

majority of the fibres which had joined previously by way of the chorda tympani, and this branch, which consists of a number of strands lying close together, contains most of the secreto- and vaso-motor fibres for the submaxillary and sublingual glands. These strands, often wrongly called the chorda tympani nerve, curve backward along the gland ducts and pass with them into the glands.

The cranial fibres for the parotid gland vary in their course in different animals, but frequently they arise from the ninth cranial nerve and course in the nerve of Jacobson, across the tympanic cavity, over the promontory of the tympanum, and pass via the small superficial petrosal and otic ganglion to the auriculo-temporal branch of the fifth, by which they are finally distributed to the parotid gland.

The sympathetic fibres to the salivary glands arise from the spinal cord in the upper dorsal region and run to the superior cervical ganglion, where a relay of nerve cells is interposed, round which the original fibres arising from the spinal cord end in arborizations. From the nerve cells of the superior cervical ganglion other fibres arise, chiefly from the lower and middle portion, and, passing to the external carotid, form plexuses upon it and its branches by which the fibres are ultimately carried to the gland without forming any more nerve-cell connections.

A similar cell station has been demonstrated in the case of the chorda tympani fibres, as lying in the many small ganglia between the point at which the fibres leave the lingual nerve and the various points at which the fibres enter the glands.

These ganglia are as a rule microscopic in size, but two can be seen with the naked eye and have been named, viz., the *sublingual*, lying in the angle between lingual and chorda, which is a cell station for fibres passing to the sublingual; and the *submaxillary*, which lies in the hilus of the submaxillary, and forms a cell station on the path of many of the fibres for that gland.

The position of these various cell stations has been demonstrated by Langley by the injection of small doses of nicotine, which paralyzes the junction between nerve fibre and nerve cell, but does not affect the nerve fibres. Hence the position of a nerve station is shown after injection of this drug into a vein, if no effect is now obtained on stimulating centrally to a ganglion, while an effect is still obtainable peripherally to the ganglion, previous experiment before injection of the drug having given an effect at both places.

Experimenting by this method, Langley has shown that every fibre leaving the spinal cord, whether by cranial nerve or sympathetic, ends somewhere on its course in a peripheral ganglion. Such a fibre is termed a pre-ganglionic fibre. From the peripheral ganglion cell a fibre arises which is termed a postganglionic fibre, and this without further interruption passes to distribution in the gland. There is hence in every case one ganglion cell and no more interposed between spinal cord and gland. The pre-ganglionic fibres are in most cases finely medullated (2 to 4 μ), while the postganglionic fibres are probably all non-medullated.

The effect of stimulation upon the nerves has been most closely studied in the case of the submaxillary nerve, but similar results have been obtained by stimulation of the corresponding nerves in the other glands, so that a description of the occurrences in the case of the submaxillary may be taken to hold for the other two glands. Excitation of the peripheral end of the cranial nerve (chorda tympani) causes, after a very short latent period, a rapid flow of a very dilute saliva, containing a very low percentage of organic constituents. Even weak stimulation produces a copious flow, and secretion can be evoked in this manner for a long period without fatiguing the nerve, so that a quantity amounting to forty or fifty times the weight of the gland can be obtained.

Accompanying this rapid secretion there is a marked vaso-dilatation, so that the gland can be seen to become much pinker to the naked eye, and when placed in a plethysmograph shows a large increase in volume.

That the increased flow of saliva is not, however, solely

due to an increased blood supply is demonstrated by the following facts:

1. After administration of atropine, the flow of saliva is no longer obtained, although the vaso-dilatation is as great as before, showing that atropine paralyzes secreto-motor fibres but leaves the vaso-dilators untouched.

2. If the cannula placed in the duct of the salivary gland be connected up to a mercurial manometer, and at the same time the carotid blood pressure be similarly observed by means of a second manometer, it is found that the flow of saliva does not stop until the pressure in the salivary manometer has risen considerably higher than that in the carotid. Now, if the secretion were merely an increased filtration due to increased blood supply, this obviously could not be so, for then the saliva would be filtering from a lower to a higher pressure.

These experiments are sufficient to show that a true secretion is taking place in the alveolar cells, under the stimulating influence of a secreto-motor nervous mechanism distinct from the vaso-dilator mechanism.

The effects of stimulation of the cervical sympathetic upon the gland are very different; there is a vaso-constrictor instead of a vaso-dilator effect, and, after a much longer latent period, there is but a scanty flow of a very viscid saliva much richer in organic constituents.

The amount of flow caused by stimulation of the cervical sympathetic is considerably increased if the cranial nerve has been stimulated a few seconds previously.

Now in the natural stimulation of the gland, as by the sight or thought of food, or by the act of mastication, it is a fairly obvious conclusion that both cranial and sympathetic nerve supplies act upon the gland simultaneously, and hence that there will be conjoined the greater flow of water and inorganic salts caused by the cranial nerve fibres, with the stimulation to increased flow of organic substances effected through the cervical sympathetic fibres.

