



# Bee 101

David Tremblay Vermont State Apiarist 2017

# Examining *Apis mellifera*

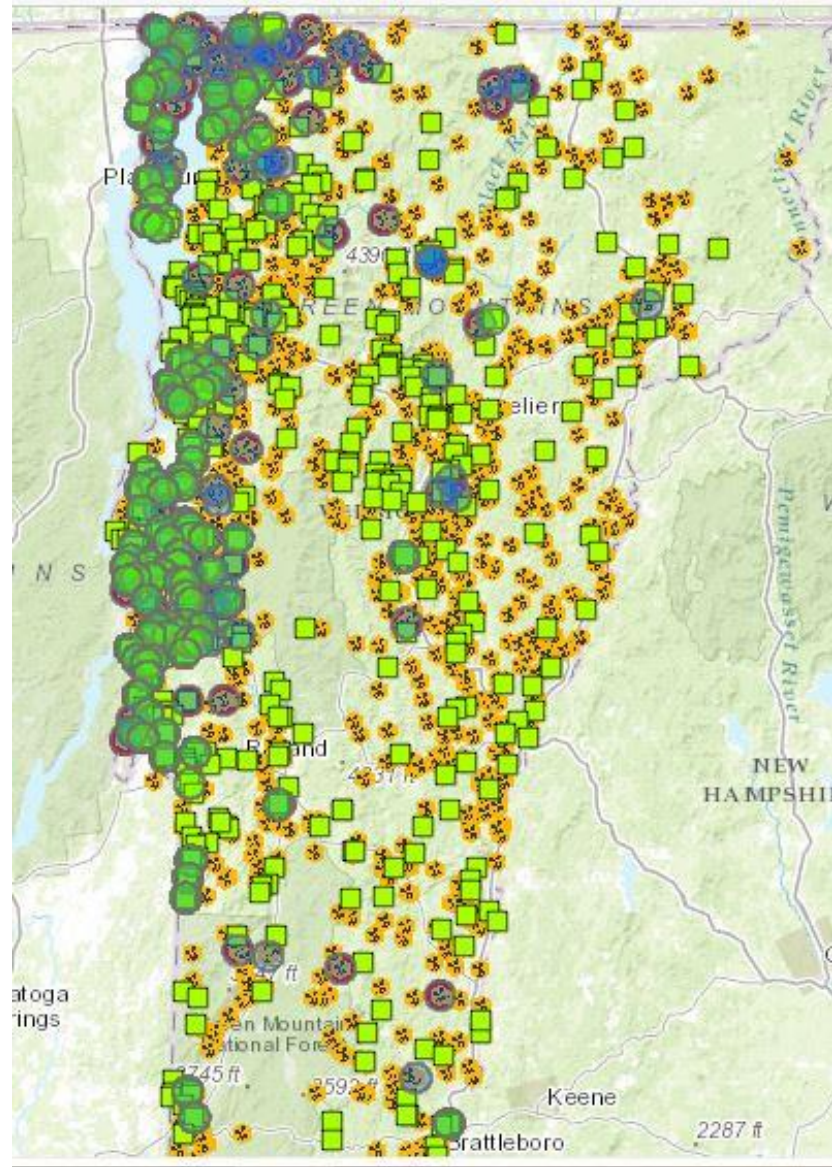
- Hear one...Bee 101
- See one... Bee 201
- Do one....
- Know one...10,000 hours



# VT Stats

- 850 beekeepers
- Apiary registration is giving us accurate numbers for *registered beekeepers*: 850
- 2016 spring and summer gave us a bumper crop of honey. ( numbers not in yet and fall flow was a bust)
- Vermont produce 240,000 pounds of honey in 2015
- \$2 million retail value honey.
- Pollinated \$34 million dollars of Vermont fruits and “vegetables” (Apples are the main crop, with pumpkins, blueberries and various small fruits and vegetable crops also pollinated.)
- 6,800 acres fruit and vegetable crops.
- Vermont beekeeping industry is increasing its ability to raise and over-winter colonies replacement nucleus colonies.
- Vermont is home to world renown bee researchers, writers, and innovators. (Mike Palmer, Kirk Webster, Chas Mraz, Ross Conrad.)
- Pollinator Protection Committee recommendations sent to legislators







# Vermont Apiary Program

- [Title 6: Agriculture](#)
- [Chapter 172: Inspection Of Apiaries](#)
- **§ 3021. Definitions**
  - (8) "Destroy" means to burn bees, combs and frames, or other equipment which cannot be disinfected by scorching or other approved methods.
  - (9) "Disease" shall mean any serious malady which is infectious, contagious, or injurious to bees and shall include: American foulbrood, European foulbrood, or external or internal parasites or parasitoids of bees.
- **§ 3022. Enforcement; inspection**
  - ((b) Any person who is the owner of any bees, apiary, colony, or hive shall pay a \$10.00 annual registration fee for each location of hives. The fee revenue shall be collected by the Secretary and credited to the Weights and Measures Testing Fund to be used to offset the costs of inspection services and to provide educational services and technical assistance to beekeepers in the State.
- **§ 3023. Duties to report**
  - It shall be the duty of any person who is the owner of any bees, apiary, colony, or hive to report to the secretary in writing:
    - (1) the location of all such apiaries and number of colonies. The location of an apiary shall become its registered location;
    - (2) the change of location of any apiary within two weeks unless the change of location is to provide pollination services and the colonies will be returned to a registered apiary. Hives from a registered apiary may be moved to another registered apiary without reregistering;
    - (3) the discovery of a serious disease within any of his or her colonies;
    - (4) the transportation into this state of any colonies or used equipment, except as noted in subsection 3032(c) of this title; and
    - (5) the fact that he or she is engaged in the rearing of queen bees or any other bees for sale, if applicable. (

# Vermont Apiary Program

- **§ 3024. Apiary inspection; owners to control or eradicate bee diseases**
- The secretary, or his or her inspectors, may examine all apiaries as necessary and ascertain whether any disease which is injurious to bees is present. If any such disease is found, the secretary shall give the owners or caretakers of the diseased apiaries written orders to treat, destroy, or otherwise handle the colonies in order to prevent the spread or dissemination of the disease
- **§ 3025. Second inspection of diseased colonies; destruction**
- The secretary or his or her inspectors shall inspect all diseased apiaries a second time no less than 10 days after the first inspection. If the existence of disease within the apiary has been confirmed by a federal laboratory, the inspector may destroy any colonies of bees if he or she finds them not cured of such disease, or not treated or handled according to his or her instructions, together with honey combs, hives or other equipment, without recompense to the owner thereof. This section shall not preclude an inspector from destroying diseased colonies at any time with the consent of the owner, or his or her agent.
- **§ 3026. Sale or other unauthorized disposition of diseased bees**
- The owner of any apiary in which a disease exists shall not knowingly sell, shall not in any way expose other bees to the danger of the disease.



# Vermont Apiary Program

- **§ 3027. Abandoned apiaries and equipment**
- Any diseased hive or hives found by the secretary or his or her inspector in an abandoned apiary shall be destroyed.
- **§ 3028. Traffic in bees; inspection; certification**
- A person engaged in the rearing of bees for sale shall have his or her apiary inspected by the secretary at least twice during each summer season furnish the owner with a certificate to free of disease.
- **§ 3029. Movable comb frames required**
- (a) All hives shall be constructed with frames containing the honeycombs and brood combs which may be removed from the hive for purposes of inspection. Upon determination that any hive containing bees is not constructed with removable frames, the Secretary or his or her inspector may:
  - (1) immediately transfer the bees to a hive with removable frames; or
  - (2) grant an extension to transfer the bees to a hive with removable frames.
- (b) permit program to allow persons to operate hives without removable frames for exhibition purposes.
- (c) the Secretary may destroy the hive or hives.
- **§ 3031. Right of entry; impeding prohibited**
- The secretary or his or her authorized inspector may enter at a reasonable hour public or private premises, except private dwellings,

# Vermont Apiary Program

- **§ 3032. Transportation of bees or used equipment into the state**
- (a) No bees, used equipment, or colonies shall be brought into the state of Vermont unless accompanied by a valid certificate of inspection within the previous ten months from the state or country of origin stating that the bees, used equipment, or bee colonies are free from bee disease.
- (b) Any person, transports used equipment or colonies to a point within this state shall provide the secretary with a copy of the certificate of inspection not more than 72 hours after entry into this state.
- (c) This section shall not apply to a shipment of bees, equipment, or colonies which originated outside the state and is destined for another point that is also located outside this state
- **§ 3033. Shipping bees or equipment into another state or country; application for inspection; expenses; certificate**
- (a) ship bees or equipment into another state or country he or she may apply for an inspection for serious bee diseases
- **§ 3034. Establishing an apiary location**
- No person shall locate an apiary within two miles of an existing apiary registered to a different person, with the following exceptions:
- (1) a person may locate an apiary anywhere on his or her own property;
- (2) beekeepers with ten hives or less shall be exempt;
- (3) existing apiaries registered are exempt;
- (4) a person may locate an apiary within two miles of another existing apiary with written permission or the existing apiary has less than 15 hives;
- (5) if a registered apiary of 15 or more hives should fall below and remain below 15 hives, 2 years
- **§ 3035. Penalty** \$500.00 for each offense.

# Langstroth Hive

Outer Cover  
with Inner Cover  
hidden underneath

Medium  
Super for  
Honey

Queen  
Excluder

2nd Deep  
Super for  
Brood

1st Deep  
Super for  
Brood

Slatted  
Rack

Screened Bottom Board

BeverlyBees.com

# Langstroth Hive





# hive

- 50,000 bees – natural colony
- 2 deeps and 2 supers approx. nature
- Super – where the honey is

# Apiary typical - drifting



Deep box with moveable frames.



Medium box with no frames



Bees with no box!





Deep = 100#  
Medium = 60#  
Shallow = 35#

- Boxes can become heavy!
- Deep = brood box = hive body
- Super = honey

## A matter of depth



Deep or Hive  
Body  
9 1/8 deep

100 lb when  
filled with  
honey



Medium or  
Illinois Super  
6 5/8 deep

60 lb when  
filled with  
honey



Shallow Super  
5 11/16 deep

35 lb when  
filled with  
honey

# Two Deeps pre-assembly

- Inner cover \$12
- Telescoping cover \$25
- Deep box parts \$18
- Split bottom bars \$5
- Wedge top bars \$5
- Side bars \$4
- Frame rest \$3
- Foundation \$2.00
- Bottom board \$30
- Slatted rack \$20
- Entrance reducer \$2
- ...total: \$180





“Pulled Out” foundation



# How to get started with bees: Package bees



# Packages on a truck





Nucleus Colony = Nuc  
Two frames of baby bees  
with caretaker bees and a  
frame of pollen (bee  
bread)

