THE BACTERIOLOGY OF
BRONCHITIS

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in Pathology.
The somewhat scanty literature dealing with the bacteriology of bronchitis reveals the fact that quite a number of micro-organisms may be present in the bronchitic secretion, and that an important aetiological relationship has been assigned to many of them.

In the following pages, I propose to deal with this subject, which is one towards which sufficient attention has not as yet been directed.

The question of the bacteriology of bronchitis, however, is so intimately associated with that of the bacteriology of the normal air passages, that I shall first quote some of the more important writings in regard to the flora of the respiratory passages, then give a short review of the chief literature dealing more particularly with the bacteriology of bronchitis, and lastly, pass on to the records of my own cases.
The Bacteriology of the Normal Air Passages

In this connection I do not propose to deal with the bacteria present in the upper air passages, the nose, pharynx and larynx. Various bacteria have been found, both in healthy and in diseased conditions of these parts; and many diseases, viz. croupous pneumonia and cerebro-spinal meningitis, are supposed to be due to an invasion of bacteria which may frequently be found on healthy nasal mucous membrane. I shall, however, only deal with the question as to whether, under normal conditions, the lower air passages, the trachea, bronchi, and pulmonary alveoli, contain microorganisms or not; and if so, whether they are of a pathogenic nature.

Firstly, the view that the lower air passages, including the bronchi and pulmonary alveoli, contain bacteria. Those who support this view base their opinions to some extent on the fact that dust particles, coal dust, bacteria and other organic particles can frequently be demonstrated in the bronchial lymphatic glands.

Thus, Baumgarten\(^{(a)}\) says he is convinced that inspired particles, dust, bacteria, etc., are carried

directly into the alveoli, and thence transported to the bronchial lymphatic glands.

Hoffmann\(^{(a)}\) says:— "The air passages always contain micro-organisms, and moreover, in the great majority of cases, they also certainly contain such organisms as are known to be capable of producing inflammation, more especially the Staphylococcus pyogenes, Streptococcus pyogenes, Fraenkel's and also Friedlander's Pneumococci. In healthy individuals these remain in the bronchi without causing any harm, the intact epithelial covering being evidently sufficient both to prevent their further entrance (into the human body) and to get rid of them." He also says: "When one considers what quantities of air we daily inspire into our bronchi, and that we are absolutely certain that all possible kinds of lower organisms get into them, sometimes into the finest twigs, and even into the alveoli themselves, there seems no doubt but that some protective appliances must exist in the bronchi themselves."

\(\text{Dürck}^{(c)}\) who holds the same views bases them on the results of bacteriological examination.

\(^{(a)}\) Hoffmann: Die Krankheiten der Bronchien, Nothnagel's Series, p.70.


\(^{(c)}\) Dürck: Deutches Arch. für klinische Medicin, 1897, Bd. 58. p.368.
According to him, the internal surface of the healthy lungs is not germ-free. First he examined, both by cultures and by histological examination, 41 cases of pneumonia in children. He found various combinations of micro-organisms quite independent of the clinical history of the pneumonia. The most frequent bacteria were Pneumococci (84.61%). The main other ones were Staphylococcus aureus and albus (53.89%), Streptococcus pyogenes (35.90%), Friedlander's bacillus (30.76%), Bact:coli commune (5.12%) besides other saprophytes, such as sarcinae, etc. In 21 of these cases where there was diphtheria he found the Klebs-Loeffl bacillus 11 times; monobacterial infection he only found three times. Then he examined non-pneumonic lungs, their normal condition being controlled in each case by microscopic examination. He found the Diplococcus pneumoniae in 12 out of 13 cases examined, and there were also streptococci, staphylococci, Pneumobacilli and Bact:coli present. In only two cases was the Diplococcus pneumoniae found alone, and in one case Friedlander's bacillus only.

In the lungs of ten pigs he found Pneumococci twice, and Pneumobacilli eight times, without pneumonia existing. In the lungs also of various healthy horses and cattle he always found bacteria, among
which were Pneumococci, staphylococci and Bact:coli. 
(a) Pansieri found in healthy bronchi eight different streptococci, several forms of sarcinae, 21 forms of bacilli and ten micrococci.

The opposite view, viz. that the lungs and lower air passages are germ-free, has, however, received much support, and is probably the correct one.

Firstly, we believe that the expired air contains no bacteria. Kümmler(b) who investigated this question made 20-30 forced expiratory efforts into flasks and tubes containing an agar or gelatine medium. On none of the media did a single colony develop. Similar results have been obtained by other investigators.

Practically, all bacteria are probably removed from the inspired air in the upper air passages, especially by the nose and the adenoid tissue of the pharynx. Such is the view supported by Müller(c) and Barlow(d), the latter saying that "few of the microorganisms which enter by the nose or mouth succeed in penetrating beyond the larger bronchi." The same view is held by Buttersack(e), who also remarks that according

(a) Pansieri: Reference in Die Krankheiten der Bronchien. 1886, p.70.
(c) Müller: Münchener med:Wochenschr: 1897, p.1382.
(d) Barlow: Manual of General Pathology, 1898, P.711.
to Vierordt's teaching the inspired air does not reach the alveoli, but remains for the most part in the upper parts of the respiratory organs.

Many experiments show that when bacteria are introduced into the trachea and bronchi they quickly die. Morse\(^{(a)}\) observed that a pulmonary mycosis never occurred in animals after inhalation of malignant bacteria which was prolonged over some months, or even after a direct introduction into the trachea. He also noticed that after spraying in cultures of septic micro-organisms, an absorption of these highly pathogenic bacteria never occurred. His attempts at the introduction of anthrax spores were equally futile.

Buchner\(^{(b)}\) conducted similar experiments with anthrax spores. If these were inhaled along with coal dust, the results were positive; with magnesia or sulphur powder, room dust, etc., the results were negative. The positive results were probably due to mechanical injury by the hard particles, and there was, therefore, a favourable factor for the entrance of the spores into the general circulation.

\(^{(b)}\) Buchner: Same reference as (a).
Lahr\(^{(a)}\) has demonstrated that staphylococci, when injected into the lungs, are quickly absorbed by cells in which they perish. His work was written under the guidance of Ribbert\(^{(b)}\) who corroborates the results.

Grammatschikoff\(^{(c)}\) draws similar conclusions in regard to the Bacillus anthracis; Nebelthau\(^{(d)}\), three days after the injection of staphylococci or even virulent Pneumococci, could no longer detect any of these bacteria in the respiratory organs. Hildebrandt as the result of many animal experiments came to the conclusions that: "The microbes contained in the inspired air do not pass unhindered into the deeper respiratory passages and lungs; but are under normal circumstances practically all retained in the nose and pharynx." (He examined by cultures the lung tissue and tracheal mucus in freshly killed rabbits. He found these to be either entirely or almost free of bacteria.) He also states that: "Those microbes which have got into the pulmonary alveoli find in the intact lung surface no obstruction to their entrance into

\(^{(a)}\) Lahr: "Ueber den Untergang des Staphylopyogen: aureus ... in den Lungen." Bonn, 1887.

\(^{(b)}\) Ribbert: Fortschritte der Medicin, 1894, pp. 382 & 383.


\(^{(d)}\) Nebelthau: Reference in Münchener med:Wochenschr. 1897, p.1334.

the system; on the contrary, they are quickly taken up into the lung tissue itself. Only certain bacteria find in the pulmonary tissue the requirements suitable for their existence and increase (Rabbit septicaemia) the majority probably die under these circumstances (Aspergillus fumigatus, Anthrax.)"

Several writers have also stated that on artificial introduction of bacteria into the nose, the nasal mucous membrane is found to possess marked bactericidal properties. Thomson & Hewlett (a), for instance, working with the Bacillus prodigiosus found that two hours later "no trace of the bacillus could ever be detected." They also say (b) "The interior of the great majority of normal nasal cavities is perfectly aseptic."

Now if, as is shown by these experiments, the respiratory passages, and more especially the bronchi, possess such a marked power of destroying invading bacteria, it is improbable that bacteria are normal inhabitants of the bronchi.

The view that the bronchi are devoid of bacteria is also supported by direct bacteriological examination of the bronchi.

Babes (c) on examining the smaller bronchi of

(c) Babes: Archives de méd. expériment. et d'anat. pathol., 1893, Tome V., p. 491.
persons previously healthy and dying as the result of some accident, found them to be germ-free. Similarly, with the smaller bronchi of healthy animals which were examined immediately after the animals were killed.

Babes & Beldiman\(^{(a)}\) state that the small bronchi in the human subject under normal conditions contain no micro-organisms.

Müller\(^{(b)}\) states that, having employed small animals and having removed the lungs under aseptic precautions and made cultivations on agar, he found the trachea, bronchi and lungs to be sterile in the great majority of cases.

Barthel\(^{(c)}\) as the result of his investigations, says that the smaller bronchial twigs were almost always germ-free, unless inflammatory processes existed in the lungs. He also states that the trachea usually contained more germs than the larger bronchi. His investigations were carried out by making cultures, in the first place from portions of lung tissue and bronchi of three rabbits. In the case of the first rabbit both of these proved to be sterile. Of the second and third rabbits, the portions of bronchi were sterile; while from the portions of lung tissue five

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(b) Müller: Münchener med: Wochenschr. 1897, p.1382.
(c) Barthel: Centralb. für Bakt. und Parasit: 1898, XXIV, p.401.
bacteria in all developed, these being fungi by which the specimens were supposed to have been contaminated during the examination.

In the case of two dogs, harmless saprophytic micro-organisms were found to be present, and in one case a bacillus of the Tetanus group, which was not more definitely investigated.

On the human subject his investigations were made on a large bronchus of the right lung. In the following case the bronchi were healthy.

Tabes. Trachea and bronchi seem normal, almost no mucus. No pathogenic organisms. Fluid expressed from lung and portion of lung tissue were sterile on agar and in bouillon respectively. Of five gelatine media inoculated with a portion of lung tissue two remained sterile, the third showed a fungus, while the fourth showed a fungus and a colony of large cocci. Portions of bronchus in bouillon and gelatine proved to be sterile. Finally, from mucus of the large bronchi there developed two colonies of cocci, and also a short bacillus non-pathogenic on animals.

Thomson & Hewlett(a) mention that the tracheal mucus from many recently killed animals was always found to be sterile.

Klipstein\(^a\) investigated the respiratory tract of a number of healthy animals (Rabbits, Cats, Dogs). While on the cultures made from the mucus of the mouth and pharynx there were innumerable colonies, there were much fewer on the cultures from the larynx, and the trachea, bronchi, and lungs were either quite sterile, or else the cultures contained a few colonies which were probably due to an "accidental contamination."

In his opinion the air passages from the glottis downwards may be considered as being free of micro-organisms under normal conditions.

Jundell\(^b\) examined the vegetation of the trachea and intermediate respiratory passages in the human subject by means of a specially constructed instrument, which in shape resembles a pair of laryngeal forceps. At the distal end is a small cotton wool pad contained in a metal sheath. The point of the instrument is passed through the glottis, the pad is then protruded and directed against the anterior tracheal wall, and it is again withdrawn inside the sheath before the point of the instrument is withdrawn through the pharynx and mouth. The manipulations were made on the cocainised larynx with the aid of a laryngeal

\(^a\) Klipstein: Zeitschrift für klinische Med: 1898, p.196.

\(^b\) Jundell: Skandinavisches Arch: für Physiol: 1898, Bd.VIII, p.284.
mirror. In his investigations he used cover-glass preparations and cultures on agar, gelatine and ascites-agar or blood-agar, using at first Petri's dishes, later on, short wide glass tubes which contained the above mentioned media, obliquely sloped. He classifies his results as follows:

1. **The first group** of 22 cases, or more than half of the total number examined, showed that "both, or at any rate one, of the samples remained quite sterile." In none of these 22 cases was there any respiratory disturbance, except that in one case there was a chronic laryngitis.

2. **In the second group**, of 16 cases, (all with normal respiratory passages, but for two cases of chronic laryngitis), none of the samples were sterile; "yet one sample at least contained a very scanty number of colonies in relation to the amount of secretion used in making the cultures. The colonies in some of the samples were so scanty that their presence may be explained by the supposition of a direct infection from the air."

3. **The third group** consists of 5 cases (the respiratory passages presumed to be healthy except in one case where there was chronic laryngitis). "All the samples contained numerous colonies." The most
important of these were formed by a diplococcus of coffee-bean shape, "very similar to the Gonococcus." It is also negative to Gram, grows on agar, but not at room temperature, and is non-pathogenic. Another coccus which was also sometimes present, is considered by him to be identical with the mucous membrane streptococci of Kruse, Pansini and Pasquale.

He also examined, immediately after death, the mucous surfaces of the trachea, larynx and vocal cords in oxen. In the case of the trachea, the following is the result:

Case 1. Trachea. 4 agar tubes, in all 2 colonies.

2. 1st agar tube, about 200 colonies.  
   2nd 100

3. 1st agar tube, 14 colonies.  
   2nd 39  
   3rd 49

4. 2 agar tubes, in all 1 colony.  
   1st agar tube, sterile.

5. 2nd 18 colonies.  
   3rd 21  
   4th 70

He also examined the larynx and trachea of 7 rabbits, the majority of these proving to be sterile. In a summary he says: (a) "Those parts of the respiratory passages which lie below the glottis, do not under normal circumstances permit of the development of bacteria; they are either quite sterile, or else they contain merely a transitory and scanty number of bacteria."

The Bacteriology of Bronchitis.

On looking at the literature of this subject, we find that in bronchitis various bacteria have been discovered in the sputum or in the bronchial secretion post mortem. Many of these have been supposed to be important causal factors in producing the inflammation.

A. Cocci.

Troup\(^{a}\) examining cover-glass preparations of the sputum says: "The bacterial forms present are usually of the coccal kinds." He describes

1. Circular and cylindro-elliptical diplococci.
2. Heaps of the same.
3. Chains composed of small diplococci laid end to end.
4. Tetrads, large and small.

(b) L. von Besser made cultures from the bronchial mucus of ten cases, two of tuberculosis of the lungs, the remaining eight of more or less well marked bronchial catarrh. He found the Diplococcus pneumon: in three cases; Strept:pyog: in two cases (Tuberculosis); a coccus similar to Streptococcus in two cases (Scarlatina); Staphylococcus pyog:aureus in three cases (Once in pure culture); Friedlander's bacillus in one case in pure culture.

(a) Troup: "Sputum", 1886, p.190.

Besides these he found the Bacillus striatus once, the Micrococcus liquifaciens once, the Micrococcus cumulium tenuis and albus each once.

The bronchial mucus in these cases was removed from the main bronchus which had been cut through with a sterilised knife. He considered some of the bacteria as the causal agents of the bronchitis in the individual cases.

Duflocq & Ménétrier (a) record six cases of pulmonary phthisis which were the subjects of secondary invasion of Pneumococci. This caused a capillary bronchitis, but no pneumonia. The sputum was examined during life, as well as mucopurulent bronchitis secretion post mortem. The cocci were, by means of the microscope and cultures — and in two cases also by inoculation of mice — identified with Pneumococci. These were always the predominant bacteria, but were associated with others; in the majority of cases staphylococci were present; Streptopyog: twice; Friedlander's bacillus once. In histological sections the Pneumococci were seen inside the epithelial cells forming the bronchial wall.

The Pneumococci were never found in the transparent secretion of such bronchi as had remained normal.

Tubercle bacilli were never found in the bronchial mucus, only in the tubercular areas.

Barthel (a) states that when cases were examined 20–30 hours after death, the flora of pathogenic and non-pathogenic bacteria in the mouth, trachea and bronchi was more or less similar.

Hence of his 46 cases only 22 are reported, viz., those when the examination was carried out "as soon as possible after death." The time elapsing between death and the bacteriological examination is, however, not mentioned.

Of these 22 cases, one where the bronchi were healthy has already been mentioned on Page 10. In the remaining 21 cases the following pathogenic organisms were present in the cultures:

- Staphylococcus pyogenes aureus in 15 cases.
- " albus in 5 "
- Streptococcus pyogenes in 11 "
- Diplococcus pneumoniae in 12 "
- Bacillus pneumoniae in 2 "
- Tubercle bacillus in 4 "
- Diphtheria bacillus in 1 case.

Barthel thinks that in some of his cases the bacteria were being eliminated from the body through the bronchial mucous membrane. It is extremely doubtful, however, whether such an elimination ever occurs, and that such a process had occurred in some cases.

(a) Barthel: Centralb. für Bakt und Parasit: 1898, XXIV, p. 401.
of these cases is, in the present state of our knowledge, a mere supposition. In other cases he considers their presence may be explained by an infection from the inspired air. These pathogenic organisms are, however, very scanty in the air, and he suggests that they had undergone increase in the bronchial mucous membrane after the protective power of the body had been overcome.

He considers the Diplococcus pneumoniae to be the most dangerous of the respiratory micrococci, for it was present in 12 out of 22 cases and on these occasions there were marked changes in the bronchial mucous membrane. The Streptococcus ranks next, the Staphylococcus pyogenes being the least virulent of the three, being present sometimes in great amount, without there being any special histological alterations.

Kruse, Pansini & Pasquale (a) examined the catarrhal secretion in 30 cases of influenza. In cover-glass preparations they found, in addition to sarcinae and scanty bacilli, diplococci in varying amount. The cocci varied in size and shape, were frequently provided with capsules and seldom formed chains. They only occasionally found large diplococci with a stained capsule, such as often occur in the oral secretion.

(a) Kruse, Pansini & Pasquale: Centralb. für Bakt. und Parasit. 1890, Bd. VII, p. 661.
Cultures were made on agar, and in these they found in addition to various sarcinae:

- Streptopyogenes: Once
  A streptococcus, morphologically different from the one last mentioned.

- Friedlander's bacillus: Once
  A bacterium similar to Babes' Bact: No.II.

In the other cases they found the "mucous membrane Streptococci", which they subdivide into five varieties; the variety most frequently found was non-pathogenic, involution forms like bacilli appearing in agar culture. Further, the cultures soon lose their vitality, no growth occurs on gelatine at 20°C. and bouillon culture is diffusely cloudy.

Dessy \(^{(a)}\) too found a coccus in the sputum of five cases of acute bronchitis. He was unable to classify it definitely among the streptococci, nor among the well-known diplococci. In none of these cases did he find the Influenza bacillus.

Bouchard \(^{(b)}\) mentions in connection with influenza that he has found a streptococcus in the bronchial mucus identical with that of erysipelas or puerperal fever.

Claisse \(^{(c)}\) considers bronchitis to be due to bacteria which have either come from the air or from the naso-pharynx. His investigations were made by cover-

\(^{(a)}\) Dessy: Lo sperimentale, 1896, p.325.
\(^{(b)}\) Bouchard: La semaine médicale, 1890, p.36.
\(^{(c)}\) Claisse: La semaine médicale, 1893, pp.297-300
glass preparations, cultures and by inoculation of mice. In the large bronchi he found a great variety of bacteria, but towards the finer ramifications the flora became more simplified, sometimes becoming reduced to a single form of micro-organism. In only one case was this the Diplococcus pneumoniae.

In five other cases, the most important organism was the Streptococcus pyogenes, which was either in pure culture or associated with staphylococci or the Diplococcus pneumoniae. As a rule no bacteria could be detected in the blood or internal organs.

After the injection of a few drops of a fresh culture of these virulent streptococci into the trachea of rabbits, no changes were visible. But if previous to the injection there had been a superficial injury to the mucous membrane by dilute sulphuric or nitric acid, a severe bronchitis occurred.

(a) Queyrat found a coccus in the sputum of 11 cases of simple acute tracheo-bronchitis. In cover-glass preparations, the cocci appeared singly, in pairs, groups or chains of three or four members. It formed yellowish, sometimes whitish colonies on agar. It did not liquefy gelatine and did not grow at a temperature of 15°C. In bouillon the cocci grew in chains. They are positive to Gram.

(a) Queyrat: Comptes rendus de la Soc. de Biologie, 1893, p.211.
At the commencement of the disease, these streptococci were very numerous, but disappeared almost completely from the sputum in the later days of the illness. He considered them to have an aetiological signification in simple tracheo-bronchitis.

Cassaeët (a) records four cases of bronchitis, which resembled pulmonary phthisis in their clinical course. The examination of the sputum revealed an entire absence of tubercle bacilli, but the presence of streptococci in great abundance. The cases terminated favourably.

Hoffmann (b), discussing the aetiology of fibrinous bronchitis says that the Pneumococcus can often be found in simple purulent bronchitis. He suggests that the fibrinous form of bronchitis develops when the Pneumococcus is alone or mainly active, while the purulent form occurs when the streptococci or other varieties of cocci predominate.

Babes & Beldiman (c) say that bacteria in greater or lesser amount are almost always present in the diseases of the respiratory tract. They are as a rule microbes of secondary infection, and are found either alone or associated with the specific bacteria.

(c) Babes & Beldiman: Annales de l'Inst. de pathol. et de bact.: de Bucarest, 1894, p. 145.
most important are the Staphylococcus aureus; Streptococcus pyogenes, Pneumococci and "mucogene bacteria". Babes has given this name to a group of bacteria which he found in the respiratory passages, especially in cases with catarrhal affections. They possess the property of producing abundant mucoid substance in cultures and he attributed to them a role in the formation of the abundant mucus in some forms of bronchitis. Some forms of Proteus, the Rhinoscleroma bacillus and Friedlander's bacillus represent members of this group. He also studied some forms of haemorrhagic bronchitis with which bacteria were associated. Of these the predominant one was a diplococcus, which is not to be confounded with the Pneumococcus or with a streptococcus. In other cases he found short virulent streptococci or the "mucogene bacteria".

Sokolowski & Nachod have also found staphylococci in cases of fibrinous bronchitis. The former records four cases: in the first case Staphyl: pyog: albus and aureus were the only bacteria present in the cultures made from the sputum. In another case cocci, either single or in groups and some with a distinct capsule, were visible in the superficial layers of the mucous membrane; while in yet another case "the principal micro-organisms were small

(a) Babes: Archives de méd expériment et d'anat. pathol: 1895, Tome V., pp. 517 & 518.
cocci either lying singly or arranged in more or less large groups. Under the microscope they reminded one of the Staphylococcus pyogenes." In this case there were in addition scantier cocci in chains, large cocci resembling the Micrococcus tetragenus, and long thick bacilli.

Nachod\(^{\text{(a)}}\) records a case in a child 4\(\frac{1}{2}\) years old, where Staphylococcus albus was the only bacterium discovered, cultivation being made on blood serum, Loeffler's blood serum and glycerine agar.

In addition to the cocci already mentioned others have been found.

Thus the Micrococcus tetragenus was found by Carrière\(^{\text{(b)}}\). The illness commenced with a severe and obstinate bronchitis, the inflammation passing on to affect the lungs and to finally cause a purulent pleurisy. The Micrococcus tetragenus was present in great amount in the expectoration and the purulent exudate; and when a guinea-pig was inoculated with the sputum, death occurred in three days, the Micrococcus tetragenus being cultivated in pure culture from its heart blood.

Seifert\(^{\text{(c)}}\) considered micrococi to be the cause of influenza. They were about 1.5 or 2.0 \(\mu\) long and 1.0 \(\mu\) broad, were extracellular, and usually occurred

\(^{(a)}\) Nachod: Prager med. Wochenschr. 1897, p.50; \\
\(^{(b)}\) Carrière: Presse médicale, 1898, No. 38, p249. \\
singly or in long chains, seldom in pairs. In the sputum of six persons suffering from simple bronchitis he failed to find these cocci.

