

early in the spring, that he transferred them into new hives, and boiled the old ones. He made new frames, taking a great deal of pains not to let the bees get any of the honey, but made up the beeswax into foundation, and after they got well filled with brood, he found it worse than at first in every colony. He is satisfied that it was carried in the wax."

On this letter the editor makes the following comments: "There is not a possibility of foul brood being contracted by using foundation made from foul-broody combs. It is sheer nonsense, to say the least, to suppose that infection was eradicated, when your friend 'boiled' the old hives, if it would linger in the foundation after the several boiling processes necessary to transform the comb into a perfect sheet."

But even this vigorous reply does not silence Dr. Butler; he writes again in this way: "If we could heat to the same point, 212°, there would be none of the foul brood germs left in it, but it is almost impossible to do it. I render all mine under glass, in my honey tank, at about 150° or 160°, and could melt my wax and make foundation in summer time, never using fire heat, if I wanted to; so for one I do not want any foundation made from foul broody wax."

At a convention of bee-keepers, held in Michigan, Mr. D. A. Jones, the bee-king of Canada, said: "Wax rendered by the solar wax extractor may possibly contain foul brood germs, but the heat necessary in making foundation is great enough to destroy the germs of foul brood."

In a paper read by Dr. A. B. Mason, at the S. E. Michigan convention in 1884, when referring to the case of a bee-keeper in whose apiary foul brood had broken out in a new part of the country where there was no known cause for it, the Dr. said: "I asked him if he had ever bought and used foundation. He said he had. I then asked him if he had the disease in his apiary before or after getting the foundation. He said after."

The foregoing opinions, though sometimes stated quite positively, are to be taken only as what is believed to be the case, and not as statements of well ascertained facts. In considering the matter, the following queries may occur to the thoughtful student, and these queries I have attempted to answer by giving selections from the writings of the best scientific authorities.

The reader will bear in mind that there is the same kind of difference between what is termed "simple vegetative organisms," the "fully developed bacterium," the "adult organisms," the "finished organisms" and

their spores or seeds, that there is between the fully developed vegetable and the tiny seed from which it grew.

He will bear in mind, too, that "the death point of bacteria is the maximum temperature at which they can live, or the minimum temperature at which they cease to live."

Query 1.—What is the death point of the most resistant of the fully developed bacteria?

"The fully developed bacterium is demonstrably killed by a temperature of 140°."—*Tyndal*.

"It appears to be very generally held that the simple vegetative organisms are deprived of life at a temperature as high as 140°."—*Huxley*.

Query 2.—How does the death point of spores compare with that of the fully developed bacterium?

"By the excellent researches of Dallinger and Drysdale, it has been proved that germs, as compared with adult organisms, possess a power of resistance to heat in the proportion of 11 to 6."—*Tyndal*.

Query 3.—Is the death point of spores affected by their condition as to dryness or moisture? If so, how?

"It appears that in a dry state these germs are able to bear far greater extremes of heat and cold than in the moist condition. Pasteur found that the spores of fungi could be exposed, without destruction, to a temperature of 248° to 257° while the same spores when moist were killed by an exposure to 212°."—*Huxley*.

"Now as regards the death point of contagion we know that in air it may be much higher than in water, the self-same temperature being fatal in the latter, and sensibly harmless in the former."—*Tyndal*.

Query 4.—What are the necessary conditions for the germination of spores?

"Heat and moisture are the requisite conditions for the germination of spores."—*Trouessart*.

"Water is absolutely necessary for the life and growth of schizomycetes." (bacteria).—*Ward*.

Query 5.—Are spores of all bacteria equally resistant to the effects of heat?

"Some seeds (ordinary plant seeds) are killed by the briefest exposure to the boiling temperature, while others withstand it for hours. The germs of the air vary as much among themselves as the seeds of the botanist."—*Tyndal*.

"It is not very easy to say exactly what the limits of temperature are, as they appear to vary in part with the kinds of living matter, and in part with the conditions of moisture which obtain along with the temperature."—*Huxley*.

Query 6.—What is the explanation of the fact