A NOTE ON THE ORGANISATION AND CONDUCT OF PLAGUE LABORATORIES.

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THE pathologist and bacteriologist, in the course of their ordinary work, run certain dangers, which are also shared by the surgeon. Considering the number of those who are engaged in the investigation of infectious diseases, it is perhaps astonishing that so few have become infected. This fact may be explained in several ways. In the first place the bacteriologist always handles cultures of pathogenic bacteria with care; secondly, knowing something of the methods of infection by the different bacteria, he takes appropriate precautions in dealing with infected animals; lastly, the cultivation of pathogenic bacteria results in a loss of virulence, and it is possible that he may become infected from time to time with attenuated cultures and acquire a partial immunity.

Most of the infectious diseases are now sufficiently well understood to ensure that with proper care the danger of infection may be reduced to a minimum. If, therefore, a bacteriologist inoculates himself with some pathogenic germ, he does not become a source of great danger to his fellows. With plague, however, the case is very different; comparatively little is known as to the methods of infection; more than this, the disease is extremely infectious, or, in other words, man is extremely susceptible to the disease. The mere handling of a rat dead of plague has been sufficient to cause death, and flies and fleas are quite capable of conveying sufficient virus to cause the disease.

As this is so no precautions can be too elaborate, and the minutest details in the construction and furnishing of the laboratories, and in the technique of the *post-mortem* examinations upon man and animals, must be attended to.

A laboratory for the investigation of plague should consist of three rooms: an anteroom for the preparation of media, cleaning of used vessels (after sterilisation), and for the many other duties which devolve upon a laboratory assistant; the laboratory proper; and a room wherein to keep all infected animals. It is preferable to have a special building for the purpose, but if that is impossible, and the laboratory forms, or is to form, part of a larger building, it should be isolated, as regards communication, from the rest of the building, and so arranged that the only ingress to the laboratory is through the anteroom, and to the animal room through the laboratory. Each of the rooms should be sufficiently large to allow the work to be done with ease. The walls and ceilings should be made of non-porous material, and should have a glazed surface without break; the floor should be of cement or of grooved tiles well set in cement. The windows must be large, and so arranged that the lighting is uniform, the window sashes of iron, and not projecting into the room. All corners must, of course, be rounded off. The ventilation of each room should be separate, the outgoing air being made to pass a gas flame. The source of heat should be, whenever possible, a gas stove, the source of artificial light gas or electricity.

Every endeavour must be made to prevent the formation and collection of dust, and to this end it is advisable to have the floor moistened with a solution of corrosive sublimate containing a little glycerine.

The amount of furniture necessary is not great, and consists of a porcelain sink, a slate or glass bench for microscopic and cultural work, a similar bench for performing necropsies on animals, a muffle for burning the dead bodies, an autoclave, small shelves for keeping the disinfectant solution, a small metal cupboard for keeping syringes, instruments, and a small stock of media, and an incubator.

The infected animal room might with advantage have a slate or glass shelf about 2 feet wide and 3 feet from the ground running round the room, upon which to place the cages containing the animals.

In the anteroom would be the ordinary sterilisers, sink, etc., and a similar shelf to that in the infected room along one side upon which to keep the stock animals. No shelf, bench, cupboard, or other article of furniture in any of the rooms should have sharp corners or edges; everything should be carefully rounded off in order to eliminate the chance of scratching the skin. All the instruments should be in the

best possible order; the syringes (with asbestos plungers) should work easily and the needles should be sharp; the knives and scissors should all be very sharp and the forceps strong and certain. If the last named do not grip securely they may slip, and small particles of infected material or drops of infective fluid may be projected upon the clothes or skin of the operator; the same may happen if the knives or scissors are blunt.

In the conduct of the laboratory the bacteriologist himself should alone handle the infected material, cultures, and animals, even to the extent of feeding the animals. Both the principal and assistant should wear mackintosh overalls, which must be frequently washed with strong disinfectant solution.

