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Salix.—Salix. The bark of *Salix alba* Linné, and of other species of *Salix* (Nat. Ord. *Salicaceæ*).

Salicinum.—Salicin. A neutral principle obtained from the bark of *Salix helix* Linné, and of other species of *Salix*. Colorless, white, silky, shining crystals, permanent in the air, odorless, having a very bitter taste and a neutral reaction. Soluble in 28 parts of water, and in 30 parts of alcohol at 59° Fahr.; insoluble in ether or chloroform. (U. S. P.) Dose, ℈j—ʒ ij. So little soluble, it were better administered in a wafer, powder, or emulsion.

ACTIONS AND USES.—Salicin promotes appetite and the digestion—properties which it possesses in common with other bitters. It is an antiferment, and has antiseptic powers similar to quinine and salicylic acid. The latter is a derivative of salicin. It is destructive to bacteria and vibrio, and prevents the reaction of amygdalin and emulsin, and of ptyalin on starch. It does not produce very sensible effects even in large doses, and is without toxic activity. It has been used as a substitute for quinine in the cases of disease to the treatment of which the latter is applied, especially in the treatment of *intermittents*. It is, however, much inferior to quinine.

Salicin is an excellent stomachic tonic in *atonic dyspepsia*, and is a serviceable remedy to prevent the fermentations which take place in the foods in cases of *gastro-intestinal catarrh*. In the *chronic diarrhœa* of children, it has been employed successfully. The good results obtained from it in these cases are doubtless due to its antiferment properties and its lack of irritating qualities.

The most important use of salicin thus far proposed, is in the treatment of *acute rheumatism*—information which we owe to Dr. Maclagan. He concludes, as the result of his experience, that the more acute the case the more beneficial the remedy; that the good effects are always experienced within forty-eight hours; that, sometimes, the disease is at once arrested; that relief of pain and fall of temperature are the earliest effects produced. Maclagan gives from ten to thirty grains every two, three, or four hours, in powder mixed with water. "Fifteen grains every three hours is a medium dose."

Much confirmatory evidence has been published; but, on the whole, salicin is generally regarded as inferior to salicylic acid. There are conditions of the system, however, in which salicin should be preferred to any of its congeners. In those cases characterized by weak heart, whether from adherent pericardium, myocarditis, fatty degeneration, or other causes, salicylic acid may be dangerous. Again,

when the vaso-motor system is depressed, salicin is far safer. As the curative results obtained from salicin are but little inferior to those from salicylic acid, whenever the latter is contraindicated, the former may be confidently relied on, if efficiently administered.

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Acidum Salicylicum.—Salicylic acid. *Acide salicylique*, Fr.; *Salicylsäure*, Ger.

PROPERTIES.—Salicylic acid crystallizes in needle-shaped crystals, which are soluble in alcohol and ether, and in hot but not in cold water. It is without smell, and its taste is slight and not disagreeable. The solubility of salicylic acid in cold water is increased by the presence of neutral salts. Three parts of phosphate of sodium will render one part of the acid easily soluble in fifty parts of water. Borate of sodium is still more efficient in promoting the solubility of the acid, and, as boracic acid has properties corresponding to salicylic, the borate should be preferred for this purpose. It has been shown that ten parts of salicylic acid can be dissolved in one hundred parts of water, by the addition of eight parts of borax (Bose). The borax should be first dissolved by the aid of heat, and the salicylic acid should be added gradually to the hot solution of borax. On cooling, filtration is necessary to separate a small quantity of undissolved residue.

The dose of salicylic acid for internal administration ranges from ten grains to one drachm.

Sodii Salicylas.—Salicylate of sodium. Dose, grs. xv—ʒ j. The best mode of administration is in the form of wafer, containing five to ten grains. These may be given rapidly until the requisite quantity has been swallowed. Salicylate of soda may be prepared extemporaneously by the addition of salicylic acid to a solution of bicarbonate of sodium. If the alkali is in excess, the resulting solution is brownish or purplish in color, and has a strong odor of wintergreen. This is not repulsive to most patients.

The following is a suitable formula: ℞ Acidi salicylici, ʒ ij; sodii bicarb., ʒ j; aquæ, ℥ ij. M. Sig.: A teaspoonful every two, three, or four hours.

