sium, and in part of certain adjuvants, notably quinine. The main point in the treatment consists in the administration of remedies to induce an alkalinization of the system as quickly as possible, for when this is accomplished further joint and heart complications are not likely to occur. Fuller gives not less than an ounce and a half of bicarbonate of potassium, largely diluted with water, in the first twenty-four hours of the treatment. Sometimes this salt is given in effervescence with lemon-juice—in the proportion of two drachms to an ounce of lemon-juice—every three or four hours, or with citric-acid solution. If the bowels are torpid, one or more compound cathartic pills are prescribed in addition. As soon as the urine ceases to exhibit an acid reaction—usually at the expiration of twenty-four hours—the quantity of potassic carbonate is reduced one half. If the urine continues alkaline at the expiration of another period of twenty-four hours, the alkali is further reduced one half, and, on the fourth day, the same conditions continuing, the treatment ceases to be exclusively alkaline. Then the alkali is reduced to the amount necessary merely to keep the urine neutral—about a half-drachm of the bicarbonate three times a day, and quinine is given. In Dr. Fuller's words, three grains of quinine, dissolved in lemon-juice, is given three times a day in effervescence with half a drachm of bicarbonate of potash. In ninety-four cases of acute rheumatism thus treated, the average duration, from the beginning of treatment, was eleven days. This method is adapted to the treatment of the plethoric, obese, and muscular subjects, and in the experience of the author is not well suited to the pale, delicate, and anæmic rheumatic.

In *irritation of the urinary organs* due to an excess of acid, the combinations of potash with the vegetable acids possess a high degree of utility. The liquor potassæ is much prescribed under these circumstances, but, as it is very irritating to the stomach, the salts are preferable, and they are equally effective. The liquor potassii citratis is an excellent form for this purpose. There is no doubt that the long-continued use of alkalies (citrate, acetate, and carbonate of potassa) will effect the solution of *renal calculi*, which are usually composed of uric acid. As the urate of soda is often the nucleus of these formations, the soda alkalies should not be used. Small doses taken daily for lengthened periods are necessary. Such alkaline waters as the Vichy may be used if more agreeable to the patient, but the best results are obtained by the administration of the citrates and tartrates in a large quantity of distilled water. When the urine is acid in any of the forms of cystic irritation—from *stone, cystitis, stricture, enlarged prostate*, etc.—great relief is experienced from the use of alkalies, notably the liquor potassæ, the citrates, acetates, and carbonates of potassium. When the urine is alkaline in reaction, no benefit can be derived from the use of these remedies.

The bitartrate and the acetate of potassium are very certain *diuretics*, especially the first named. They are most effective when given largely diluted with water. A pleasant form in which to administer cream of tartar is the familiar "cream-of-tartar lemonade," made as follows: A sufficient quantity of the remedy is dissolved in hot water; when cold the clear solution is poured off; some lemons are cut up and put in it, and it is sweetened to the taste. This solution may be drunk *ad libitum*. Considerable stomach and intestinal distress often follows the free use of dilute solutions of these potash salts, in consequence of the abundant production of carbonic-acid gas. The potash salts are indicated as diuretics in *desquamative nephritis*, and in *general dropsy from valvular disease of the heart*. By determining a free urinary discharge in the one case, they assist in washing out the obstructing epithelium in the tubules; in the other, they relieve the tension of the venous system. Very little is accomplished by the use of alkaline diuretics in dropsical accumulations in the various cavities.

Sodium.—*Soda.*—Soda; *Natrium*, Ger.; *soude*, Fr. Occurs in irregular flat masses. Is soluble in water and in alcohol.

Liquor Sodæ.—Solution of soda. A colorless liquid, having an extremely acrid taste, and a strong alkaline reaction. Dose, ♏ ij—♏ x.

Sodii Acetas.—Acetate of sodium. In white or colorless crystals, which effloresce in dry air, and are wholly soluble in water. Dose, grs. v—ʒ j.

