

Voice *of* the Hive

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Welcome

This is a collection of stories regarding Honeybees and beekeeping.

In each one I present a bee's eye view of major events in the life of colony of honeybees. Life is one set of trials after another and honeybees are not exempt. Here you will find one man's view of his bees, one man's interpretations of the events that a colony goes through.

I hope to convey a sense of what it feels like to work the bees, how it feels to watch their struggles, triumphs and defeats. The first trial awaiting a colony is just being born, as we will see in "Birth of a Package," but first we need to take a slight detour to learn "The language of Bees," and then a brief stopover with "Rosetta's Guide to Beehives."

Each major chapter is the story of a colony from the view point of the bees, then the story of the colony from the view point of the beekeeper. The last third of most sections contains information on how this is done and what I look for and do in each situation.

Confessions of a (Still Learning) Beekeeper

This is not yet a guide to beekeeping. I don't have the knowledge or experience to write with authority on the subject. When I've been doing it for twenty years I'm not sure I'll be qualified. It's more like the reader's digest version of beekeeping. It might do in a pinch but you'll want a better manual as time goes on.

Jason Nelson, 'Voice Of The Hive'

*Compiled and presented here by Glenbo,
off articles from the website
<http://www.voiceofthehive.com>*

The Language of Bees

Bees have neither vocal chords nor lungs, so they do not speak in words which ears can hear. Their behavior is often mysterious, sometimes inexplicable, and occasionally bizarre. This does not mean that their actions are without meaning. The hive does speak for those who take the time to listen. Allow me, if you will, to serve as an interpreter where I may, to speak through these stories as the voice of the hive.

The Box in the Yard

In my backyard there is a wooden box. Fourteen inches wide, twenty inches deep and ten inches high. If you were to approach it you would hear a low hum like the sound of a distant fan. This box is home to thousands of stinging insects. It is a hive, and in it lives a colony of honeybees. I have been fascinated with bees for as long as I can recall. At the zoo I stood at the observation hives for as long as my family could stand to stay. There is elegance to the organization of the hive, an organized chaos that drives it. I could sense this but there was never enough time to learn the patterns.

Twenty years later, one September at the fall fair I saw the beekeeper's booth. The small cloth covered table contained a few stacked jars of honey and a couple of observation hives. Again I stood transfixed, desperately trying to find the queen as the sign suggested. That is when the woman at the table offered me a sheet of information on bees and beekeeping. I stuffed it in my bag and continued my search. We came back by the booth three more times that day. By the last time I could spot the queen on approach. My wife joked that I should ask to take those bees home. I asked about getting bees of my own.

I spent the next few months studying about bees. In January I began gathering equipment. The average hive in the united states is what is known as a Langstroth hive, and its dimensions utilize a concept called "bee space". Reverend Langstroth observed his bees to learn, and what he learned was that an empty space over a certain size would be filled with bur comb. A space smaller than one fourth of an inch would be glued together with propolis, but in between $\frac{1}{4}$ and $\frac{1}{2}$ lay Bee Space. Bee Space is a gap sized so that the bees will not glue it together or comb it over. The pieces of equipment in a hive align to maintain bee space across the top of the hive, between the frames, and across the bottom. The box in my yard is a Langstroth hive.

The Social Organism

A single bee is alive, that is true, but bees are not like you and I. Though a single bee can fly and move, gather and perform many tasks, no bee lives for itself. It is not quite a cell either. It is a member of a society that forms the larger organism, the colony. It is the colony of honeybees

which inhabits the box in the yard. Single bees do not make decisions. Single bees do not determine if the colony leaves or stays. No single bee raises another bee. The only bee capable of performing her function alone, the queen, is in fact the product of the collaboration of many bees together. Honeybees exist in colonies and it is the colony that lives or dies. The colony grows strong and the colony weakens. They will live together in the warm summer. If they starve in the winter, they do so as one. The story of each bee is really the story of all. Together they form the story of the colony, and it is the voice of the colony we choose to listen to.

One Box of Bees, Please.

If you purchase bees you must order them long before you receive them in most cases. A group of bees you purchase is called a package, and it consists of two to four pounds of worker bees and one queen. While the actual number of bees in a pound varies wildly, the point is that a package comes with a workforce and a queen – just the basics for establishing a new colony. If you strip away all the details, then to install a package of honeybees you dump them out of the box they are in and into the box where you want them. While it might be literally accurate that description ignores the experience. To truly appreciate it you have to consider what goes on in the mind of the colony during the _birth of a package_. First though we need to take a slight detour. The language of beekeeping will grace and litter the pages that follow without apology or explanation. It will all make a lot more sense if we take some time to study *_Rosetta's Guide to Beehives_*, where you can learn to translate the glyphs that follow.

Rosetta's Guide to Hives

The terminology of beekeeping is a combination of English and bad English, of phrases that make grammar Nazis grind their teeth and confound even experienced editors. Since we'll be talking a lot about bees and hives it helps to have some idea what we are speaking about. You could jump in and keep some bees and learn what all of this is. If so you don't need this book, you need to watch and learn from your own bees. If you do not have the pleasure of working a hive read on, for this section will serve as a guide to the building blocks of a hive, a roadmap for the images to come. If you prefer to look at pictures, jump to the bottom to analyze the "Anatomy of a Beehive"

It's a Box, Jim

The hive is a box. It's a box with some very particular dimensions but it's a box none the less. What does tend to vary is the depth of the box and how many of them are needed. When a colony first starts out it is tiny, so it usually has only one box. For a few thousand bees it's roomy, much like a family of six in a New York apartment. As they grow the beekeeper adds more of these boxes, some of them holding, well, bees, and some to hold honey. More on that later.

Comb Alone

Bees build honeycomb from wax they secrete. These combs are versatile, serving as both storage for honey and pollen and tiny cribs in which to raise baby bees. Combs are not designed to be moved and that creates a problem. To grasp the state of a colony the beekeeper needs to be able to look at the surface of the comb to understand what is or isn't in there. For this reason beekeepers invented movable wooden frames, a square piece of wood in which the bees are encouraged to draw their comb. This square can be lifted out and inspected keeping the comb intact. The average hive body has ten frames in it.

Is it a lid or a cover?

It's both. Some beehives use an inner cover, a thin slat of wood that provides a dead air space above the colony. The inner cover serves as a sort of artificial "top end" for the colony. On top of an inner cover fits a Telescoping outer cover. That's a fancy phrase for a cover that fits over both the inner cover and the top of the hive body. Another common type of top is the Migratory top. A migratory top dispenses with the inner cover entirely. It is in effect a flat piece of plywood cut to the size of the hive.

Crashing boards, landing boards and other boards

With a box and a lid, some frames to go inside, you need something for all of this to sit on. That's the bottom board, which is exactly what the name implies – a board that goes on the bottom. This board has sides which lift the hive body slightly off the bottom board. It is

this space which forms the entrance to the hive. If the bottom board extends outward past the entrance, that space forms the landing board. Think of the landing board as a sort of runway and dance party combination where bees can land and come in or take off.

Excluders and Includers

A queen excluder is a metal mesh spaced so that worker bees can fit through while the queen with her wider thorax cannot. Placed on top of a hive body it is an excluder, preventing the queen from going into the boxes above. Placed at the bottom of a hive it serves as an include, preventing the queen (and drones) from leaving the hive. Using an excluder as an Includer won't keep the bees from swarming, it will just delay them. If the drones aren't let out the colony can grow quite agitated.

Back to Boxes

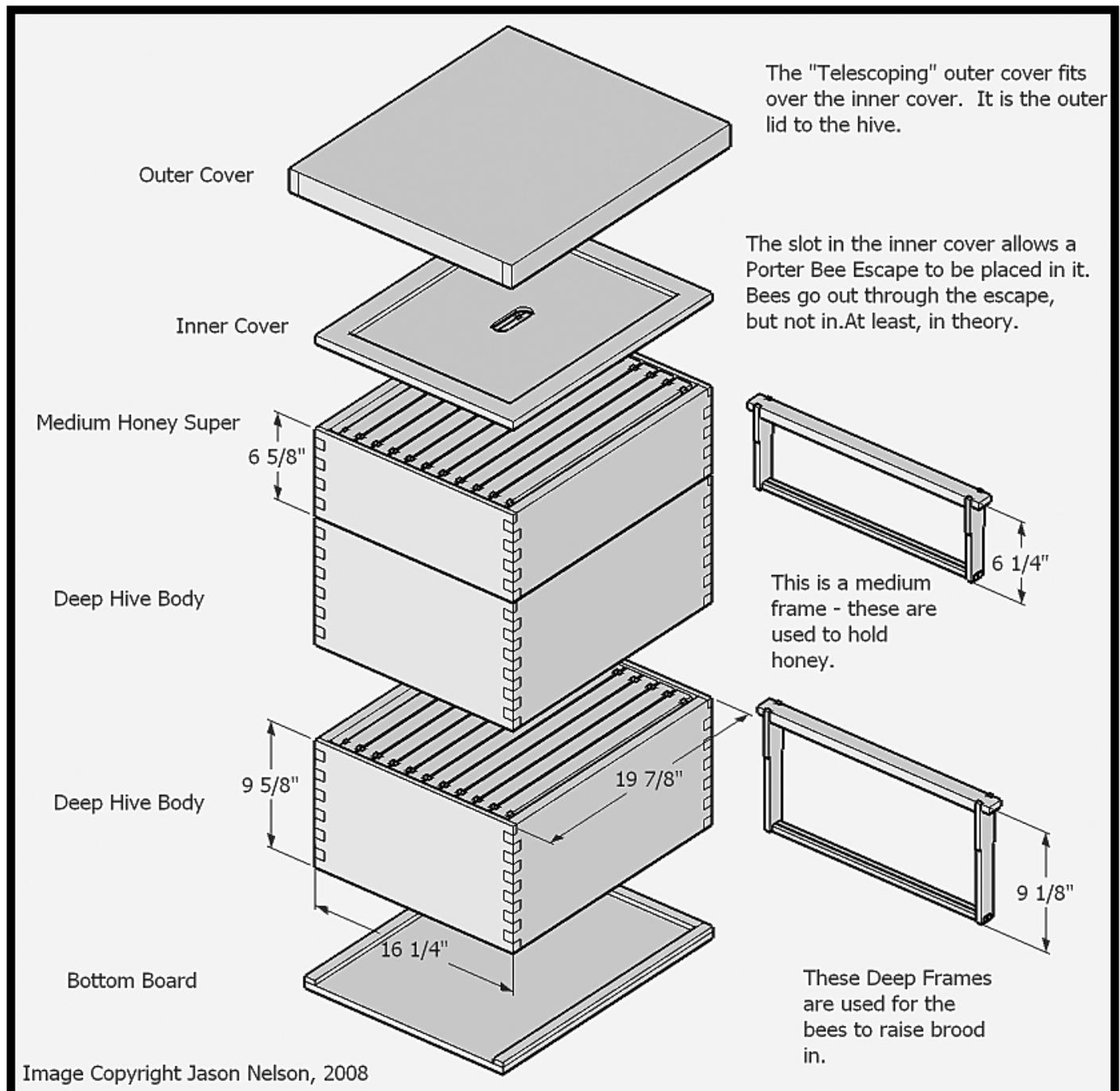
Not all boxes are created equal. Several "Standard" box sizes dominate the bee hive market, each with different purposes. Deeps, or Deep hive bodies are exactly what their name implies, deep. They're also heavy, weighing over 100lbs when full of honey. Two deeps stacked together make a respectable colony.

To deal with the weight of Deeps there are Mediums, which are just like deeps but not quite as high. Weighing in at 60lbs each these are better on the back. Three Mediums is usually accepted as equivalent to two Deeps.

Shallow or Honey Supers. Super in this case means a box put "super" or on top of another box. As the name implies, they are the shallowest of all boxes and weigh only about 35lbs full. No one uses shallows for hive bodies except in emergencies or when the queen decides to lay in them (a condition the queen excluder is meant to prevent).

Gadget and Gear

Beekeepers love gadgets. We have honey knives, heated honey knives, electrical honey knives, vibrating honey knives and several other flavors of long blades designed just to remove the cell caps for harvesting honey. We have extractors which spin the frames like an out of control carnival ride and hurl the honey out for harvest. We have feeders that sit on top of the hives and bottoms you can peak into. For every itch a beekeeper's ever had there's three gadgets that scratch it. Each has advantages, all claim to be the best and your mileage will vary as to how useful these things are. Keep your eyes open, some gadgets will be referenced on down the line.



Now that you have a basic view of the hive we can begin to discuss the events that occur inside it. What's missing so far? The bees. We'll look at how they arrive next at the Birth of a Package.

Bee Time ---

The average bee has six legs, most hair thin. They use these legs to clean, cling, carry, grapple and fight. They are thin as not to weigh down the bee, slim to fold against the body during flight, but there are downsides to this design. The key disadvantage of course, is that there's no wristwatch small enough to fit a bee.

Neither is there a clock or calendar on the inside of the hive. Bees don't keep time and they don't keep schedules and they certainly don't comply with any day to day needs that the beekeeper might feel he has. Learn this, and you learn to operate on bee time.

"Leave the watch at the house" said an old beekeeper, when I asked him for advice on inspection. His immediate meaning was that watches can push up the elastic on long sleeve shirts, giving unhappy bees a place to sting, or creating a place where an inquisitive bee might get squashed. The philosophy runs deeper through beekeeping. The colony grows on its own schedule. You can't force it, feed it, zap it, or fertilize it into operating on any schedule but it's own. So leave your watch in the house. Take your time, and relax. Be patient. Learn to wait calmly from week to week instead of peeking in on the hive every few days. Plan for the next harvest as much as this one.

This doesn't come natural in a world where we put instant coffee in a microwave and tap our fingers while we wait. The bees do things when the time is right. That time is known only to them.

A Race to Live

E14 had hatched just minutes before she was shaken from her frame and thrown into the midst of thousands of other bees. She was there from the very first moments of the colony. She may be present at its death as well. This newly formed colony is already in a race where the victor survives a generation longer and the loser is swept away. With every tick E14 gets older. With every tick the colony comes closer to that fatal finish line. To survive her colony must raise a new generation to live on. The odds are not in their favor.

E14 never knew any queen but the package queen so she accepted the queen immediately. In the darkness of the hive she quickly found her way to the heart of the cluster and waited there. For a day nothing seemed to happen. Other bees left the entrance but not E14. She is a brand new bee, too young to participate in the decision making process that drives the colony. The decisions in this case are unanimous. With only their full stomachs the bees will attempt to build a new home and raise a new generation. E14 will die, this is certain. As a single member of the composite organism that is the colony she strives for its survival.

There are no brood in the newly founded colony but for a time this is not upsetting. There is no place to put them. E14 is too young to draw wax but not too young to vibrate her wings and raise the temperature in the hive. One bee alone warms little. A thousand together, three thousand more, five thousand on top of those, and the temperature inside the hive rockets. Now it is hot in the hive in spite of the cold spring. It is warm enough to draw wax and work it. E14 will not do this yet. She maintains her post at the outside of the cluster, beating her wings. When she is hungry others feed her from their stomachs. With no stores to draw on the colony could starve, so some workers must split off to answer this need.

Oldest bees are foraging already. They have no place to store the pollen they gather so it is left on their legs in orange and yellow bundles. The nectar they bring back is passed from bee to bee as needed. In scant hours a tiny pattern emerges on the top of the wood bars that line the hive. This long line has arches and veins sprouting from it. It sets the pattern for the comb to come. With their comb line drawn the bees now work fervently to build the first row and midrib of cells. Soon a tiny heart shaped comb hangs from the bar. With greater surface area more bees can build and a building rate that was quick before becomes incredibly fast.

The comb is forming but it is shallow. This doesn't stop the workers from using it. The cells near the top are the deepest and the moment the side wall was formed the foragers began to pack pollen into these. There must be ready food for the generation to come. At night the wax work continues but slower. All the combined forces

of the colony cannot change the laws of physics and the night air saps the colony of the heat needed to build their home. They cannot be deterred. To fail is to die. At night they continue, stopping only in the coldest hours before dawn. By morning they have drawn a comb the size of a fist. It is not full depth. It is not hardened. It is fragile but in these first few cells the bees have laid their plan for survival.

The queen has little to do at first. She wants to lay eggs, always and foremost. As soon as the cells are formed she begins inspecting them. The first few lines she rejects, as too irregular and the wrong size. She cannot use them. The foragers have already packed nectar into some and pollen into others, this area is unfit. A few rows down though the cells become more even. In a half drawn area she stops and measures. These are better. These are right. She lays an egg in each. The egg is tiny but it stands as high as the wall of the cell she lays it in. No worry. Workers have ten days to complete the cell before it must be capped. She rounds the growing comb day and night, laying in each cell as soon as possible. It will be twenty one days before these eggs emerge as new workers. Three weeks that will determine if the colony lives or dies.

E14 rapidly finds a new role in life. She is a nurse bee, tending to eggs. There are dozens now. The colony needs thousands to sustain itself but to get there it must take these first few steps. Three days later the first of the eggs hatches. Tiny larva that arrives is given the best attention possible. Nurse bees fight over who will care for a given larva, pushing each other out of the way to get a chance to feed and check on the hope of the colony. The pollen cells are packed full but not for long. With care E14 mixes pollen and nectar to form the bee bread which she feeds her hungry larva.

As the days go by E14's larva grows from a tiny dot to a fat C shaped worm, curled in the bottom of the cell. E14 is now the right age to draw wax so she leaves her larva to the care of other sisters and takes her place in a chain of bees. The chain clings together, forcing tiny scales from their wax glands. Other bees crawl up and down the chain collecting them and working them into comb. The primary comb is now seven inches large, and two smaller combs hang on either side. These are not packed so heavily with pollen and nectar now though. The oldest bees are missing. They left the hive one at a time. Fewer returned each night.

After seven more days the colony has three combs packed with eggs and larva. This day the first larva sent up a chemical flag to her aunts. She is ready to be capped. Throughout the colony this scent is spreading. Wax is quickly stolen from the comb builders to cover these sisters. Ten days and the colony will have reinforcements but there is a problem.

The oldest of the bees have already died off, weakening the colony in a way that ripples through the work force. It begins with the foragers. The experienced foragers are gone. Other sisters take their place but that leaves fewer to warm the hive. The brood must be kept at ninety degrees so others do that. That leaves fewer bees to draw new comb. Now the comb grows only in the late afternoon sun. The youngest bees will easily live through two generations. They are few in number. The oldest bees are already dead, and much of the population will die before this next generation can emerge. The fate of the colony lies in the hands of each bee.

The oldest workers cannot hope to live to see their replacements. Instead they build up stores of pollen and nectar, competing with the queen for open cells to fill. E14 is old enough now to pack pollen and work the wax. She does both, but work in the hive is slowing. The foragers are dying as the adult bees of the colony die off. New foragers cannot leave the hive. They are needed to keep the brood nest warm, so two weeks later the colony is living on the stores it has built. Normally the oldest bees would replace the foragers but that cannot happen for now.

Eighteen days into the life of a colony the weather turns cold as the last blast of winter sweeps through. The colony is one third of the size it once was. Most of these sisters have never foraged. The pollen cells are nearly empty, the nectar cells the same. Capped cells cover the surface of the comb, which is now nearly a foot long and nine inches high. The queen continues to lay where available. At times the workers are forced to devour her eggs because they cannot care for them. That night the nurse bees gather to keep the colony warm but with each gust of wind the temperature drops. The cluster contracts grudgingly and many nurse bees choose to stay and freeze alone rather than abandon their brood. E14 is old enough to know other instincts now and she resigns herself to the loss of some brood. The morning of the nineteenth day shows a colony nearly in ruins. Some workers devote themselves to dragging out the dead. These mortuary bees would normally be nurse bees. Many of the uncapped larva are dead, so many that there are plenty of nurse bees for those that remain. In that daylight E14 begin to forage, bringing in wet pollen and cold nectar.

The capped larva are much more resistant to the cold. They have weathered the storm mostly intact. Workers move over the surface of the comb checking each one. They can detect dead brood by the scent. The few that died are pulled out. Their wax caps are taken to shield new sisters ready to undergo their change. Now a new threat emerges. So stripped of workers is the colony that few bees are left to guard the entrance. Across the entrance of the hive a foreign shadow falls. It moves

back and forth waiting for the guard bees that should come out. The lone guard ventures out. She does not return.

An hour later the shadow returns. After a few minutes of walking back and forth it slides in the entrance of the hive. It is a yellow jacket queen, the foundress of a new nest. She is hunting honeybees. Until now she was content to devour the dead bees thrown from the hive. With nothing to stop her the honeybee brood are appealing meals. She will chew them alive to feed her own daughters.

Even though the Yellow Jacket Queen is easily twice as large as E14, E14 is not afraid. She flies at the intruder, grabbing her by the wing. The massive wasp queen is pleased. Normally she would have to pursue her prey run them down. This meal has delivered itself to her. The wasp flexes its stinger back to strike a killing blow. Suddenly she is attacked from all angles. Bees scrape at her eyes and their stings bash her armor over and over. Her wings are bitten and pulled at. The insolent bees drag her from the hive even though she is far larger. On the landing board the wasp and bees form a rolling ball of wings and stings. At the edge of the board the wasp breaks free and flees. When her daughters are ready they will return for vengeance.

E14 retires to the hive. Her hair is pulled out in places and her left wing is bent where the wasp crushed it.

On the morning of the twenty first day the colony is nearly run dry. The sisters have spent their stores and lives on a bet that will either pay off or kill them. Today the rows of capped wax cells are ready. Unable to forage, E14 is relegated to heating the brood nest. At the edge of one cell the capping disintegrates. Bit by bit the worker inside chews her way out. When the cell opening is clear she crawls out onto the comb. She is nearly white, almost transparent. Her wings are wet and soft, her hairs are clumped together. Next to E14 this new arrival barely resembles a bee. Within minutes the new bee is at work, taking the place of an older bee near her. Throughout the day new arrivals emerge and take their places. Older bees move on to capping cells and cleaning, even drawing comb. The queen takes the newly freed cells and lays a new generation in them within hours. For the months to come the brood cycle will repeat, and through the summer and fall they will never again be without new workers to care, new workers to clean, build and harvest. These new bees will face the same contest over and over, because the race they are in is in fact a relay. Each generation must take up the baton of raising the next, and the next. They will do so, whatever the cost.

