

PART III.
SPECIAL REPORTS.

THE BACTERIOLOGY AND PATHOLOGICAL
RELATIONS OF INFLUENZA.

By the EDITOR.

WE translate from the *Centralblatt für klinische Medicin*, 1890, No. 12, March 22, the following abstracts of valuable communications which have lately appeared in the medical press of Germany, Austria, and Russia, on the all-absorbing topic of Influenza:—

1. *Anatomical and Bacteriological Investigations on Influenza.*

Ribbert (*Deutsche med. Wochenschrift*, 1890, No. 4, pp. 61–63) says that, in eight autopsies, the lungs were twice found without pneumonic processes; in three of the remaining cases the pneumonia had invaded a whole lower lobe. In contrast to ordinary croupous pneumonia, the cut surface of the hepatised lobe presented an almost smooth appearance; the exudation was soft, very rich in cells, and poor in fibrin (hypinosis). In one case also the lobar consolidation was on section seen to have resulted from lobular pneumonia—the separate lobules were not uniformly altered. In four cases the consolidated patches, radiating from separate foci, coalesced with partly smooth, partly granular surfaces. In all cases alike there was an injection, varying in its intensity, of the mucous membrane of the larger bronchi, of the trachea, and frequently of the larynx as well. The *post-mortem* examination carried out in five cases showed a considerable cellular infiltration of the mucous membrane, with extreme overfilling of the blood-vessels. The spleen was swollen in all cases, always distinctly enlarged, occasionally to several times its usual size, and generally of an abnormally soft consistence. In one case the kidneys showed cloudy swelling; on another occasion, commencing fatty degeneration of the convoluted uriniferous tubes.

In connection with these pathological changes, it is to be remarked that in seven of the patients who had died, the influenza

had supervened upon an already existing tuberculosis (in two cases), emphysema (in two cases), myocarditis with mitral narrowing (in one case), fatty heart with adherent apex (in one case), lipomatous atrophy of the muscles of the trunk and extremities (in one case).

Cultivation experiments with the tracheal mucus, the lung tissue, the spleen, and the kidneys, furnished in five cases the *Streptococcus pyogenes* or else the *Streptococcus erysipelatosus*, the presence of which microbe could be demonstrated in the sputum also of the influenza patients.

This streptococcus was found in the most unusually large numbers of all in a case in which the influenza had caused no distinctive morbid appearances in the lungs—and, in particular, no consolidations. In another case, unaccompanied by morbid appearances in the lungs, the spleen and kidneys invariably yielded pure cultures of the streptococcus. In the tissue of the mucous membrane, infiltrated as it was with cells, streptococci could not be clearly demonstrated.

On the whole, then, it appears that the streptococcus, even if it is not the specific germ of influenza, may play a very active part in the course of that disease.

2. *A Condition of the Blood in Influenza.*

Klebs (*Centralblatt für Bakteriologie*, 1890, No. 5) has, in the first place, examined the blood obtained by a prick in the tip of the finger, and has found in it—in addition to the perfectly unaltered red blood-corpuscles—an enormous mass of small, actively moving, highly refractile corpuscles, which in size, shape, and movement exactly correspond with those which he has come to recognise in pernicious anæmia, in which, at the same time, they are never present in such numbers. In distinction, however, to pernicious anæmia, no microcytes were to be found in the blood of those ill of influenza. In the blood of a patient who died of this disease, besides the monads referred to, the author found intermediate and larger oblong and oval forms, which differed from the monads in question by their very slow movements; and their shape and position could be made out very clearly in stained preparations obtained by means of Ehrlich's solution of methyl-blue. In the forms which had come to rest, a rigid stalk-like process of the same length as the diameter of the corpuscle could be observed. Further, it could be seen as clearly as possible that a large number

of flagellate organisms were present in the interior of the red blood-cells; the latter contained generally 2 or 3 to 5, rarely only one, of these flagellate organisms. The red blood-corpuscles which were filled with flagellate organisms are unmistakably recognisable by their spherical shape, while numerous other blood-discs are dish-shaped or jagged-edged.

From this, then, Klebs suggests that in all the processes which are brought about by hæmatozoa belonging to the class of the protozoa, the forms of continued fever which are so characteristic for the schizomycetes are wanting. Both in malaria and in pernicious anæmia the intermitting character or type of the fever stands out in a striking manner. In influenza, likewise, a recurrence of the febrile conditions takes place, commonly designated as a relapse; yet, in this case too, the question may be one of a phase in the development of the micro-organisms which bring about the relapse.