ANTAGONISTS AND INCOMPATIBLES.—The mineral acids, the metallic salts, and the preparations of iron in general, are chemically incompatible. From the physiological standpoint, salicylic acid and the salicylate of soda are antagonized by the arterial and cerebral stimulants.

SYNERGISTS.—The effects of salicylic acid are increased in all di-

rections by the members of the phenol group, by the arterial depressants, and by the anæsthetics and cerebral sedatives.

Physiological Actions.—In small doses, salicylic acid may stimulate digestion, but in considerable quantity, especially if frequently repeated, it causes uneasiness at the epigastrium, nausea, and vomiting. This inability of the stomach to dispose of the large doses of salicin, salicylic acid, and salicylate of soda, required in the treatment of certain diseases, is an obstacle to their use. They are diffusible and readily enter the blood. It is in a high degree probable that salicylic acid combines with an alkaline base and enters the blood as a salicylate—as a salicylate of sodium, according to Salkowsky. Binz holds that the free carbonic acid present in the blood must effect the separation of salicylic acid from its combinations, and hence that salicylate of soda must act as salicylic acid. It is well known, of course, that salicylate of soda does not possess the antiseptic property of salicylic acid, and, as both act similarly after their medicinal administration, it seems highly probable that the decomposition just mentioned does actually take place. An observation of Köhler seems to support the theory of Binz. Köhler found that, while ordinary blood containing salicylic acid did not yield it up to ether, the blood of asphyxia, which contains an exceptional quantity of carbonic acid, did yield up its contained salicylic acid to ether. The blood in the vessels unquestionably contains more carbonic acid than that which has been exposed to the air. Salicin, as Senator first demonstrated, under the action of ferments, splits up into saligerine and glucose, and saligerine is readily oxidized into salicylic acid. This process is supposed to occur in the body, and hence the comparative slowness of action of salicin and similarity in its effects to salicylic acid. Spencer, examining the blood of a person taking salicin, only got evidence of the presence of the glucoside but not of the salicylic acid, and in the urine of the same subject found but a small part of the acid which ought to have appeared, whence he concludes that the conversion of salicin into salicylic and salicyluric acids, according to Senator, is but partially accomplished in the organism. These observations adequately explain the superior activity of salicylic acid as compared with salicin.

In health, ordinary doses of salicylic acid and salicylate of sodium have but little effect on the circulation. In the carefully conducted experiments of Ringer and Morshead, made on normal subjects, considerable doses of the acid increased the pulse-rate from ten to twenty beats, but more or less feverishness was produced by the irritant action on the gastro-intestinal mucous membrane. The manometric studies of Köhler demonstrated that this agent lowers the blood-pressure, and this result occurred after division of the vagi, the depressors, and the spinal cord, whence it must be concluded that it accomplishes this result by a direct action on the heart and vaso-motor ganglia.

More recent observations by Oltramare show that when salicylic acid is thrown into the veins the first effect is to increase the energy of the systolic contractions, the number of pulsations, and the blood-pressure. These effects, he finds, are due to a direct stimulation of the heart and of the motor centers. Under the influence of increasing doses, the vessels dilate, the blood-pressure falls, and finally the heart is arrested. There is, therefore, a general agreement as to the increase of the action, lowering of the blood-pressure, etc., as studied in animals, and observed on man by Ringer and Morshead. Professor Sée, however, fails to discover any effect by salicylic acid on the heart or blood-pressure, but, as he administered the remedy by the stomach, it is probable that he did not secure admission to the blood of a sufficient amount.