The View of the Hive from the House

At the moment a colony is installed in its new home a race begins. Whether it is a package of bees created by man or a swarm leaving its parent colony the challenge is the same. A clock is ticking the minutes and hours to the death of the colony. Every bee in the colony will work toward a single goal: to hold back the clock, to live.

A summer bee lives about six weeks from the time it hatches. Less in the summer, more in the winter. A new colony contains no brood or baby bees. A new colony has no comb in which to lay the eggs that will hatch to become brood. It has only thousands of full stomachs and an intense desire to live.

To begin with the bees begin to create a home. For days before they left the hive the bees gorged themselves and prepared to leave. This heavy caused a change in their wax glands. Normally only young bees draw wax. With heavy feeding even the older bees are ready to produce tiny white flakes of wax. The oldest bees to leave will work the wax.

Bees wax is a natural wax unlike the paraffin or oil based waxes. Each of the vast combs is built one tiny crystal white flake at a time. Drawing wax is a challenge for many reasons. Foremost among these is that bees wax grows soft at about one hundred and fourteen degrees. At ninety degrees it is chewable, moldable for a time. The bees must produce this heat if the weather is not warm. To do so the colony divides itself. Some bees vibrate their wings to generate heat. A new colony is 'hot' in the cool of spring.

The first combs get drawn amazingly fast. The first cells are immediately filled with pollen and nectar. The queen has other plans though. She will immediately lay in the cells she finds fit, even if they aren't finished. The bees will take care of this, finishing the cell before the larva requires it. From this point on twenty one days will pass before the bee in the egg is a bee on the comb, ready to work. During this time the population of the colony continues to drop. There is no threat that the nurse bees will not live long enough to see the new generation. There is a serious threat that there won't be enough of them to propagate the colony.

The foragers have little hope of seeing the future of the colony arrive. Instead they contribute through the stores which must see the colony through the dangerous period ahead. They work as fast as possible, bringing in pollen, concentrating nectar into honey. The colony's growth rate slows though as bees die. It becomes difficult for them to maintain the level of heat needed to draw wax, hard for them to keep the brood warm. The brood are always the first priority, so the amount of comb drawn slows each day as more bees are needed to take care of brood. Once the larva is capped it is much more resistant to cold.

On the coldest nights of spring the colony will lose some brood and some bees to the cold. The brood die because there are too many of them, too few nurse bees, and too cold temperatures. The nurse bees die because some refuse to leave their larva. They would rather die than abandon their post. Now the colony is actually shrinking.

With fewer bees to guard the entrance predators like wasps quickly move in. Always pleased with a one to one battle, the wasps will eventually venture into the hive in search of brood. They'll pull the capped larva from their cells and devour them if not driven away.

At the point where the first bees hatch the original package is a shadow of itself. With these first new bees comes the hope of survival. Now the colony has brood at every stage. From now on it will continue to have a new wave of bees every day. In the dead of winter it may be only a handful of new bees. In the height of summer it might be more than a thousand each day. This is the brood cycle, and it will only rarely stop from now on. Each time it does so the colony is in great danger.

The Hive at Home.

Once the colony is installed in the box, there is little for the beekeeper to do. After a week though, you can come back and see how things are shaping up. Before you can open that box though, you had better plan out what you are going to do. Later on the colony will have tens of thousands of bees. If you are going to disturb them it would be wise to know why you are doing it and what you plan to do with them. So, let us start with your equipment.

Tools of the Trade

The basic implements any beekeeper needs are a veil (something to keep the bees off your face), a smoker (to generate cool white smoke for calming the bees), and a hive tool (a knife for splitting the boxes, loosening frames, etc. There are dozens of other things you might want but those are the basics. The reason for a veil is simple. Bees instinctively go for the face and eyes. Getting stung on the arm hurts, but is no serious matter. Get stung on the face and you'll feel entirely different. The smoker is a tin can with a fire in it. The bellows blows a soft puff of air into the smoker, causing the fire to rise, and then smoke as it chokes. This triggers a calming reaction in bees by masking any alarm pheromones that the guard bees release and causing them to try and find an open honey cell. Their reasoning is that the hive is about to catch fire and the bees must flee. They will have only their full stomachs to build a new home. The hive tool or knife is for prying apart parts of the hive. Bees produce and collect a glue called propolis. It's like natural tar made from resins and any crack will get sealed with it, loose things (any things) get glued over with propolis. It's not

easy to get apart and every week the bees will have glued down some things.

Before you go down to inspect, take a look at the weather and your watch. If it's cloudy. If it is raining. If it is windy. If you wouldn't like someone removing the roof to your house on a day like this, consider not doing it to them. They'll appreciate it and you can build up your immunity to bee stings some other day. Don't inspect at night unless you are really in need of bee sting therapy. They'll deliver it to you in quantities won't appreciate. The bee books will tell you (and I'll testify it's true) that a sunny day in mid morning to late afternoon is the best time to inspect. Later you may be forced to inspect in the cold, or the wet, or the wind. By then you'll be expecting what comes with that and be much better prepared.

If you are ready to get hands on with your hive, great. First things first – when you get to the hive, you are going to want a way to calm the bees. That's the aforementioned smoker but you probably would like to light it now, before you get within several feet of a box of bees. That means lighting up the smoker now. It'll be easier to do out of your veil or suit anyway. Your goal with the smoker is to build a bed of embers upon which you can put a slow burning, cool smoke producing fuel. I start with newspaper and then add cardboard, then move up to twigs. When I've got some half inch sticks burning in the bottom of the smoker I'm ready to add my material. Which material should you use? You might as well ask what flavor of ice cream to like. I'm partial to vanilla and cedar shavings (small animal bedding) myself. Other good fuels are burlap (coffee or seed) bags cut into strips, pine needles, cotton, cow dung, rolled cardboard. You can even buy "smoker fuel", which is likely one of the above. Add a handful, but be careful not to extinguish the fire. Now, a word about operating it – the best smoke is a slow puff on the bellows. Your smoker should be belching smoke like a 85 year old bingo player at this point and a slow puff will produce a cloud that could obscure a tank. You don't need that much smoke, but better safe than sorry. I highly recommend practicing lighting the smoker and getting good solid blasts of smoke before you begin your inspection.

Before you can open the hive you have to approach it and how you approach it makes a difference. Those bees just inside the entrance, those are guard bees. They are there to guard the entrance of the hive. A guard bee who sees a threat (or beekeeper) approaching will be certain to alert her sisters. So approach the hive from the side or back. To begin with send a puff of smoke at the entrance. Goal: Disorient the guard bees and send the "slurp some honey and relax" signal. Non-goal: Roast some bees. One puff of smoke. These bees are not chain smokers. If you use too much smoke you will 'raise' their

agitation level instead of lowering it. Nobody wants that. Not me. Not you.

Having puffed at the entrance you are now ready to smoke the top. I like to get a puff in the air before removing the lid. That means the first air in the top of the hive when I pull the lid off will have some smoke. Now, about the lid: I use migratory tops, meaning it's just a board on top of the top bars. The bees regularly glue this down and I have to use the hive tool to open it. You might be using a telescoping cover with an inner cover. I don't mind. If you are, do the puff of smoke in the air and then remove the telescoping top. Most inner covers have a fiendishly bee shaped hole in them. *_That_* is your new smoke target. A gentle puff through that sends the word to the bees at the top. Myself, I pull the lid off and smoke the bees on the top bar.

Now, if you are like me you might imagine that opening a hive will result in a stinging wave of brown death flying at you. The good news is that that is unlikely to be true (and if it *_is_* true, you might want to consider replacing your queen). You've smoked the entrance and puffed the air and taken off the telescoping cover. You puffed the hole in the inner cover if you had one and now with hive tool in hand, pry the inner cover (or migratory cover) off. I prefer to pry open the opposite edge and lift the lid so that it opens *_away_* from me. That way if a group of bees chooses to fly out (and some might) they'll start out flying away from you. Ok? Set the cover to the side, and be careful – there are likely bees on the underside of it. Don't squash them. They won't be amused.

Covers off, take a look at the top bars. If you see bees lined up on the top bars and small eyes staring at you in rows it is time for more smoke. They'll buzz and waggle and run down between the frames, which is where you want them. If they are lining up on the top bars they are organizing. Planning. Do you really want them to continue that? Your hive likely has ten frames in it. Ten frames is a lot of frames, and you need to pull one out. If this is your first inspection there probably aren't many bees on one side – pull that frame first and set it to the side. Be careful with those frames – later they'll have bees and comb and honey and eggs, so start your good manners now. I keep a spare hive body by my hives. As I pull frames from the hive to inspect them I transfer them into the spare until I have enough room to comfortably pull frames.

So you can take a frame out now. Great. What is it you are looking for? Bees. Comb, Eggs, Larva, Capped brood, Queens, Honey and Pollen. Wow, that's a lot to look for. You could spend all day hunting for the queen in a full sized hive. What if for now we start with just one of those?

Bees:

You can gauge your colony's strength by the number of frames it covers. If you have fewer than three frames worth of bees, your colony may be in trouble. You don't need to calculate bee density, just use common sense. The five bees on the outside frame are not covering it. The ones so thick you can't count them on the fifth frame in are.

Comb:

In the early inspections you'll be watching the bees draw comb (and likely amazed at how fast they do it). When your bees have eight of the ten frames mostly drawn and cover the eight frames, it's time to stack another hive body on. If you've already got your hive bodies, think super. If you hung your queen cage smashed between too frames, the first kind of comb you'll get acquainted with is burr comb.

A burr comb is any comb that is not where you want it. Beekeepers tend to want their comb in frames. Bees tend to want their comb in the hive. Your bees have probably drawn burr comb from the queen cage. If the queen is still in the cage, open the entrance and let her crawl out onto another comb. If she's not, be very careful. If you have a burr comb hanging from the queen cage you are going to remove it, gently brushing bees off of it. If the queen is one of those bees, hold the comb so that she can walk off of it onto the bars or another comb. Love your queen. Do not squish the queen.

Now look at the burr comb. If it's really large, you need to make a decision. Either melt it for wax, or if it contains eggs, consider large rubber bands.

A large rubber band stretched from the top bar to the bottom bar will fit nicely. Two of them can hold almost any comb in the frame. If the comb is large or there are many eggs in it, consider holding it in with large rubber bands. Otherwise, just take it out. Now you can (gently) push the frames together when you are done and maintain bee space. Watch for workers hanging in chains to produce wax, behavior called "festooning."

Next up look for eggs.

Eggs are hard to spot on white plastic foundation, since they are tiny gray dots like a grain of rice on end. If you have black plastic foundation they are easy to spot. If you are using foundationless frames or starter strips of foundation, be careful: Those combs are very weak when fresh. Give them a few months and they'll be better. If you can't spot any eggs don't panic. Come back in three days and look for larva (which are much easier to spot). Three days after that the larva are c shaped worms at the bottom of the cell and hard to miss. Speaking of larva – you might see some. At this stage they are probably C shaped. Eventually they touch in the center, then lay long ways in the cell. Finally they are capped. You can

tell what is in a cell by the capping. Honey cells are absolutely flat capped and you can often see the honey underneath the cap. Worker cappings are slightly convex and dimpled in a circle around the edge. Drone cell caps look like .22 bullets on the comb. If you see capped larva, the queen has been out and laying for at least ten days. Get used to looking at the brood pattern. A pattern in this case refers to how many empty or unused cells a queen leaves as she lays. A cell containing pollen or nectar doesn't count, we're talking about empty cells in the middle of eggs or larva. A good queen puts eggs in most available cells. An older or failing queen spaces them out.

Pollen:

Pollen is not the yellow powdery stuff you buy at the health store. It varies in color from red to yellow, orange, blue and brown (and everything in between). You should see pollen cells scattered through the brood and at the edges of the frame (called the arches, or honey arch). If you don't, don't panic. Bees don't raise brood without pollen to feed them. They have it somewhere.

Honey:

Bees like to store honey in the top and sides of the frame (forming a honey arch). You might not have capped cells yet, but look for shiny wet cell bottoms to know where they are storing it. If you are feeding the bees sugar water that's likely what is in there.

Queens:

Note the 's.' You probably have one queen in your colony, but what you want to notice is any queen bee not just the one you are looking for. The bees behave differently around the queen. They face her. While the workers skitter across the comb, the queen will move gracefully, slowly. Her abdomen is as long as some workers. Whether the queen has a dot on her back or not you can find her by watching the bees. The queen is the heart of the colony. Most people know this but it's true on more levels than might be apparent. The queen is the heart of the colony; without it the colony has no "pulse". The bees will cluster, listlessly or refuse to even keep themselves warm with no queen. The queen, however, is not the brain of the hive. The workers, her daughters, control more of the behavior of the hive. To find a queen, you need to look for bees in a circle that moves with the bee in the center.

That is a lot to look for.

I recommend starting with a rough bee count (how many frames) and then looking for eggs. If your colony is just starting out that's all you need to know things are going ok. If your queen was still trapped in the cage, don't harm your sanity looking for eggs. Once you spot what you came to see, feel free to either continue looking (and learning) or close things up. In between frames keep

an eye on the bees on the top bar. When they form a marching line on the top, another gentle puff of smoke is in order.

To close things up, insert the frames back the way you had them. Slowly, gently push the frames together. This gives bees that are between the frames a chance to vacate. Once the frames are back together take the inner cover (or migratory cover) and once again bully the bees out of the way by sliding it across the top. They'll move. Now put the inner cover on and gather your tools. Got everything? Blow the bugle and retreat. Check for hitch hikers as you remove your gear, and smother that smoker. Left to its own devices you could easily start a fire. That's it for a week. Next time come back and look for something more than this time. Bit by bit, piece by piece you'll put the puzzle together and learn to interpret the tales the bees tell yourself.

Last Flight of the Forager

My daughters called me down to stare at the dirt with them.

“Dad, it’s important,” said my oldest. So I came and we gathered to look. There in the dirt crawled a worker bee, its fur gone, its wings tattered.

“It fell to the ground, Dad. It can’t fly. You have to take it home,” said my younger daughter. So we did.

Bees live around six weeks in the summer. They live longer in the winter and even less in the summer when they work themselves to death. They do not specialize. Every bee performs almost every task in the hive at some point in its life. Right after hatching a bee will clean its cell and takes on its first role as a nurse bee. Nurse bees clean cells, feed larvae, and draw wax. After a time, they become house bees, transferring pollen and nectar from the foragers. Later they will be guard bees and finally foragers.

The old forager was weak and barely able to crawl, but the pollen baskets on its legs were packed with proof of her hard work. She fell less than fifteen yards from the hive. It might as well have been a mile.

Bees lifetimes are limited by a number of factors: cold, predators, food, but also by their wings. Their wings are gossamer strands and they literally wear them out flying back and forth. Their fur wears off over time, a hazard of scrambling over other bees, fighting with wasps, crashing into the landing board, just working.

The forager’s wings were tattered and frayed. It struggled to lift itself into the air but failed time and again. Each time it waited longer and longer to lift off. The right wing was shredded. The cool shadows cast by the setting sun meant certain death without the warmth of the colony.

My daughters are not afraid to stand near the hive but getting into the flight path, that’s another thing entirely. I gathered the forager up on a leaf and carried it over to the front. The landing board of a hive is like a combination runway, customs booth and dance party at once. Bees are flying inbound all the time, sometimes crashing on the board they are so heavily loaded. In the same airspace other bees are struggling to leave. Guard bees stand ready to attack any inbound bees that don’t belong to this hive. Other workers hang on the board, fanning their wings to spread the scent of the hive. Their

scent acts as a chemical flare drifting out on the wind, calling the workers home.

The forager crawled off of its leaf and onto the landing board. Immediately it was surrounded by guard bees and accepted. It disappeared into the hive, lost in the swirl of activity.

As the evening grew dark I went down to refill the feeder and I saw it. Two workers dragging a dead bee off the side. I looked closer, and recognized the barely present right wing. One bee among thousands, one day, one moment in six weeks of hard work, one final journey home. This is their life.

Cracking the Pollen Case

Every beekeeper has a secret recipe for fall feeding and tonight I was preparing mine: Canola oil, sea salt, fresh pepper rubbed over a thick rib eye and fried in a pan to a rich, juicy crust. Oh, perhaps I should mention this was beekeeper feed. Honeybees aren't carnivorous, or else open feeding would just involve tethering a goat in the apiary and making a run for it. I prefer to get my protein on a plate with a pat of butter; honeybees fortunately do not.

I have a lot more in common with wasps than honeybees. Wasps have the jaws of hunters and weapons to match. They are smooth, sleek, and deadly. When they need protein to raise their brood they hunt it down and kill it. Then there's the honeybee. Their jaws are not designed to rip and slice; their stings are not laced with paralytic poisons. When it comes to selecting a protein source the honeybee prefers something less mobile, something more defenseless. Something that doesn't run away when you land near it, fight back when you grab it, or have teeth, stingers or other dangerous weaponry: something like pollen.

Plants create pollen in order to make more plants, not to make more bees. Every bee book I've read talks about the miraculous relationship between the bees and the flowers. How the flowers produce pollen and the bees ferry it back and forth for the flowers and in return the flowers let them gather nectar. When a bearded man at a chicken fried steak buffet transfers some gravy from one plate to another we don't call it a miracle. For honeybees, transferring pollen from flower to flower is more a side effect than an end goal. They might transfer some pollen for the flowers but most of it is packed away for the bees to eat. Using pollen as a primary source of protein is a great choice for a bee that's not built to hunt but it does present its own problems.

The sperm cells contained in a pollen grain are extremely fragile. Left on their own they'd be destroyed long before even a rocket propelled honeybee could transfer it from one flower to another. In nature the approach taken is to build layers of protection around the genetic payload. Almonds are covered in a nut shell. Eggs have a hard layer around the embryo inside and the world outside. Even teenage drivers get wrapped in Concorde station wagons with wood panel sides. Pollen gets wrapped up too.

As a grain of pollen matures it is prepared to leave the safe harbor of the flower and take a voyage beyond the edge of the petals. The delicate genetic package is enclosed carefully in a cellulose layer called intine which acts like a baggie to keep the DNA goo together. This inner core of cytoplasm is the real source of nutrition in pollen but the cellulose by itself blocks easy digestion. On top of the intine is the exine which acts like a bullet proof vest for the pollen grain. The exine is composed of

sporopollenin, which is the scientific term for "incredibly tough." Sporopollenin is a compound resistant to most acids, bases, temperatures up to 250 degrees Celsius and immense pressure. On top of the exine is the pollenkitt, or "Sticky stuff on pollen." Pollenkitt acts like glue to stick pollen where it lands, as well as providing an additional layer of bubble wrap around the exine. Together these layers form a miniature plant which will germinate under the right conditions, growing a tube that can reach up to ten inches to deliver the sperm cells right into the heart of the plant. You can think of a grain of pollen like a chocolate covered almond, if the almond were still in the shell when it was dipped. With that many layers between the honeybee and the tasty genetic filling, how does the honeybee manage to digest pollen at all?

In order to understand how a honeybee turns a pollen grain from lock box to lunch box, you have to go inside a bee. You don't have to very far, just past the nectar crop, to the entrance to a bee's digestive organ: the ventriculus. The ventriculus is the organ in which digestion of pollen is performed. How do we know this? We looked inside a bee. Well, not me specifically. Researchers did. Researchers with sharp scalpels and a lot of free time cut tiny windows into the abdomen of bees and then fed them pollen. Then they watched the bees digest the pollen.

On my sixth birthday I received two rectangular gifts. One came from my parents and I shredded the paper to find Batman, in plastic action figure glory. I looked at the other box and saw the shape, the outline, and I knew: It must contain the Joker. That package came from my grandparents in Slaton, Texas. It was wrapped in plastic foil, followed by brown shipping paper, layered in shipping tape. I began to claw at the package. After a few minutes my mother tried to help. She broke two nails and passed it off to my Dad. He stabbed at it with a pocket knife. For the next few minutes every family member did their best to pry open that package. Finally my Dad went to the garage and came back with his toolbox. Batman and the tin snips defeated my grandmother and the US postal service but it took a while. Inside I found another Batman. That day I learned an important lesson – regardless of what is inside, some packages are harder to get into than others. The same is true with pollen.

The first stage of digestion involves unwrapping the pollen grain. The lipids in the pollenkitt are stripped away like wrapping paper. Unlike wrapping paper (which is rarely chewed up and swallowed), the pollenkitt is nutritious, rich in lipids. Under the pollenkitt lies the exine. The exine structure varies from species to species. Some exines are solid smooth and rely on the host plant triggering germination. Other exines have gaping holes

in them so wide you could back a (tiny) loading truck right up to the pores to offload the cytoplasm. Under the exine the intine stands as a final barrier between the bee and the feast. In the ventriculus the honeybee employs a number of methods to get past the hard outside to the creamy filling. The first of these is osmotic shock. Osmotic shock causes the pollen exine to rupture like a balloon bursting. Some types of pollen are like Ford Pintos, ready to explode. Other pollen grains are sturdy and require the honeybee to “pick the lock.” These pollen grains have germination pores, which function as the plant equivalent of the exit rows on an airplane. When the pollen touches down after a crash landing on the pistil the grain germinates, opening at the pores. It then grows a tube that acts as an emergency slide for the genetic material. Honeybees use this method to open some pollen grains. Inside the ventriculus, nice and warm, the germination pores begin to swell and open. What happens next is like a scene from a alien invasion movie as the digestive enzymes seep in and out, leaving nothing behind but the empty shell. It’s like eating an almond and digesting the almond from the inside of the shell. Some pollen grains are built like Volvos. These pass through the ventriculus and come out the other end not the least bit digested. While that’s a win for the pollen grain, it’s a loss for the bee in more ways than one. First there’s the fact that all that work didn’t yield protein. Secondly the bees have to burn carbohydrates on cleansing flights to get rid of the indigestible bits.

What about humans?

The local health food store sells pollen. “Bee Pollen”, said the sign above the counter. “Nature’s Best Food,” said the writing underneath. “This is real bee pollen,” said the sales lady, “it’s expensive because it contains all the protein bees need to satisfy all their needs.” Road kill contains all the protein crows need to satisfy their needs, but people don’t pay \$20 for a tiny bottle of crushed, dried possum. So how do we fare in the pollen digestion?

