six grains every three hours, or it may be given hourly in corresponding doses. Alum is generally beneficial in the paroxysmal cough, which may continue a long time after the characteristic whoop has disappeared, and in other coughs having the same spasmodic character.

How much of these substances is absorbed by the intestines, and conveyed into the blood, is unknown; but probably not a large quantity. The chief part escapes with the fæces, which the alum is said to make firmer and odourless.

It is doubtful if alum has much effect as a remote astringent to check bleeding from the lungs, uterus, kidneys, etc, and to check profuse sweating and discharges. Alum injections, one drachm to a pint, employed in the manner directed for the injection of carbonate of soda (see Potash Group), are very useful to check leucorrheal discharges. The alum solution constringes the parts, and sometimes causes severe cramp-like pains in the belly.

PREPARATIONS OF IRON.

Iron is a constant and necessary constituent of the body, and must be regarded as an important food.

None of the preparations of this metal applied to the skin produce any change in it. Several of the soluble salts combine with albumen on raw surfaces, sores, and mucous membrane, condensing the tissues, and constringing the blood-vessels; and, independently of this astringent action, they act at the same time as stimulants or irritants according to the strength of the application or the condition of the sore.

The organic salts are less astringent and stimulating than the inorganic; while, of the inorganic, the ferric salts possess these properties in a greater degree than the ferrous salts.

Several compounds of iron may be employed as astringents and stimulants; but, when a stimulant is required, other metallic preparations are preferable. The sulphate, but especially the ferric chloride, solid or in solution, is employed to check hæmorrhage. The chloride is a powerful styptic, and readily controls the bleeding from small vessels, but it has the disadvantage of irritating the surface of wounds and preventing union by first intention. Carbolic acid will probably supersede perchloride of iron; for this acid, properly employed, does not prevent the immediate closure of a wound.

The soluble preparations have a metallic astringent taste, and act on the mucous membrane of the mouth as on the abraded skin.

Iron salts are never employed as topical agents in diseases of the mouth; and as they often discolour the teeth, especially when the breath contains sulphuretted hydrogen gas, arising from carious teeth, etc., they are often taken through a quill, glass tube, or reed. They are conveniently given in the form of pill. Salts of iron stain the tongue black.

The effects of these salts in the stomach differ according to their properties. Some are astringent, stimulating, and in large doses irritating to the mucous membrane, as the pernitrate, the perchloride, the iodide, and the sulphate, while the remaining preparations are with respect to this membrane almost inert. If the stomach is irritable, then bland preparations of iron must be chosen. It is often stated that chlorotic or anæmic patients with weak stomachs must be treated with bland unirritating preparations of iron. In some instances, no doubt, the astringent preparations are ill borne, but in most cases they produce far better results than the bland forms of iron. A pale, flabby, broad, and teeth-indented tongue indicates almost always the need of large doses of the astringent preparations of iron. Thirty drops of the tincture, or three or four grains of the sulphate, may be given three times a day. Weak anæmic girls, suffering from pain and vomiting after food, with perhaps tenderness of the skin at the epigastrium, are often effectively treated by large quantities of the tincture of the perchloride.

The soluble preparations of iron combine with the albumen in the stomach, while the insoluble preparations are dissolved

to a variable extent in the acids of the gastric juice. The reduced iron is pretty freely soluble in this acid, but gives off hydrogen gas, or, if the preparation is impure and contains a sulphide, sulphuretted hydrogen; either gas causing eructations, and the latter a very disagreeable taste. The peroxide, if strongly heated, is soluble with great difficulty in the stomach; the more slightly heated forms should therefore be preferred. The carbonate and the magnetic oxide are more easily dissolved than the sesquioxide.

The metallic preparations and the proto-salts, after undergoing solution, become converted, either in the stomach or duodenum, into per-salts, very likely by means of the oxygen of the air swallowed with the saliva.

The astringent preparations, as the perchloride, acetate, pernitrate, or sulphate, are employed to check hæmorrhage from the stomach. These preparations, in proportion to their astringency, confine the bowels; but to this rule there are exceptions. As, soon after quitting the stomach, they are changed into an insoluble and inert sulphide, their astringency must be exerted on the upper part of the small intestines.

