tating, and occasionally causes excoriation. It is employed as a *strapping* for dressing ulcers on Baynton's principles.

2. **EMPLASTRUM SAPONIS,** L. E. D. This contains lead plaster, (see p. 415.)

3. **UNGUENTUM PLUMBI COMPOSITUM,** L. (Prepared Chalk, ℥viij.; Distilled Vinegar, f℥vj.; Plaster of Lead, lbiij.; Olive Oil, Oj. Mix the chalk with the vinegar; and, when the effervescence has ceased, add gradually the solution to the plaster and oil melted with a slow fire, and stir constantly until they are cooled.)—By the action of the acetic acid on the chalk, an acetate of lime is procured, and carbonic acid evolved, and the acetate of lime is then mixed with lead plaster and oil. This compound is an imitation of *Kirkland's Neutral Cerate*, used as a dressing to indolent ulcers. It is employed by Mr. Higginbottom, (*Essay on the Use of Nitrate of Silver*, 2nd ed. p. 119.) under the name of *Neutral Ointment*, as a defence for ulcers after the application of nitrate of silver.

ORDER XXVI.—ZINC AND ITS COMPOUNDS.

1. ZINCUM, *L. E. D.* [U. S.]—ZINC.

HISTORY.—Although the ancients were acquainted with the method of converting copper into brass by means of an ore of zinc, yet we have no positive evidence that they were acquainted with metallic zinc, one of the constituents of this alloy.[1] Albertus Magnus, who died in 1280, is the first writer who expressly mentions this metal.[2]

It has had various appellations, such as *Contrefeyn, Golden Marcasite, Indian Tin* (*Stannum Indicum,*) *Spiaulter, Speltre* or *Spelter* (*Speltrum.*)

NATURAL HISTORY.—It occurs only in the mineral kingdom. It is found in the form of Oxide (*Red Zinc,*) of Sulphuret (*Blende* or *Black Jack,*) of Carbonate (*Calamine,*) of Sulphate (*White Vitriol,*) of Silicate (*Electric Calamine,*) and Aluminate (*Automalite* or *Gahnite.*)

PREPARATION.—Zinc is usually procured from the native sulphuret or carbonate of that metal. It may also be obtained from the silicate.

Both the sulphuret and carbonate are roasted: by this process the sulphur of the sulphuret is transformed into sulphurous acid, which escapes, and the zinc is oxidized; while the carbonate loses carbonic acid and water. The oxide is then mixed with some carbonaceous substance and submitted to heat, by which the metal is reduced and vaporized. Sometimes the reduction is effected in a covered earthen crucible, the bottom of which is perforated by an iron tube, which terminates over a vessel of water situated in an apartment below the furnace. The gaseous products and zinc escape by this tube; and the latter is condensed in the water. This is called *distillatio per decensum.* In Silesia, however, *distillato per ascensum* is employed. (Dumas, *Traité de Chimie*, t. iv. p. 82.)

The zinc used in this country is principally imported in ingots and plates from Silesia, by way of Hamburgh, Antwerp, Dantzic, &c.

PROPERTIES.—It is a bluish-white metal, of considerable lustre. It crystallizes in four-sided prisms and needles; its texture is lamellated and crystalline. Its sp. gr. is from 6·8 to 7·2. At a common temperature it is tough; from 202° 300° it is ductile and malleable, and may be readily rolled into thin leaves (*Sheet Zinc;*) at 400° it is so brittle that it may be reduced to powder. It readily fuses, and, at a white heat, may be volatilized.

Characteristics.—It is soluble in dilute sulphuric acid, with the evolution of hydrogen gas. Ferrocyanide of potassium forms, in this solution, a gelatinous white

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[1] Beckmann, in his *History of Inventions and Discoveries*, vol. iii. p. 71, has given a good account of the history of zinc.

[2] An anonymous reviewer (*British and Foreign Medical Review*, vol. viii. p. 361,) in commenting on the above paragraph, observes, that a passage in Strabo authorizes the belief that the ancients did know this metal in its separate state, and that it is the *false silver* (ψευδάργυρον) of that ancient geographer.

precipitate (*ferrocyanide of zinc:*) if iron be present the precipitate is bluish-white. If the liquid be neutral, hydrosulphuric acid and the soluble hydrosulphates also occasion a white or yellowish-white precipitate (*hydrated sulphuret of zinc.*) Alkalis and their carbonates likewise throw down white precipitates: that occasioned by the alkalis is soluble in excess of alkali. The delicacy of these tests is, according to Devergie, (*Méd. Lég.* ii. 787.) as follows:—

		Degree of Dilution.
Ferrocyanide of Pottassium	stops at ..	4,000
Ammonia	,, ..	6,000
Potash, or Carbonate of Ammonia	,, ..	8,000
Carbonate of Potash, or Hydrosulphate of Ammonia	,, ..	10,000
Hydrosulphuric Acid	,, ..	15,000

PURITY.—The zinc of commerce is never pure. It always contains iron and carbon, and not unfrequently traces of arsenicum. By the action of diluted sulphuric acid the zinc and the iron are dissolved, while the arsenicum, when present, escapes in the form of arseniuretted hydrogen gas. A black matter remains undissolved, which has a carbonaceous appearance, but contains iron.

