

How to Draw a Bee activity.

by Jay Hosler



Draw a bee with your audience (be sure they have paper and pencil!) and discuss what the different bits and pieces do as you draw them.

HEAD: draw a triangle with tip pointed down. *The brain* takes up the majority of the head capsule. Although a honeybee brain only contains 960,000 neurons (a human brain has 86 billion), they can do sophisticated feats of learning and navigation to find and remember nectar sources.

Antenna: Draw two bent sticks projecting from the center of the head. *Antennal sensilla* are sensory structures that detect smells: A worker has 3,000 chemoreceptors, a queen has 1,600, and drones males have 300,000. Overall, a worker's acuity is the same as human, but they are 10-100 times more sensitive to smells like honey, wax, nectar.

Other senses: Taste (tongue), carbon dioxide, humidity, touch (finger), speedometer (Johnston's organ), sound/vibration

Eyes: draw long ovals on either side of the head.

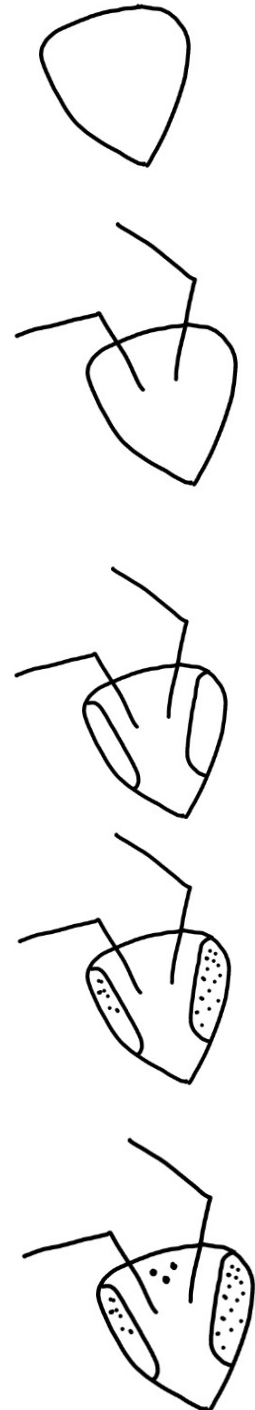
Each eye has 6900 hexagonal ommatidia. Ommatidia are long thin rod like structures. The outward facing part of the ommatidia is the lens. Below the lens are a handful of long cells that can detect light. Draw them as dots in the eyes.,

There are tiny hairs between the ommatidia facets. The hairs can detect air flow across the air, which can be important for navigation. These are very small. I usually mention them but don't draw them

Regions of the eyes can detect UV light, visible light (OYGBIVUV, not red), and polarized light. The eyes form a mosaic image mosaic image,

Ocelli: draw three dots in an upside down triangle at the top of the head.

There are three ocelli in a triangle at the top of the head. Ocelli lenses are not used to make an image. They are used for light intensity detection.



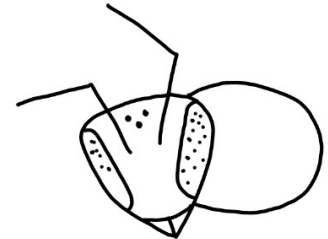
Mandibles: Bees have chewing and lapping mouthparts. They are not used for biting. Mandibles used to ingest pollen; cut, mold and manipulate wax; feed brood and queen; drag debris and dead bees out of hive; grooming; fighting.

Proboscis: (not pictured) The proboscis is like a straw to suck up nectar. It is also used to feed others (tropholaxis) as well as to lap up queen pheromone and distribute it in the hive.



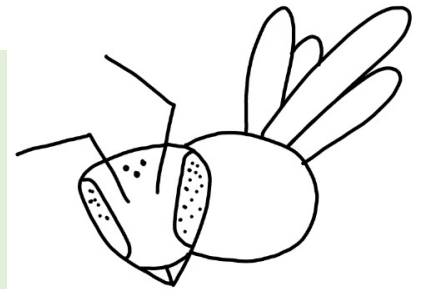
THORAX: The thorax is the middle body region of a honey bee. Draw a circle behind head that is the same height as the head. The thorax contains huge muscles that beat the wings as well as muscles to move the legs.

