For the census year ending May 31st, 1880, the total number of deaths reported as due to diphtheria was 38,143, or 52.32 per 1,000 of all deaths from known causes. For the census year ending May 31st, 1890, the total number of deaths reported as due to diphtheria was 27,815, or 33.06 per 1,000 of all deaths from known causes.

Ratio of deaths from diphtheria and croup together per 1,000 of all deaths from known causes:

In 1880 (Total, 56,109), namely, 77.96 per 1,000,

In 1890 (Total, 41,677), namely, 49.54 per 1,000,

showing a decided decrease in the latter year.

Table showing proportion of deaths from diphtheria and croup per 1,000 total deaths in cities of 35,000 population and upwards, and in rural districts:

Area.	Rate per 1,000 Deaths.	
	1880.	1890.
United States (Total)...	77.96	49.54
Cities	57.73	50.10
Rural	83.80	49.18

Tables were also presented, from which the following facts were shown:

Death-rates from diphtheria and croup per 100,000 of the population in the "registration States" (that is, those States in which a fairly accurate registration was obtained), for the year ending May 31st, 1890=95.4, namely;

Whites	96.03
Coloured	70.19

The larger death-rate among the whites was attributed to the far larger proportion amongst them of individuals under 15 years of age. In Columbia, where there was a large proportion of coloured children, the death-rates from these causes were:

Whites	67.88
Coloured	114.93

There have been great variations in the death-rates in individual years. In some of the cities they have increased; in others they have decreased. There is no general correspondence between the States and the individual cities in this respect.

Death-rate from diphtheria and croup taken together per 100,000 for year ending May 31st, 1890:

(1) In 28 Cities of the United States (of 100,000 and upwards	116.55
(2) In 28 largest German Cities	92.0
(3) In 28 largest English Cities	24.9

Analysis of the death-rates (from diphtheria and croup) in the 28 "registration cities" showed that the death-rate (1) among children under 5 years of age was much greater than in any other age group; (2) was much greater among the whites (119.76) than among the coloured (58.18); greater among those whites whose mothers were born in the United States (166.72) than among those whose mothers were born in Germany (117.05), or those whose mothers were born in Ireland (89.24). It was also shown that the death-rate from diphtheria and croup was more than twice as great in the cities (121.95) as in the rural districts (54.94). A considerable part of the differences shown in this table was attributed to the differences in the age distribution of the different classes of the population.

The bacteriological aspects of the question were presented in a report drawn up by Dr. Welch and others on behalf of the American Committee.

Between 6,000 and 7,000 cases of suspected or confirmed diphtheria had been examined bacteriologically up to May 1894.

For the bacteriological test sterilised swabs of absorbent cotton wool are used; the cultures are made in Loeffler's blood serum, the results being controlled by inoculation if there is any doubt.

According to the rule of the Health Department, "No person who has suffered from diphtheria shall be considered free from contagion until it has been shown by bacterial examination, made after the disappearance of the membrane from the throat secretions, no longer contain the diphtheria bacilli, and that until such examinations have shown such absence, all cases in boarding-houses, hotels, and tenement houses must remain isolated and undergo observation. Cultures are also made from the throats of the apparently healthy in infected houses. In a series of 6,158 cases 58 per cent. were proved bacteriologically to be true diphtheria."

Membranous Croup.—Of 286 cases in which the membrane was confined to the larynx or bronchi 80 per cent. proved to be true diphtheria, only 14 per cent. being undoubtedly not diphtheria. The diphtheria bacillus has been found in many cases where there are no symptoms of diphtheria, in cases where there is no other symptom than that of simple catarrh, and in various forms of tonsillitis or pharyngitis. Various bacteria are found associated with the diphtheria bacillus, the most common being the streptococcus pyogenes. The bacillus has been found in the throat after complete disappearance of the membrane for periods varying from three days up to five weeks.