Almost entirely dissolved by diluted sulphuric acid. The solution is free from colour. Its other properties as above [see *Zinci sulphas.*] The specific gravity is 6·86. *Ph. Lond.*

It dissolves in a great measure in diluted sulphuric acid, leaving only a scanty grayish-black residuum: this solution presents the characters just given [see *Zinci sulphas*] for the solution of sulphate of Zinc. *Ph. Ed.*

PHYSIOLOGICAL EFFECTS.—In the *metallic* state it is inert. The *compounds of zinc* are somewhat analogous in their action on the system to those of copper, silver, and bismuth, but are much less energetic. They act topically, according to their degree of concentration, as desiccants, astringents, irritants, and caustics. Taken internally they excite more or less readily, nausea and vomiting, and in large doses operate as irritant and caustic poisons. They exercise a specific influence over the nervous system, though this is much less obvious than in the preparations of the other metals just referred to. The stupor and inactivity, mentioned by Orfila, (*Toxicol. Gén.*) as being produced by the sulphate, are evidence of the affection of the nervous system. The antispasmodic power evinced by zinc, in certain diseases, can only be explained by referring it to the action of this metal on the nervous centres.

USES.—As *topical* agents we employ the compounds of zinc as caustics, astringents, and desiccants. Thus the chloride is used as a caustic; the sulphate and acetate as astringents; and the oxide and carbonate as desiccants.

Internally, the compounds of zinc are administered in large doses to excite vomiting; in smaller doses as tonics and antispasmodics in intermittent diseases and chronic affections of the nervous system.

2. ZIN'CI OX'YDUM, *L. D.*—OXIDE OF ZINC.

(Zinci Oxidum, *E.*)—[U. S.]

HISTORY.—The oxide was first prepared by Hellot in 1735. It has received various names, some of them of a fantastic nature; as *Nihil album*, *Lana philosophica*, *Pompholyx*, *Flowers* or *Calx of Zinc* (*Flores* seu *Calx Zinci.*)

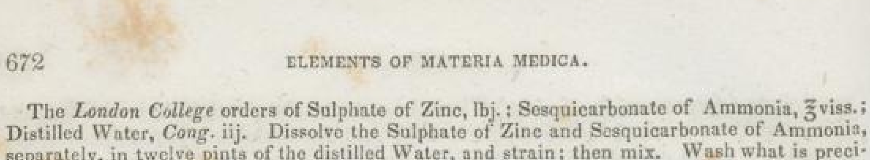
NATURAL HISTORY.—Oxide of zinc is found in America, mixed or combined with the sesquioxide of manganese, and constituting the *Red Oxide of Zinc* of the mineralogist. It is also found in various localities, in combination with carbonic, sulphuric, or silicic acid.

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

The *London College* orders of Sulphate of Zinc, lbj.; Sesquicarbonate of Ammonia, ℥viss.; Distilled Water, *Cong.* iij. Dissolve the Sulphate of Zinc and Sesquicarbonate of Ammonia, separately, in twelve pints of the distilled Water, and strain; then mix. Wash what is precipitated frequently with water; and, lastly, burn it for two hours in a strong fire. [This is the formula of the U. S. P.]

The *Edinburgh College* employs of Sulphate of Zinc, ℥xij.; Carbonate of Ammonia, ℥vj. The process is otherwise the same as that of the London College.

In these processes double decomposition takes place; sulphate of ammonia is formed in solution, and carbonate of zinc precipitates. A portion of the carbonic acid of the sesquicarbonate of ammonia escapes.



The carbonate of zinc is decomposed by the subsequent ignition, and the carbonic acid expelled, leaving the oxide.

The *Dublin College* directs Oxide of Zinc to be prepared as follows:—Take of Zinc, broken into small fragments, any required quantity. Let portions of the metal be thrown at separate intervals of time into a crucible heated to whiteness and of sufficient depth; its mouth inclining somewhat toward the door of the furnace; and after the injection of each piece of zinc, let another crucible be inverted over that which receives the metal, but loosely, that the air may not be excluded: let the sublimed light powder and the whitest part of it be preserved for use.

In this process the metal attracts oxygen from the air, and is thereby converted into oxide of zinc.

A manufacturing chemist who prepares oxide of zinc (so called) informs me that he obtains it from a solution of chloride of zinc, which he procures from the workers of palladium. This liquid is boiled with small pieces of zinc and some caustic soda, to get rid of the iron; and to the clear liquor is then added a solution of carbonate of soda (soda ash,) by which the white carbonate of zinc is precipitated. This is washed, dried, and sold as oxide of zinc.

Properties.—The form of the crystallized native oxide of zinc (containing the oxides of iron and manganese) is a right rhombic prism.

The artificial oxide of the Pharmacopœia is a white, or, when ignited, yellowish-white, tasteless, odourless powder. It is fusible, forming a yellow glass, and at a white heat is volatilized. When heated with charcoal it is readily reduced. It is insoluble in water, but readily dissolves in most acids and in alkalis. It forms two classes of salts: one (the *zincic salts*,) in which it is the base; a second (*zincates*,) in which it acts the part of an acid.

