geometrical ratio, and reproducing itself several times in the time which it takes measles or small-pox to reproduce itself once. On the other hand, there are irregularities in the behaviour of the disease difficult to reconcile with the view that the disease is propagated solely direct from person to person, and which lead me to think that co-operating circumstances of some kind are necessary for it to take on an epidemic form, and that some form of mediate infection is possible. What those circumstances are, and what the medium may be in which the *materies morbi* can multiply, are questions which I shall be grateful for your assistance in answering.

INFLUENZA IN 1891.

Read in the Section of Public Medicine at the Annual Meeting of the British Medical Association held in Bournemouth, July, 1891.

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ALTHOUGH the disease, influenza, appears to be now again rapidly abating, yet it has recently prevailed so extensively and has occupied so large a portion of our professional attention that we may well at the present time give it the very fullest consideration; and this the more because not only does its study throw light upon other epidemic diseases, but the disease itself will probably soon have disappeared and so the opportunity of investigating it will have gone for an indefinite period.

Influenza has been so widely and severely present, both this year and last year, that medical thought has necessarily been largely concentrated upon it; and, thanks not only to the efforts of the medical officers of the Local Government Board, but also to those of many other observers, our exact knowledge and understanding of the disease have been very materially increased. In one notable respect, however, our knowledge has not yet become so exact as could be wished, for, although Drs. Jolles, Weichelbaum, and others have claimed to have defined and differentiated the bacillus of influenza, yet I fear we are unable to say that its special identification is yet assured, although we must all feel certain that the specific bacillus is present awaiting demonstration, inasmuch as a contagious and multiplying germ must be a living one and have a material presence.

In East Anglia we last year suffered largely and widely from influenza, and we have again in the present year (1891) been visited with an extensive outbreak of the disease, after a distinct and prolonged period of quiescence. Although similar in general features, yet in many respects this year's visitation has differed from that of 1890. In the first place, the period of its recrudescence in a widely-diffused or epidemic form was considerably later in the present year. In 1890 it began to prevail in January and February, and in scattered cases as early as December and November of 1889. But in this year in this district the disease did not become common or severe until the months of April, May, and June. On the other hand, its epidemic prevalence in 1891 was preceded by severe influenzal, or "pink-eye," disease amongst horses, which was not the case last year. Further, I think that, although the influenza of last year showed far less affection of the lachrymal and naso-oral mucous membranes than had been observed in several previous epidemics—and I can well remember the profuse nasal and bronchial catarrhs so common in 1847—yet that this special symptom has this year been still less prominent than even in 1890.

I have said that there has been less pure catarrh in the influenza cases this year. But, on the other hand, the irritative affection of the bronchial mucous membranes has been very constant, and often very extensive. In my experience, it has varied from the slightest development of wheeziness or scattered sibilant *râles* to the most extensive and general affection of the bronchial tract—often so general and producing so much mucous and nervous irritation that it caused profuse bronchorrhœal osmosis; or, on the other hand, the attack might almost have been mistaken for one of acute but dry spasmodic asthma. Often the bronchial affection has, here as elsewhere, been accompanied or followed by inflammation of the lung tissue or of the pleural surface, the

pulmonary inflammation being generally lobular, of the congestive form, and not very prone to run into dense consolidation; whilst the pleurisy has often been acute, and very often leading to considerable pleural effusion, frequently of a purulent character.

In considering these inflammatory cases no doubt some caution is necessary. Doubtless most of them are true influenzal inflammations, and probably all of them are influenced or modified by the specialised condition of the atmosphere. Still, we should remember that pneumonias and pleurisies are common in England in the earlier half of every year; and possibly not every chest inflammation lately seen has been of this class. On the other hand, the type of these cases, where no special guiding symptoms have been present, has usually been such as to incline to the influenzal view. And certainly the disastrous results which I have occasionally witnessed where depleting measures and other such attempts to "cure" the inflammations have been resorted to have influenced my mind to the strong conviction that the only safe course at present is to regard them as all of the epidemic type and to act accordingly.