Sodii Bicarbonas.—Bicarbonate of sodium. A white, opaque powder, wholly soluble in water (1 in 12). Dose, grs. v—ʒ j.

Sodii Boras.—Borate of sodium. Borax. In colorless crystals, which slightly effloresce in dry air, and are wholly soluble in water. Dose, grs. ij—ʒ j.

Sodii Carbonas Exsiccatus.—Dried carbonate of sodium. A white, hygroscopic powder, having the same properties as the carbonate. Dose, grs. ij—grs. x.

Sodii Carbonas.—Carbonate of sodium. "Large, monoclinic crystals, rapidly efflorescing in dry air and falling into a white powder; alkaline taste and reaction." Soluble in 1·6 water at 60° Fahr., and nearly twice as soluble in hot water. Dose, grs. v—ʒ j.

Sodii Nitras.—Nitrate of sodium. Colorless, transparent, rhombohedral crystals, slightly deliquescent in damp air, having a cooling, slightly bitter taste, and a neutral reaction. Soluble in 1·3 water at 60° Fahr., and in 0·6 boiling water. Dose, ʒ j—ℨ j.

Sodii Sulphas.—Sulphate of sodium. Glauber's salts. Dose, ℨ ss—ℨ j.

Pulveres Effervescentes.—Effervescing powders. Each powder contains thirty grains of bicarbonate of sodium in one paper, and twenty-five grains of tartaric acid in the other paper. (Not official.)

Pulvis Effervescens Compositus.—Compound effervescing powder. Seidlitz powder. Each powder contains forty grains of bicarbonate of sodium and one hundred and twenty grains of tartrate of potassium and sodium (Rochelle salt) in one paper, and thirty-five grains of tartaric acid in the other paper.

Antagonists, Incompatibles, and Synergists, are the same as those given under potassium.

Physiological Actions of the Salts of Sodium.—In respect to the merely alkaline properties, there is a close correspondence between potassium and sodium, but as regards other properties there is a wide divergence. The salts of soda are alkaline, and hence neutralize the acid of the gastric juice. They are readily diffusible. Like the potash salts, they increase the alkalinity of the blood, and under suitable conditions determine a change in the urine from acid to alkaline. The same results follow the administration during or between the intervals of digestion, as in the case of the potash salts. The alkalinity of the urine induced by soda salts ceases on the day following their administration, and the acidity is then increased. Soda has but little toxic action besides the local caustic effects. Caustic soda, like caustic potash, dissolves albumen, forms soaps with fats, and destroys the tissues widely and deeply. It is, however, less active than caustic potash. The composition of the blood does not appear to be altered by the salts of soda in any reasonable quantity. Laborde, in some comparative experiments between chlorate of potassa and chlorate of soda, finds that the latter, in treble the quantity of the former, has but a transient effect, depressing the temperature half a degree, and causing a slight salivation, but producing none of the paralytic symptoms which follow the administration of the potash salts. Guttmann had previously demonstrated the same facts, and Schönlein, in some studies with the carbonate, finds that even in large doses in frogs it rarely arrests the heart's movements, only slowing and lengthening the contractions. Chloride of sodium has, unquestionably, an important office in the economy. It forms the principal part of the soluble constituents of the ash of all animal substances. Albumen owes its solubility in part to the chloride of sodium; it dissolves pure casein, and impedes the coagulation of the fibrin of the blood. In one thousand parts of blood there are about four parts of this salt. It is very abundant in various normal secretions and pathological products. The gastric juice is very rich in chloride of sodium, and it probably is the source of the hydrochloric acid of the stomach (Lehmann). In the course of an inflammation, notably of pneumonia, the chloride of sodium of the system accumulates in the inflamed area, and disappears from the urine. Its return to the urine is in the nature of a critical phenomenon, and marks the subsidence of the inflammation. The importance of this salt in the animal economy is doubtless the cause of

the universal taste; all in excess of the needs of the body is excreted, chiefly by the kidneys, and with such facility that no accumulation takes place. While a necessary amount is of high importance and excess is readily disposed of, it is probable that long and habitual indulgence in a considerable excess increases waste and lowers the vital forces.

