Honey Bees

Presented
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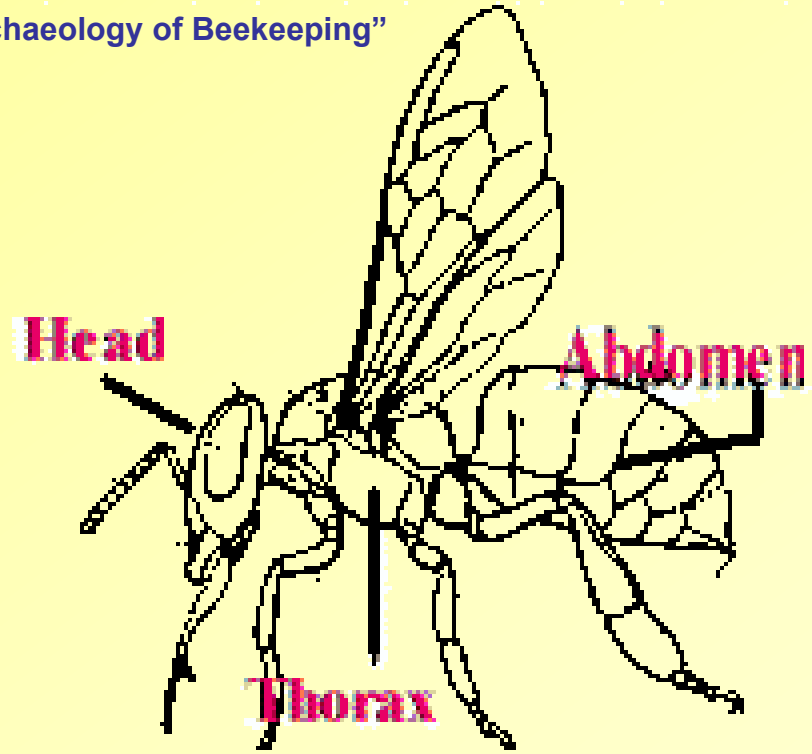
Honey Bees

Have existed for a few million years. For ten thousand years, records have survived of man's exploitation of honey.

From "The Archaeology of Beekeeping" by Eva Crane



Bees
are insect members of the Hymenoptera order

- 20,000 species of bees and wasps worldwide
- Honey bees sting humans once and die
  (Due to barbs which catch in the skin.)
- Wasps can sting multiple times (no barbs)
- Many bees and wasps have no stinger
  (most males cannot sting)
- North America had 4000 species of bees before the European honey bee was introduced.

Honey bees

- Phylum-Arthopoda
  - Class – Insecta or Hexapodia (six legs)
    - Order - Hymenoptera
      - Sub-order Apocrita
        - » Family Apidae
          * Species
            ** sub-species

- ***Apis mellifera* is the scientific name for the honey bee.**
- **The honey bee is an insect in the hymenoptera order. Hymenoptera which means narrow waist.**
- **Suborder Apocrita which includes bees, ants and wasps.**
- **Family Apidae honey bees, bumble bees, & others defined as having hind legs bearing long hairs that act as pollen baskets**
- **Species – Mellifera**
- **Sub-species**

