

Honey Bee Biology



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Welcome to the University of California, Davis
Department of

ENTOMOLOGY



University of California
Agriculture and Natural Resources

Cooperative Extension



E.L. Niño Honey Bee Lab



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PhD Student



Cameron Jasper
PhD Student

Many undergraduate and high school volunteers and interns

Our mission

To support the California stakeholders (no matter how big or small) through conducting basic and applied research, and to disseminate knowledge of honey bees and contemporary research findings through extension and outreach.

Research

- **Identify factors regulating queen mating and reproduction** (P. Bohls, C. Jasper)
 - Help inform breeding programs and improve queen quality
- **Seek additional *Varroa* control options** (B. Niño, P. Bohls)
 - Help inform colony management to improve colony health



ars.usda.gov

Extension and outreach





Using science-based information to educate stewards and ambassadors for honey bees and beekeeping.

Häagen-Dazs Honey Bee Haven

- Docent tours of the garden
- Self-guided tour
- Open dawn to dusk
- Many other events



Safety

- Honey bees are stinging insects and people can develop an allergy!
- Wear long pants, closed-toed shoes, light-colored clothing, veil, use a smoker!
- “Bee” calm when going through the hive
- Stay calm, if bees are bumping you walk away quickly

**Let's talk about
honey bees!**



Outline



- **Individuals in the hive**
- **Development**
- **Communication**

Outline



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- **Communication**

The Honey Bee Colony

- Under Natural Conditions
 - Nest in cavities
 - Build multiple comb nests
- Social Insects
 - Eusocial



Eusocial

- Cooperative care of young
- Reproductive division of labor
- Overlapping generations that share the same nest
- Other eusocial insects
 - Ants, Some wasps, Termites



A look inside the colony

Drones

ADULTS

Queen



Workers



Queen

- Larger than workers
- Sole reproductive female in the colony
- She will lay 1000-1500 eggs each day (seasonal)
- Lifespan: 1-5 years



Workers

- Female
- Facultatively sterile
- Hive upkeep and foraging
- Colony will have 20,000-60,000 in the hive
- Barbed stinger, die when sting
- Lifespan: 6 weeks



Drones

- Male
- Reach sexual maturity at two weeks
- Single purpose
 - Mating
 - Die after mating, if not mated forced out of the colony



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Outline



- Individuals in the hive
- **Development**
- Communication

Development

Larvae



Eggs



Adult

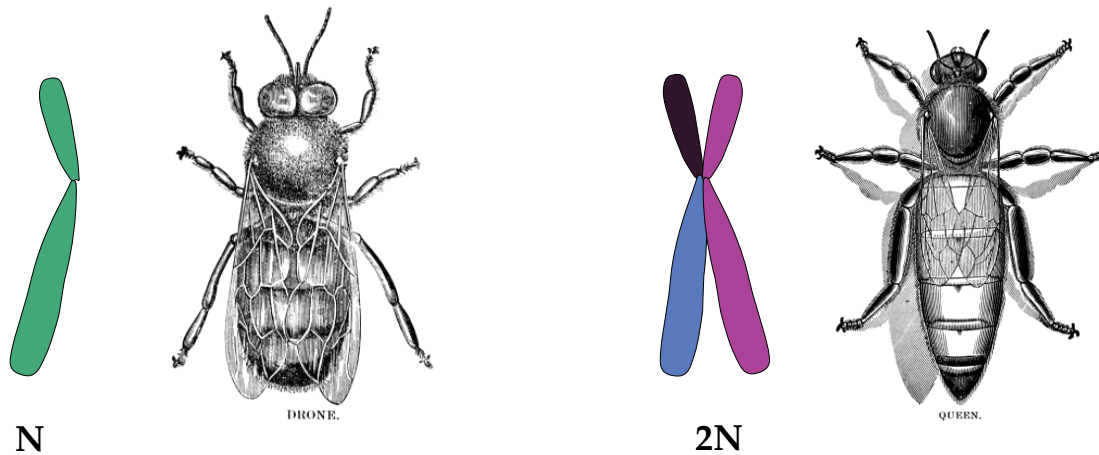


Pupae

Complete metamorphosis (holometabolous)

