearly pure; or alloyed with other metals (especially

gold, antimony, tellurium, arsenicum, and copper); or combined with sulphur, selenium, iodine, or chlorine; or united to oxygen and carbonic acid. Of these, native silver and the sulphuret are by far the most abundant.

PREPARATION.—The processes followed for the extraction of silver vary in different places, according to the nature of the ore: they are principally *amalgamation* and *cupellation*. At Freyberg the ore is mixed with common salt, and roasted, by which the sulphuret of silver is converted into the chloride of this metal: water and iron are then added, to remove the chlorine, and the disengaged silver is finally dissolved in mercury (*amalgamation*), and the solution submitted to distillation, by which the mercury is volatilized, and the silver left behind (J. H. Vivian, in Taylor's *Records of Mining*, p. 21). The process of amalgamation followed in America is somewhat different (Boussingault, *Ann. de Chim.* li. 337; also Ward, *Mexico in 1827*, vol. ii. 437).

Silver is obtained from argentiferous galena, as follows:—The ore is first roasted to expel the sulphur, and afterwards smelted with charcoal. The argentiferous lead is then submitted to cupellation, by which the lead becoming oxidized, is partly volatilized, and partly sinks into the cupel (*cineritium*), leaving the silver. (On the smelting processes of Hungary, Saxony, &c., consult Taylor's *Records of Mining*, p. 51).

Pure silver is obtained by immersing a copper rod in a solution of the nitrate. The precipitate is to be digested in caustic ammonia, to remove all traces of copper, and afterwards washed with water.

PROPERTIES.—In the native state, silver occurs crystallized in the cube and regular octahedron. When pure this metal is white, with a slight shade of yellow; inodorous and tasteless. It is moderately hard and elastic; very ductile and malleable: a single grain may be drawn out into 400 feet of wire, and leaf silver (*argentum in laminas extensum*; *argentum foliatum*) may be procured, whose thickness is only $\frac{1}{100000}$ of an inch. Its sp. gr. is 10.474. It melts at a bright red heat (1873° F. according to Daniell). When exposed to the air it does not oxidate, but readily tarnishes by sulphureous vapours. Its equivalent is 108.

CHARACTERISTICS.—It is soluble in nitric acid: the solution thus obtained throws down a white precipitate—[see the properties of this chloride, p. 105]—with hydrochloric acid or the chlorides; white also with the alkaline carbonates, oxalates, and ferrocyanides; yellow with the phosphates and arsenites; red with the arseniates; olive-brown with the alkalis or lime water; metallic silver with phosphorus or copper; black with hydrosulphuric acid.

PURITY.—The silver of the shops usually contains traces of gold and copper.

PHYSIOLOGICAL EFFECTS.—Silver in the metallic state is totally inert.

USES.—In pharmacy it is used for the preparation of the nitrate which is employed as a medicine and as a test.

Silver leaf is used for filling the hollows of decayed teeth, and was formerly employed to cover pills. An amalgam of silver is also used by some dentists for stopping teeth. It is objectionable on account of its blackening them.

Argen'ti Ni'tras.—Ni'trate of Silver.

HISTORY.—Geber (*Invent. of Verity*, ch. xxi.) describes the method of preparing crystallized nitrate of silver. When this salt is fused, it is termed the *infernal stone* (*lapis infernalis*) or *lunar caustic* (*causticum lunare*).

PREPARATION.—In the London Pharmacopœia it is directed to be prepared by dissolving one ounce and a half of silver in a mixture of one fluidounce of nitric acid and two fluidounces of distilled water. The solution is afterwards to be evaporated to dryness, and the dried nitrate fused and poured into proper moulds.

The fusion may be more readily and safely effected in a Berlin porcelain capsule over a spirit or gas lamp, by means of Griffin's lamp furnace, than in a crucible over a slow fire, as directed in the Pharmacopœia.

