A saturated solution of the muriate or of the bromide may be thus employed. There can be no doubt that a solution of quinine applied to the nares may be very beneficial at the onset of *hay-asthma*, as first shown by Helmholtz. The author has seen several cases benefited greatly; but to achieve success the applications must be thorough and timely. The secret of any good effects it has, is afforded by its toxic action on germs, and possibly on the pollen of certain grasses, to the presence of which the irritation of the air-passages is ascribed. As soon as the first symptoms are experienced, the mucous membrane should be cleared of mucus by means of a nasal syringe, throwing a solution of common salt, muriate of ammonia, or chlorate of potassa, and then the quinine solution should be applied by a camel's-hair brush to the anterior nares, or by the post-nasal syringe to the whole canal.

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AGENTS PROMOTING DESTRUCTIVE METAMORPHOSIS OR INCREASING WASTE.

ALKALIES.

Potassium.—Preparations: *Potassa.*—Potassa; *potasse*, Fr.; *Kali hydricum*, Ger. Caustic potash. Occurs in cylindrical rods, is very deliquescent, and dissolves in water and in alcohol.

Potassii Acetas.—Acetate of potassium. A white deliquescent salt, wholly soluble in water (100 in 35) and in alcohol (proof spirit 1 in 2). Dose, grs. v—℈j.

Potassii Bicarbonas.—Bicarbonate of potassium. In white crystals, permanent in the air, wholly soluble in water (1 in 3), and having a slightly alkaline taste. Dose, grs. v—℈j.

Potassii Carbonas.—Carbonate of potassium. A deliquescent salt, wholly soluble in water (100 in 75). Dose, grs. ij—grs. x.

Liquor Potassii Citratis.—Solution of citrate of potassium. Dose, ʒ j—℥ j.

Potassii Citras.—Citrate of potassium. A whitish, granular, deliquescent salt, wholly soluble in water (10 in 6). Dose, grs. v—ʒ ss.

Potassii Tartras.—Tartrate of potassium. In white crystals, which are somewhat deliquescent, and are wholly and readily soluble in four parts of boiling water. Dose, grs. v—ʒ j.

Potassii et Sodii Tartras.—Tartrate of potassium and sodium—Rochelle salt. In colorless, transparent crystals, which effloresce slightly in dry air, and are wholly and readily soluble in five times their weight of boiling water. Soluble in cold water, 1 in 2.

Liquor Potassæ.—Solution of potassa. A colorless liquid, having an extremely acrid taste, and a strong alkaline reaction. Dose, ♏ ij—♏ xx. It should be taken well diluted with water.

Potassii Chloras.—Chlorate of potassium. In colorless, tabular crystals, which have a pearly luster, and are wholly soluble in distilled water (in cold water, 1 in 16·5 ; in boiling water, 1 in 2). Dose, grs. v—ʒ j.

Trochisci Potassii Chloratis.—Chlorate of potash troches.

Potassii Nitras.—Nitrate of potassium. In colorless, prismatic crystals, unalterable in the air, and wholly soluble in water (in cold water, 1 in 4 ; in boiling water, 1 in 2½). Dose, grs. ij—grs. x.

Potassii Bichromas.—Bichromate of potassium. In orange-red, anhydrous, tabular crystals, soluble in ten parts of cold, and in much less of boiling water, forming a solution having an acid reaction. Dose, gr. ⅛—gr. ss.

Potassii Bitartras.—Bitartrate of potassium ; cream of tartar. Is sparingly dissolved in cold water (1 in 210), more freely in boiling water (1 in 18). Dose, ʒ j—℥ ss.

Antagonists and Incompatibles.—The alkalies and their carbonates are incompatible with the acids and with metallic salts. The caustic alkalies decompose the alkaloids of belladonna, stramonium, hyoscyamus, duboisia, etc. In case of poisoning, the antidotes to be employed are—acetic, citric, or tartaric acids, in the form of vinegar, cider, lemon-juice, etc. Demulcents and the fixed oils limit the corrosive action of the caustic alkalies, and should therefore be given freely.

Synergists.—The alkalies assist each other's action. All agents promoting waste—for example, mercury, the iodides, etc.—increase the therapeutical activity of the alkalies.