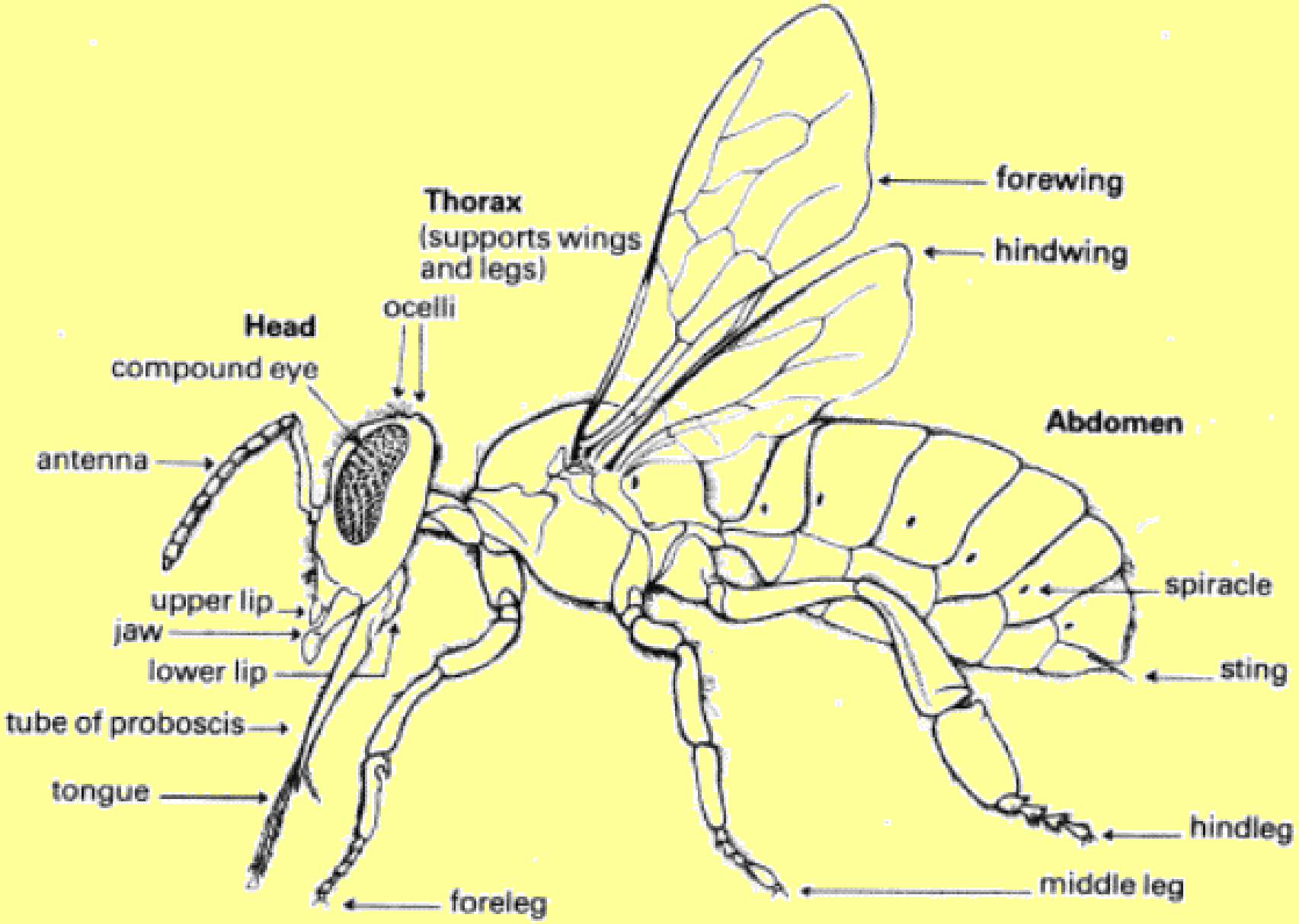
Insects

Apis mellifera:

- **The scientific name for the western honey bee.**
- **You will see the word honey bee spelled as two words and as a single word. But it is correct to spell it as two words like House fly, and bumble bee.**

Insects are classified as having

- **3 body parts (head, thorax and abdomen)**
- **three pairs of legs**
- **one pair of antennae**
- **wings optional (honey bees have 2 pair).**


forewing
Thorax
(supports wings
and legs)
hindwing
ocelli
Head
compound eye
Abdomen
antenna
spiracle
upper lip
jaw
lower lip
sting
tube of proboscis
tongue
hindleg
middle leg
foreleg

Apis mellifera

- **According to Theodore B. Mitchell who spent 38 years of his life studying bees "Bees are essential to our economy, being the chief pollinating agents of the flowering plants. They have a relation not only to agriculture, but to the conservation of wildlife and game management, and constitute an important element in the various ecologic factors that combine to form our environment. Thus the production of fruit crops such as apples, pears, melons, almonds, cucumbers, grapes, dewberries, huckleberries and strawberries, as well as cotton and various seed crops such as alfalfa, several clovers, vetch, onion, asparagus, buckwheat and celery, are dependent upon a sufficient population of bees, either the domesticated honey bee or some of our native, wild, solitary or social species."**

Honey Bee Sub-species

- Mellifera mellifera – German black bee
  - Introduced 1622 (white man's fly)
  - Wiped out by disease and introduction of other species. Genetic ghosts remain.
- Mellifera ligustica – Italian
  - Introduced 19th century
  - Light golds and browns
  - Gentle
  - Very productive
  - Prone to starvation due to expansive early spring build up in excess of food stores.
  - Susceptibility to pests and disease

Honey Bee Sub-species

- Mellifera caucasia – Caucasian
  - Trans-Caucasus region between the Black and Caspian seas
  - Introduced 1882
  - Gray/Black
  - Gentle
  - Not as productive as Itailians
  - Propolis buildup (could be a positive)
- Mellifera carnica – Carniolan
  - East-central Europe
  - Darkest of the popular races – Queens are hard to spot
  - Thought to be resistant to varroa mites
  - Conservative in using resources and brood expansion in the spring

Honey Bee Sub-species

- Russian -mixed breed, predominately Carniolan
  - Eastern Russia
  - Introduced by USDA 1990's
  - Some what resistant to varroa
  - Productivity comparable to Italians
  - Conservative spring buildup
- Mellifera scutellata - Africanized bee
  - Introduced in Brazil 1950's
  - Suited to Tropical regions, Italians were not
  - Expanded to southern USA in 1990's
  - Extremely defensive
  - Under good management they are productive and have become gentler
  - Hives/queens in this area often have African genetics mixed in.

Honey Bee Sub-species

- Buckfast - Hybrid
- It is a man-made bee race, a cross of many strains of bees, developed by Karl Kehrle, also known as Brother Adam, who was in charge of beekeeping from 1919 at Buckfast Abbey in Devon in the United Kingdom, where the bees are still bred today.
- Originaly developed to resist tracheal mites
- Hygenic
- Productive - Gentle
- Purity in TX is questionable due to open breeding

Honey Bee Sub-species

- Saskatraz - Hybrid
- Saskatraz hybrids are produced in Northern California (Orland area) by Olivarez honey Bees Inc.(OHB), using Saskatraz breeder queens produced in Saskatchewan, Canada by Meadow Ridge Enterprises LTD (Breeder, Albert J. Robertson). A detailed review of the Saskatraz project (established 2005) including breeding methods, published research articles, power point presentations and information on individual breeding families, including Saskatraz hybrids can be found at www.saskatraz.com.

Biological Information

- All honey bees come from eggs.
- All honey bees develop into larva.
- All honey bees go thru **Metamorphism**.
- The development times for all honey bees differ by caste.

Lets look at each of these.

