

Objectives

- ◉ Queens
- ◉ Genetics
- ◉ Grafting
- ◉ Hardware & Procedures
 - Cloake Board
 - Starter/Finishers
 - Mating Nucs

Honey Bee Queens

Queens differ from workers:

- Lack
 - pollen baskets
 - barbs on stinger
 - wax glands
 - royal jelly making glands
- Produce Queen Retinue Pheromones (QRP)



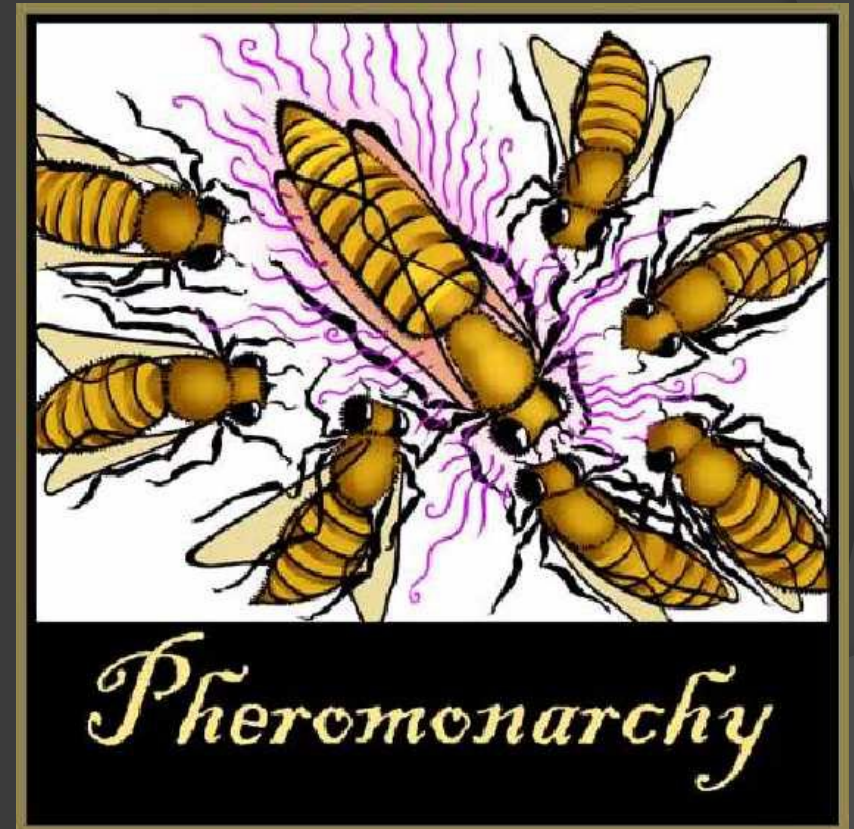
Queen Retinue Pheromones (QRP)

Thought to be mandibular pheromone => mandibular glands

28 constituents

5 pheromones
+ 23 other chemicals

Passed by scent & touch from
head, feet & abdomen
throughout colony

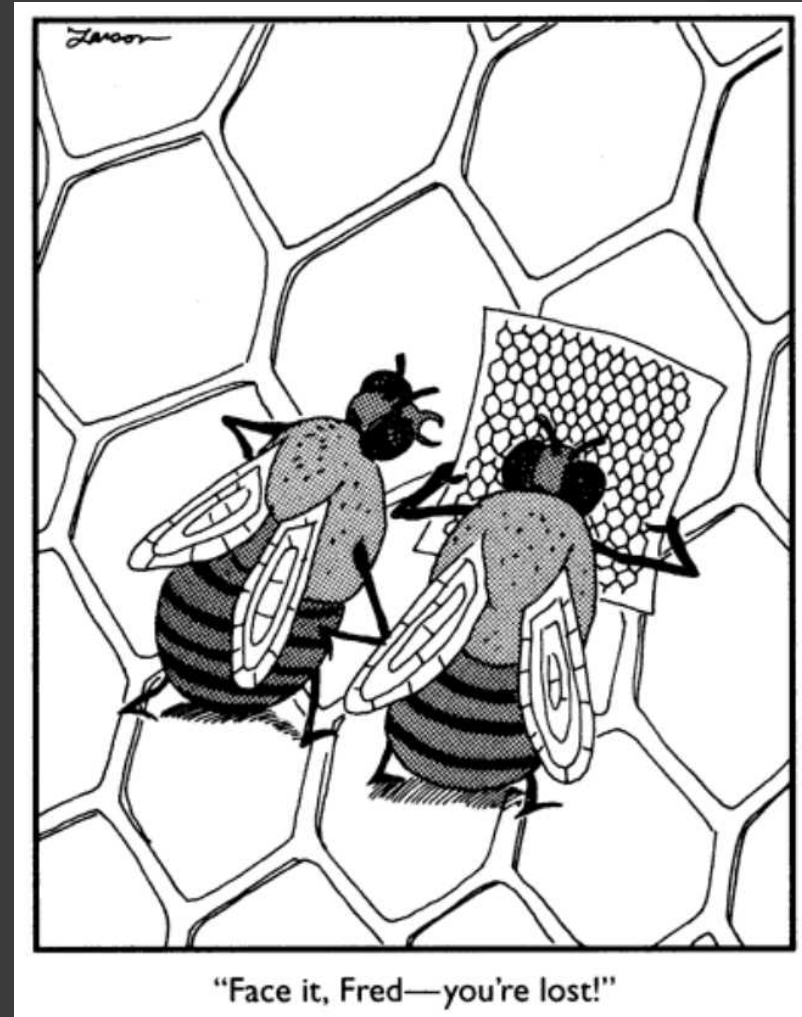


Queen Retinue Pheromones (QRP)

Keeps colony cohesive

Stimulates foraging

& brood rearing



Queen Retinue Pheromones (QRP)

