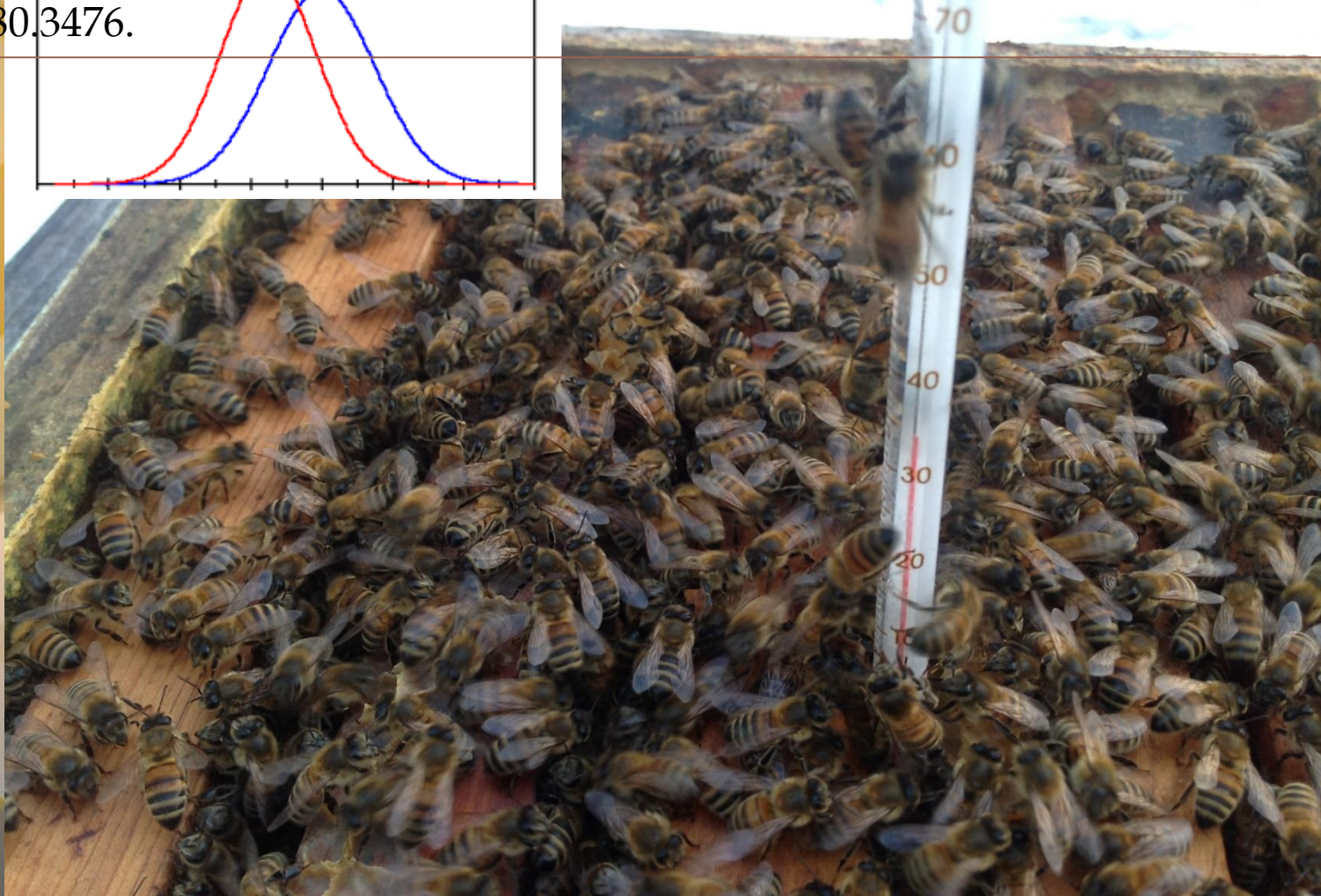
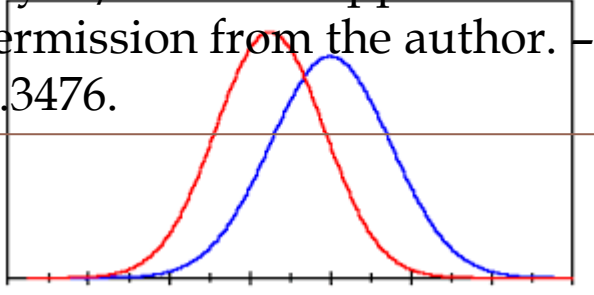


# Hive Monitoring 2.0 – 3Ws

Permission had been granted to Dori Plansky for the private use of this “Hive Mortality w/ Solutions ppt. No other copies or distributions are granted without prior permission from the author. – Alexander Zomchek; [zomchea@miamioh.edu](mailto:zomchea@miamioh.edu); 513.280.3476.





# Whole Hive and Frame monitors



Crystal Hive Project...



# Gardening analogy...

- Soil composition/sampling
- Fence..."deer!!" Regional...
- When to plant...
- From seed or seedlings...
- What to plant...selective seeds...genetics...
- Monitoring! Pests...diseases...
- Weeding...mechanical or spray(s)
- Water...seasonal...under/over consequences...
- Insecticides...herbicides...
- Harvest...Storage...



