4. *Accident*, especially to the eye—for example:

Case 6.—Injury to the right eye, July 14th, 1909; manifest nystagmus, September 30th, 1909. Oscillation more marked on the injured side.

Case 21.—Injury to the left eye, February 11th, 1910; scar across iris; manifest nystagmus, July 23rd, 1910. On converging eyes, nystagmus on the injured side only; on divergence, both sides, beginning a few moments after fixation.

Case 115.—Foreign body in the left cornea. Then found to have latent nystagmus, which became manifest nine days later.

5. *Heredity.*—In one rural district which I know well there are three large groups of families—I will call them A, B, and C—all the male members of which are miners and who work, or have worked, at the same colliery.

In group A there has only been one case of nystagmus in the last twenty-five years—namely:

Case 37.—First examined February 22nd, 1912; his age was then 37; he had worked in the pit for twenty-eight years, as a stallman for thirteen of them. He had well marked nystagmus, but in spite of this he worked regularly until recently, when he had a severe accident. Since then he has been disabled.

There are three generations of this group. The first is now represented by an old man, who still works regularly and hard, but drinks even more regularly and harder. The second generation also work well, but are all very temperate or total abstainers.

Groups B and C tell an entirely different story. So far as I have been able to find out, and I have made careful inquiry and examination where possible, there are no members of group C, and I think none of group B, who have worked in the mine all their working lives and are over 25 years of age, who are not suffering from latent or manifest nystagmus.

Also the disease is more severe in the younger generation than in the older. The first generation of group C is represented by several brothers and two sisters. Apparently the tendency to the disease is transmitted as readily by the mother as by the father.

6. *Exhaustion*, due to want of food and prolonged strain without rest, is, I believe, the most important, most effective predisposing cause of the disease. The miner's habits and their relation to his day's work must be considered. As a general rule he takes very little breakfast. Even when he says he always has a good one, he means a piece or two of bread-and-butter or of toast and a cup of tea. He then starts out to work at a period varying from 5 to 7 a.m., the time depending partly on the distance of his home from the pit and partly on the nature of his work. He works, and as a rule works hard, straining his eyes all the time, until 11 a.m., when he has a quarter of an hour's rest for food. By this time he is hungry perhaps, and bolts a good deal of food in a few minutes; then he at once sets to work again in a more or less cramped position if a holer, or continually stooping if loading, until 2 or 2.30 p.m. He gets home at from 3 to 4 in the afternoon, and then has his first decent meal of the day. This is bundled into an exhausted stomach, washed down with tea *ad lib.*, and followed later on by a pint or two of beer, and then supper. Is it any wonder that he suffers from indigestion more and more commonly; that he gets exhausted; that his eyes and his nervous system, on which the greatest strain of his work falls, become affected; and that nystagmus, at first latent then manifest, follows, and the man's usefulness as a miner comes to an end?

The Eight Hours Act came into force in January, 1908. Before then the miner had forty minutes' rest in the middle of his working day. He was able to take his food in comfort, and to give his eyes a substantial rest. Now he has fifteen minutes! Digestion had a chance to at least begin before he restarted work. Before 1908 miner's nystagmus in the lamp pits of this district was far from common. At that time I was surgeon to seven colliery companies, and did not see more than five cases of nystagmus a year. The number was five in 1908. In the first seven months of this year (1920) I had fifteen new cases from one colliery alone, and not all the cases now occurring at that colliery come under my care. The number of cases is steadily growing, and, what is worse, I believe the average age at which incapacity to work underground begins is becoming lower. Of the last thirty cases I have had under my care or examined, eight have been 50 years or over, and twenty-two under 50.

The disease is a serious one for the miner and for the industry. It is becoming more so. Good electric lamps

are already in use in most of the lamp pits of this district, though their introduction in large numbers is of too recent a date to form any conclusion as to their value. They should be a great help. But I am convinced that to get rid of miner's nystagmus, not only is better lighting necessary for the men while at work, but they must have a reasonable time for rest and food in the middle of their day's work. Forty minutes would only mean their being in the pit for half an hour longer each day—seven and a half hours in all. Why should not the experiment be tried at a few mines? The results would be interesting. The ordinary man has an hour in the middle of his working day for rest and food. Give the miner the same, or as near it as possible. Exhaustion is the explanation of some of the absenteeism we hear so much about nowadays. A miner with indigestion is a miner with exhaustion, and is therefore a candidate for nystagmus. And, quite incidentally, is a man with indigestion ever a contented man?