Cocci which are supposed to be identical with those of Seifert, were afterwards found by R. Pfeiffer. They were found in enormous quantities in the purulent expectoration of a number of cases of feverish bronchitis, which in contradistinction to influenza were characterised by a very mild course. The cocci themselves were often intracellular and possess a morphological similarity to Gonococci. Pfeiffer has named it "Kokkus Catarrhalis", and "it is distinguished from the staphylococci which it closely resembles, above all, by being decolourised by Gram, and by not liquifying gelatine."

B. Bacilli.

Friedlander's bacillus has been found by several investigators, among whom is von Besser. I have already referred to his work (page 14.).

Jaccoud records a number of cases of influenza where the bacteriological examination was made by Ménétrier. In one case where the examination was made post mortem, and where there was capillary bron-

(b) Jaccoud: La semaine médicale, 1890, p. 51.
chitis without hepatisation, Friedlander's bacillus was found along with Diplococcus pneumoniae.

(a) Mandry records the case of a paralytic man who died of marasmus. Post mortem there was bronchitis with a greyish-yellow viscous secretion on the tracheal and bronchial mucous membrane. From the bronchitic secretion, besides scantly cocci forming yellow colonies, he cultivated a bacillus identical with Friedlander's bacillus.

(b) Silvestrini has recorded a case of bronchitis due to Friedlander's bacillus. The virulence of the bacillus was very great, but gradually decreased as the disease declined.

Finally Wright and Mallory have described a case of bronchitis with broncho-pneumonia subsequent to appendix abscess and abscess in the liver. The post mortem was made 28 hours after death, and three weeks after the patient had recovered from diphtheria. Cover-glass preparations, cultures and sections were made. Capsuled bacilli of the Friedlander group were found in the bronchial muco-pus, as well as in the spleen, kidney, heart blood, and pus from the hepatic abscess. In the cultures from the lungs there were also diphtheria bacilli present in small amount.

(a) Mandry: Fortschritte der Medicin: 1890, Bd. VIII, p. 205.
(b) Silvestrini: Reference in Baumgarten's Jahresbericht, 1895, p. 77.
(c) Wright & Mallory: Zeitschrift für Hygiene und Infect: 1895, Bd. XX, pp. 220-226.
Although bronchitis occurs so frequently in cases of influenza, the literature dealing more especially with the bacteriology of the bronchitic secretion is not very extensive.

R. Pfeiffer (a) was the first to describe the Influenza bacillus in bronchitis. He recorded 31 cases of influenza, with six post mortems. The Influenza bacillus was found in the purulent bronchitic secretion in every case. In uncomplicated cases, it was found in absolutely pure culture, and as a rule the bacilli were very abundant and often situated in the protoplasm of the pus cells.

Weichselbaum (b) was also among the first writers to mention the Influenza bacillus as a cause of bronchitis. He remarked that this form of bronchitis is striking in that the inflammation affects not only the smaller bronchial twigs, but also the larger or even the main bronchi., and he pointed out that the secretion is remarkably thick and abundant.

Borchardt (c) records 18 cases of influenzal bronchitis. His results are mainly based on cover-glass preparations stained with dilute Ziehl's solution. In only some cases were cultures made, four

(a) Pfeiffer: Deutsche med: Wochenschr: 1892, p.28.
(c) Borchardt: Berliner klin: Wochenschr:1894,p.33.
of these being from bronchial pus post mortem.

The secretion is described as being muco-purulent in eight cases, purulent in four, mucous in four, as consisting mainly of mucous in four cases and purely of mucous in one case. Apart from any relation to the naked eye appearances of the secretion, the Influenza bacilli were in pure or almost pure culture in nine cases; in all the remaining nine cases except one, the bacilli were either numerous or abundant. He says that he never found the bacillus unless there was an epidemic of influenza.

Lindenthal (a) has, however, reported eight cases of sporadic influenza, all of which showed more or less pronounced bronchitis, accompanied by pneumonia. His investigations were made by means of cover-glass preparations, cultures and microscopic sections.

In the first three cases he deals more particularly with pneumatic exudate. In Case 4, the cover-glass preparations both from the bronchial pus and the pneumatic patches showed almost nothing but small bacilli. The culture from the bronchial pus revealed besides a few colonies of Diplococcus pneumon: almost nothing but colonies of Influenza bacilli. In Case 5, the cultures showed mainly Influenza bacilli, Pneumococci in smaller amount. In Cases 6, 7 & 8,

there were also influenza bacilli in the bronchial pus.

Richard Kretz (a) has also described non-epidemic cases of influenza. In the summer of 1897 he examined the sputum of 950 cases suffering from pulmonary and bronchial diseases. In such cases as showed bacilli like Influenza bacilli in the cover-glass preparations, cultures were made. He found the Influenza bacillus in 47 cases. Of these only 12 showed symptoms of influenza, while the remaining 35 cases showed the Influenza bacillus without the typical illness. He emphasizes the fact that the bacilli may be detected after long intervals of time in patients with tubercular or other chronic pulmonary affections, and considers such persons are the main sources of infection.

Grassberger (b) examined the sputum or the bronchial contents in thirty cases, making cover-glass preparations, as well as cultures on agar and blood-agar. Only six cases showed Influenza colonies in such abundance that blood-agar yielded the picture of "an almost pure culture" as described at times of influenza epidemics. In the remaining 24 cases, other bacteria were also present more or less numerously.

(a) Kretz: Wiener klin: Wochenschr. 1897; p.877.
(b) Grassberger: Zeitschr: für Hygiene und Infekions, 1897; Bd.XXV, p.453.
and in varying proportions to each other. They were:— Diplococcus pneuman, various diplococci, Streptococcus pyogenes, various staphylococci, and besides these there were in some cases fluorescent bacilli and other bacteria which are not described more definitely.

Washbourn \(^{(a)}\) records the case of a man where influenza bacilli were found in the bronchial secretion, while "the clinical aspect was that of a simple catarrh."

**Diphtheria bacillus.**

Pewzner \(^{(b)}\) examined a case of tracheo-bronchitis which occurred without any signs of diphtheria in the throat. He found the Klebs-Loeffler bacillus in the pseudo-membrane and in the catarrhal pneumonic patches in the lungs. Besides these bacilli, streptococci were also present.

Flexner \(^{(c)}\) states that in two cases of diphtheria he found the Diphtheria bacilli and membrane in the smaller bronchi. In one case the bacilli were cultivated from the lungs. Broncho-pneumonic patches were present in both cases, and contained the Micrococcus lancæolatus. In the bronchioles associated with the patches, Diphtheria bacilli were found.

\(^{(a)}\) Washbourn: The Clinical Journal, 1898; p.119.
\(^{(b)}\) Pewzner: Reference in Baumgarten's Jahresbericht, 1893; p.194.
\(^{(c)}\) Flexner: Bulletin of the John Hopkins Hospital, 1893, Vol.IV, p.32.
Lépine in discussing pseudomembranous bronchitis says there are two main forms, 1st, the diphtheritic, 2nd, the pneumococcal; and in regard to those cases which are not included in either of these two forms, it is impossible, he says, "D'emettre ... une pathogenie univoque."

The Bacteria of Whooping Cough.

Pertussis being so frequently accompanied by more or less well marked bronchitis, the various micro-organisms which have been said to cause the disease may be found in the bronchitic secretion. The most important of these is possibly the bacillus described by Afanassieff and others.

Czaplewski & Hensel in addition to 44 cases of pertussis, also examined five "cases of bronchitis, which afterwards developed into pertussis, and where by finding the 'Polbakterien' the diagnosis was made before it could be arrived at clinically."

Vincenzi in two cases with haemorrhagic sputum found the bacillus in pure culture. He calls it "coccobacillus" from its resemblance to a diplococcus.

(a) Lépine: Gazette hebdom: de méd: et de chirurgie, 1897, p.1225.
(c) Vincenzi: Deutsche med:Wochenschr: 1898, p.631.
Zusch however, says that the purer and less complicated the clinical picture, the more abundant are these particular bacteria in the sputum, while if severe bronchitis occurs, they become more scanty. In one case, too, of broncho-pneumonia subsequent to pertussis, none of these bacteria could be found in the cover-glass preparations or agar cultures from the sputum.

**Smegma bacillus.**

Pappenheim describes a case of chronic bronchitis with bronchiectasis, broncho-pneumonia, small gangrenous pulmonary abscesses and diphtheroid and follicular enteritis.

During life there were many bacilli in the sputum stained red by Gabbet's method, and the clinical diagnosis was tuberculosis of the lungs and intestine. Post mortem, the bacilli were found to be Smegma bacilli and were detected in the bronchial mucus of the larger bronchi and trachea as far up as the larynx.

Fraenkel however says he has never found bacilli similar to Smegma bacilli in simple muco-purulent sputum, although frequently in cases of lung gangrene. He looks on them merely as harmless saprophytes.

(a) Zusch: München med. Wochenschr: 1898, p. 713.
(b) Pappenheim: Berliner klin. Wochenschr; 1898, p. 809.
(c) Fraenkel: Berliner klin. Wochenschr; 1898, pp. 880 & 881.
Various other bacteria.

(a) Babes isolated from the sputum, and also from the nasal secretion, a small bacterium which he calls "Bacterium I." This is 2-4\(\mu\) thick, sometimes appearing as fine rods, sometimes forming chains. It grows both on agar and gelatine forming small transparent colonies, and it is negative to Gram. (1)

In one case (2) he says that in addition to other bacteria there were large bacilli present united to each other by filaments. He states that "This bacillus is often found in cases of bronchitis." In a case of pharyngeal catarrh and bronchitis he also describes a coccus similar to those occurring in the air and water. (3)

(b) Pansini records a number of cases where he examined the sputum by making cultivations. Among them are the following two:

Case 26: Acute bronchitis.
Sarcina variegata, bacillus aureus, streptococci, etc.

Case 26: Subacute bronchitis.
Bacillus squamosus, Bacillus coccineus, Micrococcus liquefaciens, Sarcina variegata, Streptococci (Diplococcus Pneumon: Fraenkel).

(a) Babes: Centralb: für Bakt: und Parasiten; 1890, Bd.VII, (1) p.233; (2) p.238; (3) p.239.
(b) Pansini: Virchow's Archiv: 1890; Bd.122, p.424.
Finally, I might mention some of the literature dealing with the bacteriology of putrid bronchitis. 

(a) Lumniczcr examined the sputum from such a case. In cover-glass preparations he observed monococci, diplococci, streptococci, spirilla, Leptothrix buccalis and bacilli. In agar and gelatine cultures he found various forms of cocci and a bacillus which when grown on agar caused a smell similar to that of putrid bronchitis.

This bacillus is referred to by Kolle(b) who calls it "Bacillus bronchitidis putridae". It is a large spore forming bacillus, positive to Gram, grows at higher temperatures only, with a development of foul smelling gas. It is said to cause primary foetid bronchitis.

(c) Alfieri found the Staphylopyogenes citreus and also a bacillus in foetid bronchial secretion. The bacillus was motile, pathogenic for animals, and the cultures possessed the same stinking smell as the bronchial secretion. He was unable to identify it with any well known bacillus, although resembling the Bacillus pyogenes foetidus.

(d) Bernabei also describes a motile bacillus

(b) Kolle: Die Microorganismen, 1896, p. 215.
(c) Alfieri: Reference in Baumgarten's Jahresbericht, 1893, p. 326.
(d) Bernabei: Reference in Centralb. für Bakt. und Parasiten: 1895, p. 469.
which he calls the "Bacillus putidus splendeus". He says it is the same bacillus as was found by Lumniczer and Alfieri, and mentions that it causes primary foetid bronchitis.

Hitzig (a) on the other hand, cultivated, from the sputum of a case of foetid bronchitis, two forms of bacilli. Both of them possessed the characteristic properties of bacilli of the Coli group, and when compared with one another showed only slight differences, such as the thickness of the colonies on agar and gelatine and in regard to the coagulation of milk.

If we summarise these writings, we find that the following bacteria have been found in the bronchitic secretion:

Diplococcus pneumoniae.
Various streptococci.
Staphylococcus pyogenes.
Micrococcus tetragenus.
Mikrokokkus catarrhalis and other micrococci.
Sarcinae.
Pneumobacillus, and other varieties of capped bacilli.
Influenza bacillus.
Diphtheria bacillus.
Whooping Cough bacteria.
Smegma bacillus.
Bacillus sputigenes crassus.
Bacillus aureus & Bacillus coccineus (Pansini)
Bacillus putidus splendeus.
Bacilli of the Coli group.

In addition to these, several writers note also the presence in the sputa of Tubercle bacilli and of various saprophytic fungi.

(a) Hitzig: Virchow's Archiv. 1895, Bd. 141, p. 28.
In the bacteriological examination of bronchitic secretion, one has to contend with more than one difficulty. If dealing with the sputum of adult cases, the true bronchial secretion becomes contaminated by the bacteria of the mouth and pharynx, no matter how carefully the mouth may be cleansed before expectoration, and the real value of one's investigations is greatly impaired. It is seldom, however, that adults die of simple acute bronchitis, hence post mortem investigations as to the bacteria present in the bronchitic secretion of an adult must, in the great majority of cases, be made on cases of chronic bronchitis.

Now it is just in such cases that the diseased bronchial mucous membrane affords a suitable soil for various bacteria, as do all mucous membranes when in a state of chronic inflammation. In chronic bronchitis therefore, one usually finds various secondary microorganisms, both pathogenic and non-pathogenic.

It is mainly in children that one can satisfactorily study the bacteria present in acute bronchitis and owing to the difficulty or impossibility in getting children to expectorate, it is to the bronchitic secretion obtained from the bronchi as soon as possible after death that one must look for fresh and more
ample information on the subject.

One must, of course, bear in mind the possible fallacy that the results arrived at post mortem do not represent the usual clinical conditions. Further, one must remember the possibility of a post-mortem invasion of the tissues by bacteria from the intestinal tract, and the possibility too of a contamination during the manipulations. Finally, it must not be forgotten that the bronchi are in direct communication with a septic cavity and with the external air, and that after death the saliva and other secretions may flow down from the mouth into the bronchi as demonstrated by von Besser. (a)

(a) von Besser: Ziegler's Beiträge zur pathol. Anat. 1889, Bd. VI, p. 352.
Method of Examination of the Cases.

In Cases V, VII, VIII, XI, XII, XIII, XIV, XVI, XVII, XXVI, XXXII, XXXIII, & XXXVIII the post mortem examination was presumably made in the customary manner. The lungs were obtained by me immediately after they were removed from the body, the main bronchi being cut through. The further procedure in these cases was similar to that in the other cases.

With the exception of the cases mentioned above, the method of examination was as follows:

The thorax having been opened, the lungs were at once removed. From Case I to Case XXXI inclusive this was done by removing the lungs, heart, trachea, larynx and tongue altogether. From Case XXXIV to XLIV inclusive the lungs and heart were removed together after the trachea had been cut through just below the cricoid cartilage, while from Case XLV onwards the thorax was opened with a knife, disinfected with a solution of carbolic acid, and the main bronchus (not the trachea) was cut through. (1)

The bacteriological examination was in each case carried out immediately after the post mortem examination, with the exception of a few cases where the lungs

(1) The post-mortem examinations were made by Dr. Ghon, Dr. Bayer or Dr. Landsteiner, Assistants in the Pathological - Anatomical Institute in Vienna. Immediately after removal from the body, the lungs were given to me for examination.
were placed in the ice-chamber for a space of time which will be mentioned in connection with such cases.

The pleural surface of the lungs was first washed with alcohol, 95%, then for about half a minute in a 1-2000 solution of mercuric chloride. The surface was next freed of all surplus moisture by passing a broad knife, previously brought to a red heat, several times over it, the lung was then incised with a knife sterilised by being passed repeatedly through the bunsen flame and after gentle pressure had revealed the presence of purulent or catarrhal secretion oozing from the smaller bronchi, two loopfuls were carefully removed by means of the sterile platinum loop and transferred to \( \frac{1}{2} \) cc. of sterile bouillon in a test tube and thoroughly mixed. From this mixture, cultures were made, the number being mentioned in each case. The usual number of cultures made from each case was 6, viz.

1. On ordinary agar, streak method.
2. On Pfeiffer's agar, " "

One of each from two different lobes.

Cover-glass preparations (usually three) were also made direct from bronchitic secretion of two different lobes. They were stained:
1. By Gram's method, with dilute alcoholic fuchsin solution as counterstain.

2. With Loeffler's methylene-blue solution (5 min.)

3. For Tubercle bacilli either by Ziehl-Neelsen's or Weichselbaum's method.

In some few instances, when a note to that effect will be found in the particular cases, the bronchitic secretion was taken from the trachea or main bronchus. Further, in a few cases, no bouillon was employed in making the cultures, the bronchitic secretion being applied directly to the culture media by the platinum loop. This was done in cases 1, 11, 111, L, LII, LV, LIX, & LXI.

In the case of healthy lungs, when no secretion was seen to ooze from the bronchi on slight pressure, an intra-pulmonic bronchus was opened by means of fine pointed sterilised scissors, and the mucous membrane was carefully scraped with the platinum loop, the various media being directly inoculated from the scraping.

The culture on Loeffler's blood serum was examined after standing for 24 hours at a temperature of 37°C., cover-glass preparations were made from it and examined. If any bacilli resembling those of the Diphtheria group were detected, agar subcultures were made from the growth on the blood serum, in order to investigate the suspicious bacilli more fully.
The original agar and Pfeiffer's agar cultures were inspected without lifting the covers of the Petris' Capsules, after 24 hours growth at 37°C. After 48 hours growth at the same temperature, the covers were removed, and the various colonies studied. The note on each case represents the conjoined result of the examination of the various cultures, except in those cases where the three different cultures are considered separately.

The cases have been classified in five main groups:

A. Where the bronchi showed no signs of any vital pathological change,
   (a) In healthy lungs, 9 cases.
   (b) In lungs which either showed some vital or post mortem changes, 4 cases.

B. Where bronchitis was the only pathological process present in the lungs, 27 cases.

C. Where in addition to bronchitis, pneumonia was also present. In these cases only bronchial secretion from non-pneumonic areas was examined. 13 cases.

D. Where both bronchitis and pneumonia existed. Bronchial secretion from non-pneumonic areas was examined, and in addition either broncho-pneumonic secretion or a scraping from the section surface of a pneumonic area. 9 cases.

E. Where only the broncho-pneumonic secretion was examined. 3 cases.

The examination of cases presenting either healthy bronchi, or patches of pneumonia, was of merely
secondary importance. It was only undertaken to furnish a check to the results obtained from the examination of the bronchial secretion in cases of bronchitis, this being the main object of study.

In almost all the cases, various bacteria were detected. In regard to the most important ones, I shall mention, as briefly as possible, the methods employed in making a differential diagnosis.

1. Streptococci:

A diagnosis of streptococci could seldom be made by the cover-glass preparations alone; in a few cases the cocci appeared as short chains, but as a rule only in pairs, so that the diagnosis had to rest on the cultures.

On agar the colonies, though possessing the same general features, were not always identical. They were always small, of a greyish-bluish colour, and on examination by the microscope were coarsely granular. By the high power some showed distinct coils at the edge of the colony, and if such was the case, the investigations were carried no further, the colony being one of Streptococcus pyogenes.

In another class of cases the colonies on agar resembled those just described, but for the absence of coils at the edge. In these cases, bouillon and
gelatine puncture subcultures were made. In many cases these two subcultures after 24 hours growth at 37°C. and 19°C. respectively were typical of Streptococcus pyogenes. In other cases, however, the growth in gelatine was very slow, no sign of definite growth along the line of puncture being visible till the third day of growth. Or, on the other hand, it was the bouillon culture which was not typical, the bouillon after 24 hours growth showing diffuse cloudiness, not so pronounced, however, as in the case of the staphylococci.

Cover-glass preparations made from such bouillon showed as a rule round cocci arranged in short chains, less frequently in long curved chains, and still rarer were those cases where the cocci appeared as long straight chains.

In other cases there was considerable similarity between colonies of streptococci and those of Diplococcus pneumonias. Such a colony is small and of a bluish grey colour. By the microscope it does not appear to be so coarsely granular, nor is the centre so raised as in the case of typical colonies of Streptococcus pyogenes. The edge, too, is more and regular, no coils are visible. Bouillon subcultures from such colonies were not in all cases similar;
after 24 hours they usually, however, showed either a fine diffuse cloudiness, or else a fine light sediment, consisting of cocci in short chains. In some of these cases, too, there was no growth in gelatine after three days growth at 19°C.

It is stated\(^{(a)}\) that one cannot with accuracy classify the streptococci according to the macroscopic appearance of their bouillon cultures, or according to the length or shortness of the chains; and also, that the appearance of the bouillon culture depends on the constitution of the bouillon\(^{(b)}\).

In the following pages, however, I have used the term streptococcus brevis, if the chains were short, and have noticed any other departures from the S. pyogenes type in regard to the bouillon and gelatine subcultures. I do not, however, mean to imply that such differences warrant one to classify these varieties as different forms of streptococci. On the contrary, I incline to the view that although there no doubt exist many intermediate forms between the S. pyogenes and the Diplococcus pneumoniae, yet there is, in many cases, no certain connection between the microscopic and macroscopic appearances.

\(^{(a)}\) Pasquale: Ziegler's Beiträge zur pathol. Anat., 1893, Bd.XII, pp.433-494.

\(^{(b)}\) von Lingelsheim: Zeitschrift für Hygiene und Infekions: 1892, Bd.XII, P.310.
2. **Staphylococci**

The colonies on agar were in almost every instance sufficiently typical to enable one to come to a diagnosis. In those cases, however, which were examined further, the cocci were found to conform to the typical staphylococci.

3. **Diplococcus Pneumoniae**.

In all those cases where this coccus was found, diplococci were seen in the cover-glass preparations. In some cases the diplococci were of characteristic shape and surrounded by a stained capsule. More frequently, however, one saw diplococci surrounded by a clear unstained area of oval shape, the cocci themselves being of more or less well marked lancet shape. This clear area in some cases probably represents the unstained capsule.

In some cases, in addition to these cocci which were positive to Gram, one could see other smaller round cocci negative to Gram, and often intracellular. In some cases these probably represent Pneumococci which had most their vitality.

On agar the colonies of *Diplococcus pneumoniae* were small (smaller than colonies of streptococci), bluish by transmitted light, by the microscope small, flat, finely granular, with a much more regular edge than
colonies of streptococci. Bouillon culture was faintly but diffusely cloudy, and no growth occurred in gelatine at 19°C.

The growth was often more luxuriant on Pfeiffer's agar than on ordinary agar. In some cases, however, no growth of Diplococcus pneumoniae occurred on either of these media, while there was a moderate growth of these cocci on Loeffler's blood-serum. This seems to be a medium well suited for the growth of the Diplococcus pneumoniae.

As already mentioned, there were some cases where, from the appearance of the colonies on agar, it was impossible to say whether the cocci composing the colonies were really the Diplococcus pneumoniae or whether they belonged to the group of streptococci. In these cases, unless the bouillon and gelatine subcultures were typical of Diplococcus pneumoniae, the cocci were classed among the streptococci.

4. Of cocci other than those already mentioned there are but few to mention. In Case 19 there were cocci similar to the Meningococcus; and in Case 10 there were cocci similar in many respects to the Micrococcus catarrhalis (Pfeiffer), the main point of difference being that the cocci maintained their vitality remarkably well in the cultures.
In a few other cases, one saw small cocci, which sometimes showed a striking morphological resemblance to the Gonococcus (Case 14). In none of these cases, however, could similar cocci be detected in the cultures. The question is whether they should be considered as representing cocci of the same group as the Gonococcus and Meningococcus, or merely as degenerated Pneumococci or streptococci, or lastly as ill-stained bacilli, possibly Influenza bacilli.

