

HONEY BEE MEDICINE



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INTRO



OUTLINE

- Part I: Bee Basics
 - Why Honey Bees Matter
 - Veterinarians and Honey Bees
 - Foundational Concepts
 - Beekeeper's Calendar
 - Equipment Demo
 - Colony Inspection
 - Installing Nucleus Colonies & Packaged Bees
- Part II: Honey Bee Maladies and How Veterinarians Can Help
 - Honey Bee Diseases and Conditions
 - Resources for Further Learning
 - Opportunities for Veterinarians in Honey Bee Medicine
- Honey Bee Trivia throughout!





WHY HONEY BEES MATTER

THE MAGNIFICENT HONEY BEE

- *Apis mellifera* = European honey bee
- Vital to agriculture and food security
- Globally, 70% of crops used for human consumption rely on pollinators
- Contribute over \$200 billion to crop production worldwide



U.S. HONEY BEE INDUSTRY

- 2022 U.S. honey production was 125 million pounds with 2.67 million colonies producing honey (USDA National Ag. Statistics Service)
- Beeswax is second most important hive product economically (FDA)
 - Candles, leather, wood polishes, cosmetics, pharmaceuticals



U.S. HONEY BEE INDUSTRY

- Most important contribution of honey bees to agriculture? Pollination!
 - Contribute \$15 billion to U.S. crop production (USDA)
- Many crops wouldn't exist without the honey bee at bloom time
 - Almonds (100% dependent)
 - Blueberries and cherries (90% dependent)
- Also important for apples, cranberries, melons, broccoli, and more!



Project Apis m.



U.C. Davis Department of Entomology & Nematology

POLLINATOR PROBLEMS

- Both wild and managed pollinator populations are declining
- Habitat loss and degradation
- Non-native species and diseases
- Pesticides
- Climate Change



YOUR PRODUCE CHOICES WITH BEES



Your produce choices
with bees

Courtesy of
Whole Foods Inc.

YOUR PRODUCE CHOICES WITHOUT BEES



Your produce choices
without bees

Courtesy of
Whole Foods Inc.

HONEY BEE TRIVIA:

WHAT WAS THE TOP U.S. HONEY-PRODUCING STATE IN 2022?

BONUS: HOW HIGH WAS MONTANA RANKED IN 2022 HONEY PRODUCTION?



VETERINARIANS AND HONEY BEES

THE VETERINARY FEED DIRECTIVE (VFD)

- January 1, 2017
- Food and Drug Administration
- Antimicrobial resistance
 - Serious threat to One Health
 - CDC annual estimates (United States):
 - At least 2.8 million human illnesses
 - 35,000 deaths
- As of January 1, 2017, all water-soluble, medically important antimicrobials administered to food producing animals in drinking water require a veterinary prescription, and all medically important antimicrobials administered to food producing animals through feed require a VFD.

I'M A VETERINARIAN. WHY SHOULD BEES MATTER TO ME?

- Honey bees are considered food producing animals (minor species)
- VFD final rule requires veterinarians to issue all VFDs within context of valid veterinarian-client-patient-relationship (VCPR)
- Beekeepers required to obtain VFD from licensed veterinarian for use of medically important antimicrobials in bees



HONEY BEE VETERINARIANS

- Veterinarians will be asked to visit apiaries, examine hives for signs of disease, and prescribe appropriate treatments
- In collaboration with state apiarists and extension specialists, veterinarians also have an opportunity to provide education and professional services to beekeepers on biosecurity, disease recognition and management, and more



HONEY BEE TRIVIA:

ON AVERAGE, HOW FAST DO HONEY BEES FLY?

A thick, yellow, wavy line graphic that starts at the top left and curves downwards and to the right, ending near the bottom left. It has a white outline and is set against a dark brown background.