Physiological Actions of the Potash Salts.—The most recent experiments having shown that potash has quite distinct properties from the other alkalies of the group, each member of the group is considered separately. As an alkali, potash combines with acids to form salts, and with fats to form soaps. As it has a great affinity for moisture, and dissolves albumen, and is a very diffusible substance, it exerts a destructive action on the animal tissues. These chemical facts explain the active caustic properties of potassa fusa. In the stomach the salts of potash obey chemical laws, neutralize the free acid, and saponify oily or fatty matters. Given when the stomach is empty, potash, as do the alkalies in general, promotes the acidity of the gastric juice, by increasing the diffusion of those constituents of the blood from which the acid of the stomach is elaborated ; but, as a large amount of alkali will neutralize a corresponding proportion of acid, it is obvious that, to obtain an increased quantity of acid gastric juice, the amount of alkali administered must be small and rightly timed.

When a toxic dose of potassa, of the carbonate, nitrate, or chlorate, is taken, violent local inflammation results. The action and the appearances are somewhat different as regards potassa and its salts. The former liquefies the tissues, and extends its escharotic action widely and deeply, the sloughs being surrounded by a zone of inflammation. The salts, according to their activity and the quantity taken, set up a high degree of inflammation, cause intense burning pain about the epigastrium, nausea, vomiting, sometimes of bloody mucus, purging, the stools being watery and profuse, or they may be dysenteric. In the case of caustic potash, marks of corrosive action, sloughs of the mucous membrane, bloody oozing, may be seen about the lips, mouth, and fauces, and shreds of bloody and sloughing tissues vomited. In case of toxic action of potassa and its salts, the local destruction, pain, and inflammation are accompanied by the usual systemic symptoms—great depression of the powers of life, a weak, rapid pulse, shrunken countenance, cold surface, followed by coma and insensibility. In a small proportion of cases the local mischief is not great, but the effects of the poison are expended on the nervous system, and assume the form of muscular weakness, paralysis of the inferior extremities, weak action of the heart, and coma, and a very large dose may cause death suddenly by paralysis of the heart before the local inflammation has time to develop. The nitrate and chlorate are the most active of the salts, but all potash bases have more or less power in the same direction. The well-known case of Dr. Fountain, of Iowa, illustrates some points in the action of chlorate of potassa. Entertaining some theoretical notion of the curative power of this remedy when administered in considerable doses, he took an ounce to demonstrate its innocuousness. Violent gastro-enteritis was produced ; at first there was free diuresis, but urinary suppression followed, and death ensued in seven days after the ingestion of the poison. When recovery takes place after poisoning by caustic potash, deformity of the mouth, stenoses of the œsophagus, cardia and pylorus, may remain, and then, after a partial improvement, the mechanical interference with the functions of these organs causes a more or less rapid marasmus.

When the alkaline bicarbonates are taken on an empty stomach they diffuse quickly into the blood, where, meeting the neutral phosphate of sodium, they are decomposed, acid phosphate of sodium being formed, and this compound, diffusing out of the blood into the urine, increases the acidity of that excretion (Rolfe). The result is different when bicarbonate of potassium is taken during digestion, for then, the reaction of the gastric juice being strongly acid, this salt is decomposed, carbonic acid is given off, and the alkaline base lessens the acidity of the stomach, increases the alkalinity of the blood, and diminishes the acidity of the urine. The salts of potash formed with vegetable acids undergo conversion into alkaline carbonates in their passage through the organism, and are eliminated in this form, thus causing an alkaline condition of the urine. The period of administration unquestionably influences the result to a large degree, as has just been stated. The increased alkalinity of the blood, produced by the administration of the potash salts, promotes its oxidizing function (Buchheim, Basham, Köhler, and others). The relative quantity of uric acid is diminished, and of urea increased. Basham, instructed by the observations of Schunck, that oxalurate of ammonia is a product of the oxidation of uric acid, and that the former is readily converted into urea and oxalic acid, holds that the same process takes place in the organism when uric acid is subjected to the action of the potash salts. The urine of patients suffering from uric-acid deposits was carefully examined after a course of the citrate or carbonate of potassium, and it was found, after an interval of about three days, that the urea was in one case trebled in amount, and in others more than doubled, while the uric acid was reduced to a fractional part of what had existed (Basham). The facts, then, are conclusive in regard to the increase in the oxidation processes, caused by the administration of potash, and its salts formed by combination with carbonic and the vegetable acids. The changes in the fatty constituents of the blood consist, probably, in a process of saponification and excretion. Nitrate and chlorate of potassium produce very different effects on the blood. Not parting with their oxygen in the system, and excreted undecomposed, the effects noted in the blood must be due to their action as a whole. The changes made by the chlorate in the composition of the blood have been studied recently by Marchand, in cases of poisoning in man and by experiments on animals. The blood assumes a dark, brownish, or chocolate color, and can no longer take up oxygen; the hæmoglobin is decomposed, and the injured blood-corpuscles accumulate in the spleen; the kidneys are brownish in color, and the tubules are choked with the broken-down materials of the red globules. The peculiar brownish color of the blood is found, by spectroscopic analysis, to be due to a substance identical with Hoppe-Seyler's methæmoglobin. These effects separate the chlorate, nitrate, and other compounds of