The media should be all prepared in the anteroom; the assistant should go into the laboratory as seldom as possible, and never in the absence of the principal; for this reason there should be only one key, and that in the possession of the bacteriologist.

When an animal is to be inoculated it should be prepared in the anteroom, only the actual inoculation being performed in the laboratory. During the inoculation both principal and assistant should wear indiarubber gloves, which can be easily disinfected. Unless the hands are covered they would have to be thoroughly disinfected after every inoculation; in dealing with plague bacilli this should be done as seldom as possible in order to prevent the peeling and cracking of the skin, which is the usual sequel to the constant use of disinfectants.

After the inoculation the syringe must be at once placed in boiling water or a strong disinfectant, and the animal—rat or mouse—placed in a cage. Special cages are necessary, and those used by Professor Paltan¹ are convenient.

A cylindrical glass jar is provided with a hole in the centre of the bottom, and rests upon a stand in a jar of disinfectant solution. A disc of wire gauze or perforated zinc is supported upon legs about an inch above the bottom of the jar. The lid is also a disc of wire gauze weighted in the rim. Any excreta voided by the animal will fall through into the disinfectant, thus preventing any danger from its drying or falling on the shelf.

Upon the death of the animal it is removed with forceps and fastened on a suitable block of wood, carrying small wooden plugs at the side, by means of string or wire. The cage should be at once placed in the autoclave and sterilised.

In making the necropsy gloves should be worn. The instruments having been boiled should be ready for use, and the small steriliser on the bench should be kept boiling while the necropsy is being made, so that any instrument which is finished with, either permanently or temporarily, may be at once placed in the boiling water.

Upon the completion of the necropsy the principal should sterilise all the instruments, calcine the animal in the muffle (the wood block should be placed in the muffle, no attempt being made to free the animal from it), and thoroughly disinfect the bench with disinfectant solution.

All discarded cultures must be at once placed in the muffle and incinerated, or sterilised in the autoclave before leaving the laboratory.

Lastly, the laboratory should be used only for the investigation of plague, no other work of any description should be undertaken.

It follows from what has been said above that the same scrupulous care must be taken in making a necropsy upon the human subject.

REFERENCE.

¹ Markl. *Central. Bakt. u. Parasitenk.* May 4th, 1900.

PLAGUE AND INFLUENZA: MIXED INFECTION IN HOUSES.

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(With a Bacteriological Report by Dr. J. NIELD COOK, Health Officer, Calcutta.)

DURING the months of March and April, 1900, I was making systematic efforts to obtain confirmation by cultures of the existence of an obscure form of plague pneumonia described as existing in Calcutta in the cold weather epidemic of 1899.¹ For various reasons, afterwards to be gone into, the confirma-

tion sought was not found, but bacteriological investigations, though not absolutely conclusive, make it appear probable that two, at least, of the patients in two groups of plague cases were suffering not from plague—as was thought—but from influenza. As there was no bacteriological confirmation of the diagnosis of those plague cases it will be necessary to give the history of the two houses in some detail.

HISTORY OF 10-3 S. K. M. LANE.

The house is a large three-storey masonry house, in a small bye-lane composed of very good class recently-built houses in the best part of the native business quarter. It contains twelve rooms, and at the time of the outbreak had about 20 inhabitants.

1. On February 22nd, 1900, D. M., Khettri, M., 60, died, the cause of death being registered as "colic pain." Investigation revealed that the man died after two days' fever with buboes. Information as to the site of the buboes was not obtainable. He lived on the second floor. Two days later information was given that rats were dying in the house, and had been found dead in the lane. The first rat was noticed dead on February 21st, on which day ten were thrown from the house. On February 22nd and 23rd two rats were seen dead, and on the 24th three rats.

