

"Oh, grandmother... what big eyes you have," she said.

'The better to see you with, my dear.'"

— *"Little Red Riding Hood", Wilhelm and Jacob Grimm*

Have you noticed that drones, like Rodney Dangerfield, "don't get no respect"? It seems nobody cares to get to know them. But drones, and their place within the colony super-organism, are actually pretty important. Not only that, but in my opinion, they are both the Super Bees and the Bees of Mystery of the colony. For example:

- Because drones come from unfertilized eggs, they only have a single set of chromosomes. This also means that they have a mother but not a father.
- They can drift far from home and are accepted and fed by random colonies.
- Drones have extremely large eyes which cover most of their head, and no surprise, extremely good eyesight for finding and tracking virgins in flight.
- Drones have ten times the number of antennal plate organs that workers do (30,000 per antenna versus 3,000). These are the organs responsible for smell, which, along with sight, is critical for finding and tracking virgins in flight.
- Drones are extremely large and strong, much more so than queens or workers. The reason for this is that to perform sex, drones grasp queens while in flight and fly carrying their full weight. Neither queens nor workers are strong enough to support that much weight while flying, but drones are literally made for it.
- During the spring, a mature colony strives for about ten percent of its brood to be drone brood. If drone-sized comb or foundation isn't provided, they'll squeeze drone cells into whatever space is available.

Despite the fact that drones ought to have a superhero comic book devoted to them, it



Super large eyes and terrific vision! Unbelievably sharp sense of smell! Arnold Schwarzenegger-like physique! Gentle! Amiable personality! Great with kids! Why doesn't this guy get any respect?

Photo: [Wikipedia](#)

seems that a large percentage of beekeepers are blissfully uninformed of even the most basic facts of drone biology. Let's untangle a few of the misguided, incomplete or flat-out wrong bits of information that I've heard with regard to drones.

Incomplete/misleading fact: "Drones live until they are driven out in fall"

It is true that in many (but not all) colonies, drones are thrown out by the workers in the fall. This is to conserve resources: drones aren't needed except during times when virgin queens are being produced in the neighborhood. They have no function in the winter months. Rather than keeping them around for no reason other than to consume resources, they are expelled.

That is the common fate of drones that are alive in October. But the typical cause of death for drones is the same as it is for workers: their wings wear out after many miles of flight. Bee wings are like tires on a car – they only have so many miles in them. But unlike car tires, wings can't be replaced when they wear out. After a couple of weeks of heavy flying activity, bee wings are "shot" and the bee is left stranded on the side of the proverbial road.

Therefore, the life expectancy of a drone is similar to the life expectancy of a worker

(something like four to six weeks in warm months), for the exact same reason.

Wrong: "Drones have sex all day with lots of virgin queens"

It is easy to imagine that a drone would like nothing better than to have countless sexual partners and essentially get paid to do so. The fact of the matter is that honey bee drones are monogynous; they are eternally faithful to a single virgin queen. They "mate for life". Virgin queens, on the other hand, are polyandrous: they can and will mate with a couple of dozen or more love-struck drones, one right after the other (the actual sex act only takes a little over 2 seconds).

For our young readers, here is a thumbnail description of how a daddy bee and a mommy bee get married and make baby bees:

Preacher: "Mr. Drone, do you take Miss Virgin Queen to be your lawfully wedded wife?"

Mr. Drone: "I..." *POP!!!* (his genitalia violently evert from his body; he falls to the ground and soon dies)

Miss Virgin Queen: "Next!"

So despite any intentions a young drone may have of becoming an International Playboy, an untimely death prevents that from ever happening.

Not necessarily true: "The drones we see in a hive are from that hive"

One of the interesting things that separate drone from worker behavior is their propensity to drift from hive to hive. As a somewhat loose, general rule, workers are only accepted in their own colony: foreign workers are recognized as "not ours" and may be violently attacked at the hive entrance. (The exceptions are confused foragers, loaded with newly-collected nectar or pollen, who unbeknownst to them accidentally enter the wrong hive.)

Drones, on the other hand, are freely accepted in whatever hive they enter. Drones aggregate at Drone Congregation Areas and may leave there with non-related drones. Entering any convenient hive, they are fed by the workers and treated like a Home Boy, even

if they are not related to the other bees in that colony.

That doesn't mean that any particular drone in your hive isn't from that hive; it just means that maybe he is, maybe he isn't. Don't assume that he belongs there.

What is the reason for this behavior? Inbreeding (virgin queens mating with their brother drones) can be very detrimental to a colony's gene pool (more on that a little later). To combat this, honey bee behavior causes virgin queens to seek mates close to her home (she'll fly no more than 1-1/2 miles away), while drones drift far and wide and are therefore more likely to mate with unrelated virgins. Studies have shown that it can be common for drones to mate with virgins whose colonies are 7-1/2 miles or more from their own home, far too great a distance to be achieved in a single round-trip flight. Nature's choice of which of the two (drones or queens) stays close to home and which gets scattered to distant lands makes sense: drones are plentiful and expendable whereas virgin queens are unique and precious.

Wrong: "Virgin queens won't mate with their brother-drones; they recognize them by their hive-smell"

This notion is simply not true. If a virgin queen encounters a brother-drone at a Drone Congregation Area, he has the same chance of mating with her as any other drone. Nature's way of discouraging sister/brother matings is as described above: the natural mating ranges of drones and queens are different.

