Natural Selections

A NEWSLETTER OF THE TRI-I COMMUNITY

SPRING 2024

SCIENCE FOR EVERYONE

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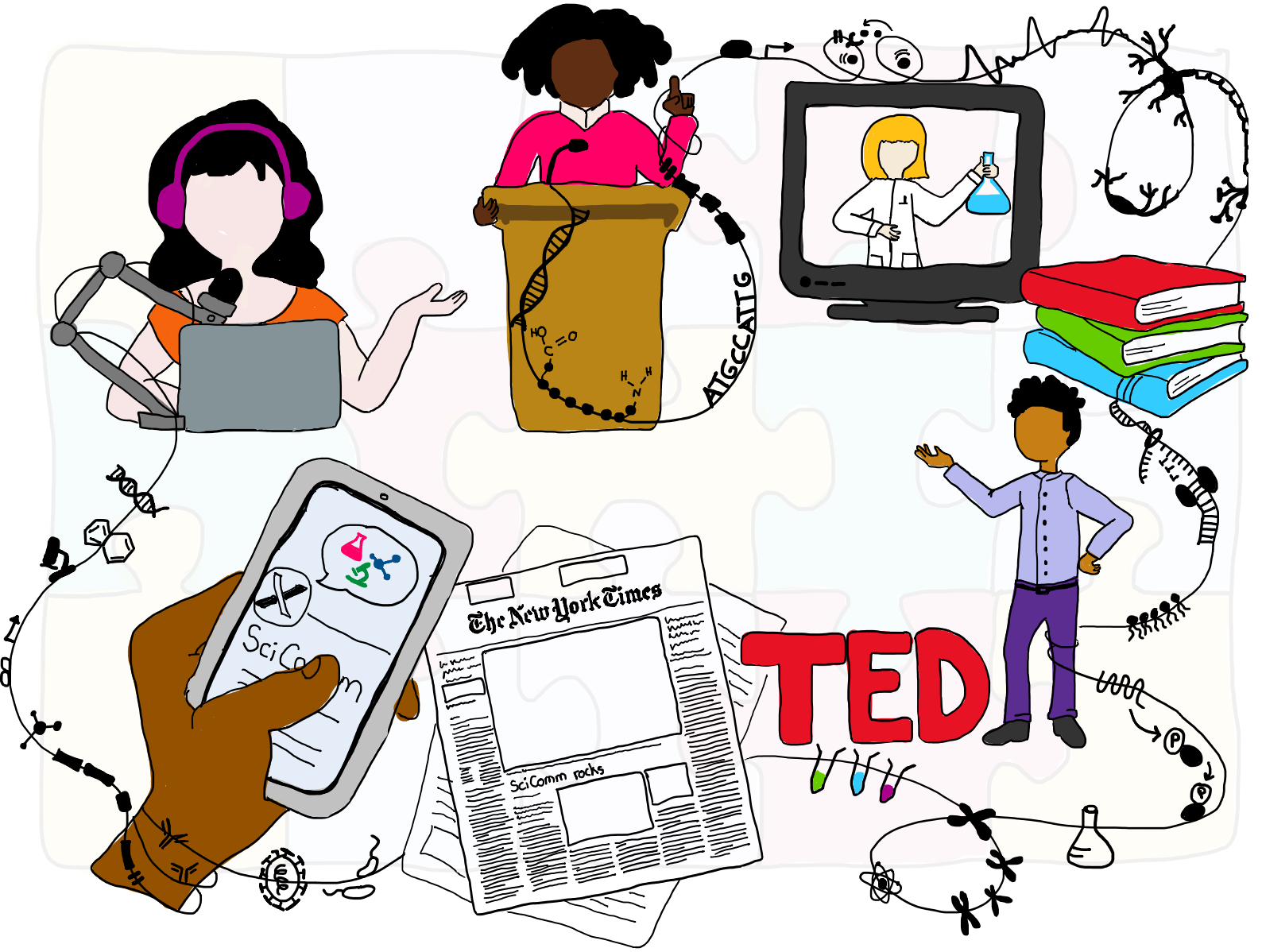

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DIRECTORY

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Interested in Science Communication? Check out these resources!

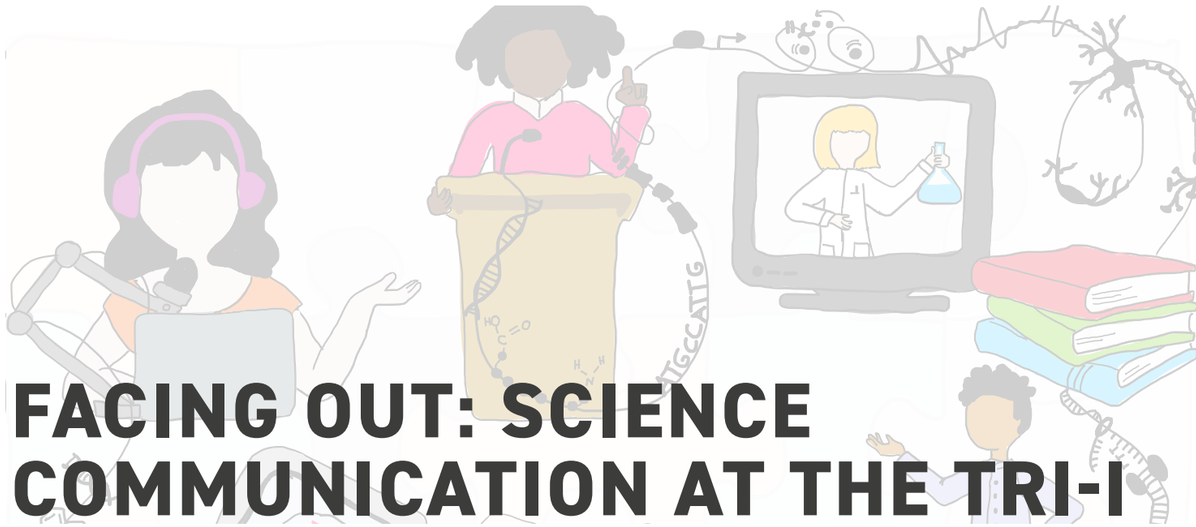
By Carmen Spicer

Videos:
1. Science communications matters and how to do it better | Jo Filshie Browning
2. Communicating Science: The Game is Changing – Make your Move! | Olle Bergman
3. The Art of Communicating Science | Beth Malow
4. Experts Explore Ideas to Counter Misinformation

Books:
1. Strategic Science Communication
2. Communicating Science Effectively
3. Houston, We Have a Narrative
4. Escape from the Ivory Tower
5. Championing Science
6. If I Understood You, Would I Have This Look on My Face?
7. The Sense of Style

Journals & Papers:
1. Science Communication (Sage Journals)
2. Using interpersonal communication strategies to encourage science conversations on social media
3. Why Science Communication, and Does It Work? A Taxonomy of Science Communication Aims and a Survey of the Empirical Evidence

Organizations & Committees
1. Story Collider
2. Standing Committee on Advancing Science Communication
3. Association of Science Communicators



FACING OUT: SCIENCE COMMUNICATION AT THE TRI-I

By Carmen Spicer

In recent years, scientists have increasingly recognized the importance of science communication, which can be defined as the practice of informing non-experts about scientific knowledge. The goals and best practices of science communication are continually refined as various institutions study how best to engage with the public. In 2017, the National Academies of Sciences, Engineering, and Medicine identified five general goals of science communication: sharing recent findings and excitement for science, increasing public appreciation of science, increasing knowledge and understanding of science, influencing the opinion, policy preferences or behavior of people, and ensuring that a diversity of perspectives about science held by different groups are considered when solutions to societal problems are pursued (NAS 2017).

Not everyone aspires to become the next Ed Yong or Carl Sagan. But scientists are often asked to share their knowledge with non-experts—whether at a podium, a board meeting, or a neighbor's dinner table. Just as everyone can enhance their understanding of science, all scientists can improve their communication skills. In fact, there are many gifted science communicators in the Tri-Institutional community, along with several Rockefeller initiatives designed to promote SciComm competence.

Many Tri-I researchers share their findings with non-experts through a variety of popular mediums—from books, news articles, and podcasts to social media, TED talks, and Netflix series. They are the faces of the Tri-I that the world sees. The intention is not to receive credit or celebrity for the profound impact science has on global health and technology. Rather, it is to increase the impact of science itself: when science has a face, people are more likely to identify with scientists, trust their findings, and therefore benefit from scientific and technological advancements. Beyond that, science is for everyone and should be shared. When experts explain their research in an engaging and easily understandable way, "non-experts"—including experts in other fields—can be inspired and even weigh in.

> When science has a face, people are more likely to identify with scientists, trust their findings, and therefore benefit from scientific and technological advancements.