This is of course a question to which no positive answer can be given; but in most cases I am inclined to regard them as being probably degenerated forms of the Diplococcus pneumoniae.

5. The Influenza bacillus was, when present, usually extracellular and in large numbers, seldom were the majority of the bacilli intracellular.

The colonies on Pfeiffer's agar were of the typical appearance, but as pointed out by Grassberger those in the neighbourhood of colonies of staphylococci usually attained a larger size than the others. It was also noticed that the presence of streptococci had a similar effect in increasing the size of the Influenza colonies. Pure cultures were, as a rule, obtained

(a) Grassberger: Zeitschrift für Hygiene und Infections: 1897, Bd. XXV, p. 453.
in each case, and the identity of the bacillus with the Influenza bacillus proved by inoculation on ordinary agar and blood agar. The former in each case remained sterile, while the latter showed a culture of Influenza bacilli.

As regards the form of the bacilli themselves, so they were the typical small bacilli described by many writers. Irregularly shaped forms were, however, sometimes seen in cover-glass preparations from cultures, as well as longish thread-like forms on several occasions, corresponding to those described as Pseudo-influenza bacilli. Lindenthal (a), Grassberger (b) and others have however described such forms in the true Influenza bacillus, the latter calling them "abnormal forms."


(i) Diphtheria bacillus. The bacilli were long, of irregular shape and grouped in irregular fashion. Club-shaped forms were frequent. The colonies on agar were also characteristic of the true Diphtheria bacillus.

(ii) Pseudo-Diphtheria bacilli. The diagnosis was made from the appearance of the colonies, combined

(b) Grassberger: Centralb. für Bakt. und Parasiten: 1898, Bd. XXIII, p. 353.
with that of the individual bacilli, and in some cases was supplemented by animal experiment. Although in some cases the colonies on agar were undoubtedly larger than those of the true Diphtheria bacillus, yet there was often but little distinctive difference. The reaction of bouillon cultures being in so many cases of but little aid in forming a diagnosis, it was only tested in one case (No. 39) where it was found to be acid.

The chief distinctive differences were morphological. The bacilli were certainly often segmented, but were shorter, straighter and more regular than the true forms. Clubbed forms were either entirely absent, or only scanty, and the bacilli were frequently arranged parallel to one another in bundles, less frequently in a radial fashion like the spokes of a wheel.

In two cases Nos. 39 and 52) such bacilli proved to be non-pathogenic for guinea-pigs.

7. Bacilli, which I was unable to identify with any well known bacilli, were also found. They resembled the Pseudodiphtheria bacilli in many respects, while differing from them in others. They were all non-pathogenic, positive to Gram, formed
fine small coarsely granular colonies on agar, and showed but little growth in bouillon, which was in some instances rendered faintly but diffusely cloudy with acid reaction. In gelatine at 19°C. there was either very scanty growth, or none at all.

A more detailed description of the bacilli is given in connection with the cases in which they occurred.

The colonies on agar were, as a rule, so characteristic that one could say they belonged to the Coli group. In the great majority of cases, however, their identity was further investigated and in some cases the bacilli were found to be the Bac:coli: commune.

In many cases, however, there were departures from the type in some respect or other. Thus I frequently failed to obtain the indol reaction even in peptone-water cultures, or in other instances no definite motility could be observed.

These bacilli were possibly not all identical, yet they were certainly members of the "Coli group." Although with increasing knowledge, we shall no doubt be able to differentiate the various bacilli included in this group, we are at present unable to do so with accuracy.
The term, moreover, is a convenient one, and I have followed the example of others in using it.

**Abbreviations used.**

A = Ordinary agar medium.

G = Gram's method, with dilute alcoholic fuchsin solution as counterstain.

LMB = Loeffler's methylene blue.

LS = Loeffler's blood-serum.

PA = Pfeiffer's agar.

W = Weichselbaum's Method of staining for tubercle bacilli.

ZN = Ziehl-Neelsen's method of staining for tubercle bacilli.

The clinical diagnosis which appears in many of the following cases is copied from the report sent by the physicians to the pathological department.

The main post-mortem diagnosis was furnished by the pathologist who made the examination.
SECTION A.

Subdivision (a)

Where the bronchi showed no signs of any vital pathological change.

And where the lungs were healthy.

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No. 1. Case I.

Theresa G.

Died: 5th December 1898, 1 p.m. Aged: 2 months, 12 days.

Sectio: 6th December, 1898, 11 a.m. Chronic Enteritis with intestinal atrophy. Marasmus. The lungs free of pathological changes. The bronchi contain no blood or secretion, and the mucous membrane is of normal appearance.

Cover-glass Preparations
from a scraping of the mucous surface of a larger bronchus of the:

1. Left Lower lobe (2 preparations: - G; LMB.)
   A moderate number of cocci all positive to Gram, mostly in pairs, seldom in short chains or small groups. The majority are distinctly lancet-shaped, but none with visible capsules. Scanty bacilli, resembling Bac:coli in size and shape, negative to Gram.

2. Right upper lobe (3 preparations: - G; LMB; Watery Fuchsine solution).
   Same as 1, except that both the cocci and the bacilli are less numerous.

3. Right lower lobe (3 preparations: - Stained as in 2.)
   Similar to 2.

4. Left upper lobe (3 preparations: - stained as in 2.)
   Similar to 2, but the bacilli very scanty.

Cultures on Agar from
a scraping of the mucous surface of a larger bronchus of the:

1. Right upper lobe.
   Moderate number of colonies of a bacillus of the Coli group.
   Scanty colonies of Streptococcus pyogenes.

2. Left upper lobe.
   Same as 1, except that the colonies of the Coli group are rather more numerous and those of the Streptococcus still more scanty.

3. Right lower lobe.
   Same as 2.

4. Left lower lobe.
   Same as 2.
No. 2. 
Case XVII.*

Josephine S.

Aged: 3 months.

Sectio: 23rd December 1898, 12 noon.
Suffocation, Chronic Intestinal Catarrh.

Cover-glass preparations from bronchial mucus of a smaller bronchus of the:

1. Left upper lobe (3 preparations: - G; LMB; ZN.)

   No micro-organisms visible.

2. Right upper lobe: (3 preparations, stained as in 1.)

   No micro-organisms visible.

Cultures from bronchial mucus of a smaller bronchus of the:

1. Left lower lobe (A; PA; LS.)

   A moderate number of colonies of a bacillus of the Coli group (a).
   On each culture, one colony of large round cocci, similar to those in the air (b).

2. Right upper lobe (A; PA; LS.)

   Scanty colonies of a bacillus of the Coli group in pure culture.

   (a) No indol reaction.

   (b) Large round cocci, frequently in pairs, in tetrads or small groups, positive to Gram. On agar they form large white colonies, coarsely granular as seen by the low power. Similar growth takes place on gelatine, which is not liquified. Bouillon is rendered diffusely cloudy.

* The Roman numerals denote the numerical sequence of the cases.
No. 2. Case XVII.


Bacilli of the Coli group from pure culture. From bronchial mucus of the right upper lobe. Stained by Gram's method with fuchsine counterstain. Magnified 1000.

Note: All the photographs by J. Hume Patterson.
No. 3. Case XIX.

Leopoldine M.

Died 26th December, 1898, Aged 1 hour.

Cause of Death: Fracture of the vertebrae during delivery. Cerebral Haemorrhage?

Sectio: 27th December, 1898, 11 a.m.
No Bronchitis, Lungs healthy.

Cover-glass Preparations from
1. A scraping from the section surface of the right lower lobe.

   (2 preparations: - G; W.)
   No microorganisms visible.

Cultures from
1. A scraping from the mucous membrane of a medium sized bronchus of the left lower lobe. (PA; LS)
   Numerous colonies of a bacillus of the Coli group.
   A few colonies of Bacillus subtilis.

2. A scraping of the section surface of the left upper lobe. (A.)
   Moderate number of colonies of a bacillus of the Coli group.

3. A scraping of the section surface of the right lower lobe (A; LS.)
   Same as 2.
No. 4. Case XX.

Johann L.

Born: 26th Dec., 1898. Died: 27th Dec. 1898, 4 a.m.

Clinical Diagnosis: Congenital Syphilis.

Sectio: 27th December 1898, 11.50 a.m.
Appearance of Lungs as if death due to Asphyxia. Trachea & Larynx normal.
No Bronchitis or Pneumonia.

Cover-glass Preparations.
from a scraping of the mucous membrane of a smaller bronchus of the:—

1. Right Upper Lobe (2 preparations: - G; W.)
   No microorganisms visible.

2. Left Lower Lobe. (2 preparations: - G; LMB.)
   No microorganisms visible.

Cultures
from a scraping of the mucous membrane of a smaller bronchus of the:—

1. Right Upper Lobe (One agar culture)
   Moderate number of colonies of a bacillus of the Coli group.
   Scanty colonies of Bacillus subtilis.

2. Right Lower Lobe (A; PA; LS.)
   A: Moderate number of colonies of a bacillus of the Coli group in pure culture.
   PA: Sterile.
   LS: Same as 1.
No. 5. Case XXV.

Mathilda V.

Born: 26th Dec., 1898. Died: 29th Dec., 1898, 7 p.m.

Clinical Diagnosis: Lobular pneumonia

Section: 30th December, 12 noon.
Septicaemia from Umbilical Suppuration.
No Bronchitis or Pneumonia present.

Cover-glass Preparations from:-

1. A scraping of the mucous surface of a smaller bronchus of the left upper lobe (2 preparations, G; W.)
   Very scanty round cocci in small groups
   (none visible in the Gram preparation.)
   No Tubercle bacilli.

Cultures from:-

1. A scraping of the mucous surface of a smaller bronchus of the left upper lobe (A; PA).
   Moderate number of colonies of Staphyl:pyog:albus.
   A few colonies of Pseudodiphtheria bacilli.
   A few colonies of a bacillus of the Coli group.

2. Section surface of the left lower lobe (A; LS.)
   Moderate number of colonies of Staphyl:pyog:albus.
   Scanty colonies of Staphyl:pyog:aureus.
Pseudodiphtheria bacilli. From a culture on Pfeiffer's agar. Stained by Gram's method. Magnified 1000.
No. 6. Case XLII

Marie S.

Died: 17th January 1899, 1 a.m., a few hours after birth.

Clinical Diagnosis: Cerebral Haemorrhage during birth.

Sectio: 18th January 1899, 11.30 a.m. Fracture of skull. Meningeal haemorrhage. On section the lungs are for the most part unexpanded; parts, however, contain air. No Pneumonia or Bronchitis. (Heart & Lungs together float in water.)

Cover-glass Preparations:
from the bronchial secretion of a smaller bronchus of:

1. The Left Lower Lobe (2 preparations: G; LMB.)
   No microorganisms.

2. The Right Lower Lobe. (3 preparations: G; LMB; W.)
   No microorganisms.

Cultures:
from the bronchial secretion of a smaller bronchus of:

1. The Left Lower Lobe (A; PA; LS.)
   Numerous colonies of Bacterium coli commune in pure culture.

2. The Right Upper Lobe (A; PA; LS.)
   Moderate number of colonies of Bacterium coli comm.
   On the Loeffler's blood-serum, there are in addition scanty colonies of Bacillus subtilis(?)(a)

(a) Large thick bacilli positive to Gram, which were not further investigated.
Culture in sugar-agar of bacilli of the Coli group after 24 hours growth at 37°C. Gas formation. From bronchial secretion of the left lower lobe.
No.7. Case XLVII. Marianna B.

Born: 18th January 1899. Died: 22nd Jan. 1899, 10 p.m.

Clinical Diagnosis: "Debilitas Vitae."

Sectio: 23rd January, 2.30, p.m.
Marked Gastro-Intestinal Catarrh:
Lungs: Larger & Smaller Bronchi healthy, the latter contain a little mucous secretion.

Cover-glass Preparations from mucous secretion of a smaller bronchus of:

1. The Right Middle Lobe (3 preparations, G; LMB; ZN.)

Scanty bacilli with rounded ends, negative to Gram, resembling the Bact:coli commune, sometimes in pairs end to end, no capsules visible.
One or two smaller bacilli without characteristic form, positive to Gram.
No Tubercle bacilli.

2. The Right Lower Lobe (3 preparations: G; LMB; ZN.)

Scanty Bacilli, negative to Gram, similar to those in 1.
Scanty large round cocci in pairs without definite capsule, most of them positive to Gram (mouth cocci?)
No Tubercle bacilli.

Cultures from mucous secretion of a smaller bronchus of:

1. The Right Upper Lobe. (A; PA.)

Abundant colonies of a bacillus of the Goli group.
Very scanty colonies of bacilli resembling Pseudodiphtheria bacilli, (b)
On Pfeiffer's agar only, a few colonies of Sarcina lutèa.

2. The Right Lower Lobe. (A; PA; LS.)

Scanty colonies of Streptococcus pyogenes. (a)
Abundant colonies of a bacillus of the Goli group
(a) No indol reaction, even after 40 hours growth in peptone water at 37°C.

(b) Colonies on agar resemble those of Pseudodiphtheria bacilli, in gelatine puncture very faint growth along the line of puncture only. Bouillon culture after 24 hours at 37°C is quite clear, with a very slight sediment in tiny balls, faintly acid reaction. The bacilli are non-motile, short & thick, some inclined to be irregular in shape, but in shape they are not typical of the Diphtheria group. They are positive to Gram, and non-pathogenic on subcutaneous inoculation in white mice.
Bacilli resembling Pseudodiphtheria bacilli. From a pure culture. Stained by Gram's method. Magnified 1000.
No. 8, Case LII

Rubis G.

Born: 24th January 1899: Died 25th Jan. 1899, 5 a.m.

Clinical Diagnosis: Premature birth and deficient vitality.

Sectio: 26th January 1899, noon.

A little mucus in the larger bronchi, but no real bronchitis present. A quantity of mucopurulent secretion in mouth and pharynx.

Cover-glass Preparations from the bronchial mucus of a larger bronchus of the:

1. Right Lower Lobe (3 preparations: - G; LMB; ZN.)
   Moderate number of large thick bacilli, negative to Gram, without visible capsules.
   Very scanty round cocci, some of them of large size, positive to Gram.
   No Tubercle bacilli.

2. Right Upper Lobe (3 preparations, stained as in 1.)
   Same as 1, except that the cocci are rather more numerous. Some are in short chains. None possess capsules, nor do any show definite lancet shape.

Cultures from the bronchial mucus of a larger bronchus of the:

1. Right Lower Lobe (A; PA; LS.)
   Numerous colonies of a bacillus of the Coli group (a)
   Scanty colonies of the Streptococcus Pyogenes.

2. Right Upper Lobe (A; PA; LS.)
   Same as 1, but the colonies of Streptococcus pyog present in moderate numbers.

(a) Similar in all respects to the Bact:coli commune, except that they possess no independent motility, and no indol reaction obtainable even in peptone water culture three days old.
Case LIX. No. 9

Child

Born: 1st February 1899. Lived half an hour.

Section: 2nd February, 1899, 11.30 a.m. Lungs kept on ice till noon. There is a little frothy fluid in the larger bronchi, but no pus and no hyperaemia of the bronchial mucous membrane. The lungs float in water.

Cover-glass Preparations

from frothy fluid in a larger bronchus of the:

1. Right lower lobe (3 preparations: - G; LMB; ZN)
   No micro-organisms visible.

2. Right upper lobe (3 preparations, stained as in 1.)
   Very scantly short thick bacilli with rounded ends positive to Gram.

Cultures

from frothy fluid in a larger bronchus of the:

1. Right lower lobe (A; PA; LS.)
   Scanty colonies of a bacillus of the Coli group (a)

2. Right upper lobe (A; PA; LS.)
   Scanty colonies of a bacillus of the Coli group.
   Scanty colonies of Streptococcus pyogenes.

(a) Typical in all respects of Bact:coli, but no indol reaction, even in peptone water culture three days old.
SECTION A.

Subdivision (b)

Three cases where the bronchi were healthy, but some pathological process present in the lungs.

-----000-----
No. 10  Case XXXVI.

Johann B.

Born: 14th December, 1898. Died: 8th Jan., 1899, 4 a.m.

Clinical Diagnosis: Pemphigus.

Sectio: 8th January 1899, 11.30 a.m. Pemphigus. Acute catarrhal pneumonia of the left lower and right upper lobes.

Cover-glass Preparations from:-

1. Mucus of a smaller bronchus of the Right Middle Lobe. (No true bronchitis or pneumonia present.) (3 preparations: - G; LMB; ZN.)

No micro-organisms.

2. Fluid secretion in a smaller bronchus of the left upper lobe. (3 preparations: - G; LMB; ZN.)

Very scanty cocci, most of which, as seen in the two preparations stained by methylene blue, are intracellular & poorly stained. In the Gram preparation some of them retain the violet stain.

No Tubercle bacilli.

Cultures from:-

1. Mucus from a smaller bronchus of a left upper lobe. (A; PA; LS.)

A: Three colonies of the Micrococcus catarrhalis (Pfeiffer) (?) (a)

PA: Two colonies of Sarcina alba.

LS: Many colonies of the coccus (a)

A few colonies of the Staphylococcus Pyogenes aureus.

2. Fluid secretion from a smaller bronchus of the right middle lobe (A; PA; LS.)

A: One colony of Sarcina alba.

PA: Sterile.

LS: Two colonies of the coccus (a)

(a) A small bacterium like a coccus, non-motile, usually in pairs, less often forming small groups, no visible capsule and negative to Gram.

On agar it forms large whitish raised colonies, about the same size as those of staphylococci. These by low power are round, brownish in the centre and almost homogenous towards the periphery; by
Footnote (a) contd.

high power they are rather more coarsely granular than staphylococcus colonies.

In gelatine, there is very scanty growth, the superficial colonies five days old being almost invisible to the naked eye; by the high power one sees small round finely granular colonies. In gelatine puncture culture four days old there is a faint growth visible along the line of puncture, while after 20 days growth, there is well marked funnel formation without liquefaction of the gelatine. In such a culture, 20 days old, vitality is well maintained.

Bouillon is rendered diffusely cloudy, the reaction remaining alkaline.

In sugar agar, no gas formation.

Peptone Water yields no indol reaction even after 10 days growth.

Non-pathogenic on subcutaneous inoculation in a white mouse.
Gocci as diplococci (A) or in groups, From a pure culture in bouillon 24 hours old. Stained by Gram's method with fuchsin counterstain. Negative to Gram. Magnified 1000.
No. 11. Case XLVI.

Anna K.

Died: 22nd January 1899, 3.45 a.m. Aet 3 hour.

Clinical Diagnosis: Premature birth, defective vitality.

Sectio: 23rd January 1899, 2.15 p.m.
Lungs for the most part atelectatic (sink in water). Bronchi empty.

Cover-glass preparations
from a scraping from the mucous membrane of a larger bronchus of the:

1. **Left upper lobe**: (2 preparations: - G; LMB.)
   - Scanty cocci, positive to Gram. Most are round, and in pairs, but some in short chains. One or two are of lancet shape and surrounded by a clear unstained area.
   - Very scanty bacilli corresponding in form to the Bac: coli, negative to Gram.

2. **Left lower lobe**: (2 preparations: - G; ZN.)
   - Same as 1.
   - No Tubercle bacilli.

Cultures
from a scraping of the mucous surface of a bronchus of the:

1. **Left lower lobe**: (A; PA; LS.)
   - Numerous colonies of a bacillus of the Coli group (a)
   - Moderate number of colonies of Strept:pyog. (b)
   - " " " " of Bac: subtilis (c)

2. **Left upper lobe** (A; PA; LS.)
   - Abundant colonies of a bacillus of the Coli group (a)
   - Numerous colonies of Strept:pyogones (b)
   - Moderate number of colonies of Bac: subtilis, (c)

(a) No indol reaction.
(b) Bouillon, diffuse cloudiness, cocci in long and short chains.
(c) On Pfeiffer’s agar only (Accidental contamination?)
No.12. Case LVI.  

Sidonie B.

Born: June 1898.  Died: 30th January 1899, 3 a.m.

Clinical Diagnosis: Peritonitis.

Sectio: 30th January 1899. 11.30 a.m.
Peritonitis, pericarditis with effusion of serous fluid. Pleuritic adhesions. Oedema of lungs. No Bronchitis or Pneumonia. Enlarged non-caseating mesenteric glands.

Cover-glass preparations from a scraping of the section surface of the:

1. Right Upper Lobe (3 preparations: - G; I MB; ZN.)

Very scanty round cocci, positive to Gram.
One or two thick bacilli, positive to Gram.

2. Right Middle Lobe (3 preparations: stained as in 1.)

Same as 1., but the cocci rather more numerous.

In the peritoneal effusion there were reported to be cocci in chains.

Cultures from a scraping of the section surface of the:

1. Right Upper Lobe (A; PA; LS.)

Moderate number of colonies of Streptococcus pyogenes.
Very scanty colonies of bacilli resembling Pseudodiphtheria bacilli (a)

2. Right Middle Lobe (A; PA; LS.)

Numerous colonies of Streptococcus pyogenes.
" " bacilli resembling Pseudodiphtheria bacilli (a)

(a) The bacilli are larger than typical Pseudodiphtheria bacilli, straight and thickish, on faint staining with methylene blue, they not infrequently show irregular staining. In cover-glass preparations, they are further frequently arranged in parallel bundles, less often like the letter V. They are non-motile and positive to Gram. On Agar they form small whitish coarsely granular colonies with irregular edges. No growth in gelatine, and form no gas in sugar agar. Render bouillon diffusely cloudy. Non-pathogenic on subcutaneous inoculation in a white mouse.
SECTION A.

Subdivision (c).

One case where evident post mortem changes were present in the bronchi of otherwise healthy lungs.
No. 13  Case LV.

Still born child.

Born: 27th January, 1899, 4 p.m. Child never respired.

Sectio: 28th January, 1899, 11 a.m.
Bacteriological Exam. noon, after being kept on ice. In the larger bronchi, there was some yellowish fluid of pea-soup consistence.

Cover-glass preparations from:

1. A scraping of the section surface of the left lower lobe (2 preparations: G; ZN.)
   Scanty large and small bacilli, the latter as long as Tubercle bacilli, but twice as thick, all positive to Gram.
   Very scanty bacilli negative to Gram.
   No Tubercle bacilli.

2. Yellowish pea-soupy contents from a larger bronchus of the right upper lobe (2 preparations, stained as in 1.)
   Scanty bacilli two or three times as long and five or six times as thick as Tubercle bacilli, positive to Gram.
   Scanty bacilli similar in size and shape but negative to Gram.
   No Tubercle bacilli.

Cultures from:

1. A scraping of the section surface of the left lower lobe (A; PA; LS.)
   All three sterile.

2. Contents from a larger bronchus of the right upper lobe (A; PA; LS.)
   A: Sterile.
   PA: Scanty colonies of Staphyl:pyog:albus.
   LS: "    "    "    "    "    "    "    "    "    "    "
SECTION A.

(a) Nine cases where the bronchi & lungs were healthy.

