minuted fracture of humerus and complete division of musculo-spiral nerve. The wound was septic; after about three weeks several small pieces of bone were removed under an anæsthetic. In three months the humerus was soundly united, with practically perfect movements at the elbow-joint; the wrist-drop was controlled by a "cock-up" splint. In August, 1917, suture of musculo-spiral. Nerve found completely divided; bulb at each cut end. The two bulbs were excised, leaving a gap of about 2 inches; end-to-end suture; considerable tension at point of union. The wound healed by first intention. Three months later there was some return of voluntary movement in the extensors and the analgesia was less marked. Twelve months after the nerve suture there was 50 per cent. of recovery in the extensors and sensation was normal. Massage, galvanism, faradism, ionisation, and electric baths, persisted in all this time, produced no further improvement and he was discharged from the Army in October, 1918.

When I saw him first, soon after Christmas, 1918, there had been no further improvement since August, 1918. He was able to make some extension of the wrist and of the fingers; movements were jerky, accompanied by some spasmodic contractions of the flexors. In Fig. 4A the scar of the operation for nerve suture can be seen above the external condyle. The photograph was taken whilst the maximum amount of extension of the wrist and fingers was being made. He was treated by persuasion, manipulation, and re-education for 35 minutes, when voluntary extension was as shown in Fig. 4B. Movements were now smooth and easy, and he was able to use his hand normally, the total recovery from the original lesion being practically 100 per cent.

CASE 6.—Patient, aged 37, sent to me with the following history:—Three and a half years previously he had had an acute illness; the main characteristics were slight pyrexia and general malaise, pains in legs, some difficulty with bladder, and increasing weakness of legs. He was in bed for about three months. The symptoms largely subsided, but he was left with the "weak legs," and his back was bent. On examination he was very bent, and hobbled with two sticks. The legs showed the signs of a lesion of the lateral tracts, weakness, spasticity, exaggerated tendon-jerks, clonus, and a bilateral extensor response; abdominal reflexes absent. His condition had been *in statu quo* for about two years; yet a great part of this, in spite of its organic basis, proved to be the perpetuation of symptoms by suggestion. After manipulating the legs and back, with persuasion to increase the range of movement voluntarily, for half an hour, the patient was able to stand upright and to walk without sticks. There was still some spasticity of the legs, but it was not very noticeable except when he tried to run. He was delighted with his improvement, and took some pride in exhibiting it to others. The physical signs were, of course, unaltered.

Conditions in which Functional Disabilities Occur

The last three cases are instances of the hysterical perpetuation of symptoms long after the original causes for them had disappeared. This is really a very common occurrence, and many similar cases might be cited. In a multiplicity of conditions this is liable to occur, especially in those which run a chronic course; nerve suture, neurolysis and capsulotomy of a traumatic neuroma must be especially mentioned. Disordered gaits are perpetuated after fractures and injuries of the lower limbs; sciatica is also specially liable to produce this condition of affairs, and many other diseases with a chronic or semi-chronic course.

Several factors help in suggesting the perpetuation of symptoms, as, for instance, the use of crutches and sticks. An officer had his foot severely crushed by a motor lorry, but there was no fracture or dislocation. An extensive ecchymosis of the dorsum cleared up in some three weeks, but he was unable to bear any weight at all on the foot when he got out of bed, and he asked for a pair of crutches. After 10 minutes' practice, however, with persuasion and encouragement, he was able to walk and even to run normally without limping, and there was no pain in the foot. On the following day he voluntarily went for a walk of six miles. In this case, only one of many, it is probable that had the patient been given a pair of crutches the idea of the disability would have been confirmed, and a disordered gait would have resulted when he discarded them after, perhaps, many weeks or months. Many other things may be the means of suggesting a perpetuation of a disability, and in some cases it is, no doubt, due to auto-suggestion.

A very large number of chronic cases of all kinds will amply repay time spent in treating what are really hysterical disabilities. Much patience and painstaking are needed, but great improvement can be effected, and sometimes complete cure.

AN INVESTIGATION OF CASES OF INFLUENZA

OCCURRING IN THE WOOLWICH DISTRICT DURING SEPTEMBER, OCTOBER, NOVEMBER, 1918.

