

Bees and Math

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Bees...by virtue of a certain geometrical forethought...know that the hexagon is greater than the square and the triangle, and will hold more honey for the same expenditure of material. — Pappus of Alexandria

Bees have not studied tessellations theory. However, some of their behavior patterns can be explained mathematically. One such phenomena which mother nature instilled in the bee is the nature to use the least expenditure of energy and materials. The bees somehow know that the square, the triangle and the hexagon are the only three self-tessellating regular polygons. Of the three, the hexagon has the smallest perimeter for a given area. So, when bees are constructing hexagonal prism cells in the hive, they use less wax and do less work to enclose the same space than if tessellating space with prisms of square or triangular bases. The honeycomb walls are made up of cells which are 1/80 of an inch thick, yet can support 30 times their own weight. A honeycomb of 14.5"x8.8" can hold more than five pounds of honey. That also explains why they are so heavy. The bees are creating hexagonal prisms in three rhombic sections, and the walls of the cell meet at exactly 120 degree angles. What is even more amazing, is the fact that the bees work simultaneously on different sections forming a comb with no visible seams. It is built vertically downward, and the bees use parts of their bodies as measuring instruments. In fact, their heads act as plummets.

If you are totally fascinated with mother nature's creations, that is not all. The honeybee's ability to navigate is influenced by its built-in "compass." As it turns out, the bees' orientation is influenced by the Earth's magnetic field. They can detect minute fluctuations in the Earth's magnetic field which are only discernible to sensitive magnetometers. This explains why bees can build a new hive starting from different parts of the new area without any bee directing them. All the bees orient their new comb in the same direction as their old hive. Bees build the cell walls with a slope of 13° to make sure that the honey should not be running out before the tops are capped with wax domes. The honeybee gets its mathematical training via its genetic codes.