Characteristics.—It dissolves in dilute sulphuric acid. The characteristics of the solution have been already detailed (p. 670.)

Composition.—Oxide of zinc has the following composition:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Proust.*	*Berzelius.*
Zinc	1	32	80	80	80·1
Oxygen	1	8	20	20	19·9
Oxide of Zinc	1	40	100	100	100·0

Purity.—Pure oxide of zinc is completely and readily soluble in diluted sulphuric, nitric, or hydrochloric acid, without effervescence. The substance met with in the shops under the name of oxide of zinc is in reality a carbonate of this metal, and, therefore, effervesces on the addition of an acid. The solution obtained by dissolving the oxide in any of the above acids yields a precipitate, on the addition of caustic ammonia or potash, which should be completely soluble in an excess of the precipitant.

If the substance sold as oxide of zinc have been prepared by adding a caustic alkali to a solution of sulphate of zinc, it will be found to be in reality a subsulphate instead of an oxide; and its solution in nitric acid yields traces of containing sulphuric acid when tested with a salt of baryta.

Oxide of cadmium has been sometimes found in it, and was once mistaken for arsenious acid. (Thomson's *Hist. of Chem.* ii. 219.) Iron and manganese (Liebig.) are sometimes present in oxide of zinc, and communicate a yellow tinge to it. The oxide is,—

White; tasteless; entirely soluble in diluted nitric acid without effervescence: this solution is not affected by nitrate of baryta, but gives with ammonia a white precipitate entirely soluble in an excess of the test. *Ph. Ed.*

Physiological Effects. *α. On Animals.*—Orfila (*Toxicol. Gén.*) gave from three to six drachms of it to small and weak dogs: they were attacked with vomitings, without suffering much.

β. On Man.—Applied to ulcerated or other secreting surfaces, it acts as a desiccant and astringent substance. On account of its insolubility, the absorption of it must be very slow. Taken into the stomach in large doses, it acts as a slight irritant, and provokes vomiting, and sometimes purging. It is said to have also caused occasional giddiness and temporary inebriation. In small doses it may be taken for a considerable period without causing any obvious effects. Sometimes, under its employment, certain affections of the nervous system (as epilepsy, chorea, &c.) subside; from which we infer that it exercises some specific influence over this system; and it is, therefore, termed tonic, antispasmodic, and sedative. But the nature of its influence is not very obvious, and is inferred rather from analogy than observation. By long-continued use it acts as a slow poison, and produces *tabes sicca.* A gentleman, for the cure of epilepsy, took daily, at an average, twenty grains of oxide till he had consumed 3246 grains, which must have taken him about five months. At the end of this time he was found of a pale, earthy hue, wasted away, and almost idiotical: his tongue was thickly coated, the bowels were constipated, the inferior extremities cold and œdematous, the abdomen tumid, the superior extremities cold and shrivelled, and the skin dry, like parchment; the pulse was about sixty, thready, and scarcely perceptible. Under the use of purgatives, a light nutritive diet, with tonic and diuretic medicines, he rapidly recovered, but he remained subject to epileptic attacks. (*Brit. and For. Med. Rev.* July, 1838, p. 221.)

Uses.—*Internally* it has been commended in some spasmodic diseases, viz. epilepsy, chorea, hysteria, catalepsy, and hooping-cough; and in some painful affections, as neuralgia and gastrodynia. Though occasionally serviceable in some of these maladies, it has so frequently failed, that practitioners have ceased to place much confidence in it.

Externally, it is employed in the form of powder, or lotion, or ointment. As a *dusting powder* it is useful, by its mild, absorbent, and desiccant properties, and is applied to impetiginous and other chronic diseases of the skin, attended with profuse secretion. It is also used to allay or prevent excoriation in children and bedridden persons, and to remove chaps and cracks of the nipples. In painful ulcers, with copious discharge, it is not unfrequently beneficial by its desiccant and sedative properties. *Diffused through water* or a *mucilaginous solution* (in the proportion of two drachms of the oxide to six or eight ounces of liquid,) it is occasionally useful in chronic ophthalmia, especially *ophthalmia tarsi.* Sommé (*Archiv. Gén. de Méd.* i. 486.) employed an injection, composed of half an ounce of oxide and two pints of water, in gonorrhœa and leucorrhœa, with success.

Administration.—Internally, it is administered in the form of pill or powder, in doses of from two or three grains gradually increased to eight, ten, or more.

1. **UNGUENTUM ZINCI**, L. E. (U. S.;) *Unguentum Zinci Oxydi*, D. (Oxide of Zinc, ʒj.; Lard, ʒvj. *M. L.* (U. S.)—The *Edinburgh College* substitutes Simple Liniment for Lard.—The *Dublin College* uses of Ointment of White Wax, lbj.; Oxide of Zinc, prepared in the same manner as chalk, ʒij. M.)—This compound is employed as a mild drying ointment in porrigo, impetigo, and other skin diseases attended with profuse discharges, after extensive burns, blisters, sinapisms, &c.; to painful ulcers with excessive secretion, to the eye when affected with chronic inflammation, &c.

