

they were grown from the heart's blood as well. Subcultures of these cocci from seven of the cases were examined at the Central C.-S. Fever Laboratory, with the result that six were found to be Type II. meningococci, while the seventh conformed to Type I. The other four strains were, unfortunately, not kept for further examination, but as, with one exception, they were derived from cases of influenza which occurred on the same transport as the other seven, and as the appearance of the films prepared from the lungs was the same, it is probable that they, too, were meningococci.

In all these 11 cases Pfeiffer's bacillus was present in association with the meningococcus; it was not always found in the films, but it always grew on plate cultures made from the lungs. In two instances pneumococci were also present; in one case streptococci and in another both pneumococci and streptococci were found.

Clinical Features: Condition of Lungs Post Mortem.

The duration of illness from the beginning of the influenza to the end in death was from 11 to 16 days, except in one instance, where the patient lived for 24 days from the date of onset. The men did not reach this hospital until they had been ill for some time, and there are no available clinical records of the course of the disease in its early part. All of them, except one who came from a hospital in France, had been attacked by influenza while on board the transport, and when they were admitted here about a week later they were very ill indeed. Four of them died within 48 hours of admission, 4 within a week, and 3 within a fortnight.

There were no special features by which these meningococcus broncho-pneumonias could be distinguished clinically from the other cases in this ship epidemic which were due to a combined infection with Pfeiffer's bacillus and pneumococci or streptococci, except that in the meningococcus infection there was possibly a greater tendency to hæmoptysis. In one or two of the cases which were seen in the earlier stages the sputum was rusty and tenacious, but for the most part it was nummular, airless pus mixed with dark blood.

In several of the cases an even high temperature was gradually coming down by lysis during the first few days after admission, when it suddenly rose again as though some fresh bacterial invasion had occurred, and instead of remaining steady there were wide oscillations between 99° F. in the morning and 104° or 105° at night. The pulse-rate in these fatal cases increased to 120 or more, and the respirations to about 60. It is noteworthy that in the case of one man, from whose heart and lungs meningococci of Type II. were isolated, the skin was a bright yellow colour for several days before he died. None of the patients showed any signs of meningitis before death took place, nor was any evidence of it seen afterwards.

In every case confluent broncho-pneumonia was found post mortem, producing large areas of consolidation, and both lungs were affected, though generally the process was more advanced on one side than on the other. In two instances red hæmorrhagic patches beneath the pleura were a striking feature, in four the pleura was covered with recent lymph, and in two there was turbid fluid in the pleural cavity.

In some cases the broncho-pneumonic patches coalesced to such an extent that whole lobes were solid and airless, while in others the patches of consolidation remained separate, so that the affected lung felt like a bag of plums. In every case when pressure was applied by squeezing the lung, thick yellow pus oozed from the blocked bronchioles. In one instance there was an abscess with ragged walls at the base of the right lung, which contained a thick, dark, red fluid full of Gram-negative cocci.

Other Observations.

Shortly after the death of these men a British soldier suffering from bronchitis was admitted from France, where he had been under treatment in an American hospital. He had been taken ill suddenly with giddiness and pains in the back 15 days before. His temperature was of the same type as that of the American soldiers who died from meningococcus broncho-pneumonia, swinging from 98° or 99° in the morning to 103° at night, but his pulse was not above 100 and his respirations were never more than 40 to the minute. Films prepared from his sputum, which was frothy and purulent, contained large numbers of Gram-negative cocci, and a plate inoculated with it gave a profuse growth of meningococci of Type IV. and a few staphylococci. This patient's temperature came down by lysis and was normal on the twenty-fifth day.

Lieutenant-Colonel M. H. Gordon, to whom I am greatly indebted for carrying out the agglutination tests on these meningococci, has very kindly drawn my attention to a paper by Jacobitz,¹ who investigated an outbreak of disease which occurred in a Jäger battalion at Colmar during February, 1906. He found two men suffering from typical cerebro-spinal meningitis without complications, three cases of meningitis associated with meningococcus pneumonia, and one case in which there was meningococcus pneumonia without symptoms of meningitis; this last case ended by crisis and recovery. In addition, he observed four cases of bronchial catarrh (with meningococci in the sputum) without any symptoms of meningitis, all of whom recovered. He does not appear to have found Pfeiffer's bacillus in any of his patients.

Summary.

1. In the post-mortem examination of 36 men who had died from broncho-pneumonia following influenza, Gram-negative cocci were the predominant organisms found in the lungs of 11 cases.

