below the middle, rounded or subcordate at the base, mostly blunt at the summit, crenulate, thickish, gray-green, and densely hairy, especially underneath, very strongly veined, the veins finely reticulate, often pinkish or purplish, as is the petiole; aromatic in odor and taste, the latter also bitter and somewhat astringent.

Sage owes its very characteristic odor and its properties as an aromatic drug to a peculiar volatile oil (less than one per cent. in the fresh, up to 2.5 per cent. of the dried leaves). It also contains an unknown bitter substance and apparently tannin, together with resin and a little gum. Oil of sage is a commercial article, and is of a yellowish or greenish-yellow color, with a specific gravity of about 0.92. Its chief constituent has been called salviol, but it is now considered identical with thujone, the active constituent of Arbor vitæ, and this occurs also in some other volatile oils. A small amount of cineol is also contained.

Sage resembles the rest of the Mint family in its general action; it is aromatic, a gastric stimulant, and by reason of its bitterness also tonic. It is also, what all are not, mildly astringent. In large quantities of hot water, like many other mints, it is given as a sudorific in the beginning of feverish colds, etc. Sage is useful in mouth washes and as a gargle. It is, however, almost entirely a domestic remedy, and even as such but little used of late, although formerly in high repute. It is one of the ingredients of the formerly official aromatic wine (*Vinum Aromaticum*), an old-fashioned liniment.

W. P. Bolles.

SAINT AUGUSTINE, FLORIDA.—This picturesque and well-known winter resort is situated on the Atlantic coast of Florida, thirty-eight miles southeast from Jacksonville, and about two hundred and fifty miles north of Palm Beach. The city occupies a narrow peninsula opposite Anastasia Island, which forms a breakwater against the open ocean. The surrounding country is flat and sandy and covered with the scrub palmetto.

The town is the oldest in the United States, and has a permanent population of between four and five thousand inhabitants, which number is doubled or more at the height of the season. The city retains many of its antiquities, and is exceedingly quaint and attractive. The narrow streets; the ancient Spanish "coquina," or shell-limestone residences, with their overhanging balconies; the old "City Hall," and Fort Marion, are all exceedingly interesting relics of the Spanish occupancy.

Many new and attractive buildings have of late years sprung up—several extensive hotels of the Spanish style of architecture, with beautiful grounds and courtyards; villas, with grounds ornamented with orange, lemon, and fig trees, palms, and a variety of tropical flowers and shrubs; churches, convents, and the restored Cathedral and Old Market.

The attractions at this resort are many and varied, as can easily be imagined. Besides those already mentioned, there are a United States military post, with daily guard mount, the sea wall affording a delightful promenade along the water front; many excursions by water; visits to the orange groves; drives, hunting, fishing, sailing, golf, and the never-ending delight of wandering through the old town. Connected with one of the hotels is a casino, where are Turkish baths, a swimming pool, various entertainment halls, lawn-tennis courts, etc.

The winter climate is a mild, equable, moist one; and in summer the heat is tempered by the sea breezes. Frosts are rare. Although the climate is of a somewhat less tropical nature than that of the resorts on the lower half of the peninsula, such as Palm Beach, Tampa, and Miami, still a very comfortable, mild atmosphere is found here in the winter, and there is a good proportion of sunny days.

The average mean temperature of twenty years for the four seasons, as given by Dr. Wall (*The Climatologist*, October 15th, 1891), is as follows (degrees Fahr.): Spring, 68.5°; summer, 80.3°; autumn, 71.5°; winter, 58.1°; and for the whole year, 69.6°. For the four winter months, according to the same authority, it is, for December, 57.2°; January, 57°; February, 59.9°; March, 63.3°. The average yearly rainfall is about 49 inches, varying quite considerably in different years; for example, it was 67.4 inches in 1880 and 33.9 inches in 1851. The least rainfall appears to be in January. The prevailing winds are from the northeast. The climatic data of Jacksonville, which is only thirty miles to the north of St. Augustine, can be taken as fairly accurately representing those of the latter resort, and the reader is referred to the article upon *Jacksonville* in Vol. V. of the HANDBOOK for more extended meteorological facts.

The water supply is abundant and obtained from artesian wells; and the streets are clean and well lighted. The sanitary conditions of the hotels are carefully looked after.

There is a well-appointed, indeed a luxurious, hydrotherapeutic establishment where hot and cold saline and hydro-electric baths are given by skilled attendants; and cases of rheumatism, gout, and nervous disorders are treated in this way. The Nauheim baths and the Schott system of treatment for heart disease; various methods of electrical applications, gymnastics, douches, and massage are also included in this establishment.

January, February, and March are the months in which St. Augustine is the most frequented. On account of its easy accessibility, mild climate, excellent accommodations and many attractions, this has become a popular and fashionable winter resort, and has been compared to Newport and Saratoga. Excursions to other portions of Florida can easily be made from this point.

Edward O. Otis.

SAINT CATHARINE'S WELL.—POST-OFFICE.—St. Catharine's, Ontario. Hotel, The Welland House.

ACCESS.—Viâ Grand Trunk Railway from Toronto, or Buffalo.

