Honey Bee Biology

2025 Beginning Beekeeping
NEKBA
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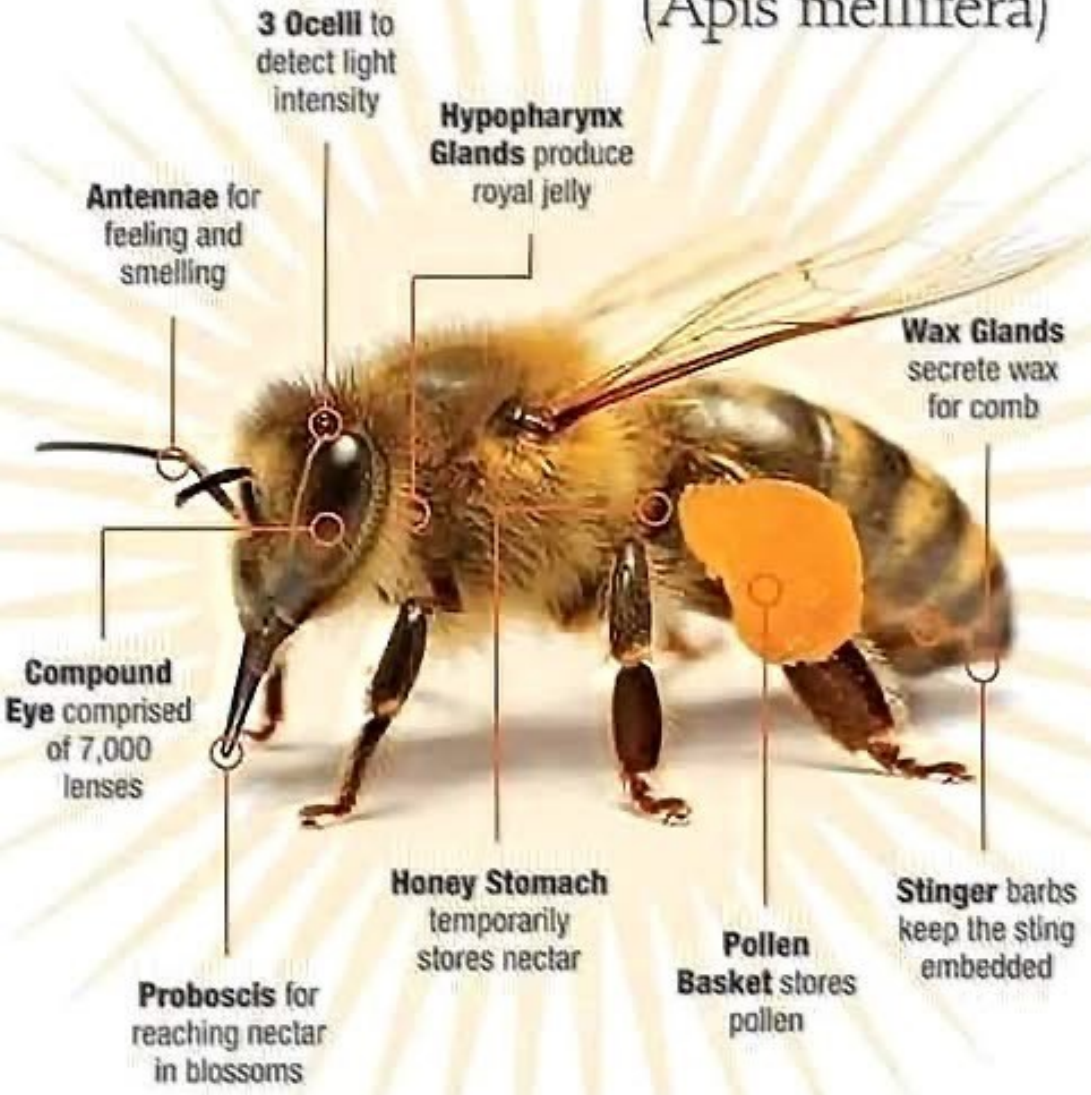
The Honey Bee Colony as a Superorganism

