

# Personal Experience Raising Monarchs 6-weeks of Learning, Defeat and Triumph



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MORE PHOTOS AND LINKS TO VIDEOS I TOOK  
CAN BE FOUND AT [HTTP://WWW.CRCAMP.COM/MONARCHS](http://www.crcamp.com/monarchs)

## REFERENCES:

MONARCHWATCH.COM

MONARCHLAB.ORG

MONARCHBUTTERFLYGARDEN.NET

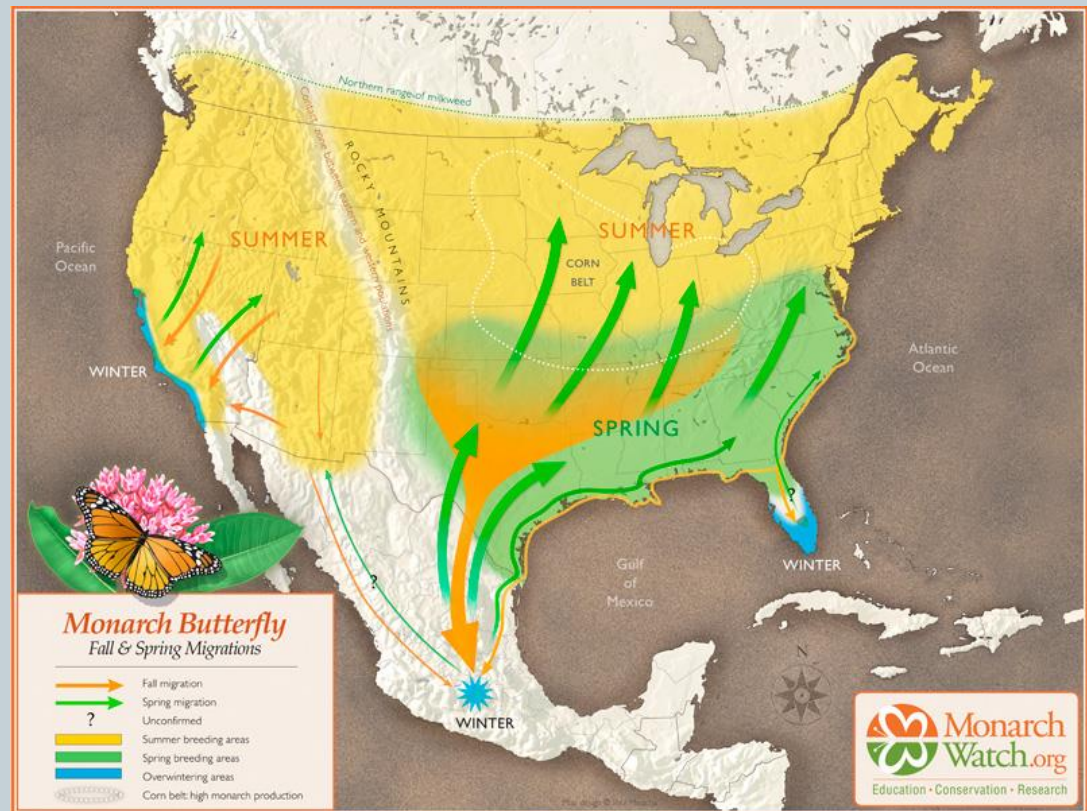
VARIOUS MATERIAL FROM TPWD SEMINARS

VARIOUS WEBSITES FROM LOOKING UP KEY WORDS

# So why was I doing this in September/October when breeding season was in the Spring

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- It was originally thought that the annual migration cycle consisted of three normal generations (living 2-6 weeks each) migrating from Mexico to Canada in the spring and a 4<sup>th</sup> *Methuselah* generation (living 6-8 months) that flew back and over-wintered in Mexico
- During that southern migration the breeding cycle was thought to go on hold and all of the Monarch's energy went to flying and nectering.
- This has all been known since 1976 when Dr. Fred Urquhart, founder of Monarch Watch, discovered the over-wintering site after looking for it for 40-years. We finished the moon walks before then.
- More recent information indicates that, at least in Texas, there may be a 5<sup>th</sup> generation that hatches out on the way back to Mexico due to not-yet-understood factors including Global Warming, extended warm weather and non-native, longer growing Mexican/Tropical Milkweed.
- This was the generation I was evidently raising



# (Day 1) The Beginning

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- **For the last 4-5 years, an expansion joint in my back driveway has had an Antelope Horn Milkweed growing up out of it – a little bigger each year.**
- **There's another couple of Green Milkweeds in the front yard from Carol's farm as well as a volunteer of a third species.**
- **On 9/12/17 I got out of the car in back and noticed that the back milkweed was almost destroyed and had two good sized 2<sup>nd</sup> or 3<sup>rd</sup> stage (instar) caterpillars busy chowing down.**