To answer that question let’s look at the six major methods known for digesting pollen. The first three involve specialized mouth parts for cracking, crushing or piercing it. Since most people don’t chew each grain of pollen individually or have needle like teeth we’ll proceed to methods four, five and six, which are osmotic shock, pseudo germination or just flat out dissolving the sporopollenin and intine. Six is a long shot - only a few insects are capable of dissolving the sporopollenin (and most of the compounds that would digest it would digest us). That leaves osmotic shock and pseudo germination. Pseudo germination is possible in honeybees because the pollen is sitting in the nectar crop and exposed to warm dilute sugar – perfect for convincing a pollen grain it’s time to grow. The human digestive system features hydrochloric acid. In the spring when my

wife starts our garden we have rows seed trays. “Soak generously in warm hydrochloric acid” never appears in the germination instructions on the seed packets, and for good reason. Even if we could get the pores to open the intine is made of cellulose and we are notoriously bad at digesting it. Without the nectar crop of a bee and the ability to induce pseudo germination we average digestion of 48% of pollen material. That leaves osmotic shock, and at least here we have good news. A pollen grain whose external barriers explode is every bit as digestible as a steak, even if it isn’t as tasty.

So honeybees have a specialized digestive tract for extracting the nutrients from pollen. Humans can gain nutritional content from raw pollen, but the number of intact and partially digested pollen grains at the end of our gut suggests we do a poor job of it. Compared to the honeybee we’re downright abysmal. I say let the bees have the pollen. You can’t pan fry pollen with butter, garlic, salt and pepper. The bees have no idea what they are missing.

Contractual Obligations

Most beekeeper know the value of a pollination contract. It's a subject of vital importance to the professional beekeeper. It's also a subject of vital importance to the professional bee. I find it amusing to talk with beekeepers who describe themselves as primarily pollinators or honey producers. Just how many almond flowers did that beekeeper visit that day? How much honey was the beekeeper holding in his crop? The bees are the producers. The bees are the pollinators. In contract law it's important to know the prior history. The history for bees goes way back, because bees negotiated the original pollination contract millions of years ago. To get a look at what things might have been like we need to conjecture with what is, what we know was, and from that derive what might have been. So we look at the life of E04, a proto-hymenoptera to see how the first pollination contracts came about.

E04 lives in a time so distant it defies comprehension, in a place so far removed it is unrecognizable. She lives in a tropical forest in what will one day be Burma. E04 is tiny, barely 3mm across, but that does not mean she is insignificant. In E04 the habits of what was are broken and the patterns for what will be begin to show. She shares a common ancestry with the wasp, carnivorous flying hunters who have roamed the lands for millions of years longer than she. Wasps are eaters of the living, hunters armed with sting and bite. In her time as now they are sleek and deadly. E04, however, is different. Wasps and Bees both enjoy sweet juices, deriving their energy from sugars when possible. In this prehistoric landscape a common source of sugar is sap, but recently a change in the plant world has made way for a change in the insect world. The vast pine forests that have covered the continents depend on wind to transfer the pollen. To compensate for the random nature of wind the trees produce a thousand times more pollen than is needed. In this rainy forest in Burma, however, there is rarely wind without moisture. The nearby falls clog the air with moisture and pollen released on the wind rots on the ground more often than it drifts skyward to a neighboring tree. Wind pollination cannot work here, but the drive to live opens the doorway for a new behavior.

In this forest live tiny beetles. Ever hungry, ever scavenging these bugs can live on all manner of plant material, and it is not long before they discover that the pollen is edible. Chewing into the stamen the beetles devour the pollen and then move on. This act of destruction is not without benefit. The beetles, you see, are messy eaters. Their mandibles are clunky and they lack a way to clean themselves, so in their gluttony the pollen at the edges of their mouth is transferred from one flower to the next. Sometimes the pollen is in fact from the same species, and so the trees survive in the mists and the rain. In survival they adapt. With the passage of a few million

years the first flowers appear, crude constructs which serve as an offering ground for pollen. The first flower petals are an offering of protection for the pollen and an enticement to the pollinators. Sheltering in the cupped leaves keeps the beetles dry and the pollen on long stalks could not be more conveniently placed for devouring by a restless beetle. In the heart of this proto-flower sap oozes. Now the stage is set for E04's ancestors to change with the plants.

In the cycle of predator and prey the populations move in waves, and the current wave sees a glut of predators. Never afraid to feed on each other, the wasps have taken to cannibalism early. On this day though, a wasp can find nothing to kill, nothing to eat. She has learned that sap is sweet to chew, and the scent of sap in a flower draws her to it. Her jaws, made for eating meat, make short work of the flower. As she cleans herself, she chews a stamen – and swallows. Though she is made for digesting meat she is capable of surviving on pollen, and through this lean cycle she continues to feed on the sap and the stamen. Her children share this trait, and it is honed through thousands of lean years, millions of generations until we arrive at E04.

E04 still has the jaws of her great grandmothers, jaws made to kill. Her most striking departure cannot be seen without a microscope. Her ancestors sported spikes on their carapace for protection, her nearer ancestors had stiff hairs. E04's hairs are stiff, and they branch like tiny trees. This makes perfect catch points for pollen, so that when E04 enters a flower she is coated, and even a tumultuous flight through the undergrowth cannot dislodge it all. These hairs make E04 a better pollinator by far than the wasps before her. The plants have continued their evolution, developing "sticky" pollen and a flower structure that places the sap, now nectar in the center of a ring of pollen stalks. The plants have evolved to make best use of unwilling pollinators but in E04 they have found a match and a cross species soul mate. She already favors a tongue to slurp nectar over jaws to chew pollen. With every visit those tiny branching hairs fulfill her end of the contract, transferring the plant's DNA in return for sweet nectar and the lion's share of the pollen. Future generations will sweeten the pot by practicing a relationship that while not strictly monogamous is no longer a one flight stand. They will return to the same type of flower over and over, reducing those messy cross species mishaps that so often end in failure.

Fundamentally inside E04 is different as well from her ancestors. Her distant cousins still roam the woodlands, their design largely unchanged. Like sharks the wasps endure, a testament to the efficiency of their design. E04 is no wasp now. She is a bee. One of her physiological changes drives a social change. At some point in the past E04's ancestors developed a barbed stinger more suited

to penetrating the hide of these annoying mammals that now cover the land. The barb helps keep her stinger firmly in place but it comes with a price – at times when she stings she cannot remove it. Tearing it loose tears her innards out. A solitary bee cannot afford to die and leave her brood, so this weakness has driven a change in how she (and others like her) live. At one time they made nests in holes in trees or nested in the mud, but now they craft tubes in which to raise their brood. Building a cluster of tubes together is more efficient but it has gone far beyond simple material efficiency in E04. Once a fierce defender of her nest, a solitary bee tolerating no interlopers, E04's kind have learned to cooperate. They are not truly a colony, more of a co-operative. Hundreds of females build nests together, hanging their tubes of wax together. When E04 comes home after each flight it is to feed her larva – if she can find them. In the massive patch of cells it's hard to sort out ten larva among the thousand, so E04 feeds the nearest larva, and relies on a social contract with her sisters that someone will do the same for her own. At times she can find her own and she always feeds them first. Millions of years from now her distant children will retain this behavior. Even in the orderly confines of the honeybee colony the workers will favor the daughters of their father over others.

New females that hatch in this co-op have an advantage – there's at least one cell that they can already lay in – the one they just hatched from. The new females clean their cells and then lay claim to any other open cells by cleaning them as well. They must leave to mate and feed, but there may be other open cells to snatch when they return. E04 stores pollen for her brood in cells nearby. Other bees may eat it but she gathers it for her own. She doesn't hesitate to take pollen from others to feed them. Among the sisters of this condominium colony there are already the signs of what is to come – a few females have been born who cannot lay eggs. Raised in a dearth, their ovaries never matured and these females, once good only for the eating, find a purpose. They have no larva of their own to care for, so they roam the cells feeding larva who remain. When their mothers return these "aunts" may skitter away but they'll return to care for their foster brood. The results will be a boon for the co-operative. These aunts as well will defend their home and adopted brood to the death. One bee alone cannot afford to die but if others will care for and continue its work sacrifice becomes possible, even probable. In a few million years most of the females will be infertile, purposefully starved to create infertile workers. Changed too is the production of the drones – the males. Once every bee laid its own drones, one out of ten "wasted" on a male. Now E04's kind will learn a new technique. The drone brood smell different. Just by the scent in the air E04 can tell if there are enough drones. If not, she will lay one. Time will remove as well the hostility between the

layers and the caregivers. Time will hone the shape of her nest to its familiar hexagonal structure, and create colony from a co-op. These changes will drive others. E04's children will develop other new behaviors as a result of living in proximity. The corpses of the dead will attract predators, predators that might threaten the co-operative, so these proto-bees will drag them far away. In a few million years her sisters will often leave the nest when it is time to die, reducing the work the co-operative must do.

This design will succeed, and E04's children will push out across the globe, in doing so changing as they are forced to. They will become stouter so that they can carry more. They'll lose the fighter plane aerodynamic of the wasp and trade them for a cargo plane functionality. The sepia will become a fine fur that makes the bees look hairy. In time they will come into contact with colder climates, and this will force the change that will define them. In these cold climates the flowers will die for weeks, months at a time. E04's children have stored nectar in cells for generations, but it is in the same manner as the bumble bee – just enough to survive a few days. The bees forced to face a cold climate learn to store nectar not only in their own cells, but in the empty cells caused by a lack of pollen. The selfish drive to steal nectar causes the bees left in the co-op nest to fill their nectar crop. Then they transfer it to their own storage cells. In the process the sugar is broken down, the nectar deposited contains a little less moisture. In time this nectar will become the substance that gives these bees their name: Honey.

Back in the prehistory E04 goes about her business. She gathers pollen, eats sap, and makes her nest near others of her kin. These are tiny changes, so incremental and opportunity driven that they seem by chance. In E04's time, however, these changes are enough to separate her from her wasp ancestors, enough to establish a contract with the plants flowers that will outlast the dinosaurs and survive the ice age to come. Enough to make her a bee.

A Drone's Life

E75 is the first of his brothers to hatch but his story begins weeks earlier, with a crew of sisters working the wax. Bees know the shape of the honeycomb in a way that can never be forgotten. It is a core tenet of their instinct. The size of the cell is quite variable and with honeybees, size matters. Actually diameter matters. It is the diameter of a cell that determines if a cell is fit for holding honey, pollen, worker bees, or drones. What the colony needs foremost and always is workers. Without a constant female influx it will die. That said, the colony cannot ignore the possibility, indeed the likely hood that the colony will need to replace its queen. To do that it must raise drones.

The sisters can sense the type of brood in the hive by their scent because different sex brood emit different pheromones. When the scent of worker brood is strong in a colony the workers change from building worker cells to drone cells. These cells have a much larger diameter than the worker cells. This is to support the growth of a much larger bee. It doesn't take much additional volume to create a bee that looks gigantic opposed to its sisters. It is in just such a cell that E75's egg is laid. The queen inspects it and recognizes it as a drone cell. When she lays the egg she skips a vital step – the egg is not fertilized. The drones are her sons and hers alone.

The first days of E75's life are no different than any other bee's, with one minor exception: Each bee that visits his egg to check on it will decide whether or not to devour it. The colony does not tolerate drones if it does not have workers. E75's colony is strong and he hatches on the third day. The workers now care for him as they would any other and he grows fat quickly. Drone larva quickly fill their cell and are forced to lay out along their cells, too fat to curl up anymore.

On the tenth day of his life E75 is ready to be capped, but now the sisters must do something new. He is so large he juts out of the cell. The sisters craft a curved cap for his cell, rounded like a bullet. Inside he spins a cocoon and goes to sleep. Drones will spend longer capped than any other type of bee. For the next fourteen days his body will change. Worker sisters hatch four days earlier. On the day E75 is ready to emerge his sisters have already been hard at work for three days.

Even the manner of his emergence says that E75 is different. Worker bees chew the caps off of their own cells, but E75 is too large to do so. His head barely fits in the domed capping and his jaws cannot reach the wax. It falls to his sisters to chew his capping away and hoist him from his cell. From the moment he crawls onto the comb he dwarfs them. His only rival in size is the queen. She is longer but he is wider and rounder.

E75 immediately heads for an open cell of nectar and begins eating. A newly hatched worker joins him, then

heads back to clean her cell once she has rested. E75 watches her go. Where his sisters feel an immediate urge to begin work he feels only the need to relax and eat. He finds a snug spot among the brood and rests there.

This is how he passes the next week, venturing out only to test his wings. Around eleven days after E75 hatches he feels his first true calling. Up until now his body has not actually been ready to fulfill the function for which he was born. E75 may seem like a slacker against the backdrop of his sisters but in truth he is extremely specialized. Where his sister's abdomen ends in a stinger E75 has nothing, only a sperm sac. He cannot defend the hive. He cannot draw wax. He is too large to fit into a cell to feed or clean. On this day E75 learns his purpose.

He flies out of the hive and circles above the foragers on their pilgrimage to the flowers. His eyes see different things from the same landscape, his instincts calculate new locations from the same sun. He flies away not lost but not knowing where he is going. A half a mile away he comes to rest in the top of a pear tree. In the cool shadow of a leaf E75 rests. Then he spots something. E75, like all drones, has massive eyes, so large they touch at the top of his head. This is so that he can spot a queen on her mating flight. What he has spotted this time though, is another drone. Another, and another. The longer he sits on his leaf the more drones he picks out. They are waiting in this grove. It is the drone congregation area.

The other drones may be his brothers or from other hives. They will gather together anyway and wait. In the evening E75 returns to the hive and begins eating again. He will repeat this ritual over and over, all the days he is alive. He does it not just for his colony, but for any others in the area. For weeks he lounges in the shade.

Then one cool day the wind brings a scent that sets the drone enclave to humming. Sharks may be fearsome with their scent of blood in millions of gallons of water but drones are equally driven by the tiny scent of a queen. Not just any queen. This is no swarm forming, no mated queen on the loose. This is a virgin queen. E75 moves to the top of the tree and takes off, circling. A cloud of drones goes with him. His huge eyes are made for this moment and he picks up a tiny blur along the tree tops. The chase is on.

A storm of drones pursues the virgin demanding her attentions. She flies faster, higher. The weaker drones drop back but E75 continues on. They are high above the ground now as the queen slows now. Drones dart in and out, hovering just out of reach. They couple together and the drones drift away one at a time. E75 is not jealous, just

hopeful – at any point the queen could plunge away and return to her hive. Flying dangerously he collides with the drones above him, dodges the ones just to the side and dives into position. He flexes his abdomen, hooking to the queen. Instinct takes over. With a sudden jerk he flexes away and pain shoots through him. He pulls harder and separates from her, leaving a part of himself behind. Now he is falling away. Before he strikes the ground E75 is dead, his life purpose complete.

The View of the Hive from the House

In a colony of 10,000 females, you might wonder what the thousands of female workers think as word spreads that there'll soon be a male moving in. I suspect I know the answer:

“There goes the neighborhood.”

When a colony is first established, what it needs most is workers. That means females. In Honeybees, all females have two parents, but the males (drones) develop from unfertilized eggs. In fact, one of the surest signs of a failing queen is that she begins to lay only drones. For the first few months, the colony produces mainly workers. It's a sure sign that a colony is getting on its feet when a few drone cells show up.

How do you tell if a given cell is a drone or a worker? Well, you don't open the top and look under its skirt. Workers fit nicely into a normal depth cell. Drones, however, are both wider and longer than workers, and resemble fat fuzzy flying barrels. The drone cells have caps like the nose of a .22 bullet, curving swiftly to a blunt point.

A hatched drone is near impossible to miss in the hive. He's considerably larger, and his eyes literally touch on top of his head - an adaptation for spotting queens who might be on a mating flight. The only bee close to him in size is the queen (as a matter of fact, practicing on drones is recommended for learning to handle queens) The drone (like many males) will likely serve no purpose to the colony during his life span. He eats, craps in the hive (the females clean it up), and hangs around.

He is an insurance policy, in case the colony needs a new queen, and cashing in on that policy will mean his death.

Drones do not gather honey. They do not gather pollen. They do not clean, or care, or do anything other than hang out in the local “Drone Congregation Area.” No matter how many hives you have in an area, the drones select a particular area, and gather loosely there to watch for queens on mating flights. It is unknown how it is that drones from one season to the next choose the same congregation area, since none normally survive. Nor is it known how the queen, on her second flight from the hive, knows where the congregation area is.

In the fall, the workers will drag the hapless drones from the hive, and refuse to allow them to return. Thanks, your services are no longer needed. During the summer though, the drone waits all day for a queen. His sole purpose in life is to procreate, but nature has played a cruel trick upon him.

To mate is to die.

The same mechanism that forms a worker's stinger is adapted to provide the drone's sexual organs. Bees die after stinging. Drones die after mating, his genitals left with the queen, and queens are trollops.

They mate with up to ten or more drones, *while* flying. The different parentage has a number of benefits to the hive. Workers from different fathers begin to cool or heat the hive at different levels, leading to a more even temperature.

It takes longer to hatch a drone than any other bee, and even when hatched, they aren't actually ready. It takes another week or so before they are ready to fulfill their duty. I tell mine to stay in the hive, kick back, and take it easy. Those one flight stands will kill you.

The Hive at Home

Many beekeepers spend their time attempting to control the number of drones in the hive. They feel that a drone's specialized nature is just a drag on the resources of the colony. If the queen fails, they'll order a mated queen to replace her. They are struggling against nature itself.

In hives built with foundation there is no appropriate place for the bees to build drone cells, but the colony still feels the need. The right number of drones in a colony is a tiny fraction of population, but the bees need this balance and they will fight to maintain it. If that means drawing drone cells in between frames or from the tops of hive top feeders, that's what they'll do. The beekeepers tear these cells out and the bees rebuild them.

I leave my bees to draw their own comb and they mix drones in with the workers as they feel is appropriate. If the colony doesn't need drones they'll devour the eggs. Drones can be of great use in the battle with varroa mites, as we shall see later.

Death of a Drone

As previously discussed the life of a drone is one of idyllic pleasure followed by either rejection, starvation or orgasmic death. They do not work in the hive, gather honey or defend it. In fact they skip from hive to hive showing no allegiance to one over the other. The cruel reality of their existence is that to mate, a drone must tear its genitalia from its abdomen and die. Those who do not live to die in mating will be cast from the hive in the fall to starve. As bad as that sounds, there are worse roles for a drone. It could be a pet for my daughters.

This particular drone shared the same special features all drones have: a round barrel shaped body, eyes that touch on the top of his head and a round abdomen missing any hint of a stinger. He was selected for one property in particular - he wasn't very fast. Some people freeze drone larvae to kill varroa mites. Some people cull drones to reduce the burden on the hive. Some people harvest drones for artificial insemination. Some people collect them as pets for their daughters.

I fall into the last category. My girls understand that a drone can't sting. That it can't bite. That it can safely be stroked, picked up, stared at, handled, even squashed (accidentally, of course). The squeals of delight when I gave my oldest the cage echoed through the neighborhood. There were three arguments before I could remove my suit. Two pushing matches before they could get inside. I should've grabbed another drone.

Bee books will tell you that a drone cannot feed itself. Those bee books were written about unmotivated drones because Dronely, as the drone was soon named, had no trouble sucking the tiny drop of honey I provided on the screen. I tucked the cage away under the laptop where it would remain warm and said good night. The next day I wasn't around to monitor the daughter/drone interaction and things didn't go so well.

Now, let's be clear - when I removed said Dronely from the hive I did not expect him to survive. Still, I didn't bear any particular malice toward him. The problems began when my oldest ate her lunch. She was hungry and therefore, she reasoned, so was Dronely. Dronely would not eat buckwheat honey. He preferred mesquite honey, she said. What a co-incidence—Dronely's taste in honey was identical to my daughters. Well, mesquite it was. Now, a drop of honey seems to be fine. The vast pool of honey provided proved too much for Dronely and he wisely retreated to the other end of the queen cage.

My daughters did not grasp that his crop was smaller than his head, or that the honey in the cage was larger than the drone. They tilted the cage so that the honey would flow toward Dronely because obviously if he hadn't eaten it all he must not know it was there. Dronely was quite aware of the ambrosian avalanche rolling toward him and made a break for the opposite end, crawling through the honey on the way.

Now the cage was sticky, so out came Dronely (into a cup, since he could not fly) and the cage was washed and then dried by hand. Next my girls noticed the drone was still sticky, in a clean cage. So they got wet q-tips, and swabbed the drone. Then re-washed the cage.

Unfortunately, the drone was still somewhat sticky, so they concluded that what it really needed was a bath. It got one. Then the cage was cleaned again and Dronely was put back in the cage, cold, wet, mangled, and stuffed. My daughters noticed that he was wet and cold and therefore decided that the appropriate way to fix that was a hair dryer. Nowhere in a natural hive do you find gale force winds at a 140 degrees, so spare a drop of pity for Dronely. The screen on the queen cage had come loose. The girls couldn't bear the thought of him getting out so out came the scotch tape and the cage was quickly "secured". Fed, swabbed, washed, blown and taped, the drone was put back under the laptop stand where warm air could blow on him. That's where he was when I came home.

Did I mention the cage was slightly wet? Tape doesn't stick well to wet cages. Tape came off. Screen came up. Dronely made a break for it as fast as his six legs could carry him. When the girls came back to "care" for him, He was not there. A hunt ensued and I was quickly assured that Dronely was found. They gathered in the kitchen, petting the back of the bee and talking to it, coaxing it back into the cage.

Meanwhile, over at the laptop, I noticed something moving. Something large and black. Something that looked quite a bit like Dronely, though somewhat more sticky, wet, and mashed than when last I'd seen him.

"Girls, which bee are you playing with?" I asked. The worker bee, who could have stung them at any point was soon released. I took the cage and went back to get Dronely. Unfortunately the forces to which he was subjected are never found in nature. Some will tell you that bees have no ability to reason, no way to see what lies in their future. I disagree. As I approached the laptop stand Dronely scurried to the edge and plummeted to his doom.

My daughters were heartbroken. They insisted on burying him in the queen cage but on the way out I dropped the cage and the dog ate him. It was a tragic end to a tragic day.

"You killed him," said my oldest to her sister, "by not feeding him."

"No, Mom said not to dry him with the towel, but you did," said the younger back. I think he jumped.

"Dad?" said my daughter. "I learned something from Dronely."

"What was that?"

"You should never blow dry a bee."

