Bee Communication
A Hive Mind

Hive Mind

- Hive Mind
  - One for all and all for one
  - Kill self to protect the hive
    - Fatal Sting
  - WHY?
    - **<u>Kin Selection</u>**: So closely related

The hive occupants:
- One queen — a fertile female
- A few drones (males)
- Thousands of workers (infertile females)

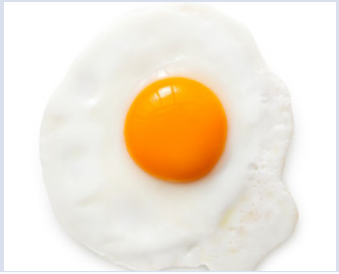
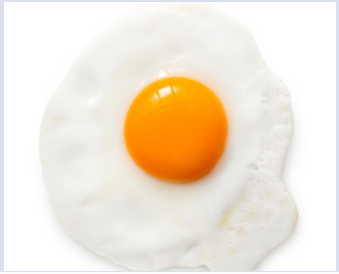
Haplodiploidy

What it is

- A type of sex determination system
  - In this system, sex is determined by the number of sets of chromosomes an individual receives.
  - Relation between worker bees (diploid females) in a hive or nest is 0.75.
  - This means the workers are significantly more closely related than siblings in other sex determination systems.

Haplodiploidy: How it works

- Males develop from unfertilized eggs
  - Haploid (X) – Have ½ the genetic material
  - Unfertilized egg = Male
- Females develop from fertilized eggs and are
  - Diploid (XX) – Have the normal amount of genetic info (paired chromosomes)
  - An offspring formed from the union of a sperm and an egg = Female

	MALE	FEMALE
CREATED BY:		 + 

Haplodiploidy: Fun Fact

- A male has no father and cannot have sons, but he has a grandfather and can have grandsons.
- Male is a clone of the queen! Making him handsome queen

Bee Communication

- Methods:
  1. **Movement**
     (Dance Language)
  2. **Olfactory**
     (Pheromones)
  3. **Sharing Food**

Pheromones for Communication

- **Honey bee pheromones: chemical scents that animals produce to trigger behavioral responses from the other members of the same species.**
- **Honey-bee pheromones provide the "glue" that holds the colony together.**
  - **The three castes of bees produce various pheromones at various times to stimulate specific behaviors.**

Pheromones for Communication

- **Certain queen pheromones (known as *queen substance) let the entire colony know that the queen is in residence and stimulate many worker bee activities.***
  - ***Outside of the hive, the queen pheromones act as a sex attractant to potential suitors (male drone bees).***

Pheromones for Communication

– ***More Effects of Queen Substance:***

- ***They also regulate the drone (male bee) population in the hive.***
- ***Queen pheromones stimulate many worker bee activities, such as comb building, brood rearing, foraging, and food storage. + Prohibit OVARIAN DEVELOPMENT IN FEMALES!***

Pheromones for Communication

- ***The worker bees at the hive's entrance produce pheromones that help guide foraging bees back to their hive.***
- ***The Nassanoff gland at the tip of the worker bee's abdomen is responsible for this alluring scent.***
- ***Worker bees produce alarm pheromones that can trigger sudden and decisive aggression from the colony.***
- ***The colony's brood (developing bee larvae and pupae) secretes special pheromones that help worker bees recognize the brood's gender, stage of development, and feeding needs.***

