It has been said by Dr. Fenwick—"With regard to the stomach, the blood-vessels get congested, the epithelium is stripped from the tubes, and the tissues become softened; the tubes are found distended by granular matter or by cells mixed with granules."

In support of this view, I would refer you to the local pathological conditions of enteric fever, which are almost identical with those of scarlet fever. We have the irritated inflamed condition, with ashy sloughs over the glands, which, when separated, leave ulcers, from which hæmorrhage often takes place. The adjacent glandular organs—mesenteric glands, liver, and spleen—are also affected.

In his article on Enteric Fever in Reynolds's *System of Medicine*, Dr. Harley says (although I do not agree with him in regard to his general views of the pathology of the disease), in speaking of the nervous symptoms, that, "if the poison be arrested by and thrown out from the liver, no general blood-poisoning, and therefore no grave nervous symptoms, are met with. If the liver be unequal to the arrest and elimination of the poison, it passes unaltered from the portal into the general circulation, and symptoms of general blood-poisoning at once appear."

There can be no doubt that the blood is deteriorated in scarlet fever; for, however bright the skin may be at the first, it soon becomes purplish, and, in bad cases, of a very deep purple colour, as if it were venous blood that was circulating, showing that the red blood-discs are in a deteriorated condition, unfitting them for their functions in the economy. It is also in a superalkaline condition. Here I will give a quotation from Dr. Chambers's *Lectures*. "Ammonia, which is always being formed and given off from the animal body, is found much more abundant in certain conditions than in others; and that these conditions are those in which nutritive metamorphosis or growth was deficient, as compared with destructive metamorphosis." He goes on to say: "For it is not shown that there is more alkali in the body than there ought to be, but more than there is acid to neutralise. Subacidity would be a synonymous term, and more suggestive of the means we have at our disposal for remedying the defect." If alkaline conditions out of the body favour the development of zymotic poisons, the same conditions in the body are likely to do the same.

With these views which I entertain of the pathology of scarlet fever, I will now give you the treatment based upon them.

In the treatment of scarlet fever, agents should be given that will prevent the reabsorption of the poison, hinder its formation, moderate and assist physiological and chemical actions and changes.

The medicine which I have used for these purposes for nearly eight years is a mixture containing tincture of steel and chlorate of potass. In this mixture we have chlorine, muriatic acid, iron, and chlorate of potass. The chlorine acts upon and destroys the poison in the stomach; and probably some of it is taken into the blood, producing the same effect there. The muriatic acid, Dr. Chambers says, "is such a large constituent of the body, that it might almost be called a food, instead of a medicine; and that it is a powerful arrester of decomposition of animal matters." He also says about the ammonia, "Very difficult indeed would it be for the eliminator to get this alkali out; but it is easy for the restorers to get acid in." By getting the acid in, we lessen the alkalinity of the blood, and neutralise one of the conditions favourable for the development of the poison. The red discs of the blood are the carriers of oxygen; but, in their "black and melanosed condition," they are not in a condition for accomplishing this function. The iron supplies that which is likely to improve the deteriorated discs, and we give that which we know rapidly increases their number. The chlorate of potass supplies oxygen to the blood—which must be very deficient, from the condition of the red discs and the rapid disintegration that has been going on—to enable the physiological and chemical changes to take place, and oxidise the disintegrated substances that are floating in the blood.

Gentlemen, these are my views of the pathology and treatment of scarlet fever. I would not have brought them before you if it had not been that I have not seen, in the communications to the medical journals, anything like a fixed and rational method of treating scarlet fever. Before I began this treatment, there was no medicine that I believed did any good. It has been very satisfactory to myself; for, from the painful and irritated condition of the throat, it was very difficult to get children to swallow any medicine. In many instances, they could not be made to swallow even cold water; but I have no difficulty with this medicine. It is taken so readily by even the youngest child, that it seems to supply a want. The pain is very soon relieved; the exudations and superficial sloughs disappear; the throat improves in appearance; the swelling, both internal and external, diminishes; the secretions become lessened, and lose their irritating character; and refreshing sleep is enjoyed. I never have hæmorrhage from the throat, nor an abscess in the ear or neck.