Pros: build colony quicker

Cons: comes with used  
equipment – disease risk





## Western honey bee



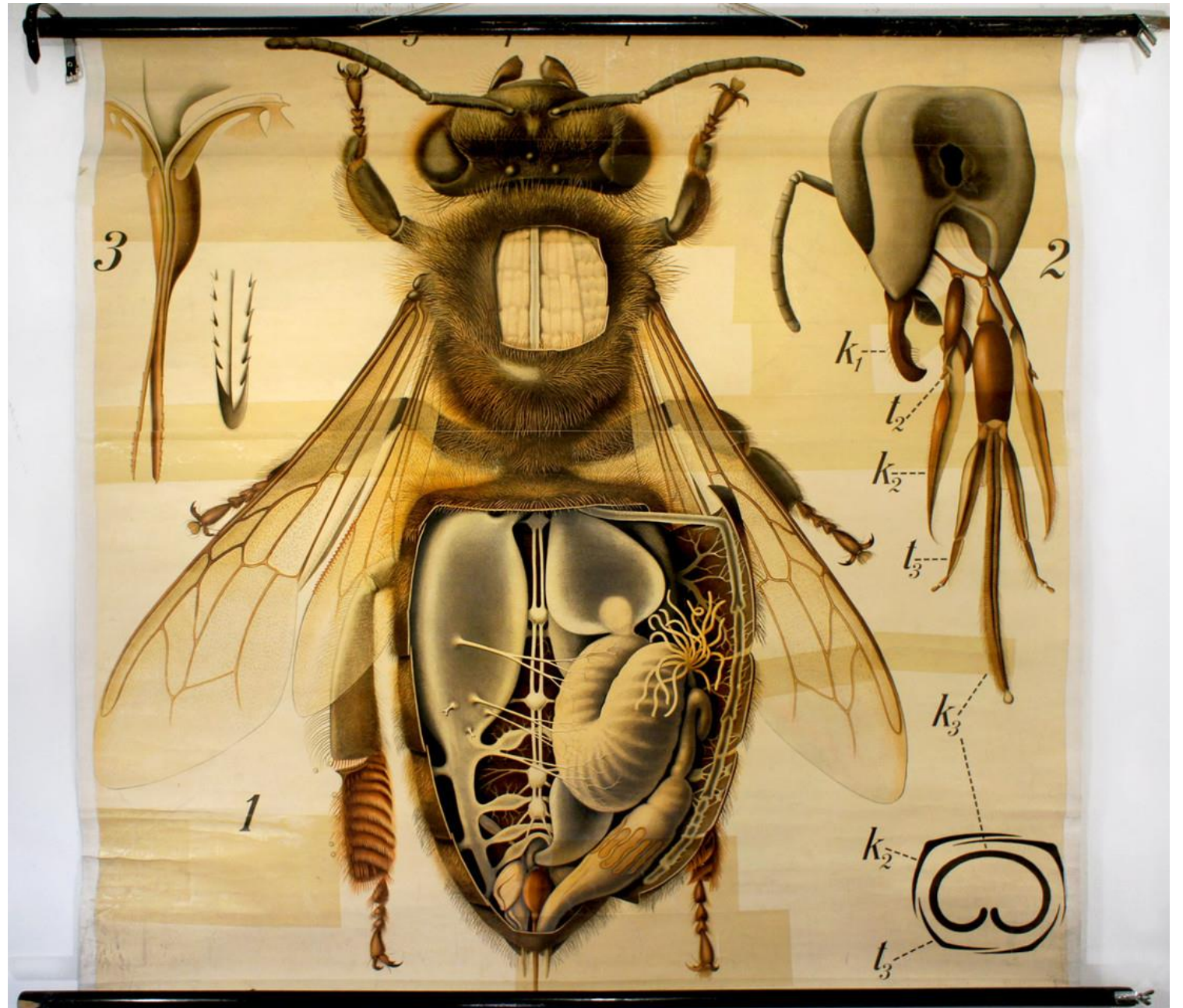
### Scientific classification

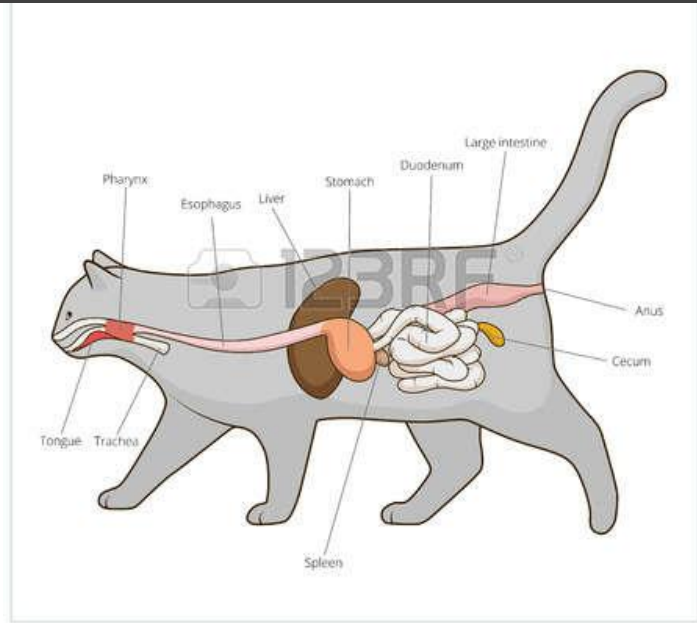
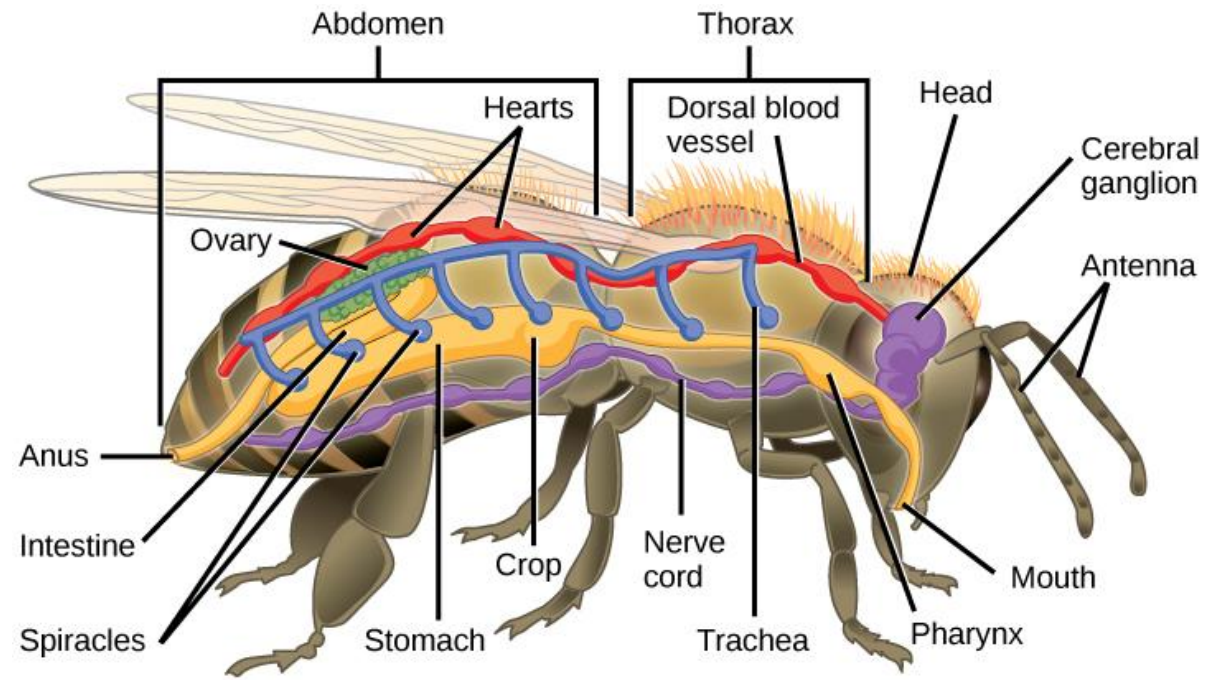
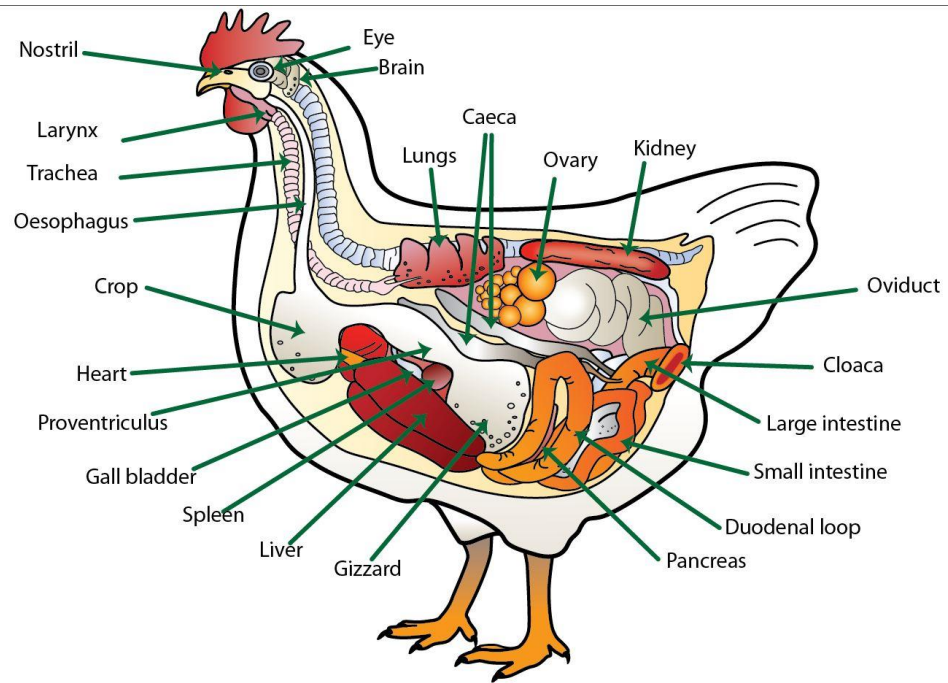
Kingdom:	<a href="#">Animalia</a>
Phylum:	<a href="#">Arthropoda</a>
Class:	<a href="#">Insecta</a>
Order:	<a href="#">Hymenoptera</a>
Family:	<a href="#">Apidae</a>
Subfamily:	<a href="#">Apinae</a>
Genus:	<a href="#">Apis</a>
Species:	<b><i>A. mellifera</i></b>

### Binomial name

***Apis mellifera***

Linnaeus, 1758





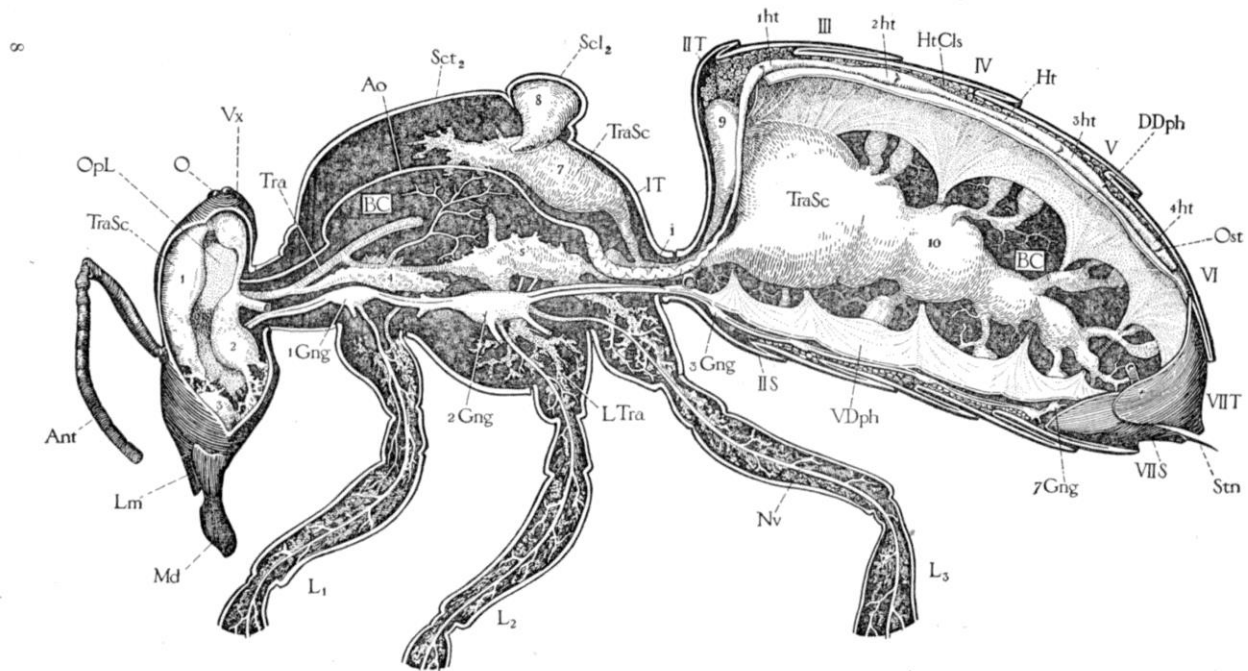


FIG. 1.—Longitudinal, median, vertical section of entire body of worker, showing nervous system (*OpL-7Gng*), tracheal system (*TraSc, 1-10*), dorsal and ventral diaphragms of abdomen (*DDph* and *VDph*), and dorsal vessel consisting of heart (*Ht*) and aorta (*Ao*).

