

## IS TETANUS (LOCKJAW) CAUSED BY VACCINATION?\*

BY F. E. STEWART, PH.G., M.D., PHAR.D.

It is important for pharmacists to know that tetanus (lockjaw) is not caused by vaccination against smallpox. It has been my duty to investigate this subject in a number of cases ascribed to impure vaccine virus by the newspapers. In every case I have been brought in contact with not only the physician who did the vaccinating, but also with the pharmacist who sold the vaccine, and I have found such an unfortunate lack of information that I am impressed with the duty of bringing the subject before the pharmacists of the country that they may have accurate information.

Much opposition is being directed against compulsory vaccination laws by the anti-vaccinationists, and all of these cases of tetanus following vaccination are used by them as stock arguments against vaccination as a preventive of smallpox. Hence it is of the greatest importance to the physician, to the pharmacist, and to the public that the possibility of this particular infection should be carefully investigated.

In a recent case, where two children died of tetanus, following vaccination, in a neighboring state, the newspapers were filled with sensational statements in which the disease was ascribed to "impure virus." To make bad matters worse, the newspapers stated that "medical authorities agree that in cases of tetanus resulting from vaccination, impure virus is the cause."

One of the children referred to was vaccinated 26 days before symptoms of tetanus made their appearance. On inspection, after admission to the hospital, it was noticed that this child had several scars and wounds from scratches on the limbs; the other child, who was vaccinated 27 days before the tetanus symptoms occurred, showed a badly-infected sore on the knee. No other cases of tetanus were reported as having occurred from the use of the vaccine. Careful investigation was made to ascertain the disposal of samples of the same lot. About 20,000 packages of this vaccine were issued, and it is safe to assume that between 40 and 60 percent of it was used for vaccination in various parts of the United States, and in no instance was there any sign of tetanus following the vaccination.

Tetanus spores are very common. The soil is contaminated almost everywhere, especially in some parts of the country. "In nature, the tetanus bacillus has been found by Nicolaier and others to occur in the superficial layers of the soil. The earth of cultivated and manured fields seems to harbor this organism with especial frequency, probably because of its presence in the digesta of some of the domestic animals.<sup>1</sup> From the alimentary canal they reach the soil, where the vegetative form probably soon dies, but the spore form is very resistant and capable of living under the most adverse conditions for months or years.

While<sup>2</sup> "The vegetative forms of the tetanus bacillus are not more resistant against heat or chemical agents than the vegetative forms of other microorganisms,

\* This paper and the remarks by Dr. William S. Wadsworth and C. Oscar Beasley, Esq., were presented at a symposium on the subject of vaccination, held on Tuesday evening, November 9, 1915, by the Philadelphia Branch of the American Pharmaceutical Association, at the Temple University School of Pharmacy.

<sup>1</sup> See footnote on next page.

<sup>2</sup> Hiss and Zinsser, *A Text-Book of Bacteriology*, p. 457.

tetanus spores, however, will resist dry heat at 80° C. for about one hour,<sup>3</sup> live steam for about five minutes. Protected from sunlight and other deleterious influences, tetanus spores may remain viable and virulent for many years. Henrijean has reported success in producing tetanus with bacilli from a splinter of wood infected eleven years before.

"The comparative infrequency of tetanus infection is in marked contrast to the wide distribution of the bacilli in nature. Introduced into the animal body as spores, and free from toxin, they may often fail to incite disease, easily falling prey to phagocytosis and other protective agencies before the vegetative forms develop and toxin is formed. The protective importance of phagocytosis was demonstrated by Vaillard and Rouget, who introduced tetanus spores inclosed in paper sacs into the animal body. By the paper capsules the spores were protected from the leucocytes, not from the body fluids. Nevertheless, tetanus developed in the animals. The nature of the wound and the simultaneous presence of other microorganisms seem to be important factors in determining whether or not the tetanus bacilli shall be enabled to proliferate. Deep, lacerated wounds, in which chips of glass, wood splinters, or grains of dirt have become embedded, are particularly favorable for the development of these germs. The injuries of compound fractures and of gunshot wounds are especially liable to supply these conditions, and the presence in such wounds of the common pus cocci or of other more harmless parasites may aid materially in furnishing an environment suitable for the growth of the tetanus bacilli. Apart from its occurrence following trauma, tetanus has been not infrequently observed after childbirth, and isolated cases have been reported in which it has followed diphtheria and ulcerative lesions of the throat.