Analysis (Professor Croft).—Ten thousand grains of water contain: Carbonate of iron, gr. 0.5210; carbonate of lime, gr. 0.0820; sulphate of lime, gr. 19.7934; chloride of calcium, gr. 174.4876; chloride of magnesium, gr. 40.6644; chloride of sodium, gr. 378.4196; chloride of potassium, gr. 2.8119; bromide of sodium, a trace; iodide of sodium, gr. 0.0140. Total, 616.7938 grains.

St. Catharine's is situated twelve miles from Niagara Falls in what is termed "the Garden of Canada." There are a number of springs which have long been famous, and at different times sanatoria have been opened. The Welland is under excellent management and has during the past year been enlarged and furnished with all the appliances of a modern sanatorium. A resident physician is in charge with a staff of skilled nurses. Every provision is made to utilize the water after the most approved methods of hydrotherapeutics. The hotel is open throughout the year.

Beaumont Small.

SAINT CLAIR SPRINGS.—St. Clair County, Michigan.

POST-OFFICE.—St. Clair Springs. Hotel, The Oakland.

ACCESS.—From Detroit by steamer from the foot of Griswold Street, twice daily; distance fifty miles. Also from Detroit viâ Grand Trunk Railway (foot of Brush Street), twice daily; distance fifty-one miles. Railroad connection for springs can also be made at St. Thomas, Ontario, viâ Canada Southern Railroad. Steamer connection once daily is made at Port Huron, Mich.

St. Clair Springs is one of the strictly first-class health and pleasure resorts of the United States. The Oakland Hotel, situated in a tract of about one hundred and sixty-five acres fronting on the St. Clair River, at the extreme southern portion of the city of St. Clair, affords all the comforts, conveniences, and luxuries to be found at our older Eastern resorts or at the European spas. The hotel is open for the reception of health- or pleasure-seekers all the year round. Two classes of mineral waters of very pronounced yet very different type are found here. The first of these is a powerful muriated saline water. The analysis is by Professor Duffield:

One United States gallon contains (solids): Sodium

chloride, gr. 8,120; calcium chloride, gr. 7,382.20; magnesium chloride, gr. 1,012.20; calcium sulphate, gr. 144.20; silica, gr. 416; alumina, gr. 830; and traces of magnesium carbonate, calcium carbonate, magnesium iodide, and magnesium bromide. Total, 17,904.60 grains. Sulphureted hydrogen gas, 25.59 cubic inches.

It will be observed that the water contains an unusually large quantity of chloride of lime. The salt is believed by some observers to possess valuable alterative properties and to be of great assistance in the treatment of the strumous diathesis. The water also possesses all the well-known virtues of the densely charged chloride-of-sodium groups. It is used only for bathing purposes and as a spray or douche. An elegant and elaborate bathhouse, presenting all varieties of baths, sprays, douches, etc., is maintained in connection with the hotel.

The "Salutaris" is a natural gaseous alkaline mineral water, very wholesome and pure. It is said to be entirely free from organic matter, and constitutes an excellent table water. It is bottled and extensively sold in the United States.

The attractions in and about the Oakland Hotel are of a manifold character: expansive shaded lawns, picturesque drives; boating and sailing on the river, and all the indoor pastimes of the day will be found here.

James K. Crook.

SAINT HELENA WHITE SULPHUR SPRINGS.—Napa County, California.

POST-OFFICE.—St. Helena. Hotel and cottages.

ACCESS.—Take ferry from San Francisco foot of Market Street, at 8 A.M. and 4 P.M. Arrive at St. Helena viâ Calistoga train at 11:03 A.M. and 7:08 P.M. Take stage to springs, two miles distant.

ONE UNITED STATES GALLON CONTAINS:

Solids.	Spring No. 2. Grains.	Spring No. 6. Grains.	Spring No. 7. Grains.
Carbonate of iron	.62	.56	4.36
Carbonate of magnesium	8.26	11.33	12.84
Sulphate of sodium	21.72	23.41	14.23
Chloride of sodium	1.32	.86	.78
Chloride of calcium	.87	2.22	.65
Sulphides of sodium and calcium	2.65	1.85	1.62
Total solids	35.44	40.23	34.48
Gases.	**Cubic inches.**	**Cubic inches.**	
Sulphureted hydrogen	6.15	4.25	Trace.

This beautiful summer resort is located in one of California's loveliest valleys. The neighboring mountainsides are covered with forests, shrubbery, ferns, and wild flowers of every description. Brooks and cascades are seen on every hand. The grand old California redwoods, which are found here in great abundance, are alone worth a visit to this region. The mineral springs are numerous and valuable, and chiefly of the saline-chalybeate type. Mr. Sanford Johnson, the proprietor, furnishes us with the accompanying analysis of three of the springs.

There are six other springs which have not been completely analyzed. The waters vary in temperature from 64.4° to 97.25° F. The analysis shows them to possess valuable tonic properties. They are said to have considerable value in rheumatism and kidney affections.

James K. Crook.

SAINT LOUIS, MO.—This great city of nearly 600,000 inhabitants is situated in the northeastern corner of Missouri upon the Mississippi River, not far from its junction with the Missouri.

A description of the city is hardly necessary or pertinent in this connection, as the climate is the chief consideration, of which certain marked peculiarities deserve mention.