No saliva flows between periods of stimulation, and it has been observed by inserting a cannula into the duct of Stenson in the horse that a flow of saliva occurs only when it is provoked reflexly, as by mastication.

Cutting the cranial nerve gives rise to the so-called "paralytic secretion," first observed by Claude Bernard; this commences commonly in from two to three days after the section, and lasts for a period of three or four weeks, during which time there is a constant slow secretion accompanied by a great decrease in weight of the gland, which finally becomes functionless. No permanent effect of a like nature follows section of the cervical sympathetic.

It is interesting that a much slighter flow accompanies the paralytic secretion, upon the opposite side where the nerves are quite intact; this peculiar secretion is spoken of as "antilytic secretion."

There is no explanation of either paralytic or antilytic secretion, outside the region of mere hypothesis.

The mouth is probably kept moist in man between the periods of eating by the secretion of the small buccal glands, for it has been shown that the secretion of the large glands completely intermits between the meals in cases of artificial fistulae of the gland ducts.

In man, the sight or even the thought of appetizing food causes an immediate flow; but secretion cannot be evoked in this fashion in some of the lower animals. Thus presenting meat to a dog in which a parotid fistula has been established does not cause a flow of saliva.

Sapid substances are the most powerful reflex stimulants to secretion when placed either on the tongue or on the mucous membrane of the mouth.

The vapors of chloroform and ether cause a rapid secretion when inhaled by the mouth, as a result of the stimulation of the gustatory nerve endings; when administered by the trachea, they are said not to produce this effect.

Alcohol, or water containing chloroform or ether, applied to the mucous membrane of the mouth, causes a rapid secretion.

The sapid substances produce their effect in the follow-

ing descending order of strength: (1) acids, (2) neutral and alkaline salts, (3) bitter substances, (4) sweet substances; but the acids (including organic acids) are incomparably more effectual in evoking secretion than the other classes of sapid bodies.

Chemical Composition.—The composition of the mixed saliva is very variable, as can readily be understood when it is considered how many glands contribute to its formation. Sublingual saliva is richest in solids, and may contain as much as three per cent.; submaxillary saliva is stated by most observers to contain a higher percentage of solids than the mixed saliva, while parotid saliva is poorest in solid constituents (0.3 to 0.5 per cent.). The total solids of mixed saliva amount to from 0.5 to 1 per cent., and the specific gravity lies between 1.002 and 1.008.

Mixed human saliva is alkaline to litmus and acid to phenolphthalein, indicating that there is an excess of carbon dioxide present above that necessary to form sodium bicarbonate. This is borne out by the large amount of carbon dioxide obtainable from saliva, which contains more of this gas than either blood serum or venous blood. Thus Kütz found in saliva 66.7 volumes of CO₂ per 100, and Pflüger 64.7 to 85.1 volumes per 100. This fact is of interest as showing the large amount of metabolism which occurs in the secreting cells, and lends a further proof, if such were necessary, that the process of secretion is not purely one of filtration and osmosis. The average amount of alkalinity to litmus is equivalent to that of a solution of 0.08 per cent. of Na₂CO₃ (Chittenden and Ely).

The organic matter of the saliva is small in total amount, and is present partially in suspension as formed elements and partially in solution.

The formed elements present include squamous cells from the buccal epithelium, salivary corpuscles, and very pale spherules resembling the granules seen in the mucous salivary cells.

The salivary corpuscles are altered leucocytes derived chiefly from the salivary glands, but possibly the tonsils also contribute to their number. The leucocytes pass from the lymph, between the alveolar cells, into the ductules, and become swollen out by imbibition from the saliva, which has a lower osmotic pressure than the lymph. For the same reason the granules which these corpuscles contain are set in active Brownian movement.

The chief organic substances in solution are mucin, ptyalin, and minute traces of proteid. The mucin can be demonstrated by its precipitation on the addition of acetic acid. The presence and action of ptyalin have been considered in the article on *Digestion*. Coagulable proteid is present only in minute traces. Urea is said to be excreted in the saliva in uræmia, and lactic acid in diabetes.

Saliva normally gives a distinct reaction for sulphocyanides when a very dilute solution of ferric chloride is added to it. The test is best carried out by wetting filter paper with ferric chloride so dilute as scarcely to color it, and then adding the saliva, when a red color is obtained. Sulphocyanates are, however, absent in certain individuals, and in the same individual are present at certain times and absent at others.

The inorganic salts present consist chiefly of chlorides, phosphates, and carbonates of the alkalies and alkaline earths, the chief constituent as usual being sodium chloride. The most interesting of the inorganic constituents is calcium bicarbonate; it is this salt which gives rise to the cloudiness observed when saliva is allowed to stand for some time. The precipitation is due to the escape of the excess of carbon dioxide, which had previously held the calcium carbonate in solution. A certain amount of calcium phosphate is similarly precipitated. Such a precipitation occasionally leads to occlusion of the gland ducts by the formation in these of salivary concretions, which consist of a mixture of calcium carbonate and calcium phosphate. When the precipitation occurs on the teeth it is termed tartar; this also contains silica in addition to the calcium salts mentioned above.

