



# Pennsylvania Beekeeper

The Official Organ of the Pennsylvania State Beekeepers Association

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## News 'n Views...

*Mark Gingrich, PSBA President*

March has arrived and the promise of spring is in the air. As I think back about the month of February, at least in our area, we had two snowstorms yielding measurable amounts. Snow cover is important for many plants and animals. Reduced snowfall and less snow cover on the ground diminish the beneficial insulating effects for vegetation and wildlife. From a beekeeping perspective, areas where snow cover melts first reveal optimum areas to place hives and overwinter colonies.

The Almond bloom in California so far looks like it has been good. Almond exports in January were up 12% year over year. This is slowly helping the carryover inventory that has been a drag on almond prices the last few years.

For more years than I can remember, sideline, commercial, and wannabe big beekeepers have moved colonies south for the winter. A tried-and-true practice started long before I was born. The premise is simple, Georgia's winter weather is mild and doesn't last long. In the southern part of the state, winter lasts from December to January, with daytime highs ranging from approximately 50 °F in the northernmost interior areas to near 70 °F along the coast and in the extreme south. As you know, here in Pennsylvania, the winter season is from December to March. The average temperature is closer to 32°F with a potential for snow throughout the period. Pennsylvania is a big state, but Georgia is larger by 29%. Back in the day, beekeepers sought milder temperatures so they could begin their season early. They could begin raising queens, making splits, building brood, and taking advantage of the nectar flow most years a month before they could have here at home. Some 15 years ago we followed the same practice of moving bees south. To manage bees properly in the spring, hives need to be checked at least every 10 days which requires constant trips back and forth or an extended stay. In mid-March, we had colonies that had 12 or 14 solid frames of brood, far ahead of what we would have had here. Timing is everything. Most years we would bring those colonies back into the colder north and the bees would cannibalize most of the brood they had produced and consume all of those early nectar gains. 20 years ago, Georgia was about 20° warmer than Pennsylvania in the first quarter of the year. In the last 10 years, there has been only a 13° average temperature variation between the states. The concept was filled with promise, but at the end of the day never really paid off. Ultimately, we concluded that moving bees south was just not economically viable.

We are approaching 80% of the nation's 2.7 million managed hives trucked to California to pollinate almonds in February and March. Large-scale beekeepers are constantly dividing hives to keep their numbers up. As a result, these colonies are generally weaker. I believe the American beekeeper just keeps trudging along absorbing rising expenses and high losses with little financial gain.

In my opinion, the future of beekeeping rests solidly in science-based innovation and climate-smart agriculture. The impact of technology on agri-business has been incredible. The implementation of technology has increased the efficiency of systems, products, and services we use. This has helped businesses reduce costs, grow rapidly, and improve operational efficiency. Automation has made it easier for businesses to manage their processes and operations. This is happening now in the world of beekeeping.

The Best Bees Company, a Massachusetts-based firm, is using artificial intelligence to keep healthier hives by using what they call smart hives. A "smart hive" is a hive that

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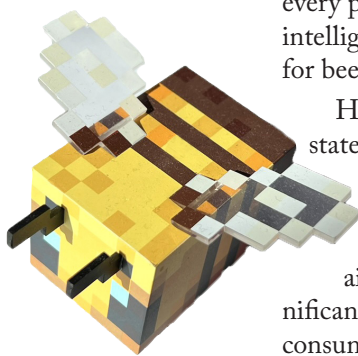
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<http://www.pastatebeekeepers.org>

employs robotics- and AI-powered hardware that can monitor and use sensors to track how the bees are doing. They feature cameras equipped with artificial intelligence technology that tracks every bee's coming and going, as well as counting each type of pollen every individual is carrying. This information is collected, allowing beekeepers to see what resources are available in the nectary. We know when bees have a diverse diet they are healthier. In addition, these hives can also help control varroa mites. They do that by using a heat mat placed on the bottom board. When activated, the heat produced will increase temperatures in the hive just enough to kill mites, but not harm the bees.

Bee Wise is like Best Bees but on a commercial scale. It is an international company that spans the US, Israel, Ukraine, and Poland. The company builds a unit called Bee Homes that uses AI and robotics to optimize the bees' care, which improves their health, and in turn, helps them be superior pollinators. The Bee Home has cameras inside of it, a robotic arm, sensors, and other systems, that allow it to execute what a beekeeper would normally do. The robotic arms within Bee Home treat pests, and feed, like what a beekeeper would do. Beekeepers can also remote control the Bee Home offering full flexibility with the upkeep of their colonies. Depending on the model, the devices support between 10 and 48 colonies. Inside the hives look similar to a wooden, Langstroth hive. The bees' living quarters did not change much, except for the fact that now a robot extracts frames, rather than a human. The bees do not interact with the robotic arm because when a frame is extracted for inspection, the bees remain within their hive. Mites are managed with a heat-based, chemical-free treatment that is activated when levels rise.

Bee Hero, headquartered in California, takes a different approach but is still aimed at large-scale beekeeping. They have developed a Smart Hive sensor technology that optimizes hive placement by identifying the farm's needs for full pollination coverage. They use IOT Sensors. I know, you're thinking what the heck is that? Internet of Things (IoT) sensors are everywhere — your thermostat, refrigerator, and smartphone but also in some of the most unusual places like a smart tray cat litter box, smart toilet, or a smart belt. IoT sensors are integrated into devices to capture critical data that users can share in real time. Bee Hero IoT sensors collect various data points inside the hive, including sounds, temperature, and humidity. Data collected from the hive is sent to a gateway device installed on every pallet. Like all data collected from IoT sensors, it is sent to the cloud, where artificial intelligence and machine learning algorithms analyze the data to create actionable insights for beekeepers and growers.



