

Potash salts are all equally poisonous and fatal in the same space of time, if applied in the same way.

Chloride of potassium, carbonate of potash, and nitrate of potash, in identical doses, are equally powerful to destroy life, and in the same period of time, even when the salt, previous to injection, is mixed with a solution of albumen.

The acid of the salt plays no part in the fatal result.

In poisonous doses great muscular weakness sets in, first appearing in the hinder extremities; while in warm-blooded animals dyspnoea and convulsions take place. They lessen the frequency and force of the heart's beats, and sometimes make them irregular. This holds good with all potash salts.

Large doses at once arrest the action of the heart, which always ceases to act in the diastole.

Traube asserts that the action on the heart is effected through the vagi nerves. This view Guttman considers erroneous, as, after the vagi were both divided, and the medulla removed, the potash salts still affected the heart as before, and even when the vagi was paralyzed by woorali, the potash salts still acted as usual on this organ. Whether their effect on the heart is owing to their action on the heart's substance, or on its ganglia, Guttman cannot say. He states that these salts lowered the temperature of the body; but certainly to a very insignificant extent.

These salts act but slightly on the muscles, and not at all on the peripheral nerves, unless applied directly to them in a strong form. The loss of sensibility and motion is due to their paralyzing action on the spinal cord, an action first evidenced and most expressed on the posterior part of the cord.

SODA SALTS, in twice or three times the quantity which proves fatal in the case of the potash salt, produce no effect on the system, except a passing weakness.

Even in larger doses, soda salts exert no action on the heart, cause no diminution in the temperature, and produce no apparent effect on the cord, brain, nerves, or muscles.

The heart of a frog suspended in a solution of potash

quickly ceases to contract, while a solution of soda of similar strength required a much longer time to produce that effect.

Many soda salts produce an opacity of the lens in frogs but this is not noticed to occur with the sulphate of soda. Guttman shows that the opacity is not due to mere abstraction of water from the lens. This opacity does not take place in mammiferous animals; it is removed by immersing the opaque lens in water.

**SOLUTION OF AMMONIA.
CARBONATE OF AMMONIA.
SPIRITS OF AMMONIA.**

These preparations have many properties in common with the alkaline potash and soda group. They possess a strong alkaline reaction, are freely soluble in water, have a high diffusion-power, and dissolve the animal textures; but they differ from the potash and soda preparations in their volatility, and in being more powerful local irritants of the living animal tissues, exciting in them very active inflammation.

Their action on the skin is in many respects similar to that of the alkaline potash and soda preparations. Liquid ammonia, owing to the water in its composition, manifests but little attraction for that of the tissues; and since its solvent action on the textures is less than that of the soda or potash salts, it physically destroys these much less quickly and extensively. Owing, however, to its high diffusion-power, it readily penetrates the cuticular covering of the body, and excites a degree of active inflammation, sufficient to destroy the tissues, and so produce, first a slough, then an ulcer. The preparations of the members of this group are never purposely employed to produce formidable destructive changes in the tissues, but, in the form of liniment or the

solution of ammonia itself, are used as vesicants and rubefacients.

The strong solution may be employed when it is desired to produce very speedy vesication. A few pieces of lint are to be cut a little larger than the desired blister, and on these ten or twenty drops of the strong solution of ammonia are to be poured, and the pledget is to be applied at once to the skin, and covered with a good-sized watch-glass. Heat, with some smarting and tingling, is soon felt, and in a short time a rim of redness appears around the glass, when the application should be removed, and a poultice applied, which promotes the vesication, and at the same time eases the burning pain. In this way a blister may be produced sometimes in ten minutes; sometimes it takes half an hour; but so great is the difference in the vesicating action of ammonia, that with some a blister is not formed at all. It must be considered a very uncertain vesicant.

As a rubefacient or "counter-irritant" it is a more useful application, but it is in no respect superior to a mustard poultice, the materials for which are always at hand. The liniment of ammonia acts very imperfectly as a counter-irritant, if merely rubbed or dabbed on the skin. It must be applied on lint or linen, kept in contact with the skin, when decided rubefaction takes place in a few minutes.

As a counter-irritant it is used for the same purposes as mustard poultices or blisters, and we must here refer our readers to the sections on these remedies.

Dr. Tilt speaks highly of Raspail's sedative lotion in the headaches occurring at the change of life or from defective uterine functions. It is made by adding two ounces of liquor ammonia^e and of common salt, three drachms of camphorated spirits of wine to thirty-two ounces of water. This lotion is applied to the painful part of the head with a small sponge and is renewed as often as may be required. It excites a sensation of burning and reddens the scalp. If too strong, it should be diluted with water and cold cream should be rubbed on the irritated skin.

