Antidotes.—The antidotes for hydrosulphate of ammonia, as well as for hydrosulphuric acid, are chlorine and the chlorides of lime and soda. In cases of asphyxia by the inhalation of these substances, the treatment consists in placing the patient on his back in the open air, with his head somewhat elevated; applying cold affusion to the face and breast; producing artificial respiration of air, through which chlorine is diffused, by pressing down the ribs and forcing up the diaphragm, and then suddenly removing the pressure; using strong friction in the course of the vertebral column, chest, soles of the feet, &c., and injecting into the stomach, stimulants; as, a weak solution of chlorine (or of chloride of lime) or brandy, &c. In the event of hydrosulphuret of ammonia being by accident swallowed in poisonous doses, dilute solutions of chlorine, or of the chlorides of lime and soda, should be immediately given, and the contents of the stomach removed by the stomach-pump as soon as possible.

Class IX. Metallic Substances.

Order XI. COMPOUNDS OF POTASSIUM.

1. POTAS′SÆ HY′DRAS, *L.*—HYDRATE OF POTASH.

(Potassa, *E.* (U. S.)—Potassa caustica, *D.*)

History.—Caustic alkaline solutions were probably known to the Greeks and Romans. We learn from Pliny (*Hist. Nat.* lib. xxviii. cap. 51.) that soap was made in his time from tallow and wood-ashes; and we may therefore conclude that some method was known of depriving the alkaline carbonate of its carbonic acid. Geber (*Invention of Verity*, ch. iv.) describes the method of making caustic alkali. Black, however, in the year 1756, first distinguished, chemically, the caustic alkalis from their carbonates. Potash was formerly called *kali*, or the *vegetable alkali*. It is the *Protoxide of Potassium*.

Natural History.—Potash in combination with acids is found in both kingdoms of nature.

α. In the Inorganized Kingdom.—Potash is found, in the mineral kingdom, in combination with sulphuric, nitric, silicic, and perhaps carbonic acids. As an ingredient of rocks, it is more abundant than soda.

β. In the Organized Kingdom.—In organized beings potash is met with in combination with phosphoric, sulphuric, nitric, carbonic, and various organic acids. It occurs more abundantly in vegetables than in animals.

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

The *London College* orders, of Solution of Potash, a gallon. Evaporate the water in a clean iron vessel over the fire, until the ebullition being finished, the Hydrate of Potash liquefies: pour this into proper moulds. [This is the direction of the U. S. P.]

The *Edinburgh College* directs any convenient quantity of aqua Potassæ to be evaporated in a clean and covered iron vessel, increasing gradually the heat till an oily-looking fluid remains; a drop of which, when removed on a rod, becomes hard on cooling; then pour out the liquid upon a bright iron plate, and as soon as it solidifies break it quickly, and put it into glass bottles secured with glass stoppers.

The process of the *Dublin College* is essentially the same as that of the Edinburgh College, except that the evaporation is to be effected in vessels of silver or iron, and the liquefied potash is to be poured out on a plate of silver or iron.

Properties.—The solid hydrate of potash of the shops, known as *Potassa fusa* (*Kali purum; Lapis Infernalis* sive *Septicus; Cauterium Potentiale*) is usually more or less coloured (brownish, grayish, or bluish,) and not completely soluble in water and alcohol in consequence of the presence of foreign matters. Pure hydrate of potash, however, is white, and dissolves in both water and alcohol. During its solution in water, heat is evolved. Its solubility in alcohol enables us to separate it from the carbonate and bicarbonate of potash, both of which are insoluble in this liquid. It has a strong affinity for both water and carbonic acid, which it rapidly attracts from the atmosphere, and in consequence becomes liquid. At a low red heat it fuses, and at a higher temperature is volatilized. It is odourless, but has a caustic, urinous taste. It rapidly decomposes organic substances. It possesses the properties of an alkali in an eminent degree.

Characteristics.—Potash, free or combined with an acid to form a neutral salt, is recognised by the following characters:—The hydrosulphurets, ferrocyanides, and carbonates, produce no precipitate with its solutions. Tartaric (in excess,) perchloric, and carbazotic acids, occasion precipitates of the bitartrate, perchlorate, and carbazotate of potash respectively. Chloride of plantinum throws down a yellow precipitate. Lastly, the potash salts communicate a violet tinge to the flame of alcohol.

Free potash is distinguished from its salts by its communicating a green colour to the infusion of red cabbage or syrup of violets; by its reddening turmeric, and restoring the blue colour of litmus reddened by an acid; by its not whitening lime water, or effervescing on the addition of an acid; by its soapy feel; by its solubility in alcohol; and by its dissolving alumina.

IMPURITIES.—Potassa fusa of the shops contains various impurities, such as sesquioxide of iron, carbonate of potash, and silica. These, however, do not materially affect its medicinal value.

> "Boiling water commonly leaves oxide of iron undissolved, which should not exceed 1·25 per cent.: the solution neutrallized with nitric acid gives a faint precipitate with a solution of nitrate of baryta, and more with solution of nitrate of silver,—owing to the presence of impurities." *Ph. Ed.*

The nitrate of baryta detects sulphates, while nitrate of silver is a test for chlorides.

COMPOSITION.—Pure *anhydrous potash* has the following composition:—

	Atoms.	*Eq Wt.*	*Per Cent*	*Berzelius.*
Potassium	1	40	83·34	83·05
Oxygen	1	8	16·66	16·95
Potash	1	48	100·00	100·00

The *hydrate of potash* is thus composed:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*
Potash	1	48	84·2	84
Water	1	9	15·8	16
Hydrate of Potash	1	57	100.0	100

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—Caustic potash promptly destroys the parts of living plants with which it is placed in contact, and even in the dilute state kills haricots (*Phaseolus vulgaris*) in a few hours. (Marcet, in De Candolle, *Phys. Végét.*)

β. *On animals generally.*—It acts on animals generally as an energetic caustic poison. It is, says Orfila, (*Toxicol. Génér.*) of all poisons, that which most frequently perforates the stomach. He found, that injected into the jugular vein of a dog, it coagulated the blood, and caused speedy death. It is, however, remarkable, that when mixed with the blood out of the body, it not only does not coagulate it, but actually prevents its spontaneous coagulation. Magendie has observed, that by the exhibition of alkalis to dogs, the urine acquires alkaline properties.

γ. *On Man.*—The general operation of alkalis has been already noticed (see pp. 194 and 207.) The local action of caustic potash, especially when in the solid form, is exceedingly energetic. It neutralizes any free acid in the part to which it is applied, and decomposes whatever ammoniacal salts may be present, causing the evolution of ammoniacal gas. It combines with fibrin and albumen, forming soluble compounds (*fibrate* and *albuminate of potash.*) Hence, rubbed between the fingers, it corrodes and dissolves the epidermis, and thereby gives rise to a soapy feel. Gelatine is also readily dissolved by it, and any phosphate of lime which may be present is deposited. These phenomena are to a certain extent comparable to those of saponification. As, then, potash and the other alkalis form soluble compounds with substances which enter largely into the composition of the organized tissues, we can readily explain an observation of Orfila, that alkalis are, of all corrosive poisons, those which most frequently perforate the stomach; for the intestinal mucus readily dissolves in alkalis, whereas it is coagulated by acids; so that the former are much more quickly brought in contact with the living tissues. These resist, for a certain time, the chemical influence of the caustics, but the affinities being powerful, the vital properties soon cease to offer opposition—the part dies, and the tissues are speedily dissolved. Hence, if a large quantity of potash be swallowed, the most violent symptoms are observed, though they are of the same general kind as when the mineral acids have been taken (see p. 122.)

When liquor potassæ is taken in small doses, and properly diluted, it saturates the free acids contained in the stomach, and which the recent investigations of physiologists have shown to be essential to the digestive functions. Hence the continued use of this or of any other alkali must be always injurious, since it disorders the assimilative process by altering the chemical properties of the healthy ventricular secretion.

If the quantity of potash swallowed be more than sufficient to neutralize the free hydrochloric acid, but insufficient to exert any important chemical action on the living tissues, it acts as a slight irritant, augments the secretions of the alimentary canal, becomes absorbed, and alters the qualities of the secreted fluids, more particularly those of the urine (see pp. 120 and 125.) Moreover, the modification thus produced in the quality of the renal secretion is accompanied by an increase in the quantity, so that the alkalis rank among our most powerful diuretics—an effect which may be in part owing to the local stimulus which they communicate to the secreting vessels in their passage through them.

By continued use, the alkalis give rise to increased activity of the different secreting organs, and of the absorbing vessels and glands; effects which are analogous to those caused by mercury. In other words, they act as *liquefacients* and *resolvents* (see p. 194.) After some time the digestive function becomes disordered, the appetite fails, the blood becomes thinner and darker coloured, and loses its power of spontaneous coagulation when drawn from the body: the whole system, and more particularly the digestive organs, become enfeebled; and a state precisely similar to that of scurvy is brought on. It is said if the alkalis be temporarily suspended the blood speedily re-acquires its coagulability, but loses it again when we resume their employment. These phenomena deserve especial notice, as being precisely analogous to those of scurvy—a disease which has been usually supposed to be brought on by the use of salt and salted provisions, and to be prevented or cured by vegetable acids (especially the citric) and fresh provisions. It appears, therefore, in the highest degree probable, that scurvy, and the effects caused by the long-continued employment of the alkalis, are analogous conditions of system (see the effects of ammonia, p. 285.)

USES.—Caustic potash, is employed for various purposes in medicine, the principal of which are the following:—

α. *As an escharotic.*—Potassa fusa is sometimes used as a caustic, though its employment is not free from objection; for its great deliquescence occasions some difficulty in localizing its action. It may be employed for the production of an issue, but we must proceed thus:—Apply to the part one or two layers of adhesive plaster, in the middle of which is an aperture of the exact size of the intended issue. Then moisten the *potassa fusa*, or the *potassa cum calce*, and rub on the part until discolouration is observed. Wash, and apply a linseed-meal poultice; and when the eschar is detached, insert the pea. Issues, however, are speedily and more conveniently made by the lancet than by caustic. In bites by poisonous animals—as venomous serpents, mad dogs, &c., this escharotic may be used with advantage. Mr. Whateley (*An Improved Method of Treating Strictures of the Urethra.* Lond. 1804.) recommends the *potassa fusa* as the agent for arming caustic bougies to be applied in strictures of the urethra; but the practice appears so dangerous (particularly on account of the deliquescence and violent action of the caustic,) that I believe it is now rarely, if ever, resorted to. There are many other cases in which this substance is employed as a caustic: for example, to destroy warts and fungoid growths of various kinds, and to open abscesses, more especially those in the groin; but for the latter purpose the lancet is to be preferred.

β. As an *antacid* we resort to the *liquor potassæ* in various affections of the digestive organs, which are attended with an inordinate secretion of acid, known by the acid eructations, cardialgia, and other dyspeptic symptoms. It must, however, be evident, that the neutralization of the acid is merely palliative. But the continued employment of alkalis frequently diminishes, temporarily, the tendency to acid secretion. Commonly it is found that the cases calling for the employment of alkalis are those benefited by tonics, and hence I believe the alkali is, in most cases, best given in some mild or tonic infusion; such, for example, as the infusion of calumba, or of gentian, or of quassia; the disulphate of quinia oftentimes disagreeing with the stomach in these cases: besides which, it would be decomposed by the alkali. The beneficial effects of alkalis are said to be particularly observed in those forms of dyspepsia which result from the inordinate use of spirituous liquors.

Of course the liquor potassæ would equally neutralize acid which may have been accidentally or purposely swallowed; but it is rarely given for this purpose, on account of its irritant qualities, and because many other agents (as chalk, whiting, magnesia, and soap) are equally efficacious as antacids, while they are free from the objections which exist in these cases to the use of the caustic alkalis.

γ. *To modify the quality of the urine*, liquor potassæ is a most valuable agent. I have already stated (see p. 198) that, under the employment of alkalis, not only may the natural acidity of the urine be destroyed, but even an alkaline property be communicated to it: so that, whenever the secretion of lithic acid, or of the lithates, is inordinate, the alkalis present themselves to our notice as chemical agents for counteracting this condition. It has been supposed by some that the efficacy of the caustic alkalis in preventing the deposition of lithic acid gravel, consists in their holding it in solution—an explanation apparently inconsistent with the fact that the carbonated alkalis and magnesia are equally efficacious, though they are incapable of dissolving it. We are, therefore, led to the conclusion, that the alkalis by their chemical influence, actually prevent the formation of this acid, or neutralize the free acid in the urine, which is the immediate cause of the precipitation of the lithic acid; whether by an action on the digestive organs or otherwise we know not. In resorting to these agents in urinary deposites, we should be careful to avoid employing them when there is any tendency to the deposition of the phosphates. The phosphate of lime, which naturally exists in the urine, is precipitated by the addition of a caustic alkali. It is generally admitted that the use of alkalis may actually cause the appearance of *white sand* (phosphates) in the urine; and in patients predisposed to its formation, its quantity may be increased by alkalis. These facts, then, have an important bearing on practice. "I have known," says Mr. Brande, (*Quart. Journ. of Science*, vol. vi. p. 198.) "soda-water exhibited in a case of stone in the bladder, *produce* abundance of white sand, which the ignorance of the patient and his medical attendant led them to refer to the solvent power of the medicine upon the stone, which they thought was gradually giving way and being voided; whereas great mischief was doing, by giving the urine more than its usual tendency to deposite the phosphates, and, consequently, to augment the size of the calculus." In the treatment of the lithic acid diathesis, it is to be remembered that the use of alkalis is, to a certain extent, a palliative mode of treatment, and that, to be successful, it should be conjoined with other means of cure.

δ. *As a liquefacient and resolvent* (see p. 194.)—The alkalis have been lately celebrated for producing beneficial effects in those *inflammations* which have a disposition to terminate in exudation and adhesion; that is to say, those that frequently give rise to the formation of false membranes or of adhesions; such, for example, as croup, pleurisy, and peritonitis. If experience should subsequently confirm the assertions already made respecting their efficacy, we shall have another analogy between the operation of alkalis and of mercury. Theoretically, it has been argued, the alkalis are likely to be beneficial in these diseases on two accounts; first, they have a tendency to diminish the supposed plasticity of the blood, which some have assumed (though without proof) to be connected with the exudation; and, secondly, we find these albuminous deposites readily dissolve, out of the body, in alkaline liquids: but arguments of this kind are to be received with great caution. In conclusion, I may add that Eggert recommends the alkalis as specifics against croup, though Sundelin (*Heilmittell.* 1^er^ Bd. S. 182.) found them ineffective. Hellwag employed them to cause the removal of the deposited lymph; Memminger gave them with benefit in hooping-cough; Mascagni in pleurisy and peripneumony. (Vogt, *Lehrbuch d. Pharmakodyn.* 2^er^ Bd. p. 529.) In the latter complaints the alkalis render the expectorated matter less viscid, and at the same time act on the kidneys and skin.

ε. In *induration* and *enlargement of the lymphatic* and *secreting glands* the alkalis have also been recommended: for example, in bronchocele, mammary tumours, affection of the testicle, diseases of the mesenteric glands, induration of the liver and salivary glands, &c. I have seen the liquor potassæ remarkably beneficial in excessive enlargement of the lenticular or glandular papillæ at the base of the tongue.

ζ. In *syphilis* and *scrofula* also the alkalis have been employed with advantage. Some of the most obstinate and troublesome forms of the venereal disease frequently occur in scrofulous subjects, in whom mercury is not only useless, but absolutely prejudicial. In several cases of this kind I have seen the liquor potassæ, taken in the compound decoction of sarsaparilla, of great benefit. In scrofula the long-continued use of the caustic alkalis (as potash and ammonia) has been attended with remarkably beneficial effects. Caustic potash was most extensively employed by Mr. Brandish,[1] during many years, in the treatment of scrofula and other chronic diseases, and, according to his report, with singular success. It is, however, more successful in young than in old persons,—and in those of fair and light complexion than in the dark and the swarthy. That, in a number of instances, scrofulous patients are greatly benefited by its use, cannot be denied; but I doubt whether this, or any other medicine, has the power of eradicating the disease from the system.

η. The alkalis have been employed as *diuretics in dropsy*, especially when this disease arises from glandular enlargements, or other causes likely to be relieved by these remedies.

ϑ. In *irritable conditions of the urinary organs* a combination of liquor potassæ and tincture of opium will be frequently found most beneficial, notwithstanding that alkalis are classed among the incompatibles of opium.

ι. There are several other diseases in which the employment of alkalis has been recommended; such as *skin diseases*, which are scaly (as lepra and psoriasis;) *chronic rheumatism;* in *uterine complaints*, as an emmenagogue; and in some chronic *diseases of the lungs.* Sometimes a very dilute solution of potash has been used as a *stimulating wash* to ulcers.

Antidotes.—In poisoning by the alkalis, the antidotes are either acids or oil, both of which form salts with the alkalis, and diminish their causticity. Chereau prefers oil. Vinegar, lemon or orange juice, even the very diluted mineral acids, should be resorted to, if oil be not at hand.

1. LIQUOR POTASSÆ, L.; (U. S.) *Potassæ Aqua*, E.; *Potassæ Causticæ Aqua*,

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[1] *Observations on the Use of Caustic Alkali in Scrofula and other Chronic Diseases.* Lond. 1811.