The forms in which I give the medicine are the following

1. For a child two years old : $\mathcal{R}$ Tinct. ferri perchloridi $\mathfrak{z}$ ss vel $\mathfrak{z}$ ij ; potassæ chloratis $\mathfrak{z}$ j ; glycerinæ $\mathfrak{z}$ iss vel syrupi simplicis $\mathfrak{z}$ j ; aquæ q. s. ad $\mathfrak{z}$ iv. Two teaspoonfuls to be taken in water every hour or two hours.
2. For an adult : $\mathcal{R}$ Tinct. ferri perchloridi $\mathfrak{z}$ iv ; potassæ chloratis $\mathfrak{z}$ iiij ; glycerinæ vel syrupi simplicis $\mathfrak{z}$ iss ; aquæ q. s. ad $\mathfrak{z}$ viiij. One table-spoonful in water every hour or two hours.

ON THE SULPHOCARBOLATES AND THE ANTI-SEPTIC METHOD IN MEDICINE.*

By A. ERNEST SANSOM, M.D. Lond., M.R.C.P.,

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THERE is scarcely any subject which possesses a greater interest at the present time to practitioners of medicine than what is known as "The Germ Theory of Disease." Warmly espoused by some observers, the doctrine is actively repudiated by others. Whilst some have pointed out certain definite living organisms which they have alleged to be the actual causes of transmissible disease, others have scouted the word "germ" as implying the existence of something for which not a shadow of evidence exists. Can there not be a golden mean between these expressions?

Let us first consider those points on which there can be mutual concord. There is scarcely any possibility of doubt that the transmissible diseases, such as fevers, syphilis, etc., are due each to the operation of a material poison. No one attributes them to the influence of mere conditions of force. There is abundant evidence that the physical causes of disease do not belong to the inorganic world. By exclusion, therefore, we conclude that these are material and organic. But does our knowledge of organic substances help us much in the elucidation of the problem? We know of no organic substance which can induce a train of symptoms resembling in kind and in mode of sequence the phenomena of any infectious disease; still less any poison the fatal dose of which is so minute as to be imponderable and invisible. Furthermore, we are acquainted with no simply organic material which can be, as we know the *materies morbi* to be, self-multiplying. If, then, the prime causes of disease be material organic particles, they must possess powers far transcending those with which we are ordinarily acquainted. With organic matter in a certain state, however, the effects of the contagia of disease show a strong analogy. It is not strange that from Hippocrates downwards they should be likened to leaven, and their operation to the process of fermentation. The resemblance was great, but there was no perfect understanding of the first causes of either the one process or the other. At very early times, the "peculiar condition" of the minute portion of organic material which induced the phenomena of fermentation or of disease was supposed to be a condition of motion of its particles, which motion it could communicate to the fermentescible liquid in the one case, or to the fluids of the body in the other. (See *A Mechanical Account of Poisons*, by Richard Mead, M.D., London, 1702, p. 81; see also pp. 13-15.) This is none other than the hypothesis of Liebig, which has so largely prevailed at the present day. It is needless to say, that at the present time there are two opposing views as to the nature of the first cause of the process of fermentation—the one holding that it is due to the effect of an unexplained catalytic action communicated to fermentescible material by an organic substance undergoing change; the other, that its phenomena are due from the very beginning to the acts of life of developing, growing, and multiplying organised particles. The upholders of these two views may, I fancy, be considered as nearly equally divided. There is, however, one point on which there is a pretty obvious agreement, and that is a point of great importance in regard to this question. It is that, whatever may be the *initial* cause of the changes in fermentation, the process, as soon as it becomes capable of discernment by vision, however highly aided, is seen to be most intimately connected with the development of living forms.