Test of Pheromones

Study:
Wheres the Nassanoff gland

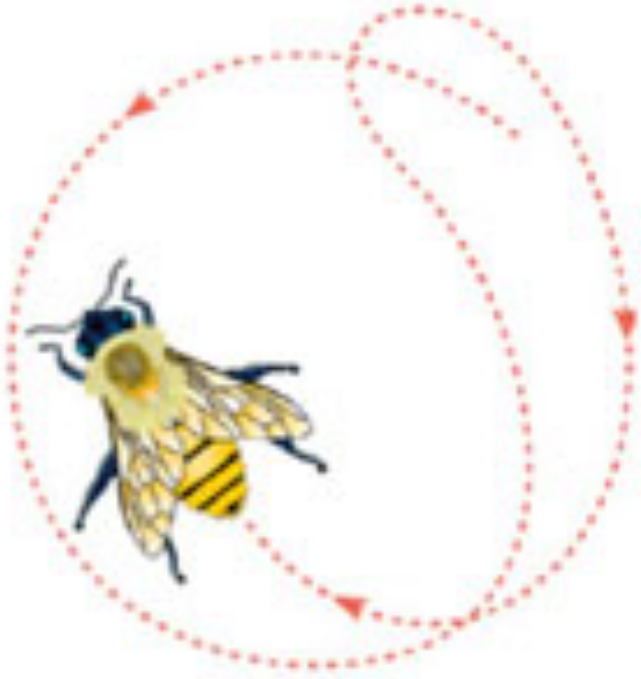
Bee Dance

- **Used to communicate to other workers the:**

1. Location of a food source
2. Quality of a food source

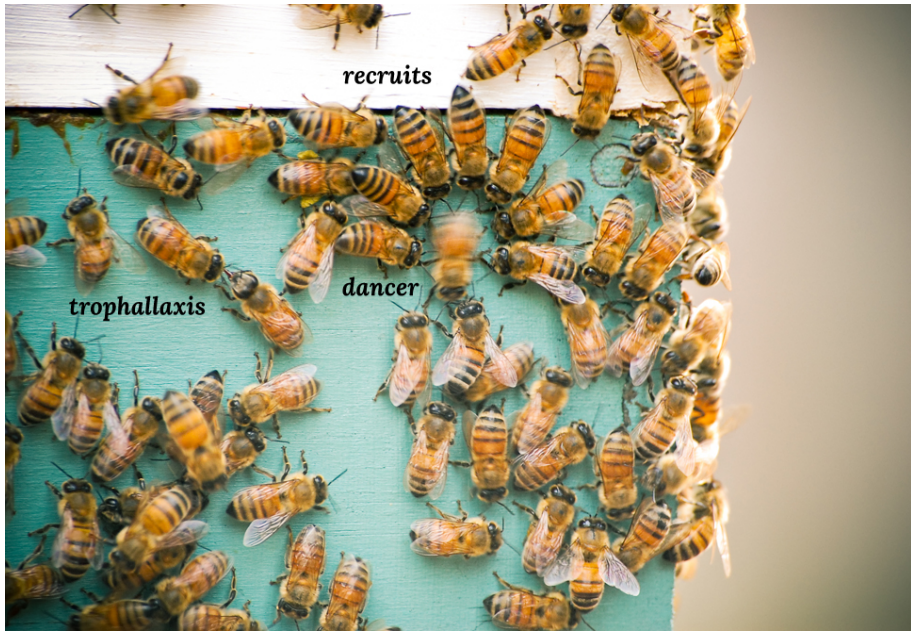
Movement Communication: Dance

- "Round dance"
  - Teaches other workers the location of food sources
  - **When**: Food Source is for food sources closer to home
    - Within **50** meters of the hive
  - **Limitation**: This dance only communicates the direction of the supply, not the distance



Movement Communication: Dance

- "Sickle dance"
  - Teaches other workers the location of food sources
  - When: Food source is a medium distance:
    - Between **50-150** meters form hive

