ARGENTUM.

Silver, Ag,—is a white, lustrous metal, which occurs in the free state, also as a sulphide, a chloride, and other compounds. It resists the action of oxygen and caustic alkalies, but is attacked by sulphur, sulphides, and by nitric acid. In medicine it is represented by three official salts, and several unofficial compounds.

Official Salts of Silver.

Argentic Nitrate, Silver Nitrate, AgNO₃,—occurs in colorless rhombic crystals, of bitter caustic taste and neutral reaction. It is soluble in water and in 26 of alcohol. It is best given in pill with potassium nitrate, or in distilled water, never with tannin or a vegetable emulsion, for this renders it less effective. It forms an exclusive compound with chloroform.

Argentic Nitrate, Kali, Argentic Nitrate, Silver Oxide, Ag₂O,—is brownish black powder, nearly insoluble in water and insoluble in alcohol. It is liable to decompose with violence when mixed or treated with reduction agents or heated alkalies. It is used locally by phlebotomists.

Argentic Cyanide, Silver Cyanide, AgCN,—has no medicinal use except for the temporary production of Hydrocyanic Acid. It is highly toxic and exceedingly dangerous. Its preparation should be avoided.

Argentic Osmium, Silver Osmide, Ag₂O,—is a brownish black powder, nearly insoluble in water and in alcohol. It is used in the treatment of various skin conditions, particularly in cases of anthrax and other infections.

Unofficial Silver Compounds.

Acetol, Silver Lactate,—is a white, inspissated and tasteless powder, which coagulates albumen and is soluble in 20 of water. It is used as a local application in burns and for purifying wound dressings. It is also used as an injection for gonorrhea. It is dissolved in from 1 to 20 of water, but the solution used in injections is 1 to 500.

Argenticum, Argenticum,—is a patented preparation consisting of Silver Phosphide to per cent., dissolved in a 10 per cent. solution of Ethylene-diamine. It is used as an antiseptic and antibiotic, and is said to be effective against syphilis. It is also used as an injection for gonorrhea. It is dissolved in from 1 to 1000 to 1 to 5000, and is recommended for use in cases of gonorrhea.

Argenticum, Silver Cyanide-sulfate,—is a combination of Silver and Cyanocobalt, and is used as an antiseptic and anodyne, and as a substitute for iodine in the treatment of wounds, skin diseases, syphilitic ulcers, etc., also as an injection for gonorrhea. It is dissolved in from 1 to 5000 to 1 to 1000, and is recommended for use in cases of gonorrhea.

Argenticum, Silver Iodide-sulfate,—is a combination of Silver and Iodicobalt, and is used as an antiseptic and anodyne, and as a substitute for iodine in the treatment of wounds, skin diseases, syphilitic ulcers, etc., also as an injection for gonorrhea. It is dissolved in from 1 to 5000 to 1 to 1000, and is recommended for use in cases of gonorrhea.

Argenticum, Silver Lactate,—is a white, inspissated and tasteless powder, which coagulates albumen and is soluble in 20 of water. It is used as a local application in burns and for purifying wound dressings. It is also used as an injection for gonorrhea. It is dissolved in from 1 to 20 of water, but the solution used in injections is 1 to 500.

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ARGENTUM.

gnum, the solutions being of 1 to 1½ per cent. strength, according to the stage of the affection.

**Nargol,** a compound of silver and nitric acid, contains 10 per cent. of silver, is very soluble in water, and is used in 1 to 5 or 10 per cent. solutions. It is more stable than Protargol and less irritant, in solutions of equal strength.

**Picratol,** Silver Trichloride Phenolic.—A combination of silver and picric acid, contains 30 per cent. of silver, and is soluble in 30 per cent. of alcohol, and in water, also in alcohol, glycerin, ether and chloroform. It is markedly antiseptic, astringent, and analgesic.

**Protargol,** a silver-gold compound, containing 8 per cent. of metallic silver, and occurring as a yellow powder, readily soluble in water. It is claimed to be absolutely non-irritant, either in the conjunctival sac or on the cornea, but its effective solutions are somewhat irritant. It is highly prized as an antiseptic and astringent application (in 1 to 2 per cent. solutions). Solutions for affections of the conjunctiva, also for wounds and gas gangrene.