The numerous observations made on the effect of salicylic acid and salicylates on the heat-function are in close accord. In health it is found that, unless toxic doses are taken, the temperature is but slightly or not at all affected. Riess, one of the first to make observations on this point, noted a constant reduction of the normal temperature; but Sée, Ringer, Fürbringer, and others, agree that in health this agent does not affect the temperature. Riess's conclusions were based on more than four hundred observations of the internal use of salicylic acid, and in twenty-three cases he ascertained a reduction of 1·6° Fahr., produced by five grammes (nearly eighty grains). If fever is present, whether produced artificially by the injection of septic materials, or arising spontaneously, salicylic acid very uniformly effects a considerable reduction. The result, however, is not always the same. That salicylic acid has a decided antipyretic action is denied by Zimmermann, Wolffberg, and some others; but the weight of testimony is overwhelmingly the other way. It is certain that the degree of antipyretic effect varies in different forms of fever (Bartels, Senator, Nathan, and others), and also according to the individual susceptibility to its action. The phenomena attending the reduction of temperature are worthy of consideration. At the onset of the action, in ten to fifteen minutes after the dose is swallowed, some increase in the heart's action, a feeling of warmth through the system, and flushing of the face with suffusion of the eyes are experienced, then the perspiration begins, appearing first on the face, then on the chest, abdomen, and extremities, and presently becomes profuse. Coincidently with the sweat, the decline in temperature begins, but it continues after the sweating. There is no ratio between the amount of sweating and the reduction of fever-heat, for with much sweating there may be but slight diminution in the temperature, and with little sweating a marked decline. In febrile cases the decline of temperature varies from 1° to 6° Fahr. (Riess, Nathan, Bartels, Ewald, and others). The quantity of salicylic acid necessary to effect any considerable reduction of tem-

perature ranges from one to two drachms. The effect is maintained from five to twenty hours, when a repetition of the dose usually becomes necessary. With the first effect of the agent on the heart, the pulse rises, but, as the sweating progresses, more or less slowing of the heart-beat occurs. There are differences of opinion, however, on this point. Thus, Ewald, Riess, Goltdammer, and a few others, hold that the pulse is little if at all affected ; but the usual expression is that, after a preliminary rise, there ensues with the perspiration and lowering of the temperature a marked decline in the pulse-rate (Buss, Stargard, Nathan, Moeli, etc.).

With the first impression of this agent on the respiratory center, the number of respirations is increased, but, with the decline of temperature and of the pulse, they are lessened. The excretion of carbonic acid, Livon shows, is the greater, the larger the dose of salicylic acid, estimated during the period of increased action of the lungs. Under the influence of large doses, accumulation of the acid takes place in the cerebro-spinal fluid, causing an excitation of the roots of the pneumogastric nerve, but the excitation is succeeded by the depression which terminates in arrest of the respiratory function.

As the effects of salicylic acid or salicylate of sodium develop, more or less headache, with a feeling of distention and frontal oppression, is experienced. Buzzing in the ears, dullness of hearing, and even deafness, are usual symptoms when the doses are large. Vision is also affected, the sight becoming dim, or strabismus or ptosis occurs. In one case sudden and complete amaurosis came on (Gatti) after the administration of one hundred and twenty-five grains of salicylate of soda ; the pupils were widely dilated, the sclerotic and cornea acquired extreme sensibility, but the retina was unchanged, and the vision fortunately was restored after ten hours without impairment. In other cases, subacute delirium, or delirium with refusal of food, and various delusions (Daly) have occurred while patients were taking considerable doses. Ordinarily, however, the cerebral effects of salicylic acid are not unlike those of quinine. The state of the intracranial circulation which it induces has not been studied. According to Blanchier and Rochefontaine, salicylate of soda depresses the functions of the central nervous system, but the irritability of both sensory and motor nerves and the contractility of muscle remain unimpaired.

Animals to whom salicylate of sodium is administered daily for some time, emaciate rapidly (Chirone and Petrucci). The toxic dose for the dog, ass, and horse, according to Oltramare, is one gramme per kilogramme of the body-weight. Death is due to paralysis of the heart, and not from asphyxia, as has been heretofore supposed (Oltramare). After death the abdominal viscera are intensely congested, unless the medulla be divided, when a marked degree of anæmia succeeds to the hyperæmia. It is this fact chiefly which induces Oltramare to maintain that salicylate of sodium acts on the vaso-motor center in the medulla.