2. **ZINCI OXYDUM IMPURUM.**—This substance is known in the shops under the name of *Tutty* (*Tutia* seu *Tuthia*,) or *Furnace Cadmia* (*Cadmia Fornacum* seu *factitia*.) It is found in the chimney of the furnace in which zinc ores are roasted, or in which zinciferous lead ores are smelted. When prepared by levigation and elutriation it is called *Prepared Tutty* (*Oxydum Zinci impurum præparatum; Tutia Præparata*.) It is applied as a dusting powder, or as a cooling ointment (*Unguentum Oxydi Zinci impuri;* composed of Simple Liniment or Lard, 5 parts; Tutty, 1 part; M.) to excoriated surfaces.

3. ZIN'CI CHLO'RIDUM, (U. S.)—CHLORIDE OF ZINC.

History.—This compound, which has been long known to chemists, was first introduced into medicine by Papenguth, (*Russ. Samml. f. Naturw. u. Heilk.* H. i. S. 79, quoted by Richter, *Ausf. Arzneim.* iv. 526.) and subsequently has been recommended by Professor Hancke, of Breslau, (Rust's *Magazin*, 1826, Bd. 22, S. 373.) and by Dr. Canquoin, of Paris. (Dr. Alex. Ure, *Lond. Med. Gaz.* xvii. 391.) It is termed *Muriate*, *Hydrochlorate*, or *Butter of Zinc*.

Preparation.—The easiest and cheapest method of obtaining it is by dissolving zinc, or its oxide, in hydrochloric acid, evaporating to dryness, and fusing in a glass vessel with a narrow mouth, as a Florence flask. In solution it is obtained as a secondary product in the preparation of some other metals, as of palladium (see p. 672.)

[The following is the method of obtaining it directed by the U. S. P. Take of Zinc in small pieces, two ounces and a-half; Nitric Acid, Prepared Chalk, each a drachm; Muriatic Acid a sufficient quantity. To the Zinc in a glass or porcelain vessel, add gradually sufficient Muriatic Acid to dissolve it; then strain, add the Nitric Acid and evaporate to dryness. Dissolve the dry mass in water and add the Chalk, and having allowed the mixture to stand for twenty-four hours, filter and again evaporate to dryness.]

Properties.—It is a whitish-gray semi-transparent mass, having the softness of wax. It is soluble in water, alcohol, and ether. It is fusible; and, at a strong heat, may be sublimed and crystallized in needles. It is very deliquescent. It unites with both albumen and gelatine to form difficultly soluble compounds, and hence it occasions precipitates with liquids containing these principles in solution. A patent has been obtained by Sir William Burnett for the preservation of wood by a solution of the chloride of zinc.

Characteristics.—Dissolved in water it may be recognised to be a chloride by nitrate of silver (see p. 218.) That zinc is the base of the salt may be shown by the tests already mentioned for the salts of this metal (p. 670.)

Composition.—Its composition is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*J. Davy.*
Zinc	1	32	47	50
Chlorine	1	36	53	50
Chloride of Zinc	1	68	100	100

Physiological Effects.—Its *local* action on living tissues is that of a caustic or escharotic, depending partly on its affinity for albumen and gelatine; so that when placed in contact with living parts into whose composition these organic compounds enter, the chloride exercising its affinity, destroys the life of the part, and unites with the albuminous and gelatinous matters present, and forms thus an eschar. Other chemical changes of a comparatively unimportant nature are also effected: thus various salts found in the solids or liquids of the part may be decomposed. For example, when the chloride is applied to a cancerous sore, it decomposes the carbonate and hydrosulphuret of ammonia found in the secretion of the sore. The effects produced by the application of chloride of zinc are the following:—Soon after it has been applied a sensation of warmth is felt in the part, quickly followed by violent burning pain, which continues for seven or eight hours; that is, until the parts in contact with the chloride are dead. A white eschar is now observed, which usually saparates in from eight to twelve days. Unless used in the neighbourhood of loose cellular tissue, there is rarely much swelling.

As a caustic, chloride of zinc is not inferior in power to chloride of antimony; nay, Vogt (*Pharmakodynamik*, i. 363. 2te Aufl.) says it appears to him to be more powerful and to penetrate deeper. It decomposes the organic tissues as quickly as the nitrate of silver, but excites more burning, and for a longer time, owing to its action extending to parts placed more deeply; for it is well known that the operation of the nitrate is confined to superficial parts. Both Vogt and Canquoin agree that chloride of zinc, besides corroding the parts with which it is in contact, exercises an influence over the vital actions of neighbouring parts. To this circumstance is owing, in great part, the efficacy of the chloride in various diseases in which it has been applied, and the healthy appearance of the sore after the separation of the eschar. There is no danger of any constitutional disorder arising from the absorption of the poison, as is the case with the arsenical and mercurial caustics.