Benjamin Moore.

SALIVARY GLANDS AND THEIR DUCTS, DISEASES OF.—*Increased Secretion of the Salivary Glands* (Ptyalism; Salivation).—The normal amount of salivary secretion is from one to three quarts in twenty-four hours, though under exceptional conditions the quantity may be as much as five quarts. While food is being taken the saliva is normally greatly increased, which may also occur during the menstrual period and during gestation. Salivation, likewise, occurs in connection with quite a number of different diseases, such as acute fevers, diseases of the liver, spleen, genital organs, and pancreas, and in all inflammatory conditions of the oral cavity. It is likewise sometimes seen in bulbar paralysis, in diabetes, and in melancholia. Quite a number of drugs are also capable of giving rise to an increased salivary secretion, among which are muscarin, tobacco, pilocarpine, potassium iodide, the salts of arsenic and copper, and mercury and its various compounds. Of all the causes the last mentioned is the one that most frequently occasions the condition, and it is true that the amount necessary to produce this result varies very greatly in different instances—some individuals tolerating large quantities of the drug, while others are affected by very minute doses.

(For the treatment see article on *Mouth, Diseases of*, in THE APPENDIX.)

Decreased Secretion of the Salivary Glands (Xerostomia; Dry Mouth).—The secretions of the salivary and buccal glands may be greatly diminished, or, in some instances, entirely suppressed. The condition is most commonly observed in nervous women, though it is occasionally seen in men as well; it may follow shock or may occur in connection with diabetes and febrile states. As a natural consequence of the arrest of the secretion the tongue and mucous membranes of the cheeks and palate become dry, and mastication and articulation are exceedingly difficult. Osler speaks of a case observed by him in which, on account of the absence of the normal secretion of the mouth, food collected along the gums and became exceedingly hard, presenting somewhat the appearance of a new growth in the oral cavity of the patient; in this instance the affection was cured in about three weeks by the application of the galvanic current.

Treatment. For dry mouth pilocarpine may be used, and, as in the case above cited, electricity may be employed with advantage. Oils applied to the mucous membrane of the mouth are of service in ameliorating the very disagreeable dry state of the oral mucous membrane. The condition is very obstinate.

INFLAMMATION OF THE SALIVARY GLANDS.—There are several distinct and separate varieties of inflammations of the salivary glands at present recognized, and there can be no question but that, as our knowledge increases, many conditions which are at present regarded as being identical will be found to be the result of causes differing widely from each other. There are specific parotitis (see *Mumps*), symptomatic parotitis, and chronic parotitis.

Symptomatic Parotitis.—Symptomatic parotitis is an affection that occurs in connection with a large number of different diseases, though the relationship between inflammations of the glands and the causes that apparently determine them are exceedingly obscure. The condition occurs most commonly during the course of the infectious fevers, such as typhoid, typhus, scarlet fever, rheumatism, pneumonia, peritonitis, pyæmia, septicæmia, and syphilis, but it is also sometimes seen in connection with consumption and gout. When the affection results from acute fevers, the inflammatory phenomena are quite severe, and, as a rule, suppuration results. If the pus be not evacuated by surgical means, it not uncommonly burrows into the tissues of the face to a considerable distance. Inflammations of these glands likewise very curiously often follow laparotomy, and operations upon the genital organs in both men and women. It has also been found associated with facial paralysis, and may occur during pregnancy or follow menstruation.

Treatment. Ice-bags should be applied in the beginning to relieve the pain, or leeches may be employed for the same purpose. Belladonna ointments are of some service during the acute inflammatory stages. When it is found that suppuration is likely to supervene, poultices should be applied, and at the first indication of supuration the glands should be incised and the pus evacuated.

Chronic Parotitis.—Chronic parotitis, for clinical purposes, may be divided into two varieties: (a) the chronic inflammation of one or more of the glands, with or without history of previous acute disease, and (b) the curious inflammatory condition in all of the salivary and lachrymal glands first described by Mikulicz.

(a) **Chronic Parotitis with or without Previous Acute Inflammations of the Glands.**—This affection is occasionally observed as a sequel of mumps, and may follow inflammatory conditions occurring in the throat. It has been observed in secondary and tertiary syphilis, in Bright's disease, and as a complication of chronic tuberculosis of the lungs. Some years ago the writer described a case of this kind that occurred in connection with chronic inflammatory changes in the pancreas, in a man suffering from diabetes. The affection may be the result of lead or mercurial poisoning.

Treatment. Except the condition be of syphilitic origin—in which case mercury and iodide of potassium should be employed—we know of no drugs that affect the course of this disease.