Let us turn for collateral evidence to the observations which have been made on the causes of cognate diseases. No one doubts now that animal and vegetable organisms, at one time enjoying separate existence, can enter the living human organism, and there initiate and continue the phenomena of disease. Well marked in cases of diseases due to parasitic animals and plants, this mode of causation has been attributed in other transmissible diseases to organisms with more and more obscurity, till it has almost reached to a *reductio ad absurdum*. Thus, cholera

* Read in the Medical Section at the Annual Meeting of the British Medical Association in Newcastle-upon-Tyne, August 1870.

has been attributed to fungoid spores, to oidium, to vibrios, to urocystis. Certain modern researches throw some light on the causes of these discrepancies. The researches of Hallier (*Gährungserscheinungen*) supported as they have been by other observations, leave little room for doubt that the same "germ" will give rise to different varieties of organism, according to as it is cultivated under different physical conditions. In fermentation, which arises without the addition of any obvious ferment, it is not necessary for the panspermatists to concede a plurality of germs. Again, in case of vegetable parasites, it has been shown that the cultivation of the "oidium albicans" from the mouth has given rise to the cells of "trichophyton" at one time, and to the filiform productions similar to those of pityriasis in another. This granted, it must be agreed that the pointing to such and such of the diseased process an organism found in the course of, or at the termination of, a given disease would be far from establishing it as *primum movens*. For it might be but the indication of a morsel of living matter infinitely more minute than itself, of which it was a stage of growth.

Researches on other forms of transmissible disease have contributed towards the elucidation of the question, particularly those of Beale and of Chauveau on vaccinia, variola, cattle-plague, etc. The researches of M. Chauveau have proved that the activity of the poisons of vaccinia, of glanders, and of sheep-pox, resides not in the fluids of the inoculated material, but in excessively minute elementary granules suspended in the fluid. He has shown, furthermore, by actual experiment, that this inoculable material may be communicated to a living body as well by the lungs and by the stomach as by insinuation beneath the skin. Dr. Beale has shown that the elementary granules of vaccine are minute masses of living matter (bioplasm) manifesting very active movements. In cattle-plague he has observed similar rapidly multiplying material in the blood of the affected animal.

In the cases, therefore, of such transmissible diseases as I have mentioned, the term "germ" has different significations.

In diseases produced by entozoa or epizoa, it denotes the transmitted ova of the animalcula specially concerned.

In diseases due to vegetable parasites, it indicates the sporules or minute granules whence the parasitic vegetables develop.

In zymotic diseases, it indicates those minute morsels of germinal matter which possess a vitality separate and distinct from the organism into which they may become absorbed, and, once gaining entrance, develop and circulate within the fluids of the containing organism. The word "germ", then, denotes nothing more than the minutest portion of living material which the mind can conceive, such material being ultimately derived in various ways from the animal or from the vegetable kingdom.

From remote times measures have been adopted having for their object the prevention or the arrest of transmissible disease. These measures have been adopted with two objects: to prevent the communication of disease from person to person, and to prevent the evolution of noxious material from fermenting and putrefying matters which have been recognised as sources of contamination. The object of disinfecting measures has been the destruction of the virus in the one case and the prevention of its evolution in the other. Materials capable of fulfilling the desired ends are very various. Inorganic as well as organic substances of endless variety of chemical constitution are capable of being good disinfectants. On a review of a large number of these substances, and an examination of their relative power in arresting fermentation, putrefaction, and the proliferation of low organisms, one cannot help concluding that the chemical constitution or the chemical properties of a body can be no index of its position as a disinfectant or an antiseptic. They operate in no traceable chemical way; but, when they kill the organisms which accompany the fermentative or putrefactive process, they arrest all the phenomena of the process.

The question occurs, Is it possible to arrest the vitality of the germs of disease within the living body, as we have reason to believe we can destroy them when external to the body? Can there be an internal as well as an external antiseptic method? In the case of the higher forms of parasites which induce disease, this can be at once answered in the affirmative; and it affords a *prima facie* case for the elucidation of the question in reference to the more subtle zymotic diseases. It is certain that an agent which can be taken with impunity by the higher animals can be a powerful poison to the lowest forms of life. Many of the medicines ordinarily administered, as bichloride of mercury, arsenic, the salts of iron, etc., even in very high dilution, at once kill lowly endowed organisms.