Chitin exoskeleton: The entire bee body is surrounded by a rigid polymer called chitin. The joints are thin spots in the exoskeleton that allow movement and flexibility.

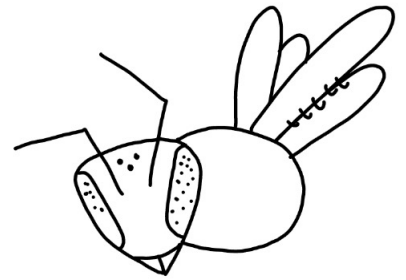


Wings: There are four wings sticking off the back of the bee's thorax. Draw four long, thin upside down "U-shapes" on the back of the bee. The wings are made of chitin and are extensions of the exoskeleton.

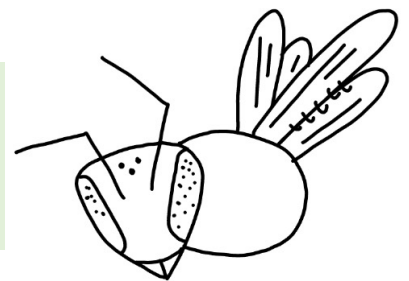
Avg flight speed is 24 km/hr



Hamuli: When the bee flies, it connects the back wing to the front wing using structures called hamuli. Hamuli are little hooks on the wings that allow them to lock together for better aerodynamics. When the bee isn't flying, it unlocks the wings and folds the back, allowing it to get into small spaces.



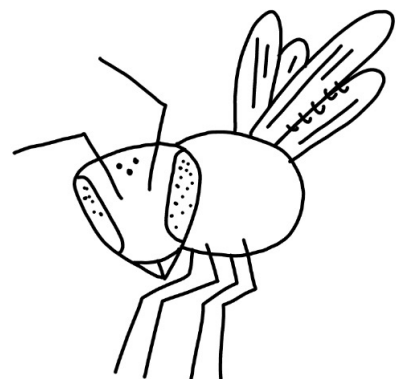
Wing veins: The veins in the wings provide structural strength and support for the wings ensuring they aren't floppy. The veins also carry blood, breathing tubes, and nerves to keep the living tissue healthy.



Legs: Like all insects, honey bees have six legs attached to the bottom of the thorax. For the front four legs, draw four lines bending forward.

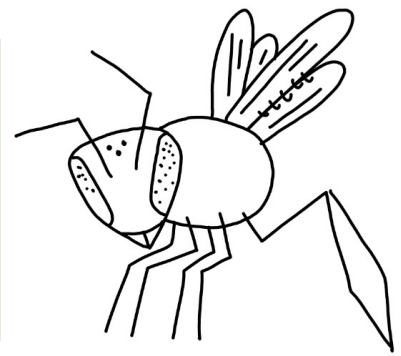
The honey bee's *forelegs* contain hairy brushes, an antennal cleaning notch, and various combs.

The honey bee's *midlegs* can clean thorax hairs and move pollen. They are so flexible there is no grooming blind spot.

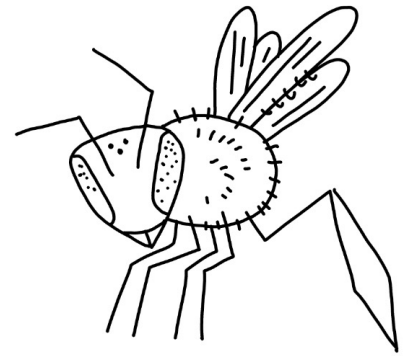


Pollen basket and back legs: The back two legs are much different than the front four. Draw a large “swollen” back leg bending back. The swollen portion of the back legs is called the pollen basket.

When the front legs brush the pollen off the thorax, they pack it into large clumps that stick to the hairs of the pollen baskets.