(b) **Chronic Symmetrical Inflammation of the Salivary and Lachrymal Glands.**—Since the publication of the paper of Mikulicz, Kummel has reported a number of instances of this disease, and in this country Osler has recently recorded a very interesting example of the affection. Nothing is known concerning the causation of this malady, but in Osler's case the patient had probably suffered from tertiary syphilis, and the enlargement of the glands gradually subsided under the use of mercury and iodide of potassium. Kummel found that the salivary glands are completely replaced by mononuclear leucocytes, and suggests the name of achrocytosis. Osler's patient died later of tuberculosis, and at the autopsy the lachrymal glands were found to be represented by masses of fibrous tissue. Though all of the glands are usually involved, in some instances this is not the case. The swollen glands are painless and the disease generally persists for a number of years. It is of interest to note that it has in some instances rapidly subsided following acute fevers.

Treatment. In cases in which the disease is secondary to syphilis the appropriate treatment for the latter affection would, of course, be called for, and even in instances in which there is no history of this disease it would be wise to give the patient the benefit of the doubt and to test thoroughly mercury and iodide of potassium. Should these remedies fail, it is not likely that other means would be efficient.

TUMORS OF THE SALIVARY GLANDS.—Carcinoma, sarcoma, adenoma, fibroma, fibro-adenoma, chondroma, myoma, and lymphoma occasionally occur in these glands, though none of them are common. Of these tumors fibro-adenoma is perhaps the most frequent. The malignant neoplasms found in the glands generally belong to the epithelial type. In all instances in which the tumors show evidence of malignancy they should be immediately removed.

DISEASES OF THE DUCTS OF THE GLANDS.—*Calculi*, consisting of carbonate and phosphate of calcium, are occasionally formed in the ducts of the salivary glands, and either they may be discharged or they may lodge in some part of the ducts; they sometimes occasion a retention of the secretions of the glands. Under these circumstances an operation should, of course, be resorted to to relieve the condition. Occasionally the ducts become dilated in glass-blowers and in musicians; when this occurs, the distended ducts present the appearance of a tumor, and contain air which may be mixed with saliva and pus.

Henry Fauntleroy Harris.

SALIX.—*Willow. Saule blanc, Fr. Cod.*—When it was official, this drug was defined by the United States Pharmacopœia as "the bark of *Salix alba* L. and of other species of *Salix* (fam. *Salicaceae*)." Salicinum now entirely replaces it in the Pharmacopœia. The species named is the common *European white willow*, now quite extensively naturalized in North America. It is a large tree with, when old, a very thick, irregular trunk, dividing near the ground into several great limbs; branches numerous, ascending, rather densely massed; twigs slender, lightly attached to the branches, possessing a light-yellow or greenish-yellow bark and white soft wood; young shoots,



FIG. 4140.—*Salix alba*. A, Staminate; B, pistillate.

buds and the under surface of the leaves silky; leaves numerous, alternate, with small lance-ovate stipules and short petioles; the blades two to four inches long and about half an inch wide, lanceolate, acute, whitish beneath, finely serrate; flowers dioecious, in slender weak spikes, each in the axil of a small bract, appearing in early spring. Only the bark of the younger branches should be collected.

Willow bark is "in fragments or quills, from one-twentieth to one-twelfth of an inch (1 to 2 mm.) thick, smooth; outer surface somewhat glossy, brownish or yellowish, more or less finely warty; under the corky layer green; inner surface brownish-white, smooth, the fibres separating in thin layers; inodorous; bitter, and astringent.

CONSTITUENTS.—Besides ordinary plant constituents, willow contains the following three glucosides: *tannin*, about ten per cent.; *salicin* (which see), about two per cent.; *helicin* (C₁₂H₁₆O₇ + ½H₂O). The properties and uses of the drug depend almost wholly upon the salicin contained, and our article on the latter substance should be consulted. As an antiperiodic, the bark is employed in doses of an ounce or more, in the form of fluid extract, or, as is more common in domestic practice, a decoction or infusion. It is often used as a tonic in doses of about one-fifth or less of this amount, the powdered bark being often used for this purpose; also as an intestinal astringent. Salix has sometimes produced good results as an anthelmintic. The powdered bark was formerly considerably employed as a vulnerary, salicylic acid having

now entirely replaced it for this purpose in medical practice.

ALLIED DRUGS.—The genus *Salix* contains about one hundred and sixty species, many of which have been employed like *S. alba*. The plants fall naturally into two classes, the one characterized by the yellow, the other by the purple color of their young shoots. The latter are said to contain more salicin, sometimes above three per cent., the former more tannin.

Populus L. is the botanical name of the Poplars, Popples, Cottonwoods or Aspens, a number of which, both European and American, are used, in the form of their barks and leaves, as willow bark is used. These drugs contain the same constituent as the willows, besides the closely allied glucoside *populin* or *benzoyl-salicin*.

The buds of *P. balsamifera* L. and *P. canadensis* Ait. are known as balm of Gilead buds. Their scales are thickly coated with a very pleasant balsamic scented oleoresin, which possesses mild aromatic, diuretic, expectorant, and vulnerary properties.

Henry H. Rusby.