I guess that will do for now.

Lions at the Gate

E45 is a forager, a bee who for the rest of her life will seek out pollen and nectar to feed the hive. Younger bees will stay at home to care for the hive. When E45 leaves in the morning the guards are already lined up on the landing board, fanning out the hive scent. Each time she returns it is like a party as guards greet and accept her. Just beyond them other bees wait to take the pollen and nectar from her. She will rest only for a moment and then be off again.

When E45 leaves the hive she circles upward, outward, catching the light of the sun and navigating by it. She knows her location absolutely just from a few golden rays, and within moments she is well on her way to the nearby fields ripe with dandelions. The colony has an ever present need for pollen to feed the brood and even if there were no brood she could always store it for the spring.

She ventures from flower to flower, carefully scraping tiny lumps of pollen from each flower and packing it onto special “hooks” on her rear legs called pollen baskets. She will visit dozens of flowers to collect the pollen she needs. On the way she is coated with the golden powder and transfers it from one dandelion to the next. In doing so she fulfills her species end of the plant and pollinator bargain. The plants produce far more pollen than they need. The pollinators consume much of it but enough is transferred to ensure survival of the flower.

E45 does not know it but she is not alone in the vast flower fields. Bouncing and buzzing along the ground is a predator, sleek and fast. Though it appears to be injured or incapable of long flights this is an illusion. It touches down every few feet because it is hunting, searching for insects crawling on the ground. As it rises from the ground again it sees a better target – E45.

As E45 skips from one flower an ominous shape buzzes overhead. She flees immediately. Away from the hive she has nothing to defend and so she flies for her life. The predator follows, sleek and shiny, with a long wing span and legs made to catch. Her kind are hunters and E45 is doomed if she cannot escape. E45 flies low along the ground, weaving through the weeds and flowers that jut upward from the ground like towers and behind her the hunter comes faster. It hovers just behind her now as E45 pitches and rolls, partly out of control from her rapid flight, partly in desperate attempt to escape. The predator lunges, and E45 shoots upward, barely avoiding her, but E45 is at a disadvantage. She is carrying pollen and nectar. She is not built for speed.

The hive is near, and its scent draws her onward. There is safety waiting at the edge of the landing board, the safety of numbers, of hundreds of workers and guards who will help to fend off the attacker. If she can make it. She rises up to pass over the tall grass at the edge of the hive and a shadow dives at her.

Struck in mid air she falls to the ground as strong forelegs grasp at her, but E45 is not dead yet. She curls her tail and twists in mid air, arching to sting, and then both grapplers slam into the ground just in front of the hive. The hunter stabs over and over with her stinger, a long jagged blade made for killing. E45 struggles to rise and dash for the landing board but the predator is on her in a heartbeat. Caught firmly by its legs E45 is stung over and over. The predator opens its jaws and tears at her, ripping her abdomen off. E45 dies just a few feet from the hive, and as she lays twitching, the predator takes off, carrying her body away to feed its young. Wasp, we call the hunter. To the bees it is a flying death.

The View of the Hive from the House

From my deck, in the afternoon sun I can see honeybee wings glint as the bees come in for a landing at their hive. Late summer is always a busy time, but this day as I looked a storm of gleaming wings hung over my colony. I went down to investigate, walking through the maze of bees, wondering if this was a swarm forming. On the landing board of the hive I saw a wrestling mass of honeybees dragging something, fighting, and stinging. I knew then why the colony had taken to the air - it was under attack.

Vespa Vulgaris, the common wasp, is the lion of the plains that honeybees roam in their search for nectar. The wasp commonly called a “yellow jacket” is not much larger than the average bee. The primary difference is in how they are wired. Wasps are predators, and behave as such. Today they attacked like a pack.

About once a year I get a link to the “Giant Asian Hornet” forwarded to me, along with the note that 30 of them can kill off an entire colony. That’s impressive, and frightening, but not as much as you might think. The Asian hornet is a giant, but the common Bald Faced Hornet (itself actually a yellow jacket) will set up a ferry chain on the landing board of a hive. A few of the wasps wait, killing the defenders as fast as they come. Others ferry the bee bits back to the nest. The bald faced hornet is tiny by comparison, but no less effective.

Though they appear similar, and most people refer to them as bees, a quick inspection shows that the wasp is about as much like the honeybee as the Volkswagen beetle in my driveway is like a Ferrari. The wasp is streamlined with smaller muscles for its wings. The heaviest thing a wasp will carry is a caterpillar or bee abdomen. Their stingers do not come out with the first sting and their venom sack carries enough venom for several discharges. Their carapace lacks hair giving little for a victim to grasp. Their jaw structure is unchanged from when the wasps were larva - these are the jaws of a killer, a meat eater. Bees have a long tongue with which they slurp nectar. Wasp mandibles are capable of delivering a bite to go with the sting, capable of chewing rotten wood and even mortar.

Disposition wise the common wasp or yellow jacket is unpleasant. While a queen-less hive can be unpleasant and even European honeybees can be vicious, wasps carry the hard wired predator aggressiveness. "Provoking" a wasp can be something as trivial as standing in the wrong spot or wearing the wrong perfume.

Wasps are often considered the psychotic members of the insect kingdom, but really they are a warrior clan. Their colony is driven by a structure as well but in it the survival of the adult is tied to the survival of the brood. Female wasps feed the brood chewed insects. The brood in turn feed the adults a clear sweet liquid. Wasps are driven to hunt by hunger as much as instinct. In the late summer and fall when the queen wasp slows her laying, worker females are driven to forage for sweets. Nectar, Soda, syrup, any sugar will do and they are aggressive because they are literally starving to death. In those times the honeybee colony stands out like a neon lit buffet.

The honeybee is built for different purposes than the wasp. It is built to lift and carry, to care for brood and work its home. It dies if it stings a mammal (but not other insects). It is not prone normally to attack unwarranted. Its design makes it both an able worker and a perfect meal for the wasp. Wasps roam the blooms eating pollen from time to time but their aim is to find a flying meal. A lone bee on a flower will stand little chance against the sting and bite of a wasp, which will ride it to the ground. The wasps will tear the bee abdomens off, toss the still living head and thorax to the side, and fly off with the fat prize. When they can enter the hive, bee larvae will be pulled whole from the cell and chewed alive. Last the honey may be taken but not always. The wasp is a predator and the empty hive doesn't call to it when there are better meals to be had. This day the wasps have come in force. The price of admission to the hive is thirty thousand stingers, but each stinger is attached to a tiny snack. The benefits to the wasps outweigh the risks. The price of failure for the honeybees is the death of the colony.

This does not mean the bees are defenseless. A hive in two deep hive bodies has a population of at least thirty thousand adults. It can mount an impressive defense. Any wasp that goes deep into the hive will be balled, where the workers form a cluster about it and beat their wings. The resulting heat cooks the wasp but leaves the more temperature resistant bee alive. Wasps near the entrance will be attacked en masse, chewed, pulled, and stung. Denied food and under attack, the wasps will be driven back if the entrance to the hive is small enough. The tiny entrance creates a mass of defenders which denies the wasps a numerically fair fight. Soon the air hangs heavy with bees. These bees in the air are hovering, watching for the predators to rise from the hive. The smaller bee,

normally prey, will brazenly attack the wasps in mid air, dragging them to the ground where others join in the beat down. The wasps will take what prizes they can and flee for the day, and in the evening the colony calms.

With sunset both wasp and bee retire to their comb. At sunrise the lions will roam once more and at the gates of the hive battle will be joined again. Only the first hard frost will bring a ceasefire to the war, killing the worker wasps on their comb and driving the bees to cluster in their hive.

The wasp queens will hibernate through the cold of winter until they wake in the spring and begin again to rally their forces. The honeybees will wait, raising new generations to survive the winter, ready to defend their home.

The Hive at Home

Colonies are most vulnerable to wasps when they are small, but wasps are not known for lack of aggression. While they prefer to attack a small colony, hunger can drive wasps to assault even a large colony. What are you going to do about it?

First off, begin by swinging the odds in the bees favor. A single bee versus a wasp is hardly a fair fight. If the wasps aren't interested in fighting fair, well, give them an unfair fight. Reduce the size of the hive entrance. If it's a package, a single bee sized hole is fine. Established colonies should get two inch wide openings. Your goal is to produce an entrance packed with bees, but not to force the bees to stand in line or wait. If they get frustrated the bees will begin crawling around looking for entrances and away from the crowd they are vulnerable.

The wasps know this and you'll see them crawling the outside of the hive, searching for a lonely and separated meal. Feel free to treat them to the end of a hive tool but remember it's the outside of the hive you are smacking. Upset enough of the bees and they'll come outside to communicate their displeasure.

Now that the entrance is smaller, distract the wasps. Many fine traps can be bought, some with angles and curves and complex openings designed to lure the wasps in. A simpler and effective trap can be made from a 2 litre soda bottle. Pour out all but a few inches of soda (this becomes the killing pool) and toss in a hunk of tuna. Set this out away from the hive – you don't want to lure predators in only to have them choose your bees over the trap.

The bottle traps work by enticing the wasps to enter. Once inside they try to fly off, and have difficulty navigating the exit. Some might make it. Most won't, and once they fall into the soda, they will drown. I won't cry for them when they do. Beware placing traps right near the hive – it is easy to attract more wasps than you had to begin with.

The next step is to apply a robber screen to the entrance. This confuses the wasps. They can smell the honeybees, and even see them, but with no knowledge of the actual exit to the hive, it will leave them grasping for bees instead of feasting. You will lose some bees that return to the landing board and are attacked, but better a few bees than the colony.

Finally, no war on wasps can be won without taking it to the nest. Be very careful. The wasps can sting over and over, and won't hesitate to do so if provoked, and killing the nest counts as provoking. Follow a wasp back to its nest and kill the nest. It's the only way to end the war for a while.

When Robbers come Calling

I am not usually afraid of honeybees. I've been around them and worked with them and I generally don't worry about whether or not they'll bother me. Today in the evening I watched as the four or five bees on the porch became twenty, then a hundred, then hundreds. I walked outside and stood in the bee heavy air. Nothing new here. Nothing unusual. Unless you count the fact that my largest colony is currently an hour and a half away, four thousand feet up in the mountains.

So I went down into the yard. Everything that had ever touched a bee hive was covered in bees. They crawled all over the empty boxes. They hung from the empty observation hive. The hive my tiny project colony was in was covered. I popped the top and looked inside. A boiling mass of bees filled the box so I closed it immediately. A swarm, I figured.

The only hive left in my garden contained tiny colony, half a frame of bees. I had no expectations that this colony would survive on its own, it was present to take care of a queen who would be placed in charge of a larger colony when they returned from the mountains. Swarms will at times take over a weak hive with appropriate resources. I've watched it happen before but this was not the case.

As the evening sun dipped beneath the sky the bees began to exit. Ten to fifteen at a time they rose in circles and flew away. As time went on more and more bees left. The key tipoff should have been that there were no bees fanning on the landing board. That's how a swarm lets the other bees know where they are gathering. There were none, because this was no swarm setting up shop. This was a bank robbery.

Honeybees are on average hard workers and honest citizens. They fly thousands of miles to produce the honey the hive requires. They labor day and night to condense the nectar into honey under normal conditions. Sometimes when nectar is scarce, under the load of temptation their work ethic breaks down and they resort to a life of crime as robbers.

Robber bees find a hive by scent, smelling it from a distance. On arrival they already know they are unwelcome. The robbers crawl the edges of the hive looking for an undefended entrance and probe the entrance looking for weak spots in the guard bees. Woe to the colony where a robber tastes sweet success.

The successful robber will flee the entrance and return to her home with news. A taste of the honey sells the others on the plan of attack. They return in waves. First they try the sneak approach, zipping back and forth before the hive. They are looking for an opening in the guards but there is more to this zig and zag than meets the compound eye. They are trying to acquire the scent of the hive. With the hive scent the guard bees will not know to deny them entrance. Those that succeed in

passing the guards immediately steal honey. Even if the house bees drag them out this ill gotten gold will incite more bees to lay aside the law and join the robbers.

Once the honey frenzy is incited the attackers attempt to overwhelm the target colony. The guard bees will not go peacefully. They'll fight to the death, dragging the interlopers from the hive, killing them when possible. While they are doing so others will enter the hive. Inside any bee that gets in the way will be killed. The queen is no exception.

Bee colonies live by social rules that vary with the season. In a nectar flow the colony is a sixties love in and all are welcome. In the late days of summer it is a wild west free for all where might makes right. In the fall the bees return to their matriarchal life where all are cared for equally (except the drones). The rule of most seasons is a respect for the colony and the society it forms. In a robbing frenzy the carefully capped honey cells are ripped apart, leaving ragged edges. Honey cells are ravaged by dozens of frenzied bees. Soon the guard bees are overwhelmed and with that the colony loses its drive to defend. In the evening the massacre slows and fades off. The victim colony tries to reorganize itself but it is doomed. The robbers will return with the first light to finish what they have started. When the comb is picked clean they'll leave the remaining bees to starve to death.

A strong colony could defend itself. A minor colony could be defended by reducing its entrance. With a few guard bees plugging the entrance the robbers would be stymied in their assault. The honey frenzy would pass and the robbers would recede like the tides. A robber screen could be applied, misleading the robbers while giving the colony a chance to regroup. That couldn't happen to my tiny colony. The assault had destroyed colony C.

This robbing behavior is most common in a nectar dearth, when the foragers still feel driven to feed the colony and grow its stores. In the wild it assures that the strong colony grows stronger and the weak colony is destroyed. As a beekeeper it leaves me watching and waiting for the fall, when the cold weather forces the bees to renounce their lawless ways and again live by kinder rules of bee society, each bee to her own colony, share and share alike.

At the edge of existence

E21 has never known the light of the summer sun. Hatched in the darkness of the brood nest, she emerged into a world that contracts and shrinks with the distant winter sun, the world of the winter cluster.

Before she could fly E21 worked for the good of the colony, beating her wing muscles to generate heat. One day when the temperatures rose and the cluster dissolved to feed she ventured to the bottom of a comb. The floor of the hive was littered with wax cappings stripped from cells as the colony fed. From the entrance to the hive shone a bright, cold light but with it came a cold breeze that numbed her. She retreated to the safety of the brood nest taking a full stomach of honey with her. She shares this honey with the others and they with her. Together in this way they have passed many bitter nights. Some bees will live their entire life this way, born in darkness and abandoned to the cold when they die but E21 lives at a time of change.

Day by day the light has grown longer, stronger and this has triggered a new instinct in the colony. The queen, who barely laid in the fall and ceased entirely in the depths of winter, has begun to lay again. In the summer the foragers packed many cells full of pollen, far more than they needed. Those foragers are dead and their memory has passed from the colony but not their legacy. It was for this time that they prepared. The colony now uses its precious stores to feed a rush of new bees.

Where the cluster once moved freely about the hive they are now rooted to the brood, who must be kept warm. By day they fan out to retrieve food, by night they cling obstinately to the brood, struggling to protect them from the cold. Sometimes the brief break a nurse bee takes to feed is too long and the larva succumbs to the cold, but E21 is dedicated to her duty. She would stay with them to the death.

The queen keeps the brood close together through the winter but during a warm spell, she lays a few eggs further down than the others. E12 begins caring for the just hatched larvae at the far edge of the brood nest, unaware that fate has set in motion the events that will lead to her death. That very evening a cold front drives the clouds away and this drive to expand becomes deadly. A niche of bees has formed about the tiny patch of brood and they will not abandon them.

As temperatures inside the hive drop the main cluster shrinks, abandoning brood only as they die. The space between bees becomes smaller, the heat shared greater, and a thousand more stomachs share food to survive.

Just inches from the main cluster this smaller band of bees struggles on their own. Without the shared heat they must work harder. This means burning more food. During the day the depleted food stores are just out of reach. As the main cluster moves higher and higher,

fewer bees pass the tiny cluster on their way back from feeding. Then the final night comes.

The tiny patch of brood is only a few cells large now and the bees are exhausted. As their stomachs run dry so does their ability to warm the brood, and as the night hours slip by, the last one succumbs to the chill. Now the nurse bees band together. E12 slips to the heart of this tiny ball, waiting with no sense of time for the sunrise. It will never come. It is too far to the main cluster for them to make a crawl for it, so they cling to each other and continue to try and keep warm. All of their energy was spent on the now dead brood. In the bitter cold of early morning E12 twitches a few final times, and then the micro cluster is dead.

A few days later with warmer temperatures mortuary bees drag bodies from the hive. Among them is the bee known as E21. Born in the darkness, raised in the warmth of the brood nest, she has given her life to the change of the seasons and the demand that the colony grow.

The View of the Hive from the House

If you stand down at the edge of the garden as the night falls, the smell of honey and wax drifts up the hill toward the house. With it comes a low humming, constant despite the wind. It is a sound that heralds spring and the sudden thrust of the colony toward starvation or success.

Spring is coming with the maples though you wouldn't tell from the weather, fifty degree days and forty degree nights. The bees know. They know in the way that they know all time, by the ebb and flow of the sun. Though it is hidden from view they have known from the winter equinox and begun a shift in behavior that will bring the colony roaring into spring or kill it in the attempt.

In the bitter cold of winter the bee garden was silent. I stood by it in the snow, listening for signs of life, and hearing only the sound of the falling snow. In the cold they hung on, clustered tightly together, their wings vibrating to generate heat, but just enough to live. This was actually the safest way to survive winter, as they consumed very little food.

Even then at the heart of the cluster the colony continued its business of breeding, a tiny handful of brood raised where the cluster could heat both sides of the comb. These winter bees had never taken an orientation flight, never left the dark safety of the hive, but they represented both the future hope for the hive, and its greatest danger. Fall bees eat more pollen, and live months longer than their summer sisters but they are not forever. Only new brood would have the strength to forage in the first cool days of spring. The danger lay in the bee's instinctive drive to care for their brood. The sound from the hive is the sound of bees vibrating their wings to keep the brood

warm, a balmy 90 degrees even in the depths of winter. A sudden cold snap can cause the cluster to contract sharply, covering only the tiny brood nest. If a patch of brood is isolated the nurse bees will not abandon them. A tiny sub-cluster forms, dedicated to saving the larva. The cold of winter is merciless and they die with the brood they struggled to save, starving to death as often as freezing.

I found such a patch when I tore down the hive for a frame by frame cleaning. A patch of brood the size of my palm still covered in dead bees. Some still had their heads stuck into cells where they starved to death looking for food long gone. I brushed them off. Future generations would clean out the dead brood, polish the cells and grow over this dead patch. In time only scars on the wax would tell it was there. As for the main cluster, the queen was well and working hard at expanding the work force. I found her at the edge of the brood nest laying in cells that had not held bees for months. In a few weeks there would be a massive population boom.

The change in behavior from hanging on to building up is as unavoidable as the risk that comes with it. The colony must build up in order to take advantage of the nectar flows that come with the spring, maple and cherry, but to do so is a gamble. Winter stores are dangerously low in early spring and though the foragers find pollen everywhere nectar is scarce. Without it they will starve. Their winter stores are not enough to survive until summer is full on but if the rush of new workers arrives before the food to sustain them, the colony will starve in a matter of days, destroyed by its own drive to succeed. If the workers arrive too late they will miss the nectar flows and again push the colony as a whole toward the edge of its existence.

This is Nature. This is Life.

In this environment the bees have lived for millions of years, each colony every year surviving or dying at the drive of instinct and the intersection of environment and weather. I worry about if they will make it but probably for nothing. Their clock may be their own but it has been set and tuned for ages beyond my imagination for the survival not of a single bee nor of a single colony but of the species.

The Hive at Home

Winter is the time of rest for the beekeeper. Spring is not. With the shift to longer days the instinct of the colony shifts. When the first dandelions bloom and the pollen starts coming in, the queen begins to ramp up laying. What do you do?

Feed, if the colony needs it. You can tell if they need it by lifting the edge of the box. Bees and comb are light – it's the stores that are heavy. If the box feels light you need to feed. 1:1 sugar water will stimulate more growth

but if you commit the colony to growth you had better be prepared to see it through. A colony can starve in just days. 2:1 syrup or high fructose corn syrup will feed the bees without stimulating as much growth.

When choosing how to feed keep in mind your temperatures. In very cold weather the bees cannot break the cluster to move about and access stores. The absolute total emergency way to food is to place a sheet of newspaper over the inner cover (fold or cut it, the goal is to provide a platform, not a blockade) and sprinkle sugar over the paper. If anything better is available the bees will ignore it. If they are starving and can reach it they will feed.

A second type of emergency feed is a candy board. A candy board is an inner cover with a deep lip. Candy fondant is cast into the lip and allowed to harden. Placed directly on top of the top bars the bees naturally move up and can eat the candy to survive. Again this is a stop gap measure.

If you own a hive top feeder remember that even starving bees might not be able to make it up to the syrup to feed. They can starve to death with honey or syrup just out of reach. So what to do about that? One option is to feed warm syrup. The bees will automatically gravitate toward the warmth and food.

Another thing to consider would be feeding with a boardman feeder over the top bars. Be careful! A leaky feeder could leak syrup over the bees, and the cold will kill them all if that happens. A feeder just off to the side of the cluster or one that doesn't leak is a better choice. If the bees can move about during the day, they can move to the feeder enough to suck the syrup out. Watch the syrup level closely – if you need to feed, you'll probably need to feed for the rest of spring.

The choice is yours. Pollen patties can be produced from soy flower and brewers yeast, but the bees won't take them if real pollen is available. Wrap the hive in tar paper to increase solar gain, and make sure it has ventilation so that moisture buildup in the hive doesn't kill them.

There is little the beekeeper can do to help at this stage, but the bees have survived for thousands of years without you, so relax. Build your woodenware. Wire your frames if you do so. Melt wax and read up. These days are short, but in the spring you will be busy enough for the rest of the year.

Borrowed Warmth

Fresh falling snow is a wondrous event where I live. It paints the houses and roads in white and makes the world seem like a canvas made fresh and new again. It also makes it easier to see the fate of dozens of bees who brave chill winds.

Honeybees cluster together whenever the weather is cold. They do not leave this cluster at all for weeks on end. When the temperature rises, however briefly, the workers are pushed to make a desperate flight or face death in the hive.