Development

Complete Metamorphosis

Egg

Larva

Pupa

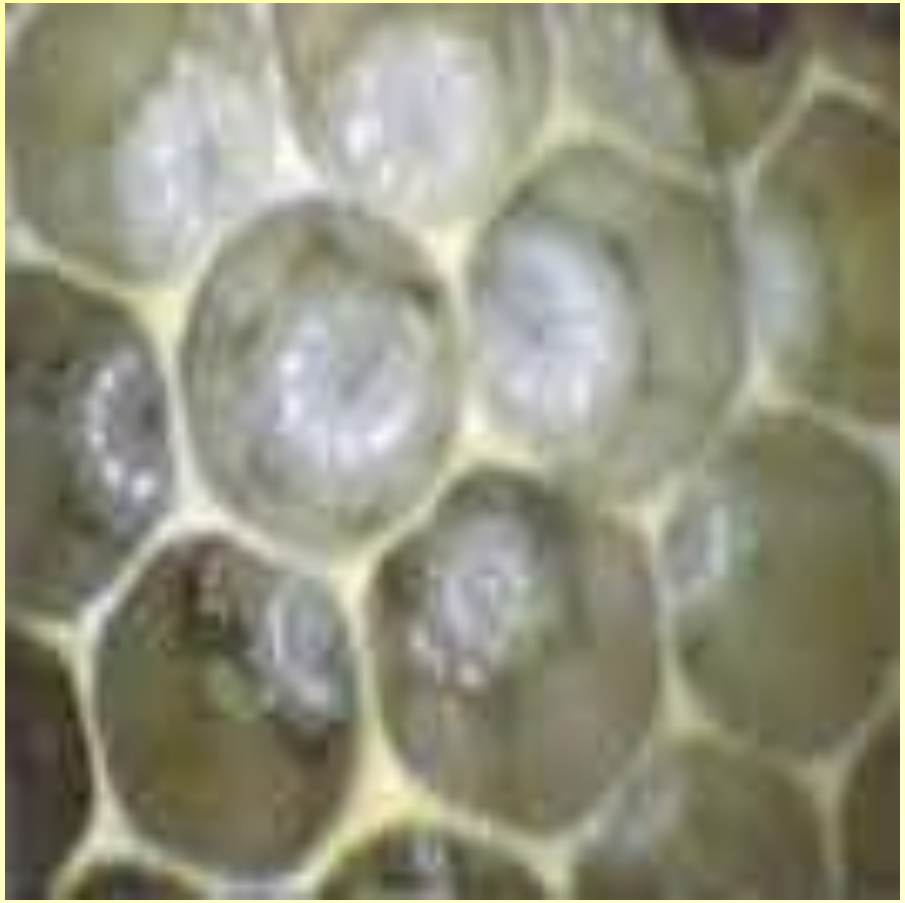
Adult

All honey bees come from eggs

- A queen honey bee can lay over 2000 eggs in a single 24 hour period.
- If your math is good, multiply this by 10, 20, 30, and 40 days the general life span of worker bees.
- Eggs are deposited into cells.

All honey bees develop into larva

- **Larva in cells look somewhat like little worms. The body is composed of a head plus 13 ring-like divisions or segments.**
- **It grows to fill the cell very quickly. Between the day it emerges from the egg until it reaches the fifth day of development, it will grow six times it's body weight during each 24 hour period of development.**
- **Healthy larva are white in color.**



Then a Pupa..

When a cell is capped – the larva transforms into a pupa. From a pupa it will develop into a imago. It then emerges as an adult.

The Players (castes)

Queen - female

Workers - female

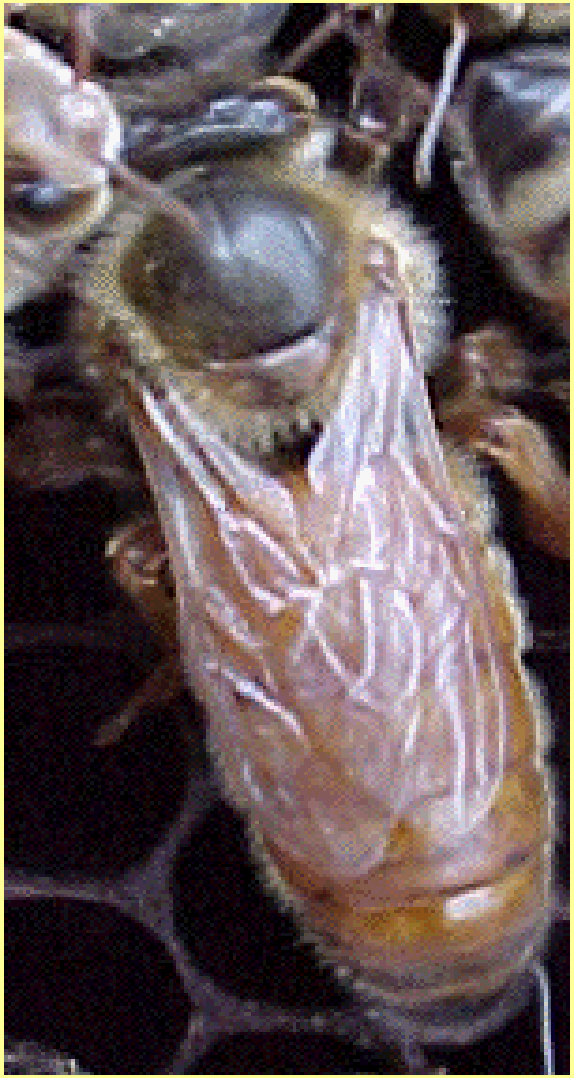
Drones - male

The Queen

- **The queen is a mature, fertile female**
- **She develops from a fertilized egg.**
- **She mates once with multiple drones during her mating flight.**
- **She stores the sperm of multiple drones in her spermatheca and can choose to lay fertilized or non fertilized eggs.**
- **She is the mother of all the bees laid in the hive.**
- **She may live for 2-5 years**
- **Her role in the hive is to produce eggs and to release pheromone signals within the hive.**

Some Facts About the Queen….

- **Normally the only actively reproducing female**
- **Can produce 1,500 -2,000 eggs per day or more at the height of the brood season**
- **She lays hundreds of thousands of eggs during her life time.**
- **She is normally larger than the other bees in the hive and has a slim torpedo shape.**
- **She does have a stinger, but uses it to kill other queens.**
- **Under normal conditions a hive will have only one queen.**



The Worker Bee

- Worker bees are sexually underdeveloped females.
- She is developed from a fertilized egg.
- They are called workers because that is what they do. They collect food and water for the colony, build wax comb, do the housework, maintain the interior temperatures of the hive and guard the hive against intruders
- She defends the hive. She has a stinger, but can sting only once. She dies soon after stinging.
- Worker/forager bees don't usually sting because they are not protecting the hive.
- Female worker bees under certain conditions can lay eggs but because they are not mated, they produce eggs that only develop into drones.