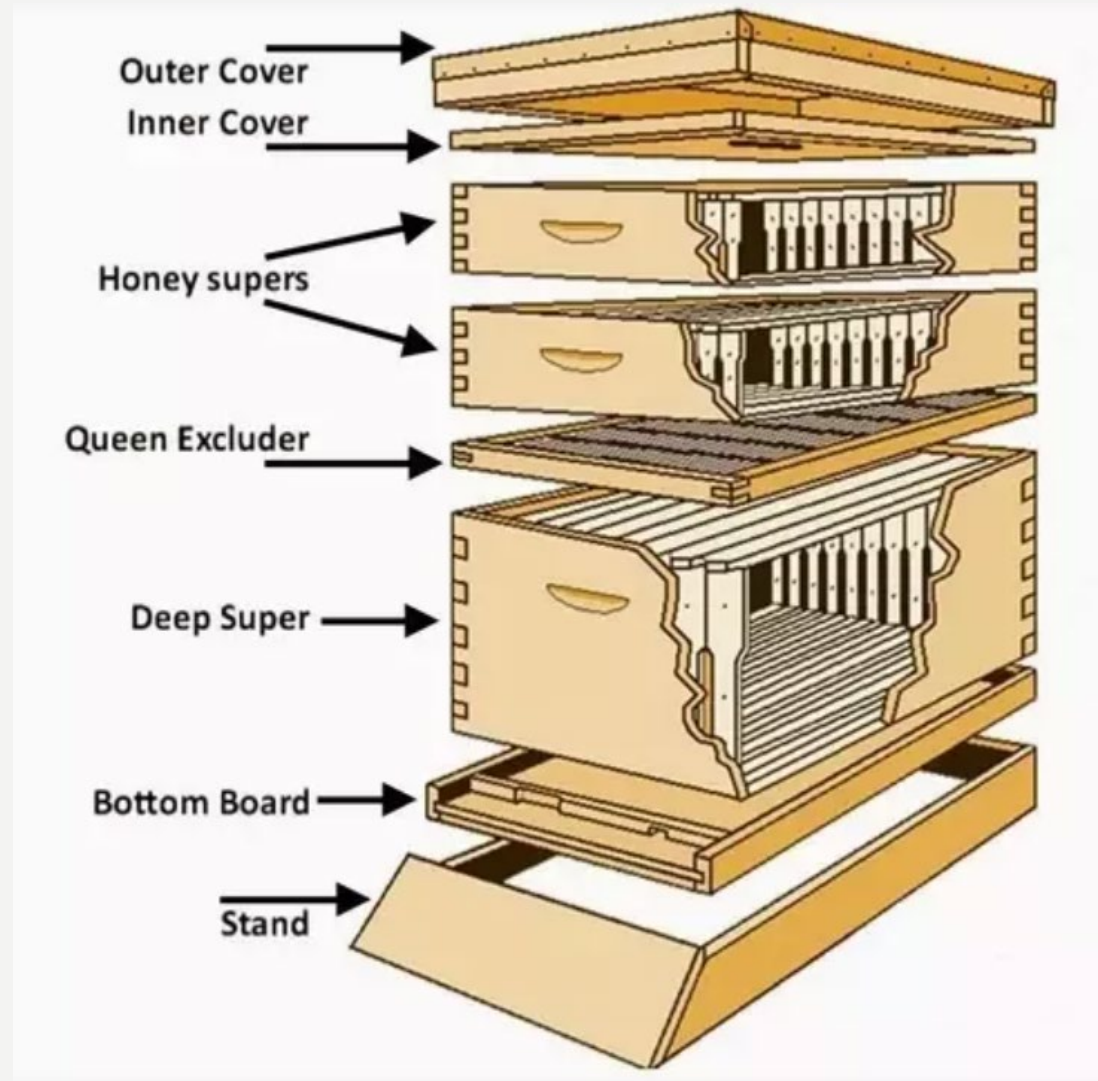
BEE BASICS: FOUNDATIONAL CONCEPTS

BASIC TERMINOLOGY

- Apiary
- Hive or colony
 - Langstroth hive most common
- Brood box or “deep”
- “Super”
- Frame
- Foundation
- Package
- “Nuc” (Nucleus colony)



LANGSTROTH HIVE DIAGRAM



OTHER BASIC BEEKEEPING TOOLS & SUPPLIES

- Protective gear
- Hive tool
- Smoker



Betterbee.com



Betterbee.com



GENERAL CLASSIFICATIONS OF BEEKEEPERS

- Hobbyists
 - 1-10 colonies
 - Typically do not move colonies
- Sideliners
 - 11-250 colonies
 - Typically engage in migratory beekeeping practices
 - Usually have a full-time job other than beekeeping
- Commercial
 - >250 colonies
 - Engage in migratory beekeeping practices
 - Typically their main source of income (pollination services, queen rearing, honey, etc.)

MONTANA APIARY REGISTRATION

- Montana Code Annotated 80-6:Apiculture
https://leg.mt.gov/bills/mca/title_0800/chapter_0060/parts_index.html
 - **80-6-102. Registration classes -- reregistration -- fees.** (1) A person who owns or possesses an apiary in the state shall, before April 1 each year, reregister the apiary site. A person who owns or possesses any bees, hives, colonies, or beekeeping equipment in this state or who owns or possesses an apiary in this state and who fails or refuses to register or re-register as provided in this part is subject to a civil penalty as set forth in [80-6-303](#).

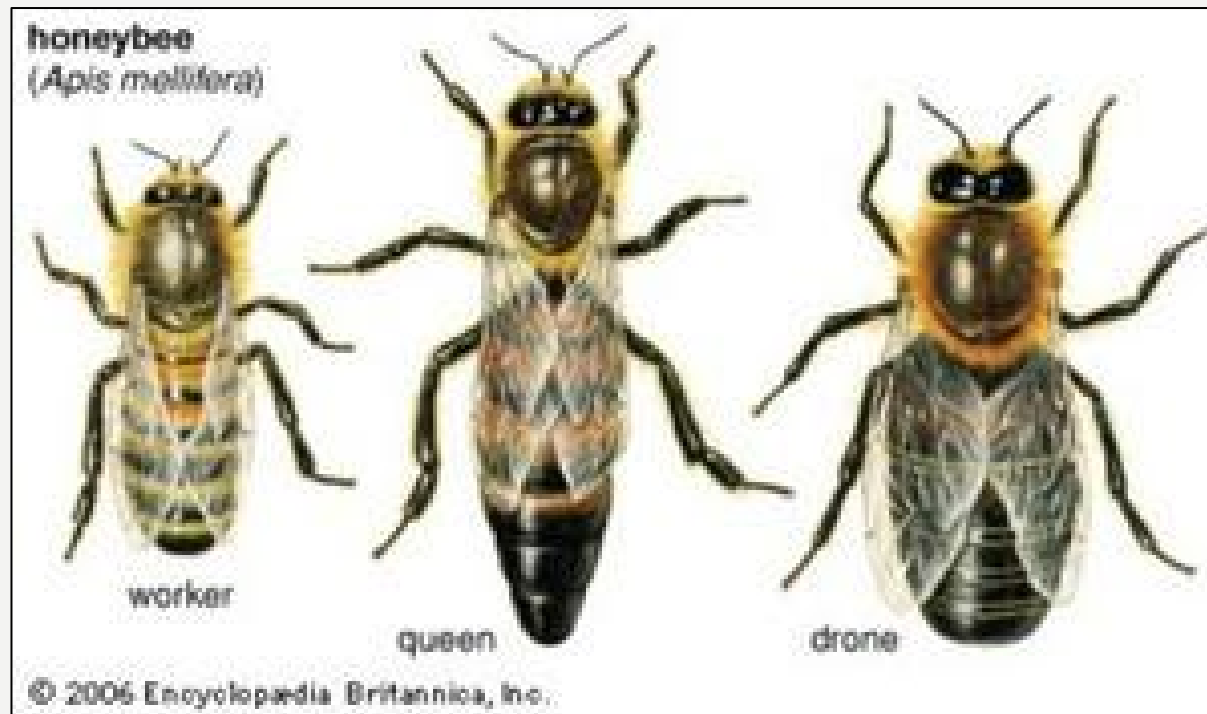
Source: Montana Department of Agriculture: Honey Bees <https://agr.mt.gov/Topics/A-D/Bees/Honeybees>