Hive Tech Solutions is focused on climate-controlled agriculture or more simply stated cold storage. Their flagship unit is an insulated box designed specifically for the health needs of honey bees and the logistical requirements of beekeepers. The concept is simple. Colonies are placed into this secure, climate-controlled environment in the fall. The unit maintains a 38° temperature, monitors humidity, and circulates air to maintain CO2 levels. Studies have shown that controlled cold storage can significantly increase survival rates and build stronger, cold hardy colonies. Additionally, bees consume less because they have lower metabolisms and consume food stores more slowly. Other advantages include protecting woodenware and pallets from the elements. Both come out cleaner and with less weather damage. Lastly, research indicates much promise in managing varroa mite levels with elevated CO2 concentrations. There are currently (4) of these units across Pennsylvania which are part of a SARE-funded research grant. In the coming months, I will explain more about the project that is underway. Technology in beekeeping is a reality and one that I believe is here to stay. ♣

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## Upcoming Events

### Berks & Schuylkill Counties Beekeepers Association

Berks & Schuylkill Counties Beekeepers Association will hold our monthly meetings in 2024 at the Berks County AG Center, 1238 County Welfare Rd, Ste 260, Leesport, PA 19533 on the 3rd Wednesday of each month at 7pm.

For more information contact us at [prez4psba@gmail.com](mailto:prez4psba@gmail.com) or on our [Facebook](#) Page.

### Lackawanna Backyard Beekeepers

Serving (but not limited to) Lackawanna County. Mission: To foster interest in backyard beekeeping and provide a forum for discussion among local beekeepers. Free and open to the public. Meetings are held at Abington Community Library, 1200 West Grove Street, Clarks Summit, Pa. 18411 (570-587-3440) in the Ryon Room, at 6:30 pm on the third Tuesday of the month. Date may change, if library has a conflict. Please check the [Facebook](#) Page or [contact](#) us or phone to confirm the date.

Co-leaders Renee Czubowicz, Brad Seward

Meeting are held the 3rd Tuesday of the month September - May. 6:30pm

June July and August meeting are TBA

Website: <http://lackawannabackyardbeekeepers.blogspot.com/>

Facebook: <https://www.facebook.com/lackawannabackyardbeekeepers>

Email: [lackawannacountybackyardbeekeepers@gmail.com](mailto:lackawannacountybackyardbeekeepers@gmail.com)

### Northwest PA Beekeepers Association

Here is a list of upcoming meeting dates:

- Feb 17
- March 16
- April 20
- June Field Day TBD, tentative June 22nd open to everyone. Non-members \$15, members free.
- Oct 19
- Nov 16

Questions? Contact Mark Anderhalt, NWPBA Secretary [mark1090@windstream.net](mailto:mark1090@windstream.net)

### Tri-County Beekeepers Association of Southwestern PA

Meetings start at 6:30pm the 3rd Wednesday of each month. The location is the California United Methodist Church, 227 3rd St, California, PA 15419. For more information, contact Fred Miller at 724-317-2009, or [fmiller@yahoo.com](mailto:fmiller@yahoo.com).



## Chester County Beekeepers Association 2024 Virtual Conference

Date: March 9, 2024  
Time: 8:00 am – 5:00 pm  
Fee: \$30.00

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- ❖ Tom Seeley, *5 Wondrous Behaviors of Bees*
- ❖ Kaira Wagoner, *UBeeO™ Assay*
- ❖ Zachary Lamas, *Mite Research on Drones*
- ❖ Rachael Bonoan, *Bee Nutrition*
- ❖ Lars Chittka, *The Mind of a Bee*

Recordings of all presentations will be available for at least 2 weeks

### To Bee Club Leaders:

The PSBA website has a page for your events to be listed. These events are also added to the PSBA newsletter.

The page is:

<https://www.pastatebeekeepers.org/Local-Club-Events/>

Also, each local club has their own page for additional information. Find your webpage at:

<https://www.pastatebeekeepers.org/Local-Associations/>.

Please email us at [webmaster@pastatebeekeepers.org](mailto:webmaster@pastatebeekeepers.org) if you have any changes, updates or additions for either of these pages.



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## Jeremy's Corner

In January I was forwarded an article from the March, 2023 edition of *Science Robotics* titled *A Robotic Honeycomb for Interaction with a Honeybee Colony*, by Rafael Barmark et al. Using the language of the report, it described 'a robotic system designed to observe and modulate the winter bee cluster using an array of thermal sensors and actuators'. The robotic system was able to observe the colony by continuously collecting spatiotemporal thermal profiles of the winter cluster, to modulate the bees' response to dynamic thermal stimulation, and, after identifying the thermal collapse of a colony, to create a "life-support" mode via its thermal actuators.'

In layman's language, these sensors, embedded in the comb, not only measure and observe the movement of the winter cluster but, in the case of a weak colony, can be activated to modulate the temperature in the cells, supposedly to augment their survival.

This is the culmination, but not the endpoint, of what Randy Oliver calls the 4th Agricultural Revolution. The first was the invention of agriculture some 12 000 years ago, followed by its industrialization starting in the late 18th century and culminating in the use of the internal combustion engine in the form of tractors and trucks. The third is what Randy calls the Green Revolution, which in my estimation started when the Soviets successfully launched a manned space rocket, Sputnik. Besides emphasizing math and science in schools (often at the cost of art and music) American farmers were encouraged to 'farm fencerow to fencerow,' so that the US would be agriculturally self-sufficient; this meant, among other things, that the hedgerows, so vital to birds, insects, animals and wild flowers, were plowed under. Perhaps the best known aspect of the Green Revolution was the production of high yield crops, especially rice and corn, not least in India, but with it came some significant downsides — a population explosion, heavy use of synthetic fertilizers, cheap labor, heavy use of water and increased use of pesticides, not to mention

increased costs which affected many small farmers dearly — and which I described at length in a previous column.