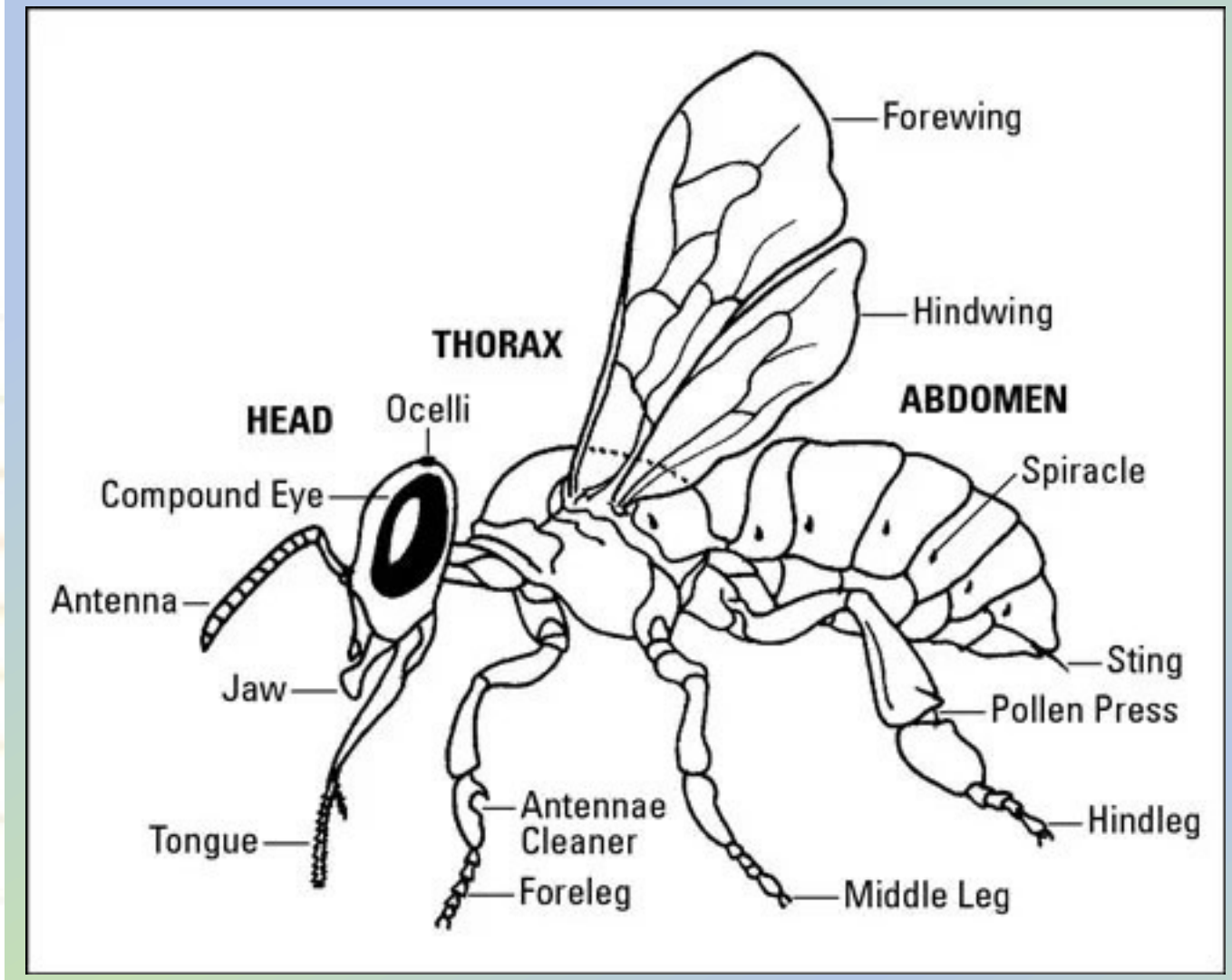
The Colony is more than just the sum of its parts, more than just the bees that compose it.

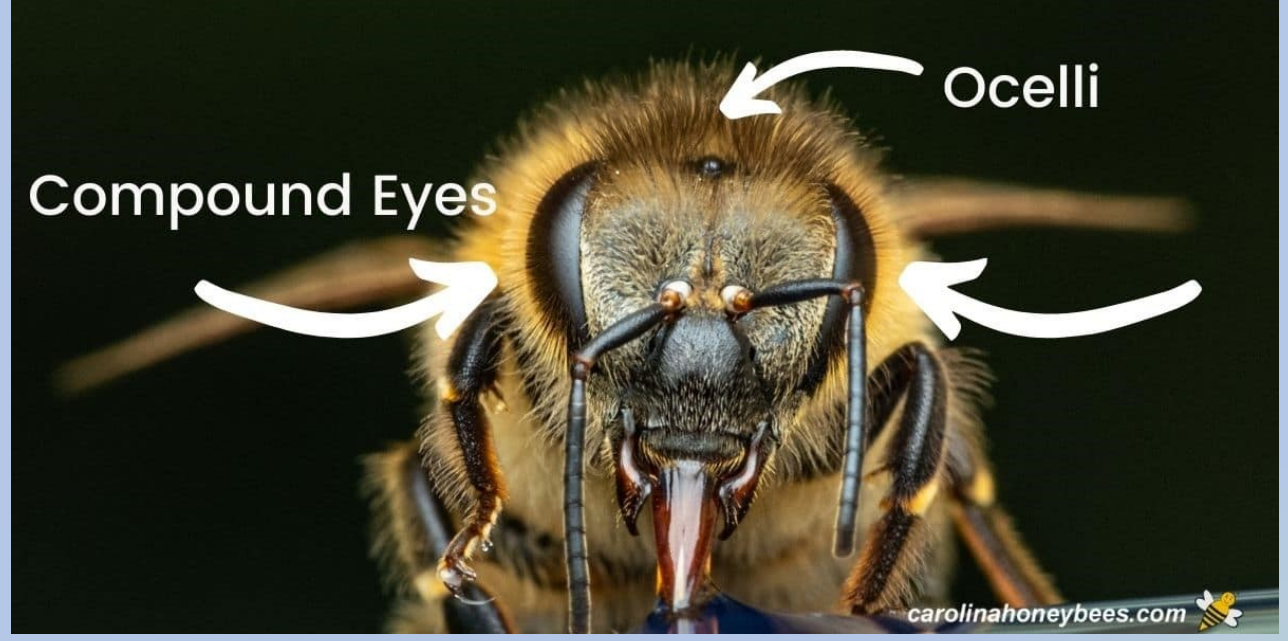
- Respiration
- Thermoregulation
- Communication/Decision-Making
- Immune Responses
- Reproduction

Honey Bee

(Apis mellifera)