Nurse bees

– 1 - 12 days

– Self-grooming

– Cell cleaning

– Feeding brood

House Bees

- 10-20 days old
- Comb building
- Hive cleaning
- Accepting nectar and pollen from foragers
- Undertakers
- Hive guarding
- Climate control

Field Bees

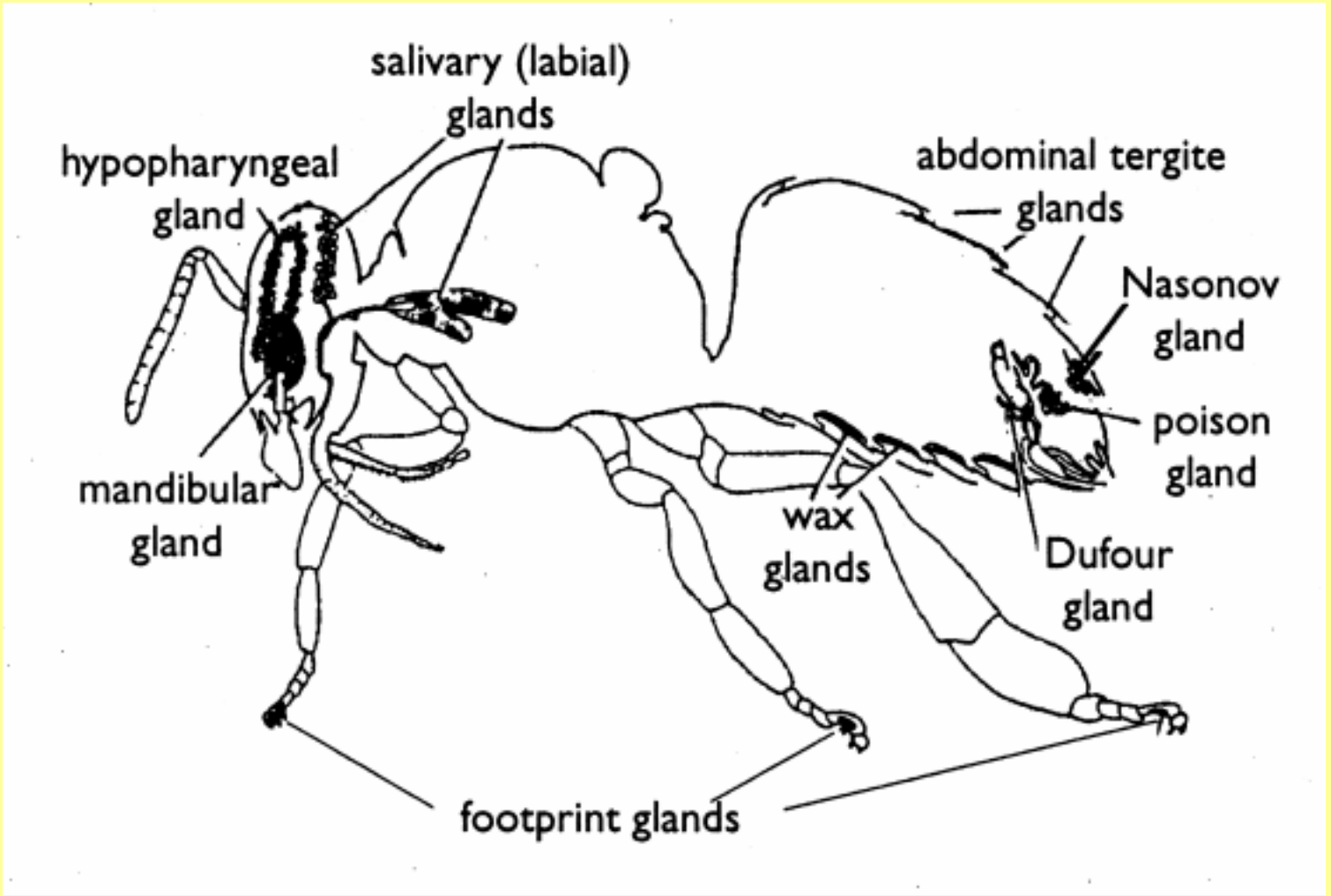
- From about 20 days until death (30-45 days)

- Collect
  - Nectar
  - Pollen
  - Water
  - Plant resins

More Facts About Worker Bees….

- **Workers control the temperature in the hive**
  - **Brood areas are kept at approximately 93ºF**
    - **They warm the hive by clustering and vibrating wing muscles to generate heat.**
    - **They cool the hive by fanning air over droplets of water.**
    - **Individual bees are cold blooded.**
    - **A colony is a superorganism, with the individual bees working like a cells work with other cells in a human to build and maintain a functional person. In this way the colony acts as a warm blooded animal.**
- **The summer worker bee lives for a short period of time – usually about 4 to 6 weeks.**
- **Winter workers live 4-5 months.**

Glands


salivary (labial) glands
hypopharyngeal gland
abdominal tergite glands
Nasonov gland
poison gland
mandibular gland
wax glands
Dufour gland
footprint glands