In a series of 48 examinations of children in houses where there was diphtheria, the bacilli were found in 50 per cent. of the children where there was no isolation, less than 10 per cent. where the isolation was good. They have also been found in membrane-free sputa of the patient, on the person and clothing of the attendants, and on the various objects surrounding the patient.

A CASE OF RECOVERY FROM TETANUS IN WHICH ANTITOXIN WAS INJECTED.

By HENRY PERCY DEAN, M.B., M.S., B.Sc.(LOND.),
F.R.C.S.,

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THE patient, A. H., aged 16 years, a butcher by trade, was admitted into the London Hospital, under my care, on Tuesday, July 24th, complaining of stiffness in the muscles of the face and jaws.

History of the Injury.—On June 28th the patient's middle finger of the right hand was crushed between the cogwheels of a chaff-cutting machine. He came to the out-patient department on the following day, and his finger was soaked for half an hour in solution of perchloride of mercury (1 in 2,000), and then dressed with the double cyanide gauze and wool. He attended the out-patient department twice a week, and the same treatment was continued. For a week or ten days previous to his admission to the hospital he dug potatoes on several occasions, and took no precautions to keep the dressing intact. On Sunday, July 22nd, he found that he could not open his mouth properly, that he had pains in the back, and felt sleepy. On Tuesday, July 24th, he came to the hospital, and was admitted as an in-patient.

Condition on Admission.—One was at once struck with the expression on the patient's face. The rigidity of the facial muscles caused a retraction of the angles of the mouth, and produced a characteristic "risus sardonicus." The masseteric and temporal muscles were markedly rigid, so that the mouth could only be opened for about a third of an inch, and mastication was impossible. The tongue could be protruded, but the patient complained of some difficulty in swallowing. The muscles at the back of the neck were rigid, producing slight retraction of the head. The pectoral and abdominal muscles were only slightly rigid. There were no spasms or twitches of any of the muscles. No other affection of the nervous or muscular systems could be discovered. The wound of the finger had healed excepting at one small spot, where a drop of pus could be wiped away from a superficial granulation. There was a troublesome cough, but no expectoration. Temperature, 100° F. Urine high coloured, specific gravity 1030; no albumen or sugar, abundance of urates.

Progress of the Disease.—July 25th. Patient sweating freely. "Risus sardonicus" still more marked, and occasional painful twitches of the facial muscles. Increased difficulty in opening the mouth, and greater rigidity of the muscles generally. Temperature, 100° F.

July 26th. A rapid increase in the symptoms since yesterday. Expression of the face very much altered by the rigidity of the facial muscles. The teeth are clenched, and the mouth cannot be opened to the slightest extent; the masseteric and temporal muscles being quite hard. The muscles at the back of the neck and trunk are rigid, causing marked extension of the body. The pectoral and abdominal muscles are quite hard. Both legs are usually quite rigid in the extended position, the right more so than the left.

CHART NO. 1.—An hourly record of the temperature during and for four days after the administration of the antitoxin.

CHART NO. 2.—The morning and evening record of the temperature during the whole course of the disease

Occasionally the rigidity of the muscles of the leg relaxes, and the patient can then flex the knees with difficulty. At frequent intervals the muscles of the face, trunk, and legs pass into a condition of spasm with twitchings, and the patient cries out with pain. The spasm of the back muscles produces a well-marked opisthotonos. Examination of the patient will generally start a painful spasm. He complained of difficulty in swallowing, but could suck milk and beef-tea through an india-rubber tube. The urine could not be passed, and had to be withdrawn by catheter. It was decided to try the effect of tetanus antitoxin, and steps were taken to obtain the drug.

July 27th. At 1.20 a.m. the temperature was 100° F., and as the patient's condition was decidedly worse, 2.25 grammes of antitoxin, dissolved in sterilised water so as to make a 10 per cent. solution, were then injected into the subcutaneous tissue of the abdominal wall and thighs. Every six hours afterwards, a quarter of this amount, namely, 0.5625 gramme, was injected. For some hours after the first injection, painful spasms were frequent, and the temperature rose to 102° F.; pulse 144; respiration 32. After about nine hours the condition of the

patient began to improve, and at 2 p.m. he was much better. The mouth could be opened at least half an inch; the marked extension of the trunk had subsided, and the left leg could be moved about. The pectoral and abdominal muscles, together with those of the right leg, were still very rigid. The bowels were opened after an enema, and the urine was passed voluntarily. Painful spasms less frequent and less marked.