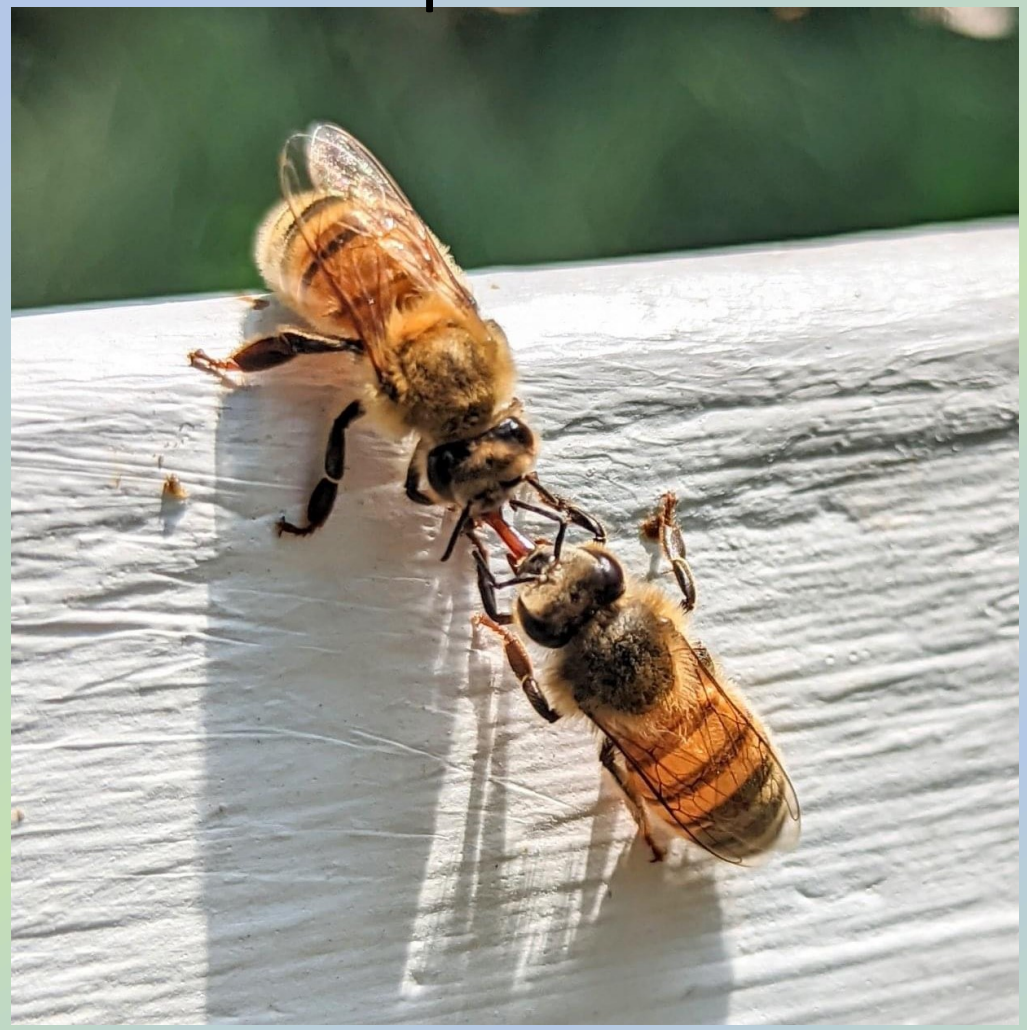




2 compound eyes, 3 Ocelli – simple eyes-detect light for orientation

Tongue/Proboscis –Collect nectar and trophallaxis (food sharing). Mandibles- jaw that protects the mouthparts. Used for cutting wax, feeding larvae, and defending the hive. Hypopharyngeal glands and mandibular glands – produce brood food for the larvae. Mandibular gland – produce some components of bee saliva and royal jelly and alarm pheromone.