3. *Bacteriological and Pathologico-Anatomical Investigations on Influenza and its Complications.*

Weichselbaum (*Wiener med. Wochenschrift*, 1890, No. 6) has utilised the rich material afforded him by the influenza epidemic at Vienna in comprehensive bacteriological and pathologico-anatomical studies, the results of which he reports in the work before us. The investigations referred, in the first place, to the sputum and blood of the patients—twenty-one in number. In nearly all the cases the pneumococcus was found in the sputum predominantly among numerous other kinds of bacteria. In one case he was successful in demonstrating the presence of the pneumococcus in the urine also. Examinations of the blood invariably yielded negative results.

Weichselbaum examined the bodies of ten patients who had died of influenza, partly with, partly without, complications. The occurrence of acute inflammations of the accessory cavities of the nose, especially the frontal and maxillary sinuses, were conspicuous by their almost constant presence. In the pus taken from these sinuses the presence of pneumococci could always be demonstrated.

In one case, suppurative pachymeningitis and leptomeningitis were found, together with a cerebral abscess. They had taken their origin from the maxillary and frontal sinuses. In three cases also of inflammation of the middle ear, pneumococci could be cultivated from the exudation.

In seven cases, further croupous pneumonia had occurred, once with the formation of an abscess; in one case, a slight broncho-pneumonia; in another case, purulent pleuritis. Enlargement of the spleen was commonly present, yet never to an extraordinary degree; also cloudy swelling of the liver and kidneys was observed.

In connection with this constant discovery of pneumococci in the sputum as well as in the pathological processes observed in the dead body, Weichselbaum proceeds to discuss the question whether the pneumococcus is the cause of influenza, or whether the latter is produced by a micro-organism as yet quite unknown to us, while the presence of the pneumococcus has the significance only of a secondary infection, which is capable of producing certain complications of influenza. Weichselbaum inclines towards the latter hypothesis, but believes that the pneumococcus constantly plays an essential part, inasmuch as it is capable, on the one hand, of maintaining and increasing catarrhal processes; on the other hand, of evoking many and severe complications, especially croupous pneumonia.

4. *Preliminary Communications on some Bacteria found in Influenza.*

Babes (*Centralblatt für Bakteriologie*, 1890, No. 8) has inoculated rabbits and guinea-pigs with the secretion from the innermost recesses of the nostrils, as well as with the sputum of recent uncomplicated cases of influenza. The animals, for the most part, perished in a few days with pneumonic phenomena. From agar-agar cultivations, dust-like, finely-granular cultures developed from all the organs at the bottom of the track made by the inoculation needle. These spread themselves out on the surface as small, entirely transparent, and colourless colonies; after a few days longer, these can scarcely be recognised any more. On nutrient gelatin, little molecules developed at the bottom, which could be distinguished from other bacteria through their transparency. On potatoes, no growth of the bacteria could be detected. These colonies consist of extremely small constricted bacteria, 0.2 to 0.4 μ (0.002 to 0.004 of a millimetre) in thickness, sometimes forming short chains, sometimes drawn out into fine rods, sometimes round or pear-shaped. At their extremities vesicular swellings are found here and there. These bacteria readily produce lung affections. They flourish *in vacuo*. Babes names them provisionally "Bacterium No. 1."

By direct cultivation of the secretion from the nostrils and frontal sinus of most of the patients, different kinds of bacteria could be obtained. Among these, small, superficial, round, transparent cultures, when cultivated on agar-agar, predominate, which are provided in the middle with a whitish projecting point. These cultures consist of constricted, deeply-stained bacteria of about 0.5 μ ($\cdot 0005$ of a millimetre) in breadth, somewhat pointed, with one convex and one straight side; often provided in the middle with an unstained transverse stripe; forming parallel groups of two individuals with the straight sides next each other; capable of being deeply stained by anilin colours as well as by Gram's method; motionless. In the case of mice and guinea-pigs, these are pathogenic, frequently causing in the former fatal pneumonia with localisation of the bacilli in the vessels of the alveolar septa, in the latter a kind of septicæmia; while in rabbits sometimes a considerable local reaction arises. This bacillus, Babes designates as "Bacterium No. 2."