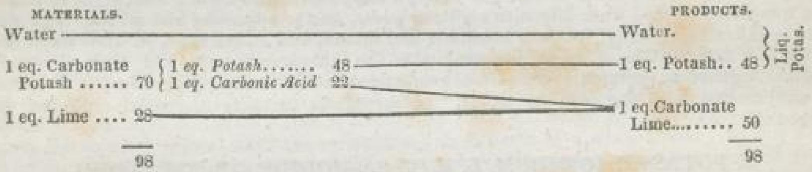
D.; *Solution of Potash; Water of Caustic Potash; Lixivium Saponarium.*—This is a solution of caustic potash.

The *London College* orders of Carbonate of Potash, ℥xv.; Lime, ℥viij.; Distilled Water, boiling, *Cong.* j. Dissolve the Carbonate of Potash in half a gallon of the water. Sprinkle a little of the water upon the lime in an earthen vessel, and the lime being slaked, add the rest of the water. The liquors being immediately mixed together in a close vessel, shake them frequently until they are cold. Then set by [the mixture,] that the Carbonate of Lime may subside. Lastly, keep the supernatant liquor, when poured off, in a well-stoppered green glass bottle. [The only difference between these and the directions of the U. S. P. is ℥xvi. Carb. Potassæ instead of ℥xv.]

The *Edinburgh College* directs of Carbonate of Potash, dry ℥iv.; Lime recently burnt, ℥ij.; Water, f℥xlv. Let the lime be slaked and converted into milk of lime, with seven ounces of the water. Dissolve the carbonate in the remaining thirty-eight fluid ounces of water; boil this solution, and add to it the milk of lime in successive portions, about an eighth at a time,—boiling briskly for a few minutes after each addition. Pour the whole into a deep narrow glass vessel for twenty-four hours; and then withdraw with a syphon the clear liquid, which should amount to at least thirty-five fluid ounces, and ought to have a density of 1·072.

The *Dublin College* employs of Carbonate of Potash, from Potashes of Commerce; Fresh burnt Lime, of each, two parts; Water, fifteen parts.—The process is not essentially different from that of the London College. The specific gravity of this product is 1·080.

In all these processes the lime abstracts carbonic acid from the carbonate of potash, forming carbonate of lime, and the potash thus set free dissolves in the water.



The liquid should be decanted or drawn off by a syphon. Filters are objectionable, as the potash decomposes and partially dissolves them. Cotton and linen are less acted on by it than paper or woollen cloth, which are readily decomposed by it. The air must be excluded as much as possible during the process of filtration, as the liquor abstracts carbonic acid from the air.

Liquor potassæ is a limpid, colourless, transparent, inodorous liquid, having an acrid taste. Prepared according to the London Pharmacopœia its sp. gr. is 1·063; according to the Edinburgh Pharmacopœia, 1·072; while, according to the Dublin College, it is 1·080. It has a soapy feel when rubbed between the fingers, and reddens yellow turmeric paper. It strongly attracts carbonic acid from the atmosphere, and, therefore, should be kept in closed vessels. It corrodes flint glass, and on that account should be preserved in green glass bottles.

It usually contains a small quantity of carbonate of potash, which may be detected by lime water, which renders the liquid turbid, or by a diluted mineral (sulphuric or nitric) acid, which causes effervescence. When pure liquor potassæ has been saturated with diluted nitric acid, it gives no precipitate on the addition of carbonate of soda, chloride of barium, or nitrate of silver: if the first cause a precipitate, it would indicate some earthy or metallic impregnation; if there be a precipitate, insoluble in nitric acid with the second, we infer the presence of a sulphate; and, lastly, if the third occasions a precipitate, soluble in ammonia, but insoluble in nitric acid, a chloride is present.

The effects and uses of this liquid have been above described. The dose of it is ten drops, gradually increased to the extent of a fluid-drachm, or even more, carefully watching its effects. It may be conveniently exhibited in the infusion of orange-peel. Table beer completely disguises the nauseous flavour of the alkali, but the vegetable acid of the beer partly neutralizes the alkali, especially when the beer is sour. Veal broth is another liquid for its administration. *Dr. Chittick's nostrum* for the stone is said to be a solution of alkali in veal broth.

2. POTASSA CUM CALCE, L. E.; *Potassa Caustica cum Calce*, D.—*Potash with Lime.* The following are the directions for preparing this compound:—

According to the *London College*, Hydrate of Potash, and Lime, of each an ounce, are to be rubbed together, and kept in a well-stoppered vessel.

The *Edinburgh College* directs, that any convenient quantity of Aqua Potassæ be evaporated in a clean covered iron vessel to one-third of its volume; add slaked lime till the fluid has the consistence of firm pulp: preserve the product in carefully covered vessels.

The process of the *Dublin College* is similar to that of the Edinburgh College.

By admixture with lime, hydrate of potash is rendered less deliquescent. Potassa cum Calce is employed as an escharotic in the same cases as Potassa fusa. When used it is made into a paste with rectified spirit, and applied to the part to be cauterized.

BRANDISH'S ALKALINE SOLUTION.—Take of best American Pearlashes, lbvj.; Quicklime, fresh prepared; Woodashes (from the Ash,) of each lbij.; Boiling Water, *Cong.* vj. Add first the lime, then the pearlashes, and afterwards the woodashes to the boiling water; then mix. In twenty-four hours the clear liquor may be drawn off.—In this process the lime decomposes the carbonate of potash contained in pearlashes and woodashes, and combines with the carbonic acid, setting free the potash. The liquid, therefore, is a solution of caustic potash contaminated with some soluble alkaline salts (sulphate of potash and chloride of potassium.) The solution is stronger than the officinal *liquor potassæ*, but is liable to vary in strength, in consequence of the varying quality of the ashes used.—Dose, according to Mr. Brandish, for an adult, is three (or even four) tea-spoonsful; for children, of from four to six years of age, one small teaspoonful; from six to eight years, a teaspoonful and a-half; from eight to fifteen, two teaspoonsful; and from fifteen to eighteen years, two teaspoonsful and a-half. The dose is to be taken twice daily, between breakfast and dinner, and at bed time, in fresh small beer or ale. A drop or two of oil of juniper covers the saponaceous taste, and gives a grateful smell. A generous regimen, and a careful avoidance of acids, were employed by Mr. Brandish, in conjunction with the alkaline liquor. In scrofulous tumours mercurial ointment was rubbed in.

2. POTAS'SII IO'DIDUM, *L. E.* (U. S.)—IODIDE OF POTASSIUM.

(Potassæ Hydriodas, *D.*)

HISTORY.—This salt, called also *ioduret of potassium*, and more commonly *hydriodate of potash*, was first employed in medicine by Dr. Coindet.

NATURAL HISTORY.—Iodine and potassium are contained in sea-water as well as in sea-weeds, but whether the iodine is in combination with potassium or with some other metal (sodium or magnesium) it is impossible to say with certainty (see p. 223.)

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

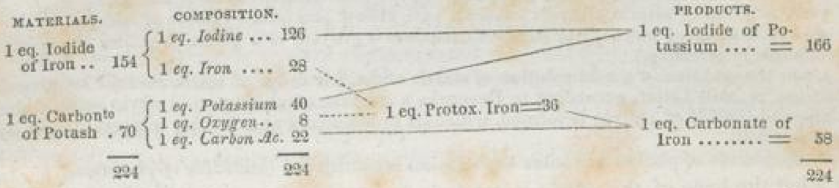
The *London College* orders of iodine ℥vj.; Carbonate of Potash, ℥iv.; Iron Filings, ℥ij.; Distilled Water, Ovj. Mix the Iodine with four pints of the Water, and add the Iron, stirring them frequently with a spatula for half an hour. Apply a gentle heat, and, when a greenish colour appears, add four ounces of carbonate of potash, first dissolved in two pints of water, and strain. Wash the residue with two pints of boiling distilled water, and again strain. Let the mixed liquor be evaporated, that crystals may be formed.

The *Edinburgh College* employs of Iodine (dry) ℥v.; Fine Iron-Wire, ℥iij.; Water, Oiv.; Carbonate of Potash (dry) ℥ij. and ʒvj. The process is much the same as that of the London College, except that the solution of iodide of potassium is to be concentrated "till a dry salt be obtained, which is to be purified from a little red oxide of iron and other impurities, by dissolving it in less than its own weight of boiling water, or, still better, by boiling it in twice its weight of rectified spirit, filtering the solution, and setting it aside to crystallize. More crystals will be obtained by concentrating and cooling the residual liquor."

[The U. S. Pharmacopœia directs, Iodine, six ounces; Iron Filings, three ounces; Carbonate of Potassa, four ounces or a sufficient quantity; Distilled Water, four pints. Mix the iodine with three pints of the distilled water, and add the iron filings, stirring frequently with a spatula for half an hour. Apply a gentle heat, and when the liquor assumes a greenish colour add gradually the carbonate of potassa, previously dissolved in half a pint of the distilled water, until it ceases to produce a precipitate. Continue the heat for half an hour and then filter. Wash the residuum with half a pint of the distilled water boiling hot and filter. Mix the filtered liquors, and evaporate so that crystals may form. Pour off the liquid and dry the crystals on bibulous paper.]

The following is the *theory* of the above processes:—One equivalent or 126 parts of iodine combine with one equivalent or 28 parts of iron. The resulting iodide of iron is decomposed by one equivalent or 70 parts of carbonate of potash, by which one equivalent or 166 parts of iodide of potassium and one equivalent or 58 parts of protocarbonate of iron are procured.

The following diagram illustrates the reaction between iodide of iron and carbonate of potash.



Prepared by this process, iodide of potassium is apt to be contaminated with carbonate of potash.

The process of the *Dublin College* is as follows:—Take of Iodine, 1 part; Sulphuret of Iron, reduced to coarse powder, 5 parts; Sulphuric Acid, 7 parts; Distilled Water, 48 parts; Water of Carbonate of Potash, a sufficient quantity; Rectified Spirit, 6 parts. Mix the iodine, by trituration, with 16 parts of the water, and put the mixture into a glass vessel. Pour the acid, previously diluted with 32 parts of water, upon the sulphuret in a matrass, and from a tube, adapted to the neck of the matrass, and reaching to the bottom of the vessel containing the iodine and water, let the gas pass through the mixture until the iodine disappears. Having filtered the liquor, evaporate it without delay, by a superior heat, to one-eighth part, and then filter it again. Then add gradually as much water of carbonate of potash as will be sufficient to saturate the acid, which is known by the cessation of the effervescence. Then expose the mixture to heat until the residual salt is dry and of a white colour; on this pour the spirit, and dissolve it with heat. Lastly, evaporate to dryness the liquor poured off from the residual salt, and preserve the residuum in a well stoppered vessel.

By the mutual action of sulphuret of iron, water, and sulphuric acid, we obtain, in this process, sulphuretted hydrogen and sulphate of iron. The sulphuretted hydrogen being conveyed into water with which iodine is mixed, a solution of hydriodic acid is obtained, and sulphur is deposited. When the hydriodic acid and carbonate of potash are mixed, mutual re-action occurs, and the products are iodide of potassium, water, and free carbonic acid.

Another mode of preparing this salt was proposed by the late Dr. Turner. It consists in adding to a hot solution of caustic potash as much iodine as the liquid will dissolve, by which means a reddish-brown fluid is obtained. Then pass hydrosulphuric acid through the liquid until it becomes colourless. Apply a gentle heat, to expel any excess of the acid; filter, to get rid of the free sulphur, and exactly neutralize the free acid present, with potash; then crystallize. When the potash comes in contact with iodine two salts are formed, iodide of potassium and iodate of potash: the latter is decomposed by the hydrosulphuric acid, the hydrogen of which forms water, by combining with the oxygen of the iodate; sulphur is precipitated, and iodide of potassium remains in solution.

Instead of decomposing, by sulphuretted hydrogen, the mixture of iodate of patash and iodide of potassium, it may be subjected to a red heat, in a crucible of platinum or iron. The iodate gives out six equivalents of oxygen, and is converted into iodide of potassium. A little iodate is, however, apt to escape decomposition.

Mr. Scanlan informs me, that if powdered charcoal be intermixed with the two salts before they are subjected to heat, the deoxidation of the iodate is easily effected.

Properties.—This salt occurs in white, somewhat shining, transparent, or semi-opaque cubes, or octohedrons, belonging to the regular system. Its taste is acrid saline, somewhat similar to common salt: it is without odour. It fuses at a red heat, and at a high temperature volatilizes unchanged. It decrepitates when heated. Both water and alcohol readily dissolve it: it requires only two-thirds of its weight of water to dissolve it at 60° F. Its aqueous solution dissolves iodine, forming a liquid called *ioduretted iodide of potassium.*

Characteristics.—A solution of this salt is known to contain an *iodide* by the following tests:—

α. A solution of bichloride of mercury occasions a vermilion-red precipitate, (*biniodide of mercury,*) soluble in excess of iodide of potassium.

β. A solution of acetate of lead produces a yellow precipitate (*iodide of lead.*)

γ. A solution of nitrate of silver causes a pale yellow precipitate (*iodide of silver.*)

δ. Protonitrate of mercury or calomel occasions a grayish or a greenish yellow precipitate (*protiodide of mercury.*)

ε. On the addition of a cold solution of starch and a few drops of nitric acid (or solution of chlorine, or, still better, according to Devergie, a mixture of chlorine and nitric acid) a blue compound (*iodide of starch*) is formed, which is decolourized at a boiling temperature, or by caustic alkali.

ϑ. Bichloride of platinum renders the solution brownish red (*biniodide of platinum.*)

That the base of the salt is potassium (or potash) is proved by the following characters:—

α. Perchloric acid occasions a white precipitate, (*perchlorate of potash,*) while the supernatant liquor becomes yellowish brown, from a little free iodine.

β. Excess of a strong solution of tartaric acid produces a white crystalline precipitate (*bitartrate of potash.*)

γ. Carbazotic acid forms yellow needle-like crystals (*carbazotate of potash.*)

δ. If a clean pack-thread be soaked in a solution of the iodide, and the wetted end be immersed in melted tallow and applied to the exterior or blue cone of the flame of a candle, this cone assumes a pale or whitish violet tint.

COMPOSITION.—This salt consists, as its name indicates, of iodine and potassium.

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Gay-Lussac.*
Iodine	1	126	76	76·2
Potassium	1	40	24	23·8
Iodide Potassium	1	166	100	100·0

The crystals contain no water of crystallization.

ADULTERATION.—Iodide of potassium is often largely adulterated with *carbonate of potash.* In 1829 I analyzed a sample, which contained 77 per cent. of the latter salt. (*Med. and Phys. Journ.* Sept. 1829.) In one specimen Dr. Christison procured 74·5 per cent. of carbonate of potash, 16 of water, and only 9·5 of iodide of potassium. (*Treatise on Poisons,* 3d edit. p. 182.) The impure salt may be distinguished by its wanting any regular crystalline form; by adding a few particles of it to lime-water, a milky fluid (*carbonate of lime*) is obtained, whereas the liquid remains transparent if the iodide be pure; by its destroying the colour of tincture of iodine, whereas the pure salt does not affect it; and lastly, by alcohol, which dissolves iodide of potassium, but not carbonate of potash.

Traces of the chlorides and sulphates are not unfrequent in commercial iodide of potassium. To detect the *chlorides,* add nitrate of silver, which precipitates the carbonates, chlorides, and iodides, and digest the precipitate in ammonia, which redissolves the chloride, but not the iodide of silver. On the addition of nitric acid to the ammoniacal solution, the chloride is thrown down, while the carbonate is converted into nitrate of silver. The *sulphates* may be detected by chloride of barium, which will occasion a white precipitate (*sulphate of baryta*) insoluble in nitric acid.

In the first edition of this work I mentioned that I had met with a variety of iodide of potassium, which, by keeping, underwent decomposition, evolved an odour of iodine, and became yellow. As it yielded me, on analysis, iodine and potash only, I was unable to account for the changes just referred to. Mr. Scanlan (*Lancet,* Aug. 29, 1840, p. 816.) has since explained them; and shown that this variety of iodide of potassium is contaminated with *iodate of potash,* the presence of which has been already accounted for (see p. 420.) It may be readily detected, by adding to a solution of the suspected iodide a solution of tartaric acid. If the iodide be pure, the resulting liquor is at first colourless, but becomes quickly yellow by the action of atmospheric oxygen on the hydriodic acid which is thus generated. If, however, iodate of potash be also present, a quantity of free iodine is instantly developed. This arises from the mutual reaction of the disengaged hydriodic and iodic acids by which water and free iodine are generated. Whether iodate be present or absent, the addition of tartaric acid causes the precipitation of crystals of bitartrate of potash.

Iodide of potassium is readily contaminated with metallic matter derived from the vessels in which it is crystallized. I have samples of it, in octohedral crystals, which contain traces of lead and tin, derived, I presume, from the metallic vessels in which they have been prepared.

The following are the characters of pure iodide of potassium according to the *London College:*

> Totally soluble in water and in alcohol. It alters the colour of turmeric either not at all or very slightly. It does not alter the colour of litmus. Subjected to heat it loses no weight. Sulphuric acid and starch added together it becomes blue. Ten grains of this salt are sufficient to decompose 10·24 grains of nitrate of silver: what is precipitated is partly dissolved by nitric acid, and partly altered in appearance; which is not the case when ammonia is added.