Our community cultivates a strong culture of engaging with the world outside our laboratory spaces. For example, RockEDU Science Outreach presents two annual events: Science Saturday and Talking Science, where faculty members share their research with young students. Many scientists have also brought their work well beyond Rockefeller's lecture halls. Dr. Vince Fischetti, leader of the Laboratory of Bacterial Pathogenesis and Immunology (currently the longest-running lab at Rockefeller) has appeared on many podcasts, including Beer With A Scientist, where he shared his research on a unique, novel way of killing bacteria. Dr. Daniel Kronauer, head of the Laboratory of Social Evolution and Behavior, showcased the wild world of ant biology at the Secret Science Club in New York City last fall. He also authored a book on army ants, complete with over 100 of his own photographs. Dr. Erich Jarvis, head of the Laboratory of the Neurogenetics of Language, appeared on the Netflix show Babies to discuss his insights on why babies can understand language before they are able to speak. In 2021, Dr. Theodora Hatziioannou, a Research Associate Professor in the Laboratory of Retrovirology, gave a TEDx talk to provide a virologist's perspective on the pandemic. Dr. Leslie Vosshall, head of the Laboratory of Neurogenetics and Behavior, started a podcast with Stuart Firestein in 2021, called Ignorance: How It Drives Science. She has also been a guest speaker on multiple podcasts and YouTube channels, including Clear + Vivid with Alan Alda.

Back in 2007, Dr. Paul Nurse, Rockefeller University President Emeritus, hosted a

PBS series on science with journalist Charlie Rose. Dr. Christopher Mason, a Weill Cornell professor and investigator, has published two books: The Next 500 Years and The Age of Prediction, which received positive reviews from popular news outlets, including Publishers Weekly, Bloomberg News, and the Financial Times. Dr. Sofia Axelrod, a Research Associate in Dr. Michael Young's Laboratory of Genetics, authored the book How Babies Sleep to introduce her baby sleep method to parents worldwide. Her book has since been translated in nine languages.

> Science is a two-way street, a dynamic and iterative feedback loop.

"Science communication goes beyond writing articles and books. It's part of the cogs and gears of how science is applied in the real world," Dr. Sofia Axelrod said. "No matter what type of science communication you want to be involved in, whether it's writing articles for The Atlantic, writing books, working in the healthcare system as a liaison, or speaking to stakeholders at a pharma or biotech company, there is a lot of skill and nuance involved with sharing information." So, how do we become better communicators? To start, Axelrod says to focus on developing two skills: speaking to different audiences and writing.

"Try to find different audiences outside of your scientific community and talk to them," Axelrod said. "Share whatever you want. It could be your research, or some aspect of health policy, whatever you think is important to communicate. See how they perceive it." Communication is a two-way street, a dynamic and iterative feedback loop. We need to practice assessing how our words land with others, listening to what is important to our audiences, and adjusting our language as needed. It's not just a matter of crafting a perfect story and reciting it verbatim. But organizing your thoughts is also important.

"If you want to improve your communication skills, you should start writing now," Axelrod said. "Start finding opportunities to write, even for yourself. If you have thoughts on something, an opinion on something, write it up. Try to make it make sense and fulfill the criteria that make it a good piece. It should be succinct, easily readable, and ideally entertaining." Dr. Axelrod also advised sharing your writing with friends and mentors and getting their feedback.

In addition to practicing these skills on your own, if you'd like to become a more confident communicator, **you can take advantage of the resources and training available to you as a member of the Tri-I community:**

1. Science writer Steve Hall teaches Science Communication workshops at Rockefeller, one for beginners and one advanced.
2. RockEDU Science Outreach offers many programs designed to promote inclusive science engagement and connect communities. They provide mentorship training to prepare members of the Tri-I community to participate in their programs.
3. The Kavli Foundation hosts a robust program of free webinars and trainings, SciComm Essentials, that are open to "anyone affiliated with a Kavli Institute—[including] graduate students, postdocs, faculty, and staff."
4. Weill Cornell students can join their Science Communication Club.
5. Writing for Natural Selections is an easy way to make your foray into the wonderful world of SciComm! The editors foster an inclusive community; all are welcome to participate. Today, Natural Selections—tomorrow, the Lewis Thomas Prize!

It's clear that the Tri-I community values science communication. There are dedicated efforts to provide opportunities for trainees to connect with audiences outside of their fields, and many resources are poured into communication and mentorship training. Dr. Jeanne Garbarino, Executive Director of RockEDU Science Outreach and host of the Kavli SciComm Essentials series, says that Rockefeller is outstanding in this area. She feels that the Heads of Laboratories (HOLs) value and support outreach and science communication participation and training. This makes sense because communication skills are essential to a successful scientific career. As the world transforms, could our programs be updated to reflect the changing needs, goals, and aspirations of its trainees?

"Rockefeller is excellent at everything and can take a leadership role by providing ways for students and postdocs to explore different pathways, learn about them, and develop the skills to find jobs in areas outside of academia," Dr. Axelrod said. "There is already a lot of that happening, which is amazing. Expanding training in these areas can build on and organically integrate with what we're already doing: making discoveries."

As a graduate student or post-doctoral fellow, you are empowered to tailor your training to your needs and interests. Once upon a time, there was a Science Communication and Media Group at Rockefeller. Are you bummed that it's inactive? You could revive it! There are funds available for outreach and SciComm. A PhD student at UC San Diego applied for a grant to buy professional recording equipment so he could improve the quality of his immunology-focused podcast. Are you inspired by this story? You could start a science podcast and take advantage of the incredible network of faculty accessible to you. Our halls are rich with history and buzzing with knowledge the world at large has yet to discover. At times, I marvel at the tales HOLs tell—how they recall the intimate and intricate details of groundbreaking research. If I ask, "How do you remember all this?" They answer, "Because I lived it." And who better to tell the stories of scientific breakthroughs, past and present, than the people who were in the room when they happened? We all love science that benefits humanity—that's why we're here. But sharing it—maybe that's the most humane act of all. So it seems we are faced with two challenges: to become better scientists, and to become better storytellers. We all have the potential. All we need is a little training, and a lot of practice.

> "Who better to tell the stories of scientific breakthroughs, past and present, than the people who were in the room when they happened?"

TO LEARN MORE, SEE RESOURCES LISTED ON DIRECTORY P. 02

WHO WAS LEWIS THOMAS?

By Izzy Seckler

Earlier this month, the Rockefeller University awarded Italian physicist Dr. Carlo Rovelli the Lewis Thomas Prize for his exceptional writing about science and philosophy. Dr. Rovelli has authored seven internationally acclaimed books, including T*here are Places in the World Where Rules Are Less Important Than Kindness* (2020) for which he is being honored. **The Lewis Thomas Prize for Writing about Science celebrates physicians and scientists who have simultaneously contributed great knowledge to their respective field and to the general public through accessible, inspirational authorship.** Past recipients include social psychologist Jennifer Eberhardt (2022), oceanographer Sylvia Earle (2017), and surgeon Atul Gawande (2014) to name a few. Thirty-one years ago, in 1993, this prize was established in honor of Dr. Lewis Thomas shortly after he passed away at the age of eighty. Why is one of the two annual Rockefeller University awards granted in honor of him? **Who was Dr. Lewis Thomas?**

Shaping the Science of Medicine in NYC

Born in Flushing, Queens, Dr. Lewis Thomas was a renowned immunopathologist, educator, and academic administrator. He previously held research appointments in the medical schools of Johns Hopkins University, Tulane University, and the University of Minnesota before serving as the dean of both, New York University School of Medicine and subsequently Yale School of Medicine. Thomas played a significant role in shaping the science of medicine at each of these institutions. He was an ardent advocate for greater funding in medical research, particularly at the frontiers of biological understanding. In 1972, Thomas helped to raise the resources to recruit Rockefeller University scientist George Palade and his wife Marilyn Farquhar to start a new program at Yale integrating cell biology into medical education. The research environment that Thomas curated supported the research for which Palade would go on to win the 1974 Nobel Prize in Physiology or Medicine for his pioneering work in cell biology. Thomas' legacy of leadership lives on through the Tri-I community, as he played an instrumental role in forging a collaboration between Rockefeller University, Cornell University, and MSK that we all know as the Tri-I Program. He served as President of Memorial Sloan Kettering Cancer Center between 1973 and 1980, Chancellor between 1980 and 1983, and President Emeritus until his death. He was also a Rockefeller University Adjunct Professor and Visiting Physician. There is a letter in the NIH National Library of Medicine archives sent by Thomas to Nobel laureate Dr. Joshua Lederberg of Stanford University in early August of 1978 that details how exactly a Rockefeller-MSK clinical research partnership would enhance the recruitment and education of M.D.-Ph.D trainees. He proposed linking the two hospitals in the same way that MSK was linked to Cornell. Thomas wrote, "I believe that we have an opportunity here to create a setting which will attract the brightest of the country's young talents for the study of human disease mechanisms, including cancer". Thomas' association with Rockefeller University actually goes back to 1942, when he spent five years conducting research on infectious disease with the then-Rockefeller Institute and a United States Naval Medical Research team, including in the lab of pioneering virologist Dr. Tom Rivers. In a 1989 interview with the Rockefeller newspaper News and Notes, Thomas credits his training at Rockefeller as the catalyst for "his obsession with virology and immunology". In the same interview, Thomas reflects on the difficulties of the growing scientific enterprise of biomedical research in acquiring funding. "My main worry is that some of the fun is going out of biomedical science," he states before adding, "I'd like to see a great deal more money put into biomedical research". Thomas saw a great need to change the narrative around health, medicine and biology in both academia and the public. In retrospect, it is entirely understandable how Lewis Thomas turned to "writing science for a general audience... more or less by accident," as he explains, because the "hideous prose used in writing up whatever I was doing in the laboratory" lacked the personal sense of conversation needed to showcase the impact of the biological mysteries being revealed. He recognized that 'modern' miracles in medicine typically resulted from years, if not decades, of basic research. Thomas was driven to ensure the early investment of adequate resources into basic research in order for impactful change in the future. During his tenure at MSK, Thomas published six collections of essays and solidified his legacy as one of the best science writers of the 20th century. In his autobiography, *The Youngest Science: Notes of a Medicine-Watcher* (1984), Thomas reflects on the evolution of medicine, his experience as a physician-scientist, and the promise of medicine as an enterprise in the 21st century. A promise, he felt, that was dependent on strengthening the funding, academic systems, and public support for biomedical research.