# Monitoring *Mentality*

Go from a hands off,

generalist,

“looksee” approach

to a

**Premeditated**

**Purposeful**

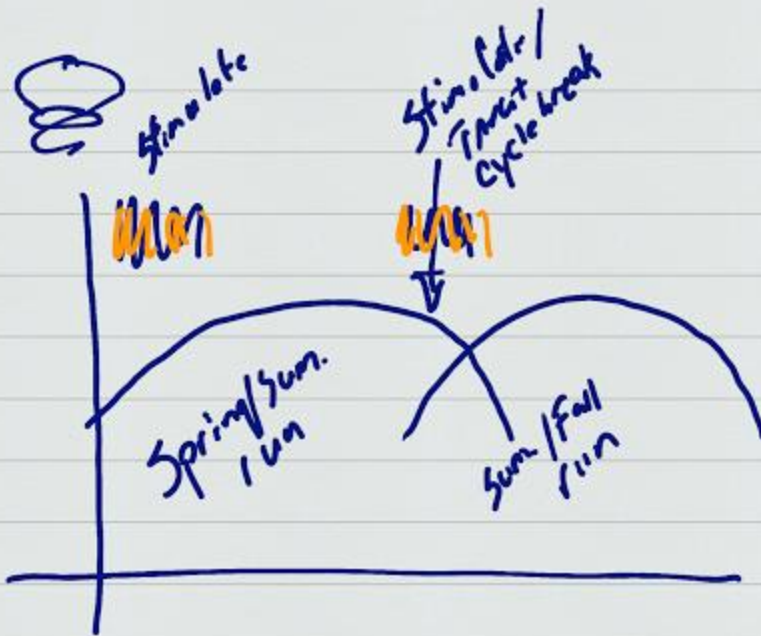
**Monitoring approach**

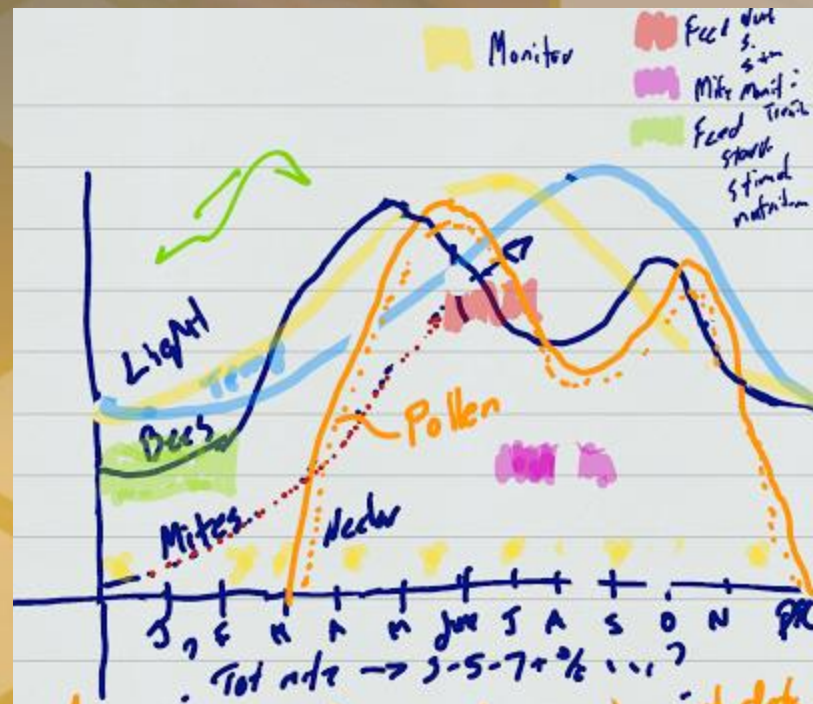
**Dr./Patient/detective metaphor...**



# Overview:

- **Retrospective...the “Golden Years”**
- **WHAT to Monitor**
  - **Primary & Secondary Pests...critical stressors vs. nuisances**
  - **Pushing operational definitions...drones/queens/you!**
  - **Diseases...micro/macro organisms...**
  - **What you can measure...and can not (at least not easily)...**
- **WHEN you can and should Monitor...Seasonality...**
  - **Understanding hive cycles...riding the Bell Curves.**
    - Internal - brood cycles, mite cycles, etc.
    - External cycles - wax moths, SHB...etc.
    - Breaking these cycles
- **Establishing baselines...acceptable limits...thresholds.**





Aside (See pollen count curve) ... get data

Adjust these curves for accuracy ...  
Overlay to make relative comparisons

Use to more accurately "push" bees  
for pop building per old valley to make  
pop/nectar curves coincide ...  
Also, for monitoring; treatment timing;  
ET.AL.!



# Golden Years...150+ million years

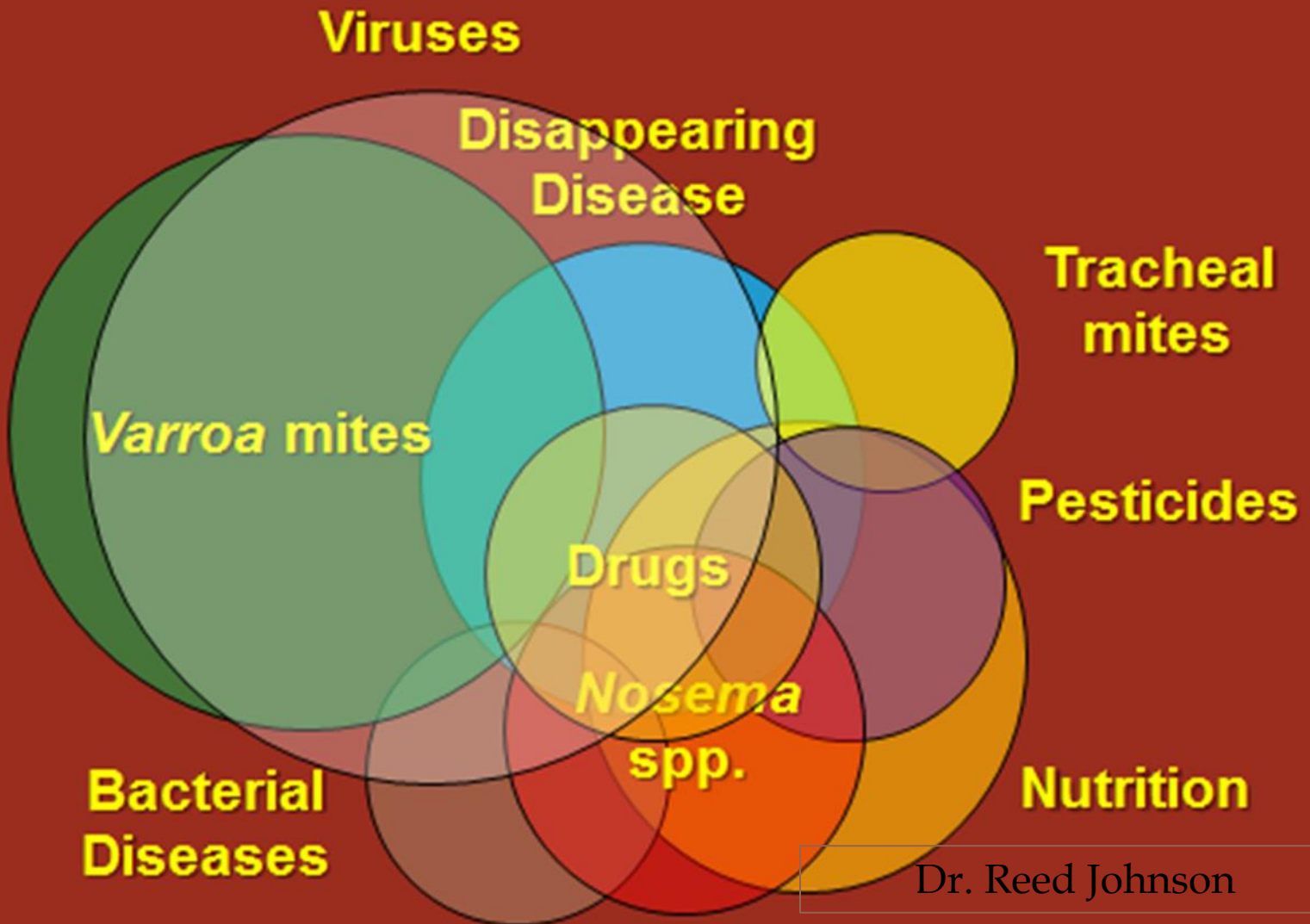
- Some old enemies...primarily bacterial, fungal, and viral diseases
  - AFB, EFB
  - Chalk Brood
- Newer
  - Sacbrood...1964
  - Tracheal mites (*Acarapis woodi*)...in the U.S. (Texas) in 1984.
  - *Nosema apis*...~1996
- Now
  - *Varroa*...1987 in the U.S.
  - *Nosema ceranae*, *N. apis*...1996
  - SHB...2002
  - Viruses, viruses, viruses...
- Apis has had other afflictions...but our:
  - co-dependent food/forage relationship
  - Commercial “scaling”
  - relatively recent scientific prowess
  - has brought honey bee health front and center.