# Bees in the hive:

- Drone
- Queen
- worker



# Plus two more queens

## **Drone Laying Queen**

- Queen has run out of fertile eggs
- Still one egg per cell
- Lays only drones
- Fixed by replacing queen

## **Laying Worker**

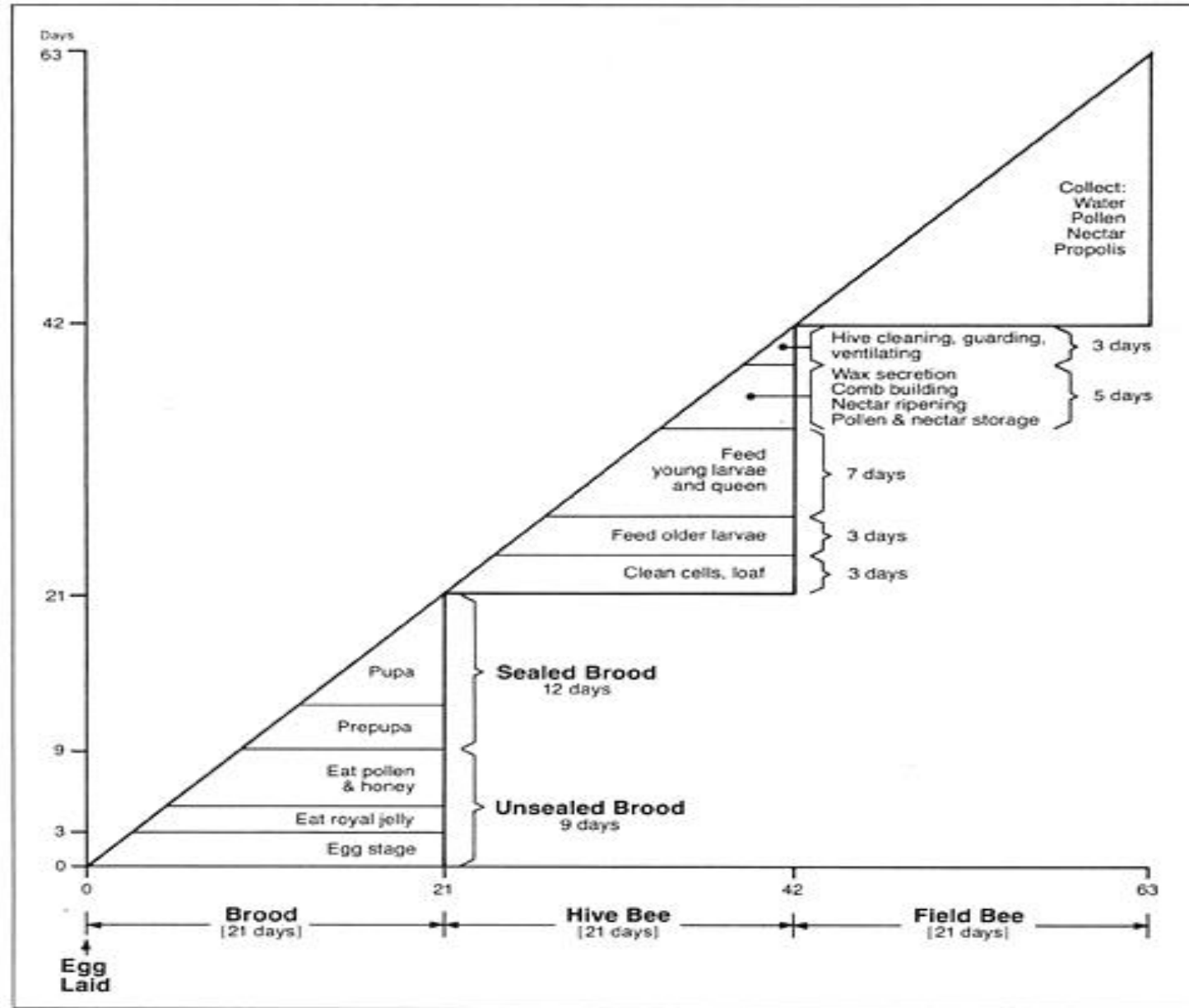
- When no eggs to turn into a queen
- Lays many eggs in one cell
- Only drones
- Hive not happy
- Difficult to remedy.

21 21 21

42

63

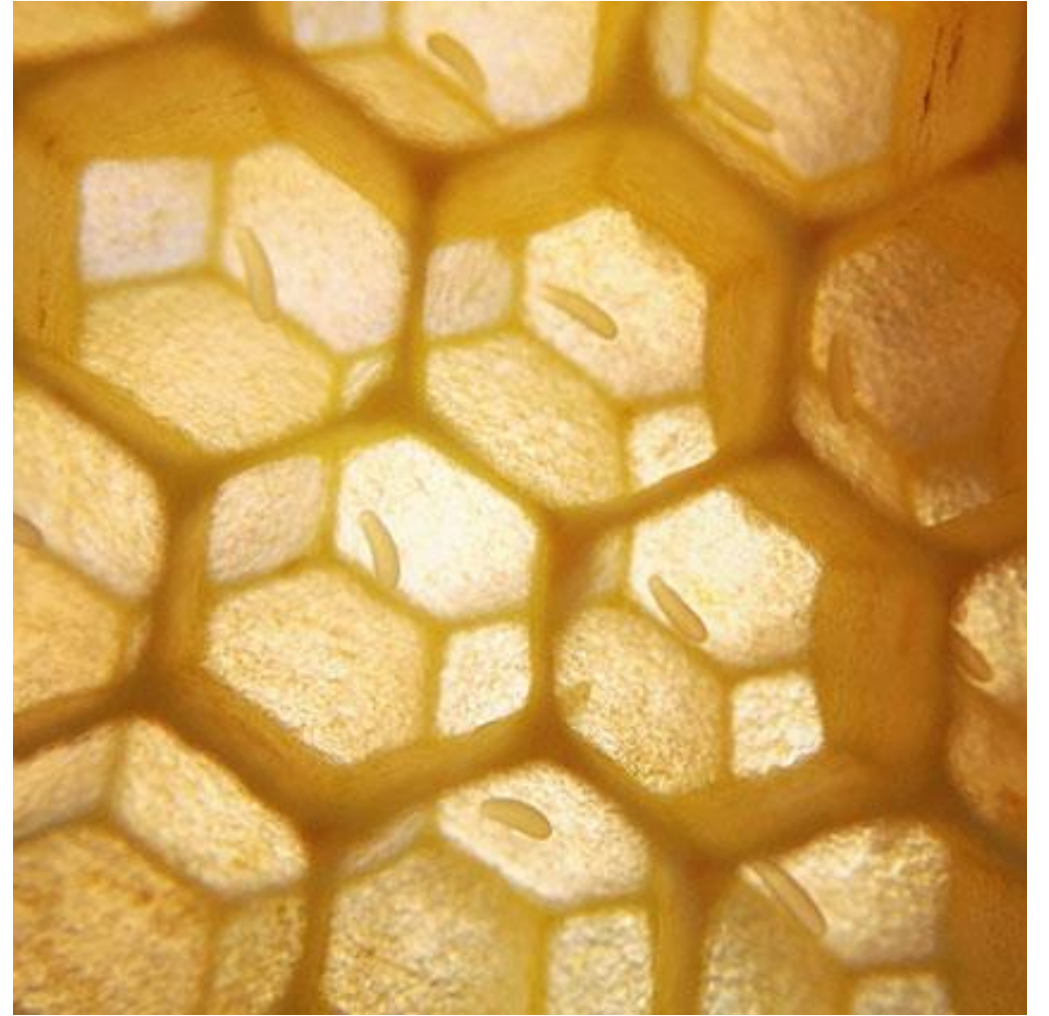
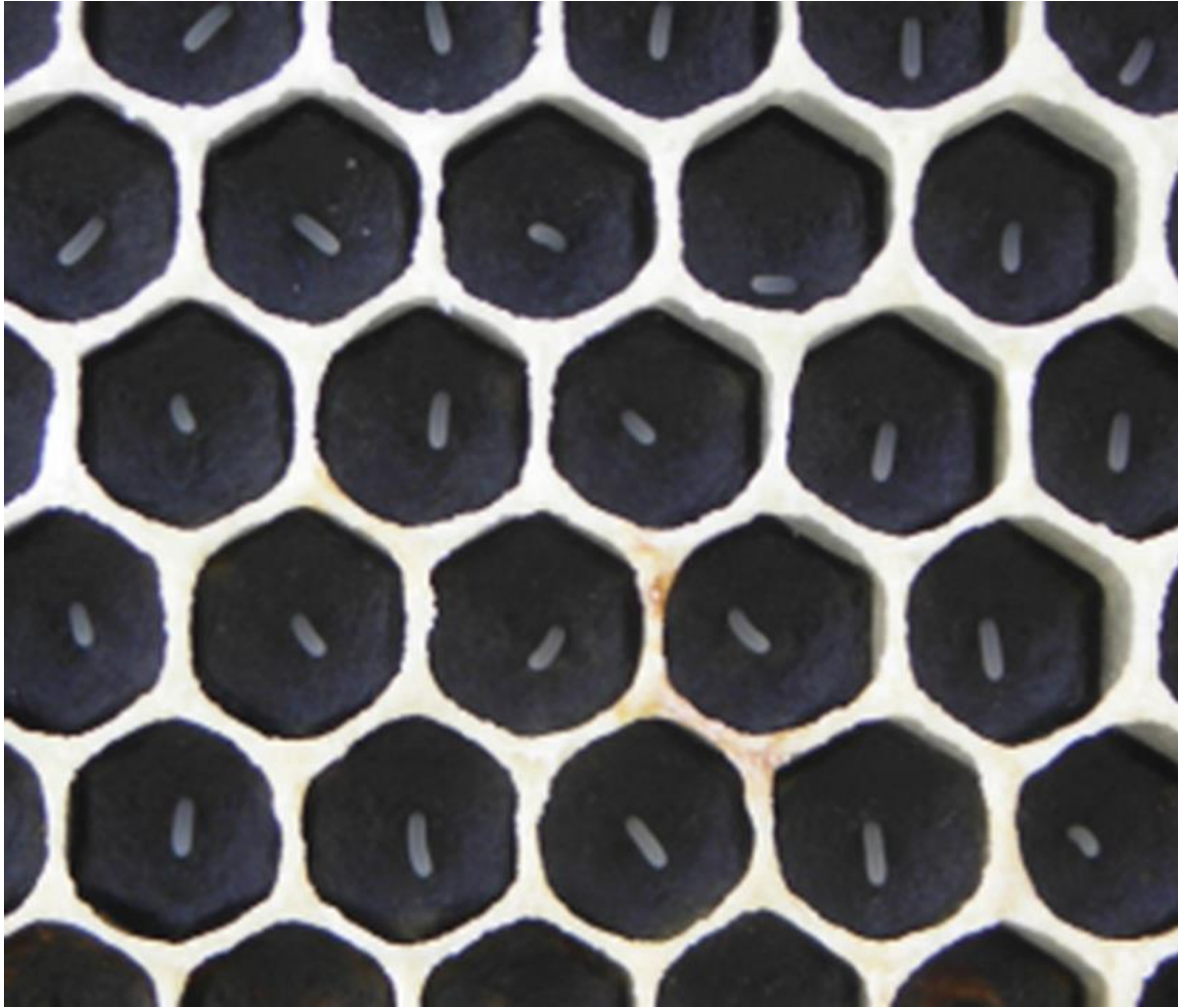
Development times  
let you know general  
health and direction  
of the hive.



