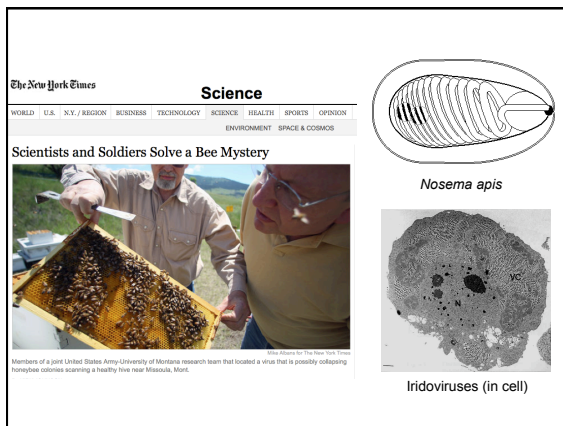


Bees in peril: pesticides and predators

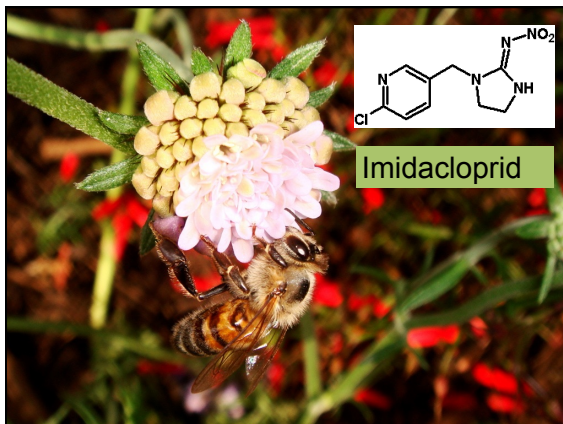
Eben Goodale
The Nieh Lab
UCSD



Are pesticides part of the problem?



Related to pesticide seed dressing?



Imidacloprid and its effects on honey bees

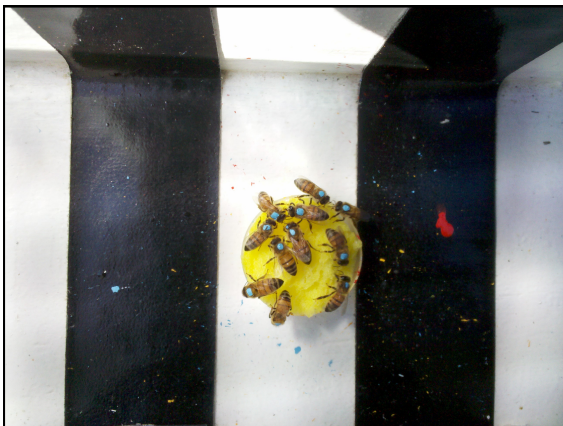
- We use very low doses of imidacloprid (0.216 and 2.16 ng/bee) compared to LD₅₀ average of 21.85 ng/bee (Schmuck 2001)
- We test bees' responsiveness to different sucrose concentrations and their ability to navigate



Work of Masters' student Daren Eiri in the Nieh Lab

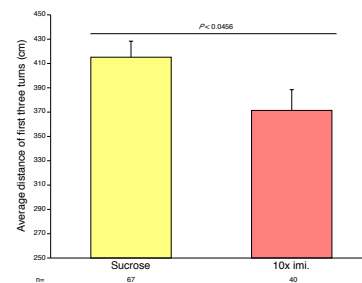
HOW DOES THE INSECTICIDE ALTER THEIR ABILITY TO NAVIGATE?

A flight of 6 m inside a tunnel is equivalent to a flight of 93 m outdoors (Srinivasan 2007)



HOW DOES THE INSECTICIDE ALTER THEIR ABILITY TO NAVIGATE?