The fourth revolution introduced electronic technology in which Randy includes the internet, Artificial Intelligence, biotechnology, gene editing, robotic labor, precision dispensing of chemicals, vertical farming and alternative energy sources.

And we cannot expect honey bees to be unaffected by this process.

On the same day I received the article from *Science Robotics*, I read Anne Murphy Paul's description of Charles Darwin's famous voyage starting in 1831. The 22 year old, torn between following a career as a doctor, a parson, or one that allowed for his burgeoning interest in natural history, received a letter from his former tutor at Cambridge University informing him of a position as a naturalist on a two year expedition aboard the HMS Beagle.

He had never kept a journal before but began to do so under the influence of the experienced ship's captain, Robert FitzRoy, whose naval training had taught him to keep a precise record of everything happening aboard the ship and of every detail of the ocean-going environment. Each day the two men ate lunch together, after which FitzRoy wrote up both the ship's log and his personal journal. Darwin followed suite : his field notebooks, his scientific journal and his personal diary were updated daily as the two years of the expedition turned into almost five.

Recording such data requires close observation of one's surroundings, the ability to run through a mental checklist of features that might be recorded, and the skill to organize them clearly. In addition, the process of taking notes in the field requires us to select, discriminate and evaluate (ie. higher order thinking skills) which in turn lead to deeper observation.

"...the 4th Agricultural Revolution."

Beekeeping technology is rapidly becoming more copious and more intrusive, yet each of us has access to pen and paper. When asked, most beekeepers acknowledge the importance of keeping good notes, and yet only a minority actually do so. It's like checking for varroa— we know the importance of monthly mite checks, yet only a few do it. And taking notes is the first step; what is critical is *using* that recorded data to make decisions for the benefit of the bees as well as for one's own professional awareness and development.

HMS Beagle returned to Plymouth Sound on October 2, 1836. Darwin spent the next three years processing those boxes of note books and another twenty years discussing and refining his conclusions, until the eventual publication of *The Origin of the Species* in November, 1859.

With the plethora of technology available today, it is easy to forget that a pencil and a notebook in the hands of a young Charles Darwin were key to developing a theory that would change our perception of the world, even as it did not seem so at the time. ♣



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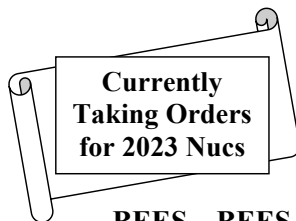
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## Honey Queen Report

*Cheyenne Brown, 2024 PA Honey Queen*

Hello Beekeepers!

It has been a fast and hectic month since the conclusion of the Pennsylvania Farm Show, and getting fully immersed in the hectic life of Penn State's campus! Although this month has been quiet as far as promotions go, I have been a buzzy bee keeping up with course work, extra curriculars, and ensuring that I am continuing to cultivate relationships around me. Here are some highlights from my life back here in State College:

- February 2nd, 2024, I was inducted into the Coaly Society at Penn State which focuses on highlighting students who are involved in clubs and organizations across campus, as well as arising leaders in the College of Agricultural Sciences.
- Over four weeks, I aided the Pennsylvania State FFA Association with their annual Agricultural Cooperation Establishes Success (ACES) Conference. Here I was able to talk with educators and almost two thousand students from across the Commonwealth.
- During the weekend of February 16th-18th, I participated as a spectator at Penn State's annual THON. Here I stood in the stands for a total of thirty-seven hours supporting my organizations dancer!
- Lastly, I was appointed as the National Student 2nd Vice-President for Alpha Tau Alpha, a professional agricultural fraternity for Agricultural Education majors nationwide.

Although the past few months have been a little slow in promotions as the weather warms, I am still so excited for the year ahead of us! There is still time, if you have an event that you would like to see the Pennsylvania State Honey Queen or Princess at please contact use at [honeyqueen@pastatebeekkeepers.org](mailto:honeyqueen@pastatebeekkeepers.org), we would love to hear from you!

Stay Sweet!  
Queen Cheyenne



**I was honored by the Penn State College of Agricultural Sciences to be inducted into the Coaly Society, for students who have demonstrated leadership excellence and satisfactory academic performance.**



**During the Pennsylvania State FFA Association's ACES Conference I facilitated a workshop on professionalism for almost four hundred students.**



If you would like to invite the Honey Queen or Princess to your event, please contact Cathy Vorisek and Lucy Winn at [honeyqueen@pastatebeekkeepers.org](mailto:honeyqueen@pastatebeekkeepers.org)





Dr. Kevin Curry

2nd Vice President  
Assistant Professor  
Penn State University  
[kcurry@psu.edu](mailto:kcurry@psu.edu)



Cheyenne Bastian-Brown

2nd Vice President  
Senior  
Penn State University

Above: The official announcement of my official appointment as the National Student 2nd Vice-President for Alpha Tau Alpha, a professional fraternity for Agricultural Education majors nationwide!

Left: The first day of THON, a no sleeping no sitting dance marathon at Penn State. I had the opportunity to visit Connor Gross, Delta Theta Sigma THON Dancer, on the floor in support of his efforts!