In this year, as in the last, the special influence of the influenzal poison appears to have been very variously exerted. Almost any organ or function of the body has seemed liable to be affected, that special tissue or organ suffering the most according to the varying susceptibility of the individual or the weakness or peculiarity of the part. But as in other epidemics, not only of this but of other widespread disorders, the entire resistance of many human organisms to the disease has been very remarkable, certain individuals having very constantly escaped in a house quite full of the disease; and from this entire immunity to extreme susceptibility there would appear to have been every degree of liability. As an example of the susceptibility of weakened tissue to such infection, I have recently seen a case of an elderly lady suffering from one-sided chronic emphysematous bronchitis, limited to the base of one lung, and who, on being suddenly seized with influenza, developed the usual moist and sibilant bronchial *râles* over the whole of the rest of this lung, the other lung remaining unaffected throughout the attack.

In another and very important respect our experiences of this year differ materially from those of 1890, namely, in the far lesser prominence of acute nerve pains of the trunk at the commencement of the illness, and the less frequency and severity of those nervous sequelæ which were then so common and so distressing. Many of those specialised nervous sequelæ were described by me at length in a paper which I read before the East Anglian Branch of this Association, and amongst others I mentioned painful local affections or neuralgias; hyperæsthesia or anesthesia of the arms, hands, back, legs, feet, gums, nose, or other portions of the skin; a sleepy or dulled condition of the brain; and many other secondary or allied affections.

On the other hand, it has appeared to me and to those with whom I have conferred, that during the present year primary disorders of the brain and mind have been exceptionally common, much more so than in 1890. Every degree of mental disturbance has been observed, from simple apathy, drowsiness, or dullness of mind, through various degrees of mental depression or of excitement, up to delirium and absolute mania, and this latter so frequently as to constitute a special feature of this year's epidemic.

It is here worthy of notice that these nervous sequelæ were almost entirely of the sensory nerves, in this respect forming a marked contrast to the paralytic sequelæ of diphtheria, in which disease the motor system is more especially involved; also, whilst in diphtheria the paralysis of the throat and head often showed themselves early after the commencement of the illness, and in the extremities usually within six weeks, in influenza the truly nervous sequelæ rarely appeared before eight weeks after seizure.

From the remarks of various writers upon influenza, I judge that after many of the epidemics these nervous phenomena have not been very prominent conditions, as, although generally mentioned, they are scarcely described at all fully by any modern author except Dr. Theophilus Thompson, writing in 1840 in the *Library of Medicine*.

Then as to the fatality. Although, if anything, more

general and diffused, I think the disease has this year been sensibly milder, and has claimed on the whole fewer victims. Pulmonary inflammation, so-called, has been the most common cause of death, but in the very old and the previously diseased, unquestionably cardiac and general nervous asthenia has been often the apparent cause of failure. But neither as to 1890 or 1891 do I think we should be justified in repeating the assertion made by one writer on this subject as to the epidemic of 1738, that "the influenza was specially fatal in Norwich."

It has been observed by several most competent practitioners in this district that although one attack has not appeared absolutely to protect those who suffered last year from illness again this season, yet that in the most remarkable way villages in which the influenza prevailed extensively in 1890 have been almost or quite free from the disease in this present year, whilst adjacent villages scarcely affected before have quite recently been generally and severely attacked.

The question of the communicability of influenza has been so fully and so ably discussed by Dr. Parsons in his recent report to the Local Government Board, that I will only say that the general experience of the epidemic in this eastern district tends to confirm the views he has there expressed. No doubt many peculiar facts connected with its propagation remain to be explained; but, beyond this, the mere discussion of its contagiousness or of its infectiousness is clearly superfluous, seeing that these two terms merely imply a varying volatility of the seeds or germs.

