

David Hocutt - Honey Bee Biology
An Introduction Into The Fascinating World Of Beekeeping

FUN BEE FACTS

- Alexander the Great was embalmed with honey
- Although most folks think bears like honey, they really want the bee larva.
- Beeswax is used in the candy coating of M&M's so they "melt in your mouth, not your hand."
- Beekeepers live longer than any other occupation in the world.
- 5 gallons of honey weighs 60 pounds.



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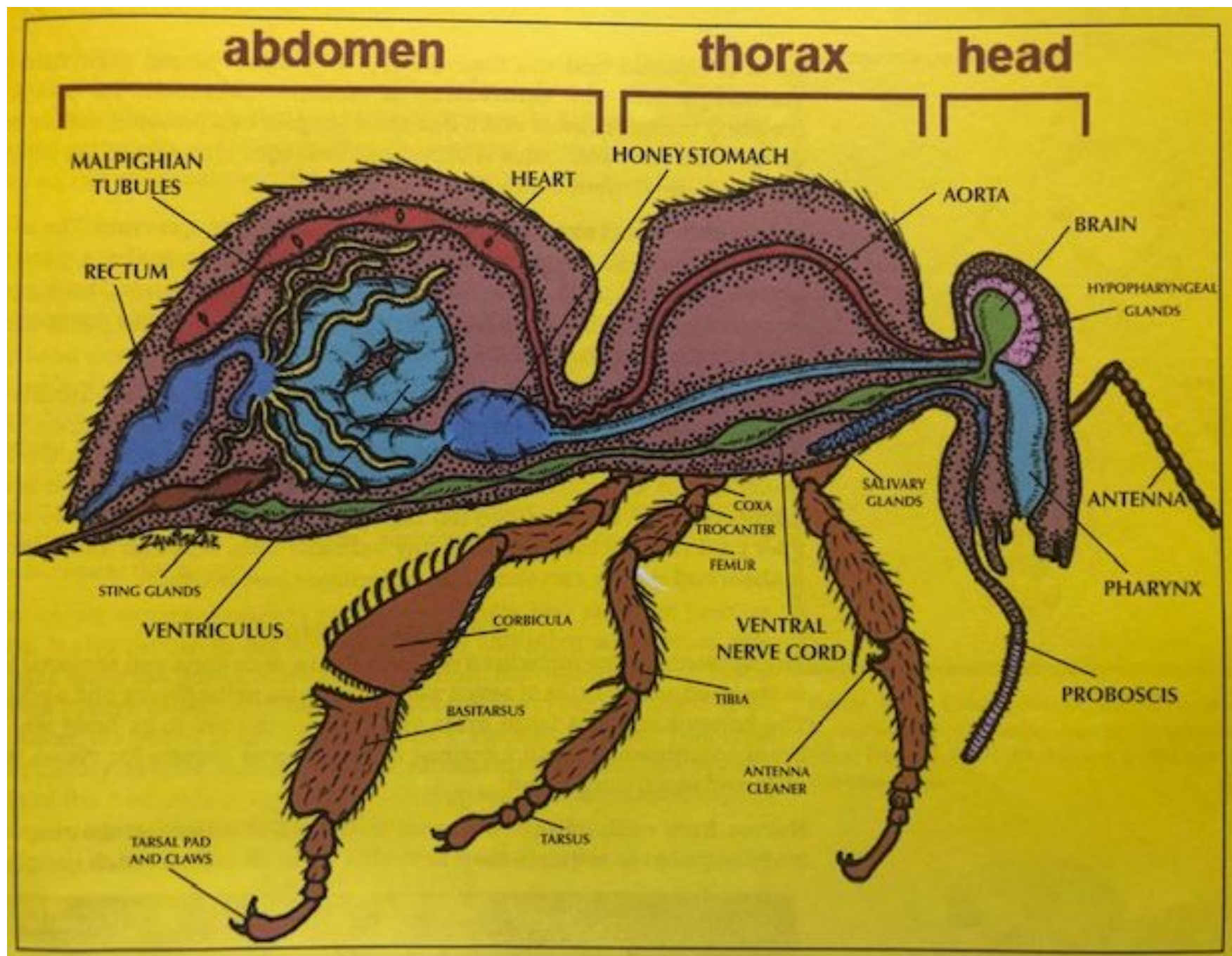
FUN BEE FACTS