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Introductory.—During the summer of 1918 it fell to the lot of one of us (B. H.) to investigate the then prevailing and mild epidemic of "influenza." The results were not published, but briefly, though proving interesting as regards the effect of this disease on the leucocyte counts, they were entirely negative as regards the isolation of *B. influenza*. In making this the second series of researches on influenza the first thing that we wish to insist upon is *that we have used exactly the same methods and the same blood medium* (Gordon's tryptic agar plus rabbit's blood) in investigating this epidemic, as in the mild one dealt with in the summer. In addition, we have examined the claims of a medium which was highly recommended by Dr. John Matthews¹ as suitable for *B. influenza*.

Our researches have been conducted *without selection of cases*. That is to say, except for refusing to examine material sent under conditions impossible for good bacteriological work, we have taken and examined anything sent down to us that seemed to offer possibilities.

General technique.—Sputum has been collected where possible in wide-mouthed sterile bottles with rubber corks. These were distributed to the ward sisters with instructions to send the first sample coughed up and not to collect a lot. This sample was then washed in sterile broth and plated out on tryptic agar plus rabbit's blood. The broth washings were also incubated. In some cases it was plated out also on Dr. Matthews's medium. Direct smears were examined also in every case. Naso-pharyngeal cultures were made with West's swabs and inoculated on to the media *at once* where possible.

Blood cultures were taken by venepuncture in the ordinary way and 10 c.cm. was distributed in varying amounts into broth tubes.

Results.

Naso-pharyngeal swabs.—The naso-pharynx in all cases seen by us has been injected and very sloppy. A prominent feature is the greatly swollen and elongated uvula, and to this uvula must partly be attributed the irritable cough and retching in many cases. Some cases have epistaxis from the great engorgement of the parts. Naso-pharyngeal swabbings have been positive for *B. influenza* in 80 per cent. of cases. Other organisms have been present, such as *M. catarrhalis*, pneumococcus, streptococcus.

Sputum.—The sputum has varied greatly. Some specimens have been thick, sticky, and stained with blood to varying degrees. This blood staining is not the "rusty" staining of croupous pneumonia, but something much brighter and in some cases amounting almost to hæmoptysis. Other specimens have been of a yellow-green "nummular" type, while others have been white and slimy. Generally speaking, we consider the white slimy specimens occur just at the beginning and when the case is clearing up, particularly the latter. The blood-stained ones indicate pneumonia, or at least severe capillary bronchitis, and that the man is a case to be anxious about. The yellow "nummular" ones seem to be chiefly where the trouble is mainly bronchial or where only a small broncho-pneumonia patch or so is present. We have seen rather more of the yellow "nummular" than the blood-stained type in the laboratory.

The result of examination of direct films of sputum has shown 70 per cent. positive for *B. influenza*, and of cultures from these same cases 75 per cent. positive. It has been interesting to us to find in some cases negative for *B. influenza* by direct film that the organism has turned up on culture. In one or two cases we failed to grow the organism in spite of its obvious prevalence as seen in the direct film. One may

¹ THE LANCET, July 27th, 1918.

say unhesitatingly that the pneumococcus has been present in 100 per cent. of the cases. In practically every sputum we have examined it has been predominant over *B. influenzae*. Other organisms have been present, *M. catarrhalis* and mouth streptococci, but we have not been able to confirm the presence of any particular hæmolytic streptococci in our cultures as has been mentioned by some observers.

We would like to point out here what have been to us very interesting features in the bacteriology of the sputum. At first it was comparatively rare to find *B. influenzae* in direct films, the pneumococcus always predominating, but as the number of admissions grew and the severity of the epidemic increased we began to find *B. influenzae* readily, and isolated it easily. Even in mild cases now at the decline of the epidemic the *B. influenzae* is readily found. This is in accord with what occurred in the great pandemic of 1888-92, for the bacillus was only found towards the end of the epidemic in 1892 by Pfeiffer.

Another interesting feature is the pleomorphic character of the bacillus in culture. It occurs in rods of very varying length (0.5-1.5 μ), and sometimes the bacillus is almost a coccus, so short is it. Again, it tends in some cultures to occur in pairs and short chains.

As regards the medium recommended by Dr. Matthews, we consider it fully bears out its claims, but we do not consider it superior to Gordon's tryptic agar enriched with rabbit's blood except in one useful detail, and that is that it does seem to inhibit for a time the growth of other organisms, enabling *B. influenzae* to be readily isolated. Gordon's medium tends to grow everything with equal intensity, and so *B. influenzae* is not so easily isolated free from other organisms.

