

Natural Selections

A NEWSLETTER OF THE TRI-I COMMUNITY

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MIND, BODY, BIOLOGY

HEALTH | MOVEMENT | COMMUNITY



Cover illustration by Marina Scherthanner

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With culture recommendations on pages 12 and 16, and poetry on page 18!

The 2024 Summer Olympic Games are upon us! Also in session are the lesser known 2024 Model Organism Olympics. Our local lab critters have been training diligently for years (or weeks, depending on their lifespan) for the opportunity to bring honor to the Tri-I scientific community. Throughout this issue you’ll find critters flexing their athletic prowess. Go team Tri-I!

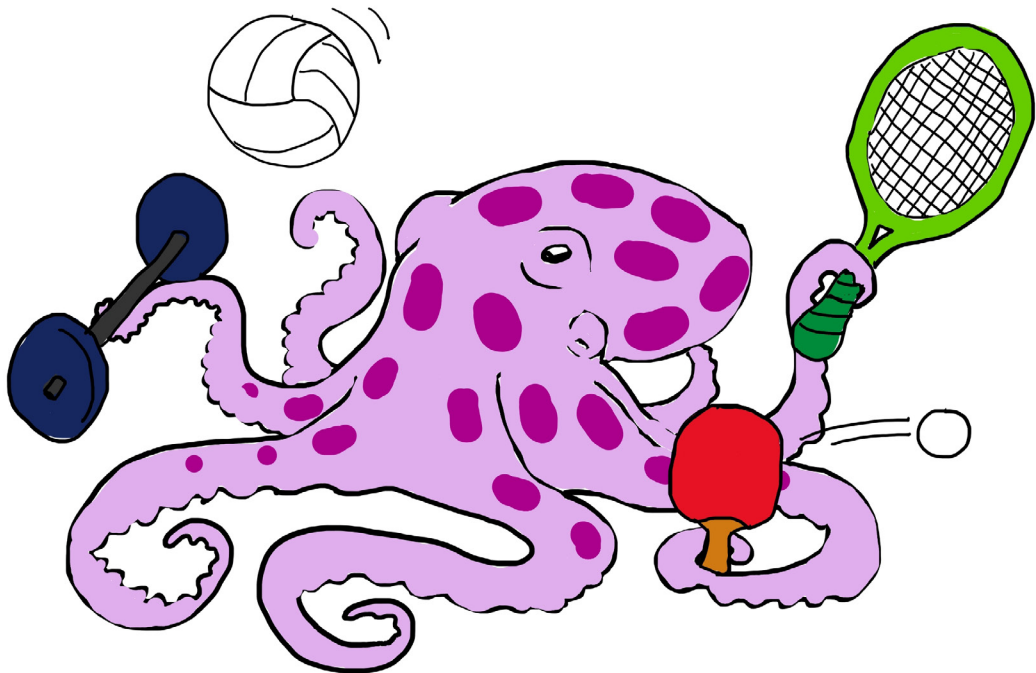
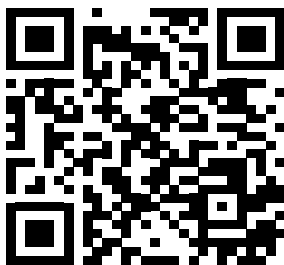


Fig. 1: An octopus can train for several events at once because each of their eight arms has a large nerve cluster, similar to a minibrain, that controls its movement. Though octopuses are naturally muscular, flexible, and well-coordinated, they are solitary creatures, and team sports are emotionally draining for them. The toughest obstacle this athlete faces is burnout.

Illustration by Marina Scherthanner; caption by Audrey Goldfarb

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Healing The Mind and Body: Insights into Complementary & Alternative Healthcare

By Audrey Goldfarb

As one of the world’s leading biomedical research communities, members of the Tri-I appreciate the volume and rigor of research done to seek and support new medical advances. In the U.S., overall life expectancy and survival rates of many diseases have steadily increased thanks to modern medicine. Paradoxically, the general well-being and [healthspan of these populations has stagnated](#), in part due to side effects of the very [treatments used to fight disease](#). We currently face an [increased rate of mortality in individuals with a history of disease](#), and institutions are investing in research to address the [growing gap between healthspan and lifespan](#). However, there are [alternative healthcare systems](#) that have existed for thousands of years to treat and prevent disease and preserve healthspan. These alternative systems are not yet integrated into Western medicine, but many are entering the mainstream of health and wellness, in large part due to promotion on social media platforms like [Instagram](#) and [TikTok](#). While these platforms are effective in raising awareness, they’re also susceptible to overhype and misinformation, especially as rigorous research is lacking. The potential benefits and risks of alternative medicine remain unclear. Efforts to increase knowledge, awareness, and accessibility of all forms of healthcare will be key to improving health and well-being.

What is complementary and alternative medicine, and how is it used?

Complementary and alternative healthcare and medical practices (CAM) encompasses

any medical and healthcare system and practice that doesn’t fall under the umbrella of conventional medicine. Because the practices included in CAM are constantly changing as mainstream medical practices evolve, it’s difficult to accurately define it as anything other than **not** modern, conventional medicine.

For example, traditional medicine, encompassed by CAM, is defined by the WHO as “the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness.” CAM extends far beyond the resources we

Alternative healthcare systems have existed for thousands of years to treat and prevent disease and preserve healthspan.

access through modern healthcare systems. As research bolsters our [appreciation for personalized medicine](#), access to more diverse healthcare may be key in advancing individual and community well-being.

[According to WHO](#), about 80% of the population in developing countries relies on nonconventional medicines as healthcare. CAM practices that originated in developing countries reflect limited local resources; therefore, many CAM treatments and remedies are produced at a lower cost than conventional Western medicine. However, the use of CAM practices does not correlate with socioeconomic status in the way one might expect and varies by country. For example, one [study](#) in Sub-Saharan Africa suggests that lower socioeconomic status correlates with CAM usage, while [another](#) in Iran indicates the opposite. [In a 2008 study](#),

the use of CAM in the U.S. was associated with higher socioeconomic status and education, but the degree of association varies among different ethnic groups.

CAM patients have more agency in decisions concerning their treatment.

The dose makes the antidote

One benefit of alternative medicine, especially to treat chronic conditions, is that it's often administered in small, innocuous doses. Many of these treatments are designed to be integrated into a long and healthy life, which requires a higher level of commitment and participation from patients. Accordingly, when compared to modern medicine, [CAM patients have more agency](#) in decisions concerning their treatment.

Chemotherapy, for example, is prescribed by an oncologist and administered in a hospital, not at home. The patient is generally expected to be passive throughout the decision-making process, and any at-home complementary treatments are secondary. Chemotherapy is administered at a high dosage, which is generally calculated from the body surface area of the patient and doesn't consider other factors that could help minimize the side effects of these drugs. Such an approach may be essential for acute injuries and illnesses but becomes a problem when treating chronic conditions.

Dr. Helene M. Langevin, director of the National Center for Complementary and Integrative Health (NCCIH), discussed different forms of complementary medicine in conversation with Neil deGrasse Tyson on an episode of [StarTalk](#). Langevin argued that the high dosage of modern medications and treatments influences cultural beliefs about proper doses of substances used over longer periods of time, such as vitamins and supplements. This could be harmful, as most drugs and vitamins have off-target effects. For example, [large doses of Vitamin E have been linked to cancer](#). Langevin recommended taking substances in the context

of one's diet rather than in pill form. "Correcting deficiency is important, but adding to that is not that beneficial," she said. "Nonpharmacological treatments, when done right, can be very effective and useful without needing drugs."

Work by Langevin and others suggests that in many situations, low-dose CAM may be more effective than high-dose modern medicine. "More is better is the mantra of our society, but what we're finding out is actually the opposite," Langevin said. "Research is starting to show that taking large amounts of anything is not a great idea."

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Bridging CAM with modern science

Ayurveda, one of the world's oldest medical systems, uses natural and holistic approaches to prevent and treat illness. [It originated in India over 5000 years ago](#) and is practiced all over the world today. Ayurveda focuses both on preventing and treating disease by maintaining balance in one's body, mind, and consciousness. It is commonly used in conjunction with conventional medicine—for example, to [mitigate side effects of chemotherapy](#). MSKCC provides [information on Ayurveda](#) for patients and caregivers dealing with the side effects of cancer and cancer treatments.

Ayurvedic treatments are generally accepted by the medical community as highly effective, but because the pharmacology, pharmacokinetics, and pharmacovigilance of Ayurvedic medicines are largely unknown, they have not been integrated into our modern healthcare system.

Dr. Vikas Singh, a research associate in the Tarakhovsky Lab at Rockefeller, grew up in a village in North India where Ayurveda was the predominant form of healthcare. As a teenager and young adult, Singh was inspired by the remarkable recoveries he witnessed

in family members treated with Ayurvedic medicines. "It's more customized to your body than common drugs," Singh said. "Taking an integrative approach could be more preventative for chronic pain and inflammation."