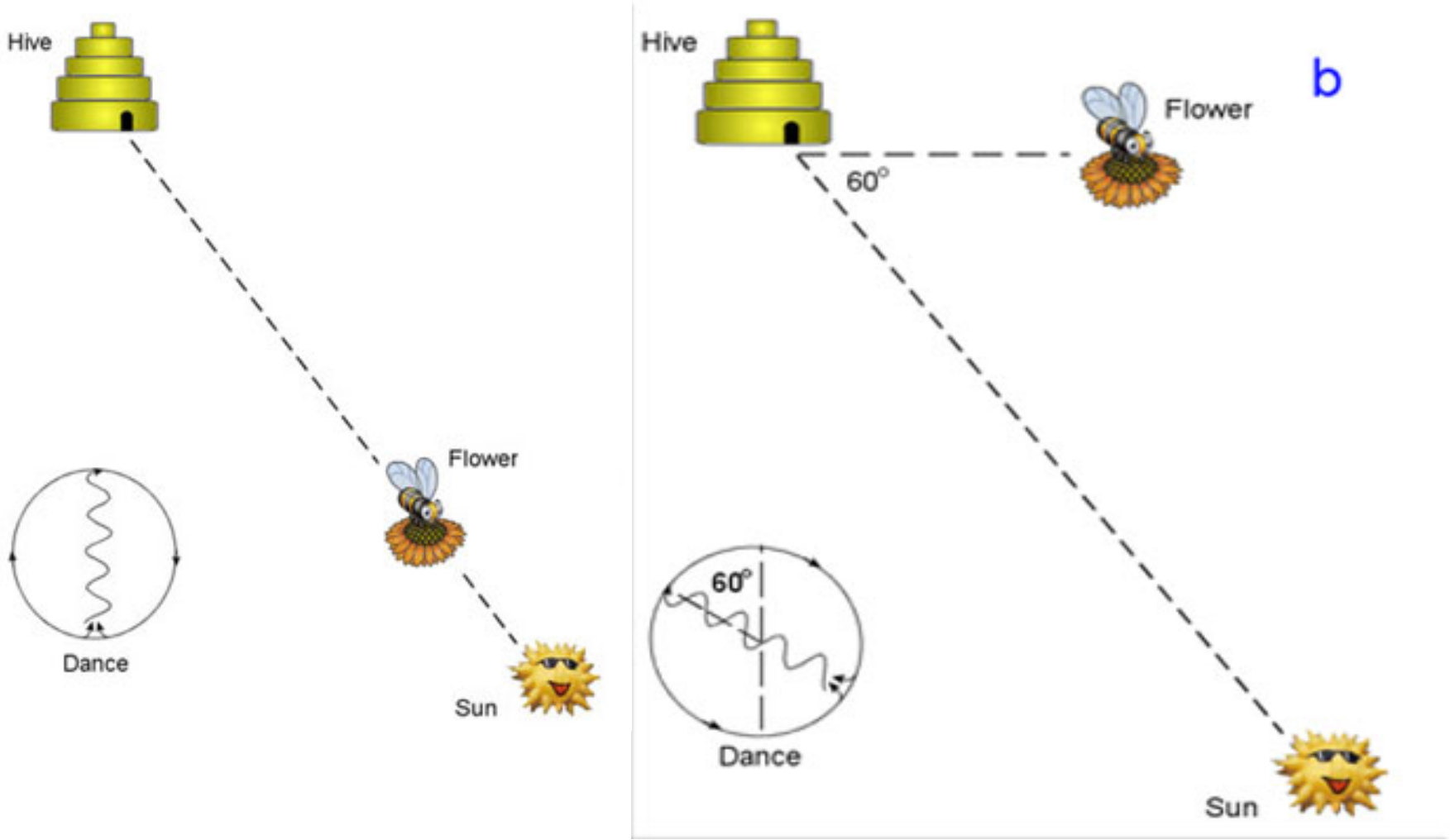


Movement Communication: Dance

- "Waggle dance"
  - Teaches other workers the location of food sources
  - **<u>When</u>**: Food source is a long distance:
    - More than **150** meters from the hive.

Movement Communication: Dance

- "Waggle dance"
  - The moves:
    1. The honey bee first walks straight ahead
       - Vigorously shaking its abdomen
       - Producing a buzzing sound with the beat of its wings.
       - The **distance** and **speed** of this movement communicates the distance of the foraging site to the others.
    2. Bee aligns her body in the direction of the food, relative to the **sun**.
       - Communicating direction
  - After performing the waggle dance, the scout bees may share some of the foraged food with the following workers, to communicate the **quality** of the food supply available at the location.



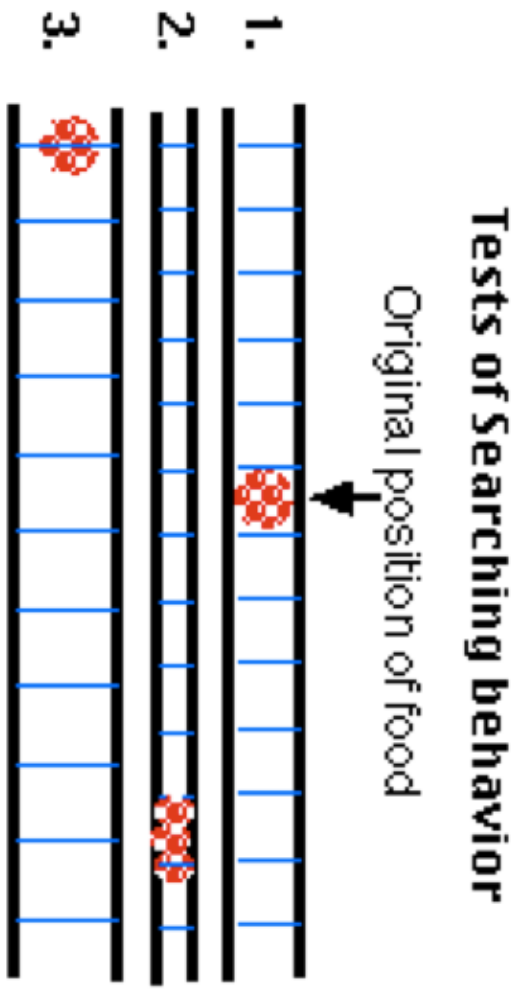
von Frisch also discovered that scouts (and foragers) don't actually have to see the sun to navigate. As long as they can see a small patch of clear blue sky, they get along fine. This is because sky light is partially polarized, and the plane of polarization in any part of the sky is determined by the location of the sun. Try it by rotating a pair of polaroid® sun glasses!

Testing Bee Communication

Tests of Searching Behavior

1. **Built tunnels decorating the interior walls with patterns to create flicker.**
2. **In these three experiments, the bees were first fed in the middle of the tunnel of standard diameter.**
3. **Then the food was removed.**
   1. **Using the same tunnel, foragers came to same spot in the tunnel.**
   2. **Using a narrower tunnel, foragers began searching for food near its entrance.**
      Why: Forced to fly closer to the vertical stripes, the images moved by faster
   3. **Using a tunnel with a larger diameter, foragers searched for food at its far end.**
      Why: Flying farther from the stripes, the images moved by more slowly

BOTTOM LINE: They use the ground to orient themselves



Dance used to find a new hive site also!

Swarming:

- **When there is a new queen being raised:**
- **Before the new queen emerges, the old queen leaves the hive, taking many of the workers with her. The swarm usually settles somewhere, e.g., on a tree branch, while scouts go searching for a new home.**

- **Each scout that finds a promising site, returns to the swarm and dances on it just as though she had found food.**
- **Eventually, the swarm departs for the location promoted most <u>vigorously</u>.**