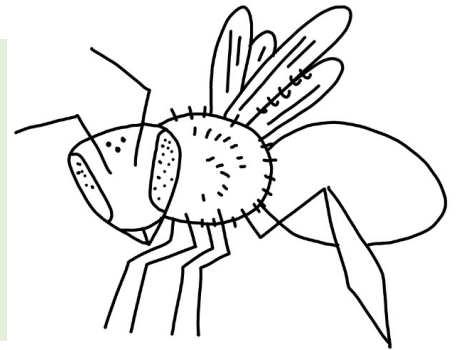


Thorax hairs: The thorax is covered in hairs giving the thorax a fuzzy look. When a bee is flying to a flower, the air friction pulls electrons off some of the electrons in the molecules of the hairs. This gives the thorax a slightly positive charge. Flowers and their pollen are actually negatively charged, so when the bee lands on the flower the negative pollen is attracted to the positive thorax, leaping onto the bee.

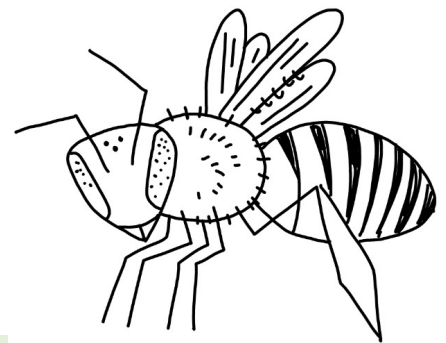


ABDOMEN: Draw a long oval off the back of the thorax. This should be slightly longer than the length of the head and thorax combined.

I don't draw the various internal organs, but there's a stomach for food, a honey stomach to store the nectar they collect, big air sacs for respiration, Malpighian tubules for dealing with waste, various glands, and weaponry.



Plates: The abdomen is composed of seven visible dorsal and ventral plate pairs. The exoskeleton is very thin between plates making them very flexible. The abdomen can readily expand to allow bee to carry more nectar. It can also swivel to sting.

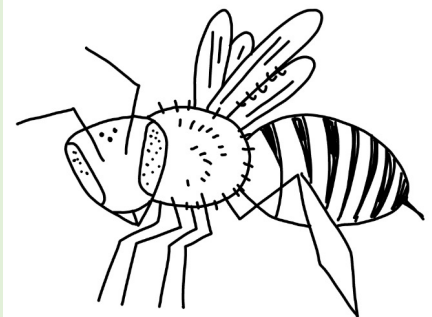


Stinger: draw a little needle sticking out of the back of the abdomen

The sting is a modified ovipositor (egg layer).

It is formed by paired, barbed lancets that saw into what the bee is stinging.

When stuck in rubbery human skin, stinger pulls out venom sac. Muscles around the sac continue to pump venom into the wound for 30-60 seconds.

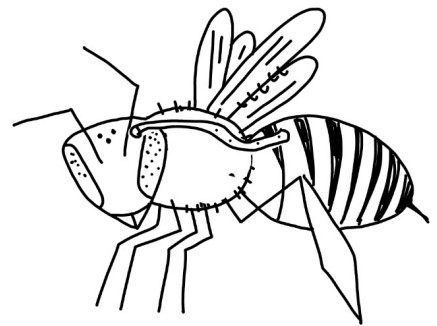
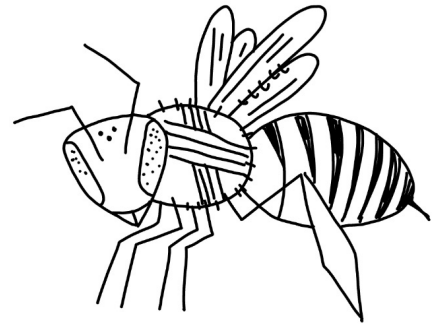


EXTRA STUFF: If there is time I often go back to the thorax and talk about the internal structures like flight muscles and the tube heart. It may require you to erase some stuff from your original drawing!

INSIDE THE THORAX

Giant flight muscles: I usually draw these in lightly, and eventually erase from the white board.

One set runs from the top of the thorax to the underside, the other set runs from front to back, essentially at right angles to each other. Flight muscles compress and stretch the thorax to raise and lower wings. These muscles can be contracted isometrically (at the same time) to shiver and generate heat needed to fly. They can generate enough heat to maintain temp above ambient.



Tube heart: The bee's heart is an open ended tube full of holes that starts in the abdomen, runs across the top of the thorax and empties in the head. It pushes blood (hemolymph) from back to front.

The nerve chord runs along the bottom of the thorax. Passing between the leg pairs.

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