When Singh was thirteen, his older brother was electrocuted by a wire carrying 11,000 volts of electricity. He had three-millimeter-deep wounds on both hands. "You could see the bones," Singh said. The recommended medication was prohibitively expensive in the quantity Singh's brother needed. However, his uncle connected them to a family who brought them a homemade Ayurvedic salve to treat the wounds. Within a week, Singh's brother saw a remarkable improvement. "He was healing with no scarring," Singh said. "I was inspired."

"I think we should be talking more about it, and discussing how and why this is more effective than any advanced medicine," Singh said. These conversations could motivate biomedical researchers to study Ayurveda, improve the research methodology used to do so, and identify the active ingredients in Ayurvedic drugs. This, Singh says, would provide the deeper understanding necessary for acceptance by the scientific community. "To integrate it into the healthcare system, you have to know the active ingredient," Singh said. "It's in the philosophical state now, and I want it to be in the scientific state. It's not yet accepted by the scientific community."

These conversations could motivate biomedical researchers to study Ayurveda.

The placebo effect: good for patients, bad for pharma

Though a strong advocate for Ayurveda, Singh is open-minded to the possibility that the benefits could be largely psychosomatic. "When you go to the Ayurvedic doctor's house, you are assured that the doctor will take care of you," he said. "It could be completely placebo."

Many practitioners argue that the placebo effect is a valid form of healthcare.

However, many practitioners argue that the placebo effect is a valid form of healthcare. The placebo effect activates [the body's ability to heal itself, one of the central tenets of Ayurveda](#). [Clinical trials with open-label placebos](#) have shown promising results in both adults and children. [Research using fMRI and PET scans](#) show that [placebos work by acting on pathways in the brain that respond to pain](#). "The placebo effect is a self-healing response," said Langevin. "It's not just about how you see the pain, but also in how you respond to the pain."

"It's not just about how you see the pain, but also how you respond to the pain."

By leveraging the body's ability to heal itself, placebos and many CAM treatments are generally inexpensive to produce and create few negative side effects. On their surface, these characteristics appear to support the integration of these treatments into our healthcare system. However, considering the [stronghold the pharmaceutical industry has on healthcare](#) and biomedical research, it's difficult to make progress on preventative treatments that would be less lucrative and diminish the need for other prescription medications.

Sleeping on preventative healthcare

The marketization of healthcare is a systemic obstacle that disincentivizes treatments that are inexpensive and preventative. Lifestyle interventions like improvements to one's diet and sleep schedule can be equally or more effective than prescription drugs but are devalued in comparison to modern medicine and overshadowed by patients' desire for a "magic pill." It might not be obvious to compare sleep with medicine, but as with our diet, the quality and dosage of sleep is one of the most impactful factors to our health.

Dr. Sofia Axelrod is a research associate at Rockefeller in the Laboratory of Genetics, headed by Nobel Laureate Dr. Michael Young. Her research investigates the biological and environmental determinants of sleep and circadian rhythms, as well as the consequences of their dysregulation. Work by Young, Axelrod, and others has shown that circadian clock disruption can have profound effects on human health. [Dysregulation of these processes and pathways is associated with metabolic, cardiovascular, and mental disorders and cancer.](#) Sleep experts argue that [this research warrants the modernization of medical care](#) to incorporate the importance of sleep into standard advice and treatments administered by healthcare professionals.

The marketization of healthcare is a systemic obstacle that disincentivizes treatments that are inexpensive and preventative.

As someone who formerly struggled with sleep dysregulation, Axelrod experienced the shortcomings of our healthcare system firsthand. In college and graduate school, Axelrod was prescribed many different types of hypnotics to help her sleep. “They knock you out so you can sleep, but you feel really groggy the next day and it doesn’t solve the fatigue,” Axelrod said. “I tried all the hypnotics there are. None of them give you restorative sleep.”

It is when conventional medicine fails that the effectiveness of lifestyle interventions and CAM reveals itself. Changes to one’s diet and routine, such as controlling light exposure and exercising, can help regulate sleep sustainably and without the side effects of hypnotics. Axelrod found success when she treated her own light

exposure and sleep schedule with the same rigorous regularity that she did with the fruit flies she studies in the lab. She also started practicing yoga, which positively impacted her physical and mental health. Yoga is also included in many [Ayurvedic treatments](#) aimed at improving sleep quality and regularity.

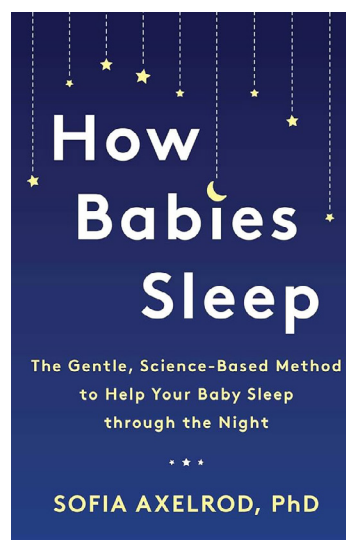
“The way medicine is done doesn’t consider how someone actually feels.”

“I think generally speaking, going to the doctor is often not satisfactory,” Axelrod said. “The way medicine is done doesn’t consider how someone actually feels.”

An estimated 50 to 70 million Americans have chronic sleep disorders, but healthcare institutions haven’t adapted their practices to reflect the current research. Patients struggling with these and other disorders aren’t always aware of the options available to them, even after seeking help from healthcare professionals. Science communication is key in raising awareness of advances that are supported by research but not yet integrated into the healthcare system.

Science communication is key to an informed discourse about CAM

Axelrod’s 2020 sleep-help book, [How Babies Sleep: The Gentle, Science-Based Method to Help Your Baby Sleep Through the Night](#), has helped thousands of parents sleep train their children using scientifically sound methods that aren’t yet common practice. Science communication that covers potentially beneficial subsets of CAM, such as Ayurveda, acupuncture, [psychedelic therapy](#), and TCM, can improve public knowledge and make these alternative treatments more accessible to those who might benefit from them.



Many biomedical researchers like Singh and Axelrod use their scientific training to investigate and responsibly spread knowledge of alternative and complementary medicine and beneficial lifestyle interventions. With advances in personalized medicine increasing, individuals and healthcare practitioners may begin to integrate CAM into their wellness toolkits.

Current applications of CAM in biomedical spaces

As awareness continues to improve, some alternative routes to supporting health and wellness are present on biomedical campuses. Alongside skin cancer and cholesterol screenings, Rockefeller’s University Health and Wellness (UHW) center offers occasional sound bath meditations, Reike, and neck and back massages.

Caroline Nestro, Associate Professor of Clinical Nursing at the University of Rochester School of Nursing, focuses on the wellness of students, staff, and faculty. She works with nursing students as a wellness coach and strengths-based therapist, meaning that she capitalizes on a person’s strengths—strategies that have helped them through tough times in the past—to address current obstacles. This principle, that one’s body and mind possess the ability to heal oneself, is common across many CAM systems like Ayurveda.

Nestro uses mindfulness, art and music therapy, and community engagement to support the mental health of nursing and medical students. “The arts and humanities are very helpful in liberating them from the stress they’re having and changing their focus,” she said.

In crisis situations, Nestro says that more often than not, employing art and music therapy prevents her patients from needing to go to the emergency psych department. Similar interventions for chronic conditions could diminish the need for people to take prescription medications with undesirable side effects. Every week, Nestro runs a drop-

in wellness group for students, many of whom are coping with enormous amounts of stress, anxiety, and sleep deprivation. “They come, color, talk with one another, and support each other,” Nestro said. “Their sympathetic nervous system can take a rest.”

“The arts and humanities are very helpful in liberating them from the stress they’re having and changing their focus.”

While conventional psychiatry is imperative in some situations, many people could benefit more from using CAM approaches. “I would see these as complementary to drugs like SSRIs,” Nestro said. “But I wish we would try some of these other things first before getting people on meds.”

The future of CAM

Unlike conventional medicine, support for CAM lacks organized research, clinical trials, and quantitative data. Although anecdotal evidence of the effectiveness of CAM is striking, the extent of potential benefits and risks of different forms of CAM are largely unknown.

Given these unknowns, many forms of CAM can still be practiced at low risk. Yoga, meditation, massage, and many dietary and lifestyle changes can decrease inflammation to improve mental and physical health. Engaging with one’s community, friends, and family also supports healthspan and happiness. These practices overlap with tenets of CAM systems, and many of the same benefits can be derived.

