n these clusters. Should the season prove unfavorable the bees would remain in clusters all the season, through the winter into the following spring. and still the temperature of the hive would not be effected to any appreciable extent by the colony of bees in it.

Bees for protection against cold cluster between their combs and form heat centers in which they carry on their work most of the year, and they retain their heat in these centers to a surprising extent. Langstroth found patches of brood in the centre of the clusters when the thermometer stood at 30 deg. below Zero., and he says that a strong colony is never without brood. If we turn back quilts of a strong colony in mid-winter we will find no heat in the hive. It is only when the bees makes the whole hive a heat centre that the hive and the bees come to be at the same temperature, and this period of uniform temperature in the hive, in our climate, does not last over four or five months in the year—in the strongest colonies.

Bees clustering between combs to form heat centres in which to maintain their existence is analogous to cosmic bodies clustering and aggregating in stellar space to form heat centres for the maintenance and perpetuation of all life. Our sun is a heat centre formed in that way. It is said "that a pebble thrown by the hand of a child, and a world launched into space by the Creator are governed by the same laws, and the same rules are required to calculate their path."

As the science of astronomy is comprised in the laws of gravitation, the science of apiculture is embraced in the laws of bee clusters, and works in bee-keeping should commence with a description of bee clusters, their properties, their laws and their relation to latitude and climate. The analysis of bee clusters is the key to the whole science of apiculture as gravitation is to astronomy.

Kepler found that that the ratio of squares and cubes determined the distances of the planets and their periodic times but long before Kepler's day the bees found that the very same ratio i.e. the proportion of volume to surface would enable them in clusters, to survive the winter. They found that as they increased the size of their clusters the radiating and cooling surfaces proportionally diminished, and if they made their clusters large enough and the cooling areas small enough, and they could find food to eat, they could defy the "freezing bitter sky." They found that the loss of heat from their clusters was inversely as their diameters, and that an eight-inch cluster had twice the advantage of a four-inch cluster in retaining its heat, and a four-inch cluster four times the advantage of a one-inch cluster, but for reasons, to be adduced hereafter, the larger clusters will be shown to have a much greater advantage.

After the bees solved the wintering problem the solitary wintering queen bee became a clustering colony of wintering bees, and their capacity for storing honey became increased a hundred fold. Whether the increased knowledge of the bees has been to their advantage or not the evolutionists will have to decide; the former are still being killed for knowing too much about ratios—martyrs to knowledge more profound than that of their owners.

The old bee-keepers with their straw skeps, found out that two colonies united for wintering would consume less than even one colony. They did not understand this, but as they increased the size of the clusters by adding more bees, the loss of heat