Trophallaxis

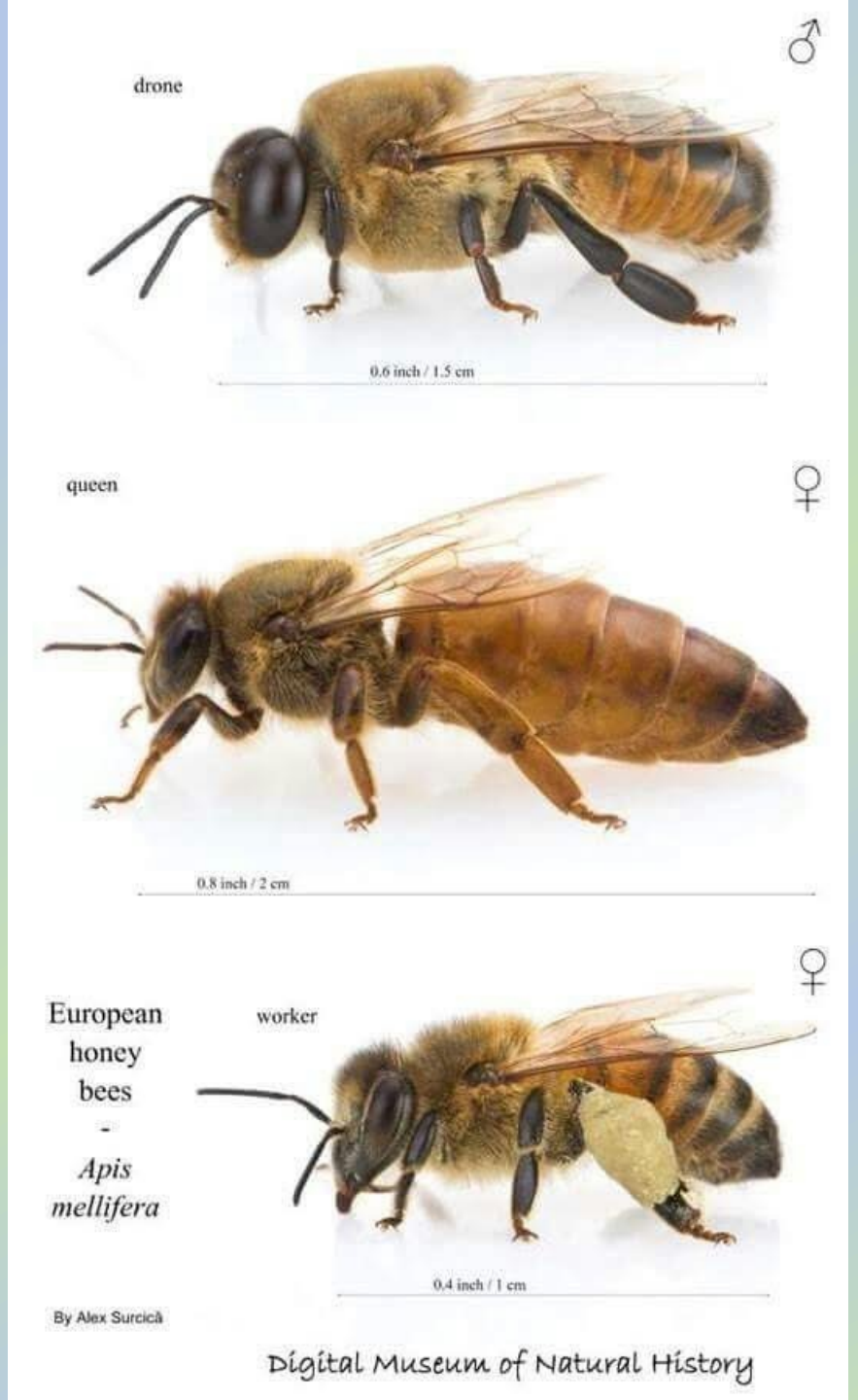


Members of the Honey Bee Colony

Drone

Queen

Worker



The Queen

- Reproductive female (1,500- 2,000 eggs/day)
- Pheromones
  - Retinue behavior
  - Inhibition of rearing replacement queens
  - Sexual attraction
  - Swarm stabilization
  - Stimulation of worker activities - foraging/brood rearing
  - Suppresses worker ovary development
  - A queen can live several years but is often replaced yearly for higher productivity.

Queen

Fertilized Egg (Diploid)

Unfertilized Egg (Haploid)

Female Offspring

Male Offspring

(Worker or Queen)

(Drone)

The Workers

- Females-sexually incomplete
- Weeks 1-3 work in the hive
  - Cleaning
  - Nursing
  - Nectar ripening and honey storage
  - Pack pollen
  - Secrete wax
  - Guarding

The Workers

- At 3 weeks – orientation flight and transform to a field bee.
- Collect/Forage
  - Nectar
  - Pollen
  - Propolis
  - Water

The Drone

- May live avg. 3-5 weeks
- NO stinger
- Does not forage
- No wax glands
- Begs food from worker bees
- May be 5% of the population (a few hundred to a few thousand
- Mates with new virgin queen
- Perhaps contributes to “normalcy” of colony
- Often removed in times of stress and in the fall

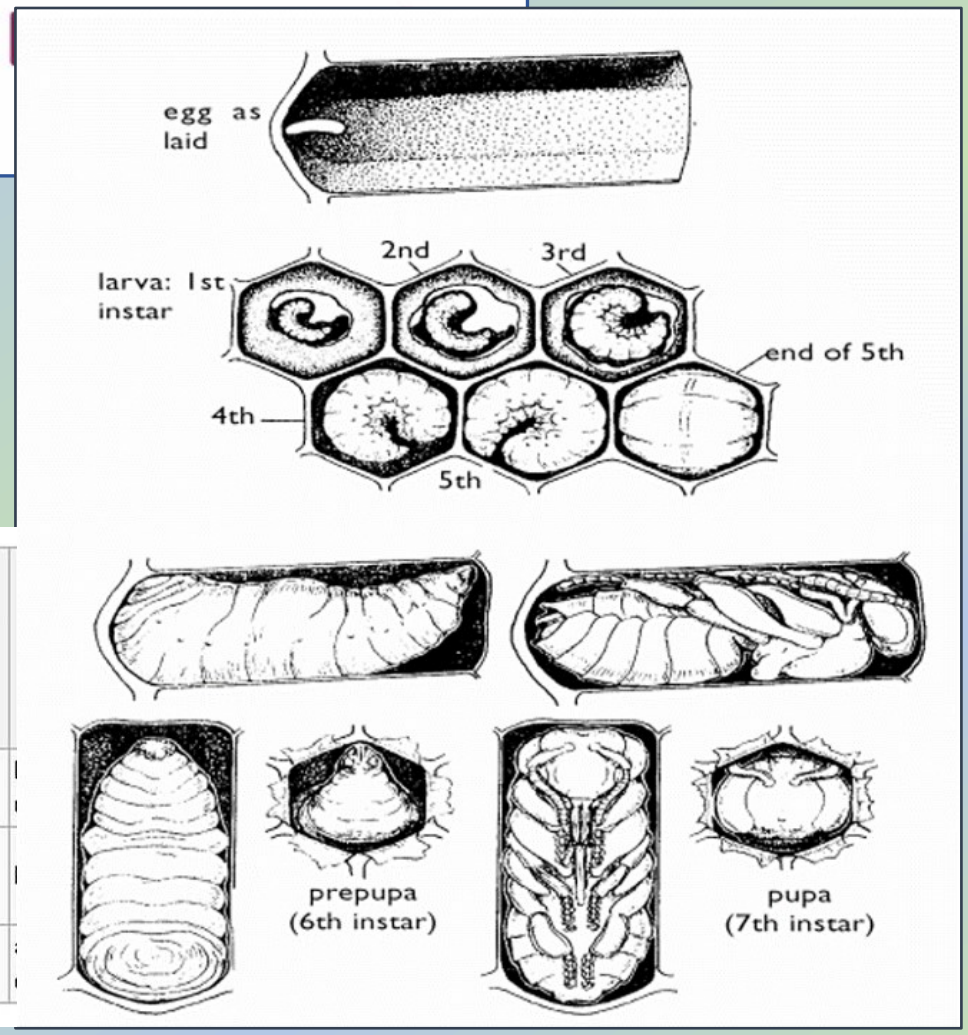
Drone congregation areas are 16-115 feet in the air. Drones hang out and wait for a queen. DCA’s are generally located within a mile of the hive.