Taken *internally*, in *large doses*, it acts as an irritant or caustic poison, and affects the nervous system. Thus it produces a burning sensation in the stomach, nausea, vomiting, anxiety, short breathing, small quick pulse, cold sweats, fainting, and convulsions. Taken in *very small doses*, no obvious effects are produced, except sometimes the amelioration of certain diseases. It is supposed, in these cases, to influence the nervous system.

USES.—*Internally* chloride of zinc has been given in small, but gradually-increased doses, in scrofula, epilepsy, chorea, and (in combination with hydrocyanic acid) in neuralgia of the face.

Commonly, however, it is employed *externally:* thus Papenguth used a dilute solution of it as a lotion in fistulous ulcers of a scrofulous nature. As a *caustic* it has been applied, by Professor Hancke and Dr. Canquoin, to produce an issue, to destroy nævi materni, and, as an application to parts affected with malignant diseases, such as fungus hæmatodes and cancer, or to other intractable forms of disease, such as old syphilitic or scrofulous ulcers. The benefit is supposed not to depend merely on the escharotic effect, but on the chloride inducing a new action in the surrounding parts.

ADMINISTRATION.—*Internally* it may be given in doses of one or two grains. Hufeland recommends it to be taken dissolved in ether; his formula for the *Æther Zinci*, as it is called, is the following:—℞. Zinci Chlor. ʒss.; Alcoholis, ℥j.; Ætheris Sulph. ℥ij. Post aliquot dies decanta. The dose of this solution is from four to eight drops, taken twice daily.

Externally it has been used as a *Lotion*, composed of two grains of the chloride and an ounce of water; or in the form of *Paste:* this may be composed of one part of chloride of zinc, and from two to four parts of wheaten flour.

4. ZIN'CI SUL'PHAS, *L. E. D.* (U. S.)—SULPHATE OF ZINC.

HISTORY.—This salt is said by Schwartze (*Pharm. Tabell.* 2te Ausg. 779.) to have been known towards the end of the 13th, or at the commencement of the

14th century; but Beckmann affirms it was not known before the middle of the 16th century. (*Hist. of Invent.* iii. 85.) It has had various names, as *Sal Vitrioli*, *White Vitriol*, and *Gilla Theophrasti*.

NATURAL HISTORY.—It occurs native at Rammelsberg, near Goslar, in the Hartz; at Holywell, in Flintshire; and other places.

PREPARATION.—It is readily prepared by dissolving zinc in diluted sulphuric acid.

The *London College* orders of Zinc, in small pieces, ℥v.; Diluted Sulphuric Acid, Oij. Pour gradually the diluted Sulphuric Acid upon the pieces of Zinc, and, the effervescence being finished, strain the liquor; then boil it down until a pellicle begins to form. Lastly, set it aside that crystals may be formed.

The *Edinburgh College* observes that this salt may be prepared either by dissolving fragments of zinc in diluted sulphuric acid till a neutral liquid be obtained, filtering the solution, and concentrating sufficiently for it to crystallize on cooling,—or by repeatedly dissolving and crystallizing the impure sulphate of zinc of commerce, until the product, when dissolved in water, does not yield a black precipitate with tincture of galls, and corresponds with the characters laid down for sulphate of zinc in the List of the Materia Medica (see p. 667.)

The *Dublin College* orders of Zinc, in small fragments, *thirteen parts;* Sulphuric Acid, *twenty parts;* Water, *one hundred and twenty parts.*

[The U. S. Pharmacopœia directs, Zinc, in small pieces, four ounces; Sulphuric Acid, six ounces; Distilled Water, four pints.]

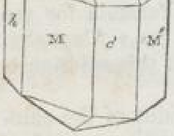
In this process 1 equivalent or 9 parts of water are decomposed; an equivalent or 1 part of hydrogen escapes, while an equivalent or 8 parts of oxygen unite with 1 equivalent or 32 parts of zinc, to form 1 equivalent or 40 parts of the oxide, which, with 1 equivalent or 40 parts of sulphuric acid, form 1 equivalent or 80 parts of the sulphate.

MATERIALS.	COMPOSITION.		PRODUCTS.
1 eq. Water 9	*1 eq. Hydrogen* 1		1 eq. Hydrogen 1
	1 eq. Oxygen .. 8	1 eq. Ox. Zinc 40	
1 eq. Zinc 32	....		
1 eq. Sulphuric Acid. 40			1 eq. Sulphate of Zinc .. 80
81			81

The impurities in commercial zinc have been already stated (see p. 671.) If a piece of zinc be added to the impure solution of sulphate, and the liquid heated in contact with air, the iron is peroxidized and is deposited.

By roasting blende (*sulphuret of zinc*) in reverberatory furnaces, an impure sulphate is obtained, which is lixiviated, and the solution concentrated by evaporation, so that on cooling it forms a crystalline mass resembling lump sugar. This is distinguished among druggists by the name of *White Vitriol*, a term which they confine to this commoner kind of sulphate. This impure salt contains iron, and usually copper and lead.

FIG. 97.



Crystal of Sulphate of Zinc.