Bees treated with high concentration of imidacloprid search for food at significantly shorter distances than control bees

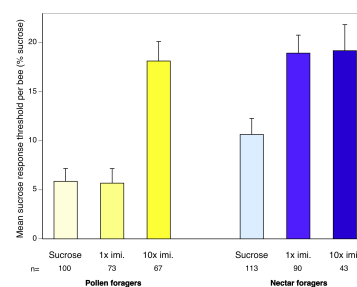


Honey Bee Sucrose Responsiveness



Honey Bee Responsiveness

- Pollen and nectar foragers become more picky with imidacloprid



Sublethal effects of the pesticide imidacloprid on honey bees

- Pesticide-treated bees become more picky and may possibly affect division of labor, affecting colony health
- They also travel shorter distances than untreated bees to a trained location, providing evidence of cognitive disruption



Bird predation : Bee eaters



Ambush predator: Praying mantis



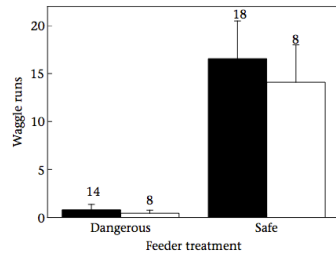
Ambush predator: Ambush bug



Ambush predator: spider



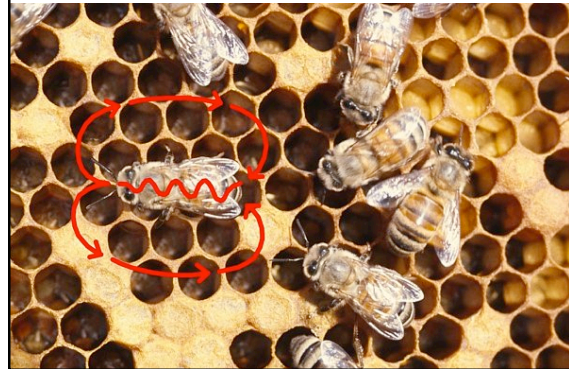
Are bees able to avoid predators?



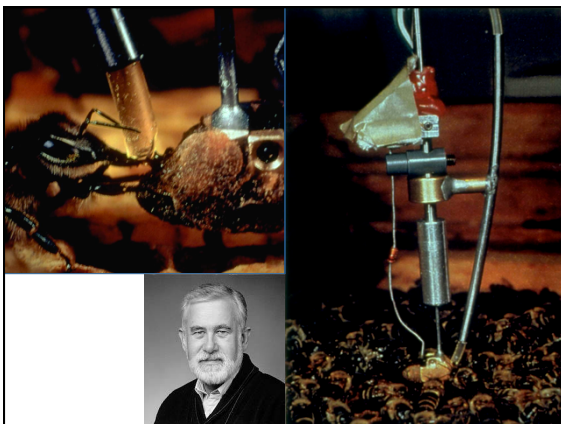
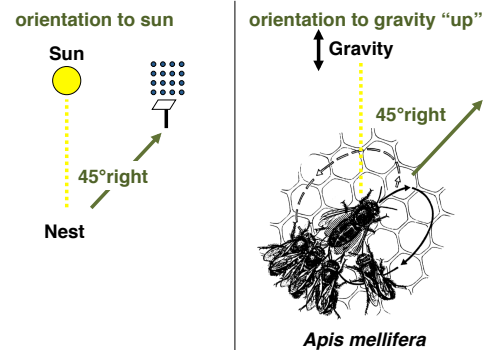
From Abbott & Dukas, 2009

But what is a waggle run?

Honey bee waggle dance



Transposing angle from sun to gravity



Do bees communicate about predators?