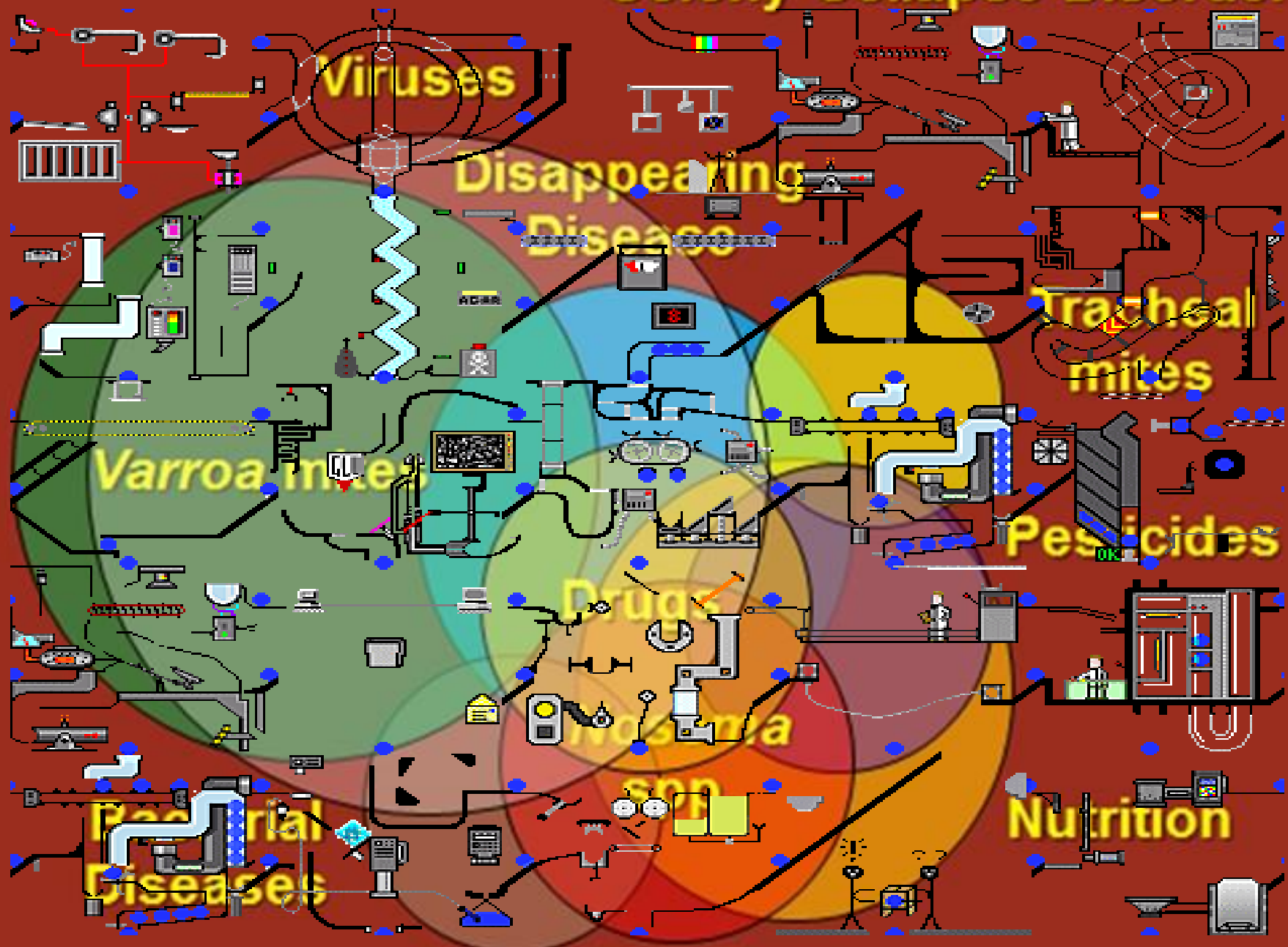
# Complex & *Dynamic*

**“Colony Collapse Disorder”**



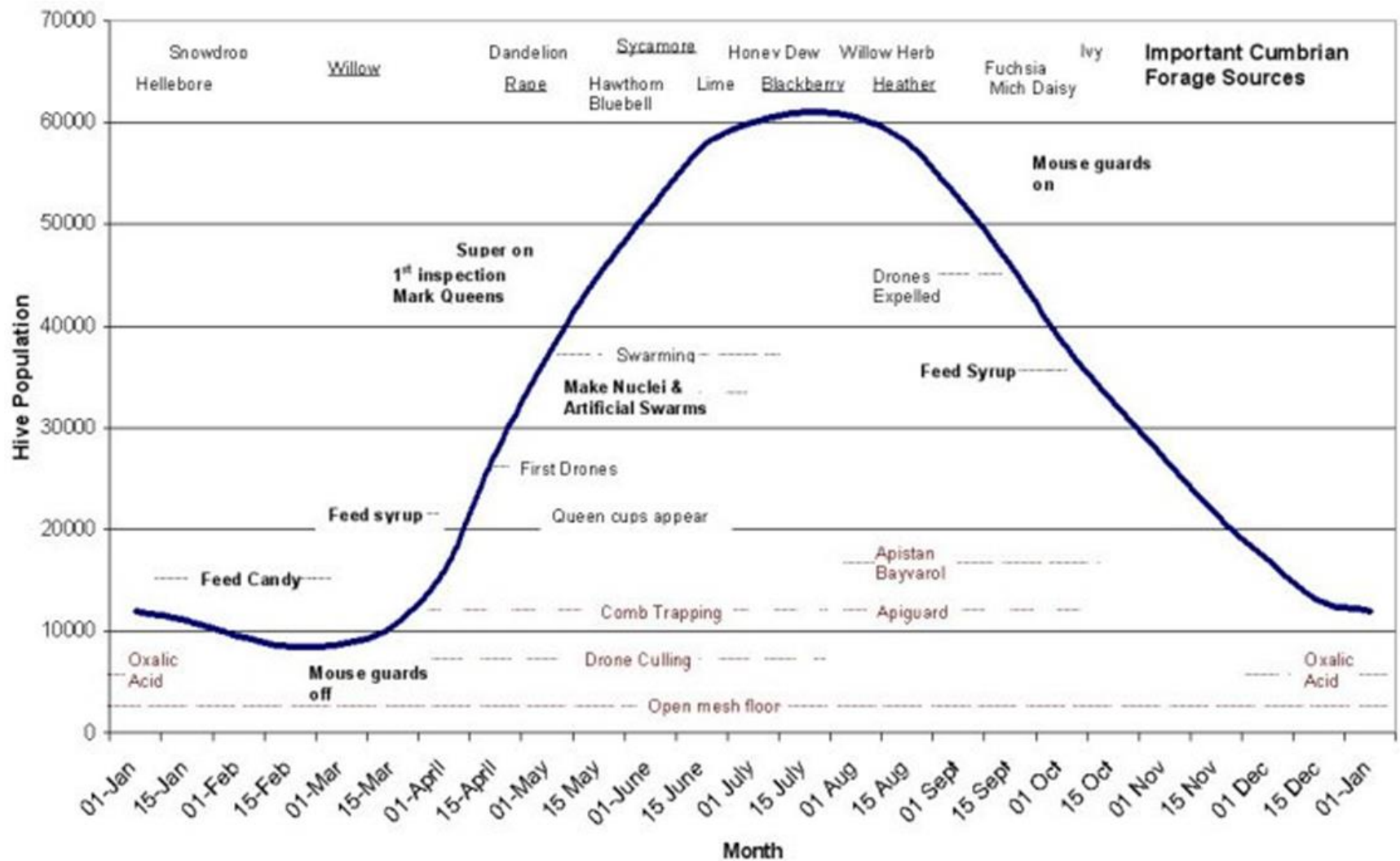
Dr. Reed Johnson

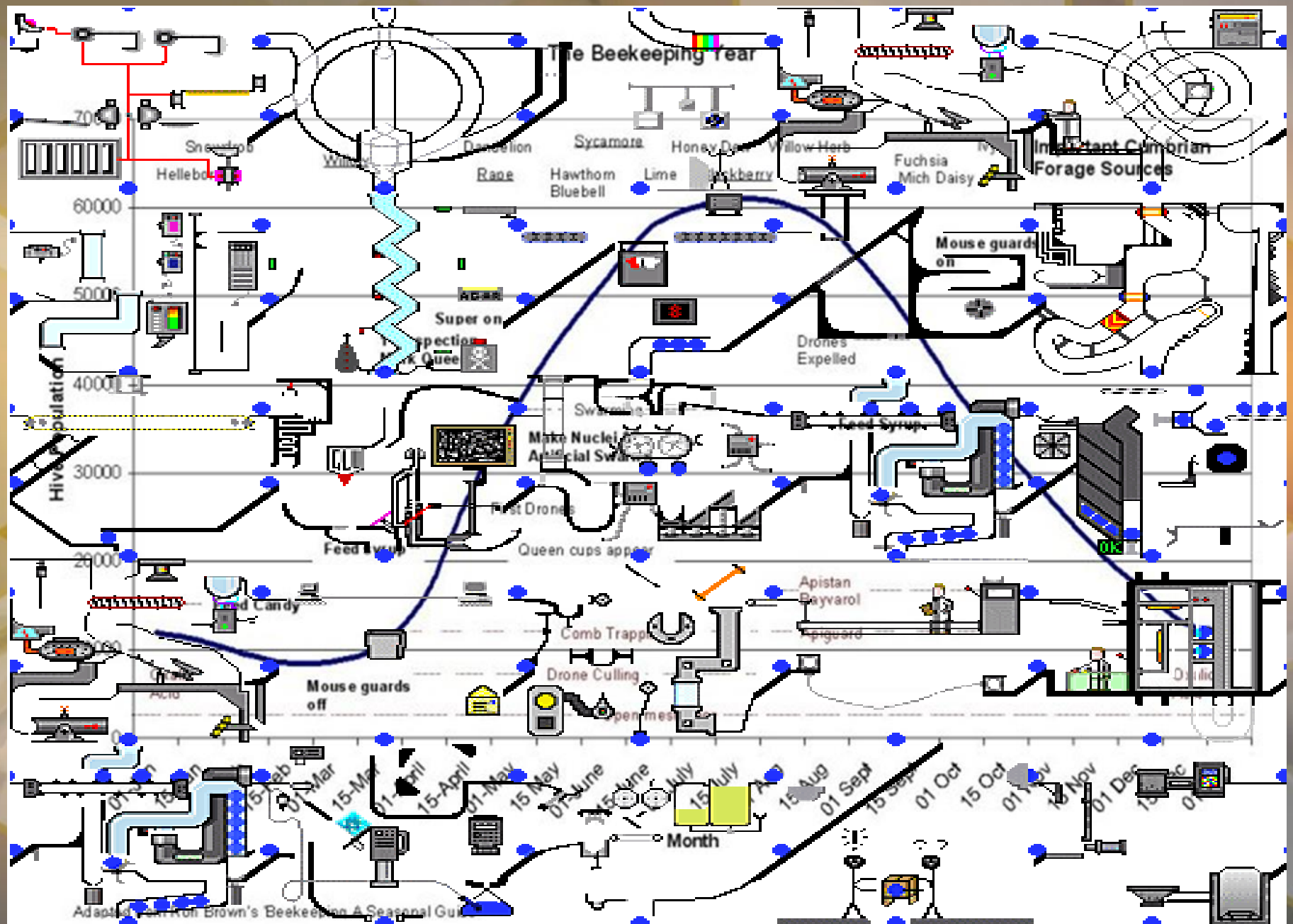
# "Colony Collapse Disorder"