2. On February 28th, K. C., Khettri, M., 21, died, the cause of death being returned as fever of six days' duration. Beyond the fact that he had six days' high fever, and that during the last three days he was semi-conscious, no particulars could be obtained. The presence of buboes was denied; but the denial was worth nothing. It was ultimately admitted by the relatives that he died of plague. On March 2nd and 3rd a group of 4 cases were found in one room; these were probably influenza; we will leave them for a moment and pass on to the remaining plague cases in the house.

3. On March 1st R. M., 55, M., Khettri, father of K. C., became ill. On March 2nd he was removed to a suburb of Calcutta, but his friends refused to take him, and he had to return to the house. On March 5th Dr. Sen, my assistant, saw him, and reported as follows: "Got high fever since three days last. He has become unconscious since two days last; complaints of pain in neck. Cannot swallow anything. No cough. Tongue typical; temperature 104° F. No glands." When seen later in the day by myself the condition was noted as follows: "Temperature 104°, pulse 118; jaw seems fixed and corners of mouth are drawn, suggesting paralysis. Seems to be unconscious. Cannot speak; cannot be got to put out tongue. Dulness at base of right lung, and no breath sounds can be heard. A small femoral gland, deep, is to be made out after some search on the right side. It is exquisitely tender." He died next day, March 6th.

4. On March 5th M., 18, M., Khettri, the remaining son of R. M., became ill. He was seen by Dr. Sen on March 6th, and his condition is described as follows: "Temperature 104°, pulse quick and intermittent. Semi-conscious. Vomited four times this morning. No gland seems to be enlarged, no cough." I saw him on the afternoon of March 7th, when his condition was noted: "Pulse 128, respirations 40, temperature 104°, eyes not congested. Tongue shows brownish strip down the centre with red dry edges. Is groaning. Small tender glands can be felt in left groin. Patches of dulness and bronchial breathing in both lungs. Fine rales can be heard in the mid-axillary line on the left side just below horizontal nipple line." In March he was seen by Major H. E. Deane, R.A.M.C. The Special Health Officer, and myself. There was then a large typical bubo in the left groin. His condition was bad. He died on March 10th.

5. and 6. S. M., 40, Bhairee, and N. 35, F., Bhairee, husband and wife, on March 7th, "were found in a pitiable condition in a pitch-dark hole under the stair. She was semi-conscious, cold, and collapsed, with what little clothing she was wearing soaked in water, the result, apparently, of trying to get a drink from a lota. Her face was covered with blood from a gash on the right cheek-bone. There were also contusions on the body the result of a fall in the courtyard at the door of the den. Speech characteristic. Medical examination impossible under the circumstances. The husband could be reached only by stepping over the woman, so narrow was the space. He was conscious in a dazed sort of way. Speech affected, but could give the particulars of himself and wife. Very dirty. Bed sore on right hip. Skin hot and dry. A gharry (hired conveyance) was procured, and Dr. Sen and I carried the patients to, some 40 yards, and sent them to Mayo Hospital. There were many servants and neighbours about, but not one would give a hand." They died in hospital; the diagnosis of plague was confirmed there, but whether buboes were present or not I cannot say. They had not lived in the house until (3) R. M. fell ill, when they came to assist as friends and to nurse him.

The history of these cases, along with the rat mortality, proves conclusively the presence of plague in the house. The first patient lived on the top floor, No. 3, R. M., the landlord and father of No. 2 and No. 4, is said to have lived on the first floor. However, they were all found ill on the ground floor. The group of influenza cases lived in two rooms on the first floor. They were not relatives of the landlord, but simply tenants. It is highly improbable, nevertheless, that they succeeded, in the unlikely event of their trying to do so, in avoiding contact with the previous plague cases.

INFLUENZA GROUP OF CASES.