MONTANA APIARY REGISTRATION CLASSES

- General (Commercial)
 - An apiary placed by permission on someone's property
 - Must be at least 3 miles from nearest registered apiary
- Pollination
 - An apiary established for pollination purposes only
 - Not subject to 3-mile buffer zone requirement
 - Limited in size and must only be placed when specific crop of interest is blooming, then removed
- Landowner
 - An apiary registered to the owner of the land the site is on
 - No buffer zone requirement and no limit on number of hives
- Hobbyist
 - An apiary placed by permission on someone's property
 - No more than 5 hives per individual or 10 hives per household
 - No minimum distance required between hobbyist apiaries

TYPES OF BEES

- Within the colony, there are three types of bees based on function:
 - Worker
 - Queen
 - Drone



BROOD

- Young, developing bees
 - Eggs
 - Larvae
 - Pupae



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Wikimedia Commons

- Eggs laid in cells in colony → after 3 days, egg hatches, and a larva emerges → larvae are fed and grow over the next 6 days → cell containing the larva is capped (open top sealed over by worker bees with porous wax) → larva then matures to a pupa inside the capped cell (**capped brood**) → eventually emerges from the cell as a bee

- Total days spent as brood:
 - 16 for queens
 - 21 for workers
 - 24 for drones



Kris Fricke

<https://creativecommons.org/licenses/by-nc-nd/2.0/>



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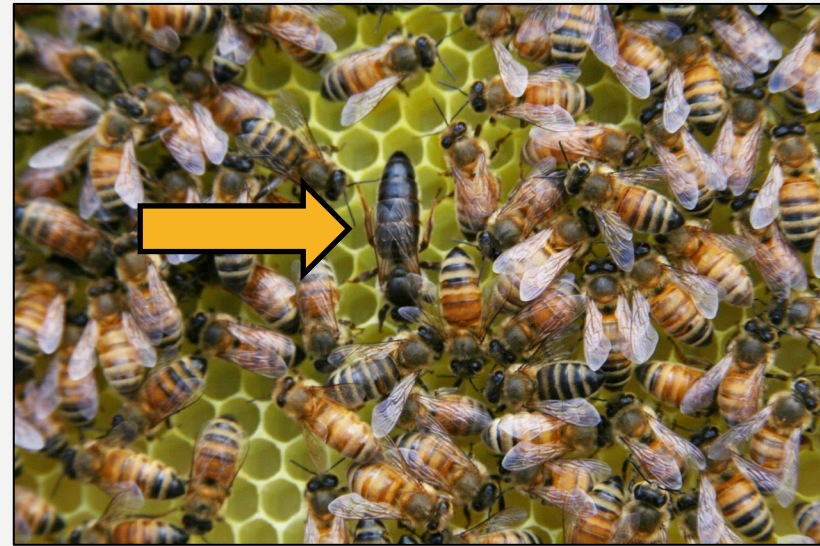
- Colony will contain brood most of the year but egg laying ceases in late fall or early winter and in times of stress

WORKER

- Female bees that perform the vital work of the colony
- Variety of functions:
 - Providing for the queen's needs
 - Cleaning cells in the comb
 - Nursing larvae
 - Producing wax and forming it into honey comb
 - Guarding and defending the hive
 - Removing dead bees from the hive
 - Cooling the hive or heating the brood
 - Carrying water
 - Gathering and transporting pollen
 - Collecting nectar
 - Sealing (capping) honey
 - Scouting for resources
- Incapable of laying fertilized eggs that can become queens or other worker bees
- Only capable of laying unfertilized eggs that become drones but this is suppressed in the presence of a laying queen
- Lifespan varies with time of year: 5-6 weeks during the spring and summer, five months or longer during the inactive winter period