## The Beekeeping Year







# Pre-Monitoring

- Cognitive Dissonance...Don't know...Don't want to know...
- Denial
  - Stage 1: Denial (this isn't happening to me! There can't be mites on my bees.)
  - Stage 2: Anger (You little hive-killing buggers – I'm gonna obliterate you with my Silver Bullet!)
  - Stage 3: Bargaining (My Miticide is not working any more – please give me another Silver Bullet!)
  - Stage 4: Depression (It's just too dangd hard to keep bees anymore!)
  - Stage 5: Acceptance (I accept the mite as a formidable enemy that I've got to learn to live with)

After we've passed through these five stages, we have a chance at RECOVERY, which in this case, is coexistence with the mite, with bees bred for handling the mite on their own.



# Primary Pests



**“Critical” stressors...an opinionated list...**

- **Varroa...in general**
- **Trachea mites.....**
- **Drones! Contentious issue... need, but....**
- **Queens...affect overall colon strength/health.**
- ***You?* Too much/little hive collapse...**





# Secondary Pests...Nusances

- Small Hive Beetle (SHB - *Aethina tumida*)
- Wax Moths
- “Zombie” flys (*Apocephalus borealis* fly) 2008
- Tropilaelaps...not here yet
- Ants...borax!
- & more...



# Wax Moth Migration

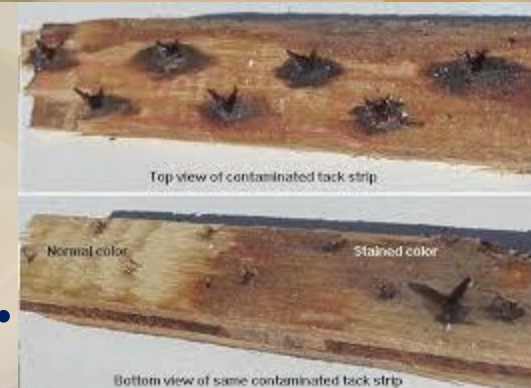




# Aside: Secondary Pests...(cont.)

## LARGER “Pests” of the hive...

- Raccoons...skunks...possums...  
often look for telltale signs...



- Bear!



- Wanderers...deer, cattle..."Hive Tipping"..



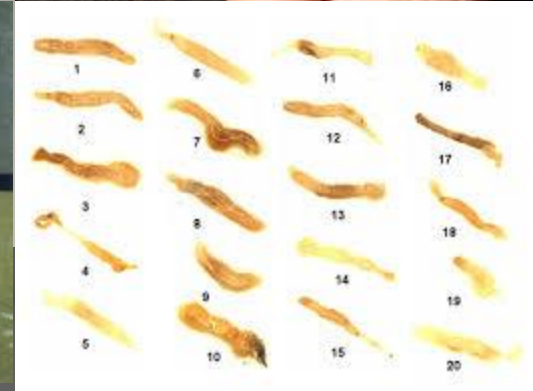
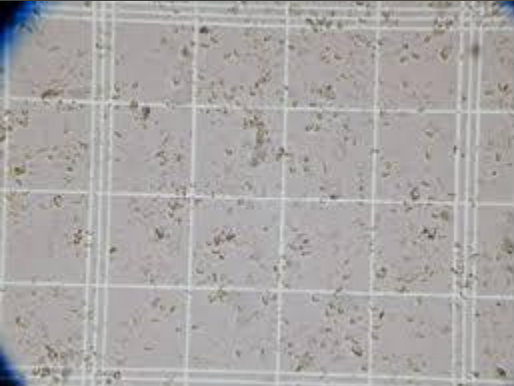
# Small Hive Beetle - SHB





# Pathogens

- Nosema Apis
- Nosema Cerena





# Viruses



- **Currently approx. 24 identified viruses.**
  - many virus infections do not present visible symptoms at all times
  - not all life stages present symptoms
  - often different viruses produce similar symptoms (e.g. paralysis)
  - a single virus may present different symptoms (e.g. CBPV)
  - symptoms can be confounded if multiple virus infections are present
- **Little we can do for field monitoring...**
- **Reduce miteloads and stressors..**
- **Better genetics!**

# Pesticides

## New method finds 57 pesticides in poisoned honey bees

A paper on the study, by the National Veterinary Research Institute in Pulawy, Poland, is published in the *Journal of Chromatography A*.

The researchers, led by Tomasz Kiljanek of the Department of Pharmacology and Toxicology, report how they developed and validated a method for simultaneously detecting up to 200 pesticides and metabolites in honey bees.





# Typical monitoring tools...

- **Cages...filters**
- **Cap scratcher...varroa test...**
- **Sugar or liquid "roll" ...3to 10!**
- **Sticky boards**
- **Traps, traps, and more traps!**
- **Bee samples...liquid and frozen...70% ethyl, methyl, or isopropyl alcohol**
- **Mechanical...rope tests, et.al.**
- **Hive scales...**
- **Cycle breaking...hive manipulation/mechanics...**

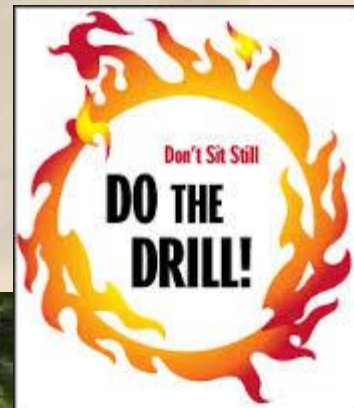


*Singularly*  
**YOU**  
are  
the  
**best hive monitor**  
**Tool!**



# Have to actually monitor...Fire Drills!

- Beekeeping doesn't take a lot of time...take **TIMING!**



# Sensate Monitoring

- **Physician metaphor...come into a patients room: palpate, thump, smell, etc...Heft those hives!**
- **‘Eyeballing’ it...not trivial...think of terrorist/flyers...circumvented the need for sophisticated human made tech...can “see” overall hive population/health...harder to quantify...**
- **Smell...e.g. AFB...**
- **Trachael mites...can observe under the microscope...or visually identify the macro symptoms**
- **Treat with menthol and grease “extender” patties.**