The reason for this flight is biological. The bees have not left the cluster through the winter months and they will not defecate in the hive. Their guts are packed now with the detritus left from consuming honey, primarily ash. There is very little of it but bees are quite small. Sixty percent of their weight might be fecal matter when they take this cleansing flight, so a brief rise above forty degrees drives the bees to take their turn and spin the wheel of fate.

In the summer different dangers await just outside the hive. Wasps, dragonflies, birds and man wait to take their toll. In the winter it is the cold itself that lurks, waiting to chill their wing muscles. Once chilled they can no longer fly and fall to the ground. Death follows shortly. Many of those leaving the hive will not make it back. Some have never left the hive and get lost coming back. Some are weak and succumb to the cold immediately. Their bodies pepper the white snow with dozens of brown and black dots.

I walked down to the bee garden and listened, hoping to hear the cluster keeping itself warm. The only sound was the soft falling snow. I reached down in the snow and picked up one of the fallen bees and sighed. This bee had all her hair. She was still new, probably bred in the brood nest just a few months ago. She was ancient by her summer sister's standards but brand new by winter's measuring stick.

I held her in my hand and observed her wings, hardened but unscarred or fractured. She had not lived long enough to work them away. The snow that clung to her melted to water in my hands and ran away. That was when her antenna moved.

I wasn't sure at first, then I saw it again, the single twitch of an antenna. I cupped my hands now against the evening and watched. Again the antenna twitched and a foot moved. I breathed gently on her and waited. "Bees will not tolerate impure air from human lungs," says one of the precepts of beekeeping. Bees will quite happily tolerate it if they are nearly frozen. This one could have stung me at any point but chose not to. She began to buzz and vibrate her wings and then to crawl. On the flat of my hand she reached out her tongue and licked my palm. I had carried syrup down for the feeder and my

hands were sticky. She sat there for minutes warming herself and preening. When she was done I placed my hand near the entrance to the hive.

She looked at the entrance and crawled down to the tip of my fingers. With a short hop she was inside the colony and soon safe within the heart of the cluster. One by one I checked the other bees but there were no other miracles to be held and had. When the sun slipped again behind a gray pale I left the hive and made my way back to the house. Would the lone bee survive to the spring? Would I see her again on the warm days. I didn't know. I didn't need to.

The Drive to Thrive

E121 lives in a colony racing into spring. She was born in the darkness but the lengthening days promise that spring is coming. Cold nights and chill winds do not cause her doubt her clock as it is set by the earth's turn. The foragers are bringing in pollen from the first dandelions and E121 can see the yellow flowers from the hive entrance on the day she takes her orientation flights. They call to her but a touch from the foragers at the entrance assures her that others are providing for that need. E121 is at the perfect age to draw wax and she spends much of her time hanging in a chain with other bees. This day E121 is working the wax, crafting it into the newest cells.

Honeycomb cells are hexagonal and near perfect for use of material and structural strength. E121 did not design the pattern but it is burnt into her instinct in ages long gone and she works it perfectly. She is one of a team of workers, each taking tiny flakes of snow white wax and chewing it, plying it into cells. She goes to collect flakes, walking the chain of living bees and returns to find her sisters have stopped.

The scent in the hive is not right. Though they cannot say this in words they know it. The scent of the queen mother is weak when it should be strong. It is spread as the queen passes and as others follow in her tracks. Its presence assures the colony that the queen is strong, that it will grow fiercely into spring and summer, ready to explode forth on the blooms. The queen's scent is weak and it causes the workers to pause.

A Queen Cup E121 isn't sure which of them acts first but suddenly they change designs in mid cell. It is agreement by action and other bees gather to assist. They build a volcano shaped structure into the comb, tearing away any opposing comb to keep the structure clear. The volcano peaks as they continue and then changes. Flake by flake a ball shaped structure grows from the tip of the wax spike. This is a queen cell. Across the brood nest other bees are doing the same, a mountain range of queen cells arises in the scope of a day.

The E30 is the queen. She is not dead. She is not missing. She is present and laying as often as possible. She has no choice. She wanders the wax city laying in rings and patches as the cells are available but as she moves past one of these outcroppings the bees surrounding her stop. She wants to move on but faces a wall of bee heads. The drive to lay grows by the second and she twitches with frustration. She circles the queen cell, probing it until she finds the cell opening. Quickly she lays a single fertilized egg in the bottom and rushes out. Now the workers let her pass. When she approaches the other queen cells they will repeat this act, forcing her to lay the seeds of change.

These eggs are laid in special cells and they are chosen

by their sisters for a special task. E78 hatches three days after her egg is laid, not the first of the sisters laid nor the last. She floats on a puddle of royal jelly much larger than her worker siblings receive but more importantly she is visited constantly. Hundreds of times a day her nurses attend to her and her sisters, feeding E78 as often as she can eat and she grows fat. The reason for her special cell becomes quickly apparent, E78 is far larger than a normal worker bee. She is even longer than her drone brothers though not as fat. Stuffed with food she grows at an astounding rate and ten days later her sisters seal her into her cell to complete her transformation. For the next four days she will undergo a metamorphosis which is a race between the queen-lings. The winner lives.

A capped Queen Cell and Attendant. Three days after she is sealed her wings are formed and she is nearly ready. Her worker siblings laid at the same time will not hatch for another week. When she can she presses her thorax to the wax and vibrates, causing a strange noise to echo through the hive. As the hours pass E78 repeats this and then suddenly freezes – another sister has answered, piping on her own. E78 begins to gnaw at the cap of her cell. For what seems like an eternity she nibbles, chewing the round dome off of her cell. She rests only for moments to pipe and then continues. Her hour is at hand.

In the early dawn of the 14th day of her life E78 pushes her way out of her cell and into the bustle of the hive. It never sleeps and neither will she until she sleeps forever. She rests on the tip of her cell and then slurps some nectar from a nearby cell. Suddenly the piping sounds again and E78 is momentarily frozen. When she moves again it is with purpose: a royal rage grips her, driving her through what must be done. Quickly she finds the nearest queen cell and tears into it. Ripping chunks from the wall, E78 quickly forms a window into her sister's cell. Her sister is nearly hatched but not quite ready to escape. She will not. E78's stinger is smooth and curved. Though it will not kill her to sting a mammal it is made to be used on other bees, on other queens. She stings her sister to death, stopping only when her rival is lifeless. Then she moves on to the next cell, and the next, and the next.

The last cell is already open. E78 circles it. The scent of other is here, the smell of a rival. The workers cannot sense it but E78 can smell nothing else. She flattens herself out and pipes for the first time since she left her cell. From the brood nest above her comes an answer. E78 turns in the darkness with surety, heading for the sound, knowing her sister is coming as well. Workers pass her in the darkness, touching, brushing her but she ignores them. Suddenly she runs near headlong into another bee. They flick tongues out, testing the scent.

It is E91, her only remaining rival. They stand head to head, testing again and again. Without warning the battle is joined.

E78 leaps onto her sister and the two tumble to the bottom of the hive, bouncing off of bees as they go. Their abdomens flex and twist as each writhes, attempting to strike a killing blow. The workers around them could put a stop to it if they desired to. If the colony were ready to swarm they might but in supersedure they will not intervene. E78 and 91 wrestle through the morning hours, neither able to gain an advantage but E91 is weakening. She breaks off the battle and scurries for the hive walls, seizing precious moments to rest. E78 senses an advantage and presses the attack. Again they fall and this time E91 lands flat on her thorax. With a single well timed strike E78 stabs deep into her sister and the battle is decided. E78 stabs her rival over and over, not stopping until other bees seize the corpse. The mortuary bees drag her sister to the entrance of the hive and E78 retreats to the darkness. She pipes once again and this time there is no answer. E78 is triumphant but she is not yet the queen.

The following days and nights join together. E78 commands no court of workers but her footsteps leave a scent that consoles the workers. The queen is failing but a change of heart is at hand. She takes orientation flights on her 18th day of life, circling ever further from the hive. One day as she returns to the hive the guard bees deny her entrance. It is warm day and the foragers are busy. They enter and leave as they please but the guard bees block E78 each time she tries to enter. Frustrated, she takes wing again and this time at the apex of her flight she feels a pull. The foragers follow paths in the air she doesn't know about but this pull feels familiar to her. As she flies out the drones take flight. She will mate in mid air with dozens of them. When E78 returns to the hive the drones do not. Drones live only to mate and depositing their sperm in her spermatheca has cost them their life. For their sacrifice E78 holds the keys to tens of thousands more bees in her abdomen.

When E78 returns to the hive she is changed forever. She loiters about the comb, lost. The other bees have a purpose but E78 cannot find it within herself to follow their lead. One day as she rests on a cell she feels an urge, an urge her sisters will never know. Awkwardly she peers into a cell and measures it, testing it. It is good and she back out and then back in, tail down. She is new to this and backs right into the bottom of the cell. Then she adjusts and effortlessly lays an egg. As she leaves the cell workers have gathered around her. If she were a worker and not a queen they would pull her from the cell and devour her egg. The first worker in to inspect is E121. E121 smells the egg. The scent is not of the queen, not the smell of E30 but it is right. New,

different, but right. The egg is left. E78 selects another cell and lays again, slightly off center. Again the workers test her egg and accept it. As bees pass her they stop to touch E78 and then pass on the scent. Word spreads through the colony of the new queen.

E78 encounters her mother only once. She passes her on a comb at the edge of the brood nest, where E30 continues to move from cell to cell, laying at times. The aggression E78 displayed to her rivals is absent. She is a laying machine and the desire consumes her every moment. She cannot remember a time before eggs nor the look of the sun in the morning. If she had an identity before hand it would be lost now. She cannot even remember to feed herself, there is only the desire to lay.

A few weeks later the early sun warms E78's colony and the first rays find the mortuary bees struggling. They grasp and pull at their load, straining to get airborne. They are carrying away E30. She died in the night, neglected by her workers and left at the edge of the cluster. The colony is once again well and waves of her grandchildren will rise in the months to come, carrying it onward.

The View of the Hive from the House

In the depths of winter, a colony of honeybees holds tightly in a cluster, wagering their survival on the heat their wing muscles generate and the stores they prepared the previous year. As one they heed the command of instinct: Survive. In the early spring the colony walks the razor's edge. Build up too soon and they will starve before the first blossoms. Too late and the colony misses a vital window to replenish meager stores. For the colony that passes these trials new challenges await requiring new sacrifices. The greatest of these may fall upon the queen. She will take part in a ritual that can only end in her death, as a new command awakens with the turning of the sun. Survive has become Thrive.

This ritual, known as supersedure, will not play out in every colony. The absolute reasons for it are known only to the bees. By instinct they gauge the state of the colony, weighing its growth rate, health, stores and a thousand other factors. If the queen is well, if the colony is healthy and the growth is solid, the drama ends. One known contributor is a type of Queen pheromone that is left as the queen passes over the comb. Other bees track this scent about the broodnest, and it is a direct inhibitor of the desire to build supersedure cells.

If the colony is stunted by disease, parasites, weather or other factors, the blame falls first on the queen. This vote of no confidence will be fatal to her, as the writing is in the wax. She has been measured and found wanting. The workers craft queen cups from the wax, oval balls that protrude from the cell face like a tiny hollow marble. Unlike the queen cells prepared for swarming these

are high in the brood nest, safe and warm. When bees are swarming the queen cells hang from the bottom of frames, and number from seven to fifteen (or more). In supersedure the goal is to produce a single queen, so they do not need numbers. The wax is smoothed, polished, worked over and over, until the queen approaches. She will lay a single fertilized egg in each queen cup and then the workers take over. They cling to them fiercely, vibrating their wings to keep the egg and larva that hatches soon warm. The larvae inside will eat a special diet of royal jelly, far more than the peasant sisters who raise them were fed. Moreover, workers feed queen candidates an order of magnitude more often than their common sisters. A developing queen larva may be fed over a thousand times, a normal worker only three to four hundred times.

Even as they act for the good of the colony the bees are also working for the good of the species. This mass creation is an act of genetic roulette. The current queen mated with up to ten drones so the probability is high that the princesses are half sisters. These different fathers have endowed their daughters with genes selected for quick birth. If the colony were preparing an emergency queen, she would hatch as soon as possible. In supersedure since the goal is a single queen the workers will not prevent the first hatchling from destroying the others. The virgin queen who bursts from her cell first rests a moment. Then amid the buzz and the hum of the hive a sound enraptures her. It is a sound like the quack of a duck, the piping of another virgin. It awakens a royal bloodlust and she quickly searches out her rivals. To find them, she pips, a sound produced by vibrating her thorax against the wax. Instinct demands of the unhatched queens that they pip back, playing a deadly game of marco polo with their soon to be murderer. She rips into their cells from the side so that they are helpless, turning their wax beds into wax tombs. With the time of her birth the princess claims her queen right. With the blood of her sisters she seals it. The workers will drag their bodies from the hive and cast them aside.

A virgin queen is torn between instincts. One whispers that she is safest when she runs. The other drives her to pip from time to time to assure herself that she is alone. With the passage of a few more days her wings harden and her hairs stiffen. The sunlight that strikes the entrance of the hive is no longer so frightening. It beckons to her and she approaches the entrance. She takes ever widening flights, assuring herself that she can find her way back. Then she returns, waiting for the next urge to drive her on.

When it comes she leaves the hive. She is only twenty one days old. Other eggs laid at the same time as her will barely hatch today, on the day she changes her role forever. The other foragers are weeks older. She flies out

with them, then leaves the forage paths to follow a map no other can see. It leads over the local Drone Congregation Area, where drones from all neighboring colonies have gathered to wait. The virgin queen bears the combined sex drive of twenty thousand sisters, so on this flight she will mate with ten to fifteen drones before she touches the earth again. This isn't the head cheerleader dating the quarterback. This is the head cheeleader dating the entire football team. Like some b grade horror movie, when the homecoming queen returns, her suitors are dead. The same apparatus that forms a worker's stinger forms a drone's genitals. After mating he literally pulls them out of his body, and falls to the ground, a look of rapture on his tiny face. She leaves the hive as princess. She returns as queen.

Safe again in the living city of wax, a new desire consumes her. It is a call her worker sisters can never hear, a command so strong and loud that it drowns all other instincts. She will not fight. She will not clean. She cannot even remember how to feed herself. She knows only to answer this new command, Lay. She does. She may lay unevenly at first, perhaps two eggs to a cell, but quickly she finds the ancient rhythm like the heartbeat of the hive. Around her a court of workers grows, dispersing her scent, her pheromone, her voice to the hive.

She may lay side by side with her mother or never encounter her on the wax plains. In time her "voice" will be so strong that she is the queen; the only queen. The old queen may be crushed by the workers. She may be thrust from the hive entrance to the night chill. She may simply be ignored, till she weakens and falls to the hive floor. Thrive is no kinder than Survive. Sister against sister, daughter against mother, for the good of the Colony it will be done.

The Hive at Home

Just exactly what are these mutant outcroppings? Queen cells? Oh no, the hive must be preparing to swarm! Not exactly. Though it is true that sometimes hives will swarm with queens produced higher up in the broodnest, most often the presence of one to seven queen cells on the middle of the combs indicates that the bees are superseding the queen.

Sometimes beekeepers are tempted to try and save the current queen, but I assure you the bees know better than you. The real question becomes whether or not to let the supersedure play out or to replace the queen on your own. To start with, it helps to make certain there really is a larva or egg in the cell. Some bees keep queen cups around for insurance purposes all the time. If yours do, check those cups every time. An abandoned cup is not likely to have a larva. A cup where the nurse bees refuse to move, where they back in and out constantly?

That one has a queen to be in it. Now it's time to decide.

You could let the drama play out. It happens a lot, even more than most beekeepers realize. A study once found that 30% of all queens are superseded, often without the beekeeper ever knowing. It helps to remember the timing of queens. Three days for the egg to hatch, ten until the larva is capped, and four more until the virgin queen hatches. Five more until she mates (weather permitting) and possibly a couple more weeks until she's really laying. 45 days. That's a long time to go without new bees. When she first hatches the virgin won't lay.

Virgin queens run. They run fast. They hide on the walls of the hive. The easiest way to spot a virgin is to pull a frame, then look down at the next frame, still in the box. See a bee running headlong for the dark? Crawling over other bees to get there? That's the one you want to get a closer look at.

Virgin queens fly. They aren't tied to the hive. Laying queens rarely take off. Not so the virgins, and you just hope she comes back. Usually they will. Don't chase the virgin unless you have to catch/kill her. Remember the bees won't defend their queen. Not a virgin, not the laying one. You can squish her on the spot. They won't care for a bit.

The best time to decide is before the virgin hatches. When they're trapped in that cell you know where they are. You can cut them out, transfer the frame to a nuc, or leave them be knowing what is where. If a hive has a virgin loose in it, it won't accept another mated queen. It will kill her. It will wait patiently to do so. So decide before hand.

If you are going to let it play out, leave the hive alone for three weeks at least from the time the cell is capped. Then monitor it closely for a laying queen. Feel free to check back in a week to see if she hatched, but after that, leave her be for a while. If you are lucky you may get to see the new queen head out for her mating flight – the hive will issue a mini explosion of bees as any available drones will follow her out. The queen is headed for the local drone congregation area, but those drones are of course interested in getting a head start.

If you are going to introduce a new queen, do something about those cells. I prefer to put them in a nuc and see how they develop. If she does well you can grow the nuc into a full colony. On the other hand, if something goes wrong you can merge the nuc back into the main colony and have her take over there. Either way order a new queen. While you need to remove the old queen, make certain you have a replacement queen alive, present, and ready to go. Otherwise you will make a bad situation worse if your replacement arrives dead and your colony is queenless. When you have the new queen in hand, find and squish the old one. Hang the new queen in

her cage and let the bees get used to her with the candy still covered with a cork. You cover the candy because a strong hive can blaze through that candy in hours. If the bees aren't aware the old queen is gone, it will take a bit for them to decide not to kill the new queen. Given that you may have just shelled out a large chunk of change for her, I would recommend patience. After five days or so go back and let the queen out. The workers on the cage should be extending their tongues to her and otherwise trying to care for her. If not, remove the cork and let them chew through the candy. A week later you can go back and look for eggs.

In supersedure the key thing to remember is that you need to monitor the hive for a laying queen. If the old one is just fading out everything will be fine while you get a new queen. If she stops laying entirely you may need a queen immediately. Watch carefully, be patient, and remember the bees know better than you do in most cases. As always.

The Empty Throne _____

I hold as a firm tenet that in most things related to beekeeping the bees know better than I. Those times when I impose my will are few. I reserve them for where a natural tendency might lead to the destruction of the colony or where I insist upon a honey tax in return for letting them live in my small wooden boxes. Sometimes I forget and must be reminded. When the workers built supersedure cells to replace a favorite queen of mine I had in mind a royal rescue. I thought there was nothing wrong with her. The bees knew better.

When I opened the hive again to find the supercedure cell capped the brood nest was clogged. Capped brood were emerging everywhere. My previous efforts to open the brood nest were nothing compared to the forager's dedication to the cause and two more frames were clogged with nectar. Most disturbing however, were the empty cells. No eggs anywhere. No larva anywhere. No sign of the queen, though I spent half an hour looking for her.

Where had she gone, the once leader of this colony? I could not say. A week ago the colony still had larva, so ten days before she was still at work. The larva I had seen last inspection were fat, C shaped, a couple days from being capped for their adult transformation. The brood pattern was tight, nest was packed and only the supersedure cells gave warning that problems abounded. I theorized that her supersedure was based on a lack of space to lay and planned a quiet coup de tat. I would spirit the queen away to live in repose in a nuc. The bees knew better.

Where has she gone? A queen on her own is lost, helpless and will starve. I found no evidence of her anywhere. A daughter waits to emerge in three days and take her place, but of the once regent there was no sign. The bees knew and prepared for a calamity I could not see coming. They were ready for an event that would have spelled the end of the colony. I have learned to read the stories written in the wax walls, to read from the cells a tale of the colonies health but again I am reminded. I am not a bee. The queen is dead. Long live the queen.

Pretender to the Throne

E55 hatches as the last of the brood in her colony. She emerges into the brood nest and before she has even dried, before her hairs are fluffed, before she has sipped a first draught of nectar, she knows that something is wrong.

Where E55 hatches she should be surrounded by bees of all ages and types. Instead everywhere she turns she finds only her older sisters. She can find no trace of her mother, the queen. Where she has gone the other bees cannot say but she is no longer here. In her absence the colony is sick.

The scent of the queen normally unites the colony and though she does not truly rule it, her presence is essential to its survival. For this reason instinct has burned her pheromones into the workers as the scent of calm, the smell of well. The colony is knit together by dozens of chemical flavors, each conveying something about the status of the colony as a whole and individual bees, their actions and intent.

Pheromone communication is built into bees from the moment their eggs hatch. Brood emit a pheromone that tells workers their sex, age, if they are ready to be capped, or even if they are hungry. Brood scent is the other half of the pheromone equation that tells a colony that it is well. E55's colony is missing both.

In the absence of something to unify them each bee does as it sees fit. Some haul in pollen on overdrive, stuffing entire combs full and then scrambling out for more. _There are no brood now, but there will be soon. The brood will need much pollen_ says this instinct. Younger bees hang on the comb, barely alive. They eat and rest, rest and eat. At this age they should be caring for young but there are none.

E55 has cleaned her cell and every one around it a dozen times at least. She scurries from cell to cell, checking them over and over again. Surely somewhere there are eggs to hatch and brood to care for. There are none. Bees can raise an emergency queen from appropriate age larva in just fourteen days but this colony has no brood. It has no hope.

E55 has never left the hive, even though she is nearly two weeks old. The hive is in no danger of starving with the foragers working but the youngest bees are two weeks old with no replacements underway. As the days past E55 has felt a strange urge stirring deep within her at times, an ache that she has no words for. She is changing.

Some species of bee have the ability to lay a special egg which develops unfertilized into a female who can be raised into a queen. Honeybees do not share this unique ability but all females retain the "plumbing." Every female has ovaries, every stinger can be used as an ovipositor. In a healthy colony the scent of the queen

and the brood prevent workers from developing ovaries but without this inhibitor E55's body has changed. She is not a queen. She can never be. That will not stop her from trying.

One afternoon as she cleans a cell over she pauses midway into it. If it were a honey cell she might be drinking, with her tail sticking out instead she is measuring it. This itch and urge within her has been growing and as she inspects the cell something feels right about it. She backs out and pauses, then backs in tail first. When her forelegs touch the rim of the cell she flexes her abdomen downward and touches...nothing. E55 was not raised in a queen cell and so never developed the long abdomen that allows a queen to reach the bottom of the cell. She curls her abdomen and lays an egg on the side of the cell. Around her a pair of workers takes notice of her actions and grapple with her.