<table>
<thead>
<tr>
<th>No.</th>
<th>Case</th>
<th>Bacteria present in the cultures from the bronchi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I.</td>
<td>Bacilli of Coli group + Strept:pyog:</td>
</tr>
<tr>
<td>2.</td>
<td>XVII.</td>
<td>Bacilli of Coli group + Air cocci.</td>
</tr>
<tr>
<td>3.</td>
<td>XIX.</td>
<td>Bacilli of Coli group + Bacillus subtilis.</td>
</tr>
<tr>
<td>4.</td>
<td>XX.</td>
<td>Bacilli of Coli group + Bacillus subtilis.</td>
</tr>
<tr>
<td>5.</td>
<td>XXV.</td>
<td>Staphyl:pyog:albus + Pseudodiphtheria bac: + Bacilli of Coli group.</td>
</tr>
<tr>
<td>6.</td>
<td>XLII.</td>
<td>Bacilli of Coli group + On one of six cultures Bacillus subtilis (?)</td>
</tr>
<tr>
<td>8.</td>
<td>LII.</td>
<td>Bacilli of Coli group + Strept:pyog:</td>
</tr>
<tr>
<td>9.</td>
<td>LIX.</td>
<td>Bacilli of Coli group + Strept:pyog.</td>
</tr>
</tbody>
</table>

(b) Three cases where the bronchi were healthy, but some pathological process present in the lungs.

10. XXXVI. Micrococcus catarrhalis(?) + Staph:pyog: aureus + Sarcina alba + Pseudodophther bac: |
11. XLVI. Bacilli of Coli group + Strept:pyog: + Bacillus subtilis. |

(c) One case where evident post mortem changes were present in the bronchi of otherwise healthy lungs.

13. LV. Staphylococcus pyogenes albus.
Excluding Case No.13, where the bronchi were manifestly not in a normal state, and Case No.12 where the bronchi themselves were not examined, we find that the results arrived at by the examination of healthy bronchi in 9 cases where the lungs were healthy, and in 2 cases where pathological processes were present in the lungs, may be summarised as follows:

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Present in Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacilli of Coli group</td>
<td>* present in 10 cases.</td>
</tr>
<tr>
<td>Streptococcus pyogenes</td>
<td>&quot; 5 &quot;</td>
</tr>
<tr>
<td>Pseudodiphtheria bacilli</td>
<td>&quot; 2 &quot;</td>
</tr>
<tr>
<td>Bacilli resembling Pseudodiph:bac:</td>
<td>&quot; 1 case</td>
</tr>
<tr>
<td>Bacillus subtilis</td>
<td>&quot; 2 cases</td>
</tr>
<tr>
<td>Staphylococcus pyogenes albus</td>
<td>&quot; 1 case</td>
</tr>
<tr>
<td>&quot; aureus</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Micrococcus Catarrhalis (?)</td>
<td>&quot; 2 cases</td>
</tr>
<tr>
<td>Sarcinae</td>
<td>&quot; 1 case</td>
</tr>
<tr>
<td>Air cocci</td>
<td>&quot; 1 case</td>
</tr>
</tbody>
</table>
SECTION B.

27 cases where Bronchitis only was present.

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No. 14. Case II. Caroline L.

Age 3 months, 27 days. Died: 7th December 1898, 7 a.m.

Clinical Diagnosis: Chronic Intestinal Catarrh.

Sectio: 8th December 11 a.m.
General subacute tuberculosis with chronic tuberculosis of the lymph glands. Purulent bronchitis.

Cover-glass preparations from purulent secretion (obtained from the bifurcation) of the:—

1. Main bronchus of the right upper lobe:
   (3 preparations:—G; LMB; ZN.)
   Numerous fine short extracellular bacilli, similar to Influenza bacilli, negative to Gram.
   Fewer lancet-shaped diplococci, with capsules, positive to Gram.
   Numerous very small cocci (?) occurring mostly as diplococci (?) or else singly, negative to Gram.
   A few Tubercle bacilli.

2. Main bronchus of the left lower lobe (2 prep: G; ZN)
   Same as 1, except that here there are distinctly recognisable diplococci, negative to Gram.

Cultures from purulent secretion of the:—

1. Main bronchus of the right upper lobe (1 agar culture)
   Fairly luxuriant growth of colonies of bacilli belonging to the group of capsuled bacilli (Friedlander's bacillus?) (a)
   Numerous colonies of Streptococcus pyogenes.
   Less " " " Diplococcus pneumoniae.
   Moderate number of colonies of Staphylococcus aureus.
   Besides these there are small homogeneous, almost transparent, colonies, probably of Influenza bac:
   but attempts at further cultivation and isolation failed.

2. Main bronchus of the left lower lobe (1 agar culture)
   Same as 1.

(a) Resembl ed Friedlander's bacillus in its growth on agar, gelatine, bouillon and sugar-agar. No animal experiment was made.
Franz H.

Died: 9th December, 1898, 5 p.m. Age 16 months.

Clinical Diagnosis: Diphtheria of the fauces & larynx.

Sectio: 10th December 1898, 11 a.m.
Diphtheria of the fauces, larynx, trachea and larger bronchi. Bronchitis, pulmonary emphysema. Degeneration of the kidneys; swelling of Peyer's patches, solitary glands, and lymphatic glands.

Cover-glass preparations from:

1. Muco purulent secretion of the main bronchus of the right lung. (2 preparations: G; LMB.)
   - Very numerous tiny bacilli, like Influenza bacilli, negative to Gram.
   - Less numerous lancet shaped diplococci, positive to Gram, occasionally forming short chains of four members.
   - Very scanty bacilli, resembling Bact:coli, negative to Gram.
   - No Diphtheria bacilli visible.

2. A scraping from the section surface of the right upper lobe (2 preparations, stained as in 1.)
   - The only bacteria visible are small bacilli similar to Influenza bacilli, negative to Gram.

Cultures from a scraping from the mucous surface of:

1. The main bronchus of the right lower lobe (A;PA;LS.)
   - Very numerous colonies of Influenza bacilli.
   - Many colonies of Diphtheria bacilli.
   - Fairly numerous colonies of Staphyl:pyog:aureus.
   - Moderate number of colonies of Strept:pyog:
   - More scanty colonies of Diplococcus pneumoniae.
   - A few colonies of Bact:coli commune.

2. A smaller bronchus of the right upper lobe (PA; LS.)
   - On PA are very numerous colonies of Influenza bacilli and a moderate number of colonies of Streptococcus pyogenes.
   - On LS besides colonies of cocci, there are many colonies of Diphtheria bacilli, and relatively fewer colonies of bacilli of Pseudodiphtheria type.
3. A smaller bronchus of the right lower lobe (A; PA.)

Many colonies of Influenza bacilli.
Moderate number of colonies of Sarcina lutea.
Very scanty colonies of Bact:coli commune
(2 or 3 on each culture.)

N.B. Some of the colonies of Influenza bacilli
attained considerable size, especially those
in the neighbourhood of colonies of cocci.
Influenza bacilli and Diphtheria bacilli from a culture on Pfeiffer’s agar.
Stained by Gram’s method, with fuchsine counterstain. Magnified 1000.
No.16. Case IV.

Born: 26th January 1897. Died: 10th Dec., 1908, 9 a.m.

Clinical Diagnosis: Chronic Intestinal Catarrh.

Sectio: 11th December 11.30 a.m. Purulent bronchitis.

Cover-glass Preparations from purulent secretion of:

1. A smaller bronchus of the right lower lobe
   (3 preparations: - G; ZN; Borax Methylene Blue (a)
   Many lancet shaped cocci in pairs, positive to Gram.
   Many small bacilli, similar to Influenza bacilli and negative to Gram.
   Considerable number of cocci of round shape, positive to Gram.
   Scanty small cocci(?) single or in pairs, negative to Gram.
   A few bacilli, negative to Gram, similar to those of the Coli group.
   No Tubercle bacilli.

2. The main bronchus of the right upper lobe
   (2 preparations: G; Borax Methylene Blue.)
   Same as 1.

3. The main bronchus of the left lower lobe
   (2 preparations, stained as in 2.)
   Same as 1.

   (a) Borax 1 gram.
       Methylene Blue 1 gram.
       Aq. dist. 100 grams.

Cultures from purulent secretion of:

1. The main bronchus of the left upper lobe
   (2 agar cultures)
   A few colonies of Diplococcus pneumoniae.
   Scanty colonies (about ten on each plate) of Streptococcus pyogenes.
   One colony of Staphylococcus albus.

over
2. A smaller bronchus of the left lower lobe (A; PA.)

Many colonies of Diplococcus pneumoniae.
Many colonies of a streptococcus (a)
One colony of Staphylococcus aureus, and
on the Pfeiffer's agar only there are a considerable number of colonies of Influenza bacilli.

(a) On agar this coccus formed colonies resembling Streptococcus pyogenes more than Diplococcus pneumoniae. Bouillon even after four days growth at 37°C. is clear with a mere trace of a very fine sediment. No growth visible in gelatine puncture after same time at 19°C.
No. 17.  Case VII.

Emma P.

Age 2$\frac{1}{2}$ months.


Cover-glass preparations from:-

1. Catarrhal bronchitic secretion from a smaller bronchus of the right lower lobe.  
   (2 preparations: - G; LMB.)

   A considerable number of Cocci, all positive to Gram. Most, but not all, showing well marked lancet shape, occurring mostly in pairs, but also singly in short chains, and in little groups.  No definite capsules visible.

Cultures from catarrhal bronchitic secretion of:-

1. A smaller bronchus of the right upper lobe.  
   (A; PA; LS.)

   Pure culture of Diplococcus pneumoniae, most luxuriant on the Pfeiffer's medium.

2. A smaller bronchus of the left upper lobe (A; PA.)

   Scanty colonies of Diplococcus pneumoniae. Scanty colonies of a coccus which is morphologically and as regards growth in bouillon similar to the Diplococcus pneumoniae, but which shows faint growth in gelatine at 19°C.
No. 18  Case VIII.

Anna K.

Aet 7½ months


Cover-glass preparations
from bronchitic secretion of a smaller bronchus of the:

1. Right upper lobe (3 preparations: - G; LMB; W.)
   Scanty lancet shaped diplococci, positive to Gram.
   Scanty small extracellular bacilli like Influenza bacilli; a few of the bacilli are larger, long and thin.
   No Tubercle bacilli.

2. Left upper lobe (2 preparations: - G; L.M.B.)
   Very few lancet shaped diplococci positive to Gram.
   One or two long thick straight bacilli, positive to Gram.
   No bacilli like Influenza bacilli.

Cultures
from bronchitic secretion of a smaller bronchus of the:

1. Right lower lobe (A; PA.)
   Moderate number of colonies of Diplococcus pneumoniae.
   Comparatively few colonies of Influenza bacilli.

2. Left lower lobe (A; LS.)
   Very numerous colonies of a streptococcus in pure culture (a).

(a) Colonies on agar, and bouillon culture are of the type Streptococcus pyogenes, but no growth in gelatine puncture after 48 hours at 190°C.
No. 19. Case IX.

Johann S.

Born: 13th October. Died: 14th December, 11 a.m.
Clinical Diagnosis: Nephritis. "Debilitis Vitae."

Sectio: 15th December 1898, 11.30 a.m.
Slight catarrhal bronchitis.

Cover-glass Preparations from bronchial secretion from a smaller bronchus of:

1. The left upper lobe (2 preparations, G; LMB.)

A moderate number of small bacilli, negative to Gram, similar to Influenza bacilli, mostly extracellular, but some intracellular.

One or two bacilli, also small and negative to Gram, but larger than typical Influenza bacilli.

Very few diplococci, positive to Gram.

Cultures from bronchial secretion of a smaller bronchus of the:

1. Left upper lobe (A; PA; LS)

The agar plate was sterile.

The Pfeiffer's agar showed pretty numerous colonies of Streptococcus pyogenes in pure culture.

From the Loeffler's blood serum we see many small cocci, negative to Gram, of unequal staining power, similar to type Meningococcus. Also a few larger cocci positive to Gram, which were not cultivated further.

Note. The bronchitis caused by the Strept:pyogenes, possibly also by the Influenza bacillus.(?)
Cocci resembling Meningococci. From a culture on Loeffler's blood-serum. The cocci usually in pairs. In the lower right hand corner of the field, the unequal staining power of the cocci is well seen. Stained with fuchsine. Magnified 1000.
No. 20.  Case XI.

Johann W.

Act 6 months

Sectio: 16th December 1898. 11 a.m.

Acute purulent bronchitis of the larger bronchial tubes, in the smaller tubes only catarrhal secretion. Septicaemia.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:-

1. Right lower lobe (2 preparations: - G; LMB.)

Preparations show mainly bronchial epithelium. No pus cells, cocci or bacilli of any kind.

2. Left upper lobe (3 preparations: - G; LMB; W.)

Same as 1.

Cultures from catarrhal secretion of a smaller bronchus of:-

1. The left upper lobe (A; PA; LS.)

After 36 hours all three sterile.

2. The right lower lobe (A; PA; LS.)

Each of these shows a slight growth of colonies of a bacillus of the Coli group, otherwise sterile.

Note  No pathogenic bacteria detected.
No. 22.  Case XV.

Marie K.

Born: 15th November.  Died: 19th December, 6 a.m.

Clinical Diagnosis:  Capillary bronchitis.

Sectio:  20th December, 1898.  10 a.m.

Tracheitis.  Bronchitis and Capillary bronchitis.

Cover-glass preparations from catarrhal secretion from a smaller bronchus of:-

1. The right lower lobe (3 preparations: G; LMB; W.)

Abundant cocci, positive to Gram, often in pairs and of well marked lancet shape; but the majority are round and in pairs, in small groups, or in short chains.

Fewer, but still numerous, large thick bacilli, with rounded ends, negative to Gram.

No Tubercle bacilli.

2. The right upper lobe (2 preparations: G; LMB.)

Same as 1.

Cultures from:-

1. Muco-purulent bronchitic secretion from a smaller bronchus of the right lower lobe (A; PA; LS.)

Numerous colonies of Diplococcus pneumoniae.

One or two colonies of Streptococcus pyogenes.

Abundant colonies of a bacillus of the Coli group.

2. Catarrhal secretion from a smaller bronchus of the right upper lobe (A; PA; LS.)

Almost a pure culture of bacilli of the Coli group, but for scanty colonies of Diplococcus pneumoniae & a few colonies of Streptococcus pyogenes.

Note. The bacilli of the Coli group were similar to Bact:coli commune morphologically, as well as in regard to growth on agar and potato and in bouillon and sugar agar. No definite independent motility.
Cover-glass preparation. Bronchitic secretion, right lower lobe. Cocci in pairs (A), one small group of cocci (B), and bacilli resembling Bact:coli (C). Stained by Gram's method, with fuschine counterstain. Magnified 1000.
No. 23. Case XVIII.

Leopoldine K.

Born: 16th September 1897; Died: 23rd Dec. 1898, 1 a.m.

Sectio: 24th December, 1898, 11 a.m.


Cover-glass preparations
from bronchitic secretion of a smaller bronchus of:

1. The right upper lobe (2 preparations: - G; LMB.)
   Scanty short thick bacilli visible in the LMB preparation only.

2. The right middle lobe (3 preparations: - G; LMB; W.)
   A few rounded cocci, positive to Gram.
   A few short thickish bacilli, positive to Gram.
   No Tubercle bacilli.

Cultures
from bronchitic secretion of a smaller bronchus of:

1. The right lower lobe (A; PA; LS.)
   On agar & LS, a scanty growth of colonies of a bacillus of the Coli group in pure culture.
   On the Pfeiffer's agar there are in addition four colonies of a coccus. (a)

2. The right middle lobe (A; PA; LS.)
   Same as 1. but that there are only two colonies of the coccus on PA.

(a) Colonies on agar are smaller than typical Strept: pyogenes colonies, and are finely granular.
   Bouillon culture shows the fluid clear with very fine sediment. Not further investigated.
   (Diploccoccus pneumoniae?).
No. 24. Case XXI.

Joseph M.

Born: 11th December 1898. Died: 28th December 1898.

Clinical Diagnosis: Intestinal catarrh.

Sectio: 28th December, 1898, 11.30 a.m.
Entero catarrh. Slight diffuse bronchitis.

Cover-glass Preparations from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (3 preparations: - G; LMB; ZN.)
   Very scanty lancet-shaped cocci, mostly in pairs, positive to Gram.
   No Tubercle bacilli.

2. The left upper lobe (2 preparations: - G; LMB.)
   Numerous cocci, mostly in pairs, and some of well marked lancet shape, positive to Gram.
   Fewer short thick bacilli, resembling Bact:coli, negative to Gram.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The left lower lobe (A; PA; LS.)
   Moderate number of colonies of Diplococcus pneumoniae.
   Moderate number of colonies of a bacillus of the Coli group.
   One or two colonies of Streptococcus pyogenes.

2. The left upper lobe (A; PA; LS.)
   Numerous colonies of Diplococcus pneumoniae.
   Fairly luxuriant growth of colonies of a bacillus of the Coli group.
No. 25. Case XXIII.

**Born:** 4th December 1898. **Died:** 28th Dec., 1898, 2 a.m.

**Clinical Diagnosis:** Umbilical sepsis.

**Sectio:** 29th December 1898, 11.30 a.m.
- Epysipelas of face. Diffuse purulent bronchitis.
- Chronic intestinal catarrn.

**Cover-glass preparations**
from purulent secretion of a smaller bronchus of:—

1. **The left lower lobe** (3 preparations:— G; LMB; W.)
   - Many cocci, some in pairs and of well marked lancet shape, others round; all positive to Gram.
   - Abundant small short extracellular bacilli, negative to Gram. Many are so small as to resemble cocci.
   - No Tubercle bacilli.

2. **The right lower lobe**
   - Abundant cocci, nearly all in pairs, all positive to Gram.
   - Scanty small cocci (?) negative to Gram.
   - Moderate number of large thick bacilli, negative to Gram.

**Cultures**
from purulent secretion of a smaller bronchus of:—

1. **The left upper lobe** (A; PA; LS.)
   - Many colonies of Diplococcus pneumoniae.
   - Many colonies of a bacillus of the Coli group.
   - One or two colonies of Streptococcus pyogenes.

2. **The right lower lobe** (A; PA; LS.)
   - Abundant colonies of a bacillus of the Coli group.
   - A few colonies of Diplococcus pneumoniae.
   - A few colonies of Streptococcus pyogenes.
Case XXIV.

Maria Z.

Born: 28th November 1898. Died: 29th Dec., 1898. 10 p.m.

Clinical Diagnosis: "Debilitas vitae" (Dyspepsia) Bronchitis. Pressure sore in the right axilla after intertrigo.

Sectio: 30th December 1898, 12 noon.
Purulent bronchitis. Entero catarrh.

Cover-glass preparations from purulent secretion of a smaller bronchus of:-

1. The right lower lobe (3 preparations: - G; LMB; W.)

Many lancet-shaped diplococci, positive to Gram.
Many very small extracellular bacilli, negative to Gram.
A few bacilli of fair size and similar in form to Bact:coli, negative to Gram.
No Tubercle bacilli.

2. The right upper lobe (2 preparations: - G; LMB.)

The same bacteria are present as in 1, but the lancet-shaped cocci are not so numerous, the small bacilli more abundant, and many are intra-cellular.

Cultures from purulent secretion of a smaller bronchus of:-

1. The right lower lobe (A; PA; LS.)

Moderate number of colonies of Diploc:pneumoniae
Moderate number of colonies of Bacillus pyocyaneus.
A few colonies of Streptococcus pyogenes.
A few colonies of Staphyl:pyog:aureus.
A moderate number of colonies of a bacillus of the Coli group.

2. The right upper lobe (A; PA.)

Same as 1.
Bacillus pyocyaneus. From a pure culture in bouillon. Stained by Gram's method with fuchsine counterstain. Magnified 1000.
No. 27. Case XXVI.

Karl T.

Age 1½ months.

Sectio: 31st December 1898, 9.30 a.m.
Suffocation, Bronchitis. Acute intestinal catarrh.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The right lower lobe (2 preparations: G; W.)

Considerable number of cocci, positive to Gram. The majority are of round form, but some of them are lancet shaped and in pairs. Many short bacilli, with rounded ends, positive to Gram. Considerable number of bacilli, negative to Gram, varying in size, some being long and thin. No Tubercle bacilli.

2. The left lower lobe (2 preparations: G; LMB.)

Moderate number of cocci, positive to Gram, most are round, but some of lancet shape. Scanty long bacilli, negative to Gram.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (A; PA; LS.)

Moderate number of colonies of Strept:pyogenes. Moderate number of colonies of a bacillus of the Coli group (a).

2. The left lower lobe (A; PA; LS.)

Many colonies of Streptococcus pyogenes. Moderate number of colonies of a bacillus of the Coli group (a)

(a) No indol reaction.
No. 28. Case XXVII

Gabrielle P.

Born: 4th March, 1898. Died: 31st December 1898, 6 p.m.

Sectio: 2nd January 1899. 12 noon.

Cover-glass preparations
from purulent secretion of a smaller bronchus of:-

1. The right upper lobe (3 preparations: - G; LMB; ZN.)

Abundant small bacilli, intra and extracellular, negative to Gram.
Scanty cocci, positive to Gram, most of them are round and in pairs or short chains.
No Tubercle bacilli.

2. The left upper lobe (3 preparations: - G; LMB; ZN.)

Pus cells and bronchial epithelium, but no microorganisms visible.

Cultures
from purulent secretion of a smaller bronchus of:-

1. The right upper lobe (A; PA; LS.)

Moderate number of colonies of Influenza bacilli.
Moderate number of colonies of Diploc: pneumonias.
Moderate number of colonies of a bacillus of the Coli group.
Very scanty colonies of Staphylococcus pyog: albus.

2. The left upper lobe (A; PA; LS.)

Scanty colonies of Influenza bacilli.
Scanty colonies of a bacillus of the Coli group.
One or two colonies of Staphyl: pyog: albus.
No. 28. Case XXVII.

No. 29.  Case XXVIII

Caroline W.

Born: 25th March 1898.  Died: 1st January 1899, 2 p.m.

Clinical Diagnosis: Intestinal catarrh.

Sectio: 2nd January 1899. 12 noon.
Chronic tuberculosis of the bronchial glands.
Granular tuberculosis of the lungs, especially of the right upper lobe. Adhesive pleurisy with right sided pneumothorax. Purulent bronchitis. Tuberculosis of spleen and liver. Chronic intestinal catarrh with intestinal atrophy. Chronic internal and external hydrocephalus.

Cover-glass preparations from:

1. Purulent secretion from a smaller bronchus of the Right upper lobe (2 preparations: - G; ZN.)

   Abundant round cocci, positive to Gram, in groups, in pairs or single.
   Abundant short and long bacilli, positive to Gram, one or two are, however, negative to Gram.
   No Tubercle bacilli.

2. Mucous secretion from a smaller bronchus of the right upper lobe. (3 preparations: - G; LMB; ZN.)

   Same as 1.

Cultures from:

1. Purulent secretion from a smaller bronchus of the right upper lobe (A; PA; LS.)

   Abundant colonies of Streptococcus pyogenes. Considerable number of colonies of a bacillus of the Coli group.

2. Mucous secretion from a smaller bronchus of the left lower lobe (A; PA; LS.)

   Numerous colonies of Streptococcus pyogenes. Moderate number of colonies of a bacillus of the Coli group.
No.30  Case XXXII.

Anton W.

Aet 3 months

Sectio:  7th January 1899, 10 a.m.
Acute catarrhal bronchitis.