On man as well as on animals sometimes salicylic acid produces serious symptoms. The intoxication, with delirium and delusions which it causes in certain subjects, especially those suffering from acute rheumatism, has been referred to. In drunkards it is especially apt to act unfavorably, bringing on in them violent delirium. In rare instances salicylic acid and the salicylates have induced a condition of collapse, with restlessness, delirium, great dyspnœa, feeble pulse, and involuntary evacuations. The vaso-motor paresis, which is a result of large doses in feeble subjects, may be accompanied by great relaxation of the skin, the rapid formation of bed-sores, etc. Dr. Tuckwell, of the Radcliffe Infirmary, Oxford, gives the following symptoms as occurring in two cases under his observation : "Loud, deep, and sighing respiration ; a strange restlessness, gradually increasing to delirium, and not unlike that of delirium tremens, with involuntary evacuation of urine and fæces in the worst of the two cases ; a slow and laboring pulse ; an olive-green color of the urine." No fatal case, distinctly due to these preparations, has been reported, but many have occurred in which very dangerous symptoms arose ; but, fortunately, all disappeared on stopping the administration of the remedy. The existence of albuminuria is an important factor in the causation of bad results (Huber).

The rate of diffusion of salicylic acid has been closely studied by Blanchier and Rochefontaine, with the following results : When injected into the veins of a dog, salicylate of soda appeared in the saliva in four to five minutes ; in the urine, eight to ten minutes ; and in the bile and pancreatic secretion, in fifteen to twenty minutes. When taken into the stomach, it appeared in the saliva in twenty minutes, and in the urine in forty-five minutes. In man salicylic acid is excreted chiefly, almost wholly, by the kidneys, and appears in the urine in twenty minutes after it is taken into the stomach. It is excreted as salicyluric acid, which may be seen as a deposit at the bottom of the vessel, "of a white, feathery consistence." The urine presents a more or less deep greenish tint. The presence of the acid is readily ascertained by the solution of chloride-of-iron test. To the urine suspected to contain salicylic acid, add slowly, drop by drop, the chloride-of-iron solution ; phosphate of iron is first formed, which is whitish in color, but presently, if salicylic acid be present in a free state, a violet color is developed. The urine, during a course of the acid or of the salicylates, frequently contains albumen, due, doubtless, to the irritation of the kidneys as elimination is going on. The facts do not yet warrant any conclusion in regard to the damage which may be permanently inflicted on the kidneys by the prolonged administration of this agent. The influence over the urinary excretion has been examined

by Bouchard. There is reason for believing that the urinary water is not augmented, the extractives are somewhat increased, and the phosphates and coloring-matter are unchanged. Prof. Sée finds that the excretion of uric acid in gouty cases is promoted. It is maintained by others that the amount of urea present in the urine is greater than normal. Livon and J. Bernard have ascertained that salicylic acid, after being thrown into the stomach or into a vein, appears within an hour or two in the saliva, milk, pancreatic secretion, bile, as well as urine, and it was always found in the cerebro-spinal fluid. They conclude that it acts locally at these points of contact with the structure of organs. Hence, it appears highly probable that the local stimulation increases the product of those glands through which the acid or its salt passes, but not in the urine, if Bouchard's observations can be relied upon. Albuminuria, according to Gubler, is produced by it in some cases, and temporary impotence has been observed in others.

Therapy.—The applications of salicylic acid in the treatment of disease are based on the results of the physiological examination. In the diseases of the stomach characterized by fermentative changes in the food, as in *catarrh*, *dilatation* of the organ, etc., salicylic acid is an effective remedy. The author has seen admirable results from its use in *gastralgia*, even when distinctly periodical. In the vomiting of a pasty, fermenting mass of ingesta, whether or not accompanied by the organism, *sarcina*, or other germs of fermentation, good results are derived from this remedy. In these stomachal disorders, the best effects are had from ordinary doses (five to ten grains), given in a wafer, either in anticipation of the attack—as of gastralgia appearing at a fixed hour—or during the process of fermentation in the stomach contents. As a portion of the remedy taken passes into the fæces, it is probable that salicylic acid is just as effective in the corresponding troubles in the intestines. Ilgin reports the removal of *tænia solium* in six cases by the administration of salicylic acid, in eight-grain doses every hour until five doses were taken—preceding and following the acid with a dose of castor-oil. It has been employed successfully in the removal of *ascarides*, by local application and by internal administration. An enema of water should precede the salicylic-acid solution, which may be composed of borax and salicylic acid with some glycerin. ℞ Acid. salicylic., ʒ ss ; sodii biborat., ʒ ss ; aquæ, Oj. M. Sig. : Warm, and administer the whole amount at one time. For a young child, this quantity should be reduced one half, or more.