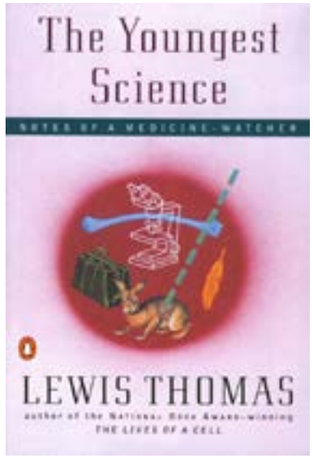
> "My main worry is that some of the fun is going out of biomedical science."

Illustration by Izzy Seckler

He found lessons from nature - parallels about life, death, happiness, order, chaos, and community in cells.

The Scientist as a Poet: Notes of a Biology Watcher

The history of medicine, including the evolution of medical education, was of as much interest to Thomas as the philosophy of the human experience. The more research revealed the mechanisms underlying life, the more questions arose about what life means. He found lessons from nature—parallels about life, death, happiness, order, chaos, and community in cells. He also found lessons from art and culture—parallels to the innumerable sense of scale of biochemical molecules, organelles, and cells that make up our own bodies. He was a prolific writer on these topics and more, sharing insights gained over decades of study and reflection. From his undergrad days at Princeton University writing poems and parodies for the university newspaper to selling poetry to *The Atlantic*, then called *The Atlantic Monthly Magazine*, during his medical training at Harvard Medical School, Thomas refined his witty and unconventional philosophical voice. He initially viewed his science-adjacent musings as entirely separate to the discourse of peer-reviewed papers and conference talks. Later on, he started to carry the spirit of poetry into his medical lectures, which ultimately led to his popular bimonthly column, 'Notes of a Biology Watcher', in the New England Journal of Medicine. He built a bridge between the siloed worlds of humanities and science that would guide hundreds of thousands of readers in addition to scientific and medical trainees. Thomas' first published collection titled *The Lives of a Cell: Notes of a Biology Watcher* (1974) earned him two U.S. National Book Awards. Thomas brings the reader on a journey across scales of biology, starting with what makes us human biologically before looking at what makes societies like an organism and what makes the Earth like a living cell. He shares his fond thoughts on mitochondria in "Organelles as Organisms"; "They feel like strangers, but the thought comes that the same creatures, precisely the same, are out there in the cells of seagulls, and whales, ... I cannot help thinking that if only I knew more about them, and how they maintain our synchrony, I would have a new way to explain music to myself" (*The Lives of a Cell*). Thomas found an overlapping beauty in organismal biology and classical music, as both are an emergent collective of many individual parts. His second collection of essays titled *The Medusa and the Snail: More Notes of a Biology Watcher* (1979) continues to explore the paradoxical mechanisms nature has devised to mark self versus not-self, including symbiosis and various antagonistic relationships ranging from viral infection to cancers all the way to the Cold War. He viewed pathogenic bacteria and viruses as the outliers, in contrast to the innumerable beneficial microbes and viral carriers of genetic information. Thomas' third collection, *Late Night Thoughts on Listening to Mahler's Ninth Symphony* (1983), ventures deeper into his feelings on the notion of death, from 'natural causes' to the modern plague of possible nuclear annihilation. On the process of science research itself, Thomas notes that "it sometimes looks



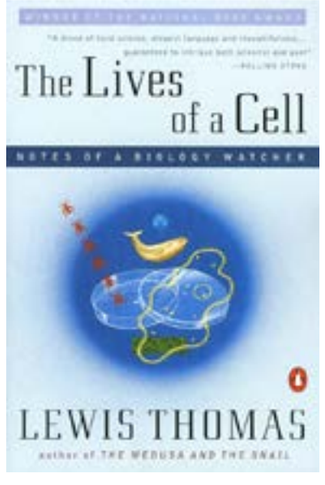
"This is a very big place, and I do not know how it works."

like a lonely activity, but it is as much the opposite of lonely as human behavior can be" (*The Lives of a Cell*). He goes on, "There is nothing so social, so communal, and so interdependent. An active field of science is like an immense intellectual anthill; the individual almost vanishes into the mass of minds tumbling over each other, carrying information from place to place, passing it around at the speed of light" (*The Lives of a Cell*). Academia is not perfect, but it is an evolving community of people united under

"There is nothing so social, so communal, and so interdependent. An active field of science is like an immense intellectual anthill"

a singular drive to advance our understanding of life. Thomas often referred to medicine as the youngest science with innumerable opportunities to grow. In his final publication, he makes a pointed observation: "much of what is happening in both cancer and brain research is the outcome of basic research" (*The Fragile Species*, 1992). To highlight just how important continued basic research will be, Thomas ultimately concludes that "this is a very big place, and I do not know how it works. I am a member of a fragile species, still new to the earth, the youngest creatures of any scale, here only a few moments as evolutionary time is measured, a juvenile species, a child of a species."

So who was Dr. Lewis Thomas? He was a brilliant physician-scientist who merged a sense of wonder for nature with a deeply grounded sense of humanity, putting science in a new light for countless people.



JEANNE GARBARINO'S ECOSYSTEM OF OUTREACH

By Audrey Goldfarb

Jeanne Garbarino, Rockefeller's Director of Science Outreach, does it all. In the last twelve years, she has fundraised over eight million dollars in collaboration with Rockefeller's Development office, developed and consulted on dozens of science education and outreach programs across NYC, and trained several hundred scientists spanning every career stage. She's one of the scientific community's greatest assets. And somehow, she will always have time for you.

It is this last piece that makes Garbarino so beloved among the Rockefeller community, especially by the people who work closely with her. "As a manager, Jeanne operates off of trust, respect and relationship-building," Lizzie Krisch, RockEDU's community manager, said. "We are brought into spaces that help us grow, we are challenged to reach the next level in our careers, and foremost we are gifted solid leadership, direction and support from Jeanne."

Design by Brianna Naizir

Building RockEDU

Garbarino stepped into her role as Rockefeller's Director of Science Outreach at the end of 2012, after completing her postdoc in the Breslow Laboratory, and got to work acquiring lab space and funding. In the basement of Flexner Hall, Garbarino built the RockEDU laboratory we know today, and within two years began hosting high school and college students and building lasting relationships with teachers from nearly 100 NYC public schools.

After securing funding from the estate of Brooke Astor in 2012, Garbarino established the infrastructure for the Lab Experience program, which provided full-day immersive field trips for 1500–1800 middle and high school students each year. After that came the LAB Jumpstart program, and in 2015, Garbarino launched Science Saturday, another cornerstone of Rockefeller's ecosystem of outreach.

Early on, Garbarino prioritized "community inreach" and focused on developing the scientists who participated in RockEDU programs. She knew that for scientific mentors to meet a high standard of skills and commitment, she would need to ensure that they were also fulfilling their career development goals. Over 1500 scientists have volunteered in these programs during Garbarino's tenure as director.

"She is one of the most understanding people I've ever worked for," said Dr. Jen Bohn, RockEDU's research education program manager. "She's incredibly supportive and from the very beginning I felt that she wasn't just my boss but also my advocate."

"Being inclusive is actually way more rigorous, and you capture way more."

When the pandemic hit in March 2020, Garbarino's team was among the first to launch remote programming. After months of effort planning Science Saturday in person, the team pivoted to holding it virtually. They also launched an interactive web series, Data for the People, that hundreds of people attended to learn more about COVID-19, social behavior, and medicine. Garbarino also developed at-home experiments for Summer Science Research Program (SSRP) students, which demonstrated how laboratory science can be made more accessible. The RockEDU team shifted their approach away from one-on-one mentorship towards team science and found that implementing more rigorous mentorship training maximized the likelihood of success.

"After participating in the SSRP Program, I am deeply aware of the fact that science is not a field only some have access to, but rather it is an endeavor that anyone can contribute to anywhere (even in their own homes!)," one student said. RockEDU's response to the pandemic was a master class in agility, problem-solving, and creativity.