**Silver and Sodium Hypochlorite,** very soluble in water, does not conglomerate albumin, and may be given by the stomach or hypodermically. It has been used internally for leucopeny stools and is preferred to silver nitrate for local application to the throat, being more agreeable to the taste. It does not stain the skin or the clothing. Dose, by the mouth, gr. 5-15; hypodermically, gr. 4-6 daily.

**Physiological Action.**

Metallic Silver is antiseptic, probably by forming a lactate with the lactic acid produced by microbes. In contact with colonies of germs it kills them without exercising any inimical action on the animal tissues (Credé). Locally the silver salts are antiseptic, astringent, irritating and caustic, according to the strength of the applications. They are less irritant than the salts of mercury and more so than the salts of lead. The soluble salts of silver, taken internally in medicinal doses, are tonics to the nervous system, increase tissue change and promote the secretion of bile; in larger doses they depress the heart, reduce the temperature and impair the respiration; in overdoses they act upon the central nervous system, producing tetanic convulsions or paralysis. In mammals they affect the medullary centres particularly at first stimulating and then depressing them, causing a primary rise of blood-pressure which afterwards falls, also slowing and exhausting the respiration, which finally falls from paralysis of the respiratory centre. The heart is but slightly affected and often continues to beat for some time after the breathing has stopped. The mucous membrane of the stomach and intestines shows congestion, ecchymoses and ulceration, the kidneys are irritated and edema of the lungs often occurs. None of these effects have been observed in man, but in him the prolonged use of the silver salts will produce chronic silver poisoning, known as *Argyria.* The first sign of this condition is a slate-colored line along the margin of the gums, some inflammatory swelling. Subsequently grayish patches appear on various parts of the skin and mucous membranes, and extend over the whole integument, which becomes slate-colored. No organ of the body, except the parenchymatous cells and the epidermis, is exempt from this pigmentation, which is due to the deposit of silver, either in the metallic state or as an oxide or some organic compound, in the connective tissues. In the skin it is found in the derma, not in the epidermis. As a rule argyria does not produce any serious effect upon the health of the subject, though some authorities have ascribed to it gastro-intestinal catarrh, faulty assimilation, changes in the blood, and fatty degeneration of the heart, liver, and kidneys. It is probable that in most cases some degree of deranged nutrition is produced. A local argyria may be caused by the frequent topical application of a soluble silver salt for a long time. In a few cases general argyria has resulted from the local use of a silver salt, usually in the mouth or throat; and it appears in workers in the manufacture of artificial pearls, who use silver as a pigment. Argyria is incurable, though many attempts have been made to remove the discoloration by the administration of iodides. The only solvent is potassium cyanide, which is inadmissible by reason of its violent toxicity.

Silver salts unite with albumin to form albuminates, which are soluble in the digestive fluids, but it is not certain that silver is thus absorbed. According to some authorities the salts are reduced in the stomach and also in the intestinal canal, the tendency of such action being towards the separation of the metal, most of which passes through the alimentary canal unabsorbed, a very small portion finding its way through the lymphatics to the tissues and remaining imbedded therein indefinitely.

The Nitrate is the most soluble of the silver salts. It is antiseptic, astringent, hemostatic, irritant, and a limited escharotic, also antiphlogistic, antispasmodic and toxic. It has a strong affinity for albumin, with which it unites to form an albuminate. Locally applied in dilute solution it causes a marked contraction of the bloodvessels, but in stronger solutions it is irritant, dilating the vessels and acting as a superficial caustic by coagulating the albumin of the tissues to which it is applied and destroying their vitality. A dense layer is thus formed which prevents the further penetration of the salt and limits its escharotic action. This albuminous coating is at first white but soon turns black under the influence of light. The stains made by handling or applying it to the skin may be removed by washing with a strong solution of potassium cyanide, and may in great part be prevented by immediately neutralizing the silver salt with a solution of common salt. Internally, in small doses, the Nitrate stimulates the heart, promotes nutrition and acts as a nerve tonic. In larger doses it produces violent gastro-enteritis, corrosion and ulceration of the gastro-intestinal mucoous membrane, due to thrombosis of its veins. Burning pain is felt in the throat and stomach, followed by nausea, vomiting and often by purging. Central impairment of the nervous system may occur, with loss of co-ordination power and paralysis. Collapse follows, with weak pulse, pinched face, coldness of the surface and shallow respiration; and this condition may be followed by coma, convulsions, and finally death from paralysis of the respiratory centre. The lethal dose has not been determined.