Cues retinue to care for QN

Stronger chemical cue => larger retinue

Indicates if queen is mated or not

Inhibits supercedure

Controls swarming

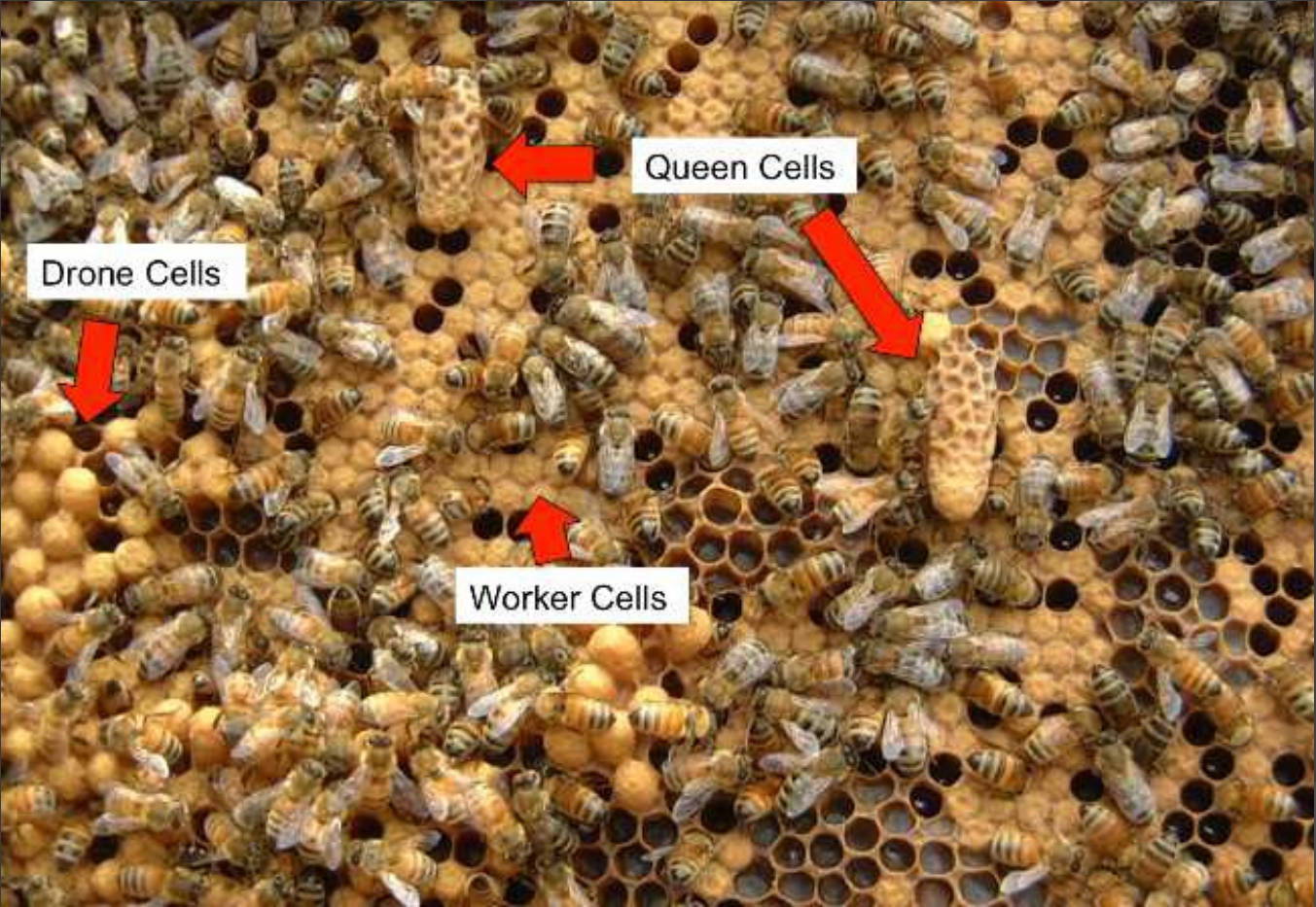
Inhibits development of ovaries in worker bees



Queen Cups



Supersedure cells



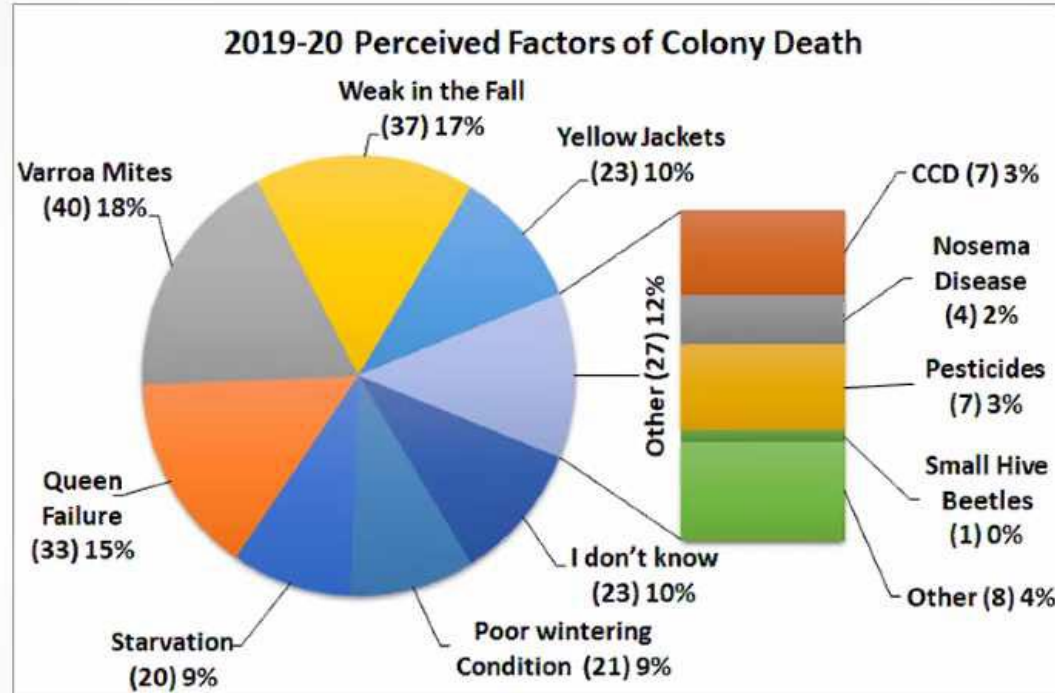
Emergency cells – age, illness, beekeeper error

Swarm Cells

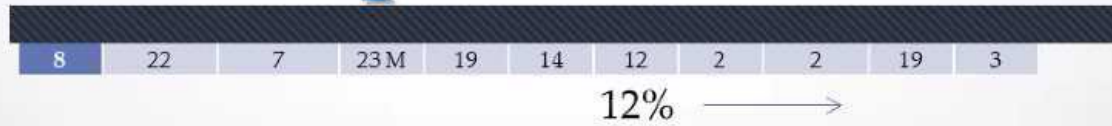


Reason for loss

n=188



Acceptable Loss



Com'l beekeepers will replace queens every year.

Why raise your own queens?

Foundation of good colony management

- Acclimated to local micro climates
- Avoid stresses of purchased queens

How long were queens stored in banks?