SALOL—C₉H₈C₇H₅O₃. Salol is the name given to the salicylic ether of phenol (carbolic acid). It is compounded of salicylic acid and phenol and represents sixty per cent. of the former substance and forty per cent. of the latter. It is official in the United States Pharmacopœia under the title *Salol*, Salol. Salol is a white crystalline powder, melting at 43° C. (109.4° F.) into a colorless, oily fluid. It is nearly insoluble in water, but dissolves in alcohol, ether, and fixed oils. From its insolubility in aqueous fluids it is practically tasteless in powder, but it has a faint aromatic smell.

Salol is used as a substitute for the common salicylate salts, on the grounds that it is equally effective as a medicine, while at the same time, in medicinal doses, it is much less deranging to digestion on the one hand, and less productive of constitutional toxic effects on the other. It is insoluble in the fluids present in the stomach—whence the lack of gastric derangement in its employment—but suffers solution by chemical decomposition in the small intestine through the action of the pancreatic juice, resolving into salicylic acid and carbolic acid (phenol). Constitutionally, salol, in ordinary dosage, has produced little disturbance beyond an occasional and trifling ringing in the ears. In experimenting, however, with a dosage exceeding 6 gm. (about a drachm and a half) distributed over the twenty-four hours, toxic symptoms have been observed, as might be expected, considering that the medicine is nearly one-half carbolic acid. Salol, taken internally, imparts to the urine of the subject the peculiar coloration seen after ingestion of carbolic acid, a phenomenon that may persist for several days after discontinuance of the medicine. The average medicinal dose of salol for an antirheumatic or antipyretic effect is from 0.6 to 1 gm. (gr. x. to xv.), given twice, or thrice, daily. A dosage reaching 8 gm. (about two drachms), in the course of a day, was followed, in one instance, by severe vomiting, gastralgia, and tinnitus. Salol may be taken dry upon the tongue, in powder, the dose to be washed down with a little water, or may conveniently be administered in pill form.

Because of the fact that salol only gradually suffers resolution into its constituents, the substance makes a useful intestinal disinfectant in diarrhea or typhoid fever.

Salol should not be given when there is any disease of the kidneys, because of the carbolic acid of its constitution.

Edward Curtis.

SALOL-CAMPHOR.—These two substances, when mixed in certain proportions, alter their physical state and become an oily, colorless liquid, insoluble in water, freely soluble in ether, chloroform, and oils. It is prepared by adding twenty parts, by weight, of powdered camphor to thirty parts of salol, and warming gently until fusion is complete.

It possesses the properties of its constituents, and is highly recommended as a stimulating antiseptic.

Beaumont Small.

SALOPHEN.—(*Acetyl-para-amido-salol*.) A patented compound which is, chemically, salol in which one atom of hydrogen in the phenyl group is replaced by the monivalent group N₂H(CH₃O). It occurs in minute, white, crystalline plates, insoluble in cold water, very slightly soluble in hot water, soluble in alcohol and ether. Alkalies render it soluble, even in cold water. It is without taste or odor, and is neutral in reaction. Salicylic acid is present to the extent of fifty-one per cent. The acid secretion of the stomach has no effect upon it, but when it comes in contact with the pancreatic ferments it is decomposed into salicylic acid and acetyl-para-amido-phenol. The object in view in the production of this compound was to improve upon salol by combining with the salicylic acid a phenol compound which was perfectly harmless.

It is recommended as a remedy for acute articular rheumatism in doses of sixty to seventy-five grains during the day, the usual dose being fifteen grains every three or four hours. It does not disagree with the stomach nor produce any toxic symptoms. Relapses and the ordinary complications are not prevented. Salophen has proved serviceable in neuralgia, sciatica, and other painful affections of the nerves. Reports of its favorable use in severe attacks of pruritus have been published. It has also been used with success in influenza.

Beaumont Small.

SALOQUININE, the quinine ester of salicylic acid, C₂₀H₂₁OH.CO.O.C₂₀H₂₁N₂O, is a mild substitute for quinine with added analgesic properties. Its advantages, as stated by Overlach, are that it has no disturbing effect upon the digestive or urinary organs or the nervous system, does not produce cinchonism, and is tasteless. He employed it in sciatica in 2 gm. (gr. xxx.) doses with good effect. Tauszk has used it in supraorbital neuralgia, influenza, the pains of locomotor ataxia, muscular rheumatism, acute articular rheumatism, and typhoid fever. He recommends it as an efficient antineuralgic with mild antipyretic action. In doses of 0.5-3 gm. (gr. viij.-xlv.) daily, no vertigo or tinnitus was complained of, though in some cases mild sweating was observed.

Fitch, Sternberg, and von Kolozsvary speak highly of its use in malaria, large doses 0.3-1.3 gm. (gr. v.-xx.), being administered several times a day. Being free from taste it is easily taken by children.

The salicylate of saloquinine is "rheumatin."

