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## Nest cells support heavy weights: bees and wasps



Hives of bees and wasps support heavy weights using hexagonal cells in offset positions.

### Biomimicry Taxonomy



Maintain physical integrity >  
Manage structural forces >  
Compression

### Biomimetic Application Ideas

Designs for buildings, packaging, and nanoscale products that utilize 120° angles to minimize

material use, construct ultra strong structures, create strong yet light packaging.

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## Summary

"The hexagonal cells of bees and wasps create an extraordinarily strong space-frame, in particular in the vertical bee comb with two cell layers back to back with half a cell's shift in the position to create a three-dimensional pyramidal structure. The extraordinary strength is exemplified by a comb 37 centimetres by 22.5 centimetres in size, which is made of 40 grams of wax but can contain about 1.8 kilograms of honey." (Pallasmaa 1995:81,101)

"A bees' honeycomb is one of the wonders of the world. Layer upon layer of hexagonal cells of identical size and shape are stacked together as precisely as if the bees had worked to a grid drawn on graph paper. But why should bees build hexagonal cells? Why should they not be square, like boxes, or circular?...As we have already noted, natural organization is economical, expending the least amount of energy and using the least material necessary for a task...Three-way junctions of 120° angles occur quite widely in nature, being the most economical angle for joining things together." (Foy and Oxford Scientific Films 1982:30)

## About the inspiring organism

Hymenoptera  
*Hymenoptera*

Organism/taxonomy data provided by:

Species 2000 & ITIS Catalogue of Life: 2008 Annual Checklist

## Bioinspired products and application ideas

**Application Ideas:** Designs for buildings, packaging, and nanoscale products that utilize 120° angles to minimize material use, construct ultra strong structures, create strong yet light packaging.

**Industrial Sector(s) interested in this strategy:** Architecture, packaging, nanotechnology, engineering, building

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## References

Pallasmaa, J. 1995. *Animal architecture*. Helsinki: Museum of Finnish Architecture. 126 p.

Foy, Sally; Oxford Scientific Films. 1982. *The Grand Design: Form and Colour in Animals*. Lingfield, Surrey, U.K.: BLA Publishing Limited for J.M.Dent & Sons Ltd, Aldine House, London. 238 p.