# Jelly and Eggs



# Eggs





# Eggs in vertically sliced comb



# Eggs and Larvae





Larvae : 3-9  
days old on  
black plastic  
foundation.





Sealed Brood  
10- 21 days.



# Counting bees

- No of cells on deep frame = 50h x 90 w = 4500 per side
- Bees in  $\frac{1}{2}$  cup = 300
- 1 pound = 3,700 bees
- 6 cups = One pound of bees
- 1 pound = critical mass for cluster warmth.
- 1000 eggs laid per day.
- 50,000 bees in a hive

# House Call – The Inspection

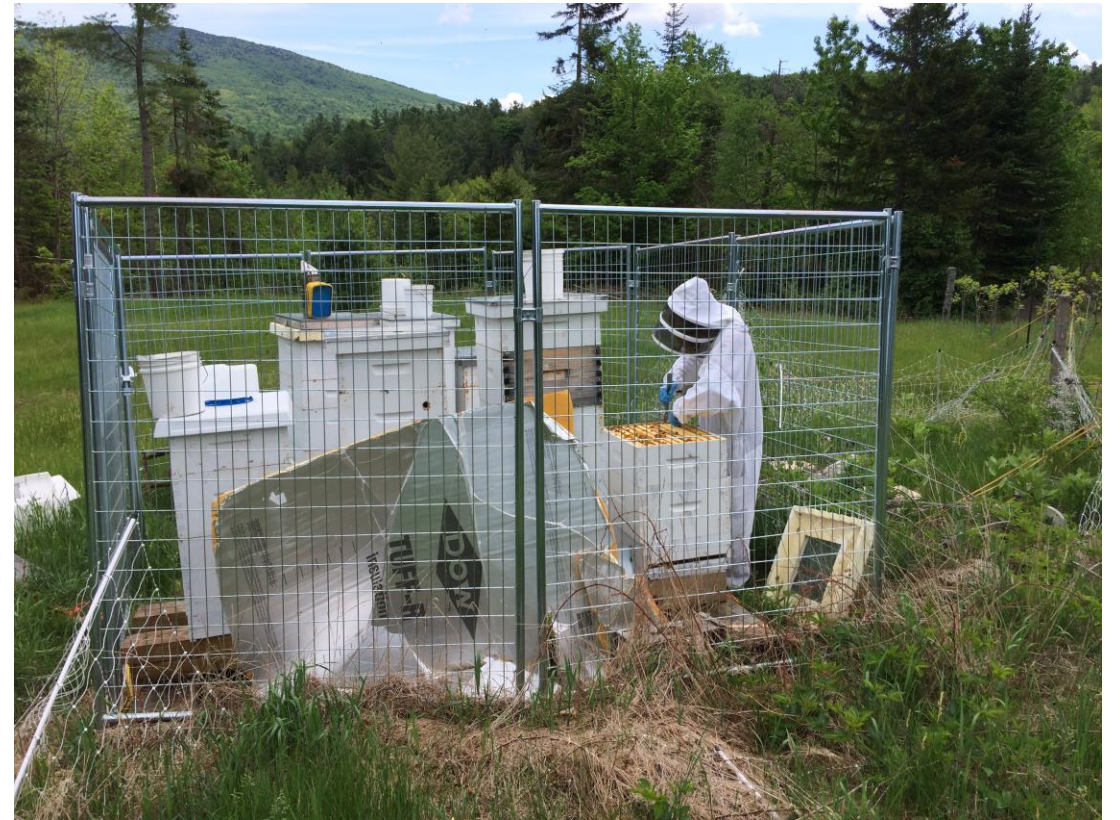


Good Manners and Biosecurity



# Apiary Etiquette

- Beekeepers and vet/inspectors look at hives for different purposes
- Beekeepers are managing
- Vet is inspecting
- Can tell if bees are aggressive if they try sting your hand when you hold it over the frame
- All apiaries should have an electric fence around them to keep the bears out



# Apiary Etiquette

- Half of beekeepers are first years, 75% are second years
- Offer to let beekeeper open hive/ use their tools/smoker.
- Bees have different traits
- Vet brings:
  - Vet needs to be able to open the hive on their own
  - Hive tool
  - Smoker, fuel, lighter (torch)
  - Bee suit
  - Fully covered



# Bee Suits and Gloves

- Bee Suit
  - Washable
  - Wear a freshly washed one to each apiary
  - Care of suite
  - Hand wash veil
  - Wash separately from other clothes due venom
  - Fits over clothes or commando
- Gloves – plus or minus
  - Purpose – if bees are aggressive but interfere with dexterity
  - Use thick exam gloves
  - Dishwashing gloves

# Appropriate Clothing

- No leather
- No wool
- No black clothing
- No perfume



# Implement Biosecurity SOPs

- Equipment and vehicles: No honey, wax and colony debris is left on vehicles and apiary equipment in order to prevent robbing.
- Wash down facilities to clean vehicle of honey, wax, bee defecation, and associated colony debris, especially after visiting other apiaries.
- All tools and equipment, including hive tools, gloves, pallets, boxes and any other equipment used in the apiary are regularly cleaned and sterilized. SOP Soap, biocide, alcohol, flame. – all surfaces! Edge and holes of hive tool!
- Discussions are regularly with beekeepers about your SOPs and then show them you follow them!

Which hive tool can you Clean and Disinfect?



# Hive inspection

- Pull up at farm
  - Don't get bit by dog
  - Park near apiary
- Lay out decon equipment by the car, sampling equipment available
- Don clean bee suit and gloves
  - be prepared for the most aggressive bees
- Light the smoker
- Go to hive with owner with your smoker and hive tool
- Don't get shocked – electric fence.
- Approach hive from non-bee-side entrance



# Hive Inspection

- Smoke 'em
- Examine entrance for dead bees – bee activity - observe.
- Remove cover with hive tool
- Place cover upside down on the ground or another box
  - Cover may be plywood or more substantial, flat, held down with a rock
  - Tool is for inner cover that is often glued
- Pull outer frame of top box – look for honey, sign of colony strength and nectar flow. Aggressiveness?
- Remove honey supers – stack on cover.
- Do you smell bananas?





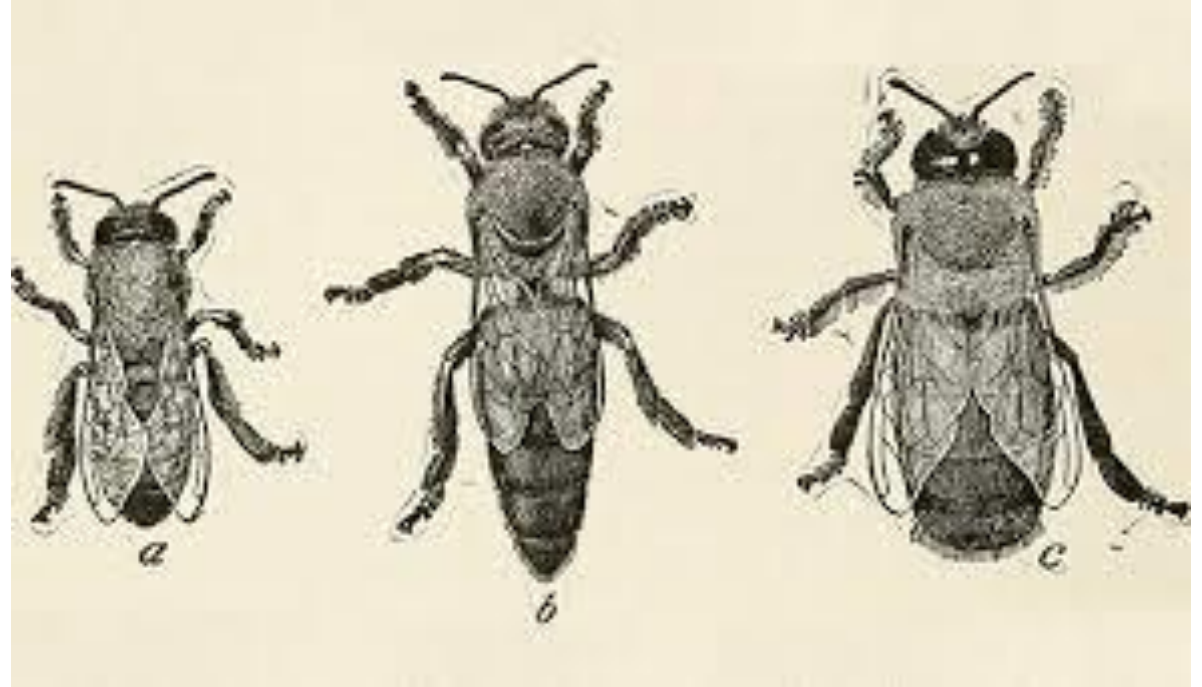
# Queen excluder

- Between honey super and brood boxes.
- Keeps queen from laying eggs in honey supers.
- Must be flipped to keep side against brood next to brood box.
- Always inspect for queen!



# The queen

- Recognize
- Do not kill.
- Do not “roll” a queen
- \$30 queen + production loss + re-queening = \$100
- Do not disturb. Know where she is during inspection.



Queen Identified with Paint



# Frame Inspection and Handling

- Pull outer frame of brood box – set aside.
- Slide next frame over, pull and inspect.



# Missing Reinforcement - Careful



# What To Look At

- Mite count? – sugar shake?
- Disease?
- Pests? SHB- Wax Moth- mice...
- Strength?
- Queen health?
- Swarm potential.
- Beekeeper care (heavy propolis? Reversed? Add boxes)

# End of Inspection

- Inspection ends once you have enough info.
- By the bottom box bees will be agitated.
- Restack without crushing bees – use beekeeper's brush and smoke – two people.



# Avoid Being Stung

- Is everything back as it was?
- Hive tool?
- Secure smoker for transport. – ash safety
- Keep jacket veil ready when done due to guard bees



# Potential Veterinary Involvement

- For suspected Foulbrood
  - European and American
- Deadouts/winter kill
  - Beekeeper doesn't know why hive is dead
  - Post-mortem
- Sick-looking hives
  - Parasitic mite syndrome
- Strange bee behavior

# Vets and the Agency of Agriculture

- Call when you:
  - Have questions
  - Suspect Foulbrood
  - Need to take samples
  - Bee movement out of state

# Colony Examination

- Develop a form
- Examine at hottest point of the day
- Beekeeper manipulates hive, vet observes (?)
- Medical History
- External exam
  - Apiary, hive, overall sanitation/husbandry
- Internal exam of colony
  - Initial observations when opening
  - Adults
  - Broods and frames
  - All sections
  - Bottom

# Bee Diseases – Spread and Response

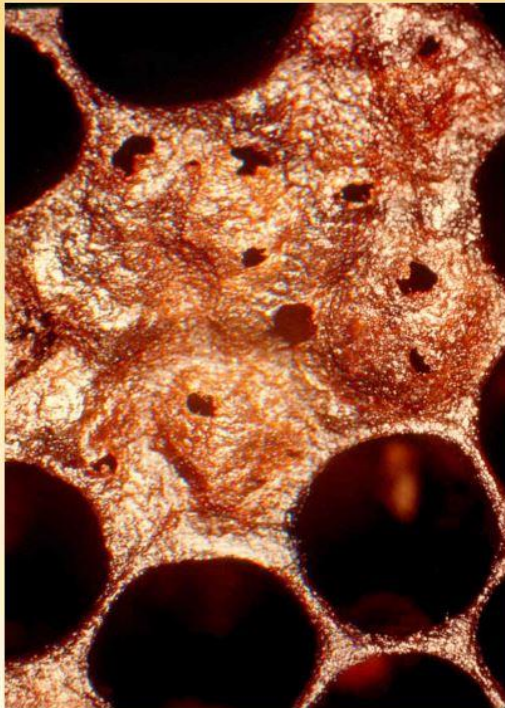
- Resource – Arkansas Honey Bee Vet Med Handbook!
- Spread by
  - Bees
    - Foraging (bees travel up to 3-5 miles from hive)
    - Robbing, drifting
  - Beekeepers - equipment
- Response - some of these diseases are regulated
  - Response in statute
  - Think of the veterinary reportable disease list
  - Work with Agency

# Bee Diseases

- American Foulbrood (AFB)
  - Paenibacillus larvae – bacterial spore (highly resistant)
  - Extremely lethal and contagious – kills larvae
  - Larvae die after cell is capped
  - See sunken, perforated caps/sulphurous decay odor
  - Larvae consume spores in contaminated food
  - **Antibiotics do not cure AFB** – only hide symptoms
  - Dead larvae filled with millions of spores.
- Law requires destruction of colony
  - Extremely contagious to colonies w/in 3 miles
- **Call David**

# AFB – 1cm of gooey ropey brood

## Diagnosing American Foulbrood



Cells infected with AFB will have cappings that are dark, sunken, and punctured.