# Visual (my “grab bag”)





# Visual inspection

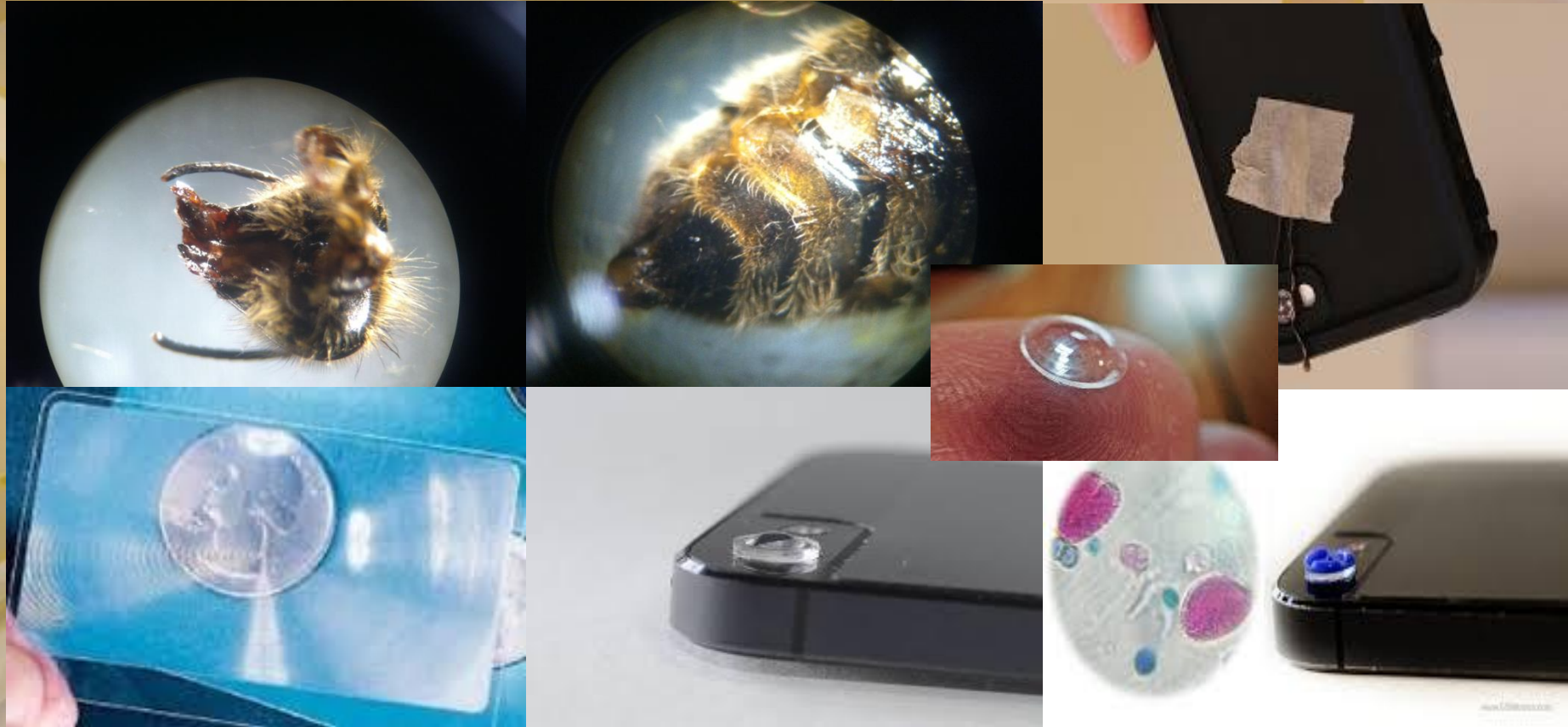






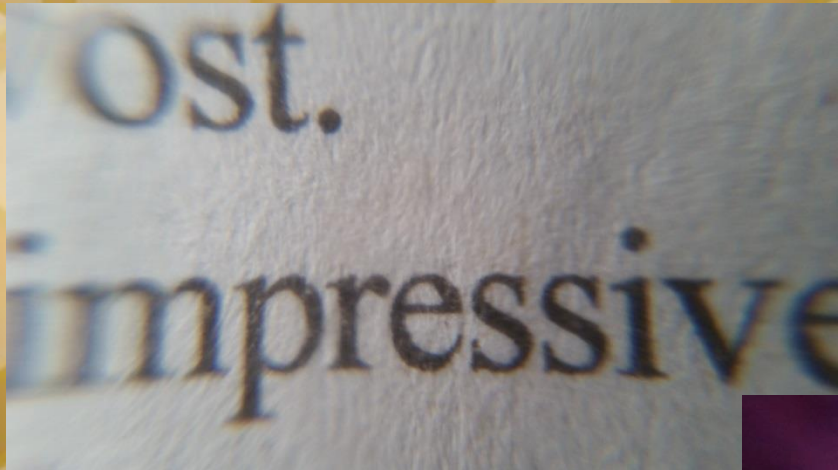


# Visual (micro/macro)



Combine simple lenses, smart phone cameras,  
and some “imagineering” ...

# Monitoring can be FUN





# Smell

- AFB, Apitherapy, Cancer, etc.



**Bees Have Been Trained To Sniff Out Cancer in Humans**



# Understand “B-Curves”...how and when they play...

- Build a Foundation to make compares / contrasts...
- Developing a seasonal intuition...like hefting hives for food stores...
- Seasonal colony populations...then skew it for yearly variations...

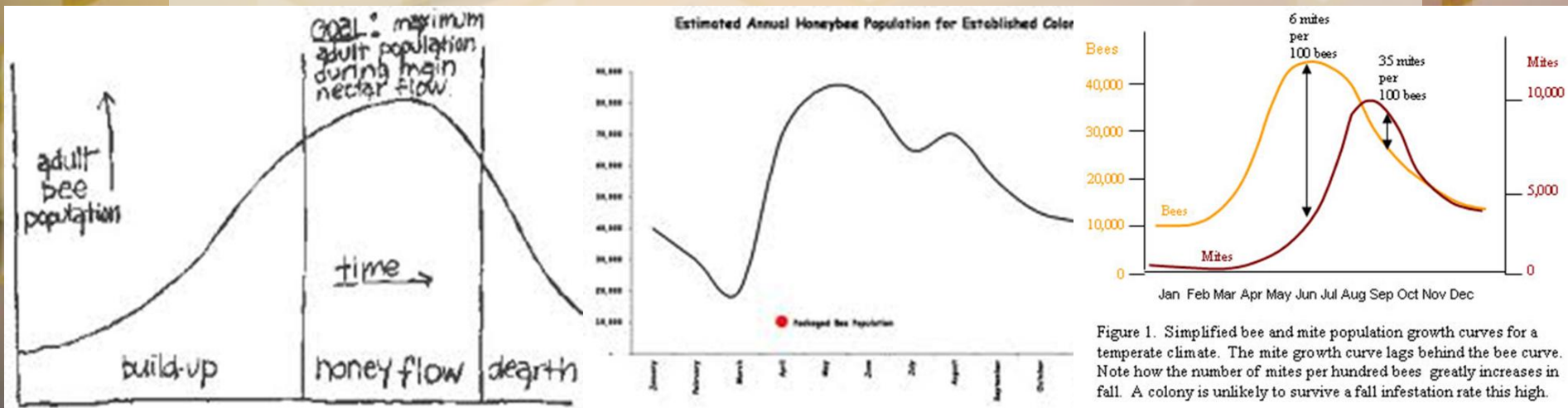


Figure 1. Simplified bee and mite population growth curves for a temperate climate. The mite growth curve lags behind the bee curve. Note how the number of mites per hundred bees greatly increases in fall. A colony is unlikely to survive a fall infestation rate this high.