In the first place, as will be observed from the table, the excessive extremes of temperature are striking, the annual range being 123.4° F. Although the winter mean temperature is only a few degrees higher than that of New York, for example, the mean summer temperature is five and one-third degrees higher. In July a maximum temperature of 104° F. is noted, while in January a minimum temperature of — 16° F. occurred in the cold wave of 1889. St. Louis is called a "Southern city," and yet it is seen that the winters are severe and quite like those of a Northern city. The summers are usually very hot, the nights as well as the days, and a continuous high temperature may exist for many days in succession; moreover, this heat may continue through the month of September. In July, 1901, there was hardly a day for three weeks in which the temperature was not 100° F. or over. The daily range of temperature is also seen to be considerable, and, consequently, one might hastily conclude that the summer nights would be comparatively cool; but if the day temperature is very high, a diminution of fifteen or eighteen degrees would still give a high night temperature.

Another striking feature of this climate is the prevalence of south winds throughout the year, except in March, when the blizzards change the direction from south to northwest.

The mean relative humidity indicates a moderate amount of moisture, a little less than that of New York City. The rainfall is not excessive and is pretty evenly distributed throughout the year, rather more falling in the spring and summer. There are a few more clear and fair days in St. Louis than in New York, especially in the summer and autumn. The flatness of the surrounding country and the atmospheric conditions favor the

CLIMATE OF ST. LOUIS, LATITUDE, 38° 38'; LONGITUDE, 90° 12'. PERIOD OF OBSERVATION, THIRTEEN YEARS.

	January.	March.	May.	July.	September.	November.	Spring.	Summer.	Autumn.	Winter.	Year.
Temperature, Degrees Fahr.—											
Average or normal	31.7°	43.1°	66.1°	78.8°	68.0°	42.4°	54.7°	76.8°	55.9°	34.0°	55.3°
Average daily range	15.8	16.8	18.7	18.2	19.2	15.5					
Mean of warmest	38.7	53.5	75.4	88.2	79.2	52.1					
Mean of coldest	22.9	36.7	56.7	70.0	60.0	36.6					
Highest or maximum	72.0	82.0	93.0	104.0	101.5	82.0					
Lowest or minimum	−16.0	8.0	32.0	57.0	40.0	5.0					
Humidity—											
Average mean relative	71.2%	66%	64.2%	67.9%	64.7%	67.9%	63.3%	67.4%	65.8%	70.9%	60.8%
Precipitation—											
Average in inches	2.19	3.04	3.86	4.36	2.55	2.79	10.25	11.74	8.12	7.48	37.59
Wind—											
Prevailing direction	S.	N. W.	S.	S.	S.	S.	S.	S.	S.	S.	S.
Average hourly velocity in miles	10.2	11.6	9.7	7.7	8.5	10.6	10.7	8.0	9.5	10.2	9.6
Weather—											
Average number of clear days	8.8	7.7	9.8	11.4	13.9	7.7	26.9	33.5	34.4	24.5	119.3
Average number of fair days	11.3	11.9	11.5	12.9	10.9	12.2	35.2	40.5	34.9	33.0	143.6
Average number of clear and fair days	20.1	19.6	21.3	24.3	24.8	19.9	62.1	74.0	69.3	57.5	262.9

formation of tornadoes; and on May 27th, 1896, there occurred in St. Louis one of the most terrific ones ever known in the United States, ploughing in a moment a huge furrow through the city and destroying a large number of lives and an immense amount of property. Such calamities, however, are rare, but, nevertheless, the latent conditions are always existent, and what has happened may happen again.

During the summer months all who are able seek a cooler climate at the seashore or in the mountains; but during the rest of the year St. Louis is a comfortable and wholesome place of residence. It has been feared that the Chicago drainage canal, which empties into the Illinois River,—which latter in turn flows into the Mississippi above St. Louis,—might pollute the waters of this river as it flows past St. Louis. No sure evidence, however, to the writer's knowledge, has been adduced to show that this is the fact, or that the drinking-water, which is derived from the river, is injuriously affected.

For a description of the manifold attractions in and about the city, the guide books must be consulted; and for the history of the founding of the city, the reader is referred to Parkman's fascinating works.

From St. Louis interesting excursions can be made either up the river to St. Paul, or in the other direction to New Orleans. The steamers are comfortable and commodious. From St. Louis to New Orleans is a distance of 1,250 miles, and the steamer occupies about a week in traversing it. For one who desires a slow, restful journey amidst oddly picturesque scenery, a journey soothing to tired nerves and yet of strange interest, this voyage down the Mississippi can be unqualifiedly recommended from personal experience. *Edward O. Otis.*

SAINT LOUIS SPRING.—Gratiot County, Michigan. Post-Office.—St. Louis. Hotels and sanatoriums. Analysis by S. P. Duffield:

One United States gallon contains (solids): Sodium bicarbonate, gr. 88.66; calcium bicarbonate, gr. 57.83; magnesium bicarbonate, gr. 14.58; iron bicarbonate, gr. 1; calcium sulphate, gr. 55.41; calcium silicate, gr. 5.60; silica, gr. 2.40; organic matter and loss, gr. 1.66. Total, 227.14 grains. Gases, sulphureted hydrogen, a trace; carbonic acid, 5.17 cubic inches.