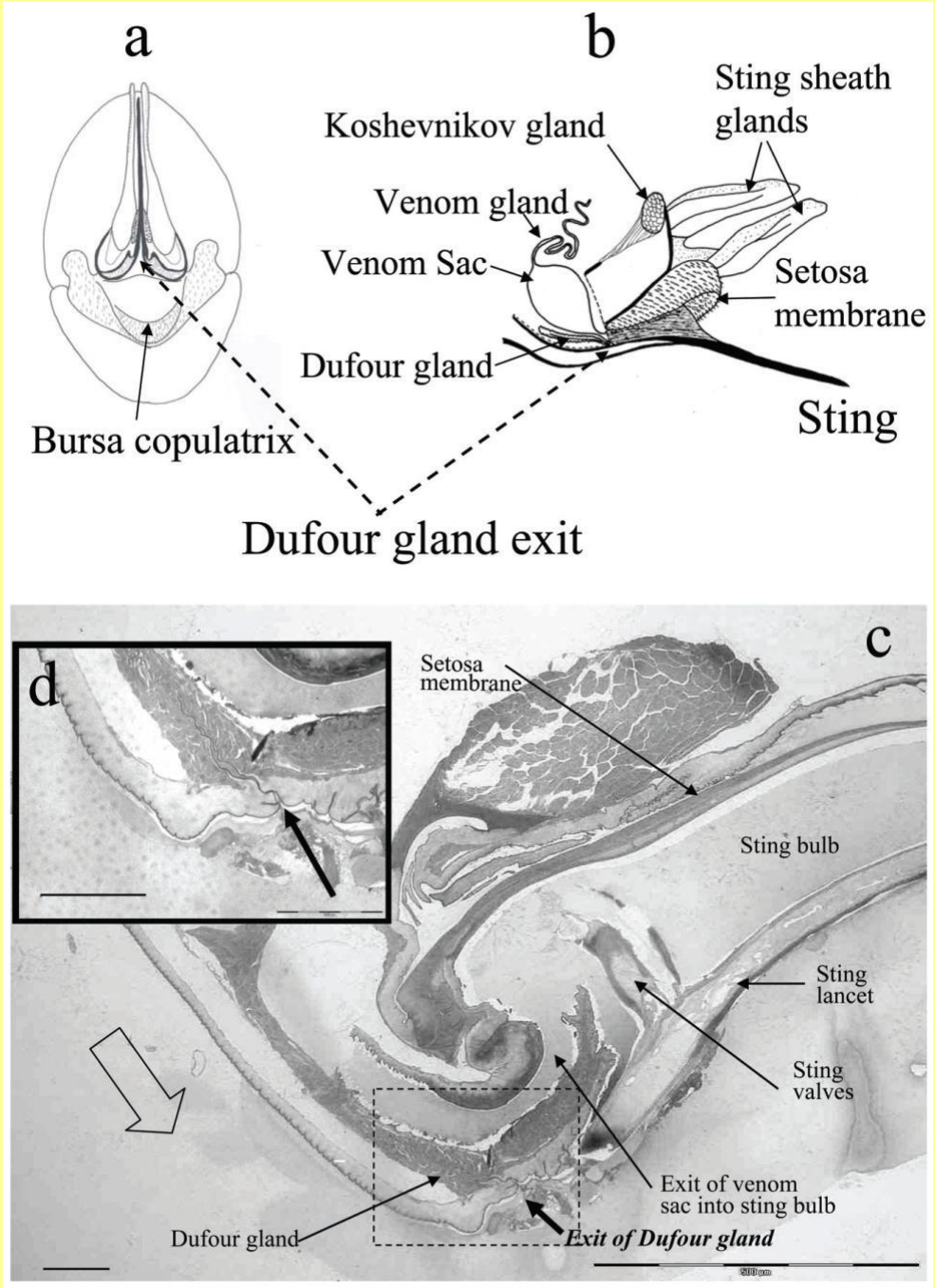
What to Feed the Babies

- Hypopharyngeal gland secretions are clear and contain mostly proteins
- Secretions from the mandibular glands are white and contain lipids
- This mixture is called royal jelly

Wax Glands

Footprint Glands

- **Worker: orientation-finding nectar**
- **Queen: queen cell inhibition**



Dufour Gland

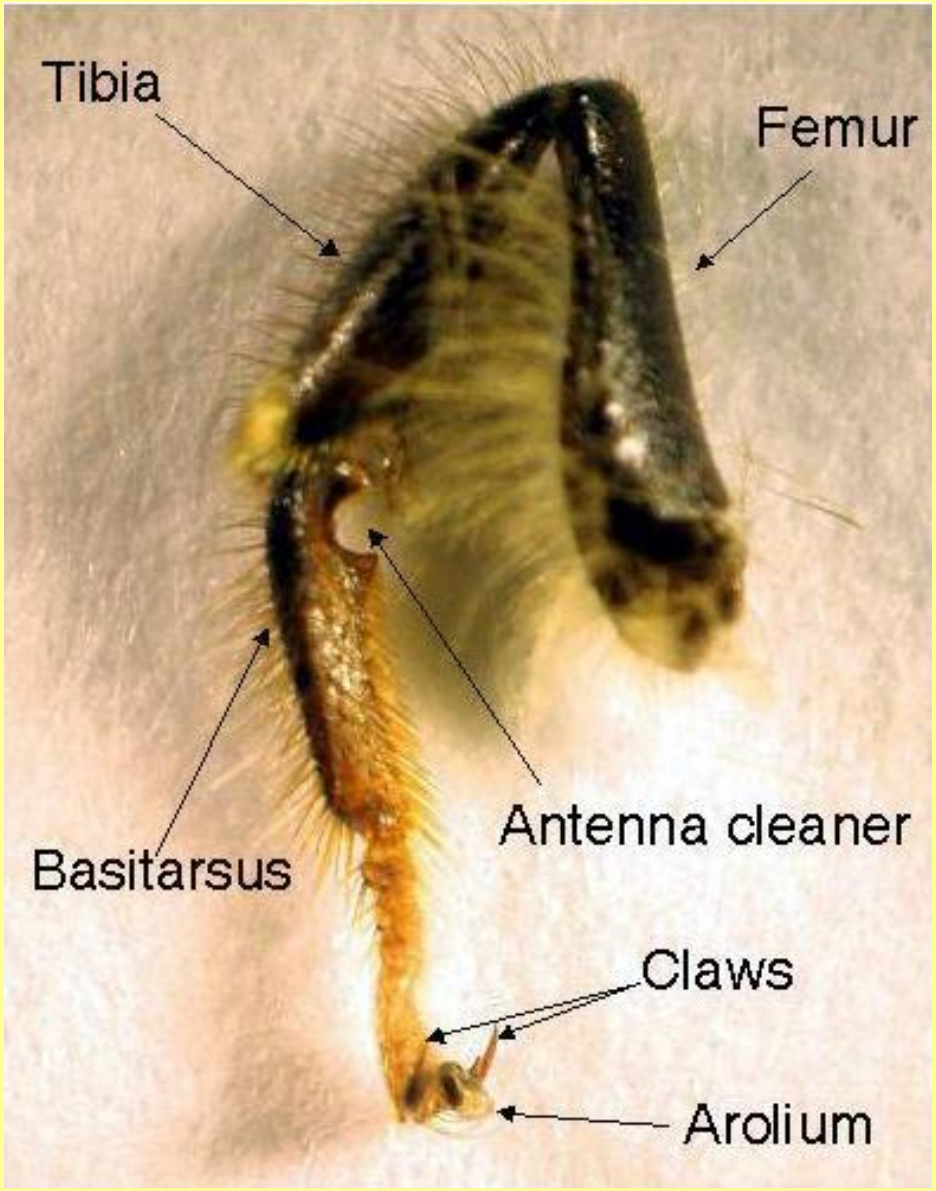
- **Defense and reproduction**
- **Nest recognition in other bees**