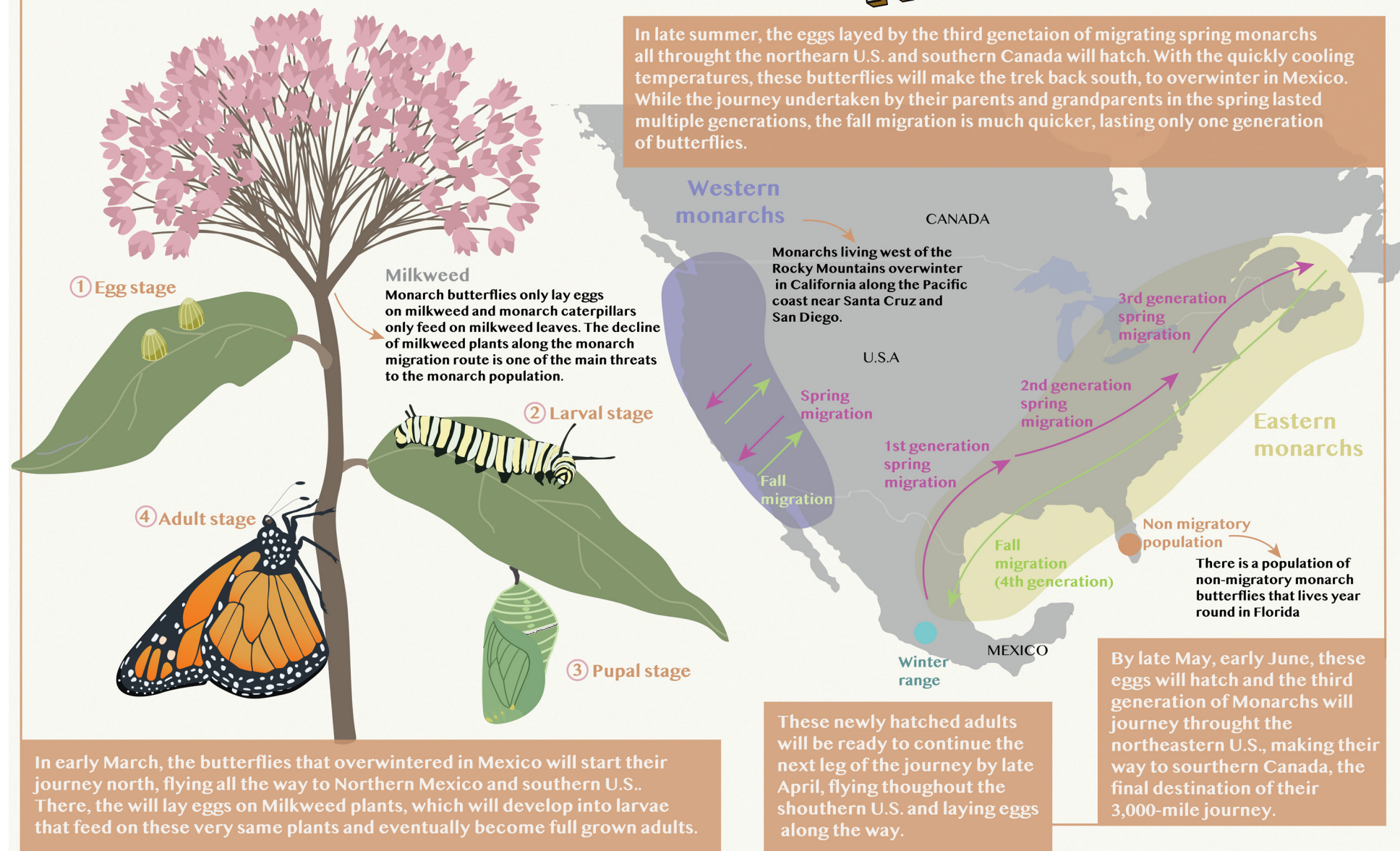
Members of the biomedical community are fortunate to have access to a wide range of healthcare options and possess the literacy and scientific reasoning to find an individualized balance between conventional medicine and CAM. Additionally, we can use our position to amplify legitimate data concerning CAM, advocate for future research, and do our part in supporting the healthspan of people in our community and beyond.

As temperatures rise and the days become longer, New York City will soon be greeted by most spectacular events on earth-the Monarch butterfly migration.

Monarchs are the only butterflies that migrate south in the winter and north in the summer. Unlike other butterfly species that can overwinter as larvae, pupae, or even adults, monarchs cannot survive the cold winters of North America. Instead, the travel almost 3,000 miles every fall to overwinter in the mild climates of western Mexico. When the temperatures increase in spring and summer, the monarchs return to the U.S. and Canada.

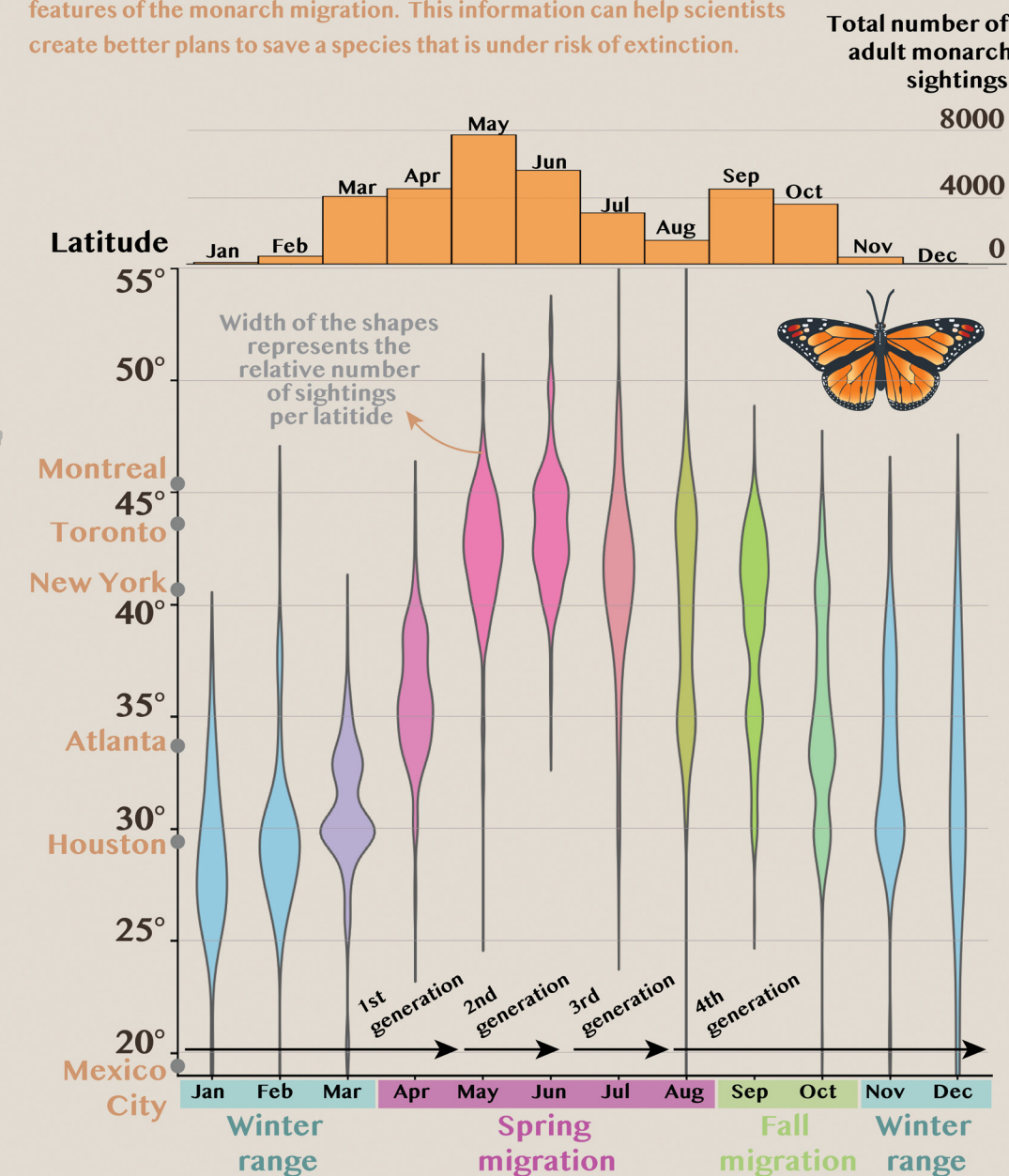
ON THE TRAIL OF THE MONARCHS

In late summer, the eggs laid by the third generation of migrating spring monarchs all throughout the northeastern U.S. and southern Canada will hatch. With the quickly cooling temperatures, these butterflies will make the trek back south, to overwinter in Mexico. While the journey undertaken by their parents and grandparents in the spring lasted multiple generations, the fall migration is much quicker, lasting only one generation of butterflies.



AMIGRATION IN NUMBERS

Tracking a migration of this magnitude is no simple undertaking. To help with this task, researchers have creating a citizen science project called Journey North, in which anyone along the monarch migration path can register monarch sightings. The data collected by this project recapitulates the main features of the monarch migration. This information can help scientists create better plans to save a species that is under risk of extinction.