In 1857, Professor Polli of Milan, having observed the power of sulphurous acid and the sulphites in arresting fermentative processes, initiated a plan of administering the latter in cases of zymotic disease. An able paper by Dr. Polli was read at the meeting of the British Medical Association in 1867 (see BRITISH MEDICAL JOURNAL, Novem-

ber 16th, 1867). The author did not consider that the sulphites, when internally administered, acted as poisons to morbidic ferments, but that they rendered the components of the recipient organism incapable of being acted on by the catalytic germs. It is difficult to understand this hypothesis; for, whether the sulphites attack the germs directly, or whether they render the soil unsuitable for them, the ultimate result is their death. It is possible that Polli agreed with Bernard, who said, "We cannot neutralise these ferments in the living organism; it is impossible, because to effect such a purpose it would be necessary to interfere with the functions of the blood to such an extent that it would be incapable of maintaining life". This would be the case if the agent acted as a poison in virtue of its chemical properties; to oxidise or deoxidise the ferment would be to gravely interfere with the functions of the blood. But we find that the most feeble oxidisers or deodorisers are the most potent poisons to low organisms: the sulphite, which can be shown at once to kill myriads of animalculæ or fungi, can be shown to exercise scarcely any deoxidising power, for it is recoverable from the body not as sulphate, but as sulphite undecomposed. In my opinion, therefore, we should conclude that the action of the sulphite or any absorbed antiseptic would be the action of a poison upon germinal matter.

As to the success of Polli's treatment, there is discrepancy in the evidence. On the one side, many observers attested to much success. From 1861 to 1867, Polli received one hundred and forty-eight papers, which, with the exception of five or six, confirmed "in the strongest terms, by many hundreds of detailed observations, the value of the remedies". On the other hand, many who have employed them in this country have expressed themselves as disappointed with the results. From a review of the conditions, it can be at once seen that we have no right to expect from any treatment pursued with the object of arresting the course of septic poisoning, an uniformity of success. The opposing conditions are many and powerful. Common experience tells us that there may be the absorption of a morbid poison long before the manifestation of any subjective or objective symptoms, or these may be so slight as to pass unnoticed. During this incubation, there can be little doubt that collateral physical degenerations are occurring in the tissues of the body. And when the symptoms of disease have set in, a variety of induced perturbations contribute to form their complex cause; so the induced condition may be of far greater gravity than the original. Thus the ova of certain tæniæ may exist in the human body unnoticed, but their development as echinococci induces the gravest lesion. In cholera, the exfoliation of epithelium from the gastro-intestinal tract is another example of secondary disintegration. There is, therefore, abundant reason for the discrepancy between different observers. Many have probably been discouraged by a want of success at the outset. The logical conclusions are, that the value of the plan can only be determined by numerical data, and that, if it be adopted, collateral measures, suited to the various complications, should be put in force as well.

The fulfilment of the plan of treatment by the sulphites does not involve the abandonment of a plan which has been proved to have a probability of success. Our present treatment of zymotic disease is manifestly expectant. The complications which arise can be treated in the one case as in the other; and by the sulphite the functions of a saline causing the reduction of a heightened temperature are fulfilled, and something more.

Since Professor Polli's first advocacy of the sulphites, I used them in the treatment of zymotic disease, and I considered that my results confirmed his own. I felt that in the path which he had indicated there was work to be done, and that an agent might be discovered having therapeutic powers perhaps exceeding those of the sulphites. Carbolic acid then came prominently before the medical world, and its powers as an antiseptic became daily more apparent. Certain difficulties attended the internal administration of itself and its simple salts; but in 1867, my attention was called by Mr. Crookes, F.R.S., to a salt which he had procured of a compound acid, sulphocarbolic, with potassium. I pushed the inquiry further, and procured the sulphocarbates of most of the alkalis, alkaline earths, and metals, and endeavoured to study chemically and therapeutically their various characters. (See *Obstetrical Transactions*, 1868, p. 291; *Medico-Chirurgical Transactions*, 1869, p. 139; *Practitioner*, July 1869, p. 5.)

The general mode which I have recommended for the preparation of salts is this: a definite sulphocarbolic acid is first formed by mixing 97 parts by weight of pure carbolic acid, liquefied by the acid of heat with 101 parts of strong sulphuric acid. Much heat is evolved, and a syrupy liquid results, which after a time becomes crystalline. Sulphocarbolic acid may, by slow crystallisation, be obtained in long colourless deliquescent needles. On neutralising the liquid sulphocarbolic acid with equivalent weight of the various bases, very beautiful regularly crystalline and stable salts are formed.