potassa very distinctly from the compounds with vegetable acids, while the latter also differ distinctly from the former in the power to alkalinize the blood and urine.

A very considerable reduction of temperature is produced by large doses of the potash salts (Podcopaew, Guttmann, Traube). This effect, due especially to chlorate and nitrate of potassium, may be readily explained by the changes in the hæmoglobin, which impair its function as a carrier of oxygen. Ordinary doses do not affect temperature decidedly, probably because they do not have the power to change the properties of hæmoglobin. The alterations produced in the composition of the blood by the salts of potash necessarily affect the nutritive functions. The increased elimination of urea, the waste of the fatty constituents of the blood and of the tissues, the more rapid process of oxidation, results of the action of the potash salts, necessarily place these remedies among the list of those promoting destructive metamorphosis.

Drs. Ringer and Murrell find chloride of potassium to be a protoplasmic poison, and to this effect they refer its action on the brain and nervous system and on the heart. That potash is a poison to the heart has long been known. The experiments of Podcopaew, repeated subsequently by Guttmann, confirm this. Whether introduced directly into the circulation, by injection into the jugular vein or subcutaneously, the paralysis of the heart follows—more speedily, when the poison reaches the heart more directly. The arrest of the heart takes place in the diastole, and occurs after division of the pneumogastric, whence it must be concluded that the effect on the heart is not exerted through increase of the inhibition. As, when a large dose is suddenly precipitated on the heart, its movements are speedily arrested, and the muscle of the heart does not then respond to electrical excitation, the effects of the poison must be expended chiefly on the muscular tissue (Traube), but not wholly so, since, before the electro-contractility is entirely abolished, all motion may be arrested. The cardiac ganglia must therefore participate in the changes wrought by the poison. The effect of potash on the tension of the vessels—on the blood-pressure—is much influenced by the quantity and mode of administration. A large quantity by intra-venous injection quickly poisons the heart and lowers the pressure in the arterial system. On the other hand, small doses increase the tension (Hummel, Traube). As elimination takes place very rapidly, it is not surprising to find that the normal pressure is quickly restored. This difference in the result, due to the size of the dose, is largely responsible for the conflicting statements which have been put forward.

It has been ascertained by Ringer and Murrell, and by Guttmann, that the contractility of the muscles and the irritability of the motor nerves persist after complete paralysis induced by the potash salts.

The paralyzing action must, therefore, be exerted on the spinal cord. In fact, as Ringer and Murrell have shown, potash, being a protoplasmic poison, affects most injuriously the most highly specialized structures; hence the brain and spinal cord suffer earlier and more severely than do other tissues. Valentin has made some very interesting comparative observations on the effects of the chlorides of the alkalies, when frogs are immersed in solutions of these salts. In a ten-per-cent solution of chloride of ammonium, the frogs died in two or three minutes; in the chloride of potassium and lithium solution of the same strength, death occurred in ten minutes; in chloride of sodium solution, in ten to twenty-five minutes; and in chlorides of calcium and barium solutions, also of the same strength, death ensued in the course of thirty minutes. Besides the cutaneous irritation, the effects were similar to those already mentioned, except the changes in nerve and muscle reactions, the result, doubtless, of imbibition. The early suspension of the reflexes, the fibrillary trembling of the muscles, and the loss of electro-contractility almost at once, indicate the local action of the poison.