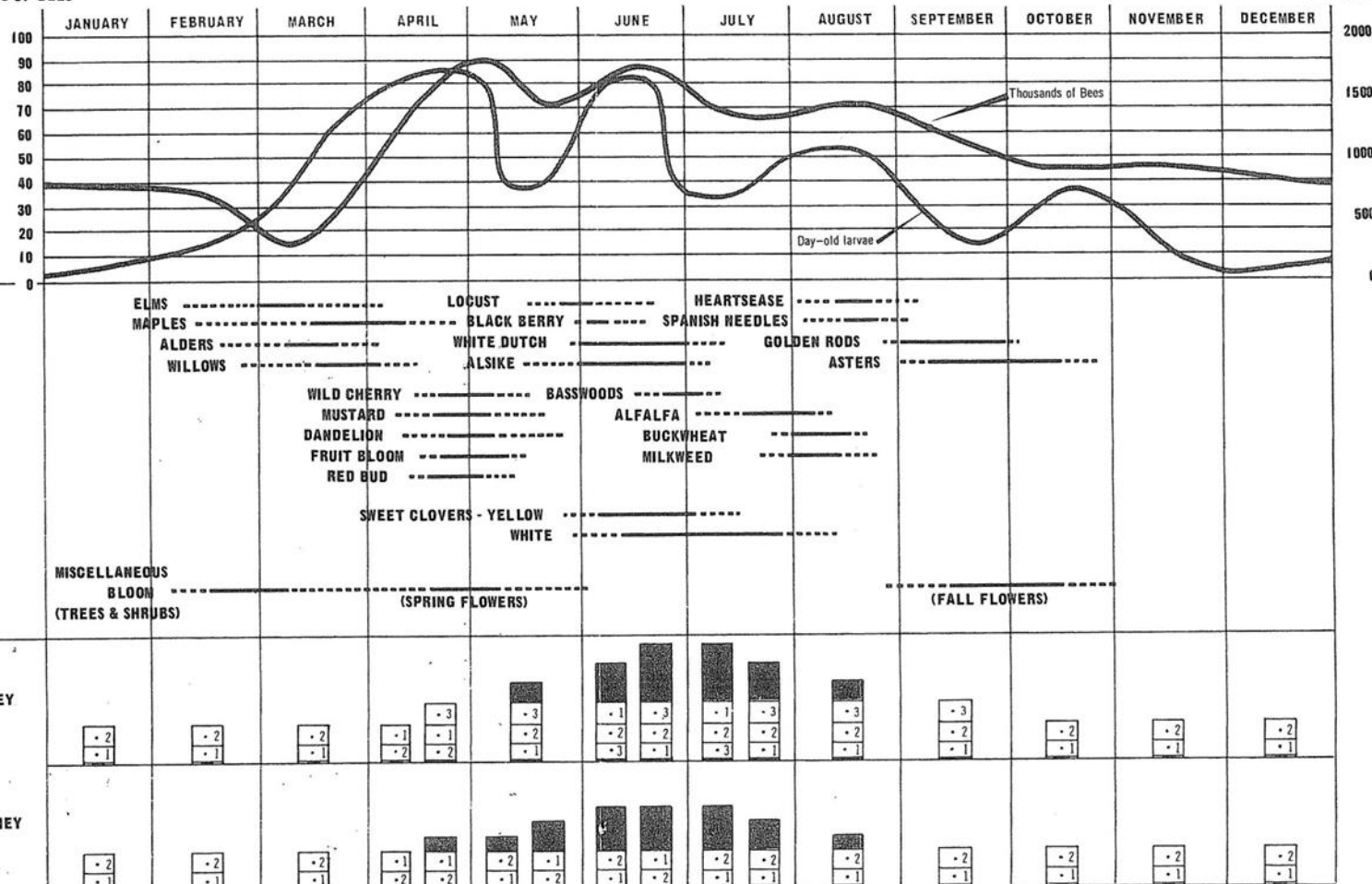
# ADULT BEES AND BROOD

## SOURCES OF POLLEN AND NECTAR

## HIVE EQUIPMENT POSITION AND ADJUSTMENTS

THOUSANDS OF BEES

DAY-OLD LARVAE



EXTRACTED HONEY

CHUNK COMB HONEY

MANIPULATIONS

Inspect for position of cluster and stores.

Inspect for laying queen, ample stores, properly positioned cluster.

Repeat inspections and feedings. Clip queen's wing and mark. Inspect for disease.

Inspect weekly for swarming. Add supers. Re-queen.

Remove honey, extract, pack. Remove supers. Re-queen.

Inspect for laying queens and disease. Remove last supers.

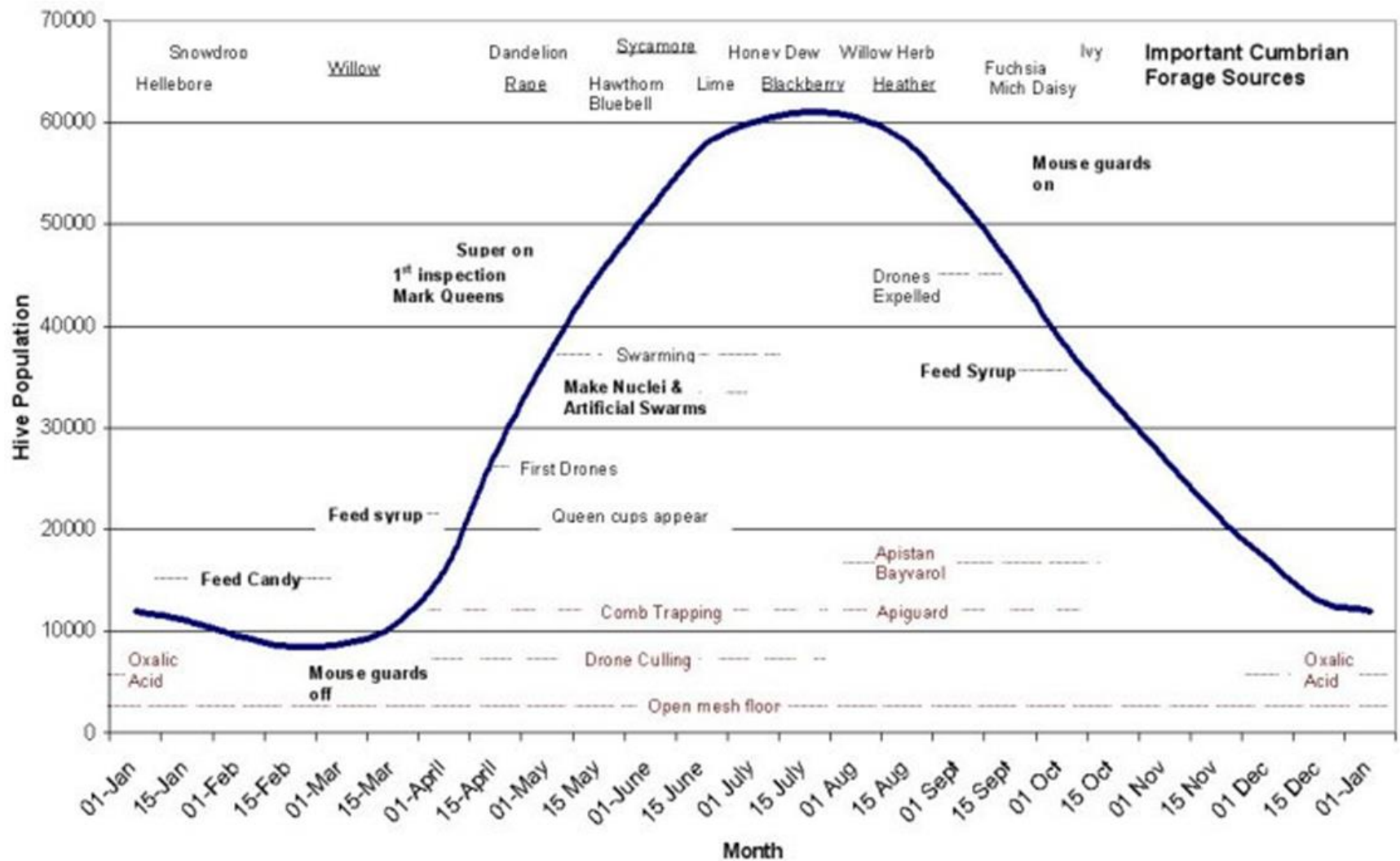
Arrange brood nest for winter. 60 pounds honey, mostly in 2. Bees covering 7 combs, mostly in 1. Put entrance cleats in place.