When the heart is weakened from any cause, salicylic acid and salicylate of soda must be exhibited with caution. The experience thus far accumulated warrants the assertion that the dose of fifteen grains of the former and twenty of the latter should rarely be exceeded, if frequent repetition of the dose is practiced. From Riess, who regards salicylate of soda as a specific in *typhoid fever*, to Filatow,

who holds that it is worse than useless, there are various shades of opinion, with the weight of authority decidedly in favor of the view that it is a remedy of real value. Since Riess, no one has claimed in this remedy a specific for typhoid, but it is generally admitted that it renders the course of the disease milder by keeping the temperature within safe limits (Tomkins, Hallopeau, Butt, Immermann, Senator, etc.). Weiss concludes, after an experience of ninety-six cases of typhoid in children, treated with salicylate of soda, that it is a powerful antipyretic in the typhoid of children, and that, while it does not shorten the course of the disease, it renders it much milder. He finds that the results are better, when the typhoid of children is treated by salicylate of soda, than have hitherto been obtained from quinine and cold baths. A still more recent English experience is to the same purport as the German. Dr. Tomkins finds that in the salicylates we have the means of reducing fever-heat, more certain and more agreeable than by the cold bath. In the *eruptive fevers*, the same principles obtain as in typhoid. Salicylate of soda is preferable to salicylic acid, because it is less irritating, safer, and equally effective as an antipyretic. The object of its administration is to reduce the heat, which is the most important source of danger. The amount required to accomplish this object is now definitely known. Twenty grains of the soda salt may be given every two hours, until the temperature is reduced to the proper point, at which it may be held by ten-grain doses at the same interval, unless the occurrence of an exacerbation requires the exhibition of a larger quantity. In the case of children, the daily quantity ranges from half a drachm to a drachm. Probably the best mode of administering the salt is in the form of wafer, but when these can not be obtained, a solution may be readily prepared, or the salt may be constructed extemporaneously by adding the acid to a solution of sodic carbonate as follows : ℞ Acid. salicylic., ʒ iv ; sodii bicarbonat., ʒ j ; aquæ, ℥ jss ; syrup. simpl., ℥ ss. M. A tablespoonful contains about twenty grains salicylate of soda. It should be borne in mind that this remedy is not safe if the heart is very weak, or if albuminuria is present.

In *relapsing fever*, according to Riess, salicylic acid accomplishes something more than the mere reduction of temperature. Although it does not prevent the usual relapse, even when administered in large doses during the interval, it lessens the severity and duration of the relapse. It does not destroy the *spirilla* in the blood, nor indeed lessen their activity (Riess), and hence can not be a curative agent in this disease. In *pyæmia*, *septicæmia*, *puerperal fever*, *diphtheria*, etc., salicylate of sodium is used under the same rules as in typhoid. The indication for its use is high fever, and the good accomplished by it is determined by the degree in which the temperature is reduced. The antiseptic action is quite secondary to the antipyretic. In *mala-*

rial fevers it was supposed by Senator and others, in the enthusiasm attending the introduction of the remedy, that salicylic acid would prove equal to quinine. If administered in a full dose just before the advent of a paroxysm, it will prevent it, but it does not possess the curative powers of quinine over the effects of the malarial poison, and hence will not prevent relapses. By using salicylate of sodium to abort an impending paroxysm, and quinine to prevent relapses, the curative result will be attained with the least pecuniary expenditure. In the mildest cases of intermittents, salicylate of sodium may be depended on alone, but, to succeed, it must be administered before the expected paroxysm.

Out of the enormous mass of published experience in regard to the value of salicylic acid in *acute rheumatism*, it is difficult to select. From the first trials of Buss, followed by Stricker and Traube, there has been an almost unanimous expression of opinion by the German physicians in regard to the value of this agent in rheumatism. At first it was supposed that the disease could be invariably cut short in forty-eight hours to three days, but larger observation has qualified these opinions. By way of illustration of the measure of success now attained in Germany with salicylic acid in rheumatism, we may take the recently published statistics of Diesterweg. Of one hundred cases treated with this remedy, the disease was cut short in thirty-six or twenty-four hours; in eighty-five, within the period of forty-eight hours; in ninety-eight, within seventy-two hours; in one the disease was prolonged to eighty-four hours; and in one the remedy had no effect on the disease. It is not intended to convey the impression that the cases got well in so short a time, only that the fever and joint-swelling and pain subsided, and convalescence was established. Relapses occurred in eleven cases, and cardiac complications in five.