July 28th. Patient's condition not so good as yesterday at 2 p.m. Spasm and pain more marked and mouth not opened so well. At 4 p.m. another half-bottle of antitoxin, that is, 2.25 grammes, was injected, and the remaining half bottle was divided into four parts and injected every six hours as before.

July 29th. Patient has had considerable pain since yesterday, and during the night a hypodermic injection of morphine (gr. $\frac{1}{2}$) was given. Doses of chloral hydrate and bromide of potassium (gr. 10 of each) were given occasionally to relieve the pain, but they did not seem to have any effect. Since yesterday patient has been sweating profusely, and his temperature has kept about 103° F. The cough is very troublesome, the expectoration being ejected with great difficulty, and causing the patient considerable pain.

July 30th. Condition about the same. At 7 P.M. 2.25 grammes of antitoxin were injected, but were not followed by the small doses.

July 31st. Patient's condition decidedly better. Spasms and pain confined chiefly to the right leg. Cough is still very troublesome, owing to the difficulty in ejecting the mucus. Although the injured finger was quite healed, it was considered safer to amputate it. Patient was anaesthetised with chloroform, and had to be placed very deeply under its influence before the rigidity of the muscles began to disappear. In the trunk and abdomen the rigidity never completely disappeared. While under the anaesthetic, another dose of antitoxin (2.25 grammes) was injected.

August 1st. Patient had a much better night, and the temperature began to fall rapidly. From 10.30 A.M. to 9.30 P.M. he had no painful spasms; cough still very troublesome.

August 2nd. Improvement continued until 2 P.M. but then he became very restless; more muscular rigidity and an increase in the painful spasms; considerable headache.

August 3rd. Patient's condition slightly worse; had a very bad night, chiefly owing to the troublesome cough; very few spasms. No antitoxin was given as the stock was exhausted, and no more could be obtained until August 7th.

August 4th to 6th. Patient much better; cough less troublesome; no spasms; sleeping well. Temperature between 99° and 100°.

August 7th. Patient in about the same condition excepting that occasionally there were a few spasms. Between 11 A.M. and 3 P.M. there were several painful spasms, and at 7 P.M. 2.25 grammes of antitoxin were injected. Between 8 P.M. and 10 P.M. there were severe spasms.

August 8th. Good sleep obtained; had two spasms at 6 A.M.; perspiring freely; patient complains of throat feeling sore and swollen; muscles of legs and trunk still rigid; mouth can be opened about 1 inch.

August 9th to August 16th. The tetanic symptoms gradually improved; the temperature varied between 99° and 103°, and soreness of throat still felt. So far as examination of the throat was possible, nothing abnormal could be seen.

August 17th to August 24th. Patient's general condition good; temperature still high occasionally (102° F.).

August 25th to September 4th. Steady improvement maintained; all signs of tetanus have disappeared. Patient rapidly gaining strength and taking food well.

REMARKS.—1. As regards the diagnosis, there is not the slightest ground for doubting that the patient was suffering from tetanus. On July 27th—that is, on the fifth day after the onset of the disease, when the antitoxin was first administered, the symptoms were of considerable severity, and were rapidly becoming worse.