Current Biology 20, 370–375, February 23, 2010 ©2010 Elsevier Ltd All rights reserved. DOI:10.1016/j.cub.2009.12.009

A Negative Feedback Signal That Is Triggered by Peril Curbs Honey Bee Recruitment

James C. Nieh^{1,*}
¹University of California San Diego, Division of Biological Sciences, Section of Ecology, Behavior, and Evolution, 9500 Gilman Drive, Dept. 0116, University of California San Diego, La Jolla, CA 92037-0116, USA

Summary

Decision making in superorganisms such as honey bees involves often times self-organizing behaviors. Feedback loops that allow the colony to gather information from multiple individuals and achieve reliable and agile solutions. Honey bees use positive feedback from the waggle dance to recruit nestmates to a new food source. However, the role of negative feedback signals in honey bee recruitment is poorly understood. Here, we demonstrate that a negative feedback signal that curbs recruitment of bees to a new food source is triggered by a clear natural trigger. Signaling preferentially targeted nest-

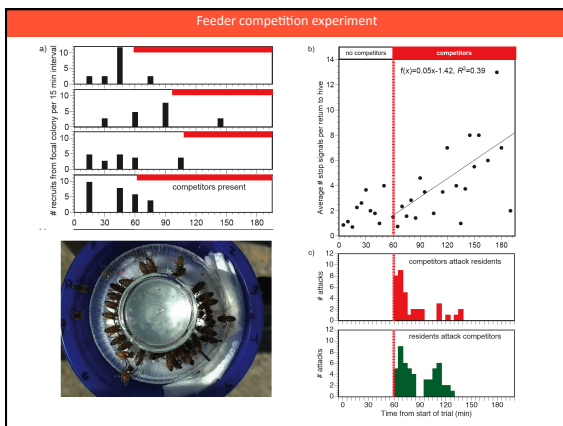
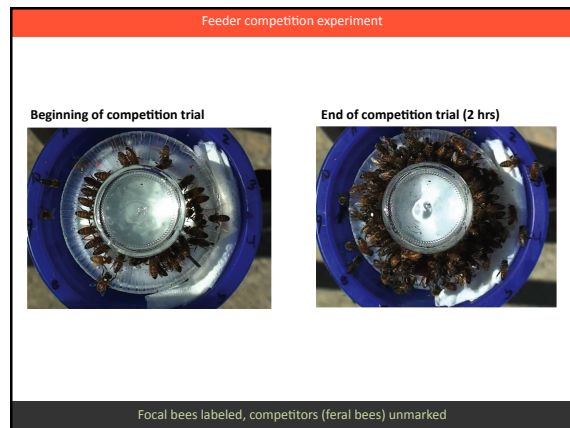
mate(s) returning from a rich food source can produce a foraging activation phenotype [2]. Honey bees (*Apis mellifera*) waggle dance to recruit nestmates to resources such as food, water, and nest [3]. In both cases, individuals generate positive feedback recruitment signals based on internal responses (thresholds, and allocation of the foraging force results from the sum of individual responses [2]). However, recruiting bees to a rich food source can produce a foraging activation phenotype [2]. The clearest example is the Pomeroy's and Pomeroy's phenomenon, which describes recruitment phenomenon that generates positive feedback but can also use a negative, recruited phenomenon to track unchanging color trails and thus prevent the system from jumping straight to a suboptimal solution [2]. In honey bees, the waggle dance is a powerful source of positive feedback that can locally increase foraging at a specific location, promoting significant fitness benefits for the colony [2, 16]. However, there is a signal, which remains poorly understood, that actively counteracts the positive feedback provided by the waggle dance.