The non-action on turmeric proves the absence of alkali (or its carbonate) and acid. If it decompose more than the above quantity of nitrate of silver, the presence of chloride of potassium may be suspected.

The *Edinburgh College* gives the following characters of the pure iodide:—

> Its solution is not affected, or is merely rendered hazy, by solution of nitrate of baryta. A solution of five grains, in a fluid ounce of distilled water, precipitated by an excess of solution of nitrate of silver, and then agitated in a bottle with a little aqua ammoniæ, yields quickly, by subsidence, a clear supernatant liquor, which is not altered by an excess of nitric acid, or is rendered merely hazy.

The nitrate of baryta will form a white precipitate with either an alkaline carbonate or sulphate. The nitrate of silver is used to detect any chloride.

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—The effects of this salt on vegetables have not been ascertained.

β. *On Animals generally.*—The experiments of Devergie (*Médecine Légale,* t. ii. p. 536.) on dogs, as well as those of Dr. Cogswell (*Experimental Essay on Iodine.* Edinb. 1837.) on rabbits, have shown that, to these animals, iodide of potassium is a powerful poison. It operates as a local irritant, and thereby inflames the tissues with which it is placed in contact. Four grains injected into the jugular vein of a dog caused convulsions and death within a minute. Two drachms introduced into the stomach gave rise to vomiting aad great depression; the latter increased until death, which occurred on the third day: after death, ecchymosis, ulceration, and redness of the stomach, were observed. (Devergie, *op. cit.* p. 506.) Dr. Cogswell injected three drachms of the iodide beneath the skin of the back of a dog; the animal died on the third day. On chemical examination, iodine was detected in the blood from the heart, in the brain and spinal cord, the liver, spleen, stomach, muscles, tongue, and the bones freed from their appendages; likewise in the contents of the bladder. (Cogswell, *op. cit.* p. 91.)

γ. *On Man.*—Both the physiological effects and therapeutical uses of iodide of potassium show that its operation is analogous to that of iodine.

The *local action* of iodide of potassium is that of an irritant. When taken internally, in large doses, it not unfrequently occasions nausea, vomiting, pain and heat of stomach, and purging. Applied to the skin in the form of ointment, it sometimes produces slight redness. It is much less energetic in its action than free iodine; and, therefore, may be given in larger doses, and continued for a longer period, without evincing the same tendency to produce disorder of the stomach and intestinal canal. Lugol[1] found that baths at 100° F., containing three ounces of iodide of potassium, produced temporary itching only; whereas baths at the same temperature, containing ten scruples of iodine, caused prickling, then itchiness, smarting, rubefaction (which was not commensurate with the itchiness,) punctuated, separated, or confluent, and subsequently desquamation of the epidermis. The chemical action of iodide of potassium on the tissues is slight, as, indeed, might be expected, seeing that no obvious changes are produced when a solution of this salt is mixed with albumen, fibrin, or gelatine, the three most abundant organic constituents of the animal body.

Iodide of potassium *becomes absorbed* and is carried out of the system by the different secretions, in which, as well as in the blood, it may be easily detected.[2] Moreover, it deserves especial notice, that it has been found in the urine several days after it has been swallowed. (Christison, *Treatise on Poisons*, 3rd. ed. p. 185.) To detect it in the urine, add first starch to the cold secretion, then a few drops of nitric acid (or solution of chlorine,) and the blue iodide of starch will be formed if the iodide be present.

The *remote* or *constitutional effects* of iodide of potassium are very analogous to those of iodine. Diuresis is a common consequence of its use. Relaxation of bowels is not unfrequent. Occasionally ptyalism has been observed.[3] Dr. Wallace mentions that irritation of throat is produced by this salt. Atrophy of the mammæ is a very rare effect of it, but a case is mentioned by Mr. Nesse Hill. (*Edinb. Med. and Surg. Journ.* vol. xxv. 1826, p. 282.) Wasting of the testicle also is said to have resulted from its use. (*Lancet*, Oct. 16, 1841.) Headach, watchfulness, and other symptoms indicative of the action of this salt on the nervous system, have been noticed by Dr. Clendinning and Dr. Wallace. Increased secretion from, and pain of, the mucous membrane lining the nasal passages, have been observed. I have repeatedly remarked, that the pocket-handkerchiefs used by patients, who are taking this salt, acquire a distinct odour of iodine.

Great discrepancy exists in the statements of authors as to the effects of given doses of iodide of potassium. "The average dose of this medicine," says Dr. Williams, (*Lond. Med. Gaz.* vol. xiv. p. 42.—See also *Lancet*, Oct. 16, 1841.) "is eight grains; carried beyond that quantity it purges; and even limited to that quantity, it requires some management to obviate nausea." In two cases mentioned by Dr. Wallace (*Lancet*, for 1835–6, vol. ii. p. 9.) a drachm of this salt taken in divided doses caused vomiting, colicky pains, slight diarrhœa, frequency of pulse, and exhaustion. These statements, then, show that this salt possesses very active properties, and coincide with the experience of many practitioners, and with the results obtained from the experiments on animals. But we have, in opposition to the above, the evidence of Dr. Elliotson (*Lancet*, vol. i. 1831–2, p. 728.) and of Dr. Buchanan (*Lond. Med. Gaz.* vol. xviii. p. 519.) The first tells us that six drachms may be given daily (in doses of two drachms) for many weeks without inconvenience; and the second states half an ounce may be given at a dose without producing pain of the stomach or bowels, purging, or any hurtful effect. Farthermore, both physicians vouch for the purity of the salt employed. It is difficult to explain such discrepancies. But I cannot help thinking that peculiarities of constitution and morbid conditions of system (especially affections of the stomach) are principally concerned in modifying (either increasing or diminishing) the tolerance to this salt. I do not think that the different effects observed can be wholly ascribed to alterations in the quality or adulterations of the medicine employed, though I have published a case, (*Lond. Med. Gaz.* vol. xvii. p. 839.) showing that the adulterated is much less active than the pure salt.

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[1] *Essays on the Effects of Iodine in Scrofulous Diseases*, translated by Dr. O'Shaughnessy, p. 65. Lond. 1831.

[2] Buchanan, *Lond. Med. Gaz.* vol. xviii. p. 519; Wallace, *Lancet*, for 1835–6, vol. ii. p. 6: the latter authority failed to detect it in the blood.

[3] Dr. Clendinning, *Lond. Med. Gaz.* vol. xv. p. 869; and Dr. Wallace, *Lancet*, for 1835 and 1836, vol. ii. p. 8.

Uses.—Having so fully detailed (p. 228 *et. seq.*) the uses of iodine, it is unnecessary to notice at any length those of iodide of potassium, since they are for the most part identical. Thus it has been employed in bronchocele, scrofula, in chronic diseases accompanied with induration and enlargement of various organs, in leucorrhœa, secondary syphilis, periostitis, articular rheumatism, dropsies, &c. As a remedy for the hard periosteal node brought on by syphilis, it was first employed by Dr. Williams, (*Lond. Med. Gaz.* vol. xiv. p. 42.) who obtained with it uniform success. At the end of from five to ten days its mitigating effects are felt; the pains are relieved, the node begins to subside, and in the majority of cases disappears altogether. In these cases Dr. Clendinning (*Lond. Med. Gaz.* vol. xv. p. 833.) has also borne testimony to its efficacy. In the tubercular forms of venereal eruptions, Dr. Williams found it beneficial. In Dr. Wallace's lectures (*Lancet*, for 1835–6, vol. ii. and for 1836 and 1837, vols. i. and ii.) are some valuable observations on the use of iodide of potassium in venereal diseases. In chronic rheumatism accompanied with alteration in the condition of the textures of the joint, it is, in some cases, remarkably successful.[1] As an ingredient for baths, Lugol (*Essays*, p. 75.) found the iodide would not answer alone, but that it was useful as a solvent means for iodine.

Administration.—Iodide of potassium may be employed alone or in conjunction with iodine, forming what is called iodurretted iodide of potassium. *Internally* it has been given alone in doses varying from three grains to half an ounce (see p. 424.) To be beneficial, some think it should be given in small, others in large doses. Not having had any experience of the effects of the enormous doses before referred to, I can offer no opinion thereon. It may be administered dissolved in simple or medicated water, or in some bitter infusion. The more usual mode of exhibiting it is in combination with iodine.

Antidotes.—No chemical antidote is known. In a case of poisoning, therefore, the first object will be to evacuate the contents of the stomach, exhibit demulcent and emollient drinks, combat the inflammation by the usual antiphlogistic measures, and appease the pain by opiates.

1. **UNGUENTUM POTASSII IODIDI**; *Unguentum Potassæ Hydriodatis*, D. *Ointment of Iodide of Potassium.* (Iodide of potassium, ℈j.; Prepared Hog's Lard, ℥j. Mix.)—By keeping, this ointment is apt to acquire a yellowish colour, obviously from a little iodine being set free. In some cases this may depend on the iodide being contaminated with a little iodate of potash. It usually, however, arises from the action of the fatty acid (contained in the rancid fat) on the potassium of the iodide. When pure and fresh made, this ointment does not stain the skin like the compound ointment of iodine. It is, however, seldom employed. If used, its strength should be twice or thrice that of the Dublin preparation.

2. **UNGUENTUM IODINII COMPOSITUM**, L. *Unguentum Iodinei*, E. [*Unguentum Iodini Compositum*, U. S.] *Compound Ointment of Iodine; Ointment of Iodurretted Iodide of Potassium.* (Iodine, ʒss.; Iodide of Potassium, ʒj.; Rectified Spirit, fʒj.; Lard, ℥ij. First rub the iodine and iodide of potassium with the spirit, then mix with the lard, *L.* (and U. S.) The *Edinburgh College* omits the spirit, but uses the same proportions of the other ingredients.)—This ointment is employed in bronchocele, enlargement of the lymphatic glands, &c.

3. **TINCTURA IODINII COMPOSITA**, L. *Compound Tincture of Iodine.* (Iodine, ℥j.; Iodide of Potassium, ℥ij.; Rectified Spirit, Oij. Macerate until they are dissolved, and strain.)—This solution may be mixed with water, without any deposition of iodine. The dose at the commencement is ♏ x., which may be gradually increased to fʒj. or more. When wine is admissible, sherry is a good vehicle for its exhibition. [The Tinctura Iodini Composita (U. S.) is the same as this, half the proportions are directed.]

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[1] Dr. Clendinning, *Lond. Med. Gaz.* vol. xv. p. 866; and Dr. Macleod, *Lond. Med. Gaz.* vol. xxi. p. 361.

4. LIQOUR POTASSII IODIDI COMPOSITUS, L. *Compound Solution of Iodide of Potassium; Solution of Ioduretted Iodide of Potassium.* (Iodide of Potassium, grs. x.; Iodine, grs. v.; Distilled Water, Oj. Mix, that they may be dissolved.)—It is a brown-coloured solution, having the peculiar smell and taste of iodine. It may be diluted with water without suffering any change. It may be usefully employed in the diseases of children.—Dose for adults, from fʒij. to fʒvj., or even beyond this.

[**5. LINIMENT OF HYDRIODATE OF POTASH.**—This preparation for the external use of the Hydriodate of Potash is made by taking Iodide of Potassium, ℥i.; Soap of Animal Oil, ℥iss.; Alcohol at 20° f℥viij. Dissolve the iodide and soap each separately in half the alcohol, the latter solution being made upon a sand bath at a moderate temperature, and mix the two together. Flavour with a few drops of oil of lavender, and before congelation takes place pour into wide mouthed bottles. The above formula is that given by Mr. Duhamel. (American Journal of Pharmacy, vol. xiv. No. ij. p. 102, and is a modification of one in the *Journal de Pharmacie.*) The liniment is similar to solid opodeldoc and is used by friction in the same way. It is stated to have been used with success in Lausaune as an application to goitre. It possesses the recommendation of not staining the skin, and is stated to keep a long time without undergoing decomposition.—J. C.]

Solutions of IODURETTED IODIDE OF POTASSIUM, of various strengths, have been employed for different purposes by Lugol.[1] The following are the most important:—

α. *Lugol's Concentrated Solution of Iodine in Iodide of Potassium* consists of Iodine, ℈j.; Iodide of Potassium, ℈ij.; Distilled Water, ℥vij. Mixed with 3 pints and 13 fluid ounces of water, it forms a solution equal in strength to the *Liquor Potassii Iodidi compositus*, L.

β. *Lugol's Ioduretted Mineral Water* is prepared of three degrees of strength:—

	No. 1.	No. 2.	No. 3.
Iodine..................	gr. ¾	i	i¼
Iodide of Potassium.....	gr. i½	ii	ii½
Distilled Water.........	℥viii	℥viii	℥viii.

The solutions are yellowish or orange-coloured, and are quite transparent. When sweetened it is readily taken by children, but the sugar should be added at the time of administration, as in the course of a few hours it effects a chemical change in the solution. From six to eight ounces should be taken daily.

γ. *Lugol's Caustic, Rubefacient, and Stimulant Solutions*, are composed of the same ingredients, but in different proportions.

Stimulating Washes.			Rubefacient. Solution.	Caustic Solution.
No 1.	2.	3.		
Iodine............ gr. ii.	gr. iii.	gr. iv.	℥ iv.	℥ i.
Hydriodate Potash gr. iv.	gr. vi.	gr. viii.	℥ i.	℥ i.
Distilled Water .... lb. i.	lb. i.	lb. i.	℥ vi.	℥ ii.

Lugol uses the stimulating washes in scrofulous ulcers, ophthalmia, fistulous abscesses, &c. When the scrofulous surfaces require stronger excitement than usual, he employs the rubefacient solution. In tubercular tumors which have obstinately resisted all other forms of treatment, the rubefacient solution may be applied in admixture with linseed meal (forming the *ioduretted cataplasm* of Lugol.) To prepare the mixture, the poultice is first made in the ordinary manner; and when moderately cool, a sufficient quantity of the rubefacient liquid is poured on it with a wooden measure. The caustic solution is used for touching the eyelids and nasal fossæ, to repress excessive granulations, &c.

δ. *Lugol's Ioduretted Baths.*—These are employed in the treatment of scrofula. They are to be made in wooden vessels.

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[1] Lugol's *Essays on the Effects of Iodine in Scrofulous Diseases*; translated by Dr. O'Shaughnessy, p. 167. Lond. 1831.

IODURETTED BATHS FOR CHILDREN.				IODURETTED BATHS FOR ADULTS.			
Age.	Water.	Iodine.	Iodide of Potassium.	Degree.	Water.	Iodine.	Iodide of Potassium.
	(Quarts.)	(Troy Grains.)	(Troy Grains.)		(Qrts.)	(Drms. Troy)	(Drms. Troy.)
4 to 7	36	30 to 36	60 to 72	No. 1.	200	2 to 2½	4 to 5
7 „ 11	75	48 .. 60 .. 62	96 .. 120 .. 144	No. 2.	240	2 .. 2½ .. 3	4 .. 5 .. 6
11 „ 14	125	72 .. 96	144 .. 192	No. 3.	300	3 .. 3½	6 .. 7

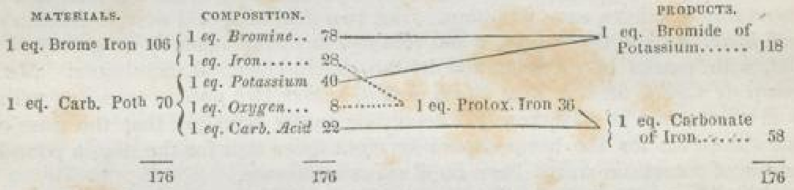
3. POTAS'SII BRO'MIDUM, *L.*—BROMIDE OF POTASSIUM.

History.—This salt, also called *hydrobromate of potash*, was first described by Balard in 1826. (*Ann. de Chim. et de Phys.* xxxii.)

Preparation.—The *London College* directs it to be prepared a follows:—

Take of Bromine, ℥ij.; Carbonate of Potash, ℥ij. and ʒj.; Iron Filings, ℥j.; Distilled Water, Oiij. First add the Iron, and afterwards the Bromine, to a pint and a half of the distilled water. Set them by for half an hour, frequently stirring with a spatula. Apply a gentle heat, and when a greenish colour occurs, pour in the carbonate of potash dissolved in a pint and a half of water. Strain and wash what remains in two pints of boiling distilled water, and again strain. Let the mixed liquors be evaporated so that crystals may be formed.

In this process bromide of iron is first formed: this is afterwards decomposed by carbonate of potash, by which protocarbonate of iron and bromide of potassium are produced.



Another mode of procuring this salt is to mix bromine with a solution of caustic potash, by which bromide of potassium and bromate of potash are formed. The bromate of potash may be converted into bromide of potassium by heat or by hydrosulphuric acid (see *Iodide of Potassium*, p. 420.)

Properties.—This salt crystallizes in whitish transparent cubes, or rectangular prisms. It is inodorous: its taste is pungent, saline, and similar to common salt, but more acrid. It is permanent in the air. When heated it decrepitates, and at a red heat fuses without suffering decomposition. It is very soluble in both cold and hot water, and slightly so in alcohol.

Characteristics.—That this salt is a *bromide* is known by the characters before mentioned (see p. 236) for this class of salts. That its base is potassium (or potash) is shown by the tests already given for this substance (see p. 415.)