When stirred with a small stick, AFB-infected larvae "rope out" an inch or more when the stick is removed.



The pupal tongue sticks to the top of the cell when killed by AFB.

# AFB – oozing through perforations



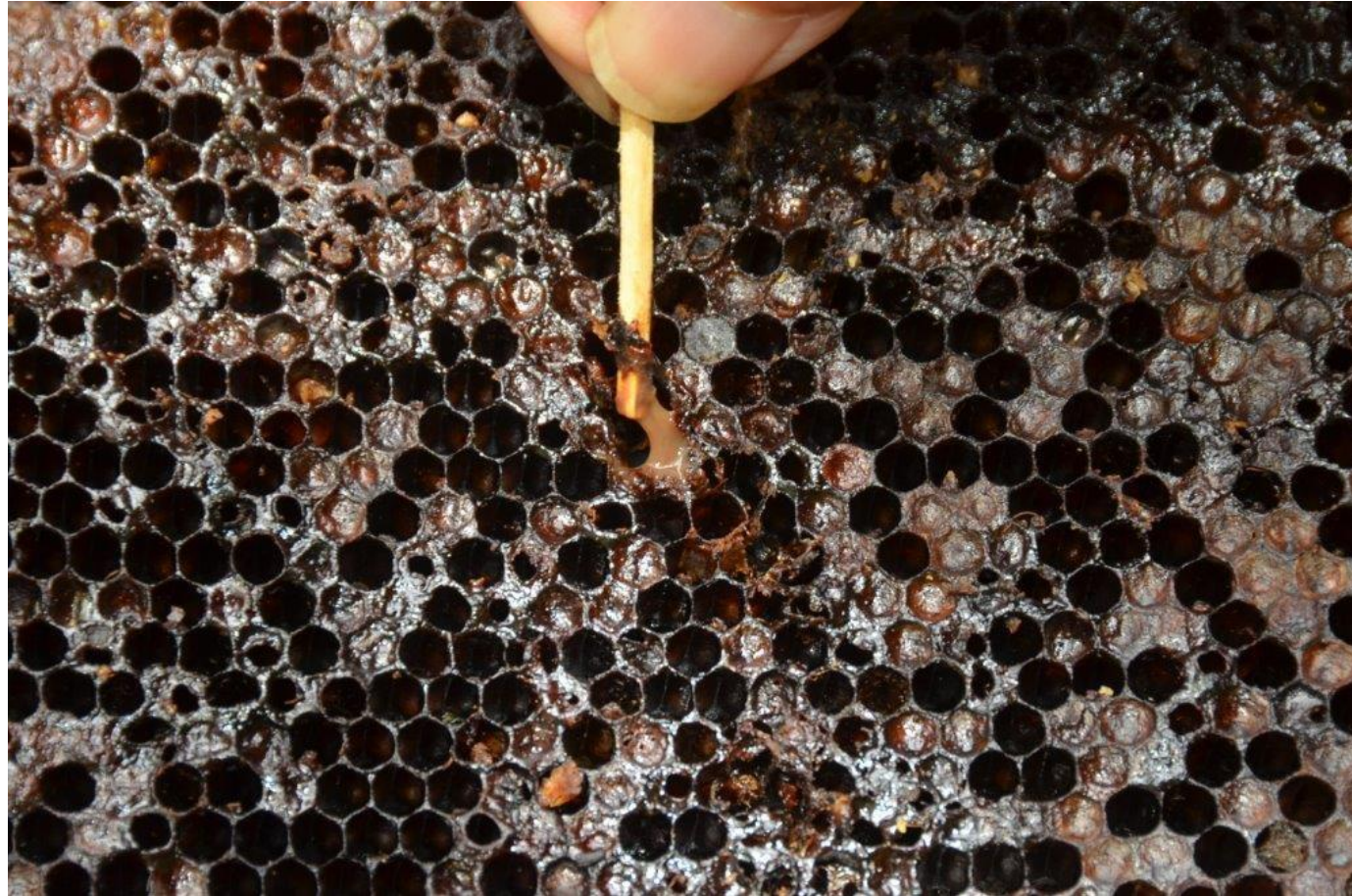
In a colony heavily infested with AFB you will see moisture on the sealed brood. You will also see brood oozing from perforated cells at this stage.

# AFB - Scale





# Ropey-ness - AFB

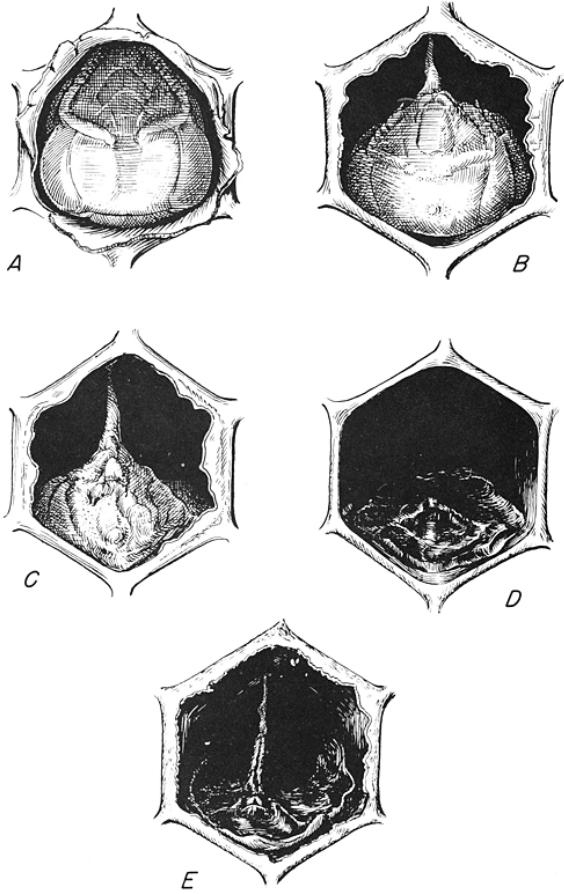
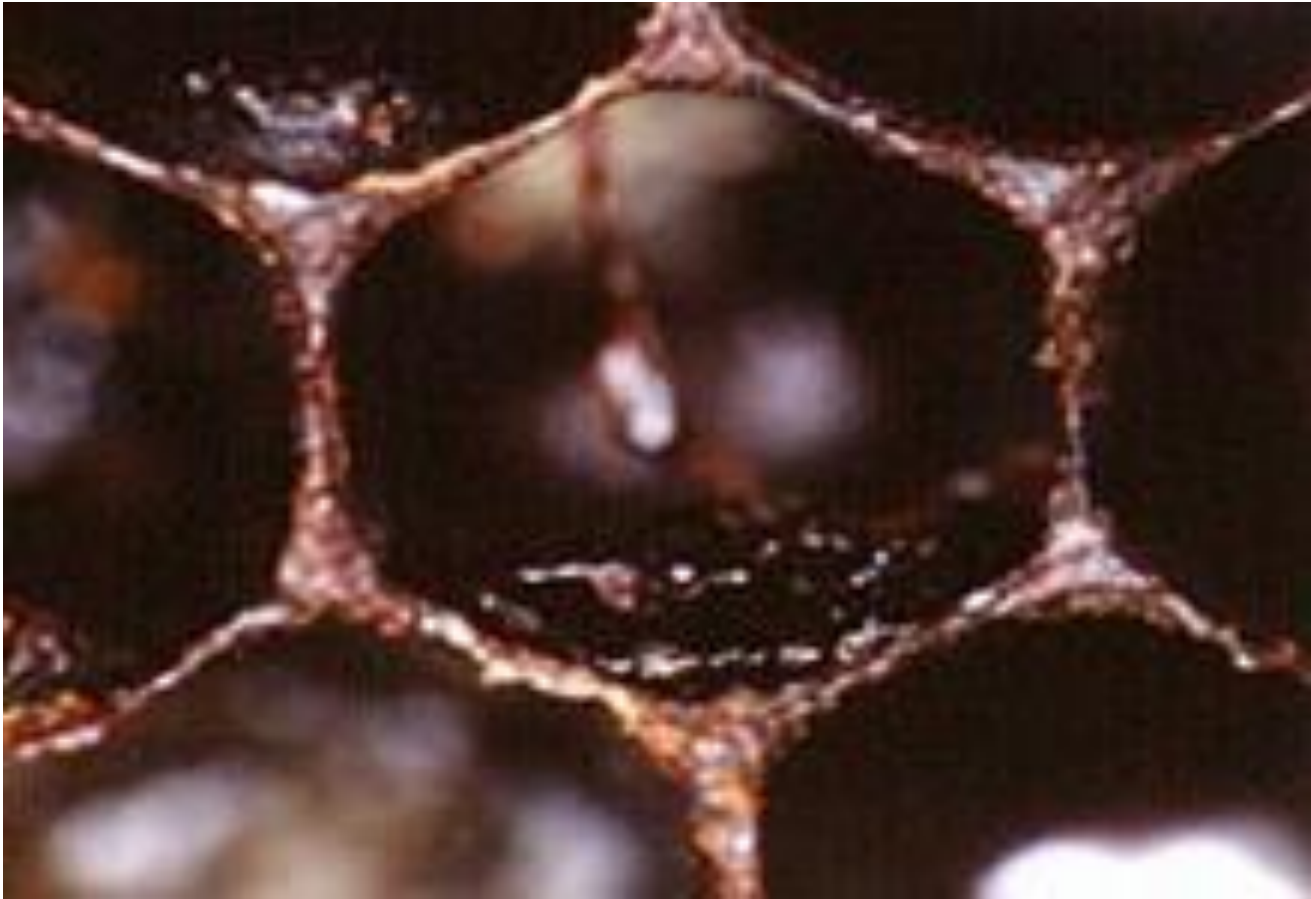