Shipping effects queen fertility

Heat

Travel agitation

Food & water in transit

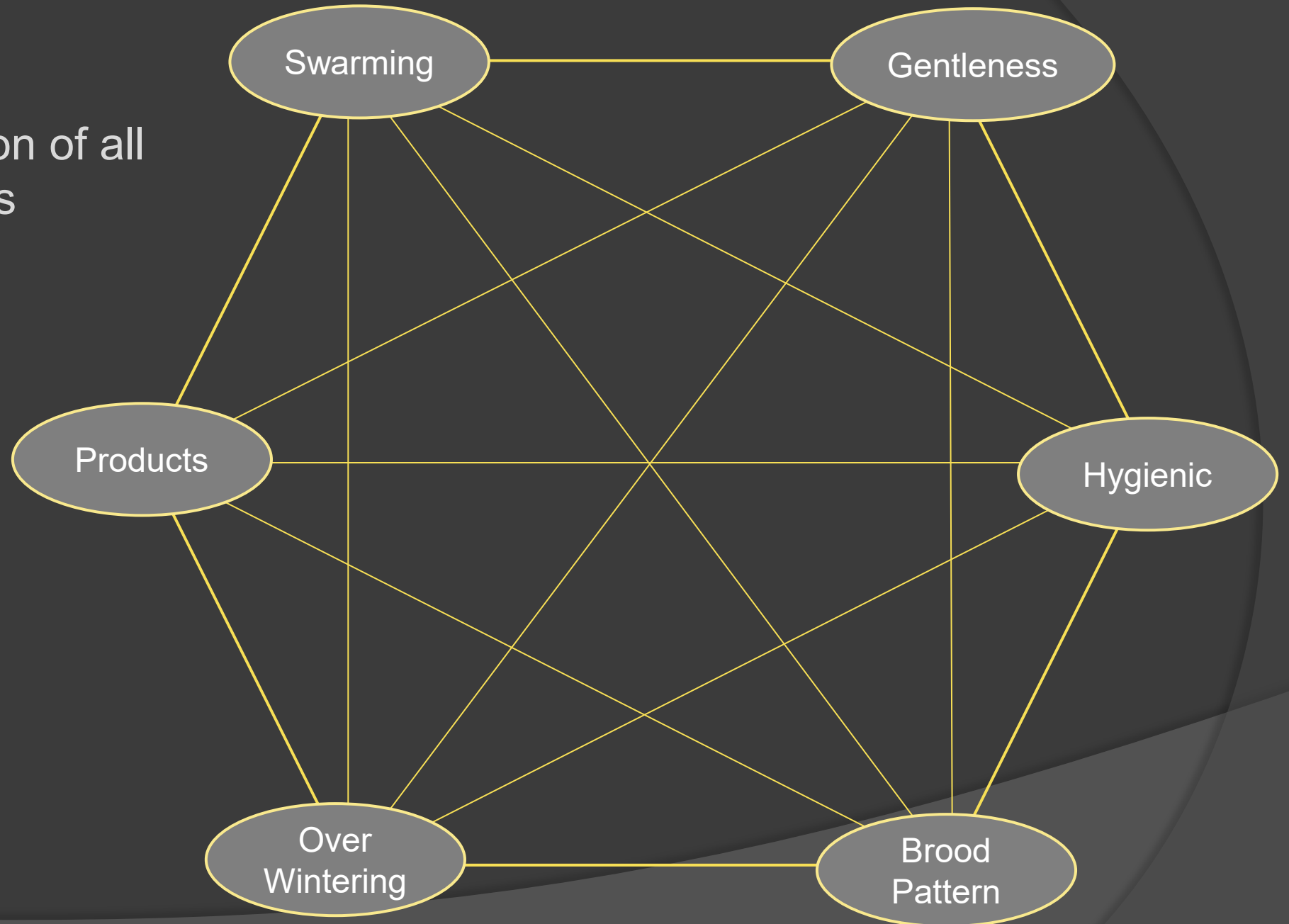
Diseases from other apiaries

- Control genetics
- Maintain sustainable apiary w/young vigorous queens
- Have supply of queens on hand

Genetics - Selection

- Swarm tendencies
- Gentleness
- Over wintering
- Solid brood pattern
- Products: honey, propolis, wax (comb stability), royal jelly
- Hygienic behavior
- Mite resistance
- Color

Complex interaction of all these genetic traits



Selection of New Queen Genetics

- Start with 2-3 characteristics
- Add new characteristics one by one
- *** Use 3 yr old queens ***
(hasn't swarmed, survives diseases & winter)
- Mutation, Natural Selection, Genetic Drift

Drone Congregation Areas - DCAs

- Queens fly farther to DCAs than the drones
 - avoids inbreeding
 - allows drones to spend more time in DCA
- Queens may fly ~2 miles
- Drones ~.6 to 1.2 miles

Easiest Ways to Raise Queens

Pinch old queen

Walk away split

Nuc w/eggs & larva

Caution!!!

- Never check a split, hive or nuc with newly emerged or virgin queen. Bees may kill her.
- Wait 4 weeks before opening the hive.
- Incoming pollen is an indication of a laying queen.



All methods similar

Stimulate queen rearing

queenless starter -> emergency response

queen-right finisher -> swarm mode

Move

Nursery colony/incubator

Mating nuc or colony

When Is The Right Time?

Donor colony - well fed, healthy & populous

Drones are flying

Good weather

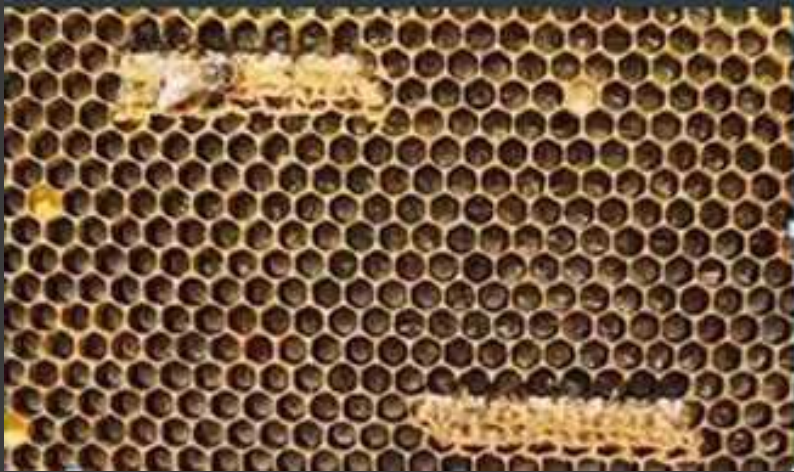
Night temps > 50

Day temps > 60

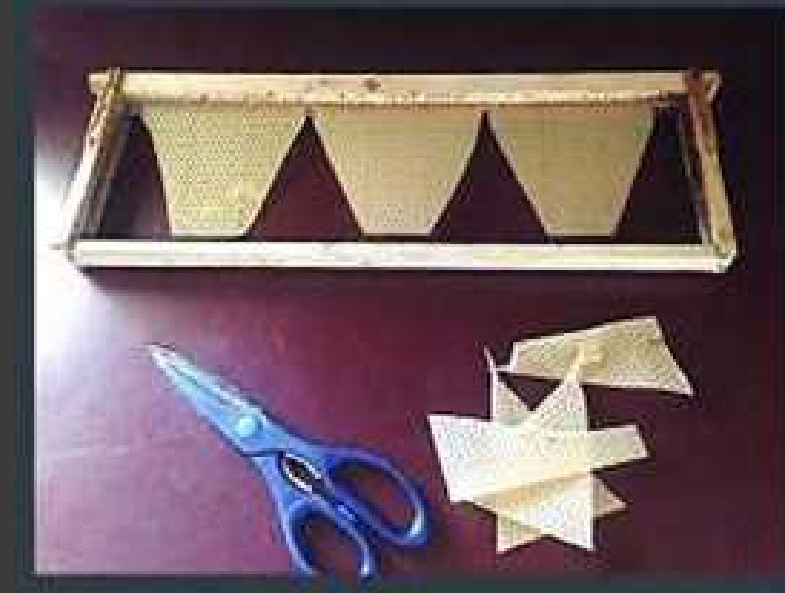
Your nerves are steady!