W. A. Bastedo.

SALSOMAGGIORE, ITALY.—This new cure resort is pleasantly situated in Northern Italy, Lat. 44° 48' N., Long. 27° 38' E., two hours' ride by rail south from Milan. It lies in the valley of the Po, surrounded by low hills covered with the vine, maize, and mulberry trees. To the south rises the Apennine range.

The village itself is picturesquely situated at an elevation of about 500 feet, and contains 1,200 inhabitants. It is said to be unusually healthy, and is well supplied with good drinking-water.

The climate is temperate, the heat being never unduly excessive, and the sun is hidden by the hills before five o'clock in the summer.

The country round about is very attractive and affords many interesting excursions either by road or by rail. From here Bologna, Parma, Modena, and other spots of interest are readily reached by rail.

The accommodation is excellent, there having been opened in 1900 "The Grand Hotel des Thermes," with three hundred rooms and fitted with all modern equipments in the way of sanitation and comfort. There are music, billiard, and reading-rooms, elevators and electric lighting, and the baths can be taken in the hotel itself, each floor being provided with special bathrooms.

for that purpose. The charges are not excessive. The season extends from April 1st to November, although July and August are the least desirable months in which to visit the spa.

Salsomaggiore is one of the two best-known spas in Italy, the other being Bagni di Lucca. The waters are what are known as muriated iodobromine, locally called "salso-iodic," and are furnished by numerous artesian wells. Their natural temperature is 57.2° F. For the "cure" either the "salso-iodic" or the mother water, made by extracting the salt by evaporation, is employed. The analysis of the water is as follows:

IN 1 KGM. OF WATER FROM SALSOMAGGIORE THERE IS:

	Gm.		Gm.
Potassium chloride....	0.000	Aluminum chloride....	0.0500
Sodium chloride.....	153.990	Magnesium chloride....	.0057
Lithium chloride.....	.735	Magnesium bromide....	.3037
Ammonium chloride....	.637	Iodide of magnesium...	.0663
Calcium chloride.....	15.848	Borate of magnesium...	.0116
Strontium chloride....	.256	Bicarbonate of iron...	.0778
Magnesium chloride...	5.584	Sulphate of strontium...	.0033
Iron chloride.....	.063	Silicate.....	.0230

Hot baths, mud baths, and inhalations are used in the treatment, which occupies from two to three weeks. The temperature of the baths is from 95° to 98.6° F., and the also-iodic water is generally employed, although also-iodic water mixed with the mother water can also be used. The duration of the baths is from fifteen to sixty minutes, and after the bath the patient goes to bed and rests. It is recommended that the cure be repeated again during the year, and followed up for two or three years. An after-cure in the mountains is advised.

There is an inhalation hall where this method of treatment is pursued for various affections of the respiratory tract, such as bronchitis, pharyngitis, laryngitis, etc.; for chronic eye affections, such as conjunctivitis, iritis, and keratitis; and for certain skin diseases. The diseases for which the baths are recommended are chronic rheumatism and gout; various gynecological affections, such as metritis, salpingitis, ovaritis, perimetritis, and sterility; anaemia; convalescence from protracted illness; infantile rachitis; neurasthenia; bone and joint tuberculosis; tertiary syphilis, and some forms of neuralgia and neuritis. Massage and Swedish gymnastics, electricity, and various forms of douches are also employed. The mud baths, which are given in conjunction with and apart from the baths, are used especially for rheumatoid arthritis. The mud obtained from the deposit of the tanks at the well (rich in salt, iodine, bromine, lithium, and petroleum), is applied to the affected parts as hot as can be borne, and is left on for about twenty minutes. It is then removed and generally followed by a bath of medicated water.

Besides the arrangements for baths in the "Grand Hotel," there are bathhouses (*stabilimenti*) where every precaution is taken as regards cleanliness, sanitation, and

disinfection. All laundry linen is carefully disinfected and sterilized after being used.

Salsomaggiore can be reached from London in about thirty hours. In going from Milan to Florence one alights at Borgo San Domino, and takes a half-hour's ride in a branch train to Salsomaggiore.

For a charming description of the excursions about this spa, one is referred to "Salsomaggiore and Its Surroundings," by Lady Colin Campbell.

Edward O. Otis.

SALT LAKE CITY, UTAH.—This city and the great region of the Salt Lake basin deserve consideration as a health resort of no mean degree, particularly as a place of residence for the consumptive. This basin of a former great inland sea, a huge remnant of which is the existing Salt Lake, has an average elevation of 4,300 feet, and is bounded on the east by a range of mountains and on the west and south by a desert. It is, then, a plateau of moderate elevation fed by the pure air from the mountains and the desert, and possessing a "maritime" quality from the presence of such a large body of salt water as the great Salt Lake, which covers an area of 2,360 square miles. Such an elevation, moreover, gives the peculiar climatic conditions incident to height above sea-level. The air is pure, cool, and dry; the sensible temperature is not oppressive, on account of the dryness of the atmosphere; the rainfall is small; high winds are absent, and the sunshine is abundant. Further, the softness of the air is a striking feature, very evident to one who first sets foot in this region, and giving a delightful sense of restfulness. The principal place of importance and resort is Salt Lake City, latitude 40° 45' N., longitude 111° 50' W., containing 53,531 inhabitants, and located 4,348 feet above sea-level. The city occupies an extensive area, is well built and attractive, with wide and well-shaded streets, and possesses an efficient sanitary system and excellent water works. The accommodations are good, there being several modern hotels. The soil is adobe. Irrigation is used, the water being carried in ditches along the sides of the streets.

