

absent, or present only in a few bacilli on the slide. If care be taken not to stain too heavily, or to remove excessive stain with alcohol very carefully, the peculiarity may be demonstrated. In smears it often occurs in pairs. It does not stain by the method of Gram. In broth, it generally occurs in chains of very short coccobacilli, which have almost the appearance of a chain of streptococci. In old cultures, especially those on dry agar, involution forms readily occur. These are large organisms of various distorted shapes, and frequently stain very indistinctly. The formation of these involution forms is very characteristic.

Effect on Animals.

In guinea-pigs and rats death generally occurs in from three to five days, although my older cultures have taken as long as eight and even ten days to cause death in the guinea-pig, and fully seven days in the rat. This is when a small quantity of culture or of infected material is inserted by means of a needle in a "pocket" underneath the skin.

The symptoms exhibited are not very characteristic. Generally in from twenty-four to thirty-six hours after inoculation, the animal shows signs of febrile disturbance, refuses food, or eats but daintily, and a slight swelling of the nearest lymphatic gland becomes evident. A catarrhal discharge from the eyes is generally present. At times a slight recovery may take place (in the case of the West Coast bacillus, with guinea-pigs, always) to be followed by a relapse with prostration and paralysis of the affected limb. Towards the end, convulsive paroxysms may be evinced, and at times the animal may be found after death presenting the appearance of having succumbed in a paroxysm of pain.

Post-mortem Appearances.

Rats.—Lymphatic gland above seat of inoculation is enlarged, and inflamed with œdema of the surrounding tissues. The alimentary canal may show a few hæmorrhagic spots. The spleen is generally dark, and is frequently enlarged, but by no means invariably so. The liver is often congested. The lungs are generally healthy, with the exception of patches of metastatic congestion. I have never found, in the many rats with which I have experimented, true pneumonia as a result of plague.

Guinea-pigs.—Lymphatic gland above seat of inoculation enlarged to four or five times its usual size, and inflamed, the surrounding tissues being also inflamed and more or less œdematous. The other lymphatic glands are also frequently enlarged. The intestines may be slightly congested, and exhibit petechiae, but are generally normal. The spleen, if death is delayed after three days from inoculation, is swollen to an enormous extent, with greyish-white, more or less circular patches, varying from the size of a pin-head to a millet-seed, showing up against the dark substance of the congested spleen. If death occurs before three days, the spleen will be found enlarged, and dark in colour, but not mottled. The liver is generally congested, and frequently presents a few greyish-white points similar to those in the mottled spleen, generally about the size of a pin-head. The lungs, if death occurs before five or six days after inoculation, are, in my experience, always normal, or practically so. Later, pneumonia, affecting more frequently the base of the lung occurs, with a few greyish-white areas of degeneration, as in the spleen.

The attached reproduction of a beautiful drawing in colour by Mr. H. C. Wilkie, F.R.C.V.S., of a guinea-pig, which succumbed in seven days and a half after inoculation, will convey more to the reader than any description that could be given by the pen, as it is an exact representation of what may be seen on *post mortem*. Moreover, I believe that such lesions are absolutely characteristic alone of plague infection in the guinea-pig. In tuberculosis of the guinea-pig, it is true, there is also a mottled spleen, but it is not produced nearly so rapidly. Besides which, in tubercle, there are other great distinctions, such as the infection of the lymphatic system and other general appearances which no one could mistake.

Location of the Bacilli.

In the affected gland (bubo), and in the spleen they are present in enormous numbers, so much so that a thin smearing has almost the appearance of a smear from a pure culture under the microscope. In the spleen of the rat they are generally fewer in numbers comparatively than in that of the guinea-pig, where the whitish patches consist almost solely of bacilli. The liver generally contains a large number. The blood at the time of death may contain, as in guinea-pig No. 3, very large numbers, but usually there are comparatively few present. Microscopical examination alone will often fail to discover any, and even inoculation of media by the needle may not succeed in disclosing the presence of any; but if a drop from the Pasteur pipette be distributed evenly over the whole surface of an agar plate it will be found to contain from fifty to two hundred bacilli, even when none may have been detected in the smears.

Cultures.

On solidified blood-serum the bacillus grows as very small separate colonies almost transparent, and if streak cultures are made it shows in a narrow streak with irregular borders. On agar agar media, it appears as very small, circular, moist-looking, semi-transparent colonies, after a lapse of thirty-six hours from the time of inoculation from an affected organ. If very careful examination of a tube be made at twenty to twenty-four hours after inoculation, small, almost completely transparent points may be distinguished, but even if present they are generally overlooked. Sub-cultures grow much more readily and definitely than first cultures, and show as a narrow streak with irregular borders. If the culture be pure, the liquid of condensation at the bottom of the tube remains clear, but on the surface of this liquid a thin pellicle may be seen which is easily precipitated, and at the bottom and sides there is generally a slight growth. After the lapse of four or five days, if left at a suitable temperature, many of the colonies become less readily distinguishable, while thick