The results of treatment with these waters, according to Dr. Stiles Kennedy, show them to be especially beneficial in dyspepsia, neuralgia, and chronic rheumatism. The water, as shown by the analysis, is strongly alkaline, and also contains sufficient iron to impart to it the properties of the chalybeate class. The waters were once supposed to be strongly magnetic, but it has been proved by the experiments of Walton, and corroborated by a committee of the Michigan State Medical Society, that the so-called magnetic properties were derived from the metallic tubing which encased the well. The resort is still kept up well and is very popular. *James K. Crook.*

SAINT MORITZ, SWITZERLAND. See *Engadine.*

SAINT PAUL, MINN.—This city, and several other points in Minnesota, wer formerly popular as winter health resorts for consumptives, on the theory that steady cold weather was peculiarly bracing to the constitution, and thus hardened the patient was put in a more favorable condition to overcome his disease. There is undoubted truth in this, provided the air is pure as well as cold, and provided other favorable climatic factors exist, such as sunshine, absence of high winds, and dryness. There have been developed, however, other and better climates of the bracing winter type, such as the various well-known resorts in the Alps and in Colorado; and, in consequence, the former reputation of Minnesota has declined. Further, large cities are obviously never so favorable as health resorts for pulmonary tuberculosis, and hence St. Paul and its sister city, Minneapolis, now grown so large, could not be recommended for a residence to those suffering from this disease, even if the climate were better than it actually is.

The characteristics of this climate are, first of all, the steady cold winter weather, the mean temperature of the four months, December, January, February, and March, being 19.6° F., while the minimum temperature has been as low as — 39° F. in December and — 31° in January. Secondly, may be mentioned the freedom from the sudden and constant great variations in temperature so common along the Atlantic coast; it is very cold in winter, but it is a steady cold, and there are no thaws. Again, when we consider the low winter temperature, a relative humidity of 72.4 per cent. indicates a dry atmosphere, quite different from that of New York City, for instance, with about the same relative humidity in winter, but with an average mean winter temperature 14.8° F. higher, the absolute humidity at St. Paul being only half as great in the winter as at New York City; so that we have a dry as well as a cold atmosphere. The average precipitation is seen to be small, about two-thirds of that of New York City.

There is no great amount of wind at St. Paul, particularly in the winter; and a very considerable amount of sunshine. In both of these respects St. Paul shows a marked superiority over New York City.

From its inland location, St. Paul is free from all those perturbations of temperature caused by the influence of the sea, which prevail in the large sea-bound cities of the United States, or in the cities lying upon the great lakes.

St. Paul is a beautiful city, and affords many attractive excursions in the vicinity;—one is to Lake Minnetonka, forty miles distant, a popular summer resort with hotels and cottages, where the air is pure and invigorating, and where many opportunities are afforded for out-of-door life. Convalescents and those suffering from nervous affections are said to do well in this climate. From St. Paul the journey down the Mississippi River begins,

Climate of St. Paul, Minn. Latitude, 44° 58′; Longitude, 93° 3′. Period of Observation, Thirteen Years.

	January.	March.	May.	July.	September.	November.	December.	Winter.	Year.
Temperature, Degrees Fahr.—									
Average or normal	12.9°	28.5°	58.8°	71.8°	58.4°	30.1°	18.7°	16.6°	43.7°
Mean of warmest	24.3	41.2	68.7	82.8	70.7	40.2	28.2		
Mean of coldest	5.8	22.2	48.3	62.7	50.7	28.8	12.2		
Average daily range	19.5	19.0	20.4	20.1	20.0	16.4	16.0		
Highest or maximum	49.0	68.0	94.0	100.0	94.0	72.0	56.0		
Lowest or minimum	−31.0	−22.5	24.0	46.0	30.0	−24.5	−39.0		
Humidity—									
Average mean relative	72.1%	69%	60.5%	69.9%	70.7%	72%	74.3%	72.4%	69.1%
Precipitation—									
Average in inches	1.07	1.64	3.72	3.22	3.26	1.42	1.28	3.42	29.94
Wind—									
Prevailing direction	N. W.	N. W.	S. E.	S. E.	S. E.	N. W.	N. W.	N. W.	S. E.
Average hourly velocity in miles	7.8	9.2	9.6	7.2	8.2	8.3	7.5	7.8	8.4
Weather—									
Average number of clear days	8	8.3	8.8	10.6	9.1	6.5	8.8	25.6	106.2
Average number of fair days	13	12.0	14.2	15.8	13.8	13.7	12.8	36.2	159.9
Average number of clear and fair days	21	20.3	23.0	26.4	22.9	20.2	21.6	61.8	266.1

and the portion between this city and St. Louis, constituting the first stage, is one of beautiful and grand scenery. The distance is about eight hundred miles. *Edward O. Otis.*

SALACETOL — salantol, $C_6H_4.OH.CO.OCH_2.COCH_3$ —is a compound of acetone and salicylic acid containing seventy-one per cent. of the latter. It occurs as fine acicular crystals or scales insoluble in cold water, slightly soluble in cold alcohol, and freely soluble in hot alcohol, ether, and chloroform. In its action it resembles salol, the analogous compound of phenol and salicylic acid, and like it separates into its components in the intestine. The dose is 1–3 gm. (gr. xv.–xlv.). *W. A. Bastedo.*

SALACTOL is a solution of the lactate and salicylate of sodium in a one-per-cent. solution of hydrogen dioxide. It is employed in diphtheria as a gargle, or applied to the throat with a brush. *W. A. Bastedo.*

SALICIN.—(*Salicinum*, U. S. P., B. P.), $C_{13}H_{18}O_7 = 285.33$. This is a neutral principle obtained from several species of *Salix* and *Populus* (Fam. *Salicaceæ*).