# (Day 3) Two Days Later

4



- **One stem almost gone and they both, now significantly larger, both have moved to the flower head which they apparently like much better than the stem/leaves. Based on a number of things, I revised my estimate of their development to 4<sup>th</sup> instar.**



# Development Timeline

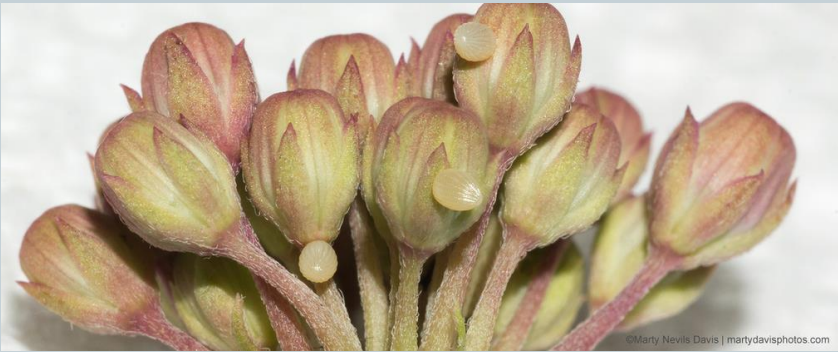
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Stage	Name	Duration
0	Egg	3-5 days
1	Larva Instar 1	1-3 days
2	Larva Instar 2	1-3 days
3	Larva Instar3	1-3 days
4	Larva Instar4	1-3 days
5	Larva Instar 5	3-5 days
6	“J” Chrysalis/Pupa	~18 hours 10-14 days
7	Adult Gen. (3x northerly) Methuselah Gen. (1x southerly)	2-6 weeks 6-8 months

- Approximately 1 month from egg to adult
- Instars are the stages between molts; molts occur every 1-3 days depending largely on temperature and food availability.

# The Egg Stage

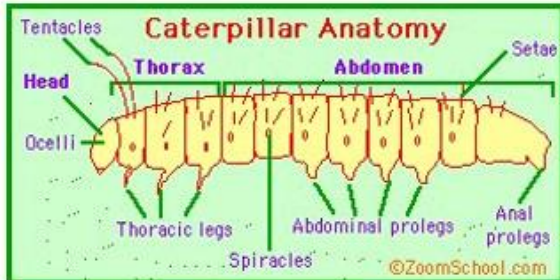
6



- Females lay 300-400 in the wild; 400-700 in captivity; often more
- Usually one per plant usually on underside of leaf, but many exceptions
- Unknown if multiples are different females or one returning to the same plant
- Females mate overnight and retain sperm for fertilization in a sack (bursa)
- Shell is wax coated and fully formed when laid – like a chicken egg – but fertilized before being attached to plant
- Fertilization is via funnel-shaped openings at top of egg (*micropyles*)
- Egg is creamy white until a few hours before hatching when the black head-capsule becomes visible
- Egg is usually the Instar<sub>1</sub>'s first meal.

# The Larval (caterpillar) Stage

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- Consists of 5 larval stages called *Instars* between 5 molts
- Early n vs. late n-1 instars are sometimes difficult to distinguish
  - Instar 1 is unique and easily identified
  - Instars 2 & 3 lumped into Early Instars
  - Instars 4 & 5 lumped into Late Instars
  - Late stage Instar 5's are often noticeably *plump* like a guy in a fat-suit with a tiny head
- Visual stage determined by
  - Length/Width and stripe coloration and vividness
  - Head Capsule Diameter
  - Filament length
- Overall weight increase 3000% in 2 weeks
- Molting involves literally crawling out the old skin head first.
- Old skin is usually first thing first thing to be eaten to retain nutrients – only head capsule is left



# Filaments vs Tentacles vs Antenna

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- All three words are used to describe those fleshy *things* on late stage monarchs
- IMO - Filament is probably the best word.
  - Tentacles grab things – these do not
  - Antennas are definite sensory organs – these are not
  - Filaments are probably like the whiskers on a cat. They help by sense of touch but that's about all. But they certainly are aware of anything touching them