PROPERTIES.—Crystals of sulphate of zinc are right rhombic prisms: they are transparent and colourless, and have a metallic astringent taste. They are soluble in $2\frac{23}{100}$ times their weight of cold water, and less than their own weight of boiling water. They are insoluble in alcohol. In dry and warm air they effloresce. When heated they undergo the watery fusion; and if the liquid be rapidly cooled, it congeals into a granular, crystalline, white mass: if the heat be continued the salt becomes anhydrous, and, at an intense heat, is decomposed, leaving a residue of zinc.

Characteristics.—That this salt is a sulphate, is proved by the action of chloride of barium on it; a white precipitate is produced, insoluble in nitric acid (see p. 406.) Acetate of lead also occasions a white precipitate. The presence of oxide of zinc in the solution is recognised by the tests already mentioned for this substance (see p. 670.)

COMPOSITION.—This salt has the following composition:—

	Atoms.	Eq. Wt.	Per Cent.	Berzelius.	Mitscherlich.
Oxide of Zinc	1	40	28	32·585	55·24
Sulphuric Acid	1	40	28	30·965	
Water	7	63	44	36·450	44·76
Crystallized Sulphate of Zinc	1	143	100	100·000	100·00

PURITY.—Ammonia added to a solution of sulphate of zinc throws down a white precipitate soluble in excess of ammonia. If any oxide of iron or magnesia be present it remains undissolved; while any oxide of copper would form an azure blue solution (*cuprate of ammonia.*) Arsenic or cadmium may be detected by adding excess of sulphuric acid to the solution of the sulphate, and then passing a stream of hydrosulphuric acid through it: the arsenicum and cadmium are thrown down in the form of sulphurets. The impure sulphate called *White Vitriol* occurs in irregular masses; here and there stained yellow with the iron.

Totally dissolved by water. What is thrown down by ammonia is white, and when the ammonia is added in excess it is again dissolved. On the addition of chloride of barium or acetate of lead they are decomposed. *Ph. Lond.*

When a solution in six waters is boiled with a little nitric acid, and solution of ammonia is then added till the oxide of zinc first thrown down is all redissolved, no yellow precipitate remains, or a trace only, and the solution is colourless. *Ph. Ed.*

PHYSIOLOGICAL EFFECTS.—In *small and repeated doses* it acts as an astringent on the alimentary canal, checks secretion, and promotes a constipated condition of the bowels. It exercises a specific influence over the nervou system, manifested by its power of removing certain spasmodic affections: hence it is reputed antispasmodic. To the same influence is to be referred its power of preventing the recurrence of intermittent maladies, from which it has principally derived its denomination of a tonic. Its astringent effect is not confined to the bowels, but is manifested in the pulmonary and urethral mucous membranes, the secretions from which it diminishes: hence the advantage of its use in catarrhal affections of these parts. It does not appear to possess any power of checking cutaneous exhalation.

In *full medicinal doses* it is a powerful but safe emetic; it excites speedy vomiting without giving rise to that distressing nausea occasioned by emetic tartar, though this statement is not in accordance with the experience of Dr. Cullen, (*Treat. of the Mat. Med.*) who observes that "in order to render its effects certain, the dose must generally be large; and if this is not thrown out again immediately it is apt to continue a disagreeable nausea, or even a vomiting, longer than is necessary." But this observation does not agree with the experience of other practitioners.

In *excessive doses* it acts as an irritant poison, causing vomiting, purging, coldness of the extremities, and fluttering pulse.

The *local action* of it is that of an astringent and desiccant, and in a concentrated form it is a powerful irritant and caustic. Its external use is said to have been found fatal in one case, by causing vomiting, purging, and convulsions. (Christison, *op. cit.* p. 468.) Its causticity depends on its affinity for albumen and fibrin.

USES.—As an *emetic* it is almost exclusively employed in poisoning, especially by narcotics. In these cases it is the best evacuant we can administer, on account of its prompt action. As an *internal astringent* it is administered in chronic dysentery (Impey, *Lond. Med. and Phys. Journ.* ix. 55, 1803.) and diarrhœa, in chronic bronchial affections attended with profuse secretion, and in gleet and leucorrhœa. In the latter cases it is usually associated with terebinthinate medicines, and is sometimes decidedly beneficial. (See a paper on this subject, by Mr. Graham, in the *Edinb. Med. and Surg. Journ.* vol. xxvi.) As an *antispasmodic* it has been employed with occasional success in epilepsy, chorea, hysteria, spasmodic asthma, and hooping-cough. I have little faith in its efficacy in any of these cases. As a *tonic* it has been sometimes serviceable in agues, but it is far inferior to sulphate of quinia or arsenious acid.

As a *topical astringent* sulphate of zinc is most extensively employed. We use its aqueous solution as a collyrium in chronic ophthalmia, as a wash for ulcers attended with profuse discharge, or with loose flabby granulations; as a gargle in ulcerations of the mouth, though I have found it for this purpose much inferior to a solution of sulphate of copper; as a lotion for chronic skin diseases; and as an injection in gleet and leucorrhœa.

Administration.—As an *emetic* the dose should be from ten to twenty grains; as a *tonic*, *antispasmodic*, or *expectorant*, from one to five grains.