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TREATMENT OF RHEUMATOID ARTHRITIS BY VACCINES.

NOTES OF ONE HUNDRED AND FORTY-THREE CASES.*

BY

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THERE is no satisfactory definition of rheumatoid arthritis. Nor is a universally acceptable definition possible until the pathology has been worked out and opinion is more settled as to what really constitutes this disease. No definition will therefore be attempted here. But for the purpose of this paper the great majority of the cases may be taken as conforming to the usual conception of rheumatoid arthritis.

Essentially it is a disease presenting trophic disturbances as one of its most characteristic features. Later manifestations include changes in the joints of a degenerative nature. Swelling of the periarticular structures is a constant sign of activity. Anaemia, cyanosis, muscular degenerations and contractures complete the final picture.

The cases extend over the period from December, 1910, to the present time, excluding the last three years of the war. Fifty-two were not seen personally, but pains have been taken to make as certain as possible that these were cases of genuine rheumatoid arthritis. With few exceptions the remainder received treatment for longer or shorter periods at the hands of the writer.

A critical review of the literature recording vaccine treatment is much hampered by the difficulty of definition. It is also unfortunate that authors for the most part have been content only to publish their successes. This is misleading, for the fact is that hitherto the application of vaccine therapy to rheumatoid arthritis has given but few encouraging results. Those that have been successful, almost without exception, fall into one of two groups: either a focus of infection has been found and vaccines have been made from the germs present, or such large doses of vaccine have been given that the effect may well have been entirely non-specific, as in the method of protein shock.

Previous to 1912 a few reports had appeared. Bannatyne and Lyndsay¹ isolated organisms from the blood of two cases and treated them successfully by autogenous vaccines. The organisms grew in clusters and were presumably staphylococci. This is interesting in view of Case 1 described below. Lyon Smith² treated four cases by a vaccine of a small streptococcus. Ball³ ascribed the cure of four cases to a vaccine of a mouth streptococcus. In America Painter⁴ treated nine cases with a bacillary organism without improvement, though exacerbations followed the injections. This is one of the few recorded instances of failure. In his Hunterian lecture of 1911, Goadby⁵ records forty-nine cases of fibrositis and arthritis. There is no attempt to differentiate the diseases further, but the symptoms of each are carefully described and it is

* Read before the Therapeutic Section of the Royal Society of Medicine, November 16th, 1920.

clear that some of the cases in his groups A and C were rheumatoid arthritis. Goadby considered his *Streptobacillus malae* to be causative in the great majority, and an autogenous vaccine of this organism was given in doses of from 10 to 200 million. Oral sepsis was treated radically. A fair proportion were cured or improved. In 1912 Horder⁶ gave a useful warning against the indiscriminate use of vaccines in the disease, which is evidence of some misplaced activity in this direction. Possibly he had been struck by the extreme sensitiveness of rheumatoid cases and the disastrous results which were found to follow excessive dosage. A few other reports appeared about this time but the diagnosis of rheumatoid arthritis is doubtful.

Efforts to treat the disease were encouraged by good results in other forms of arthritis, as reported for example by Collins.⁷ Sherman⁸ described his own work in America and referred to that of his brother. These observers had good results by using alternately 30 million of a small streptococcus and 100 million of a mixed staphylococcus vaccine. Their method seems to have been empirical. From the size of the doses it is almost certain that the response was not specific. Greene⁹ reported success from a vaccine made from two organisms isolated from the blood—the one a bacillus similar to Blaxall's and the other a diplococcus resembling that described by Poynton and Payne. In 1913 there were several contributions, notably by Hughes,¹⁰ Veitch,¹¹ Wynn,¹² and Rowlands.¹³ These writers all agree that to find a focus of infection, treat that radically, and to use an autogenous vaccine gives the best chance of success. In the absence of any discoverable focus vaccine treatment had failed. Stock vaccines had not been of use. Wynn, like Goadby, lays particular stress on oral sepsis.

So far, then, opinion seemed to be crystallizing in favour of the radical and specific treatment of an infective focus. In the absence of a focus vaccine treatment was not successful. The inference drawn by a good many writers was that rheumatoid arthritis might be due to many different organisms, or from absorption of toxins from the colon.