E55 is hauled from the cell and a worker darts in. A queen's egg is doused with queen pheromone when it is laid but E55's egg has no such pheromone on it. The worker sniffs it and then devours it. E55 scurries down the comb and then slows. She measures a new cell, then backs in and lays an egg. It feels right. It feels good. She backs out, then back into the same cell again and lays another and another. Though she shares the mechanics for laying her instincts are undeveloped so E55 will lay anywhere.

Workers continue to devour E55's eggs but not all are found in time. Some hatch and once hatched the bees will care for them. E55 has never taken a mating flight and cannot lay a fertilized egg, so her children will all be drones. Drone brood emits the same scent the colony so desperately desires and it is calmed. E55 is changing further as time goes on. With each act of laying she becomes more and more sure of her position and now her body even emits a pale imitation of the queen scent. In the absence of a true queen the bees cannot tell the difference. The workers no longer devour her eggs. Instead they care for them and soon a wave of brood line the combs, all drones.

The oldest workers are dying off and a new generation is not emerging, so the colony clings to life, consuming its stores in the absence of foragers. They are holding on for the hope of the brood to come. When the brood do hatch the cruel reality is laid bare. Drones do not work in the hive and have no stinger. They can only consume precious resources. The hope of the colony has been shattered.

Without workers to defend it the wasps set in like vultures. No longer content to scavenge bee corpses from the area outside the hive they now venture in, plucking E55's helpless children from their cells, devouring drones at will. E55 is ancient now. She is a worker, and workers live only a few weeks. When she dies there

are no mortuary bees to ferry her from the hive. A passing wasp does the honors, feeding E55's corpse to its ravenous children. The colony has been brought to ruin by the loss of their queen and the disastrous reign of E55.

The View of the Hive from the House

Of all the chemical blends essential to a functioning hive brood pheromone is the most vital. Brood pheromone is what tells the workers that the colony is growing, that it has a future. Brood emit pheromones from the moment they hatch for the rest of their life. The general scent they emit tells the colony that there are open brood. This scent is an anchor which will draw the nurse bees to the brood and keep them there. Only Africanized Honeybees abandon brood.

The brood also emit another pheromone that tells the workers which sex the developing larva is. In a healthy colony a lack of drone brood will drive workers to produce drone cells. In a laying worker colony the scent is everywhere, but the worker scent is missing.

As noted, all female bees share the core organs needed to lay. A worker has ovaries, though they are tiny and underdeveloped. She has a stinger with which to lay eggs. She even has the sperm sac with which she could fertilize the egg. For all of this the worker is still not a queen.

Queens are raised in special queen cells, which allows them to grow longer abdomens. Queens are fed a thousand times or more as larva. Queens take a mating flight, allowing them to fertilize eggs. Most importantly, Queens develop solid laying instincts.

When a hive has a queen and open brood, the brood and queen pheromones suppress the development of a worker's ovaries. The workers are kept in check by the scent of brood. Even if a lone worker were to develop a laying urge her eggs would not be covered with queen scent. Attendant workers check the eggs to make certain they contain a queen's marker. A laying worker cannot cover her egg in this marker, and the workers perform an action called "worker policing" in which eggs that are not a queen's are devoured. Hatched brood are another case entirely (open queen cells being an exception). Once a larva hatches the nurse bees will care for it. This is true if a larva is a worker, and true if it is the first drone of the season. It's unfortunately true if the egg is the thousandth drone in the frame.

As stated before workers can lay only unfertilized eggs. Unfertilized eggs can develop only into drones. Drones can't assist the hive in any way other than to fertilize queens, so the development of a laying worker is a mortal blow to a colony in most cases. To complicate matters, though E55 was the laying worker focused on, in most laying worker hives multiple workers lay. Removing a single laying worker won't resolve the issue.

The final complication on the matter is brood scent. The drone larva give off a scent that partially satisfies the worker's desire for brood. A laying worker colony considers itself queenright, so even if a true queen were offered to the colony they would not accept her. This leaves the colony in the untenable state of having no new workers, no functioning queen, and an ever rising number of drones. A laying worker spells the doom of a colony without drastic measures.

The Hive at Home

Every beginning beekeeper, faced with a lack of eggs, immediately suspects a laying worker. The facts of laying worker development indicate that in most cases this fear is unfounded. Remember that it takes weeks for a colony that is without a queen to develop laying workers. Begin by asking yourself some basic questions:

1. Do I have open brood that are not drones or capped worker brood? Going back to bee math, capped workers could only be capped for at most eleven days. That means that eleven days ago there was open brood, and brood pheromone.
2. What are my other colonies doing? I recommend at least two for this reason. If you have no mentor, you won't know when to expect the bees to cut out brood production, as they so often will during a nectar dearth (like late summer). The brood cutoff can be sudden and drastic, leaving you worried about a queen who might be in good shape. Is your other colonie(s) cutting back brood at the same time? Relax, it's probably just a natural break in brood rearing.
3. Did you see supersedure cells within the last month? If you are monitoring for a laying queen post supersedure, again, check bee math. Twenty eight days to see the first eggs is not unheard of. If it hasn't been a month, wait patiently. If it has, time for plan B. Plan B often involves sacrificing a queen. If you introduce her to a queen right colony she dies. If there's no queen the colony dies. Choices, choices.
4. Are there swarm cells? If so, don't expect brood.

No supersedure cells, the other colonies are doing fine, and there's no brood here for a month. You might have a laying worker. Here are the ways to determine if you have a laying worker. All methods of identifying a laying worker bee involve inspection, in which the you examine the brood pattern and type to identify if a healthy queen is present, or a potential laying worker. Here is what to look for:

Brood Pattern: Look for empty cells scattered through brood. Laying workers lay eggs that lack the queen's egg recognition pheromone, meaning that other workers may remove the eggs. This results in a spotty brood pattern, in which empty cells are scattered heavily through capped brood.

Number of Eggs per Cell: Look at the honeycomb cells to see how many eggs are laid in each one. Queen bees will usually lay only a single egg to a cell, but laying workers will lay multiple eggs per cell. By multiple eggs I mean five or more. Multiple eggs per cell are not an absolute sign of a laying worker because when a newly mated queen begins laying, she may lay more than one egg per cell.

Egg Position: Egg position in the cell is a good indicator of a laying worker. A Queen bee's abdomen is noticeably longer than a worker, allowing a queen to lay an egg at the bottom of the cell. A Queen bee will usually lay an egg centered in the cell. Workers cannot reach the bottom of normal depth cells, and will lay eggs on the sides of the cell or off center.

Drone Brood in Worker Cells: Look for hundreds of drones in a area you know held worker brood earlier. A good indicator is drone brood in worker sized cells. Drones are raised in larger cells than workers. Drone cells are recognizable by their larger size, and when capped Drone cells are capped with blunt pointed caps. Drones in worker cells are a sure sign of a failing queen or laying worker.

Removing a laying worker bee

So you have a laying worker? The task ahead is difficult. Laying workers may not appear different from other workers, so don't waste time hunting for them with your hive tool in hand. Anyway, in hives where a laying worker develops multiple workers will lay, meaning that killing a worker spotted laying will not resolve the problem. You'd like to give them a queen, right? The problem is that they think they have one. That's not to say it can't be done. Here are a few of the methods you can use. As always there are more.

Shake out the bees: In a shake out, you are going to throw all the bees out of the hive and disband the old hive. The bees may be allowed to disperse to other hives where they will likely accept the current queen, or you can let the field bees return to the hive location. To shake out a laying worker hive, put an empty box with lid and floor where the laying worker hive is. Make sure you are wearing all your equipment – there will be many bees in the air soon. Carry the colony twenty yards away and open it. One frame at a time shake all the bees off. It helps to have a empty box handy to put the frames in and a towel to cover it so the bees cannot return to their old equipment. When all frames are shaken off brush the bees clinging to the inside of the box off and walk away. The field bees are oriented to the old location and will return. You may choose to put a frame of open brood and a queen (safe in her cage) in that spot. The theory behind a shakeout is that laying workers are nurse bees who have not taken orientation flights and thus will not find their

way back. Should they make their way to a queenright hive the brood pheromone will aid in suppressing their urge to lay.

Requeen the laying worker hive via Push in Cage: A push in cage is a plastic cage that can be pushed into the wax comb while leaving space for bees to move over the enclosed portion. It prevents bees outside the cage from reaching the queen inside and contains the queen in a small area, reducing her ability to lay. The new queen can lay in the enclosed cells, which usually include capped brood who are ready to emerge. The bees that emerge in the push in cage will accept the queen and care for her. The beekeeper can release the queen from the push in cage later when there is a population of workers who have accepted her. Using a push in cage is simple – take a frame of emerging brood, identifiable by the bees chewing their way out of their cells and push the cage in to the wax. Some bees will be killed where the cage punctures their cells but don't sweat the small losses. Most push in cages have an door by which to put the queen inside. Bees that emerge see the new queen and accept her. She can begin laying in the cells that open up as soon as they are clean, and the fresh worker brood will help suppress the worker's urge to lay.

Combine the laying worker hive with a queenright hive: Combining a laying worker colony with a queen right hive puts the the workers from the laying worker to use. The danger in combining a laying worker with a queenright hive is that the workers from the laying worker colony might harm the queen from the queen right hive. Many beekeepers consider this risk unacceptable. Introducing frames of open brood into the laying worker colony before the combine can increase the odds of a good merger. Again, brood pheromone helps suppress the urge to lay. If you see the bees making emergency queen cells the hive is ready to combine (after you remove the emergency cells). Bees that are making emergency cells may also be willing to accept a new queen, but be wary of introducing a new queen into a colony of bees that are too old to survive until the new brood emerge.

Under New Management

I knew the colony was queen-less before I left the house. I knew it before I had my suit on. Before I was within twenty yards of the hive I knew that there was no queen. Five feet from the hive it was impossible to deny. The evidence was as clear as the dozens of bees buzzing, bumping and trying to sting the nose on my face.

The colony needs the queen like no other bee and the workers know it. While they may go listless they may `_not_`, and when they do not the results are singularly unpleasant. Two hundred yards from the house the bees were buzzing people. Fifty yards from the hive they were crawling all over me. At the hive they were running in lines down my arms. That wasn't the ominous part. The thing that had me most worried was the sound, the roar of a wounded animal.

The queen-less roar is a sound no beekeeper can expunge from memory. It is louder than any other sound the hive makes except when swarming (when the roar is in fact the sound of many bees in a pleasant mood). On the other side of the house I could hear it. Down at the hive I could hear little else. To make matters worse I was largely defenseless.

Smoke is the beekeeper's primary weapon. It disorients the guard bees and masks alarm pheromones, triggers an urge to prepare for flight and generally calms the hive. It is not terribly effective against queen-less bees. If the decision is flight or fight the queen-less colony is predisposed to fight. I opened the lid from the top of the colony only after shrouding myself in smoke. All the bingo parlors in hell couldn't compete with the smoke screen I laid down and I was glad.

Before I kept bees I always believed that opening a hive would result in a rush of angry bees but that's not normally the case. A queen-less hive is not normal. Bees crawled the lid and lined up thick on the top bars, the cloud of bees above the hive thickened and the roar of the colony was un muffled now. Now was the time to do what I came to do.

I have a pocket on my bee suit. Only one, wide and shallow. It lies open most of the time and I'm careful to look inside before reaching because more often than not I pick up a friend or two. That day there were no friends in the hive, only an angry sorority morning the passing of their leader elect. In my pocket though I held the key to the colony.

The key to a colony comes in a tiny wood and screen box the size of a nine volt battery. In this box was a mated Italian queen and a tiny court of workers to feed her. I removed the cage and inspected her. Like most queens she disliked the light and grew nervous in the strong sun. Then the first worker from my hive landed on the cage and the magic began.

The first worker was quickly joined by a second and a

third, a fourth and a dozen more. They lined up on my fingers and clung to the cage, fanning their wings. In unison the hive fell silent. Where before there was only the sound of angry bees now there was nothing. The cloud of bees above me fell inward, many landing on my hand. If I was nervous before I was more so now.

Bee by bee I brushed them from my hands and the cage. Some refused to go. I reached down to put the queen cage safely into the hive where it could rest on the top bars and the bees moved up to meet me. As I reached for the lid I watched the bees under the cage clinging tightly. Then the sound of the colony returned.

A soft buzz, the sound of the colony at night or in the rain filled the air. With the lid on I could barely hear it. At the front of the hive the foragers moved out and waited for some signal I could not sense and then one by one they took flight, returning to the purpose of their life. In a few days they would chew through the candy holding the queen in her cage and unleash their new monarch to unify and drive them. I stayed to listen to the sound of a colony one more set right. It was the sound of life.

The Death of a Thousand Pinpricks

E28 is born a worker in a colony at war. It struggles for its life against a destroyer that cannot be stung to death. Unlike the wasps outside this enemy cannot be dragged from the hive. E28's colony has been infected with a disease.

E28 was at the entrance of the hive greeting foragers on the day the destroyer arrived. Not old enough to be a guard bee, she hangs back waiting for the foragers who pass the test of the guard bees. She will take their pollen and nectar and transfer it up into the colony. The foragers are freed to return to the hazardous fields, risking their lives with each trip for the sweet prize.

On this day a old forager lands on the board and brushes past the guard bees. Her hair is worn off and her wings are near destroyed but her crop is full – of honey! This forager found some unguarded gold and has stolen it for her own hive. She cannot know that in her crop she bears the the seeds of destruction.

The honey she brought back is deposited in a cell at the edge of the brood nest, where nurse bees wait to dilute it and pass it on to the brood. Before the night is over the first larva is infected.

A few days later that larva stretches out along its cell and dies, its nose contorted upward. A nurse bee stops to check the cell and discovers the dead larva. It is pulled from its cell and cast from the hive, but by now the contagion is everywhere. Each time an infected nurse bee visits a larva, each time it offers food, it leaves a trace of death. In a week the infection is full blown.

The bees are not complacent. They respond with every ability they have. The nurse bees redouble their checks on the larva and they are merciless with removing any that show the slightest hint of disease. The queen lays as often as cells are available and with time the infection is slowed. Though most larva die before their cells are capped some do not. The larva trapped with the disease have no escape during their metamorphosis, so the colony responds by tearing the capping from their cells and dragging them away. Fighting this disease saps the colony of strength. Without a constant influx of new workers the foragers have been depleted.

The house bees are kept at their stations by the pheromones issued by the foragers. Without this scent they long to venture out themselves, but the colony needs them in the brood nest, where this war will be lost or won. Without new stores coming in it the war becomes a three way race. Disease will claim the colony if it can, but starvation looms closely. The deciding battle will not be one of stings and wings, but eggs and tiny larva. The bees cannot win through wrestling, but through constant vigilance. Their will is unlimited. Their stores are not.

E28 is ancient now, nearly seven weeks old. For a summer bee she is so old that there are few like her left. She

has been caring for brood and ignoring the call of the blooms for her entire life. The brood nest is expanding. With each day fewer larva are pulled from their cells. With each day new workers hatch to aid in the war. It is to E28's surprise that one day she moves from cell to cell and bumps into nurse bee after nurse bee. As she retreats down the comb she realizes that she has passed the edge of the brood nest. The entrance lies only a few inches away. On the floor below a forager enters, one of the few. She is transfixed.

This new forager waggles fiercely, walking a line and shaking the whole time. To E28's instincts these are clear directions of an area. The ferocity of the dance makes her tingle and she bursts forth from the entrance to the hive and flies away. Instinct creates from the sun and the dance a map to this promised land of nectar. It is a field of golden rod.

She is not capable of flying faster than she does, each flower holds the promise of a new bounty. Again and again she fills her nectar crop, over and over she packs her pollen baskets full. Each time at the entrance bees are waiting for _her_. She is finally released to roam the wild waves of flowers, and the goldenrod is everywhere.

She pauses in the late afternoon on a broad pedal to clean herself. In that warm autumn sun E28 dies. With her dies the memory of how the colony beat back the plague, and her death far from home keeps the disease that still lingers in her gut at a distance. Her colony will forever fight this war. Disease has come to the colony and it will lurk at the edges and corners for as long as the colony survives. Other bees will own that struggle, and others face that fight. For E28 the battle is won.

The View of the Hive from the House

Disease is an ever present threat to the welfare of a colony, but most diseases can be overcome. In E28's case European Foulbrood is the name of the disease. Its cousin, American Foulbrood, is so deadly that the treatment involves burning the affected hive, sterilizing all tools, and often destroying neighboring hives or entire yards. European foulbrood is not the same class of disease. It often shows up in colonies already under stress. The larvae die, contorted in their cells, twisting, writing as the virus ravages them. They stink like rotten fish. Those that live to be capped die there, trapped under wax lids with their destroyers.

Stress, in this case, would be a weak or low laying queen. When a colony is strong, the affected larva are removed so quickly that the disease has trouble progressing. If the colony is weakened foulbrood gains a toe hold. Bees have six legs, so that's a lot of toes to hold onto.

Foulbrood can also rear its head in the spring. When a queen begins laying in a weak hive, the workers can't care for the number of eggs she lays. There simply aren't

enough nurse bees to care for the sudden rush of larvae arriving. What has to happen is that a small wave of nurse bees hatches, followed by larger and larger waves, until the brood nest is roaring, crawling, covered in bees of every age and type.

If a disease takes hold in a weak hive, the first wave of workers is stunted, tiny. There may just barely be enough hatched to replace the bees that died caring for them. These bees are rapidly forced to begin foraging, long before they are ready. The alternative is starvation.

Foraging bees cannot care for larva, meaning that the next wave is small. And still, the disease lingers, growing stronger as the work force shrinks. Now there are not enough workers to remove the infected larvae, and new larvae hatch to an environment so tainted with the disease, their chance of survival is miniscule. The cluster shrinks, and the chill of the night claims more of the unborn.

The Hive at Home

Foulbrood is just one of many diseases which can plague a hive. To take a tour of brood diseases, we begin with those without a pathogen –

Chilled Brood: Chilled brood are exactly what their name implies – brood which could not be kept warm enough. Bees heat or cool the brood nest to a constant 90 degrees. An uncapped larva cannot survive longer than a few minutes without its nurse bees to warm it. Chilled brood is often a sign of a weak colony that cannot care for all its brood. If the colony is weak, a follower board can be used to reduce the space the bees need to heat. Just don't pack them in and forget to remove it later. Chilled brood is also common in the early spring. Nights are still very cold, but with the colony expanding sometimes the broodnest grows further than the nurse bees can maintain. Particularly if you spot chilled brood after a warm stretch followed by a cold snap, don't be alarmed. The colony will probably be fine.

American Foulbrood: American Foulbrood is one of the most contagious diseases of the honeybee, and a sure destroyer of an untreated colony. AFB kills the brood after they are capped in most cases, causing a pattern of sunken and perforated cappings, as well as a spotty brood pattern. AFB is called "Foul" brood because it smells horrible. The scent permeates the colony and can often be detected just from sniffing the open hive. The best test for American foulbrood is the "rope" test – take a match stick or toothpick and remove the sunken capping from a dead larva. Poke the match stick into the brood and pull it straight out. If the gooey slime ropes outward for half an inch or more, it's American Foulbrood. AFB can be treated with antibiotics, but the hives are often destroyed. To destroy a hive the bees are killed with sulfur gas and the frames are burned or buried. The hive

bodies can be scorched with a blow torch and re-used. Keep in mind that you cannot out wait AFB – if you put infected equipment to the side, your grandchildren could pick it up and have a ready source of disease to kill their colony.

European Foulbrood: European foulbrood is virus based and is not nearly so destructive as American Foulbrood. Often considered a stress disease, EFB can only weaken a colony, and can only gain a toe hold when there is an extended break in brood rearing. EFB does not require burning the equipment but many beekeepers rotate brood frames out after an infection. European foulbrood is characterized by spotty brood pattern (caused by dead larva), sunken cappings with perforated tops, and dead brood which smells like rotten fish. Unlike American foulbrood, you may need to pull out a dead larva and squish it to smell the odor. Once you do you will never forget it. EFB larva often die longways in their cell with the larva twisted up. Unlike AFB European foulbrood infected larva do not rope at all.

Chalkbrood: Caused by a fungus which first devours the larva's food causing it to starve, then moves on to consume parts of the larva's body, leaving a white chalky casing behind. Chalkbrood is often associated with humid conditions and lack of ventilation, so propping open a top enough to allow some airflow can aid in chalkbrood battles.

Stonebrood: Stonebrood is another fungal disease which causes the larvae to mummify into a rock hard shrunken version of itself which looks quite bizarre. Similar to Chalkbrood and EFB, failure to fight off chalkbrood is a symptom of a weak hive than a sole destroyer.

You may be wondering why nosema, parasitic mite syndrome, or other pest caused problems aren't listed. We'll get to those in due time, when we look at Mites and Men.

Breath Deep

On a cold day in February a colony of honeybees is best left alone but not this day. Rain and wind, clouds and colds couldn't stop me today. The feeder had to go on. The bees had to eat, and they needed to eat now. In the syrup I carried with me lay the key to their survival, the only way to catch their breath.

Many parasites infect the honeybee but few the same way as the tracheal mite, or t-mite. Tracheal mites, as their name implies, infest the trachea of the Honeybee. Imagine if an insect the size of a cockroach were to crawl into your lungs. Imagine it never leaves. Imagine it breeds more and they live in your lungs and esophagus as well. Now you know what tracheal mites are like.

The mites live in the bee tracheas. They are parasitic but the harm they do to the bee by feeding is low compared to the obstruction of the bee's airway. Nosema, this disease is called. Tracheal mites are not as brutal as Varroa, their vampire mite cousins. That doesn't mean they don't kill bees just as well. Most colonies that die in late winter and early spring die from one of two causes. Starvation is number one. Nosema is a close second.

The syrup I carried with me was hot, so hot it almost hurt to touch and with reason. I had just mixed it up and medicated it to fight the tracheal mites. The warm syrup would attract bees to feed even on a cold day. They would come for the warmth. They would stay for the syrup. The medication would just be an added bonus.