Rigorous Inclusivity

The adaptability that Garbarino demonstrated during the pandemic extends to creating space for everyone who wants to participate in science. Inclusivity is woven into the fabric of RockEDU. "The people always come first," Bohn said. "You can see the real results of that in watching how all the students create a home for themselves in science."

As described on their website, RockEDU's program aims to connect people through the wonder of science, a justice-centered process that is integral to our humanity. This objective goes deeper than grades or publications,

and assessing qualitative metrics of success takes enormous time, effort, and thoughtfulness. For example, one goal is for mentees to develop "STEM identities" and the ability to define themselves as scientists. This is not something that can be quantified, but rather something that must be continually reflected upon and assessed in language that might be unique to each mentee. "The reason why metrics like this aren't widespread [is] because they take so much time," Garbarino said. "This attention to personalized experience is why we are up to our ears in work."

Garbarino is building an ecosystem, not an empire.

This process involves a series of reflective essay prompts given to mentees throughout the program to assess their experience. The team also gathers data using end-of-program surveys and interviews with peer mentors. "Most importantly," Garbarino said, "we actually spend the time to review all this info and adjust our programming to meet the new needs and new goals."

Finally, the RockEDU mentors and leaders directly respond to the feedback by updating the mentees about what they heard and how they're responding. The result is a seamless cycle of feedback, thoughtful analysis, and response. "The reason why it looks easy is because there is so much work going on behind the scenes," Garbarino said. "Being inclusive is actually way more rigorous, and you capture way more."

Garbarino with Jumpstart students in February 2020 photographer: Mario Morgado

The challenge of pioneering a symbiotic approach to science

Garbarino is building an ecosystem, not an empire. And like an ecosystem, collaboration and connection are at the core of RockEDU's mission. Garbarino and her team maintain prolific networks amongst students and teachers throughout NYC. They continue to grow RockEDU's breadth and depth of impact. The toughest challenge Garbarino currently faces is right here at home: fostering a deeper understanding of RockEDU's program in Rockefeller scientists and leadership.

RockEDU's mentorship tools and curricula used to train Rockefeller scientists are effective only alongside an appreciation for the depth of expertise required to do science inclusively.

Rockefeller boasts a culture of innovation and open-mindedness in biomedical research and emboldens scientists to take risks and boldly pursue new frontiers. That allowance, however, doesn't always extend to outreach and informal education. Ironically, Garbarino's work may be more broadly useful to our community than any other research program at Rockefeller. For example, 100% of NSF grants and an increasing number of philanthropic funding organizations require a Broader Impacts element, such as a mentorship initiative. "She had to fight against people who didn't think this work is important, and now it's essential," Bohn said.

"People were willing to tokenize the program, but also to dismiss the program as 'childish' and didn't understand the scholarly nature of our work," Garbarino said. "[They] liked the idea of RockEDU but didn't actually understand the depth of our experiences and connection to science for the benefit of humanity."

Outreach is not every scientist's priority or area of expertise. Developing and executing this expertise is a full-time gig for outreach professionals like Garbarino, as is running a research program for a head of laboratory (HOL). The difference is that by its very nature, Garbarino's work is made to be shared, propagated and integrated. RockEDU can serve as a web that unites the work of Rockefeller scientists in a more public, community-engaged direction. "I think what I would want most are more clear paths to getting in sync with everyone in the university," Garbarino said. "Making sure that RockEDU is serving the mission in both, the ways that humanity demands of us, but also in the ways that people in our community prefer to operate."

If the Rockefeller community can better understand RockEDU as a resource, everyone will benefit. When HOLs or groups of Rockefeller scientists want to apply for grants involving outreach or establish relationships with NYC colleges and high schools, they should first seek out RockEDU's expertise. "People can come to us at the outset to kick things off more effectively and efficiently," Garbarino said.

However, Garbarino has encountered barriers to raising awareness of what RockEDU has to offer. Routes of communication such as the Monday lecture series are established for HOLs to share their work broadly, but Garbarino isn't included. "People like me don't have a platform to engage with the campus as a whole," Garbarino said.

The Rockefeller community has begun to recognize the importance of Garbarino's work in accordance with a widespread movement in academic culture towards DEIJ - Diversity, Equity, Inclusion and Justice - and outreach initiatives. The continued growth of groups like the Rockefeller Inclusive Science Initiative (RiSI) and appointment of Ashton Murray as Rockefeller's inaugural chief diversity officer and vice president for DEI exemplify other ways that Rockefeller effectively channeled its resources towards bettering our culture and impact. But why are we satisfied with staying in step with academia at large, and why do we not respect this work at the same level as biomedical research? Rockefeller's research philosophy is centered on pioneering new frontiers of scientific discovery. To continue making meaningful strides in this space, empowering pioneers like Garbarino is fundamental.

"I want people to take the time to see what we have," Garbarino said. "I want to go deep and go with everyone together."

AI-GENERATED IMAGES FOR USE IN SCIENTIFIC COMMUNICATION

By Merima Šabanović and Sarthak Tiwari

How does text-to-image AI work?

Artificial Intelligence (AI) has seen tremendous growth in the last two decades such that it is now starting to permeate most workplaces, especially with the recent open-source models like DALL-E and chatGPT. Science is no different.

AI uses machine learning algorithms that refer to the ability of a computer to find and learn data patterns without explicit instruction in ways that humans may not be able to. Most of the recent powerful machine learning algorithms try to mimic human neuronal networks, by creating elaborate connections between network nodes (mimicking neurons). Unlike the human brain, these neural networks learn via backpropagation. Backpropagation is a method with the goal of increasing accuracy of the neural network. This is accomplished by employing an algorithm that minimizes the error between the predicted and the actual results and then feeding that error optimization to the earlier steps of its algorithm. This is why computers need hundreds or even thousands of images to reduce their prediction errors.

The recent boom in AI is primarily due to the advances in computational power.

The field is busy with developing different architectures that allow networks to learn more efficiently with fewer nodes. All of the recent AI natural language processing uses the transformer model architecture developed by Google. At the heart of the transformer is a multi-head, self-attention mechanism that weighs the information content of an input by considering the input's context to adjust its influence on the output, i.e. the model uses the fact that word meanings depend on their context. Another important feature is that the outputs are generated in parallel, making training more efficient. AI image generators such as DALL-E extend the transformer's capabilities to the domain of image generation. By training on a vast dataset of text-image pairs, the transformer learns which sequence of pixels (visual representation) best represents a scene (textual descriptions). However, the newer DALL-E 2 and 3 versions now use a method called diffusion, whereby image generation begins with a random field of noise which the neural network subsequently denoises to align the image to the interpretation of the prompt. Other models like Midjourney have all focused on the diffusion architecture in their most recent releases, as it shows the most promise.

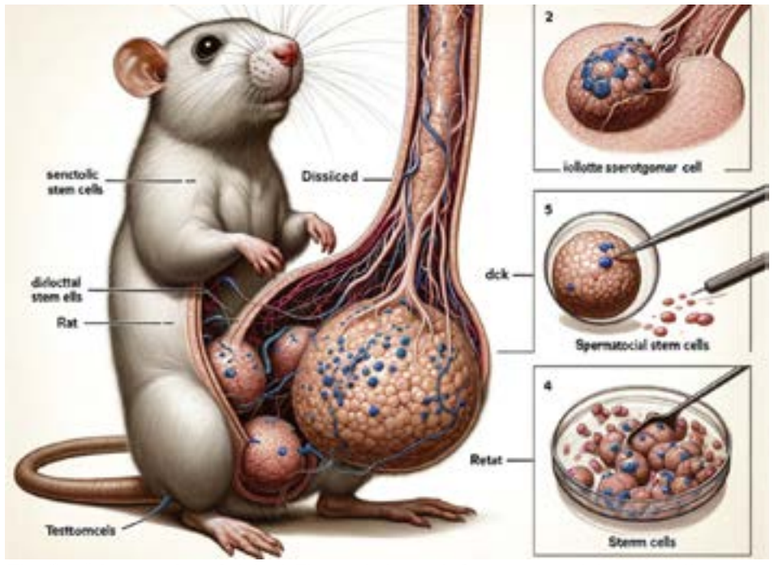
Critical debates about how such powerful tools can or even should be used by scientists cannot keep up with the rapid developments in the AI field.

The recent boom in AI is primarily due to the advances in computational power, data gathering and storage, and the use of large parallel computing platforms like graphics processing units (GPUs). However, it seems that critical debates about how such powerful tools can or even should be used by scientists cannot keep up with the rapid developments in the AI field.

AI controversies in science

Using AI models is incredibly attractive to busy researchers, because it saves us lots of time in writing, editing, research, coding, debugging, and data visualization. Yet, there are a lot of concerns and unknowns about the accuracy of these models. Despite rapid and astonishing progress, generative AI tools still have critical limitations - they have a curious tendency to "hallucinate" and produce confabulations with high confidence, such as referencing non-existent publications, generating false statements and incorrect images.