SUPERS

BROOD CHAMBERS



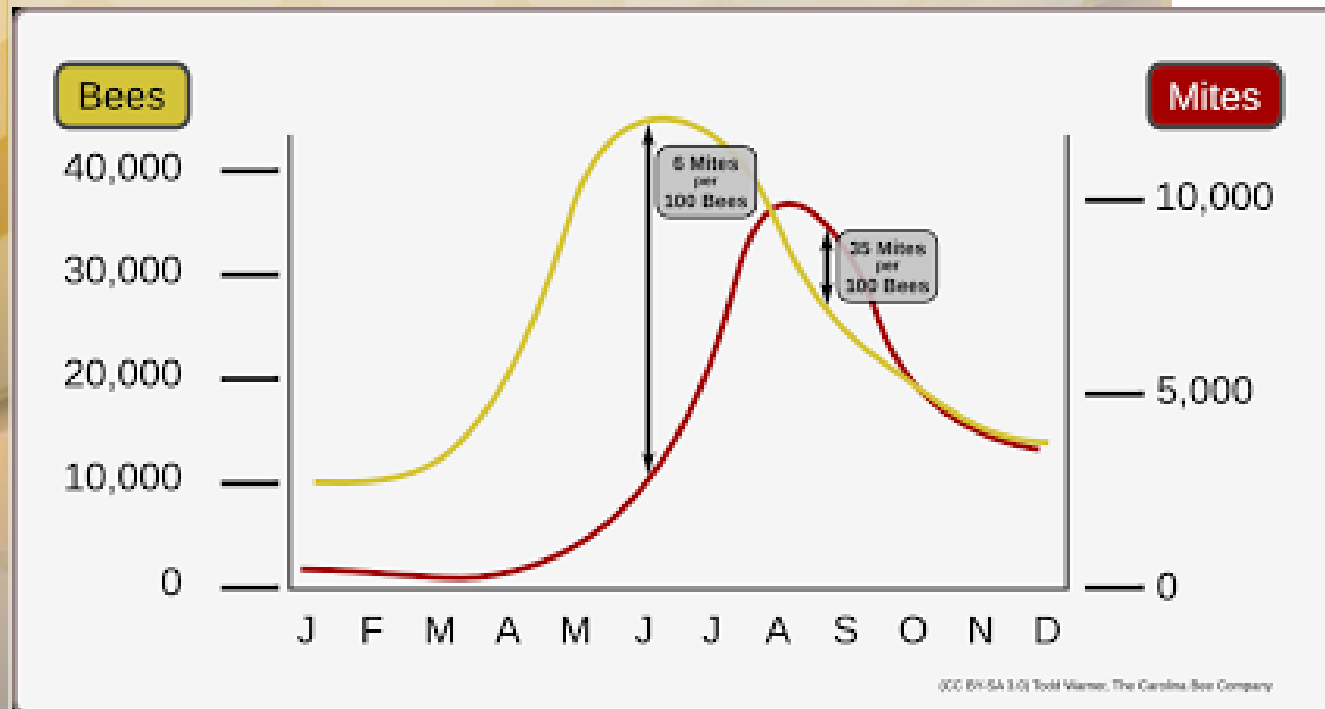
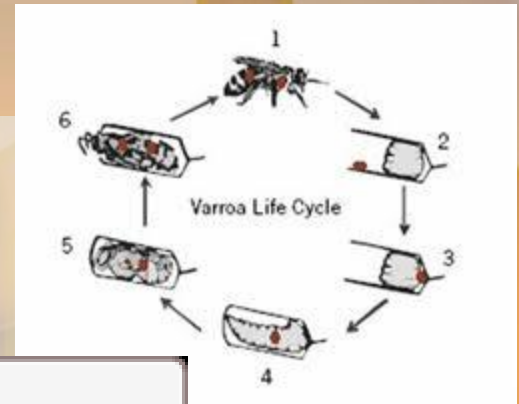
## The Beekeeping Year



# Monitoring EXAMPLE

## ~ Varroa ~

- First, important to know WHEN to test for varroa.



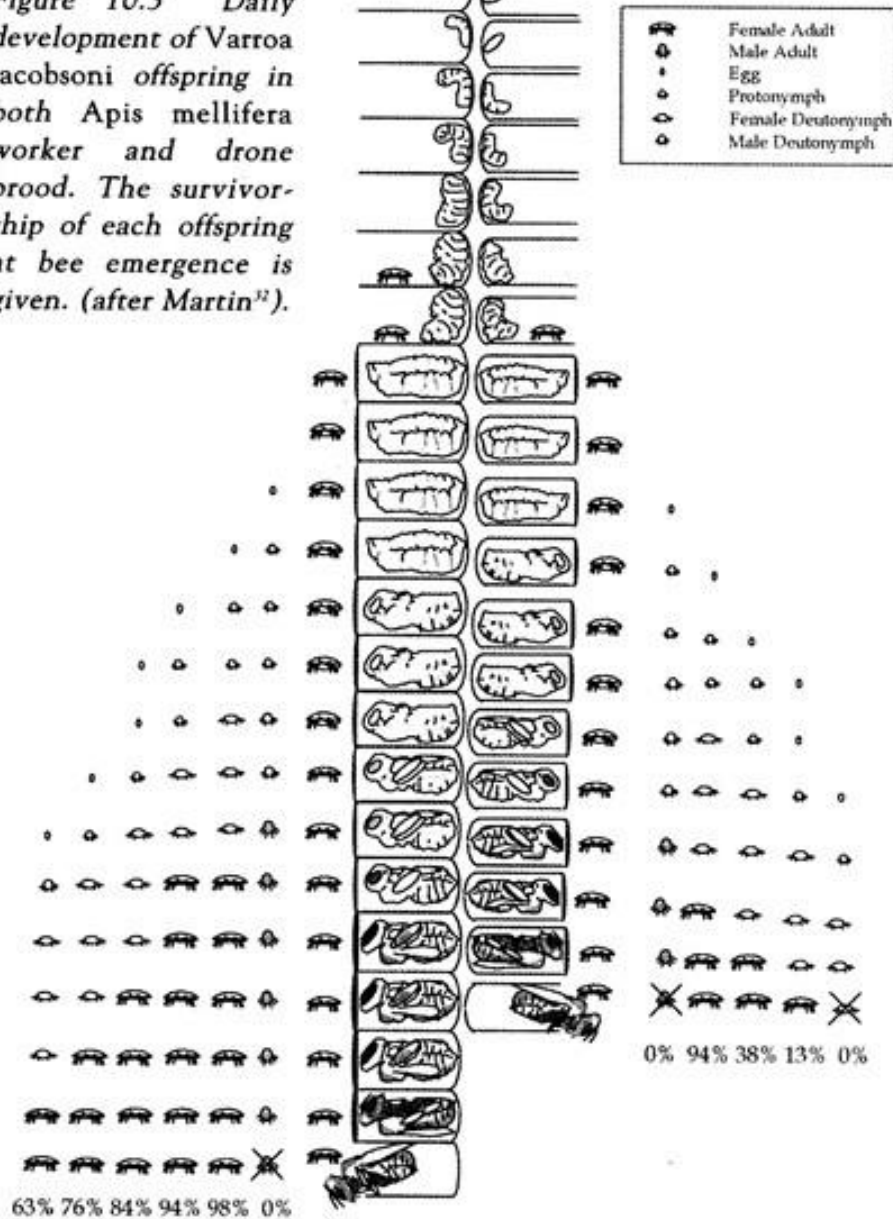
...keep in mind regional timing...