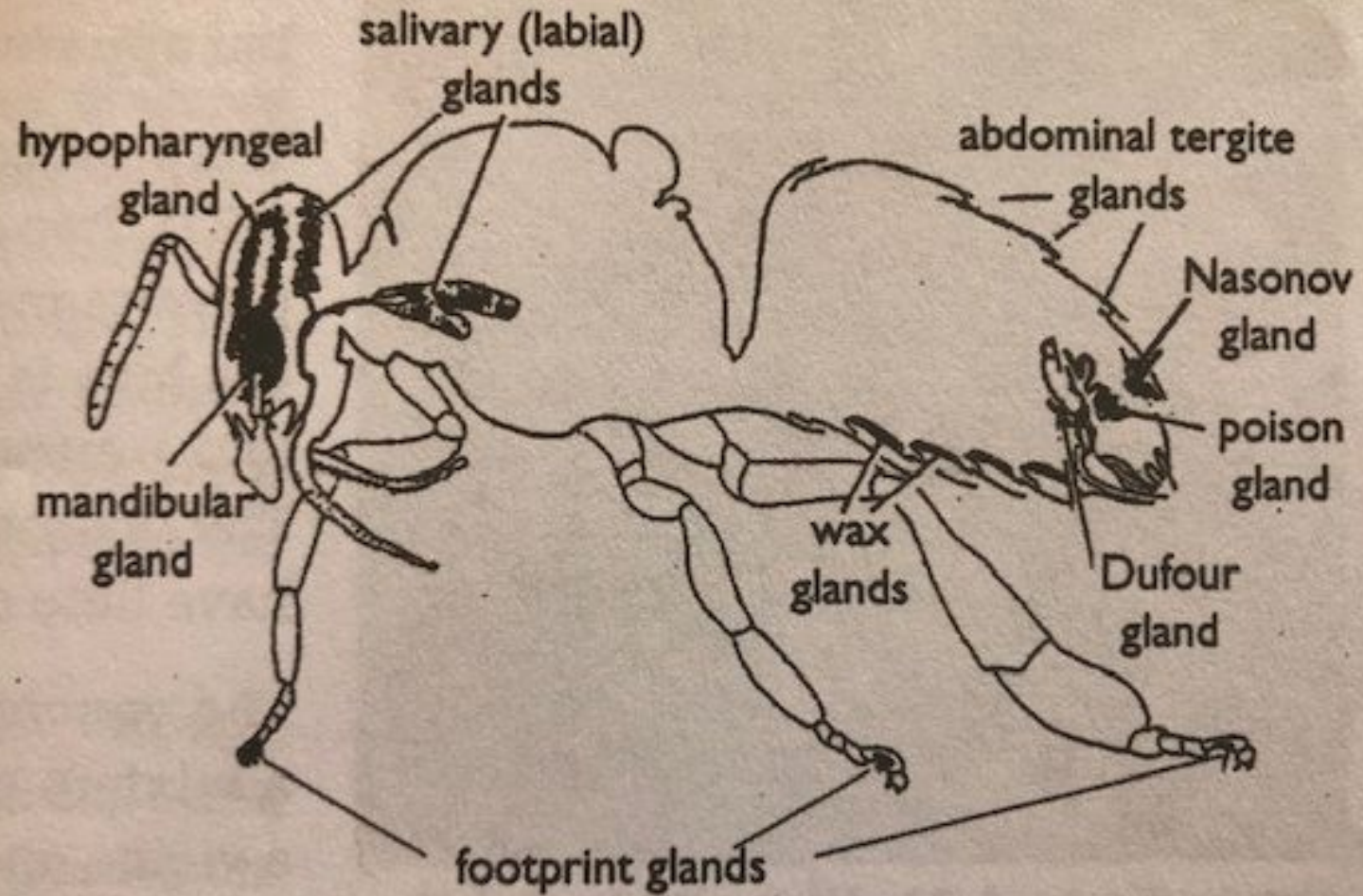
- It takes 12 bees their entire life to produce a teaspoon of honey.
- Honeybees are the only insect that produces food for humans.
- Queen bees are fed Royal Jelly their entire life.
- There are approximately 3200 bees in a pound.
- The average swarm includes 10,000 – 15,000 bees.
- Approximately 1600 bees can cover a deep frame.
- Counting both sides of a deep frame, there are about 6400 cells.

