

of most affections of this organs, whether depending on organic or so-called functional disease. Therefore, in cancer, chronic ulcers, and chronic inflammation of the stomach, bismuth is often serviceable. It is especially useful in the chronic gastritis of drunkards, subduing the pain, checking the vomiting, and enabling the stomach to tolerate food. It is also useful in gastrodygnia and cramp of the stomach. Many forms of vomiting in children, and notably that depending on acute or chronic catarrh of the stomach, yield speedily to this remedy. The various forms of pyrosis, whether acid, alkaline, or neutral, are very amenable to this drug, although our limited knowledge concerning the causes of this symptom fails to enable us to lay down precise rules respecting the particular kind of pyrosis most benefited by bismuth.

Dr. Graves successfully treated acidity of the stomach with nitrate of bismuth, and experience confirms his recommendation. He generally mixed it with opium or morphia, and sometimes magnesia. Flatulent dyspepsia, in some of its forms, yields more or less to bismuth; it may be mixed with an equal quantity of vegetable charcoal.

These remedies prove useful in some forms of chronic diarrhœa, succeeding often when other remedies fail. Their action is most conspicuous in checking the exhausting purging of phthisis. It is necessary to give as much as half a drachm to a drachm of the nitrate several times a day, and this large quantity, taken with milk, does not disturb the stomach. It often subdues diarrhœa, the most intractable to other treatment, effecting sometimes so great an improvement in the general health, that patients, whose speedy death seemed inevitable, rally, and return to the ordinary duties of life.

Bismuth in large doses is freely used on the Continent in the various forms of diarrhœa of young children. Thirty to sixty grains hourly are recommended, and at the same time milk is withheld. Much smaller doses, however, are often useful and may be given with milk. A grain hourly is very

efficacious, and its good effects are often enhanced, by adding to it a sixth of a grain of grey powder.

The bismuth preparations are not employed to act on the remote organs of the body.

A bismuth injection, consisting of bismuth, half an ounce; glycerine, half an ounce; water, three ounces, is very useful in gonorrhœa, especially in the chronic state. The same injection sometimes proves serviceable in gleet.

The chief part, if not all the bismuth, is evacuated with the fœces. Some indeed may be absorbed, but the quantity entering the blood is probably extremely small.

LEAD SALTS.

LEAD added to albuminous fluids, forms a precipitate composed of albuminate of lead. Like other metals, the soluble salts of this group, when applied to the abraded skin or to sores, or to mucous membranes, coat them with an impermeable air-proof covering; if, however, a protecting covering is required, other metals are generally employed. Besides combining with the albumen of the secretion, any excess of the solution will combine with the tissues themselves, in which manner, probably, lead salts condense these structures, and constrict the blood-vessels. The soluble lead salts are used as lotions to unhealthy and over-secreting sores, and to eczematous eruptions. In some forms of eczema lead lotions are very useful. When there is much inflammation, and when the surface is raw and weeps copiously, a lead lotion allays inflammation, checks the discharge, and quells the itching, burning, and tingling, so often accompanying eczema. Two or three drachms of liquor plumbi in ten ounces of water is generally sufficient; but a stronger lotion, consisting of two ounces of liquor plumbi, two ounces of glycerine, and four

ounces of water, is sometimes more successful. If the inflammation is great and the weeping abundant, the rash must be constantly covered with rags soaked in the lotion. In some cases it is useful to apply a poultice at night and the lotion during the day. The stronger lotion is especially useful in diffused eczema, without weeping, but with excessive itching and tingling. The diseased skin should be sponged with the lotion several times a day. A weak alkaline or a sulphur bath greatly assists the action of the lotion. The fluid oozing so abundantly in eczema being strongly alkaline, the property of these lotions to check this discharge may be owing to their weak alkaline reaction (*vide* 124). The stronger lotion allays very effectually the itching of pityriasis. Lead lotions occasionally ease the itching of urticaria.