On March 2nd, that is, nine days after the first dead rat was noticed, and eight days after the death of the first plague patient I was taken to see three women lying ill in one bed in a room on the first floor. The notes of the cases run as follows:

1. Sewrani (aunt of Ram Nath's wife), 22, F., Brahmin. Is heavy and stupid, but puts out tongue and attends to directions. Has been ill six days. High fever came on with a rigor. Cough is present, but little expectoration. Has lost her voice and been unable to speak for the last

two days. The temperature early in the morning was 102° F. It is now 104°; pulse 120, soft and compressible. Had pain in the head to begin with, but none now. Respiration very little hurried. Careful examination revealed nothing abnormal in the chest. Dr. Sen also failed to find anything abnormal. Tongue coated with yellowish-white fur; bowels loose, two or three loose motions a day. There are said to be no glands. The groins, however, were not examined. Condition on March 3rd: Is tossing and moaning; hands are thrown about. I refused to give medicine as she was dying. No congestion of the eyes. Lungs again examined, but nothing found. Died the same day.

2. Ram Nath's wife, F., 14, Brahmin. Lies on one side. Very restless, moaning, and apparently in pain. Coughs frequently, but no expectoration. Tongue coated. Temperature 103°; pulse 110, fairly strong. Respiration hurried. Says she has no pain. Nothing abnormal found in the chest. Bowels constipated. No gland about neck or axilla. Has been ten days ill. Ordered jacket poultice. Condition on March 3rd: She is sitting up, is much better, and was relieved by poultice and slept; pulse 90, temperature normal.

3. Phoolbasia, 40, F., Brahmin (mother-in-law of Ram Nath's wife). Sits up and talks quite well. Temperature 102°. Cough is very troublesome, but she cannot get up much expectoration. She has been eight days ill. The tongue is stained with betel nut. Had pain all over, in the joints, head, and back to begin with. Now only the cough troubles her. It causes no localised pain. Sputum was seen in pellet the size of a pea, white, mucoid, non-aerated. It is dotted with white flocculi. No enlarged glands. I thought I detected on percussion slight deficiency of resonance just inside right scapula behind. Dr. Sen failed to make it out, and the stethoscope showed nothing abnormal. General condition pretty fair. Loose stools two or three times a day. Voice not altered. Condition on March 3rd: Seems to have practically recovered, though still coughing.

4. Sew Gobin, 18, M., Brahmin. A cousin of Ram Nath; he was seen on March 2nd, apparently in good health. On the night of the same day he became ill with a rigor. On March 3rd he was found lying on the same bedding as the three women in the following condition: Temperature 104°, pulse 110, eyes not congested. Tongue typical—that is, white fur all over except the tip and edges, which are red and dry. No glands. Nothing found on examination of the chest. Is coughing very little, with almost no expectoration. Speech and intelligence are unaffected. He is cousin to Ram Nath. He died on March 4th.

Cultures were made by me on agar tubes on March 3rd from Ram Nath's wife, from saliva, expectoration not being obtainable, from Phoolbasia from sputum, and from Sen Gobin from saliva, no expectoration being obtainable. In the report which follows from Dr. Nield Cook, Health Officer, Calcutta, to whom my sincere thanks are due for his courteous assistance in this investigation, it will be seen that, while the others were negative, Sen Gobin's culture showed what appeared to be the influenza bacillus. None showed any indication of the plague bacillus.

On visiting the house on March 4th I found the rooms vacated. I heard that Raghoo Mull, the landlord, had left ill, and also that another woman was ill on the ground floor, but the people denied it, and I failed to find her. Probably this was plague patient No. 6. Eventually I got the information that after Sewrani's death on March 3rd, and Sew Gobin's death on March 4th, the two other women left on March 4th for up-country practically cured, and subsequently did well.

CLINICAL REMARKS ON THE GROUP.