All winter long I provided grease patties made of shortening, sugar and essential oils. These oils help combat the mites and whenever the weather was warm there were bees nibbling at the edges. Nosema is a silent killer. There is no k-wing or parasitic mite syndrome to diagnose. It most often takes hold at a time when bees aren't flying about anyway. It can reduce the colony strength by sixty percent. Diagnosing it means beheading a bee.

There are no bee guillotines – the goal is to pull the head off of the bee in such a way that the trachea is exposed. The beekeeper begins with a dose of alcohol or similar substance to dull feeling (the beekeeper's). Next the head is pulled off a bee, leaving the trachea exposed or trailing behind. The trachea should be clear. My bees had black trachea clogged with mites.

The day before I had performed a French revolution at the bee hive. Marie Antoinette and King Louie and a dozen others had been beheaded to satisfy my desire to be certain these were tracheal mites. They were. Bee pathologists will study the trachea under a microscope. The rest of us just look for dark tracheas.

Within moments of filling the feeder the first bees crawled up to the steaming syrup. These first responders would act as medics for the rest of the hive, delivering the syrup mouth to mouth, bee to bee until the entire

colony has received it. This process will repeat over and over until the nosema are wiped out. They won't be gone. They just won't be a factor in a hive with a thousand new births a day. Bees communicate by scent, so the smell of wax and honey, of propolis and hive scent is an essay to a bee on the state of the colony. To me it is the scent of *_life_*, and before I left I took another deep whiff of hit. *_Breathe deep, bees_,* I thought. I will.

Divide and Conquer

E88 lives in a colony which has weathered the trials of life. It has survived winter and disease, fended off attackers, replaced its ailing queen and finally mastered the cycle of life. For its labors the colony will now be torn to pieces.

E88 is a forager in her colony, but just barely. She knows the patterns of the hive and the location of the fields and flowers. She will guard her hive aggressively and gauge its health with every moment she is in it. Her colony is well established, with many combs full of brood at every stage. The establishment of the broodnest was done by others. The queen laid the eggs. The house bees chose the ones that would remain to keep it shaped like an oval. The house bees take whatever comb remains for storage.

This leads to the natural storage of honey above the brood nest. This is no accident. In the winter E28's colony will slowly eat itself upward through its stores. In the summer it will grow downward. This is not E88's concern. She will not live to see the winter and the house bees store the nectar. She lives the free life of a forager, choosing the flower and the pollen from a thousand windborne scents.

In the evening the hive is too warm and workers fan the entrance. E88 takes her turn doing so but mostly she just sits on the face of the hive with the other foragers waiting for the night to cool. As the days warm the foragers have had to wait outside earlier and earlier each day. Inside the brood nest is crowded with nurse bees and covered in larva.

No single bee makes a decision but in the cool of the early may evening the foragers outside sense a change in direction. Instinct is calling them to a new pattern. The first light of the sun will see its shape take form.

The next day when E88 takes off the foragers leave in a cloud. They work overtime all the time until they die but this is different. As they fill their nectar crops the foragers return to the hive and E88 is no different. This time though she passes the guard bees at the entrance and walks right past the house bee waiting to take her nectar.

Up into the broodnest she crawls until she finds an empty cell. No pollen, no nectar. Here she deposits her nectar, leaving a shiny wet film at the bottom of the cell. Behind her another forager moves in and does the same. E44 is a house bee and she is torn. Normally she would relay the nectar to its spot. She would move it to make room for the queen to lay, but the older bees insist on putting it right there in the middle. This is the sign to her of the forager's plan and she agrees. Other house bees gather and begin to condense the nectar. E88 is not present, she's off on another flower or another hundred.

The apple blossoms are opening now and the house bees

are literally overwhelmed with nectar. The foragers return faster than their worker sisters can manage the nectar and they continue their plan, filling in open spots in the brood nest. Those bringing in pollen follow suit, plugging frames with pollen as quickly as possible. E44 is now on board with the plan. Though she did not help decide she knows what must be done.

Each time the queen passes by E44 nips at her causing her to run. When she stops to feed the other house bees ignore her more and more often. They aren't killing her. E88 passes the queen on a trip inward and approves. The queen isn't being allowed to lay. Her long abdomen is shrinking as she loses weight.

Meanwhile E44 and her sisters are hard at work. This colony needs no new comb but they are drawing wax and crafting from it queen cups everywhere along the bottom of the brood nest. These the queen is allowed to lay in without disturbance. When the larva in these special cells hatch they are given royal treatment. They are fed constantly. Across the entire colony eating is on the rise. From the day the eggs are laid the workers begin to gorge themselves. E88 and her coven continue to plug the broodnest. At night they eat as often as possible. The queen is now flight worthy, having survived a brutal diet and exercise regime at the hands of her daughters. Now the colony waits, for what it does not know.

For the first few days the E88 continues her crazed quest for pollen and nectar. As the days go by though she leaves the hive less and less. Each time she returns the scent of the queen brood fills the hive. Each flight she takes is shorter. Finally she will not leave at all. The foragers return to their plotting point on the front of the hive. A change is coming and they cannot afford to miss it.

Now ten days have passed since the queen laid eggs in the cups. One of them will become her successor and inherit the throne of this colony. The current queen will never see her daughter's ascension. The nurse bees have capped each of the queen cells, making white peanuts of wax to cover their royal sisters. The colony takes a deep breath.

E88 isn't the first to signal. She is quick to join though. A wordless bugle rings through the colony, electrifying the bees inside. They beat their wings and the colony roars. Foragers still inside the hive lead the charge. They rush out the entrance of the hive and take flight. Some hover in front of the hive and others circle. They aren't going anywhere yet but so many of their sisters must leave that the landing board cannot hold them all.

Inside the hive the queen is herded down the combs of the brood nest. She shies away from the light. She has not left the hive since her mating flight and she is uncertain of her wings. The house bees will not be denied their

demands though and she is driven downward and into the light. With her the ascension begins as thousands of bees are faced with the decision to leave or stay.

The queen takes flight and wobbles upward. She is no longer a trim flying machine and her navigation skills are poor at best but to escape the nipping of her daughters she zips upward. A nearby tree branch looks safe and shaded and she lands on it. Behind her come thousands of her daughters. They alight on the branch and form a wall of bees, a ball of bees encasing the queen, keeping her safe.

Back in the hive E44 is racing across the comb. She heads for the door again and again but turns back each time. The roar of the colony has fallen silent and the house bees and their younger sisters are uncertain of what has happened. Many of E44's generation has left as well, and hundreds of nurse bees as well. They do not know where they are going. Only that they are. E44 approaches the entrance once more and then turns decisively. Up the comb she crawls to the nearest queen cell and takes up a position on it. Let the others leave, her lot is cast.

Outside on the tree limb the swarm is a mass of confusion. The nurse bees and house bees huddle in the center. Again and again they check the queen. Her scent calms the swarm. The queen is here, it says. That is enough for now. E88 and her sisters are already at work on the next phase of their ploy.

The moment the swarm achieves critical mass E88 is driven to leave. She can find her way back by scent alone. What she is searching for is a home. She flies as a forager does in wider and wider circles. Then something catches her attention. A hole in an old oak which grubs and rain has rotted out. She approaches with caution. The entrance faces to the west. She would prefer one to the south but still she looks inside. Through the hollow she crawls, gauging its size, its scent. This hollow has an old smell, the smell of a colony long gone. With a flick of wings she is on her way back.

The swarm has no comb to land on but E88 doesn't stop. She lands on a living wall of bees, the younger bees that can't be trusted to search. From the moment she lands she begins to dance. Her dance tells the others the way to her chosen spot. The ferocity with which she performs it tells the others how excited she is. E88 is very excited. Another colony found this hollow acceptable. Surely it is good for hers as well. Other foragers return without finding a nesting site. These land and watch E88 dance. One is interested and takes off to check out her site himself. Nearby another bee dances harder and harder for her site.

The colony will make this decision together. When the scouts return from E88's site they begin to mimic

her dance, enticing others to look. Another forager is continuing her dance in competition though. A contest of followers emerges as scouts examine both sites and then pick sides. As the hours go by E88 is becoming tired. She stops for a moment to rest. In that moment the dance of the other foragers seizes her and off to the other site she flies.

This site is an old bird house, long ago abandoned by the birds. The entrance faces south and the inside is spacious. The single round hole is defensible but what sets E88 on fire is the smell. It is the scent of comb. She can tell from the smell that there is no colony here but the comb they drew still hangs. Wax worms have destroyed much of it but it is salvageable. E88 returns a convert.

With more and more foragers dancing for the new site the dance contest is quickly won. The foragers crawl quickly to the inside of the cluster and begin to beat their wings. Pressing their thorax to the wall of bees they continue this until the swarm repeats it. The temperature inside the cluster rises, warming the bees for the flight ahead. At 90 degrees it is time. The swarm lifts off en masse, following the foragers to their new home. The bees cover the bird house, streaming into the entrance as fast as space permits. The queen waits with the others outside. Inside the bees mount a brutal battle against the wax worms and spiders that remain inside. It is over in moments. Now the queen proceeds inside and behind her a long train of daughters. A new colony is born.

Back at the old colony E44 and her sisters wait. Though the foragers have left the hive is packed with bees and now the reason for their stockpiling nectar is clear. They must wait for the new queens to hatch. When they do the colony will once again be queen right, and can begin the process of building itself again.

The View of the Hive from the House

What to do if you awaken one morning to find a ball of bees on your tree, car, porch, or roof?

Don't kill them.

You don't have to take up beekeeping yourself. Just call a beekeeper to do it for you. Most beekeepers pick up swarms that aren't 20 feet up a tree for free. If they are 20 feet up the tree, you aren't going to be able to bother them anyway. If there were 20,000 kittens in a ball in that tree, well, actually that would be pretty strange. It would probably involve some sort of cult and a lot of super glue. The point is you wouldn't kill them.

The instinct to swarm begins days before the actual event, as a series of conditions combine to trigger that most ancient instinct of life. If in the winter they heeded the call to survive, and in the early spring to thrive, then in mid spring it becomes reproduce. Like most organisms,

Bee colonies reproduce by splitting in two. The old queen goes with the swarm, leaving the first virgin to hatch to lead the old colony. As I said, the process begins much earlier.

Days before, the bees begin to gorge themselves on honey. This influx of food triggers the wax glands, stimulating them to produce in a manner that even newly hatched nurse bees cannot match. At the same time, the foragers operate on overdrive, backfilling the colony's stores deep into the brood nest.

Beekeepers argue and debate over whether this backfill is the cause or result of the swarm instinct. As with most things related to bees, the answer is probably both. A clogged brood nest simulates the same conditions as would be created by the foragers in any case. Special queen cells are constructed everywhere, and the queen lays in them. Then the queen ceases laying. Sometimes this is because she has no room. Sometimes this is because the workers nip at her, preventing her from resting. They feed her less and less, and her abdomen shrinks. In days she is flight worthy. In that same interval the queen cells are capped, and the queenlings begin their metamorphosis.

A change sweeps through the hive, and the foragers become listless. They mill about in the front of the hive, sometimes hanging from the front. They cannot leave. They do not know the time and the date, but the division is fast approaching, and they do not want to miss it.

The queen cells are now a leathery brown, resembling peanuts cast of wax, and inside the virgins pip to each other, a sound like a duck quacking. It is a challenge. It is a beacon. A hatched virgin pips to find unhatched virgins. Unhatched virgins pip back, playing a game of marco polo with their soon to be murderer.

In the morning as the sun warms the hive, their tone shifts. They gorge themselves one last time, filling their crop. The bees surge toward the entrance in a wave, pouring out of the hive in a steady stream, circling until they achieve critical mass, and then clustering on a nearby branch. Here the swarm organizes itself, going through a checklist of sorts. Primary among these are: Is the queen with us? If she is not (perhaps she cannot fly) the swarm will return to the colony. They won't give up, but they'll return. If the queen rejoins them (say, by crawling back into the hive), the process will repeat, and again they gather. Most of the time the queen is present.

Now the scouts depart, looking for homes. Each returns to incite other bees to come look at its location. If those return and incite more, the mass of bees "voting" for a location grows, and grows, until a tipping point is reached. The swarm reaches a breaking point, and takes off toward the new home, or at least to a closer spot.

Here is where you come in. It might be your car, or your tree, or your lamp post. Keep in mind a few things:

1. Bees fight to defend the hive. These bees have no hive.
2. Bees fight to defend brood. These bees have no brood.
3. Bees are more likely to sting when hungry. These are stuffed.
4. Full bees cannot get their stingers into proper stinging position (though to say they can't sting is a mistake).

That ball of bees is looking for a home. You do not want that home to be in the walls of your house. Or the wheel well of your car. Or the tailgate of your truck. The bees want a home. You want them to have one. Here's how you get what you both want.

Call a beekeeper. Most do not charge for swarm pickup.

Do not gas them.

Do not spray them.

Do not mess with them.

If you live in an Africanized Honey Bee area that swarm is not a pet you want to take home. Sure it's cute and cuddly now, but later comes the running, and the screaming.

Don't know a beekeeper? Call the fire department. Most beekeepers register their names with the FD to come "rescue" you from the bees (and those bees from you).

Do not call them for yellow jackets.

Or other wasps.

Or mosquitoes. We do not collect swarms of mosquitoes, until someone finds a way to make mosquito honey that doesn't involve a pound of mosquitoes and a blender.

Do not expect them to pull a colony out of the wall of your house for free.

On a related note, if there's a bee colony in the walls of your house, poisoning them could be a disaster. Bees cool the hive, keeping the comb from collapsing. If they've been there more than a week or so, and you kill them off, when the heat comes you'll have honey dripping down the walls (if you are lucky), or wax attracting wax moths. Walling them in won't work either - bees don't normally chew, but if you trap them, they'll surprise you. A beekeeper can remove them, but it will take time (and probably money).

Particularly if you live in an AHB area, do not mess with the bees. Just remember if that ball of bees shows up at your house, be a good neighbor. Help them find someone who wants to give them a home. Think of it like putting kittens up for adoption. You'd do it for them, and you can't get anything edible from a kitten. At least, not without breaking some animal cruelty ordinances and

ruining your blender. It's like one of those pet adoption stories, only with 20,000 tiny fuzzy faces.

The Hive at Home

Swarming: The nemesis of every beekeeper. Short of varroa mites nothing else consumes the time and energy of the beekeeper. Understanding the mechanisms behind swarming is the key to minimizing swarming. The key thing to remember is that swarming occurs because the brood nest becomes clogged. By clogged I mean there isn't open space for the queen to lay. Bare foundation does not count (though it is better than pollen, capped brood and honey). Many beekeepers make the mistake of assuming that if space requirements are met all swarming is eliminated. This ignores the fundamental truth that swarming is a reproduction mechanism.

Bee colonies 'exist' to reproduce. While there's no question that letting the broodnest get full will trigger the swarm impulse, it is entirely possible that a backlogged brood nest is equally a symptom of the forager's drive to backfill the colony's stores. This is highly debated, and you will find beekeepers who swear that each is the only cause. That will be up to you to decide.

That said, managing space in the broodnest is essential to preventing some swarms. Premature swarms are usually bad for everyone involved. The neighbors run in fear of the thousands of bees in flight. The beekeeper scrambles to recover the swarm (which may contain half of his colony). The colony which casts the swarm is now queenless and dependent on a new queen to mate. The break in the brood rearing cycle may cancel any hope of harvesting honey. That is why beekeepers work to minimize swarming.

It all begins with space

Bees with space in the broodnest are less likely to have congestion. If you've ever driven home in rush hour traffic and thought "If I could go somewhere else to get out of this, I would", you understand what motivates bees to swarm in a congested broodnest. Congestion can be caused by not having enough hive bodies on and having a sudden population explosion. Many times bees build up in a nice and even manner in the spring. Sometimes however they explode at the seams, having a population that nearly doubles in the span of just a few weeks. Those colonies are ripe for swarming. Make certain that when eight of the ten frames in a body are drawn you add a new body or super. The exception to this is late fall, when you want the bees to build up stores in a limited space.

Keep it fresh (the queen)

By this point you know that the queen pulls the hive together. As a queen's pheromones weaken one effect is to drive the foragers to swarm. A strong queen unites a strong colony. A weak queen can't do the same. I recommend

that you re-queen in the spring. Why the spring? In the fall it will be more difficult to get the bees to accept a new queen (they do so best when nectar is coming in and brood is being reared). Plus, normally lower spring populations make it easier to find and ...remove the old queen.

Draw and Draw again

Drawn comb is a beekeeper's second most important asset. His curiosity and observance of the bees is the first. I can't help you with curiosity but drawn comb is another matter. If you see white wax bur comb between frames in a hive full of drawn comb the bees are letting you know they are ready to draw wax. Keep spare frames ready to go in. If you use foundation, you may install it ahead of time (or not). Take the frames of stores (which should be brood free) and take two out. Slide the frames in the center out and place the fresh frames in the center of the brood nest. They'll draw out the frames with new comb, giving them a useful place to put their wax to work and room to cluster. The new cells are empty and can be put to use. What about the old frames? Freeze them (to kill anything that might be lurking in the comb) and pull them out when you need stores. If the cells are empty even better – those can be inserted into the brood nest at any point to give the bees space.

Know the flow

This ties in really closely to the first point but most swarms occur (and are triggered) during nectar flows. Whether you believe that the backfill is the cause or result of swarming it's much easier for handle if you know it is coming. This is an area where I cannot help you. Beekeeping is an extremely regional activity and your fellow beekeepers can tell you what will bloom and when. Have space available before the bees need it and you be less likely to trigger the swarm impulse. For minor flows maybe an open frame at the outsides will do. For major flows have supers on standby and don't be afraid to check to make sure they are being used and don't need to be uncapped. Bees can easily fill a medium super in a week if they have drawn comb, so check up during flows.

What's done is done

You opened the hive and there are no eggs and no larva. Swarm cells adorn the frames like air fresheners. You blew it. Maybe, maybe not. You can't control all swarming impulses. Whether it was beekeeper mistake or bee nature at work, once a hive decides to swarm one of two things will happen: Either the beekeeper will fulfill the swarm desire in an artificial way or the colony will swarm.

What to do?

Decide on a course of action. If you live out alone and have time to sit with them you can always let them swarm. The impulse must play out. You can perform "artificial swarms" by shaking the bees out on a blanket.

You can do any one of a dozen complicated methods for dealing with the impulse. Or you could try a simpler method.

Splits, or splitting a hive, involves separating a colony into two. One half gets the old queen. The other half gets the swarm cells. The half with the queen won't swarm. You can combine them together again later once the queen cells have hatched and mated (or you destroy them and add a new queen).

I'm not touching That

If your bees swarmed they probably didn't go far to start. The queen is really a pitiful flyer and her map reading skills are even worse than when she was a virgin so the whole swarm will coalesce somewhere close to start. It's a nice safe way to collect and make sure everyone is present with seat belts fastened before beginning the ride. That's your chance to grab them. Or it may be that the neighbors are pounding on the door and begging you to come save them from the bees (yours or not). Go ahead, be the hero. Always keep at least a couple of hive bodies and frames ready, along with a piece of gutter guard or steel window screen cut to fit over the entrance to your spare hive. They might not be your 'A' frames and equipment. The lid might be a piece of plywood or OSB. The floor might be rough wood with 1x2 supports. That's ok. Have it ready.

Two Scoops of Bees, Please

When a swarm arrives at a new home the first to enter set up fanning at the entrance. That tells the others to come here. If you can reach the swarm set the spare hive up at your feet. Floor on the ground, box on the floor, frames in. I use a measuring cup to scoop a glop of bees out of the cluster and dump them into the box. Then gently put the lid on. Now watch the entrance. With luck you'll see the scooped bees exit the hive and start fanning. Once that scent hits the cluster they'll usually go straight for the box. If they are crawling all over it because they can't all get in at once that's a great sign. Watch closely and you might spot the queen going in. Once most of the bees are in you can put the screen on the entrance and take them home. Remember – swarms have nothing to fight for and are usually well mannered. The exception of course (and what beekeeping 'rule' doesn't have exceptions?) is dry swarms, swarms that left the hive a few days ago and have had nothing to forage. If you spent three days hanging on a branch eating you would likely be in a foul mood as well. I keep a bottle of sugar water ready. Swarms get a solid dose of sugar water for two reasons: Wet bees don't fly well, and if they are hungry it gets them started eating. As always, watch the bees. They'll tell you if they are hungry by how quick they slurp up the sugar water you spray.

Like anything else in beekeeping there are many ways to collect a swarm. You could hold the box or a bucket under the swarm and shake them into the box. If you get the queen they'll stay for a bit. If you don't they'll fly back to her. You can build and use a bee vac (but careful, a unturned bee vacuum's primary function is to produce mush that used to be honeybees). The number of devices created to catch swarms high in trees or in other inaccessible locations is amazing.

Jose's Swarm

"You knew Jose died, didn't you?" my mother asked. I hadn't. I knew he was old with a face like the cracked plaster and a wide grin over brown teeth, but I didn't know he died.

I once did humanitarian work deep in the mountains of central Mexico, where beekeeping wasn't something you did for a hobby. It wasn't something you did for money. It was something you did so that maybe your children wouldn't starve over the winter.

We were roofing mud buildings that might have come from the previous decade or perhaps the previous century. The house of that day was miles away, and though we set out when the frost was still crisp on our sleeping bags by the time we were working, the sun hung high enough to fill the valley. We worked away the hours, conversation flowing like rain from the workers on the ridge row down the corrugated tin, back and forth through the houses. It was around ten in the morning, the air was warm and filled with the scent of the ancient cedars. The hive nearest the house changed its tone.

We had encountered bees the day before that chased us down the road for the crime of being twenty yards away and I was terrified of these bees. One of my team mates delighted in tossing other people's tools into the flight path of the nearest hive. As I walked over to retrieve once more my hammer, I could not help but interpret their change in tone as "come one step closer and you will regret it." The nails were waiting for me and my hammer lay just a few yards away beneath the constant flow of bees.

With my eyes fixed on the entrance to the hive I edged into the bee stream like it was freezing water. I turned myself sideways in an effort to present less of a target. As if on cue the bees began to surge out of the hive like water being poured from a dish. There were so many bees they couldn't all take off, so many they were colliding with each other, swirling in the air, bouncing off of me. The buzz of ten thousand wings filled the air, rising in volume like the terror that rippled through me.

I was not a beekeeper.

I had never witnessed a swarm.

I was certain this was the beginning of a hideous painful death.