Such mishaps led to a recent controversy with a paper published in Frontiers in



The "rat" in question. Original Figure 1. legend: Spermatogonial stem cells, isolated, purified and cultured from rat testes.

Cell and Developmental Biology on February 14th, 2024. The paper reviewed the JAK/STAT signaling pathway in spermatogonial stem cells and included an obviously AI-generated, awkward, if not grotesque, image of rat testes and a collection of other scientific-looking diagrams with little to no accurate scientific content. Even the labels had terrible spelling errors or were complete gibberish. Any biologist would realize how ridiculous and meaningless such images are within seconds, but the editors didn't find the images troubling enough to reject it in review. Once published, the paper was soon retracted for "concerns [that] were raised regarding the nature of its AI-generated figures". This brought up several questions about the use of AI generated images in science and the potential issues of peer review. How this paper passed peer review to be published is still a question, but the leading consensus seems to be that it was not reviewed at all. While this case was caught quickly post-publication, there are likely many more that have slipped by with problems that are trickier to catch. We do not yet have proper tools to check the integrity of AI-generated work and differentiate between the legitimate and the fabricated, so we need to rely on a robust peer review process instead. Currently, many instances of research misconduct in the submission, peer-review, and editing stages occur because of an inadequate level of human attention to detail. Issues go unnoticed because they receive too little scrutiny from authors, editors, and reviewers.

> … an obviously AI-generated, awkward, if not grotesque, image of rat testes and a collection of other scientific-looking diagrams with little to no accurate scientific content.

Community response to AI images

AI technology is rapidly developing, so the policies directing its use in scientific work and publishing need to keep up with the new ways in which AI images and text are being used. While most journals agree that using AI-generated text does not warrant attributing authorship to the language model, generative AI images raise new kinds of copyright issues and research integrity concerns. Legal issues surrounding AI-generated material are broadly unresolved and not universally accepted. Fortunately, some journals have already made explicit instructions on how or when such material can be used and how it is to be reported, even long before the Frontiers paper controversy.

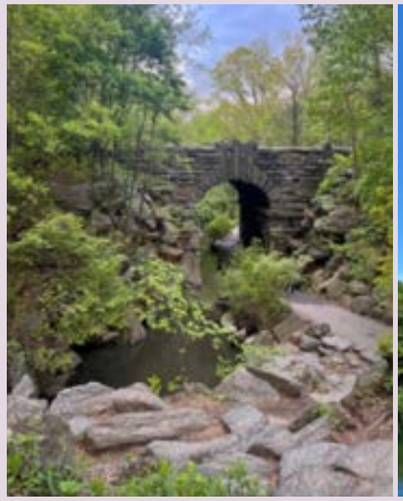
Springer Nature and the Science family journals do not allow AI-generated images in their publications, with the exception of publications specifically relating to AI and images explicitly permitted by the editors. A violation of these policies constitutes scientific misconduct considered no differently from manipulatiaton of data images or plagiarism of existing works. Springer's policy does permit AI-generation of text– and numerical-based materials such as tables, flow charts and simple graphs. Meanwhile, the World Association of Medical Editors (WAME) recommends authors to provide the full prompt, the date and time of the query and the AI tool used when reporting AI-generated tables, figures or code. PLOS ONE follows a similar principle, allowing AI images only if the authors declare the AI tool, the query, and how the authors verified the quality of the generated content. The International Committee of Medical Journal Editors (ICMJE) also urges journals to require disclosure of AI use in both cover letters and submitted work. The ICMJE also encourages journals to hold authors responsible for ensuring the generated work does not constitute plagiarism. Similarly, the Council of Science Editors (CSE) also recommends that journals enforce policies about the use of AI-generated images and ask authors for the technical details of the model and the query used.

Continued on next page.

NYC Recommendation (more on p. 13 & 16)

By Alex Donatelle

As spring unfurls, it's a lovely time to travel a few blocks west and enjoy some time in **Central Park** …



From manicured gardens to winding wooded paths, the park offers as many settings as there are days of spring. **In the south end**, walk from the **Olmsted Flower Bed** down the bustling mall to the iconic **Bethesda Terrace** featuring *Angel of the Waters*, a towering sculpture designed by Emma Stebbens in 1868. Walk across the **Bow Bridge** to the **Ramble**, a small forest with serpentine trails and outcroppings of Manhattan schist. The park's most peaceful expanses lay in i**ts northern extent**. Spring brings duckweed to the **Pool** - a sheet of tiny green flowering plants lends the water an otherworldly matte stillness. Sit in the grassy slopes under its willows and maples or walk along the **Loch** through **Huddlestone Arch** to the **Harlem Meer**.

> At a time when trust in science is eroding … it is important for scientists to recommit to careful and meticulous attention to detail.

Where does the Tri-I stand?

Within our Tri-I community, a multidisciplinary task force at Cornell issued a report in January 2024 offering perspectives on generative AI and practical guidelines for its use in academic research for experimental conception, execution and dissemination, as well as funding proposals, funding agreement compliance and translation of research work to copyrights or patents. The poor information quality and accuracy resulting from AI hallucinations, biases or bugs were of great concern. Some of the risks highlighted in the report include poor oversight of compliance that could lead to financial, regulatory, legal, and reputational consequences for the institution and the individuals involved. The reputational damage of improper AI use could extend beyond institutions to impact funding organizations, community dissatisfaction, public relations, and faith in scientific publishing as a whole.

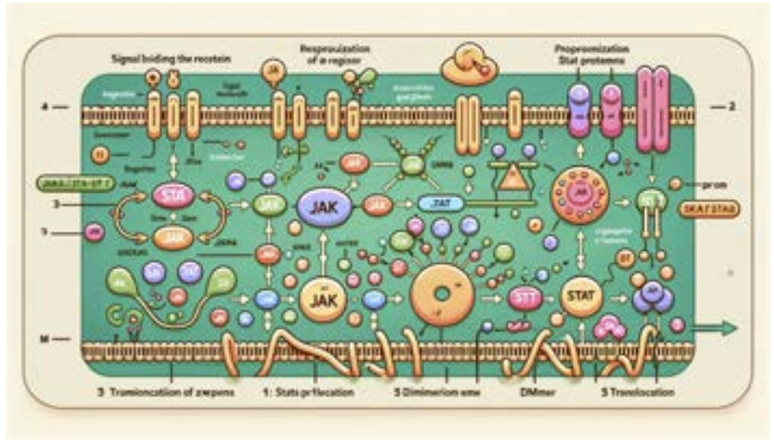


Figure 2. When AI text turns out to be gibberish. Original figure legend: Diagram of the JAK-STAT signaling pathway (…)

Where do we go from here?

As it stands, only the authors are accountable for all aspects of a manuscript including the accuracy of the content that was created with the assistance of AI, regardless of how many other people may have been involved in facilitating the publication. The controversy surrounding the Frontiers paper lies in the fact that the manuscript passed review without any of the reviewers or editors catching the glaring scientific inaccuracies. At a time when trust in science is eroding due to the reproducibility crisis and political attacks on scientists' trustworthiness, it is important for scientists to recommit to careful and meticulous attention to detail. This is especially true for those put in charge of determining what kind of science gets published; these publication decisions often determine the opportunities scientists have to advance their careers. As AI models become more advanced and harder to distinguish from human work, regulation could play an important role in determining what kind of scientists we will be in the future.

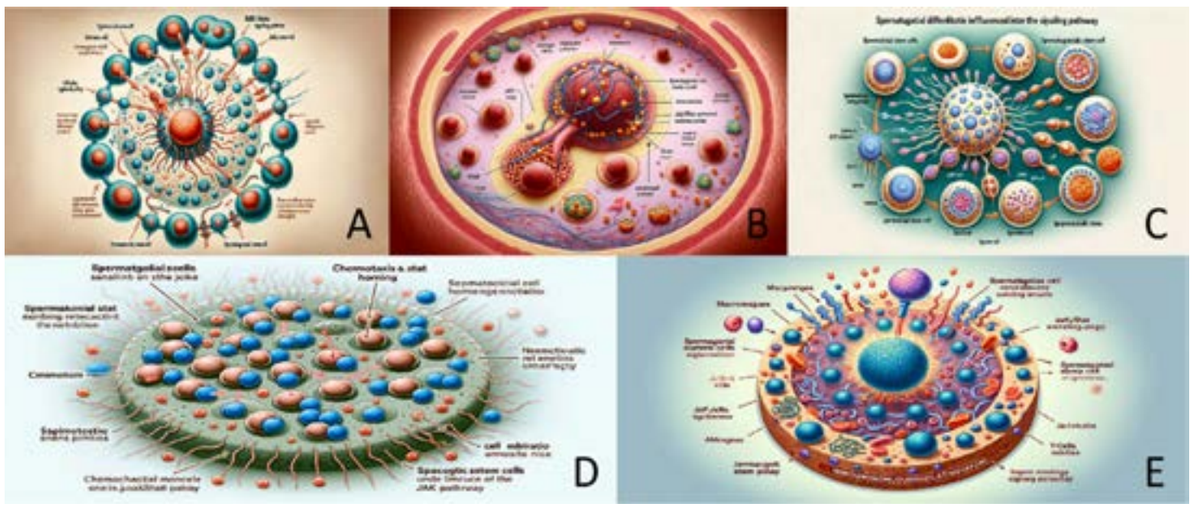


Figure 3. from the paper claims to show the biological properties of spermatogonial stem cells via JAK/STAT signaling pathway.