In 1913 I described a new organism,^{14 15} and Soltan¹⁶ treated four cases by means of a stock vaccine with excellent results. This was the first time that small doses of a stock vaccine had been successful. The only other observer who claims to have isolated a specific germ recently is Vipond,¹⁷ who gets it from the juice of enlarged glands, which he finds to be a constant feature of rheumatoid arthritis. Protein shock therapy has had a good many adherents, though not always under that name. Several French writers have claimed a measure of success by injecting large doses of tuberculin. Oppenheim and Laing¹⁹ gave a tuberculin test to 49 cases of severe arthropathies. A positive tuberculin reaction occurred in every one with one or other of the three doses. The last dose was 1 mg. A "joint reaction" was noticed in 25 per cent. The claim was made that a large proportion of arthropathies are tuberculous in origin. Two cases out of eighteen treated by increasing doses of tuberculin showed definite improvement.

The modern methods of protein shock do not come within the scope of this article; yet, from the fact that an injection of 150 million typhoid bacilli caused focal joint reactions in rheumatoid arthritis (Miller and Lusk), it is clear that such reactions do not necessarily indicate that a vaccine is specific. Professor Hastings,²⁰ however, considers that reactions following small doses are strong evidence of specificity in the vaccine. That the organisms he employed were specific was established, in his view, by positive complement deviation tests. Though doubt must certainly exist as to how far a focal reaction can be taken as evidence of specificity, it is clear that the smaller the dose the greater the probability that such a response is evidence of the injection of a homologous toxin. Fairly frequently, in mixed infections, where two vaccines are being used alternately, their action seems to be selective. A striking example of this occurred in the practice of the writer.

In 1912-13 a lady was receiving inoculations for muscular rheumatism and brachial neuralgia. In the urine were found a typical faecal streptococcus and the *M. deformans* (Crowe). Vaccines of each were given separately. After deformans vaccine the patient used to complain of "the burning pain in

the arm," and after the streptococcal vaccine the "rheumatism" was worse. The sequence was then varied without informing the patient. Thus on January 9th and 23rd 1 million streptococci were given and on the 16th and 20th 1 million deformans. On each occasion the patient knew from her sensations which was the vaccine. On the 27th carbolic saline alope was injected. Following this the patient's words were: "I'm afraid you've stumped me this time, as I did not notice any reaction at all," which testified both to the patient's honesty and to the actuality of the symptoms. Appearances in this case were decidedly in favour of the vaccines being specific.

The basis of the treatment in this series was the hypothesis put forward by the author in 1914.¹⁵ Briefly stated, it was that rheumatoid arthritis was primarily due to an organism, the *Staphylococcus epidermidis albus* (var. *deformans*); that, just as in tuberculosis, there were present in the majority of cases secondary infections, with or without a local focus; that it was these secondary infections which caused the variety of joint manifestations; that where the radical treatment of a local infective focus, with or without vaccines, resulted in amelioration or cure of the disease, the explanation was that the system, relieved of some of its microbic enemies, had then been strong enough to overcome the primary organism; and, finally, that the *M. deformans* or its toxin acted primarily on the nervous system and was responsible for the neuropathies which are the predominating, if not the sole, symptom of uncomplicated rheumatoid arthritis.

All the cases were treated, without exception, on this hypothesis, and no other treatment was given to any of the successful cases, with the exception of simple symptomatic measures, such as occasional aspirin for the relief of pain and latterly some mild hydrotherapy (Cases 109 to 143). Deformans vaccine was given to every case. Although some nine years have elapsed, the same vaccine is still in use with no apparent deterioration. It was prepared originally from two strains as described in a communication of 1913.¹⁴ This vaccine was either combined or given alternately with autogenous vaccines when a definite infective focus was found, or if the urine was infected. When the symptoms were such as to suggest a coincident rheumatic infection, then a streptococcus vaccine was also given prepared from a large number of strains isolated from severe cases. None of the strains were isolated from joints, but from such conditions as acute nephritis with joint swellings and strepto-bacteriuria, and acute tonsillitis and rheumatism. No pyogenic streptococci were combined in the vaccine, but all conformed to one or other of the alimentary types.

Results.

One hundred and seven cases were treated more than four years ago, 36 recently. The earlier cases have been tabulated under fifteen headings: (1) Number and initials of patient and doctor in charge; (2) sex; (3) age; (4) length of history; (5) condition when starting treatment and date; (6) bacteriology; (7) vaccines employed; (8) dosage of vaccines; (9) whether sensitiveness developed; (10) length of treatment; (11) immediate result; (12) condition a few weeks after cessation of treatment; (13) relapse and if vaccines readministered; (14) condition in 1920; (15) abstract of results. With regard to the condition a few weeks after cessation of treatment, it has been noticed that in some sensitive cases where treatment was stopped because the patient seemed to be getting worse, a few weeks later symptoms had so far improved that the verdict was completely reversed.