Composition.—This salt consists of bromine and potassium in the following proportions:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Balard.*	*Liebig.*
Bromine	1	78	66·1	65·56	67·42
Potassium	1	40	33·9	34·44	32·58
Bromide of Potassium.	1	118	100·0	100·00	100·00

The crystals may contain water, lodged mechanically between their plates, but no combined water (water of crystallization.)

Purity.—The purity and goodness of this salt may be known by the following characters:—the form of the crystals, their freedom from colour, and their neutrality with respect to litmus and turmeric. A solution of this salt should give no precipitate with chloride of barium, showing the absence of carbonates and sulphates. The method employed by Rose (*Journ. de Pharm.* t. 23, p. 489.) for detecting minute quantities of the chlorides in bromides, is the following:—If pure bromide of potassium mixed with excess of bichromate of potash be distilled with concentrated sulphuric acid in a tubulated retort, to which is adapted a receiver containing excess of solution of caustic ammonia, pure bromine distils over, and the ammoniacal liquor remains perfectly colourless. But if the bromide contains a chloride, both bromine and the chromate of chloride of chromium distil over, and the ammoniacal liquor becomes yellow: chromic acid may be detected in the solution by the usual tests.

The characters of good bromide of potassium are, according to the London College, as follows:—

> Totally dissolved by water. It does not alter the colour of litmus or turmeric. Chloride of barium throws down nothing from the solution. Sulphuric acid and starch added together render it yellow. Subjected to heat it loses no weight. Ten grains of this salt are capable of acting upon 14·28 grains of nitrate of silver, and precipitating a yellowish bromide of silver, which is dissolved by ammonia, and but very little by nitric acid.

If more nitrate of silver than the quantity above stated be decomposed by the bromide, the presence of a chloride may be suspected.

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—The effects on plants have not been ascertained.

β. *On Animals.*—Thirteen grains of bromide of potassium dissolved in water, and injected into the jugular vein of a dog, coagulated the blood, caused convulsions and death in a few minutes. (Barthez. *Journ. de Chim. Med.* t. 5^{me}, p. 214.) The same experimenter introduced a drachm of the salt into the stomach of a dog without any ill effects, save vomiting. But two drachms, and even a drachm and a half, killed dogs in three days, when retained in the stomach by a ligature of the gullet, with marks of inflammation in the gastro-intestinal membrane. Maillet (*Journ. de Chim. Méd.* t. 3, 2^{e} Série, p. 225.) gave two ounces to a dog without any ill effect; and he observes, that according to the principle, that the dose of a saline substance for the horse should be eight times that for the dog, a pound of bromide of potassium would have no ill effect on horses.

γ. *On Man.*—The effects of bromide of potassium on man require farther investigation. They appear to be analogous to those of iodide of potassium. Dr. Williams (*Elements of Medicine*, vol. i. p. 338.) gave five grains of this salt three times daily for fourteen months, without any injurious effect. I have given the same dose to a boy of about 14 years old, affected with enlarged spleen consequent on intermittent fever, for several weeks, without any marked effect. By the application of starch and a few drops of chlorine to the urine, a yellow bromide of starch was obtained, showing the presence of a bromide in the urine. The case is now under treatment; but the volume of the spleen appears to be lessening.

In most cases it acts as a diuretic. In irritable conditions of the alimentary tube it is apt to occasion diarrhœa. Three cases are mentioned by Dr. Williams, in which, on account of this state of the bowels, more than four or five grains could not be exhibited at a time, and even then it was occasionally necessary to give opium. Under the continued use of it, enlargements of the spleen and liver, and swellings of the lymphatic glands, have disappeared; so that it appears to agree with iodine, mercury, and the alkalis, in being liquefacient and resolvent (see p. 194.) Dr. Williams thinks that it possesses "unusual, if not specific, powers in the cure of diseases of the spleen."

USES.—In 1828, Pourché (*Journ. de Chim. Méd.* t. iv. p. 594.) employed this salt with benefit in the treatment of bronchocele and scrofula: it was taken internally, and applied externally in the form of ointment. In 1836 it was introduced into the London Pharmacopœia, in consequence of the great success obtained from the use of it in a case of enlarged spleen, under the care of Dr. Williams. (*Op. cit.*) In this, and in three other successful cases of the same disease, it was used internally only. Dr. Williams also gave it with success in a case of ascites. Magendie (*Formulaire*, 8^{me} éd. 1835.) employs it as an antiscrofulous remedy, as an emmenagogue, and against hypertrophy of the ventricles. Prieger (Dierbach, *Die neusten Entdeck. in der Mat. Méd.* 1837.) applied it externally in the form of ointment in tinea capitis.

Administration.—It is exhibited in the form of pill or solution in doses of from four to ten grains three times a day.

Antidotes.—In a case of poisoning by this salt the treatment will be the same as for iodide of potassium.

UNGUENTUM POTASSII BROMIDI. *Ointment of Bromide of Potassium.*—This is composed of from ℈j. to ʒij. of bromide to ℥j. of lard. Bromine is sometimes added.

4. POTAS'SII SULPHURE'TUM, *L. E.* (U. S.)—SULPHURET OF POTASSIUM.

(Potassæ Sulphuretum, *D*)

History.—Geber (*Invention of Verity*, ch. vi.) was acquainted with the solubility of sulphur in an alkaline solution; but Albertus Magnus taught the method of procuring sulphuret of potassium by fusion. The preparation kept in the shops is a mixture of the sulphuret of potassium and sulphate of potash, and was formerly called *Sulphuret of Potash*, or *Liver of Sulphur*.

Preparation.—The process for the preparation of this compound is the same in all the British pharmacopœias.

Take of Sulphur, ℥j.; Carbonate of Potass, ℥iv. (℥ij. U. S.) Rub them together, and place them upon the fire, in a covered crucible, until they have united.

When sulphur and commercial carbonate of potash are fused together, water and carbonic acid are evolved. Part of the potash is decomposed; its potassium combining with sulphur to form a sulphuret of potassium; while its oxygen unites with sulphur to form one or more acids which combine with some undecomposed potash. A portion of the carbonate of potash remains undecomposed.

Properties.—When fresh prepared, it has a liver-brown colour; and hence its name *hepar sulphuris*. Its taste is acrid, bitter, and akaline. If quite dry it is inodorous, but when moistened it acquires the odour of hydrosulphuric acid. Exposed to the air it undergoes decomposition, from the action of the aqueous vapour and oxygen. It becomes green and moist, and ultimately whitish. This change depends on the absorption of oxygen, in consequence of which part of the sulphur is deposited, while a portion of the sulphuret of potassium is converted into hyposulphite, afterwards into sulphite, and ultimately into sulphate of potash. Sulphuret of potassium is soluble in water.

Characteristics.—Hydrochloric acid causes the evolution of hydrosulphuric acid gas and the precipitation of sulphur; the solution of the sulphuret in water produces a reddish or black precipitate with a solution of lead. That it contains potassium may be determined thus:—Add excess of hydrochloric acid to a solution of it; boil, and filter. The before-mentioned tests for potash (see p. 415) may then be applied.

"Fresh broken it exhibits a brownish-yellow colour. Dissolved in water, or in almost any acid, it exhales a smell of hydrosulphuric acid. The aqueous solution is of a yellow colour. What is thrown down by acetate of lead is first red,"[1] and it afterwards blackens." *Ph. L.*

Composition.—Berzelius (*Traité de Chimie*, t. ii. p. 301. Paris, 1831.) says, that if 100 parts of carbonate of potash be fused with 58·22 of sulphur, the product is a mixture of three equivalents of tersulphuret of potassium and one equivalent of sulphate of potash; and he adds, that if less than the above proportion of sulphur be employed, a portion of carbonate of potash remains undecomposed. But Winckler[2] has shown, that if the carbonate employed be quite pure, and the

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[1] The precipitate with acetate of lead I find may be red, reddish black, or black. The alkaline monosulphurets cause a black, the polysulphurets a red, precipitate with solutions of lead. (See *Hydrosulphuret of Ammonia*, p. 412.)

[2] *Berlinisches Jahrbuch*, Band. XLI. S. 321; 1839.—A corrected abstract of this paper is contained in the *Pharmaceutisches Central-Blatt für* 1839, S. 547.

operation be very carefully conducted, no sulphate is obtained, but hyposulphite and sulphite of potash. He fused together 900 grs. of crystallized basic carbonate of potash (dried at 212° F.) with 518 grs. of washed flowers of sulphur. The per-centage composition of the product was as follows:—

Tersulphuret of Potassium	53·2905
Hyposulphite of Potash	29·4580
Sulphite of Potash	6·8613
Sulphate of Potash	0·7730
Carbonate of Potash	2·8780
Loss	6·7392
Hepar Sulphuris	100·0000

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—There can be no doubt but that this compound is a powerful poison to plants, though I am not acquainted with any experiments made with it.

β. *On Animals Generally.*—From the experiments of Orfila (*Toxicologie Générale.*) on dogs, sulphuret of potassium appears to be a powerful narcotico-acrid poison. Six drachms and a half, dissolved in water, and introduced into the stomach, caused convulsions and death in seven minutes.

γ. *On Man.*—In *small doses* (as from four to ten grains) it acts as a general stimulant; increasing the frequency of the pulse, augmenting the heat of the body, promoting the different secretions, more especially those of the mucous membranes, and sometimes exciting local irritation, marked by pain, vomiting, and purging. By continued use it acts as a resolvent or alterative; and, on this account, is employed in certain forms of inflammation.

In *large doses* it is an energetic narcotico-acrid poison. In two instances it proved fatal in fifteen minutes; the symptoms were, acrid taste, slight vomiting, mortal faintness, and convulsions, with an important chemical sign, the tainting the air of the chamber with the odour of hydrosulphuric acid. (Christison, *Treatise on Poisons*, p. 228.)

Its local action is that of a powerful irritant: hence the acrid taste, burning pain, and constriction in the throat, gullet, and stomach, with vomiting and purging. But the nervous system also becomes affected; as is proved by the faintness, the almost imperceptible pulse, the convulsions, and (in some cases) sopor. These symptoms are analogous to those caused by hydrosulphuric acid; which, in fact, is copiously developed in the stomach.

USES.—Internally, it has been administered in very obstinate skin diseases, such as lepra and psoriasis, which have resisted all the ordinary means of cure. It has also been employed as a resolvent in inflammations attended with lympathic exudation, as croup, and in glandular enlargements. In chronic rheumatism, gout, hooping-cough, and various other diseases, against which it was formerly employed, it is now rarely if ever administered. It ought not to be given as an antidote for metallic poisoning, since it is itself a powerful poison.

Externally, it is applied in the form of lotions, baths, or ointment, in chronic skin diseases, such as eczema, scabies, lepra, &c.

ADMINISTRATION.—Internally it may be administered in the dose of three or four grains gradually increased. It may be given either in solution, or in the form of pill made with soap. For external use it is employed in solution in water, either as a bath or wash, or in the form of ointment. *Lotions* are sometimes made by dissolving an ounce of the sulphuret in two or three quarts of water. The *ointment* is composed of ʒss. of sulphuret to ℥j. of lard.

ANTIDOTES.—In the event of poisoning by this substance, the antidote is a solution of chloride of soda, or of chloride of lime.

1. **SOLUTIO POTASSII SULPHURET**; *Potassæ Sulphureti Aqua*, D. (Washed Sulphur, 1 part; Water of Caustic Potash, 11 parts. Boil during ten minutes, and

filter through paper. Let the liquor be kept in well-closed vessels. The sp. gr. of this liquid is 1·117.)—By the mutual reaction of sulphur and potassa, aided by the water and heat, a solution of sulphuret of potassium and hyposulphite of potash is obtained. The colour of this preparation is deep orange. It is sometimes administered in scabies, tinea capitis, and other allied eruptive diseases.—Dose from ♏x. to fʒj., sufficiently diluted with water.

2. **BALNEUM SULPHURATUM**; *Sulphurated* or *Sulphurous Bath.* This is prepared by dissolving ℥iv. of sulphuret of potassium in 30 gallons of water (Rayer.) It should be prepared in a wooden bathing vessel.—Used in obstinate skin diseases, as lepra and scabies. If an acid be added to this bath, sulphur is precipitated and sulphuretted hydrogen evolved. Care must be taken, lest asphyxia be produced by the inhalation of the latter.

3. **BALNEUM SULPHURATUM ET GELATINOSUM**; *Dupuytren's Gelatino-Sulphurous Bath.* This is prepared by adding one pound of Flanders glue (previously dissolved in water) to the sulphuretted bath above described.—It may be used as a substitute for the waters of Barèges; the glue representing the *Baregine*, an organic matter found in these waters. Barèges waters have been celebrated for cleansing foul ulcers, healing old wounds, and curing obstinate skin diseases.

5. POTAS'SÆ BISULP'HAS, *L. E. D.*—BISULPHATE OF POTASH.

History and Synonymes.—The mode of preparing this salt was taught by Lowitz and Link, at the latter end of the last century. The salt has had various names, such as *Supersulphate of Potash, Sal Enixum, Acid Vitriolated Tartar*, and *Sal Auri Philosophicum.*

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

The *London* and *Edinburgh Colleges* direct it to be prepared by adding sulphuric acid to a solution of the salt which remains after the distillation of [pure, *E.*] nitric acid. The London College uses lbij. of the salt, lbj. of sulphuric acid, and Ovj. of boiling water. The Edinburgh College employs the same quantity of salt and water, but only f℥vij. and ʒj. of acid.

The *Dublin College* prepares it from Sulphuric Acid of commerce, two parts; Carbonate of Potash, from Potashes, as much as may be sufficient; Water, six parts. Let one portion of the sulphuric acid, mixed with the water, be saturated by the carbonate of potash, then let another portion of the acid be added to the mixture. Let the liquor evaporate until on cooling, crystals are formed.

The salt which remains in the retort after the preparation of the Acidum Nitricum, *L.* & *E.*, is bisulphate of potash. When "the solution is allowed to crystallize, it occasionally happens that some sulphate and sesquisulphate are mixed with the bisulphate, owing to the partition of the excess of sulphuric acid between the water and the sulphate of potash. This inconvenience is remedied by the addition of sulphuric acid now directed to be employed." (Mr. R. Phillips, *Translation of the Pharmacopœia*, p. 295, 4th edit.

Fig. 61.

Prism of Bisulphate of Potash.

Properties.—It is crystallizable; the crystals belong to the right prismatic system. It has a very acid taste, and reacts strongly as an acid on vegetable colours, and decomposes the carbonates with effervescence. It is soluble in about twice its weight of water at 60°. By a red heat it evolves sulphuric acid, and is converted into the neutral sulphate of potash.

Composition.—It consists of—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Geiger.*
Sulphuric Acid	2	80	54·80	54·77
Potash	1	48	32·87	32·53
Water	2	18	12·33	12·70
Crystallized Bisulphate Potash	1	146	100·00	100·00

Characteristics.—The presence of sulphuric acid may be recognised by the chloride of barium (see p. 406.) When subjected to a red heat, bisulphate of potash loses half of its acid. The residue is the neutral sulphate; the potash of which may be detected by the characters already mentioned for this substance (see p. 415.) From the neutral sulphate of potash it is distinguished by its acid taste, its action on litmus and on the alkaline carbonates, and by its greater solubility.

Physiological Effects and Uses.—It is rarely used as a medicine. It possesses the combined properties of sulphuric acid and sulphate of potash. The excess of acid renders its local operation that of an astringent. When swallowed it operates as a mild purgative, and may be employed in the same cases as the sulphate, over which it has the advantage of greater solubility. Conjoined with rhubarb it covers the bitter taste of the latter without injuring its medicinal properties. Dr. Barker (*Observations of the Dublin Pharmacopœia*, p. 138. Dublin, 1830.) says it may be used to form a cheap effervescing purgative salt, as follows:—73 grains of bisulphate of potash and 72 grains of crystallized carbonate of soda, to be separately dissolved in two ounces of water, and taken in a state of effervescence.

Administration.—The dose of it is from gr. x. to ʒij. properly diluted.

6. POTAS′SÆ SUL′PHAS, *L. E. D.* (U. S.)—SULPHATE OF POTASH.

History and Synonymes.—The mode of preparing this salt was taught by Oswald Croll, in 1643. It has been known by various appellations, such as *Specificum Purgans Paracelsi*, *Arcanum duplicatum*, *Vitriolated Kali*, *Vitriolated Tartar*, *Sal Polychrest* (literally signifying *salts of many uses* or *virtues*,) *Sal de Dubous*, &c.

Natural History.—Sulphate of potash is found in both kingdoms of nature.

α. In the Inorganized Kingdom.—It has been met with in small quantities in some mineral waters of Saxony and Bohemia, in native alum, in alum-stone, and in a mineral called *polyhalite*, in which Stromeyer found no less than 27·6 per cent. of the sulphate of potash.

β. In the Organized Kingdom.—It has been found in the root of Polygala Senega, Winter's bark, the bulb of garlic, myrrh, opium, &c. The blood and urine of man also contain it.

Preparation.—It is prepared from the residuum of the distillation of nitric acid.

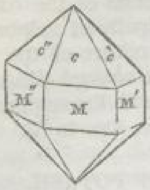
The *London College* orders of the salt which remains after the distillation of Nitric Acid, lbij.; Boiling Water, *Cong.* ij. Ignite the salt in a crucible until the excess of sulphuric acid is entirely expelled, then boil it in the two gallons of water until a pellicle floats, and the liquor being strained, set it aside that crystals may be formed. The liquor being poured off, dry them.