The *theory* of the process is readily comprehended. Three equivalents or 324 parts of silver abstract three equivalents or 24 parts of oxygen from one equivalent or 54 parts of nitric acid, thereby disengaging one equivalent or 30 parts of binoxide of nitrogen, and forming three equivalents or 348 parts of oxide of silver, which unite with three equivalents or 162 parts of nitric acid to form three equivalents or 510 parts of nitrate of silver.

REAGENTS.		RESULTS.
1 eq. Nitric Acid 54	} 1 eq. Bin. Ox. Nitrog. 30 3 eq. Oxygen 24	1 eq. Bin. Ox. Nitrog. 30
3 eq. Silver		3 eq. Ox. Silver 348
3 eq. Nitric Acid	324	3 eq. Nitrate Silver 510
	162	

PROPERTIES.—Nitrate of silver forms transparent, colourless crystals, whose primary form is the right rhombic prism. Its taste is strongly metallic and bitter. When heated it fuses: if the temperature be increased, decomposition ensues; nitric acid and oxygen are evolved, leaving metallic silver. It is soluble in both water and spirit. It does not deliquesce: when exposed to the atmosphere and solar light it blackens, probably from the action of organic matter, hydrosulphuric acid, or water contained in the atmosphere. Mr. Scanlan (*Athenæum*, Aug. 25, 1838) finds that nitrate of silver in a clean dry glass tube, hermetically sealed, undergoes no change of colour by exposure to solar light: the contact of organic matter readily occasions it to become black.

CHARACTERISTICS.—It is known to be a nitrate by its deflagration when heated on charcoal, and the evolution of nitrous fumes. Its characters as a silver salt have been already described (p. 426.)

COMPOSITION.—Nitrate of silver is thus composed:—

	Eq.	Eq. Wt.	Per Cent.	Proust.
Oxide of Silver . . .	1 . .	116 . .	68·23 . .	69·5
Nitric Acid . . .	1 . .	54 . .	31·76 . .	30·5
<hr/>				
Nitrate of Silver . .	1 . .	170 . .	99·99 . .	100·0

PURITY.—Nitrate of silver should be white, and completely soluble in distilled water. By the action of organic matters it blackens from a partial reduction. The presence of copper may be detected in its solution by the blue colour produced with caustic ammonia. The watery

solution from which the silver has been thrown down by hydrochloric acid should be unchanged by the addition of hydrosulphuric acid, shewing the absence of lead and copper; and be completely volatilized by heat: if any saline residuum be obtained, the nitrate was adulterated. The white precipitate produced with either hydrochloric acid or chloride of sodium should be readily dissolved by caustic ammonia: if chloride of lead be present the effect will be otherwise.

PHYSIOLOGICAL EFFECTS. (a.) *On animals.*—Orfila (*Toxicol. Gén.*) found that it acted on animals as a powerfully corrosive poison. When dogs were made to swallow it, gastro-enteritis was induced. No symptoms indicating its absorption were observed. Dissolved in water, and thrown into the jugular vein, it produced difficult respiration, convulsive movements, and speedy death.

(b.) *On man.*—The *local action* of nitrate of silver is that of a caustic or corrosive. This might be expected, from observing its action on albumen and fibrin—substances which form the principal part of the animal textures. If a solution of nitrate of silver be added to an albuminous liquid, a white curdy precipitate is formed, composed of nitrate of silver and albumen, insoluble in caustic ammonia; and after some time becoming coloured and ultimately blackish, from the partial or complete reduction of the silver: a soluble compound of albumen and nitrate of silver is formed simultaneously with the insoluble one. The action of nitrate of silver on fibrin is analogous to that on albumen: that is, a white compound of nitrate of silver and fibrin is at first formed, but gradually the metal is reduced. These facts assist us in comprehending the nature of the changes produced by the application of nitrate of silver to the different tissues.