The sulphate, acetate, perchloride, pernitrate, in common with other astringent metallic preparations, may be given in diarrhœa. The pernitrate, much praised in the chronic forms of this complaint, is probably an efficient preparation.

Owing to the astringency of iron salts, it is a useful practice to combine with each dose some laxative, as a quarter of a grain of aloes, a few grains to half a drachm of sulphate of magnesia, soda, or potash. Some consider that the combination with a laxative promotes markedly the absorption of the iron.

In their course along the intestines, the iron salts, as we have said, are changed into a sulphide of the metal, giving to the fæces a black and characteristic appearance. A very small quantity of an iron salt is sufficient to stain the motions deeply, and to keep them darkened for several days after the discontinuance of the medicine. Iron salts have no direct influence on the pancreatic or biliary secretions.

In the treatment of the small thread-worms infesting the rectum, the tincture of the sesquichloride, in the strength of half a drachm of the tincture to a pint of water, is an efficient injection. The iron coagulates the albumen of these animals, and so destroys them.

Now comes an interesting and important question,—How much iron is absorbed into the blood? Probably but little of the insoluble compounds, as the quantity of acid in the stomach is not great. Of the soluble preparations it is hard to say. The increase of the iron in the urine being very small after administering a soluble iron salt, it has been concluded that very little passes into the blood; and the fact that almost all the iron taken by the mouth may be re-obtained from the fæces, seemed to strengthen this view; but a wider knowledge concerning the elimination of metals from the body proves this reasoning to be inconclusive. Most metals probably, but iron certainly, are eliminated from the system through the intestines, and make their exit with the fæces; for when iron salts are injected into the blood, almost the whole of the metal is ultimately recoverable from the fæces. That much more is absorbed than is appropriated by the blood corpuscles, is shown by the coloration iron produces in all the albuminous secretions of the body; for the fluids bathing the various cavities become coloured reddish-brown.

In the treatment of anæmia, many physicians advocate the use of large doses of iron salts; others as strenuously maintain that all the good effects may be obtained from very small doses, and they instance the beneficial effects of ferruginous waters. In many instances, no doubt, anæmia is curable by the employment of small quantities of iron, but it is likewise certain that large quantities, when they can be borne, act far more promptly. Half-drachm doses of the tincture, or six to eight grains of the sulphate, may be given two or three times daily. The following pill, originally employed by Blaud, is strongly recommended by Niemeyer: Sulphate of iron, carbonate of potash, of each half an ounce; tragacanth, as much as is required to make ninety-six pills.

Three of these are to be taken three times a day, an additional pill being added daily. No doubt this pill is very efficacious; but the iron without the carbonate appears to answer as well. These large doses of iron, while rarely upsetting the stomach, or producing headache, cure anæmia with astonishing rapidity.

Iron salts, in anæmia, possess important properties other than influence over the growth of the corpuscles. They act bracingly on the relaxed mucuous membrane of the digestive canal, and probably in this way tend to restore its functions. Moreover, it is highly probable that, after its entrance into the blood, the iron exerts an influence beyond that of merely increasing the quantity of red corpuscles; hence iron preparations are useful, not simply as a food in promoting the formation of the blood discs, but on account likewise of their beneficial influence on the tissues of the body. Iron, therefore, cannot be regarded merely as a food to the system; it is also an important curative agent. Large quantities of the soluble astringent preparations should be administered where we desire to benefit tonically, the mucous membrane of the digestive canal and the tissues.

The experience of physicians of the last generation accorded with these views, and so does that of many highly practical men of the present day, but on the introduction of the bland and almost tasteless preparations of iron, they were assumed to be in every way superior to the astringent forms. Their comparative tastelessness is certainly in their favour; moreover, it was considered, mainly on speculative grounds, that the astringent preparations must disorder digestion in anæmic persons. These theoretical opinions still prevail, but the author believes them to be ill-founded, and that, in the class of patients just described, the astringent preparations, even in large doses, are preferable; and that a large share of the benefit derived from them is due to their direct action on the mucous membrane of the stomach and intestines, and on the organs which stud them. It has been experimentally shown that sulphate of iron does not check the solvent action

of the gastric juice, and experience justifies the conclusion that in weak anæmic patients it does not lessen, but rather increases the formation of this secretion.