**Therapeutics.**

The local uses of Silver Nitrate, which are the most important, depend on its antiseptic, hemostatic, astringent, caustic and stimulant properties. As an antiseptic it has proved an efficient prophylactic against ophthalmia neonatorum,
a drop of a 1 per cent. solution being instilled into each eye of the new-born
infant. In this disease, when the discharge is purulent, a similar solution
should be applied to the conjunctivae daily, and when the discharge is very
profuse a 2 per cent. solution is not too strong. A solution of the latter strength
is commonly employed in the purulent conjunctivitis of adults, applied once
daily to the everted lids by a brush, after cleansing and drying the surface; the
excess being removed by washing with warm water or by neutralization with
a solution of common salt. When the cornea is intact a solution of ½ to 1 per
cent. strength may be occasionally dropped into the conjunctival sac, but
care must be taken that it does not come in contact with an inflamed or ulcer-
ated cornea, as it is not well borne in such cases and may cause a permanent
corneal opacity by the deposit of silver.

In chronic purulent inflammation of the middle ear Silver Nitrate is one
of the most valuable applications, in solutions varying from ½ of one per cent.
to saturation, applied by a special syringe through the perforated tympanic
membrane or by dropping into the external meatus. Aural polypi have been
successively treated with solutions of from 6 to 20 per cent. strength. Weak
solutions are useful in eczema of the ear and in external otitis, also for chronic
inflammation of the lining membrane of the nasopharyngeal tube, to abort aural
fornices, and to relieve pain from the external auditory meatus.

In the local treatment of the nose and throat Silver Nitrate is useful but
should be employed with care. The stick of caustic is brittle and liable to
break off while in use, hence it might be swallowed and produce acute poison-
ing. The danger of general argyria occurring from the prolonged use of the
salt in this situation should be remembered. For ulcers on the nasal septum,
vascular granulations arising after operations on the nose, fissures of the tongue
and lips, and mucous patches and ulcers of the mouth, the fused stick or a moder-
ately strong solution is a good application. In subacute and chronic laryn-
gitis a weak solution is sometimes very effective, as it is also in ulcer of the
larynx when not due to laryngeal tuberculosis.

In genito-urinary surgery Silver Nitrate has many uses. In solutions of
various strengths, 1 in 500 to 1 in 500, it is an old remedy for gonorrhea, ap-
plicated to the urethra during the course of the disease. Stronger solutions, up
to 1 per cent., have been employed in the early stage with the view of aborting
the inflammation, but this procedure causes great pain and has many oppo-
nents as well as many advocates. If it fails to cut the disease short it will prob-
able aggravate the inflammation considerably. The milder solutions are use-
ful applications in chronic gleet, prostatitis, vesiculitis, vaginitis and chronic
cystitis. In the form of gelatin bougies impregnated with the salt it may be
applied to the urethral mucous membrane with more facility and with better
results than by injection with a syringe. A 2 per cent. solution injected into
the substance of buboes in their early stage has given satisfaction. Indolent
sinuses from buboes or abscesses may be stimulated to healing by the appli-
cation of lunar caustic lightly or a strong solution of the salt. It has been much
used in the treatment of cervical endometritis and erosion of the os uteri.