The weaker solutions of ammonia are sometimes applied to the bites or stings of insects, as wasps, spiders, etc., to neutralise the formic acid, the active principle of the poison.

Salts of ammonia applied to the nose, and breathed into the air passages, are commonly used in fainting and in poisoning by narcotics. They are used in the same way in the early stages of colds in the head, or they are serviceable as derivatives to remove pain and inflammation of the nose and frontal bones. Ammonia inhalations have been recommended in chronic bronchitis to ease and probably to lessen the overabundant expectoration.

In the stomach ammonia acts much in the manner it affects the skin. It neutralises the acid it encounters, and is hence an antacid; at the same time, if incompletely neutralised, it acts as an excitant, or even irritant, of the mucous membrane.

Soon after the administration of ammonia, a sensation of warmth at the pit of the stomach sets in, which soon spreads to the rest of the body. It may be used as an excitant when the functions of the stomach and upper part of the intestines are depressed. It often obviates spasm of the intestinal canal, and braces up the relaxed mucous membrane. Ammonia compounds of this group are therefore among the best antispasmodics. They are useful remedies for children, especially for infants, who are frequently tormented by colic or flatulent distension of the intestines, generally owing to bad feeding.

In the after-stages of diarrhoea, after the removal of the irritating excitant cause, when the mucous membrane continues to pour out a watery secretion which perpetuates the diarrhoea, these preparations may be profitably employed.

The alkaline preparations of ammonia are employed in flatulent distension of the stomach and intestines, with the view of absorbing the excess of gas, generally consisting of carbonic acid. There is no doubt that these remedies are often temporarily useful as palliatives in these affections, owing to their exciting the muscular coat of the intestine to

contract, and so promote the expulsion of the distending gases.

These remedies in full doses excite an increased formation of mucus, and even vomiting; and as emetics they act without inducing nausea or depression. They are seldom employed alone, but are added to other emetics to obviate the depression these usually induce.

If administered too long, they excite catarrh of the stomach and intestines.

These substances readily enter the blood, and must to some extent increase its alkaline reaction; but owing to their volatility and high diffusion-power they are rapidly eliminated, and therefore exert only a transient action on the blood and the organs of the body.

The effect of ammonia on the blood is at present unknown. It has been maintained without much show of proof that carbonate of ammonia is the poisonous agent in uræmia; that the urea decomposes in the blood, forms this carbonate, which in its turn produces the serious symptoms constituting uræmic poisoning.

Ammonia induces a slight increase in the force of the pulse, some excitement of the brain, and a general sensation of warmth. Being a slight stimulant of the heart, ammonia is used in fainting and exhaustion. Ammonia is frequently administered as an antispasmodic—an action depending probably in part, on its power to strengthen the heart's action, but, like all other antispasmodics, its influence is but brief.

Carbonate of ammonia is often employed as a stimulating expectorant in chronic bronchitis, when the expectoration is profuse, and the patient's strength is diminishing. It is often given with hydrochlorate of ammonia, which probably acts in a similar manner. Carbonate of ammonia is often of signal service in severe bronchitis, or broncho-pneumonia of children, especially when they are prostrate, and livid from obstructed breathing.

Carbonate of ammonia, in three to five grain doses, administered uncombined with any other drug, hourly, or every two

or three hours, according to the severity of the case, has been highly praised in scarlet fever. It was largely used by the late Dr. Peart, who, from the time he employed it, "did not lose one patient out of nearly three hundred." The late Mr. Wilkinson also employed it largely with equal success; and recently Mr. Charles Witt has written a pamphlet extolling its virtues. It is said to be useful in all forms of scarlet fever, especially when given early. The immediate effects of the remedy are stated to be diminution of heat, fever, and delirium, and a disposition to sleep. Mr. Wilkinson says it is equally useful in measles, and that the ammonia treatment leaves no secondary evils. Mr. Charles Witt says, care must be taken that no acid drinks nor acid fruits of any kind are permitted, or the ammonia, becoming neutralized, loses its efficacy. Solution of acetate of ammonia, is a useful diaphoretic and is largely employed in fevers. It is especially useful in the milder forms, as in common catarrh. A full dose of spirits of ammonia or Mindererus' spirit will often speedily sober and steady a drunkard. The supposed effect of ammonia in preventing iodism is noticed in another place.

Owing to their high diffusion-power, these substances escape very readily from the body in different ways, a portion passing with the breath, some probably with the sweat, and much with the urine.