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## At Home Beekeeping Webinar

Distance Learning for Beekeepers



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**All are welcome!! Join us for this free event!!**

- March 26 – *Selecting a Merit Queen for Propagation: Characteristics of a Mother Queen* – Cameron Jack, University of Florida
- April 30 – *Swarming: Biology and Management* – Jon Zawislak, University of Arkansas

**Last Tuesday of the month**

**6:30 – 7:30 pm  
Central Time**

Watch via Zoom Webinar

<https://auburn.zoom.us/j/904522838>

or Facebook Live: <https://www.facebook.com/LawrenceCountyextension/>

Questions? Email Allyson Shabel [ams0137@aces.edu](mailto:ams0137@aces.edu)

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## Bees-N-Trees Farm Package Bee Run 2024 Order Form

We have your package delivery scheduled for April 6<sup>th</sup> & 7<sup>th</sup>, 2024.  
In the event of bad weather and slow build-up we would reschedule for April 13<sup>th</sup>.  
Please Email your order to [Beesntrees@hotmail.com](mailto:Beesntrees@hotmail.com):

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Address: \_\_\_\_\_  
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Email Address: \_\_\_\_\_  
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717-329-3216 Cell  
<https://bees-n-trees.business.site/>  
[Copies of order form here](#)

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Number of Marked Packages Ordered @ \$\*141(tax included): \_\_\_\_\_  
Number of extra Queens @ \$\*44.50(tax inc): \_\_\_\_\_  
Number of extra Marked Queens @ \$\*48.75 (tax inc): \_\_\_\_\_  
5 Frame Med\* NUCs @ \$155 + tax: \_\_\_\_\_  
5 Frame Deep\* NUC @ \$175 + tax: \_\_\_\_\_  
- 3 Med. 8 Frame Starter Hives/Colonies:  
Complete marked Q. Med. Hives with bees. \*\*Package April 15<sup>th</sup> @ \$ 456 +tax: \_\_\_\_\_  
Complete marked Q. Med. Hives with bees. NUC Colony May 17<sup>th</sup> @ \$ 476+ tax: \_\_\_\_\_  
  
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Limited quantities of equipment available such as frames, boxes, covers, bottoms, hive tools, smokers, suits, excluders, pollen traps, other stuff & etc. Call or Text me for a complete list.

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# Ask 2 Beekeepers

**There is a saying in beekeeping: "Ask 2 beekeepers a question and you will get 3 answers."**

Do you have a question for the Beekeepers? Email your questions to [secretary@pastatebeekeepers.org](mailto:secretary@pastatebeekeepers.org) and they will appear in the next month's Ask 2 Beekeepers. Please note that the questions or responses may include the opinions of the individual beekeepers and are not necessarily those of the PA State Beekeepers Association.

**Q1: At a new year party, it came up that I keep bees. I was slammed by someone for killing native bees and ruining the environment. Then on Facebook a friend of mine wrote a nice thing about honey bees and she was put in her place by one of her 'friends' who said they didn't belong on this continent. I was taken aback at it all. With so many other really big problems environmentally... really?! Is this a trend? How would you answer this person?**



**Charlie Vorisek > < Mark Gingrich  
& Steve Repasky**

**Q1: Mark:** Pennsylvania is supportive of pollinators and understands the value they bring to ecosystems across the state. The Commonwealth has a pollinator plan that outlines actions that benefit and promote pollinators such as the establishment of meadows and orchards, outdoor lighting guidance, and invasive plant species reduction to name a few. The plan can be found by searching "Bureau of Forestry Pollinator Conservation Plan". The Bureau of Forestry manages 2.2 million acres of dual-certified FSC and SFI state forest lands. Additionally, they manage the PA Natural Heritage Program that inventories, and protects rare, threatened, or endangered species. I have discussed managed colonies on State Forest lands with state ecologists—and the placement of honeybee hives, at this time, does not align with the bureau's ecological management goals. While important for agriculture purposes, they understand that honeybees are non-native and there are concerns regarding their role in native ecosystems and the impacts they may have on native pollinators, bees, and ecosystems. In most circles, honey bees are viewed as beneficial additions.

**Q1: Steve:** Social media is possibly one of the worst things to ever happen to society and certainly doesn't help beekeepers — not only from an educational standpoint (everyone is an expert on social media and can be keyboard bullies) but from a misinformation standpoint as well. It has

been shown that honeybees can compete with native bees for forage in some cases and certainly can cause diseases to be passed (such as DWV in bumblebees) but ultimately honey bees have been here since at least the 1600's so it's a little late to do anything about them NOT being here. What we can do is provide the correct information and the right facts about how ALL bees have their place and what we can do. The "old" mantra of "Save the Bees" was never meant to be directed towards honey bees — they do not need to be saved or rescued. We DO need to refocus our

energy (at least the energy of those who are NOT beekeepers) towards doing things that benefit our natives such as planting for ALL pollinators just not honey bees. Don't get me wrong, I'm not saying that beekeeping is the problem, but when people ask me about keeping bees I gently guide them towards doing things that support natives but also supporting those who do keep honey bees by doing things like planting natives, buying honey from their local beekeeper, not spraying their lawn for clover and dandelions, etc. We don't necessarily need more beekeepers, we need more beekeepers to do better with managing their colonies and educating those around the us about honey bees and other pollinators. We may have other big things environmentally, but it all starts with the little things.

**Q1: Charlie:** I find this to be an example of cherry-picking studies and the herd mentality of social media. Prior to the introduction of honeybees to North America, this continent only had native pollinators. With the introduction of honeybees, agriculture around the world is better able to provide food production on much larger scale. Not so long ago, I sat in on some workshops that explored native pollinators and honeybees. Maps were shown of which bees were found in different areas of flowering crop fields. Native pollinators often couldn't reach more than a few hundred yards into a



crop, because they simply don't range as far. On the other hand, honeybees could reach all areas. When there is competition for pollination, the crop benefits with more visits. There are native plant species that honeybees ignore and are not competition.