Non-Grafting - Manipulating Brood Comb

On The Spot (OTS) - one of easiest
only hive tool required



Miller Method (one of the oldest)



Hopkins Method



More Involved Ways

Cell Punch

Grafting

Instrument insemination – Sue Cobey



Grafting – Doolittle Method

“Scientific Queen-Rearing” - G.M. Doolittle 1889

Originally queen cups (queen acorns)

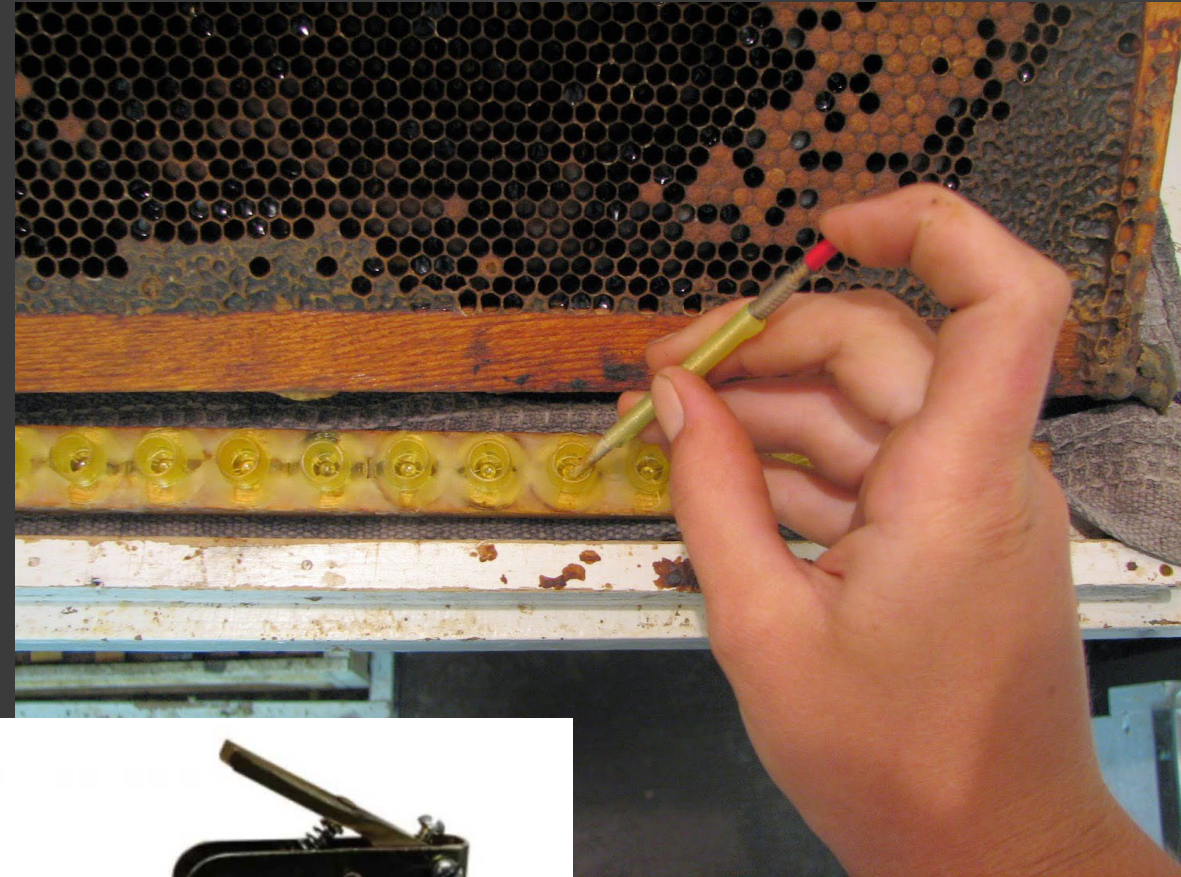
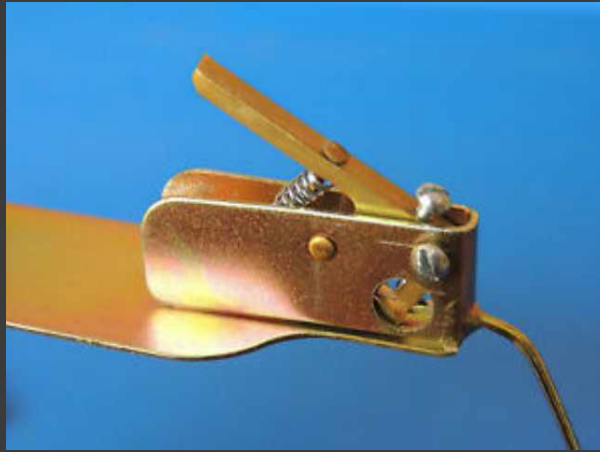
transfer young larva (grafting)