Therapy of Sodium Salts.—One of the important salts of soda—the phosphate—has been considered under the head of phosphates. The soda salts are to be preferred in the alkaline treatment of stomach-diseases, but the potash salts when it is desired to promote oxidation in the system, or to alkalinize the urine. The urate of soda is insoluble. In case of *excess of acid* or *acid indigestion*, the use of soda after meals is very effective; but, while the immediate result is good, the after-effect is to increase the production of acid. Those who habitually take sodium bicarbonate for acid indigestion suffer severely from acidity. Taken before meals, or on an empty stomach, soda bicarbonate is useful in *atonic dyspepsia*, to increase the acid of the gastric juice. *Acute indigestion*, with vomiting, especially if the vomited matters are very acid, and there is burning at the epigastrium, may be quickly relieved by the effervescing powder. The *acid diarrhœa of children* is relieved by the bicarbonate of sodium. This salt may be utilized as an *emetic* in narcotic stupor when other emetics fail to act. The author has known this method to succeed in opium narcosis. A half to a drachm of bicarbonate in solution in water is swallowed or thrown into the stomach by the pump, and this is followed immediately by a similar quantity of tartaric acid. Brisk effervescence ensues, and the contents of the stomach are evacuated. In *intussusception*, the same expedient has been practiced with success. The solution of bicarbonate of sodium is thrown into the rectum, and is followed by the acid. Strong pressure must be made on the anus; the gas forces the bowel back through the ileo-cæcal valve and thus relieves. A stomach or bowel much softened by inflammation, or weakened by ulceration, is a contraindication of such an expedient.

In the treatment of the febrile state, and to lessen the acidity of the urine, the soda salts have been proposed as substitutes for the potash salts. The researches of Laborde, Guttmann, Podcopaew, and others, have shown that the former do not have the same powers as the latter, and that therefore the substitution can not be made successfully.

Calcium.—*Calx.*—Lime; *Kalk*, Ger.; *chaux*, Fr.

Calcii Carbonas Præcipitatus.—Precipitated carbonate of calcium. A fine, white powder, insoluble in water. Dose, grs. v—℈j.

Creta Præparata.—Prepared chalk. Dose, grs. v—℈j.

Liquor Calcis.—Lime-water.

Liquor Calcis Saccharatus.—Dose, ʒ ss— ʒ ij (unofficial).

Testa Præparata.—Prepared oyster-shell. Dose, grs. v—ʒ j (unofficial).

Mistura Cretæ.—Chalk-mixture. Dose, ʒ j—ℨ ss.

Syrupus Calcis.—Sirup of lime (lime 5 parts to 100 sirup). Dose, a teaspoonful or more.

Calcii Chloridum.—A colorless or whitish salt, sometimes translucent, very deliquescent. It is soluble in two parts of water, and also in alcohol. Dose, grs. v—ʒ j, and is preferably administered in milk. *This should not be confounded with chlorinated lime.* (Other salts of calcium are included under phosphates, hypophosphites, sulphides, and bromides.)

Antagonists and Incompatibles, and Synergists, the same as for potassium.

Physiological Effects of Calcium Salts.—The important position of phosphate of lime in the organism has been already set forth under the appropriate head. It is only necessary to state in this connection that the lime salts are antacid, or alkaline, and as such they neutralize the acid of the gastric juice. They act locally as sedatives to the mucous membrane. Some of them have a local action merely, but the chloride is very diffusible, and the carbonate feebly so. Entering the blood in small quantity, they promote constructive metamorphosis; but the habitual use of large quantities hastens waste, or the retrograde metamorphosis of the tissues.