2. All the men, with one exception, had been taken ill on board the same transport.

3. In six cases these Gram-negative cocci were Type II. meningococci and in one case they belonged to Type I. In four instances the cocci were not tested by agglutination.

4. In each of the 11 cases Pfeiffer's bacillus was found in symbiosis with the Gram-negative cocci.

5. The meningococcus, like other "respiratory" organisms, may, when it occurs in conjunction with Pfeiffer's bacillus, produce a fatal broncho-pneumonia.

APPARENT IMMUNITY FROM INFLUENZA AT A PUBLIC SCHOOL.

BY G. E. FRIEND, M.R.C.S., L.R.C.P.,

MEDICAL OFFICER, CHRIST'S HOSPITAL SCHOOL, WEST HORSHAM.

IN view of the fact that certain statements have appeared in the public press in reference to the absence of cases of influenza among the 800 odd boys at Christ's Hospital School, West Horsham—which statements were not entirely accurate—it is possible that some authentic account of the local conditions may be of interest.

Incidence in Summer and Winter Terms.

The summer term, which had shown a good health return, ended on July 25th. On Saturday, July 20th, the school cricket XI. went to Brighton to play a match. As a sequel to this visit five of the team became infected with influenza and were admitted to the school infirmary on Sunday morning with 3 other boys who were not in the team but came from the same houses as those who were, and had obviously been infected from them. Only 2 cases were admitted on July 22nd, and 7 on Tuesday, 23rd, 18 on Wednesday, 24th, and 4 cases on the morning of the 25th. There were thus 39 cases occurring as a result of this exposure. Nearly all these boys were from the same houses as the first five. There were during the previous ten days 21 cases of mild influenza occurring in various houses of the 16 that comprise the school, but they were sporadic and milder in type than the 39 later cases. None of these 60 cases were severe, and there was no case with any complication in the school.

Several cases (probably about 30) occurred after the boys arrived home among those who must have been ill on the morning of leaving but who did not report. Every term all the boys are inspected by me on the afternoon of the day before going home, but as they start at 6 A.M. in the morning it is impossible to inspect them nearer the time of departure.

During the holidays the infirmary was washed down and the mattresses and wards used for influenza cases were disinfected. I did not, however, think it necessary to carry out disinfection on a larger scale.

The winter term began on Sept. 13th and ended on Dec. 18th. During the whole term the medical illness was less than it had been in any term since 1898. The total number of medical cases admitted was 115 for 13 weeks. Of these, 36 were "chills"—i.e., cases of illness with raised

¹ Der Diplococcus Meningitidis Cerebrospinalis als Erreger von Erkrankungen der Lunge und Bronchien, Jacobitz, Zeit. f. Hyg., 1907, lvi.

temperatures of 24 hours or more without definite physical signs. The cases occurred sporadically among the 16 houses, and there was nothing in their distribution or incidence to suggest that they were anything more than the ordinary so-called "chill."

Preventive Measures.

After the experience of the summer term one was naturally anxious, and at the beginning of the winter term I advised the Headmaster to stop all leave of absence and to keep the boys strictly in bounds. The school is self-contained and lies in a ring fence. Walks outside were allowed, but the town, $2\frac{1}{2}$ miles away, and all the houses off the school estate were put out of bounds. It was not found possible to keep visitors away, and swarms of these arrived every Wednesday and Saturday throughout the term, many usually staying over the week-end, nor was it possible to stop all leave of absence. There was a further exposure to infection via non-resident masters and servants, the latter especially being possible carriers. These are supposed to report to me in the event of any illness occurring in their homes, and when possible I suspend them coming into contact with the school, but I do not think this is a very certain check. As an attempt to adjust actual conditions to the reduced diet values which have recently pertained we had previously increased the amount of sleep by one hour and decreased the amount of work and play, and these measures were continued in force. I also introduced the nasal drill as described by Dr. Isabel Ormiston in THE LANCET of August 24th, 1918. The method used is substantially as described by her, and the boys do the drill twice daily—on rising in the morning and before going to bed at night. The nose-blowing is performed six times to the word of command, which is given by the monitors, who act as pupil instructors of physical training, and form the first exercise at every P.T. drill, which at present is done in the dormitories after washing in the morning. (I am aware that this is not the most suitable time, but at present it has not been found possible to give another time for P.T., and it is not done on an empty stomach, as the boys are given two wheaten biscuits each on rising.)