If the digestive mucous membrane is in an irritable state, then, as we have previously pointed out, the astringent iron preparations, in full doses, may do harm.

There are also individual peculiarities in respect of iron. Some persons cannot take iron in any form, not even a single dose of a weak ferruginous water. The digestive organs of some patients are easily upset by it; in some it induces fulness and pain in the head, while others in apparently similar conditions take it not only without inconvenience, but with great benefit.

It is sometimes advisable to humour the stomach by occasionally changing the preparation of iron.

According to most authorities, the iron in the blood combines with albumen. Bernard thinks it exists in the blood as a protoxide. Under certain conditions iron increases the quantity of blood corpuscles, and in this way improves the general nutrition of the body.

Iron salts are thus useful "in maladies attended with defect of the red corpuscles of the blood; as in anæmia, with or without irregularity of the uterine functions (chlorosis, amenorrhœa, dysmenorrhœa, and menorrhagia), and whether occurring spontaneously and without any obvious cause, or resulting from profuse discharges (hæmorrhages, fluxes, as leucorrhœa, etc.), from food defective in either quantity or quality, and from deficiency of light and pure air. In these cases the use of iron, conjoined with sufficient nourishing food, pure air, abundance of light, and, when necessary, the employment of purgatives, proves curative. But, when the anæmia or hydræmia is dependant on organic diseases, as cancer, granular degeneration of the kidney, or morbis cordis, the use of iron can at best be palliative only. Also in some chronic affections of the nervous system great benefit is obtained by the use of iron. Chorea, in a large number of cases, may be relieved, and oftentimes cured, by chalybeates;

though in general they are inferior to arsenic, which usually cures chorea much more speedily and certainly than they do. Cases, however, sometimes occur in which the chalybeates are preferable, as where anæmia co-exists. Epilepsy and hysteria are other nervous affections which are sometimes benefited by a course of iron, especially when they are attended with anæmia or uterine obstructions." (Pereira.)

The long-continued use of iron is highly beneficial in scrofula and rickets.

Iron-salts are commonly administered in amenorrhæa. Conjoined with this affection there is usually much anæmia, so that the iron, by remedying this condition assists in restoring the proper functions of the uterine organs.

It must be remembered that anæmia is dependent, not on deficiency in the supply of iron, but on a scanty assimilation of it; hence its use must be conjoined with well-regulated hygienic circumstances, otherwise iron does comparatively little good.

In a case of neuralgia, when no organic cause can be discovered, salts of iron are especially recommended where the patient is anæmic, although it is true their action is very uncertain. The huge doses in which these salts, especially the sesquioxide, have been given are probably injurious, and exert less influence over the disease than smaller ones. Large doses of perchloride of iron are of great benefit in diphtheria. It is a good plan to use the solution rather than the tincture, and to give the medicine very frequently—every hour, or even oftener. It is uncertain whether the effects on the throat depend on the topical action of the medicine, or whether they take place after its entrance into the blood. The solution is frequently painted on the throat, taking great pains to apply it very gently, lest by increasing the inflammation it does more harm than good, and this process appears to arrest the spread of the disease, and it is said to maintain the strength of the patient. The solution may be applied with the atomizer, so as to penetrate into the trachea and bronchial tubes. Large hourly doses of the perchloride have been found of

great use in erysipelas. In the hands of some observers this treatment has altogether failed, which may possibly be accounted for by the long intervals between the doses. The *frequent* repetition of the medicine is one of the most necessary conditions of success.

In the so-called hysteria of middle-aged women, occurring especially at the cessation of menstruation, they often experience distressing fluttering of the heart, a sensation of fulness of the head, with heat and weight on the vertex, frequent flushings of the face, and "hot and cold perspirations." This combination of symptoms is generally removed by considerable doses of the sesquichloride of iron, given three times a day. If the symptoms are limited to the head and face, then other remedies are more successful (nux vomica, opium, belladonna).