**MAGNESIA, LIGHT MAGNESIA, CARBONATE OF
MAGNESIA, LIGHT CARBONATE OF MAGNESIA,
SOLUTION OF CARBONATE OF MAGNESIA.**

THESE substances having an alkaline reaction, might on this account be placed in the group of potash and soda alkalies. Their effects on the body, however, are in many respects very different. We have elsewhere treated of the properties pertaining alike to all alkaline substances, including, of course, the members of this group. (See Potash group.)

Some of the oxide of magnesia combines with the acids of the gastric juice, and becomes soluble; the remainder is unaffected, and is left insoluble. Part of the carbonate, decomposed by the acids of the stomach, sets free its carbonic acid.

These substances act as antacids, and as antidotes in poisoning by the strong acids and by some metallic salts. In some cases they are preferable, as antacids, to bicarbonate of soda or lime. The advantages of the members of this group are—(1) their large saturating capacity for acid; (2) their purgative property; (3) when given in excess, they are harmless on account of their insolubility.

Their disadvantage consists in their great bulk. The oxide or carbonate of magnesia is generally used as an antacid; but the oxide is preferable, as the carbonate, by giving off much gas, may produce disagreeable distension of the stomach. It must not be forgotten that they are merely temporarizing remedies, and that acids are far better remedies for acidity of the stomach. (See Acids.)

The oxide of magnesia is a convenient antidote to the strong mineral or vegetable acids. These it neutralizes, and protects the delicate structures of the stomach from their corroding action. It precipitates many metals from their acids, and renders them less soluble, and therefore less poisonous. They form an insoluble compound with arsenic, and thus take rank among the antidotes of this poison.

The magnesian salts combine in part with the acids of the gastric juice. The oxide and carbonate cannot pass into the blood on account of their insolubility; nor does the chloride pass in any amount because of its low diffusion-power. Hence almost all the magnesia passes into the intestines.

Here the salts of magnesia undergo changes according to their composition. The chloride probably is decomposed by the bile, and the oxide precipitated, part of which combines with the biliary acids. The oxide is converted first into the carbonate, then into the bicarbonate by the carbonic acid of the intestines, and so made soluble, and capable of acting as

a purgative. The carbonate is changed in a similar manner into the bicarbonate, and likewise becomes a purgative. Thus they act as purgatives only after conversion into bicarbonates, in which form they possess most of the properties of the group which includes sulphate of magnesia, etc. Like the members of this group, the bicarbonate has a very low diffusion-power, and, like them, it is purgative. Its action in this respect being, however, very mild, it is termed a laxative. Their mild action, freedom from taste, and antacid property, fit these substances admirably for children. They are generally combined with a little rhubarb. If unduly employed, these substances occasionally accumulate, and form concretions of ammonio-magnesian phosphates in the intestines.

Bicarbonate of magnesia, fluid magnesia, as it is termed, is a useful and mild aperient.

Magnesia has been lauded in sympathetic vomiting, as that of pregnancy, when it is to be presumed the vomiting depends on excessive secretion of acid from the stomach; but its effects are very transient. Should it fail, recourse may be had to oxalate of cerium (one grain every three hours), ipecacuanha, quinine, acids, etc. (See Ipecacuanha).

The chief of the magnesia passes out with the fæces, and, for the reasons stated, a small portion only enters the blood. In excess of uric acid, members of this group prove useful by saturating much of the acid in the stomach, and carrying this out of the body.

LIME, CAUSTIC LIME, LIME-WATER, LINIMENT OF LIME, SACCHARATED SOLUTION OF LIME, CARBONATE OF LIME.

This group contains highly valuable medicinal substances which might with advantage be more extensively used in disease.

Thus, lime is a necessary constituent of the body's hard and soft tissues, of bone and the parts more vitally endowed, as

the nerves and muscles; wherever there is active growth, whether natural or unnatural, there lime salts are found in excess, probably as phosphate, being in all likelihood the form of lime required by the body for the performance of many of its functions. In practice, however, we find the other salts of lime of equal service in almost precisely the same morbid states in which the phosphate is so valuable, and it seems feasible that a portion of the lime salts becomes united in the body with phosphoric acid.

Their diffusion-power being very low, and having little affinity for animal structures, they produce very little change when applied to the skin. But caustic lime, having a strong attraction for water, will withdraw this from the dermis when deprived of its cuticle, and to some extent effect the destruction of the tissues. Yet, as its diffusion-power is slight, it fails to penetrate the tissues, and consequently its action is but superficial. Caustic lime is not often used as an escharotic. Mixed with caustic potash, it forms a compound less deliquescent, far more manageable, and safer than simple caustic potash, especially in affections of the neck of the uterus.