The *Edinburgh and Dublin Colleges* order the salt left after the distillation of nitric acid to be dissolved in water, and its excess of acid to be saturated. The Edinburgh College employs for this purpose white marble (carbonate of lime:) while the Dublin College uses carbonate of potash. The neutral solution of sulphate of potash is then to be evaporated and crystallized.

The heat employed by the London College is to drive off the excess of sulphuric acid.

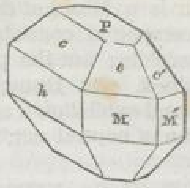
Properties.—It usually crystallizes in single or double six-sided pyramids. The two pyramids are sometimes united at a common base, or are separated by a short

FIG. 62.



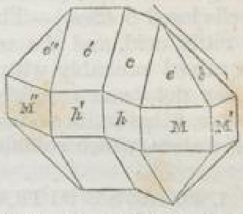
Common bipyramidal crystal.

FIG. 63.



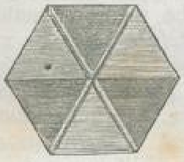
Ditto modified.

FIG. 64.



Compound crystal composed of three so united that their upper edges meet at angles of 120°.

FIG. 65.



Tessellated appearance of a plate of sulphate of potash seen by polarized light.

intervening prism (fig. 62.) These forms agree very closely with those belonging to the rhombohedral system. But they have been shown by Dr. Brewster[1] to be composite crystals; being composed of several crystals belonging to the right prismatic system, agglutinated so as to simulate the forms of the rhombohedral system. If a plate, cut perpendicular to the axis of the double pyramid, be examined by polarized light, it presents the tessellated structure shown in fig. 65; and each of the six equilateral triangles are found to have two axes of double refraction.

Crystals of sulphate of potash are hard, inodorous, have a saline bitter taste, and are unchanged by exposure to the air. When heated they decrepitate. At 60° F. they require sixteen times their weight of water to dissolve them: they are insoluble in alcohol. A solution of them is decomposed by tartaric acid, which forms crystals of bitartrate of potash.

Characteristics.—I have already stated these, when describing the bisulphate.

COMPOSITION.—The crystals contain no water of crystallization. They are thus composed:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Wenzel.*
Sulphuric Acid......	1	40	45·45	45·25
Potash..............	1	48	54·55	54·75
Sulphate of Potash..	1	88	100·00	100·00

PHYSIOLOGICAL EFFECTS.—It acts as a very mild purgative, without occasioning any heat, pain, or other symptoms of irritation. Its operation is, in fact, too mild for ordinary use.

USES.—It is particularly serviceable as a laxative in disordered conditions of the alimentary canal, as diarrhœa and dyspepsia, in hepatic disorders, and in hemorrhoidal affections. It is best given in combination with rhubarb. Thus, from five to ten grains of rhubarb, with from fifteen grains to two drachms of this salt, will be found to act mildly and efficiently in many cases of dyspepsia and diarrhœa. It is an excellent aperient for children. The objections to its employment are its slight solubility, and that when given in large doses to children it is apt to produce vomiting. It is useful, on account of its hardness, for triturating and dividing powders, as in the *pulvis ipecacuanhæ compositus.* Its powder is an excellent dentifrice: the only objection to its use is its taste.

DOSE.—It is given in doses of from fifteen grains to four or five drachms.

POTASSÆ SULPHAS CUM SULPHURE, E.; *Sal Polychrestum Glaseri; Glaser's Sal*

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[1] *Edinburgh Philosophical Journal*, vol. i. p. 6. Edinb. 1819.—See also Mr. W. Phillips, *Annals of Philosophy*, N. S. vol. iv. p. 342, Lond. 1822; Levy, *Quarterly Journal of Science*, vol. xv. p. 285, Lond. 1823; and Mr. Brookes, *Ibid.* N. S. vol. vii. p. 20, 1824.

Polychrest. (Nitrate of Potash, and Sulphur, equal parts; mix them thoroughly; throw the mixture, in small successive portions, into a red-hot crucible; and when the deflagration is over, and the salt has cooled, reduce it to powder, and preserve it in well-closed bottles.)—The sulphur is oxidized at the expense of the oxygen of the nitric acid, and the resulting compound consists principally of sulphate of potash, mixed probably with some sulphite; but the precise nature of the compound has not been carefully determined. Dr. Duncan (*Edinburgh Dispensatory.*) says, "that in its medical effects and exhibition it agrees with the sulphureous mineral waters, which contain a portion of neutral salt."—Dose, ʒss. to ʒj.

7. POTAS'SÆ NI'TRAS, *L. E. D.* (U. S.)—NITRATE OF POTASH.

History.—At what time this salt became known is difficult now to determine. As it is found in various parts of the East, on the surface of the earth, it appears probable that it must have been known at a very early period. Furthermore, if the Chinese and Hindoos were acquainted with the art of making gunpowder and fireworks at a very early period of history, they must have employed, and, therefore been acquainted with, nitre. Geber, (*Invention of Verity*, ch. xxiii.) however, is the first who distinctly mentions it. He describes the mode of making nitric acid from it. But the terms *neter* of the Old Testament, (*Proverbs*, ch. xxv. 20; *Jeremiah*, ch. ii. 22.) translated *nitre*,—*νιτρον* of Herodotus (*Euterpe*, lxxxvii.) and Theophrastus (*De Igne.*)—and *nitrum* of Pliny, (*Hist. Nat.* xxx. i.) appear to have been applied either partially or exclusively to *natron.* (See Beckman's *History of Inventions and Discoveries*, vol. iv.) The word *saltpetre*, usually applied to nitre, is evidently derived from *sal petræ*, literally signifying rock salt. (See *Sodæ Carbonas* and *Sodæ Sesquicarbonas.*)

Natural History.—This salt occurs in both kingdoms of nature.

α. In the Inorganized Kingdom.—In the East Indies, Egypt, Persia, Spain, and other parts of the world, large quantities of nitre are found in the soil. It would appear to be formed below, and to be brought to the surface of the soil by efflorescence. It has been usually supposed that the nitric acid was formed by the direct union of the nitrogen and oxygen of the air; but there are no facts which justify this opinion. It is much more probable that it is formed by the oxidation of ammonia (which is a constant constituent of the atmosphere;) the products being nitric acid and water. The simultaneous oxidation of hydrogen is necessary to effect the union of oxygen with nitrogen. The cause of this is that the acid and water unite, so that water may be said to be a condition of *nitrification.*[1] Azotised animal matter is no farther necessary than as yielding ammonia. In a nitre-cave in Ceylon, Dr. Davy (*Account of the Interior of Ceylon.*) found nitre without animal matter. The potash of the nitrate is in most cases easily accounted for, being found in some of the constituents of the soil, as feldspar and mica.

β. In the Organized Kingdom.—This salt has been found in various plants, as in the roots of *Cissampelos Pareira*, *Geum urbanum*, &c. (De Candolle, *Phys. Végét.* p. 387.)

Extraction.—The nitrate of potash consumed in this country is imported from India, where it is obtained from natural sources. In some parts of Europe it is obtained artificially.

The district of Tirhût, in Bengal, is more productive of nitre than any other place in India. It is most abundant in those parts containing a redundancy of carbonate of lime. An average sample of the soil analyzed by Mr. Stevenson (*Journ. of the Asiatic Society of Bengal*, vol. ii. p. 23.) gave the following composition:—

Matter insoluble in three Mineral Acids	Silex	50·0
Matter soluble in ditto	Carbonate of Lime	44·3
Matter soluble in water	Sulphate of Soda	2·7
	Muriate of ditto	1·4
	Nitrate of Lime	0·9
	Nitrate of Potash	0·7
		100·0

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[1] Liebig, *Organic Chemistry in its Application to Agriculture and Physiology*, edited by L. Playfair. Lond. 1840.

"In the month of November the *leonahs*, or native manufacturers of saltpetre, commence their operations, by scraping off the surface from old mud heaps, mud buildings, waste grounds, &c., where the saltpetre has developed itself in a thin white efflorescence, resembling frost rind. This saline earth being collected at the factories, the operator first subjects it to the process of solution and filtration. This is effected by a large mud filter, lined on the inside with stiff clay." It has a false bottom of bamboo, covered with close wrought grass mats, on which are placed vegetable ashes. Upon these the nitrous earth is laid. Water is then added to dissolve the saline matters of the earth, and the solution thus obtained, filtering through the mats, drops into the empty space between the real and false bottom, and is conveyed away into an earthen receiver. In its passage through the wood-ashes the carbonate of potash contained in the latter reacts on the nitrate of lime of the solution, and produces nitrate of potash and carbonate of lime. The solution is afterwards evaporated in earthen pots, filtered, and put aside to crystallize. The impure nitre thus procured is termed *dhouah:* it contains from 45 to 70 per cent. of pure nitrate of potash. It is redissolved and crystallized by the native merchants, who supply the Calcutta bazaars, and when thus purified is called by the natives *kalmee.*[1]

ROUGH NITRE.—Saltpetre is imported into this country principally from Calcutta, but some comes from Madras. It is brought over in cloth bags, which contain from 150 to 175 lbs. each. Its quality varies considerably. It is always more or less impure: but the common varieties, which have a dirty yellowish appearance, are termed *rough* or *crude saltpetre*, or *grough petre*, while the purer and cleaner looking kinds are called *East India refined*. The loss which it suffers in refining, or, in other words, the impurities which it contains, are technically designated *refraction*. This varies greatly in different samples, but is usually between 5 and 15 per cent.[2]

PURIFICATION.—Refined rough nitre is purified by dissolving it in water, boiling the solution, removing the scum, and, after the liquid has been allowed to settle, it is strained, while hot, through a hempen cloth, and set aside to crystallize. At the Waltham Abbey powder-mills the crystallization is effected in copper pans. When it has been dissolved and crystallized once only it is called *singly refined nitre:* when twice, *doubly refined.*[3] Its purity may be ascertained by testing it with nitrate of silver, chloride of barium, and oxalate of ammonia. The first detects the chlorides, the second the sulphates, and the third the calcareous salts.

The *Dublin College* orders *Purified Nitrate of Potash* (*Potassæ Nitras purificatum*) to be thus prepared: Take of Nitrate of Potash, *one part*. Dissolve in two parts of hot water, filter the liquor, and set it aside, that, on cooling, crystals may be formed.

NITRE FROM ARTIFICIAL SOURCES.—The artificial preparation of nitre is practised in several parts of Europe. The establishments in which it is carried on are called *Artificial Nitrières.*[4] The mode adopted varies, however, in different places.

At Appenzel, a canton in Switzerland, nitre is formed from the urine of animals. A hole is dug near to stables, and in this is put a sandy kind of earth, which is kept moistened with the water running from the stables. In two or three years this earth yields nitre.

In Sweden, (Berzelius, *Traité de Chimie*, t. iii. p. 391.) where each landed proprietor is compelled to furnish a certain quantity of nitre, it is prepared as follows:—Decomposing animal and vegetable matters, mixed with cinders, lime, or marl, are placed in heaps (called *nitre beds*) under cover, the mass being occa-

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[1] See Stevenson, *op. cit.*; also, *India Journal of Med. and Phys. Science*, new series, vol. i. p. 10. 1836.

[2] For the methods of determining it, consult Dumas, *Traité de Chimie*, t. 2me, p. 762; Brande's *Manual of Chemistry*. 4th ed. p. 549.

[3] Colonel Moody informs me that the rough nitre now supplied to the Waltham Abbey powder-mills has about 3 per cent. refraction, and requires one crystallization only to render it sufficiently pure for the manufacture of gunpowder.

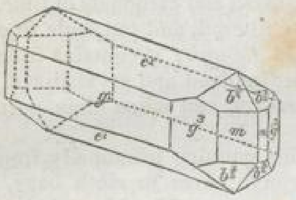
[4] For full details of this process consult Thénard, *Traité de Chimie*, t. iii. p. 239, 5me éd. Paris, 1827; Dumas, *op. supra cit.*; and Kuhlmann, *Mém. Acad. Sciences de Lille*, 1838. and in Liebig's *Annalen*, xxix. 272.

sionally moved, or holes made in it, so that they are exposed to the air. From time to time they are watered with urine. At the end of two or three years the nitrogen has combined with oxygen, and this with bases to form nitrates. By lixiviation the salts may be separated, and any nitrate of lime present may be converted into nitrate of potash by adding wood-ashes, which contain carbonate of potash.

In Prussia *nitre-walls* are employed instead of nitre-beds. These have two advantages,—they economize land, and they expose a large surface to the air. (Dumas, *op. cit.*)

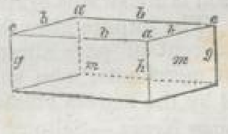
PROPERTIES.—Nitrate of potash usually crystallizes in the form of a six-sided prism with diëdral summits, which belongs to the right prismatic system.[1] It has, therefore, two axes of double refraction, and presents a double system of rings in polarized light (see figs. 35 and 36, p. 169.) When pure the crystals are transparent and colourless, have a sharp cooling taste, and undergo no change by exposure to the air. When heated, nitrate of potash fuses, and when cast in moulds forms the *Nitrum Tabulatum*, or, from its having formerly been cast into small balls, and stained of a plum colour, *Sal Prunelle.* At a strong red heat it is decomposed, with the evolution of oxygen and the formation of hyponitrite of potash, which, when rubbed to powder and mixed with sulphuric acid, emits red fumes (composed of nitrous acid and binoxide of nitrogen.) One hundred parts of water at 32° dissolve 13·32 parts of this salt, but at 77° they dissolve 38 parts. During the solution cold is generated. In pure alcohol nitre is insoluble.

FIG. 65.



Crystal of Nitre.

FIG. 66.



Primitive right rhombic prism.

Characteristics.—This salt is known to be a nitrate by the characters already detailed (p. 267) for this class of salts. That its base is potash is shown by the tests before mentioned (p. 415) for this substance.

COMPOSITION.—Nitrate of potash has the following composition:—

	Atoms.	*Eq. Wt.*	*Per Ct.*	*Wollaston.*
Nitric Acid	1	54	52·9	53·332
Potash	1	48	47·1	46·668
Nitrate of Potash	1	102	100·00	100·000

		Atoms.	*Eq. Wt.*	*Per Ct.*
or	Nitrogen	1	14	13·75
	Oxygen	6	48	47·10
	Potassium	1	40	39·15
		1	102	100·00

PHYSIOLOGICAL EFFECTS. *α. On Vegetables.*—Nitrate of potash dissolved in 300 times its weight of water promotes vegetation: but a solution containing $\frac{1}{30}$ part of nitre is injurious to the growth of plants. (Davy, *Agricultural Chemistry.*)

β. On Animals generally.—Orfila (*Toxicol. Générale.*) found that when introduced into the stomach of dogs it acts as an irritant poison. If administered in doses of two or three drachms, it is capable, when not vomited up, of causing death. Its operation is that of a narcotico-acrid poison. When applied to the cellular tissue it produces, according to this experimentalist, local effects only, and does not become absorbed. But Devergie (*Médecine Legale.*) states, on the

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[1] Levy, *Quarterly Journal of Science*, vol. xv. p. 284; also, Miller, in *Philosophical Magazine*, for July, 1840.

authority of J. E. M. Smith, that half an ounce applied to the thigh killed a dog in thirty-six hours. Eight ounces dissolved in a pint of water, and swallowed, killed a horse in twenty-four hours with all the symptoms of violent intestinal irritation. (Moiroud *Pharmacologie Vétérinaire.* Paris, 1831.) Veterinarians use nitre as a diuretic and refrigerant in doses of from two to four drachms.

γ. *On Man.*—In *very large doses* (such, for example, as one ounce or more) nitre has in several instances caused death; but the effects of it are not uniform, since, in other cases, this quantity has not appeared to have any very remarkable or obvious effect. For example, Dr. Christison knew an instance in which one ounce was taken without occasioning any other unpleasant symptom than vomiting; and it was retained on the stomach for above a quarter of an hour. In those cases where violent effects followed the ingestion of it, the symptoms were twofold: on the one hand, those indicating inflammation of the alimentary canal (such as pain, vomiting, and purging;) on the other hand, an affection of the nervous system (marked by giddiness, convulsions, failure of pulse, tendency to fainting, dilated pupil, insensibility, and palsy.) It is probable that the operation of nitre is influenced by the quantity of aqueous liquid in which the salt is dissolved, and that the more we dilute, the less powerfully does it act as a poison. In no other way can we reconcile the discrepant statements in regard to the effects produced by an ounce of nitre.