Dr. E. L. Hunt, bacteriologist to St. George's Hospital, suggested to me the possibility of vaccine prophylaxis—and after talking it over with him we decided to give a single small dose of polyvalent influenza vaccine. We were averse to using a mixed vaccine, because we regard cases of pneumonia and streptococcal infections as "complications" occurring, in the majority of cases, after the onset of an influenzal infection. In some cases, it is true, pneumonia is present when one first sees the case, but that is, we think, to be expected in a certain percentage of cases. Also, as the inoculation of a large school might, if not successful, have occasioned considerable comment, I preferred what seemed to me the lesser risk of an unmixed vaccine. We decided to give a 70 million dose to all boys over 14 and 30 million to those under 14. A post-card was sent to every boy's parent or guardian informing them that their boy would be inoculated as a preventive measure unless they wrote to me that they objected.

Account of the Prophylactic Vaccination.

I inoculated the boys on Oct. 30th (approximately at half term).

306 boys received 70 million. | 327 boys received 30 million.

Total: 633 boys inoculated.

39 boys' parents objected to inoculation.

128 boys I considered unsuitable for inoculation.

19 boys were absent ill.

Total: 186 boys not inoculated.

Approximately 77 per cent. of the school were inoculated. In addition 34 of the staff received 70 million.

The proceeding was, of course, voluntary as regards the staff and their families, but the response to the invitation was poor, as approximately 13 per cent. only of the staff and families were inoculated. Every precaution was taken. Temperatures were taken morning and evening the day before, the day of, and three days following, the inoculation. All games and O.T.C. parades were stopped for the same period, and only very moderate exercise allowed until the sixth day after.

All the boys were inoculated the same day by me, with the assistance of two nurses, one charting particulars, the other preparing the skin. The injection was made with a 5 c.cm.

Record syringe, holding $10\frac{1}{2}$ c.cm. doses, and given in the left forearm on the extensor surface just below the elbow. The first 100 were swabbed with ether, but after that, owing to the fumes, tinct. iodi was used.

The boys marched to the infirmary by houses, according to a time table previously circulated, stripped coats in my outpatient room, and then came through an inner room where the injection was given. Then returned to the first room and waited until the whole 50 boys in the house had been inoculated or rejected. In this way any bleeding, faintness, &c., was known of and seen to.

The needle used was dipped into boiling water between each puncture, and the syringe refilled every 10 punctures. The vaccine was made for me by Dr. Hunt from a series of cultures of Pfeiffer's bacillus obtained at St. George's Hospital in the year's epidemics, and was put up in bottles of 100 doses, the dose in each case being $\frac{1}{2}$ c.cm. of vaccine, the labels for the bottles containing the 70 and 30 million doses being different. In this way I was able to get through the whole 633 inoculations and see also the 167 rejected. Every boy was seen and questioned by me as to fitness before inoculation. Each house of 50 boys came up in charge of the head boy, who brought a list showing the temperature of the boys for that morning and the previous evening.

The temperatures were taken in each house by the house matrons, assisted by the masters or senior boys, and this work was supervised during the day by a nurse who was specially employed for this purpose and who afterwards charted the complete records. Possibly as a result of these precautions there were no cases of severe reaction.

The boys were all seen again three days after the inoculation (when they attended for the mid-term weighing) and were questioned by the nurse in my presence as to reaction with the following result:—

Dose in millions	Local.		Focal.		General.		Inoculated.
	Marked	Slight.	Sore throat.	Cold.	Malaise	Diarrhoea.	
70	0	4	10	1	19	0	306
30	0	6	9	4	29	1	327
Total...	0	10	19	5	48	1 (G. total, 83)	633

In no case was a rise in temperature recorded. Of the 83 only one boy was sufficiently incommode to report at the infirmary, and he was one who had light brawny swelling round the site of puncture, which subsided after the application of a couple of cold-water compresses. Of the 48 cases of malaise probably half can be discounted, if not more, as no one had reported, and the majority of the histories were given in response to leading questions by the nurse. If all are included the number of reactions equal 13 per cent.

The Immunity from Disease in the Winter Term.