Applied to the broken skin and to sores, the carbonate and lime-water are slightly astringent; hence lime is sometimes used to check the discharge from sores and skin eruptions.

Lime-water with oil, in equal quantities, or in the proportion of four of lime-water to one of oil, enjoys a high reputation in the treatment of burns.

Lime-water as a lotion to cracked nipples is sometimes useful.*

Lime-water is sometimes employed to check the abundant discharge of certain skin diseases, as eczema, and likewise as a sedative to ease the smarting and tingling. Where the in-

* But it is far better, if possible, to prevent cracked nipples, which is much easier than curing them. The nipple should be carefully washed and dried immediately the child is removed from the breast, and the tissues may be hardened by washing them some short time before delivery, and after each suckling, with a little brandy and water. It is also a useful practice constantly to wear a zinc shield over the nipple.

flammation of eczema has been subdued, but the discharge is great, lime-water and glycerine form a useful and comforting application.

Carbonate of lime is sometimes used as a dusting powder in eczema or intertrigo, with the intention of absorbing the abundant secretion, of preventing discharges from irritating the already inflamed skin, and of protecting the skin from the air. This powder, in common with other dry powders, is, in the author's opinion, inferior to some simple, bland, or slightly stimulating, greasy application. Cases occur, however, which are certainly more benefited by dry powders, as oxide of zinc, bismuth and carbonate of lime, than by ointments.

Carbonate of lime, as we have said, is used for intertrigo of the buttocks and perinæum of young children, to protect the skin from the irritation of the urine and of the air. Napkins soaked in urine being very generally the cause of this eruption, it is obvious that greasy applications afford a more efficient protection, for the powder readily absorbs discharges, becomes itself irritating to the skin, and cakes and cracks, leaving parts of the surface exposed. The best treatment indeed consists in frequent ablutions with soap and water, and greasy applications.

Lime-water, on account of its astringent quality, is used as a wash in discharges from the ears and vulva, and is of most service when some active inflammation is still present. In the chronic stages of ear disease it is far inferior to the glycerine of tannic acid, and other astringents.

Dr. Joseph Bell recommends lime-liniment with cotton-wool to prevent pitting from small-pox. Cotton-wool cut in proper shapes is dipped into the liniment, and applied so as to cover the face and neck carefully, leaving apertures for the eyes, nose, and mouth. No crevice must be allowed, and a large handkerchief must be tied over all, and the dressing allowed to remain on until convalescence.

Lime-water is often useful as an injection in leucorrhœa, and its good effects are probably due to its alkalinity.

Chalk makes a good tooth-powder, and is preferable to

powders with hard and angular particles, which wear away the enamel, and lay bare the dentine of the teeth.

Lime-water is occasionally used to lessen the discharge, and promote the healing, of inflammatory and ulcerative diseases of the mouth.

These substances neutralize the acid in the stomach, and are hence antacids; but other remedies are mostly preferred. Salts of lime are useful in poisoning by oxalic acid.

At present it is not easy to indicate precisely the therapeutic value of lime-water in vomiting, but, in some forms of it, few remedies are more useful. It is generally useful in chronic vomiting. It often arrests the vomiting from chronic ulcer of the stomach. It should be mixed with milk, either in equal parts, or in the proportion of one of lime-water to four of milk; and if the vomiting is incessant, the patient should be fed on this only, small quantities, a tea or table-spoonful, being frequently administered. Young children not uncommonly eject much of their milk in large lumps.* These

* This vomiting occurs in early months of life, sometimes even during suckling. If the child is brought up "by hand" the milk should be sufficiently diluted, and during the first month with at least an equal quantity of water; (indeed some authorities advise two parts of water to one of milk,) as the child grows older the relative quantity of milk may be increased. A child a month old may take a pint to a pint and a half. Dr. Meigs, of Philadelphia, recommends the following excellent food for healthy children, and especially for those suffering from the kind of vomiting under consideration. Soak a scruple of gelatine in a little cold water for a short time, and boil it in half a pint of water till it is dissolved, that is about ten or fifteen minutes. Just before finishing the boiling, add milk with some arrowroot made into paste with cold water, and afterwards some cream. The proportion of milk, cream, and arrowroot, depends on the age of the child. For an infant less than a month old he advises three to four ounces of milk, a teaspoonful of arrowroot, and half an ounce to an ounce of cream, to half a pint of gelatine-water; for older children the milk may be increased to a half or two thirds. The gelatine and arrowroot prevent the lumpy coagulation of the milk, while the small quantity of arrowroot will not disorder the stomach. If even this food is rejected, then dilute the milk with three or even four parts of a very thin decoction of arrowroot, or try merely cream and water, one part of cream to three or four of water. This food consisting of milk, cream, arrowroot, and gelatine-water is very useful in diarrhoea.