For external use, solutions are made of various strengths. Half a grain of the sulphate to an ounce of water is the weakest. The strongest I ever knew employed consisted of a drachm of sulphate dissolved in an ounce of water: it was used with success as an injection in gleet. But solutions of this strength must be applied with great caution, as they are dangerous.

Antidotes.—Promote the evacuation of the poison by demulcents. Afterwards allay hyperemesis by opium, blood-letting, and the usual antiphlogistic regimen. Vegetable astringents have been advised.

5. ZIN'CI ACE'TAS. (U. S.)—ACETATE OF ZINC.

History.—This salt was discovered by Glauber.

Preparation.—It may be procured by dissolving oxide of zinc in acetic acid, and crystallizing the saturated solution; or it may be readily obtained by double decomposition: 143 grains of crystallized sulphate of zinc, dissolved in water, and mixed with 190 grains of crystallized acetate of lead in solution, will produce 152 grains of sulphate of lead, which, being insoluble, precipitates, while 91 grains of the anhydrous acetate of zinc (equal to 154 grains of the crystallized acetate) are left in solution; or it may be procured by immersing a piece of zinc in a solution of acetate of lead, until the liquid forms a white precipitate with hydrosulphuric acid. In this process the lead is reduced to the metallic state, (forming the *Arbor Saturni*, or *Lead Tree*,) while the zinc replaces it in solution.

[The U. S. Pharmacopœia directs, Acetate of Lead, a pound; Zinc, granulated, nine ounces; Distilled Water, three pints. Dissolve the Acetate of Lead in the Water and filter. Add the Zinc to the solution, and agitate them occasionally together, in a stoppered bottle for five or six hours, or until the liquid yields no precipitate with a solution of iodide of potassium. Filter the liquor, evaporate it with a moderate heat to one-fifth and set it aside to crystallize. Pour off the liquid and dry the crystals on bibulous paper. Should the crystals be coloured, dissolve them in Distilled Water; and having heated the solution, drop into it while hot a filtered solution of Chlorinated Lime, until it ceases to let fall sesquioxide of iron; then filter the liquor, acidulate it with a few drops of Acetic Acid, evaporate and crystallize.]

Properties.—It usually crystallizes in rhomboidal plates, having a pearly or silky lustre, closely resembling talc. The form of the crystals is the oblique rhombic prism. The salt is odourless, but has a bitter metallic taste. It dissolves readily in water, and is slightly efflorescent.

Characteristics.—When heated it fuses, and gives out an inflammable vapour, having the odour of acetic acid. When sulphuric acid is added to the salt, the vapour of acetic acid is evolved: this is easily recognised by its odour. These characters show it to be an acetate. That it is a zincic salt is proved by the tests before mentioned for a solution of this salt (p. 670.)

Composition.—Its composition is, according to Dr. Thomson, as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Oxide of Zinc	1	40	26·00
Acetic Acid	1	51	33·10
Water	7	63	40·90
Crystallized Acetate of Zinc	1	154	100·00

Physiological Effects.—Its effects are analogous to those of the sulphate of zinc. Its local action is astringent. Taken internally, in small doses, it acts as a tonic and antispasmodic; large doses occasion vomiting and purging. Deveaux and Dejaer (Orfila, *Toxicol. Gén.*) deny that it is a poison, even in large doses.

Uses.—It is rarely administered *internally;* but is applicable as an emetic, tonic, and antispasmodic, in the same cases in which the oxide or sulphate of zinc is employed.

As a *topical* remedy, it is used on account of its astringent qualities in chronic ophthalmia, gleet, and leucorrhœa. In the latter stages of gonorrhœa I have found it far more successful than the sulphate. Its beneficial effects were first described by the late Dr. Wm. Henry, of Manchester. (*Lond. Med and Phys. Journ.* ix. 53. 1803.) Sir A. Cooper (*Lancet.* iii. 199.) recommends, as the best injection which can be used in the third week of gonorrhœa, a mixture of six grains of sulphate of zinc and four ounces of liquor plumbi subacetatis dilutus. Of course double decomposition takes place, and the active ingredient is the acetate of zinc.

Administration.—When exhibited internally, as a tonic or antispasmodic, the dose is one or two grains gradually increased. As an emetic it is rarely administered: the dose is from ten grains to a scruple: its operation is very safe. As a lotion or injection, it is employed in the form of aqueous solution, containing two or more grains of the salt to an ounce of water.

ZINCI ACETATIS TINCTURA, D. (Sulphate of Zinc; Acetate of Potash, āā *one part.* Triturate them together, and add sixteen parts of Rectified Spirit; macerate for a week with occasional agitation, and filter through paper.)—Here we have double decomposition: sulphate of potash and acetate of zinc are formed. The first is precipitated, being insoluble in spirit, the second remains in solution. One drachm contains a quantity of acetate of zinc equal to about four grains of the crystallized acetate. When diluted with water it is used as a collyrium and injection.

