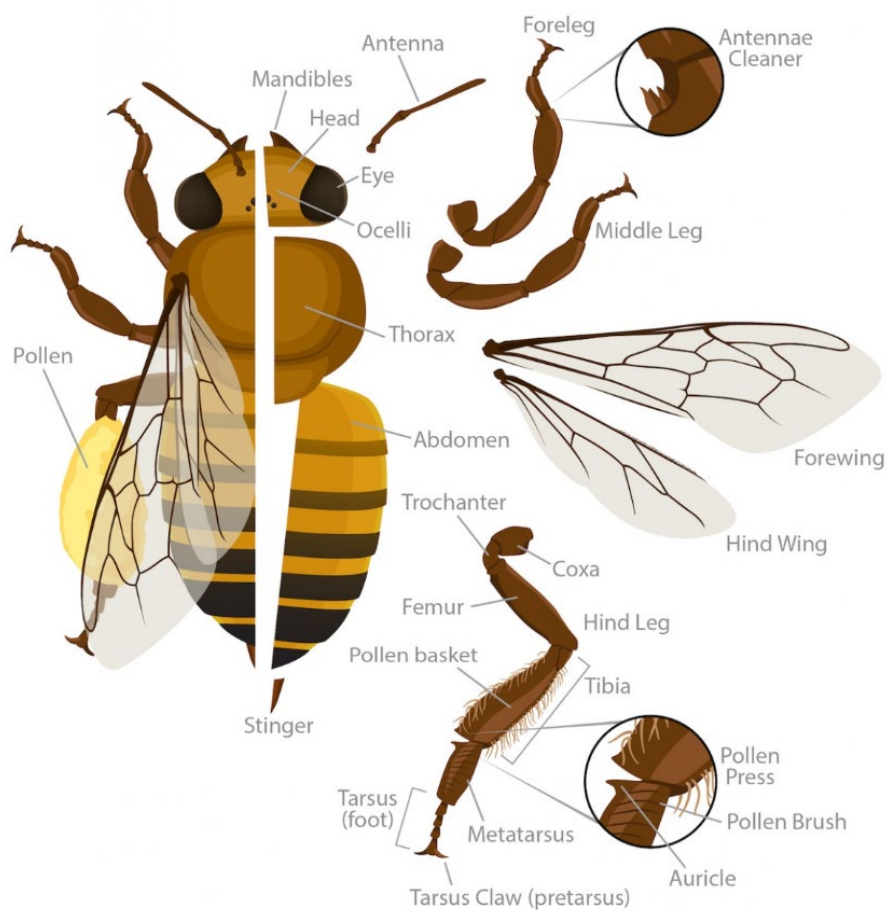


## To bee or not to bee: the biology of bees and the biochemistry of honey

# Bee anatomy

### The external anatomy of the honeybee

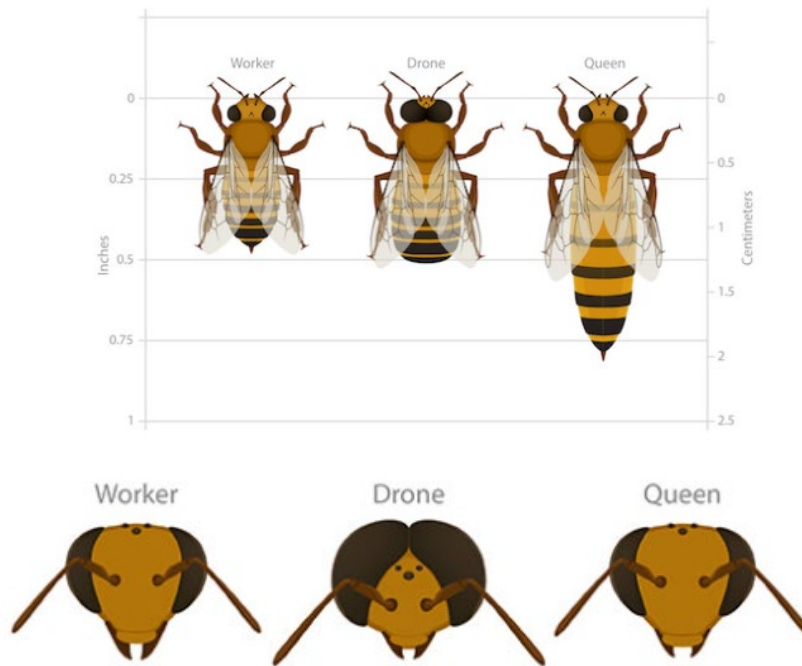


Key external features of a honeybee (a worker bee in this case)

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### Honeybee casts

Honeybees are eusocial insects that live in large colonies, consisting of different types (or castes) of bees with different roles: the queen, worker, and drone bees. Each of these castes perform different roles in the colony and have different physical features.



