

al, and especially the surrounding glands, end by being invaded by an enormous number of the rod-shaped organisms: the insect loses its vivacity, grows languid, and finally perishes after a more or less protracted interval.

Virulent granulations cultivated in salt veal-broth or on plaies of glycerated Agar-Agar produce bacillary bacteria, which, when given in food to the larvæ, undergo in their turn segmentation into virulent granulations, whereas in the case of the adult bees they still probably retain the bacillar form for a long time, though they do not fail in the end to cause its death.

The culture and transformations of the foul-brood bacterium cannot take place in the honey; so much is certain. Still, I may mention that in diseased hives the honey and wax are always more or less infected on the surface by bacilli, virulent granulations, excrements &c.

I have on several occasions succeeded in reproducing the whole series of phenomena mentioned above experimentally, and have, without difficulty, infected insects which had been perfectly healthy and vigorous up to the moment of the experiment. My mind is, therefore, quite free from doubt in the matter. It is the adult bee which is first infected in its digestive canal by a foul-brood bacterium obtained from some unknown source. In feeding the larvæ it infects in its turn the digestive tube of this latter, and here, owing to the action of the albumenoids, the bacillar bacteria are transformed into virulent granulations, which invade the tissues and finally bring about the death of the insect.

Contaminated honey may be a cause of the propagation of foul-brood in the sense that, being polluted by foul-brood bacteria or by virulent granulations, the healthy adult bee which allows this substance to enter its digestive canal is rapidly attacked by the disease, and will even itself soon communicate the infection to the brood. Experiment in such cases gives the most convincing results. Still, in the case of foul brood, as in the case of virulent affections which attack vertebrate animals, certain individuals seem to enjoy exceptional immunity, and resist the infection. Is this due to previous inoculations, or to some individual predisposition? This is a point which I am not at present prepared to decide.

I had only once an opportunity of examining the queen of a hive infected with foul brood, the property of M. Matthey, of Bassins.\* The eggs of this insect were healthy, and contained neither bacilli nor virulent granulations. The queen herself was perfectly healthy, a point which I was able to place beyond a doubt by

means of a careful post-mortem. I hesitate to draw any conclusions from this isolated instance, though I confess that, judging from the course the disease takes, I do not believe that, as a rule, the malady can be propagated by the rearing of larvæ produced from infected eggs.

In my opinion, therefore, it is always the digestive canal of the nurse-bee which is infected, and it is always by the act of feeding that the adult bee infects the digestive canal of the larvæ, the death of which latter is the speedy result of such inoculation.

Therefore a knowledge of the above facts leads me to the following conclusions:—

1. The bacteria of the third form described, as already shown by Mr. Cheshire, are in effect the true cause of foul brood. They are the active agents of contagion and of the propagation of the disease. Numerous laboratory experiments, too long to be described here, prove this beyond the shadow of a doubt.

2. Seeing that the foul brood bacteria must necessarily kill all brood the digestive canal of which is inoculated by the act of feeding, it appears to be absolutely useless to endeavor to cure these larvæ, as all their tissues are rapidly invaded by the virulent granulations\* into which these bacteria resolve themselves.

3. Adult bees, whose digestive canal is infected by the foul-brood bacteria may frequently survive for a considerable period. Some even, owing to special circumstances, seem to resist the virulent stage of the malady. We must therefore direct our efforts to the digestive canal of the worker-bees, the feeders of the queen, if we desire to attack at its source the evil which may spread with lightning rapidity among the rising generation of larvæ, which is the sole hope of the colony.

- IV. The treatment, then, ought to be internal and as energetic as our little patients are willing to allow. External treatment, by means of fumigations or sprayings of any kind, are (I do not for one moment deny) also helpful, since these methods contribute largely to the disinfection of the hives, combs, and tissues of the bees, &c. It is even possible, under certain circumstances, to succeed in diminishing the virulence possessed by the bodies of the larvae after death during the process of desiccation. But I must repeat that such external treatment can only be useful

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\*I employ the word granulations purposely in preference to the term *spores*, which is used by several writers. I cannot bring myself to believe that true sporulation, similar to that observed under certain conditions in bacteria or anthrax and in that of blood from spleen, really takes place in foul brood.