IX. *Observations on the Cause and Cure of the Tetanus.* By Benjamin Rush, M. D. Professor of Chemistry in the University of Pennsylvania.—From the *Transactions of the American Philosophical Society, held at Philadelphia, for promoting useful Knowledge.* Vol. II. 4to. Philadelphia, 1786.

DURING my attendance upon the military hospitals of the United States, in the course of the late war, I met with several cases of the tetanus. I had frequently met with this disorder in private practice, and am sorry to say that I never succeeded with the ordinary remedy of opium in any one case that came under my care. I found it equally ineffectual in the army. Baffled in my expectations from a remedy that had been so much celebrated, I began to investigate more particularly the nature of the disorder. I found it to be a disorder of warm climates, and warm seasons. This led me to ascribe it to relaxation. I resolved to attempt the cure of it by a set of medicines in some measure the opposites of most of the medicines that had been employed in that disorder. Soon after I adopted this resolution, I was called to visit Colonel John Stone, who

who was wounded through the foot at the battle of Germantown on the 4th of October 1777. He was in the third day of a tetanus. His spasms were violent and his pains so exquisite that his cries were heard near a hundred yards from his quarters. His head was thrown a little backwards, and his jaw had become stiff and contracted. He was under the care of a skilful regimental surgeon who was pouring down opium in large quantities without effect.

Duty and friendship both led me to do my utmost to save the life of this valuable officer. I immediately dismissed the opium, and gave him large quantities of wine and bark, to the amount of two or three ounces of the latter, and from a bottle to three pints of the former in the day. In a few hours I was delighted with their effects. His spasms and pains were less frequent and violent, and he slept for several hours, which he had not done for several days and nights before.

With the same indication in view, I applied a blister between his shoulders, and rubbed in two or three ounces of mercurial ointment upon the outside of his throat. He continued to mend gradually under the operation of these medicines, so that in ten days he was out of

danger, although the spasm continued in his wounded foot for several weeks afterwards. In the summer of the year 1782 I was called to visit a servant girl of Mr. Alexander Todd, merchant of this city, who had brought on a tetanus by sleeping in the evening on a damp brick pavement, after a day in which the mercury in Farenheit's thermometer had stood at near 90°. The case was nearly as violent and alarming as the one I have described. I treated her in the same manner, and with the same success. To the above-named medicines, I added only the oil of amber which she took in large doses, after I suspected the tonic powers of the bark and wine began to lose their effects. The good effects of the oil were very obvious. She recovered gradually and has continued ever since in good health. In the summer of the same year I was called to Alexander Leslie, a joiner, who had run a nail in his foot. I found him the day afterwards in extreme pain, with small convulsions and now and then a twinge in his jaw. The wound in his foot was without swelling or inflammation. I dilated the wound and filled it with lint moistened with spirit of turpentine. This in a little while produced a good deal of pain and a great inflammation in his

his foot. While I was preparing to treat him in the manner I had treated the two former cases, the pains and spasms in his body suddenly left him, and in twenty-four hours after I saw him, he complained of nothing but of the pain and swelling in his foot, which continued for several weeks and did not leave him till it ended in a suppuration. From the history of these three cases, I beg leave to make the following remarks.

1. That the predisposition to the tetanus depends upon relaxation. This relaxation is generally produced by heat; but excessive labour, watchings, marches, or fatigue from any cause, all produce it likewise, and hence we find it more frequent from wounds received in battles, than from similar wounds received in any other way. These wounds more certainly produce the tetanus, if they have been preceded for some time with warm weather. Dr. Shoepft, the physician general of the Anspach troops that served at the siege of York in the year 1781, informed me of a singular fact upon this subject. Upon conversing with the French surgeons after the capitulation, he was informed by them that the troops who arrived just before the siege from the West Indies with Count de

Grafse, were the only troops belonging to their nation that suffered from the tetanus. There was not a single instance of that disorder among the troops who had spent a winter in Rhode Island.

2. As the tetanus seems to be occasioned by relaxation, the medicines indicated to cure it are such only as are calculated to remove this relaxation and to restore a tone to the system. The bark and wine appear to act in this way. The operation of the blisters, is of a more complicated nature. That they are sedative and antispasmodic in fevers is universally acknowledged, but in the peculiar state of irritability which occurs in the tetanus, perhaps their effects are more simply stimulating. But I will go one step farther. In order to cure this disorder, it is necessary not only to produce an ordinary tone in the system, but something like the inflammatory diathesis. The absence of this diathesis is taken notice of by all authors, particularly by Dr. Cullen*.

Mercury appears to act only by promoting this diathesis. Hence it never does any service unless it be given time enough to produce a

* First Lines, Vol. III.

salivation;

salivation. The irritation and inflammation produced in the mouth and throat, seldom fail to produce the inflammatory diathesis, as blood drawn in a salivation has repeatedly shewn.

I apprehend that the oil of amber acts as a stimulant chiefly in this disorder. I have heard of a tetanus being cured in the island of Grenada by large doses of mustard. Dr. Wright, lately of the island of Jamaica, relates in the 6th volume of the London Medical Essays, several remarkable cases of the tetanus being cured by the cold bath. Both these remedies certainly act as stimulants and tonics. By reasoning *à priori*, I conceive that electricity would be found to be an equally powerful remedy in this disorder.