Cover-glass preparations
from catarrhal secretion of a smaller bronchus of:-

1. The left upper lobe (3 preparations:- G; LMB; ZN.)
   No micro-organisms visible.

2. The right middle lobe (3 preparations:- G; LMB; ZN.)
   Moderate number of cocci, positive to Gram, some of well-marked lancet shape, but with no stained capsules visible; others are round, and some of them in short chains.
   A few bacilli resembling Bact:coli, negative to Gram.
   No Tubercle bacilli.

Cultures
from catarrhal secretion of a smaller bronchus of:-

1. The left upper lobe (A; PA; LS.)
   Agar & LS are sterile.
   PA shows 10 colonies of Bacterium coli commune.

2. The right middle lobe (A; PA; LS.)
   Scanty colonies of Streptococcus pyogenes.
   Moderate number of colonies of Bacterium coli com:
No. 31. Case XXXIV.

Johann M.


Clinical Diagnosis: Enteritis and bronchitis.

Sectio: 7th January 1899, 10.30 a.m.
Umbilical suppuration. Acute enteritis.
Diffuse catarrhal bronchitis. Kept on ice till 12.15 p.m., when examined bacteriologically.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (3 preparations: - G; LMB; ZN.)

Somewhat scanty cocci, positive to Gram., many of them of well marked lancet shape.
Very scanty short thick bacilli, negative to Gram.
No Tubercle bacilli.

2. The left upper lobe (3 preparations, stained as 1.)

Very scanty cocci, positive to Gram.
One or two bacilli of largish size, negative to Gram.
No Tubercle bacilli.

Cover-glass preparations from umbilical pus:
(2 preparations: - G; LMB.)
Scanty fair sized bacilli, negative to Gram.
Very scanty cocci, positive to Gram.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (A; PA; LS.)

Agar and Pfeiffer's agar show a pure culture in considerable amount of Bact:coli commune.
On the Leoffler's blood serum, there are in addition scanty colonies of Diploc:pneumoniae.

2. The left upper lobe (A; PA; LS.)

Same as 1.
No. 32. Case XL.

Rudolph Karl N.

Born: 22nd November 1898. Died: 12th Jan. 1899, 1 a.m.

Clinical Diagnosis: Broncho-pneumonia.

Sectio: 12th January 1899, 11 a.m.


Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (3 preparations: - G; LMB; W.)

Very scanty round cocci in pairs, positive to Gram.

No Tubercle bacilli.

2. The right lower lobe (3 preparations, stained as 1.)

Same as 1, except that here there are in addition a few poorly stained intracellular bacteria of indefinite form visible.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (A; PA; LS.)

Numerous colonies of Streptococcus pyogenes. Scanty colonies of Influenza bacilli.

2. The right lower lobe (A; PA; LS.)

Same as 1.
No. 33. Case XLI.

Carolina P.


Clinical Diagnosis: Congenital Syphilis. Jaundice. Septicaemia?

Sectio: 15th January 1899. 11.30 a.m.

Congenital syphilis, with enlarged liver and spleen, jaundice. Diffuse purulent bronchitis.

Cover-glass preparations from purulent secretion of a smaller bronchus of:

1. The left lower lobe (3 preparations: G; LMB; ZN.)

Numerous round cocci, mostly in pairs, positive to Gram.

One or two very short thick bacilli (?) positive to Gram.

No Tubercle bacilli.

2. The right upper lobe (3 preparations, stained as 1.)

Same as 1, except that the cocci are hardly so numerous.

Cultures from purulent secretion of a smaller bronchus of:

1. The left lower lobe (A; PA; LS.)

Moderate number of colonies of Influenza bacilli. Scanty colonies of Streptococcus brevis. Scanty colonies of a bacillus positive to Gram and described more fully on the next page.

2. The right upper lobe (A; PA; LS.)

Same as 1, except that the growth is more scanty. Thus on PA there are only about a dozen colonies of Influenza bacilli, and on ordinary agar four colonies of a bacillus positive to Gram and similar to that in 1.

From a scraping of section surface of the Spleen (A; LS.)

Scanty colonies of Streptococcus pyogenes.

" of a bacillus positive to Gram and similar to that in 1.

" of Bact. coli commun.
Notes.

(a) In the primary cultures the Streptococcus showed growth on the Loeffler's blood serum only, thus resembling a Diplococcus pneumoniae of low vitality.

(b) The Bacilli positive to Gram.

Growth on agar is in the form of small flat colourless transparent colonies, at the edge of which one sees bacilli quite plainly by the high power. After 48 hours growth the colonies are still small, by low power round, medium granular and slightly elevated.

On Pfeiffer's agar some of the colonies attain a somewhat larger size.

In gelatine, the growth is very slight and the gelatine is not liquified.

In sugar agar tubes, (grape sugar) there is no gas formation.

Bouillon is rendered diffusely cloudy, and the reaction becomes acid.

The bacilli themselves are non-motile, of varied size, but often as long as Tubercle bacilli, thus in the same preparation one sees bacilli as long as Tubercle bacilli, others three times as long, others as longish unjointed threads, mostly as thick as Tubercle bacilli. The ends are usually a little rounded. The bacilli occur either singly or in pairs joined end to end, and then frequently so as to form an obtuse angled V.

Bundles of bacilli arranged parallel to one another are frequently seen.

No spore formation visible, and no involution forms.

After subcutaneous inoculation into two white mice, no abscess formation, deterioration of general health, etc., could be observed, both animals being alive and well fourteen days later.
No. 34. Case XLIV.

Winkler, G.

Born 18th December 1898. Died: 20th Jan., 1899, 5 a.m.

Clinical Diagnosis: Entero-catarrh.

Sectio: 21st January 1899, noon.

Lungs, especially the left, congested with small subpleural haemorrhages. Slight diffuse catarrhal bronchitis (hyperaemia - scanty secretion). Bacteriological exam. 12.30 p.m.

Cover-glass preparations from catarrhal secretion from a smaller bronchus of:

1. The right upper lobe (3 preparations: - G; LMB; ZN.)
   
   Very scanty round cocci, positive to Gram.
   No Tubercle bacilli.

2. The right lower lobe (2 preparations: - G; ZN.)
   
   Same as 1.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (A; PA; LS.)

   Numerous colonies of Streptococcus pyogenes in pure culture.

2. The right lower lobe (A; PA; LS.)

   Scanty colonies of Streptococcus pyogenes in pure culture.
Streptococcus pyogenes, from a pure culture in bouillon. Stained with fuchsine. Magnified 1000.
No. 35.  Case XLV.

Joseph K.

Born 11th December 1898.  Died 23rd Jan. 1899, 5 a.m.

Clinical Diagnosis: Broncho-pneumonia.

Sectio:  23rd January 1899, 2.45 p.m.
Small areas of pulmonary collapse.  Lungs, trachea, and bronchi quite healthy, but for a little thick catarrhal secretion in some of the smaller bronchi of both lower lobes.  Slight gastro-enteritis.

Cover-glass preparations

1. From a scraping of the mucous surface of a healthy bronchus of the left upper lobe (3 preparations; G; LMB; ZN.)

Scanty cocci; a number of them are lancet shaped, positive to Gram and surrounded by a clear area, but no stained capsules visible.  The majority, however, are situated inside the protoplasm of leucocytes, are of less characteristic shape and stain poorly.

2. From catarrhal secretion of a smaller bronchus of the left lower lobe (3 preparations, stained as 1.)

Same as 1, but the cocci are rather more numerous.

Cultures

1. From a scraping of the mucous surface of a healthy bronchus of the left upper lobe (A; PA; LS.)

Fairly numerous colonies of Diplococcus pneumoniae.  Very scanty colonies of Streptococcus pyogenes.  Very scanty colonies of a bacillus of the Coli group (a).

2. Catarrhal secretion from a smaller bronchus of the left lower lobe (A; PA; LS.)

Numerous colonies of Diplococcus pneumoniae.  Moderate number of colonies of Influenza bacilli.  Very scanty colonies of a bacillus of the Coli group (a).  Very scanty colonies of Sarcina alba (On PA only)

(a) No indol reaction.
No. 36. Case XLVIII.

Franz Joseph H.

Born 22nd December 1898. Died 23rd January 1899, 8 p.m.

Clinical Diagnosis: Bronchitis.

Sectio: 24th January 1899, noon.

Purulent tracheitis and bronchitis, no pneumonia.

Cover-glass preparations
from purulent secretion of a smaller bronchus of:

1. The left upper lobe (3 preparations: - G; LMB; ZN.)

   Very abundant small extracellular bacilli, negative to Gram.
   Abundant cocci, positive to Gram, mostly lancet shaped diplococci, surrounded by a clear unstained area.
   No Tubercle bacilli.

2. The left lower lobe (3 preparations, stained as 1.)
   Same as 1.

3. From pus in the trachea (2 preparations: - G; LMB.)
   Same as 1, but that the small bacilli are not quite so abundant.

Cultures
from purulent secretion of a smaller bronchus of:

1. The left upper lobe (A; PA; LS.)

   Abundant colonies of Diplococcus pneumoniae.
   Numerous colonies of Influenza bacilli.
   Moderate number of colonies of Strept: brevis.

2. The left lower lobe (A; Pa; LS.)
   Same as 1, but growth scantier.

3. From pus in the trachea (A; PA; LS.)

   Abundant colonies of Influenza bacilli.
   Numerous colonies of Diplococcus pneumoniae.
   Moderate number of colonies of Strept: brevis.
   Very scanty colonies of a bacillus of the Coli group.
   Very scanty colonies of Sarcina lutea.
Cover-glass preparation from purulent secretion.
Smaller bronchus of the left lower lobe. Lancet shaped diplococci surrounded by a clear unstained area. Numerous small indistinct bacilli.
Stained by Gram's method with fuchsine counterstain. Magnified 1000.

Influenza bacilli and cocci (A) of indefinite form (Diplococcus pneumoni) from a culture made on Pfeiffer's agar from purulent tracheal secretion. Two micro-photographs from different portions of the same cover-glass preparation. (In No. 1. many "abnormal forms" (B) of the Influenza bacillus are visible. They are represented diagrammatically on the next page).
Stained with fuchsine. Magnified 1000.
Diagrammatic drawing of "abnormal forms" of the Influenza bacillus as seen in photograph on the preceding page (enlarged)
No. 36.  Case XLVIII.

No. 37. Case LIV.

Marie L.

Died: 27th January 1899. Aged 3 days.

Clinical Diagnosis: Bronchitis.

Sectio: 28th January 1899. 10.45 a.m.
Diffuse catarrhal bronchitis. The lungs were kept on ice till 11.15 a.m.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The left upper lobe (3 preparations: G; LMB; ZN.)
   Numerous cocci, positive to Gram. Most of them are in pairs, fewer in short chains; some are lancet shaped, but most are round. Moderate number of bacilli of fair size; and negative to Gram.
   Very scanty large bacilli, positive to Gram.
   No Tubercle bacilli.

2. The left lower lobe (3 preparations stained as in 1)
   Same as 1, except that the bacilli of both kinds are here more numerous.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The left upper lobe (A; PA; LS.)
   Moderate number of colonies of a bacillus of the Coli group (a)
   Scanty colonies of Streptococcus pyogenes.

2. The left lower lobe (A; PA; LS.)
   Same as 1.

(a) No indol reaction.
No. 38. Case LVII.

Male Child

Died: 30th January 1899, 10 a.m. Aet. 13 days old.

Sectio: 31st January 1899, 11 a.m. Suppuration at umbilicus, extending along the umbilical veins and the right umbilical artery. Fibrino-purulent peritonitis with tenacious viscid exudate. Recent pleurisy on both lungs. Diffuse catarrhal bronchitis of finer tubes. Erysipelasatos inflammation (no pus) of abdominal wall. Enlargement and congestion of spleen. Catarrhal enteritis, with thickening of the walls of the intestine, and much viscid mucus in their lumen.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (3 preparations: - G; LMB; ZN.)

Numerous large bacilli positive to Gram, many are as long as Tubercle bacilli, but about five times as thick.
About as many bacilli negative to Gram, most of which are both shorter and thinner than those mentioned above.
In the LMB preparation many bacilli are seen surrounded by a sharply defined elliptical clear unstained area (capsules?)
No Tubercle bacilli.

2. The right middle lobe (3 preparations, stained as 1.)

Same as 1.
fibrino

3. From purulent peritoneal effusion (1 preparation: G.)

Abundant round cocci, mostly in pairs, positive to Gram.

Cultures

1. From catarrhal secretion of a smaller bronchus of the right upper lobe (A; PA.)

Moderate number of colonies of a bacillus belonging to the group of capsuled bacilli (a)
Moderate number of colonies of a bacillus of the Coli group (b)
2. From fibrino-purulent peritoneal effusion (A; PA).

Pure culture of Streptococcus pyogenes.

(a) Non-motile bacilli, negative to Gram. Colonies on agar and gelatine are similar to those of a capsule bacillus.
   Gas formation in sugar agar medium.
   No indol reaction.
   Non-pathogenic on subcutaneous inoculation on a white mouse.

(b) In all respects typical of Bact:coli commune, except that it possesses no independent motility, and yields no indol reaction.
No. 38. Case LVII.

Culture in sugar-agar of capsuled bacilli, after 24 hours' growth at 37°C. Gas formation. From bronchitic secretion of the right upper lobe.
Case LXII.

Leopold Z.

Born 14th October 1898. Died: 4th February 1899, 4.30 p.m.


Sectio: 5th February 1899. 11.15 a.m.


N.B. In nasal pus, post mortem, there are diplococci, staphylococci and bacilli similar to Diphtheria bacilli. In the otitic pus there are diplococci only.

Cover-glass preparations from catarrhal secretion of:-

1. A larger bronchus of the right upper lobe
   (3 preparations: - G; LMB; ZN.)

Moderate number of cocci, mostly in pairs. Some are of lancet shape with stained capsules, others more round in shape. All positive to Gram. Fewer bacilli, positive to Gram, not characteristic of Diphtheria bacilli. No Tubercle bacilli.

2. A smaller bronchus of the right lower lobe
   (3 preparations, stained as in 1.)

Same as 1, but both the lancet shaped and the more rounded cocci are much more plentiful.

Cultures from catarrhal secretion of: -

1. A larger bronchus of the right upper lobe (A; PA; LS.)

Abundant colonies of Pseudodiphtheria bacilli (a) Moderate number of colonies of Strept. pyogenes. Moderate number of colonies of a bacillus of the Coli group (b)

2. A smaller bronchus of the right lower lobe. (A; PA; LS)

Same as 1.
(a) Bacilli almost typical morphologically of Pseudodiphtheria bacilli - shortish bacilli in parallel bundles or in radial arrangement. Bouillon culture is acid in reaction. Non-pathogenic on subcutaneous inoculation in a guinea pig.

(b) Non-motile, no indol reaction. Otherwise similar to Bact:coli.
No. 40 Case LXIV.

Franz S.

Born: 14th January 1899. Died: 8th February 1899, 9 p.m.


Sectio: 9th February. 11.45 a.m.
Slight simple pleurisy on the left lung.
No pneumonia on either side. Acute catarrhal bronchitis of larger and finer bronchial tubes
Peritonitis. Intestinal catarrh. Acute purulent otitis media on both sides.

Cover-glass preparations from:

1. Catarrhal secretion of a smaller bronchus of the right upper lobe (3 preparations: - G; LMB; ZN.)
   Abundant cocci, mostly in pairs, some in short chains and most of them of well marked rounded type: all positive to Gram, and no capsules visible.
   Moderate number of bacilli as long as Tubercle bacilli, but three times as thick, without visible capsules, negative to Gram.
   One or two short or longish bacilli; all positive to Gram.
   No Tubercle bacilli.

2. Catarrhal secretion of a smaller bronchus of the right lower lobe (3 preparations, stained as in 1.)
   Same as 1.

3. Pus from the right tympanic cavity (2 preparations: G; ZN.)
   Abundant round cocci in short chains or pairs, positive to Gram.
   Scanty bacilli, without visible capsules, as large as, or smaller than Tubercle bacilli.

4. Pus from nasal cavity (One preparation: G.)
   Bacilli, some of which are a little irregular in shape, but most of them are straight and regular, often forming V-shaped figures, thus resembling Diphtheria bacilli. All positive to Gram.
   Small bacilli negative to Gram.
   Round cocci, positive to Gram.

5. Peritoneal exudate (2 preparations: - G; ZN.)
   Round cocci in chains, positive to Gram.
   No Tubercle bacilli.
Cultures from catarrhal secretion of a smaller bronchus of:-

1. **The right upper lobe** (A; PA; LS.)
   
   Many colonies of a bacillus belonging to the group of capsuled bacilli (a).
   One or two colonies of a streptococcus.

2. **The right lower lobe** (A; PA; LS.)
   
   Same as 1.

3. **From peritoneal exudate** (A; PA.)
   
   Agar remained sterile.
   Pfeiffer's agar, pure culture of colonies of a bacillus of the Coli group.(b)

(a) Short thick non-motile bacilli, about the size of Friedlander's Pneumobacillus, negative to Gram.
Colonies on agar and bouillon culture are typical of a capsuled bacillus. Gelatine puncture culture resembles that of Bact:coli. Forms gas in sugar-agar. No indol reaction.

(b) Similar in all respects to Bact:coli commune, except that the bouillon culture has a faintly alkaline reaction, and gas formation in sugar-agar is either extremely scanty, or else entirely absent.
Culture in sugar-agar of capsuled bacilli, after 20 hours' growth at 37°C. Gas formation. From bronchitic secretion of the right upper lobe.
**SECTION B.**

27 Cases where only bronchitis was present.

<table>
<thead>
<tr>
<th>No.</th>
<th>Case</th>
<th>Bacteria present in the cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.</td>
<td>IV.</td>
<td>Diploc:pneumon + Influenza bacilli + streptococci.</td>
</tr>
<tr>
<td>17.</td>
<td>VII.</td>
<td>Diploc:pneumon:</td>
</tr>
<tr>
<td>18.</td>
<td>VIII.</td>
<td>Diploc:pneum: + streptococci + Inf:bac:</td>
</tr>
<tr>
<td>19.</td>
<td>IX.</td>
<td>Strept: pyog: + cocci similar to Meningococci.</td>
</tr>
<tr>
<td>20.</td>
<td>XI.</td>
<td>Bacilli of the Coli group.</td>
</tr>
<tr>
<td>23.</td>
<td>XVIII.</td>
<td>Diploc:pneum: + Bacilli of Coli group.</td>
</tr>
<tr>
<td>24.</td>
<td>XXI.</td>
<td>Diploc:pneum: + Bacilli of Coli group + Strept:pyog:</td>
</tr>
<tr>
<td>25.</td>
<td>XXIII.</td>
<td>Diploc:pneum: + Bacilli of Coli group + Strept:pyog:</td>
</tr>
<tr>
<td>27.</td>
<td>XXVI.</td>
<td>Strept:pyog: + Bacilli of Coli group.</td>
</tr>
<tr>
<td>29.</td>
<td>XXVIII.</td>
<td>Strept:pyog: + Bacilli of Coli group.</td>
</tr>
</tbody>
</table>
### SECTION B. (Continued).

<table>
<thead>
<tr>
<th>No.</th>
<th>Case</th>
<th>Bacteria present in the cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td>31.</td>
<td>XXXIV</td>
<td><em>Bact:coli commune</em> + <em>Diploc:pneumon:</em></td>
</tr>
<tr>
<td>32.</td>
<td>XL</td>
<td><em>Strept:pyog:</em> + <em>Influenza bacilli.</em></td>
</tr>
<tr>
<td>33.</td>
<td>XLI</td>
<td><em>Influenza bacilli</em> + <em>Strept:brevis</em> + <em>Bacilli resembling Pseudodiphtheria bac:</em></td>
</tr>
<tr>
<td>34.</td>
<td>XLIV</td>
<td><em>Streptococcus pyogenes.</em></td>
</tr>
<tr>
<td>35.</td>
<td>XLV</td>
<td><em>Diploc:pneum:</em> + <em>Influenza bacilli</em> + <em>Bacilli of Coli group</em> + <em>Sarcina alba.</em></td>
</tr>
<tr>
<td>36.</td>
<td>XLVIII</td>
<td><em>Influenza bacilli</em> + <em>Diploc:pneum:</em> <em>Strept:brevis.</em></td>
</tr>
<tr>
<td>37.</td>
<td>LIV</td>
<td><em>Bacilli of Coli group</em> + <em>Strept:pyogenes.</em></td>
</tr>
<tr>
<td>38.</td>
<td>LVII</td>
<td><em>Capsuled bacilli</em> + <em>Bacilli of Coli group.</em></td>
</tr>
<tr>
<td>39.</td>
<td>LXII</td>
<td><em>Pseudodiphtheria bacilli</em> + <em>Strept:pyog:</em> <em>Bacilli of Coli group.</em></td>
</tr>
<tr>
<td>40.</td>
<td>LXIV</td>
<td><em>Capsuled bacilli</em> + <em>streptococci.</em></td>
</tr>
</tbody>
</table>

### Summary.

In 27 cases of bronchitis, the following bacteria were present in the cultures:

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Present in 20 cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streptococci</td>
<td>&quot;</td>
</tr>
<tr>
<td>Bacilli of Coli group</td>
<td>&quot; 16 &quot;</td>
</tr>
<tr>
<td>Diplococcus pneumonieae</td>
<td>&quot; 15 &quot;</td>
</tr>
<tr>
<td>Influenza bacilli</td>
<td>&quot; 9 &quot;</td>
</tr>
<tr>
<td>Staphylococcus pyogenes aureus</td>
<td>&quot; 4 &quot;</td>
</tr>
<tr>
<td>Capsuled bacilli</td>
<td>&quot; 3 &quot;</td>
</tr>
<tr>
<td>Pseudodiphtheria bacilli</td>
<td>&quot; 2 &quot;</td>
</tr>
<tr>
<td>Bacilli resembling Pseudodiphtheria Bac</td>
<td>&quot; 1 case</td>
</tr>
<tr>
<td>Sarcinae</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Diphtheria bacillus</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Bacillus pyocyaneus</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Staphylococcus pyogenes albus</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Coci similar to Meningococci</td>
<td>&quot; 1 &quot;</td>
</tr>
</tbody>
</table>
Where in addition to Bronchitis, pneumonia was also present. In these cases only bronchial secretion from non-pneumonic areas was examined. 13 cases.
No. 41. Case VI.

Franz Z.

Died: 13th December 1898, 9 a.m. Age 1 year.

Clinical Diagnosis: Diphtheria of fauces and larynx. Tracheotomy. Pneumonia.

Sectio: 14th December 11 a.m.

Cover-glass preparations from purulent secretion of a smaller bronchus of:-

1. The left lower lobe (2 preparations: - G; W;)
Moderate number of round cocci, single, in pairs or short chains. All positive to Gram. No Tubercle bacilli.

2. A non-pneumonic area of the right lower lobe. (2 preparations: - G; LMB.)
Moderate number of round cocci, single, in pairs, in groups of four or in short chains, all positive to Gram. Fewer lancet shaped diplococci, positive to Gram. One or two bacilli, as long but twice as thick as Tubercle bacilli, positive to Gram. None are typical of Diphtheria bacilli.

Cultures from purulent secretion of a smaller bronchus of:-

1. The left lower lobe (A; PA; LS.)
Considerable number of colonies of Influenza bac: Numerous colonies of a streptococcus (a)
Moderate number of colonies of Staphylococcus pyogenes. Very scanty colonies of Bacillus prodig (b)
Scanty colonies of Pseudodiphtheria bacilli on the Loeffler's blood serum only.