6. ZIN'CI CAR'BONAS.—CARBONATE OF ZINC.

(Calamina; Carbonas Zinci impura, *L.*—Calamina præparata; Levigated impure Carbonate of Zinc, *E.*—Carbonas Zinci impurum; Calamina, *D.*)

History.—The native carbonate of zinc was perhaps known to the ancients, though they were unacquainted with its nature. The term *Calamine* is applied both to the native carbonate and native silicate of zinc: the latter is termed by way of distinction *Electric Calamine.*

Natural History.—Native carbonate of zinc (*Calamine*) is found in great abundance in several parts of England, (in the counties of Somerset, Derby, Durham, &c.,) as well as in various parts of the continent of Europe (in Carinthia, Hungary, Silesia, &c.) It occurs crystallized or in compact or earthy masses. Its colour varies, being more or less gray, yellow, or brown. Its sp. gr. is 4·2 to 4·5.

Preparation.—Calamine (*Calamina*) or the impure carbonate of zinc (*Carbonas Zinci impura,*) is directed to be calcined, in order to make it pulverizable. But in this process water and more or less of the carbonic acid is expelled. It is then reduced to a very fine powder (usually in mills,) and is afterwards submitted to the process of elutriation. By this means we obtain *Prepared Calamine* (*Calamina Præparata,* L. E.; *Zinci Carbonas impurum præparatum,* D.)

Properties.—Prepared calamine is met with in the shops in the form of a heavy pinkish or flesh-coloured powder, or made up into little masses. When pure, it dissolves in nitric, hydrochloric, or sulphuric acid, with effervescence. Various impurities mixed with calamine are insoluble in these acids.

Characteristics.—The effervescence with the mineral acids shows calamine to be a carbonate. The presence of zinc in the solution is determined by the tests before mentioned for this metal (p. 670.) The action of these tests, however, is more or less impeded by the presence of foreign matters in calamine.

Composition.—Carbonate of zinc has the following composition:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Smithson.*		
				(Mendip Ore.)		(Derbyshire ore.)
Oxide of Zinc	1	40	64·5	64.8	to	65.2
Carbonic Acid	1	22	35·5	35·2	to	34·8
Carbonate of Zinc	1	62	100·0	100·0	to	100·0

Impurities.—The substance sold in the shops as prepared calamine frequently contains only traces of zinc. If hydrochloric acid be poured on it, effervescence (owing to the escape of carbonic and hydrosulphuric acids) takes place, and a portion is dissolved; but the greater part remains undissolved. Mr. Brett (*Lond. Med. Gaz.* xx. 72.) found from 78 to 87·5 per cent. of sulphate of baryta. The remainder of the powder consisted of oxide of iron, carbonate of lime, lead, [sulphuret of?] and mere traces of zinc.

Physiological Effects.—Pure carbonate of zinc is probably similar in its action to the oxide.

Uses.—Calamine is employed as a dusting powder for children, and as a mild desiccant and astringent in excoriations, superficial ulceration, &c.

1. **CALAMINA PRÆPARATA**, L; *Zinci Carbonas impurum præparatum*, D. [Zinci Carbonas præparatus, U. S.] *Lapis Calaminaris præparatus.* (Burn the Calamine, then bruise it. Afterwards let it be made into a very fine powder in the same manner as we have directed chalk to be prepared, *L.*—The directions of the *Dublin College* are essentially similar.) Some remarks on the preparation have been previously offered. The *Edinburgh College* gives no direction for the preparation of calamine.

2. **CERATUM CALAMINÆ**, L. E.; *Unguentum Calaminæ*, D.; [Ceratum Zinci Carbonatis, U. S.;] *Turner's Cerate; Ceratum Epuloticum.* (Calamine; Wax, āā lbss.; Olive Oil, f℥xvj. Add the calamine to the melted wax and oil when they begin to thicken, *L.*—[The U. S. Pharm. directs Lard, lbij. instead of the olive oil.]—The *Edinburgh College* uses of prepared Calamine, *one part;* and Simple Cerate, *five parts.*—The *Dublin College* employs of prepared Calamine, lbj.; and Ointment of Yellow Wax, lbv. M.) It is an excellent desiccant and astringent application (when prepared with good calamine) to burns, scalds, excoriations, superficial ulcerations, &c.

NON-OFFICINAL PREPARATION OF ZINC.

ZINCI CYANIDUM; *Hydrocyanate, Cyanide*, or *Cyanuret of Zinc.* This salt was introduced by the German physicians, as a substitute for hydrocyanic acid. It is prepared by adding recently-made oxide of zinc to hydrocyanic acid; or by adding a solution of sulphate of zinc to a solution of cyanide of potassium. It is a white powder, insoluble in water or alcohol. If a strong mineral acid be added to it, hydrocyanic acid is developed, and a soluble salt of zinc obtained. The latter is recognised by the tests before mentioned for a solution of zinc (p. 670.) It consists of one equivalent or 32 parts of *Zinc*, and one equivalent or 26 parts of *Cyanogen.*

Its effects have not been carefully ascertained, but they are supposed to be similar to those of hydrocyanic acid. It has been used principally in affections of the nervous system, as epilepsy, hysteria, and chorea. It has also been employed in cardialgia and cramps of the stomach, and as an anthelmintic in children. The dose is a quarter of a grain to a grain and a half three times a day. It may be taken in the form of powder mixed with calcined magnesia.