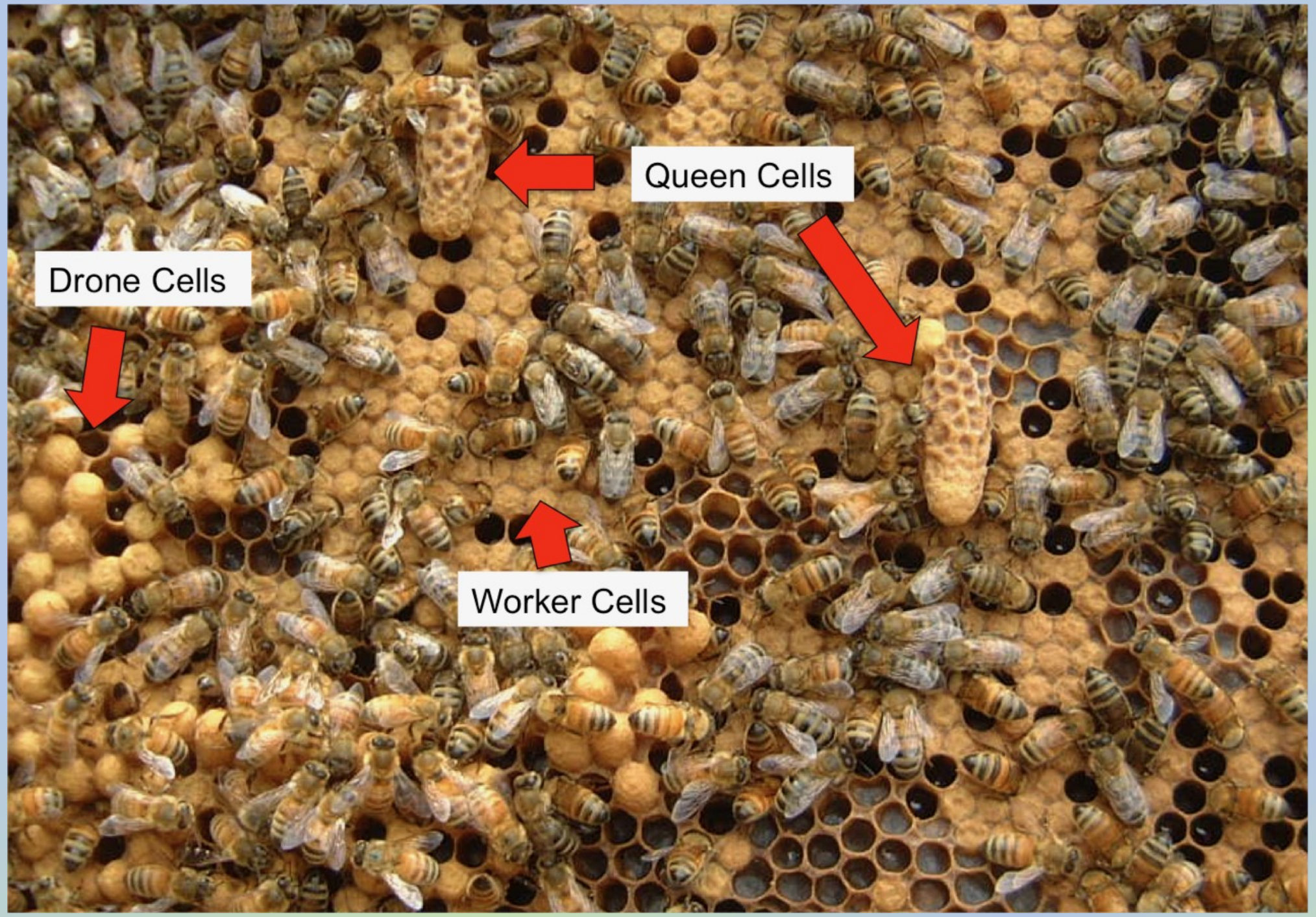
Drone brood pupae

Bee Brood

- Egg – 3 days
- Larva
- Pupa
- Adult bee
  - Worker 21 days
  - Queen 16 days
  - Drone 24 days