There were during the term no cases of definite influenza among the boys except one—a boy who had been inoculated with a 30-million dose on Oct. 30th. He went home to attend his mother's funeral on Nov. 20th, she having died from influenza. On his return on Nov. 24th he reported to me according to the school rule, and I kept him isolated. The same evening he had a slight rise of temperature, with headache and pain in the back; the next day coryza and cough—no other signs—and the temperature became normal in three days. Probably this was mild influenza. In regard to the rest, there were during the term 36 cases of "chill," as already mentioned. These were cases of raised temperature, malaise, slight sore-throat, &c., without definite physical signs admitting of an exact diagnosis. They all recovered with a day or two in bed on a light diet.

Influenza was from September on very prevalent in Horsham and in all the surrounding villages, and from Oct. 14th onwards there were cases among the staff living in the school precincts. On Oct. 14th a maid from the Preparation School House went down with influenza, and on the 15th and 18th a second and third went down. Two of these developed pneumonia the second day of disease. A fourth maid from the same house went home on the 19th quite well and went down with influenza at home that afternoon. She afterwards developed pneumonia. On the 23rd and 26th two maids in another house developed mild influenza. All these cases were immediately isolated in the infirmary, and there was no further spread in the school. On Oct. 24th a

master's wife and on Nov. 4th a second master's wife, living at the opposite end of the avenue, developed definite influenza. They were both isolated, and no further spread occurred. About 10 other cases occurred in various houses on the estate, but not so immediately in contact with the school proper. All these cases recovered, and except the 3 pneumonias there were no complications. None of these were inoculated, and of these cases 6 only occurred after the school had been inoculated.

As already stated, the total number of medical cases treated in the school during the term was considerably lower than the number for any other term, winter or summer, since 1898, before which date the records have not been tabulated. The majority of these were definite cases of bronchitis, pleurisy, gastritis, &c., but 36 were perforce classified as "chill." It may be argued that these were cases of modified influenza. Unfortunately, bacteriological examination was not practicable.

Against the diagnosis of influenza are the absence of definite symptoms, the short duration of illness in the majority of cases (the average time in hospital of the 36 is just under three days), and the complete absence of after-effects. In favour of the diagnosis is the known contact with many potential carriers and close proximity to several definite cases. Twelve of the 36 occurred before Oct. 30th, and 24 occurred after Oct. 30th. Of the 24 occurring after Oct. 30th, 7 were among the uninoculated = 4.2 per cent., and 17 were among the inoculated = 2.6 per cent. (2 with 70, 15 with 30 million).

The view has been put forward that the administration of any vaccine produces an increase of resistance to any organisms in the individual. 77.2 per cent. of the school were inoculated on Oct. 30th. Sixty-four medical cases of all kinds were admitted to the infirmary after that date; of these, 41 had been inoculated = 6 per cent.; 23 were uninoculated = 13 per cent.

The statement was made in the Press that I had instituted a routine nasal douche of potassium permanganate. This is incorrect. It would have been impossible to arrange to douche 800 noses by trained help, and I should regard such a proceeding, if left to the unaided resources of the boys, as a most unsafe method. I think the fact that inoculation was performed acted as a great mental factor. It is possible that the cases labelled chills were in fact cases of modified influenza, though, in my opinion, the clinical evidence is against this.

The chief factors in what is an extraordinary immunity appear to be—(a) the physical training, which though it has been seriously undertaken for six months only, has already produced a marked improvement in physique. (b) The nasal drill, which perhaps is the most important of all. (c) The fact that for the past three months the caloric value of the school diet has reached practically the pre-war value of 3000 calories per boy per diem—for the first time since 1916. (d) The effect of inoculation, therapeutic and moral.

It will be interesting to know when the school reassembles how many boys have contracted influenza, or have been definitely exposed to it during the holidays.

Note by Dr. E. L. HUNT.

The following note as to particulars of the preparation of the vaccine has been kindly added by Dr. Hunt.

The vaccine used was a polyvalent one, containing only the influenza bacillus, obtained from different sources.

The organisms used were as follows:—

- (a) *Bac. influenza* obtained from nose, October, 1918.
- (b) " " " sputum, June, "
- (c) " " " nose, October, "
- (d) " " " sputum, July, "
- (e) " " " " September, 1918.

These organisms from when first isolated had been kept going on blood-agar medium at 37° C.

The medium used for the vaccine tubes was rabbit's blood agar, made by adding some 5 drops of the blood, freshly obtained under aseptic conditions, to 4 c.cm. of melted lemco-peptone-salt-agar at about 60° C., the tubes being mixed, slanted, and allowed to cool.

Ten tubes were inoculated (Oct. 26th, 1918) from each of the 5 organisms, respectively (50 tubes) and grown for 48 hours at 37° C.