Applied to the skin it produces first a white mark (owing to its union with the coagulated albumen of the cuticle): gradually this becomes bluish grey, purple, and ultimately black, owing to the partial reduction of the silver. If the integument be moistened, and the nitrate applied three or four times, it causes at the end of some hours vesication, which is attended with less pain than that produced by cantharides. In some cases it excites acute pain. In one instance in which I applied it freely to the scalp for a cutaneous affection, fever with delirium was produced, which endangered the life of the patient (a girl of six years.) This is deserving of notice, because in Mr. Higginbottom's work (*Essay on the Use of the Nitrate of Silver*, 2d ed. p. 198) we are told that nitrate of silver applied as a vesicant "causes scarcely any constitutional irritation, even in children." In a few days the black and destroyed cuticle cracks and falls off, without any destruction of the subjacent cutis vera.

Applied to the hair or nails the nitrate stains them black, as in the case of the cuticle; and, in consequence, it is one of the substances employed as a hair-dye. When recently applied, the black tint of the hair, and even of the cuticle, may be removed by washing with a solution of chloride of sodium, and then with ammonia-water, to dissolve the chloride of silver which is produced (*Journ. de Chim. Méd.* vii. 542.) To detect silver in stained hair, the latter is to be treated with chlorine, by which chloride of silver is produced, which is soluble in ammonia, and precipitable from its solution by nitric acid (Devergie, *Méd. Leg.* ii. 933.) Part of the black colour of the hair stained by the nitrate probably depends on the formation of sulphuret of silver.

When nitrate of silver is applied to an ulcer it produces a white film (owing to its union with the albumen, and perhaps also with the chloride, of the secretion.) This film in a few hours assumes a dark colour, and ultimately forms a black eschar. This hardens, and in few days becomes corrugated, separates at the edges, and at length peels off altogether, leaving the surface of the sore beneath in a healed state (Higginbottom, *op. cit.* p. 10.) The intensity of the pain varies much in different cases; but it is, on the whole, very much less than might be imagined by those who have not tried this remedy.

When applied to mucous membranes, a similar white compound of the nitrate with the animal matter of the secreted mucus is formed, and this defends the living tissue from the action of the caustic, so that the effects are not so violent as might be expected. Thus the solid nitrate may be applied to the mucous surface of the vagina, and even to the os uteri, in cases of leucorrhœa and gonorrhœa, oftentimes without exciting any pain or inflammation: in some instances, however, it produces smarting pain, which lasts for several hours, but no serious effects have resulted from its use, even when, by accident, two drachms of nitrate have been left to dissolve in the vagina. (Dr. Hannay, *Lond. Med. Gaz.* xx. 185; also Mr. Bell, *ibid.* 473; and Dr. Jewel, *Prat. Observ. on Leucorrhœa.*)

Its chemical effects on the other mucous membranes are analogous to those just mentioned; but the pain which it produces varies with different membranes, and in the same membrane under different states. Its application to the conjunctiva is attended with acute pain, (especially when inflammation is going on) though in general it soon subsides. On all these surfaces it acts as an astringent.

The safety with which, in most cases, large doses of the nitrate are administered internally, must depend on the presence of the mucus which lines the internal coat of the stomach; the animal matter of which combining with the nitrate prevents its action on the living tissue. It is deserving of especial notice that larger doses may be exhibited without inconveniencing the stomach, in the form of pill, than in that of solution. Dr. Powell (*Med. Trans. of the College of Phys.* iv. 85) in some cases was enabled to give 15 grains at a dose in the form of pills, while he rarely found stomachs that could bear more than five grains in solution. Fouquier (*Dict. Mat. Méd.* i. 403) has also remarked the greater activity of the solution. If cautiously exhibited, beginning with small doses and gradually increasing them, it may be exhibited for a considerable period without producing any obvious changes in the corporeal functions, though it may be exercising a beneficial influence over the constitution, evinced by its amelioration of certain diseases, as epilepsy. In some cases it has caused an eruption (Sementini, *Quart. Journ. of Science*, xii. 189; Copland, *Dict. Pract. Med.* i. 68.) If the dose be too large it causes gastrodynia, sometimes nausea and vomiting, and occasionally purging. Taken in an excessive dose it acts as a corrosive poison; but cases of this kind are very rarely met with. Boerhaave mentions an instance in which it caused excruciating pain, gangrene, and sphacelus of the first passage.