A very curious circumstance bearing upon this point was mentioned to me a few days ago. A gentleman called upon me suffering from distinct but mild influenza, who told me that he traced his attack to having licked with his tongue for the purpose of sealing it the gum of an envelope sent to him for return in a letter from a correspondent, who wrote that he was suffering severely from the disease. He said that he immediately felt that he had done a foolish thing; and curiously enough in about forty-eight hours from this time he was himself seized with influenza. If he was correct in his view, this simple incident would show positively (1) that the disease-germ is capable of adhering to solid substances, which may thus become the medium of its communication; (2) that it is communicable by contact with the mucous membrane of the mouth; and (3) that the period of its incubation is, or may be, about two days.

The experience of us all has doubtless shown the most infinite variety of so-called seizures. As last year, and as always, I believe sudden headache, pain of the back and lower limbs, fever, and more or less irritation of the respiratory membranes, have been the usual initial signs, with not infrequently some nausea, vomiting, or diarrhoea, superadded. But none of these have been absolutely constant, and they severally have varied greatly in degree and intensity. Chills and rigors have been not infrequent at the commencement of the attack, but these have not been necessarily present, although a sense of shock, of great prostration and debility have been so nearly always, in greater or less degree. Neither has any special lachrymal irritation been observed, as stated by Dr. Besly Thorne.

These introductory or primary symptoms have, as usual, been followed after an interval of hours or days by other signs which may well be called secondary; such as catarrh, tonsillitis, bronchitis, pneumonia, pleurisy, or, indeed, irritation or inflammation of almost any or every viscus, as well as of the skin and of the nerves or nerve centres. An excellent summary of these various affections has recently been given in the *BRITISH MEDICAL JOURNAL* by Dr. Nicholson.

Amongst the rarer secondary affections of which I have recently seen examples may be mentioned profuse bronchorrhoea; inflammation and swelling of the throat glands; a scarlatina-like eruption; swelling of and effusion into the knee-joint; acute alopecia (?); intense sleepiness—the so-called "nona;" and puerperal symptoms, scarcely distinguishable from those of ordinary septicæmia; whilst other and later affections have been not uncommon, though scarcely so much so as last year, such as empyema, purulent mucous discharges from the nose or ear, albuminous or bloody urine, a recrudescence or revival of the disease from slight causes, and a markedly abiding cardiac and general asthenia.

Several cases of a most distressing nature have recently occurred in this district, and in the practice of different and widely separated medical men, where the patient was located in a house or district in which influenza was prevalent, and who developed symptoms indistinguishable from ordinary puerperal septicæmia or so-called "puerperal fever" within one, two, or more days after a prosperous confinement. The seizure was attended with shivering, high temperature, more or less altered uterine discharges and mammary secretions, and other indications of blood contamination; and in at least one of these cases the termination was a fatal one. In these patients no ordinary cause of septic poisoning could be detected, and the infection appeared to be fairly attributable to the prevailing epidemic influence.

As to the probable causes of these variations of the disease as seen in 1890 and 1891—as we have not yet had time to forget, the winter and spring of this year, have been singularly cold and dull, the temperature has been persistently low, and there has been a minimum of sunshine; and these assumed unfavourable atmospheric conditions may very possibly have modified the vitality and the infecting power of the germ cause. They may, in fact, have delayed its appearance by lowering its vital activity. Or, again, other possible causes more referable to the human subject may have been the potent factors in the case. Suitable and abundant food, no doubt, are as essential to the full activity and potentiality of minute germs as of larger animated beings. And how such matters as appropriate food and other conditions do affect and modify some bacillary growths will be well remembered by those now present who were able to attend the demonstration on this subject in the Cambridge laboratory at the conjoint meeting of the East Anglian, Cambs and Hunts and South Midland Branches in June; for we were there able to see with our own eyes the remarkable differences of colour and appearance produced by growing certain bacilli under different conditions and in different media. So that it may well be that a different condition of the human prey may have had the larger influence over the variability of this year's phenomena.

This disease being doubtless, like other infectious disorders, due to the implantation upon the mucous membrane of living germs, which subsequently multiply, and infect the system after a period of so-called incubation—this being the case, it would appear to be highly probable that the so-called seizure, the sudden attack, is due rather to a commencing secondary poisoning of the blood, nerve centres, and tissues, than to the mere shock from the reception of the living cause upon the surface membranes.