I worked a couple seasons as a Crop Adjuster for Farm Service Agency. One apple orchard routinely filed for losses. They didn't hire in any honeybees. The trees with any amount of fruit were conspicuously on the edges, near a cow pasture. I speculate that flies and solitary bees from the pasture visited blossoms they could reach. Otherwise, there were simply not enough native bees to pollinate that orchard.

I find some well-meaning people (perhaps 'friends') are quick to destroy habitat that supports native pollinators. Old trees, dead wood, woody shrubs, weed stocks and ground nests. Urban expansion has been as devastating as agriculture in creating voids without pollinator habitat.

We can debate the pros and cons of Europeans settling in North America. They brought plenty of non-native species of plants and insects. There is nothing we can do to turn back time. If we believe in any sort of evolution, I believe it is on-going over the existence of the planet and includes species moving beyond their initial boundaries.

---

**Q2: As a follow up question to January month's discussion about crystallization, I was wondering if you noticed a difference in the amount of crystallization if you extracted honey at different times of the season? This year I had to extract a month (June) earlier than I normally do and had much more crystallization than any other year I have extracted. (I am a backyard beekeeper and only have a few hives. I have been doing this for 10 years). If it is not the difference in time, is it the amount of pollen that makes the difference?**

**Q2: Mark:** Although I have no science to back it up, in my opinion, spring glucose-rich honey from early in the season crystallizes quickly, sometimes in days or weeks. Summer honey stays liquid in warm temperatures but crystallizes in the fall when temperatures cool. Fall flow honey starts to crystallize at temperatures below 50 °F. Yes, the amount of pollen in honey affects its crystallization. Unfiltered honey will crystallize sooner than honey filtered of its pollen content. Honey with a higher fructose ratio will crystallize more slowly. Conversely, honey with a higher glucose ratio will crystallize faster. Water content and storage temperature also have an impact on the rate at which your honey will crystallize.

**Q2: Steve:** Crystallization is ultimately a result of several factors which include variables such as storage temperature, how it was strained or filtered and even more so they type of honey harvested. The higher the glucose content the

more likely and faster the honey will crystallize — add into that mix a "poorly" filtered/strained honey and cool storage — your honey will crystallize. I see my honey crystallize at different times all over the board. Some years I have spring honey that will crystallize, some years it won't crystallize at all. Every year we get a different smorgasbord of blooming plants and each year that nectar profile will vary. That varied nectar profile is more likely the culprit than the time of year that you harvested.

**Q2: Charlie:** The rate of crystallization is primarily a result of the plant varieties that happen to bloom during each window of time. In general, spring honey varieties don't crystallize as quickly as late season honeys. It has everything to do with the plant rather than season. The sugar ratios change from plant to plant. In my experience, honeys that crystallize faster are dandelion, star thistle, jewel weed, goldenrod and aster. Honeys that are slower to crystallize and easier to re-liquefy are Russian olive, locust, clovers and some specialties like milkweed and beard's tongue. I don't believe there is any correlation with the amount of pollen in the honey, other than suspended pollen is a starting point for crystals.

The process of extracting, straining and moving from one container to another, will add air bubbles and wax particles to honey. Crystallization will occur faster if the honey is not warm enough to allow those particles and air to float out. ♣



**Do you have a question for the Beekeepers?**

**Email your questions to**

**[secretary@pastatebeekeepers.org](mailto:secretary@pastatebeekeepers.org)**



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# INNER NATURE

## Time: Reality or Illusion?

Vidya Rajan

When his dear friend Michele Besso passed away, Einstein wrote a condolence letter: *“Michele has left this strange world a little before me. This means nothing. People like us, who believe in physics, know that the distinction made between past, present and future is nothing more than a persistent, stubborn illusion.”* Whether time is real, or whether it is “nothing more than a persistent, stubborn illusion” is what I will be interrogating in this article.

We are familiar with the way time seems to slip by, smoothly and continuously. However, to give ourselves a sense of control over this “flowing” of time, we impose artificial quantities on it — dates, hours, minutes, seconds — thereby giving us discrete units which we can measure, monitor, and regulate. But time is actually unfettered by these actions because it does not stand alone as an independent entity. According to Einstein’s special theory of relativity, time relates to space in a construct called space-time, which permeates everything in the universe. Light, planets, and we ourselves move through space-time at different rates. This leads to something called time dilation: the faster something moves through space, the slower it moves through time. Imagine an observer on a hill who sees two people covering a certain distance using two different modes of transport: Person 1 is sitting<sup>1</sup> in a regular car driving along a road, whereas Person 2 is sitting in a rocket-propelled car traveling the same distance along the same road. To the observer, Person 1 will appear to be moving slowly through space but more time will be consumed. Person 2 in the rocket will be moving fast through space, with less time used. Since Person 2 uses up less time, they will age a little slower than Person 1.<sup>2</sup>

Einstein’s general relativity uses this concept of space-time to also describe gravity. In a similar, but opposite manner, to how a rubber sheet distends when a bowling ball is placed on it, space-time warps in the presence of mass. But it stretches thinner farther away from the mass and contracts to greater thickness closer to it.<sup>3</sup> Because of this warping, time passes more slowly in proximity to a mass than away from it, and the bigger the mass, the slower time passes. Thus, if you are on top of a mountain, time passes more quickly than if you are at sea level. If you are on the surface of a black hole, time barely passes at all. Curiously, it seems biological processes also slow down proportionately. In the case of two identical twins delivered at the exact same moment, but separated instantly, the one who grows up on a mountain will be a little older, biologically, than the one who spends his life down a mineshaft. Thus, time stretches or shrinks with velocity and gravity.