All the above-mentioned symptoms are referrible to its local action, and from them we have no evidence of its absorption, or of the nature of its influence over the general system. But the discoloration of the skin, presently to be noticed, fully proves that absorption does take place when the medicine is exhibited in small but long-continued doses. It exer-

cises a specific influence over the nervous system ; at least I infer this, partly from the effects observed by Orfila when it was injected into the veins of animals, and partly from its occasionally curative powers in affections of his system, as epilepsy and chorea.

The blueness, or slate colour, or bronze hue of the skin just alluded to, has been produced in several patients who have continued the use of the nitrate during some months or years (*Medico-Chirurg. Trans.* vii. and ix.) In some of the cases the patients have been cured of the epilepsy for which they took the medicine ; in others the remedy has failed (Rayer, *Treatise on Skin Diseases, by Willis*, 961). In one instance which fell under my notice, the patient, a highly respectable gentleman, residing in London, was obliged to give up business in consequence of the discoloration ; for when he went into the street, the boys gathered around him, crying out "there goes the blue man." In this instance no perceptible diminution of the colour had occurred for several years, but in some cases it fades in intensity. The corion is the essential seat of it. Dr. Baddeley (*Med.-Chir. Trans.* ix. 238) found that blisters rose white,—a proof that in his patient the colouring matter was below the epidermis. But in some instances the cuticle and corpus mucosum of the face and hands participate in the tint. In one instance the mucous membrane of the stomach and intestines was similarly tinted. A case is mentioned by Wedemeyer (*Lond. Med. Gaz.* iii. 650) of an epileptic who was cured by nitrate of silver, but eventually died of diseased liver and dropsy : all the internal viscera were more or less blue, and Mr. Brande obtained metallic silver from the plexus choroides and pancreas. The discoloration of the skin is usually regarded as permanent and incurable ; but I have been informed that in one instance washes of dilute nitric acid diminished it. If this observation be correct, I would suggest the exhibition of nitric acid internally, as well as its external use. Dr. A. T. Thomson (*Elem. of Mat. Med.* i. 715) suggests that if nitric acid were conjoined with nitrate of silver, the discoloration might be prevented ; and the suggestion certainly deserves attention. But I would observe, that if the acid should prove efficacious, his hypothesis, that the colour depends on blackened chloride of silver, will be disproved ; for nitric acid can neither prevent the action of the compounds of chlorine on the salts of silver, nor can it dissolve the white chloride or the black subchloride.

USES.—Nitrate of silver has been employed *internally* in a very few cases only ; and of these the principal and most important are epilepsy, chorea, and angina pectoris. Its liability to discolour the skin is a great drawback to its use ; indeed, I conceive that a medical man is not justified in risking the production of this effect without previously informing his patient of the possible result.

In *epilepsy* it has occasionally, perhaps more frequently than any other remedy, proved successful. Dr. Sims (*Mem. of the Med. Soc. of Lond.* iv. 379), Drs. Baillie, R. Harrison, Roget, and J. Johnson (*Treat. on Nerv. Dis.* by J. Cooke, M.D. ii. Pt. 2, 147), have all borne testimony to its beneficial effects. Its *methodus medendi* is inexplicable. This, indeed, is to be expected, when it is considered that the pathology and causes of epilepsy are so little known, and that, as Dr. Sims has justly observed, every thing concerning this disease is involved in the greatest doubt and obscurity, if we except the descriptions of a single fit, and that it returns at uncertain intervals. In this state of ignorance, and with the already-

mentioned facts before us, as to the curative powers of this salt, the observation of Georget (*Physiol. du Système Nerv.* ii. 401), that he has great difficulty in conceiving how the blindest empiricism should have led any one to attempt the cure of a diseased brain by cauterizing the stomach, is, I conceive, most absurd, and unwarranted. The cases which have been relieved by it are probably those termed by Dr. M. Hall (*Lect. on the Nerv. System*, p. 143) eccentric. In the few instances in which I have seen this remedy tried, it has proved unsuccessful; but it was not continued long, on account of the apprehended discoloration of the skin.