A lead lotion is often of great service in pruritus pudendi, especially when the mucous membrane is red and excoriated. A weak lotion fails sometimes where a strong one succeeds. It may be necessary even to use equal parts of liquor plumbi and glycerine, an application which may excite a little very temporary smarting. When pruritus pudendi depends on ascarides, hæmorrhoids, or a tumour in the urethral passage, it is obvious that these applications are useless.

A lotion of one part of liquor plumbi,* with one or two parts of glycerine, applied warm after the crusts have been entirely removed, is useful in the milder forms of lupus.

While lead salts have many properties in common with those of other metals, they are distinguished by their unirritating, soothing character, whence they are used only as astringent and soothing applications. The soluble lead preparation may be used to check bleeding from small vessels; but other astringents are more effective.

Solutions of the acetate and diacetate are employed as injections and washes in chronic otorrhœa and vulvitis of children. They lessen the production of pus, and ease pain, by virtue of their astringency and their soothing qualities. They are of most use when the acute stage has just subsided,

* When liquor plumbi is mentioned, we refer to the strong solution.

the tissues remaining irritable and painful. Stronger astringents are needed in the later stages.

Bland, unirritating plasters made of lead are in common use.

These plasters, and lead applications generally, are sometimes objectionable, owing to the black discoloration they produce from the formation of the black sulphide with the sulphuretted hydrogen gas produced by the decomposition of the discharges.

Pain in the loins, due to weakness, is often relieved by a stout plaster. Burgundy pitch on leather is generally used, but is very liable to produce a crop of itching papules which may spread over the greater part of the body, while lead plaster, though somewhat less adhesive, is free from this objection. Plasters sometimes relieve back pains due to uterine disease or piles.

For sweating feet Hebra employs an ointment composed of equal parts of lead plaster and linseed oil spread on linen and wrapped round the feet, renewing the application every third day for nine days.

The foregoing ointment applied on soft linen twice daily is sometimes invaluable in the sub-acute stage of eczema.

In ulceration and sloughing of the cornea, lead washes must be avoided, lest a white compound become deposited in the structures of the ulcer, leaving a permanent opacity.

Lead injections are sometimes employed in gonorrhœa, gleet, and leucorrhœa.

Lead may be absorbed by the skin in quantity sufficient to produce lead-poisoning, entering the blood probably as an albuminate, which is soluble in weak acids and alkalies. Lead-poisoning occurs only when the solutions are applied continuously to large raw surfaces; moreover, this incident occurs so rarely as not in any way to prohibit the use of lead lotions.

The insoluble lead salts are tasteless; the soluble have a sweetish acid and astringent taste.

The soluble preparations are astringent to the mucous

membrane of the mouth, and combine with the albuminous substances they meet with there.

That portion of the soluble compounds of lead which escape combination with albumen in the mouth, is converted into an albuminate in the stomach.

The soluble lead preparations are sometimes used in hæmatemesis, and have been much recommended to check pyrosis.

The albuminate of lead in the intestines is probably speedily decomposed into a sulphide of lead, an insoluble and inert compound. The soluble salts act powerfully as astringents of the intestines, and cause constipation. They control many forms of diarrhœa, even that dependent on disease of the lower part of the small or of the large intestine.

The effects of lead on the parts of the intestines distant from the stomach and duodenum must be manifested through the nervous system; and we know the intimate sympathy existing between the different parts of this canal.

In summer diarrhœa, a few grains of the acetate with a small dose of morphia is a sure and speedy remedy.

It has been recommended in cholera, especially in its early stages. In the purging from dysentery and typhoid fever, and from tubercular disease of the intestines, few remedies are so useful. The acetate should then be combined with opium.

Added to a starch injection, used to check various forms of diarrhœa, it will increase its efficacy. It may be applied for a similar purpose as a suppository.

The acetate, in large doses, acts as a weak irritant poison, but the symptoms it produces differ from those of other irritants chiefly by the presence of constipation instead of diarrhœa.

It is by no means common to meet with cases of acute poisoning with lead salts, and even the most soluble salts rarely cause death.