Salicin is easily prepared from willow bark by extracting with water, precipitating tannin, etc., with litharge, evaporating and crystallizing out the salicin, and purifying by re-solution and repetition of the process. From populin it is prepared by boiling with lime water or barium hydroxide. It can also be prepared synthetically. The following is the official description:

Colorless, or white, silky, shining crystalline needles, or a crystalline powder, odorless, and having a very bitter taste. Permanent in the air.

Soluble, at 15° C. (59° F.), in 28 parts of water, and in 30 parts of alcohol; in 0.7 part of boiling water, and in 2 parts of boiling alcohol; almost insoluble in ether or chloroform.

When heated to 198° C. (388.4° F.), salicin melts, yielding a colorless liquid which, on cooling, congeals to a crystalline mass. Upon ignition, it is consumed, leaving no residue.

Salicin is neutral to litmus paper.

On heating a small portion of salicin in a test tube until it turns brown, then adding a few cubic centimetres of water, and afterward a drop of ferric chloride T.S., a violet color will be produced.

Cold, concentrated sulphuric acid dissolves salicin with a red color; the solution, after the addition of water, becomes colorless, and deposits a dark-red powder insoluble in water or alcohol.

On heating a small portion of salicin with 1 c.c. of potassium dichromate T.S. and 2 c.c. of sulphuric acid, the odor of salicylic aldehyde (or of oil of meadow-sweet, *Spiræa ulmaria* L., Fam. *Rosaceæ*) will become noticeable.

The aqueous solution of salicin is not precipitated by tannic or picric acid, nor by mercuric potassium iodide T.S. (absence of, and difference from, *alkaloids*).

Salicin is a glucoside, yielding, upon treatment with dilute acids or a powerful galvanic current, glucose and saliretin, or saligenin. It is readily convertible into salicylic and related acids and numerous other compounds. In the system it is partly converted into salicylic acid, so that its effects are very similar to those of that substance; but, since the percentage thus changed appears inconstant, its action is very irregular. Between two and three ounces of it are recorded as having been taken with no marked effect, though far smaller amounts are often very active. Although its chemical reactions outside of the body are thus of great interest, they lend but little assistance in determining its physiological action, and its therapeutics is almost wholly empirical. As indicated above, its action is, weakly and irregularly, that of salicylic acid.

Salicin has undoubted antipyretic power, although less than is possessed by quinine or salicylic acid; its antiperiodic action is much less than that of either of them. As a remedy in rheumatism, salicin has also been obliged to yield to the more useful salicylic acid. As a tonic, in small doses, it is occasionally used, but is far inferior to gentian or quinine. Four or five grams (ʒ i. ad ʒ iss.) may be given as a dose, and repeated every three hours; as a tonic 1 or 2 dcgm. (gr. iss. ad gr. iij.) is sufficient. *Henry H. Rusby.*

SALICYLAMIDE.—A compound prepared from salicylic acid by the introduction of the amidogen radical. Its chemical formula is $C_6H_4.OH.CONH_2$. The benefit of the combined action of this stimulating radical had already been demonstrated in chloralamide, and the same advantage was looked for in salicylamide. It may be prepared by the action of concentrated ammonia upon oil of wintergreen. It forms in colorless crystals and in thin transparent plates, melting at 142° C. It is soluble in alcohol, ether, chloroform, readily soluble in hot water, and in two hundred and fifty parts of cold water.

Salicylamide was proposed as a substitute for salicylic acid and its salts, the advantage claimed for it being its greater solubility, its tastelessness, and its freedom from any depressing action on the system. A very careful study of its physiological properties has been made by Dr. W. B. Nesbitt, of Toronto (*Therapeutic Gazette*, October, 1891). He sums up the result as follows: 1. Pharmacologically, it prevents conduction in nerve; paralyzes nerve first, then muscle. 2. On the heart, its chief effect is on the motor apparatus, most probably through its activity on conduction. 3. Diminishes spinal reflex for motor impulses. 4. Diminishes spinal conductivity for painful impressions. 5. Diminishes muscular irritability. 6. In mammals, it exerts no particular effect on respiration. 7. It produces no particular effect on blood pressure. In medicinal doses it reduces temperature and causes ataxic gait and hebetude in fowls.

It is employed for all conditions in which the salicylates are indicated. The dose advised is about fifteen grains daily, in divided doses of three to five grains. *Beaumont Small.*

SALICYL-BROMANILID. See *Antinervine.*

SALICYLIC ACID AND SALICYLATES.—Salicylic acid, chemically *ortho-oxybenzoic acid*, $HC_7H_5O_3$, takes its name from the principle *salicin*, found in willow bark, from which substance it is possible to make salicylic acid by fusion with potassium hydrate. Salicylic acid in the condition of the ethereal salt, *methyl salicylate*, constitutes about ninety per cent. of oil of gaultheria (wintergreen), and occurs also in other plants. Salicylic acid can be made from oil of gaultheria, but at present almost all the acid used in medicine is made, by the process of Kolbe, from carbolic acid. The principle of this process consists in the forcing of a molecule of carbon dioxide upon the molecule of carbolic acid, an addition which just converts one molecule of the phenol into one of salicylic acid. In this process, carbolic acid and a concentrated solution of soda are first evaporated to dryness, and over the product, heated, a stream of dry carbon dioxide is made to pass. As a result, one-half of the phenol used is converted into salicylic acid in the condition of sodium salicylate, which salt, on decomposition by treatment of its aqueous solution with hydrochloric acid, yields salicylic acid under its own form. Kolbe's process, by reason of its cheapness, has practically superseded all others for the procurement of salicylic acid.