"A definite period of incubation elapses between the time of infection with tetanus bacilli and the development of the first symptoms. In man this may last from five to seven days in acute cases, to from four to five weeks in chronic ones. Experimental inoculation of guinea-pigs is followed usually in from one to three days by rigidity of the muscles nearest the point of infection. This spastic condition rapidly extends to other parts, and finally leads to death, which occurs within four or five days after infection."<sup>4</sup>

The tetanus bacillus and its spores are so wide-spread in nature that opportunity presents itself for contamination of the vaccinal wound and the virus itself. This fact is well known and its significance thoroughly appreciated by the producers of vaccine virus. Every precaution is, therefore, taken in the preparation of the virus, and physicians should realize the necessity for observing great care in the treatment of the vaccinal wound, to insure the patient from the risk of infection from the soil by protecting the wound against contact with any substance liable to contain tetanus spores. However, in spite of such precautions on the part of the physicians, ignorance and carelessness on the part of parents and their children sometimes defeat these precautionary measures. It is exceedingly difficult to always determine the source of infection in each case of vaccinal tetanus, but investigations indicate that the virus itself is not the vehicle of infection.

The results of extensive investigations of this subject by Dr. John F. Anderson,

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<sup>3</sup> W. F. Elgin, Director of the Mulford Vaccine Laboratories, says: "Later work of Francis, however, puts a higher limit than 80° C. In fact, one of our methods for differentiating tetanus from other bacilli is to heat to 80° C. for one hour to destroy toxins and other bacteria, leaving tetanus spores still viable." (Personal communication.)

<sup>4</sup> Francis, in a bulletin published by the U. S. Bureau of Hygiene (No. 95), gives as the shortest time, three days, and from that on to nine days, most commonly three to four days.

Director of the Hygienic Laboratories of the United States Public Health Service, are set forth in Public Health Report, vol. xxx, No. 29, July 16, 1915. The evidence is of the most exhaustive and convincing character. Surgeon Edward Francis, of the Division of Pathology and Bacteriology, working under Director Anderson, conducted experiments to determine the possibility of infecting guinea-pigs and monkeys, which are susceptible to both vaccinia and tetanus, by inoculating with a mixture of vaccine and tetanus organisms. All experimental animals failed to develop tetanus, neither did the living tetanus germs establish themselves in the vaccination sores, nor were there any symptoms of poison from tetanus toxin, which would have been the case if the germs had been able to grow in the sores. In other words, as stated by Dr. Anderson, "It is difficult, if not impossible, to produce tetanus in susceptible animals by vaccination with virus containing large numbers of tetanus organisms which have been purposely placed therein."

It is pointed out by Dr. Anderson "that this conclusion is strengthened by the rarity of such cases, only 41 being recorded among over 31,000,000 vaccinated subjects during 1904-1913 inclusive."

This view was further strengthened by the failure of the Bureau of Hygiene to demonstrate tetanus organisms in a large amount of vaccine virus, specifically examined for that purpose.

The production of vaccine virus is conducted by the large propagators under government license, issued by the Bureau of Hygiene. No vaccine is permitted to enter into interstate commerce except under the inspection of the Bureau. The inspectors are always alert and are constantly examining the facilities of the manufacturers and testing their products by purchasing vaccine virus on an open market and examining the same for tetanus spores and other contaminating micro-organisms.

In conducting the work of the Bureau, samples of vaccine virus sufficient for 2,000,000 vaccinations, obtained from the various propagators, have been examined, and in not a single instance were tetanus spores discovered in the vaccine. Dr. Anderson, therefore, further concludes "that, in view of the failure to demonstrate tetanus organisms in the large amount of vaccine virus specifically examined for that purpose, it seems exceedingly improbable that vaccine virus, as sold in the United States, contains organisms."

