

**BEGINNING BEEKEEPING**  
**CLASS 3: RACES OF BEES, LIFE CYCLE OF BEES, SOME BEE BIOLOGY**

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**RACES OF BEES – PICKING A QUEEN**

- ✦ All honeybees are in species *Apis Mellifera* or Western Honeybee
- ✦ Most common races of bees in US
  - + Italian - *Apis mellifera ligustica*
  - + German or English - *Apis mellifera mellifera*
  - + Carniolan - *Apis mellifera carnica*
  - + Caucasian - *Apis mellifera caucasica*

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**HYBRIDS AND LINES WITHIN RACES**

- ✦ Buckfast - Cross between Anatolian, Italian, and Carniolan bees. Bred by Brother Adam from Buckfast Abbey in UK.
- ✦ Russian - a line of Caucasian bees
- ✦ Cordovan - a line of Italian bees that are popular for their lemon yellow coloring
- ✦ VSH or SMR or VSH Pol-line - "Varroa Sensitive Hygiene" or "Suppression of Mite Reproduction" or VSH with traits for pollinators. Bred for traits, but mostly Italian.

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**HYBRIDS AND LINES WITHIN RACES**

- ✦ Minnesota Hygienic - bred for hygienic traits at University of Minnesota (Dr. Marla Spivek & Gary Reuter)
- ✦ Saskatraz - combination of German and Russian bees - bred for varroa control in Saskatchewan, Canada
- ✦ Africanized Honey Bees (AHB) - a cross between African honey bees (*Apis mellifera scutelata*) and Italian honey bees.

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## HOW MIGHT THEY LOOK?



Italian



Cordovan



Buckfast



Russian



Sakabraz



Caucasian

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## BUT WAIT! THERE'S MORE!

- \* Leg Biter & Mite Mauler Honey Bees - Can be just about any race. Bred for their aggressive approach to dealing with Varroa Mites. Research being done at Purdue University (Dr. Greg Hunt) in cooperation with the Heartland Honey Bee Breeders Coop [HHBBC] & Indiana Bee Breeders.
- \* They are chewing bees that aggressively go after the varroa and chew legs off or take a bite out of them.

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## HOW DO YOU KNOW IF YOU HAVE A CHEWING BEE?




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## CHARACTERISTICS OF TYPES OF BEES

Table 1. Comparison of bees and their traits.

	Italian	German	Carniolan	Buckfast	Caucasian	Russian
Color	Light	Dark	Dark	Medium	Dark	Gray
Queen resistance						
Worse	-	-	-	-	-	+
Buckfast	-	-	-	+	0	+
Caucasian	0	-	-	0	0	0
Other	0	0	+	+	-	0
Winter survival	Moderate	Low	High	Low-Mid	High	Low-Mid
Spring buildup	Good	Low	Very good	Low	Very low	OK
Queen rearing	Good	Very good	Good	Good	OK	Very good
Queen rearing ability	OK	OK	High	Low	Low	OK
Winter productivity	Very good	OK	Good	Good	Low	OK
Propolis	Low	OK	Low	Low	High	OK
Other traits	Heavy robbing	Short tongue, not able to reach deep nectar	Low robbing, good nectar foragers	Superior foragers, produce excellent colonies	Long tongue	Good robbing, affected by high queen cells, always produce

0=OK, +=worse, -=better

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## REASONS TO CONSIDER ITALIAN BEE

- Most common in this area
- Easiest to work with for new beekeeper – more reliable behavior
- Hygienic and VSH (Varroa Sensitive Hygienic) bees based on Italian bee

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## MORE ON ITALIAN QUEENS

- Just because the queen is Italian doesn't mean the worker bees will be purely Italian. If the queen was open mated and some of the drones she mates with are Carniolan, the workers may be darker.