Plastic cups - larger production

All major queen producers use a variation this method

Can produce thousands of queens

Grafting Tools



Grafting

Good lighting & Magnifier

Sloped frame position

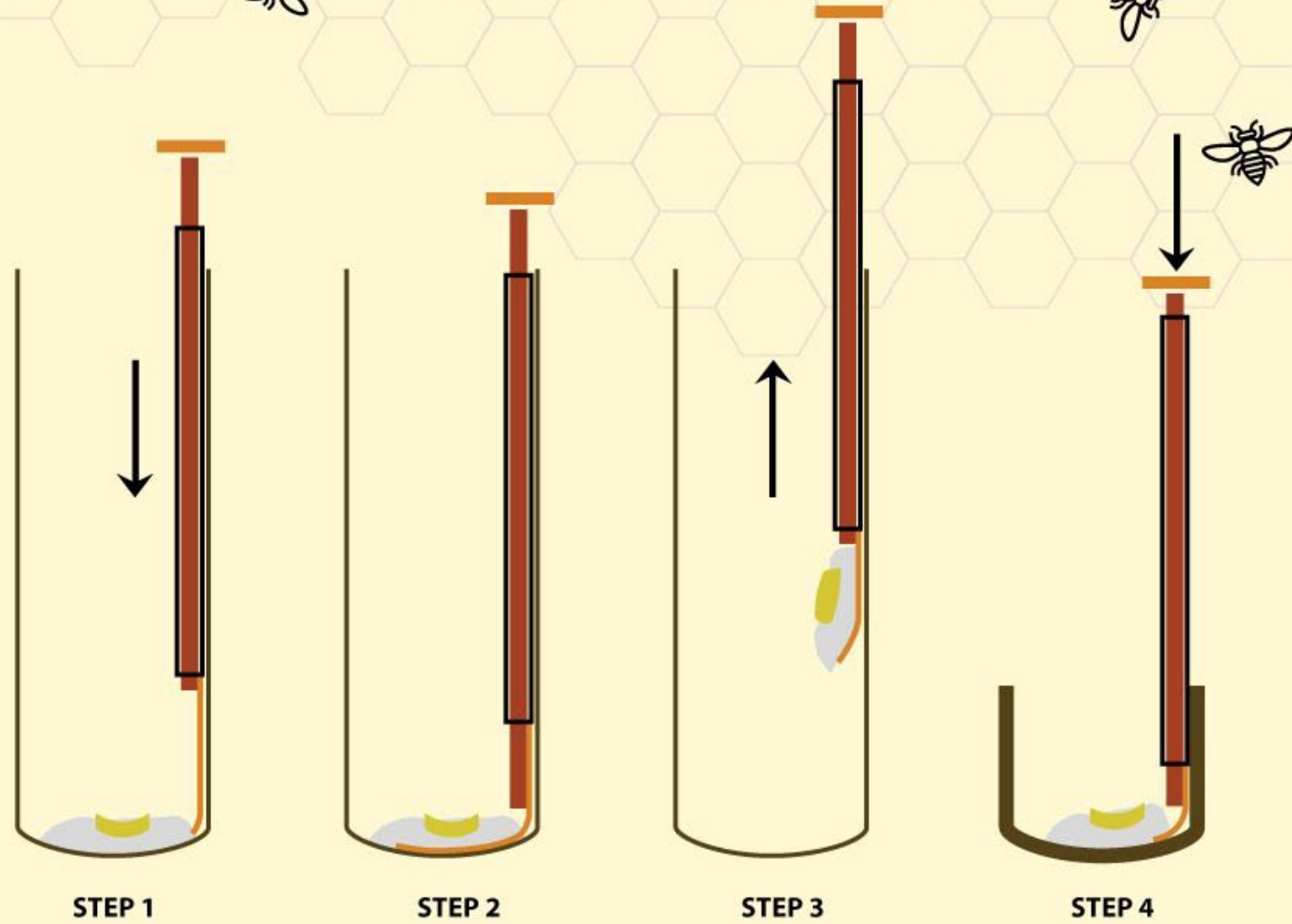
Select larva w/ grafting tool


Deposit in center of cup

Cover w/moist towel

Not a lot to it but need practice, patience & good vision

Grafting your own Queens

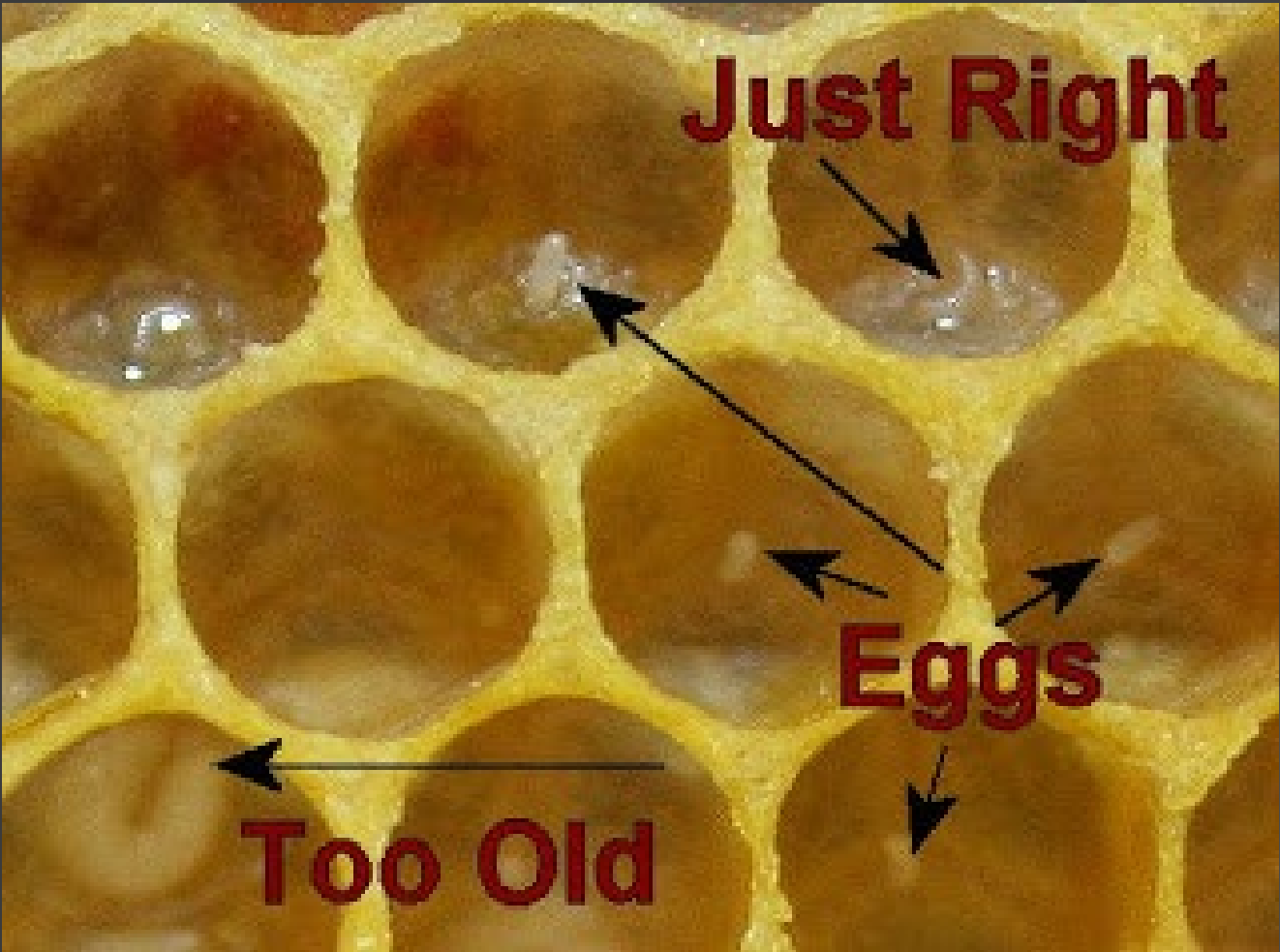


 = Jelly  = Larvae

What sized larvae?



What sized larvae?



Queen Cell Bar with Cups



Starter / Finisher Colony – Cloake Board Procedure

Several days before graft install Cloake board w/o slide

Move several frames of open brood from lower box -> upper box

Replace with drawn comb

Leave queen in bottom

Rotate bottom board & close entrance

Top should have nectar, pollen, foundation

Starter / Finisher – Cloake Board Procedure

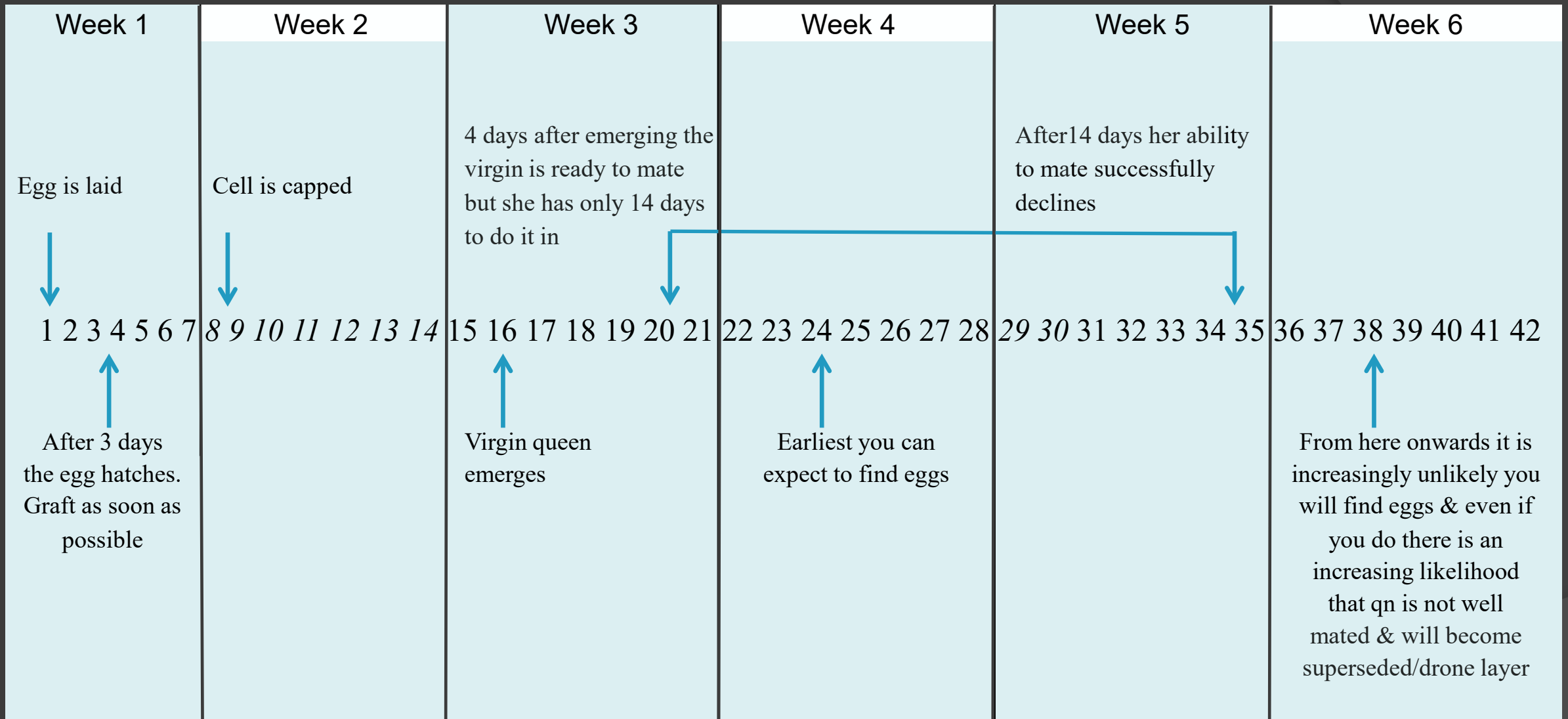
12-24 hrs before graft place slide in position & close back entrance