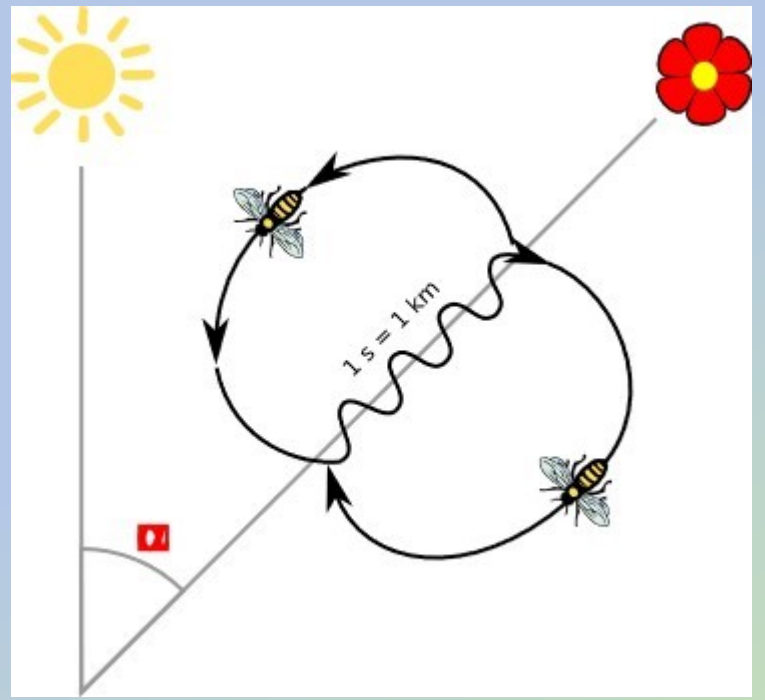
Type	Egg	Larva	Cell capped	Pupa	Average Developmental Period (Days until emergence)
Queen	up to Day 3	up to Day 8½	Day 7½	Day 8 until emergence	16 days
Worker	up to Day 3	up to Day 9	Day 9	Day 10 until emergence (Day 11 or 12 last moult)	21 days (range: 18–22 days)
Drone	up to Day 3	up to Day 9½	Day 10	Day 10 until emergence	24 days




Queen Cells
Drone Cells
Worker Cells

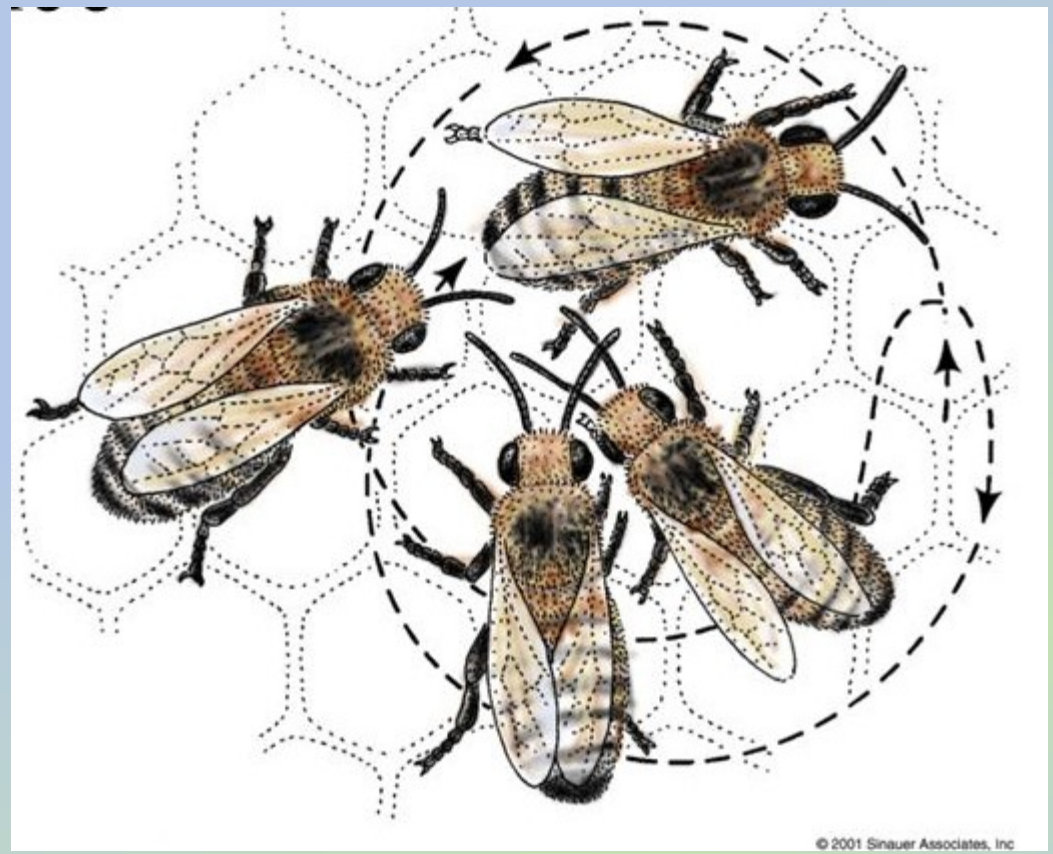
Communication

- Professor Von Frisch discovered how bees communicate by waggle dancing.
- Bees navigate by using the sun to tell their sisters where it is, how far it is, and how good it is!
- Bees dance to communicate food, water, propolis, or a new home.