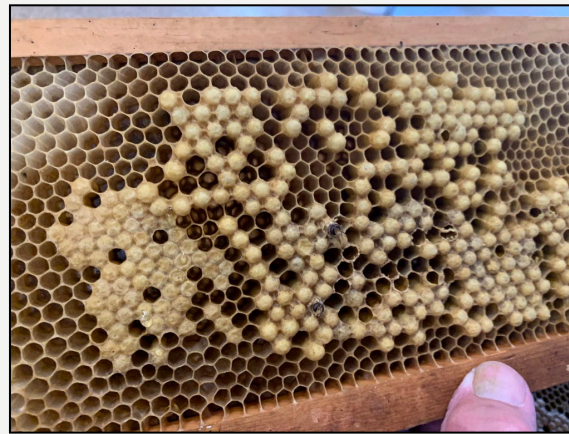
QUEEN



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- Each colony generally contains one queen
- Fertile female of the hive and the sole source of fertilized eggs that become worker bees
 - Can lay up to 2,000 eggs per day during peak production
- Largest bee in the hive with long, tapered abdomen
- Colony will only produce new queens when it prepares to reproductively split by swarming, when the old queen has died, or to replace a failing queen
 - Many queen cells will be created → First one to emerge will kill the remainder and fight with other emerged queens so that only one remains
 - One to two weeks after hatching, virgin queen will go on several mating flights where she will mate with 10-20 drones, storing the sperm for use over her lifetime.
- Colony can only function normally when a queen is present and laying well

DRONE



Dr. David Schmitt



Wikimedia Commons

- Only male bees in the hive and are haploid (having only one chromosome set) because they arise from unfertilized eggs
 - Queens and workers are diploid because they arise from fertilized eggs
- Large, thick bodies
- Perform no functions inside the hive—sole duty is to search for and mate with virgin queen bees on their mating flights
 - If fortunate enough to mate, endophallus is removed in the process and the drone dies
- Drones are made whenever the colony has sufficient resources
 - Can have hundreds of drones in summer but are kicked out of colony before winter so they don't consume precious resources

HEALTHY BROOD PATTERN



DIET



Wikimedia Commons

- Entirely from flowers!
- Floral nectar = carbohydrates
- Prefer fresh nectar when available, but store it in cells for when there are no available flowers
 - To prevent nectar fermentation, bees dry the nectar to below 18% water content = HONEY
- Pollen provides source of protein, vitamins, fats, and minerals
 - To store pollen, bees pack it into cells, add nectar, and ferment into storable substance called bee bread

IN A HEALTHY HIVE:

- Queen is laying enough eggs
- Workers can raise enough brood to replace the workers that are dying
- There are enough members of each age of worker to perform all the necessary tasks of the colony



Max Pixel

HONEY BEE TRIVIA:

**HONEY BEE FORAGERS MUST COLLECT
NECTAR FROM ABOUT HOW MANY FLOWERS
TO MAKE 1 POUND OF HONEY?**



**A YEAR IN THE
LIFE OF A
BEEKEEPER**

THE BEEKEEPER'S CALENDAR

- Directly related to the seasons!
- Must shift for the local area and current weather patterns



SPRING

- First hive inspections of the season
- Mite checks & treatments
- Feeding
- Examine dead outs from winter
- Install packages/nucleus colonies
- Swarms!



SUMMER



- Frequent hive checks (every 7-10 days)
- Add supers
- Watch for signs of disease and pests
 - Mite checks +/- treatment

FALL

- Honey harvest!
- Mite checks & treatments
- Feeding
- Begin winter prep
 - Mouse guards
 - Entrance reducers



WINTER



- Winterize hives
 - Insulation
 - Moisture control
- Keep snow away from entrance
- Inventory and prep for next season
- Winter bee checks
- Emergency feeding, if needed

BE BEAR AWARE

- Montana is home to both black and grizzly bears
- Beehives are an attractive food source (protein-rich larvae and honey)
- Electric fence is the most effective deterrent
- Resources: MDA
https://agr.mt.gov/_docs/bees-docs/BearsInfoSheet.pdf



HONEY BEE TRIVIA:

**WHAT IS THE PRIMARY FORM OF
COMMUNICATION USED BY HONEY BEES?**



EQUIPMENT DEMO



COLONY INSPECTION


BASIC STEPS

- Weather
- Practice good hygiene
- Inspect records
- Examine the hive
 - Let the beekeeper lead!

VIDEO DEMO



University of Guelph Honey Bee Research Centre: <https://youtu.be/tlqXDInZUoE>



INSTALLING A NUCLEUS COLONY OR “NUC”





INSTALLING PACKAGED BEES



HONEY BEE TRIVIA:

HOW MANY BEES DOES ONE HIVE TYPICALLY CONTAIN?



HONEY BEE DISEASES AND CONDITIONS

HONEY BEE MALADIES

- Bacterial
 - American foulbrood (AFB)
 - European foulbrood (EFB)
- Viral
 - Paralytic viruses
 - Sacbrood
- Microsporidial
 - Nosema
- Fungal
 - Chalkbrood
- Parasitic
 - Parasitic Mite Syndrome (PMS)
 - Tracheal mites
 - Small hive beetles
- Other
 - Idiopathic Brood Disease (IBD)
 - Malnutrition
 - Pesticide toxicity
 - Colony Collapse Disorder (CCD)



Wikimedia Commons

HONEY BEE MALADIES

- Only two diseases (AFB and EFB) are commonly treated with antibiotics
- Other diseases can appear similar to AFB and EFB
- Colonies can be infected with multiple diseases at the same time
 - Veterinarian must be able to differentiate
- Important to note:
 - How heavily infected is colony?
 - Record percentage of brood demonstrating signs of disease
 - Condition worsening or improving?
 - Many mild infections can be cleared on their own without the need for treatment

