Self-organizing pattern formation on the combs of honey bee colonies

Summary. A characteristic pattern of brood, pollen, and honey develops on the combs of a honey bee colony, consisting of three distinct concentric regions - a central brood area, a surrounding rim of pollen, and a large peripheral region of honey. That the pattern is consistent and well-organized suggests its adaptive value for the colony, yet the mechanism of pattern formation has not been elucidated. Two hypotheses are presented. The blueprint (or template) hypothesis suggests that there are particular locations specified for the deposition of eggs, pollen and honey, i.e., the pattern develops as a consequence of the bees filling in the comb according to the orderly arrangement latent in the blueprint. An alternative is the "self-organization" hypothesis: pat□tern emerges spontaneously from dynamic interactions among the processes of depositing and removing brood, pollen and honey, without a plan specifying spatial rela□tionships. Computer simulation of the self-organization hypothesis demonstrates how the colony-level pattern can emerge and how, using only local cues and simple behavioral rules, the bees can create an overall, global pattern of which they have no concept.