# AFB - Scale

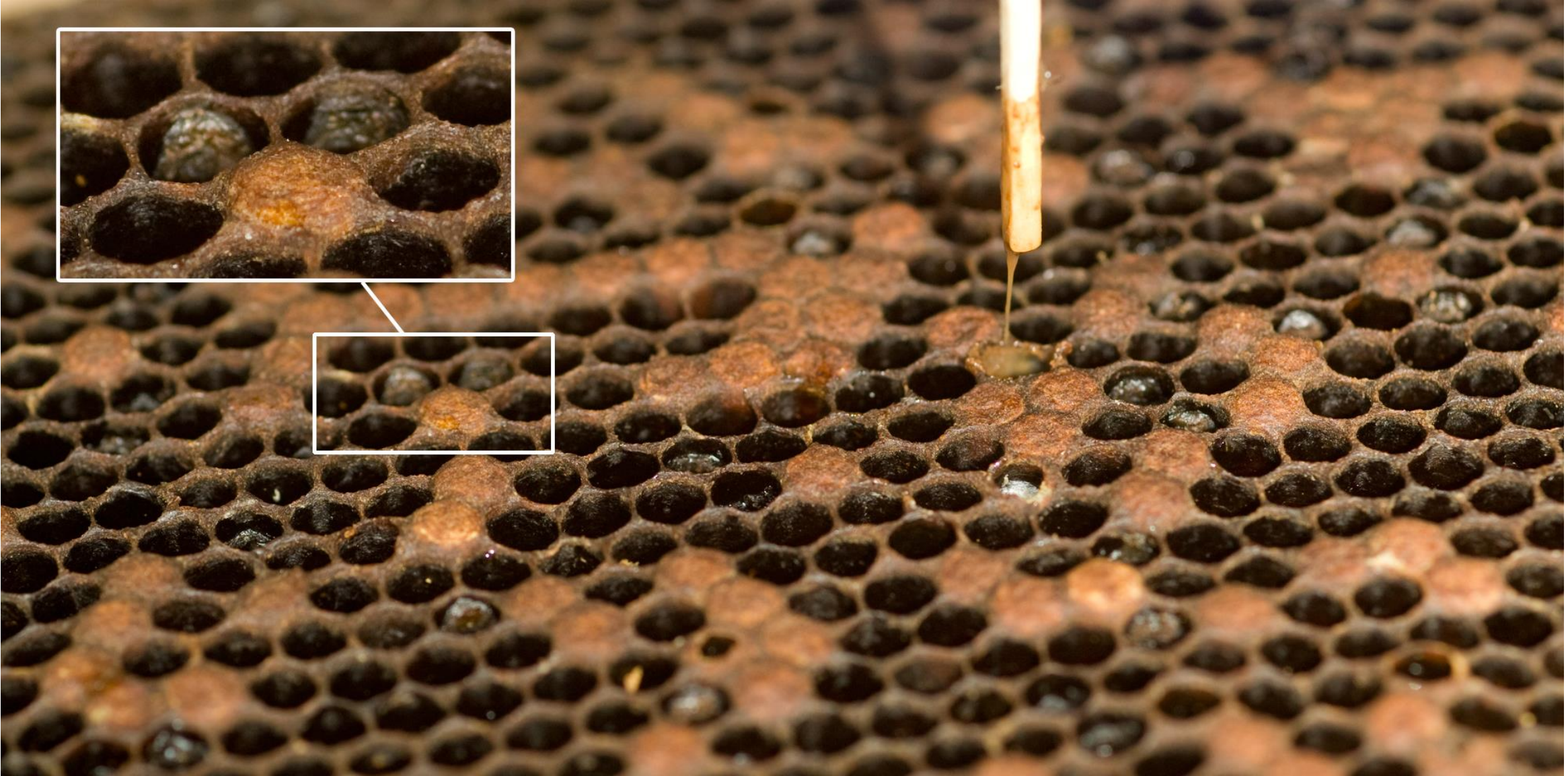


- Larvae dead and dried to bottom side of cell

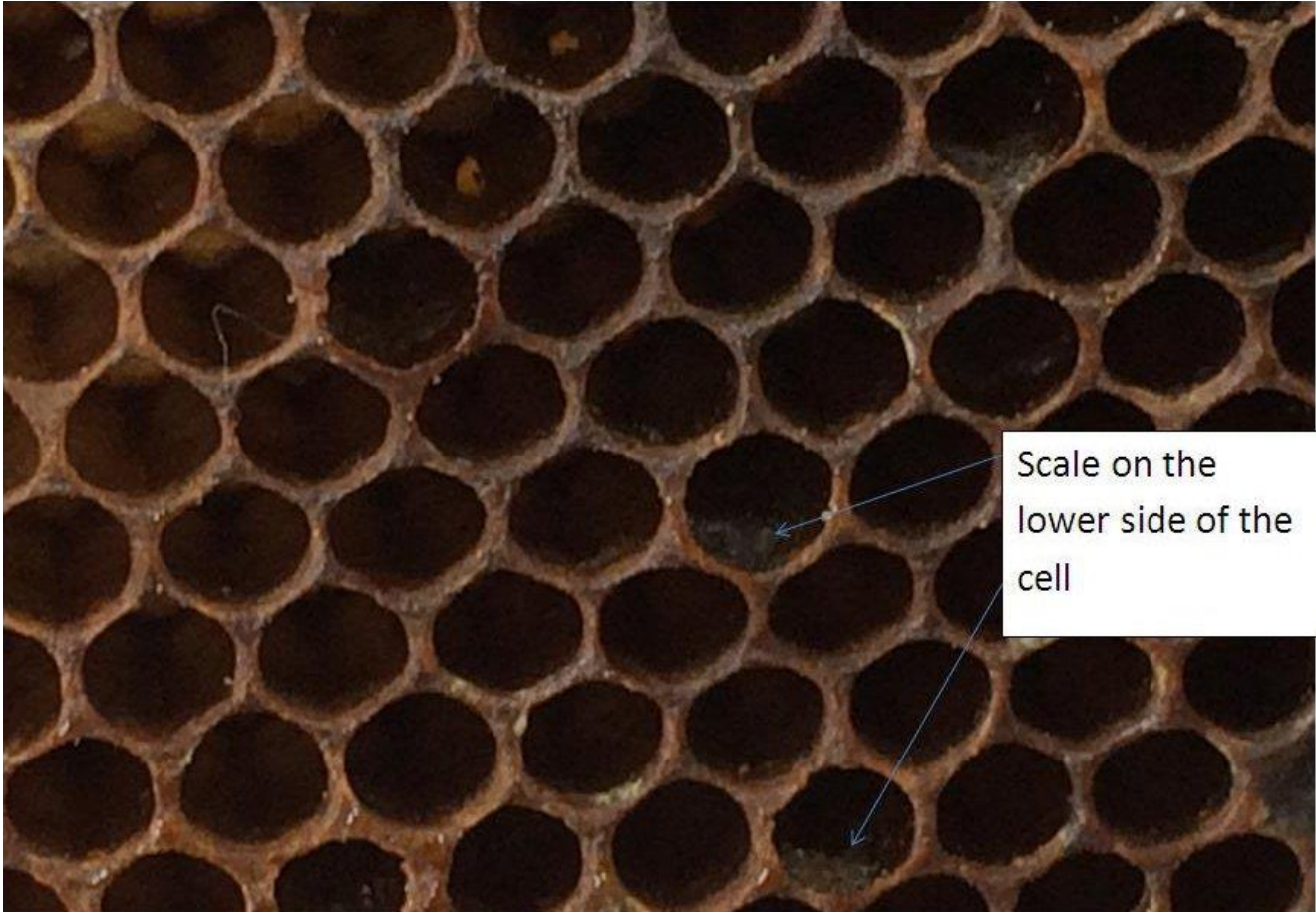
# AFB – Scale and tongue



# AFB – Scale and Ropey



# AFB – on old equipment



# Bee Diseases - EFB

## European Foulbrood (EFB)

- *Melissococcus plutonius*
- Bacteria does not form long lived spores
- Colony can recover from infection (mild)
- Larvae consume spores in contaminated food
- Larvae dies before cell is capped, light-colored rubbery scale
- See spotty brood pattern and discolored melting larvae
- Treat with antibiotics or without
- **Call David**

## Treat w/o antibiotics

- Goal – break the brood cycle to interrupt transmission
- Cage or remove queen bee
- Shake all adult bees onto new foundation
- Feed heavily with sugar syrup
- Requeen or release queen in 2 weeks

# European Foul Brood

- Yellow rotted larvae die before being capped – leave rubbery C shaped mummy.
- Brood food becomes contaminated and yellows
- other bacteria, for example, *Enterococcus faecalis*, *Paenibacillus alvei*, *Brevibacillus laterosporus*, *Bacillus pumilus*, and *Achromobacter euridice*, have been shown to co-occur with EFB as the so-called **secondary invaders**



Larvae infected with European Foulbrood die still in a 'c' shape before the cell

# EFB

- EFB infection starts when larvae ingest the bacteria which can be present in the brood food, or can be transmitted from infected nurse bees.
- The bacteria then multiply in the mid-gut of infected larvae.
- The multiplying bacteria compete with the larvae for food, often causing the larvae to die before capping.
- The larvae then becomes a semi-fluid (sometimes described as molten) mass and changes colour from a healthy pearly white to a yellow then brown colour.



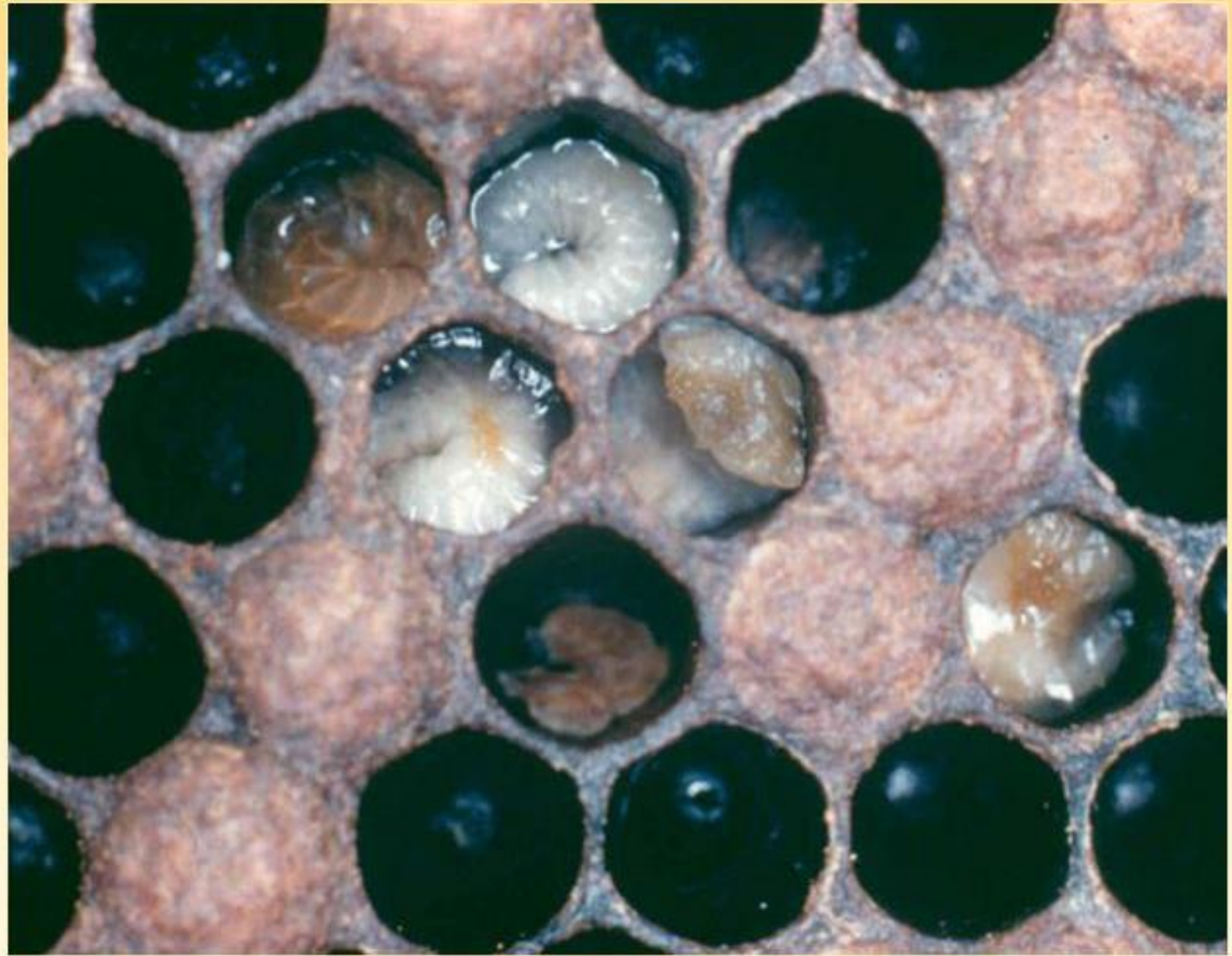


EFB



# EFB

- The dead larvae slowly dry out becoming a 'rubbery' scale that adheres loosely to the cell.
- Nurse bees attempt to remove the dead or dying larvae. While removing infected larvae the mouth parts of nurse bees become contaminated with the bacteria.
- EFB is subsequently spread by the nurse bees to larvae while feeding.
- Occasionally some infected larvae will survive infection as larvae and become adults, which spread the bacteria in their feces, further infecting the colony.