Pleural fluids.—In the early part of the epidemic empyema was uncommon, probably because the cases with extensive lung changes did not live long enough to develop one. In the latter part of the epidemic empyema was more common. The fluids were of a yellow-green colour and rapidly separate out into a layer of slimy pus below and bright yellow fluid above. In direct films cocci in pairs and short chains have occurred in practically every case; capsulation was observed also. In one case chains of great length occurred, but the chains had the appearance of being made up of a series of pairs of cocci. In culture the cocci always grew in pairs and chains, these chains always being very much longer than any seen usually in the direct film, and some were of great length. Where the chains were of great length they always had the appearance of being built up of a regular series of pairs, and the appearance was quite different to the ordinary streptococcus. This organism appears to be either the *Streptococcus mucosus* or closely allied to it, and probably *S. mucosus* is a variant of *S. pneumoniae*. We had great difficulty in getting most pleural cultures to subculture freely even on blood media. In two of our cases we found *B. influenzae* in the pleural fluid as well as *S. mucosus*. As regards hæmolytic properties on blood-smeared agar, our cultures varied even with cultures of apparently similar morphology. Some hæmolyzed fairly; others showed no signs of hæmolyzing; none hæmolyzed well.

Blood cultures.—Of all our cases these may be regarded as the only ones in which it may be said that they were selected, since medical officers only requested this in severe cases. We obtained 50 per cent. positive cultures, and these cultures showed cocci with somewhat similar characteristics as those described in the pleural fluids. In no case, however, did we observe such long chains as in the pleural cultures, and the chains more closely resembled those of *S. pneumoniae*. For some reason which we were unable to explain we could not get the organisms of the blood cultures to grow in subculture. The blood in the blood-broth mixture, however, did not undergo any marked hæmolysis even after four days.

Leucocyte counts.—We were able to confirm our previous results (summer epidemic) as regards the cases only affected by high temperature, pains, and no chest symptoms—viz., little or no leucocytosis, and generally a qualitative increase in the mononuclears.

In pneumonic cases ending fatally or cases of great severity we noticed that the leucocytes showed no increase, and in most cases a leucopenia, but that there was a qualitative increase of the polymorphonuclear cells. In one fatal case in which the blood culture was positive (pneumococcus) the count was as low as 3000 per c.mm.

In the average severe bronchitis or mild pneumonia case there was a quantitative and qualitative polymorphonuclear leucocytosis. The leucocytosis was moderate, averaging 18,000 per c.mm. 80 per cent. of our cases showed a leucocytosis.

Post-mortem and histological findings.—The first point we wish to make is that in no case did we see those appearances conjured up by the term "grey hepatisation."

The average appearance of the lungs when removed from the thorax was that of an infant suffering from broncho-pneumonia. In the very acute cases they resembled acute hæmorrhagic broncho-pneumonia. As a rule, one lobe (usually a lower lobe) was more affected than the rest, and if the case had lasted some days this lobe might be solid. The cut section of a solid area was firm, of a deep-red colour, more resembling liver tissue, and a frothy purulent fluid oozed from the bronchi. Here and there a small greyish area with a wavy outline might be seen, but we saw no evidence of actual breaking down of tissue. This greyish area marked, however, an intense exudate into the alveoli. In the very acute cases there was no particular affection of any one lobe, all lobes usually showing areas, varying in size, of intense engorgement resembling hæmorrhagic infarction. The pleura was usually involved over the lung or lobe most affected, forming in some cases a thick gelatinous layer of 1 to 2 inches. The trachea and bronchi were always intensely engorged and covered with a tenacious mucopurulent coating. The liver and kidneys usually showed slight toxic changes.

Microscopical sections showed intense engorgement and dilatation of capillaries and blood-vessels. In places, particularly in the acute cases, the blood has escaped into the alveoli, and gives the appearances seen in ordinary hæmorrhagic infarction (of mitral stenosis, &c.). The exudate in the alveoli is chiefly of alveolar cells and mononuclear cells. Polymorphonuclear cells are relatively few, and this is a very striking feature, even in the solid portions. In sections of bronchioles and neighbouring alveoli in apparently non-affected areas the capillary engorgement is very well marked. It is also evident from any section how the completely solid state of a lobe is arrived at; for one can see that certain neighbouring areas are more involved than others, and that the inflammatory condition has spread peripherally till such areas coalesced, and where such areas are numerous in any lobe it is obvious that the lobe will become eventually solid.

