

OR004*Social synchronization of activity rhythms and the temporal organization of honeybees***Taro Fuchikawa**, Moshe Nagari, Ada Eban-Rothschild, Guy Bloch

Temporal organization of activity may improve the coordination and efficiency of insect societies. Young honeybee workers typically perform in-hive activities such as brood care and therefore spend most of the time inside the dark and thermoregulated hive. Nevertheless, when removed from the hive they show circadian rhythms in locomotor activity and brain clock gene expression that are synchronized to the ambient day-night cycles. We examined the relative importance of social and light synchronization in free-foraging colonies by exposing young nest bees to conflicting social and photic environmental cycles. We established hives with conflicting information for photic (illumination regime) and social (forager activity) environmental cycles. To determine the phase relationships between the bee rhythms and these two conflicting environmental cycles we transferred bees from the hive to individual cages in constant lab conditions and monitored their locomotor activity. We found that: (1) the rhythms of foragers were synchronized to the hive entrance opening and closing cycle, (2) the rhythms of nurse-age bees that were housed in a cage adjacent to the observation hive were synchronized to the illumination regime, (3) the rhythms of nurses were similar to that of foragers in that the offset of activity was comparable to the time of hive entrance closing. In a complementary set of experiments we caged young bees in single- and double-mesh enclosures inside the hive. These experiments showed potent social synchronization even in bees deprived of direct contact with the brood or other bees. Together our results suggest that nest honeybees adjust their activity rhythms to environmental cycles through volatile, vibration, or microenvironmental cues related to forager activity. These findings are consistent with the hypothesis that the evolution of sociality in honeybees was associated with modifications in the circadian clock and its environmental regulation by social cues.