Acute poisoning by the acetate induces the following symptoms:—Dry burning sensation in the throat, thirst, vomiting.

colic (the pain of which is relieved by firm pressure), tenderness of the abdomen, obstinate constipation, dark slate-colour motions from the presence of plumbic sulphide, great prostration of strength, cramps of the extremities, cold sweats, giddiness, numbness and even paralysis of the lower limbs; sometimes coma; urine scanty and high-coloured. In one case it is reported that in less than five hours the extensor muscles of the extremities became paralysed, and the flexors rigidly contracted. The subacetate is even more powerful than the acetate. The carbonate has no irritant action.

The treatment of acute poisoning is to promote vomiting by lukewarm drinks, to give sulphate of soda, or sulphate of magnesia, or fresh precipitated sulphide of iron; but this last is rarely at hand; the stomach-pump should be used, and milk, with white of egg, may be given with advantage.

Small, nay even minute, quantities taken for a long time, will produce chronic lead-poisoning, which may occur in various ways, owing to the manifold uses of lead compounds. Oxide of lead is used to sweeten wines, the soluble salts are used as hair-dyes, and wafers are often coloured with red lead. The carbonate being the basis of all paints, when the lead is ground down it often occurs, unless great care is taken, that the finer particles are inhaled. Snuff is sometimes adulterated with lead, and in this way sufficient may be taken into the system to produce chronic poisoning. Dr. Garrod has lately narrated an instructive case of chronic lead-poisoning through the decomposition of the leaden envelope of a packet of snuff. Then painters become poisoned by eating their meals with unwashed hands, and so introducing lead into the system. Again, drinking-water sometimes becomes contaminated with lead dissolved from the lining of the tanks. Certain conditions of the water respectively favour and retard the solution of the lead. Thus, pure water, and waters containing carbonic acid, carbonate of lime, and sulphate of lime act but little on lead. But, on the other hand, waters containing much oxygen, organic matters, nitrites, nitrates, and

chlorides, act freely on this metal. Carbonic acid is very protective of lead; it crusts the metal with an insoluble covering of carbonate, and protects it from the further action of the water.

A very small quantity of lead is adequate to produce all or some of the symptoms of lead-poisoning; even one-fortieth to one-fiftieth of a grain per gallon. But there appear to be individual differences in respect to the action of lead, some persons becoming sooner affected by it than others. In some cases this difference can be explained, as will be mentioned shortly. Acetate of lead, in five grain doses, may be given for weeks, or even months, without producing symptoms of lead-poisoning, as has been abundantly proved at the Brompton Hospital, where the acetate is largely employed to check the diarrhœa of consumption; yet it is extremely rare, even after the medicine has been continued for months, to meet with any symptoms attributable to the lead.

The symptoms indicative of chronic lead-poisoning are briefly—constipation and, it may be, impaired digestion, with a sweetish taste. A blue line is soon observed at the edges of the gums, produced by the sulphuretted hydrogen developed from the tartar of the teeth penetrating the tissues of the gums, and, uniting with the lead, forming a black sulphide; consequently the blue line is most marked in persons who do not clean their teeth. It is seen only at the edge of the gums, where they come in contact with the teeth; where the teeth are absent, the blue line is absent. It is observed first, and is always most marked, in the gums in the neighbourhood of the incisor teeth. This blue line is one of the earliest indications of the effect of lead, and is one of the slowest to disappear. Dr. Garrod says this blue line is never absent if there are any teeth, and that it may extend to the whole gums, and sometimes it is seen on the parts of the lips and cheeks corresponding to the gums. Besides the foregoing symptoms, the nutrition is impaired, the skin becomes very sallow, and sooner or later, severe colic, with obstinate constipation, and

sometimes vomiting, sets in. Colic may occur without any premonitory signs. In lead-colic the abdominal walls are retracted, and very rigid. The pain is mostly eased, but is sometimes aggravated, by firm pressure.