In *chorea* it has been successfully employed by Dr. Powell (*Med. Trans. of the College of Phys.* iv. 85), Dr. Uwins (*Ed. Med. and Surg. Journ.* viii. 407), Dr. Crampton (*Trans. of the King and Queen's College of Phys.* iv. 114), Lombard (*Rust's Magaz.* xl.), and others. In *angina pectoris* it has been administered in the intervals of the paroxysms with occasional success by Dr. Cappe (*Duncan's Annals of Med.* iii.), and by Dr. Copland (*op. cit.*) In *chronic affections of the stomach* (especially morbid sensibility of the gastric and intestinal nerves) it has been favourably spoken of by Autenreith (Dierbach's *Neust. Entdeck. in d. Mat. Med.* 1837, i. 528), Dr. James Johnson (*On Indigestion*, 2^d ed. p. 87), and Rueff (Diebach, *op. cit.*; also *Americ. Journ. of Med. Scien.* May 1837, p. 225). It has been employed to allay chronic vomiting connected with disordered innervation, as well as with disease of the stomach (scirrhous and cancer), and to relieve gastrodynia. The foregoing are the most important of the diseases against which nitrate of silver has been administered internally.

As an *external agent* its uses are far more valuable, while they are free from the danger of staining the skin. It is employed sometimes as a *caustic*, and as such it has some advantages over potassa fusa and the liquid corrosives. Thus, it does not liquify by its application, and hence its action is confined to the parts with which it is placed in contact. It is used to remove and repress spongy granulations in wounds and ulcers, and to destroy warts, whether venereal or otherwise. It is applied to chancres on their first appearance, with the view of decomposing the syphilitic poison, and thereby of stopping its absorption, and preventing bubo or secondary symptoms. This practice has the sanction of Mr. Hunter. I have several times seen it fail, perhaps because it was not adopted sufficiently early. The nitrate should be scraped to a point, and applied to every part of the ulcer. This mode of treating chancres has been recently brought forward by Ratier (*Arch. Gén. de Méd.* xv. 47, and xvi. 62) as if it were new, and as forming part of Bretonneau's *ectrotic* (*ectrotica*, ἐκτριψόσκω, *I abort*;) method of treating diseases!

The application of nitrate of silver to *punctured wounds* is often attended with most beneficial effects, as Mr. Higginbottom (*op. cit.*) has fully proved. It prevents or subdues inflammatory action in a very surprising manner. It is equally adapted for poisoned as for simple wounds. To promote the healing of *ulcers* it is a most valuable remedy. In large indolent ulcers, particularly those of a fistulous or callous kind, it acts as a most efficient stimulant. To small ulcers it may be applied so as to cause an eschar, and when at length this peels off, the sore is found to be healed. Mr. Higginbottom (*op. cit.* p. 11,) asserts that "in every instance in which the eschar remains adherent from the first

application, the wound or ulcer over which it is formed invariably heals." Dry lint will, in general, be found the best dressing for sores touched with the nitrate.

Nitrate of silver was proposed by Mr. Higginbottom as a topical remedy for external inflammation. It may be applied with great advantage to subdue the inflammatory action of erythema, of paronychia or whitlow, and of inflamed absorbents. In some cases it is merely necessary to blacken the cuticle; in others, Mr. Higginbottom recommends it to be used so as to induce vesication. In what way it subdues inflammation—in other words, its *methodus medendi*—is completely unknown.

Bretonneau and Serres (*Arch. Gén. de Méd.* viii. 220 and 427) recommend the *cauterization of variolous pustules* by nitrate of silver, in order to cut short their progress. It is principally useful as a means of preventing pitting, and should be employed on the first or second day of the eruption. The solid caustic is to be applied to each pustule after the apices have been removed. This etrotic method has also been employed in the treatment of *shingles* (*herpes zoster*): in one case the disease was cured in a few hours (*Arch. Gén. de Méd.* xviii. 439). Some good rules for its application have been laid down by Rayer (*Treatise on Skin Diseases*, by Willis, p. 260).