Data from Journey North Citizen Science Data (journeynorth.org)

By Sofia Avritzer

Choreographing the Mind: Dancing Scientists Decode the Neurobiology of Dance

By Dvir Avnon-Klein

Feet struck the floor in a percussive staccato. Hands clapped in syncopation with a drumbeat. Wrists flicked. Fingers snapped.

It might sound like a scene from a dimly lit Spanish flamenco club, where the scent of tapas and sangria mingles in the air. But in reality, it was a neuroscience lecture/performance featuring Rockefeller's own dancing scientists, Dr. Erich Jarvis and Dr. Constantina Theofanopoulou. Their rhythmic display wasn't just for show. It illustrated a fundamental scientific question they study: What happens in our brain while we dance?

Pathways involved in vocal production might be similar to those used in dance.

Dance can be defined as synchronizing body movements to rhythmic sound. This can be as simple as synchronizing footsteps to a musical beat with a stable tempo, a capability that few other species possess. Drs. Jarvis and Theofanopoulou aim to identify the brain pathways responsible for this motor-auditory integration. A significant breakthrough in their research was realizing that the pathways involved in vocal production—which also requires sensorimotor integration—might be similar to those used in dance.

While many researchers have hobbies outside the lab, few integrate them into their research as seamlessly as these two. Dr. Theofanopoulou, who grew up in Athens, spent her entire childhood dancing without sacrificing academic excellence. It was her



Jarvis and Theofanopoulou in February 2024 delivering a lecture entitled, "Tapping into the Neurobiology of Speech and Dance" at The Center for Ballet and the Arts at New York University. Photos courtesy of Joe Carrotta.

medium for self-expression, but also a way to maintain a disciplined attitude toward all facets of life. In many ways, it helped her be a better scientist: the precise timing required to execute a piece of choreography is not much different from the precise timing required to execute an experimental protocol. These days, she specializes in flamenco, drawn to its intricate rhythms and expressive movements.

Dr. Jarvis's journey began with winning dance contests by imitating John Travolta's moves from Saturday Night Fever. He went on to major in ballet at LaGuardia High School of Performing Arts and the Joffrey Ballet School. Later, he trained in modern and jazz dance at the renowned Alvin Ailey dance company. His passion for dance led him to study neuroscience, driven by a desire to understand how the brain could control something he loved as much as dance. Throughout his career, he has explored African dance and now specializes in Latin styles like salsa and bachata. He particularly enjoys the added complexity of social partner dancing, which requires coordinating the movements of two bodies to the music.

Dr. Theofanopoulou is taking her research a step further by actually incorporating human dancers into her studies. By attaching EEG headsets to dancers as part of a performance piece, she measured interbrain synchrony (specifically fast gamma oscillations) between dancers. This was tracked from the initial stages of learning the choreography, to later stages of learning, to the final performance.

The results from this experiment might also inform dance pedagogy. When it comes to using auditory feedback to learn a piece of choreography, there are many approaches: some use only a metronome beat, some a more complex drum beat; some layer on melodic phrases, while others include lyrical singing. The most effective approach differs from person to person, and understanding the brain's response could be a quick way to determine the best method.

The question of how artistic behaviors are represented in the brain is still largely unexplored. When asked what particular question she would explore given unlimited resources, Dr. Theofanopoulou pointed to the evolutionary origins of dance. Some existing hypotheses suggest that dance could have originated from the ability to control the fine laryngeal movements essential for speech and sound imitation. The evolutionary pressures that honed speech-based motor control may have simultaneously endowed humans with the capacity for dance.

The introduction of rhythmicity to these hand gestures might have been the spark that ignited the development of dance.

Genetic research from the Jarvis lab and others supports this. When the genomes of humans who excel at motor-auditory synchrony were compared with genes upregulated by singing in the basal ganglia song nucleus of songbirds, there was a high degree of overlap. To further substantiate this hypothesis, Dr. Jarvis proposes genetically engineering a species capable of imitating sounds to determine if it's possible to also bestow them with the ability to dance.

Another hypothesis suggests that dance evolved as a mechanism for social cohesion, facilitating coordinated motor activities within group settings. Alternatively, some theories propose that dance emerged through sexual selection, serving as a proxy for physical and mental fitness in mate choice.

Additionally, it's believed that dance could have developed as an enhancement to speech, similar to how hand gestures—observed in other species like chimpanzees and macaques—enhance communication precision. The introduction of rhythmicity to these hand gestures might have been the spark that ignited the development of dance.



Theofanopoulou in February 2024 at The Center for Ballet and the Arts at New York University. Photos courtesy of Joe Carrotta.

To investigate these questions, Dr. Theofanopoulou proposes using a combination of fMRI scans and spatial transcriptomics. She plans to prompt test subjects to engage in dance behaviors and compare them to the aforementioned behaviors thought to be linked to the origins of dance. By analyzing subjects neural activity, she aims to identify overlaps which would suggest a shared evolutionary trajectory. Additionally, spatial transcriptomic analyses of post-mortem tissue from individuals with dance-related behavioral defects would further clarify the evolutionary mystery.

An unconventional model organism that might help probe this question is the parrot. Parrots can entrain their body movements to a beat, and future work could build on the known gene expression and circuit profiles of their brains. Chimpanzees can also engage in repetitive body movements, though they cannot achieve a high degree of synchrony with a beat. It might be the case that they are cognitively capable of beat

synchrony, but it's just not rewarding for them because it's irrelevant in their ecological niche.

What does it take to be both a scientist and a dancer? Even during the busiest times in the lab, Dr. Theofanopoulou believes that you should never stop dancing. Have the dedication to return to the dance floor when the moment allows. Stay innovative in both fields: just as you embrace new technologies in research, be open to new movements in dance. Dr. Jarvis points out that dancing keeps the mind fresh and recommends taking every opportunity to dance.

So, if you ever see Dr. Jarvis or Dr. Theofanopoulou showing off their dance moves at a scientific retreat or holiday party, remember, it's all for the good of science.

Culture Recommendation: Facts Machine!

By Audrey Goldfarb

Facts Machine is a monthly science comedy show and podcast co-hosted at [Caveat NYC](#) by our very own [Emily Costa](#)! Formerly a Ph.D. student at Weill Cornell, Costa recently joined the RockEDU team as a Civic Science Associate. Costa is joined by neuroscientist [Noah Guiberson](#) and Biobus community scientist [Rob Frawley](#) as they interview expert guests on brain science, marine biology, symbiosis, and more. The show concludes with written trivia, which also has a comedic spin!

I attended Facts Machine's OUR WETTER NATURE show in June, and although our team got every single trivia question wrong, we won by learning the most! Did you know that a "mermaid's purse" is not an accessory for merpeople, but rather a tough leathery pouch that protects a developing shark or skate embryo? Now you do!

Join Facts Machine fourth Thursdays at 7pm for hilarious and educational science storytelling and the opportunity to flex your science trivia knowledge (or, if you're me, get wrecked). Grab [tickets to their show on August 15th](#) and use code "gradstudent" or "postdoc" at checkout for a \$5 discount.



Photo courtesy of Emily Costa

Trust your Instincts: Gut-Brain Research at Tri-I

By Rebecca Su

Have you ever experienced "butterflies in your stomach?" Maybe a "gut feeling" that just cannot be explained? Nerve cells can be found in even more places than the brain or the central nervous system: enter the enteric nervous system (ENS). The ENS, a unit of the peripheral nervous system, is a group of nerve cells found in the digestive tract that control digestion. It is connected to the brain – hence the gut-brain connection. These nerve cells are responsible for controlling feeding behaviors, intestinal muscle contractions, and much more.

[The gut microbiome refers to bacteria that live in the gut and secrete signaling molecules such as neurotransmitters, short chain fatty acids, and amino acids that could affect the ENS.](#) A growing [body of research](#) suggests that the connection between the microbiome and the brain influences the manifestation and progression of diseases such as Parkinson's disease, gastrointestinal conditions, and mental illness. The earliest of such findings was the colonization of certain E. coli strains that could confer resistance to dysentery among World War I soldiers.¹ In the 21st century, researchers observed that [different species of microorganisms colonized different parts of the digestive tract](#). As an example, groups used ileostomy samples to observe that the small intestine, due to its high acidity, harbors more fast-growing anaerobes than the large intestine. Now, researchers are returning to the microbiome as a potential factor contributing to mental disorders and neurodegeneration. One day, gastroenterologists may even prescribe antidepressants for conditions such as irritable bowel

One day, gastroenterologists may even prescribe antidepressants for conditions such as irritable bowel syndrome.

syndrome because of this connection. This connection has also led to research initiatives, such as the [National Institutes of Health Human Microbiome Project](#) (2007-2016) which aimed to determine what bacteria made up the human microbiome.

There are many researchers in the Tri-I that are studying this gut-brain connection. Ilyan D. Iliev, Ph.D., at Weill Cornell Medicine, studies immunity in the mucosa, specifically focusing on fungi. [A recent paper from Dr. Iliev's lab](#) found that fungal communities, also known as the mycobiota, are able to modify the host

immune system and affect social behavior through IL17R-signaling in neurons. Dr. Iliev is also the co-director for the Microbiome Core at Weill Cornell Medicine which supports investigators who wish to sequence microbiological samples.