Though the history of the house with its previous plague cases and accompanying rat mortality inevitably suggested the diagnosis of plague in the group of three women, the symptoms and history of the group awakened a doubt in my mind that would never have arisen in connection with the cases individually. While failure to find definite physical lung symptoms or a bubo in a single case of plague would have had little significance, it seemed curious to find in 3 cases simultaneously, and again the comparatively long duration of illness in cases like these with indications of pneumonia or respiratory mischief, though one might expect to find it occasionally in an individual case, was quite contrary to experience in a group of cases. Strongest of all was the fact that Phoolbasia was recovering, for though there are cases on record of recovery from plague pneumonia, they are very rare and in Calcutta almost unknown. Personally I have only known two, and one of those was due to an immediate antecedent preventive inoculation cutting the disease short. The speech paralysis seen in Sewrani's case is highly characteristic of plague, but on the other hand it is not rare in severe influenza.² Altogether I was so doubtful of the diagnosis—influenza being in my mind—that I hesitated till next day before returning them as plague. Sewrani's death and the subsequent death of Sew Gobin after 24 hours' illness seemed to indicate that I had done rightly, but the result of the bacteriological examination upset this.

HISTORY OF 79 LR. CHITPORE ROAD.

The hut is one of a group of four or five, two storeyed, kutchra

(that is, mud and wattle) built, consisting of seven rooms and a cowshed. No rats have been reported in connection with the hut. It is the centre of a badly infected area however, plague cases having occurred all round. First of all two not suspicious deaths occurred in the hut, but it is very doubtful whether any reliance is to be placed on the histories given in these deaths.

1. Chooni Bawa, F., Hindu, 80, died on March 10th. It is noted: "Had an attack of high fever since fifteen days ago. Had unconsciousness. Denies glandular swelling." (2) Bhola Nath, 70, M., Hindu, died March 18th. "Suffering from chronic bronchitis for the last three years; he was very old. Passed loose stools before death. No fever and no swelling." Three days later, on March 21st, a girl, Monoria, F., Hindu, died, and the history in her case was distinctly that of plague. Had fever for the last four days, was unconscious, had swelling at the left axilla, had no cough.

INFLUENZA CASE.

While investigating this last death Dr. Sunyal discovered a woman ill; she was a lodger, and no relative of those who had previously died. The particulars are as follows:

Goneshi Bibi, 50, F., Hindu, "has been suffering from fever for fifteen days; temperature 103°; nothing abnormal in chest; no swelling; is unconscious and is in moribund condition March 22nd, 1900." I failed to see her next day, but on March 24th, 1900, I found her in the following condition: "Pulse 114, feeble; respiration is laboured; occasional râles; bronchi and bronchial breathing over the whole of the right lung in front; fine liquid râles at the base of the same lung; dulness on percussion marked at the apex of the right lung and elsewhere in patches; temperature is 104°; tongue is coated." Next day I found her improved, restless, and coughing a good deal; she had still some fever. A culture was made from the sputum. She slowly improved, and on April 4th, 1900, there is an entry: "Seen to-day; weak but perfectly recovered."

In this case there was well-marked nervous excited restlessness. This is very characteristic of influenza, but in plague a heavy stuporose condition is the rule. Accordingly I was prepared in this case for the result of the culture, which was identical with that obtained from Sew Gobind.

It may be taken, I think, as fairly well established by the cases given that it is possible for plague and influenza to co-exist in the same house; but, before passing on to the considerations raised by this possibility, it is necessary to say just a word in explanation of the presence of influenza in Calcutta, and of the form in which it manifests itself there.

INFLUENZA IN CALCUTTA.

In 1890 the disease was pandemic over all Europe and Asia and about the month of March it reached Calcutta from Bombay, and broke out in Burra Bazaar. Thence in April it spread all over the city, laying up whole houses at once, to such an extent that business was seriously interfered with. It was looked on as a new disease, and was known as the "Bombay fever," but it showed exactly the same set of symptoms as recorded in the various outbreaks of Europe. Dr. Koilas Chunder Bose has put on record a very good clinical account of the outbreak. The first epidemic was of a mild type, the fatal cases were few, and the general mortality showed only a slight rise, though bronchitis and pneumonia were not uncommon complications. "Fever," under which the great majority of influenza mortalities would be registered, showed an increase of only 82 per mille over the previous year. The increase in pneumonia deaths was, however, marked, being 186 against an average for the previous ten years of 106, 129 in 1884 being the highest previously recorded. In 1891 it recurred earlier in the year in the cold weather, and this year the disease was of a severer type, and fatal cases were more numerous. In 1892 it is again described as epidemic, but not of a virulent type. Subsequent to this I can find no mention of it, unless for a few cases recorded in the mortality returns, which are as follows:

