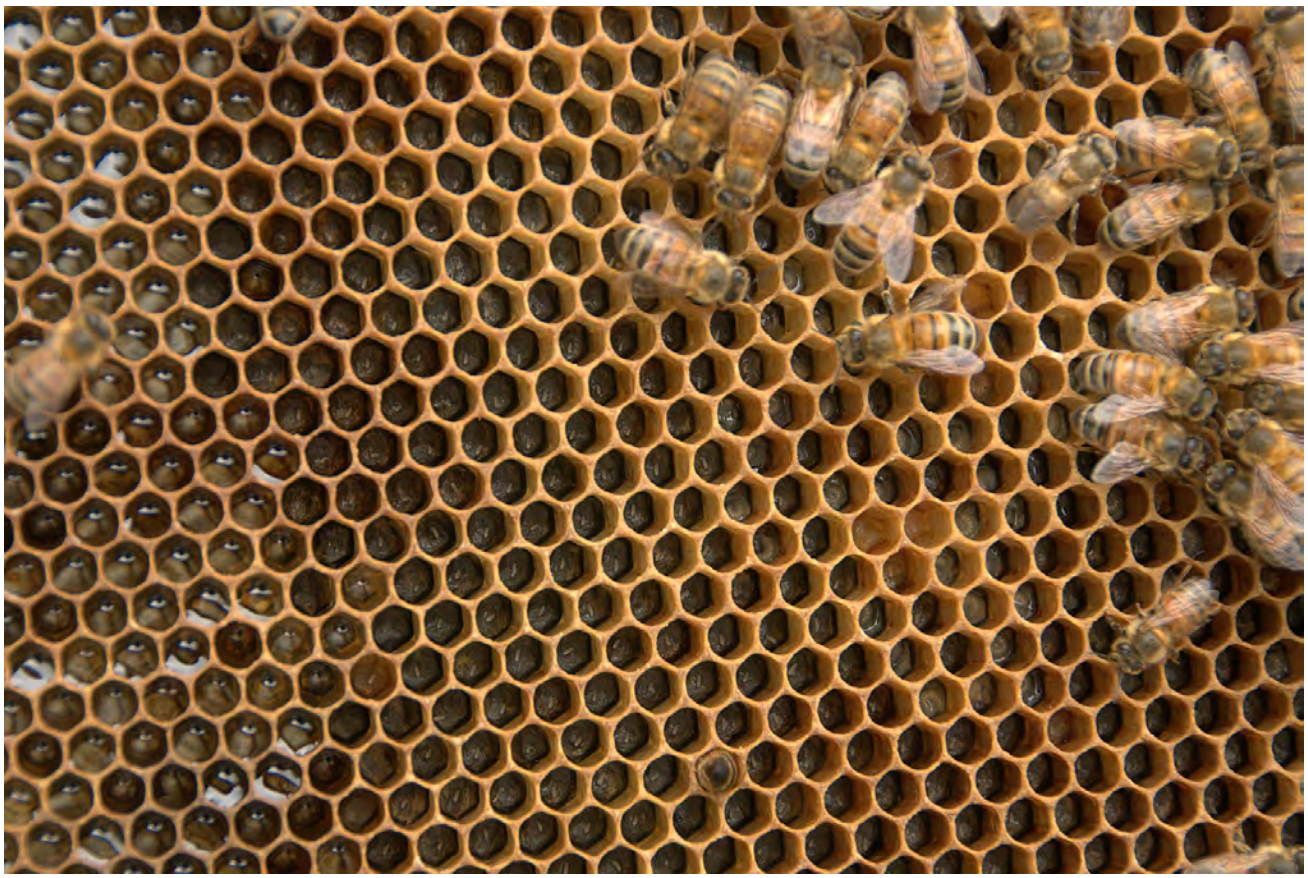

Mortality

Late fall is full of metaphors about life and change. For a honeybee colony, it's a time of preparation for the long season ahead. Winter is really sleep, though some views look very much like death. Leaves break off. Trees go bare. Flowers vanish. Seen from outside, the hive is an oblong box, its small door dark and still when the world is cold.

An ear to the outside wall, however, can answer the question**:** sleep or death? It's quite a surprising observation, really **…** and one that a beekeeper can easily make at any time during the long months of dormancy. Is there sound / life **...** or is there silence?

Realize that honey to the honeybee is actually a solution for perpetual life in a land with predictably barren cycles. How can a colony of animals that gathers only floral nectar and pollen survive in a place where flowers burst forth every spring and summer, but go away for many months every year? How to live when the flowers disappear? How to stay warm? How to be ready with a full foraging force when spring erupts again in abundance?

Coordinated activity inside the hive during winter defines the reality of honeybee-colony-as-superorganism every bit as much as activity inside and outside the hive in spring and summer and early fall. Nothing much to *see* in the cold season, but anyone interested can always *hear* the constant hum of life inside. It's the buzz of the football-shaped winter cluster, as bees huddle together around queen and brood cells, drifting as needed within the stacked layers of their hive, staying always in touch with each other and with their honey comb. The sound comes from constant vibration of wing muscles, converting chemical energy stored in honey into kinetic energy, but now giving heat instead of flight.

During the warmer seasons, constant turnover conceals the high mortality rate of individual bees. In spring and summer, each foraging bee leaving the hive is dead and gone 3 weeks later. This reality is masked by incessant egg-laying, feeding, and production of new foragers, which are added by the hundreds daily at times. It's the overall total colony population that we see in spring and summer. In this regard, mortality of individual bees and their constant replacement is simply the cruel beauty secret of the colony's perpetual youth

Winter loss, however, can be catastrophic, exposing the truth about honeybees**:** *the entire colony is the relevant individual, the superorganism for which mortality is a meaningful term*. There is a critical mass of bees, a certain geometric organization of sufficient honeycomb, and a coordination of complex social interactions required for a colony to survive a winter season. When circumstances go awry - perhaps a winter too long or too cold for the available supply of honey or a winter cluster somehow losing physical contact with honey stores - cluster temperature begins to drop as the bees who serve as metabolic heaters fail. At a certain point, activity stops.

Silence.