Even before the appearance of influenza in Bucharest, malignant attacks of bronchitis and pneumonia prevailed in that city, many of which went on to a *post-mortem* examination. Bacteriological investigations in these cases, revealed in the bronchial tubes, sometimes also in the internal organs, in addition to *Staphylococcus aureus*, *Streptococcus pyogenes*, &c., the presence of peculiar bacteria, which appeared to be fastened together by radiating processes, and so reminded one of a myxomatous tissue. These bacteria also formed considerably raised, gelatinous, almost entirely transparent, colonies. These in places cause a drying up of the oblique surface of the stiffened agar solution, in other places the accumulation of an abundant gelatinous mass at the bottom of the test-tube. These bacteria are pathogenic in mice and guinea-pigs. In respect to size and shape these micro-organisms differ one from the other.

During the epidemic of influenza these forms were very abundant, and were demonstrated in six cases out of nine which were examined. In addition to them, peculiar-shaped streptococci were found in many cases.

5. *Influenzal Pneumonia.*

Finkler (*Deutsche med. Wochenschrift*, 1890, No. 5) has observed 45 cases of influenzal pneumonia, of which only two came under the description of typical lobar pneumonia, while the other 43

were regarded as cases of the disease, which Finkler has now often described as "Streptococcus Pneumonia." The phenomena of pneumonia do not stand out very clearly in these cases. The breathing is generally much quickened, often combined with cyanosis; marked dyspnoea (*Lufthunger*) is commonly present. The cough is very trifling and dry; the expectoration is usually scanty, rusty-brown pneumonic sputa being quite inconstant in appearing. The phenomena on physical examination are very diverse, dulness and bronchial breathing are often very slightly marked. The pulse is generally extremely frequent, small and weak.

Seven of Finkler's patients died, *post-mortem* examinations being made in three instances. The essential feature in the pathologico-anatomical appearances consisted in this, that the inflammation developed from foci, that these foci, spreading out in all directions and ramifying through the lobes of the lung, are composed of small lobular pneumonias which, although scattered broadcast, yet include between them small air-filled portions of lung tissue. The cut surface of the pneumonic foci is generally smooth, sometimes distinctly granular. The infiltrated portions of lung tissue are not hepatised, but splenified. The pathological condition is that of a preponderating cellular inflammation with participation of the interstitial tissue. The cellular nature of the inflammation, together with the pronounced tendency it exhibits to develop by spreading indefinitely, justifies us in describing this disease as an erysipelas of the lung. The resemblance of this form of pneumonia to erysipelas consists, not alone in the anatomical character of the inflammatory process, but also in the fact that both diseases depend on the presence of streptococci. Finkler, for example, found in all the pneumonic lungs the streptococcus, of which he had already obtained pure cultures in the cases of streptococcus pneumonia previously described by him, and which he had conceived to be the exciting cause of the same. Only in one lung did Finkler find, in addition, a staphylococcus and a diplococcus, which, however, was essentially different from Fraenkel's *Diplococcus pneumoniae*. Finkler looks upon this streptococcus pneumonia as a localisation of the exciting cause of influenza in the lungs. Therapeutically, Finkler has seen no result from the bath-treatment; on the contrary, he commends the ice-treatment and quinine, from which he has seen advantage from a prophylactic point of view also.

6. *Bacteriological Discoveries in Influenza.*

Levy (*Berliner klin. Wochenschrift*, 1890, No. 7) reports on the bacteriological investigations conducted at the Strassburg *clinique*. These concerned the sputum in the first place; in it, besides staphylococci and streptococci, Fraenkel's *Diplococcus pneumoniae* was found in great numbers. Next, Levy examined the secretion in seven cases of otitis—a disease which occurred as a complication with singular frequency at Strassburg, in all instances poured upon slides of agar-agar and gelatin, and inoculated into white mice. In the six first cases he obtained Fraenkel's *Diplococcus pneumoniae* in a pure culture, in the seventh case the *Staphylococcus pyogenes albus* was, in addition, present. Further, among nine pleural exudations of different kinds, Fraenkel's *Diplococcus pneumoniae* was found eight times, once together with the *Staphylococcus pyogenes albus*, and once the latter was found alone. In the broncho-pneumonia of influenza, Levy was able only once to cultivate Fraenkel's diplococcus from the lung; in one case of lobular pneumonia, in which there was an autopsy, in addition to the diplococcus pneumoniae among others, the *Staphylococcus pyogenes albus* appeared in the infiltration (gray hepatisation). Levy believes, not that any one of the micro-organisms which were found should be regarded as the primary exciting cause of the disease, but that the question is much more one of a secondary infection, for which the influenza merely laid the foundation. Levy finally lays stress on the frequency with which fibrinous pneumonia occurs simultaneously with influenza.