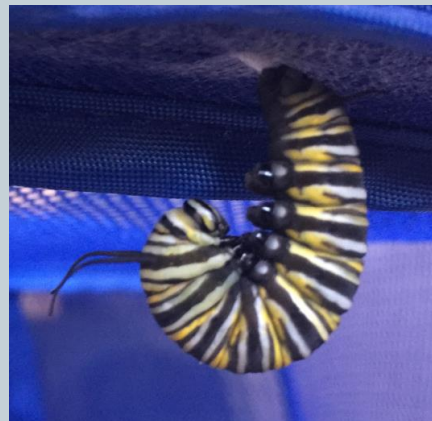


# The Pupa Stage – the “J”

9



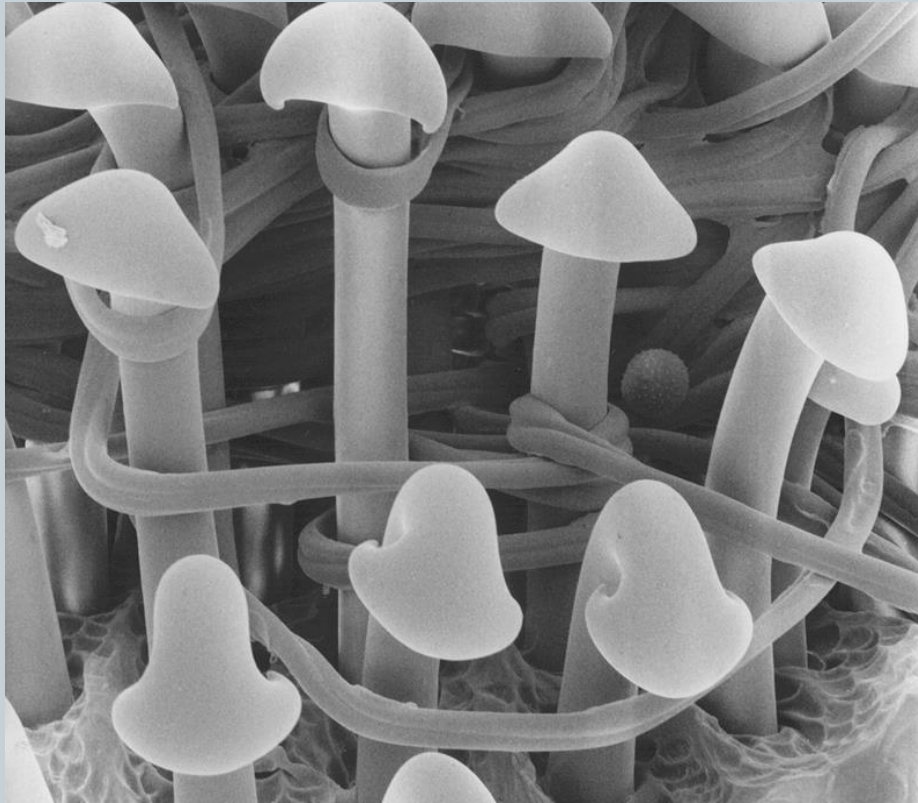
Note: There is an error in the text near the end. The larva is NOT attached by the cremaster – it does not exist yet. It IS attached by the anal prolegs.



- To escape predation during the chrysalis phase, the Instar 5 goes on a walkabout to find suitable place to pupate
- Finding a good location, it lays down a pad (button) of silk from its mouth – a much larger field of silk barely visible supports the pad
- It may do this several times until it has one it likes
- Then it shifts around and grabs the pad with its anal prolegs (2:05)
- Then it swings down and hangs motionless in a J shape while the chrysalis forms *inside the skin* for the next 18 hours (close to 18 but may delay if cooler)
- It is not entirely helpless or motionless. It can jerk around to dislodge parasites or react to other stimuli. Especially during the first few hours

# The Cremaster & Clasping Buttons

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- The *Clasping Buttons* and the *Cremaster* are two important but overlooked parts of the Chrysalis.
- They aren't part of the butterfly or the Larva. They are part of the Chrysalis itself and develop *inside* the skin sack of the hanging Instar 5 larva.
- The two *Clasping Buttons* are there to keep the developing Chrysalis from falling loose to the bottom of skin sack.
- The *Cremaster* is the stalk that will eventually hold the Chrysalis to whatever the larva is hanging from now
- The end of the Cremaster has hundreds of tiny hooks that will eventually entangle with silk pad
- Cremaster SEM photograph – like Velcro
- But ... right now all this is *inside* the hanging Instar 5 and does not exist yet.
- After the Chrysalis is formed, the cremaster has to get outside the skin without the chrysalis falling ... somehow ... both the Clasping Buttons and Cremaster are critical parts of this process

# The Pupa Stage – the Chrysalis Emerges

## This is NOT a simple process

11



After 18 hours, the J straightens out for 1-2 hours and the chrysalis is ready to break free from the skin – a process that, once it starts takes about 5 minutes. Don't answer the phone, you'll miss it.

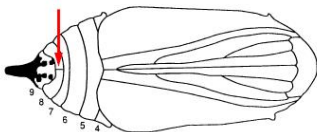
The skin splits at the bottom and is gradually accorinated up to the top where the anal prolegs are still holding everything to the silk pad

The chrysalis is held inside the skin upside down only by the two clasping buttons at the very top of the chrysalis – imagine being upside down in a sleeping bag hanging by your toes with your arms tied.