Nasanov gland

Specialized Structures of Honey Bee Legs

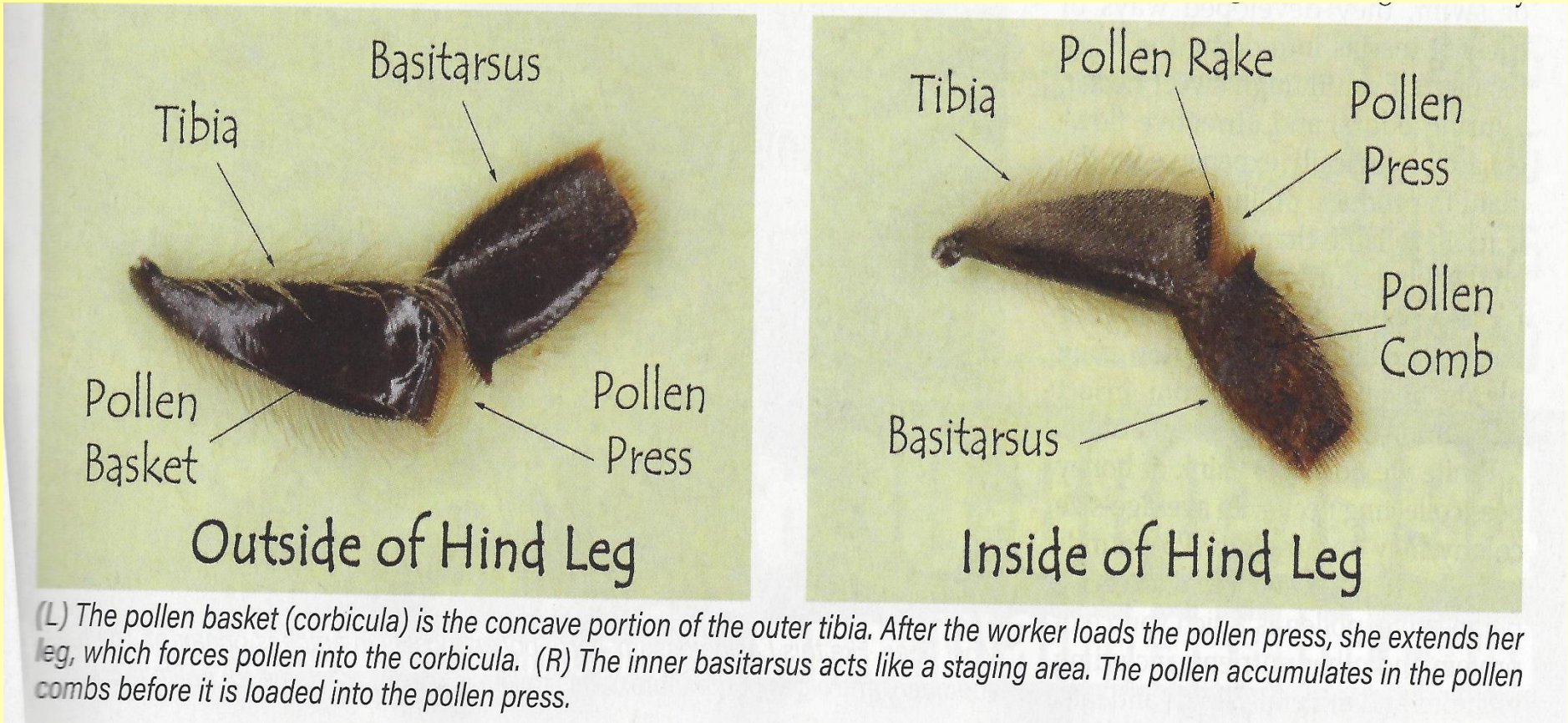
- Worker forelegs are covered in hairs which help clean dust and pollen from head.

- Worker middle legs are used to clean thoracic hairs and for transport



More Facts About Worker Bees….

- **The worker bee has pollen baskets on her rear legs to gather and collect pollen while she is foraging for nectar outside the hive. Her legs have combs to remove pollen from her body hairs.**



(L) The pollen basket (corbicula) is the concave portion of the outer tibia. After the worker loads the pollen press, she extends her leg, which forces pollen into the corbicula. (R) The inner basitarsus acts like a staging area. The pollen accumulates in the pollen combs before it is loaded into the pollen press.

Some Facts About Worker Bees….

