Name(s)	Project Number
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Project Title

Why Are Honeycombs Hexagonal?

Abstract

Objectives/Goals
The purpose of this project is to investigate why honeycombs are hexagonal. My hypothesis is that honeycombs are hexagonal because hexagons require the least amount of wax for a given cell size and/or hexagons are the strongest shape.

Methods/Materials
The circumradius of each shape was first calculated. Using the circumradius, an array of 36 cells with same wall thickness and cell volume was designed in the program Blender. After 3D printing, the models were weighed and their strength tested using a push-pull force gauge.

Results
As predicted, the hexagon had the smallest total cell perimeter of all the models. Though the hexagon was not the strongest model, it had the greatest value of strength over perimeter of all cells so it is the strongest for a certain amount of material. It also had the greatest value of strength over weight.

Conclusions/Discussion
Of all the models, the hexagon uses the least amount of material, which is important because wax is time consuming to make. The hexagon model is also the strongest for a given amount of wax and a specific weight, which allows bees to create a lightweight, strong honeycomb. Overall, the hexagon is the optimum choice for a honeycomb.

Summary Statement

This project investigated the best cell shape for honeycombs to give highest strength that uses the least material.

Help Received

Testing the strength of the models required strength so my dad helped with the push-pull force gauge. I created models in Blender after my mom taught me how to use the software. The 3D printing course that I took at Cabrillo College taught me the basics of 3D printing.