7. *Microscopical Conditions of the Blood in Influenza Patients.*

Kollmann's investigations on this subject (*Berliner klin. Wochenschrift*, 1890, No. 7) yielded the following results:—In fresh, unstained preparations, actively moving forms are present in greater or less numbers; they have an oval or round shape, or the shape of short rods, more rarely that of longer rods. The latter are occasionally swollen at both ends, so as to resemble dumb-bells (*hantelartig*). In addition, forms joined in pairs to each other, so as to resemble diplococci, are frequently present. Some are, however, so small, that it is quite impossible further to define their shape. As far as one can judge from the mere microscopical observations, these forms are none other than those which would be met with also in perfect health, if an examination of the blood was carried out

under the same conditions. Above all, the round and oval forms are sometimes to be seen here in considerable numbers.

The white blood-corpuscles were increased in the cases examined by Kollmann; once to even more than thrice the normal number. This augmentation could be observed as early as the first day of the fever, but in the case of a patient with slow convalescence persisted for several weeks.

8. *On the Influence of La Grippe on the Course of Phthisis, and the type of this disease when complicated with La Grippe.*

Wiltshur (*Petersburger med. Wochenschrift*, 1890, No. 5), in the first place, establishes by statistics that the number of consumptives who, during the epidemic of influenza or "la grippe," sought admission to the department in the Obuchow Hospital attended by him, as well as the number of fatal cases, increased absolutely and relatively, whilst the average duration of the stay in hospital diminished. By this the old opinion is confirmed that influenza is very dangerous to consumptives.

The type of phthisis when complicated with influenza was sharply distinguished from the usual type. The patients are, for the most part, still well nourished. Cyanosis of the face and extremities generally comes on; further, asthma, extreme weakness, high temperature ($40\cdot5^{\circ}$ – 41° C. = $104\cdot9^{\circ}$ – $105\cdot8^{\circ}$ F.); in the lungs, loud sibilant rhonchi and râles. Frequent pulmonary hæmorrhages and a rapid course of the phthisis were the most noteworthy features. The progressive extension of the disease could often be observed from day to day.

Many patients also passed into a state of extreme prostration; many perished quite unexpectedly. The suddenly fatal cases Wiltshur is inclined to explain by implication of the cardiac ganglia.

Lastly, the occurrence of extremely rapid phthisis (galloping consumption) in the course of influenza, in people who had never before shown the slightest sign of lung delicacy, seems to be worthy of note.

Through the kindness of Dr. Henry T. Bewley, we are able to add to the foregoing, abstracts of two recent contributions to the subject of influenza—one English, the other American:—

9. *The Influenza Epidemic in Glasgow.*^a

The epidemic of influenza in January, 1890, in Glasgow was mild when compared with the characters of the outbreaks elsewhere. As Professor Gairdner says, Glasgow was on the outskirts of the infected area. The most important facts mentioned are:—

(1) Although the month of January was, as far as temperature is concerned, unusually mild, the mortality from acute respiratory diseases was as great as in the unusually severe winter season, 1886–87, and differed entirely, in the direction of excess, from other mild winters.

(2) He suggests that the outbreak may have had something to do with the unusually still and stagnant condition of the atmosphere.

(3) The attacks of influenza in many cases differed from ordinary colds in that they came on more suddenly, subsided more rapidly, and were often quite unattended with catarrh.

(4) For a month previous to the epidemic in January, a very severe and widespread epidemic of influenza, or “pink-eye,” in horses had been observed. It did not appear, however, that the men who came most in contact with these horses suffered in any special way from the disease.

10. *Bacteriological Studies on the Influenza and its Complicating Pneumonia.*^b

Dr. Prudden examined the sputum of seven cases of uncomplicated influenza, and of five cases in which it was complicated with pneumonia. In all these cases the only pathogenic bacteria discovered were the *Diplococcus Pneumoniae*, the *Staphylococcus pyogenes aureus*, and the *Streptococcus pyogenes*—none of which are special to influenza. Dr. Prudden suggests that the micro-organism of influenza may not perhaps belong to the class of Bacteria at all, but may belong to some other class of organisms as different from bacteria as the *Plasmodium malariae* is.

^a Influenza: by W. T. Gairdner, M.D., LL.D., Professor of Medicine in the University of Glasgow. Reprinted from the Glasgow Medical Journal for March, 1890. Pp. 27.

^b By T. Mitchell Prudden, M.D., Director of the Laboratory of the Alumni Association of the College of Physicians and Surgeons, New York. Reprinted from the Medical Record, February 15, 1890.