In diseases of the skin the Nitrate is employed to destroy parasitic fungi,
to cause exfoliation of the epidermis and for stimulant effect upon indolent
ulcers and sores. Lunar caustic is used to destroy warts and other small growths,
to arrest capillary hemorrhage, and for other similar purposes. Solutions of
various strengths are useful in some forms of eczema, relieve the itching in
prurigo and lichen, and are said to prevent pitting in varicola. It is a very
efficient application in pemphigus, if used in a 4 per cent. solution to the sur-
face of the dermis, after removing the epidermis over the blisters and cleansing
their bases of all secretion. Chilblains may be painted with a strong solution
to relieve the irritation, and in lupus, psoriasis, erythema and ringworm, solu-
tions of this salt have been applied with satisfactory results. In erysipelas
a concentrated solution, 20 grains to the dram, was formerly applied on the
inflamed surface and over the healthy skin beyond, to the extent of two or three
inches, after washing and drying the part, with the object of checking the spread-
ing inflammation or at least rendering it less severe; but this procedure has
been superseded by other methods of treatment. For application to the skin
a solution in Spirit of Nitrous Ether is recommended. This solution deposits
a light-colored precipitate but itself does not turn black like the simple alcoholic
solution. It blackens the skin however in a shorter time than any other solu-
tion.

In general surgery the moulded stick (lunar caustic) is much employed to
cut down exuberant granulations in suppurating wounds, and to stimulate the
healing of Indolent ulcers, sores and sinuses. Bedsores may often be pre-
vented by painting the red but unbroken skin with a 2 to 4 per cent. solution.
Cysts and hydroceles may be cured by the injection of a strong solution into
them after evacuating their contents, the result being the exciting of an adhes-
itive inflammation which obliterated the sac.

The internal use of Silver Nitrate is almost wholly confined to the treat-
ment of affections of the gastro-intestinal tract. Its astringent and tonic actions
are sometimes very efficient in cases of weak and irritable stomach accompanied
by great depression of spirits, morbid apprehensions and want of courage. It
is employed in persistent vomiting, in chronic gastric catarrh, in hematemesis,
and in gastric ulcer. When given for stomach affections it should be admin-
istered when the viscus is empty. Chronic gastritis has been treated with
benefit by irrigating the stomach with solutions of various strengths, from 2
to 4 grains gradually increased to 20 grains in 6 drachms of water, immediately
followed by a 3 to 5 per cent. solution of common salt. The Nitrate has often
proved of value in chronic inflammation of the large and small intestine, espe-
cially where there was ulceration of the intestinal mucous membrane. It has
done good service as an internal remedy in acute dysentery, and in chronic
dysentery a solution of 20 to 30 grains to the pint of distilled water as an injec-
tion into the colon has given satisfactory results in many cases, and is considered one of the most valuable methods for the treatment of that affection. As an internal remedy it has rendered good service in choleræ infantum after the acute symptoms abated, and has given marked relief to the pain in catarrhis of the biliary ducts. Its employment in spinal sclerosis, gloo-lo-batio-lymphgeal paralysis and similar affections has not proved very successful, but it is said to be one of the few remedies which are of any service in locomotor ataxia. It was formerly used as a nerve tonic in epilepsy, but has been superseded by other agents which are less objectionable and more efficient. It has cured epilepsy where the bromides have failed, and it is an established fact that patients who have been subjected to a course of silver medication which has produced a deposit of the metal in the tissues possesses a remarkable degree of immunity from various minor nervous ailments. It may be inferred that a remedy which is deposited in the tissues may interfere by its presence with the chemical activity of adjacent atoms, preventing their explosive union (Murray).

Several silver compounds have been introduced as substitutes for the Nitrates, with the view of obtaining greater penetrative local action, as the latter salt is decomposed by the proteins and chlorides of the tissues and possesses only limited powers as an antiseptic and astrigent. These compounds are marketed under various trade-names (see pages 131 and 142), and are used with satisfaction as local applications in gonorrhœa, conjunctivitis, ophthalmia, laryngitis, pharyngitis, dysentery, cystitis, empyema of the antrum, cystitis, and other inflammatory and suppurative affections. Protargol has probably been the most popular, though Nielsen states that the results of 870 cases of gonorrhœa treated therewith show that the average duration of the disease is not lessened by this agent more than by other recognized methods of treatment. Colloidal has been used internally, by injection, and by intravenous injection. It is said to cause marked and rapid leucocytosis, to be completely excreted within a month, to have inhibitory action in the blood on bacteria. It has been used with benefit in skin and venereal diseases, local suppurations, and septic disorders; also in diphtheria, scarlet fever, pneumonia, pertussis, and typhoid fever.