We would suggest that the mode of infection is probably as follows. Infection of pharynx and trachea (nearly all cases complain of rawness over larynx and sternum at onset) with *B. influenzae* which rapidly spreads to bronchi, bronchioles, and alveoli. This "lowered resistance" of the respiratory tract leads to a secondary infection with pneumococcus and perhaps other organisms—i.e., *S. mucosus*. It is a well-known fact that mixed infections are more severe than pure infections, and to this we may attribute the severity and mortality of this epidemic. In short, we regard the infection as an acute capillary bronchitis and alveolitis.

We cannot confirm in our work the presence of any constantly hæmolytic streptococcus as has been described by some workers. We may have been unlucky, but it does not seem essential to consider a hæmolytic streptococcus as constantly necessary to produce the intense blood engorgement seen in the lungs. The microscopic appearances alone show that the blood in the alveoli has resulted from a rhexis of the enormously dilated capillaries. Again the epistaxis that occurs can be seen to come from intensely engorged nasopharyngeal vessels, and also the blood in the sputum is bright recent blood, not altered blood. This streptococcus is said by some to have been superadded as the result of the numbers of war wounds about, yet in peace time such appearances were familiar to every morbid anatomist.

We have been able to identify the "pneumococcus" in sections of the lung, but not *B. influenzae*.

Summary of Results.

1. *B. influenzae* was present in the sputum by direct film in 70 per cent. of cases and by culture in 75 per cent. of cases. Pneumococcus was present in 100 per cent. Other organisms of the *catarrhalis* type were present, and mouth organisms.

2. *B. influenzae* was present in naso-pharyngeal swabs in 80 per cent. of cases.

3. In pleural fluids we found a pleomorphic streptococcus having many characteristics of the pneumococcus, but often occurring in chains of great length. Some cultures showed hæmolytic properties, others did not. We regard this as *S. mucosus*, which is a "variant" of pneumococcus probably.

4. Blood cultures were positive in 50 per cent. of cases and the organism was a pneumococcus, or a close ally of *S. mucosus* type.

5. A leucopenia was usually present in severe or fatal cases. In the average pneumonic case a moderate polymorphonuclear leucocytosis was present.

6. Post-mortem and histological appearances show the disease to be an acute capillary bronchitis and alveolitis.

We cannot conclude without reference to the assistance we have received from our laboratory attendant, L/Cpl. L. G. Blore. Our laboratory necessities throughout the whole of the epidemic were always forthcoming, and since this work was thrown on to the laboratory in addition to the routine work of the district, his success in this matter is one for which we desire to express our appreciation, and, indeed, was no small achievement on his part.

THE INFLUENZA EPIDEMIC IN BRITISH GUIANA.

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THE recent influenza pandemic appears first to have made itself manifest in Georgetown, the capital of the colony, in November, 1918. Clinically the symptoms do not appear to differ from those characteristic of the disease in other centres which have suffered its ravages. The disease has taken a fearful toll, more particularly of the lower classes of the community, the poor East Indian and black, generally already debilitated by the ravages of chronic malaria or filarial infection. Death has been due, in the vast majority of cases, to a rapidly fatal broncho-pneumonia, and the purpose of this article is to give a short account of the pathology and bacteriology of the disease in this country.

Post-mortem findings.—These are based on post-mortem examinations carried out on 24 fatal cases of influenza at the height of the epidemic. Generally marked cyanosis was present externally. Internally the pathological changes appear to centre in the respiratory tract; naso-pharynx, pharynx, larynx, trachea, and bronchi show congestion of the mucous membrane, with exudate varying to a certain extent in character, but generally tenacious and sometimes stained with blood. Pleurisy was rare, only being present in two cases, and then of the acute fibrinous variety.

The heart and pericardium showed no particular change. The lungs showed generally a broncho-pneumonia of the diffuse variety. If only a portion of a lung were involved, it was invariably the base, and a constant feature was the intense congestion of the lungs; the broncho-pneumonic areas, on section, are hard and reddish-grey in colour.

The brain was involved in only one case in a meningitis which proved to be of pneumococcal origin. The empyma and pyopericardium described as occurring in other parts of the world were never found. The spleen, when showing no evidence of malarial infection, was slightly enlarged, congested, and firm in consistence. An acute parenchymatous nephritis was present in a few cases. The liver showed frequently some fatty change.