BACTERIAL DISEASES: AMERICAN & EUROPEAN FOULBROOD

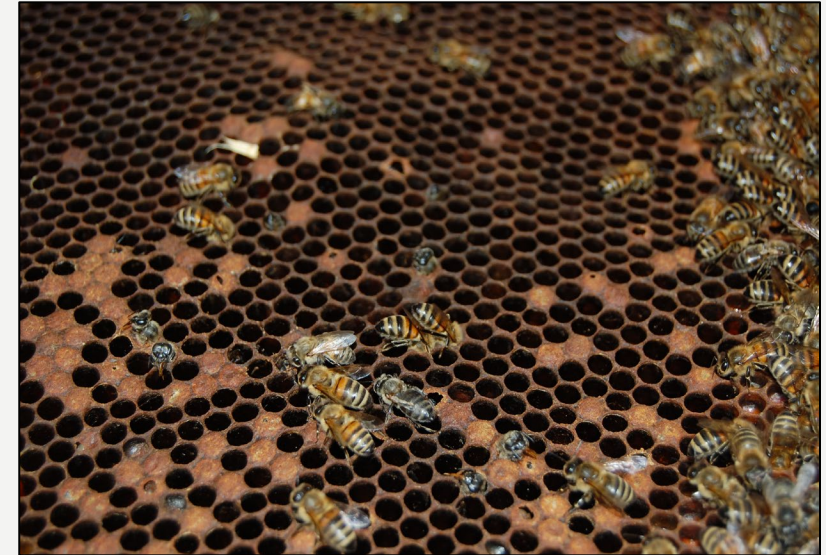
- Two significant honey bee diseases
- Both have worldwide distribution
- Name originated due to foul smell arising from decay of infected brood but AFB and EFB are not closely related
- Commonly treated with antibiotics

AMERICAN FOULBROOD (AFB)

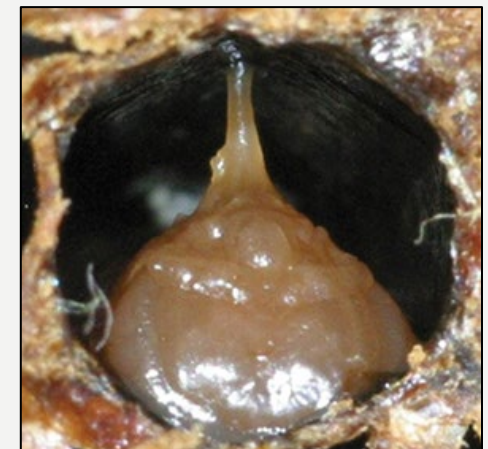
- Cause by *Paenibacillus larvae*, a spore-forming bacteria
- Usually only affects pre-pupal and pupal stages of development
- Infective, vegetative state of bacterium is susceptible to antibiotics
- Spores
 - Not affected by antibiotics
 - Resistant to temperature changes and chemicals
 - Can persist in honey and the environment for up to 70 years

AFB VISUAL INSPECTION FINDINGS

- Foul odor—often compared to dirty gym socks
 - Can often be smelled from a few feet away
- Shotgun brood pattern
 - Indicative of any disease affecting brood—not pathognomonic for AFB
 - Indicates that brood are dying before they are capped
- Perforated caps
 - Sunken and discolored
 - Perforations with irregular edges
- Pupal tongues
 - Kills bees at specific developmental stage
 - May die with developing proboscis exposed = ‘pupal tongue’
 - Characteristic of AFB but not always present
- Larval scale
 - Bottom of cell and difficult to remove



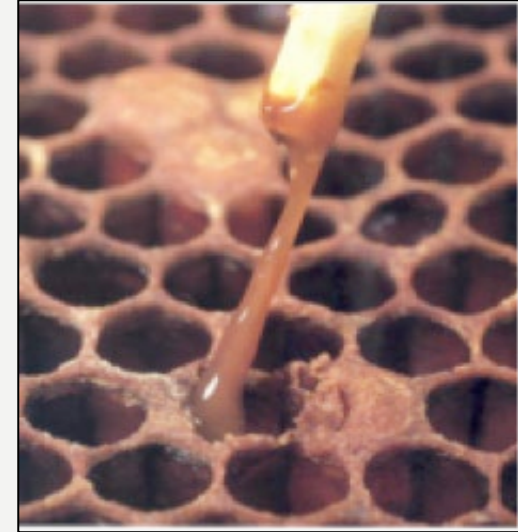
Wikimedia Commons



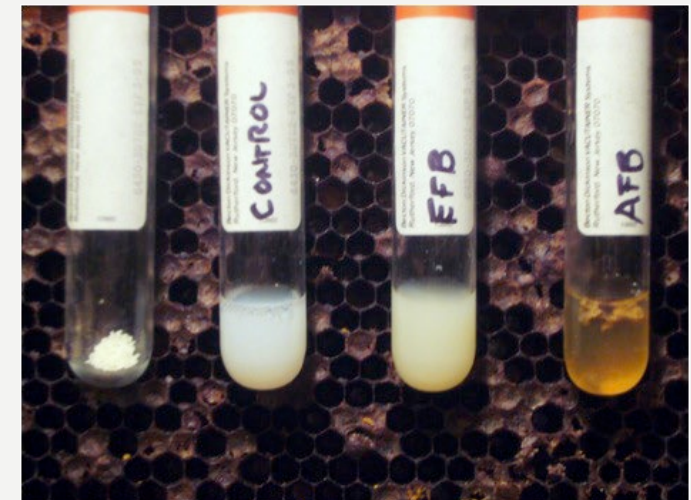
The Management Agency, National AFB
Pest Management Plan, New Zealand