Michael Kaplitt, MD, PhD., also at Weill Cornell Medicine, is looking into how the gut-brain connection can be implicated in Parkinson's disease.

With support from The Michael J. Fox Foundation, Dr. Kaplitt's lab studies how Parkinson's disease could start in the gut and spread to the brain through the vagus nerve. [A recent finding](#) from the lab found that injection of alpha-synuclein, a presynaptic protein, into the digestive tract of mice induced aggregates that could travel along the vagus nerve.

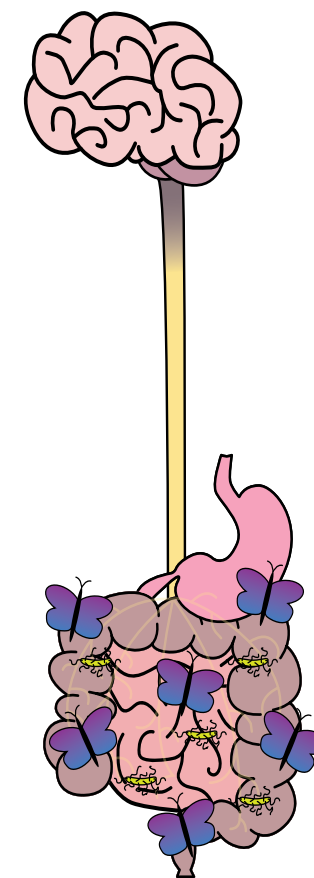


Illustration by Sarah Foust

These aggregates could lead to non-motor phenotypes of Parkinson's disease, such as depression and sleep disturbances.

Another investigator on this grant is Dr. Roberta Marongiu, who investigates the effect of menopause on Parkinson's disease and the gut. Women have an increased likelihood of developing Parkinson's disease after menopause, suggesting a link between estrogen levels and non-motor phenotypes of Parkinson's.

Across the street, Daniel Mucida, Ph.D, a Howard Hughes Medical Institute investigator at the Rockefeller University, is researching how the intestinal environment contributes to and affects immune response. [A recent paper](#)

[from his lab](#) shows that the gut microbiota can activate sympathetic neurons in the ENS through heightened expression of a transcription factor called cFos, which leads to regulation of gastrointestinal movement. Furthermore, the authors found that bacteria expressing short-chain fatty acids led to the downregulation of cFos expression in gut sympathetic neurons.⁶

The Tri-I institutions have long been at the forefront of innovative research and research on the gut-brain connection includes many areas yet to be resolved. As precision medicine and other technologies become increasingly improved, researchers can hope to make discoveries broadening our understanding of how our diets and gut microbiome are linked to our brains.

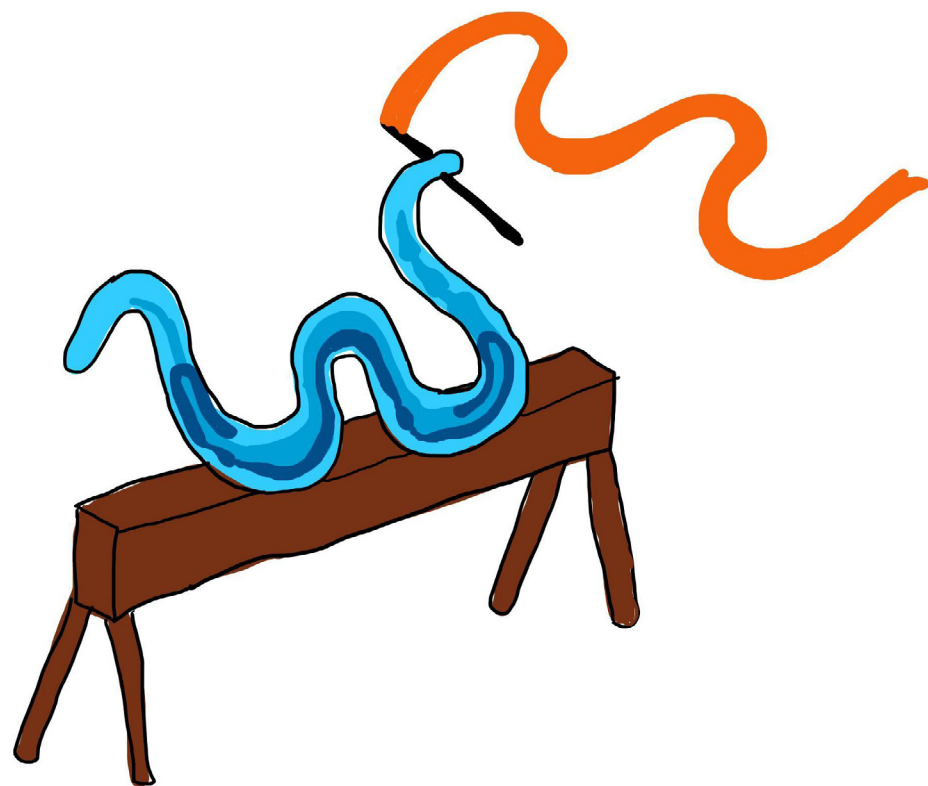


Fig. 2: *C. elegans*' small size and simple body plan endows them with excellent flexibility and elegant movement. Most *c. elegans* are hermaphrodites, making the female-dominated sport of rhythmic gymnastics a controversial choice that challenges long-standing stereotypes and traditions. However, these worms lack traditional sex hormones and most are under two weeks old, so the Olympic Committee made an exception.

Illustration by Marina Scherthanner; caption by Audrey Goldfarb

A Scientific Speaker's Guide to Losing Your Audience

By Sofia Avritzer

Let's face it, scientific talks are the most annoying part of a researcher's job. Talks are an unwelcome interruption to the real work – the actual doing – of science. We are constantly being forced to explain, again and again, what our research means and why it's important – as if that was not painfully obvious. To help my colleagues to get through this tedious task, here are **six easy steps** I use to minimize the time spent preparing talks, so that we can all return as quickly as possible to the real job of a scientist.

When deciding what data to include in a talk, more is more. Talks are the time to show our colleagues how much work we have accomplished. Should I tell three stories instead of one? Yes. Should I include this control experiment that is only relevant to five people with in-depth knowledge of my field? Yes. Should I show all the alternative ways of quantifying the same data? Absolutely. Don't be shy about what plots to add or what points to make. We can always fit several results into the same slide, if necessary.

When in doubt, always assume prior knowledge. When giving talks, pick an imaginary person who your talk is for. Imagine that your target audience is the person in the room with the most knowledge about your field. Audiences do not like to be talked down to, or have concepts that they learned 10 to 20 years ago in a class they once took explained to them again. Everyone knows what the role of pyruvate is in cell metabolism, or how to read a t-SNE plot. Instead of wasting time explaining obvious concepts, use that time to include more data (see previous point).

Make your introduction broad—super broad, almost irrelevant. A good introduction should consist of general facts the audience almost certainly knows, to warm them up before

you jump into your data. Make it as generic as possible. It needs to only be peripherally related to what you are going to talk about. A good litmus test I use when thinking about whether or not something should be included in the background is to ask myself “Will I reference this information later in the talk?” If the answer is yes, I make sure to leave that fact out of my introduction to avoid redundancy.

*When making slides,
I like to imagine myself as a
Jackson Pollock approaching
a blank canvas.*

Think of slides as abstract art. When making slides, I like to imagine myself as a Jackson Pollock approaching a blank canvas. Instead of splatters of paint, I decorate my slide deck with big blocks of text and diagrams consisting of 20-50 items – because this is too much for anyone to read in the three seconds allotted to the slide, it creates a “choose your own adventure” experience for the viewer, guaranteed to engage and stimulate any audience. To create the ideal composition, I recommend asking an optometrist what is the smallest font-size visible to the human eye.

The minimalist route is an alternative, yet equally successful approach. This aesthetic style consists of removing from the slides anything that could be helpful for the public's understanding of the information being presented. A non-comprehensive list of things I like to leave out on my slides includes: slide titles, axis labels, axis numbers, axes in general, abbreviation legends, and anything else that throws off the balance of my composition. Don't be alarmed if you end up with an almost blank slide. You can always just talk for ten minutes without any visual aid.

Summary slides are a waste of time. Never remind listeners of anything you’ve previously said. They should have been paying enough attention to remember. Reminding people of previously stated points takes time away from the data. Besides, telling your audience how a set of experiments fits together denies them the intellectually rigorous experience of puzzling it together for themselves.

Pace yourself. You should be no more than halfway through your slides by the time there are only 5 minutes left. This will force you to speed through the last part of your talk, reinforcing in the audience the effect of being overwhelmed by the sheer amount of data. If anyone was still holding on at this point, this will be a sure way to lose them.

