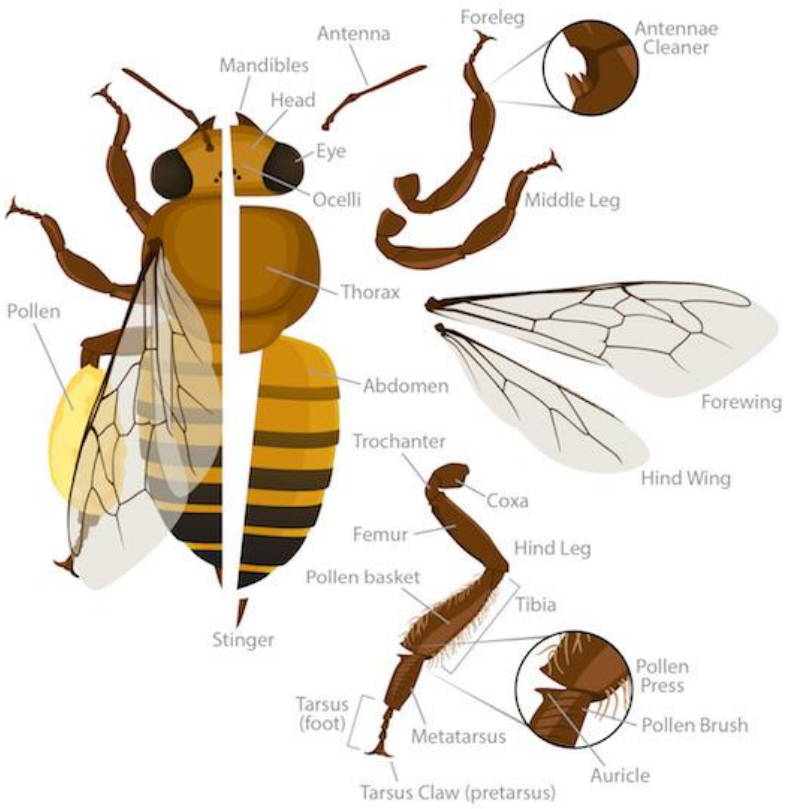
The Anatomy of Bees by Sofia Theoharidou



Looking at the Outside of a Honey Bee

Head	Location of the eyes, brain, where the antennae attach.
Mandibles	Strong outer mouthparts that help protect the proboscis.
Proboscis	(Not shown) Tube-like mouth part used to suck up fluids.
Ocelli	One of two types of insect eyes used to detect motion.
Eye (Compound)	The second type of eyes made of many light detectors called ommatidia.
Antenna	Movable segmented feelers that detect airborne scents and currents.
Thorax	Midsection where the (6) legs and wings attach.
Abdomen	Hind part of the bee and where the stinger is located.
Stinger	Or sting, is a sharp organ at the end of the bee's abdomen used to inject venom.
Forewings	Wings closest to the head.
Hind Wings	Wings farthest from the head.
Forelegs	Legs closest to the head.
Antennae Cleaners	Notches filled with stiff hairs that help bees clean their antennae. There is one on each foreleg.
Middle Legs	Leg located between the foreleg and hind leg.
Hind Legs	Legs farthest from the head. In workers, these legs have a unique set of tools used to collect and carry pollen called the press, brush, and auricle.
Coxa	First segment of an insect leg.
Trochanter	Second segment of an insect leg.
Femur	Third segment of an insect leg.
Metatarsus	Fifth segment of an insect leg; the metatarsus of the hind leg holds special pollen collecting tools.
Tarsus	The last segment of the leg and what touches the walking surface.
Tarsus Claw	Claw found on the last segment of the leg.

The anatomy of the bee has a stunning efficiency. *With honey bee anatomy, every element has a clear, well-defined purpose, to the point of being fine-tuned to reflect the differences in roles between the worker, drone and queen bees.*