WHAT THE GINKGO CAN TEACH US ABOUT AN ENVIRONMENTALLY CONSCIOUS FUTURE

By Teague Dilgen

The meticulously curated grounds at Rockefeller's sixteen acre oasis host a wide variety of flora. As listed on the university's tree map, the campus boasts a whopping forty-seven species of trees. Upon taking a role as a research assistant at Rockefeller, I was astounded to see such a verdant island in the mid-

"I've recently developed a deeper appreciation for this species due to its status as an evolutionary unicorn."

dle of our concrete sea. Being an avid botany enthusiast and the child of an NYC Park Ranger, naturally, I spent my first week touring the grounds with the university's tree map in hand to familiarize myself with some of the species with which I was less acquainted. In the recent years of my time as a plant-nerd in NYC, it has been a challenge to find spaces and time within which to observe such a dense diversity of flora as that hosted by Rockefeller. While I am fortunate enough to frequent our botanical gardens and vast parks on the occasional weekend and holiday, I find it most convenient to be surrounded by a Zen Garden at the workplace. During my inspections of the campus gardens, I noticed some of the more common street trees I had seen growing up in NYC: the London plane tree, the much contested Callery pear, and the honey locust.

It was particularly delightful to see so many types of dogwoods and crabapples but, above all, I was thrilled to see the Ginkgo biloba right outside of the Rockefeller Research Building. The Ginkgo may be familiar to some for its extract, often marketed as a treatment for blood disorders and memory issues1. In addition, it's used as a symbol in many Asian countries. For example, the Ginkgo leaf can be found as the Symbol of the Tokyo Metropolis. While these virtues alone are enough to arouse my fondness for the Ginkgo, I've recently developed a deeper appreciation for this species due to its status as an evolutionary unicorn. Roughly 300 million years ago during the Mesozoic era, the seed-bearing Ginkgoaceae family gave rise to an estimated sixteen genera2. These genera were spread over the entirety of the world. The genus which contains the Ginkgo biloba we know and love today is believed to have evolved sometime around 170 million years ago. Most interestingly, it has remained largely unchanged since then. By around 2.5 million years ago in the middle of the Pleistocene epoch, cycles of extreme glaciation and deglaciation forced all Ginkgos to the brink of extinction2. Only a few populations remained of a single species within the genus of Ginkgo. Impressively, the species is also the only remaining genus in the Ginkgoaceae family, the only family in its Ginkgoales order, and the only order in its Ginkgoopsida class. To put the Ginkgo's uniqueness into perspective, it may be helpful to think about another division of spermatophytes, the clade to which contains almost all seed producing plants. Conifers, or pinophyta, are one such example. Pinophyta contains six living families and an estimated 630 living species, whereas Ginkgophyta contains only one living family and one living species3. This stark contrast between just these two clades of living, seed-bearing plants is staggering and further emphasizes the remarkable individuality of the Ginkgo.

Like many Ginkgo fanatics I've encountered over the years, I was brought up on a highly romanticized story which told of Buddhist or Taoist monks who saved the Ginkgo from near extinction. It is said that the monks recognized the tree for its distinctiveness and bold yellow leaves and thus safeguarded the species at their monasteries for millennia. While it is true that there are great populations of Ginkgo surrounding human set-

Illustration by Marina Schernthanner

"In many ways, humans have saved the Ginkgo. It has transitioned from a species found only in remote mountain ranges of China to one of the most well-known trees in the world."

tlements in China (which is likely the basis for this tale), it has been well agreed upon since the 1920s by geneticists, botanists, and anthropologists alike that this story is false, as evidenced by the presence of native populations of the trees outside of monasteries4. Anthropologists suggest that these older monastic trees (some between 1000-3500 years in age) are found near settlements because of their ability to produce their famous butyric acid-filled fruit5. Despite their smell–that reminds many of the scent of vomit–and the presence of a compound like urushiol, responsible for poison ivy rash, and other toxins, ginkgo nuts are quite a delicacy when prepared properly6.

"It may be helpful for us to use the story of the Ginkgo as a framework upon which to build our future."

While it is unknown how many singular Ginkgo trees existed prior to their adoption as an ornamental and fruiting tree, it may be said with great confidence that the Ginkgo's population has greatly increased because of their association with humans. It is my opinion that the monk fable does not stretch the truth too far and, in many ways, humans have saved the Ginkgo. It has transitioned from a species found only in remote mountain ranges of China to one of the most well-known trees in the world. The success of the revitalization of the Ginkgo can be seen wherever you look. One estimate predicts there are tens of millions of Ginkgos on the continent of Asia alone. This is also exemplified right here at home in NYC. As of 2018, the five boroughs housed an estimated 60,000 Ginkgos, and that number is only growing5. Whether through glaciation or habitat destruction, Ginkgo could have easily "gone the way of the dodo," but thanks to safeguarding by human societies, it is thriving around the globe.

Despite the rejuvenation of this "living fossil," the Ginkgo has been designated as endangered on the International Union for Conservation of Nature (IUCN) Red List since 1998, an appointment which likely needs updating7. The IUCN Red List (which tracks global biodiversity and designates different species on a scale depending on their proximity to extinction) recognizes 44,000 species at risk of extinction. As this figure grows yearly, it may be helpful for us to use the story of the Ginkgo as a framework upon which to build our future. With this model in mind, we may be able to maintain what is left of our biodiversity by nurturing threatened species. But this is not enough. To quote a 2019 article from Peter Crane who inspired this piece through his book Ginkgo: The tree that time forgot, "Ginkgo reminds us that conservation through cultivation is an important means of protecting threatened plants... [but] must not cause us to forget the conservation of natural habitats."5 While legislation must be put into place to hold corporations accountable for the terror they inflict upon the natural world, there is still much that individuals may do to help. To discover ways in which you can help right here in our city, check out the New York Restoration Project at www.nyrp.org and the City Parks Foundation at https://cityparksfoundation.org/volunteer-its-my-park.

Ginkgo biloba Blagon

NYC Recommendation (more on p. 10 & 16)

By Katarina Liberatore

Photo from metmuseum.org

Late Nights at the Met

Spending the night at a museum seems to be a childhood dream come true, which can be realized **every Friday and Saturday** at the Metropolitan Art Museum where it remains **open until 9:00 PM**.

Monikered **"Date Night at the Met,"** these extended hours provide a unique opportunity for a late-night excursion with friends, partners, or solo. After hours, the museum adopts a new atmosphere; there is a more hushed and (slightly) less chaotic air in the galleries while the grand halls are filled with live chamber music. Perhaps the most stunning are the sculpture rooms, which are cast in a completely different light and drape ancient Greek and Roman masterpieces in dramatic shadows. As always, living in New York ensures that the only entrance fee is a donation of your choice. For a peaceful yet entertaining weekend evening, consider perusing the vast collections at the Met.

GENOMIC DATA IN 'ALL OF US' AT ODDS WITH SCIENTIFIC COMMUNITY

By Rebecca Su and Sarthak Tiwari

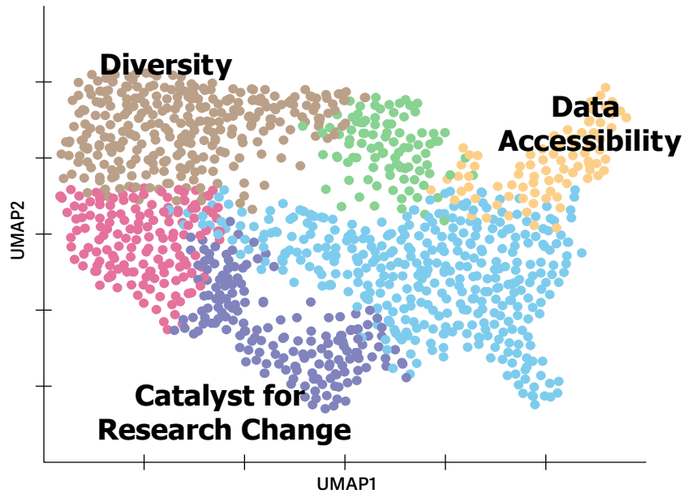


Illustration by Sarah Foust

Next-gen sequencing spurs precision medicine initiatives

Next-generation sequencing has given clinicians and researchers the power to examine the code of human biology—DNA. With such advancements came the idea that a patient's DNA could hold the key for their own treatment: precision medicine. As sequencing technologies became less expensive and more accessible, many initiatives were formed to collect and sequence the DNA of large population cohorts in an effort to expand biomedical knowledge.