It will thus be seen that both the natural and the artificial acids are prone to impurities. Their purification, especially that of the synthetic, is a matter of much importance. Carbolic acid is the commonest and one of the most serious impurities, as are the creosotic acids (see below) frequently occurring in the artificial variety. Salicylic acid is official in the United States Pharmacopœia under the title *Acidum Salicylicum*, Salicylic Acid. It occurs in fine, light, perfectly white needle-shaped crystals, or in a white crystalline powder. A reddish tinge in a sample of the acid signifies impurity, and such a sample

should be rejected. Salicylic acid is permanent in the air; is, when pure, free from odor of carbolic acid, but has a sweetish taste, with an acrid after-flavor. It dissolves in 450 parts of cold water and in 14 parts of boiling water; in 2.4 parts of cold alcohol, and very readily in boiling alcohol. Although salicylic acid is but feebly soluble in cold water, it dissolves freely in many saline solutions. Thus the pharmacopœial *solution of ammonium acetate* will dissolve twenty-five per cent. of salicylic acid; a twelve-and-a-half-per-cent. aqueous solution of potassium acetate will dissolve twelve and a half per cent. of the acid; a twelve-and-a-half-per cent. solution of potassium citrate in equal volumes of glycerin and water will dissolve six per cent. All of these solutions possess the sharp stinging taste of the uncombined acid. A serviceable and permanent solution of the acid, and one that instead of being sharp to the taste has a pure bitter flavor only, can be made as follows: Dissolve two parts of borax in twelve of glycerin by the aid of heat; add one part of salicylic acid, continue the heat, and stir until the acid dissolves. Almost all solutions of salicylic acid, either immediately or after a while, turn of a reddish or of a smoky color, resembling that of solutions of carbolic acid.

Salicylic acid is incompatible with strong oxidizing agents, like potassium permanganate, and with chlorine, bromine, iodine, ferric salts, carbonates, the most of which it decomposes, and spirit of nitrous ether. A soft or semi-liquid mass is formed with exalgin, antipyrin, phenacetin, urethane, and other synthetics, as well as with lead acetate and sodium phosphate. The salicylates give precipitates with strong solutions of most alkaloidal salts, as well as with strong acids. Lime water also yields a precipitate.

Salicylic acid, taken into the mouth, has not much taste, proper, but speedily and quite suddenly after the tasting a sharp stinging seizes the *throat*, often severe enough to bring tears to the eyes. Similarly, a little of the dry acid snuffed up the nostrils will sting quite strongly. The acid brings sharp pain to cuts and abrasions, but, swallowed, is much less irritant to the stomach than its effects on the throat would lead to suppose. Large doses, so taken, may upset digestion and cause a strong sensation of heat, and even actual burning pain, but no serious or lasting results follow. The acid is rapidly absorbed from the stomach into the circulation, presumably in saline combination, and thereupon exerts the peculiar influence characteristic of the salicylates (see *Salicylates*, below).

Salicylic acid was at first used as an internal medicine for the procurement of the therapeutic effects of the salicylates; but now, and very properly, salicylates themselves, because of their freedom from the locally irritant action of the uncombined acid, have superseded the acid for this purpose. The present medicinal application of the acid is for local purposes as a deodorant, detergent, or so-called antiseptic—purposes which salicylic acid fulfils by reason of its having a fairly potent germ-sterilizing faculty. (See Salicylic Acid in article *Germicides*.) For general local use, the solution of the acid in a glycerin solution of borax is convenient, this solution bearing any necessary dilution with either water or alcohol without precipitation. A dilution representing a two-per-cent. solution of acid is one very commonly employed. For other salicylic preparations for local use, see Salicylic Acid in article *Antiseptics*.