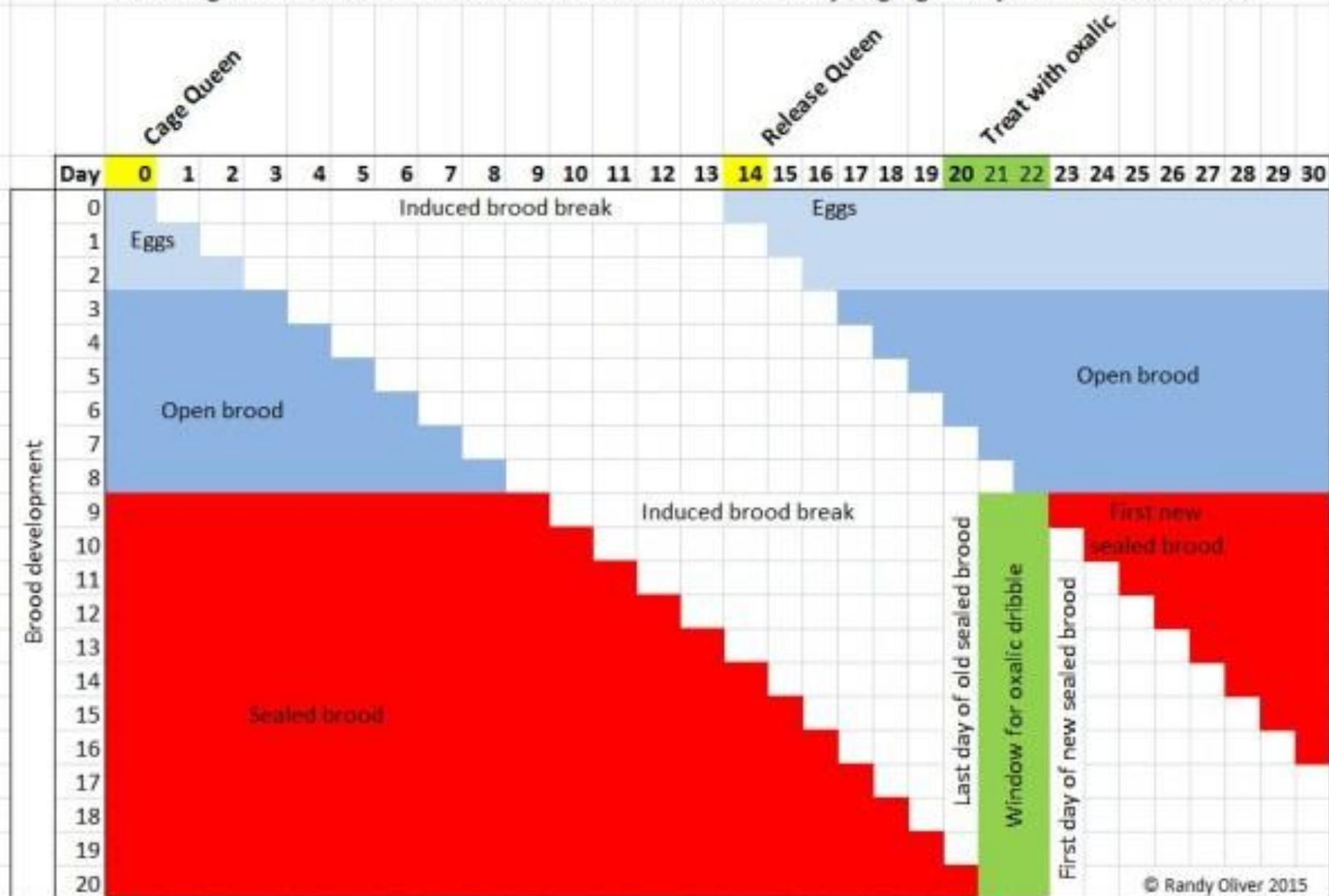
## DRONE

## WORKER

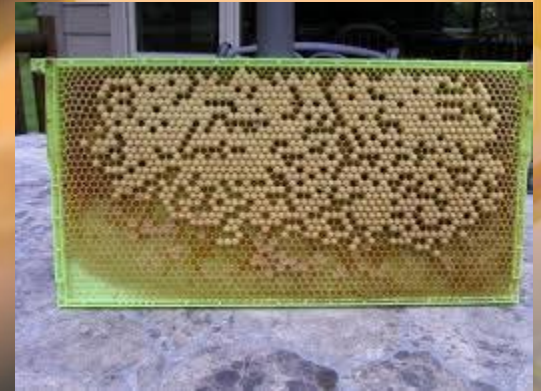
Figure 10.3 Daily development of *Varroa jacobsoni* offspring in both *Apis mellifera* worker and drone brood. The survivorship of each offspring at bee emergence is given. (after Martin<sup>32</sup>).



# Creating an induced brood break for oxalic treatment by caging the queen for two weeks.



# Evolution of Varroa monitoring



...and more...



# Classic varroa sticky board test

- Introduce an miticide ...
  - Hard and Soft chemicals
  - Powdered sugar...
- Sticky board:  
...trouble is...tough to *quantify*...



# A Better Varroa monitor

- Varroa “Buster” ...shake method.



- More accurate:  $\frac{\text{\#mites}}{\text{\#bees}} = \% \text{infestation}$ .
- Establish baselines...thresholds...



# Monitoring - IPM

- Monitoring pest population levels, and taking action as such pest levels approach seasonally-adjusted treatment thresholds is integral to integrated pest management.
- When brood is present in a hive, varroa increase is nearly always exponential from Day 1—in non resistant bees, doubling about once a month.
- Monitoring of the infestation rate of adult bees does not directly reflect the total mite population in the hive, since a proportion of the mites are typically hidden in the brood (about 50% for much of the broodrearing season).
- Seasonal treatment thresholds must take into account a number of factors, such as the point in time of seasonal colony population buildup and decline, the amount of brood present, available windows for treatment (often determined by whether honey supers are present), the method of monitoring, and the expected curve for the mite population in the near future (it declines when there is little broodrearing).

# Monitoring Thresholds

- The most important concept to keep in mind is that it is not the mites that kill the colony—it is epidemics of viruses vectored and triggered by a high rate of mite infestation. So long as the infestation rate of the adult bees remains below about the 2% level (assuming complete recovery of mites by your sampling method), viruses are seldom a serious issue. As the level approaches 5%, depending upon the individual colony, in-hive epidemics of either DWV, one of the paralytic viruses, or Lake Sanai Virus begin to occur.
- Such virus epidemics, as well as the rate of recruitment of new bees via broodrearing, are highly influenced by the protein intake of the colony, in the form of pollen or pollen sub.
- The proactive beekeeper understands pollen, bee, and mite population dynamics, and manages his hives to prevent the relative population of the vector (the mite infestation rate) from exceeding the threshold at which viruses are likely to go epidemic.



# Review/Conclusion

- **Monitoring is a “mindset” or predisposition**
  - Dr./Patient or Detective
- **Premeditative, Purposeful...train your brain!**
- **Compare/contrast individual hive behaviors**
- **Takes time to train/educate your senses.**
  - mentoring...workshops...
- **Understand seasonal bee & pest cycles.**
- **Monitoring is evolving...refining...**
- **Use, well, YOU...best instrument to-date.**

# Colony Commandments

- Be diligent with varroa! Don't let levels ever get high. Any number of methods will work to control the mite. But definitely get mite levels way down mid August at the latest. This will help keep viruses in check.
- Monitor nosema infestation, and treat in a timely manner if appropriate. Especially check colonies that fail to build normally.
- Don't baby colonies that aren't thriving, or have spotty brood. Kill or requeen them! (Some successful beekeepers requeen more than once a year!) Get sick colonies off to a hospital yard.
- Maintain good colony nutrition with regard to pollen, especially in late summer and fall. Move to better pasture, or feed your bees if necessary.
- It may be wise to maintain genetic diversity in your operation, since colonies vary in their resistance to different pathogens. Naturally resistant stocks go a long way toward success.



# Beekeeper Redefined...

- **Just a handful of Pests & Diseases causing some 98% of the problems.**
- **Diseases more often than not come from not controlling Pests.**
- **Just a handful of treatment options out there.**
- **Monitoring is the key: Knowing What to look for; When to look; and What to do about issues.**

**"Nothing can teach you better about quality than attempting to produce it." –Meathead**

# The Future Of Hive Monitoring...

(The End? Hardly!)

*...for there is a fresh wind blowing;  
we may yet again do things  
like mountains,  
and music and beekeeping  
because  
they are hard, and clean  
and clear  
in the morning!*

*- Philip Gillett*



**Crystal Hive Project...**

*That the powerful play goes on, and you will  
contribute a verse.*

*-Walt Whitman*

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**513.280.3476**