Time dilation due to relativity, intangible though it seems to our senses, has a real impact on technology. For example, when you plug a destination into your direction-finding app, the satellites that coordinate and map your location on the Earth are orbiting way up in the sky where time passes faster. To understand how time computes to distance, consider that the formula:  $distance = velocity \times time$ . Since satellite-based clocks measure time faster (by 38 microseconds) than on the ground, the distance values on land would accrue errors of up to 6 miles per day. But physicists from the US Department of Defense, who first developed GPS in the 1980s, took relativity into account and made the corrections necessary to land you on “X marks the spot” that you had chosen, rather than over a cliff or into the river alongside. Nor is this potential positional disaster merely hypothetical (as far as history goes). In 1707, four British Royal Navy vessels ran aground, killing up to 2,000 men, because their imprecise navigation system had guided them 15 miles off course onto lethal rocks off the Isle of Scilly. No one wants that sort of thing to happen today; today, we have social-media outrage and ambulance-chasing lawyers.



There is still more weirdness afoot. According to the British astrophysicist Sir Arthur Eddington<sup>4</sup>, the second law of thermodynamics is the reason that time appears to move forward “like an arrow”. This law (simplified) posits that every contained system in the universe, incorporating matter or energy — or politics (just kidding!) — tends towards increasing disorder or “entropy”. To reverse the direction of time, disorder would have to spontaneously revert to order, and that is not empirically observed<sup>5</sup>. Entropy can be seen as a manifestation of heat<sup>6</sup>, and time mirrors the probabilistic movement of heat from hot objects to cold ones rather than the other way around. This observation is also stated as an “entanglement” between the two objects one uses to observe the passing of time, such as the cooling of a hot cup of coffee in a room. The hot coffee demonstrates quantum entanglement with the cooler room atoms, and equilibrates over time<sup>7</sup>. Discrete chunks of this state of entanglement relate to time moving forward as the coffee cools. Another related idea is that the forward movement of time is due to the emission of radioactive particles from atoms, which obviously can go in only one direction — particles do not spontaneously enter atoms and make them radioactive. The past is gone, the future is not yet here; we exist in the *now*.

Carlo Rovelli, a contemporary physicist and author who brings a poetic clarity to arcane theories, shatters the rather satisfying link of time to increasing entropy by showing that our perception of entropy is misleading. Using a pack of cards as an example, he describes an orderly pack, with the first 26 cards being “red” cards and the next 26 being “black” cards. If shuffled, they become disordered from the perspective of card color, but only card color. Other types of order may arise from the shuffling — the first 26 cards of the deck may be a jumble of black and red, sure, but they may manifest a different order. For example the first 26 may be more dog-eared, or may be picture cards, or have increasing numerical value. It all depends on the perspective. Thus entropy does **not** necessarily increase on shuffling, and therefore the concept of time as such does not even exist. Go figure. This brings us to the concept of the block universe where the past, present and future are all concurrent: they all exist simultaneously<sup>8</sup>. To mathematicians and physicists, this is reality. We just cannot perceive it with our senses.

Back to *now*. What sort of *now*? This also depends on the perspective, called the “frame of reference”. When two objects or people share the same “frame of reference”, then things happen simultaneously. You can observe a car arriving and picking up passengers and leaving. As long as you all share the same “space”, that event would occur at the “same time” for both observer and passengers. However, if you are way up in the atmosphere, the frames of reference differ, and the timing of the event would not be shared between an observer on the ground and one on the space station. In other words, the event would not happen simultaneously. This felt weird for me to contemplate. Think about this: If the same event — say the assassination of John F. Kennedy — were viewed from the Space Station and Dallas, they would not happen simultaneously for the observers; the *now* would be offset. The assassination would happen at different times for the different observers. Isn’t that just crazy? But this is the mind-bending consequence of relativity. Note: This is different from the effect of the distance light has to travel. Since light travels at 186,282 miles/second and the space station is 250 miles above in the atmosphere, it would take about 0.001342 sec<sup>9</sup> for the information to be transmitted. This is really very little “clock time”. The difference in the time-perception is due to the lesser warping of space-time around the space station and greater warping near the Earth.

To go back to the original question: Is time real, or an illusion? It depends. Specifically, it depends on your frame of reference. If you are in it, it feels real. If you are outside it, it is warped by the effects of speed, gravity, or the block universe. Since we are inexorably and inescapably trapped in our frame of reference, the construct of time for us feels real.

To end with another quote:

*The past is history. The future is a mystery. Today is a gift. That is why it is called the present.*<sup>10</sup>



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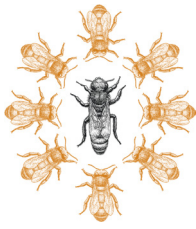
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## Bibliography and Notes:

1. Sitting is defined as a “stationary” action, but that is also an illusion. We are sitting on the surface of a planet spinning on its axis at about 1,000 mph, while flying around the sun at 66,000 mph (which would take us from Washington DC to San Francisco in 3 minutes), while the solar system orbits our Milky Way galaxy at 483,000 mph.
2. The fun part of this time dilation is the extrapolation that if humans could be accelerated to near light-speed velocities<sup>2</sup>, it would have the same effect as slowing down time, so no one need be put into suspended animation for interstellar travel because they would barely age, at least for the duration that they were traveling at near light velocity!
3. This may seem counter-intuitive, because the imaginary rubber sheet will get thinner where it is distended by a weight. For space, imagine it to be anti-rubber, such that it stretches and expands more away from mass, and becomes thicker and denser closer to the mass. In the case of a black hole, the density is so massive that it crushes everything into subatomic soup and causes a bending so steep that even light cannot emerge from the depth of the hole caused by the warping. On the surface of our imaginary black hole, time will stop.
4. Eddington, along with Frank Watson Dyson, demonstrated the deflection of light calculated by Einstein due to the warping of space-time by observing the bending of light during a solar eclipse. There is a story of Eddington at a meeting. *“Eddington recalled that as the meeting was dispersing, Ludwig Silberstein (the author of one of the early books on relativity), came up to him and said, ‘Professor Eddington, you must be one of three persons in the world who understands general relativity’. On Eddington demurring to this statement, Silberstein responded, ‘Don’t be modest Eddington’. And Eddington’s reply was, ‘On the contrary, I am trying to think who the third person is!’”* Reference: <https://www.physicsforums.com/threads/only-three-people-understand-general-relativity.935624/>
5. The second law of thermodynamics defines a “closed system” where no energy is input. Energy can reverse disorder, but the universe is a closed system with no energy coming into it from an external source. Recently scientists did “unboil” an egg, but they only made the proteins uncoil rather than return the egg to viability to hatch. But then, more recently, scientists created a “time crystal” which reverts to its original condition without absorbing energy, effectively acting like a perpetual motion machine. It is now considered a new phase of matter. Is this time crystal reversing entropy and breaking the second law? Probably, at least at minute scales. <https://www.quantamagazine.org/first-time-crystal-built-using-googles-quantum-computer-20210730/>. Watch an explanatory video from Physics Girl here: [https://youtu.be/ieDlpgso4no?si=kSzj3re\\_e2M5LWDO](https://youtu.be/ieDlpgso4no?si=kSzj3re_e2M5LWDO)
6. Heat is related to entropy. When a cup of water is hot, it is in a state of higher disorder because the atoms are moving faster. But some of the heat is dissipated into the atmosphere so it becomes part of the background. Therefore, even as the water is cooling, it is increasing the entropy of the universe. To impose order on the water, it would have to be turned to ice, with energy extracted from the water, dissipating that heat into the universe, increasing its entropy further.
7. WIRED Staff (2014). *New Quantum Theory Could Explain the Flow of Time*. [online] WIRED. Available at: <https://www.wired.com/2014/04/quantum-theory-flow-time/>
8. You can only understand this as a concept by imagining yourself stepping out of the space-time dimension and looking back. You can look to the *present* of your dog occupying your armchair in your absence, to the *past* where the dog looked around for you and then eyed your armchair covetously, and to the *future* when you return to turf the dog out and retake possession of the armchair. Or maybe a different future where the dog refuses to yield. You will know when you step out of our constraining space-time.
9. Loo, W.B. (n.d.). *Speed of Light Calculator*. [online] Available at: <https://www.omnicalculator.com/physics/speed-of-light>
10. Attributed to a speaker at the 1993 Rutgers Preptheoni graduation. <https://quoteinvestigator.com/2023/07/26/past-history/>

Suggested further reading:

NPR. (2022). *Researchers say time is an illusion. So why are we all obsessed with it?* [online] Available at: <https://www.npr.org/2022/12/16/1139780043/what-is-time-physics-atomic-clocks-society>.



## CiCi's Bees:

### *The Beekeeper's Stand: Sting & Honey of Advocacy*

Ever give any thought of how you can advocate for your beekeeping goals in 30 seconds? If not, maybe it's time to make a stand, and decide on your personal slogan.

Someone walks up to your honey stand during a fair, and asks loudly, "Why would anyone want to eat bee VOMIT?" What is your actual gut response to this rude person? Wait... don't answer yet... there's a group that forms to hear your response, amusement and interest evident on their faces. You pause in your response, look around at the bystanders, turn to Vomit Dude, and say...

Let us consider two probable responses:

Smart-Arse: "You ever eat an egg? Know where THAT comes from?"

Helpful Sarcasm: "Try it, you might like it!" (sample spoon forced into his mouth)

Although the two responses would be really fun and could diffuse any tension by laughing away the question, neither addresses the amazing opportunity provided by Vomit Dude. Remember that it's actually not the Dude we are trying to answer. Vomit Dude isn't interested in the content of your answer; he's trying to shock 'n awe you with his cleverness. He just set up a perfect stage and audience for your brilliant response.

Let's back up, starting with a definition—

*Advocacy: an activity by an individual or group that aims to influence decisions.* Advocating for honey bees and beekeepers is right in most bee organization's mission statements. Consider Northwestern PA Beekeepers Association's slogan statement, "Supporting, Educating & Promoting Local Beekeeping." This slogan is ripped directly from the rather long mission statement, proclaiming the reason of the club's existence. NWPBA is essentially a group of beekeepers ADVOCATING for local beekeepers and honey bees through support, education and promotion.

How many of us, as individuals, have a beekeeper's mission or slogan? And if we don't have one, maybe its time we decide what resonates for us so it becomes our identity when the stage is set and the lights are on you.