If the vaccine virus in the United States had been at fault during the time in which the production has been under the observation of the Bureau of Hygiene, many more cases of tetanus should have followed vaccination.

Further, no cases of tetanus following vaccination were reported in the United States Army and Navy during the ten years between 1904 and 1913 among 585,000 persons vaccinated, although the lymph used came from the same stocks as were used for the civil population. This, Dr. Anderson states, "is an argument in favor of the contention that the cases of tetanus following vaccination in the country at large were not due to infection contained in the virus."

The average period from vaccination to onset of symptoms of tetanus in 83 cases of tetanus following vaccination was 20.7 days, while the average mortality of 93 cases was 75.2 percent, this being slightly higher than the mortality of cases of tetanus due to other causes with an incubation of ten days or less.

Therefore, as concluded by Dr. Anderson, "cases of tetanus, occurring 15 or 20 days subsequent to vaccination, do not receive their infection through the vaccine virus. In all probability the infection is received about the tenth day." The cases above referred to were those of children who had been vaccinated 26 days previously, and, therefore, in the light of what has just been stated, it is evident that

the infection was not caused by the vaccination, but occurred not less than ten days afterward.

As stated by Dr. Anderson, "the infection with tetanus is received by a contamination of the vaccination wound, such as may occur in the infection or any other surgical wound not properly cared for. No matter how carefully the physician cares for the wound produced by vaccination, infection may occur, because it is impossible to keep the patient under continuous observation. While it is true that it is difficult, if not impossible, to produce tetanus by injecting the tetanus germs into healthy tissues, yet a suppurating wound, owing to the lowered resistance of the tissues, resulting from the growth of pus-producing organisms, is particularly susceptible to infection by tetanus germs derived from the soil or possibly blown in the dust by a passing wagon or automobile."

It should always be remembered that the occurrences of tetanus not following vaccination are far more frequent than post-vaccinal cases. For example, in 1909 the total vaccine virus distributed by the Health Department of Philadelphia, as recorded by Dr. Wadsworth, the Coroner's Physician, was 40,400; the total cases of tetanus investigated by the Health Department during the same year were 25, of those only three were post-vaccinal. In 1910, 65,000 packages were distributed; total cases of tetanus reported, 30 (post-vaccinal, 4). In 1911, 44,183 packages were distributed; total cases of tetanus reported 24 (post-vaccinal, 3). In 1912, total virus distributed by Health Department, 40,844; total cases of tetanus reported 24 (post-vaccinal, 2).

In these four years the city distributed 190,427 "vaccinations," and Dr. Wadsworth estimates that private firms sold at least double this amount, making more than one-half million vaccinations in the city. Tetanus followed in only 13 cases, while there were 90 cases of tetanus having no relation to vaccination. This would certainly seem to demonstrate that tetanus following vaccination can be accounted for in the same way as tetanus following any other wound presenting proper conditions for the reception and development of tetanus spores.

Before the introduction of vaccination, smallpox was the greatest scourge that affected the human race. In 1796, Junker wrote that 400,000 lives were lost yearly by smallpox. In 1803, King Francis William of Prussia, in an edict, stated that 40,000 died annually in Prussia of the disease. From 1761 to 1800, in the city of London, there was an average death rate of 2037 persons yearly from smallpox. From 1700 to 1800 it is estimated that an average of 500,000 persons died yearly from smallpox throughout the world. Before Jenner's discovery it is estimated that one-tenth of all the children born died of smallpox. Since the early part of the nineteenth century, when smallpox—which at first assumed epidemic form in Europe about 1700—had become a veritable scourge, suddenly began to decline coincident with the general adoption of vaccination, and that decline continued for decade after decade until the disease lost its terrors, the great majority of physicians now living have never so much as seen a case. Do we want a return of this terror? Do we want a return of the terrible smallpox epidemics of the Middle Ages? Do we want a return of conditions described by Lord Macaulay, who, writing of the death of Queen Mary of England, in 1694, said of smallpox:

"That disease, over which science has achieved a succession of glorious and beneficent victories, was then the most terrible of all the ministers of death. The havoc of the plague has been far more rapid, but the plague has visited our shores only once or twice within living memory; and the smallpox was always present, filling the churchyards with corpses; tormenting with constant fears all whom it had not yet stricken, leaving on those whose lives it spared the hideous traces of

its power, turning the babe into a changeling at which the mother shuddered, and making the eyes and cheeks of the betrothed maiden objects of horror to the lover."