Remove young brood from top box

Add pollen frame in center & add water & feeder

Day

- 1 Graft & place in center of top box (starter)
- 2 Remove slide. Close rear entrance (finisher)
- 3 Gently check progress
- 9-10 Place in mating nucs or colonies



Meghan Milbrath – ABJ 8/2020

There will be a period of time, about 4-5 weeks where the hive **looks queen less.**

As the brood is emerging, no replacement eggs are being laid.

Remember you have a new virgin queen or a newly mated queen.



Success !!!



Success !!!



Timing !!!





**Queen Rearing Calendar for
03/24/2021**

Brought to you by The Beekeepers of the
Susquehanna Valley
www.thebeeyard.org

Mother Colony Name/ID

Grafting Medium Used

Cell Cup Style/Color

Grafter's Name

Days Old	DOW	Date	Task/Status	Notes
0	Sunday	3/21	The egg is laid by the queen mother.	
1	Monday	3/22		
2	Tuesday	3/23	Select or create a queenless starter hive	Starter hive Name/ID:
3	Wednesday	03/24	Graft the day-old larvae into cell cups, and insert into a queenless cell builder colony.	Number of Cells Grafted:
4	Thursday	3/25		
5	Friday	3/26	Check your grafts: the bees should have started to draw out the cells and feed the larvae with royal jelly. If not, re-graft.	Number of Cells Accepted:
6	Saturday	3/27		
7	Sunday	3/28		
8	Monday	3/29	Queen cells are capped	
9	Tuesday	3/30	Sensitive developmental phase - do not move cells and be very gentle when opening the hive.	
10	Wednesday	3/31		
11	Thursday	4/1		
12	Friday	4/2	Move the capped queen cells into mating nucs	
13	Saturday	4/3		
14	Sunday	4/4		
15	Monday	4/5	Queens hatch	
16	Tuesday	4/6		
17	Wednesday	4/7	Discard any unhatched cells	
18	Thursday	4/8		
19	Friday	4/9		
20	Saturday	4/10	Mating Flights	
21	Sunday	4/11		

<https://thebeeyard.org/queen-rearing-calendar/>

Incubator



Mating Nucs

Mating Nucs



Are primarily used by queen producers for mating a virgin queen

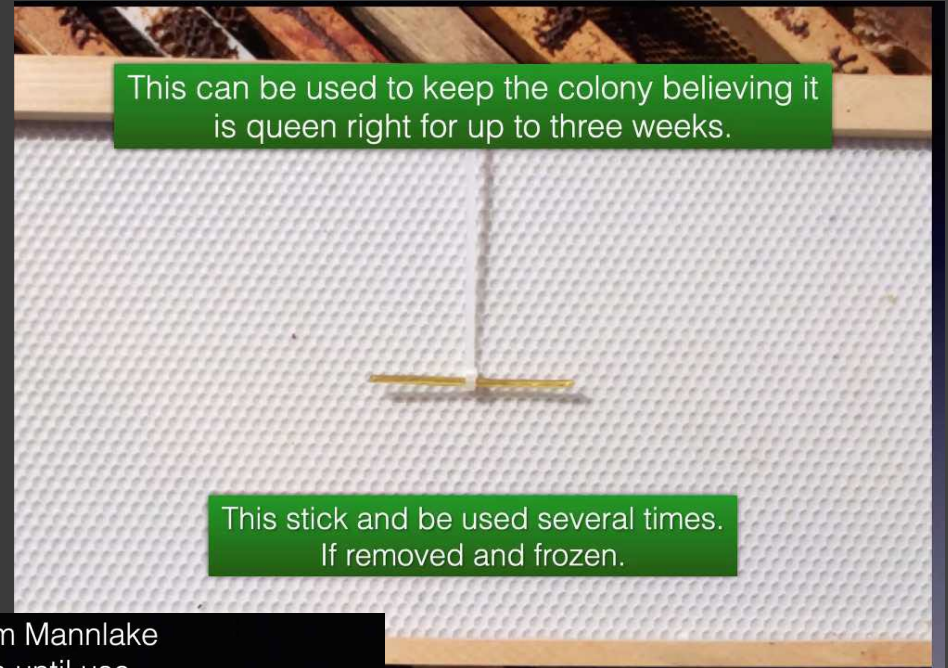


Mating Nucs



Don't disturb when virgin queens are present.

Don't forget to check for mites !!!!!!!

Another way to help with re-queening is to use a TempQueen stick.



Available from Mannlake
Keep frozen until use.

	
DC-705 TempQueen 10 pack \$27.25 29.95	DC-715 TempQueen 50 pack \$81.85 89.95

48 Hour Queens Cells

These larvae are about midpoint in their larval development. The larvae are large enough to withstand time outside the colony and away from nurse bees, but still small enough so they will not crawl out of the cell when stressed.



The potential for this is huge. Even a small hobby beekeeper can produce queen cells for his or her own operation and carry them to a second location...



QUEEN REARING ESSENTIALS

Second Edition



LAWRENCE JOHN CONNOR



BEET ESSENTIALS



Grafting

Resources needed

Hives required

Breeder

Starter

Finisher

Mating nucs

Timing

Club members get special price

Stage	Day	
Egg	1	
	2	
	3	
Unsealed larva	4	Egg hatches -> larva fed royal jelly
	5	
	6	
	7	
	8	
Capped	8.5 – 9	
Pre-pupa	10	
	11	
	12	
Pupa	13	QN pupa fully formed. Days 13 – 14 are the
	14	best times to move cells for distribution
	15	
Queen emerges	16	
Mating flights	20	
Egg laying	23 - 30	

Marked Queens



(c) Kathy Keatley Garvey

Queen Marking Cages



Marking The Queen

Practice with drones

Grab gently by thorax

Roll between thumb & forefinger

Color by year

Marking pens

Use

Precautions



1 6 Wow

2 7 You

3 8 Raise

4 9 Green

5 0 Bees

Should You Replace Your Queen?