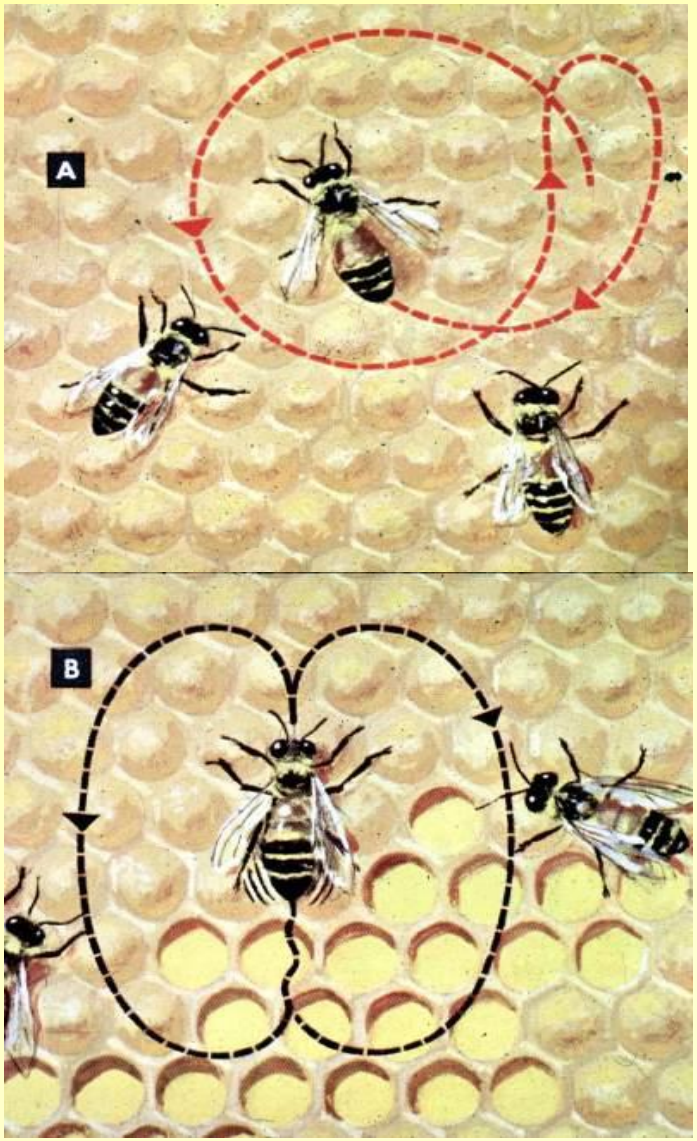
- **Workers have a separate honey stomach used carry nectar and water.**
- **The forager will focus on one type of flower when collecting nectar.**
- **They have enzymes they add to the nectar that starts the process of converting the nectar to honey.**
- **They pass the nectar to bees waiting at the entrance.**
- **Nectar may be passed from bee to bee several times until enough enzymes have been added, before being stored in a cell.**
- **They collect resources based on the speed the entrance bees accept supplies.**
- **For example, if a bee is carrying water and it is not needed at that time, the water bees will line up like storage tankers until the water is needed.**

From Nectar to Honey

- Nectar is 80% water, whereas honey is only 19% water
- To make 1 pound of honey, a colony of bees collects nectar from over 1 million flowers

Communication

- Communication basics
- A bee discovers a food source….
- she returns home to tell her sisters
- where it is, how far, & how good !