If we do not want a return of this terrible time, let the newspapers, instead of frightening people concerning the "dangers" of vaccination by scare headlines, when an occasional death occurs from tetanus following vaccination, carefully investigate such reports in all cases, and, instead of permitting the public to draw erroneous conclusions from the publication of half-truths, let them caution the public in relation to the care of vaccination wounds to prevent possible infection with tetanus spores.

From the beginning there has been opposition to vaccination, some of which prevails even at the present time. The Anti-vaccination Society was formed in London to combat Jenner in his work. All kinds of arguments were brought forward against vaccination. It was claimed that the physical characteristics of the bovine species were transmitted by the vaccine, and that the persons who submitted to the operation developed horns and hoofs like a cow. Thousands of circulars were distributed, illustrated by a very remarkable picture, entitled "Cow-pox; or, the Wonderful Effects of the New Inoculation." This picture represented vaccinated persons with the heads of cows growing out of their foreheads: Women, otherwise good looking, were represented as having horns and hair of a cow in place of the natural hair. Various portions of the cow grew out of the body in different places.

*Dr. Osler's Challenge to the Anti-vaccinationists.*—"A great deal of literature has been distributed casting discredit upon the value of vaccination in the prevention of smallpox. I do not see how any one who has gone through epidemics, as I have, or who is familiar with the history of the subject, and who has any capacity left for clear judgment, can doubt its value. Some months ago I was twitted by the editor of the Journal of the Anti-vaccination League for 'a curious silence' on this subject. I would like to issue a Mount Carmel-like challenge to any ten unvaccinated priests of Baal. I will go into the next severe epidemic with ten selected vaccinated persons and ten selected unvaccinated persons. I should prefer to choose the latter—three members of Parliament, three anti-vaccination doctors, if they could be found, and four anti-vaccination propagandists. And I will make this promise, neither to jeer nor to gibe when they catch the disease, but to look after them as brothers, and for the four or five who are certain to die I will try to arrange the funerals with all the pomp and ceremony of an anti-vaccination demonstration."

#### COMPULSORY VACCINATION LAWS.

We have digressed somewhat from our subject. The question before us for discussion is, "Is Tetanus Caused by Vaccination?" and the foregoing evidence proves overwhelmingly that post-vaccinal tetanus is not caused by impure virus. One of the reasons advocated by the anti-vaccinationists in support of their attempt to have the compulsory vaccination laws repealed is that the virus is impure and the vaccination carries with it various infectious diseases, including tetanus. We have shown that, so far as tetanus is concerned, this claim is unwarranted. The limits of this paper will not permit discussing the other phases of the subject. The intent of the paper is neither to advocate nor discourage compulsory vaccination laws, but to point out that one of the strong arguments against these laws urged by the anti-vaccinationists has no reasonable foundation. There is another phase of our subject which ought to be referred to before closing the paper, and that is—

how to prevent accidents following vaccination—and I can bring this paper to a conclusion in no better way than to impart some of the suggestions that have been made by public health officials in regard to the proper precautions to be observed in conducting this operation.

Study of the cause of post-vaccinal tetanus brings out one very interesting feature, and that is the influence of season in its relation to post-vaccinal tetanus. In 77 cases of tetanus following vaccination, the date of onset was determined, and of this number it was found that 29 persons who had been vaccinated developed tetanus in October, 15 in September, 10 in August, and 8 in November. The other eight months of the year show a total of 15 cases, with none in March or April. Therefore, over 80 percent of these cases occurred in the late summer and three fall months.