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## HONEY BEE CASTES



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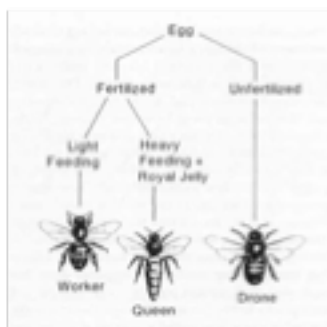
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## HONEY BEE CASTES



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## HONEY BEE DEVELOPMENT TIME

- Workers
  - Egg days 0 to 3 = 3 days
  - Larva days 3 to 9 = 6 days
  - Pupa days 9 to 21 = 12 daysTOTAL 21 days
- Drones
  - Egg days 0 to 3 = 3 days
  - Larva days 3 to 10 = 7 days
  - Pupa days 10 to 24 = 14 daysTOTAL 24 days
- Queen
  - Egg days 0 to 3 = 3 days
  - Larva days 3 to 8.5 = 5.5 days
  - Pupa days 8.5 to 16 = 7.5 daysTOTAL 16 days

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## LIFE CYCLE OF HONEYBEE



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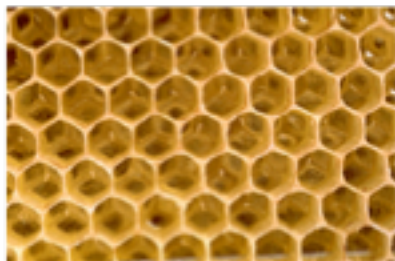
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## EGGS: DAYS 0-3



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## LARVA: DAYS 3 UP TO 10



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## DIFFERENT AGES OF LARVA



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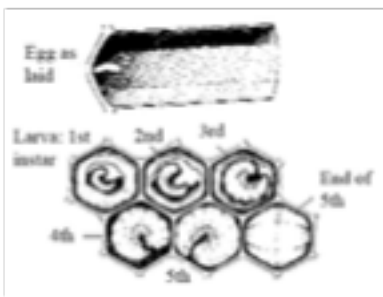
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## LARVA GROWTH



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## PUPAL STAGE



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## PUPAL STAGE



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## EMERGING BEE



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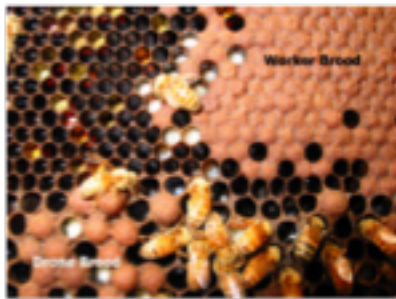
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## BROOD



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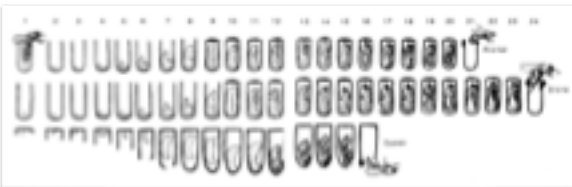
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## BEE DEVELOPMENT



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## DRONES

- **Males**
  - + develop from unfertilized egg
  - + fertile
    - × boricles, sperm
- Normally develop within larger cells in 24 days
- Big abdomens
- Large eyes – vision 20/20
- No sting
- Only eat and take mating flights
- Number controlled by workers
  - + about 600 / hive
  - + live 4 – 16 weeks until Fall
- 17 % of cells in feral colonies are drone sized (1/4" or 7 mm)



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## QUEEN

- ♀ Female
  - larvae fed royal jelly
  - fertile
    - well-developed ovaries
    - spermatheca
- Unbarbed sting
- No pollen baskets, no wax glands
- Bald thorax, long pointed abdomen, folded wings
- Develop in 16 days
- Orientation and mating flights
- Lays eggs 10 months / year
- 1 / hive
- Lives 1 – 2 years (record 5 yrs)



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## QUEEN IN PUPAL STAGE



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## QUEEN CELLS VS QUEEN CUPS



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## BEE MATING / EGG LAYING

- Virgin queen orients (flies) on days 3 – 5
- 1 - 3 mating flights on days 4 – 13, mating w/ > 12 drones
- Mating occurs in DCAs > 2km away at tree top level
- Sperm migrate to her spermatheca over 2 days
- Egg laying starts in 2 - 3 days
- She releases 3 – 5 sperm onto each (fertilized) egg
- No sperm are released onto eggs laid in drone-sized cells