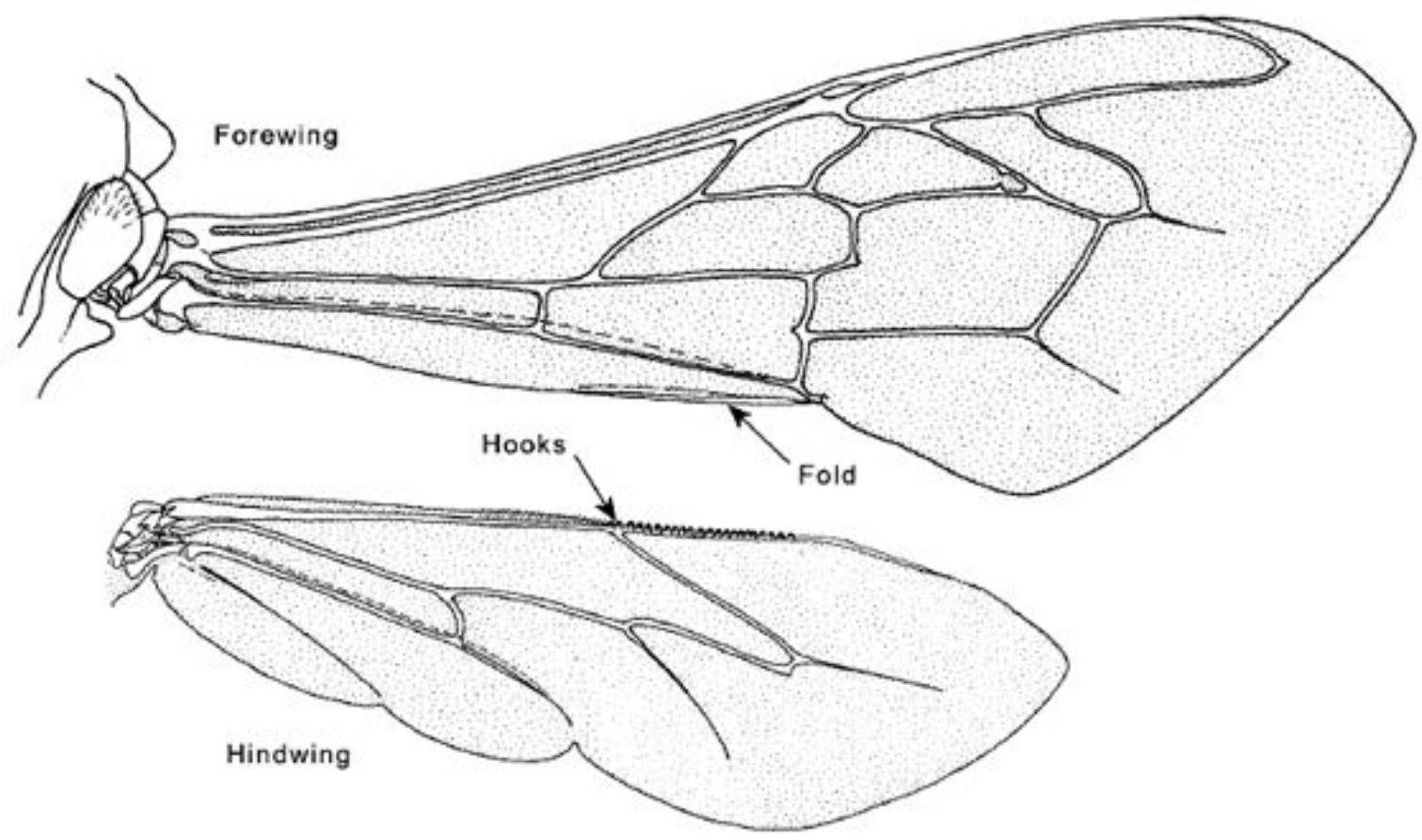


Honey Bee Biology

The Life of the Honey Bee







Types Of Bees In The Colony