Frequent cramps—often severe—occur in the calves, and sometimes in the uterus, penis, and scrotum; pains about the joints, generally of the extremities, increased by movement or wet weather, and, closely simulating rheumatic pains, sometimes harass the patient.

Sometimes paralysis takes place, generally affecting the upper extremities and the extensors of the arm, with its supinators and pronators. The muscles of the ball of the thumb waste greatly, and in severer cases the deltoid and even the muscles of the neck and trunk are similarly affected. Indeed, in the worst cases general paralysis may occur, with wasting of the muscles of the whole body, even the voice becoming weak. The paralysis mostly affects motion only, but sometimes sensation also is lost. Epilepsy, delirium, convulsions, or coma may occur, and destroy the patient; but death from chronic lead-poisoning is uncommon.

The cramps are not confined to the muscles of the extremities. The intestines are also affected, sometimes almost throughout their length, but generally only a limited extent is involved. If the finger is passed up the rectum, the contraction can sometimes be felt in the lower part of the bowels. The bloodvessels are said to be subject to cramps, like other parts of the body.

How the lead produces these paralyzes and spasms, whether by attacking the muscles, nerves, or bloodvessels, or some or all of them, is at present quite unknown.

The colic is generally dependent on constipation; for when this is set right the colic very generally disappears.

The influence of lead on the urates in the blood is most singular. Dr. Garrod, in his remarkable discoveries concerning gout, has elucidated this subject, and shown the intimate connection existing between lead-poisoning and gout. In gout, as this philosophical observer has shown, the

urates, probably undergoing increased formation, are retained in the blood. In gout, especially during the acute attacks, scarcely any uric acid is to be found in the urine, while an abundant quantity is detectible in the blood. The urates dissolved in the blood manifest especial affinity for particular structures, as the cartilages, bursæ, and fibrous tissues, particularly those of certain parts, and during the deposition of the urates in the joints, acute inflammation is excited, and this constitutes gout.

Now, lead checks the separation of urates from the blood by the kidneys, diminishes the uric acid of the urine thus greatly augmenting that of the blood, and thus we have the pathological condition which excites the gouty inflammation. Dr. Garrod has further shown,—and his experience is corroborated by all who have investigated this subject,—that gout very frequently occurs among lead-workers, and that gouty patients often exhibit the characteristic blue lead line on their gums.

There, too, is the fact, in further confirmation of Dr. Garrod's discoveries, that if to a gouty person, free at the time from an acute attack, a salt of lead is administered, it develops acute gout, with its accompanying symptoms of severe pain and high fever. The author has repeatedly verified this fact first pointed out by Dr. Garrod, which affords an explanation, in part at least, of the good effects of iodide of potassium on gout, since, as we have shewn already, this salt promotes the excretion of lead from the system.

Lead is used for a variety of purposes, but chiefly for its astringent action on the tissues, as in profuse discharges of the mucous membrane from the lungs in bronchitis, in which disease it has been strongly recommended, and to check bleeding from the nose, lungs, kidneys, and uterus.

It has been conjectured that lead in Bright's disease might check the escape of albumen from the blood and therefore lessen the amount of it in the urine and George Lewald has published some experiments instituted with the view of testing this point. He does not mention the form of kidney disease

his patients suffered from, but it was probably the pale, flabby, fatty kind. He observed at the same time the influence of the lead on the amount of urine voided. These experiments, too few perhaps to decide the question, showed that lead constantly diminished the albumen of the urine, but to a very small extent only, namely, to about nine or ten grains in the twenty-four hours. The diminution appeared to hold no relation to the quantity of lead administered. The quantity of water was simultaneously increased on an average by 200 c.c. in the twenty-four hours. Here, again, the increase held no proportion to the quantity of lead employed.

Lead has been found in the lungs, kidneys, spleen, liver, and brain, but there is no evidence of its possessing an especial affinity for these parts.

M. Paul who has investigated the influence of lead-poisoning on the foetus, says that women working in lead factories frequently abort; and that the father may cause abortion, even when the mother is not a lead-worker.