Dr. W. F. Elgin, in his paper entitled "Accidents Following Vaccination" (American Journal Public Health, September, 1915), calls attention to the same fact. He notes, by reference to his statistics, that a large proportion of the tetanus cases developed in the fall, while large amounts of virus are also distributed in winter and spring, with a small case rate for tetanus, and he asks, "Does this not indicate that weather conditions, dust, etc., are more favorable to tetanus development in the summer and fall than at other times?" Believing this to be so, he strongly urges that health officers and others responsible for the vaccination of school children should insist on a change in the time when this operation is performed as a routine procedure.

Vaccination is a surgical procedure, and the same care should be exercised in conducting the operation and in the after-care of the wound as employed in relation to any other surgical operation. Therefore, the following rules should be observed:

*First.*—Rigid cleanliness should be exercised in preparing the patient for vaccination.

*Second.*—Deep scarification should be avoided; no blood should be drawn. Also the cross-scarification method of vaccination, which is prohibited by law in some European countries, and the employment instead of two needle scratches or the rotary vaccinating chisel are recommended.

*Third.*—The physician should dress the patient's arm and give careful instructions as to the subsequent care of the vaccination wound.

*Fourth.*—The vaccination wound should be left alone for a week or ten days, at which time the dressing should be removed and the area around the vaccination cleaned with sterile water. The arm should then be dressed by the physician and the patient instructed to return at intervals for the inspection of the vaccinated area until the scab drops off in the regular way, which occurs from the twenty-third to the twenty-eighth day. It is important to avoid the use of the old-time bunion-plaster-shape shields, attached by irritating adhesive strips. The parents of the child should be provided with proper dressing and instructed how to use the same during the interim.

*Fifth.*—Only active vaccine should be employed, and the physician should be sure that the virus has been carried in a refrigerator and not exposed to heat, remembering that unless kept at low temperature the vaccine soon becomes inert and will not "take."

*Sixth.*—Vaccination should preferably be performed in the winter to get the best results, as the vaccine, being a living virus, is easily destroyed by summer temperature. Furthermore, there is less liability to accidents following vaccination in the winter, because the children are less exposed to dust and contaminating

bacteria. During cold weather children are not so liable to play in the streets or around stables where they are exposed to tetanus germs, and the vaccinated area receives protection from infection by the clothing.

REMARKS BY WILLIAM S. WADSWORTH, M.D.

I came to listen and learn, not to talk, but I do not hesitate to take my stand for any good work being done for the public health, and I gladly add my word in this good cause. While my addition to this subject has been very small, being limited to the paper already quoted, on tetanus records of Philadelphia, I am deeply interested in the problems and the subject as a whole.

Dr. Stewart has already given you a very clear and true summary of the conclusions and the facts on which they are based. It is certainly pertinent to the subject, if not altogether pleasant, to consider the opposition.

It is difficult to see how high-grade men can oppose such a movement, but the methods employed by the opposition are not those of high-grade men. These methods lack honesty and honor, and the subject is most unattractive to one who would like to think well of his fellow men.

How can there be two sides to the fight against pestilence? Of course, any crime will be defended by some lawyer, but such proceedings do not raise our enthusiastic approval. I cannot conceive how those who fight in the interests of pestilence can justify their acts. I can understand contending for greater care and improved methods, but not for such nihilistic standards.

To me there is one side—that of the honest and earnest worker for the health of the whole public, who, by using every possible precaution and striving with heartbreaking strain to find new precautions, seeks to make the only known means of fighting this pestilence safe. Perhaps one instance of the methods of crafty and unscrupulous opposition will be in order. While the paper quoted was in the hands of the printer, the opposition had published in an Ohio city a flashy account of cases of tetanus in Philadelphia *occurring in previously healthy persons and wholly due to vaccination*, and giving the number of cases which had resulted from all causes as due to vaccination alone. The number given corresponded with those given by me before the commission, and occurred nowhere else at that time.

This single instance is only a sample of the way truths are perverted for a bad cause. I could give you many. You simply cannot believe a word the opposition utters. Even when it contains the truth there is glaring falsehood.

I congratulate you on hearing Dr. Stewart's paper and thank you for the pleasure of meeting and speaking to you.