In France the treatment of acute rheumatism by salicylic acid was taken up by Jaccoud, Lepine, Gueneau de Mussy, and others, but especially by Prof. Sée, who has devoted to it several important lectures. As a result of Sée's observation, he concludes that salicylic acid has a marked and peculiar benefit in acute rheumatism; that the pains invariably cease in from twelve to eighteen hours; that the articular swelling disappears at the end of three days, and that the fever subsides with the pains. If the fever persists, other joints will become affected. Out of fifty-two cases treated by Prof. Sée, fifty-one recovered in from two to three days. These results are quite equal to the German. Sée makes an important observation in regard to the rapidity with which salicylic acid and salicylate of sodium are eliminated, and the necessity, therefore, of continuing the remedy for some time after all the joint-troubles have ceased, to prevent relapses. Prof. Gubler does not share the general enthusiasm as to the value of this agent in rheumatism. He emphasizes the uncertainty and the

dangers attending its use, and maintains that it has no antipyretic effects.

In England salicylic acid and salicylate of sodium have been used with a large measure of success, but the rheumatism of England, as of this country, does not yield with the promptness characteristic of the Continental disease. The general results of the treatment, as conducted in England by Broadbent, Carafy, Spencer, Boggs, Greenhow, and many others, is very much as expressed by the last-named in his important communication to the Clinical Society. The temperature speedily falls, sometimes within a few hours and almost always in two or three days, the pulse declines at the same time, the pains subside correspondingly, and the joint-swelling diminishes and disappears within three or four days. Greenhow points out that such a result is not a cure even in the most favorable cases; that the remedy acts very injuriously on the heart and causes a deep anæmia, and that, therefore, the duration of the disease, from beginning to the termination, is not actually shortened. Dr. Maclagan (also Charteris) strongly urges the substitution of salicin, on the ground that it is equally effective with salicylic acid and much less dangerous; but it is difficult to appreciate this argument, since salicin is converted into salicylic acid in its passage through the system.

In this country, the experience of the Maine physicians, and of the medical staff of the Massachusetts General Hospital, has been published. It is conceded that it has good effects. As regards the experience at the Massachusetts General Hospital, the facts are as follows: In eight cases out of seventeen treated with salicylic acid, the duration of the longest case was twenty-six days, and the shortest five days, the improvement being very marked from the beginning of treatment. Of three patients who took salicylate of soda only, the duration of the disease was less than twelve days in each case, the shortest being two days. In the remaining nine cases the duration was six weeks or more.

In summing up the testimony, it is clear that salicylate of soda is a most valuable remedy in acute rheumatism, but various unpleasant, even dangerous symptoms arise in some cases. Violent headache, vertigo, and *tinnitus aurium*, are common; wild delirium is an occasional symptom; weakness of the heart, obscuration of the first sound, and profound anæmia, are especially noted by Greenhow; very great gastro-intestinal disturbance is now and then produced. Empis narrates a fatal case of acute rheumatism which was treated by salicylic acid. Great depression of the powers of life, in rare instances approaching collapse, has been observed. Sufficient is now known of the danger attending the salicylic medication of acute rheumatism, to justify the author in urging circumspection on the attention of his readers. The robust and vigorous rheumatics are proper subjects for this treatment, whereas, in the pale, feeble, and cachectic, especially those with weak

hearts, this treatment must be pursued cautiously, or not undertaken at all. Relapses are frequent, probably because of the very rapid elimination of the remedy, as suggested by Prof. Sée, and hence its administration must be continued for some time after all of the local and systemic symptoms have subsided.

In *gout*, *chronic rheumatism*, *myalgia*, and *lumbago*, salicylate of sodium often acts most serviceably. It is more effective the more acute the malady, as a rule, but it sometimes does great good in the most chronic cases. Abbott reports the cure of *sciatica*, and Brun of rheumatismal *irido-choroiditis*, by its use. The author has succeeded in some instances very promptly in the cure of sciatica by the salicylate of soda—the formula used being that for the extemporaneous solution. The cases in which this remedy has proved most efficacious, were those of functional disturbance in the nerve, the muscles being in their normal condition, and the pain having nocturnal exacerbations.