"All of Us" started in 2015 under the Obama administration as the Precision Medicine Initiative Cohort Program and is led by the National Institutes of Health. The project funds research that would personalize medical prevention and treatment for the individual based on their genetics, lifestyle, and environment. Furthermore, it has the goal of collecting the health data of at least one million diverse people living in the United States. The program partners with researchers at academic and healthcare institutions to fund and disseminate studies related to precision medicine.

All Of Us Research Program criticized for mishandling race and ethnicity data

Recently, an article was published in Nature titled "Genomic Data in the All of Us Research Program." This was the first paper to come out of the initiative, providing insight into the data that has been collected so far from 245,388 participants. Many other studies are planned to come from the research program. Importantly, the authors indicate that 77% of the participants are from communities traditionally under-represented in biomedical research, and 46% are from under-represented racial and ethnic communities. This study has the potential to help researchers develop personalized medicine for communities that have historically been left out of these studies. But did the paper make the intended impact? Shortly after publication of the whole-genome sequencing data, one particular figure in the paper incited significant controversy amongst researchers.

This figure (see image on next page) includes a Uniform Manifold Approximation and Projection (UMAP) that clusters All of Us participants into distinct racial and ethnic groups. The first UMAP is colored by race, while the second UMAP is colored by ethnicity. One criticism is that the UMAP seems to conflate race and ethnicity. While they do two individual UMAPs, due to the density of the data, it is visually difficult or impossible to identify the difference between the "no race" and "Hispanic or Latino" groups. By not including those statistics of the overlap between race and ethnicity, it makes it easy to conflate Hispanic or Latino with no race, when they can self identify with any race. The separation into 2 UMAPs was done properly, but the visualization doesn't make the difference clear, and likely causes more harm.

One criticism is that the UMAP seems to conflate race and ethnicity. For example, due to the density of the data and the parameters chosen for generating the UMAP, it is difficult to distinguish "No information" in the UMAP colored by race from "Hispanic or Latino" in the UMAP colored by ethnicity. This implies that there is a biological connection between not identifying with a race and reporting "Hispanic or Latino" ethnicity.

UMAP is criticized for exaggerating differences between racial and ethnic groups

Another concern raised is that UMAP tends to distort distances between variables, leading to an exaggeration of the differences between racial and ethnic groups. Arbitrarily pooling smaller populations into larger, loosely defined subgroups completely reduces the representation of subpopulations and ultimately exaggerates overall differences. This is worsened by the fact that race and ethnicity do not have a genetic basis. In reality, race and ethnicity are social constructs. Genetic diversity within certain racial groups is often much greater than between races. The same applies to ethnicity. However, due to the nature of UMAP, differences between groups are artificially inflated, creating a figure that seems to show large genetic differences between races and ethnic groups.

Some researchers in the field, such as Jonathan Pritchard, Professor of Genetics at Stanford University, would have recommended a different dimensionality reduction technique, such as principal component analysis (PCA). "UMAP pulls unusual genotypes towards the majority clusters; in particular it fails to represent admixture in a sensible way (admixture is fundamentally additive, while UMAP is not). In this setting the messiness of Admixture or PCA plots yield a better reflection of the data," Pritchard wrote on X (formerly Twitter).

However, it's important to note that PCA only finds linear relationships in the data—even the most trivial nonlinear relationships would be missed. UMAP was made as an alternative to visualize these nonlinear data by finding clusters and trying to group them together on the final 2D image. However, UMAP does not have the same level of mathematical rigor. PCA guarantees that the reduced dimensions will capture the greatest amount of variance in the data, making it the optimal linear dimensionality reduction approach. The distances captured by PCA are also quantitatively meaningful and can even be used for statistical tests. However, the distances on the UMAP plot don't represent any real distance in the data outside of small local structures. UMAP also contains no statistical guarantees, and adjusting a few parameters can produce a completely different UMAP that is still "correct." This issue is compounded by the fact that UMAP was not used directly on the data; rather, PCA was used to reduce the dimensionality of the single nucleotide polymorphisms to sixteen, then UMAP was applied on that to visualize the data. This has "strong potential to even further artificially inflate differences between clusters by giving the UMAP only the principal components chosen to most strongly separate the data," according to Michael Baym, an associate professor at Harvard, on X.

This analysis was performed by the Broad Institute when they developed and published the Genome Aggregation Database (gnomAD) in 2020. It is likely that All Of Us was following a similar procedure, but criticism from high-profile faculty like Jonathan Pritchard caused further discourse and controversy around the use of UMAP in this context, which was not the case with gnomAD. The high amount of social media engagement brought significant attention to the nuances and potential implications of applying UMAP in such a sensitive analysis.

Consequences and potential contributions to scientific racism

Representing race and ethnicity as biological classifications can encourage scientific racism, or the belief that people can be cleanly sorted into a racial hierarchy based solely on genetics. Existing racial categories in the United States are based more on social and historical factors than on biology, emphasizing the fact that race is a social construct. Scientific racism justifies existing racial hierarchies, creates health disparities, and erodes the public's trust in science and medicine. The idea that race is biologically meaningful has been disproven in many studies demonstrating that genetics are more varied within racial groups than across groups. As mentioned before, this intra-group genetic complexity is lost due to the arbitrary

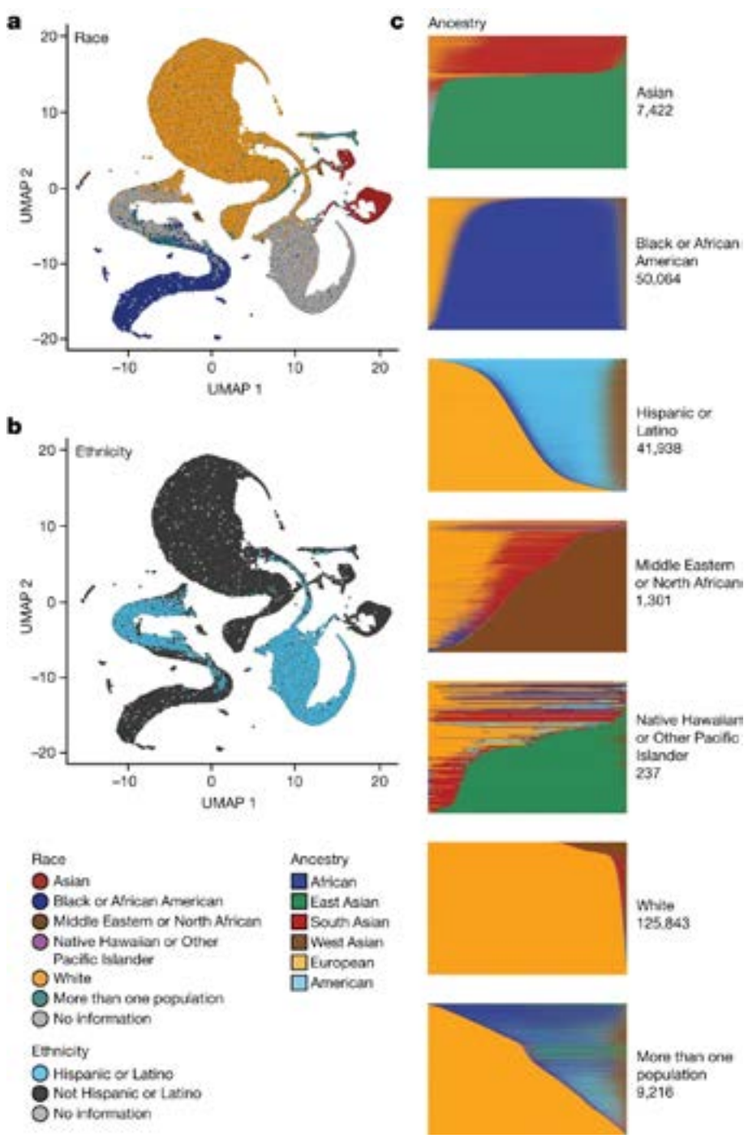


Figure 2 from Genomic data in the All of Us Research Program (Nature 2024)

pooling of small populations into larger groups with UMAP. Furthermore, it's important to note that the data collected from these individuals also have self-identified race and ancestry, which may obfuscate attempts to group the data. While there's not a great alternative to self reporting, highlighting these self-reported characteristics as valid ways to distinguish genetic data places emphasis on the labels, when they aren't biologically relevant. Ultimately, the authors could have been more careful about examining assumptions and prioritizing details in their data that contain important information that could affect their data analysis and study conclusions.

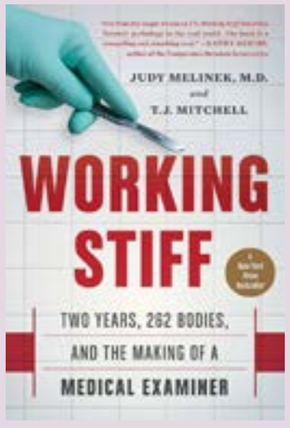
This discourse paves the way for methodologically sound and socially responsible scientific advancements.

How will this controversy impact the potential to advance precision medicine?

