

# Social Insects Lab



# Objectives

- To learn the types of insect sociality.

To learn about social insects and their behavior through studying *Apis mellifera*.

- To explore honeybee biology by visiting the bee research unit at the University of Florida.

Note: There is a study guide and a worksheet for this lab. The study guide is for your use, but the worksheet should be submitted for a grade. Please refer to the syllabus for due dates.



# Introduction

Social insects are an important part of our world. Without their masses, we would lack wax, honey, efficient decomposition of wood, and crop pollination. Please read through the next few slides that explain exactly what social insects are and then we will take a field trip to the UF Bee Research Unit, by video of course.

There are two sections to the video.

First you will learn how bee keepers “work” bees, how the queen is marked, how workers collect pollen, how drone larvae differ from worker larvae, how cells are capped off, why honey bees die after they sting, how queens are kept low in the hive, how bee keepers protect the hive from invaders, and how smoke is used to manage hives.

In the second section, you will visit the honey room. Sounds like a sweet place huh? There you will see how the queens are reared, and how honey is extracted from the comb and how the honey filtered. The tour guide for this trip is Dr. Glen Hall, a world renown expert on social insects.



# Insect Sociality

There are several types of insect sociality, insects may be:

**Solitary** - Do not congregate at all. Many orders exhibit this type.

**Subsocial** - Meet one of the three criteria for sociality. The several orders in this type often form aggregates or care for young (i.e. Blattodea and Dermaptera).

**Parasocial** - Meet two of the three criteria for sociality. A few Orders exhibit this type.

**Eusocial** - Have all three criteria for eusociality. Only Isoptera and some members of Hymenoptera.

\*Note: Eusociality will be focused on in this lab.



Cicada killer - a solitary wasp



Hornet's nest

# Eusocial Insects

## Criteria for classifying insects as eusocial

1. They display cooperative brood care
2. They share a nest that has an overlap of generations
3. There is a reproductive division of labor (i.e. there is a non-reproductive worker caste)



Termite Reproductive



Worker Termites

# Hymenoptera

## Characteristics of eusocial Hymenoptera

Societies are matriarchal (have a queen)

Worker castes are females

Sex determination is haplo-diploid (full sisters share  $\frac{3}{4}$  of genes)

Queens and workers come from fertilized eggs (diploid)

Males come from unfertilized eggs (haploid)

Function of males is reproduction



Polistes nest



Yellowjacket nest under fallen tree.  
Notice the hole from where  
it was pulled.

## Hymenopteran groups exhibiting eusociality

Apidae – honeybees (only females sting)

Polistinae (sub-family of Vespidae) - paper wasps

Vespinae (sub-family of Vespidae) - hornets, yellowjackets

Formicidae - ants

# Isoptera

Isoptera exhibiting **eusociality**:

- Castes of both sexes are diploid-diploid
- Societies are large families consisting of both males and females.
- Workers are blind and softbodied.
- They communicate through pheromones.
- They share protozoa through trophallaxis



Termite soldiers



Termite worker

*Note: we will cover more about social insects in unit 7 of the lecture.*

# Trends from primitive to advanced eusociality:

Some insects are more advanced in their degree of eusociality. Here are some trends.

- More pronounced reproduction division of labor between queens and workers
- More pronounced morphological differences between queens and workers
- Larger colony sizes
- Reproductive dominance maintained by pheromones rather than physical aggression
- More defensive behavior exhibited
- Increased homeostasis (internal stability)

Examples:

Primitive: Wasps – *Polistes* (Paper wasps)

Bees – *Bombus* (Bumble Bees)

Advanced: Wasps - *Polybia* (Epiponines), *Vespula* (Vespinae)

Bees - *Melipona* (Meliponines - stingless bees), *Apis* (honey bees)



Think about some of the trends above in relation to familiar things like a wasp nest or a bee hive. Can you see some of those trends? As you learn more about the bees, you will be able to realize that they are more advanced in their social lifestyle than are their wasp cousins.



# Nest Structure and Food Sources

Here we will look at some different architectural designs of hymenopteran nests. In a home there is always a food storage area, so we will also list what food sources are stored within the nest. As you watch the video see if you can catch the bee with the corbicula full of pollen.