I.—SULPHOCARBOLATES OF ALKALINE BASES.

Of these the sodium, potassium, and ammonium salts have been obtained. In testing their therapeutical characters, I have confined myself, for the sake of uniformity, to the sodium salt. The dose has been usually twenty to thirty grains three times a day to adults, though I have given as much as a drachm every four hours. At the North-Eastern Hospital for Children, I have had abundant opportunities of testing the action of this salt in diseases of children. The patients coming from the most impoverished quarters of London, there are numerous examples of the various conditions of wasting disease. In cases of *thrush*, I have found the oidium-growth to pass away much more quickly during the administration of sulphocarbonate of sodium than under any other plan of treatment, the sulphites not excepted. There has been during the present year a great prevalence of *stomatitis*—the occurrence of small circular ulcerations upon the tongue, gums, and internal surface of the cheeks. I have noticed a very strong relation subsisting between this condition and diarrhoea. In the diarrhoea which prevails at the present time, I have, on close inspection of the mouth, been able to detect in numerous instances cicatrices indicating that a condition of stomatitis has existed unnoticed. This fact may, I think, be of subsequent importance with reference to the consideration of the causation of diarrhoea. This condition of stomatitis has invariably, under the sulphocarbonate, disappeared from the third to the seventh day of treatment.

Follicular Inflammation and Ulceration of Tonsils.—I have administered the sulphocarbonate in eleven such cases, with the result of complete recovery in one case on the third day; in eight cases on the fourth day; two were not observed till the seventh day—they were then quite well. Several of these cases had previously had the same affection going its course to suppurative tonsillitis—in none of them was there a trace of suppuration. I should add that they were all cases accompanied by severe pyrexia.

Sloughing Ulceration.—In three cases of great severity, accompanied by diphtheritic signs, there was complete recovery without complications. Convalescence took place in one case on the seventh day; in another, wherein the thermometer had registered 106 degrees Fahr., the child was able to walk on the fourteenth day; in the third, with severe pyrexia (temperature 105 degrees Fahr.), delirium, and large ashy slough over each tonsil, perfect power of swallowing returned on the sixth day, and progress was uninterrupted.

Scarlatina.—In eighteen cases in which the sulphocarbonate was administered, recovery was very rapid. The throat-signs became rapidly alleviated; it was an almost invariable rule that, at the end of the fourth day of treatment, all throat-distress had passed away. It should be added, that in all these cases not any local treatment to the throat whatever was practised, nor any other remedy save the sulphocarbonate. The pyrexia rapidly diminished. Complete convalescence took place in six cases in seven days; in one, in eleven; in one, in fourteen; in one, in fifteen days. The sequelæ were, in one case general anasarca resulting in recovery; in one, albuminuria for a single day; in one, abscess of a superficial gland in the neck; and, in one, a persistent slight glandular swelling.

Varicella.—My experience of the remedy in this affection is very limited; but I think it is sufficient to induce an extended trial. I have used it in two cases; one of these was a gentleman of middle age, who made an excellent recovery. He had, however, been vaccinated, so the result could have but little weight. I have since, however, had a severe case in a child of one year and eight months, unvaccinated. The progress was uninterrupted, the pitting very slight, and complete convalescence took place at the end of the fourth week. In none of the zymotic cases thus treated did a death occur.

Enteric Fever.—I have not myself had any opportunity of using the sulphocarbonates in this disease. Dr. Ligertwood, of Newbury, has, however, put the plan in practice, and has forwarded me a tabular statement of twenty-four cases so treated. Dr. Ligertwood says: "I think the treatment was very successful. There did not seem to be the same tendency to relapse that I have found occur under other treatment. The diarrhoea, often very severe, never became so exhausting as to call for any special treatment, and the average duration of the fever was certainly not more than under the usual modes of treatment."