Different castes of honeybees can be distinguished based on their appearance.

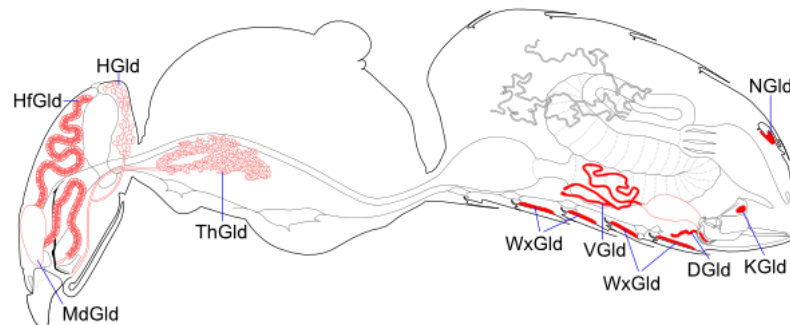
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Queen	Worker	Drone
<p>Each colony has a single queen. The queen bee of a colony is a fertilized female, whose primary function is to lay eggs. The queen bee is the largest bee in the colony; it lives for 2–5 years and is the mother of (almost) all bees in the colony. New queen bees are raised in special cells, and upon hatching will kill any other nearby new queens. Queen bees do have a stinger, but it is not barbed, so, unlike worker bees, queen bees can sting repeatedly.</p>	<p>Workers bees are all female and develop from fertilized eggs. They have lifespans ranging from 1–2 months (busy summer time) to 6–8 months (winter). Workers make up the majority of the colony, and, as their name suggests, do all the work, including maintaining the hive temperature, taking care of the developing brood, guarding the entrance, and foraging for pollen and nectar to make honey. They have barbed venomous stingers to defend the hive.</p>	<p>Drones are male bees that develop from unfertilized eggs. This means that they are haploid; they have only one set of chromosomes instead of the usual two copies of each. Drones are easily distinguished by their huge eyes. They have round abdomens and no stingers, and they live for just a few weeks to a few months. Drones contribute little to the hive and are fed by the worker bees. Their main function is to fertilize a new queen, ideally from a different colony, and they die after mating.</p>

## Honeybee glands

Honeybees have several interesting types of glands to enable them to fulfil various specialized functions.<sup>[1,2]</sup>

### Glands



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The glands of a honeybee

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### *Mandibular glands (MdGld)*

This gland produces different substances in different types of bees:

**Nurse bees** (young workers): lipid-rich secretions that make up a substantial part of royal jelly.

**Forager bees** (older workers): part of the alarm pheromone.

**Queen:** the queen substance, which contains pheromones that help maintain the structure of the colony, e.g. by modifying the behaviour of worker bees and preventing the raising of new queens. It also attracts drones during the mating flight.

**Drones:** produces a substance that helps coordinate the formation of drone gatherings.

### *Hypopharyngeal glands (HfGld)*

This gland also has different functions in different bees:

**Nurse bees** (young workers): protein-rich secretions that contribute to royal jelly.

**Forager bees** (older workers): the enzyme invertase, which catalyzes the breakdown of sucrose in nectar into fructose and glucose to make honey.

### *Head salivary glands (HGld) and thoracic salivary glands (ThGld)*

Produce salivary secretions to lubricate mouthparts and soften beeswax for working.

### *Wax glands (WxGld)*

Produce beeswax, which is used to build honeycomb, which makes up the structure of the hive and contains cells for rearing brood and food storage.

### ***Venom gland (VGld)***

This produces venom for the stinger. Bee venom (apitoxin) has many components, including a large proportion of the pain-causing peptide toxin melittin.

### ***Dufour's gland (DGld)***

Only present in females. Secretes chemicals with a variety of purposes, including family recognition.

### ***Koschevnikov gland (KGld)***

Releases an alarm pheromone, which attracts other bees to sting an animal considered a threat. Alarm pheromone is made up of a mixture of many components, including isopentyl acetate, which is also used in the food industry to give artificial banana or pear flavour.

### ***Nasanov gland (NGld)***

Produces a mixture of chemicals that acts as a pheromone and forms part of bee communication, for example, guiding foragers back to the hive entrance.

## **References**

[1] A website with more information about honeybees:

<http://honeybee.drawing.org/book/glands>

[2] Anatomy of the honey bee: <https://carrsconsulting.com/honeybee/normal/anatomybee.htm>

## **Resources**

For more fun facts about the fascinating world of honeybees, check out the [bee bonanza pages](#) from Arizona State University.