## Nest design:

- Social wasps - paper, combs with hexagonal cells, multiple combs, pedicel, envelopes
- Social bees - secreted wax, pots or combs

## Food source:

- Social wasps - nectar for adults (carbohydrates); insect prey for larvae (protein)
- Social bees - nectar for adults (carbohydrates); pollen for larvae (protein). Specialized plumose hairs, scopae, and corbicula are used to collect pollen.



Honeycomb



Baldfaced hornet's nest

# Honey Bee Facts

We are almost ready for our field trip, so lets blitz through some interesting facts about honey bees.

- They originated in Southeast Asia.
- They may nest openly in single comb or in cavities with multiple combs.  
Multiple combs allow for thermoregulation and the ability to communicate location of food sources in the dark. This allowed *Apis mellifera* to spread west and into the temperate regions of Europe and Africa.
- Honey bee combs are made of wax and are hexagonal cells with a central midrib and vertical combs. There is a “bee space” between combs where bees can turn around and there are worker and drone sized cells.
- They use the combs for brood rearing and food storage (arranged concentrically).  
\* You can see this in the video.
- Queens choose to fertilize eggs or not (using stored sperm in her spermatheca) as she lays them.
- Eggs are fertilized or unfertilized depending on the size of the cell.
- Bees are holometabolous. The egg is at the bottom of the cell and as the larva hatches and emerges it is fed worker jelly and pollen. Pupation occurs and the cell is capped over in the worker and drone castes. The adult then chews through the cap and emerges.
- Queens are fed royal jelly and mature in vertical, temporary cells.

# Honey Bee Facts Continued



Conditions when queens are reared:

## 1.) Queenless colony

- Recruit young worker larvae, construct surrounding queen cell.
- Virgin queen emerges and kills other virgins.
- She mates within 2 weeks with multiple drones from distant colonies and stores the sperm in her spermatheca.

2.) Queen failing - There is a coexistence of two mother and daughter queens. The young queen is raised in a preconstructed queen cell cup.

3.) Swarming - This is caused by crowded conditions, usually in the spring. The old queen leaves the colony with half of the workers, clusters, finds and moves to a cavity, and builds combs. Workers start new queen cells. When the new virgin queen emerges, she mates and takes over egg laying for the colony.

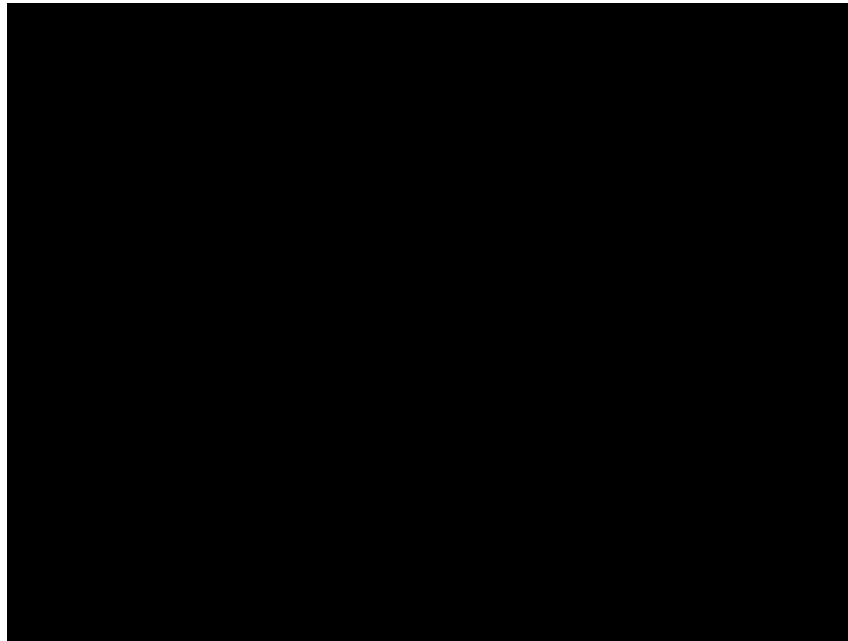
# Field Trip – “Working” Bees and Honey Room

Don't forget to fill out your study guide about social insects so you will be prepared for the final exam. Once you have watched the following videos, do some web surfing to find out information about beekeeping for your worksheet.