In some diseases of the eye nitrate of silver is a most valuable remedial agent. It is used in the solid state, in solution, and in ointment: the solution may be used as a wash or injection, or applied by a camel's hair pencil. In deep ulcers of the cornea, the solid nitrate should be applied,—in superficial ones, a solution (of from 4 to 10 grains of the salt to an ounce of distilled water) may be employed (Mackenzie, *On the Diseases of the Eye*, 2d ed. 578). There is one drawback to the use of this substance in ulcers of the cornea, as well as other affections of the eye; viz. the danger of producing dark specks in the cornea, or of staining the conjunctiva (Jacob, *Dubl. Hosp. Rep.* v. 365). In both acute and chronic ophthalmia, Mr. Guthrie (*Lond. Med. and Phys. Journ.* lx. 193, lxi. 1) employs this salt in the form of ointment (Arg. Nitr. gr. ij. ad gr. x.; Liq. Plumbi Subacet. gtt. xv.; Ung. Cetacei, ʒj.) Of this he directs a portion (varying in size from a large pin's head to that of a garden pea) to be introduced between the lids by the finger or a camel's hair pencil. It causes more or less pain, which sometimes lasts only half an hour, at others till next day. Warm anodyne fomentations are to be used; and the application of the ointment repeated every third day. In acute cases, two or three applications will arrest the disease. With this treatment, blood-letting, and the use of calomel and opium, are preceded or conjoined. (For some judicious remarks on this practice, consult the article *Ophthalmia*, by Dr. Jacob, in the *Cyclop. of Pract. Med.* iii. 201). While many surgeons hesitate to use nitrate of silver in the first stage of acute purulent ophthalmia, all are agreed as to its value in the second stage of the disease, as well as in chronic ophthalmia. Besides the diseases of the eye already mentioned, there are many others in which the oculist finds this salt of the greatest service, as a caustic, astringent, or stimulant. (Vide Dr. Mackenzie's *Treat. on Diseases of the Eye*; and Mr. Ryall's paper, in the *Trans. of the King and Queen's College of Phys.* v. 1).

In *inflammatory affections and ulcerations of the mucous membrane of the mouth and fauces*, nitrate of silver is sometimes a most valuable

application (Hunt, *Lond. Med. Gaz.* xiii. 129). When the fibrinous exudation of croup commences on the surface of the tonsils and arches of the palate, its further progress may be stopped, according to Mr. Mackenzie (*Edin. Med. and Surg. Journ.* xxiii. 294), by the application of a solution composed of a scruple of nitrate of silver and an ounce of distilled water. The solid nitrate has been introduced through an aperture in the trachea, and applied to ulcers on the inner surface of the larynx, in a case of phthisis laryngea, with apparent benefit, (Liston, *Elements of Surgery*, part ii. p. 256).

In some forms of *leucorrhœa* the application of nitrate of silver, either in the solid state or in solution, is attended with beneficial effects. This practice was first recommended by Dr. Jewel (*Pract. Observ. on Leucorrhœa*, 1830). It is, I believe, most successful in cases dependent on local irritation or subacute inflammation, and not arising from constitutional debility. The solution may be applied by a piece of lint or sponge, or may be injected by means of a syringe with a curved pipe. Its strength must vary according to circumstances. Dr. Jewel generally employs three grains of the nitrate to an ounce of water; but in the Lock Hospital, solutions are sometimes used containing half a drachm or even two scruples to the ounce. In some cases the solid nitrate has been applied to the cervix uteri and vagina by means of a silver tube. In *gonorrhœa of the female* a solution of nitrate of silver, or even this caustic in the solid state, has been used with the best effects. It was first employed by Dr. Jewel, but subsequently, and on a much more extended scale, by Dr. Hannay (*Lond. Med. Gaz.* xx. 185), and without any injurious consequences. In many cases the discharge ceased, never to return, in twenty-four hours. The fear of ill effects has prevented the general adoption of this practice. In *gonorrhœa of the male*, the introduction of a bougie, smeared with an ointment of nitrate of silver, is, occasionally, a most effectual cure: but the practice is dangerous. In one case I saw acute and nearly fatal urethritis brought on by its employment. The individual was a dresser at one of the London hospitals, and had practised this mode of treatment in many instances on the hospital patients with the happiest results. An aqueous solution of the salt has been successfully used in chronic gonorrhœa (Rognetta, *Lancette Française*, Mar. 31, 1836).