The *cremaster* (the stalk that the chrysalis will hang from) reaches out, fumbles around and connects with the pad (2:42)

The chrysalis, still hooked to the skin, twists and turns the cremaster to make sure it's hooked in good to the pad's silk strands

- Then the internal hooks are released and the skin drops away while the chrysalis twists and turns to *really* hook itself in.
- Over the next few minutes, the abdominal segments contract to the final form, the color changes to opaque lime green and all movement stops. The signature gold spots and 'diadem' will take another 24 hours to develop.
- The butterfly sex can be determined at this point – no line means male.
- Over the next 10-14 days all the insides will re-configure into the adult form before eclosure commences



# The Adult Stage

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- [After 10-14 days, the chrysalis will begin to darken over a 12-24 hour period until the wing coloration shows through the transparent shell](#)
- Once fully dark and the orange wings can be seen, the eclosing process itself starts and will take about 5 minutes as the adult escapes the chrysalis.
- Once out, it will take another 15-30 before the new adult can fly off to its first meal.
- You can almost see the checklist
  - Escape prison – check
  - Get the Butt out - check
  - Antennas – check
  - Proboscis – check
  - Pump fluid from abdomen to wings – check
  - Takeoff
- The newly hatched female adult is ready to lay eggs in about 5 days – but she may be fertilized by a male almost as soon as she emerges from pupa

# (Day 4) The Move to the Front Yard

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- **The milkweed in the back was the only milkweed around and if they left it I was worried that they'd starve.**
- **On the 4<sup>th</sup> day (after consulting with Carol) I clipped the bare stalk off and moved it and the two caterpillars to the Front, leaning the stalk against the new plant.**
- **They immediately moved over and began eating with renewed vigor**
- **The new plant also had a 1<sup>st</sup> instar Queen butterfly larva and a 2<sup>nd</sup> instar Monarch**
- **During the move, both of these guys let go, fell 3-ft to the ground and curled up.**
- **Lesson: Instars 1 & 2 fall and hang by a thread; Instars 3-5 just fall, curl up and don't like to be handled. Neither are likely to be hurt by the experience.**



# (Day 5) - Larder Replenishment

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- **The way these guys were eating was amazing. By the next morning they had sliced the stem so the flowerhead was hanging down – (a practice called *petioling* – concentrate the sap? Restrict the sap? ?? But a common practice for 5<sup>th</sup> instars)**
- **They were eating so fast I was worried that they'd run out before the day was over**



# (Day 6) - Bad Day in Larvaville

16

- Carol told me of a supply of plants nearby (unused street median in Allen)
- I clipped a few stems and laid them on the plants in the front.
- Two hours later a check showed everybody was still eating – now there are 2 large and 4 much smaller Monarchs plus two Queens
- Two hours later ... No caterpillars at all.
  - I found one of the large ones 5 feet away on the sidewalk humping along looking for someplace to pupate. I named him Bob and moved him into a 1 gallon plastic jar with leaves in the house. I was luck he wasn't 30 feet away.
  - Never found the other large one and all except two smaller monarchs (now named Tom and Sally) were washed away when the Sunday sprinklers turned on.
- **Lesson: When they get to the fat Instar 5 stage, the fun stuff is coming up fast**
- **Lesson: Blasting them on the plant with water isn't a good idea**

# 5<sup>th</sup> Instar Walkabout

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- The walkabout is evidently genetically programmed into them for protection.
- A fat larva hanging from a stripped stem could be a tempting lunch
- They have been found up to 30 feet away from their last meal. So if you lose one, you have 2800 square feet they could be in.
- Sometimes they start, go a few feet then go back and eat some more.
- All the walkabouts I saw (6) occurred with fatman larva.