By following these steps, I find that the audience always fully grasps the meaning of my research. This becomes obvious by the complete lack of questions, a clear sign of perfect understanding on the audience’s part. Mission accomplished. Now I can go back to the real work.

Culture Recommendation: Happy Medium Café

By Hera Canaj

For those looking for a creative outlet in the city, consider [Happy Medium Café](#)! This art café is located near Chinatown at 49 Market street and offers all the tools and treats you need to make something within a 2 hour stay while enjoying a night out. You can order off their art menu to pick your experience.

Activities include painting a clay pot, making friendship bracelets, air dry clay sculpting, water color, and a charcoal or pastel experience. Additionally, the cafe has a giant collage-making center with print media to cut up and paste. The ambiance is perfect for a night out with warm lighting and people happily working away on their crafts while enjoying yummy beverages and snacks along the way. Each experience is \$28 per person, with the exception of \$15 charcoal drawing and \$80 bracelet beading.

The café also offers classes and figure drawing workshops, like a “build-a-chair-workshop” where you get to make your own furniture from scratch, pottery classes, and a newly opened large canvas painting class. They have a location in Manhattan and another in Greenpoint, so make sure to add this place to your list of summer activities in the city!



Eliminating Toxic Aluminum Waste: The Promise of Plasma Hydrogen Reduction

By Alice Gadau

Aluminum production now has a greener way to deal with its waste. Aluminum is one of the most produced metals in the world. Lightweight and durable, it is a versatile material that can be used to create a wide variety of items, from electric cars to reusable lunch boxes. Aluminum has long been championed as a green and recyclable metal - but only if you overlook the tons of toxic byproducts produced each year during aluminum [refinement](#). In a study published in [Nature](#) on January 24, chemist Matic Jovičević-Klug and colleagues at the Max Planck Institute for Sustainable Materials in Duesseldorf, Germany, discovered an exciting green solution to convert red mud into industrial building blocks: steel and [oxide](#).

Aluminum production now has a greener way to deal with its waste.

The primary source of the world’s aluminum is bauxite rock. Each year, around 400 million metric tons of bauxite are extracted from large open-pit mines. To produce aluminum, the bauxite is first refined into alumina, which then gets smelted into aluminum. The alumina refinement leaves behind a toxic alkaline residue known as red mud. The hazardous red mud often gets dumped into landfills and concealed behind massive dam walls to be forgotten. However, as aluminum production continues to rise, it becomes increasingly difficult to ignore the staggering four billion tons of red mud that have accumulated. In addition to toxicity, dam failures are also a major concern surrounding red mud landfills, as evidenced by the 2010 red mud dam break in Ajka, Hungary. The break killed ten people, inflicted injuries on hundreds, and destroyed forty square kilometers of agricultural land—an area roughly half the size of Manhattan.

The break killed ten people, inflicted injuries on hundreds, and destroyed forty square kilometers of agricultural land—an area roughly half the size of Manhattan.

Red mud does come with a silver lining (or iron lining), however—it has high iron oxide content, which Jovičević-Klug and colleagues sought to extract and transform into pure steel using a novel plasma hydrogen reduction method they developed. The researchers placed the red mud into an electric arc furnace and exposed it to a plasma with 10% hydrogen, or ionized hydrogen gas. The plasma hydrogen in the electric furnace melts the liquid iron and liquid oxides in the red mud, which can then be more easily separated. In fifteen minutes, the reaction can extract as much as 2.6 grams of pure metallic iron from [15 grams of red mud](#). The resulting iron is so pure that it can be directly repurposed to produce steel, which can then be used in automobiles and packaging. An added bonus of the reaction is that it reduces the toxic alkalinity of the residual red mud to safe levels. This non-hazardous red mud can also be repurposed: for example, oxides are essential components in concrete, asphalt, paints, and various construction binders.

There is a clear benefit to using plasma hydrogen to reduce red mud: it yields a pure form of iron in a quick single-step process while simultaneously neutralizing the residual red mud. However, the drawback is the substantial energy input required to power the furnace in which the reaction takes place. To overcome this bottleneck, the authors suggest using renewable energy to power the furnace, which would make the process carbon-neutral.

It is difficult to gauge how this technology could be scaled up without true cost analysis experiments. Countries like China, Australia, and Brazil, where most alumina refineries are located, [stand to benefit the most from plasma hydrogen reduction](#). Renewables constitute over 14% of the [total energy consumption in all three countries](#). Notably, the share of primary energy consumption in Brazil is 48%, making it a good candidate for the [initial adoption of plasma hydrogen reduction](#). China, however, surpasses all other countries in alumina production, generating over 57% of the world’s alumina each year. This makes it an ideal place for the widespread implementation of [scaled-up plasma hydrogen reduction](#). Plasma hydrogen reduction could provide a lucrative second life for billions of red mud landfills. With strategic investment, steel may become the healthy alumina waste of the future.

Fleas in a Jar a poem by Nina Skiba

A classic experiment was conducted in psychology
Intended to limit the motion of the body via the mind:
A jar, a glass lid, two dozen fleas and three days.
Trap the fleas in a jar of glass walls
and set their sky at an invisible cap.
Let them jump in place for three days,
Inevitably hitting the omnipresent limit
With each sisyphian ascent.

They learn
That the possibilities visible beyond the glass
Are beyond their leaps
And now they cannot unlearn it.
They will never jump higher than the lid,
Even when it has been removed for days.

These fleas are part psychology, part philosophy
Entirely, they are reflections of cynic reality
Just as cogs in any machine
Just as any member of modernity
Just as a student of any discipline
Just as any creature in Plato’s Cave
They are bodily trapped by the shadow of a limit
That was imposed by an arbitrary glass structure
And immortalized by the acclimatized, comfortable mind.

Modern studies and popular psychology debate the
existence of free will
And no consensus is reached except that
Processes below the threshold of consciousness
Grasp the fate of the self that is bound to its mind.

THE TOXIC LEGACY OF ALUMINUM: RED MUD

Aluminum, one of the most produced metals globally, is obtained by refining bauxite rock into alumina and then smelting it using the Bayer process. This process generates hazardous "red mud".

Global alumina production in 2022

The majority of our alumina is produced in China, followed by Australia and then Brazil

Plasma hydrogen reduction and Renewables

Plasma hydrogen reduction requires extensive energy, but coupling it with renewables could create a green solution for this technology. Brazil, with its abundant renewable resources, may be an ideal location for the initial deployment of this technology.

Brazil Leads in Renewable Energy Production Among Top Alumina Producing Countries (2022)

The Pickleball Experiment: How Courts Created Community

By Izzy Seckler

A silly name for a serious game. Pickleball is a paddle sport invented in 1965 that combines tennis, badminton, and ping-pong into a fast-paced game. The simple rules make it an easy sport to get into for all ages, but a more competitive pickleball scene has quickly overtaken New York City. For young professionals and retirees alike, pickleball is “highly contagious”, so naturally it has also become a high-priority subject of interest for Rockefeller University.

Two Cooks in the Kitchen

Rockefeller University has a long history of providing outdoor spaces for group sports. The newest development is on the ‘Multi-Sport Court’, which initially just housed a tennis court and a basketball net. Tim Blanchfield, the Fitness Manager of Rockefeller University, and Alex Kogan, the Associate VP of Physical Facilities and Housing, designed the most recent experiment in Rockefeller sports and facilities history to test the hypothesis that if you build a pickleball court, the picklers will come.

In early 2021, the two decided to expand the tennis court at the 68th street end of campus to

build two pickleball courts. At the time, when most facilities were reopening for the first time after COVID-19-related closures, the pickleball hype had already descended upon NYC as a great community-based activity. After months of leading online fitness classes via Zoom, Tim was also eager to get Rockefeller members motivated for fitness outside!

First came the introductory classes, then came the weekly afternoon ‘pickleball socials’. Within a few months, multiple labs and departments on campus had even organized private group sessions with Tim. The pickleball courts were a huge hit! But organizing all of the pickleball events while managing the growing interest from new players was no small feat - Tim took on the development of an entirely new racket-sport community.

Dr. Seth Darst, head of the Laboratory of Molecular Biophysics, became an active member of the RU pickleball community over the past several months.

“I would just like to stress that we should all be very grateful to Tim Blanchfield for

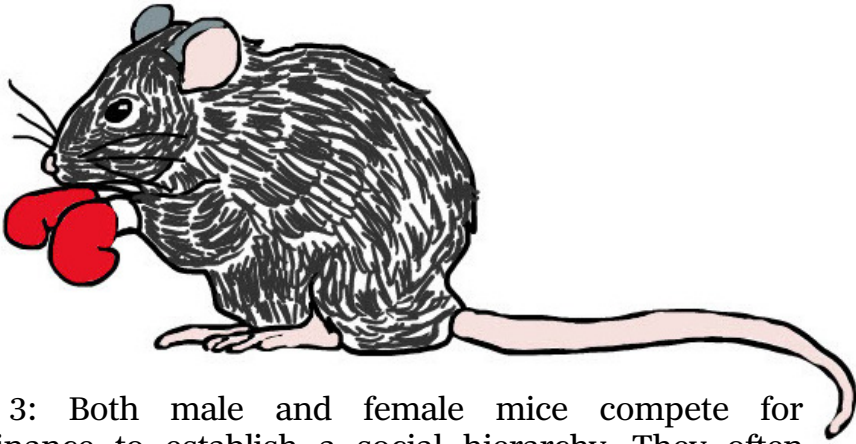


Fig. 3: Both male and female mice compete for dominance to establish a social hierarchy. They often make loud squeaking noises during fights which intimidates their opponent and makes the crowd go wild.