# Response Protocols for Foulbrood

## **EFB**

- Colony can be cured – no spore
- Colony can overcome if there is a good nectar flow
- Poor nectar flow
  - Destroy colony OR
  - Use antibiotics
  - Re-queen.

## **AFB**

- Colony can't be cured – spore
- Antibiotics only mask signs
- Call Agency – regulated issue
- Colony must be destroyed
- Agency must inspect this hive and neighboring hives within 3 miles
- Watch neighboring hives – don't treat.

# Antibiotics

- Used in apiaries and transitioning from OTC to VFD
  - Lincomycin – rarely used in beekeeping
    - LIncomix
  - Oxytetracycline – most commonly used
    - TM, OXTC, Pennox. Terramycin
  - Tylsolin – only recommended for oxy-resistant strains of bacteria
    - Tylan, Tylosin, Tylovet
- Antibiotics mixed with sugar or syrup

# Drugs that will need an Rx for use in **water**

Apramycin

Gentamicin

Neomycin

Spectinomycin

Streptomycin

Erythromycin

Tylosin

Penicillin

Oxytetracycline

Chlortetracycline

Sulfachloropyrazine

Sulfachlorpyridazine

Sulfadimethoxine

Sulfamerazine

Sulfamethazine

Lincomycin

Carbomycin

Tetracycline

Sulfaquinoxaline

# Drugs that will need a VFD for use in **feed**

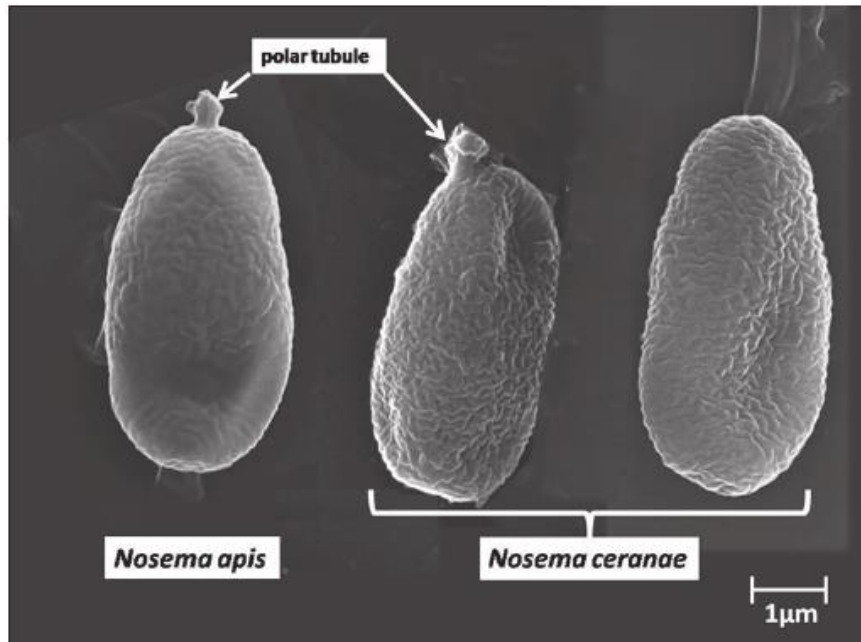
Apramycin  
Hygromycin B  
Neomycin  
Streptomycin  
Ormetoprim  
Lincomycin  
Oleandomycin  
Erythromycin  
Tylosin  
Penicillin

Virginiamycin  
Sulfadimethoxine  
Sulfamerazine  
Sulfamethazine  
Sulfaquinoxaline  
Chlortetracycline  
Oxytetracycline

- Note: avilamycin, florfenicol, tilmicosin, and tylvalosin are already VFD drugs.

## Nosema

- Fumagilin-B – for treating nosema
- *Nosema apis*
- *Nosema ceranae* now more common



Nosema-infected colonies will sometimes stain the inside and outside of their hives.



### Related Topics

## Bee Disease Diagnosis Service

The diagnosis of bee diseases has been a focus of this laboratory since its inception in 1891 and we operate a "Bee Disease Diagnosis Service" for beekeepers across the U.S.

There is no charge for this service.

Samples received of adult bees and beeswax comb (with and without bee brood) are examined for bacterial, fungal and microsporidian diseases as well as for two species of parasitic mites and other pests associated with honey bees (*i.e.*, small hive beetle, *Aethina tumida*).

When requested, American foulbrood samples are cultured and isolates are screened for their sensitivity to Terramycin (oxytetracycline) and Tylan (tylosin).

We do not analyze samples (bees, wax comb, pollen, etc.) for the presence of viruses or pesticide residue.

We do not make determinations about which species of *Nosema* (*N. apis* or *N. ceranae*) are present, when nosema disease is detected.

Diagnostic reports are transmitted to both the beekeeper, submitter of the samples and to the appropriate apiary inspectors.

We are only able to accept samples originating from the U.S. and its territories. We do not accept samples from other countries.

[How to submit samples](#)

**Bee Disease Diagnosis  
Bee Research Laboratory  
10300 Baltimore Ave. BARC-East  
Bldg. 306 Room 316  
Beltsville Agricultural Research Center - East  
Beltsville, MD 20705**





### USDA Honey Bee Disease Diagnostics Lab

- Beekeepers, bee businesses, and regulatory officials may submit samples.
- Samples are accepted from the United States and its territories; samples are NOT accepted from other countries.
- Include a short description of the problem along with your name, address, phone number or e-mail address.
- There is no charge for this service.
- For additional information, contact Sam Abban by phone at (301) 504-8821 or e-mail: [samuel.abban@ars.usda.gov](mailto:samuel.abban@ars.usda.gov)

### How to Send Adult Honey Bees

- Send at least 100 bees and if possible, select bees that are dying or that died recently. Decayed bees are not satisfactory for examination.
- Bees should be placed in and soaked with 70% ethyl, methyl, or isopropyl alcohol as soon as possible after collection and packed in leak-proof containers.
- USPS, UPS, and FedEx do not accept shipments containing alcohol. Just prior to mailing samples, pour off all excess alcohol to meet shipping requirements.
- Do NOT send bees dry (without alcohol).

### How to send brood samples

- A comb sample should be at least 2 x 2 inches and contain as much of the dead or discolored brood as possible. NO HONEY SHOULD BE PRESENT IN THE SAMPLE.
- The comb can be sent in a paper bag or loosely wrapped in a paper towel, newspaper, etc. and sent in a heavy cardboard box. AVOID wrappings such as plastic, aluminum foil, waxed paper, tin, glass, etc. which promote decomposition and the growth of mold.
- If a comb cannot be sent, the probe used to examine a diseased larva in the cell may contain enough material for tests. The probe can be wrapped in paper and sent to the laboratory in an envelope.

### Send samples to:

Bee Disease Diagnosis  
Bee Research Laboratory  
10300 Baltimore Ave. BARC-East  
Bldg. 308 Room 316  
Beltsville Agricultural Research Center – East  
Beltsville, MD 20705

[www.ars.usda.gov/northeast-area/beltsville-md/beltsville-agricultural-research-center/bee-research-laboratory](http://www.ars.usda.gov/northeast-area/beltsville-md/beltsville-agricultural-research-center/bee-research-laboratory) (or just search for "usda bee lab")

Burning  
AFB  
infected  
hives.



# Winter Deadout – Parasitic Mite Syndrome

Winter dead-outs is a specific type of colony death.

Characteristics of the common early winter death in northern states:

We see this classic set of symptoms over and over in the states with a proper winter. This is death by varroa associated viruses.

**1.The big colonies** –Since varroa mites reproduce in capped brood, the colonies that made the most brood (i.e. got the biggest) are the ones most at risk of having a high population of varroa.

**2.Lots of Honey** – Lots of honey means that the colony died fairly early. Colonies with high levels of varroa, they tend to die fairly early in the season (before February), leaving lots of honey behind.

**3.Small cluster** – Varroa levels peak right when the winter bees are getting formed. The bees that emerge from varroa infested cells are weakened, and more importantly, are riddled with viruses.

- When bees are close tight in a winter cluster, the viruses can spread very quickly.

**4.No bees on the bottom board** – When a colony starves, the bees just drop to the bottom board, and you end up with a pile of dead bees in the hive.

- When bees get sick with viruses and other pathogens, however, they often will fly away.

**5.Patch of spotty brood/ Bees dying on emergence** – When a colony succumbs to varroa associated viruses or parasitic mite syndrome (PMS), we see a lot of effects in the brood.

- It is one of the only diseases where you see bees dying right as they emerge.

**6.White crystals in the brood** – Around the cells where the brood died (the last place of the brood nest), you will often see white crystals stuck to the walls of the cells. These are dry (not suspended in liquid like crystalized honey), and are the crystalized pee of varroa.

Varroa mites defecate in the cells, and the resulting guanine crystals are left behind, and visible to the naked eye.

**7.No records that varroa was under control.** Notice that this says ‘varroa was under control’, and not that ‘the colony was treated’. You may have applied a treatment, but it may have been too little, or (more likely) too late.

# Varroa destructor



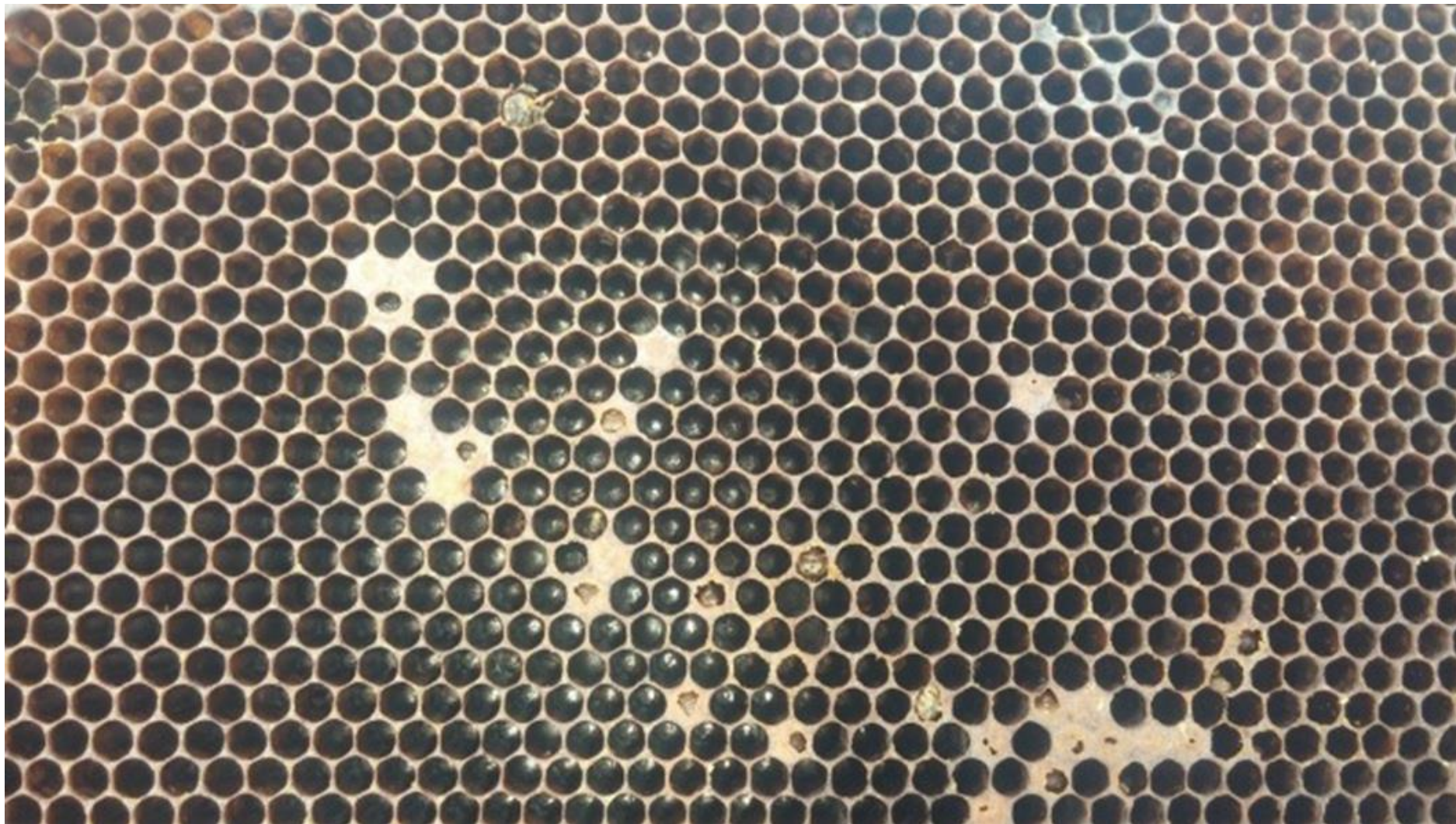
Varroa mites on a removed pupa.