1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.
13	1	66	5	1	5	0	8	2	

It must be noted that these returns, owing to defective registration, give absolutely no indication either of the total amount of influenza or the number of fatal cases. However, from those figures, and from statements of Calcutta practitioners, it is clear that from 1892 onwards it has continued to exist in more or less sporadic form. Very possibly it may account to some extent for the great increase in fever and pneumonia deaths prevailing from that time. In 1899, in parts of the city at least, it tended to be epidemic. Thus Dr. Das informs me that from October to December he saw some 40 cases in Ward IX; whole houses were laid up at once; bronchitis was very frequent, and this occasionally passed into broncho-pneumonia, but no case proved fatal. Now, in

1900, this tendency is still present. In my own staff I have seen four cases, and have heard of many others in the course of investigations. Many Europeans have been attacked in the last three months. That the disease, though generally mild, may assume in India the same exceptional virulence that it has sometimes shown in Europe is exemplified by the case of Surgeon C. Quarry, reported to have died at Cannanore after an attack of only twenty-four hours' duration.³ This would dispose of the objection that Sew Gobin's death in twenty-four hours must have been due, if not to plague alone, at least to plague in association with influenza, a combination known to occur.

BEARING ON PLAGUE REGISTRATION.

In Calcutta the registration of plague depends in great part on investigation of all deaths made subsequent to death by responsible European medical officers. Up to the present this system has worked so admirably, as tested by the close approximation of plague deaths to the unaccounted-for excess mortality, that it is specially recommended by the Plague Commission; but if along with plague we have influenza contemporaneously epidemic, with a knowledge that both may coexist in the same house, the task of these officers in deciding from the history whether a given death is due to plague or influenza becomes an almost impossible one; for even with every opportunity for full medical examination and observation of the patient, no diagnosis can be more difficult than that of virulent influenza from non-bubonic plague. The subject is too large to take up here, but it may be pointed out that the leading characteristics of both are identical—suddenness, intensity, cardiac weakness, and a great tendency to nervous developments, meningitis and various paralyses. In both pneumonia is one of the manifestations of the disease rather than a complication, and in both it tends to be accompanied by indefinite physical signs. Of course it will be easy to distinguish in a group of cases, though even there you have the difficulty of mixed infection coming in, but in the individual case it may be almost impossible to decide. In this connection mention may be made of cerebro-spinal meningitis. This too, I know by experience, may be extremely difficult to diagnose from plague, particularly as enlarged glands are not uncommon. In a case of my own there was marked enlargement of the cervical glands, and in a case seen by a colleague of the inguinal glands. This latter case was diagnosed by my colleague as plague, but other medical men held that it was cerebro-spinal meningitis. As similar cases followed in connection with it, the latter diagnosis was probably correct. Again, in its milder form, the disease may very closely approximate influenza. Altogether, with the three diseases all at present sporadic⁴ in Calcutta, the task of the district medical officer is not an easy one, particularly as owing to the prevalence of false information he cannot place much reliance on the alleged absence of buboes. Fortunately the cerebro-spinal meningitis is practically confined to one locality, and the proportion of influenza to plague, so far as known, is insignificant, but if the two former diseases increase the problem of how to register plague will be a difficult one to solve.

BEARING ON ILL-DEFINED PLAGUE PNEUMONIA.