2. The left upper lobe (A; PA; LS.)
Considerable number of colonies of Influenza bac: Numerous colonies of Streptococcus pyogenes.
Moderate number of colonies of Staphylococcus pyogenes. A few colonies of a bacillus of the Goli group.

over
(a) Bouillon culture is similar to that of Strept:pyog: In gelatine puncture no growth after 48 hours at 19°C.

(b) Further attempts at identification failed, as no growth occurred in the subcultures.
No. 42. Case XXII.

Johann L.

Born: 14th November 1898. Died: 29th Dec., 1898, 5 a.m.

Clinical Diagnosis: "Debilitas vitae". Enterocatarrh and bronchitis. Weight at birth 1900 grams; last weight 2050 grams.

Sec. Ion: 29th December 1898, 10 a.m.
Catarrhal pneumonia of the right middle and lower lobes, with pleurisy on right lung. Diffuse bronchitis. Enteritis.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (2 preparations: - G; LMB.)
   Scanty cocci in pairs or in short chains of four to six members; only a few are lancet shaped. All are positive to Gram.

2. The Left Upper Lobe (1 preparation: - G.)
   No micro-organisms visible.

3. From purulent secretion of a smaller bronchus of the left lower lobe (1 preparation: - LMB.)
   Scanty round cocci in pairs.
   Moderate number of short bacilli similar to Bact: colli commune.

Cultures

1. From catarrhal secretion of a smaller bronchus of the right upper lobe (A; PA; LS.)
   Moderate number of colonies of Strept: pyog: Very scanty colonies of Staphyl: pyog: albus, (viz. only one colony on agar, where there is also one colony of Sarcina alba.)

2. From purulent secretion of a smaller bronchus of the left lower lobe (A; PA; LS.)
   Fairly numerous colonies of Streptococcus pyog: Scanty colonies of Staphyl: pyog: albus.
   Moderate number of colonies of a bacillus of the Coli group.
No. 42 Case XXII.

Staphylococcus pyogenes albus. (Groups, tetrads & pairs) Cultivated from bronchitic secretion, left lower lobe. Stained with fuchsin. Magnified 1000.
No. 43. Case XXXI.
Marie K.

Born: 15th August 1898. Died: 5th January 1899, 11.45 a.m.


Cover-glass preparations:- from purulent secretion of a smaller bronchus of:

1. The right upper lobe (3 preparations: - G; LMB; W.)
   One or two lancet shaped cocci in pairs, positive to Gram.
   Scanty small bacilli, negative to Gram.
   No Tubercle bacilli.

2. The left upper lobe (3 preparations, stained as 1.)
   Scanty cocci in pairs, some well stained, others degenerated and ill stained.
   Scanty small bacilli, negative to Gram.
   No Tubercle bacilli.

Cultures:

1. From purulent secretion of a smaller bronchus of the right upper lobe (A; PA; LS.)
   A: is sterile
   PA: shows four colonies of Sarcina alba.
   LS: shows pure culture of Diplococcus pneumoniae.

from catarrhal secretion of a smaller bronchus of:-

2. The right middle lobe (A; PA; LS.)
   A: shows one colony of Sarcina alba
   PA: is sterile
   LS: shows pure culture of Diplococcus pneumoniae.

3. The left upper lobe (A; PA;)
   Both remained sterile.

N.B. The meningitic & pericarditic secretions are both reported to have contained Diplococcus pneumoniae in pure culture.
Died: 5th January 1899, 11.30 p.m. Aet: One year

Clinical Diagnosis: Four weeks before death tracheotomy was performed for diphtheria (Diphtheria bacilli present). Cachexia. Bronchitis, gradually developing pneumonia, in sputum no Influenza bacilli.

Section: 7th January 1899, 11.30 a.m.
Tracheotomy wound. No diphtheritic membrane in larynx or fauces or bronchi. Tracheitis below the level of the operation wound. Diffuse purulent bronchitis of the larger and smaller bronchi. Catarrhal pneumonia of the left lower lobe. Prae-laryngeal abscess. Degeneration of the kidneys, liver and myocardium.

Cover-glass preparations from purulent secretion of a smaller bronchus of:-

1. The right lower lobe (3 preparations: - G;LMB;ZN.)
   Very abundant small short extracellular bacilli, negative to Gram.
   Abundant round cocci, some in short chains, positive to Gram.
   No Tubercle bacilli. No Diphtheria bacilli.

2. The left upper lobe (3 preparations, stained as 1.)
   Same as 1.

Cultures from purulent secretion of a smaller bronchus of:-

1. The right lower lobe (A; PA; LS.)
   Moderate number of colonies of Strept:pyogenes:
   Moderate number of colonies of Strept:brevis (a)
   Moderate number of colonies of Staphyl:pyog.aureus.
   Very scanty colonies of Bacillus pyocyaneus.
   Moderate number of colonies of Diphtheria bacilli (on the Loeffler's blood serum only.)

2. The left upper lobe (A; PA; LS.)
   Same as 1, except that the colonies of Bacillus pyocyaneus are rather more numerous.

(a) Bouillon culture 24 hours old is quite clear with a fine sediment consisting of chains of 6-10 members. Growth in gelatine at 19°C.
No. 45. Case XXXV.

Alois B.


Sectio: 7th January 1899, 11 a.m.

Purulent bronchitis. Confluent lobular pneumonia of the lower lobes of both lungs, with fibrinous pleurisy on left lung. Chronic enteritis with intestinal atrophy.

Cover-glass preparations

1. From mucopurulent secretion of a smaller bronchus of the left upper lobe (3 preparations: G; LMB; ZN)

Pus cells and bronchial epithelium, but no micro-organisms visible.

2. From catarrhal secretion of a smaller bronchus of the right middle lobe. (3 preparations, stained as in 1.)

Scanty cocci in pairs, of well marked lancet shape, but with no capsules visible. All positive to Gram.

No Tubercle bacilli.

Cultures

1. From mucopurulent secretion of a smaller bronchus of the left upper lobe (A; PA; LS.)

A: Sterile
PA: Numerous colonies of Bact: coli commune.
LS: A few colonies of Bact: coli commune and moderate number of colonies of streptococci (a)

2. From catarrhal secretion of a smaller bronchus of the right middle lobe (A; PA; LS.)

A: One colony of Sarcina alba.
PA: One colony of Sarcina alba.
LS: Sterile.

Causal agent probably the Diploc: pneumoniae which had lost vitality by the time the examination was made.

(a) Colonies on agar sometimes typical of Strept: pyog:, at others smaller, more finely granular and without coils at the edge. Bouillon culture after 24 hours shows diffuse slight cloudiness, cocci in chains or in pairs. No growth in gelatine puncture even after 8 days.
No. 46. Case XXXVIII.

Leopoldina W.

Died: 7th January 1899. 12.30 p.m. Aet 20 months.

Clinical Diagnosis: Scarlatina. Diphtheria of fauces and larynx (No typical Diphtheria bacilli cultivated, the reason for this being probably the dry culture medium.)

Sectio: 8th January 1899, 1.30 p.m.

Scarlatina. Diphtheritic membrane in larynx and fauces. Pneumonic patches at the lower part of right upper and upper part of right lower lobes. On surface of lungs (mainly on left lower lobe) are small haemorrhages. Catarrhal bronchitis.

Cover-glass preparations from catarrhal secretion of a larger bronchus of:

1. The right upper lobe (Hyperaemic mucous membrane with catarrhal secretion (3 preparations: G; DMB; ZN.)

Moderate number of cocci; mostly round, some lancet shaped, all positive to Gram.

A few bacilli, positive to Gram, resembling, but not characteristic of Diphtheria bacilli.

No Tubercle bacilli.

2. The right lower lobe (3 preparations stained as 1.)

Same as 1, except that here there are also many bacilli typical of the Diphtheria group.

Cultures from catarrhal secretion of a larger bronchus of:

1. The right upper lobe (A; PA; LS.)

Numerous colonies of Diphtheria bacilli.

Very numerous colonies of Streptococcus pyogenes.

2. The right lower lobe (A; PA; LS.)

Abundant colonies of Diphtheria bacilli.

Abundant colonies of Streptococcus pyogenes.
No. 47. Case XLII.

Carl S.

Born: 10th January, 1899. Died: 20th Jan. 1899, 10.30 p.m.

Clinical Diagnosis: Congenital Hydrocephalus

Sectio: 21st January 1899. 12.15 p.m.
Diffuse catarrhal bronchitis (Mucous membrane is hyperaemic, lumen contains fluid secretion, no pus.) Broncho-pneumonic patches in both lower lobes with pus in the corresponding bronchi. Marked cerebral atrophy.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The left upper lobe (3 preparations: - G; LMB; ZN.)
   Abundant round cocci, single or in pairs, less often in short chains, positive to Gram.
   Very scanty lancet shaped cocci, without visible capsules, positive to Gram.
   Very scanty bacilli of fair size, negative to Gram.
   No Tubercle bacilli.

2. A non-pneumonic area of the left lower lobe (3 preparations, stained as in 1.)
   Same as 1.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The left upper lobe (A; PA; LS.)
   Abundant colonies of Streptococcus pyogenes.
   Numerous colonies of a bacillus of the Coli group.

2. A non pneumatic area of the left lower lobe (A; PA; LS.)
   Same as 1.

(a) Motile bacilli, negative to Gram. On agar forms a layer all over the surface, slowly liquifies gelatine. Forms gas in sugar agar. Indol reaction positive.
No. 48. Case LI.
Emma S.


Clinical Diagnosis: Bronchitis. Catarrhal pneumonia of right lung.

Sectio: 26th January 1899 11.30 a.m.
Bronchitis. Catarrhal pneumonic patch at the root of the right lung, and at the apex of the right upper lobe. Also confluent catarrhal pneumonia at the root of the left lung, affecting the upper lobe to a slight extent. Slight intestinal hyperaemia.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of a non-pneumonic area of:

1. The left upper lobe: (3 preparations: - G; LMB: ZN.)
   Numerous small bacilli, mostly intracellular, poorly stained, and only visible in the methylene blue preparation.
   Scanty lancet shaped cocci in pairs, positive to Gram.
   No Tubercle bacilli.

2. The left lower lobe (3 preparations, stained as 1.
   Same as 1, but that the small bacilli are much scantier.

Cultures from catarrhal secretion of a smaller bronchus of a non-pneumonic area of:

1. The left upper lobe (A; PA; LS.)
   On all three there is a pure culture in moderate amount of Diplococcus pneumoniae.

2. The left lower lobe (A; PA; LS.)
   Numerous colonies of Diplococcus pneumoniae.
   Moderate number of colonies of Influenza bacilli.
   (On Loeffler's blood serum there are also a few colonies of Bacillus subtilis.)
No. 49. Case LIII.

Franz D.

Born: 10th August 1899. Died: 27th Jan. 1899, 2 a.m.

Clinical Diagnosis: Chronic intestinal catarrh.

Sec: 27th January 1899, 9.30 a.m.

Bronchitis. Catarrhal pneumonia of left lower lobe. Kept on ice till 10.15 a.m.

Cover-glass preparations

from catarrhal secretion of a smaller bronchus of:-

1. The right lower lobe (3 preparations: - G; LMB; ZN)

Very abundant small extracellular bacilli, negative to Gram.

Scanty cocci, mostly in pairs, the majority without lancet shape, fewer of well marked lancet shape, all positive to Gram.

Scantier round cocci in pairs, negative to Gram. No Tubercle bacilli.

2. The right upper lobe (3 preparations stained as 1.)

Same as 1.

Cultures

from catarrhal secretion of a smaller bronchus of:-

1. The right lower lobe (A; PA; LS.)

Very abundant colonies of Strept:pyogenes.

Moderate number of colonies of Diplococcus pneumoniae.

Scanty colonies of Bacillus pyocyaneus.

2. The right upper lobe (A; PA; LS.)

Numerous colonies of Diplococcus pneumoniae.

Moderate number of colonies of Bacillus pyocyaneus.

Scanty colonies of Staphylococcus pyogenes albus.
No. 50  Case LVIII

Anna S.

Born: 10th January 1899. Died: 31st Jan. 1899, 10 a.m.

Clinical Diagnosis: "Debilitas vitae."

Sectio: 1st February, 1899. 10.30 a.m.

Diffuse catarrhal bronchitis, acute catarrhal pneumonia of left lower lobe, with a small patch in the right upper lobe. Gastro-intestinal catarrh. Fatty degeneration of the liver. Uric acid infarcts in the kidneys.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The right lower lobe (3 preparations: - G; LMB; ZN.)

   Abundant small intracellular bacilli, (not visible in the Gram specimen).
   Very scanty cocci in pairs, positive to Gram.
   No tubercle bacilli.

2. A non-pneumonic area of the right upper lobe
   (3 preparations, stained as 1.)

   Abundant small intracellular bacteria, resembling bacilli, but not of distinctive form.
   Very scanty short thick bacteria (coci?) in pairs, positive to Gram.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The right lower lobe (A; PA; LS.)

   A: numerous colonies of Influenza bacilli in pure culture.
   PA: Blood used was impure and Influenza colonies could not be isolated.
   LS: A few colonies of large cocci (a)

2. A non-pneumonic area of the right upper lobe
   (A; PA; LS.)

   A: Many colonies of Influenza bacilli.
   Very scanty colonies of large cocci (a).
   PA: Numerous colonies of Inf:bac: in pure culture.
   LS: Same as agar.

(a) Large round cocci usually in pairs, positive to Gram. On agar they form large white medium granular colonies.
Rudolph B.


Sectio: 4th February 1899. 11.30 a.m.
Diffuse purulent bronchitis. Acute catarrhal pneumonia at left apex. Marked gastro-intestinal catarrh.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:-

1. The right upper lobe (3 preparations: - G; LMB; ZN.)
   Abundant small round cocci, often in pairs, extracellular, negative to Gram. In their relation to each other some are like Gonococci. Very scanty lancet shaped cocci, without visible capsules, positive to Gram. Abundant large bacilli, positive to Gram. Very scanty smaller bacilli, negative to Gram. No Tubercle bacilli. In the Ziehl-Neelsen preparation, many of the large bacilli are seen to possess pink stained spores (?) at one or both ends.

2. The right lower lobe (3 preparations, stained as 1.)
   Same as 1, but all the bacteria are present in smaller amount. In the Ziehl-Neelsen preparation there are no pink stained spores visible.

Cultures from catarrhal secretion of a smaller bronchus of:-

1. The right upper lobe (A; LS.)
   Scanty colonies of Staphylococcus albus. Numerous colonies of a bacillus of the Coli group (a) Numerous colonies of Torulae. Moderate number of colonies of bacilli resembling in some respects bacilli of the Bacillus subtilis group (b)

2. The right lower lobe (A; LS.)
   Same as 1, except that the Torulae colonies are only present in small numbers.
(a) Non-motile bacilli. No indol reaction.

(b) Non-motile bacilli of various sizes, but often as long and three times as thick as Tubercle bacilli. The bacilli possess square or rounded ends, and occur singly or more often in long jointed threads, in preparations stained by methylene blue the ends are separated by a stained intervening area or "gangway" as broad as the bacilli themselves.

They are positive to Gram. Involution forms or spore formation could not be detected.

On agar they form small whitish colonies resembling to the naked eye colonies of Diphtheria bac; or Diplococcus pneumoniae. By the high power such colonies are seen to consist of bacilli which form concentric wavy lines at the periphery and resemble young colonies of Bac:anthracis or Bac:subtilis.

No growth occurs in gelatine at 19°C. They render bouillon diffusely cloudy, with an acid reaction, and form no gas in sugar-agar medium.

Non-pathogenic on subcutaneous inoculation in white mice.

Photograph on the next page.
Large bacilli, from colonies on agar resembling those of Bacillus subtilis. These bacilli, however, were non-motile and formed no spores.
Culture in sugar agar of bacilli of the coli group after 20 hours' growth at 37°C. Gas formation. From bronchitic secretion of the right lower lobe.
No. 52.  Case LXI.

Maria H.

Born: 24th April 1898.  Died: 5th Feb. 1899, 5 a.m.

Clinical Diagnosis:  Catarrhal pneumonia of both lungs, with acute purulent otitis media of the left side, subsequent to nasal diphtheria.  (Non-pathogenic bacilli similar to Diphtheria bacilli present')

Sectio:  5th February 1899, 11 a.m.
Purulent rhinitis (no membrane present)
Slight catarrhal bronchitis.  Acute catarrhal pneumonia of the left lower lobe, with a small pneumatic area at the root of the right lung involving the lower lobe only and also one at the extreme right apex.  Acute purulent otitis media on the left side.

Cover-glass preparations from:-

1. Catarrhal secretion from a smaller bronchus of a non-pneumonic area of the right upper lobe.
   (3 preparations: G; LMB; ZN)
   Moderate number of small intracellular bacilli.
   Very scanty rather larger extracellular bacilli without characteristic form.
   No Tubercle bacilli, no cocci.

2. Scraping from the mucous surface of a smaller bronchus of a non-pneumonic area of the right lower lobe.
   (3 preparations, stained as 1.)
   Same as 1, but that the bacilli are more scanty.

3. In the nasal pus there were reported to be various cocci and small bacilli.

Cultures from:-

1. Catarrhal secretion from a smaller bronchus of a non-pneumonic area of the right upper lobe (A; PA; LS.)
   Abundant colonies of Influenza bacilli.
   Fairly numerous colonies of Pseudodiphtheria bacilli (a)
   Moderate number of colonies of a bacillus of the Coli group (b)

2. Scraping from a smaller bronchus of a non-pneumonic area of the right lower lobe (A; PA; LS.)
   Same as 1.
(a) Morphologically they resemble Diphtheria bacilli more closely than Pseudodiphtheria bacilli. Most of the bacilli are long, and many show segmentation and a tendency to clubbing, and are as a rule not arranged in parallel bundles. Subcutaneous inoculation on a guinea pig shows them to be non-pathogenic.

(b) No indol reaction.
No. 53. Case LXIII

Joseph H.

Born: 29th August 1898. Died: 5th Feb. 1899, 7 a.m.

Clinical Diagnosis: Intestinal catarrh.

Sectio: 6th February 1899, 3.30 p.m.
Diffuse catarrhal bronchitis. A small patch of catarrhal pneumonia in the centre of the right lower lobe with pus in the corresponding bronchi. Chronic catarrh of the colon. Marasmus.

Cover-glass preparations from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe. (3 preparations:—G; LMB; ZN.)
   Scanty cocci in pairs, without lancet shape, positive to Gram.
   No Tubercle bacilli.

2. The right lower lobe (3 preparations:—G; LMB; ZN.)
   Scanty round cocci, mostly in pairs, very seldom in groups of four, positive to Gram.
   Scanty very small thin extracellular bacilli resembling Influenza bac: negative to Gram.
   One or two bacilli, as long as Tubercle bacilli, but twice as broad. Positive to Gram.
   No Tubercle bacilli.

Cultures from catarrhal secretion of a smaller bronchus of:

1. The right upper lobe (A; PA; LS.)
   Numerous colonies of Influenza bacilli.
   Scanty colonies of Staphylococcus pyogenes aureus.

2. The right lower lobe (A; PA; LS.)
   Numerous colonies of Influenza bacilli.
   Moderate number of colonies of Staphyl:pyog: aureus.
   And on the Loeffler’s blood serum only, there are scanty colonies of short thick bacilli resembling Pseudodiphtheria bacilli and positive to Gram.
**SECTION C.**

Thirteen cases where both bronchitis and pneumonia were present, **but only bronchitic secretion from non-pneumonic areas examined.**

<table>
<thead>
<tr>
<th>No.</th>
<th>Case</th>
<th>Bacteria present in cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td>41.</td>
<td>VI.</td>
<td>Influenza bacilli + streptococci + staphyl: pyog: aureus + Pseudodiphtheria bacilli + Bacilli of Coli group + Bac: prodigiosus (?)</td>
</tr>
<tr>
<td>42.</td>
<td>XXII.</td>
<td>Streptococcus pyogenes + Staphyl: pyog: albus + Bacilli of Coli group + Sarcina alba.</td>
</tr>
<tr>
<td>43.</td>
<td>XXXI.</td>
<td>Diplococcus pneumoniae + Sarcina alba.</td>
</tr>
<tr>
<td>44.</td>
<td>XXXIII.</td>
<td>Diphtheria bacilli + streptococci + Staphyl: pyog aureus + Bacillus pyocyaneus.</td>
</tr>
<tr>
<td>45.</td>
<td>XXXV.</td>
<td>Streptococci + Bac: coli commune.</td>
</tr>
<tr>
<td>46.</td>
<td>XXXVIII.</td>
<td>Diphtheria bacilli + Streptococcus pyog:</td>
</tr>
<tr>
<td>47.</td>
<td>XLIII.</td>
<td>Streptococcus pyogenes + Bac: of Coli group.</td>
</tr>
<tr>
<td>50.</td>
<td>LVIII.</td>
<td>Influenza bac: + large air cocci.</td>
</tr>
<tr>
<td>51.</td>
<td>LX.</td>
<td>Bacilli of Coli group + Bac: subtilis (?) + Torulae + Staphyl: pyog: albus.</td>
</tr>
<tr>
<td>52.</td>
<td>LXI.</td>
<td>Influenza bac: + Pseudodiphtheria bac: + Bacilli of Coli group.</td>
</tr>
<tr>
<td>53.</td>
<td>LXIII.</td>
<td>Influenza bacilli + Staphyl: pyog: aureus + Pseudodiphtheria bacilli.</td>
</tr>
</tbody>
</table>
**Summary of Section C.**

The following bacteria were present in the cultures:

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Present in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streptococci</td>
<td>7 cases</td>
</tr>
<tr>
<td>Bacilli of Coli group</td>
<td>6 cases</td>
</tr>
<tr>
<td>Influenza bacilli</td>
<td>5 cases</td>
</tr>
<tr>
<td>Diplococcus pneumoniae</td>
<td>3 cases</td>
</tr>
<tr>
<td>Staphylococcus pyogenes aureus</td>
<td>3 cases</td>
</tr>
<tr>
<td>Staphylococcus pyogenes albus</td>
<td>3 cases</td>
</tr>
<tr>
<td>Pseudodiphtheria bacilli</td>
<td>3 cases</td>
</tr>
<tr>
<td>Diphtheria bacilli</td>
<td>2 cases</td>
</tr>
<tr>
<td>Bacillus pyocyaneus</td>
<td>2 cases</td>
</tr>
<tr>
<td>Bacilli of Bacillus subtilis group</td>
<td>2 cases</td>
</tr>
<tr>
<td>Sarcina alba</td>
<td>2 cases</td>
</tr>
<tr>
<td>Torulae</td>
<td>1 case</td>
</tr>
</tbody>
</table>
SECTION D.

Where both bronchitis and pneumonia existed. Bronchial secretion from non-pneumonic areas was examined, and in addition either bronchopneumonic secretion or a scraping from the section surface of a pneumonic area. 9 cases.
No. 54. Case V.
Rosina L.

Age: 9 months.

Sectio: 14th December 1898.
Purulent Bronchitis. Catarrhal pneumonia of the right upper and middle lobes.

Cover-glass preparations

1. From purulent secretion of a smaller bronchus of the left upper lobe (2 preparations: - G; LMB.)
   Moderate number of cocci, either single or in chains, positive to Gram.
   A few bacilli, about the same length or else twice as long and two or three times as broad as Tubercle bacilli, sometimes appearing in jointed threads of two or three members, all positive to Gram.