The salts of iron sometimes excite considerable irritation of the bladder, with frequent desire to pass water, which may contain a considerable quantity of mucus. They may cause in children even nocturnal incontinence of urine. Yet iron salts not unfrequently cure this troublesome complaint, even when not dependent on worms in the rectum, or other irritation. The astringent preparations of iron are employed to arrest hæmorrhages, as from the lungs and kidneys, and the acetate is the best preparation; and the following is stated to be a very effectual way to administer it:—Add sufficient of the salt to water to make it taste distinctly, but not disagreeably, and let the patient sip this constantly. Sufficient can be taken thus without exciting nausea or disgust; indeed, patients often like it.

The salts of iron appear to lessen profuse secretions, such as occur in chronic bronchitis and leucorrhœa. Dr. Graves gave the compound iron mixture, in doses of one or two fluid drachms, to check excessive bronchial secretion.

The iodide of iron may be given where both iron and iodine are indicated, for instance, in syphilis complicated with anæmia. It is a question of much interest whether it is preferable to administer these two agents separately or combined

in the iodide of iron, and whether they continue in combination in their course through the stomach and circulation, or whether the salt is decomposed. Viewing this question simply from a chemical point of view it would seem that an iodide of sodium and albuminate of iron must be formed in the stomach or blood; but some observations made, I believe, by Bernard, throw much doubt on this conclusion; for it was found that if iodide of potassium and a salt of iron were injected into the blood, no iron appeared in the saliva, but if an iodide of iron was injected, then both iodine and iron were found in this secretion.

The iron of the effete red corpuscles probably escapes with the bile; and when iron salts are swallowed, this fluid contains an excess of the metal. This, therefore, is one way by which iron may be separated from the body.

Its further separation takes place by means of the albuminous secretion of membranes; and as iron, very probably, like most other metals, exists in the body only as an albuminate, it has been conjectured that it can be separated only by the secretions containing albumen; and certain facts and considerations favour this view. For when iron is injected into the blood, much of it reappears in a short time on the surfaces yielding an albuminous secretion, as the mucous membrane of the intestines, of the bronchial tubes, of the gall-bladder, of the urinary bladder, and the serous membranes, as the pericardium, peritoneum, and pleura. A small quantity escapes with the urine; but whether excreted by the kidneys, or separated by the mucous membrane lining the urinary passages, is uncertain. Some maintain that it is separated by the mucous membrane, and, in support of this view, urge that when the iron of the urine is much increased, irritation of the mucous membrane always sets in, shown by the frequent desire to make water, and by the excess of mucus in the urine.

The tincture of the percloride of iron, in the proportion of half a drachm to half a pint of water, with a drachm of laudanum, makes a capital injection for gonorrhœa or gleet, often

speedily checking the discharge, and easing the pain on micturition. Mr. C. C. Fuller, of Albany Street, finds very useful, an injection, used three times a day, composed of sulphate of iron, twelve grains, tincture of opium, half an ounce, water, eight ounces.

The syrup of the phosphate of iron, is a useful form, if there are any indications for the employment of phosphoric acid. (See Phosphate of Lime.)

NITRATE OF BISMUTH.
CARBONATE OF BISMUTH.

These powders are commonly used as harmless cosmetics; in intertrigo, and sometimes in eczema, they are useful as dusting powder; but other remedies are to be preferred in eczema.

When applied to the broken or unbroken skin, these substances, being insoluble in any fluid they may meet with then, are not absorbed.

Trousseau employed equal parts of bismuth and Venetian calc in chronic non-syphilitic ozœna, ordering the patient to snuff up some of this powder, after clearing the nasal passages by strongly blowing the nose. He, however, prefers mercurial powders. (See Mercury.)

Being insoluble, they are tasteless, but they sometimes occasion a disagreeable sensation of roughness, and sometimes they blacken the tongue. This rough taste may generally be obviated by administering the drug in milk.

Little is known at present of the changes these medicines undergo, nor of their effect on the stomach. Whether they are dissolved or not, or whether their efficacy depends on physical or chemical properties, are questions remaining yet unsolved.

In many diseases of the stomach, these preparations, and the nitrate especially, are very valuable. They ease the pain

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 conspicious 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 fæces. 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 constringe 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