In 123 pregnancies, seventy-three children were born dead; and of these, sixty-four were abortions, four premature births, and five born at the full time. Of the fifty born alive, twenty died in the first year, eight the second, seven the third; one later; and only fourteen reached the age of ten.

Our knowledge is scant concerning the elimination of lead. A little lead only passes off with the urine; its elimination however, is increased by the administration of iodide of potassium.

It is a further question whether the metal is separated by the kidneys with the urine, or by the mucous membrane of the urinary tract. On theoretical grounds it is difficult to imagine how metals, existing in the body as albuminates, can be eliminated with a non-albuminous secretion; moreover, after the administration of lead, as after that of iron and other metals, an increased quantity of the metal is detected in the urine; an increased amount of mucus too, simultaneously, with signs of irritation of the lining membrane of the bladder,

even to the extent of inducing a catarrhal condition; whence it has been inferred that the metal is separated with the mucus secreted by the mucous membrane.

NITRATE OF SILVER.
OXIDE OF SILVER.

The soluble preparation of silver, when painted on the entire skin, colours it first an opaque white, which changes gradually to brown and black; and the application if a strong one will even produce vesication. Nitrate of silver is sometimes applied as a caustic to warts and other excrescences.

Applied to the abraded skin or to sores, the soluble silver salts form an albuminate which coats the surface with a thin layer and protects the skin from the irritation of the air. The nitrate of silver acts as a powerful excitant of the tissues, and destroys them, but only very superficially. It is very frequently applied to unhealthy and unclean ulcers, to induce healthier growth. It gives much smarting pain, which, however, soon passes away.

Like most other soluble metallic preparations, the nitrate causes condensation of the tissues as well as contraction of the blood-vessels, on which account it is used to stay hæmorrhage. Being liable, however, to excite much inflammation and pain, other blander astringents should first be tried. Sometimes it is necessary to check the bleeding from leech-bites by touching them with a stick of nitrate of silver.

It is stated that if a burnt or scalded surface is painted over with nitrate of silver, before vesication takes place, both the blistering and pain are prevented.

The pitting of small-pox may be prevented if each vesicle is opened, as soon as formed, and nitrate of silver is applied to the raw surface beneath. Dr. F. Bowen has recorded an instructive case showing the good effects of this treatment. He treated the vesicles on one side of the face and neck in the

way described, but left untouched the vesicles on the opposite side, with the result that on recovery the untreated side was deeply pitted, while the opposite side remained smooth and scarless. Dr. Bowen, who has devoted much attention to this subject, states that it is easily carried out by a nurse. At an early stage of the eruption, at the latest on the fourth or fifth day, he punctures the vesicles with a fine needle dipped in a solution containing twenty grains of nitrate of silver to an ounce of water. Mr. Higginbottom finds it unnecessary to puncture the vesicles. It is enough, he says, to paint the skin in the manner recommended by him in erysipelas, which subdues inflammation and prevents suppuration.

Bed-sores are best prevented by painting the threatened but unbroken skin, as soon as it becomes red, with a solution of nitrate of silver (20 grains to an ounce) with the effect of dispersing the redness, hardening the skin, and preventing the bed-sore, unless, as in the case of paralysis, there is a great proneness to the formation of bed-sores.

That species of boil which, beginning first as a papule matures into a pustule, and inflames and extends till a large dead core is produced, may, it is said, be arrested in its early pustular stage by painting it over at its very commencement with a strong solution of nitrate of silver. The author has had no experience of this method; but of the beneficial influence of collodion on similar boils, to be mentioned in another place, he can speak with great confidence.

Herpes labialis and the vesication of shingles may be arrested if the patch of erythema is painted over with nitrate of silver before or as soon as the vesicles begin to form.

It is not uncommon to meet with patients annoyed with a patch of lichen, the size of the palm of the hand, affecting almost any part of the body. The irritation caused by this patch may be excessive, sufficient even to break the sleep, and injure the health. By painting the patch with the nitrous ether solution (*vide* p. 202) of silver every day, or second day, as the itching may require, it may generally be removed.