Bacteriology.—An investigation was first carried out into the bacteriology of 13 cases of well-marked clinical type by means of post-nasal swabbing, as recommended by Matthews,¹ as well as by making films and cultures from the sputa. In these cases the culture-medium used was Matthews's trypsinised blood-agar, using sheep's blood. From 9 cases of the 13 a bacillus morphologically indistinguishable from Pfeiffer's bacillus was isolated, in 2 cases in pure culture. A hæmolytic streptococcus was present in only one case, Friedländer's bacillus in one case, while pneumococcus co-existed with Pfeiffer's bacillus in 6 cases, and with *Staphylococcus albus* in one case in which they were the only pathogenic organisms isolated. Out of 4 cases which gave a negative result in culture films made from a post-nasal swab revealed the presence of an influenza-like bacillus in two.

Bacteriological examination of the lung tissue and exudate in the 24 cases mentioned above gave the following results. In these cases the medium used was Levinthal's, as described by Fildes, Baker, and Thompson.² From 15 cases a bacillus morphologically identical with Pfeiffer's bacillus was isolated. In 10 cases pneumococcus was present along with Pfeiffer's bacillus, while from 3 cases it was isolated in pure culture. *Staphylococcus albus* was present in 3 cases along with pneumococcus and Pfeiffer's bacillus, while a hæmolytic streptococcus was found in 2 cases, once in pure culture and once in conjunction with the influenza bacillus of Pfeiffer.

Prophylactic inoculation.—In view of these results a mixed vaccine was quickly prepared, containing *Bacillus influenzae*, pneumococcus, streptococcus, and staphylococcus, using strains isolated during the outbreak and following closely the recommendations of the War Office Committee.³ Nearly one thousand people have received this inoculation, and reactions appear as a rule to be mild or almost completely absent. It is as yet too early to judge of the efficacy of this procedure.

INFLUENZAL INTRA-ABDOMINAL CATASTROPHES.

By REGINALD ECCLES SMITH, M.B., F.R.C.S. EDIN.,
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DURING the recent epidemic of influenza which has passed along through the hospital in three successive waves from June to December, several important abdominal complications have been observed. They may be divided into three classes, comprising those directly due to a specific bacillus, those to associated toxæmia, and those which are coincident and noted as a warning to the surgeon.

Simulation of Severe Abdominal Lesion by Influenzal Lung Complications.

In the earlier days cases were being constantly sent in to the surgical section with the diagnosis of perforated gastric or duodenal ulcer, less frequently as an acute appendicitis, and this latter mainly on account of the youth of the patient rather than from minute clinical observation, and even as empyema of the gall-bladder. The onset has in almost all cases been sudden. The patient has come in with a history of malaise for a short period followed by acute generalised pain in the abdomen, associated with generalised rigidity, often vomiting, a temperature raised two or three points above normal, and a running pulse.

In a number of such cases there have been no clinical signs in the chest to lead to a definite diagnosis, and hints of diaphragmatic pleurisy have been hesitatingly offered. Careful observation has shown that the rigidity and the pain in these pseudo-abdominal lesions are not absolute, but in most cases are referred to the upper zone of the abdomen, and in a minority to the lower zone, including the right iliac fossa. The pain and rigidity in the upper zone are referred along the eighth, ninth, and tenth intercostal nerves and when traced are much more severe on that side of the abdomen which corresponds to the chest lesion either definitely present or appearing later. On two occasions I blocked the eighth and ninth intercostal nerves in a supposed upper abdominal catastrophe and the symptoms disappeared. Less frequently the eleventh and twelfth intercostal nerves have caused the referred pain and a perforated appendix has been very closely simulated, especially as no other physical signs could be found anywhere.

The true diagnosis is often difficult, especially as true abdominal complications can arise either directly or coincidentally, for which the physician and surgeon must always be on the alert. Apart from the knowledge that a devastating epidemic is abroad in which chest lesions are common and therefore kept in the surgeon's mind, three valuable points have been observed in the influenzal pseudo-abdominal catastrophe which differ from the true surgical abdominal lesion. These points may not, of course, hold good in a superimposed surgical lesion due to and grafted on to the original influenzal infection.

(a) The movement of the *alæ nasi*. In cases of influenza with acute abdominal pain, even when no physical signs

¹ THE LANCET, 1918, II, 104.

² THE LANCET, 1918, II, 699.

³ THE LANCET, 1918, II, 565.