"Salt Lake City," says Solly ("Medical Climatology"), "is one of the three Western cities of good size possible for the residence of those to whom a sunny climate is necessary and who desire to settle in an active business centre. The other two large cities are Denver, which shares with Salt Lake City the advantage of altitude, and Los Angeles, which is equally sunny but exposed to ocean influence."

At the Salt Lake Hot Springs Sanatorium sulphur and salt baths can be taken; and on the border of the lake, thirteen miles distant, reached by train, is the Salt Air Bathing Resort, well appointed, with nearly one thousand bathrooms. Here one can enjoy the strange experience of bathing in water containing nineteen per cent. of salt, and so buoyant that one can float in it with a

CLIMATE OF SALT LAKE CITY. LATITUDE, 40° 45' N.; 111° 50' W. ELEVATION, 4,348 FEET. PERIOD OF OBSERVATION, TEN TO SIXTEEN YEARS.

	January.	March.	May.	July.	September.	November.	Spring.	Summer.	Autumn.	Winter.	Year.
Temperature, Degrees Fahr.—											
Average monthly temperature.....	29.0°	49.0°	57.5°	75.4°	64.3°	38.6°	49.5°	71.5°	51.3°	31.0°	51.3°
Mean of warmest.....	35.7	50.6	69.3	88.0	75.4	46.2	59.5	85.3	60.9	38.5	61.0
Mean of coldest.....	20.7	32.2	47.3	63.3	52.4	28.3	39.6	60.8	39.0	24.0	41.2
Average daily range.....	15.0	18.4	22.0	27.7	23.0	17.9	19.9	24.5	21.9	14.2	19.5
Highest or maximum.....	48.8	63.9	83.3	95.0	87.5	61.4	72.9	94.7	74.9	50.4	
Lowest or minimum.....	-6.1	21.6	35.6	51.6	53.1	18.8	28.9	49.2	30.0	0.2	
Humidity—											
Average relative.....	61%	52%	45%	37%	37%	47%	49%	37%	43%	61%	48%
Precipitation—											
Average in inches.....	1.49	1.74	2.06	.53	.36	1.40	6.36	2.16	3.82	4.39	16.73
Wind—											
Prevailing direction.....	S. E.	S. E.	N. W.	N. W.	N. W.	N. W.	N. W.	N. W.	N. W.	S. E.	N. W.
Average hourly velocity.....	4.07	5.6	6.2	5.6	5.4	4.0	5.8	4.9	4.1	4.1	5.3
Weather—											
Average number of clear and fair days.....	19.8	20.5	23.7	28.3	27.3	21.5	64.4	83.3	73.2	56.3	277.2

considerable portion of his body out of water. The lake is very shallow for a long distance from the shore, and it is a laborious task to wade to deep water. The temperature of the water is comparatively high.

Standart ("The Climate of the Great Salt Lake Basin," Transactions of the American Climatological Association, vol. vii., 1890) calls attention to the fact of the longevity of the inhabitants of this region, which he attributes to the influence of the climate; and he narrates the incident of a gathering of old folks representing three per cent. of the adult population of the great Salt Lake basin, where there were a thousand people who had attained the age of seventy years or over.

Good hunting and fishing are to be had in the mountains and streams round about, and there are many short excursions to mountain resorts lying on the banks of attractive lakes. A few miles from the city, reached by an electric road, is Fort Douglas, a military post, from which is an extensive view.

From the climatic table it will be seen that the temperature partakes of the characteristics of that of elevated regions. The diurnal range is large and it does not appear to be very cold in winter or excessively hot in summer. According to Solly, the average number of days above 90° F. is 30, and below 32°, 109. The average annual range as given by Standart is 93.5°. The average relative humidity is very low and the rainfall small, indicating a very dry atmosphere. The prevailing wind is from the northwest, and the average hourly velocity 5.3 miles for the year. The number of clear and fair days is 277, which means a large amount of sunshine.

Edward O. Otis.

SALT LAKE HOT SPRINGS.—Salt Lake County, Utah.