If nitre (or any other neutral alkaline salt) be mixed with dark-coloured venous blood out of the body, it communicates to it a florid or arterial hue. Now as this salt, when taken into the stomach, becomes absorbed, it is not unreasonable to suppose that while mixed with the circulating blood it might have an analogous effect. Dr. Stevens (*Observations on the Blood*, p. 298. Lond. 1832.) asserts, that in the last stage of fever, when the blood is black, it has this effect. Moreover, he tells us (p. 154,) that in a case which occurred in America, where a person swallowed an ounce of nitre, by mistake, in place of Glauber's salts, the blood when drawn from a vein was completely florid, and remained as fluid as if the nitre had been added to it out of the body.[1]

In *moderate doses* nitre acts as a refrigerant, diuretic, and diaphoretic. Its refrigerant properties are best seen when the body is preternaturally hot, as in febrile disorders. Mr. Alexander, (*Essays*, p. 105, *et seq.* Edinb. 1768.) in his trials with it, made on himself, experienced a sensation of chilliness after each dose, but he could not recognise by the thermometer any diminution of heat in the external parts of his body. He found, in most of his experiments, that it had a powerful influence over the vascular system, and surprisingly diminished, in a very short period of time, the number of pulsations. Thus, on several occasions, a drachm of this salt, within a few minutes, reduced the frequency of the pulse from 70 to 60 beats. Sundelin (*Heilmittell.* Bd. i. S. 59.) says nitre diminishes the orgasm and plasticity of the blood, perhaps by a chemical action on the cruor and fibrin. Diuresis is another, and very generally observed effect. As the nitre can be detected in the urine, its operation as a diuretic depends, perhaps, on the local stimulus which is communicated to the renal vessels while the salt is passing through them. Like most of the neutral salts of the alkalis, the continued use of it promotes alvine evacuations. Full doses frequently produce pain in the stomach. As a diaphoretic it is usually given in combination with emetic tartar.

Uses.—It follows, from what has been now stated in regard to the physiological effects of nitre, that this substance is indicated when we wish to diminish preternatural heat, and to reduce the force and frequency of the pulse, as in febrile disorders, inflammatory affections, (except, perhaps, those of the stomach, bowels,

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[1] For some remarks on the effects of nitre on the blood, by Mr. Carlyon, see *Lond. Med. Gaz.* vol. viii. p. 626; and on nitre as a therapeutic agent, by Dr. Hancock, see *Lancet* for 1831-2, vol. ii. p. 766.

kidneys, and bladder,) and hemorrhages[1] (especially hemopytysis.) In continued fever it is frequently given in combination with emetic tartar, and sometimes also with calomel. It is not often used as a diuretic, because its activity in this respect is not very great; but it is adapted for those cases which are accompanied with arterial excitement. In sore throat it is mixed with white sugar, and gradually swallowed. A mixture of nitre and powdered gum has long been a favourite remedy for diminishing the scalding of gonorrhœa. Nitre is rarely employed as an external agent, except as a means of producing cold. Thus, five ounces of nitrate of potash, with five ounces of muriate of ammonia, dissolved in sixteen ounces of water, reduces the temperature 40° F.; that is, from 50° to 10°, according to Mr. Walker. Hence, therefore, we sometimes employ this mixture, placed in a bladder, as an external application (see p. 66.)

On the belief that fever, cholera, and other malignant diseases, were produced by a deranged state of the blood, and that this derangement depended on, or consisted in, a diminution or entire loss of the saline parts of the blood. Dr. Stevens employed nitre, chloride of sodium, and other alkaline salts, in the treatment of these diseases. (*Op. supra cit.* pp. 296, 298, &c.) Nitre, in large doses, has been employed in the treatment of scurvy, and with considerable success, according to the statement of Mr. Cameron. (*Medico-Chirur. Review*, March, 1830, p. 483.)

Administration.—It may be given in doses of from ten grains to half a drachm, in the form of powder, mixed with sugar, or in solution. If administered as a refrigerant, it should be dissolved in water and immediately swallowed, in order that the coldness of the solution may assist the action of the salt. If employed as a diuretic, we ought to give mild liquids plentifully, and keep the skin cool.

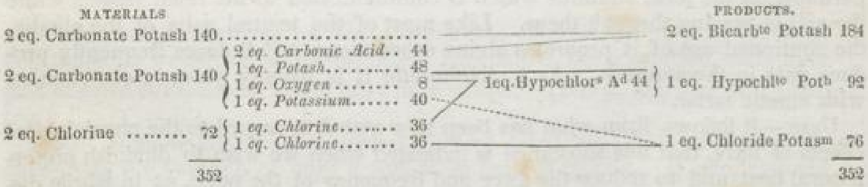
Antidote.—No chemical antidote for this salt is known. In case of poisoning, therefore, we should remove the poison from the stomach as speedily as possible, and administer tepid emollient drinks. Opiates, perhaps, may be advantageously administered. The inflammatory symptoms are to be combated by the usual antiphlogistic measures.

8. POTAS'SÆ CHLO'RAS, *L.*—CHLORATE OF POTASH.

History.—Chlorate of potash (also called *oxymuriate* or *hyperoxymuriate of potash*) was first procured by Mr. Higgins, who seems to have confounded it with muriate of potash. In 1786 it was distinguished by Berthollet.

Preparation.—It is prepared by passing chlorine gas slowly through a cold solution of carbonate of potash placed in a Woulfe's bottle. The liquid is allowed to stand for twenty-four hours in a cool place, and is then found to have deposited crystals of chlorate of potash. These are to be drained, washed with cold water, dissolved in hot water, and re-crystallized.

When chlorine gas comes in contact with a solution of carbonate of potash, three salts are formed: chloride of potassium, hypochlorite of potash, and bicarbonate of potash.



In proportion as the quantity of chlorine increases, the bicarbonate becomes decomposed: carbonic acid is evolved, and a farther quantity of hypochlorite of pot-

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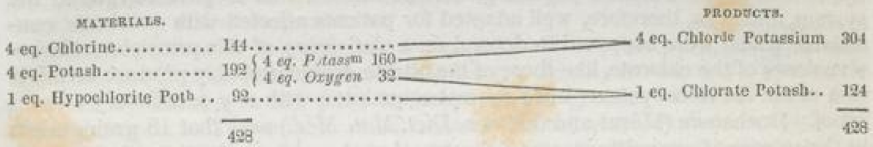
[1] Gibbons, *Medical Cases and Remarks*, Part II. *On Nitre in Hæmorrhagy*, 2d ed. Sudbury, 1811.

ash and chloride of potassium is produced. By the reaction of the carbonic acid on some hypochlorite of potash, a portion of hypochlorous acid is set free, which gives the liquor a yellow tinge. (Delmar, in *Lond. Edinb. and Dubl. Phil. Mag.* for June, 1841, p. 422.)

When the solution is strongly charged with hypochlorite, the action of the chlorine on the potash is somewhat changed: it abstracts the potassium from the potash, and thereby forms chloride of potassium, while the oxygen thus set free combines with some hypochlorite of potash, and thereby converts it into the chlorate, the greater part of which crystallizes.



The residual liquor contains a little chlorate, some free hypochlorous acid, and a considerable quantity of hypochlorite of potash and chloride of potassium.

The preceding process is attended with some practical difficulties, to obviate which Professor Graham (*Proceedings of the Chemical Society*, No. 1.) recommends that carbonate of potash be mixed intimately with an equivalent quantity of dry hydrate of lime, and the mixture exposed to chlorine gas: the products are carbonate of lime, chlorate of potash, and chloride of potassium.

PROPERTIES.—Chlorate of potash crystallizes in nearly rhomboidal plates belonging to the oblique prismatic system. Its taste is cool, and somewhat similar to nitre. When rubbed in the dark it becomes luminous. 100 parts of water at 32° F. dissolve 3·5 parts of chlorate: at 59° F. 6 parts: at 120° F. 19 parts.

Characteristics.—This salt is known to be a chlorate by the following characters:—When heated, it fuses, gives out oxygen, and is converted into chloride of potassium: when thrown on a red-hot coal it deflagrates—a property, however, common to several other salts. Sulphuric acid gives it an orange-red colour, evolves chlorous acid (peroxide of chlorine,) known by its yellow colour, and great explosive power when heated. Rubbed with sulphur or phosphorus it explodes violently. Mixed with hydrochloric acid and then with water, it forms a bleaching liquid. The base of the salt is known to be potash, by the tests for this substance already mentioned (see p. 414.)

COMPOSITION.—It is an anhydrous salt.

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*
Chloric Acid	1	76	61·30	61·5083
Potash	1	48	38·70	38·4917
Chlorate of Potash	1	124	100·00	100·0000

IMPURITY.—Chloride of potassium is the usual impurity. This may be detected by a solution of nitrate of silver producing a white precipitate (*chloride of silver.*) Pure chlorate of potash undergoes no obvious change on the addition of nitrate of silver to its solution.

PHYSIOLOGICAL EFFECTS. *α. On Animals generally.*—In one series of experiments, Dr. O'Shaughnessy (*Lancet* for 1831–2, vol. ii. p. 369.) injected from 10 to 60 grains of chlorate of potash dissolved in three ounces of tepid water, into the cervical vein of a dog: no ill effect was observed; the pulse rose in fulness and frequency, the urine was found in a short time to contain traces of the salt, and the blood of the tracheal veins had a fine scarlet colour. In another series of experiments the animal wns stupefied by hydrocyanic acid or hydrosulphuric acid gas: the brachial vein was opened, and a few drops of excessively dark blood could with difficulty be procured. Half a drachm of the chlorate dissolved in water of the temperature of the blood was injected slowly into the jugular vein: the pulsation of the heart almost immediately began to return, and in the course of eight minutes scarlet blood issued from the divided brachial veins. In twenty minutes the animal was nearly recovered, and passed urine copiously, which was found to contain the chlorate.

β. *On Man.*—The action of this salt on man requires farther investigation. It appears to be refrigerant and diuretic, analogous to nitrate of potash. Wöhler and Stehberger have recognised chlorate of potash in the urine of patients to whom it had been exhibited, so that it does not appear to undergo any chemical change in its passage through the system. This fact is fatal to the hypothesis of the chemico-physiologists, who fancied that it gave oxygen to the system, and was, therefore, well adapted for patients affected with scorbutic conditions, which were supposed to depend on a deficiency of this principle. Excessive doses of the chlorate, like those of the nitrate, would probably produce an affection of the nervous system; but I am not acquainted with any satisfactory case in proof. Duchateau (Mérat and de Lens, *Dict. Mat. Méd.*) says that 18 grains taken at thrice caused convulsions and delirium; but the observation is probably erroneous; for others have not experienced these effects from much larger doses. Dr. Stevens (*On the Blood*, p. 155.) says chlorate of potash gives a beautiful arterial colour to the venous blood, and reddens the gums much faster than mercury.

Uses.—Chlorate of potash was originally employed as a medicine for supplying oxygen to the system, where a deficiency of that principle was supposed to exist. With that view it was successfully administered by Dr. Garnett (Duncan's *Annals of medicine*, 1797.) in a case of chronic scorbutus. Dr. Ferriar also tried it in scurvy with success. (*Med. Hist. and Reflect.* vol. iii. p. 250.) It was subsequently applied in the venereal disease and liver complaints as a substitute for mercurials, whose beneficial effects were thought to depend on the oxygen which they communicated to the system.[1] It has also been tried in cases of general debility on account of its supposed tonic effects, but failed in the hands of Dr. Ferriar. (*Op. cit.*) In a case of dropsy under the care of the latter gentleman, it operated successfully as a diuretic. More recently it has been used by Dr. Stevens (*Op. supra cit.* p. 296.) and others, as a remedy for fever, cholera, and other malignant diseases, which he supposes depend on a deficiency of saline matters in the blood, but as it is usually employed in conjunction with common salt (see *Chloride of Sodium*) and carbonate of soda, it is impossible to determine what share the chlorate had in producing the beneficial effects said to have been obtained by what is called the *saline* treatment of these diseases. Köhler (*Lancet* for 1836–7, vol. i. p. 33.) tried it in phthisis, without experiencing benefit from it.

It appears, then, that most of the uses of this salt have been founded on certain views of chemical pathology, some of which are now considered untenable. It is very desirable, therefore, that some person, unbiassed by theoretical opinions, would carefully investigate its effects and uses, which I am inclined to think have been much overrated.

Administration.—The usual dose of it is from ten or fifteen grains to half a drachm. Dr. Wittman, in one case, gave 160 grains daily, with a little hydrochloric acid immediately after it, to decompose it: the effects were hot skin, headach, quick, full, and hard pulse, white tongue, and augmentation of urine.

9. POTAS'SÆ CAR'BONAS, *L. E. D.* (U. S.)—CARBONATE OF POTASH.

History.—It is probable that the ancient Greeks, Romans, and Egyptians, were acquainted with this salt. Pliny (*Hist. Nat.* lib. xiv. and xxviii.) describes some of the uses of wood-ashes, and mentions a lye of them (*cinis lixivius.*) For a long period carbonate of potash was confounded with carbonate of soda. Geber, (*Invent. of Verity*, ch. iv.) in the eighth century, describes the method of pro-

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[1] See the reports of Mr. Cruikshank and Dr. Wittman, in Dr. Rollo's *Cases of Diabetes Mellitus*, 2d edit. pp. 504 and 563: also, Dr. Chisholm's Letter in the same work, *Preface*, p. x.

curing it by the combustion of tartar. It has been known by various names: such as, *Salt of Tartar*, *Mild Vegetable Alkali*, *Fixed Nitre* and *Subcarbonate of Potash*.

NATURAL HISTORY.—Reuss (Gairdner, *On Mineral Springs*, p. 18.) found carbonate of potash in the waters of the Wuissokow, and in the chalybeate of Twer.

It is formed during the combustion of inland plants, by the decomposition of the vegetable salts of potash (the acetate, the malate, and the oxalate, but principally the first.) Hence it is procured in great abundance from wood-ashes. In some few cases it has been supposed to exist ready formed in plants, as in a fern referred to by Mr. Parkes, (*Chemical Essays*, vol. ii. p. 17.) the expressed juice of which is employed by the poor weavers of Yorkshire, in the cleansing of cloth at the fulling-mills.

PREPARATION. **a. Of Potashes and Pearlashes.**—It is principally obtained from *Wood-ashes* (*Cineres Vegetabilium seu Cineres e Lignis combustis.*) These are procured by burning wood piled in heaps on the ground, sheltered from the wind, or in pits.[1] The soluble constituents of the ashes are, *carbonate, sulphate, phosphate, and silicate of potash, and chlorides of potassium and sodium.* The insoluble constituents are, *carbonate and subphosphate of lime, alumina, silica, the oxides of iron and manganese, and a dark carbonaceous matter.* In America the ashes are lixivated in barrels with lime, and the solution evaporated in large iron pots or kettles, until the mass has become of a black colour, and of the consistence of brown sugar. In this state it is called by the American manufacturers *Black Salts* (*Cineres clavellati crudi.*) The dark colour is said by Dumas to be owing to *ulmate of potash.*

To convert this substance into the *Potashes* of commerce (*Cineres clavellati calcinati*,) it is heated for several hours, until the fusion is complete, and the liquid becomes quiescent. It is then transferred by large iron ladles into iron pots, where it congeals in cakes. These are broken up, packed in tight barrels, and constitute the Potashes of commerce. Its colour varies somewhat, but it is usually reddish, in consequence of the presence of sesquioxide of iron.

To make the substance called *Pearlash* (*Potassa impura*, Ph. L.; *Lixivus Cinis*, Ph. D.) (Potassæ Carbonas impurus, U. S.) the mass called black salts, instead of being fused, is transferred from the kettles to a large oven-shaped furnace, construçted so that the flame is made to play over the alkaline mass, which in the meantime is stirred by means of an iron rod. The ignition is in this way continued until the combustible impurities are burnt out, and the mass, from being black, becomes dirty bluish white: this is pearlash. (*United States Dispensatory.*) The colouring matter is probably manganesiate of potash.

The following table shows the composition of various kinds of potash and pearlash, according to Vauquelin:—(*Ann de Chim.* xl. 273.)

Kinds of Potash.	Caustic Hydrate of Potash.	Sulphate of Potash.	Chloride of Potassium.	Insoluble residue.	Carbonic Acid and Water.
American Potash......	857	154	20	2	1 19
Russian Potash........	772	65	5	56	2 54
American Pearlash.....	754	80	4	6	308
Potash of Trèves......	720	165	44	24	199
Dantzic Potash........	603	152	14	79	304
Potash of Vosges......	444	148	510	34	16

In this table it will be observed, that the American potash contains the largest quantity of caustic potash: this arises, probably, from the use of lime in its manufacture. Moreover, pearlash contains more carbonate of potash than potashes:

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[1] For an account of the proportion and composition of wood-ashes, see Berthier, *Traité des Essais*, t. 1er, p. 259. Paris, 1834.

this must arise from the absorption of carbonic acid during its preparation.[1] The potash and pearlash employed in this country are principally imported from the British North American colonies, from Russia, and from the United States of America.

β. **Of Refined Potashes;** *Potassæ Carbonas*, L. E.; (U. S.) *Potassæ Carbonas e Lixivo Cinere*, D.—The London and Dublin Colleges give directions for the preparation of this substance.

The *London College* orders of impure Carbonate of Potash, lbij.; Distilled Water, Oiss. Dissolve the impure Carbonate of Potash in the water, and strain; then pour it into a proper vessel, and evaporate the water, that the liquor may thicken; afterwards stir it constantly with a spatula until the salt concretes.

The *Dublin College* directs of Pearlash, in course powder, of Cold Water, each, *one part*. Mix, by rubbing them together, and macerate during a week in any open vessel, occasionally shaking the mixture. Then filter the lixivium, and let it evaporate to dryness in a perfectly clean silver or iron vessel. Towards the end of the evaporation let the saline mass be continually stirred with an iron rod. Thus reduced to a coarse powder, let it be laid by in close vessels. If the Potashes be not sufficiently pure, before they are dissolved, let them be roasted in a crucible until they become white.

[The U. S. Pharmacopœia directs Impure Carbonate of Potassa three pounds, water two pints and a half. Dissolve the Impure Carbonate of Potassa in the water and filter the solution, then pour it into a clean iron vessel, and evaporate the water over a gentle fire till the solution thickens; lastly, remove it from the fire and stir it constantly with an iron spatula till the salt granulates.]