Illustration by Marina Scherthanner; caption by Audrey Goldfarb

organizing all of the pickleball activities and for creating a competitive but fun, sportsmanlike environment for everyone,” he says.

When asked about why he and so many others caught the pickleball bug so quickly, Tim emphasized that “it’s not just about sports. It’s about self-improvement. Whether it’s work or personal relationships, you should always be trying to improve!” The gratification that comes with practicing a new skill, in combination with the fun atmosphere of group activity, is a perfect way to spend one or two hours of your day.

Tim’s approach to pickleball at Rockefeller actually parallels the way many scientists approach research in the lab. It takes discipline and motivation to improve your gameplay, just as discipline and motivation are two key components of developing quality scientific experiments.

“It’s an evolution - some people get it on their own, some people have to see it, some people have to be told... so it’s a different journey for everyone, but you have to take it. If you don’t have a focus on something you need improvement

on, then you will only get marginally better.”

It is no surprise that this sentiment resonates with a community of people dedicated to biomedical research, a continuously self-iterating process.

The People Want Pickle

It’s no secret that having access to Rockefeller’s multi-sport court is one of the most coveted New York exclusive memberships (aside from Costco). The price to play at Central Park’s new seasonal courts at Wollman Rink might cost you upwards of \$60 for just two hours of court time. Local leagues run by organizations like ZogSports or Volo Sports cost nearly \$200 for 6 weeks of weekly game time. Several public parks have courts, but you’ll have to either fight the retirees for your spot in the queue or wait a few hours for a court to free up. With the excitement for pickleball skyrocketing this summer, we have to thank Tim Blanchfield and Alex Kogan for creating such an accessible and welcoming pickleball community - just don’t ask the tennis players how they feel about sharing court space.



Tim Blanchfield with partner Vikas Singh on July 22. Photo courtesy of Molly Monge.

Unfortunately, the outdoor multi-court and the indoor pickleball court are both limited to card-carrying Rockefeller members only. Most students, faculty, and employees of Memorial Sloan Kettering and Weill Cornell have to rely on the friendliness of Rockefeller members to gain access. Choose your pickle friends wisely. Hopefully, one day soon, we will have a Tri-I open pickleball tournament. As of now, popular demand for pickle playing time is just too high for the courts to accommodate players beyond Rockefeller University having direct ability to sign up for court time.

That’s a big reason why this past winter, Tim took the opportunity to convert the old dining hall area in the lobby of the Weiss building into a full-sized indoor pickleball court once Rockefeller’s physical therapy moved to the gym in Founder’s Hall. Even as the colder weather rolled in, the demand for pickle reached an all-time high for seasoned players and first-time dinkers alike. With the indoor

court available, Tim was also able to run regular introduction to pickleball classes and offer specialized coaching with the help of a ball-return machine and a wall-mounted dink pad for technical practice. For whichever level you want to play at, there’s a pickleball group for you at Rockefeller.

Dan Oh, a graduate student co-mentored by the Darnell and Heintz Lab, has been one of the most active members of the pickleball community since its beginning. “Pickleball has been such an amazing addition to my student experience here at RU! Not only is it a fun way to stay active and fit, I’ve also been able to meet numerous people on campus that I never would have met before, all the way from first-year students to Heads of Labs,” Dan commented.

Pickleball draws in a lot of ex-competitive athletes who still want to play a high-energy sport, but are looking for something less

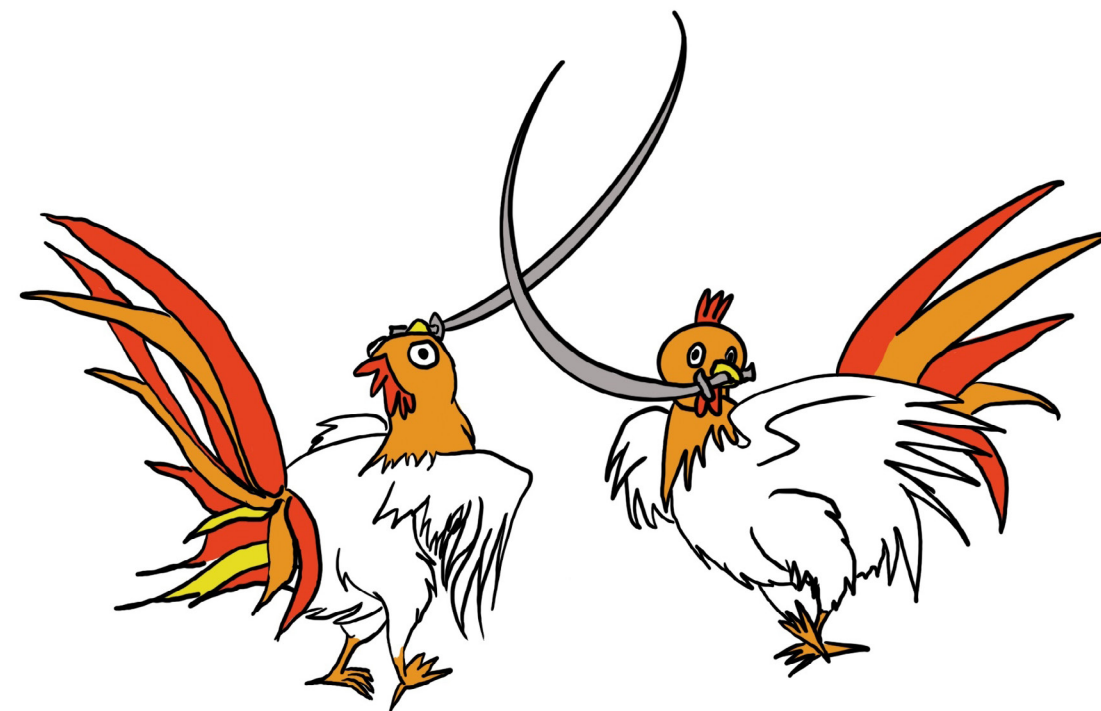


Fig. 4: Chickens fight primarily using their beaks and feet, for reasons usually related to social hierarchy, territory, and resources. However, biting and scratching is not sanctioned by the The Fédération Internationale d’Escrime, the governing body for Olympic fencing.

Illustration by Rebecca Su; caption by Audrey Goldfarb

physically demanding than tennis or soccer.

“Pickleball is a fun way to get back into group sports as an ex-competitive athlete. It brings an energy to working out that I’ve been missing since leaving competitive tennis behind,” says Molly Monge, a second year Tri-I MD-PhD student. However, she adds that “the best part about pickleball at Rockefeller is networking with PIs, graduate students, postdocs, and those with non-science careers at RU. It’s often the highlight of my day!”

If competition is not something you are looking for, pickleball is also one of the most beginner-friendly games that allows you to improve hand-eye coordination in a short amount of time with practice!

Serving Up that Competitive Spirit

At the first tournament held this past October, 48 people showed up ready to compete in either the Open or Novice division.

Alvaro Hobbs, a graduate student in the Victora Lab, is the three-time reigning champion of the pickleball tournaments. He is a life-long tennis player who has mixed feelings about the rise of pickleball on campus.

“Although I’m a bit salty that the tennis court reservations are now more competitive, I see how addicting pickleball is and it’s been fun seeing how many people have picked it up/gotten really good. It’s more social/faster-paced compared to tennis. Although for now I’m still a tennis snob, I’m sure I’ll be fully converted to pickleball at some point - in my retirement.”

“I’ve been lucky to have great partners during these tournaments, and I plan on continuing to dominate every single one during my tenure here.”

Ready to step on the court yourself?

Community-building is typically a natural extension of a team sport like pickleball, but Tim played an instrumental role in connecting people from across the Rockefeller community.