The vaccine was heated in a water-bath at 55° C. for 30 minutes. Sufficient vaccine was thus obtained to yield—

5 × 50 c.cm. bottles, $\frac{1}{2}$ c.cm. = 70 million.
5 × 50 c.cm. " $\frac{1}{2}$ c.cm. = 30 "

Clinical Notes : MEDICAL, SURGICAL, OBSTETRICAL, AND THERAPEUTICAL.

NOTE ON A CASE OF PERICARDIOTOMY.

BY T. P. NOBLE, M.D. EDIN.,

CAPTAIN, R.A.M.C.;

AND

A. B. VINE, M.R.C.S., L.R.C.P. LOND.,

CAPTAIN, R.A.M.C.

IN the following case pericardiotomy was performed on the twelfth day after passage of a rifle bullet through the chest, with recovery of the patient.

The patient, a lieutenant in the Lancashire Fusiliers, was wounded on April 11th, 1918, by a rifle bullet which entered in the third interspace $\frac{1}{2}$ in. internal to the nipple line on the left side, and had its exit $1\frac{1}{2}$ in. to the left of the mid-line behind, on a level with the seventh dorsal spine. His first sensation when he was hit was a burning pain behind; then he fell, and all power seemed to leave him. A few minutes later he was able to run 50 yards with the aid of a man supporting him on either side. He did not lose consciousness, but had considerable dyspnoea. Admitted to No. — C.C.S. (April 11th). The notes on his field medical card show the following: "Entrance and exit wound left chest, swelling in the left pectoral region, and signs of a small hæmothorax."

Admitted to No. — Stationary Hospital on April 14th. Considerable difficulty in breathing, and had to sit almost upright. P. 90, R. 30, T. 100.6° F. E. and E. wound as noted. (See Figure.)

The entrance wound was merely a puncture with a rather larger exit one. Cardiac dullness: Right side, 1 in. to right of sternum; left side, to the nipple line and upwards to the lower edge of the second rib. Pericardial friction heard to the right of the sternum and near the apex. Posteriorly there was dullness up to the level of the exit wound, breath sounds heard all over, but weak. April 16th: T. varies from 100° to 102°. Friction more marked and audible all over the præcordia. Dyspnoea continues and cough troublesome. April 20th: Cardiac dullness slightly increased, friction persists, dyspnoea more marked, cough very distressing. P. 92, T. 102.6°. Seen by Major-General Sir John Rose Bradford, who advised exploration of the chest and, if necessary, pericardiotomy. April 21st: Condition worse, cough, dyspnoea and pulse-rate all increasing. An X ray photograph which was taken showed the pericardium distended with fluid.

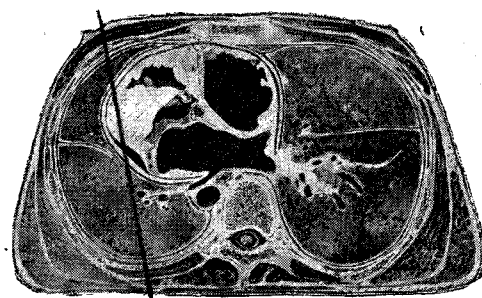
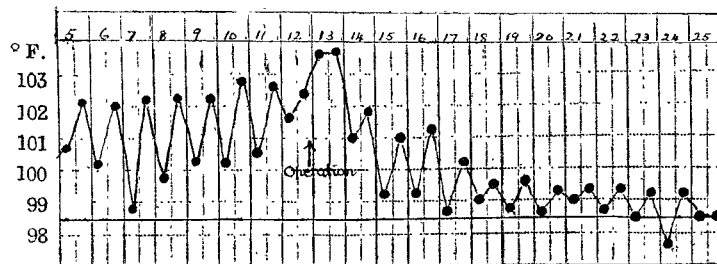


Plate from Johnson Symington's "Atlas of Topographical Anatomy," indicating the probable path of the bullet, which appears to have punctured the pericardium and grooved the muscular wall of the heart.



Operation.—General anaesthesia with chloroform and ether, with preliminary morphia and atropine hypodermically. Twelve ounces of clear fluid were withdrawn from the left pleural sac, which was proved to be sterile. An incision was now made along the fifth rib and cartilage from the mid-line to the nipple-line, the fifth costal cartilage was resected, the fibres of the triangularis sterni muscle were separated, and the internal mammary artery drawn inwards. The