# (Day 7) Moving to a More Protected Environment

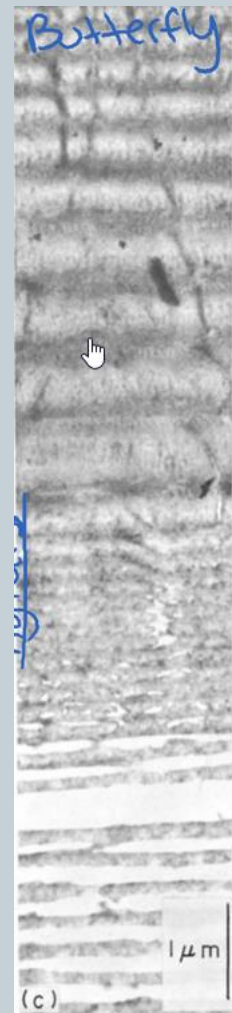
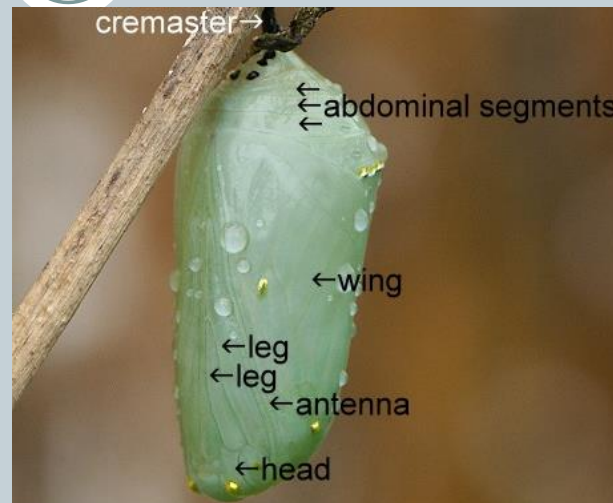
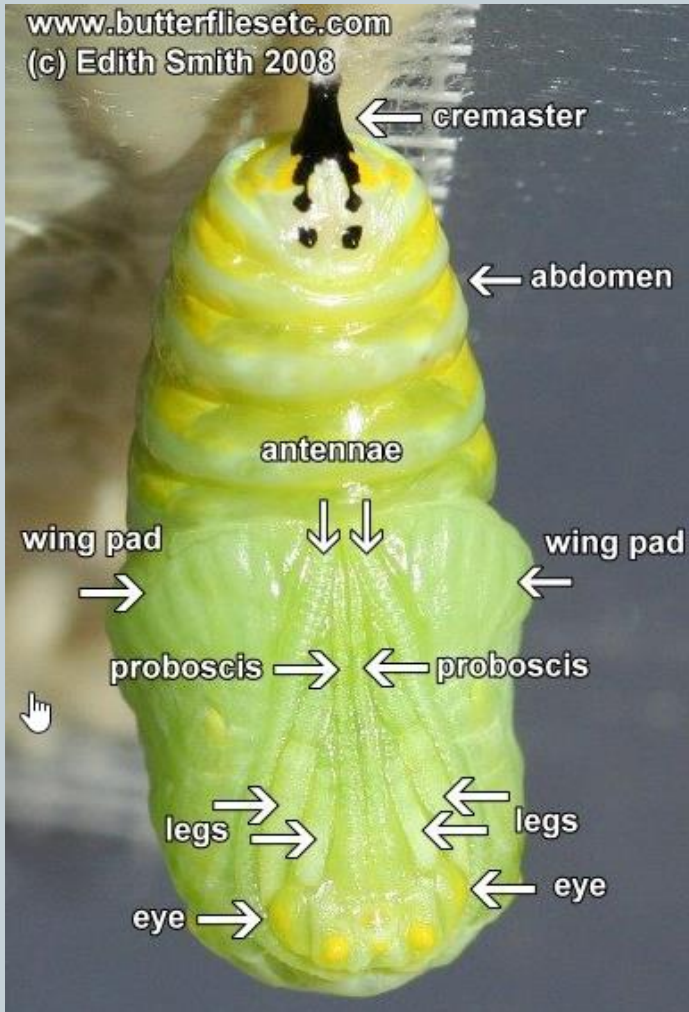
18



- The single remaining Instar 5 was put in a 1-gal plastic jar with cheese-cloth on the top and several fresh stalks.
- About 18 hours after the rescue, around 1am, he went ‘J’ at the bottom of an almost hidden leaf. I had to cut away a few leaves to take the photo.
- At 10am I went to the dentist
- At noon he was a chrysalis – I missed it!!
- **Lesson: Respect the J as an omen of something big coming soon**

# Chrysalis Morphology

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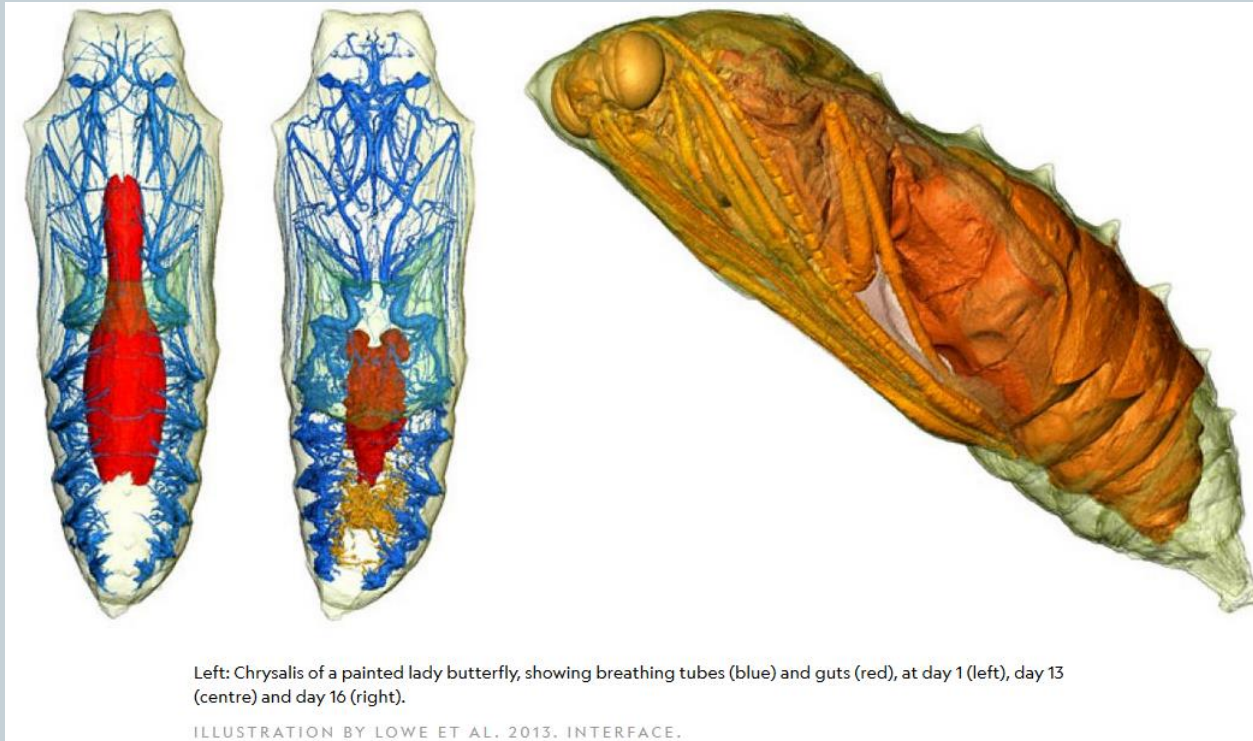