AFB DIAGNOSIS: FIELD TESTS

- Matchstick/rope test
 - Positive test is characteristic of AFB, negative test doesn't rule it out (larvae must be in appropriate stage of decay)
 - Insert matchstick, toothpick, or similar object into cell with discolored/oozing cap and slowly pull it out
 - Decaying products in cell will form viscous string that will rope out ≥ 2 cm
- Holst milk test
 - Positive test suggestive of AFB, negative test doesn't rule it out
 - Need two test tubes of highly diluted milk
 - Add infected larvae or content from rope test to one tube (other tube serves as control) → incubate both tubes in pocket or warm cup of water for 10-20 min, occasionally shaking both tubes → if milk changes to transparent, brownish fluid, this suggests AFB
- Field ELISA Test
 - Manufactured by Vita Europe, available from most U.S. bee supply companies



Ipswich & West Moreton
Beekeepers Association



Randy Oliver, ScientificBeekeeping.com

AFB DIAGNOSIS: LABORATORY TESTING

- Send brood samples to USDA Agricultural Research Service (ARS) laboratory in Beltsville, MD
- See USDA-ARS Bee Research Laboratory website for more details on specimen submission
 - <https://www.ars.usda.gov/northeast-area/beltsville-md/beltsville-agricultural-research-center/bee-research-laboratory/>

AFB TREATMENT

- **Many states require that colonies diagnosed with AFB be immediately destroyed**
 - Always follow state regulations
 - Burning most common method
 - Recommended even if not required by state due to persistence of spores
- Three types of antibiotics are FDA-approved to control AFB
 - Oxytetracycline (resistant strains exist)
 - Tylosin
 - Lincomycin
- Antibiotics not effective against spores—used for mild infections or to prevent infection from worsening or spreading
 - Treatment should occur even if only a single infected cell is detected
 - Still burn frames with infected brood → sterilize boxes and move bees to clean/new equipment → treat colony and all other colonies in that bee yard



Agriculture Victoria

AMERICAN FOULBROOD (AFB)

- **REPORTABLE DISEASE IN MONTANA (Recommended)**
- **If AFB is confirmed in a hive, Montana Law requires burning or charring of all beekeeping equipment and tools**

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State Entomologist and Apiary Inspector

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Web: www.agr.mt.gov/bees

Source: Montana Department of Agriculture: American Foulbrood
<https://agr.mt.gov/docs/bees-docs/Amer.-Foulbrood-Info-Sheet.pdf>

EUROPEAN FOULBROOD (EFB)

- Caused by *Melissococcus pluton*, a non-spore-forming bacteria, but infection is associated with variety of bacterial strains
- Only affects the honey bee larval stage and is more contagious than AFB
- More commonly affects stressed colonies
- May resolve spontaneously if stress is reduced and honey bee health is improved
- Less severe than AFB but can still cause devastating brood loss
- In recent years, has shifted its pathogenicity in U.S. → no longer spontaneously clears and likely to persist in hive

EFB VISUAL INSPECTION FINDINGS

- Shotgun/patchy brood pattern
- Poor colony buildup in spring—diseased larvae may be difficult to detect without thorough inspection
- Discolored larvae (yellow or brown)
- Twisted or corkscrew-shaped larvae
- Visible trachea in larvae
- No scale is formed—dead larval bodies are easily removed
- Often a “sour milk” odor
- Yellow royal jelly around larvae



EFB DIAGNOSIS

- EFB and AFB share many visual characteristics
 - EFB should be a differential when signs of AFB/EFB are observed but characteristic tests (rope test and Holst milk test) are negative for AFB
- Commercial field test is available from Vita Europe (similar to AFB)
- Laboratory testing also available
 - Send brood samples to USDA Agricultural Research Service (ARS) laboratory in Beltsville, MD
 - See USDA-ARS Bee Research Laboratory website for more details on specimen submission
 - <https://www.ars.usda.gov/northeast-area/beltsville-md/beltsville-agricultural-research-center/bee-research-laboratory/>

EFB TREATMENT

- Oxytetracycline and tylosin have been used to treat EFB; however, ***oxytetracycline is the only drug FDA approved for EFB***
- If infection is mild (<10% of brood infected), beekeeper may employ watchful waiting: infected frames are marked and colony is re-inspected in a week to identify if infection is spreading or improving
- In severe infections, recommended to remove frames with diseased brood and replace with new comb in addition to treatment with antibiotics
- Since the bacteria that causes EFB does not have a spore form, frame and equipment destruction is not required
 - Frames can be reused after several months of storage or sterilization with bleach solution

USING ANTIBIOTICS IN HONEY BEES

- Water soluble forms of oxytetracycline, tylosin, and lincomycin are available for use in honey bees by prescription
 - Tylosin and lincomycin are only approved for treatment of AFB, not EFB
 - Extra label drug use is allowed with a **prescription** under ELDU regulations
 - Be sure to follow VCPR requirements
- **VFD orders do not allow for extralabel drug use**
 - VFD must expire within 6 months of issue but may specify a shorter expiration date
 - Only one drug available by VFD for honeybees—oxytetracycline
 - Must have valid VCPR and at least preliminary diagnosis of EFB or AFB prior to initiating treatment
 - With valid VCPR and proper training of staff, veterinarian could prescribe an antibiotic to be used when beekeeper's staff recognizes EFB or AFB