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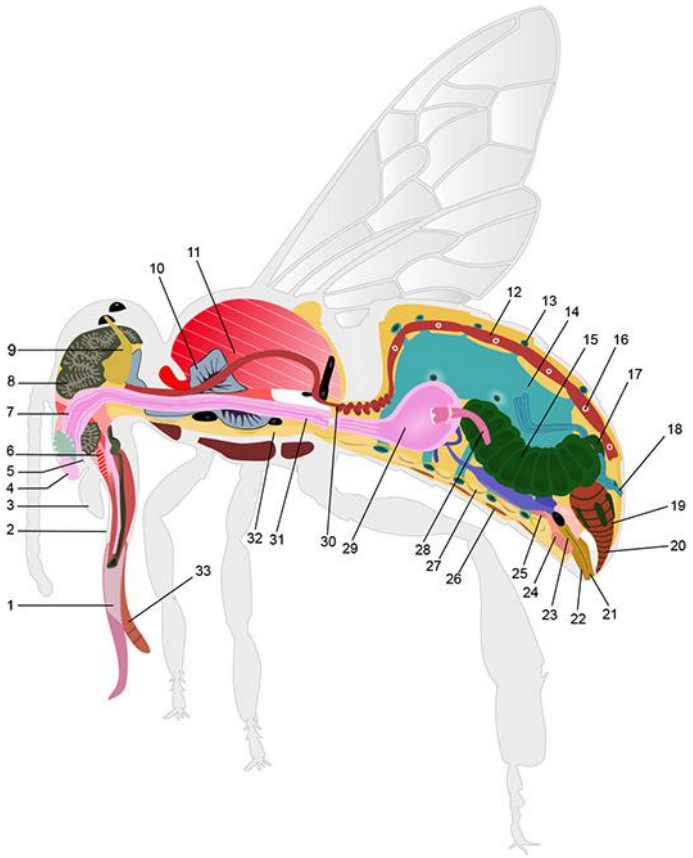

Looking Inside a Honey Bee

1	Proboscis	Straw-like mouthparts of a bee used to drink fluids.
2	Maxillae	The outer sheath of the proboscis which surrounds the labium.
3	Mandible	A pair of jaws used to chew pollen and work wax for comb building. They also help with anything that the bee needs to manipulate.
4	Labrum	A movable flap on the head that covers the opening of the food canal and proboscis
5	Food Canal	Like our mouths, this is the opening by which the bee will take in food. Bees' food is almost always liquid in the form of nectar or honey.
6	Pharynx	Muscles used to move the labium and suck up nectar from flowers.
7	Esophagus	The hollow tube through which ingested fluids pass to the honey stomach and later the midgut.
8	Hypopharyngeal gland	Gland that produces some of the compounds necessary for making royal jelly, used to feed the larvae.
9	Brain	Honey bees have excellent learning and memory processing abilities. Their brain processes information used in navigation and communication as well as memory. The brain also controls many of the basic bee body functions.
10	Salivary Gland	The salivary glands have a number of functions. Like the hypopharyngeal gland, the salivary glands produce some compounds necessary for producing royal jelly. The salivary glands produce liquid used to dissolve sugar, and also produce compounds used to clean the body and contribute to the colony's chemical identity.
11	Flight Muscles	The thorax muscles, which power the bee's wings for flying and movement. These muscles work very hard and can help
12	Heart	Unlike in mammals, honey bees and insects have an open circulatory system, meaning their blood is not contained
13	Opening of Spiracle	The respiratory system in insects is a series of hollow tubes connected to air sacs in the body. The openings of these
14	Air sac	Air filled sacs used as reservoirs of air in the insect body.
15	Midgut	Contains the proventriculus, ventriculus, and small intestine. This is where most of the digestion and nutrient absorption
16	Heart Openings	Openings in the heart tube which take in and pump out hemolymph.
17	Ileum	A short tube connecting the midgut to the hindgut. The Ileum also often houses microbes, which aid in digestion.
18	Malpighian Tubules	A set of small tubes that are used to absorb water, waste, and salts and other solutes from body fluid, and remove them from the body.
19	Rectum	The rectum acts like our large intestine and is the bees primary location of water absorption for the gut after digestion and nutrient absorption.
20	Anus	The exit of the digestive system, used to excrete food waste (poop) while in flight.
21	Stinger	Also called "sting" is used to puncture the skin and pump venom into the wound. In worker bees the stinger has a barbed end. Once pushed into the skin the stinger remains in the victim. The venom sac will remain with the stinger. If left in the body the stinger will continue to pump venom from the venom sac into the victim. Queen bees have a longer and un-barbed stinger. Drones (males) do not have a stinger.
22	Stinger Sheath	The hardened tube, from which the stinger can slide in and out.
23	Sting Canal	The sting is hollow, allowing venom to pass through the stinger. This is also the canal via which an egg is passed, when the queen lays an egg.
24	Venom Sack	Holds the venom produced by the venom gland, and can then contract to pump venom through the stinger.
25	Venom Gland	The gland which produces the venom that damages tissue if injected into the body.
26	Wax Glands	Worker bees start to secrete wax about 12 days after emerging. About six days later the gland degenerates and that bee will no longer produce wax. The queen is continually laying eggs to maintain colony size and to produce more new workers that produce wax.
27	Ventral Nerve Cord	Like the nerve cord in our spine, which holds bundles of nerve fibers that sends signals from our brain to the rest of
28	Proventriculus	A constricted portion of the honey bee foregut or honey stomach, which can control the flow of nectar and solids.
29	Honey Stomach (Foregut/Crop)	A storage sac, used in honey bees to carry nectar. The honey stomach is hardened to prevent fluids from entering the
30	Aorta	Blood vessel located in the back of a bee that carries blood from the heart to the organs.
31	Esophagus	Part of the bee digestive system that begins below the mouth and connects to the honey stomach.
32	Ventral Nerve Cord	Same as 27. This is a large bundle of nerves from the brain that sends signals to the rest of the bee's body.
33	Labium	In bees a tongue-like appendage used to help drink up nectar. Like our tongue bees can taste with this organ. The

