

objects is to have an evenly filled section, and to have a perfect alignment of cells and not an irregular comb. Of course, as stated by my correspondent here, it is to furnish the material and in that way save time and energy which the bees could utilize in the production and storing of honey. But you see this makes the question a very much broader one, and with regard to those points, it is not one upon which chemistry can throw any light. The only solution to the problem, as far as chemistry is concerned, must be in regard to the economy of furnishing material and in ascertaining if there are any differences in the ductility of the different waxes. I want to state this matter fully and plainly to show you where I am, and also that I may, just at the close of these brief remarks, have a discussion which will do me good in prosecuting this study in the future, because I wish to be upon the right line. In my estimation, if my work is to be of any value to you, it is necessary I should be put in possession of all facts and theories in regard to the matter so that our work may be initiated upon correct lines.

The details of the third year's work are tabulated and in the main they corroborate those of the two previous years. We found again that those foundations which were, as I may term them, extremely light, required a larger amount of wax to be added to them by the bees; and we found those foundations which were heavier required the least amount to be added. There are one or two points in connection with that; one, I wished to ascertain if when a heavy foundation was supplied to the bees they continued to build it heavy, or if they utilized that extra amount of wax that they were furnished with to build up the cells. It seems, from my work, that after a certain height in the cell is reached that they do not touch the bottom wax at all, that they do continue building that cell wall moderately heavy, if a heavy foundation comb has been furnished them; but I make this deduction: after a certain height in a cell wall is reached they no longer (and it stands to reason) can utilize the wax that is furnished to them. That is very well brought out by using one of these inferior and darkly colored foundation combs, and you can very readily trace in the empty comb which has been carefully cleared, where new wax has been added, and you can see the height of the cell wall to which the original foundation has been drawn from that fact, that there would be no object in supplying a very large amount of wax be-

cause it could not be utilized by the bees and it would only render a hard thick fish-bone in the finished comb, so that there is a limit. You must understand that although these results point to the advantage and economy and the profit of supplying a moderately heavy foundation comb, yet you must not push that argument too far; there are limits where it is no longer economical to supply an extra amount of wax because it cannot possibly be utilized by the bees and only remains there and destroys the salability of the finished product.

In the third year of the investigation we carefully removed each cap separately and then placed the full honey comb in successive quantities of water, until we had completely dissolved out all the honey and then we allowed it to dry. Then I thought probably I should arrive at some useful data with regard to the relative ductility of the wax, and if we could shave off all the superstructure and leave what remained of the foundation and if I weighed that as compared with the same area of foundations which was supplied to the bees, I thought I should have some data which would allow me to draw a conclusion as to the relative ductility of different foundations. I did think, but I confess I met with great difficulties, because the foundation was not all on one plan and consequently it was impossible to so cut the foundation as to leave nothing but the foundation and none of the cell walls; if I was to shave off all the cell walls in one part I should cut through the foundation in another. The matter was done, however, with the greatest care and all possible accuracy and the results have been obtained and are tabulated, so that now we have not only the weight in grammes of the foundation supplied, but we have the amount in grammes of the foundation which has been removed by the bees from these various brands. There is a very interesting table of per centages in that respect. We found that some waxes were utilized to the extent of fifty per cent; that is to say, one-half the wax supplied them in the foundation was utilized in cell wall structure; we found in other foundation that only seven per cent. of the wax furnished them in the foundation was utilized in building cell walls.

Mr. Holtermann—Were those specimens drawn out during the same honey flow?

Prof. Shutt—Personally I cannot vouch for that, but I can tell you this, they were taken out of the same hive at the same time and put in at the same time.