USING ANTIBIOTICS IN HONEY BEES

- With any antibiotic use, make sure records are kept of dates of treatments, drug, dosage, prescribed withholding time, and identity of hives
- For treatment of EFB or AFB:
 - Can mix oxytetracycline with powdered sugar according to label instructions and apply to top of the frames of the brood nest following dosage and timing on label
 - Dusting of uncapped brood cells has been reported to cause death of larval honey bees
- Antibiotics should be fed early spring or fall and consumed by the bees before main honey flow begins to avoid contamination of production honey
 - Remove at least 6 weeks prior to main honey flow
 - Do not use in a manner contrary to state apiary laws and regulations
 - Each state has specific regulations relative to disease control and medications
 - Contact appropriate official or state departments of agriculture for specific inter- and intrastate laws and regulations

AFB & EFB LOOK-ALIKES

- Idiopathic Brood Disease (IBD) & Parasitic Mite Syndrome (PMS)
- May not require antibiotics for treatment
- Specific etiologic agents unknown but thought to be caused by multiple viruses and found in presence of secondary bacterial infections



IDIOPATHIC BROOD DISEASE (IBD)

- Visual inspection findings
 - Shotgun/patchy brood pattern
 - Larvae may turn yellow but retain 'C' position
 - Larval death in pre-pupal stage—sticking straight up parallel to the cell
 - Larvae appear melted and gummy
 - Larvae eventually melt into dark gray
 - Perforated cappings
 - May form a loose scale
 - Often a foul odor (but different from EFB and AFB)
- Diagnosis
 - Pupal tongue not present
 - Rope test negative
 - No definitive field or laboratory test available
- Treatment
 - Mixed results with antibiotic treatment
 - Removing diseased frames and re-queening can be helpful

PARASITIC MITE SYNDROME (PMS)

- Varroa mites (*Varroa destructor*) are ectoparasites with worldwide distribution
- In the U.S. since 1987
- **Number one killer of honey bees!**
 - Feed on fat body tissue
 - Target larvae that are about to be capped → move to bottom of cell and feed off larva once cell is capped → mites mate inside the cell and mature → once bee emerges from the cell, it will already have female mite offspring on it
- Cause larval or pupal death and can transmit a multitude of viruses and other pathogens (deformed wing virus, acute bee paralysis virus)
- PMS caused by viruses transmitted by the varroa mite
 - Exhibited in severely infested colonies
 - Most commonly seen late season in colonies where mites have not been actively managed
 - Deformed wing virus (DWV) is likely the major pathogen causing disease in PMS



Wikipedia



Entomology & Nematology Dept.
University of Florida

PARASITIC MITE SYNDROME

- Visual inspection findings
 - Shotgun/patchy brood pattern
 - Melted larvae
 - Bees dying on emergence from cells with tongues sticking out
 - Guanine crystals on walls of cells (mite fecal deposits—appear as white spots)
 - Adult bees exhibiting deformed wings
 - Chewed pupae
 - Uncapped pupae (eyes visible)
 - Visible mites
- Diagnosis
 - Regular monitoring for mites (techniques vary)
- Treatment
 - Integrated pest management: active monitoring paired with physical, mechanical, and chemical controls, as needed



Wikipedia



Cox's Honey

INTEGRATED PEST MANAGEMENT



Honey Bee Health Coalition: <https://youtu.be/aFILPZ5KbgU>

MITE CHECKS

- Two main methods:
 - Sugar shake
 - Alcohol Wash



MITE CHECKS



Iowa State University Extension & Outreach: <https://youtu.be/xNT0jxFMC9o>

MICROSPORIDIAL DISEASE: NOSEMA

- Two types of infections possible, caused by single-celled, microsporidia *Nosema apis* or *Nosema ceranae*
 - *Nosema apis* tends to be worse in northern climates in fall and winter when bees cluster together to maintain hive warmth
- Spread from bee to bee by feeding and fecal/oral transmission
- Clinical signs:
 - “K-wing”
 - Yellow, orange, or brown fecal staining on front of hive
 - Bees wandering on ground outside colony
 - Poor growth of bees
 - Death
- Diagnosis must be confirmed by simple microscopy
- Must differentiate from normal feces of honey bees