It is a very interesting fact, first distinctly stated by Dr. Pye Smith, of Guy's Hospital, London, that, during the administration of salicylic acid and the salicylates, the urine exhibits the reaction for sugar on the application of Trommer's test. This has been observed in rheumatism and in other diseases treated with this agent. The urine is a little increased in amount, but its specific gravity is not changed. The reduction of the copper is effected by the acid or by the glycogen, which is one of the products of the decomposition of salicylic acid. Müller, the assistant of Eckstein in the clinic at Kiel, has published some important observations on the use of salicylate of soda in the treatment of *diabetes*. It appears that full doses of the salt cause the sugar to disappear entirely, but this is not a permanent result, for, after a time, the sugar returns. A very great tolerance to the remedy exists in this disease, and large doses may be taken with impunity. Bouchardat, in commenting on these observations, states that he has not had good results from this treatment. Since, however, the remedy is well tolerated, and during its exhibition in considerable doses the sugar disappears, it may be used with advantage at critical times to stop the waste.

Salicylate of sodium has feeble antiseptic properties, and hence salicylic acid, which is even superior to carbolic acid in its power to destroy minute organisms and to prevent change in putrescible materials, should be preferred for all topical applications. Being free from odor, and more active than carbolic acid, it should be used instead of carbolic acid for most purposes. For all toilet purposes, it is decidedly preferable. It is an excellent addition to the ordinary powder *dentifrices*, and its solution with borax is an efficient deodorant in *fetid perspiration*. This disagreeable affection, as it attacks the feet, may be relieved by dusting the feet thoroughly with powdered salicylic acid before putting on the stockings. It is useful, also, to fill the interstices of the stockings with the powder. Extraordinary success has been achieved by the local application of this remedy in *eczema of the head and face*. Those cases characterized by much weeping seem to be best adapted to the cure by salicylic acid, but *eczema rubrum* and *eczema impetiginodes*, that resisted other approved means, have yielded to the application of this agent (Wagner, Will). It is generally conceded that, as a local application to *syphilitic ulcers*, salicylic acid is inferior to carbolic acid.

The most important therapeutical uses of salicylic acid are in the antiseptic treatment of wounds and injuries. When it was shown that this agent had a power to destroy the activity of ferment and disease-germs equal to that of carbolic acid, while it is free from the irritating quality and disagreeable odor of the latter, Thiersch, who is a strong advocate for Lister's antiseptic method, resorted to the use of salicylic-acid solutions. Further experience has, however, rather proved the superiority of carbolic acid in respect to the germicide and antiseptic properties for which these remedies are now so largely employed.

To *cancer*, *gangrenous and sloughing wounds*, pure salicylic acid may be applied in powder. To prevent the contact and multiplication of atmospheric germs, operative procedures may be conducted in salicylic spray, the sponges and dressings may be saturated with salicylic solutions, and the wound may be irrigated by the same. In order to carry out all the details of the antiseptic method, salicylic acid is substituted for carbolic in the forms and combinations of dressings employed by Lister. Wounds are covered with cotton-wool, impregnated with an alcoholic solution of the acid, in the proportion of three and ten per cent. As cold water takes up only one part to three hundred, which, however, is strong enough to destroy bacteria, etc., the addition of borax is generally necessary to obtain a solution of sufficient strength for the antiseptic applications. A salicylic-acid plaster may be prepared as follows: Salicylic acid, ʒ ss—ʒ j; white wax, ʒ j; paraffin, ʒ ij; almond-oil, ʒ ij. The ingredients are melted, and rubbed up together in a heated mortar (Will), and spread on muslin. An ointment more readily melted by the heat of the body is the following: Sperm-oil, ʒ jss; cacao-butter, ʒ vss; salicylic acid, ʒ ss—ʒ j. This should be melted together, thoroughly incorporated, and spread on lint (Will). An ointment for the same purposes may be prepared in a simpler way by the addition of salicylic acid to simple cerate. A solution of salicylic acid in olive-oil, in the proportion of one drachm to eight ounces, is an efficient local application for *burns*.