Administered in the ordinary way, however, the lime salts furnish materials needed by the organism in its growth. The carbonate of lime is taken up in limited quantity by the stomach-juices and re-enforces the same constituent in the blood. The chloride of calcium has a different office in the economy. It acts in a similar manner to the other chlorides, and has close relationship to the iodides. Clinical experience has shown that it possesses the ill-defined property known as *alterative*, removes certain toxic or morbific materials, and secures their excretion by the organs of elimination. The recent studies of the therapeutical actions of chloride of calcium have shown it to possess the remarkable property of an antagonist or antidote to the strumous constitution. No mere physiological investigation could have demonstrated this power; it is an empirical fact which we can not explain as yet by physiological methods. It has been shown, however, that under its use enlarged and cheesy lymphatics gradually resume their normal condition, tubercular deposits undergo a process of calcification, and ulcerating cavities discharge their contents and cicatrize. It can not, of course, be asserted that such surprising changes frequently occur, but, that they do sometimes take place, clinical experience has proved. From this point of view, then, chloride of calcium assumes a high degree of importance.

Therapy of the Calcium Salts.—No remedy is more frequently prescribed for *vomiting* than lime-water. It is given very often with milk, one half, one fourth, as may be, and the combination is effective in arresting vomiting due to acute troubles of the abdominal organs, and also useful in vomiting of cerebral and reflex origin. When the milk-cure is prescribed, lime-water is frequently added to enhance the digestibility of the milk. Carbonate of lime is a useful restorative and antacid in the acid indigestion, and in the diarrhœa of strumous children. By Dr. Warburton Begbie and by Dr. Coghill the chloride of calcium is strongly urged, as the most efficient remedy in the feeble digestion and disordered secretions of strumous children. The latter especially commends the use of the chloride in "children when the sleep becomes restless and troubled, the breath fetid, the tongue foul and coated, the tonsils enlarged, the evacuations irregular and offensive, with deficient secretion of bile." In the *colliquative diarrhœa* of the strumous, it is said to be curative, even when accompanied by enlargement of the mesenteric glands. According to the published observations of Begbie, Coghill, and Bell, we possess no agent so valuable in the *wasting diseases* of children of strumous origin, in *glandular enlargements*, etc. The testimony which has been lately published in respect to the curative power of chloride of calcium in *consumption* is certainly very striking, and especially in those cases succeeding to glandular enlargements heretofore so little amenable to treatment. According to Rodolfe, chloride of calcium cures *chorea* speedily.

Lithium.—Lithium.

Lithii Carbonas.—Carbonate of lithium. A white powder, sparingly soluble in water (1 in 100), and having a feeble alkaline reaction. Dose, grs. ij—grs. x.

Lithii Citras.—Citrate of lithium. A white powder, deliquescent and soluble in twenty-five parts of water.

Lithii Salicylas.—Salicylate of lithium. A white powder, deliquescent on exposure to air, having a sweetish taste and a faintly acid reaction. It is freely soluble in water and in alcohol. Dose, gr. v—ʒ j.

Lithii Benzoas.—Benzoate of lithium. A white powder, or small shining scales, permanent in the air, having a cooling, sweetish taste and a faintly acid reaction. Soluble in four parts of water and twelve parts of alcohol at 60° Fahr. Dose, gr. ij—gr. xv.

Antagonists and Incompatibles, and Synergists, are the same as for the other alkalies.

Physiological Actions of the Lithium Salts.—These remedies have strong alkaline and basic properties, and act on the organism of man in the same manner as the other members of the group. The compound of uric acid and lithium is readily soluble, differing in this

respect from the urate of soda. It is said that the lithium salts alkalinize the urine more decidedly than even the potash salts.