Queen

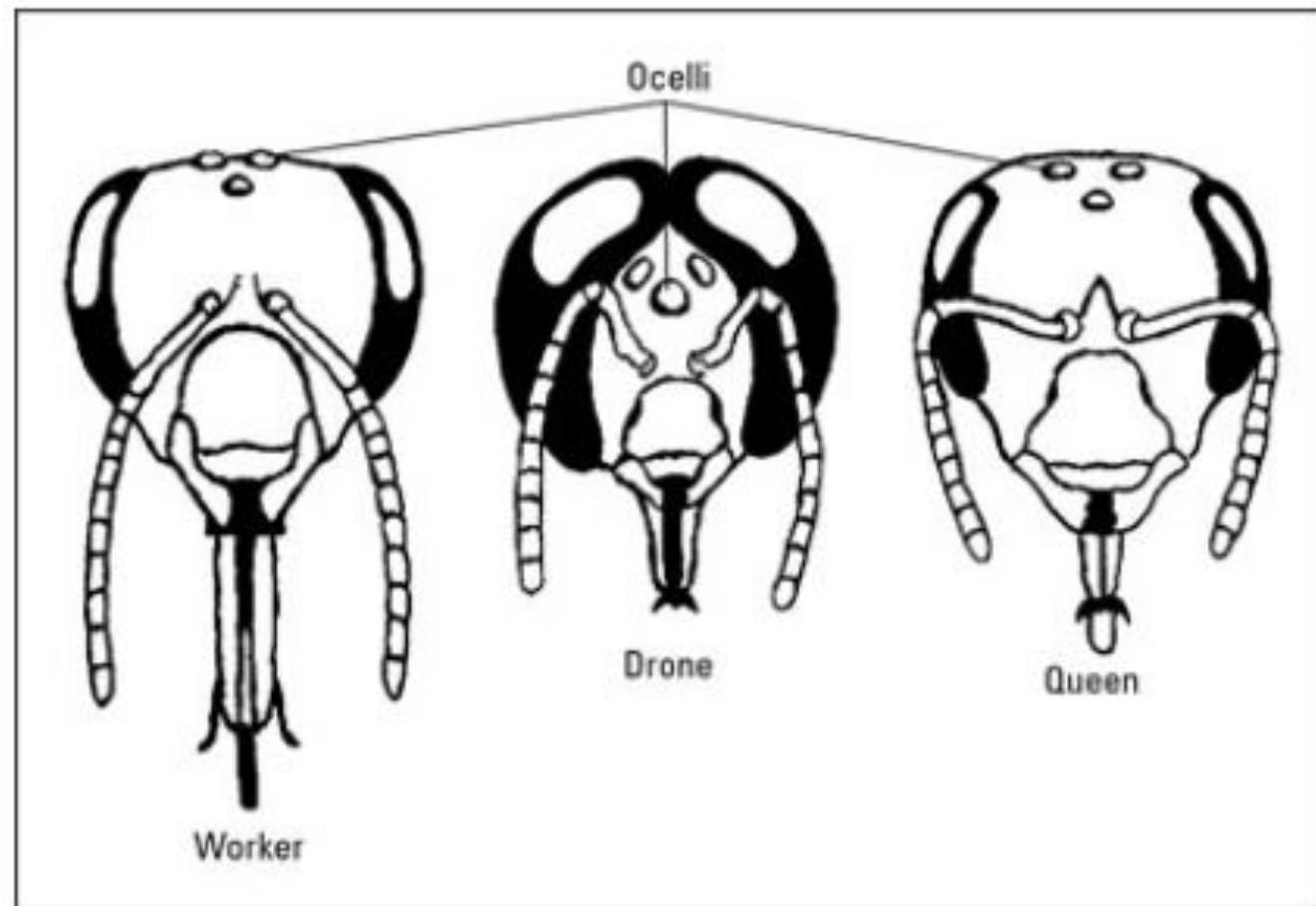


Worker



Drone





The Secret Of **Successful** Beekeeping!