2. From Purulent broncho-pneumonic secretion of a smaller bronchus of the right middle lobe.
   (2 preparations, stained as in 1.)
   Many cocci single or in chains, positive to Gram.
   Fewer lancet shaped cocci, often in pairs, positive to Gram.
   Very scanty bacilli, similar to those in 1.

Cultures

1. From purulent secretion of a smaller bronchus of the left upper lobe (A; PA; LS.)
   Many colonies of Diplococcus pneumoniae.
   Moderate number of colonies of Strept. pyogenes.
   Moderate number of colonies of Pseudodiphtheria bacilli.
   Moderate number of colonies of Bact:coli commune.
   Very scanty colonies of Sarcina lutea.

2. From a scraping of section surface of pneumonic area of the right upper lobe (agar),
   Numerous colonies of Diplococcus pneumoniae.
   Moderate number of colonies of Streptococcus pyog:
   Very scanty colonies of Bact:coli commune.
No. 55. Case X.
Eduard E.

Born: 23rd November, 1898. Died: 14th Dec., 1898, 3 p.m.

Clinical Diagnosis: Entero-catarrh.

Sectio: 15th December, 1898, noon.


Cover-glass preparations

1. From muco-purulent secretion of a smaller bronchus of the left lower lobe (2 preparations: - G; LMB.)

Very numerous small bacilli, like Influenza bacillus, feebly stained by the methylene blue and negative to Gram.

Many very small cocci (?) mostly in pairs, negative to Gram.

A few cocci, single or in pairs, some of well-marked lancet shape, positive to Gram.

One or two long bacilli, positive to Gram.

2. From muco-purulent secretion of a smaller bronchus of the right lower lobe (3 preparations: - G; LMB; W.)

Same as 1.

No Tubercle bacilli.

3. Peritoneal pus (2 preparations: - G; LMB.)

Abundant short thick bacilli like Bact: coli commune, negative to Gram.

Cultures

1. From muco-purulent secretion of a smaller bronchus of the left upper lobe (A; PA; LS.)

Many colonies of Diplococcus pneumoniae.

Moderate number of colonies of Influenza bacilli.

Many colonies of Bact: coli commune.

2. From muco-purulent secretion of a smaller bronchus of the right upper lobe (A; PA.)

Same as 1.
3. From broncho-pneumonic secretion of a smaller bronchus of the right lower lobe. (A; LS.)

    Same as 1, except that there are no colonies of Influenza bacilli.

4. Peritoneal pus (A; PA.)

    Pure culture of Bact;coli commune.
Case XIII.

Died: 16th December, 1898, 9 a.m.  
Age: 5 years.

Clinical Diagnosis: Diphtheria of fauces, larynx and bronchi.

Sectio: 17th December, 1898. 11 a.m.  
Diphtheria of the pharynx, larynx, trachea, and larger bronchi.  
Diffuse bronchitis.  
Confluent lobular pneumonia of the left lower lobe.  
Chronic pleurisy on both sides.  
Parenchymatous degeneration of the kidneys and myocardium.  
Swelling of the solitary glands and Peyer's patches, some of the latter being pigmented.

Cover-glass preparations

1. From a scraping from the diphtheritic membrane in a large bronchus of the right lower lobe.  
(2 preparations: - G, LMB.)

Very abundant small bacilli like Influenza bacilli, extracellular, negative to Gram.  
Many diplococci, with lancet shape as a rule not well marked.  Positive to Gram.  
A moderate number of typical diphtheria bacilli.

2. From catarrhal secretion from a smaller bronchus of the right lower lobe (3 preparations: - G; LMB; W.)

Same as 1, except that no cocci visible.  
No Tubercle bacilli.

3. From catarrhal secretion of a smaller bronchus of the right upper lobe (1 preparation: - G.)

Same as 1, except that no cocci visible.

4. From a scraping of section surface of catarrhal pneumonia (2 preparations: - G; LMB.)

Same as 3.

5. From a scraping of section surface of spleen.  
(1 preparation: - G.)

No bacteria visible.
Cultures from:-

1. Scraping from the diphtheritic membrane in a large bronchus of the right lower lobe (L).

   Abundant colonies of Influenza bacilli.
   Numerous colonies of Diphtheria bacilli.

2. Catarrhal secretion from a smaller bronchus of the right lower lobe (A; PA; LS.)

   Abundant colonies of Influenza bacilli.
   Abundant colonies of Diplococcus pneumoniae.
   Moderate number of colonies of Diphtheria bacilli.
   Two colonies of Sarcina alba on the agar only.

3. Catarrhal secretion from a smaller bronchus of the right middle lobe (A; PA; LS.)

   A: One colony of Staphylococcus aureus.
   """" Sarcina alba.
   PA: Sterile
   LS: Moderate number of colonies of streptococci.

4. Scraping from section surface of catarrhal pneumonia (A; PA; LS.)

   Abundant colonies of Influenza bacilli.
   Abundant colonies of Diplococcus pneumoniae.
   Moderate number of colonies of streptococci.
   Moderate number of colonies of Diphtheria bacilli.
   Two colonies of a bacillus of the Coli group, on agar only.

5. Scraping of section surface of the spleen (A; PA; LS.)

   All three remained sterile.
No. 57. Case XIV.

Theresa H. Aet 2 years, 8 months.

Clinical Diagnosis: Post-diphtheritic heart paralysis.

Sectio: 19th December 1898. 10.30 a.m.
Diphtheria of the faucæ, tracheitis, bronchitis, catarrhal pneumonia of the left lower and right lower lobes.

Cover-glass preparations from:

1. Scraping from the diphtheritic membrane on the posterior surface of the soft palate.
   (2 preparations: - G; LMB.)
   Many typical Diphtheria bacilli.
   A few bacilli similar to Bact: coli, negative to Gram.
   Moderate number of round cocci, in small groups or chains, positive to Gram.
   A few lancet shaped diplococci, positive to Gram.

2. Catarrhal secretion from a smaller bronchus of the right middle lobe (3 preparations: - G; LMB; W.)
   Very scanty lancet shaped diplococci, positive to Gram.
   Very scanty bacilli resembling Bact: coli, negative to Gram.
   No Tubercle bacilli or Diphtheria bacilli visible.

3. Catarrhal secretion from a smaller bronchus of the left upper lobe (3 preparations stained as in 2.)
   Same as 2, except that there are no bacilli negative to Gram visible.

4. Scraping of section surface of catarrhal pneumonia, left lower lobe (2 preparations: - G; LMB.)
   The only bacteria visible are scanty lancet shaped diplococci, positive to Gram.

Cultures from:

1. Scraping from the diphtheritic membrane on the posterior surface of the soft palate. (A; LS.)
   Numerous colonies of Diphtheria bacilli.
   Numerous colonies of Diplococcus pneumoniae.
   Moderate number of colonies of Staphyli: pyog: aureus.
   Moderate number of colonies if a bacillus of the Coli group.
2. Catarrhal secretion from a smaller bronchus of the left upper lobe (A; PA; LS.)

Abundant colonies of Diphtheria bacilli.
Abundant colonies of Diplococcus pneumoniae.
Moderate number of colonies of a bacillus of the Coli group.
Very scanty colonies of Streptococcus pyogenes on the agar only.

3. Bronchó-pneumonic secretion from a smaller bronchus of the right lower lobe (A; PA; LS.)

Very abundant colonies of Diphtheria bacilli.
Abundant colonies of Diplococcus pneumoniae.
Moderate number of colonies of a bacillus of the Coli group.
Three colonies of Sarcina alba on the Pfeiffer's agar only.

4. Scraping of section surface of catarrhal pneumonia left lower lobe (A; PA; LS.)

Abundant colonies of Diphtheria bacilli.
Numerous colonies of Diplococcus pneumoniae.
Case XVI.

Infant a few months old.

Sections: 20th December 1898. About 5 p.m.
Diffuse purulent bronchitis.
Catarhal pneumonia of the right upper lobe.
Bacteriological examination, 21st December, 10.30 a.m. Lungs kept on ice overnight.

Cover-glass preparations from:

1. Purulent secretion from a smaller bronchus of the left lower lobe (2 preparations: G; LMB.)

   Very scanty small bacilli visible in the methylene blue specimen only.

2. Broncho-pneumonic secretion from a smaller bronchus of the right upper lobe (3 preparations: G; LMB; W.)

   Same as 1.
   No Tubercle bacilli.

Cultures from:

1. Purulent secretion from a smaller bronchus of the left lower lobe (A; PA; LS.)

   All three sterile.

2. Broncho-pneumonic secretion from a smaller bronchus of the right upper lobe (A; PA; LS.)

   A: One colony of large round cocci, positive to Gram and similar to air cocci.
   PA: Six colonies of Pseudodiphtheria bacilli.
   LS: Sterile.

N.B. No pathogenic bacteria present, but one must note that about 18 hours elapsed between the post mortem and the bacteriological examination. The organism which had caused the disease was probably the Diplococcus pneumoniae or the Influenza bacillus, at any rate some organism which quickly loses its vitality post mortem.
Case XXIX.

Alexandrin J.

Born: 15th August 1898. Died: 1st Jan. 1899, 10.30 p.m.

Clinical Diagnosis: Pulmonary emphysema.

Sectio: 2nd January, 12.30 p.m.
Chronic tuberculosis of the bronchial glands, with disseminated tuberculosis of the lungs, and tuberculosis of liver. **Diffuse purulent bronchitis.** Pneumonia of the right lobes. Enlarged spleen. Fatty degeneration of the liver. **Cardiac hypertrophy and pulmonary emphysema.**

Bacteriological examination, 3rd January 1899 9 a.m. Lungs kept in ice chamber.

Cover-glass preparations from:-

1. Purulent secretion from a smaller bronchus of the left upper lobe (2 preparations: - G; ZN.)
   Scanty cocci in pairs, visible in the Ziehl-Neelsen preparation only.

2. Purulent broncho-pneumonic secretion from a smaller bronchus of the right upper lobe (3 preparations: - G; LMB; ZN.)
   Fairly numerous cocci, many in pairs, fewer in small groups or short chains, positive to Gram. Some are intracellular.
   No Tubercle bacilli.

Cultures from:-

1. Purulent secretion from a smaller bronchus of the left upper lobe (A; PA; LS.)
   Fairly numerous colonies of *Streptopyog:* in pure culture.

2. Purulent broncho-pneumonic secretion from a smaller bronchus of the right upper lobe (A; PA; LS)
   Same as 1.
No. 60 Case XXX.

Ludwig F.

Born: 28th October 1898. Died: 4th Jan. 1899, 6 a.m.


Sectio: 5th January 1899. 10 a.m.

Diffuse purulent bronchitis. Catarrhal pneumonia of both lower lobes. Chronic intestinal catarrh.

Cover-glass preparations from:

1. Purulent secretion from a smaller bronchus of the left upper lobe (3 preparations: - G; LMB; ZN)

   Numerous small extracellular bacilli, poorly stained by methylene blue.
   A few round cocci, usually in pairs.
   No Tubercle bacilli.

2. Broncho-pneumonic secretion from a smaller bronchus of the right lower lobe (3 preparations, stained as 1)

   Same as 1.

Cultures from:

1. Purulent secretion from a smaller bronchus of the left upper lobe (A; PA; LS.)

   All three sterile, but for one colony of Strept: pyog: on agar.

2. Broncho-pneumonic secretion from a smaller bronchus of the right lower lobe (A; PA; LS.)

   On all three are a moderate number of colonies of Bacillus pyocyaneus.
   On LS, there are in addition two colonies of Streptococcus pyogenes. (a)

(a) Bouillon subculture diffusely cloudy, with a faint stringy slimy sediment consisting of cocci in long straight chains.
Case XXXIX.

Julianna W.

Born: 14th December 1898. Died: 9th Jan. 1899, 10 p.m.


Section: 10th January 1899, 11.15 a.m.
Acute catarrhal bronchitis. Confluent lobular pneumonia of all three lobes of the right lung, also of the lower lobe of the left lung. Intestinal atrophy.

Cover-glass preparations from:

1. Rusty coloured catarrhal secretion from a smaller bronchus of the left upper lobe (3 preparations: G; LMB; ZN.)
   Abundant small extracellular bacilli, negative to Gram.
   Scanty cocci, some of well marked lancet shape, positive to Gram.
   No Tubercle bacilli.

2. Purulent broncho-pneumonic secretion from a smaller bronchus of the left lower lobe (3 preparations, stained as in 1.)
   Same as 1, but the bacilli still more abundant.

Cultures from:

1. Purulent secretion from a smaller bronchus of the left upper lobe (A; PA: LS;)
   Moderate number of colonies of Influenza bacilli.
   Moderate number of colonies of Strept:pyogenes.
   A few colonies of Diplococcus pneumoniae.
   On LS there are in addition scanty colonies of cocci negative to Gram, which failed to grow on agar.

2. Purulent broncho-pneumonic secretion from a smaller bronchus of the left lower lobe (A; PA: LS.)
   Same as 1.
No. 62. Case XLIX.
Karl K.

Born: 5th September, 1898. Died: 24th January 1899, 7 p.m.


Sec: 25th January 1899. 11.30 a.m.
Pleurisy with effusion on right side. Chronic pneumonia, right upper lobe. Acute confluent catarrhal pneumonia of the right middle and lower lobes, of the left lower lobe, and a patch at root of left upper lobe. Diffuse bronchitis. Fatty degeneration of liver and kidneys. Catarrh of rectum.

Cover-glass preparations from:-

1. Catarrhal secretion from a smaller bronchus of a non-pneumonic area of left upper lobe (3 preparations: G; LMB; ZN)
   Very scanty round cocci, positive to Gram.
   No Influenza bacilli visible.
   No Tubercle bacilli.

2. Pus from a smaller bronchus of a pneumonic area of the left lower lobe. (3 preparations, stained as 1).
   Numerous round cocci nearly all in pairs, very few in chains of four members, positive to Gram.
   Scantier lancet shaped cocci, positive to Gram, with capsules visible.
   No Influenza bacilli visible.
   No Tubercle bacilli.

Cultures from:-

1. Catarrhal secretion from a smaller bronchus of a non-pneumonic area of the left upper lobe (A; PA; LS)
   Numerous colonies of Streptococcus pyogenes.
   Very scanty colonies of Bact: coli commune.

2. Purulent secretion from a smaller bronchus of a pneumonic area of the left lower lobe. (A; PA; LS.)
   Same as 1, except that the colonies of Bact:coli are more numerous.
(a) = Bronchitic secretion from non-pneumonic areas.
(b) = Broncho-pneumonic secretion.
(c) = Scraping of section surface of pneumonia.

<table>
<thead>
<tr>
<th>No.</th>
<th>Case</th>
<th>Bacteria present in the cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
<td>V.</td>
<td>(a) Diplococcus pneumoniae + Streptococcus pyogenes + Bacterium coli commune + Pseudodiphtheria bacilli + Sarcina lutea.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) &quot; + Streptococcus pyogenes + Bacterium coli commune.</td>
</tr>
<tr>
<td>55</td>
<td>X.</td>
<td>&quot; + Influenza bacillus + Bacterium coli commune.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) &quot; + Bacterium coli commune.</td>
</tr>
<tr>
<td>56</td>
<td>XIII.</td>
<td>&quot; + Influenza bacillus + Bacterium coli commune.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) &quot; + Diptheria bacilli + Staphylococcus pyogenes + Streptococci + Sarcina alba.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&quot; + Diptheria bacilli + Streptococci + Bacillus of coli group.</td>
</tr>
<tr>
<td>57</td>
<td>XIV.</td>
<td>(a) Diptheria bacilli + Diplococcus pneumoniae + Bacillus of coli group + Streptococcus pyogenes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) &quot; + Diplococcus pneumoniae + Bacillus of coli group + Sarcina alba.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(c) &quot; + Diplococcus pneumoniae.</td>
</tr>
<tr>
<td>58</td>
<td>XVI.</td>
<td>(a) Sterile.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Pseudodiphtheria bacilli + air cocci.</td>
</tr>
<tr>
<td>59</td>
<td>XXIX.</td>
<td>(a) Streptococcus pyogenes.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) &quot;</td>
</tr>
<tr>
<td>60</td>
<td>XXX.</td>
<td>(a) &quot; (one colony.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Bacillus pyocyaneus + Streptococcus pyogenes (2 colonies)</td>
</tr>
<tr>
<td>61</td>
<td>XXXIX.</td>
<td>(a) Influenza bacillus + Streptococcus pyogenes + Diplococcus pneumoniae + cocci negative to Gram.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) Influenza bacillus + Streptococcus pyogenes + Diplococcus pneumoniae + cocci negative to Gram.</td>
</tr>
<tr>
<td>62</td>
<td>XLIX.</td>
<td>(a) Streptococcus pyogenes + Bacterium coli commune.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(b) &quot; + &quot;</td>
</tr>
</tbody>
</table>


The following bacteria were present in the cultures:

(a) Streptococci present in 7 cases.
- Diploc. pneumon: 5 cases
- Bacilli of coli group: 4 cases
- Influenza bacillus: 3 cases
- Diphtheria bacillus: 2 cases
- Sarcinae: 2 cases
- Pseudodiphtheria bacilli: 1 case
- Staphylococcus pyog. aureus: 1 case
- Cocci negative to Gram: 1 case

(b) Streptococci present in 4 cases.
- Diploc. pneumon: 3 cases
- Bacilli of coli group: 3 cases
- Influenza bacillus: 1 case
- Diphtheria bacillus: 1 case
- Pseudodiphtheria bacilli: 1 case
- Bacillus pyocyanus: 1 case
- Cocci negative to Gram: 1 case
- Sarcina alba: 1 case
- Air coccos: 1 case

(c) Diploc. pneumon: present in 3 cases
- Streptococci: 2 cases
- Diphtheria bacillus: 2 cases
- Bacilli of coli group: 2 cases
- Influenza bacillus: 1 case

Summary of all the 49 cases where bronchitic secretion was examined:

- Streptococci: 34 cases
- Bacilli of coli group: 26 cases
- Diploc. pneumon: 25 cases
- Influenza bacillus: 17 cases
- Staphyl. pyogenes aureus: 8 cases
- Pseudodiphtheria bacilli: 6 cases
- Diphtheria bacillus: 5 cases
- Sarcinae: 5 cases
- Staphyl. pyogenes albus: 4 cases
- Capsuled bacilli: 3 cases
- Bacillus pyocyanus: 3 cases
- Bacilli resembling Pseudodiph: bac: 1 case
- Bacilli of the Bac. subtilis group: 2 cases
- Cocci similar to Meningococci: 1 case
- Other cocci negative to Gram: 1 case
SECTION E.

APPENDIX.

Three cases where only broncho-pneumonic secretion was examined.
No. 63. Case XXXVII.

Maria M.

Died: 8th January 1899, 4 a.m. Aged two days.

Clinical Diagnosis: "Debilitas Vitae".

Sectio: 8th January 1899, 1.30 p.m. Catarrhal bronchitis. Catarrhal pneumonia of all three lobes of the right lung, and of the lower lobe of the left lung, and in the lungs there are circumscribed purulent patches of small size, mostly in the left lung, less numerous in the right.

Cover-glass preparations from:

1. Secretion from a smaller bronchus of a pneumonic area of the right upper lobe (3 preparations: - G; LMB; ZN.)

Many round cocci in pairs, short chains or less often in small groups, positive to Gram. No Tubercle bacilli.

 Cultures from:

1. Secretion from a smaller bronchus of a pneumonic area of the right upper lobe (A; PA; LS.)

Moderate number of colonies of Strept:pyogenes. Scanty colonies of Diplococcus pneumoniae. Scanty colonies of Bacterium coli commune.
No. 64. Case L.
Joseph S.

Born: 8th January 1899. Died: 25th Jan. 1899, 1 a.m.


Sectio: 25th January 1899. 11.45 a.m.
Acute confluent catarrhal pneumonia.
Bacteriological examination, 12.30 p.m.
(Lungs kept meanwhile in ice chamber.)

Cover-glass preparations from:-

1. Pus from a smaller bronchus of a pneumonic area of the left upper lobe (2 preparations: - G; LMB.)

Very abundant small extracellular bacilli, resembling Influenza bac: negative to Gram.
Abundant lancet shaped cocci, positive to Gram, and surrounded by a clear, unstained area.

Cultures from:-

1. Pus from a smaller bronchus of a pneumonic area of the left upper lobe (A; PA; LS.)

Numerous colonies of Influenza bacilli.
Fairly numerous colonies of Diplococcus pneumoniae.
Very scanty colonies of a bacillus of the Coli group. (a)

(a) Actively motile bacilli, negative to Gram, and morphologically similar to Bact: coli.

Form round white colonies on agar, with bacilli visible at their edge by high power.
Grow in gelatine which is slowly liquified.
Form no gas in sugar-agar. No indol reaction in peptone-water culture, 48 hours old.
No. 65. Case LXV.

Infant aged: —

Died: 9th February 1899, 12 midnight.

Clinical Diagnosis: Bronchitis.

Secio: 10th February 1899. 11 a.m.
Acute catarrhal bronchitis. Acute confluent catarrhal pneumonia of upper and lower right lobes and of left lower lobe.

Cover-glass preparations from:

1. Purulent secretion from a smaller bronchus of a pneumonic area of the right upper lobe (3 preparations: — G. LMB. ZN.)

Very abundant smallish bacilli, extracellular, negative to Gram.
Moderate number of cocci, single or in pairs, mostly of round shape and without visible capsules, all positive to Gram.
No Tubercle bacilli.

 Cultures from:—

1. Purulent secretion from a smaller bronchus of a pneumonic area of the right upper lobe (A; PA; LS.)

Abundant colonies of Influenza bacilli.
Scanty colonies of Staphylococcus pyogenes aureus.
SECTION E.

No. Case. Bacteria present in cultures.

63. XXXVII. Streptococcus pyog: + Diploc: pneumoniae + Bacilli of coli commune.

64. L. Influenza bacilli + Diploc: pneumoniae + Bacilli of Coli group.

65. LXV. Influenza bacilli + Staphyl: pyog: aureus.

Summary of 10 cases (Sections D and E where broncho pneumonic secretion was examined:-

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Present in 5 cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diploc: pneumoniae</td>
<td>&quot; 5 &quot;</td>
</tr>
<tr>
<td>Bacilli of Coli group</td>
<td>&quot; 4 &quot;</td>
</tr>
<tr>
<td>Influenza bacillus</td>
<td>&quot; 3 &quot;</td>
</tr>
<tr>
<td>Diphtheria bacillus</td>
<td>&quot; 1 case &quot;</td>
</tr>
<tr>
<td>Pseudodiphtheria bacilli</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Bacillus pyocyaneus</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Staphyl: pyog: aureus</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Cocci negative to Gram</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Sarcina alba</td>
<td>&quot; 1 &quot;</td>
</tr>
<tr>
<td>Air coccus</td>
<td>&quot; 1 &quot;</td>
</tr>
</tbody>
</table>
When we come to compare the bacteriological results arrived at in the five sections, the following facts strike one.

In section A, where neither bronchitis nor pneumonia was present, we find that in no case were the bronchi found to be germ-free, but that various microorganisms were present in varying combinations, the two chief bacteria being bacilli of the Coli group and streptococci.

These facts, however, are not at all at variance with the view that the smaller bronchi intravitam and under normal conditions contain no micro-organisms.

In the first place, the bronchial mucous membrane showed no signs of inflammatory reaction, and secondly, bacteria were as a rule present in but scanty amount as compared with the abundance of bacteria found in the bronchitic cases. Hence it is not only possible, but even probable, that the greater number of the bacteria in these thirteen cases had gained entrance to the bronchi post mortem.