Therapy of the Lithium Salts.—Garrod first introduced these remedies into medical practice for the treatment of *rheumatism*, and in his recent Lumleian lectures has demonstrated anew their exceptional value. Recently the compound of lithium and salicylic acid has been brought forward as a more effective remedy in the rheumatic diseases. The subacute and chronic cases, and the so-called *rheumatic gout*, are the forms of the disease in which the lithium salts are most serviceable. In the so-called *uric-acid diathesis*, in *renal calculi* composed of uric acid, and in *irritable bladder* from an excess of acid in the urine, the salts of lithium are useful. In the case of a renal calculus a very protracted use of a well-diluted solution is necessary.

External Applications of the Alkalies.—A solution of common soda (impure bicarbonate) freely applied will often remove the *fetid sweat of the feet*, and the *odorous emanations which in some subjects escape from the axillary glands*. *Acne* occurring in persons with a greasy skin, and prominent and black sebaceous follicles, may sometimes be cured by alkaline lotions. ℞ Liq. potassæ, ʒ j ; aquæ rosæ, ℥ iv. M. Sig. : Apply with a soft sponge twice a day. For *acute eczema* where there is much serous discharge, no applications are more efficient than solutions of the alkalies. ℞ Sodii carbonat., ʒ ss ; aquæ, Oj. M. Sig. : The eruption to be covered with lint soaked in this solution. Stronger solutions can be used in old cases where the skin is much thickened. As alkalies, by absorbing the moisture and combining with the fat of the sebaceous matter, make the skin dry and harsh, it is useful to apply some form of oil after these alkaline applications, certainly after the stronger solutions. Mutton-suet is one of the best fats for this purpose.

In *prurigo* great relief is often obtained by an alkaline warm bath at bedtime. A solution of carbonate of potassium (ʒ iij— ℥ iv) is recommended by Trousseau as a remedy for that obstinate affection—*pruritus vulvæ*. In *freckles*, *sunburn*, and *tan*, the following lotion is useful : ℞ Potassii carbonat., ʒ iij ; sodii chloridi, ʒ ij ; aquæ rosæ, ℥ viij ; aquæ aurantii flor., ℥ ij. M. Sig. : Lotion.

To cleanse the scalp from dandruff (*pityriasis*), there is no more suitable application than a saturated solution of borate of soda. Powdered borax, mixed with sugar, is a domestic remedy for *aphthæ* of children ; it is simply placed on the tongue. A saturated solution of borax in rose-water is a useful application to remove freckles, and to allay *pruritus vaginæ*.

A solution of permanganate of potassa (gr. j— ℥ j) is an elegant toilet remedy for correcting *fetor of the breath*. In *ulcerous diseases of the buccal cavity* it is used to destroy foul odors, and to improve the condition of the sloughing surface. In *ill-conditioned wounds* generally solutions of this salt, in various strengths, are employed with a view to change the action, but little more is accomplished than temporary destruction of odors. There are many other agents, much less expensive and more powerful, which can be used for these purposes.

The so-called *ingrowing toe-nail* may be cured by the application to the irritable granulation, at the margin of the nail, of a solution of liquor potassæ (ʒ ij— ℥ j). This solution is to be applied on cotton-wool, to the margin of the nail and to the ulcerated surface of the toe, until the nail is so far softened that it can be cut away without pain.

Unhealthy and *sloughing ulcers* may be destroyed by potassa fusa, and a healthy granulating surface be left. No more efficient escharotic can be used in *hospital gangrene*. As it penetrates deeply and widely, great care must be used to limit its application to the affected parts, and, as soon as the destruction is sufficient, to check the further extension of the caustic by washing with a dilute acid. Vienna paste—which is a mixture of equal parts of potassa and lime made into a paste with alcohol—is milder in operation, and therefore usually preferred. Caustic potash was formerly much employed to make *issues*, to open *abscesses* and *carbuncles*, but these applications are now quite obsolete. Induration of the *cervix uteri* and *chronic metritis* (hyperplasia of the connective tissue) are, it is said (Dr. Bennet), very effectively treated by application of caustic potassa and potassa cum calce; but such powerful means must be used with great caution, if at all. In *carcinoma*, when the disease is limited to the neck of the uterus and not too far advanced, caustic potassa may be used with advantage to destroy the diseased surface. This caustic is quite as efficient as any, probably, for the escharotic treatment of *cancer* when this method of treatment is employed.