Maintain The
Physiological Balance
of The Colony

Bee Colonies Are Eusocial

Eu = True

Social = Collective

Characteristics of Eusociality

- Reproductive Caste
- Cooperative Brood Care
- Generational Overlap

The colony acts as a superorganism

Temperature – The Concept of Critical Mass

Temperature Activity

Colony

- 96 to 100 F Comb Builders Most Efficient
- 93 F Brood Nest Temperature
- 57 F Clustering Begins

Individual Bee

- <49 F Unable to Fly
- 45 F Chill Comatose
- <40 F Dead



Colony's Needs

1) Shelter – High + Dry + Wind Protected



2) Forage – Nectar + Pollen + Water + Propolis



3) Reproduction – Survival of the Species

Queen – The Center of Attention

Two Functions

1) Egg Production –
Builds Population
Numbers



2) Pheromone Production -
Regulates Worker Activities
And Functions

Queen Pheromone

Produced by Mandibular Gland

Functions

- ❑ Inhibits the rearing of replacement queens
- ❑ Stimulation of foraging and brood rearing
- ❑ Hive functions
- ❑ Swarm stabilization
- ❑ Sex attraction

Produced by Footprint Glands

- ❑ Alerts colony of queen presence/absence

Queen Pheromone

Produced by Tergite Glands

Functions

- Worker ovary suppression
- Queen retinue behavior
- Alerts colony of queen presence/absence

Queen pheromones are spread throughout the colony by trophallaxis and antennation.

Queen Facts

- Usually only 1 queen per colony
- Kills other queens
- Averages laying 1500 eggs per day
- Fertilized Eggs = Females – Queens or Workers
- Unfertilized Eggs = Males = Drones
- Mates with 12 to 20 drones on a single mating flight
- Capable of storing collected sperm for her entire life
- Egg laying slowly dwindles down in the fall, sometimes stops altogether and starts again after winter solstice



Workers – Where the Action Is

□ Functions

At Age

Days 1 – 3 - Cleaning cells and incubating eggs

Days 3 – 6 - Feeding younger larva

Days 6 – 10 - Feeding older larva and queen

Days 8 – 16 - Receiving nectar from field bees

Days 12 – 18 - Wax making and cell building

Days 18 – 21 - Guarding entrance

Days 21 + - Nectar, pollen, water, propolis foraging

polyethism



Worker Bee Adult Life Span

6 weeks when very active during foraging

24 weeks or longer when clustered for the winter

Shorter if weakened by diseases

Nectar Collection

- Nectar and pollen collection dictated by colony's needs
- Bees communicate the location of forage by the waggle dance
- Bees suck nectar through their proboscis into their honey stomach where enzymes begin the conversion of nectar into honey
- Upon entering the hive the nectar is transferred to house bees, who evaporate it from about 85% moisture down to 18% moisture
- The evaporation process is done by house bees fanning their wings
- House Bees Cap The Honey When It Is Ripe



Pollen Collection



□ Pollen collect on the bees' hair which she then brushes into a ball and packs it into her pollen baskets on her hind legs

□ Pollen balls are kicked off her hind legs into a cell, she then turns around and packs the pollen into the cell with her head



□ Honey is added to the pollen in the cell to make bee bread



Propolis Collection

Resins from trees and plants

Functions

- Antibacterial and antifungal coating for hive interior
- Fill in bee space infractions
- Reduction in entrance size opening



Worker Pheromones

Produced the Sting Gland

Function

Alarm Pheromone - Alerts bees to sting at this spot
(Banana like smell)



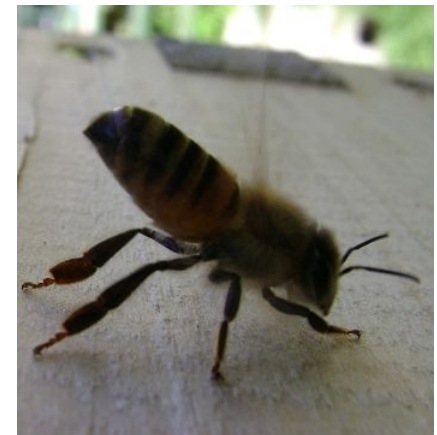
Produced by Worker Mandibular Gland

□ Alarm Pheromone – Alerts guards to foreign intruders
and recruits guard reinforcements