Haplodiploid System

- Haplodiploidy is a sex-determination system in which males develop from unfertilized eggs and are haploid, and females develop from fertilized eggs and are diploid



Timeline

- Unfertilized eggs become drones (24 days)



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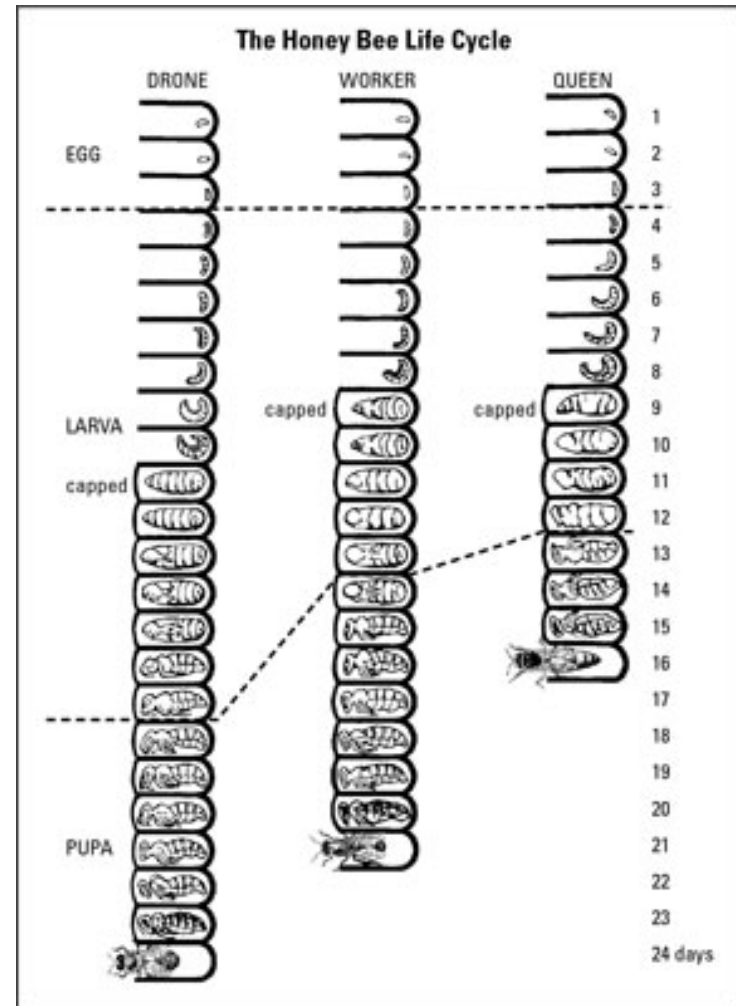
- Fertilized eggs can become workers (21 days) or QUEENS (16 days)



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Queen VS Worker development

- All female larvae are fed the same diet for the first 3 days
- Queens are continually fed Royal Jelly
 - Special Protein Royalactin
 - Plant compounds
- Workers are fed brood food
 - Mix of glandular secretions, pollen, honey



Rearing of a New Queen

- Swarming
 - Natural process of colony reproduction
- Supersedure
 - Current queen is replaced
 - Injury
 - Laying few eggs/drones
- Emergency
 - Queen dies
 - We squash her



Basic Queen Biology

- Emerge after 16 days
- Virgin queens will search out the capped queen cells and kill the individual inside (workers will also cull queen cells)
- If multiple virgins emerge simultaneously then queen death match ensues
- A single virgin queen will survive and mate generally within a week
 - Queens mate with multiple drones (avg. 12-14)
 - Should start egg-laying within a week of being mated



Mating Flight Attempt



Virgin VS mated Queen

- Virgin

- Moves erratically
 - Slender
- No retinue
- Flies readily



- Mated

- Moves slowly and predictably
 - Large abdomen
- Retinue present
- Will only fly if swarming