REMARKS OF C. OSCAR BEASLEY, ESQ.

As Doctor Wadsworth, in his remarks just finished, characterized the anti-vaccinationists as being "ignorant," as "using underhanded methods of fighting," and as "championing the cause of pestilence," I think that it is only fair that the audience should have a look at an anti-vaccinationist, for inspection purposes, to see whether we have horns or not, and also to hear the arguments that come from such "crazy" people.

Doctor Wadsworth says that there is only one side to the vaccination question. I say in reply to this what John Stuart Mill says: "He who knows only his own side of the case knows little of that."

The great obstacle that stands in the way of every attempt to secure, by intelligent discussion, a settlement of the vaccination question is that the vaccinationists

do not meet our objections with scientific data. Mere epithets and assumptions prove nothing.

The vaccination question has its historical and political, as well as its scientific, aspects. It is historical, in the sense that it involves consideration of the experience of communities with smallpox epidemics; and it is political, in that an influential element of the medical profession has caused compulsory vaccination to be put into the statute law, which is enacted by the legislative representatives of the people.

The greatest smallpox epidemic in history, both in the number of cases and in the proportion of deaths, occurred, not in pre-vaccination times, but in 1872, after more than a half century of well-nigh universal vaccination. It has been conclusively proved that of the more than 44,000 deaths from smallpox that occurred in England and Wales in 1870-71-72, at least 90 percent occurred in vaccinated persons, and the experience of Prussia and other German states, in the same epidemic, was similar. This failure of vaccination to protect the world from the furious smallpox epidemic of 1872 turned the minds of men toward more thorough investigation than had before been undertaken, of the protection that vaccination was alleged to afford to communities against epidemics of smallpox.

Jenner assured the English House of Commons, in his petition for remuneration, presented in 1802, that cow-pox "admits of being inoculated on the human frame with the most perfect ease and safety, and is attended with the singularly beneficial effect of rendering through life the person so inoculated perfectly secure from the infection of the smallpox." This was soon shown by actual experience to be a false premise.

Cow-pox virus contaminated with the virus of smallpox Jenner denounced as spurious.

Now the medical profession has almost entirely discarded cow-pox, and smallpox, only, is generally used for the propagation of vaccine virus. In other words, the members of the medical profession have thrown overboard their vaccination hero, Jenner. They have put Jenner's cow-pox virus into the scrap heap, and have substituted for it the matter of human smallpox.

Another dead-surely-right cult, arm-to-arm vaccination, which was upheld by the members of the medical profession for nearly a century, they finally discovered to be a mistake; and this, also, they have thrown overboard. In fact, they have now thrown overboard nearly everything, nearly every alleged fact, nearly every argument, upon which, in the beginning, they induced the governments of the leading civilized nations of the world to endorse vaccination, and subsequently to force it upon their people by the instrumentality of statutory compulsion.

Arm-to-arm vaccination was found to be a mistake, because it was dangerous to health and life. It was proved that by it many diseases had been transmitted from one arm to another. It was therefore discarded.

Anti-typhoid serum is a sterile substance made of dead typhoid fever germs; so, also, is diphtheria antitoxin a sterile substance. But vaccine virus is not sterile. It is decaying living matter derived from suppurating sores on diseased beasts. The introduction of such diseased matter into the human circulation is denounced by true biologists, except when vaccination against smallpox is concerned. Why the introduction of diseased living matter is always dangerous, except when vaccination against smallpox is concerned, is as yet unexplained.

Something has been said of the safety of which the public can rest assured because of laboratory inspection, not only by the vaccine manufacturer, but also by



representatives of the United States Public Health and Marine-Hospital Service. When we recall, however, that for five or six years several vaccine farms in this country propagated vaccine virus contaminated with the foot-and-mouth disease of cattle, and that this contamination escaped discovery during that time, causing hundreds of thousands of diseased vaccine points to be used for the vaccination of children, we can gather some idea of what the so-called laboratory inspection amounts to from the standpoint of public safety.