The elimination of the potash salts takes place by various channels, chiefly by the kidneys, but they also appear in the saliva, sweat, milk, and other secretions. The effect of these salts on the reaction of the urine and the differences in result due to the period of administration have been pointed out. The state of acidity of the stomach greatly affects the reactions of the urine produced by the carbonates of potassa (Ralfe). The salts of vegetable acids undergo decomposition in their passage through the system; they render the urine alkaline, and greatly increase the excretion of free carbonic acid (Parkes). The after-condition of the urine is that of increased acidity (Ralfe). The nitrate and chlorate of potassa are eliminated unchanged, and do not affect the reaction of the urine (Laborde). The notion entertained in some quarters that chlorate of potassa parts with its oxygen, is entirely erroneous. These salts increase the amount of urinary water, and, in common with the other members of the family, promote oxidation and the excretion of urea. While the acetate increases the discharge of urinary water, it actually lessens the quantity of solids excreted (Parkes). The production of saliva is much increased by the chlorate, which is freely eliminated by the salivary glands (Laborde). It is a very important fact, which we owe to Dr. Jacobi, of New York, that chlorate of potassa irritates the kidneys, and if continued a sufficient time sets up a chronic nephritis. Others have made similar observations, so that the popular use of this supposed harmless agent should be discouraged by the medical profession.

Therapy of the Potash Salts.—Chlorate of potash is in almost universal use as a remedy for *catarrhal inflammation of the mouth and fauces*, for *acute tonsillitis, aphthous ulcerations of the mouth*,

stomatitis materna, or nursing sore mouth, and *mercurial stomatitis*. As above stated, the domestic use of this remedy for sore mouth and sore throat has become an evil which should be discouraged. For ordinary purposes this remedy should not be employed. The utility of the chlorate is, however, so decided in the case of *stomatitis materna*, that all other considerations are merely secondary. In this malady large doses (fifteen grains to ʒj three or four times a day) are necessary, and a less amount will fail to effect a cure. In mercurial stomatitis, ulcerative tonsillitis, diphtheritic angina, etc., the following formula may be applied locally: ℞ Potassii chlorat., ʒj; acid. carbolic., ʒ ss; glycerini, ℥j; aquæ, ℥iij. M. Sig.: Lotion.

The potash salts are used with great advantage in many stomach-disorders. It is an undoubted chemical fact that an *excess of acid* is relieved by an alkali, but the result is not permanent, and the cause of the acidity is not removed. Small doses of an alkali, given with a bitter before meals, promote the flow of gastric juice, and are a serviceable combination in *atonic dyspepsia*. ℞ Inf. calumbæ, ℥ iv; liq. potassæ, ʒ ss. M. Sig.: A dessert to a tablespoonful three times a day before meals. Administered after meals, the alkalies will relieve the acidity due to an excessive production of acid, or to the acid fermentation of the starch, sugar, and fat, in the food. An acid given before meals is the proper remedy for the excessive formation of the acid of the gastric juice. Alkalies render an important service in case of *indigestion of fats*. Not only do they prevent the formation of butyric acid, but they assist in the process of emulsionizing the fats and help their absorption. In diseases of the liver, and when from any cause the flow of bile into the intestine is prevented, alkalies assist in the digestion and absorption of fats. The *indigestion* of *obese* subjects, and of the *gouty* and *rheumatic*, is usually cured or alleviated by alkalies. The lithia salts are generally to be preferred in gouty and rheumatic subjects; but, generally speaking, the bicarbonate of potassium is the most useful of the alkali remedies in the above-mentioned maladies.

The salts of the alkalies, especially the citrates, tartrates, and carbonates of potassium, are useful in *inflammatory diseases* to lessen heat, and to promote excretion of the products of inflammation. When oxidation is deficient, as represented in an *excess of uric acid in the urine*, a coated tongue, hebetude of mind—the so-called "bilious state"—relief is afforded by the use of the alkalies and their laxative salts. The alkaline treatment of *acute rheumatism* is based on these principles. Although this plan of treatment may not be adapted to all cases, there can be no doubt of its utility in respect to a considerable proportion. It must be borne in mind, as Dr. Fuller, the most influential advocate of the method, informs us, that the alkaline treatment consists in a plan, made up in part of the use of bicarbonate of potas-