Wrong: "Queens can mate with drones in the hive"

Until fairly recent history, philosopher-scientists assumed that drones and virgin queens mate inside the hive; no one had ever seen them do otherwise. That makes perfect sense based on what we know about dog, cat, human and parakeet biology. However, it is just not true and appears to be biologically impossible for our *Apis mellifera* honey bees. François Huber demonstrated that fact in the late 1700s with incredibly simple experiments:

he confined virgin queens with lots of drones of all ages, never letting the queen leave the hive, and observed that those queens never, ever produced fertilized eggs. From what we know now about honey bee sex acrobatics, it is obvious that it is impossible for the act to occur anywhere except where it does: high above the ground in rapid flight.

Incomplete fact: “All fertilized eggs make females; all unfertilized eggs make males (drones)”

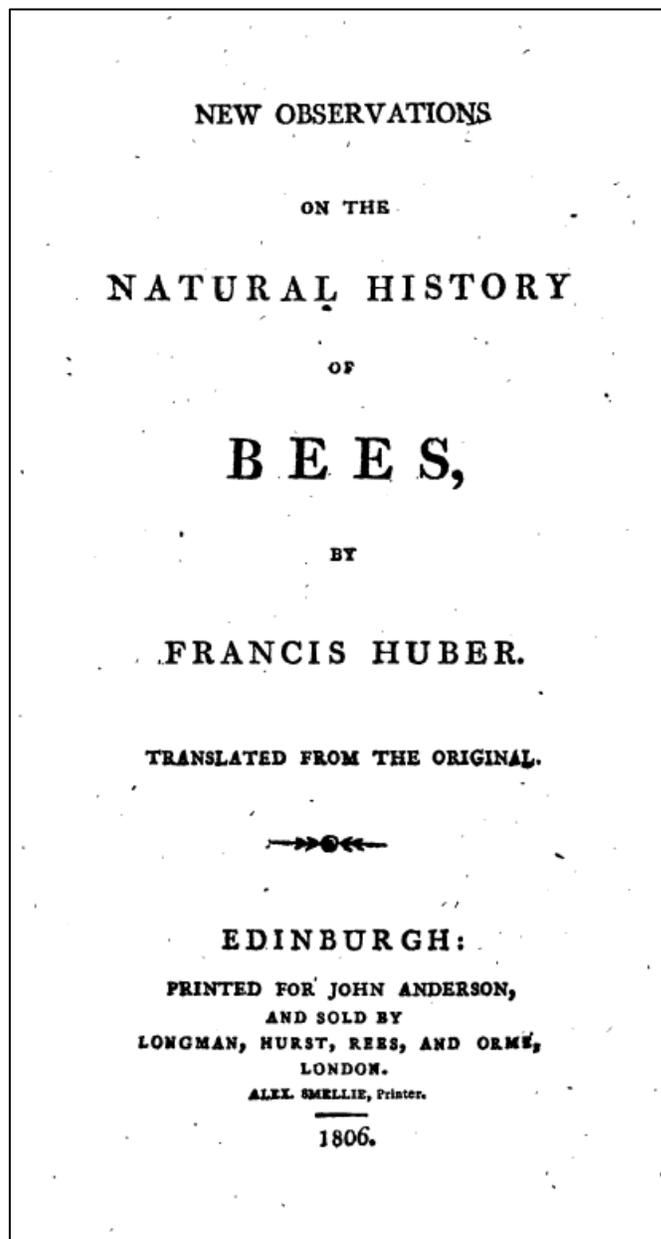
This is an interesting one, and it separates the casual beekeeper from the well-educated one. In our honey bees, we all know that drones come from unfertilized eggs. However, that doesn't mean that all fertilized eggs create females (workers or queens). Huh? There is a disconnect here.

The back story is that sex determination in honey bees (whether an egg develops as a male versus a female) depends on a single gene. There are perhaps 18 different variants (alleles) that an egg could have for that gene. If an egg has a single variant, as will always be the case for a haploid drone (which only has one set of chromosomes), the egg develops into a drone. If the egg has two different variants, the egg develops into a worker. This can only occur when the egg is diploid (has two sets of chromosomes).

The wrinkle is that it is possible for there to be the same version of the sex allele twice in a diploid egg. This occurs if the allele from the mother-queen's contribution matches the allele from the father-drone's contribution. When this happens, the egg will be for a diploid drone!

Why don't we see this in our hives? The answer is that worker bees know diploid drone eggs “aren't right” and they eat them.

The implication for this is that if a virgin queen were to only mate with her brothers, the possible variations in the sex allele would be very limited. This would result in many diploid



Through careful observation, Huber discovered the truth about honey bee mating behavior as well as many other aspects of bee biology. His conclusions formed the basis for further investigation and experimentation by people such as Langstroth.

drone eggs, which would be eaten by the workers. The visible evidence would be a large number of empty cells amongst the normal worker brood cells, a condition called “shotgun brood”.¹ The colony would not be able

¹ Note that a “shotgun brood” pattern is also caused by other, more likely, issues, such as extreme Varroa mite infestations.

to reach full strength, because even with a very productive queen, only a percentage of the eggs would mature into workers.

Now, if you really want to stray from “what everybody knows is true”, the Cape Honey Bee, *Apis mellifera capensis*, has a genetic variant whereby some unmated diploid workers can produce diploid female offspring, either workers or queens. But those aren't our bees!

Your turn

Now that you know the facts, it up to you to go out there and make a difference! Treat your drones with respect and they'll return the favor. For example, drones are the only honey bees that I ever let my children play with. They don't have stingers so they make fascinating playmates. That's one more reason they should be called superheroes!



Drones are gentle and incapable of stinging, making them great playmates for children of all ages.

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