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## QUEEN REPLACEMENT / SWARMS

- ✦ Supersedure
  - ✦ Lack of queen substance feedback due to 'failure' / old age, and/or a lack of brood pheromones
  - ✦ Old queen balled by workers
- ✦ (Reproductive) swarms
  - ✦ Division of successful colonies in Spring
  - ✦ The old mated queen leaves w/ ~ 60 % bees
  - ✦ A new queen emerges, mates, and takes over hive
- ✦ Emergency queen replacement
  - ✦ Begins within 24 hours of queen loss

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## QUEEN CELL TYPES



Up on the frame are either supersedure or emergency



On the bottom of the frames are swarm cells

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## REPRODUCTIVE SWARM PREPARATIONS

- ✦ Typically March 15 – April 21
- ✦ Over-Wintered colonies with rapid spring buildup and lots of drone brood (and adult drones)
- ✦ Broodnest reduction
  - ✦ Nectar congestion at the top of and within the broodnest
  - ✦ Very few eggs / young larvae
- ✦ New wax added to queen cups
- ✦ Royal jelly, an egg, larva, or capped pupa in queen cells
- ✦ Less royal jelly fed to queen, who loses 1/3 her weight over 8 – 10 days
- ✦ Workers engorge honey / foraging decreases
- ✦ Activity inside the hive becomes frantic just before the swarm casts

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## SWARMS

- ✦ Docile for first few days because their honey stomachs are full
- ✦ 'Dry' swarms can be defensive
- ✦ Mated (primary) or virgin (secondary) queen, workers, and drones
- ✦ Lots of wax makers
- ✦ Get the queen and the rest of the bees will follow!

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## WHAT IF YOU SEE THIS?




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## WORKERS

- Females
  - larvae fed worker jelly
  - infertile
    - poorly developed ovaries
    - ovary development inhibited by DMP and brood pheromone
    - no spermatheca
- Barbed sting
- Pollen baskets, wax glands
- Live 2 – 5 weeks in Summer, 4 – 8 weeks in Spring/Fall and 5 months in Winter
  - develop in 21 days
  - typically 21 days of hive duty
  - typically 21 days of foraging
- 10,000 – 60,000 / hive



workers on capped worker brood

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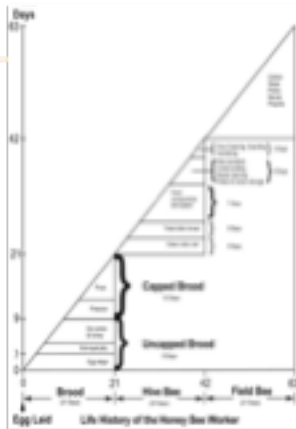
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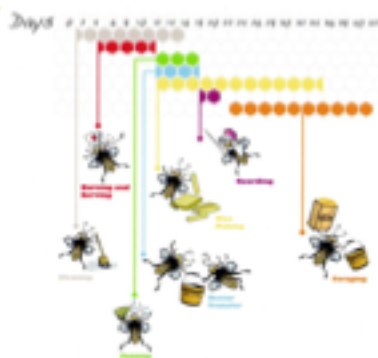
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## A Worker Bee's Life




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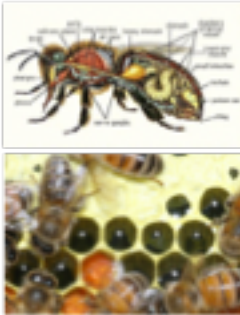
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## NECTAR AND HONEY

- ✦ Watery sugar stored for flight in the honey stomach
- ✦ Delivered to house bees
- ✦ The enzyme invertase is added to break down sucrose
- ✦ Bubbled into cells and fanned to decrease the water content (below 18 %)
- ✦ Cured honey is then capped with wax



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## HONEY

- ✦ It takes 12 worker bees their entire lifetime to make 1 teaspoon of honey.
- ✦ Honey is the bees food. Adults eat mostly honey. Larva need honey and pollen.
- ✦ It takes 1 cell of honey + 1 cell of pollen make a bee.
- ✦ Bees in North Carolina need about 70-80 pounds of honey to make it through the winter (that's two 10 frame shallow supers of honey)

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## POLLEN COLLECTION

- ✦ Worker bees are covered with hairs all over their bodies (even their eyes)



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## ATTRACTING POLLEN

- ✦ When the worker bee flies, the hairs get electrostatically charged. When she lands on a plant with pollen, the pollen sticks to her.