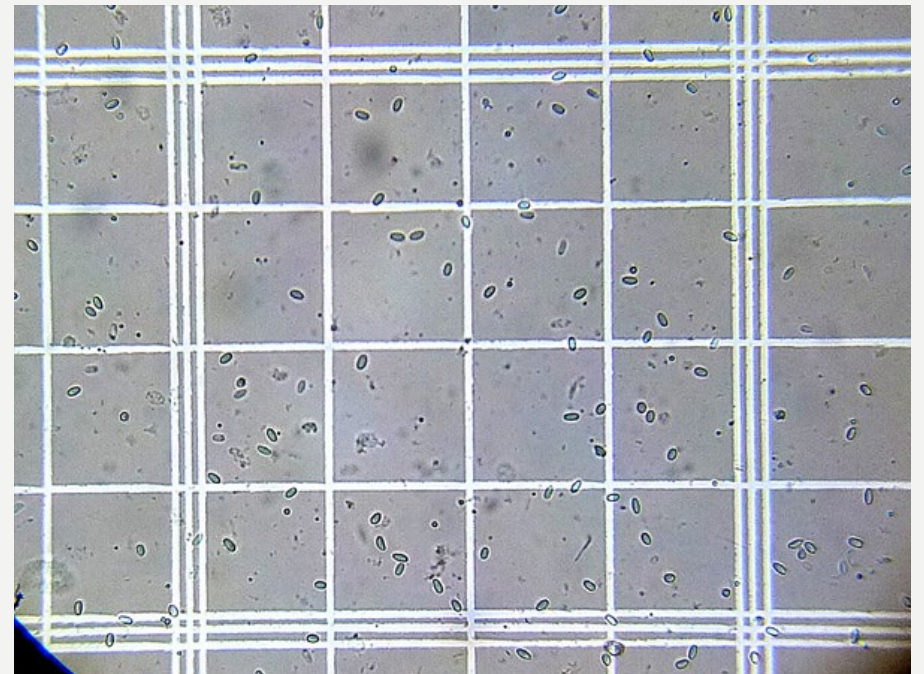


Photo source: © Randy Oliver, ScientificBeekeeping.com

NOSEMA TREATMENT

- Currently no approved treatment in U.S.
- Many colonies clear infection without treatment
- In chronic cases, requeening and food supplementation might be useful
- Though it is not approved for use in the U.S., some beekeepers treat Nosema with dicyclohexylammonium Fumagilin Soluble Powder HS

COLONY COLLAPSE DISORDER (CCD)

- In 2006, beekeepers began observing dramatic declines in honey bee colonies
 - Further investigation revealed situation was different from previously known causes of loss
- CCD is defined as a dead colony with no adult bees and no dead bee bodies but with a live queen and usually honey and brood still present
- Does not include honey bee colonies lost due to any identified reason, such as described previously
- Despite intense research, cause for CCD has not yet been proven
 - Most research points to a complex of factors being involved but factors are not uniform in all incidents
- An emergency response kit is available to evaluate a collapsing hive and protocols are available for sampling



PESTS: WAX MOTHS

- Opportunistic
- Invade weak hives or stored beekeeping equipment
- Two species:
 - Greater wax moth (more common) – *Galleria mellonella*
 - Lesser wax moth – *Achroia grisella*
- Found throughout the U.S.
- Burrow through comb and into wood of frames and boxes
- Silky webbing left behind
- Prefer darkness and little air flow



Photo source: © Randy Oliver, ScientificBeekeeping.com

OTHER BEE DISEASES & CONDITIONS


- Viral
 - Paralytic viruses
 - Sacbrood
- Fungal
 - Chalkbrood
- Parasitic
 - Tracheal mites
 - Small hive beetles
- Other
 - Malnutrition
 - Pesticide toxicity

BUT WAIT, THERE'S MORE!



HONEY BEE TRIVIA:

WHAT ARE A HONEY BEE'S DANCE MOVES CALLED AND WHAT DO THEY MEAN?



RESOURCES FOR VETERINARIANS

WHERE CAN I LEARN MORE?

- Join your state and local beekeeping organizations!
 - Montana State Beekeeping Association (Facebook):
<https://www.facebook.com/groups/760355480971159/>
- Take a beginner beekeeping course
- Get to know your State Apiary Inspector:

Alyssa Piccolomini

State Entomologist and Apiary Inspector

302 N Roberts St | Helena, MT 59601

T: (406) 444-3790

E: apiccolomini@mt.gov

Web: www.agr.mt.gov/bees

WHERE CAN I LEARN MORE?

- Textbooks:
 - Honey Bee Medicine for the Veterinary Practitioner. www.wiley.com/buy/9781119583370. Wiley Press, 2021. (*coupons available*)
 - Honeybee Veterinary Medicine: *Apis mellifera L.* by Nicolas Vidal-Naquet. First Edition 2015. 5m Publishing.
- Web Module:
 - USDA-APHIS National Veterinary Accreditation Program Module 30: The Role of Veterinarians in Honey Bee Health: <https://nvap.aphis.usda.gov/BEE/bee0001.php>

WHERE CAN I LEARN MORE?

- Web-based Resources:
 - Honey Bee Veterinary Consortium <https://www.hbvc.org/>
 - Honey Bee Health Coalition <https://honeybeehealthcoalition.org/>
 - <https://honeybeehealthcoalition.org/resources/varroa-management/>
 - Bee Informed Partnership <https://beeinformed.org/>
 - American Veterinary Medical Association: “Honey Bees 101 for Veterinarians”
<https://www.avma.org/resources-tools/one-health/antimicrobial-use-and-antimicrobial-resistance/honeybees-101-veterinarians>
 - American Beekeeping Federation <http://www.abfnet.org/>
 - Michigan Pollinator Initiative <https://pollinators.msu.edu/>
 - U of MN Bee Lab <https://beelab.umn.edu/>
 - U of FL Honey Bee Research & Extension Lab <https://entnemdept.ufl.edu/honey-bee/>

OPPORTUNITIES FOR VETERINARIANS IN HONEY BEE MEDICINE

- VFDs
- Biosecurity
- Disease recognition and management
- Education and outreach
- Work in collaboration with state apiarists and extension specialists

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BONUS HONEY BEE TRIVIA:

WHAT IS DR. CLARK'S FAVORITE FLOWER?

Courtesy of
Whole Foods Inc.



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**THANKS FOR
ATTENDING!**