The crown of golden points (*diadem*) takes 24 hours to develop the sheen and their purpose is totally unknown.

The color comes from a combination of yellow carotenoid pigments (same stuff that makes tree leaves yellow & red) that they ingest from the Milkweed. The shiny gold sheen comes from a physical structure inside the chrysalis 'shell' from physical micron thick layers that refract/reflect light.

# Chrysalis 3D Micro-CT

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- Lots, but not everything, changes of the next 10-14 days
  - Some structures, heart, breathing tubes and guts stay largely the same
  - Others, like muscles and prolegs, break down into re-usable clumps of cells.
  - Some, like the skin and filaments, are discarded.
- **Lesson:**  
**Not Everything turns to mush inside the new chrysalis**

<https://www.nationalgeographic.com/science/phenomena/2013/05/14/3-d-scans-caterpillars-transforming-butterflies-metamorphosis/>

# (Days 8-9) - The Chrysalis Does Its Thing

22



- Bob is definitely a “He” (no line) and is now hanging out ... metamorphosing – I moved him and his leaf to a lampshade inside.
- The chrysalis itself is transparent
- His individual serial number is clearly visible (in Sanskrit :-)

The chrysalis can be moved ... but carefully. A 2-ft drop to a hard surface or a hard bump can destroy it or severely damage it.

**Lesson: Handle only by cremaster to be safe**



# (Day 10) - Another Day Another Larva

23



- Bob still hanging around no change
- Irma (from outside) joined Tom and Sally inside (temp 75)
- Irma and Tom are the largest with Sally smaller
- All three adopted a 'head-up' posture for almost 20 hours
- Spritzed them and put them outside (a much warmer 87 degrees).
- 5 hours later they were up high on the leaves and eating like mad.
- Could have been temperature ... or *probably* something much darker.
- Bottom picture is Bob's cast off 5<sup>th</sup> Instar skin showing the anal prolegs on the right that were holding onto the silk button. On left are the head filaments

# (Days 11-12) – New Home

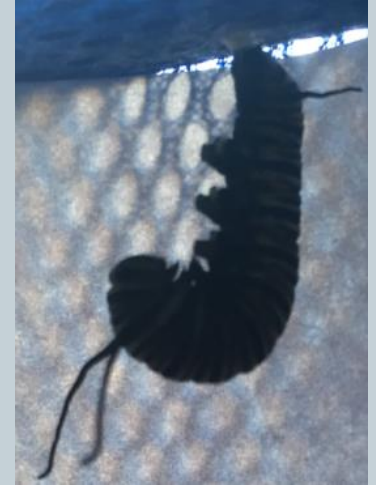
24



- It's getting cramped with two more pupas coming in the next day or so and 5 new eggs to hatch c/o Carol who was trying to find homes for 90!
- And the plastic jar I've had them in is difficult to take photos through
- Carol to the rescue again with a better enclosure – A collapsible *Meshy-bag Dirty Clothes Hamper* available in 6 colors from Amazon
- Top and one side have zippers – lots of room – absolutely perfect!
- Everybody was moved to the new home with lots of fresh milkweed.