To judge of the result of treatment each patient has been placed in one of six classes. Class I comprises all those who were cured as far as cure was possible. Cure implies the complete absence of any signs or symptoms of active disease, together with a return to a fairly normal life. Further than this, the condition of cure must be maintained—that is, either no relapse at all or only very slight, or having relapsed, returned for treatment and again got well. Class II: Cured, yet relapsed seriously, but with more than twelve months' good health, or very greatly improved and ground well maintained for some time. Class III: improved definitely, but may have relapsed again soon. Class IV: Not improved, no worse. Class V: Definitely worse after vaccines. Class VI: Data insufficient to justify classification.

Rather than incur the suspicion of describing only selected cases, every case known to the author, which has been treated by his vaccines has been entered in the table.*

*Difficulties of publication prevent the insertion of the table in the JOURNAL. A copy can, however, be seen on application to the author, who hopes to publish the table in full elsewhere at a later date.

even though in a few the particulars are too meagre to be of any interest. Largely owing to the war, too, about 40 per cent. of the earlier cases have been lost sight of. No particular sequence has been observed in drawing up the table, but patients have been grouped as follows; Nos. 1 to 8 are monarticular cases. Nos. 9 to 71 comprise those whose notes are fairly complete. These are again subdivided into two subgroups according to the severity of their symptoms. Nos. 72 to 108 are incomplete, and Nos. 109 to 143 are recent cases arranged in chronological order.

The strain of the war has put the final result of treatment to a severe test. Mental strain is recognized by all authorities as a frequent contributory factor in this disease. It is known that several relapses dated from the shock of losing relatives. The first case, which has already been published,¹⁸ was an acute monarticular inflammation in the right knee-joint, associated with brachial neuralgia. Fluid obtained from the joint was sterile. *M. deformans* (Crowe) was isolated from the blood. A vaccine was successful. For five years the patient suffered no relapse and as far as is known has remained well to the present day.

The other monarticular cases on the whole responded badly. Three only obtained some measure of relief. In two of them the result was undoubted. There has been no relapse in one, where the shoulder was affected, though five years later osteo-arthritis developed in another joint. The subsequent history of the other is not known.

Nos. 9 to 39: General rheumatoid arthritis, not severe; histories and notes fairly complete. The abstract of results places 15 in Class I, 8 in Class II, 3 in Class III, and 5 as failures in Class IV; 26 out of 31 showed definite improvement; 8 are still free from symptoms; the remainder have suffered some degree of relapse; 3 remained free for more than four years, 3 for three years, and 6 for about two years. It is almost certain that a renewal of treatment, when the symptoms reappeared would have met with success. Two patients came back for treatment recently, and the result justifies this assumption. Both had tried other vaccines during the war without success. Both commented on the immediate effect of *deformans* vaccine.

Nos. 40 to 70: Severe general disease; notes fairly complete. Results: Class I 8, Class II 12, Class III 3, Class IV 5, Class V 3; 23 out of 31 definitely improved, though 2 relapsed within a year; 1 relapsed only after six years, 4 others held their own for two, three, four, and five years respectively. Of these one (51) who was an absolutely helpless cripple, and had even to be fed, and who regained most of her powers of movement, has recently had another course of vaccine with complete success. One case had no sign whatever of rheumatoid arthritis up to the time of her death five years after treatment. Five are reported as still perfectly well.

Nos. 71 to 108: Particulars incomplete. In this group are the greater number of those not seen personally. Results: Obviously none can be placed in Class I; 6 are found in Class II; 6 in Class III; 5 in Class IV; 1 in Class V; and 20 in Class VI, which it will be remembered are too incomplete for a judgement to be formed.

Nos. 109 to 143 are the recent cases. To suit these the method of tabulation has had to be altered. Final results are omitted, and the results have been abstracted under four classes only:

Class A. Treatment markedly successful	... 16
" B. Treatment giving a fair measure of success	... 6
" C. No improvement	... 3
" D. Insufficiently advanced for a judgement to be formed	... 10

In two of those in Class C the treatment had to be given up owing to the extreme degree of sensitiveness which developed. It is hoped to resume again later.

Data Extracted from the Tabulated Cases.

Males, 18.44 per cent. Females, 81.66 per cent.