2. As regards the severity of the case, there is considerable difficulty in the present instance in determining its degree. In cases of tetanus generally it is very difficult, in the early period of the disease, to say whether the case is likely to end fatally or not; and in trying the effect of any new remedy it is most important to determine, if possible, the degree of severity of the case. Some look upon the length of the incubation period as forming a very good guide. The shorter the period of incubation the more severe the symptoms are likely to be. In the present case the duration of the incubation period is by no means certain. It is quite possible that the bacillus gained entrance into the tissues, not at the time of the first injury, but subsequently while the patient was working, digging potatoes, etc. The rapidity with which the symptoms develop after their first appearance and their intensity seem to be fairly safe guides. My colleague, Mr. Jeremiah McCarthy, however, in his article in *Heath's Dictionary of Surgery*, states that "no correct inference can be formed from the apparent mildness of the symptoms. The writer had under his charge three cases of tetanus in the year 1884, which all ended fatally, although the symptoms in each case were not severe." In the present case the rapidity with which the symptoms developed was not great, three or four days elapsing between the onset and the presence of well-marked opisthotonos. On the fifth day, however, the symptoms were decidedly severe. The inability to open the jaw was complete, and the painful spasms affected nearly the whole body. Before the commencement of the treatment by antitoxin the temperature

remained about 100° F., and such a moderate degree of fever is said to indicate a favourable prognosis. After the fifth day the temperature began to rise, but was never more than 103.2° F. From these considerations it will be evident that no accurate or even approximate prognosis concerning the termination of the case could have been made before the fifth day—that is, before the antitoxin was administered. Looking at the statistics of the termination of cases of tetanus, we find that the chances are greatly against recovery. Thus, Gowers states that "in traumatic tetanus the mortality is nearly 90 per cent., and seems to be rather greater in women than in men." Taking the cases admitted into the London Hospital during the last sixteen years, I find that the mortality is almost exactly 80 per cent.

3. Whether the administration of the antitoxin had any share in the favourable termination it is impossible to say. The objection that is usually brought forward when recovery of a disease during the administration of a new remedy takes place—namely, that the patient would have got well without the remedy—applies with considerable force in this case. The value of any remedy cannot, so far as I can see, be determined by a single successful case, or even by two or three successful cases. Considering the overwhelming evidence in favour of the value of antitoxin in the treatment of tetanus induced experimentally in lower animals, it is only right to give such a remedy a fair trial in the case of man, and my chief reason for publishing this single instance is to give additional support to the view that the remedy is, to say the least, a perfectly harmless one. The maximum dose recommended by Professor Tizzoni is 4.5 grammes, but as my patient was only 16 years old, and as the symptoms were not of alarming intensity, I started with half this quantity, that is, 2.25 grammes, and repeated a quarter of this amount, that is, 0.5625 gramme every six hours. Altogether the patient was given 15.75 grammes of the antitoxin. So far as I could ascertain the drug had no effect, either immediately or for some hours afterwards, on the pulse, respiration, or consciousness; in other words, the drug seemed to have no "physiological action." Whether the drug had any influence upon the disease I am, as I have said before, unable to say. It is true that there was a marked improvement in the symptoms about eight hours after the first dose, and that this improvement did not continue. I could trace no definite relationship between the administration of the subsequent doses and amelioration in the symptoms. Although more than two dozen injections were given, there were no signs of inflammatory reaction in the region of the punctures. I may add that with the exception of one small hypodermic injection of morphine and occasional doses (gr. 10) of chloral hydrate and pot. bromide, no drug, other than the antitoxin, was administered. The drug is an expensive one, costing £1 per gramme; it is prepared according to the directions of Professor Tizzoni, of Bologna, and is imported into this country by Messrs. Allen and Hanburys. I desire to express my thanks to the members of the House Committee of the London Hospital for the promptness with which they consented to the administration of so expensive a remedy.

A CASE OF TRAUMATIC TETANUS WHICH RECOVERED UNDER ANTITOXIN INJECTIONS.

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THE following brief notes may be interesting to your readers.

W. S. (a boy, aged 13 years and 11 months) of this village fell on Friday, June 8th, cutting his right knee on the road, and leaving some of the road dust embedded in the wound. He was away from home at the time but returned to his father on June 26th.

On July 16th he began to experience "stiffness in the back and pain between the shoulders." On the following day the pains were worse, and there was some difficulty in mastication.

On July 22nd the pains were worse and more frequent; the "head was quite drawn back." He cried loudly during the