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## PACKING POLLEN TO TAKE BACK TO HIVE

- ✦ The worker bee combs the pollen off her body and stores it in her pollen basket on her hind legs.



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## POLLEN PROCESSING



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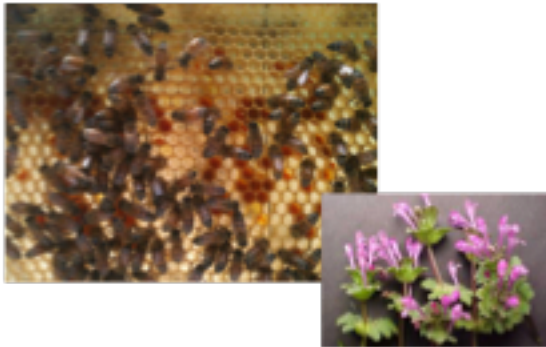
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## LOCAL POLLEN



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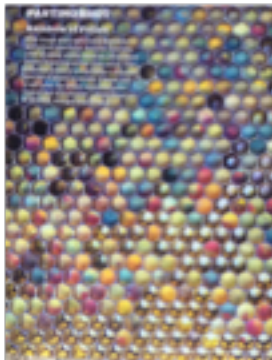
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## POLLEN



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## STORED POLLEN / BEE BREAD

- ✦ Fall-Reared bees are larger than summer bees due to more pollen consumption and larger fat bodies
- ✦ When pollen supplies are low, workers eat drone larvae first, then eggs, then pupae
  - ✦ They will begin to cannibalize drone larvae within 48 hours of a shortage, and pupae within 7 days

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## PROPOLIS AND WATER

- ✦ Propolis
  - ✦ Sticky sap substance with antimicrobial properties
  - ✦ Collected on their pollen baskets
  - ✦ Used to:
    - ✦ reinforce loose hive components
    - ✦ plug holes and narrow entrances
    - ✦ cordon off foreign material within the hive
    - ✦ self-medicate
- ✦ Water
  - ✦ Collected in late Winter / early Spring
  - ✦ Uses:
    - ✦ to dilute honey!
    - ✦ added to bee bread (yeast to produce brood food)
    - ✦ placed on tops of frames and fanned to cool hive

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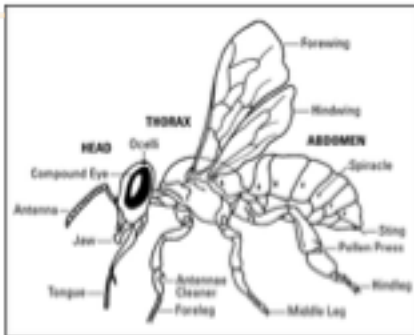
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## BEE BIOLOGY



Major parts of the bee

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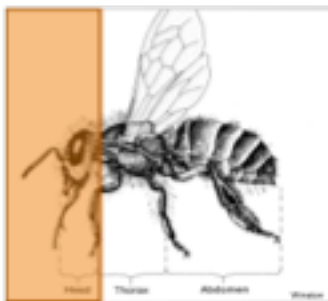
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## BEE BIOLOGY - HEAD



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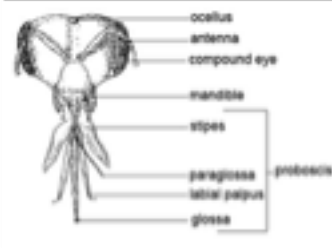
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## BEE BIOLOGY - HEAD

- ✦ Ocellus or Simple Eyes (3)
- ✦ Compound Eyes (2)
- ✦ Antenna (2)
- ✦ Mandibles (2)
- ✦ Proboscis



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## BEE BIOLOGY – HEAD :: EYES

- ✦ A - Compound Eyes (2)
- ✦ B - Simple Eyes (3)



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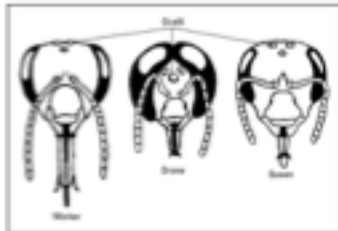
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## BEE BIOLOGY – HEAD :: SIMPLE EYES



- ✦ Placement of Ocelli or Simple Eyes on types of bees
- ✦ Used in the poor light conditions within hive. On/off switch telling bees when the sun is shining.