Salicylates.—In saline combination, whether with metallic or ethereal bases, the local pungency of free salicylic acid disappears while yet the faculty for constitutional action remains. As already said, it is probable that the acid, when taken as an internal medicine, enters the circulation only after conversion into a salicylate, so that, as a matter of fact, what is commonly called the constitutional action of salicylic acid is, so far as we know, the action of a salicylate. The constitutional effects in question are as follows: After a full dose a non-pyrexial subject experiences, in about fifteen minutes, a moderate reddening of the face with a sense of fulness of the head, or perhaps even a pronounced headache, and a buzzing or roaring in the ears precisely similar to what occurs in cinchonism. Almost simultaneously free perspiration begins, and, according to dose, there is more or less tendency to a reduction of pulse rate, of respiration rate, and of body temperature. Tests for salicylic acid will reveal the presence of the substance in the urine, the saliva, and the sweat. The urine, furthermore, will be discolored, appearing brown by reflected and green by transmitted light, from the presence of indican or of pyrocatechin. It will also contain a something that will reduce copper salts in copper test solutions (Brunton), and will show an increased amount of urea and uric acid. In overdoses, salicylates readily irritate the kidneys, setting up albuminuria; may derange the cerebral faculties, causing hallucinations and delirium; and may dangerously or even fatally depress the functions of heart and lungs, determining collapse or death by failure of respiration. These several untoward effects occur very irregularly, and, according to Squibb, in "a very large proportion" of instances are determined, not by the salicylic acid, but by a *contaminating acid* very commonly present in market samples of salicylic acid, and hence in salicylates derived therefrom. The constitutional effects of salicylates, which are valuable in medicine, do not appear in experimentation with a subject in health. They consist, in general, in a reduction of fever temperatures, and, in particular, in an abatement of pains in fibrous tissues, notably the pains in acute articular rheumatism. The antipyretic power of salicylates is second to none, in all the three elements of quickness, degree, and duration of reduction of temperature. For a full antipyretic effect, however, considerable dosage is necessary—considerable enough to cause disagreeable sweating, *tinnitus aurium*, depression of pulse and respiration rate, and, every now and then, actual toxic symptoms. Other antipyretics, therefore, which act more kindly, are preferable, except in rheumatism. The antirheumatic faculty of salicylates is unapproached by any other known medicine, so that, as is well known, salicylates constitute a standard set of medicines for the treatment of acute rheumatism. Under salicylate medication the fever lessens, pains abate, and the disease runs a shorter as well as milder course. It is therefore particularly as remedies for rheumatism and, though not so surely, for gout that salicylates are prized in medicine.

The salicylates in *common medical use* for the purpose of salicylate medication are the salicylates, respectively, of *sodium*, *lithium*, and *methyl*. The salicylates, respectively, of *physostigmine*, *quinine*, and other alkaloids, are used for the sake of the medicinal action of the respective bases only.

Sodium Salicylate, $2NaC_7H_5O_3.H_2O$. The salt is official in the United States Pharmacopœia under the title *Sodii Salicylas*, Sodium Salicylate. It occurs as an amorphous powder, white, without odor, and having a sweetish, saline, and slightly alkaline taste. It is permanent in the air, dissolves readily in water, glycerin, and boiling alcohol. In cold alcohol it requires six parts for solution. It should be kept in well-stoppered bottles, protected from heat and light. Sodium salicylate is the most commonly used salicylate, and is a very important medicine. It is easily made *in solution* by mixing salicylic acid and a sodic carbonate in the presence of water, whereupon sodium salicylate results, and remains in solution, and carbon dioxide gas escapes in effervescence. From this solution the salt can be obtained by evaporation to dryness, carefully conducted. Extemporaneous preparation of the medicine *in solution* being easy, Squibb points out an advantage of such extemporaneous making of the salt in all cases in which the prescriber or the dispenser may not be certain of the purity of the market article. The point is that it is not possible to establish the purity of a given sample of *sodium salicylate* except by an elaborate chemical analysis, whereas a good sample of *salicylic acid* is immediately recognizable by the simple fact of its *crystalline condition*. Hence, in making one's own sodium salicylate from a selected well-crystallized sample of salicylic acid, purity is assured. And in the instance of this salt purity is important, since, as above said, there is probably good reason to lay many of the untoward effects of salicylates to the door of the contaminating acid of salicylic acid. Squibb recommends the following formula for the preparation of a solution of sodium salicylate of a strength convenient for use as a medicine: "Take of salicylic acid, well crystallized, 437 grains = 28.32 gm.; bicarbonate of sodium, 270 grains = 17.5 gm.; water, free from iron, a sufficient quantity. Put the acid into a vessel of the capacity of a pint, add 4 fluidounces = 120 c.c. of water, stir well together, and then add the bicarbonate of sodium in portions with stirring, until the whole is added and the effervescence is finished. Filter the solution, and wash the filter through with water until the filtered solution measures 6 fluidounces, or 180 c.c. This solution contains 10 grains (= 0.65 gm.) of the medicinal salicylate of sodium in each fluidrachm (= 3.75 c.c.). If made from good materials, the solution before filtration is of a pale, amber color, but as most ordinary filtering paper contains traces of iron, the filtered solution is often of a deeper tint." The proportions of the ingredients for this solution are estimated so that the solution shall be neutral, but, "owing to the varying proportions of hygrometric moisture in the materials," the neutrality may not always be absolute. According to Squibb, a well-made sample of sodium salicylate, prepared by use of a well-crystallized sample of acid, is always, when evaporated to dryness, *white*, and is free from all *odor of carbolic acid*, unless it has been shut up for a long while in a bottle. Even then, however, the odor should be but very faint—only perceptible on close examination, and should disappear upon exposure of the sample to air. *Solutions* of sodium salicylate of good quality should have none of the carbolic-acid smell.