lumps of curd may pass into the intestines, and escape with the motion, causing, in their passage, severe colic and much wind. Cows' milk is apt to induce this condition, as gastric juice coagulates it in lumps, while it generally coagulates human milk in fine flakes. Lime-water, by preventing this lumpy coagulation, checks this kind of vomiting generally at once; or, should it continue, the rejected milk is no longer curdled. In case of constipation, bicarbonate of soda should be substituted for lime-water. One-eighth of lime-water is generally sufficient, but if this fails, a larger quantity, even equal parts of each, should be tried. Half a drachm to a drachm of bicarbonate of soda should be added to a pint of milk. These remedies both sometimes fail, and it may be necessary for a time to withhold milk, and to feed the child on sopped bread, water gruel, and chicken broth, or veal broth.

Again, in young children suffering from chronic vomiting and diarrhoea, and consequent wasting, lime-water is often of great benefit, improving digestion, and apparently assimilation, and obviating that highly irritating state of the urine, which so commonly occasions intertrigo.

Solutions of these salts pass but slowly into the blood, on account of their low diffusion-power, hence the greater part pass through the intestines, and are ultimately voided with the fæces.

These substances neutralize any acid present in the intestines, and check the secretion from the mucous membrane; and sometimes by one means, and sometimes by both, act efficaciously in diarrhoea. Carbonate of lime and in a less degree lime-water, deservedly hold a high place among remedies for diarrhoea. They are useful in the later stages, when the irritant is got rid of. Common chalk mixture is useful in the diarrhoea depending on more serious causes, as ulceration in phthisis or typhoid fever; but in these cases other remedies are to be preferred.

It has been said that saccharated solution of lime does not confine the bowels, but, on the contrary, relieves constipation.

It should not be taken on an empty stomach, lest it excite nausea.

Dr. Warburton Begbie extols chloride of calcium in ten to twenty grain doses, in scrofula with glandular enlargements of the neck; in cases resembling tabes mesenterica, and chronic diarrhoea with weak digestion. It should be given in milk after food and must be continued for a considerable time, its good effects in many cases not at once becoming apparent.

Lime-water is reputed to be useful in whooping-cough, and this may well be, owing to its astringency; for in certain forms of this disease, astringents, as alum and tannin, often effect a decided improvement.

Lime-water is a useful injection to destroy the thread worms which infest the rectum. It has been also used as an injection in gleet.

From their low diffusion-power, a small quantity only of these substances passes into the blood; so small, probably, that it might well be doubted if they could in any way influence the organs remote from the intestines. But experience shows that lime-water or carbonate of lime are valuable remedies in deficient nutrition, and in convalescence from serious disease, their good effects being most marked in children, in some stages of rickets, mal-nutrition, etc.

In some instances these good results are traceable to the action of the lime salts on the mucous membrane of the intestines. The action of these salts, however, being very similar, although inferior, to that of phosphate of lime, we refer our readers to the section which treats of this salt. One point may be noticed here, confirmed by both theory and experience, that, since but little of these substances pass into the blood, as much good may be obtained from small as from large doses.

PHOSPHATE OF LIME.

BOTH in health and in disease this salt is of very great importance. It must be ranked among the most valuable and necessary foods, being probably as essential to proper growth and nutrition as the nitrogenous and fatty foods. Observations have abundantly proved its physiological importance. It gives solidity to the skeleton, and if the quantity supplied to the body is small, or if the demand for it is greater than the supply, these solid structures suffer and lose their hardness. Chossat produced softening of the bones of animals fed on food free from lime salts; while, during pregnancy, much phosphate of lime being required for the ossification of the skeleton of the foetus, it is found that the fractured bones of pregnant women unite slowly and imperfectly.*

Some experiments by Milne Edwards bear practically on this point. He found that animals' bones intentionally fractured united more quickly if the animals were supplied with phosphate of lime.

But far greater than merely to give solidity to the skeleton, is the importance of this necessary food to the soft and growing tissues, in promoting cell growth and natural nutrition.

That this is a very feasible conclusion the following considerations tend to show:—

1. The presence of this salt throughout the body.
2. Its presence in much larger proportion in the intercellular fluid of the body than in the blood itself.
3. The fact that in herbivora the intercellular fluid is as rich in this salt as it is in carnivora, though the vegetable-feeders take so little of it with their food; hence it must be carefully retained in the intercellular fluid for some important purpose.

In respect to the two foregoing considerations, it must be

* The urine of pregnant women is said to be deficient in lime salts, but the evidence on this point is very discrepant.