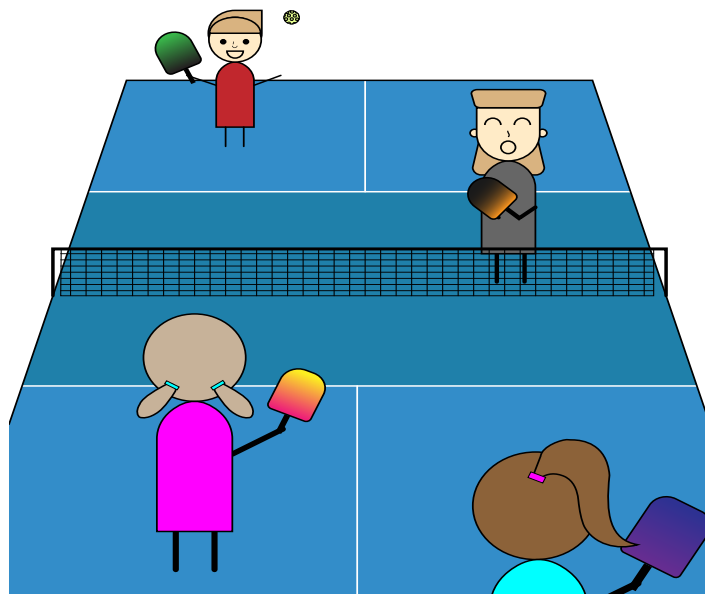


Illustration by Sarah Foust

Earlier this year, Tim formed small groups of people based on their initial skill level and availability for “Pickleball 5’s” - a dedicated weekly time for a given group of five people to get together and play. His approach, basically an initial pickleball blind-date for pickleball, successfully brought players together who would otherwise have never found each other. However, Pickleball 5’s are limited to Rockefeller personnel for now. If you are a non-Rockefeller affiliate of the Tri-I community interested in joining the pickleball network, you can reach out to Tim Blanchfield.

Tim and Alex are currently planning the next phase of the pickleball experiment. They want to paint two more full courts over the current tennis court so that more people can play at any given time. The new courts are expected to be completed by the end of this summer. Hopefully, with more court availability, the pickleball community will be able to host Tri-I players and more open events.

Keep your eye out for Tim’s next email about next pickleball introductory classes, weekly socials, and tournaments.

Pets of Tri-I: Our Furry Friends’ Summer Shenanigans

By Merima Šabanović



Photos courtesy of Silvia Martinelli

As summer heats up, it’s the perfect time to grab a cool drink, find a cozy spot, and enjoy these charming insights into the lives of the pets from our community.

Whether you’re a cat lover or a dog enthusiast, we believe in giving equal representation to both paws and claws. So, in the spirit of fun and fairness, we interviewed two of our community’s most beloved pets, a nonchalant Babaganoush and the infamous playful Boomer.

Merima (M): It is a pleasure to have you with us, Babaganoush! Thank you for agreeing to forfeit a nap to talk to me. Your name is so unique—do you have any Middle Eastern roots?

Babaganoush (B): No, not at all. I am originally from Switzerland, but my humans love the aubergine dish and thought it would be a nice name for me.

M: I understand you are a global citizen, regularly traveling between Italy and the US supporting your humans trying to have it all. How did you feel about the big move and have you found your American dream?

B: I have been moving around since I was born and I love it. As long as I have my privacy somewhere, I am happy to explore new places.

M: What is your advice to all the cats who want to travel the world?

B: Just go for it! We cats are free, we can go anywhere we want.

M: We’ve heard through the grapevine that you can be very vocal to the pet cam when your humans are away. It is silly that humans don’t understand meow language, but, taking into account their intellectual limitations, what would you like to say to them?

B: Humans are weird, always thinking and overthinking. We cats know that there are no messages or lessons to be given. We mind our own business and live happily all our nine lives.





M: And a warm welcome to you Boomer! You are quite famous in the halls of RockEDU but let's get the wider community up to speed on your greatness. How did you and Jen become science partners?

Boomer: Back in May of 2022, Jen had just finished running her first half marathon and felt like she was ready for her next big challenge, so she signed up with Rescue City to be a dog foster parent! Shortly after, she picked me up from Brooklyn and I peed in her zipcar on the way home. We've been best friends ever since!

M: Can you tell us a bit more about how you support research education at Rockefeller? What is your favorite part of coming into the lab?

B: I see my role as a truly essential one and that is to greet each and every student and mentor to ensure they know they belong in the space... And to provide emotional support too... You know, the usual.

M: As someone so committed to their work of being a "good boy", how do you find the balance of keeping your independence and partying it up?

B: This is a really tough question and one that I really appreciate. It is really the off-leash hours at Central Park that allow me to party it up.

There is nothing like endless tail-chasing and begging for snacks from other dog parents.

M: What is your advice to other research dogs on how to relax? Is there a special toy or a treat that helps you wind down at the end of the day?

B: Relaxing after a hard day's work (and before one too) is really essential. My end-of-the-day wind-down snack has got to be chicken meatballs from Milo's Kitchen... I've never met Milo, but I love him.

M: And finally, where do you see yourself in 5 years? What are your aspirations?

B: In 5 years, I would love a big yard with endless afternoons to lay in the sun and chase the bugs. Maybe even have my own room????!!?



Photos courtesy of Jen Bohn

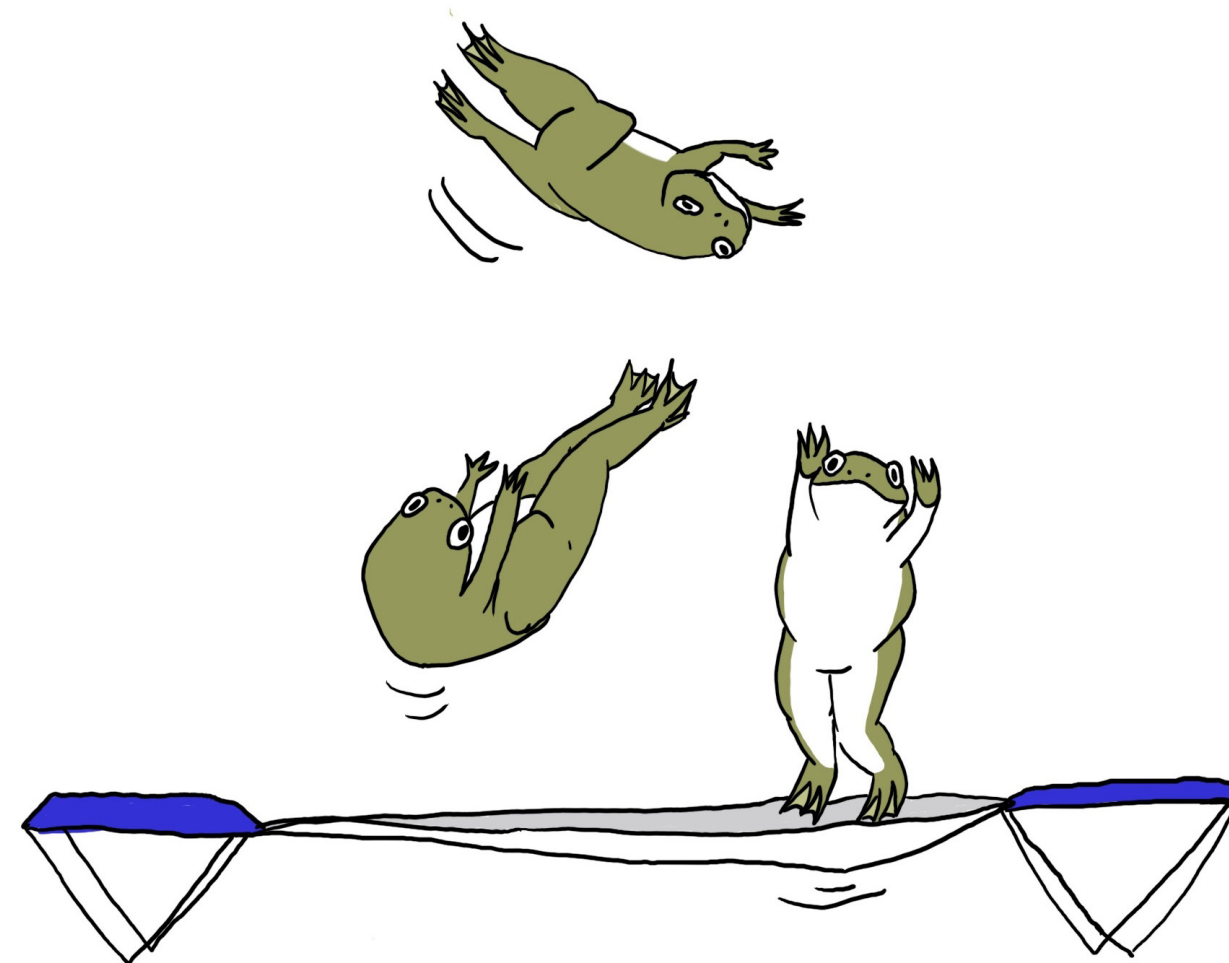


Fig 5: Xenopus frogs are primarily aquatic and not known for their jumping or balancing abilities on land. However, they are hard-working, adaptable, and self-motivated. "They said I'd flop as a gymnast," the athlete depicted here said in an interview with our staff. "But I took the leap and proved them all wrong."

Illustration by Rebecca Su; caption by Audrey Goldfarb

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