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## BEE BIOLOGY – HEAD :: COMPOUND EYES



- ✦ **Compound eyes** are used to detect colors, position of the sun, and recognize landmarks

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## ANTENNAE

- Antennae: Bees do not have noses, but they can smell a wide variety of odors with their antennae. Smell and tactile sensations are how bees move around and conduct their duties inside the hive.



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## MANDIBLES AND PROBOSCIS

- Mouth parts: The bees mandibles (jaws) are used for feeding larvae, collecting pollen, manipulating wax, and carrying things.
- Proboscis: The bee's proboscis is much like a party noise maker that unrolls when you toot it. When the bee is at rest, the organ is retracted. When the bee is feeding or drinking, it unfolds to form a long tube that the bee can use like a straw.

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## BEE BIOLOGY – HEAD :: MOUTH & TONGUE



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## GATHERING NECTAR



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## FEEDING EACH OTHER



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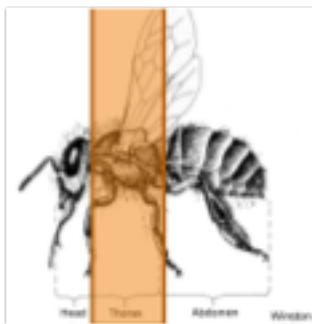
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## BEE BIOLOGY - THORAX



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## BEE BIOLOGY – THORAX :: WINGS

The thorax is the middle part of the bee and includes all muscles, all nerves, and appendages

- ✦ **Wings:** The honeybee has 4 wings, two pairs attached fore and aft to the bee thorax. The wings are hooked together in flight separate when the bee is at rest.



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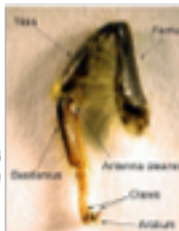
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## BEE BIOLOGY – THORAX :: LEGS

- ✦ **Legs:** The bee has 3 pairs of legs, each different. Each leg has six segments that make them quite flexible. The bees have taste receptors on the tips of their legs.
  - ✦ The **forward legs** are used to clean its antennae.
  - ✦ The **middle legs** help with walking and are used to pack pollen (and sometimes propolis) into the **pollen baskets** that are part of the hind legs. (Propolis is the sticky resinous substance that the bees collect from the buds of trees and use to seal up cracks in the hive.)



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## BEE BIOLOGY – THORAX :: LEGS



- ✦ The **hind legs** are specialized on the worker bee. They contain special combs and a pollen press, which are used by the worker bee to brush, collect, pack and carry pollen and propolis back to the hive.

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## BEE BIOLOGY - ABDOMEN

- ✦ The abdomen is the part of the bee's body that contains its digestive organs, reproductive organs, wax and scent glands (workers only) and the stinger (workers and queen only).

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## BEE BIOLOGY – ABDOMEN :: STINGER



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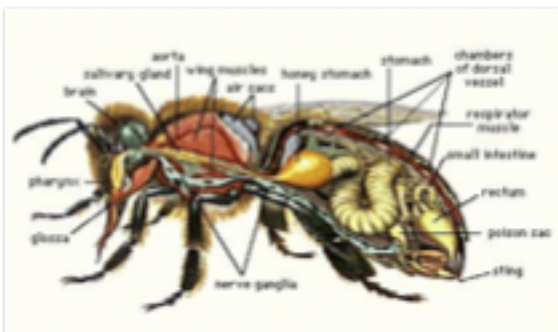
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## BEE BIOLOGY – INTERNAL ANATOMY



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