A DESCRIPTION

OF

A NEW PATHOGENIC MICROBE OF SEWAGE :
BACILLUS PYOGENES CLOACINUS.

By E. KLEIN, M.D., F.R.S.,

OCCURRENCE.

THIS microbe was isolated in pure culture from the purulent peritoneal and pleural exudations of a guinea-pig that died 48 hours after subcutaneous injection of a small amount of the deposit of fresh sewage; also from the subcutaneous abscess of this and the companion guinea-pig injected at the same time. The above purulent exudations, as also the pus of the abscess, were crowded with the microbe, either free in the fluid or enclosed in groups within the substance of the pus cells, some of the pus cells, packed with the bacilli, being swollen and disintegrating.

Morphology.—The microbe is a minute bacillus, the average length varying between 0.6μ and 1.25μ , few are longer, cylindrical, and in chains; its thickness is about 0.4μ . The thickness of the microbe in culture is a little larger than in the purulent matter. It is a non-motile bacillus; no movement can be seen in the hanging drop, although on staining for flagella, after van Ermengem's method, here and there a bacillus is found exhibiting at one end one short spiral filament. The microbe stains slightly in Gram (1 minute in gentian violet aniline water, 4 minutes in iodine iodide of potassium).

CULTURAL CHARACTERS.

In gelatine plates kept at 20° to 21° C. the first traces of growth show themselves after forty-eight hours in the form of grey translucent round dots; these enlarge slowly, forming circular flat discs, slightly thicker in the centre than at the margin. After a fortnight, that is, when fully developed, the colonies measure only $\frac{1}{2}$ to 1 mm. in width; they are grey translucent.

In gelatine streak the growth is grey translucent; when growth is complete, say, after two to three weeks, it shows under a magnifying glass a thicker knobby centre and a thin translucent margin, the breadth of the streak is not more than $1\frac{1}{2}$ to 2 mm.

In gelatine stab the track of the needle becomes marked as a thin whitish line, which under a magnifying glass is seen composed of closely-placed minute droplets; on the surface of the stab a circumscribed flat grey expansion is just noticeable with the unaided eye. The gelatine is not liquefied after weeks and months. On the agar surface the colonies are translucent grey, moist, viscid discs; in agar streak translucent grey viscid bands; in agar stab (37° C.) the growth is like that in gelatine stab, except that at the surface of the stab there is a circular distinct plate-like expansion of the growth.

In alkaline beef broth kept at 37° C. the growth is rapid; the broth is slightly turbid already after twenty-four hours, but after several days the broth clears and shows numerous fine granules along the sides and a powdery precipitate at the bottom of the tube. The broth, even after growth is completed, has a distinctly alkaline reaction; no indol is produced. The microbe grows well in litmus milk and in milk without altering either the litmus or the fluid condition, reaction, and aspect of the milk.

In shake culture in ordinary gelatine or in grape sugar gelatine it produces no gas; it grows very feebly in the depth of the gelatine. On potato no growth is visible or demonstrable by microscopic specimens. The microbe does not grow on acid media, and in fluid media distinctly produces alkali. Neither the pus of the abscess nor the purulent exudations nor any of the cultures have any smell.

ACTION ON ANIMALS.

The microbe, when injected in minute doses, is pathogenic. Small doses—even a portion of one colony—cause disease in the guinea-pig. When injected subcutaneously into the groin in the majority of instances only a local abscess is the result; this commences as a small tumour a day or two after the injection; this enlarges, and soon becomes changed in the

course of two or three days into an abscess, from the size of a bean to that of a hazel nut, filled with creamy thick pus. Under the microscope the fluid contains an abundance of the bacilli as single individuals, or more frequently as dumbbells, some few are cylindrical and some in chains. Many of the pus cells contain the bacilli, occasionally their protoplasm being packed with the bacilli. Some pus cells are greatly swollen by the number of bacilli, and eventually disintegrate, so that the groups and clumps of the bacilli become free. In a large minority of instances, however, the result of subcutaneous injection is, besides the local abscess, general disease, ending fatally in three to four days; purulent peritonitis, with pyogenic membranes covering the liver, spleen, and kidney; purulent pericarditis, the pericardial cavity being filled with grumous pus; purulent pleuritis, with pyogenic membranes and solid lymph in the mediastinum, the lungs deeply coloured and partially collapsed. Under the microscope the fluid is densely crowded with the bacilli, many pus cells contain in their protoplasm smaller or larger numbers of the bacilli, some completely filled with them, swollen, and in the process of disintegration.

When the result of inoculation is a local abscess only no bacilli can be found in the blood, but when it is a general purulent inflammation of the serous membranes, the blood of the heart and of the viscera, spleen particularly, contains an abundance of the microbe.

Injection of minute doses into the peritoneal cavity of guinea-pigs leads to fatal result within twenty to twenty-four hours. On *post-mortem* examination purulent peritonitis, with pyogenic membranes on the liver, spleen, diaphragm, and kidney, and inflammation of the small intestine, occasionally pleural and pericardial exudation are also present.

In the mouse subcutaneous injection of the culture in small doses causes general septicæmic infection, the blood of the heart and of the viscera teeming with the microbe, the viscera of the abdomen and thorax being greatly congested.

In the rabbit no pathogenic effect is produced either locally or generally.

From these observations, both as to cultural characters and as to the result of animal experiments, it is clear that our microbe is distinct from Passet's bacillus pyogenes fetidus, as also from Bolton's bacillus pyogenes soli. Culturally it resembles to a certain extent the bacillus suisepitici (German *Schweineseuche*) of Loeffler and Schütz, but the action of this latter on rodents is altogether of a different nature from that described above of our microbe. On account of its derivation from sewage and its conspicuous pyogenic action, I propose for it the name "bacillus pyogenes cloacinus."

REMARKS

ON

PLASTIC OR CROUPOUS BRONCHITIS.

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PLASTIC bronchitis is an affection which comes within the observation of few medical men. So rare is the illness that many physicians holding hospital appointments pass through their term of office without seeing a case. Within the last few months it has been my fortune to see two patients suffering from this uncommon malady. At *post-mortem* examinations of croupous pneumonia I have occasionally seen some of the bronchi occupied by firm fibrinous plugs, but in the patients whose notes are subjoined the illness is in no way associated with either pneumonia or tracheal croup. The cases are illustrations of plastic bronchitis, an illness whose pathology has yet to be written, since it falls to the lot of even the few fortunate physicians who meet with it seldom to see more than one or two cases. It is this circumstance that explains our rather scanty knowledge of the illness. From the photographs which accompany this paper an opinion can be readily formed as to the seat of formation of the casts. In neither patient was the larynx or trachea the least affected. Presumably therefore plastic bronchitis has nothing whatever to do with croupous laryngitis or diphtheria.

CASE I.—L. E., aged 47, a coal miner, was sent to me by Mr. Ingram-Johnson, of South Moor, on January 14th, 1899, suffering from recurrent