# (Day 13) – Tom, Irma and Sally J-up

25



# (Day 14) – Death, Death and More Death



- At 2am, Tom, Irma and Sally were all J'd up,
- At 11am, all had un-J'd and were just hanging
- Irma appears to be much thinner and tangled up in her own silk
- Tom also appears emaciated with a strand of silk hanging down
- They're all dead
- **Lesson: the silk thread is the clue**



# (Day 15) – Death by Covert Assassination

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Tachinid Fly Parasitoid



- All three had been parasitized by the *Tachinid Fly* before I brought them in
- Possibly why they all three ‘froze’ in position for hours – being eaten alive
- The larvae eat only non-essential-for-life parts of the caterpillar
- I isolated the infected Monarch larva in a jar and searched the bottom of the bag for Fly pupa (brown, about 3/8” long)
- I found 3 fly pupa on the bottom of the bag.
- Two more fly larva oozed out of Tom and Sally’s carcasses over the next hour
- I filled jar with alcohol and terminated them with prejudice
- **Lesson: Work with eggs or Instar 1s you have control over rather than late instars harvested in the wild**
- **Remember: Tennyson’s “Nature red in tooth and claw” applies here**

# (Day 16) – New Larva from Carol

28



- Cleaned out the habitat and picked up an additional 5 Instar 1s and started over on September 27.
- Only one of the 7 eggs I got from Carol on Day 12 made it and it was a Queen butterfly.
- Bob is still hanging around but now a dusky green instead of lime green
- **Lesson: Don't give up**

# (Day 17) – Bob’s Hhhheeeerrrrreeee

29

Bob’s chrysalis was black this morning

- It was still black when I had a phone call a couple of hours later and I missed the eclosure.
- 15-20 minutes later, the chrysalis was an empty husk – no butterfly around – not on rug, on chair, under chair, curtain.
- Finally found him up inside the lamp – And he is indeed a “He”
- Let him crawl on my finger to put him outside - very willing to climb on and then off. He was gone an hour later
- **Lesson: They want to crawl up, not down, while waiting to fly.**
- **Lesson: Try to release somewhere there are a lot of Nectoring Plants easily available.**



# (Day 1 October 1) – A new Batch Arrives

30



- Definite learning curve to doing this
- Now raising the 2<sup>nd</sup> set starting with 3 Monarch Instar 2s (maybe a 3) and a Queen instar 2 from Carol
- Named them Bigboy1, Bigboy2 and Smallboy by size
- Needed more milkweed – my guidelines for gathering
  - Try to take mostly leaves and an occasional flowerhead or pod
  - Leave each plant with something so it doesn't have to start over
  - Don't strip an area
  - Try not to harvest from a sprayed area
  - Inspect and wash each stalk, tinfoil the stem ends with a little water inside and put in plastic bag in the fridge (like lettuce). It will keep for a couple of weeks. Replace stock every couple of weeks
  - When you take it out, cut an inch off the bottom, wrap the end in a piece of very wet paper towel and wrap *that* in tinfoil. Good for several days or until eaten.
  - In the mornings spritz with water to mimic dew.

# Day 5 – An Unknown Casualty

31



- Got a new batch of leaves out of the fridge and discovered a frozen chrysalis in it
- Poor guy had been the dark cold 37 degrees for at least 4 days before pupating and then froze.
- **Lesson: Inspect the leaves well to avoid a similar tragedy**

# (Days 6-8) - Getting Close

32

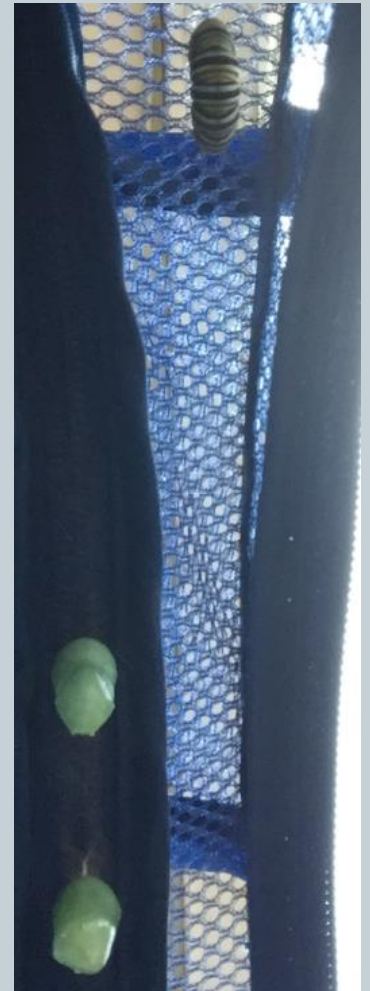


- Eat, eat, eat, eat, love that pod, eat, eat, eat, eat
- Fatboy on the move



# (Day 9-10) - All three J-up and Make Chrysalis'

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# (Day 11-17) – A Chrysalis Tree

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**Lesson: peel the wider silk off with tweezers and then tie a piece of Dental Floss around it – don't tie to the cremaster itself**



# (Day 18) – Packing for Corpus

35



- The three monarch larvae took the same course as Bob from the last batch
- All three made it all the way to eclosure
  - One emerged in my front yard Lantana while I was packing to go to the TMN Annual Conference
  - The other two emerged *at* the TMN conference at the Help Desk and were released in the flowerbeds out in front of the hotel