Tetanus germs exist in soil and in hay, and in the alimentary canal, the hair, and the manure of the calf. We can easily realize, therefore, that the very origin of vaccine virus is in an environment of tetanus. And when we recognize, further, that tetanus in the form of spores is apt to elude discovery, and, further, that tetanus spores require for their development only just such a favorable culture medium as the vaccination sore furnishes, we may conclude, by reasoning from analogy, that these facts are in favor of the theory that the germs of tetanus implanted in the vaccination sore are derived from the vaccine matter rather than of the theory that they are acquired from extraneous infection.

It has been asserted here to-night that Doctor Anderson's tests have shown that when tetanus germs were mixed with vaccine matter for the purpose of experimentally determining whether such matter could produce tetanus, this matter failed to produce tetanus in guinea-pigs inoculated with it. If this is so, why does it happen that these same germs cause tetanus when they are directly introduced into the vaccination wound, from outside infection, although they do not cause tetanus when they are directly introduced into the vaccination wound in the experimental inoculation of guinea-pigs?

The spores of tetanus cannot grow into adult tetanus germs and produce their specific toxin except in the absence of oxygen, and this is aided by the presence, also, of pyogenic organisms. So long as the vaccination sore is open and discharging its pus outwardly there is little likelihood of the tetanus spores developing, but when, after the scab begins to form, the air is excluded, and the affected tissues are deprived of oxygen, the spores develop in the suitable culture medium provided by the vaccination sore and produce their appropriate toxin, and the disease tetanus results. These conditions and the time required for the tetanus spores to develop into full-grown tetanus organisms account for the prolonged incubation period that usually characterizes cases of vaccinal tetanus. Indeed, Dr. Joseph McFarland, in his paper on "Tetanus and Vaccination," read at the Second Annual Meeting of the American Association of Pathologists and Bacteriologists on March 28, 1902, in speaking of severe local lesions following vaccination, says: "Lastly, and I think truly, it may mean that it is only when such local lesions occur that the implanted tetanus bacilli can find conditions suitable for their development." And Doctor McFarland adds, as one of the conclusions that he thinks seem justifiable from the facts stated in his paper: "The tetanus organisms may be present in the virus in small numbers, being derived from the manure and hay."

Dr. Robert N. Willson, of Philadelphia, while making bacteriological examinations of the contents of glycerinated vaccine points, found pus-organisms, the streptococcus, the staphylococcus, and the pneumococcus. Doctor Willson says that glycerin "would tend to accelerate rather than to retard the action of the tetanus process." Doctor Willson inoculated a white mouse with a culture of vaccine virus, with the result that one minute later the mouse died in convulsion. This culture was derived from a glycerinated point purchased in the open market and ready for use.

Thus it has been shown that vaccine virus itself, and the vaccination sore, furnish the best possible media for the development of the tetanus spores into the adult germs of tetanus, resulting in the disease itself. And in the face of these facts it is idle to declare that it is proved that cases of tetanus following vaccination must necessarily be due to some outside infection. This is especially so as Bolton states, in "Williams's Manual of Bacteriology," that "the toxic substance of tetanus appears not to be a ptomaine, as was at first supposed," and that "its exact nature is not determined." As the very nature of the toxic substance of tetanus is unknown, any positive statements, such as have been made here to-night, about the virus used in vaccinating not being the infecting agent, are manifestly unwarranted by the facts.

What the anti-vaccinationists want is to receive satisfactory answers to all these questions, such as will clear up all the doubtful points concerning vaccination, and not mere dogmatism and mere assertion. Present experience proves that smallpox can be kept out of a community or kept under control by quarantine and isolation and other sanitary measures without vaccination. In England and Wales vaccinations have decreased in number nearly 50 percent in recent years, and smallpox has been kept down to the lowest point it has reached there during the last four hundred years. The medical profession will have to deal more frankly with the public in this matter if it expects the confidence of the public. Utah has expressly prohibited compulsory vaccination, and various other states of the Union have done away with the general enforcement of vaccination; and Great Britain is relieved by parents being simply required to make a written declaration, and the child is left unvaccinated, and no increase of smallpox has followed among its great unvaccinated population.