Produced by Nasanov Glands

□ Marks Location of Hive Entrance
□ Marks Location of Forage



Drones

□ One Function

To mate with a queen



Drone Pheromone

Function

Drone Pheromone

Function

- **Attracts Other Drones To Form A Drone Congregation Area**

Drone Comet



Drones locate queens with their huge eyes

Drone Facts



- ❑ Produced from an unfertilized egg
- ❑ No stinger
- ❑ Does not forage, but eats nectar and pollen
- ❑ Universally accepted into any hive
- ❑ Flies to drone congregation areas to mate with queens about mid afternoon
- ❑ Most never have an opportunity to mate
- ❑ Immediately die after mating
- ❑ Removed from the hive by worker bees in the fall

Other Notable Pheromones

Egg Pheromone

Brood Pheromone (each instar has a different pheromone)

Recognition Pheromone

Residual Comb Pheromone

Death Pheromone

Honey Bee Life Cycle Chart

Type	Egg	Larva	Cell capped	Pupa	Average Developmental Period	Start of Fertility
Queen	3 days	5 1/2 days	7 1/2 days	8 days	16 days	Approx. 23 days
Worker	3 days	6 days	9 days	12 days	21 days (Range: 18-22days)	N/A
Drone	3 days	6 1/2 days	10 days	14 1/2 days	24 days	Approx. 38 days

Nutrition

- **Nectar / Honey** – Carbohydrate source for energy
- **Pollen** – Protein, vitamin, and mineral source for producing brood and pheromones
- **Water** – Required for diluting honey for feeding larva. (Also required for cooling hive when necessary.)

When nutrition sources are not available, the beekeeper needs to provide suitable substitutes. There MUST be enough food in the hive to feed ALL of the bees ALL of the time.

Reproduction – A Matter of Survival

- Queen measures cell size with her forelegs to determine if she should fertilize the egg
- If the queen is failing or the colony is preparing to swarm, the queen is forced into laying eggs into supersedure or swarm cups (to make queen cells)
- In an emergency, ANY fertilized, day old larva can produce a queen if fed copious amounts of royal jelly during the larva stage. (This is the basis for grafting.)

Reproduction – A Matter of Survival

- Queen larva receives 1600 feeding visits from nurse bees versus 150 for worker larva per day
- Egg laying is positively influenced by
 1. Increased day length
 2. Warmer temperatures
 3. High queen pheromone levels
 4. Bountiful nutrition
 5. Open cells in comb
 6. Balanced hive population

Reproduction – Making Queens

By Beekeeper Intervention

□ Emergency simulation – methods that remove the queen from the colony and stimulate the workers to feed royal jelly to day-old larva to produce a new queen

1. Splits

2. Divides

Queen less portion(s)

Must have eggs or

One day old larva



Reproduction – Making Queens By Beekeeper Intervention

- Swarm Simulation – Crowding colony to induce the formation of swarm cells.
- Grafting – Transplanting day old larva into artificial queen cups, incubated in queen less hives.



Swarms

- ❑ Good – if you catch one!
- ❑ Bad – if it is your hive that swarmed
- ❑ Ugly – The sight of your post – swarmed hive with less than half the bees you had yesterday



Biology of Swarming

- A colony will only swarm if there are abundant provisions in the hive
- Triggers – must have both
 1. Crowding
 2. Abundance of incoming forage.



Process of Swarming

- Workers force queen to lay eggs in multiple queen/swarm cells.
Typically near the bottoms of combs.
- Workers “exercise” the queen to make her lighter and more able to fly.
- Workers begin to engorge themselves on honey
- Queen stops laying 3 – 4 days before swarm
- Swarm emerges from hive after swarm cells are capped
- 10 – 15 thousand bees congregate within a few hundred yards of the hive until scout bees find a new home

Swarm Prevention

- ❑ Remove queen and/or split the hive before it swarms
- ❑ Add open comb/super to avoid crowding
- ❑ Open the honey dome – checker boarding
- ❑ Open brood nest – insert empty frames
- ❑ Can be used as a management tool for colony increase



Catching Swarms



- Easy!
- Bees are usually gentle
- Trick – If you get the queen into your box, the rest of the bees will march right in. Awesome to watch!
- Keeping swarms from absconding
 1. Add a frame of brood
 2. Screen the entrance for 3 days
 3. Cage the queen