In *fissured or excoriated nipples* the application of the solid nitrate of silver is of great service. It should be insinuated into all the chaps or cracks, and the nipple afterwards washed with tepid milk and water. (*Lond. Med. Gaz.* v. 207; xiv. 674, 719, and 754).

The application of solid nitrate of silver is a most effectual remedy for the different forms of *porrigo* which affect the heads of children. The caustic should be well rubbed into the parts. I have never known the practice to fail, or to cause the loss of hair. Where the greater portion of the scalp is involved, the different spots should be cauterized successively at intervals of some days; for, as already mentioned, I have seen fever and delirium produced in a child from the too extensive use of the remedy. In *psoriasis* the same medicine was found by Dr. Graves (*Lond. Med. Gaz.* vii. 520) most effectual. An aqueous solution of the nitrate is also valuable as an astringent wash in other skin diseases, as *impetigo*. The solid nitrate is sometimes employed to stop the progress of irritative or erysipelatous inflammation, by applying it in a circular

form around, and at a little distance from, the inflamed portion; but I have frequently observed the inflammation extend beyond the cauterized part. Mr. Higginbottom (*op. cit.*) reports favourably of the effects of applying the nitrate to *burns* and *scalds*; and his observations have been confirmed by those of Mr. Cox (*Lond. Med. Gaz.* x. 672).

In strictures of the urethra and œsophagus, bougies armed with lunar caustic in their points (*the caustic or armed bougie*) are occasionally employed with great advantage, at least in urethral stricture. When the common bougie (*cereolus simplex*) is formed, the point of it should be heated with a conical piercer, and the caustic introduced while the composition is quite soft. The point of the bougie should then be rubbed smooth on a piece of polished marble till no inequality in the size of it appear (Dr. Andrews, *Observ. on the Applic. of Lunar Caustic to Strictures*, 1807, p. 126.) Notwithstanding that the application of nitrate of silver to stricture of the urethra has been advocated by Mr. Hunter, Sir E. Home, Mr. Wilson, Dr. Andrews, and others, it is now but little employed; yet of its efficacy and safety in many obstinate cases, where the simple bougie fails, I am assured by repeated observation. It is commonly supposed that it acts by burning or destroying the stricture: such is not the fact. It induces some change in the vital actions of the part, which is followed by relaxation of the narrowed portion of the canal, but which change is as difficult to explain as is the subduction of external inflammatory action by the application of this salt. Of the use of the caustic bougie in stricture of the œsophagus I have no experience.

ADMINISTRATION.—Nitrate of silver may be exhibited in doses of $\frac{1}{6}$ of a grain, gradually increased to three or four grains, three times a day. As before mentioned, Dr. Powell has augmented the dose to fifteen grains. The usual mode of administering it is in the form of pills made of bread-crumbs; but the chloride of sodium, which this contains, renders it objectionable: some mild vegetable powder with mucilage is preferable. Common salt or salted foods should not be taken either immediately before or after swallowing these pills. Dr. Johnson (*Essay on Morbid Sensibility of the Stomach and Bowels*, 2d ed. p. 90), asserts "that there is no instance on record where the complexion has been affected by the medicine when restricted to three months' administration." It is advisable, however, not to continue the use of it beyond a month or six weeks at a time.

For external use an aqueous solution is employed of strengths varying from a quarter of a grain to two scruples, in an ounce of distilled water. The formula for Mr. Guthrie's ointment has already been given.