By the above proceedings the earthy impurities, insoluble in water, are got rid of.

γ. **Of Pure Carbonate of Potash;** *Potassæ Carbonas purum*, E.; *Potassæ Carbonas e Tartari Crystallis*, D.; (*Potassæ Carbonas purus*, U. S.)—All the British Colleges give directions for the preparation of this substance.

The *London College* states that Carbonate of Potass may be prepared more pure from the crystals of Bicarbonate of Potash, heated to redness.

The *Edinburgh College* observes, that Pure Carbonate of Potash may be most readily obtained by heating crystallized Bicarbonate of Potash to redness in a crucible, but more cheaply by dissolving Bitartrate of Potash in thirty parts of boiling water, separating and washing the crystals which form on cooling; heating those in a loosely-covered crucible to redness so long as fumes are discharged; breaking down the mass and roasting it in an open crucible for two hours, with occasional stirring, lixiviating the product with distilled water, filtering the solution thus obtained, evaporating the solution to dryness, granulating the salt towards the close by brisk agitation, and heating the granular salt nearly to redness. The product of either process must be kept in well-closed vessels.

The process of the *Dublin College* is as follows:—Take of Crystals of Tartar any required quantity; heat them to redness in a silver crucible lightly covered, until they cease to emit vapours. Let the residue be reduced to a coarse powder, and roasted in the same crucible without a cover, with frequent stirring, during two hours: then boil it with twice its weight of water during a quarter of an hour, and after the requisite subsidence pour off the clear liquor. Let this be done three times. Filter the mixed washings, and let them evaporate in a silver vessel. Let the residual salt, whilst becoming dry, be reduced by frequent stirrings to a granular form; then let it be heated to an obscure red. Before it has perfectly cooled take it from the vessel, and preserve it in well-stoppered bottles.

[The U. S. Pharmacopœia directs, Bitartrate of Potassa, two pounds; Nitrate of Potassa, a pound. Rub them separately into powder; then mix and throw them into a brass vessel heated nearly to redness, that they may undergo combustion. From the residue prepare the Pure Carbonate of Potassa in the manner directed for the Carbonate.

The salts undergo decomposition by the deflagration to which they are subjected, the tartaric and nitric acids are completely decomposed, and sufficient carbonic acid is formed by their decomposition to saturate the potassa of both salts, and form the Carbonate of Potassa.]

When bicarbonate of potash is submitted to a low red heat it loses half its carbonic acid, and is converted into the carbonate.

When bitartrate is ignited various volatile substances are evolved, and the residue in the crucible is a mixture of charcoal and carbonate of potash, and is denominated *black flux*. "If made with raw tartar, which contains nitrogen, it is contaminated with bicyanide of potassium" (Turner.) By roasting, the charcoal is burnt off, and nearly pure carbonate of potash is obtained from the residue by lixiviation.

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[1] For the mode of estimating the quantity of alkali present, see Mr. Faraday's *Chemical Manipulation*, art. *Alkalimetry*; also, Brande's *Manual of Chemistry*, 5th edit.

The high price of pearlash has occasionally led to the manufacture of carbonate of potash from *Sal Enixum*, (bisulphate of potash,) by heating it in a reverberatory furnace with charcoal. This yields a sulphuret of potassium, in consequence of the carbon deoxidizing the bisulphate. By roasting, this sulphuret is decomposed, and converted into carbonate of potash; the sulphur being dissipated, and the potassium combining with oxygen and carbonic acid.

PROPERTIES.—Carbonate of potash is usually kept in a granular condition, on account of the difficulty of crystallizing it. In this state it is commonly denominated *Subcarbonate of Potash* (*Potassæ Subcarbonas*) or *Salt of Tartar* (*Sal Tartari; Sal Absinthii; Kali præparatum.*) It is white, inodorous, and strongly alkaline to the taste. It reacts powerfully as an alkali on turmeric. It renders the red sulphate of red cabbage blue, and restores the blue colour of reddened litmus. It is fusible at a red heat; has a strong affinity for water, so that by exposure to the air it attracts water, and becomes liquid, forming the *Oleum Tartari per deliquium*. It is insoluble in alcohol, but is very soluble in water.

Pure carbonate of potash may, though with some difficulty, be crystallized from its aqueous solution. The crystals are rhombic octohedrons, and belong to the right prismatic system.

Characteristics.—It is known to be a carbonate by its effervescing with the strong acids, and by a solution of it causing a white precipitate (soluble in acetic acid) with lime water or with chloride of barium (see the tests for the *carbonates*, p. 332.) That it is a potash salt is determined by the tests for potash already mentioned (see p. 415.) From the bicarbonate of potash it is distinguished by a solution of bichloride of mercury causing a brick-red precipitate. The presence of chloride of sodium checks or prevents the formation of this precipitate. Sulphate of magnesia produces a white precipitate with the carbonate of potash, and not with the bicarbonate. This test, however, will not recognise the carbonate when mixed with a large quantity of bicarbonate.

COMPOSITION.—Mr. Phillips (*Translation of the Pharmacopœia*, p. 284. 4th ed. 1841.) says, 100 parts of the carbonate of potash of the shops loses about 16 parts of water when heated to redness. Hence, supposing the carbonate to have been pure, (which that of commerce never is,) its composition would be as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Potash	1	48	57·6
Carbonic Acid	1	22	26·4
Water	1½	13·5	16·0
Pure Granulated Carb. Potash	1	83·5	100·0

	Atoms.	*Eq. Wt.*
Carbonate Potash	1	70
Water	2	18
Crystallized Carbonate Potash	1	88

IMPURITIES.—The ordinary impurities in this salt are water, silicic acid, the chlorides, and sulphates. The first is detected by the loss of weight which the salt suffers by heat; the second is recognised by supersaturating with hydrochloric acid, evaporating, and igniting the residue: the silicic acid is insoluble in water. The other impurities are detected by supersaturating the salt with nitric acid: if the resulting solution give a white precipitate with nitrate of silver, the presence of a chloride is to be inferred; if it produce a white precipitate with chloride of barium a sulphate is present.

The *London College* states the following to be the characters of good carbonate of potash:—

> Almost entirely dissolved by water; in an open vessel it spontaneously liquefies. It changes the colour of turmeric brown. When supersaturated with nitric acid, neither carbonate of soda nor chloride of barium throws down any thing, and nitrate of silver but little. 100 parts lose 16 of water by a strong heat; and the same quantity loses 26·3 parts of carbonic acid on the addition of dilute sulphuric acid.

The *Edinburgh College* states, that—

> "100 grains [*of commercial carbonate of potash*] lose not more than 20 on exposure to a red heat: and, when dissolved and supersaturated by pure nitric acid, the solution gives a faint

haze with solution of nitrate of baryta, and is entirely precipitated by 100 minims of solution of nitrate of silver [*Ph. Ed.*]"

Pure Carbonate of Potash "does not lose weight at a low red heat: and a solution supersaturated with pure nitric acid is precipitated either faintly, or not at all, by solution of nitrate of baryta or nitrate of silver."

PHYSIOLOGICAL EFFECTS.—Its effects are in *quality* precisely those of caustic potash already described, but their *intensity* is much less, on account of the presence of carbonic acid, which diminishes the alkaline properties of the base. When it is taken into the stomach in large quantities, it acts as a powerfully caustic poison, sometimes inducing death in twelve hours, and producing symptoms similar to those caused by the mineral acids: at othes times, however, the patient recovers from the immediate effect of the alkali, but, in consequence of the altered condition of the alimentary canal, the assimilative process cannot be carried on; and, after dragging on a miserable existence for a few weeks, the unfortunate sufferer dies of absolute starvation. And, lastly, in some cases, the caustic operation of the poison is principally confined to the œsophagus, causing stricture and death. In one case, related by Sir Charles Bell, (*Surgical Observations*, part i. p. 82.) a patient swallowed soap lees: this produced inflammation, which terminated in stricture. She lingered for twenty years, and died literally starved. Several other cases have been detailed. (Christison, *On Poisons.*) In one case no vomiting occurred, but death took place from suffocation. (*Lancet*, 1834-5, vol. ii. p. 660.) A weak solution of carbonate of potash produces no change in the sanguineous particles drawn from the body: a saturated solution slightly and gradually diminishes their size.

USES.—This salt is employed, in medicine, in most of the cases already mentioned when describing the uses of caustic potash. For example, as an antacid in dyspeptic affections; as a diuretic; as an antacid in that form of lithiasis which is accompanied with an increased secretion of lithic acid, or the lithates; in those forms of inflammation in which there is a tendency to the formation of false membranes; in gout, &c. On the recommendation of Mascagni,[1] it has been employed in peripneumonia and other inflammatory diseases with benefit. (See pp. 194, 416, and 418.) Mixed with cochineal it is a popular remedy for hooping-cough. Externally, it has been applied in the form of a solution to wounds; as an injection in gonorrhœa; as a collyrium in some affections of the cornea, &c. Lastly, it is sometimes employed in the manufacture of the common effervescing draught, made with either the citric or tartaric acid.

20 grs. of Carbonate of Potash are saturated by about	17 grs. of commercial crystals of Citric Acid,
	18 grs. of crystals of Tartaric Acid,
	fʒiv. of Lemon Juice.

ADMINISTRATION.—It may be given either in the solid or liquid state. In the solid state it is given in doses of from gr. x. to ʒss.

ANTIDOTES.—When swallowed as a poison, the antidotes are oils or acids, as already mentioned for caustic potash.

LIQUOR POTASSÆ CARBONATIS, L.; (U. S.) *Potassæ Carbonatis Aqua*, D.; *Aqua Kali; Solution of Carbonate of Potash.* (Carbonate of Potash, ℥xx.; Distilled Water, Oj., dissolve and strain, *L.* (U. S.)—Carbonate of Potash form crystals of Tartar, *one part;* Distilled Water, *two parts.* Dissolve and filter. The sp. gr. of this solution is 1·320.) A colourless, inodorous solution. Prepared according to the London Pharmacopœia, its sp. gr. is 1·473.—Dose, ♏x. to fʒj.

10. POTAS'SÆ BICAR'BONAS, *L. E. D.* (U. S.)—BICARBONATE OF POTASH.

HISTORY.—This salt, formerly called *carbonate of potash* or *aërated kali*, was first prepared by Cartheuser, in 1752.

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[1] *Memoria della Società Italiana delle Scienze*, t. xi. Modena, 1804.—Negri, *Lond. Med. Gaz.* vol. xiv. p. 713.

The *London College* orders it to be prepared with Carbonate of Potash, lbvj.; Distilled Water, *Cong.* j. Dissolve the Carbonate of Potash in the Water, afterwards pass Carbonic Acid through the solution to saturation. Apply a gentle heat, so that whatever crystals have been formed may be re-dissolved. Then set aside (the solution,) that the crystals may be again produced: the liquor being poured off, dry them.

Carbonic Acid is very easily obtained from chalk, rubbed to powder, and mixed with water, to the consistence of a sirup, upon which Sulphuric Acid is then poured, diluted with an equal weight of water.

The process of the *Dublin College* is similar, except that when the solution becomes turbid [from the precipitation of silicic acid,] it is to be filtered, and again exposed to the stream of carbonic acid gas. The gas is ordered to be generated by the action of diluted muriatic acid on white marble.

[The *U. S. Pharmacopœia* directs Carbonate of Potassa, four pounds; Distilled Water, ten pints. The process is the same, except to filter the saturated solution before evaporation, and a heat above 160° should not be used.]

In this process each equivalent of carbonate of potash unites with an additional equivalent of carbonic acid, and thereby forms the bicarbonate. The silicic acid is separated partly while the carbonic acid is passing through the solution, and partly during the crystallization of the bicarbonate.

At Apothecaries' Hall, London, the process is conducted in two iron vessels; in one of which carbonic acid is generated (by the action of sulphuric acid on whiting,) in the other is contained the solution of carbonate of potash, through which the carbonic acid is passed. "The following proportions may be used for the preparation of bicarbonate of potassa upon the large scale:—100 lbs. of purified carbonate of potassa are dissolved in 17 gallons of water, which, when saturated with carbonic acid, yield from 35 to 40 lbs. of crystallized bicarbonate; 50 lbs. of carbonate of potassa are then added to the mother-liquor, with a sufficient quantity of water to make up 17 gallons, and the operation repeated (*Hennell.*") (Brande, *Manual of Chemistry*, 5th ed. p. 642. Lond. 1841.) Sulphuric is preferable to muriatic acid for generating carbonic acid, as being both cheaper and less volatile.

The *Edinburgh College* directs it to be prepared from Carbonate of Potash, ℥vj.; and Carbonate [Hydrated Sesquicarbonate] of Ammonia, ℥iijss. Triturate the Carbonate of Ammonia to a very fine powder; mix with it the Carbonate of Potash; triturate them thoroughly together, adding by degrees a very little Water, till a smooth and uniform pulp be formed. Dry this gradually at a temperature not exceeding 140°, triturating occasionally towards the close, and continue the desiccation till a fine powder be obtained, entirely free of ammoniacal odour.

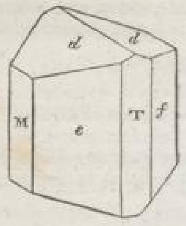
In this process the volatility of the ammonia, and the affinity of the carbonate of potash for more carbonic acid, together cause the decomposition of the sesquicarbonate of ammonia: the ammonia with a small portion of carbonic acid is disengaged, while the remaining acid converts the carbonate into the bicarbonate of potash.

The process adopted by the Edinburgh College is that commonly known as *Cartheuser's process.* MM. Henry and Guibourt (*Pharmacopée Raisonée*, 3^{me} èd. p. 605. Paris, 1841.) give the following directions for its performance:—

Dissolve 500 parts of (pure) carbonate of potash in 1000 parts of distilled water, and filter: place the solution in a porcelain capsule in a salt-water bath, and gradually add 300 parts of pulverized carbonate of ammonia: slightly agitate the liquor until only a feeble disengagement of ammonia is perceived, then filter over a heated vessel, and put aside to cool. The proportions employed by Geiger (*Handbuch der Pharmacie*, 3^{tte} Aufl.) are somewhat different: they are, a pound of carbonate of potash, sixteen ounces of water, and six ounces of carbonate of ammonia.

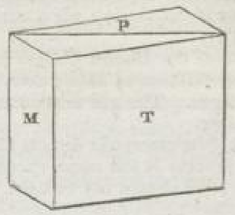
PROPERTIES.—It is a crystalline, colourless solid. The crystals belong to the oblique prismatic system. (Rose.) The primary form is, according to Mr. Brooke, (*Annals of Philosophy*, N. S. vol. vi. p. 42.) a right oblique-angled prism. It is inodorous, has an alkaline taste, and reacts very feebly as an alkali on vegetable colours. It is soluble in four times its weight of water at 60° F., but is insoluble in alcohol. When exposed to the air it undergoes no change. When exposed to a red heat it gives out half its carbonic acid, and becomes the carbonate.

Fig. 67.



Modified Prism of Carbonate of Potash.

Fig. 68.



Prism derived by Cleavage.

Characteristics.—The presence of carbonic acid and potash in this salt is known by the tests for these substances before mentioned. From the carbonate of potash it is best distinguished by a solution of bichloride of mercury, which causes a slight white precipitate or opalescence with it: whereas, with the carbonate it causes a copious brick-red precipitate. This test, however, will not, under all circumstances, detect the carbonate; as when the quantity is very small; or when chloride of sodium is present. Sulphate of magnesia will not prove the absence of all carbonate, as I have before stated (p. 443.)

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

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berard.*
Potash	1	48	47·58	48·92
Carbonic Acid	2	44	43·60	42·01
Water	1	9	8·82	9·07
Crystallized Bicarbonate Potash	1	101	100·00	100·00

IMPURITIES.—The presence of chlorides and sulphates may be recognised in this salt as in carbonate of potash (see p. 443.) Bichloride of mercury may be employed to detect carbonate of potash, with which it forms a brick-red coloured precipitate.

Totally dissolved by water, the solution changes the colour of turmeric. Sulphate of magnesia throws down nothing from this solution, unless it be heated. From 100 parts, 30·7 are expelled by a red heat. After the addition of excess of nitric acid, chloride of barium throws down nothing, and nitrate of silver very little, if any thing, *Ph. Lond.*

"A solution in 40 parts of water does not give a brick-red precipitate with solution of corrosive sublimate; and when supersaturated with nitric acid, is not affected by solution of nitrate of baryta or nitrate of silver," *Ph. Ed.*

PHYSIOLOGICAL EFFECTS.—The effects of this salt are similar to those of the carbonate of potash, except that its local action is much less energetic, in consequence of the additional equivalent of carbonic acid. Hence it is an exceedingly eligible preparation in lithiasis and other cases where we want its constitutional, and not its local, action.

USES.—It may be employed for the same purposes that we use caustic potash (vide *Potash,*) except that of acting as an escharotic. Thus, it is used as an antacid, to modify the quality of urine, in plastic inflammation, in glandular diseases, affections of the urinary organs, &c. But its most frequent use is that for making effervescing draughts, with either citric or tartaric acid. The proportions are as follows:—

20 grs. of Crystallized Bicarbonate of Potash are saturated by about	14 grs. of Commercial Crystals of Citric Acid, 15 grs. of Crystallized Tartaric Acid, ʒiijss. of Lemon Juice.