My team mates ran for cover. I stood petrified as my knees quivered, my stomach squirmed and my brain tried to decide which of my ears it most wanted to crawl out of.

I did not know (and would not have believed) that the bees were not after me. The swarm swirled, dove, and filled the air like a cloud, bees streaming after each other till they blended together in streams like flying ribbons. It came to rest about 100 feet of the ground in a tree.

Calm enveloped the work site. It was quiet. I could hear

the Senora of the family patting blue corn tortillas for the lunch to come. I could hear the goat bells ringing as they brushed against the split log fences, and the sound of my own pulse throbbing in my ears as the fear receded.

I concluded that I was neither dead nor mortally wounded and went back to work. It was hard to hammer and keep an eye on the bees but I found a way.

The villagers were not pleased. The swarm was too far up the tree to climb and there was no convenient place to fell the hundreds of years old mountain cedar. My co-workers came back to work while the men gathered to discuss this with the oldest man in the village, Jose.

Jose had once been a Catholic priest, and he was still the corazon of the village, father in flesh to many, in spirit to all. Jose squinted and leaned on his cane, then spoke quiet words. Jose had a plan, and the younger men were dispatched to put it in motion.

Around lunch the activity picked up as his extended family arrived. Women, children, men, all carrying dented and worn pots, cans, even a rusted VW hubcap. Work on the house came to a stop as we watched this carnival. Around the tree the villagers gathered, and Jose began to count in Spanish, loud, strong, as his flock beat their makeshift instruments in time.

It was loud.

It was really, really loud.

I pulled aside the interpreter and asked him what they were doing.

"Move, move them" he yelled. It was amazing how loud the ad-hoc band of drummers were but their beat was impeccable. The air echoed sharply with each syllable and rebounded from the valley walls. While I could not see the swarm against the high sun, the hive on the ground was definitely reacting. Bees crawled out of the entrance and up to the top, milling back and forth like a carpet of glistening brown. Bees zoomed from the hives back and forth everywhere.

My team mates fled to less bee infested ground. I heard shouting from the men. The swarm moved. The shouts quickly turned to hisses because the swarm moved from one cedar to another a few yards away and equally tall. They never broke time and I was not in the least surprised to see that marching band surround the next tree, still raising a cacophony like the heartbeat of hell. This time the swarm moved quickly and landed lower on the tree. Again shouts came up. Again they beat louder, harder.

I am not a bee.

I cannot speak to them.

They do not speak to me.

I cannot say what they were thinking.

However, I can testify that at this point I wanted to relocate to any place further away from that awful noise. I winced with each pulse, grimaced at the echoes. It could not have continued more than half a minute. It could not have been less than an eternity until the clump of bees dissolved and coalesced again on a wooden fence across the field.

Jose's son triumphantly swept into a burlap bag. As quickly as it arrived the bee banging army dissolved, drifting back to their fields and houses.

Fascinated, I asked our interpreter (who also kept bees) about the tactic. He explained to me that keeping in time was the key to agitating the bees. He also said it was not uncommon to rile the surrounding colonies to the point of leaving the hive. "The important thing is to beat the pans –if you beat the pans, the swarm will move." When would they move? "Right now, if it's loud enough. Otherwise about a day. Just beat the pans."

So now we arrive where beekeeping, tradition, and superstition intersect. Better beekeepers than I say that beating pots, pans, or farm implements does not affect the behavior of bees. They say that banging a pot was to warn other people that the swarm was claimed by someone following it. I didn't know that at the time. Jose would not have cared. The tradition passed from father to son was a hereditary programming as fixed as the instinct that drives the bees.

It has been nearly two decades since I first set foot in that valley. I have little reason to believe that things have changed. The mountains that break the approaching storms seemed to stall time itself. Their life moved slowly and changed little. They probably still welcome swarms as a easy way to get more bees. They probably still beat the pans to "move" swarms. They could be wrong to do so, or perhaps ineffective. I cannot say. I have learned that there are many things I'll never know about bees and many that I might know but perhaps these particular bees did not.

Jose died a few years ago. He lives on at the crossroads of my memories, where the summer day goes on forever. His son now keeps the bees, passing on what he was taught before. It is a mixture of truth and belief, tradition and superstition. Two decades and a generation of beekeepers later they still count the days to harvest on a worn coca cola calendar. The bees keep their own time on a calendar no man can read. If they know the years have passed they do not say.

Of Mites and Men

E23 is a winter bee, born late in fall as the last of the major brood cycles. She is fed differently than her summer sisters. She eats more and eats more pollen than the bees of August. She is bred to survive the cold of winter. Stalking her colony is a tiny destroyer which will suck the life from all it touches.

When E23 first climbs out of her cell she is already infested with four of them. As she sits on the comb, preening her still soft fur her hind leg catches on something. She instinctively gives it a flick. A red dot the size of her mandibles lands on a capped cell and immediately the legs begin wiggling. She wastes no time in firmly biting it and tossing it to the hive floor. What she does not know is that two more cling to her back and one is on the move.

Up her abdomen the parasite crawls, making her wings twitch as it passes. On the way it stops to puncture E23 and drink several times. At the base of her thorax it slides around and wedges itself into the armor plating that forms E23's skeleton. Now no bee can remove the mite. It will not stop feeding until it is ready to breed or E23 is dead.

The third mite is waiting patiently for a chance event it knows must come. A drone bumbles by in the nest and the mite reaches out and catches on as it passes. The drone is already carrying five others but the mites do not fight over it. They will feast on him first and others as convenient.

E23's wings don't work quite right. She can't get the right one to close and is unable to take an orientation flight. The guard bees are reluctant to let her back in when she tries to enter. The hypocrites carry pests of their own. The mites are everywhere.

E23 finds that as she walks the cells of capped brood not all smell right. Instinct drives her to open a cell, tearing open her sister's bed. The larva inside is nearly formed but even its eyes are still white. The red specks stand out clearly on the pale carcass. The mites are buried in the larva flesh and remain that way when the mortuary bees drag it away.

The foragers of E23's colony are dying. This is expected as they knew they would not live through the winter. As they die their attackers leave the dead and search for new victims. E23's original mite finally left its place at her thorax. E23 was checking a larva and the mite just slipped away to the bottom of the cell. Not to worry. Four more have taken her place.

She can barely walk now and the dead are left in a pile at the front of the hive. The mites leave the dead and crawl back into the hive hunting for new hosts. New bees are not being born. They are dying under their cells, sucked to death by groups of mites in concert. It isn't too much longer until E23 dies as well and the colony falls silent.

The last few drones to hatch eat their fill of honey, which the mites care nothing for. Then they leave for better parts, other colonies. With them goes the crawling death.

The View of the Hive from the House

The greatest threat to honeybees today is not a pesticide or poison. It's not a rat, a skunk, or even an angry neighbor. It is a mite. A tiny insect so small it appears as a red speck on a bee. Given the chance it will kill them all.

Varroa or V-Mites as they are sometimes called, are best observed under a microscope. They are also best observed dead, preferably in mass quantities indicating that a colony has been effectively purged of mites. If you take a close up look at one you will see a round shaped body with tiny legs. It resembles a tick. It feeds like one too. This is the greatest enemy of the honeybee and the beekeeper. American Honeybees have few defenses against the mites and the mites will literally bleed them to death before moving on to new hosts.

You might wonder how such a balance can exist in nature. It does not. Man introduced the mite and the western honeybee. Like a blind date gone horribly wrong the results have been disastrous. Varroa are native to Asia where the Asian bee, *Apis Cerana*, is able to co-exist or at least survive the infestation. Accidentally introduced into America, they have devastated the feral bees in America and caused a seismic shift in beekeeping.

Before Varroa bees were more or less left alone. The theory was that they'd done all right by themselves for 30 million years and they would be ok for a few months with no checkup. Feral bees were everywhere. The "art" of finding feral bees involved walking straight forward in the woods until you ran into a tree. Odds are it had a bee colony in it. Post varroa beekeepers must constantly measure the mite levels, treat and search for treatments. Failure to do so will result in the death of the colony. The feral bees were for the most part slaughtered.

When the varroa first arrived, beekeepers found a pesticide which combated them, Apistan. Apistan (fluvinate) was so effective that surviving mites couldn't be found. After the crash of thousands of mite infested colonies and the bankruptcy of many beekeepers, we breathed a collective sigh of relief. And confidence. Fluvinate was a kind of triumph of technology over nature, proof that we could put the genie back in the bottle. That was not true.

The survivors might have been hard to find, but they were present and highly motivated to find each other. Their offspring bore a natural tolerance to fluvinate. Beekeepers didn't help. They treated year after year with Apistan, often leaving the treatment strips in long after the killing dose wore off. What was thought to be

the war on mites, won, was in reality just the opening skirmish. Resistant mites bred together and in hives with weak levels of fluvinate a resistant mite appeared. Again hives began to crash, and again we searched for new chemicals to win the war, and we found them. New comers to the battle lines included Check-Mite (and now Check Mite II), acids of several sorts, and more types of gadgets than one can list.

To understand the battle you have to know your enemy, so first we must take a closer look at the mite. Varroa adults can transfer by contact with bees or even from flower to bee as necessary, and so a mite free colony can get a gravid female mite brought in quite easily. Drones skip from one hive to the next and as we shall see, Varroa prefer drones. Therefore much of the blame can be placed on the man of the hive (no surprise there). The female mite, once in the broodnest, will climb off onto the comb and seek open brood which are about to pupate. Current theory (and it makes sense) is that the brood are located by the pheromones they produce which signal workers that they are ready to be capped. Into the cell the mite crawls, and waits. She crawls down into the bottom of the cell where she is safe from any workers who pass by to check.

Once the cell is capped over the pupa will spin a cocoon in which to undergo its metamorphosis, and the mother mite will be certain to be inside the cocoon. There she will lay eggs, many eggs. She lays them on the walls of the cocoon. When they hatch the new mites are trapped with their food source. They rapidly begin to feed.

Varroa are vampiric, drinking the bee's "blood". As the bee grows the mites feast upon it. This has a number of effects on the bees. The most common one is "K-wing", where the wing of a bee juts out at an angle, but legs can be missing or malformed, abdomens twisted and scarred. The worker hatches bearing healthy mites that are ready to reproduce. The mother mite will slip out and try to find another cell to reproduce in. Her daughters stay with their ride. As long as the bee is alive it's fit to eat and they will stay with it until something juicier comes along or an open cell calls to them with a fresh meal. Why do varroa prefer drones? Drones take longer to hatch than any other bee, a full four days longer than workers. Laying on a drone means the mites can complete nearly two cycles of reproduction before the hapless drone emerges (if he ever does). The mites that emerge will be fully prepared to continue the infestation.

The bees don't ignore the varroa. Hygienic bees are bees that clean themselves (and others) often. They will bite and discard mites, a highly desirable trait. To counter this mites wedge themselves into the plates in a honeybee's body. Safely out of reach they can feed for as long as necessary to breed.

Beekeepers have chosen many methods to battle the mites, chemicals, acids, powdered sugar, and a technique called "Drone Baiting". In drone baiting, drawn drone comb is placed in a colony in the heart of the brood nest. How do you get drawn drone comb? With frames of drone foundation, sized so that the bees will naturally draw thousands of drone cells on a single frame. In a strong colony the queen will lay in these quite quickly. The beekeeper knows this, and ten to twelve days afterwards he will remove the drone brood, which has just been capped. The varroa have chosen these drones to reproduce, and many of the females are currently safely sealed under wax, feasting on the hapless bees. The beekeeper bags and freezes the frames, killing the drones and devastating the varroa. The frames are then re-introduced, where workers will clean them out and prepare the trap once more.

Other beekeepers have sought different ways. Some noticed that not all feral bees died out. In fact, as time went on there was a very slow return of feral bees. Studying these bees led those beekeepers to conclude that the size of the cells was what counted. Smaller cells produce smaller bees. Smaller bees (at about 4.9 mm) are capped sooner, and hatch sooner. The change in timing is also devastating to the varroa, which are not prepared for the earlier capping and emergence. This is called "Small cell Beekeeping", and focuses on "regressing" your bees so that you have only small bees, drawing small cells. Finally you have "Natural Cell" beekeeping, where the bees are encouraged to draw their own comb. This comb will be of mixed cell size. Some storage cells are huge and deep. Some drone cells are monstrous. Some worker cells are average, and many are tiny. The colony naturally utilizes the range of bees produced in this method.

Foundationless frames or frames with starter strips of foundation allow the bees draw the frames without foundation, so the cells are whatever size the bees want to make them. The beekeeper can rotate the old frames out so that the bees have the chance to draw new, different sized cells if they desire. This doesn't mean that chemical treatments shouldn't also be considered. Avoiding the mite killing pesticides for now is preferable and leaves more options than one would expect. Powdered sugar, integrated pest management, essential oils and vaporized acid all can play a part.

We haven't seen the final chapter in this war. There will be no final chapter as long as there are mites or bees. Men will continue to try and poison and prod and force things to operate their way, and nature will continue to one up them, finding a way to survive toxin and technique. The bees will keep trying to do what they do, in spite of both man and mite in their eternal pursuit of honey.

The Hive at Home

Vast papers have been written on the subject of varroa. Many schemes concocted to deal with them. Some feature gadgets that blow sugar or oil into the hive. Others use scented oils to inhibit the mites. Still others blast the hive with chemicals until it nearly glows at night. For all this many efforts fail.

You can classify most treatment methodologies into one of two categories: Pesticides and Natural. Despite the impact of pesticide based treatments one shouldn't consider them all bad. It's true you don't want the pesticides in your honey. It's also true that pests become immune to the cides in time. What we have now battled varroa long enough to understand is that said resistance is not forever. Over the years of non exposure the mites tolerance for these foreign chemicals drops. At times a chemical treatment may be the only thing that can save a colony. Take one look at the prices and you'll rapidly conclude that maybe there _are_ better ways to deal with varroa.

Don't Treat

I don't consider this an option for a normal hive on full foundation drawn comb. I list it anyway because year after year beekeepers decide to try this treatment strategy. It is an excellent method of leaving the beekeeping hobby without collecting money for any colonies you have raised. Mite "crash" as it is called is nearly assured. I don't recommend this.

Small Cell

Small cell regression revolves around the theory that since a smaller bee is uncapped sooner it disrupts the mite's breeding cycle. Capped a day sooner, emerging a day sooner, the mites timing is thrown off. The foundation of small cell is allowing the bees to draw natural comb. That means no foundation, or only starter strips. Once the bees have drawn a full broodnest of natural comb and raised a cycle of brood, the outside comb is removed and fresh frames are inserted. The smaller bees then get to draw new comb and will theoretically draw it even smaller. After two complete cycles of drawing fresh frames the cells should measure roughly 4.9mm. Some beekeepers successfully use this method year after year but getting there can be hard.

Natural Cell

Natural cell builds on small cell but is less focused on the size of the resulting cells and more focused on getting the bees to draw fresh comb. The fresh comb may in fact be smaller and it will certainly have less disease and potentially chemicals built up in them. What to do with all those frames you are pulling? You can melt them down for wax or use them to hold honey if you are using the same size frames in the brood nest and in your honey supers. A common figure cited is that bees spend eight

pounds of honey to draw one pound of wax. There's no scientific backing for this, and the bees behavior doesn't support it. They don't recycle wax unless they are forced to or in emergencies. Those wax cappings on the bottom boards are never re-used unless the bees are desperate. What is not disputed is that bees that have drawn comb to work with take off faster and collect more honey because they can concentrate on storing rather than drawing wax.

Acids

Oxalic and Formic acids both rely on vapors that don't harm the bees but kill the mites. Be careful with acids, particularly Formic acid. Ants sting with it, people etch with it, and it kills lung cells quite effectively. Used correctly Oxalic acids are quite effective.

Powdered Sugar, Sucroside

One is something you get at the store, the other is one you don't (unless you shop at bee supply stores a lot). Powdered sugar, dusted over all the bees and brood in a hive has acceptable to poor varroa killing properties. It might be good for knocking down the varroa count of a low infestation but you need heavier guns for heavier problems. Sucroside is that heavier gun. A liquid sugar you spray over the bees with a garden sprayer, application is very labor intensive – you spray every bee, every frame.

Oils and Screens

Essential oils in grease patties form a miticide that some beekeepers swear by, and others at. I'll render no judgment either way and you should be open to options as well. Integrated pest management is using screened bottom boards to allow mites to fall out of the hive (and hopefully die). Screened bottom boards with collection trays also provide a way to get a mite drop count from a hive.

Nuc 'em till the glow (and shoot them in the dark)

Don't rule out chemicals completely. A time may come when you need those chemical poisons to save a colony. In that case the best advice is what the state apiary inspectors have said for years – Know what pesticides work in your areas and which don't. Don't use fluvinate if your mites are resistant, it just prolongs the process. Don't use any chemical other beekeepers near you already know to not work. I won't cover how to use pesticides. The labels are the best source of information and the only way to use them.

Conclusions

Read, study and always be on the lookout for the next thing down the pipe. You haven't seen the final chapter in the war on mites and neither have I. The best a beekeeper can do is prepare for the battle, know his enemy, formulate a plan and follow through. The rest is up to the bees. They will do their part.

A Perfect Silence

The entrance to the hive, the landing board, should resemble a tiny storm of bees in the summer. Foragers fly like tiny helicopters in, barely avoiding the rush of outbound bees. Guard bees line the entrance, testing the inbound bees, ready to attack. Other bees line up noses into the hive, fanning their wings to cool it, and still others fan their abdomens, their scent calling the workers home. This day the landing board was deserted.

On closer inspection, not exactly deserted – in front of the hive lay a pile of dead bees, some still twitching. On the corner of one entrance a worker ran in crazed circles, ever slower. The guard bees refused her entrance each time she approached, and eventually she stopped her mad dash and lay on the board, feeble legs moving helplessly.

In a healthy hive the mortuary bees will drag the dead far from the colony to avoid attracting ants, but I could not see no bees taking off dragging the dead away. Then I opened the hive. The sound of the hive is like a song, and its words tell you of their mood and their health. This hum, however, was faint. More dead bees lay inside the entrance, and as I lifted frames from the hive body they fell away. Larva, normally curled in a wet c shape at the bottom of their cells, languished out along the walls, dead. I knew what had caused this.

This was a pesticide kill.

Pesticides come in as many forms as the pests they “protect” against, and many are needed to prevent the ruination of crops. Their use comes with a price, as many are poisonous to insects beyond their intended targets, and the spray meant for the apple blossoms falls just as well on the dandelion beneath the tree.

Some pesticides have a diesel carrier, and these kill the bees that get sprayed. That’s bad, but there are worse scenarios. Some pesticides infect the pollen of the flower, and as such, get carried back to the hive. If the colony is fortunate the pesticide kills the bee en route, or affects its behavior such that the guard bees deny it entrance. It will die on the landing board, but there are worse things that could happen. If the bee makes it back to the hive, and gains entrance, the poisoned pollen will be packed into cells.

Nurse bees will mix this pollen with nectar to feed the larva, and kill them where they lay. Newly hatched bees will feed from it, and die on the frame. The harvesters die in the field, the nurse bees on the frame, the larva in their cells, and the colony is dealt a mighty blow.

I knew the poison could have come from anywhere, from the fields down the street to the parks up the hill, so I swept out the dead, and put on a feeder, and reduced the entrance, and left the wounded colony. That evening my wife and I took a walk, and our usual route took us up the street and past a garden. I love that garden, and the

bees do too, hanging heavy on the roses. This evening there were few bees on the roses though. Then I saw it.

In the flower bed by the garden edge, a can of malathion based pesticide, a green label with a pink rose adorning it. I approached the gardener, who was watering his flowers, and asked him if he had been spraying for bugs. Yes, he was. Did he know the bees were in his garden? Yes, he did. They kept coming back, he said. Why did he spray? Because the thrips kept eating at the roses. He wanted them to be perfect.

I have since looked up that word in the dictionary, and the word perfect has a meaning. It is complete. For nature, the rose is complete even with the tiny scars. It is only to man that perfect means absolutely without blemish. In nature, perfection it is the completion of all things. In our quest to be rid of flaws, we have left behind this understanding of perfect, and the cost is high.

There is a silence in the bee garden tonight, where there should be the beat of many wings, and down the street there blooms a perfect rose. It is complete, as nature intended, and without flaw, as its gardener desired, and it is alone, perfectly alone.

Buying Honey

A good little spiel!

Buy Honey From Me (or don't)

I'm selling honey from my bees. You are welcome to mail me and buy some if I have any available but I want to be absolutely clear about something:

I recommend you buy from a local beekeeper.

With local sales your money stays in your community and you help people do business and live in your area. Your local farmer's market should have at least one honey seller. Get their contact number. Get to know them. They can let you sample the honey first. They'll give you price breaks on your mead making acquisitions in some cases and you can negotiate with them. If you buy from me you get what I send you without being able to taste it first. No, I cannot ship you a sample spoon for you to taste first.

Bears, Bees and Honey

It's entirely unclear to me what the fascination with plastic bears and honey is. We don't make plastic junkies with heroine inside, or plastic Major League players filled with Steroids, or plastic models pumped full of silicon. Bears and honey are another matter entirely. The really strange thing about this is that real bears don't come for the honey. They come for the bees and brood. They'll eat honey too. Bears are like sharks and college students in being unable to discern food from garbage. The one thing I won't argue with is market forces. Honeybears sell more than other containers. You like the bear, don't you? Admit it.

What you get

While a real "honey bear" would contain large amounts of mashed bee larva and wood splinters, I'm offering only ones that contain pure honey, specifically Fireweed Honey. I'm offering one size at prices intended to discourage you from buying from me. I am quite aware that you can find honey cheaper on google. You can also find it cheaper locally where you don't have to pay shipping. My coworkers tried it and said "It tastes like honey." That's an endorsement I can live with. I think it's delicious but I'm hardly a neutral party here. For those who still want some honey I'm offering one is a ten ounce honeybear, containing about ten ounces of honey wrapped in an attractive plastic bear. Well, it's attractive if you have a fetish for plastic bears. The ten ounce bears cost \$10 (That's 5.00 for the bear, what I'm selling it for locally, 4.05 for priority mail and some change). You are welcome to order more than one 10oz bear and yes, they will be combined to the same package. Shipping two 10z bears together in the same box has an advantage on pricing. The two lb bears are going to a charity auction at some point. You could get more honey locally for less.

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