Ages.	...	...	...	...	...
Under 20	...	...	...	...	1 case
20 to 30	...	...	...	...	8 cases
30 to 40	...	...	...	...	21 "
40 to 50	...	...	...	...	33 "
50 to 60	...	...	...	...	28 "
60 to 80	...	...	...	...	24 "

That the age of the patient had some influence on the probabilities of cure is clear from the chart, where the three middle decades, in which the numbers are approximately equal (of those providing a final result), are divided by ordinates, the number of cases as abscissae, and curves of the various classes are plotted. From the age of 50 to that

of 69, Classes I and II are at their lowest, whilst Classes III and IV (with V) are at their highest.

Chart showing relation of patient's age to results of treatment.

Etiological Factors.

In the majority none could be detected. The disease dated from marriage in three, from parturition in three, menopause in two, and hysterectomy in one. Rheumatism, either acute or chronic, preceded the condition in six, nasal catarrh in three, definite pyorrhoea in four. No doubt many others had had pyorrhoea. It was remarkable how many had had all their teeth removed years before ever the rheumatoid arthritis developed. Three patients ascribed the onset of the disease to being run down through nursing sick relatives. Seven cases began with neuritis or sciatica.

Other exciting causes given were bronchitis, malaria, accident, mental shock, exophthalmos, tonsillar trouble, scarlet fever, influenza, gout, exposure, gastric catarrh, constipation, and gonorrhoea.

Bacteriology.

M. deformans was found in the urine in 31.59 per cent. of the cases, but it must be said that if it were not noted at the first examination, no particular pains were taken to isolate this organism; *deformans* vaccine was always used. Streptococci appeared in the urine in 36 cases; coliform organisms in 16, but only in four of these in sufficient numbers to justify the description of coli bacilluria. The later cases (among women) have all been catheter specimens, and only 2 cases of coli infection have been met with, though *M. deformans* and streptococci appear frequently.

The presence of a mixed infection has had a very definite bearing on the result of the treatment, and this is the point where the present series differs most markedly from all other cases hitherto published. It will be remembered that the view was expressed by a number of writers that success in the vaccine treatment of rheumatoid arthritis depended on finding a focus of infection and extracting the organisms for the vaccine from that. If no such focus were to be found the treatment had been useless and stock vaccines had failed. The figures given below show that the success of the treatment was less, if anything, among those patients who provided a mixed infection. From the sixty-two cases with fairly complete notes we find:

Infection.	Classes I and II.	Classes III, IV, and V.
Mixed	18	11
<i>M. deformans</i> only	26	7

Sensitiveness developed amongst the completed cases fifteen times. Unless extreme, it apparently did not influence the result, but only the method.

Dose of Vaccine.

The dose of *deformans* vaccine is too variable for any useful data to be given. As low a dose as 10,000 germs of ordinary vaccine, or of 10 million sensitized, has aroused a focal reaction. On the other hand, quite sensitive cases have taken up to 500 million toward the end of treatment.

The initial dose in the enormous majority of cases was half a million. The daily weight has been found to be a satisfactory method of controlling the dosage. The interval with small doses has been three to four days; with larger doses a week. Patients do not seem to have been quite so sensitive to the secondary organisms when present, but still great caution had to be exercised; streptococci were given in doses of half a million to 5 million and *B. coli* the same.

Length of Treatment.

It has been difficult to obtain reliable information as to the total length of the treatment in a good many of the cases, where the treatment had been either continued or carried out in full by the patient's own doctor, but taking those known and averaging out the rest, a method which could to some extent be checked by noting the dates of the cessation of correspondence, it works out at five months. Excluded from this are two or three whose treatment extended intermittently over two years or more, and also some where interruptions occurred.

Discussion.

I do not bring forward these cases as proof that the *M. deformans* is the primary cause of rheumatoid arthritis, but as evidence tending in that direction. I do, however, claim that, used as a working hypothesis, better results have been obtained than by any other method of treatment. Among the sixty-two cases of whom the notes are fairly complete, only 21 per cent. failed to respond in some degree. Other 95 per cent. improved but slightly or relapsed early; 70 per cent. may be said to have been cured for the time being as far as cure was possible, and of these it is known that 15, or 25 per cent. of the total, still maintain their position. From recent experience it is suggested that those who have relapsed would have regained their health under further vaccines, and only the war, in the majority of the cases, prevented this.