The Oxide is the least irritant of the silver salts and does not discolor the skin so quickly as the nitrate, but eventually the same result follows its continued administration. It has been employed with more or less success in gastric neuralgæ, irritable dyspepsia, pyrosis, gastric and pulmonary hemorrhages, dysmenorrhœa, hemorhoids and other uterine affections, also to check profuse sweating, to relieve vomiting even in severe gastritis, and to control diarrhea depending on reflex nervous irritation. As an ointment, 5 to 10 grains to the drachm of lard, it is employed for application to venereal sores and to the urethra in gonorrhœa.

A course of silver medication should be regulated by suspending the remedy after 5 or 6 weeks' use, then promoting elimination by purgatives, diuretics and baths. To prevent the general discoloration Potassium Iodide may be given conjointly with the silver, and baths of Sodium Hypochlorite used frequently. The dark line at the margin of the gum is removable by a course of the Acid Tartarate of Potassium. Argyria has been produced in three months and after the use of Zinco of the cutaneum.

ARNICA, Arnica, is the dried flower-heads of Arnica montana, Leopold's Bane, a perennial of the nat. ord. Compositæ, indigenous to the mountains of Northern Europe and Siberia, and said to have been found in the mountains about the watercourses of the Mississippi and Columbia rivers. It has large orange-yellow flowers and a small, curved rhizome with several rootlets. It contains two alkaloids, Arnbiaone and Cystine, the latter being probably identical with the active principle of Cystotis lobularis, the Lobenium; also Trimethylamine (CH₃)₂N, an amononal alkaloidal principle, which has been looked upon as the active ingredient. Arnica also contains Indin, Cafroenic and Corpovy Acid, tannin, mucilage, resin, and two essential oils, one in the flowers, the other in the root. Dose, gr. v-vv, [iv. gr. xv.]

Preparations.

Tinctura Arnicae, Tincture of Arnica,—strength 20 per cent. Dose, iv. xx, [i. iv. xv.]

Infusum Arnicae, Infusion of Arnica (Unofficial).—Arnica flowers 20, to 100 parts of water, is thought by many observers to be the best form for local use, as it does not excite dermatitis, probably from containing none of the Volatile Oil.

Trimethylamine, Trimethylamine, C₁₃H₁₇N (Unofficial).—A thin, colorless, strongly alkaline fluid, boiling at 492 F., and at ordinary temperatures a colorless, inflammable gas. The Hydrochloride is the most stable salt, crystallizing in white or colorless prisms, nearly odorless, of pleasant taste, very deliquescent, freely soluble in water and in alcohol. Dose, gr. v-vv, in syrup every 4 hours.

Trimethylamine has been obtained from Arnica flowers and those of several other plants, from Ergot, Hop, Codonie, Coal-liver Oil, and decomposing alluminous substances, such as human urine containing-pickle, and the residue left in making sugar from beer. It is sometimes incorrectly named Propylamine, a term also applied to an impure trimethylamine, but is really an allied and isomeric compound.

Incompatibilities.

Incompatible with Arnica preparations are: Acids (mineral), Ferras Sulphate, Lead Acetate, Zinc Sulphate.

PHYSIOLOGICAL ACTION AND THERAPEUTICS.

Arnica is irritant, stimulant, depressant, antipyretic, diuretic and vulnerary. It irritates the gastro-intestinal tract, and in some persons the local use of alcololic preparations of the flowers will excite erythematous inflammation of the skin, though those of the root have not been observed to do so. In small doses internally it increases the action of the heart, raises the arterial tension and stimulates the action of the skin and the kidneys. Large doses produce a transient excitement, followed by depression of the circulation, respiration, and nerve-centres; headache, unconsciousness, and even convulsions being induced, the body-temperature lowered, the pupils dilated, and muscular parsiis produced. A toxic dose paralyses the nervous systems of animal and organic life, causing collapse and death. Cinchne is a powerful central emetic, and in large doses paralyses the motor nerves. Its direct action on the circu-