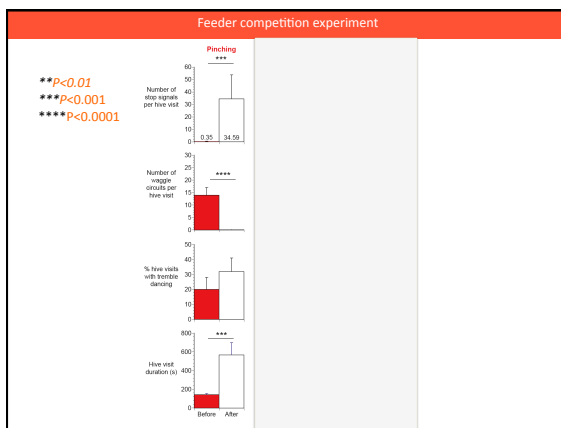
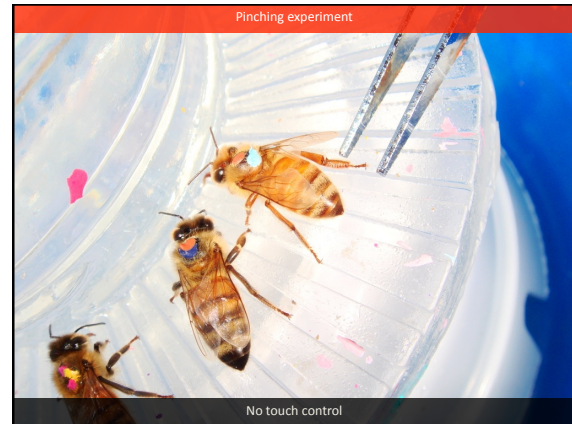
Report



Work of James C. Nieh

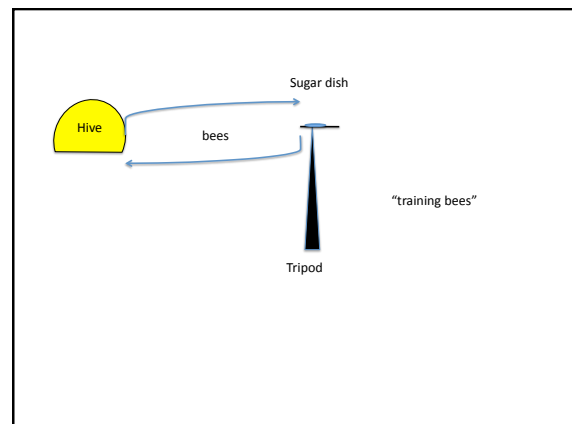
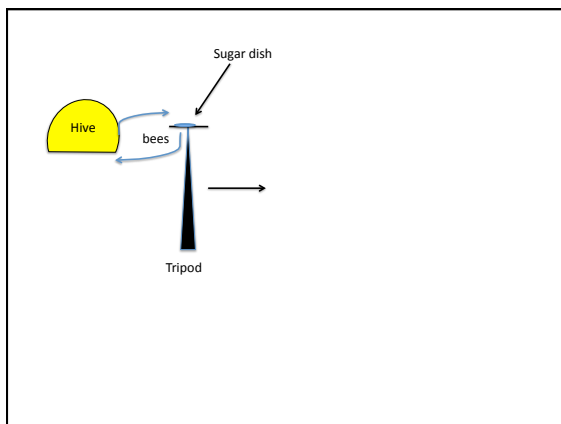
Bees make a special vibrational sound called a stop signal that stops bees from recruiting to a place.

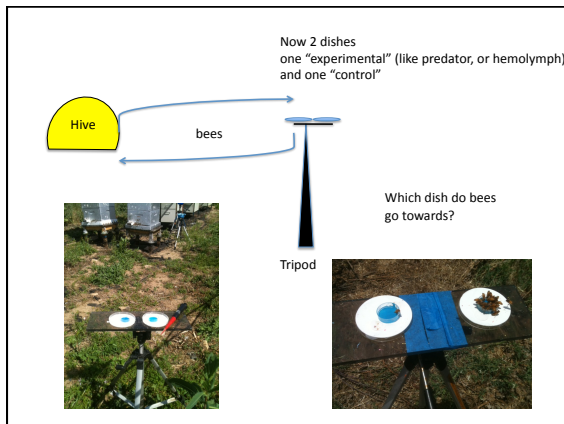




Goals of SD Bee Predator Studies

- What predators prey on bees in SD?
- Can bees avoid predators by picking up their scent, or by seeing them?
- Can bees avoid predators by using the cues of an attack (bee hemolymph)?





Thanks to

- SD Foundation
- Ms. Jesse Wade-Robinson and Mr. David Berggren
- And to you!