Judging the brood pattern



New World Bee Imports

~ 30 races of *A. mellifera*

Subsp.	Origin	Arrival
<i>mellifera</i>	Europe	1600' s
 <i>ligustica</i>	Europe	1859
<i>lamarckii</i>	Africa	1866
 <i>carnica</i>	Europe	1877
<i>cypria</i>	Middle East	1880
<i>syriaca</i>	Middle East	1880
 <i>caucasica</i>	Europe	1880-1882
<i>intermissa</i>	Africa	1891
<i>scutellata</i>	Africa	1990
<i>pomonella</i>	Kazakhstan	2015

Each import was a subset of species genetics

Genetic Bottleneck Necking in US

Interbreeding since 1922

Dwindling gene pool diversity

Breeders use <500 queens to create
1 million queens each year

Constrains diversity

Disease vulnerability -> devastate the population

Genetically diversity -> more robust population & handles diseases better

- * WSU only lab in US permitted to import genetic mat'l
Preserve by freezing it in liquid nitrogen

1922 Honey Bee Act

Restricted importation
of honey bees into the
U.S. - an attempt to
keep out tracheal mites



Reasons for Spotty Brood

Hygienic removal of larva

Early season

Nutrition - pollen, nectar dearth

Weather

Disease

Mites

Queen issues

Young queen

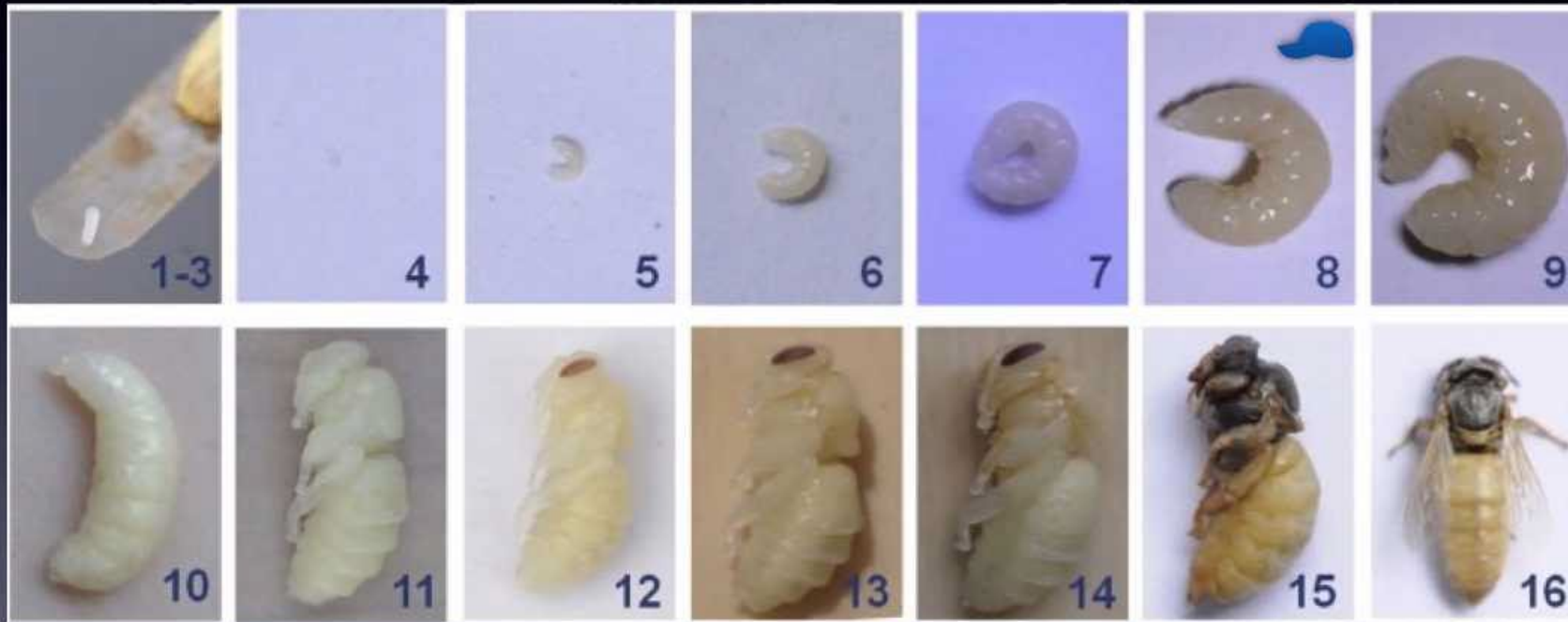
Inbred or poorly mated

Failing or just old

Genetics

Don't turn **capped** cells upside down.

48 hour cells are not capped.



The legs and wings can be easily damaged by the larva sliding up and down.

Overcrowding Method

Overcrowding Your Hive (swarm cell)

Wait till after the nectar flow and push bees down one box size
(Remove old queen/place in nuc box with one frame of dark capped brood)

Add pollen patty and syrup feed jar (you want lots of resource)

Check 3 days for cells/save largest cells

Check day 10 cut/or frame with cells move to mating nuc(s)

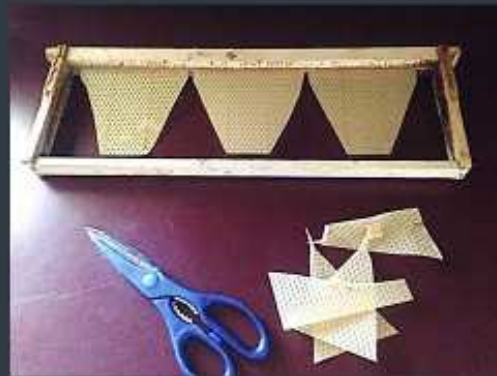
Check 3 days for emergence

Check 10 days for eggs

Fun to be a bad beekeeper and raise queens!

Old queen can be recombined to old hive if needed

Miller Method



Three capped queen cells,
Miller Method

Photo- Albert Chubak

OTS (Mel Disselkoen)

Pick a frame with day old larvae (barely a "C" shape)

Take your hive tool and depress the wax rib below that line of larvae cells (bottom edge of cell)

Place frame in your **starter/finisher**

Add pollen patty and syrup feeder jar

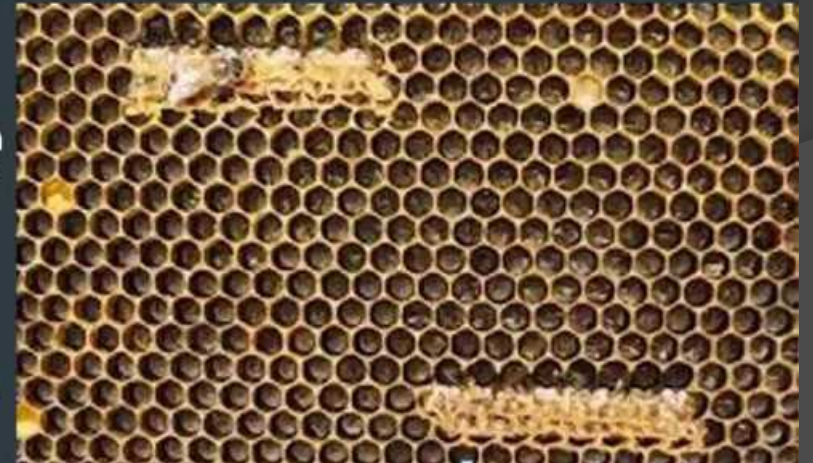
Check 3 days for capped cells

Check 10days for cells to harvest

Harvest and move cells to mating nucs



Cut Rib Line



Cell Punch Method



Finding the Queen

Frames with most bees

Queen like movement

Virgin queens - nervous & easily frightened

Mated queens - deliberate & sedate

Eggs or brood -> queen present



Ready for the Finisher



Honey Bee Queens

- Queen development dependent on hormones & genes
- Queens - 1600 feeding visits/day (workers - 143)
- Royal jelly does not change cast from worker to queen
worker larvae fed royal jelly => poorly fed workers
- It's more complicated - queen jelly
worker jelly
drone jelly