LIQUOR ARGENTUM NITRATIS, Ph. Lond. (Nitrate of silver, ʒj.; distilled water, fʒj. dissolve and strain. The solution is to be preserved from the light in a well-closed vessel.) It has been introduced into the Pharmacopœia merely as a test.

ANTIDOTE.—The antidote for nitrate of silver is common salt (chloride of sodium.) When this comes in contact with lunar caustic, nitrate of soda and chloride of silver are produced: the latter compound is, according to the experiments of Orfila (*Toxicol. Gén.*), innocuous; though it has been said to possess antisyphilitic powers (Serre, *Lond. Med. Gaz.* xvi. 703). The contents of the stomach should be removed, and the inflammatory symptoms combated by demulcents, bloodletting, and the usual antiphlogistic means.

When the local use of nitrate of silver causes excessive pain, relief may be gained by washing the parts with a solution of common salt. Pieces of caustic have been left in the vagina and urethra without unpleasant consequences resulting. Injections of a solution of common salt are the best means of preventing bad effects.

To diminish the slate-coloured tint of the skin arising from nitrate of silver, acids or the super-salts offer the most probable means of success. The external and internal use of dilute nitric acid, or the internal employment of bitartrate of potash, may be tried: the discoloration is said to have yielded to a steady course of the last-mentioned substance (*United States Dispensatory*).

Argen'ti Cyan'idum.—Cy'anide of Silver.

HISTORY.—This compound, sometimes called *hydrocyanate*, *cyanuret*, or *cyanodide of silver*, or *argentum zootinicum*, has been studied by Scheele, Ittner, and Gay-Lussac.

PREPARATION.—In the London Pharmacopœia this compound is directed to be prepared by adding a pint (℥_{ss}xx.) of diluted hydrocyanic acid to a solution of two ounces and two drachms of nitrate silver in a pint of distilled water. The precipitate is to be washed with distilled water, and dried.

In this process one equivalent, or 27 parts of hydrocyanic acid react on one equivalent, or 170 parts of nitrate of silver: thereby generating one equivalent, or 134 parts of cyanide of silver, and one equivalent, or 9 parts of water, and setting free one equivalent, or 54 parts of nitric acid.

REAGENTS.		RESULTS.	
1 eq. Nitrate Silver 170	{ 1 eq. Nitric Acid . . . 54	1 eq. Nitric Acid . . .	54
	{ 1 eq. Oxygen 8	1 eq. Water	9
	{ 1 eq. Silver 108		
1 eq. Hydroc. Acid 27	{ 1 eq. Hydrogen 1		
	{ 1 eq. Cyanogen 26	1 eq. Cyanide Silver	134

PROPERTIES.—When first thrown down it is a white curdy precipitate, which by drying becomes pulverent. It is insipid, insoluble in water, but dissolves in caustic ammonia. It is decomposed by hydrochloric and hydrosulphuric acid, both of which develop with it hydrocyanic acid. It combines with other metallic cyanides to form the *argento-cyanides*. By exposure to the atmosphere and solar rays it assumes a violet tint. It is not decomposed by mixture with neutral vegetable substances (*Journ. de Chim. Med.* 2nde Ser. iii. 407.)

CHARACTERISTICS.—It is insoluble in cold nitric acid, but soluble in the boiling acid. When carefully dried and then heated in a glass tube it yields cyanogen gas (which is readily known by its combustibility and the bluish-red colour of its flame) and a residuum of metallic silver. The latter is recognised by the before-mentioned tests for this metal.

COMPOSITION.—The following is the composition of this substance:—

	Eq.	Eq. Wt.	Per Cent.
Silver	1	108	80.60
Cyanogen	1	26	19.40
<hr/>			
Cyanide of Silver	1	134	100.00

PHYSIOLOGICAL EFFECTS AND USES.—I am unacquainted with any experiments made to determine its effects on man or animals. Serre, of

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

ORDER 20. MERCURY AND ITS COMPOUNDS.

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

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

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

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

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

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