We all know that the ordinary symptoms of an influenzal attack are headache, pains of the back and lower limbs, fever, and various other indications of systemic irritation and alarm; and Dr. Theodore Williams quite recently, in describing the effects of the injection of Koch's tuberculin, stated them as "rigors, fever, pain in the limbs, languor, great fatigue, often vomiting, increase of cough and expectoration, and occasionally an eruption like measles;" whilst Virchow has further spoken of "catarrhal pneumonia" as one of the effects of the injection.

Professor Koch tells us that this tuberculin is a "glycerine extract of pure cultivation of tubercle bacilli in which the parasites have been killed." In other words, the product of bacilli is the active material injected as tuberculin.

As the symptoms of these two morbid conditions are so similar, indeed, almost identical, I suggest that this fact lends strong probability to the view that the secretion of these bacilli is the lethal agent in producing the severe results both in influenza and in other allied diseases, and that the early life and multiplication of the infecting parasite is represented by the comparatively innocuous incubation period, which in the case of the influenza germ has been passed on the mucous membrane of the invaded individual, but in the case of the tuberculin-bacillus has been passed in a prior host. And it is a further point for notice that as the injection of tuberculin appears often to set free tubercle bacilli, and to promote the fresh advance of phthisical disease so unquestionably last year in the experience of practitioners in this district, phthisis was infinitely more prevalent than in many previous seasons. If this is the true order and sequence of the phenomena, and if the apparently primary

symptoms are really but secondary, and the sign of absorption of bacillary products, then doubtless the same holds with the numerous other diseases due to these minute living bodies.

I fear that our increased experience has not shown us any specific remedy capable of controlling the disease, unless salicin or the salicylates may in some degree possess this power. As its main effect is to depress nervous vitality, so the avoidance of any debilitating treatment has been the first essential principle, and all measures calculated to rest and comfort and support the patient the second. Of drugs, I think that antipyrin in five-grain doses has held its ground as the most effective remedy for the primary headache; whilst for the bronchial irritation and inflammation, nothing has appeared to be so generally useful as the carbonate, or the spirit of ammonia with tincture of bark, combined with chloric or sulphuric ether as required. Champagne, or other wine, or some spirit, has been most valuable; and warmth externally, anodyne embrocations, and inhalations of carbolic acid with conium have proved most useful in suitable cases; also, after the existence of the disease for some days or longer, the tincture of iron with quinine and a mineral acid has occasionally given distinct relief. The treatment by iron has of late been specially recommended, but we must not forget that in 1847 Sir Thomas Watson wrote: "I know no tonics so good as the sulphate of quinine or of iron for these patients." The iron salt would appear to be specially useful in those cases where a suppurative or alkaline tendency has shown itself.

THE DISCHARGE OF TOWN SEWAGE INTO THE SEA IN THE VICINITY OF WATERING PLACES.

By LOUIS C. PARKES, M.D., D.P.H.LOND.,

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WHILST a majority of those who are engaged in public health work are ready to admit that the water-carriage system of removing sewage from towns is far superior as regards health, comfort, and decency to any conservancy system, it cannot be denied that water-borne sewage is more difficult to dispose of satisfactorily than the waste refuse obtained by the more primitive methods. In the case of towns on or near the seashore, the problem looks simple enough. The sea is close by, the volume of water in it is immeasurable; therefore why not cast the sewage into the sea? Many towns, including a good many noted health resorts, pursue such a system to the greater or less satisfaction of their residents and visitors; why should not all do so? This, then, is the consideration I wish to bring before you on this occasion, in a town whose popularity is so immense, that its future as a successful rival of Brighton, the queen of English watering places, is only a matter of time.