POST-OFFICE.—Salt Lake City. Hotel and sanatorium. The springs are located in the northern outskirts of Salt Lake City. The water is conducted from thence to a sanatorium and bathing establishment in the heart of the city. This fine, commodious structure has a floor space of about fifty thousand square feet. The water, at a temperature of 112° F., is drawn from the springs through an eight-inch pipe, with a flow of about four hundred gallons per minute, and enters the establishment at a temperature of 110° F. Besides large separate swimming pools for men and women, there are twelve private pools and a number of elegant private bathrooms. A hotel and gymnasium are also connected with the enterprise in the same building. According to an analysis by H. Hirsching, analytical chemist, in 1893, the water contains rather more than three hundred grains per United States gallon of solid ingredients. This is largely composed of chloride of sodium (about two hundred grains), but the water also contains appreciable quantities of the chlorides of calcium and magnesium, the sulphates of sodium, calcium, and magnesium, the carbonate of sodium, and small amounts of several other compounds. It is also charged with sulphureted hydrogen in small quantities, as well as a considerable percentage of carbonic acid gas. The water is useful in the various ailments for which hot saline sulphur baths are prescribed.

James K. Crook.

SALTS, DISSOCIATION OR IONIZATION OF.—See THE APPENDIX.

SALT SULPHUR SPRINGS.—Monroe County, West Virginia.

POST-OFFICE.—Salt Sulphur Springs. Hotels. **ACCESS.**—Via Chesapeake and Ohio Railroad to Fort Spring, where carriages meet visitors for springs.

These well-known springs have been under the present management for many years, and have become justly esteemed as one of the most charming and homelike of the Virginia Mountain resorts. The location is two thousand feet above the sea level, and is surrounded by the usual beautiful scenery and wholesome climate of the Alleghanies. The hotel buildings are chiefly of brick and

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limestone. The largest, built of stone, contains seventy-two pleasant rooms, and has wide piazzas, two hundred feet long, overlooking the lawn. The parlor and great ball-room are also in this building. There are accommodations for three hundred guests. The springs are three in number, known as the "Old" or "Sweet" Spring, discovered in 1802; the "Salt Sulphur," discovered in 1805; and the "Iodine" Spring, known since 1821. We present analyses of the Old Spring and the Iodine Spring, the former by W. B. Rogers, the latter by D. Stewart:

ONE UNITED STATES GALLON CONTAINS:

Solids.	Old Spring.	Iodine Spring.
	Grains.	Grains.
Sodium carbonate.....	10.80
Calcium carbonate.....	10.26	33.00
Magnesium carbonate.....	3.31	7.00
Potassium carbonate.....	2.53
Sodium sulphate.....	22.36	24.00
Calcium sulphate.....	84.90	68.00
Magnesium sulphate.....	18.21	20.00
Organic matter.....	9.24
Earthy phosphates, sodium chloride, calcium chloride, magnesium chloride, iron peroxide, alumina, silica, iodine, and bromine.....	2.00	7.35
Total.....	150.28	172.48
Gases.	Cubic inches.	Cubic inches.
Carbonic acid.....	13.28	34.56
Sulphureted hydrogen.....	3.44	19.12

These are valuable waters, containing as they do a large proportion of active mineral ingredients. Both contain a sufficient quantity of the purging sulphate to render them cathartic in their effects. The iodine spring contains a fair proportion of iron and appreciable quantities of iodine and bromine, rare ingredients of sulphur waters. This water resembles those of Challes, in Savoy, and possesses alterative properties. It proves especially beneficial in scrofulous and syphilitic diseases. The waters of both of these springs are useful in abdominal engorgement, chronic constipation, chronic metallic poisoning, functional hepatic disorders, rheumatism, gout, and scaly skin diseases. Cases of bronchial troubles and early phthisis also do well at this resort.

James K. Crook.

SALUBROL—tetra-bromo-methylene-di-antipyrin—is prepared by the action of bromine on methyl antipyrin. It is without odor, and is used as an antiseptic dusting-powder in place of iodoform. It is said to be a good hæmostatic like antipyrin.

W. A. Bastedo.

SALUMIN, aluminum salicylate, Al₂(C₆H₄OHCOO)₂ + 3H₂O, is a reddish-white powder, insoluble in water and alcohol, and soluble in alkalis. It is employed as an astringent dusting-powder in catarrhal conditions of the upper air passages. It is known as "salumin (insoluble)." With ammonia it forms aluminum ammonio-salicylate, Al₂(C₆H₄ONH₂COO)₂ + 2H₂O, which is readily soluble in water and is used in the nose and throat as an astringent spray or gargle. This compound is called "salumin (soluble)."

W. A. Bastedo.

SALVATOR MINERAL SPRINGS.—Brown County, Wisconsin.

POST-OFFICE.—Green Bay. This spring is the source of the Salvator Mineral Water. It does not appear to be used as a resort. An analysis by Professor Delafontaine, of Chicago, shows the following mineral ingredients: One United States gallon contains (solids): Sodium chloride, gr. 1.60; sodium bicarbonate, gr. 1.30; calcium bicarbonate, gr. 20; magnesium bicarbonate, gr. 17.16; iron bicarbonate, gr. 1.30. Total, 41.80 grains.

This analysis shows an excellent alkaline, diuretic, and mild laxative water, with ferruginous properties. It is