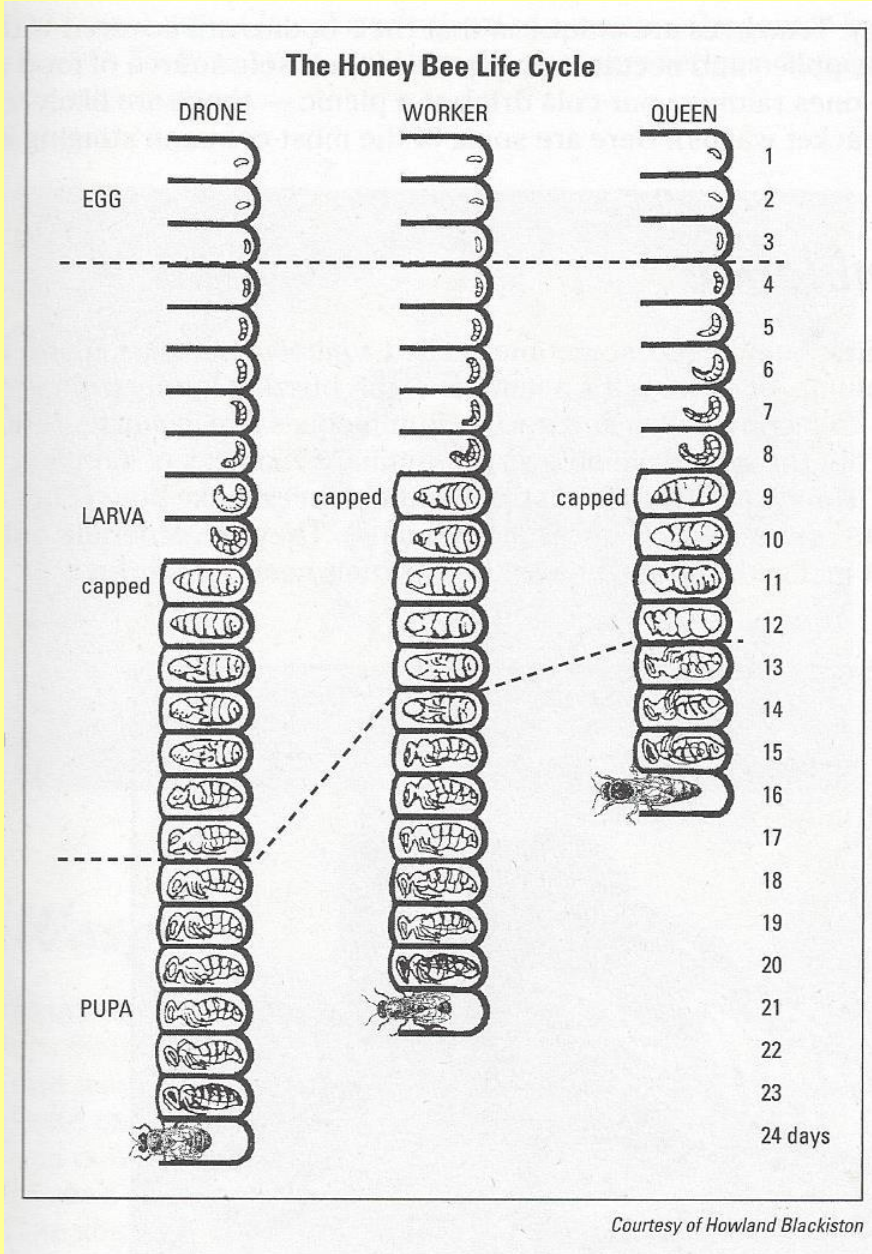
The Drone Bee

- Drones are the males in the colony.
- Note the general shape of the drone. Notice two things:
  - 1) the head is large and the eyes predominate the head and
  - 2) the rear-end of the drone is rounded --they have no stinger and can not sting.
- Drones do not work, they don't feed others, they don't produce or collect anything. Worker bees care for them.
- Although they are usually considered worthless, they contribute to the continuation of one generation to the next generation.
- Drones will drift into other hives and are normally welcomed.

Some Facts About Drones….

- He develops from an unfertilized egg. Meaning he is passing on genetic material from his mother only.
- He provides ½ of the genetic material in worker bees.
- His life span depends on the health of the colony. During poor honey flows and honey shortages, drones may be driven from the hive. This happens at the onset of winter as well.
- Drones can be created by laying worker honey bees.
- Drones do not mate with queens from their own hive
- Drones do not survive mating.

Beekeeping for Dummies Chart



Courtesy of Howland Blackiston

Worker vs. Queen

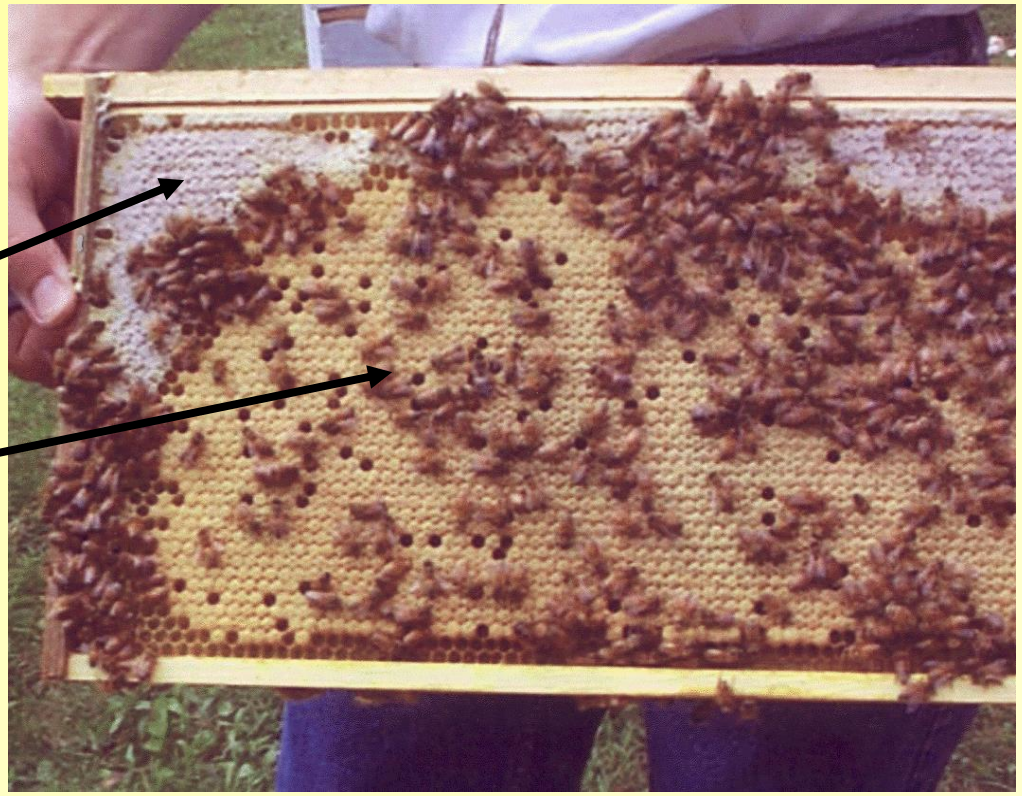
All fertilized eggs have the potential to become Queens

Eggs and Larva

Some Facts About….

What you will observe within a hive of bees

This frame from the brood chamber is close to ideal.



Honey is stored at the top of the frame

Capped brood fills much of the rest of the frame.

The cells that look open may have stored pollen/beebread

Worker cells vs. Drone cells

Workers

Drones

When is a new queen made?

Swarming – Normal colony reproduction.

Swarming should be avoided.

Supersedure – Replace an old or failing Queen

Emergency – When something happens to the Queen???

Queen Cells

Supercedure cells are queen cells found along the center of a given frame. Because they select existing eggs or new larva still being fed royal jelly.

Swarm cells are found clinging to the bottom of the brood frame and are used to rear a new queen for the colony.

Queen Cells

Supersedure

Swarm

In all cases the selected fertilized future queen larvae are

- **Housed in larger cells**
- **Fed large amounts of royal jelly throughout larval and adult life.**

The honey bee is a highly socialized or eusocial insect

Features (by definition):

1. **Overlap of Generations**
2. **Division of labor**
3. **Cooperative rearing of young**
4. **Caste system – not all individuals reproduce**

A Honey Bee Colony

- **Honey bees live in a colony of many individuals whose joint effort is required for survival.**
- **They may number 20,000-60,000 in a colony.**
- **The population of a colony depends on a number of factors such as:**
  - **The egg laying ability of the queen**
  - **The space available in the hive**
  - **The incoming food supply.**

BEE RULES
(FROM THE BEES VIEWPOINT)

- Need a dry cavity with enough space
- Need flowers
- Need water
- Need to control pests

Any Questions ???