In four of the thirteen cases, although the bronchi showed no signs of inflammatory reaction there was some abnormal condition present in the lungs. Thus, in case No. 10 there was acute catarrhal pneumonia
in some of the lobes; in case No. 11 the lungs were for the most part unexpanded; in case No. 12 pleuritic adhesions and pulmonary oedema; and in case No. 13 the larger bronchi contained foreign material somewhat resembling pea soup in colour and consistence.

There thus remain for consideration nine cases where neither bronchi nor lungs showed any abnormal changes. In most of these the bacteria were present in but scanty amount, and in four of them no bacteria could be detected in the cover-glass preparations.

On considering the individual bacteria present in the cultures, we find that bacilli of the Coli group were the bacteria most frequently found, in each of the nine cases. The Bact. Coli is however so often met with post mortem, that one is not astonished to find it present in healthy bronchi after death. Its presence may be accounted for in several ways. Firstly the possibility of accidental contamination in the course of the examination can by no means be excluded with absolute certainty, even though the lungs were removed before the further examination of the abdominal viscera, etc., was carried out. Secondly, we must remember the possibility of a post mortem invasion of the tissues by the Bacterium coli.
This, however, is a subject on which the opinions of various authorities differ, but that this invasion does not always occur, is well illustrated by the fact that out of a total of 65 cases, bacilli of the Coli group were only found by me in the cultures of 38 cases, i.e. were absent in 41.5%. Thirdly, we have to remember the possibility, I might almost say the probability, of the oral secretions flowing down into the trachea and bronchi post mortem. That this can occur, has been positively proved by von Besser (a). It seems to me that this factor is even of more importance in the case of children than of adults, for the comparatively small size of the infant cadaver renders it more liable to be placed in varying attitudes which would favour the downflow of saliva, etc. into the trachea than is the case when one is dealing with the cadaver of an adult.

Streptococci rank next in order of frequency, being found in four of the nine cases (Nos. 1, 7, 8 & 9); in Nos. 1, 7, & 9 in scanty amount, in No. 8 rather more numerously.

Are these cocci to be considered as being normal inhabitants of the bronchi? The more probable explanation seems to me to be afforded by the assumption that they only gained entrance post mortem. We

(a) See p. 35.
know that streptococci are normally present in the mouth and the presence of such cocci in scanty amount in the healthy smaller bronchi post mortem, can be explained by the supposition that, in these particular cases, they derived their origin from the secretions of the mouth. Such a supposition is greatly increased in regard to case No. 8, where there was a quantity of muco-purulent secretion in the mouth and pharynx.

Thirdly comes the Bacillus subtilis, occurring in three of the nine cases, but always very scantily, thus on two of the four cultures in case No. 4, and colonies of similar bacilli on only one of six cultures in case No. 6. It is therefore quite possible that their presence is due to accidental contamination during the making of the cultures, or else, as seems the more probable explanation in case No. 3, that they obtained entrance from the mouth post mortem, similarly to the Bact:coli.

For the Bacillus subtilis has been found by (a) Schild during life in the normal intestine of newly born children in ten out of fifty cases.

Fourthly, the Staphyl:pyog:albus in one case (No. 5). Since this coccus is an almost constant

inhabitant of our epidermis, its presence in these cultures might be attributed to an accidental infection either from the skin of the cadaver or from the fingers during the manipulations.

Two other possibilities present themselves. The first is, that the septicaemia was due to a joint infection by the S. pyogenes aureus and the S. pyog: albus (both being found in the lungs, the latter only in the bronchi.)

On the other hand, we have to note that although at the post mortem there was no bronchitis or pneumonia, there had been a clinical diagnosis of lobular pneumonia. The vital activity of the bronchial mucous membrane being reduced in consequence of the preceding pneumonia, it is possible that the cocci entering the bronchi were not so rapidly destroyed as they would otherwise have been, and hence were capable of growth in the culture media.

On turning to those cases where bronchitis was present, we find that pathogenic bacteria were present in nearly all the cases in considerable numbers, the only exceptions being cases Nos. 20, 30, 45, 51 58 & 60. In these six cases, the bacteria which had caused the disease had probably lost their vitality by the time the bacteriological examination was made.
Thus in -

Case No. 45, examined 18 hours after death, lancet shaped diplococci were visible in the cover-glass preparations.

Case No. 51, examined almost 24 hours after death, there were abundant small cocci negative to Gram in the cover-glass preparations. These were probably some form of cocci which had lost their vitality.

Case No. 58, examined about 18 hours after the section was made, bacilli similar to Influenza bacilli were seen in the cover-glass preparations.

Case No. 60, examined 28 hours after death, and where the inflammation was evidently caused by the Bacillus pyocyaneus.

In cases No. 20 and 30 I was unable to ascertain what period of time had elapsed between the death of the children and the post mortem examination, but in the latter case cocci of well marked lancet shape were visible in the cover-glass preparations.

Excepting in these cases, pathogenic bacteria were, as already mentioned, present in large numbers.

I. Streptococci, were present in 34 cases out of a total of 49. Their presence may be accounted for in a number of ways, the chief of which are:

1. Owing to a flowing down of the secretions of the mouth, &c. into the trachea and bronchi post mortem.

2. That the cocci were present in the bronchi during life
   (a) as the sole bacterial agents of the existing bronchitis.
(b) As a joint agent with other bacteria.

(c) Because of a secondary invasion of previously diseased mucous membrane.

Now, excluding case No. 60, where there was only one colony of Strept: on three cultures, the streptococci were only found twice in pure culture (Cases No. 34 & 59). Being present in considerable amount in the cultures of these two cases, and cocci being the only bacteria visible in the original cover-glass preparations, the bronchitis may be considered as having been caused by S. pyogenes.

In the remaining 31 cases, the streptococci were associated with other bacteria, of which the principal one are here mentioned:

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Streptococci</td>
<td></td>
</tr>
<tr>
<td>Bac. of the Coli group</td>
<td>17</td>
</tr>
<tr>
<td>+ Diploc: pneumoniae</td>
<td>15</td>
</tr>
<tr>
<td>+ Influenza bacilli</td>
<td>10</td>
</tr>
<tr>
<td>+ Staphylococci</td>
<td>8</td>
</tr>
<tr>
<td>+ Diphtheria bacilli</td>
<td>5</td>
</tr>
<tr>
<td>+ Pseudodiph:</td>
<td>4</td>
</tr>
<tr>
<td>+ Bacillus pyocyaneus</td>
<td>3</td>
</tr>
<tr>
<td>+ Capsuled bacilli</td>
<td>2</td>
</tr>
</tbody>
</table>

What significance is to be assigned to the presence of the streptococci in these 31 cases, were they present as causal agents, or merely as the result of some post mortem change?

In six of these cases (Nos. 27, 29, 37, 39, 47 & 62) saprophytic bacteria alone were present in the cultures besides streptococci, which were present in such con-
siderable numbers, that one is justified in assuming for the streptococci an aetiological relationship with the bronchitis.

There are two other cases (Nos. 30 & 45), which have already been spoken of, and where besides streptococci there were only saprophytes present in the cultures.

In these two cases, where the infective agent seems to be the Diplococcus pneumoniae, the origin of the streptococci remains obscure. Possibly they merely represent a post mortem condition, as they are hardly present in sufficient numbers to possess any very definite aetiological importance.

There remain for consideration 23 cases where streptococci were present. In 17 of these, the large number of Streptococci present would seem to indicate that they had an aetiological relationship to the bronchitis. Thus in case No. 19 where there were streptococci, cocci similar to Meningococci and bacilli similar to Influenza bacilli, the last mentioned, however, in the cover-glass preparations only. Also in case No. 42 where streptococci were in great excess of the Staphylococcus epidermidis, which was the only other pathogenic micro-organism in the cultures, the bacteriological examination being made five hours after death.

In the other 15 cases, the streptococci were present in large numbers in addition to other patho-
genic bacteria also numerously present, and the most probable explanation of this fact is to consider that the bronchitis in these cases was caused by more than one kind of micro-organism, of which one was the streptococcus.

There remain only six of the 34 cases to consider. (Nos. 22, 24, 25, 40 & 57.) In these cases, the streptococci were present in but scanty amount, while other pathogenic bacteria were present in large numbers.

On the whole it would seem as if in these cases the streptococci were of secondary importance, possibly they only reached the bronchi post mortem. Yet one must bear in mind that only a small amount of the bronchitic secretion was examined, and as bronchitis seems in many cases to be due to a joint infection of several bacteria, it is quite possible that the streptococci might have been found in abundance in some other part of the bronchial tract, although but scantily present in the secretion which was examined, and where other bacteria such as Influenza bacilli or the Diplococcus preponderated.

To summarise:-

Streptococci (two cases in pure culture, six cases combined with Saprophytic bacteria) to be considered as the causal bacteria in eight cases.
Streptococci, combined with other pathogenic bacteria; the bronchitis probably due to a joint infection of more than one micro-organism

nineteen cases

Streptococci present in scanty amount, while other pathogenic bacteria are numerous. Their aetiological relationship to the disease doubtful;

seven cases

II. Bacilli of the Coli group present 26 times in 49 cases examined, i.e. in 53%. The presence of the bacilli in these cases can be accounted for in the same way as their presence in the healthy bronchi, either as the result of accidental contamination during the manipulations, or owing to a downflow of fluid from the mouth into the trachea and bronchi post mortem, or to a post mortem invasion.

In regard to the last mentioned view, viz., that of a post mortem invasion, I have already stated that, taking the total number of all cases examined, the Coli bacilli were present in 58.4%.

With a view to seeing what relation there might be between the period of time elapsing between death and post mortem examination, and the amount of Bac:coli present in the cultures, I was able in 49 cases (out of the total of 65) to ascertain what period of time had elapsed between the death of the child and the bacteriological examination. This interval varied from five to 42 hours.
14 cases were examined within 12 hours of death
35 " " more than " after "

Of the former, no Coli bacilli could be detected in seven cases, while of the seven cases in which the bacilli were present only two showed more than a scanty number of colonies.

Of the 35 cases examined more than 12 hours after death, 15 showed no colonies of Bact:coli, five showed them in scanty amount, while the remaining fifteen cases showed either a moderate number of colonies, or else colonies in large numbers.

From these facts it would appear that the greater the period of time elapsing between death and the bacteriological examination, the greater is the probability that Bact:coli will be met with in the cultures, and the more abundant will the colonies be.

III. Diplococcus pneumoniae occurred 23 times out of 49 cases, being met with 15 times in cases of pure bronchitis, 8 times in cases where both bronchitis and pneumonia were present.

In the cases of pure bronchitis, the Diploc: pneumoniae was found:

    in pure culture in 1 case
    +Streptococci in 10 cases
    +Influenza bac. in 7 "
    +Staphylococci in 5 "
    +Diphtheria bac: in 1 case
    +Bac:pyocyaneus in 1 "
Grouping all the cases of bronchitis together, we obtain the following:

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>In Pure Culture</th>
<th>As Isolated From Sputum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diplococcus pneumoniae</td>
<td>In 1 case</td>
<td></td>
</tr>
<tr>
<td>+ Streptococci</td>
<td>In 15 cases</td>
<td></td>
</tr>
<tr>
<td>+ Influenza Bac.</td>
<td>In 11 cases</td>
<td></td>
</tr>
<tr>
<td>+ Staphylococci</td>
<td>In 7 cases</td>
<td></td>
</tr>
<tr>
<td>+ Diphtheria Bac.</td>
<td>In 3 cases</td>
<td></td>
</tr>
<tr>
<td>+ Bacillus pyocyaneus</td>
<td>In 2 cases</td>
<td></td>
</tr>
</tbody>
</table>

Is the Diplococcus pneumoniae to be considered as an important bacterium in the causation of bronchitis, or is it to be ranked along with the Bact: coli as having no aetiological significance? The answer to this question seems to me to be that the Diplococcus pneumoniae is to be considered as one of the most important bacteria in the causation of bronchitis, if not the most important.

In the first place, it was never met with in such cases as showed no pathological changes in the bronchi. Too much stress must not, however, be laid on this point, for the number of such cases examined was but a limited one, and it is quite conceivable that these cocci might be found post mortem in scanty amount in the bronchi owing to a down flow of fluid from the mouth into the trachea, and owing to the fact that the Diplococcus pneumoniae occurs so frequently in the saliva of healthy people, according to Netter in 15\%\(^{(a)}\).

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\(^{(a)}\) Netter: Comptes rendus, 1887, 4th November.
A more important fact to be considered is that this coccus was met with in 23 cases, or 44.23%, and further, that in all but two of these cases, it was present in large numbers, these two exceptions being cases Nos. 15 & 23.

In case No. 15, Influenza bacilli, staphylococci, and streptococci were all present in greater numbers than were the Diplococcus pneumoniae. The case was no doubt one of a joint infection by the various bacteria; while in regard to case No. 23, no less than 34 hours elapsed between the death of the child and the bacteriological examination, so that it is not surprising to find the Diplococcus pneumoniae so scantily present.

Apart from these two cases, we have 21 cases remaining where the Diplococcus pneumoniae was one of the important causal agents, being either in pure culture or more often in combination with other pathogenic bacteria, of which the most important are the streptococci.

IV. Influenza bacillus. This must also be classed among the important causal bacteria of infantile bronchitis, being found in 9 cases of pure bronchitis, and in 17 out of a total of 49 cases.

When present, the bacilli were usually very
abundant and at the same time mainly extracellular, indicating an acute process in contradistinction to older and less acute cases where the majority of the bacilli are intracellular.

Although the growth on Pfeiffer's agar was as a rule luxuriant, the bacilli were never found in absolutely pure culture. The chief bacteria with which they were associated were as follows:—

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza bacillus</td>
<td>11</td>
</tr>
<tr>
<td>Diplococcus pneumonia</td>
<td>10</td>
</tr>
<tr>
<td>Streptocci</td>
<td>5</td>
</tr>
<tr>
<td>Staphylocci</td>
<td>4</td>
</tr>
<tr>
<td>Pseudodiphther bacillus</td>
<td>2</td>
</tr>
<tr>
<td>Diphtheria bacillus</td>
<td></td>
</tr>
</tbody>
</table>

The first few cases where the Influenza bacillus was found were particularly interesting, viz:— Nos. 15 & 41, and also No. 52, all three being cases with a clinical diagnosis of diphtheria. In the literature I have been unable to find any cases recorded where there was a joint infection of Diphtheria and Inf: bac: or where influenza occurred as a secondary and possibly fatal complication of diphtheria. The cases where the bacilli were found towards the beginning of the series were cases of sporadic influenza, such as have been described by Lindenthal, and although the Influenza bacillus was more frequently found in the cases towards the end of the series, yet they too must be considered as sporadic cases, as there was no real influenza epidemic prevailing during those months in which the cases were examined.
V. Staphylococci.

Staphylococcus pyogenes aureus occurred in 8 cases.
" " albus " " 4 "

Thus there are 12 cases to consider.

In eight of these staphylococci were present in exceedingly small amount, as compared with the other pathogenic bacteria present, so that they may be regarded as having little or no significance from the standpoint of etiology. Thus, in case No. 56, where there was only one colony visible, on one of the nine different cultures which had been made. In this case, its presence must be ascribed to accidental contamination very possibly by the fingers in the course of the manipulations. Similarly, in cases No. 28 and 42.

In four cases however, staphylococci were present, either in moderate amount, or fairly numerous, these cases being Nos. 14, 15, 41 & 44.

Case No. 14 was a case of general subacute tuberculosis with purulent bronchitis as the pathological process present in the lungs. In this case the staphylococci possess undoubtedly a minor importance in comparison with the Diploc; pneumonia and the Influenza bacilli which were also present. In this case there are no very definite indications as to the origin of the staphylococci, but as in the case of
certain streptococci, there are three main explanations. Firstly, that they were present owing to a downflow of fluid from the mouth. Secondly, that they were a concomitant factor along with the other bacteria in causing the bronchitis, and thirdly, that they had obtained entrance into the bronchi owing to the already diseased condition of the mucous membranes.

It is of course impossible to say which of these three explanations is the correct one, but I am inclined to think that the last mentioned is the most probable of the three. The same probably holds good for case No. 15, a case of diphtheria of the fauces, larynx, trachea and bronchi. In cases Nos. 41 & 44 tracheotomy had been performed for diphtheria, so that in these two cases we have not only to deal with diseased bronchi offering a suitable site on which secondary micro-organisms might develop, but with the fact that tracheotomy had been performed, and the entrance of bacteria into the smaller bronchi thus greatly facilitated.

VI. Diphtheria bacillus. Eight cases (Nos. 15, 39, 41, 44, 46, 52, 56 & 57) were examined where besides bronchitis there was either a clinical or post mortem diagnosis of diphtheria. In five of these cases
(Nos. 15, 44, 46, 56 & 57) the Diphtheria bacillus was found. The chief bacteria with which it was associated were as follows:

<table>
<thead>
<tr>
<th>Bacteria Combination</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria bacillus + Streptococci</td>
<td>5</td>
</tr>
<tr>
<td>Diphtheria bacillus + Diplococcus pneumonia</td>
<td>3</td>
</tr>
<tr>
<td>Diphtheria bacillus + Staphylococci</td>
<td>3</td>
</tr>
<tr>
<td>Diphtheria bacillus + Influenza bacillus</td>
<td>2</td>
</tr>
<tr>
<td>Diphtheria bacillus + Pseudodiphtheria bac:</td>
<td>1</td>
</tr>
<tr>
<td>Diphtheria bacillus + Bac:pyocyaneus.</td>
<td>1</td>
</tr>
</tbody>
</table>

Now, although Zupnik\(^{(a)}\) has recently stated that the whole group of Diphtheria bacilli merely consists of harmless saprophytic bacteria, which possess at most a secondary significance in regard to infection, and that the real cause of diphtheria is still unknown, the Diphtheria bacillus is generally classed among the more virulent pathogenic bacteria. Further, in all these five cases it was present in very considerable amount.

Now in cases No. 15 & 56 where there was a diphtheritic membrane extending down into the larger bronchi, the Diphtheria bacillus was no doubt the main bacteriological factor.

In the other cases, however, although the aetiological relationship is not quite so evident, it is extremely probable that the bacilli had acted along with other bacteria in causing the bronchitis, similar to the manner in which it may cause a simple

\(^{(a)}\) Zupnik: Hygien: Rundschau 1898; No. 21, p.1069.
catarrhal angina.

There is, however another possible way in which one might account for the presence of the Diphtheria bacillus in the bronchi, namely that the bronchitis had been due to some other micro-organism and that the Diphtheria bacillus had only gained entrance to the bronchi post mortem, owing to a downflow of secretion from the larynx into the bronchi.

Finally, in connection with case No. 44 where there was no longer any diphtheritic membrane visible by the time the child died, one must remember that virulent bacilli may persist in the nose and throat of cases which have been convalescent some weeks. There is therefore the possibility that the bacilli came from the mouth or pharynx post mortem. The bacilli being in such considerable numbers however, renders this supposition improbable.

VII  Pseudodiphtheria bacilli were present in six cases. In three of these there was a clinical diagnosis of diphtheria (Nos. 15, 39, & 41) and in the first of these cases it was present along with the Diphtheria bacillus. The bacilli being such frequent inhabitants of the mouth and pharynx, it is quite conceivable that they should be occasionally found in the diseased bronchi.
VIII Bacillus pyocyaneus was present in the cultures of three cases (Nos. 26, 44 & 49) while in case No. 60 numerous bacilli which were evidently the Bacillus pyocyaneus were seen in the cover-glass preparations, but failed to grow in the cultures made from the bronchitic pus.

In none of these cases was the bacillus found in pure culture, but was associated with various cocci and bacilli.

The question as to whether or not the Bacillus pyocyaneus is a pathogenic bacterium lies outside the scope of this thesis, but on the whole the evidence seems to point undoubtedly to the fact that it can become pathogenic under certain circumstances, and Kossel says, "in children, and especially in infants, it may be in the highest degree dangerous." One of his cases is particularly interesting, the Bacillus pyocyaneus being found in pure culture in the aural and nasal pus and in the mucous secretion of the larynx and trachea.

(a) Hirschmann & Kreibich record a case of "ecthyma gangraenosum" due to the Bacillus pyocyaneus, occurring in a child nine months old and ending fatally.

(a) Kossel: Zeitschrift für Hygiene und Infections: 1894; Bd. 16; p. 368.
Monnier (a) records a case of general infection with broncho-pneumonia, purulent pleurisy and endocarditis. Harbitz (b) a typical acute pneumonia where the Bacillus pyocyaneus was present along with a Staphylococcus and Bact:coli commune. Gruber (c) shows that it may be present in pure culture in purulent inflammation of the middle ear. Many other cases might be mentioned, but in the literature I have not been able to find any case where bronchitis was ascribed to this bacillus.

The bacilli, however, were so numerous in the cover-glass preparations of cases Nos. 26, 49 and 60 as to warrant the assumption that the bacilli in these three cases (and possibly also in case No. 44) had acted along with the other bacteria which were found as causal agents in the production of the bronchitis.

There are two other explanations which might be advanced to account for the presence of the Bac: pyocyaneus, but they are hardly so satisfactory.

The first is that the bacilli are merely present as saprophytes in the diseased bronchial tubes, the second is that they originated from the intestinal tract post mortem, where, according to Kanthack (d),

(a) Monnier: La semaine médicale 1895, p. 382.
(b) Harbitz: Reference in Baumgarten's Jahresbericht, 1895, p. 51
(c) Gruber: Monatschr. für Ohrenheilk: 1887, p. 145
they are often present both in healthy and sick people. This assertion is, however, not in conformity with the view generally held as regards the distribution of the *Bacillus pyocyaneus*; and I think it is more probable that the bacillus entered the bronchi from the air rather than from the intestinal tract.

IX. Capsuled bacilli. Bacilli belonging to this group were found in three cases, Nos. 14, 38 & 40. In Case No. 38, they were in pure culture except for bacilli of the Coli group. It is, however, possible that they were not the sole bacteriological factor in producing the inflammation, for, 25 hours elapsed between death and the post mortem examination, and bacteria which quickly lose their vitality might also have been present intra vitam.

Case No. 40 seems to have been one of joint infection by these bacilli and streptococci; and Case No. 14 one of infection by at least four different forms of bacteria, one of these being the Capsuled bacillus.

Little or nothing need be said of the remaining bacteria, which were found in the cases; they were either saprophytic micro-organisms, or else only present in scanty amount on the cultures, and have little or no aetiological significance.
There is little further remaining to be said. It is of course quite possible that in some cases of acute bronchitis, it is not bacteria which are the exciting cause. I have, however, shown that even post mortem in practically every case of acute bronchitis, in contradistinction to healthy bronchi, there were numerous pathogenic bacteria in the bronchi. The inference to be drawn from this fact is that, as in inflammatory processes of other parts of the body, bacteria are practically speaking the exciting cause of acute bronchitis.

It is of course improbable that bacteria are the sole factors in the causation of the disease. As in the case of pneumonia, the various predisposing causes, no doubt, also play an important part. This question, however, lies beyond the scope of my thesis.

In conclusion, to summarise the results of the examinations:

1. Various bacteria are found in the bronchial secretion in cases of acute bronchitis in infants.

2. These bacteria are not the same in all cases.

3. Some of the bacteria are exciting causes of the existing bronchitis.

4. The infection is more frequently due to a joint action of two or more forms of bacteria than to one form alone.

5. The most important bacteria causing bronchitis are:
   a. The Diplococcus pneumoniae.
   b. The streptococci.
   c. The Influenza bacillus.