It may well be asked if influenza is not the real explanation of the cases I previously recorded as an "Undescribed Form of Plague Pneumonia," cases observed in 1899, and characterised by great indefiniteness of physical signs and a general absence of acute symptoms, particularly as the article was written in ignorance of the presence of the first-named disease. In favour of this suggestion it will be cited that in 1900 I failed to obtain plague cultures, and instead unexpectedly obtained influenza cultures. But there are reasons for this failure. The main one is that there was a change in the characters of the plague epidemic of 1900 from those shown in 1899. In the earlier epidemic, mild and abnormal cases were not uncommon, whereas in the later one the cases were nearly all of the virulent classical type, with a total duration of illness of only two or three days. Thus it several times happened that when I went to obtain sputum cultures, I would find the patient dead; again it frequently happened that the patient's condition would be so bad that it was impossible to obtain sputum; again, it was often found that a case which at first had seemed of the abnormal type we were looking for, by the time the tubes arrived had turned into a

typical ordinary case with buboes, in which there was no need of a culture to complete the diagnosis. This mild type, then, was hardly to be found in this last epidemic, and that from the two cases which were cultured no plague was isolated, is not surprising considering the extreme difficulty of isolating it from such an impure culture as sputum gives. The strongest argument against those pneumonia cases having been due to influenza is that they all proved fatal, for even in a severe epidemic of influenza the proportion of fatal cases is extremely small.

NOTES AND REFERENCES.

¹ *Journal of Tropical Medicine*, February 15th, 1900. An Undescribed Form of Plague Pneumonia, with 5 cases, by William C. Hossack, M.D.; also *BRITISH MEDICAL JOURNAL*, 1, 1900, p. 313. ² *BRITISH MEDICAL JOURNAL*, 1890, p. 702. ³ *Indian Medical Gazette*, 1890, p. 158. ⁴ Strictly speaking plague is epidemic with 40 to 60 cases a week, but the cases are all scattered and comparatively it is only sporadic.

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BACTERIOLOGICAL REPORT BY DR. J. NIELD COOK, D.P.H., HEALTH OFFICER, CALCUTTA.

On March 3rd I received some agar slopes from Dr. Hossack for examination for the plague bacillus. In one of these I noticed a few minute translucent colonies amongst a number of other growths. As these were the only colonies that bore any resemblance to plague, I made subcultures from them on agar and in broth, and incubated them, at 37° C. Streak cultures showed a single line of translucent droplets, barely visible to the naked eye. Even after some days they showed no tendency to increase in size or to spread, the line resembling a scratch on glass. When spread by a rod over the whole surface of the agar the same characteristic appearance of tiny dewdrops was maintained, and there was no tendency to spread or coalesce. In both cultures the broth remained clear, but contained a whitish fluffy mass at the bottom of the tube, which separated into flocculi when shaken up, but soon subsided again. Stained microscopic specimens from agar and broth examined under $\frac{1}{2}$ -inch oil immersion showed chains of a small bacillus, not unlike a streptococcus but squarer, and each bacillus distinctly showed bipolar staining. I inoculated flasks of peptone bouillon with oil floating on the surface, but obtained no stalactite growth, such as would have occurred with a plague culture, but only got a fluffy deposit on the bottom of the flasks, similar to that in the broth tubes. From a culture made by Dr. Hossack from another of his cases, I separated a bacillus in all respects identical with the above. From the cultural and microscopical appearances I believe them to have been the bacillus of influenza described by Pfeiffer, Kitasato, and Klein. The bacillus I separated was certainly not that of plague, and the clinical history of the cases favours the view that it was the bacillus of influenza.

NOTE.—August 8th. Since this was written I have examined a culture obtained by Dr. Hossack from a typical case of influenza with bronchitis. From it I isolated an organism identical with that above described.—J. NIELD COOK.

PLAGUE IN NEW SOUTH WALES.—The Governor of New South Wales notified on September 14th that clean bills of health, without endorsement, began to be reissued on September 8th. The three persons still remaining at the Quarantine Station have recovered from the plague, and are now only suffering from remote consequences of the disease. The first case of plague occurred in Sydney on January 25th, 1900.

PANDEMIC PLAGUE.