Round Dance

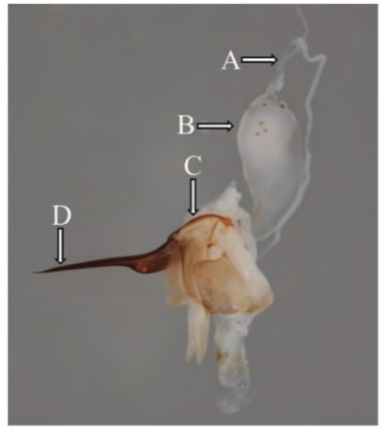
- Von Frisch described this dance
- Source is close < 50 m from hive (164 ft)
- Other dances have been identified
  - Shaking signal - worker bee grabs onto another with her forelegs and vibrates her body
  - Tremble dance – forager bee shakes her body while slowly walking across the comb.



Pheromones-Worker

A chemical signal between members of the same species that serves as a stimulus for one or more behavioral responses.

- Orientation
  - Nasonov gland (scenting/fanning)
- Footprint
- Alarm
- Target



Queen Piping

- Newly emerged queen
- Swarming
- While still within their queen cell

Swarming

- Asexual reproduction
- Whirring dance precedes/queen piping
- Random division but more older bees
- 50-75% of bees leave the parent hive
- Cluster nearby – minutes to days
- Scouts find a new home – dance on the cluster
  - Move en masse to new home
  - Colony social life is now reproduced

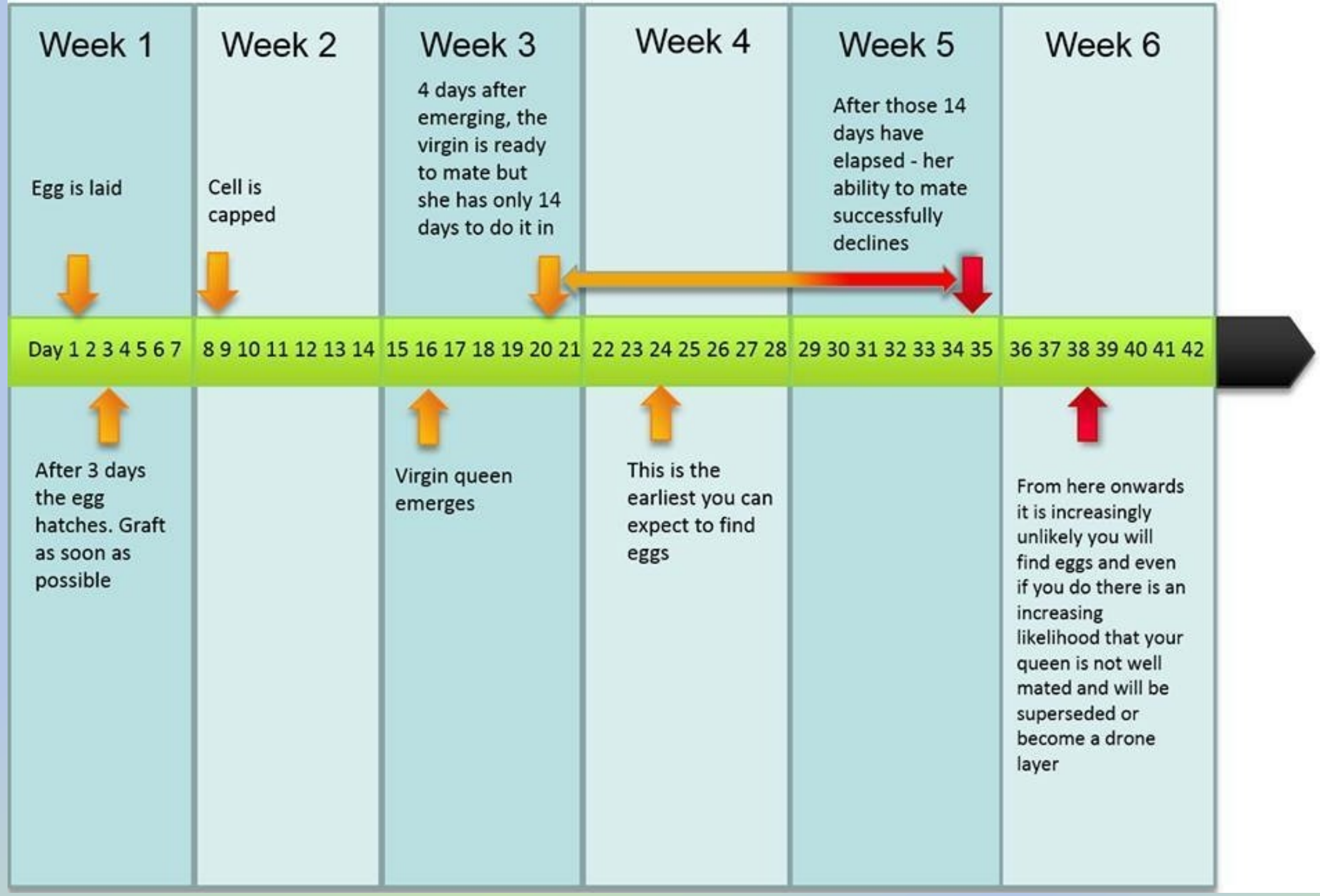

Week 1
Egg is laid
Week 2
Cell is capped
Week 3
4 days after emerging, the virgin is ready to mate but she has only 14 days to do it in
Week 4
Week 5
After those 14 days have elapsed - her ability to mate successfully declines
Week 6
Day 1 2 3 4 5 6 7
8 9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31 32 33 34 35
36 37 38 39 40 41 42
After 3 days the egg hatches. Graft as soon as possible
Virgin queen emerges
This is the earliest you can expect to find eggs
From here onwards it is increasingly unlikely you will find eggs and even if you do there is an increasing likelihood that your queen is not well mated and will be superseded or become a drone layer

Figure 1. A queen cup. The comb on which the queen cup has been built is leaning back to the left. In its proper orientation, the opening of the queen cup would be pointing down. *Photograph by Mike Bentley*.