First, if the sewage is discharged by an outfall sewer or sewers close to the confines of the town, unless the period of discharge is very limited, and the site of the outfall very carefully chosen, it is more than probable that the sewage, or part of it, will be cast back upon the beach within the town, or will traverse more or less of its frontage. If the sewage is conveyed outside the town, even for a considerable distance—two, three, four, five, or six miles—there is still a risk of such occurrences during certain states of tide and weather, for it must be remembered that on our coasts sea currents and tides flow only in one direction for a certain time, and then flow back again, so that it is possible that when spring tides are giving place to neap, or the reverse, and when aided by strong and persistent winds from the right quarter, the sewage discharged on any one tide may be carried back by the next, or those following it, and so reach the beach, the promenade, and the pier of the town from which it came. Such sewage is, of course, much diluted with sea water, but the mixing action between sea water and sewage is not so quick or intimate as between sewage and fresh river water, and it

may well be that under certain circumstances the mixing and dilution has not been sufficient in amount to destroy and render innocuous the harmful matters of the sewage.

Again, the effect of the sea salts upon the dissolved matters of the sewage is to cause their partial precipitation, and upon the suspended and solid matters to harden them and cement them by a sort of pickling action. Human faeces have much the same specific gravity as fresh water. When not buoyed up by gases entangled in their meshes they usually, however, sink in water. Owing to the greater specific gravity of sea water faeces come to the surface and float when sewage is discharged into the sea, and the lumps of solid faeces not broken up by the flow of sewage in the sewers are hardened by the salt, rise to the surface, and, floating there, are liable to be acted upon by the winds and propelled in directions and to distances which often seem impossible. Probably many bathers at a great number of seaside resorts, especially if long swimmers, have been surprised, when at a considerable distance from shore, to come across some of these unwelcome visitors which seem to have come from no one knows where. I myself have had such unpleasant experiences, and probably some of my audience could corroborate me.

Now, if such things can and do happen, what are the consequences? We all know that people who bathe, especially the inexperienced bathers—the women and children—are very apt to swallow involuntarily at times some of the fluid in which they disport themselves. Does there not lie here an explanation of some of that illness—attacks of diarrhoea, vomiting, headache, etc.—which visitors at some seaside resorts appear to suffer from, whose cause is often very doubtful, but which is generally attributed to the strength of the air, the heat of the sun, or some other fanciful origin? And if such cases, why not those apparently unaccountable cases of typhoid fever, which are so often said to have been incubating since the patient left his or her home, and which nothing in the sanitary condition of his lodgings or of the town generally can satisfactorily account for? I do not wish to lay too much stress upon this point, but to ask my hearers who are medical men at seaside resorts, when they meet with suspicious cases of illness simulating drain poisoning, or even with attacks of typhoid fever for which they cannot find a cause, to inquire as to the bathing habits of the patient, and as to his ever having found himself in the neighbourhood, when bathing, of floating sewage.

Besides this danger, which is a hidden and insidious one, there is of course the obvious and recognisable offence of sewage matters cast up on the foreshore in or near the town. The nuisance here, and the danger to those who make the beach their playground, is so obvious and tangible that I need not allude to it further. A remedy is sure to be sought and applied by the responsible authority for the good name and material interests of the town. My intention is rather to indicate the hidden and unseen dangers of discharging crude sewage into the sea, and to sound a note of warning to the authorities of those towns who—relying upon the advice of engineers and the evidence of float experiments carried on usually under normal conditions of wind and weather—are prepared to assert that the method of discharge which they are about to inaugurate is absolutely incapable of allowing any sewage to find its way back to the town and its beach. No one believes now that sewage discharged into the sea is carried away at once to mid-channel, there to disappear. What usually happens is that the tidal currents setting along the shore carry the sewage a certain distance up the coast, and then bring it back again, more or less diluted it is true, and not generally recognisable as sewage, but still possibly pregnant with danger from non-destruction of its harmful qualities.

The general conditions I would formulate under which town sewage may be discharged into the sea are briefly as follows:—

1. The spot chosen for discharge should be some miles from the town or from any part of the beach usually resorted to by visitors.
2. The sewage must only be discharged for three hours of every tide, and of course with the tidal current carrying it away from the direction of the town. If discharged for much longer than three hours some of the sewage will be borne back past the outfall with the flowing or ebbing tide, as the