Where there is great irritability of stomach, I believe the effervescing draught, made with bicarbonate of potash and citric acid, to be more efficacious than that made with carbonate of soda and tartaric acid; the resulting *Citrate of Potash* (*Potassæ Citras*) being, in my opinion, a milder preparation than the tartrate of soda. The citrate promotes slightly the secretions of the alimentary canal, the cutaneous transpiration, and the renal secretion; and, like other vegetable salts of potash, renders the urine alkaline.

Administration.—This salt may be given in doses of from gr. x. to gr. xv., or to the extent of half a drachm, or even a drachm.

1. **LIQUOR POTASSÆ EFFERVESCENS**, L.—*Potassæ Aqua Effervescens*, E.; *Effervescing Solution of Potash.* (Bicarbonate of Potash, ʒj.; Distilled Water, Oj. Dissolve the Bicarbonate of Potash in the Water, and pass into it of Carbonic Acid, compressed by force, more than sufficient for saturation. Keep the solution in a well-stoppered vessel.) This is a solution of bicarbonate of potash, surcharged with carbonic acid. It is an agreeable mode of exhibiting bicarbonate of potash, without injuring its medicinal power. It may be extemporaneously imitated by pouring a bottle of soda water (i. e. *carbonic acid water*) into a tumbler containing grs. xx. of bicarbonate of potash.

2. **LEMON AND KALI.**—Under this name is kept in the shops a mixture of powdered white sugar, dried and powdered citric acid, and powdered bicarbonate of potash. It is employed as an extemporaneous effervescing draught. As it abstracts water from the atmosphere, it must be preserved in a well-stoppered bottle (See *Pulveres Effervescentes*, Ph. Ed.)

POTAS'SÆ ACE'TAS, *L. E. D.* (U. S.)—ACETATE OF POTASH.

History.—It appears to have been first clearly described by Raymond Lully, in the thirteenth century, and has been known by several appellations; such as *Terra Foliata Tartari, Diuretic Salt*, &c.

Natural History.—Geiger (*Handbuch der Pharmacie.*) says this salt is found in some mineral springs. It probably exists in most of those plants which by incineration, yield carbonate of potash. The sap of the elm, and of most trees, Winter's bark, linseed, senna leaves, the rhizome of ginger, &c. are said to contain it.

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

The *London College* orders of Carbonate of Potash, lbj.; Acetic Acid. f℥xxvj.; Distilled Water, f℥xij. Add the carbonate of potash to the acid, first mixed with water, to saturation, then strain. Evaporate the liquor in a sand-bath, the heat being cautiously applied, until the salt is dried.

The *Edinburgh College* orders of Pyroligneous Acid, Oiss.; Carbonate of Potash (dry,) ℥vij., or a sufficiency. Add the carbonate gradually to the acid till complete neutralization is accomplished. Evaporate the solution over the vapour-bath till it is so concentrated, as to form a concrete mass when cold. Allow it to cool and crystallize in a solid cake; which must be broken up, and immediately put into well-closed bottles.

The *Dublin College* gives the following directions for its preparation:—Take of Carbonate of Potash from Crystals of Tartar any required quantity. Pour on it, by repeated additions, Distilled Vinegar of a medium heat, and in quantity about five times the weight of the salt. When the effervescence shall have ceased, and the liquor have given off vapours during some time, let the additions of distilled vinegar be repeated at intervals, until effervescence shall have completely ceased. By continued evaporation the salt will become dry, and by a moderate increase of the heat it is to be cautiously liquefied. When the salt has cooled, let it be dissolved in water: filter the liquor, and boil it down until, when removed from the fire, on cooling, it forms a mass of crystals.

[The U. S. Pharmacopœia directs acetic acid a pint, Carbonate of Potassa a sufficient quantity. Add the Carbonate of Potassa gradually to the acetic acid till it is saturated;

then filter and evaporate cautiously, by means of a sand-bath, until a dry salt remains, keep this in closely stopped bottles.]

In this process the acid unites with the potash of the carbonate, and disengages carbonic acid.

Properties.—It is usually met with as a colourless, white solid, with a foliated texture (which is given to it by fusion and cooling,) odourless, but having a pungent saline taste, and a soapy feel. It is exceedingly deliquescent; and, therefore, ought to be preserved in a well-stoppered bottle. It is very soluble both in water and alcohol; indeed, in water, it is one of the most soluble salts we are acquainted with. At 60°, 100 parts of the salt will dissolve in 102 parts of water. When heated, it fuses, and is decomposed into *acetone* or *pyroacetic spirit* ($C^3 H^3 O$) and *carbonate of potash*. One equivalent of this spirit contains the elements of one equivalent of acetic acid, minus those of one equivalent of carbonic acid.

Characteristics.—See the tests for the *acetates*, p. 350, and for *potash*, p. 415. Its deliquescence is a characteristic.

Composition.—Its composition is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Wenzel.*
Potash	1	48	48·5	50·15
Acetic Acid (dry)	1	51	51·5	49·85
Acetate of Potash	1	99	100·0	100·00

Impurity.—It should be white and perfectly neutral. Frequently, however, it re-acts as an alkali, owing to a slight excess of potash. The presence of chlorides may be detected by nitrate of silver; of sulphates, by chloride of barium; of metals, by hydrosulphuric acid, or ferrocyanide of potassium.

Physiological Effects.—Two or three drachms cause purging, which is sometimes accompanied with griping. In smaller cases, more especially if largely diluted, this salt acts as a mild diaphoretic. In its passage to the kidneys it becomes decomposed, and is converted into the carbonate of potash, which may be detected in the urine. Probably the pulmonary excretions of those who employ it also become impregnated with this salt, since it has been said that in persons with delicate lungs it acts as an irritant to these organs.

Uses.—In this country it is rarely employed, except as a diuretic in dropsical complaints. It is a valuable adjunct to other renal excitants. On the continent, it is administered in various diseases, as an alterative or resolvent. Thus in schirrhus of the pylorus, chlorosis, and visceral and glandular enlargements. It may be employed in the lithic acid diathesis, to render the urine alkaline. It is of course improper when phosphatic deposites are observed in the urine.

Administration.—It is given as a diuretic in doses of from a scruple to a drachm and a half, dissolved in some mild diluent. In larger doses, as two or three drachms, it acts as a purgative.

12. POTAS'SÆ BITAR'TRAS, *L. E. D.* (U. S.)—BITARTRATE OF POTASH.

History.—In its impure form as a deposite from wine, it must have been known at a very early period. "It is called *tartar*," says Paracelsus, "because it produces oil, water, tincture, and salt, which burn the patient as *hell* does." Scheele, in 1769, first explained its nature. Its synonymes are *Cream of Tartar*, *Supertartrate of Potash*, and acidulous *Tartrate of Potash.*

Natural History.—It is a constituent of many vegetables: thus it is found in Grapes, Tamarinds, *Cetraria Islandica*, &c.

Production.—All the bitartrate of commerce is obtained during the vinous fermentation. It exists in solution in grape juice; but being very slightly soluble in a mixture of alcohol and water, it deposites during fermentation (that is, when alcohol is produced,) and forms a crust on the sides of the cask. In this state it is known in commerce under the name of *Crude Tartar* (*Tartarus crudus*,) or

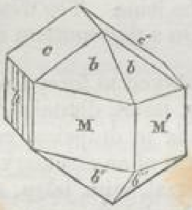
Argol, and which is termed *White* or *Red* (*Tartarus albus* vel *Tartarus ruber*,) according as it is obtained from white or red wine.

Argol, or *Crude Tartar*, occurs in crystalline cakes of a reddish colour, and is composed of the bitartrate of potash, tartrate of lime (and sometimes biracemate of potash,) colouring and extractive matter, &c.

At Montpellier, bitartrate of potash is procured thus:—Argol is boiled in water, and the solution allowed to cool, by which a deposite of crystals is obtained: these are washed with cold water, and dissolved in boiling water, containing charcoal and alumina (clay;) the latter substances being employed to remove the colouring matter with which they precipitate. The clear liquor is allowed to cool slowly, by which crystals of the bitartrate are formed. These constitute the *Tartarus depuratus* or *Crystalli Tartari* of the older chemists. If a hot saturated solution of tartar be cooled, the surface of the liquid becomes coated by a layer of very fine crystals of bitartrate: hence this crust was called *Cream of Tartar* (*Cremor Tartari*.)

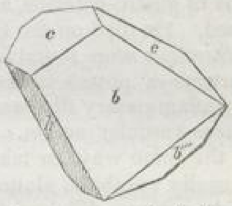
PROPERTIES.—As met with in commerce, this salt forms a white crystalline mass, without odour, but having an acidulous and gritty taste. According to Mr. Brooke (*Ann. of Phil.* N. S. vol. vii. p. 161.) its crystals are right rhombic prisms (figs. 69 and 70.) Liebig, (Turner's *Chemistry*, 7th ed.) however, says they are oblique rhombic prisms. It is unaltered by exposure to the air; but when heated, it decomposes, swells up, evolves various volatile products, gives out an odour of caramel, and is converted into *Black Flux* (*Fluor niger*,)—a compound of charcoal and carbonate of potash (see p. 442.) If the bitartrate be deflagrated with nitrate of potash, the residue is *White Flux* (*Fluor albus*,) or carbonate of potash (see p. 442.) Bitartrate of potash is very slightly soluble in water, and is insoluble in alcohol.

FIG. 69.



An ordinary perfect Crystal of Bitartrate of Potash.

FIG. 70.



Common Crystal of ditto.

Characteristics.—One character of this salt is derived from the phenomena attending its conversion into black flux, as above mentioned. If black flux be digested in water we obtain a solution of carbonate of potash, known by the properties before mentioned (p. 443.) Another character of the bitartrate is its slight solubility in water, and its solution reddening litmus. The addition of caustic potash increases its solubility, whereas alcohol diminishes it. Acetate of lead added to a solution of the bitartrate forms a copious white precipitate; lime water has the same effect. Mixed with alkaline carbonates it produces effervescence. Boracic acid, or borax, very much increases the solubility of this salt in water, forming what has been termed *Soluble Cream of Tartar* (*Cremor Tartari solubilis*,) or *Tartarus Boraxatus* of some writers.

COMPOSITION.—Crystallized bitartrate of potash has the following composition:—

	Atoms.	*Eq Wt.*	*Per Cent.*	*Berzelius.*
Potash	1	48	25·3	24·80
Tartaric Acid	2	132	70·0	70.45
Water	1	9	4·7	4·75
Crystallized Bitartrate of Potash	1	189	100·0	100·00

Impurity.—Bitartrate of potash usually contains from 2 to 5 per cent. of tartrate of lime, and hence a little carbonate of lime may be detected in black flux. This is of no material consequence in a medicinal point of view. If the powdered bitartrate be adulterated with either alum or bisulphate of potash, the fraud may be detected by chloride of barium, which causes a white precipitate (*sulphate of baryta*) insoluble in nitric acid.

It is sparingly dissolved by water. It renders the colour of litmus red. At a red heat it is converted into carbonate of potash. *Ph. Lond.*

"Entirely soluble in 40 parts of boiling water: forty grains in solution are neutralized with 30 grains of crystallized carbonate of soda; and when then precipitated by 70 grains of nitrate of lead, the liquid remains precipitable by more of the test." *Ph. Ed.*

Physiological Effects.—When taken in *small doses*, diluted with water, it acts as a refrigerant and diuretic: in *larger doses* (as two or three drachms) it purges, and frequently creates flatulence and griping. By continued use it disorders the digestive functions, and causes emaciation, most probably from defective nutrition. In *excessive doses* it produces inflammation of the stomach and intestines. A fatal case has been recorded by Mr. Tyson. (*Lond. Med. Gaz.* vol. xxi. p. 177.) A man, to relieve the effects of drunkenness, swallowed four or five table-spoonsful of cream of tartar. It caused violent vomiting and purging, and other symptoms of gastro-enteritis, and pain in the loins. The thighs and legs appeared paralyzed. He died on the third day. On a post-mortem examination the stomach and intestines were found inflamed.

Uses.—Bitartrate of potash is frequently employed to form a refrigerant drink in febrile and inflammatory diseases. It allays thirst, diminishes preternatural heat, and reduces vascular action. As a *diuretic* in dropsical complaints it is used either in the same way, or taken in the form of an electuary. As a *purgative* it is not usually exhibited alone, but, in general, with jalap, sulphur, senna, or some other purgative. Thus, in dropsical complaints, a very valuable hydragogue cathartic is a mixture of jalap and bitartrate of potash. In skin diseases and affections of the rectum (as piles, stricture, and prolapsus,) a very useful purgative is an electuary composed of sulphur, bitartrate of potash, and confection of senna. An effervescing aperient may be prepared by mixing three drachms of the bitartrate with two and a half drachms of carbonate of soda: the resulting salt is the potash-tartrate of soda. As a *tooth-powder*, bitartrate of potash is sometimes used on account of its gritty qualities: a very good dentrifice consists of equal parts of bitartrate, powdered rhatany root, and myrrh (see some observations on dentrifices at p. 211.)

Administration.—As a hydragogue cathartic the dose is from four to eight drachms: as an aperient, one or two drachms: as a diuretic, in repeated doses of a scruple to a drachm (See *Pulvis Jalapæ Compositus.*)

1. **IMPERIAL**; *Tisana Imperialis.*—It is formed by dissolving one drachm or a drachm and a half of cream of tartar in a pint of boiling water, and flavouring with lemon peel and sugar. When cold the solution may be taken, *ad libitum*, as a refrigerant drink in febrile complaints, and as a diuretic.

2. **SERUM LACTIS TARTARIZATUM**; *Cream of Tartar Whey.*—This is prepared by adding about two drachms of the bitartrate to a pint of milk. It may be diluted with water, and taken in febrile and dropsical complaints.

13. POTAS'SÆ TAR'TRAS, *L. E. D.* (U. S.)—TARTRATE OF POTASH.

History.—This salt was known to Lemery. It has been termed *Tartarized Tartar*, *Tartarized Kali*, *Soluble Tartar*, or *Vegetable Salt.*

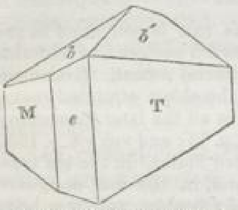
Preparation.—All the British Colleges give directions for the preparation of this salt.

The *London College* orders of Bitartrate of Potash, powdered, ℔iij.; Carbonate of Potash, ℥xvj., or as much as may be sufficient; Boiling Water, Ovj. Dissolve the carbonate of potash in the boiling water, then add the bitartrate of potash, and boil. Strain the liquor, and afterwards boil it down until a pellicle floats, and set it aside that crystals may be formed. The liquor being poured off, dry these, and again evaporate the liquor that crystals may be produced.

The processes of the *Edinburgh* and *Dublin Colleges* are essentially the same. [And also that of the U. S. Pharmacopœia.]

In this process the excess of acid in the bitartrate is saturated by the potash of the carbonate; the carbonic acid escapes.

FIG. 71.



Crystal of Tartrate of Potash.

PROPERTIES.—In is usually met with in the shops in a granular state, but it ought to be crystallized. Its crystals are right rhombic prisms. To the taste this salt is saline, and somewhat bitter. It deliquesces when exposed to the air, and is soluble in its own weight of water at 50°; the solution decomposes by keeping.

Characteristics.—When heated to redness it is decomposed, leaving as a residue charcoal and carbonate of potash. A solution of the tartrate produces white precipitates with solutions of acetates of lead, nitrate of silver, and chloride of calcium; the precipitates being soluble in nitric acid. Bichloride of platinum, assisted by heat, causes a black precipitate in a solution of this salt. When heated, the salt evolves the odour of caramel. If an excess of any strong acid (as the sulphuric) be added to a solution of this salt, we obtain crystals of the bitartrate. Hence acids, and most acidulous salts, are incompatible with it: as also are tamarinds. The tartrate is readily distinguished from the bitartrate by its deliquescent property, its greater solubility, and its want of acidity.

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

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*
Potash	1	48	42·1	41·31
Tartaric Acid	1	66	57·9	58·69
Tartrate of Potash.	1	114	100·0	100·00

The large crystals contain, according to Dr. Thomson, (*First Principles of Chemistry*, vol. ii. p. 264.) two equivalents of water. The same authority states, that he has had crystals of this salt in needles which seemed to contain no water of crystalization.

IMPURITY.—It may contain excess of acid or of base, either of which is easily recognised; the one by litmus, the other by turmeric. The sulphates may be detected by chloride of barium throwing down a white precipitate insoluble in nitric acid.

PHYSIOLOGICAL EFFECTS.—This salt is a gentle purgative, analogous in its action to the sulphate of potash, from which it differs in being milder in its operation, and partially digestible; for, like the other vegetable salts of the alkalis, it is decomposed in the system, and converted into the carbonate, in which state it is found in the urine.

It is said to have the power of preventing the griping of other more active cathartics, as senna and scammony; but, from my own personal observations, I doubt the correctness of this statement.

USES.—It is employed as a mild purgative in dyspepsia, at the commencement of diarrhœa, in some liver complaints, &c. Sometimes it is used as an adjunct to other more active purgatives; as the infusion of senna.

ADMINISTRATION.—it may be given in doses of from two or three drachms to half an ounce, or even an ounce.