# Sign of lost large cluster

- *This colony had a large brood nest (indicated by the dark comb in this frame from the top deep box), and a large cluster going into winter (indicated by the large amount of honey that is eaten away where the winter cluster started). Varroa were never monitored or managed in this colony, and it was dead by February, if not sooner. (Photo by Meghan Milbrath)*



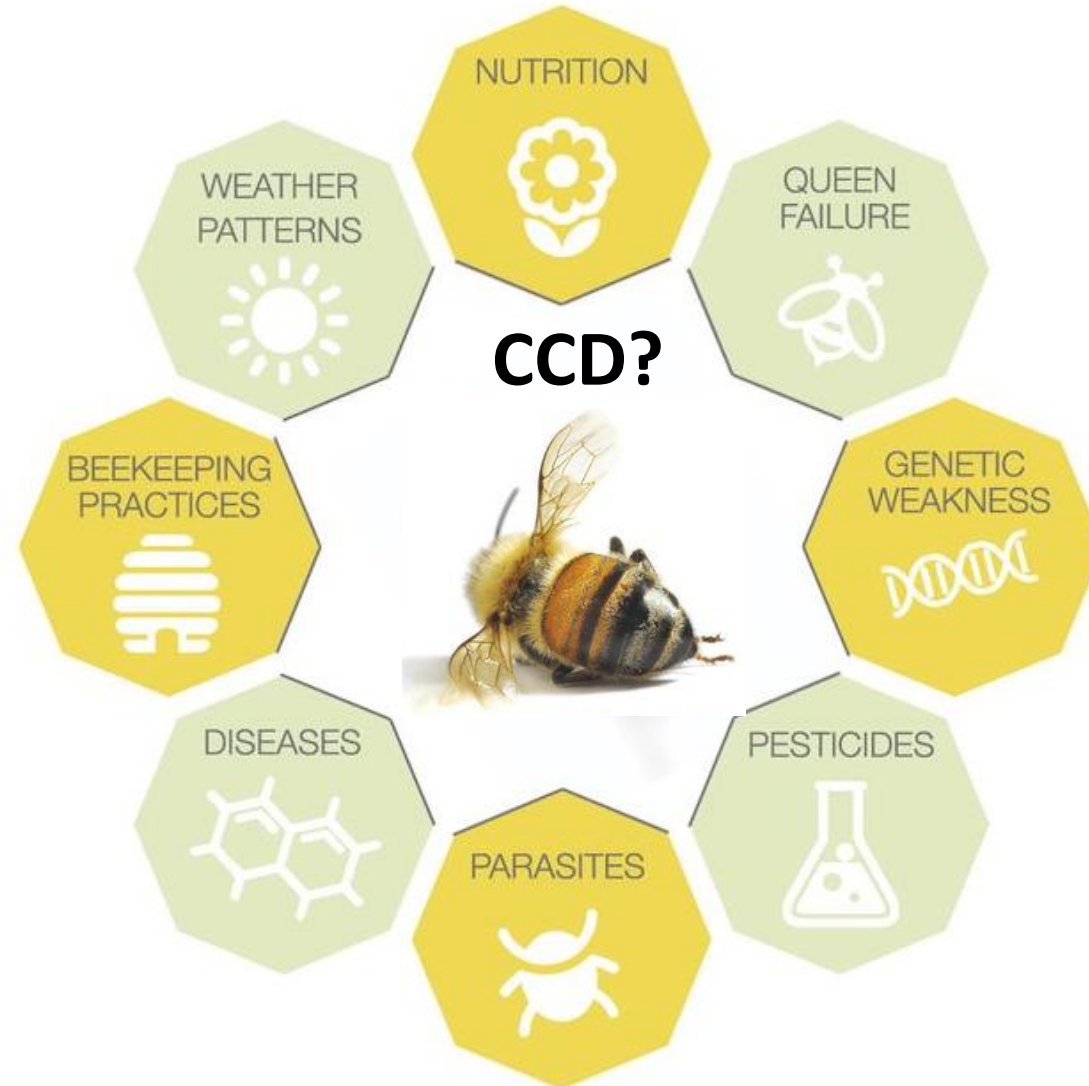
# Bees dying on emergence



White crystals in brood cells – guanine acid indicating varroa defecation



# Honey Bee Health Issues





# Visible bee virus

**K-Wing**



**Deformed Wing Virus (DWV)**



# Communication & Foraging Behavior

**Pheromones** or chemical signals are another way bees communicate. The queen, workers, drones and even the brood emit pheromones.

**Queen pheromones** are transmitted throughout the colony by physical contact between bees. The queen is surrounded by young worker attendants, who lick her body for the pheromones that are needed for the well being of the colony. These pheromones stimulate feeding of the queen, inhibit the construction of queen cells, stimulate normal foraging behavior, attract drones to mate with virgin queens, and inhibit the growth of worker ovaries. Queen pheromones are transmitted throughout the colony by physical contact between bees.

The **Nasonov pheromone** or “come hither” scent is released by worker bees to orient returning forager bees back to the colony. To broadcast this scent, bees raise their abdomens, which contain the Nasonov glands, and fan their wings vigorously. Bees use this pheromone to find the entrance to their colony or hive, they release them on flowers so other bees know which flowers have nectar and it is used during swarming behavior.



# Communication & Foraging Behavior

**Alarm pheromone**, produced by workers, is a releaser pheromone that calls nest mates to help defend the colony from intruders. A sting, which also releases alarm pheromone, causes other bees to sting too.

**Brood ester pheromone (BEP)**, produced by larvae, is a primer pheromone that, among other things, inhibits ovarian development in worker bees.

**Drone pheromone** is released by drones and allows them to find each other and form a drone congregation area (DCA).

**Footprint pheromone**, also known as trail pheromone, is found in many social insects. Worker honey bees secrete the pheromone from their feet as they go about their daily business, and the odor is attractive to other honey bees.

**Worker pheromone** (Ethyl oleate) is a primer pheromone produced by foraging bees that slows the maturation of nurse bees into forager bees. It is believed this pheromone helps to maintain a proper balance of nurse bees to forager bees in the colony.



# Communication & Foraging Behavior

## Pollen

Pollen grains are collected by foraging honey bees in order to provide a nutritional protein source for the developing bees in the colony. Pollen is found on flowering buds of plants and trees and is collected directly or indirectly by the hair on the bee's thorax. It is brought back to the hive attached to the bee's pollen baskets.



# Communication & Foraging Behavior



## Nectar

Nectar is collected by foraging worker bees as a source of water and carbohydrates in the form of sucrose. The dominant monosaccharides in honey bee diets are fructose and glucose but the most common circulating sugar in hemolymph is trehalose which is a disaccharide consisting of two glucose molecules. Adult worker honey bees require 4 mg of utilizable sugars per day and larvae require about 59.4 mg of carbohydrates for proper development.

# Communication & Foraging Behavior

## Propolis

Propolis is the sticky tree resin that bees gather from trees buds or bark. Propolis is transported back to the hive in the bee's pollen basket, where it is chiefly used as a 'bee glue' to seal and strengthen the hive. It has antimicrobial properties which control pathogens and limit contamination. This lining in the brood nest insures a clean environment for the rearing of brood.

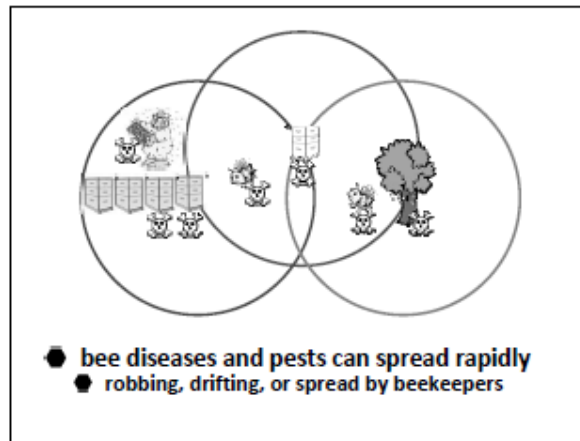
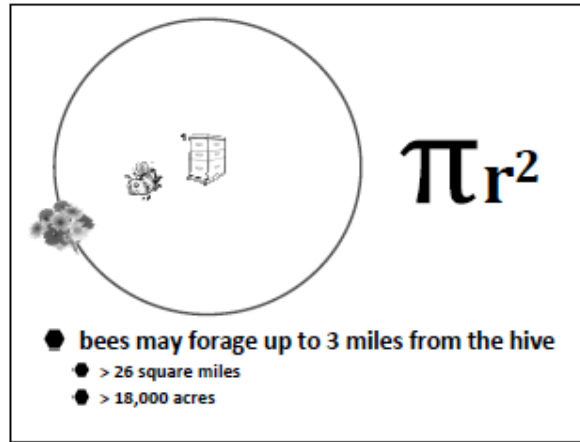


# Communication & Foraging Behavior



## Water

Honey bees require water to maintain osmotic homeostasis, prepare liquid brood food, and to cool the hive through evaporation. A colony's water needs can generally be met by nectar foraging as it has high water content. Occasionally on hot days or when nectar is limited, foragers will collect water from streams or ponds to meet the needs of the hive.





# Life History, Hive Biology & Seasonal Activity

The surviving virgin queen will fly out on a sunny, warm day to a "drone congregation area" where she will mate with 12-15 drones. If the weather holds, she may return for several days until she is fully mated. Mating occurs in flight. The young queen stores up to 6 million sperm from multiple drones in her spermatheca. She will selectively release sperm for the rest of her life.

The young virgin queen has a limited time to mate. If she is unable to fly for several days because of bad weather and remains unmated, she will become a "drone layer." Drone-laying queens usually signal the death of the colony, because the workers have no fertilized (female) larvae from which to raise worker bees or a replacement queen.

Though timing can vary, matings usually take place between the sixth and tenth day after the queen emerges. Egg laying usually begins 2 to 3 days after the queen returns to the beehive, but can start earlier than this





# Life History, Hive Biology & Seasonal Activity

Young worker bees, sometimes called "nurse bees", clean the hive and feed the larvae. When their royal jelly-producing glands begin to atrophy, they begin building comb cells. They progress to other within-colony tasks as they become older, such as receiving nectar and pollen from foragers, and guarding

	<b>Worker</b>
<b>Age (days)</b>	<b>Responsibilities</b>
<b>1-2</b>	Cleans cells and warms brood
<b>3-5</b>	Feeds older larvae
<b>6-11</b>	Feeds younger larvae
<b>12-17</b>	Hive repair, food transport within the hive, attend queen
<b>18-21</b>	Guard the hive entrance
<b>22-45</b>	Field bee collecting pollen, nectar and water

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Propolis has over 38 compounds called flavonoids (plant derived pigments and active compounds) that have anti-viral, anti-microbial, and anti-oxidizing properties. Propolis is used as an ingredient in natural supplements and herbal medicines. It is also used as an additive to skin lotions, beauty cream, mouth washes, shampoos, chewing gum, even lipsticks. A spray version of propolis is a popular treatment of sore throats, cuts, and skin rashes.

# Life History, Hive Biology & Seasonal Activity