A solution of the bichromate of potassium (gr. j—grs. x — ℥ iv) is an excellent local application in the treatment of the *catarrhal state of the nasal, buccal, or vaginal mucous membrane*. A saturated solution of this salt may be used as a caustic in place of chromic acid.

Carbonate of soda in saturated solution has been used lately with signal success in the treatment of *burns:* it allays the pain, checks suppuration, and favors healing (McClellan, Pring, etc.). Cloths dipped in a saturated solution, and covered with oiled silk, are kept on the part, the solution being renewed as rapidly as may be necessary. Dr. Duckworth reports that *toothache* may be quickly allayed by holding a solution of carbonate of soda in the mouth. Recently chlorate of potash has been used with success in the treatment of *epithelioma*. This practice was first suggested by Vidal in the treatment of *chancroid*, and has since been successfully employed in the treatment of *obstinate ulcers*, epithelioma and *cancer* (Fereol, Leveque). In

the simpler cases a saturated solution may be applied, but in epithelioma and cancer the powdered chlorate is thickly placed over the sore. It is said to allay pain, remove fetor, and promote cicatrization when so applied. The internal use of the salt is recommended in conjunction with the topical application in cancer, epithelioma, and lupus.

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ALKALINE MINERAL SPRINGS.

1. North America.

Bladon Springs, Choctaw County, Alabama. A rolling, pine-woods region.

They contain carbonate of soda, carbonate of magnesia, carbonate of iron, carbonate of lime, sulphate of lime, carbonic-acid gas, sulphureted hydrogen (traces), and chlorine.

Congress Springs, Santa Clara County, California. In the Coast Range of mountains.

They contain carbonate of soda (15·418 grains to the pint?), carbonate of iron, carbonate of lime, chloride of sodium (14·894 grains to the pint), sulphate of soda, etc. They are highly charged with carbonic-acid gas.

California Seltzer Springs, Mendocino County, California.

They contain carbonate of soda, carbonate of magnesia, carbonate of lime, carbonate of iron (a trace), and chloride of sodium. They are also highly charged with carbonic-acid gas.

Perry Springs, Pike County, Illinois.

They contain carbonate of potassa, carbonate of magnesia, carbonate of iron, carbonate of lime, sulphate of soda, silicates of soda and potassa. Temperature of the water is from 48° to 50° Fahr.

St. Louis Spring, Gratiot County, Michigan.

This water contains carbonate of soda (7·684 grains to the pint), carbonate of magnesia, carbonate of iron, carbonate of lime (5·019 grains to a pint), sulphate of lime (6·925 grains to a pint), silicate of lime, and silica. This is one of the so-called "magnetic springs"—the magnetic property being due not to the water, but produced by the magnetization with terrestrial currents of the vertical iron tube through which the water flows. It is unfortunate that this part of the peninsula of Michigan, in which the numerous alkaline and saline springs abound, is very decidedly malarious.

Buffalo Lithia Spring, of Virginia. Contains well-defined traces of lithia, and is alkaline. This has been used with great advantage in gouty, rheumatic, and renal affections.

The Hot Springs, Bath County, Virginia, contain carbonates of lime and magnesia, sulphates of lime, magnesia, and soda, and chlorides of sodium, calcium, and magnesium. The temperature of the water ranges from 100° to 106° Fahr.

The Warm Springs, Bath County, Virginia, have a composition similar to the hot springs, but the temperature of the water is somewhat less. At these springs, extensive bathing-pools have been constructed. The best results have been obtained from the bathing, conjoined with the internal use of the water.

Berkeley Springs are also situated in Bath County. The waters