Pests And Diseases

☐ Parasitic mites

1. Varroa
2. Tracheal



☐ Bacterial Diseases

1. American Foulbrood
2. European Foulbrood



☐ Fungal Disease

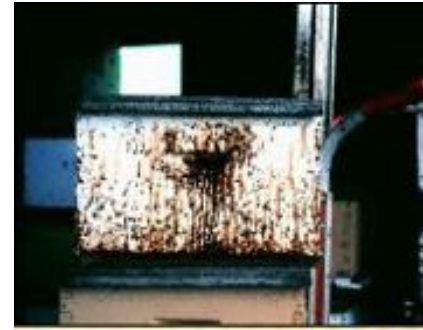
Chalkbrood



Pests And Diseases

□ Microsporidian

1. Nosema



□ Viral Diseases

1. Sacbrood
2. DWV



□ Pests

1. Wax Moth
2. Small Hive Beetle



Pests And Diseases

Colony Collapse Disorder

1. Still a mystery ??

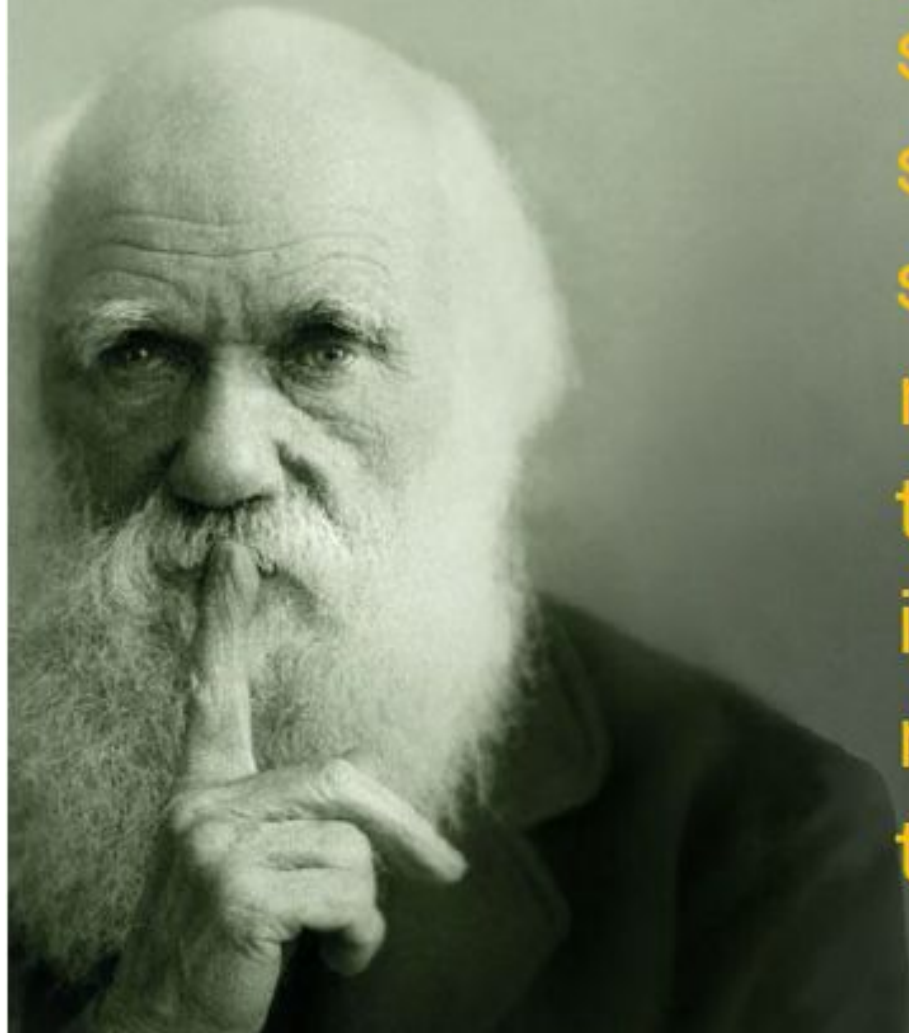
□ Biggest Pest

1. Beekeepers
 - a) Rolled Queens
 - b) Chilled Brood
 - c) Improper Husbandry
 - d) Misuse of
Insecticides/Pesticides/Medications
 - e) You Tube / Facebook



For reliable internet sources for honey bee information go to:
Honeybeehealthcoalition.org

CHARLES DARWIN



“It’s not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change.”

The End

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Happy Beekeeping !

Actually Only The Beginning