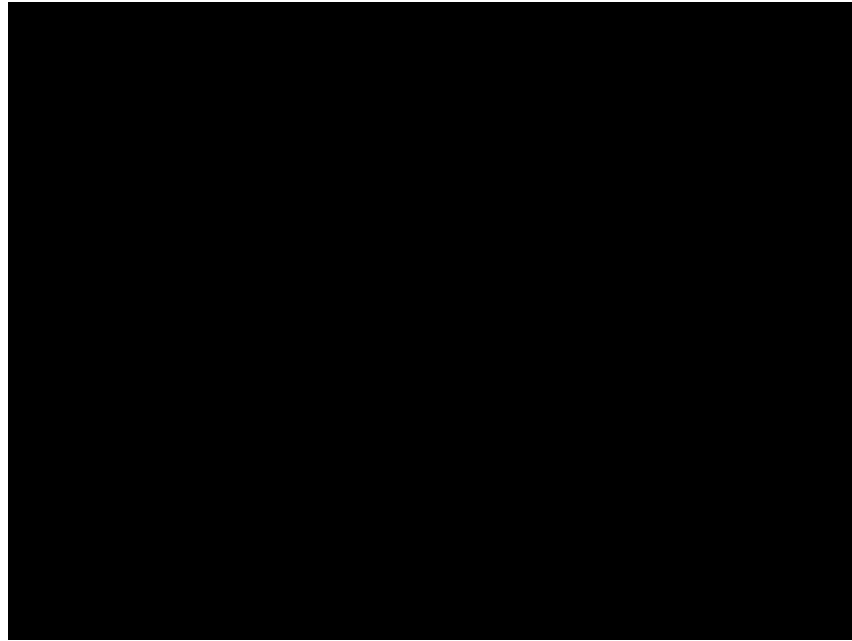
Let's don our bee veils and gloves and visit the UF Apiary with Dr. Glen Hall. There are four video segments about working bees and one where you visit the honey room. “Bee” careful and don't get stung.

**Watch the “Working Bees” and “Honey Room”  
Videos on the next slides.**

# Working Bees, Part I



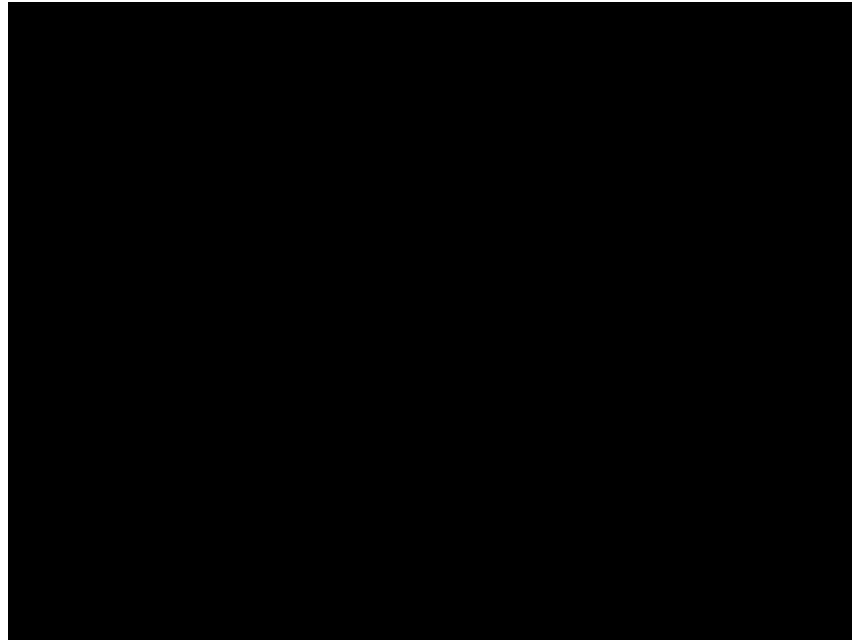
# Working Bees, Part II



# Working Bees, Part III



# Working Bees, Part IV





# Honey Room



Note: This video is ~12 minutes long. The last three minutes have been corrupted and are audio only.