As a general inflammatory diathesis disposes to topical inflammation, so topical inflammation disposes to general inflammatory diathesis. Wounds, upon this account, are less apt to inflame in summer than in winter. In the tetanus I have uniformly observed an absence of all inflammation in the wounds or injuries that produced it. A splinter under the nail produces no convulsions, if pain, inflammation and suppuration follow the accident. It is by exciting pain and inflammation I apprehend that the spirit

rit of turpentine acts in all wounds and punctures of nervous and tendinous parts. I have never known a single instance of a tetanus from a wound, where this remedy had been applied in time. It was to excite an inflammation in the foot of Mr. Leslie, that I dilated the wound and filled it with the spirit of turpentine. I was not surprised at its good effects in this case, for I was prepared to expect them.

I find a remarkable case related in Dr. W. Munro's Thesis, published in Edinburgh in the year 1783, of a black girl who had a tetanus from running a nail in her foot; being perfectly cured by deep and extensive incisions being made in the wounded part by Dr. John Bell, of the island of Grenada.

It is by producing inflammation in a particular part, and tone in the whole system, I apprehend that the amputation of a wounded limb sometimes cures a tetanus; and it is because the degrees of both are too inconsiderable to oppose the violence of the spasms in the advanced stages of the tetanus, that amputation often fails of success.

I have been informed by a physician who resided some time at St. Croix, that the negroes on that island always apply a plaster made of
equal

equal parts of salt and tallow to their fresh wounds, in order to prevent a locked jaw. The salt always produces some degree of inflammation.

If the facts that have been stated are true, and the inferences that have been drawn from them are just, how shall we account for the action of opium in curing this disorder? I do not deny its good effects in many cases, but I believe it has failed in four cases out of five in the hands of most practitioners. It is remarkable that it succeeds only where it is given in very large doses. In these cases I would suppose that its sedative powers are lost in its stimulating. It is upon a footing, therefore, in one respect, with the stimulating medicines that have been mentioned; but from its being combined with a sedative quality, it is probably inferior to most of them. I am the more inclined to adopt this opinion, from an account I once received from Dr. Robert, of the island of Dominique, who informed me that after having cured a negro man of a tetanus with large doses of opium, he was afterwards seized with a disorder in his stomach, of which he died in a few days. Upon opening him, he found his stomach inflamed and mortified. I

do not forbid the use of opium altogether in this disorder. I think small doses of it may be given to ease pain, as in other spasmodic disorders; but as its qualities are complicated, and its efficacy doubtful, I think it ought to yield to more simple and more powerful remedies.

To the cases that have been mentioned, I could add many others, in which I have reason to believe that the excitement of a topical inflammation by artificial means, has effectually prevented a tetanus.

To this account of the tetanus, I beg leave to subjoin a few words upon a disorder commonly called the jaw-fall in infants, or the *Trismus Nascentium* of Dr. Cullen, which is nothing but a species of tetanus.

I have met with three cases of it in this city, all of which proved fatal. The stage of the disorder in which I was consulted, and the age and weakness of the infants, forbade me to attempt any thing for their relief. I have introduced the subject of this disorder in children, only for the sake of mentioning a fact communicated to me by the late Dr. Cadwalader Evans of this city. This gentleman practised physic for several years in Jamaica, where he had frequent

quent opportunities of seeing the tetanus in the black children. He found it in every case to be incurable. He supposed it to be occasioned by the retention of the meconium in the bowels. This led him invariably to purge every child that was born upon the estates committed to his care. After he adopted this practice, he never met with a single instance of the tetanus among children.

Perhaps it may tend to enlarge our ideas of the tetanus, and to promote a spirit of inquiry and experiment, to add, that this disorder is not confined to the human species. I have known several instances of it in horses from nails running in their feet, and other accidents. It is attended with a rigidity of the muscles of the neck, a stiffness in the limbs, and such a contraction of the jaw as to prevent their eating. It is generally fatal. In two cases I had the pleasure of seeing the disease perfectly cured by applying a potential caustic to the neck under the mane, by large doses of oil of amber, and by plunging one of them into the river, and throwing buckets of cold water upon the other.

How far the reasonings contained in this paper may apply to the hydrophobia, I cannot determine, having had no opportunity of seeing

the disease since I adopted these principles; but from the spasmodic nature of the disorder, from the season of the year in which it generally occurs, and, above all, from the case related by Dr. Fothergill, of a young woman having escaped the effects of the bite of a mad cat by means of the wound being kept open, (which, from its severity, was probably connected with some degrees of inflammation) is it not probable that the same remedies, which have been used with success in the tetanus, may be used with advantage in the hydrophobia? — In a disease so deplorable, and hitherto so unsuccessfully treated, even a conjecture may lead to useful experiments and inquiries.

CATALOGUE OF BOOKS.

1. **O**BSERVATIONS on the Diseases incident to Seamen. By *Gilbert Blane*, M.D. F.R.S. Physician Extraordinary to the Prince of Wales, Physician to St. Thomas's Hospital, and Physician to the Fleet in the late War. 8vo. *Murray*, London, 1786.

2. Introduction to the Practice of Midwifery, Part the First. By *Thomas Denman*, M.D. Physician