CHAPTER XIII.

INFLUENZA.

Bacillus Influenzæ (R. Pfeiffer[1]).

Notwithstanding a large number of bacteriologic examinations conducted for the purpose of determining the cause of influenza, it was not until 1892, after the great epidemic, that there was found simultaneously by Canon and Pfeiffer a bacterium which conformed, at least in large part, to the requirements of specificity.

The observers mentioned found the same organism—one in the blood of influenza patients, the other in the purulent bronchial discharges.

The specific organisms (Fig. 130) are bacilli, very small in size, having about the same diameter as the bacillus

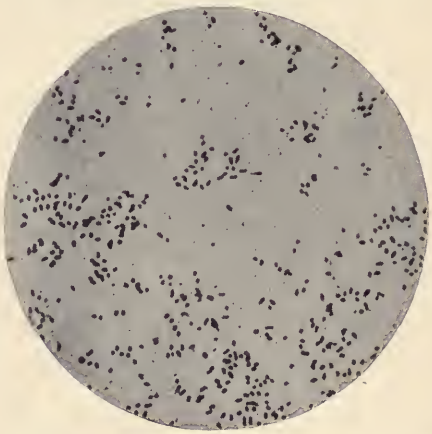

Fig. 130.—Bacillus influenzæ, from a gelatin culture; × 1000 (Itzerott and Niemann).

of mouse-septicemia, but only about half as long (0.2 by 0.5 μ). They are usually solitary, but may be united in chains of three or four elements. They stain rather

[1] *Deutsche med. Wochenschrift*, 1892, 2; *Zeitschrift für Hygiene*, 13.

poorly, except with such concentrated penetrating stains as carbol-fuchsin and Löffler's alkaline methylene blue, and even with these the bacilli stain more deeply at the ends than in the middle, so that they appear not a little like diplococci.

For the demonstration of the bacilli in the blood Canon recommends a rather complicated method. The blood is spread upon clean cover-glasses in the usual way, thoroughly dried, and then fixed by immersion in absolute alcohol for five minutes. The stain which seems best is Czenzynke's:

Concentrated aqueous solution of methylene blue,	40;
0.5 per cent. solution of eosin in 70 per cent. alcohol,	20;
Distilled water,	40.

The cover-glasses are immersed in this solution, and kept in the incubator for three to six hours, after which they are washed in water, dried, and then mounted in Canada balsam. By this method the erythrocytes are stained red, the leucocytes blue, and the bacillus, which is also blue, appears as a short rod or often as a dumb-bell.

Sometimes large numbers of the bacilli are present; sometimes very few can be found after prolonged search. They are often enclosed within the leucocytes. It really is not necessary to pursue so tedious a staining method for demonstrating the bacilli, for they stain quite well by ordinary methods. They do not stain by Gram's method.

The bacillus is non-motile, and, so far as is known, does not form spores. Its resisting powers are very restricted, as it speedily succumbs to drying, and is certainly killed by an exposure to a temperature of 60° C. for five minutes. It will not grow at any temperature below 28° C.

The bacillus does not grow in gelatin or upon ordinary agar-agar. Upon glycerin agar-agar, after twenty-four hours in the incubator, minute colorless, transparent,

drop-like cultures may be seen along the line of inoculation. They do not look unlike condensed moisture, and Kitasato makes a special point of the fact that the colonies never become confluent. The colonies may at times be so small as to require a lens for their discovery.

In bouillon a scant development occurs, small whitish particles appearing upon the surface, subsequently sinking to the bottom and causing a "woolly" deposit there. While the growth is so delicate in these ordinary media, the bacillus grows quite well upon culture-media containing hemoglobin or blood, and can be transferred from culture to culture many times before it loses its vitality.

FIG. 131.—Bacillus of influenza; colonies on blood agar-agar; low magnifying power (Pfeiffer).

It cannot be positively proven that this bacillus is the cause of influenza, but from the fact that the bacillus can be found only in cases of influenza, that its presence corresponds with the course of the disease in that it is present as long as the purulent secretions last, and then disappears, and that Pfeiffer was able to demonstrate its presence in all cases of uncomplicated influenza, his conclusion that the bacillus is specific is certainly justifiable.

The bacillus is pathogenic for certain of the laboratory animals, the guinea-pig in particular being subject to fatal infection. The dose required to cause death of a guinea-pig varies considerably, in the immunization experiments of Deline and Kole[1] $\frac{1}{20}$ of a 24-hour old culture being fatal in twenty-four hours. They found that the toxicity of the culture does not depend upon a soluble toxin, but in something retained in the bodies of the bacilli. The outcome of the researches, which

FIG. 132.—Bacillus of influenza; cover-glass preparation of sputum from a case of influenza, showing the bacilli in leukocytes; highly magnified (Pfeiffer).

were made most scientifically and painstakingly, was the total failure to produce immunity. Increasing doses of the cultures injected into the peritoneum resulted in enabling the animals to resist rather more than a fatal dose, but never enabled them to maintain vitality when large doses were administered. This discovery is in exact harmony with the familiar clinical observation that, instead of an individual being immune after an attack of influenza, he is as susceptible as before, if not more so.

[1] *Zeitschrift für Hygiene*, etc., Bd. xxiv., 1897, Heft. 2.

A. Catanni, Jr.[1] trephined rabbits and injected influenza toxin into their brains, at the same time trephining control-animals, into some of whose brains he injected water. The results were that animals thus receiving 0.5–1 mgr. of the living culture constantly died in twenty-four hours with all the nervous symptoms of the disease, dyspnea, paralysis beginning in the posterior extremities and extending over the whole body, clonic convulsions, stiffness of the neck, etc. Control-animals injected with a variety of pathogenic bacteria in the same manner never manifested similar symptoms. The virulence of the bacillus was also observed to increase rapidly when transplanted from brain to brain.

Wynekoop[2] has successfully employed, for diagnosticating influenza and isolating the bacillus, a culture-outfit similar to that used for diphtheria-diagnosis, except that the serum contains more hemoglobin. The swab is used to secure secretions from the pharynx and tonsils, and from the bronchial secretions of patients with influenza, then rubbed over the blood-serum. In many such cultures the minute colonies corresponding to those of the influenza bacillus were found. Those most isolated were picked up with a wire and transplanted to bouillon, from which fresh blood-serum was inoculated and pure cultures secured.

Carbol-fuchsin was found most useful for staining the bacilli. An interesting observation made by Wynekoop was that influenza and diphtheria bacilli sometimes coexist in the throat, and that influenza bacilli are present in the sore-eyes of those in the midst of household epidemics of influenza.

[1] *Zeitschrift für Hygiene*, etc., 1896, Bd. xxiii.

[2] *Bureau and Division Reports*, Department of Health, City of Chicago, Jan., 1899.