Tuberculosis.—In testing the therapeutic effects of sulphocarbonate of sodium upon phthisical patients at the Chest Hospital, where I first begun to employ it, I was so struck with the signs of general improvement that I determined to give it an extended trial in these cases. It must be remembered, however, that in most cases cod-liver oil was used in addition. In eleven cases of children showing signs of general tuberculosis, eight improved considerably; two seemed uninfluenced; and one went from bad to worse, the progress of tuberculation being evidently unchecked. From notes of seventy-eight cases of pul-

monary phthisis in which I employed it, the following are the results. *First Stage:* fifteen cases. In eleven much improvement, with marked decrease of symptoms and increase in nutrition. *Second Stage:* fifty-one cases. Thirty manifested much improvement; seven slight improvement; twelve uninfluenced; in two disease progressed rapidly. *Third Stage:* sixteen cases. Ten much improvement; twelve uninfluenced; in two disease progressed rapidly. I entirely leave the interpretation of these results.

II.—SULPHOCARBOLATES OF THE ALKALINE EARTHS.

The *magnesium* salt crystallises in large clear rhombic prisms. One of the most interesting of the whole series is the *calcium* salt. This is obtained in long, fine, delicate crystals, which, interlacing, somewhat resemble benzoic acid. It is exceedingly soluble; and this I consider to be a most valuable characteristic. The following expresses the solubility of calcium salts at 60 deg. Fahr.

Calcium carbonate	} insoluble.
phosphate	
hydrate	I part soluble in 800 of water.
sulphate	I " 500 "
sulphocarbonate	I " I "

I thought that the calcium sulphocarbonate might prove useful in the treatment of rachitis. I accordingly employed it in twenty-six cases, with these results: great improvement in sixteen cases (of these there was, to all seeming, complete recovery in ten); moderate improvement in five; doubtful result in five.

In some of the cases cod-liver oil was administered in addition; but in many, in which there was the most marked improvement, the sulphocarbonate alone was given. The usual dose for children between the first and second year was five grains. I have also used the sulphocarbonate added to ordinary chalk-mixture in cases of chronic diarrhoea in unhealthy children, apparently with good result. Of the efficacy of the treatment in rachitic disease I think I am entitled to speak with some confidence.

III.—SULPHOCARBOLATES OF THE METALS.

Of these I have obtained the iron, the copper, and the zinc salts, all of which present highly characteristic appearances. The zinc salt is in brilliant colourless right rhombic prisms; the copper salt possesses a blue colour, much resembling that of the sulphate. Mr. John Wood has employed these in lotions to prevent suppuration in wounds: he considers that they exercise an obvious control over the suppurative process. The only salt of the internal administration of which I have had any experience is the iron sulphocarbonate. This is a colourless very soluble salt, crystallising in rectangular plates. It assumes, in the presence of peroxide of iron, a deep mauve or purple tint. I employed it as a general tonic in diseases of debility in children; some cases of eczema and of impetigo became rapidly better under its influence, but I did not conclude that it was superior to the other salts of iron. In a case of enlarged and strumous glands, there was much amendment, and the swellings almost entirely disappeared. In ten cases of threatened tubercle there was considerable improvement in four; in the remainder it was doubtful. In cases of pulmonary tuberculosis there was much improvement in six cases; slight improvement in seven cases; no improvement in eight cases. I could state confidently that the results were not nearly so satisfactory as in the cases treated by the sodium salt.

In conclusion, I trust that these few imperfect observations will induce many of my professional brethren to test in actual practice the value of these interesting salts. Their place in therapeutics can in no sense be fixed by the experience of one individual. As to their mode of action, there may be very many who widely differ from me in the opinions which I have enunciated; but their physical characters alone will, I think, enable them to hold a useful place in our materia medica.

CASES OF INHERITED PURPURA, OR HEREDITARY HÆMORRHAGIC DIATHESIS.

By FREDERICK WATERHOUSE, M.R.C.S., Pontypridd.

IN the JOURNAL of February 5th last, I described a case showing the consequences of injury in subjects of a hæmorrhagic tendency; and it will no doubt be of interest, more especially to those working for the Jacksonian Prize, if I now record the subsequent history of the family in which that case occurred.

The mother has several times since suffered from intractable menorrhagia.

The boy, whom I have previously described, was again under treat-