**Taking your beekeeper's stand to a county fair can be sticky: long hours, overexcited kids with feet-weary parents, and lots of folks who walk by fast avoiding eye contact. I have found that folks tend to be ruder, hiding in assumed anonymity.**

A 30 second 'elevator pitch' provides an opportunity to share a quick summary of yourself and your beekeeping mission. **The elements to include in an elevator pitch is: who you are, what you do, what's unique about you/subject, and what your "ask" is<sup>1</sup>.** The actual words and focus varies depending on the situation, and this formula is often used to network, get a job or sell something...we are using it to advocate (sell) honey bees to our audience. According to a recent Microsoft study, 8 seconds is the average person's attention span... about the same as a goldfish's attention span. So, you have 8 seconds to hook, and 22 seconds to reel them in.

So let's break the thirty seconds down... here's some examples to get you going:





**My daughter working a Bee Club sales table at a week-long fair, surrounded by other vendors dealing with environmental conservation and farming. As usual, I found myself explaining bees to all ages at the observation hive non-stop during my shift, which was a delight. Interestingly enough, more adults shrunk away from the display with a shudder, than the kids.**

**Who you are, What you do** (work your name/company in, as appropriate)

“As a beekeeper with about forty colonies...”

“I am president of my local bee club, and we focus on supporting and promoting beekeeping.”

“I absolutely love everything about honey bees, which is a good thing, since I’m a beekeeper!”

**What’s unique about you/subject** (choose two options that ‘feel right’ to you, and research them to thoroughly know your facts)

- Pollinators Unite! (keep pollinators happy, and you save... us!)
- Wallet Pains (economic woes are in front of us if pollinators go down)
- Wholesome Hive (every product of the honey bee colony is good for us)
- Therapeutic Gold (emotionally/physically fulfilling hobby/lifestyle)

This list is not all-inclusive, but is a great place to start.

The key is to know what resonates for yourself, in terms of advocating for honey bees, and RESEARCHING what you plan to advocate, so you are prepared.

**What is your “ask”** (any good salesperson tries to close the sale)

- “I’m so glad to hear you enjoy honey- would you like to compare a few varieties to decide which you want to take home?”
- “It is truly a relaxing hobby, even when working hard- I’m going into my bee yard on Saturday; would you like to join me?”
- “So I would really appreciate it if I could place several colonies on your unused land, which would also help your raspberry bushes and apple trees set up more fruit... does that sound good to you?”

I can hear some readers saying, “Wait- shouldn’t advocating be selfless, without getting anything for it?” In this, you can have your cake and eat it, too. For truly selfless individuals who abhor folks who want to profit on their beekeeping hobby/business, ant farming may be the way to go, and ants are very beneficial to the environment<sup>2</sup>. I am mostly serious... ants are amazing insects that would be very cool to tend, except for the lack of tangible products, health benefits, and income source honey bees provide. I hold to the belief that we can further our advocating principles while earning a living (or at least breaking even), and there shouldn’t be guilt in that.

Practice several 'pitches,' and combine/recombine to be used in multiple scenarios. So we come back full circle to Vomit Dude, and what you would say to the growing crowd who await your response. He asks loudly, "Why would anyone want to eat bee VOMIT?"

"I am so glad you asked that question! My family LOVES honey; we eat it all the time. (*turning to crowd*) We especially like how raw honey has antibacterial and anti-inflammatory properties, with even burn centers using it on patients. As a beekeeper, I watch my bees work really hard to provide food for their colony, and I feel great that I manage such a wonderful pollinator that helps my neighbor's garden and apple trees be twice as productive as it might otherwise be<sup>3</sup>. Would anyone like to try creamed honey?"

Personally, I LOVE the 'Smart-Arse' response, "You ever eat an egg? Know where THAT comes from?" The problem is, that keeps the exchange to 'zinger' level, trying to one-up each other without any meaningful exchange. If you haven't considered your personal viewpoint on what it means to advocate for honey bees and beekeeping, and if you haven't researched/practiced facts that back up your viewpoint, you might later regret what comes out of your mouth.

So choose two or more viewpoints research thoroughly and PRACTICE 30 second pitches using **who you are, what you do, what's unique about you/subject, and what your "ask" is**. Next time a naturalist attacks *Apis mellifera* as



Small community fairs in church basements are a great place to practice a 30 second pitch on any bee topic, with no need to include an 'ask.' These are your neighbors, looking to learn.

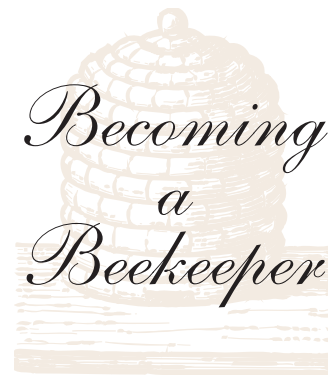


Each one of those Girl Scouts had a parent listening to the honey bee presentation and helping with the activities. Half of the kids had never tried honey before that day.



an invasive species dooming native bees, or a neighbor is concerned about their kids being stung by 'your' bees, or a curious shopper at the grocery store asks what you are baking with 30 bags of sugar, YOU ARE PREPARED with a solid answer.

Advocate for those beloved honey bees. Support managed beekeeping. Make Vomit Dude wish he just took a sample of your honey and kept quiet. It's time to stop relying on just the bee organizations to speak up: make a beekeeper's stand, and advocate for our bees. ♣



### References

- 1 <https://careerservices.fas.harvard.edu/blog/2022/09/07/how-to-give-a-great-elevator-pitch-with-examples/>
- 2 <https://hortnews.extension.iastate.edu/ants-are-ecologically-beneficial>
- 3 [https://usapple.org/wp-content/uploads/2022/03/2022\\_03\\_18\\_USAPPLE\\_PollinatorReport\\_F.pdf](https://usapple.org/wp-content/uploads/2022/03/2022_03_18_USAPPLE_PollinatorReport_F.pdf)

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