NOTES ON THE HISTORY OF PLAGUE.

It is, we believe, now generally accepted that the pestilence which overran the Roman Empire in the sixth century, the Black Death, which caused so awful a mortality in the fourteenth century, and the plague of the seventeenth century, were identical with the plague (*pestis*) which has in recent years caused so many deaths in India, and is now threatening Western Europe and both North and South America.

EARLY EPIDEMICS.

Hirsch¹ appears to be inclined to accept the conclusion that a disease characterised by "pestilent buboes very fatal and acute" which is recorded to have occurred in Libya, Egypt, and Syria at the end of the third century or the beginning of the second century B.C. was really epidemic plague. Rufus of Ephesus gives an account of the observations made by Dioscorides and Poseidonios of Alexandria of a disease which they had seen in Libya at about the date of the commencement of the Christian era. As Hirsch says, the description leaves no doubt as to what it was. The symptoms were:

Acute fever, pain, perturbation of the whole body, and delirium with the appearance of buboes great and hard, which did not go on to suppuration, not only in the ordinary places, but also in the popliteal spaces and at the elbows.

After this date there are no certain references to plague in Europe until the sixth century, and it is safe to assume that there was at least no great epidemic during the interval.

THE PANDEMIC OF THE SIXTH CENTURY.

This is the great outburst of the disease which as it affected Constantinople has been described by Gibbon in his inimitable manner. He concludes the forty-third chapter of the *Decline and Fall* "with the comets, the earthquakes, and the plague, which astonished or afflicted the age of Justinian." The plague appears to have been heard of first in A.D. 542 in Egypt. "Ethiopia," writes Gibbon, "and Egypt have been stigmatised in every age as the original source and seminary of the plague." The infection reached Constantinople in 544, and eventually "from Persia to France the nations were mingled and infected by wars and emigrations." Gibbon, who relies upon Procopius, thus describes the symptoms of the disease, which in the bubonic form agree very nearly with those seen at the present day, while the opening words of the passage may perhaps refer to the septicæmic form:

The infection was sometimes announced by the visions of a distempered fancy, and the victim despaired as soon as he had heard the menace and felt the stroke of an invisible spectre. But the greater number—in their beds, in the streets, in their usual occupation—were surprised by a slight fever; so slight, indeed, that neither the pulse nor the colour of the patient gave any signs of the approaching danger. The same, the next, or the succeeding day, it was declared by the swelling of the glands, particularly those of the groin, of the armpits, and under the ear..... If they came to a just swelling and suppuration, the patient was saved by this kind and natural discharge of the morbid humour. But if they continued hard and dry, a mortification quickly ensued, and the fifth day was commonly the term of his life. The fever was often accompanied with lethargy or delirium; the bodies of the sick were covered with black pustules or carbuncles, the symptoms of immediate death; and in the constitutions too feeble to produce an eruption, the vomiting of blood was followed by a mortification of the bowels.

Every rank and profession was attacked, though it was noticed that women suffered less than men. The greatest consternation prevailed, and when the Emperor himself fell ill of the disease, though he eventually recovered, something like social disorganisation set in.

The order of funerals and the rights of sepulchre were confounded; those who were left without friends or servants lay unburied in the streets or in their desolate houses; and a magistrate was authorised to collect the promiscuous heaps of dead bodies, to transport them by land or water, and to inter them in deep pits beyond the precincts of the city.

Procopius observed that it always spread from the sea coast to the inland country, and that the most sequestered islands and mountains were successively visited. It was indeed "not till the end of fifty-two years" that the disease finally disappeared. As to the mortality which this pandemic produced Gibbon professes himself unable to hazard any conjecture.

I only find that during three months 5,000, and at length 10,000, persons died each day at Constantinople; that many cities of the East were left

¹ *Handbook of Geographical and Histological Pathology*. Second edition. Translated by Charles Creighton, M.D. New Sydenham Society, 1883, p. 495, et seq.