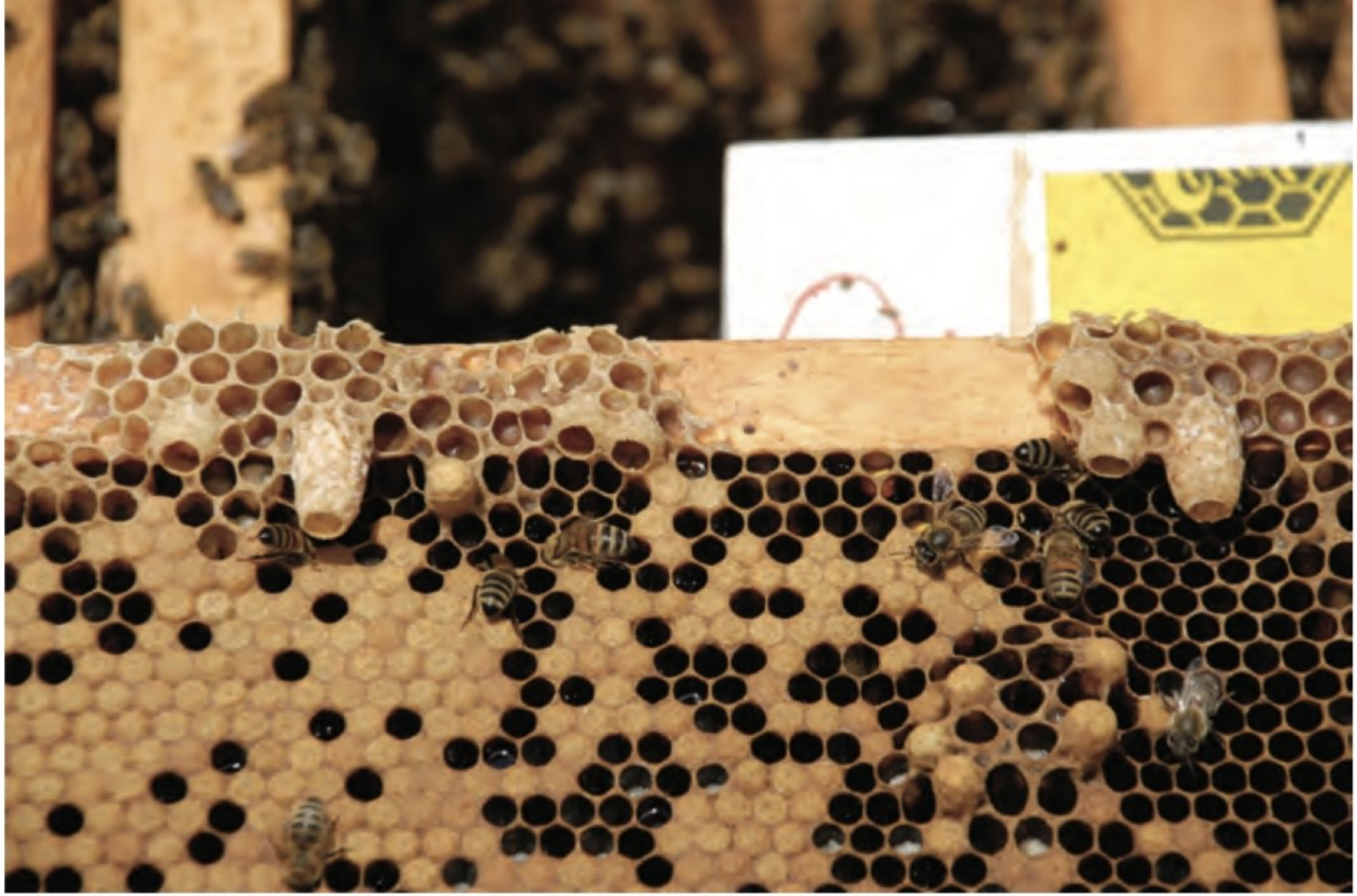


Figure 2. Swarm cells (the longer cells pointing down) and queen cups (the smaller cells pointing down) being developed at the top of a frame. The queen cups contain no eggs while the two longer swarm cells contain developing queen larvae feeding on royal jelly. These cells will remain open until the larvae are finished eating and the adult worker bees cap them. *Photograph by Mark Dykes, University of Florida (now with Texas A&M University).*

Figure 5. Swarm cells at the bottom of a frame. A virgin queen emerged correctly from the cell on the left (the tip of the cell is open) and killed her sisters while they were developing in the cells (the queen cells were opened from their sides). These cells suggest that the swarm has happened already and that the colony will not swarm again. How can this be known? The placement of the queen cells on the perimeter of the brood comb suggests that they are swarm cells rather than supersedure cells. The fact that one is opened from the tip suggests a virgin queen has emerged and replaced the swarming mother queen. Swarm cells opened from the side suggest that the virgin queen is not going to swarm with a secondary swarm given that no replacement queens for her remain alive. *Photograph by Keith Delaplane, University of Georgia*.