Sodium salicylate is used almost exclusively as an internal medicine, being commonly held to be lacking in the germ-sterilizing faculty which gives salicylic acid, as such, its applicability as a local antiseptic. For the purposes of internal salicylate medication, as set forth above, the salt is thoroughly effective, and, if made from a well-crystallized and therefore fairly pure sample of salicylic acid, rarely produces untoward effects in reasonable doses. So large a quantity as 5 gm. (about seventy-seven grains) has been given at a single dose in rheumatism without producing serious derangement, but the ordinary dosage for an antipyretic or antirheumatic effect does not exceed 1.3 gm. (20 grains) repeated every two hours, for three or four doses, or until a distinct impression is produced, followed by doses of half the quantity every hour or two thereafter, so long as the influence of the medicine may be required. The medicine is readily enough taken in simple aqueous solution, but if the faint, mawkish taste of the salt be objectionable, the addition of twenty per cent. of glycerin and the flavoring with a drop or two of oil of gaultheria will render the mixture perfectly palatable.

Lithium Salicylate, $2LiC_7H_5O_3.H_2O$. The salt is official in the United States Pharmacopœia under the title *Lithii Salicylas*, Lithium Salicylate. It occurs as a whitish powder which deliquesces on exposure to the air. It dissolves freely in water and alcohol, and resembles the sodium salt in taste. It should be kept in well-stoppered bottles. The effects of this salt are similar to those of sodium salicylate, with the possible superaddition of medicinal virtues, in rheumatic or gouty cases, derived from the basic element. The dose is similar to that of the sodic salt.

Methyl Salicylate, $CH_3C_7H_5O_3$. This salicylate is an ethereal body which constitutes nine-tenths of the substance of oil of wintergreen and practically the whole of the volatile oil of betula, both of which oils are themselves official medicines. Under the title, however, *Methyl Salicylas*, Methyl Salicylate, the United States Pharmacopœia recognizes the salicylate as made in the laboratory by distilling salicylic acid or a salicylate with methylic alcohol and sulphuric acid. Methyl salicylate is a colorless or slightly yellowish liquid, with the characteristic odor and taste of oil of wintergreen. It dissolves freely in alcohol. It should be kept in well-stoppered bottles protected from light. Methyl salicylate acts like the salicylates generally, with the usual pungent qualities of the volatile oils. In large doses—half an ounce or more—it is dangerously and even fatally poisonous, causing intense irritation of the stomach and intestines with constitutional symptoms of the salicylic influence. In doses of from five to fifteen minims it makes a very efficient salicylic medicine for rheumatism, and is, with many, the favorite salicylate. It may be administered in emulsion or in capsules.

Sodium Dithio-salicylate. Dithio-salicylic acid is a product of reaction between salicylic acid and sulphur chloride, under the influence of heat. The sodium salt of this product is a grayish-white, very hygroscopic powder, freely soluble in water. It has been proposed as a substitute for ordinary salicylates, on the score of being equally, if not more, potent as an antirheumatic remedy, while it is less apt to disturb the stomach. About 0.2 gm. (gr. iij.) may be given two or three times a day, or oftener, according to indications. It is not official in the United States Pharmacopœia.

Iodo-salicylic Acid is a modification of salicylic acid that has been used as a substitute for the ordinary acid in acute rheumatism. It occurs as a white powder slightly soluble in water, but freely so in alcohol, ether, and the fixed oils. It may be given in quantities of from 1 to 3 gm. (gr. xv. to gr. xlvi.) a day.

Cresotic Acid, *Cresotinic Acid.*—This is an homologue of salicylic acid to which it is allied in physical, chemical, and physiological properties. Its formula is $C_6H_3OHCH_3COOH$. There are three isomeric acids, the ortho-, meta-, and paracresotic acids. They are always present in salicylic acid of commerce. In 1890 (*Phar. Jour. and Trans.*, November 22d) Professors Charteris and Dunstan, of Glasgow, pointed out that the ill effects that often followed the employment of salicylic acid were due to the presence of ortho- and paracresotic acids. These statements were described more in detail in a second paper in the *British Medical Journal*, March 25th, 1901.

The only preparation of this acid that has been employed for therapeutic purposes is the paracresotate of sodium. It posseess antipyretic and antirheumatic properties similar to those possessed by salicylate of soda, but in a lesser degree. The dose is from five to twenty grains three or four times a day; it is free from toxic action, and may be administered more freely if necessary. *Edward Curtis.*

SALICYLIC ALDEHYDE, salicylous acid, ortho-oxybenzaldehyde, artificial oil of spiræa, $C_6H_4.OH.COH$, is obtained by heating phenol and sodium hydroxide with chloroform. A colorless fluid with the odor of meadow-sweet, it is readily soluble in alcohol and chloroform, but in water is soluble only enough to impart its odor. In dose of 0.1–0.5 gm. (gr. iss.–viiss.), it is employed as a diuretic and intestinal antiseptic. *W. A. Bastedo.*

SALICYLIDEN-PHENETIDIN. See *Malakin.*

SALICYLO-ACETIC ACID. See *Aspirin.*

SALICYL-QUININE. See *Saloquinine.*

SALICYL-QUININE SALICYLATE. See *Rheumatin.*

SALICYL-RESORCIN-KETONE, tri-oxy-benzophenone, is a compound which in the intestine sets free salicylic acid and resorcin. It is used externally in skin diseases, and internally as an intestinal antiseptic. Dose, 3–4 gm. (gr. xlv.–lx.). *W. A. Bastedo.*

SALICYL-SULPHONIC ACID.—$C_6H_3(OH)(SO_3H)$-$COOH$. A white crystalline body, very soluble in water and alcohol. It is formed by the action of sulphuric anhydride on salicylic acid.