# (Later on Day 18) - Emerging Bigboy2

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**Lesson: Use a camera with good manual focus and as wide a depth of field as possible – AND carry it with you all the time**

- I knew they were close so I set the pot with all three under some Lantana while packing the car
- A few minutes later I saw a leg wiggling out of the chrysalis
- By the time I ran to get the camera she was out – these photos are 1 minute apart
- Bigboy2 was badly named – he's a female and the 1<sup>st</sup> to eclose

# (Day 19-20) Emerging Bigboy1 & Smallboy

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- Bigboy1 and Smallboy turned black on the 19<sup>th</sup>
- Bigboy1 eclosed in our hotel room on the 20<sup>th</sup> between 9:20 and 11am (when this picture was taken) while we were eating Breakfast downstairs
- Smallboy eclosed on the 20<sup>th</sup> at the Help Desk between 11:51 and 12:07 and, again, I was helping someone and just missed it. TMN's Mary Pearl Meuth live streamed it.
- Both were female and were released in the Bougainvillea in front of the Hotel

# A Few Are Fun and Instructive but ... How do you Process This Many??

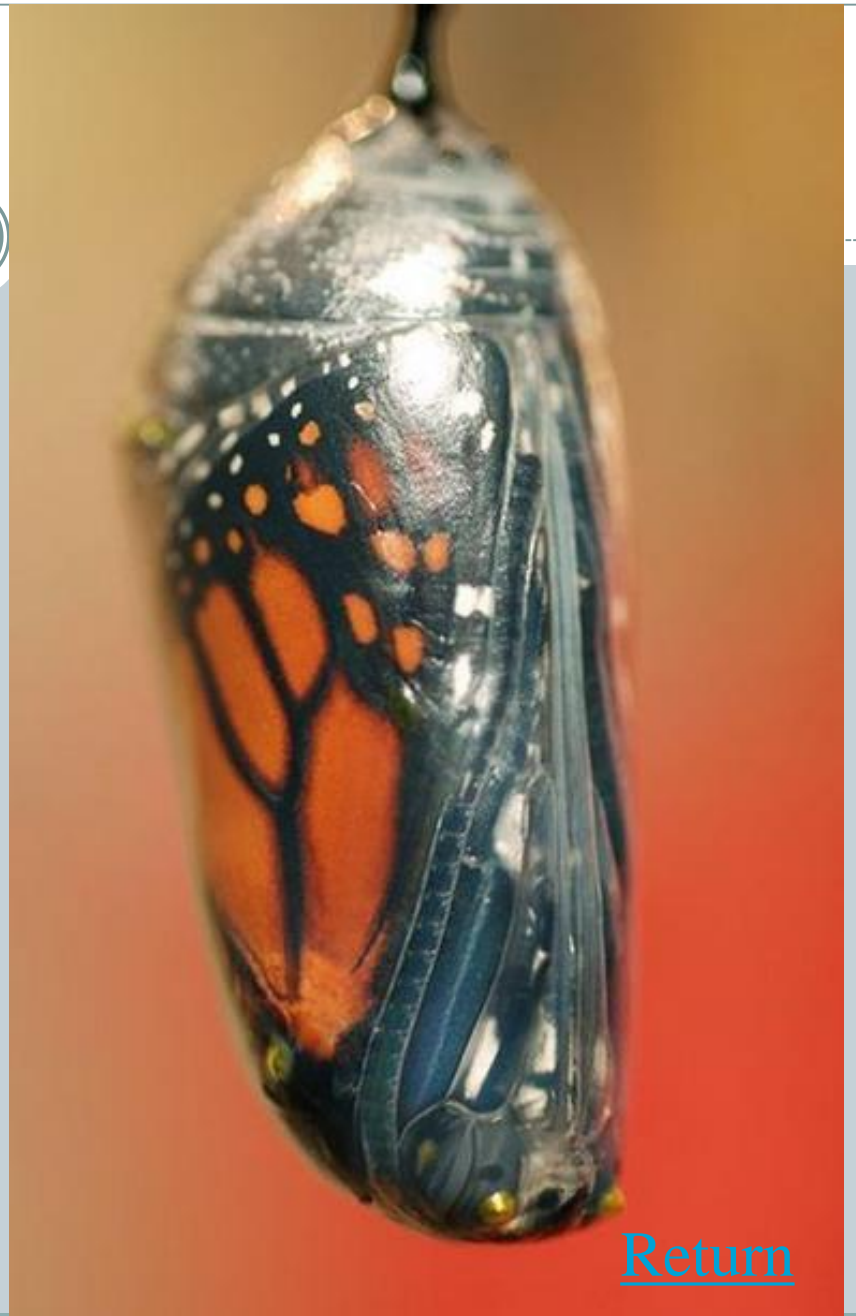
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# Questions?

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