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Resorcin. (Not official.)

History.—Resorcin is a chemical compound, discovered by Hlasiwetz and Barth, and was obtained from certain resins by the action of fusing alkalies. They assigned to the new compound the name *resorcin*, partly because it is derived from a *resin*, and partly because it has some similarity to *orcin*, a peculiar substance obtained from archil. Subsequently resorcin was constructed synthetically by Körner, and at the present time it is obtained in various ways, the product being both pure and cheap (Andeer).

Properties.—Resorcin is a member of the phenol group. It occurs in tabular prismatic crystals, rather shining and lustrous, somewhat sweetish to the taste, with a little after-pungency. When struck or rubbed in the dark, it appears phosphorescent. In odor it is somewhat like phenol, but not nearly so pronounced. It is freely soluble in water, in the proportion of 86·4 parts of resorcin to 100 parts of water at 0° C. It is dissolved by all liquids except chloroform and carbon sulphide. Aqueous solutions exposed to the air and light, assume a more or less brownish tint, but without any apparent change in quality. Albuminous liquids treated with a concentrated solution of resorcin, become turbid by the formation of an albuminate of resorcin. Various secondary products are obtained from it by the action of chlorine, iodine, bromine, nitric and nitrous acids, etc. In the process by which resorcin is produced, are also *hydroquinone* and *pyrocatechin*. The best vehicles, according to Andeer, are alcohol, glycerin, and sirup of orange. The dose for usual purposes ranges from five to fifteen grains. For a decided antipyretic effect a drachm may be given, but this amount could not be frequently repeated. Five grains may be given every two hours, in an ordinary case.

Antagonists.—From the physiological standpoint, resorcin is antagonized by the cerebral excitants, by the agents which raise the arterial tension, and by the cardiac and respiratory stimulants—by atropine especially.

Synergists.—Its effects are promoted by quinine, salicylic acid, carbolic acid, etc.

Physiological Actions.—Resorcin does not irritate, nor is it absorbed by the unbroken integument. The solution injected into the subcutaneous tissues produces but little irritation, and never inflammation and abscess. Applied to the moistened mucous membrane, it causes vesication, and a white blister forms, like that from carbolic acid. It has decided anti-ferment properties, arrests decomposition in animal tissues, deodorizes, and is destructive of the minute organisms on the presence of which putrefactive decomposition is dependent. A one-per-cent solution will prevent the decomposition of urine when exposed to the air for months (Andeer). Applied to unhealthy wounds, it arrests the decomposition, destroys the fetor, and promotes healthy cicatrization (Dujardin-Beaumetz).

The action of lethal doses is necessarily to be studied on animals. Murrell has, it is true, given a good account of the symptoms produced by an overdose, but the details can be obtained only by experiments on animals. Soon after the administration of a full dose—thirty centigrammes (about five grains) of resorcin per kilogramme (about thirty-five ounces) weight of the animal experimented on—trembling begins, due to fibrillary contractions of the muscles, and this passes into general clonic convulsions of an epileptiform type. These convulsions regularly increase in severity, and, reaching their maximum in a few minutes, as regularly decline, the whole duration of this phase of the action being about two hours, sometimes longer. The spinal cord is doubtless the seat of the action, since the irritability of the peripheral nerves and muscles is diminished only, and not entirely destroyed. The general sensibility is preserved, whence it must be concluded that the action of resorcin is on the motor elements (Callias). The blood seems not to be altered in respect to its composition or properties; it presents a normal appearance, coagulates in the usual manner, and the venous blood, exposed to the air, assumes the proper red hue.

The lethal dose, according to weight, is ninety centigrammes per one kilogramme. The phenomena observed when such a dose is administered are the same as those above sketched, except that sensibility is impaired as well as motility.

Resorcin, through the action on the nervous system, affects the respiration and circulation when the dose is large. At first the respiration is greatly increased in frequency, becomes convulsive and jerking, and afterward shallow and weak but rapid. The action of the heart also becomes rapid, the pulse weak and somewhat irregular, but the respiration ceases before the action of the heart. The temperature rises, and just before death attains to 103° to 105° Fahr. This increase of the body-heat is doubtless correctly attributed to the extreme muscular action (Dujardin-Beaumetz), and not to irritation of a hypo-