The vaccine virus now most generally used is human smallpox matter modified by passage through lower animals and by mixture with glycerin. In the original preparation of seed virus the most satisfactory material was found to be pulp taken from the vesicles on the corpses of persons that had died of smallpox. This material was inoculated into the monkey, on whose body it makes a sore and sometimes an eruption. After passage through several monkeys, the resulting decayed and diseased matter from the sores of the monkey is in turn inoculated into the calf, when another kind of sore is produced, resulting from the diseased smallpox matter, plus the diseased tissues of the monkey; and then the process is completed by the addition of impurities derived from cultivation of this diseased matter in the skin of series of calves. Such an origin for any substance to be introduced into the human circulation is abhorrent to both reason and science.

Continued inoculation of the seed virus, from calf to calf, in time produces a still further modified virus, which loses the power to make a satisfactory sore. The vaccine manufacturer must then get something to start with again that is sufficiently impure to last for a while. Finding themselves in this predicament some years ago, propagators of vaccine virus sent to Japan and procured some seed vaccine virus from that country. What it was, was unknown. It seemed, however, to be of sufficient impurity and disease-producing character to start a new strain of vaccine virus in the United States. For five or six years this virus was sent out, and then it was discovered that in spite of the Federal inspection this seed virus was matter either derived from or contaminated with foot-and-mouth disease. Meanwhile, many hundreds of thousands of children had been inoculated with the vile stuff, and what diseases it left in its train is not known.

## COMMENT.

Some of the foregoing statements will doubtless be challenged by the medical profession generally. According to Edwardes,<sup>6</sup> the epidemic of smallpox in Europe in 1870-5, referred to by Mr. Beasley as occurring in 1872, "after more than a half century of well-nigh universal vaccination," really occurred at a period in England when compulsory vaccination was only just beginning. Comparison of the death-rate during this pandemic of smallpox between countries where compulsory vaccination existed and those without compulsory vaccination demonstrated so clearly the benefit of compulsory vaccination laws that it acted as a touchstone in Europe and greatly stimulated the passage of such laws. The vaccination laws throughout the world were made much more stringent from this time. Vaccination was already compulsory in the German Army, but Emperor William, as a result of his observation in regard to this epidemic, issued an order making vaccination compulsory in civil life, and the result has been that smallpox epidemics in Germany have been unknown since that time. According to Edwardes, the death-rate per million population during the years 1871 and 1872 was as follows:

## 1871.

*With Compulsory Vaccination Laws.*—England, 1012; Scotland, 428; Bavaria, 1045; Sweden, 78.

*Without Compulsory Vaccination Laws.*—Prussia, 2432; Austria, 392; Belgium, 4168; Netherlands, 4355.

## 1872.

*With Compulsory Vaccination Laws.*—England, 821; Scotland, 718; Bavaria, 611; Sweden, 81.

*Without Compulsory Vaccination Laws.*—Prussia, 2624; Austria, 1899; Belgium, 1560; Netherlands, 1021.

It was not until 1873 that Austria was influenced by the epidemic to any great extent. During that year the death-rate in that country was 3147.

For further statistics see Report of The Pennsylvania State Vaccination Commission, March, 1913. Henry C. Lippincott, Secretary.

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<sup>6</sup>"Concise History of Smallpox and Vaccination in Europe," by Edward J. Edwardes, M.D., member of the Royal College of Physicians, London.

### ANTITOXIN IN BLOOD OF TETANUS CONVALESCENTS.

Löwy found no evidence of an antitoxin in the serum from 4 patients with tetanus (drawn before antitetanus serum had been injected), nor in 5 normal serums, but the tests were positive in the serum from 10 among 15 convalescents. Excluding the 5 whose serum reacted positively to horse precipitinogen, this leaves 5 with an unmistakable antitoxin content in their serum, capable of neutralizing the dose of toxin fatal for the mouse. This antitoxin does not last long; by the thirty-seventh day it failed to neutralize the toxin effectually and the mouse died. No connection between the antibody production and the course of the tetanus or location of the wound could be detected.—*Wiener Klinische Wochenschrift*, November 25, 1915, through *J. A. M. A.*