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The anatomy of the bee has a stunning efficiency. With honey bee anatomy, every element has a clear, well-defined purpose, to the point of being fine-tuned to reflect the differences in roles between the worker, drone and queen bees.

The **body** of the honey bee is divided into 3 sections – the head, the thorax and the abdomen. Each section serves its own purpose and supports the functions of the attached body parts.

- **The head** features eyes, antennae, mandibles and a very functional, yet tiny, brain
- **The thorax** is the base for the legs and the wings
- **The abdomen** contains the stinger, wax glands and reproductive organs

Together these form the honeybee's **exoskeleton** – an "external skeleton". This is largely covered in a layer of hair to aid the bee in gathering pollen and regulating body temperature.

The **antennae** on the head of the honey bee form a sensory power house, providing a function for a bee's sense of **touch, smell, taste** and even a unique form of **hearing**. Curiously, males have 13 segments making up each antenna, while females have 12. In both cases, there is an elbow-like "joint" along the antenna.

Honey bees possess **two sets of eyes** – compound and simple.

The large eyes you observe when looking at a honey bee are **compound eyes**. Each compound eye is comprised of **many eye units**. These units take in a separate image and transfer the information to the brain where it is pieced together into a **single image**. This process also helps with the honey bee's ability to see the world in polarized light.

Polarized vision is like looking through a pair of sunglasses. This type of vision allows bees to **navigate** and process information faster and **protects their eyes** from the harshness of daylight. Viewing the world through polarization gives bees a form of tunnel vision that guides them to their food source and back to the hive.

The three **simple eyes** of the honeybee have a **single lens**, which collects **UV light**. The UV light allows the bee to see the **location of pollen** as a dark spot, so they know where to land.

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The **proboscis** is another name for the **tongue** of a bee. It is like the human tongue, in that it is soft and can be extended. Relative to the size of the average honey bee, the proboscis is long, a result of evolution helping the bee to **reach the center of a flower** to collect nectar. The proboscis is also used to clean their hairs or to **groom** one another, especially the queen.

Mandibles are the honey bee's incredibly **strong jaws** that **protect** the rest of the mouthparts. The mouthparts consist of a tongue and other complicated organs that collect nectar from flowers.

The mandibles of the worker bee differ from the queen and her drones. The queen and drones have pointed mandibles to aid in cutting and biting, but worker bee's mandibles are smoothed to aid in the production of wax**.**

Of course, hidden from view is the **brain.** Given its size, the bee brain has an extraordinary capacity to **process rich information** and make decisions**.**

The thorax is the **midsection** of the honeybee and is primarily focused on **locomotion**. The thorax features **six legs and two pairs of wings**. The muscles in the thorax allow the bee to control the movement of the wings during flight. The rapid contractions of the muscles produce the quicksilver movement of the wings.

The **wings** of a honey bee can carry the insect through the air at 15 miles per hour**.** These wings are arranged in **two pairs,** connected by a row of **hooks** on the back wing.

The honey bee has **three pairs of legs** which split into **six segments**, making them very flexible. The front legs are specially designed to clean the antennae, while the rear legs have a section devoted to pollen accumulation called a pollen basket.

Of all components of the anatomy of a bee, the **sting or stinger)** is the one that the layman considers first! The stinger is the honey bee's only true line of **defense**. **Honey bees will sting only as a last resort when threatened because once they have used their stinger they typically die**.

In conclusion, the anatomy of the bee is beautiful and incredibly efficient. The next time you see a honey bee, consider how that tiny body packs so much into such a small space.