Queen Life Cycle

Queen lays millions of eggs in her lifetime (1-5 yrs)

up to 2,000 eggs/day

Fertilized eggs

female workers
queens

Unfertilized eggs (drones) – determined by cell size

worker cell size is 5.1 - 5.4mm

drone cells 6.4 - 6.8mm

As she ages - egg-laying decreases & laid in less organized patterns

workers induce replacement or supersedure

old queen is killed

Weakened Pheromones

Over population => diluted queen pheromone => swarming

Old queen with swarm

Weakened queen pheromone => supercedure

queen replaces herself
she is killed

Total lack of pheromones => laying worker

Installing New Queen

Induces brood break, inhibits mites, discourages swarming

Techniques

Pinch queen 24 hours before

Place queen cage/cell between brood frames

Masking tape for longer acceptance time

Sources for the best queens

Buy locally

Raise your own!

Understand the Biology

	Eggs	Larva	Capped	Emerge
Queens	3	8 ½	5	16
Drones	3	9 ½	10	24

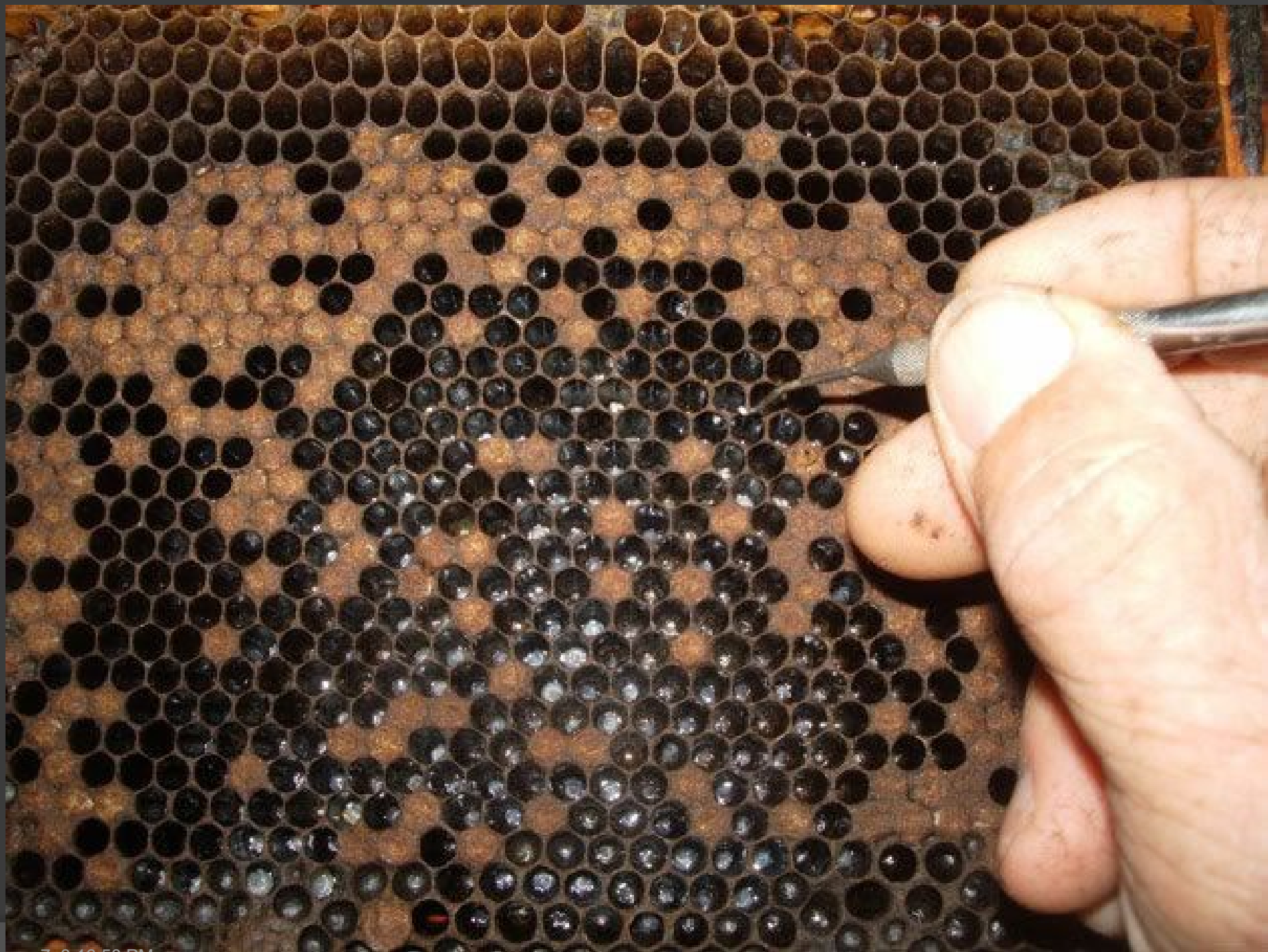
Queens are fertile at 23 days

Drones are fertile at 38 days

Queens are failing – Why?

1. Poor mating?
2. Thermal hazards?
3. Chronic pesticide exposure?
4. Organic acids?
5. Other? How can you tell?





NC State Extension

	<i>Italian</i>	<i>German</i>	<i>Carniolan</i>	<i>Buckfast</i>	<i>Caucasian</i>	<i>Russian</i>
Color	Light	Dark	Black	Medium	Dark	Gray
Disease resistance						
<i>Varroa</i>	-	-	-	-	-	+
<i>Tracheal</i>	-	-	-	+	0	+
<i>AFB*</i>	0	-	+	0	0	0
<i>EFB**</i>	0	0	0	0	0	0
Gentleness	Moderate	Low	High	Low-Mod	High	Low-Mod
Spring buildup	Good	Low	Very good	Low	Very low	OK
Over-wintering	Good	Very good	Good	Good	OK	Very good
Excess swarming	OK	OK	High	Low	Low	OK
Honey processing	Very good	OK	Good	Good	Low	OK
Propolis	Low	OK	Low	Low	High	OK
Other traits	Heavy robbing	Short tongue, nice white cappings	Low robbing, good comb builders	Supersedure queens produce defensive colonies	Long tongue	Brood rearing affected by flow, queen cells always present

From egg, to a laying queen, to brood

- It takes **16 days** from a new egg for a new queen to emerge.
- The **virgin queen** “rests” (matures) for 5-7 days.
- The **virgin queen** leaves the hive in late morning to mate with up to 20 drones.
- The **virgin queen** may leave the hive several days in a row to mate.
- The **mated queen** “rests” for up to 7 days before laying her first eggs.
- By the time the **mated queen** starts laying, the hive will appear to be “queen less”, (no brood). (40 DAYS)



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