Retinue



Worker Behavior and Tasks

- Based on:
 - Age of the worker
 - Colony needs



House Bees

- ~1-20 days old
- Comb building
- House cleaning
- Brood care
- Accepting nectar and pollen from foragers
- Undertakers
- Hive guarding
- Climate control



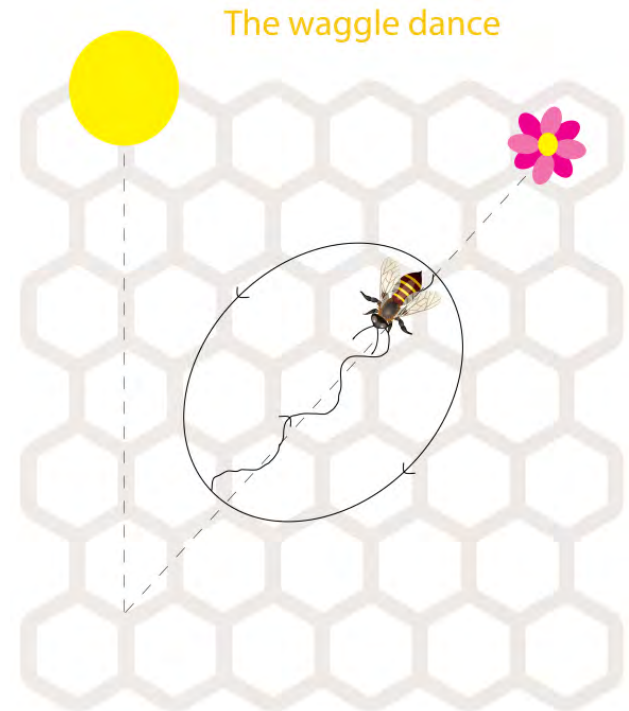
Foragers

- ~20 days until death
 - (30-45 days)
 - Highly variable
- Collect
 - Nectar
 - Pollen
 - Water
 - Plant resins (propolis)



Dance Language

- Carl von Frisch - Austrian Zoologist
 - Cracked the dance code (foraging) of honey bees
- **Foraging - location of a food source**
 - Forage up to five miles
 - Forage for highest quality resources
- **Swarming**





Foraging for pollen and nectar

Nectar needed for sugar
Provisioning for winter/dearth
Wax production

Pollen needed for proteins
Brood food



Pollenergie.fr







Wet brood



Dry brood



Foraging for water
Drinking
Climate control

Foraging for propolis
Antimicrobial



Outline



- Individuals in the hive
- Development
- **Communication**

Communication via Chemicals

- Identification of the colony members
- Pheromones
 - Queen
 - Alarm
 - Brood
 - Many more



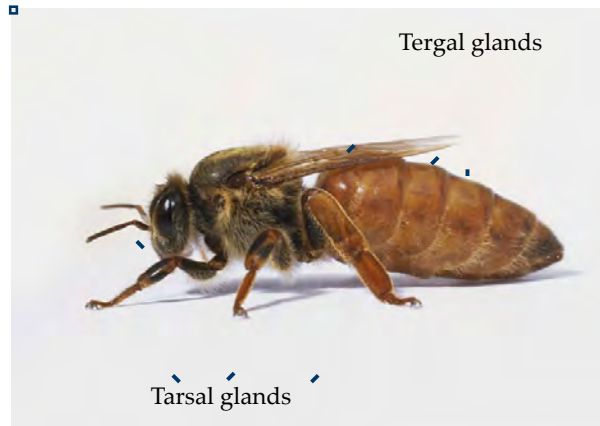
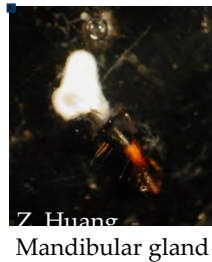
Colony Recognition

- Each colony has its own “smell”
- Workers use it to identify non colony-mates
- The smell is acquired (usually after first 24 hrs)
 - Newly emerged bees can be placed into any colony



Queen produces many pheromones from multiple glands

- Composition depends on age, mating status, quality
- Many functions, regulate social organization of the hive



Synthetic versions available

Adult and Brood Pheromones



Alarm pheromone



Brood pheromone

Questions???