

## Work schedules impact sleep schedules in foraging honey bees

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### **Introduction:**

Shift-work tests humans' capacity to be flexible when scheduling both work and sleep. Honey bees (*Apis mellifera*) shift their foraging schedules depending on resource availability and are known to exhibit sleep behavior (Kaiser 1988). We hypothesized that bee sleep schedules may depend on timing of resource availability.

### **Methods:**

We transplanted two colonies on two separate dates in observation hives to a biological station devoid of native colonies and with limited natural food resources. We trained individually marked bees to forage for two days at a sugar solution feeder in the morning (6:45-9 AM) and examined behaviors suggestive of sleep (relative immobility, including states of immobility of the antennae) across a 24h period. We then shifted the bees' foraging period for two days to the late afternoon (4-7 PM) and reexamined sleep signs exhibited by the same bees across a second 24h period.

Foraging attempts were measured by numbers of bees that attempted to exit the hive (in trial 1).

### **Results:**

Although the numbers of observations of sleep signs exhibited by foragers did not differ between morning and afternoon treatments in either colony ( $P = .83$  &  $.60$ , matched-pairs analysis), the *timing* of sleep differed within bees.

No sleep was observed during periods of resource availability, but bees did sleep at other times of the day (and night, as expected).

Also, more bees attempted to forage by 9am when trained in the morning than in the afternoon (25 versus 15).

### **Conclusion:**

Shifting temporal availability of food resources shifted the sleep schedules of foraging honey bees, suggesting that plasticity in timing of foraging is matched by plasticity in timing of sleep. A correlation between resource availability and sleeping schedules demonstrates, for the first time, temporal plasticity of sleep under ecologically relevant conditions in an insect.

Kaiser, W. 1988. J. Comp. Phys.A. 163:565-584.