There is no other method of treatment which can show anything like these results in rheumatoid arthritis. Hitherto the results of vaccine treatment have been unsatisfactory, and in fact the method seems largely to have fallen out of fashion. Professor Stockman does not even mention the possibility in his book on arthritis published this year. S. Boorstein, of the Montefiore Home in America, whose experience must be considerable, made the following statement as recently as last March²¹:

VACCINE TREATMENT: A great deal has been written on, and many patients abused by, vaccine treatment. As shown before, it is very hard to state definitely the bacteria which are the true etiological factors in a given case. Even if the source of entry is exactly found, it is doubtful whether the organism in the joint is the same as in the focus, as the organism changes under different environments. It is, therefore, absolutely worthless to give vaccines, perhaps even harmful. Some have injected non-specific protein antigen with the idea that the proteins of the bacteria are responsible for the cures. Those cases which I have observed following all forms and kinds of vaccine injection have turned out badly, and I have therefore abstained from using them.

One very substantial benefit conferred by the treatment has been that after a course of vaccines, when the active signs of the disease have subsided, joints can be manipulated under an anaesthetic without fear of lighting up further trouble. In three of the recent cases operations have been performed. Tendons have been cut, joints cleaned up and freed, and in several others adhesions have been broken down under gas, so that limbs have been brought into use again after long periods of inactivity.

In conclusion, the author desires to make his best acknowledgements to all those of his medical confrères, too numerous to mention individually, who have so kindly assisted him with notes of their cases, and many of whom have taken great pains in the matter of tracing their patients.

Harrogate.

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A DIPHtheria CARRIER OF UNUSUAL TYPE.

BY

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A CASE of pharyngeal diphtheria occurred on July 26th, 1920, in one of the sons of a family consisting of father, mother, daughter, and three sons. The patient was removed to the Isolation Hospital the same day, and the premises and eating utensils disinfected. Another son developed the disease on July 28th, 1920, and was removed to the Isolation Hospital, and disinfection was again carried out. On August 10th, at 5 p.m., an interval of twelve clear days having elapsed since the last case, the sister complained of sore throat and malaise; no membrane or nasal discharge could be seen, but there was some increased redness of the pharynx and tenderness of the cervical glands. A swab was taken from the throat. On visiting her the next day a patch of membrane the size of a florin was seen on each tonsil, and there was marked narrowing of the space between the tonsils; the swab was reported to show *B. diphtheriae*.

The remaining brother, who slept in the same room, also had a small patch of membrane on one tonsil. After removal of these two cases and disinfecting, swabs were taken from the father and mother. That from the latter was reported to show *B. diphtheriae*, but no clinical signs of diphtheria were present. On admission to hospital she was found to have pediculi capitis, and a small area of impetigo on the scalp; a swab from this was returned showing *B. diphtheriae*; she had therefore *B. diphtheriae* present both in the throat and in the scalp lesion.

It was then found that another son had died from diphtheria in September, 1914. The mother may have been the cause of this case, or she may have become a carrier after contact with it. She herself had never had any marked illness which might have been diphtheria. It appears probable that she was at least the infecting agent in the last two cases, the interval of twelve days being overlong for infection from the first two. As no other source of infection could be traced for the first two cases, it is possible that she was the infecting agent here also.

In view of the possibility that the bacillus found on the head of the mother, though morphologically indistinguishable from *B. diphtheriae*, might be merely a diphtheroid bacillus, this bacillus was isolated, and its pathogenicity proved by animal inoculation. The strain proved to be of medium virulence; 2 c.cm. of a forty-eight hour broth culture killed a guinea-pig weighing 600 grams in less than three days; the post-mortem examination showed haemorrhagic oedema at the site of inoculation, and marked congestion of the suprarenal glands.

The impetigo of the scalp had been "present for several months." The series of cases indicate very strongly the necessity of swabbing all contacts in the home irrespective of age, and also of searching for and examining any other lesions.

LIFE-HISTORY OF ASCARIS LUMBRICOIDES.

BY

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THE following is a note of work on the life-history of *Ascaris lumbricoides*, in continuation of that published in the BRITISH MEDICAL JOURNAL, July 1st, October 7th, December 2nd, 1916, January 25th, 1919, and in *Parasitology*, February, 1917, January, 1918, October, 1919.

Four sucking-pigs three days old were fed with ripe eggs of *Ascaris suilla*, Dujardin (the round worm of the pig, probably identical with *A. lumbricoides*, the common round worm of man). All four suffered from ascaris pneumonia on the seventh and eighth days after infection, proving that the larvae of the worm were then passing through the lungs. One died during the night of the seventh-eighth. The remaining three pigs were killed on the fifteenth, seventeenth, and nineteenth days, and larvae of ascaris,