Criticism of this analysis is not to suggest that scientists abstain from using genomic data to develop precision medicine therapies. Jonathan Pritchard, whose criticisms are quoted above, retweeted a claim that UMAP "is drawing attention away from the incredible accomplishments of the All of Us research program in building a massive, diverse cohort that will fuel decades of important research." This work lays the foundation for future population-level studies and is poised to become an invaluable NIH resource. Despite the good intent and effort by the All of Us team, the analysis and subsequent data representation enables misguided and potentially detrimental interpretations. This situation highlights the benefit of fast and wide-reaching platforms like X for scientific discussion. In bringing attention to issues with current analysis methods, the online discourse surrounding the All of Us study may pave the way for scientific advancements that are not only more rigorous, but also more socially responsible.

Book Recommendation: *Working Stiff*

By Sarah Foust



Do you enjoy true crime and crime scene investigation stories?

Have you ever wondered what it would be like to work as a forensic pathologist?

In Judy Melinek and T.J. Mitchell's book, Working Stiff, they retell Judy's first two years as a medical examiner in New York City. Judy began her job at the NYC Chief Medical Examiner's office shortly before 9/11. The story chronicles her role in the aftermath of the attack as well as the several harrowing deaths she helped investigate in the city. It is an engaging book for those who like crime, medicine, science, and a little bit of grisliness!

NYC Recommendations (more on p. 10 & 13)

By Katarina Liberatore

The Peggy Rockefeller Concerts

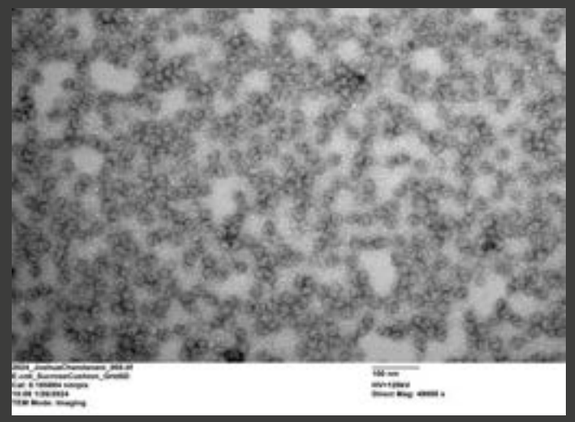
We often gather at the **Caspary Auditorium** to be inspired by scientific inquiry; however, several nights during the year, its walls resound with music. This concert series, which invites musicians and ensembles to display their technical mastery and passion for music at Rockefeller's campus, has been **an ongoing endeavor of music-admiring professors since the late 1950's**. With a commitment to share these performances with the whole community, the organizers of the Peggy Rockefeller Concerts provide **student and postdoc discounts**, which make this state-of-the-art musical experience more affordable than ordering takeout. The 2024-2025 concert series was recently announced and expanded to feature world-class string, wind, and vocal artists that will undoubtedly offer a mesmerizing experience close to home.
Learn more at: https://www.rockefeller.edu/peggy/

Concert in Caspary Auditorum, c. 1970, Digital Commons @ RU

GRASSROOTS LAB @ TRI-I: ARTXSCIENCE

Collected by Hera Canaj

Science and art often collide.
There's sometimes an art to performing a certain technique and getting a beautiful result, and sometimes there's a science to achieving a look artistically. We love these moments where art and science collide and wanted to have a space where we can show and appreciate the science and artistic pursuits of the community!



Joshua Chandanani & Anoosha Banerjee – Graduate Fellows, Rockefeller University & TPCB

Negative stain transmission electron micrograph (at 68,000x magnification) of *E. coli* ribosomes, collected by the Darst-Campbell Lab at the RU EMRC

Sample collected by Anoosha Banerjee (Laboratory of Molecular Biophysics) at the RU EMRC (Dr. Anurag Sharma) and prepared by Joshua Chandanani (Laboratory of Molecular Biophysics).

Hera Canaj – Graduate Fellow, Rockefeller University

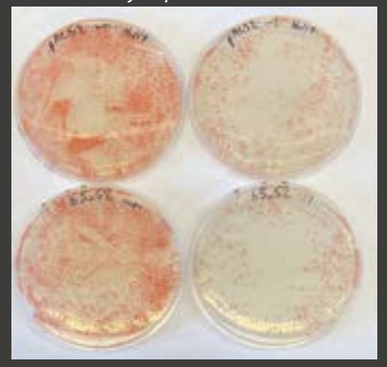
This is a cyanotype or "sun print." During the pandemic, cooped up inside, I came upon this new hobby which combined my love of art and science as well as allowed me to play with flowers and plants (another love of mine). To make the cyanotype, the paper has been coated with a mix of ferric ammonium citrate and potassium ferricyanide rendering it sensitive to UV light.

UV rays from the sun react with the paper to generate a cyan blue background. If an object is placed in front of the paper and thus blocking light – the pigment will not react with the UV rays and will be washed away in the water fixation step leaving behind a white print on a cyan background. I experimented with different objects and learned that some translucence allows beautiful details to come through – almost like a sun photograph. I dried and pressed an orchid flower then exposed it quite a bit to the sun on a bright day. Although it took a few tries, I finally produced a more detailed image showing some of the petal's veins.

GRASSROOTS LAB @ TRI-I: ARTXSCIENCE

Alice Cassel – Graduate Fellow, Rockefeller University

Pretty in pink colonies!



Haloferax volcanii are salt-adapted archaea that produce pink and red carotenoid pigments, which help protect the cells from UV radiation and osmotic stress.

Joanna Yeung – Graduate Fellow, Rockefeller University

Portrait of me, my brother, and my grandparents in front of our favorite Japanese restaurant called Koyama in Shanghai, China. I drew this portrait on my iPad while on the plane flying away from Shanghai because I had already begun to miss them and needed to do something on the plane. The girl sitting beside us told me that I was a good artist.

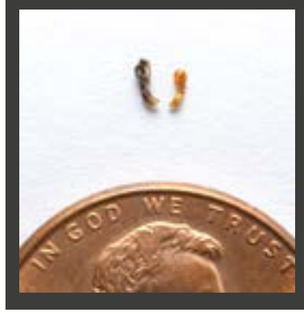
Clare Cahir – Graduate Fellow, Rockefeller University, TPCB

Assortment of Thin-Layer Chromatography:

During my very first chemistry lab in college, my professor brought our class to the on-campus museum to analyze the symmetries in the artwork and compare them to the symmetries in organic molecules. It was from this experience that I realized my love for science and my love for art can work together. Throughout my time in undergrad, I tried to capture a few of these moments where science and art coincided. For one experiment, we were asked to check the products of our reaction using thin-layer chromatography. With my experiment completed, the colors and positioning of the separated products caught my eye and compelled me to photograph the moment as shown.

Kip Lacey – Graduate Fellow, Rockefeller University

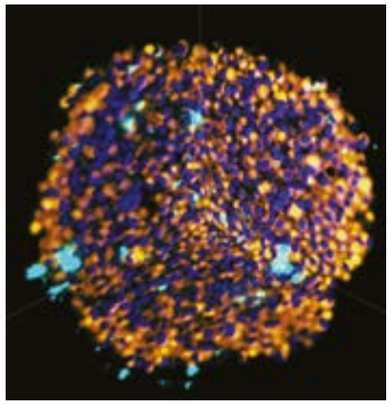
This is a male (left) and a female (right) clonal raider ant, Ooceraea biroi, pupa placed above a penny to put into perspective their relatively small size. In addition to being highly sexually dimorphic, with males having eyes, wings, and a different coloration, the species exhibits haplodiploidy – the trait mark of the hymenoptera order. This means that males are haploid, whereas females are diploid. In the case of the clonal raider ants, the vast majority are basically all female so these males are vestigial "happy accidents."

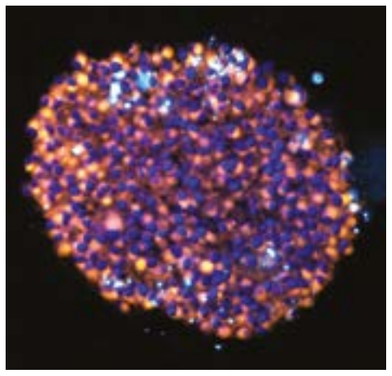


GRASSROOTS LAB @ TRI-I: ARTXSCIENCE

Gabriel Small – Graduate Fellow, Rockefeller University

CryoEM is a low signal-to-noise technique in which particles are extracted from micrographs, the 2D images of particles are assembled into 2D class averages, and then used to construct the 3D volumes into which atomic models are built. The example shown here is the SARS-CoV-2 replication-transcription complex with the NiRAN domain trapped in a catalytic intermediate of mRNA capping.





Aria Ahmed-Cox, PhD, AFHEA – Fulbright Future Scholar – SKI Molecular Pharmacology Program

The 3D revolution: mini brain tumors for advancing cancer therapy.

Brain cancers persist as a group of solid tumors that are very difficult to treat. They are often complex, aggressive, and securely hidden behind the blood-brain barrier. Recent research in brain cancers has moved to include this complexity at the earliest stages of drug development, by growing three-dimensional "mini" tumors in the lab. Here, glioblastoma tumor cells in orange and their nuclei in dark blue have formed a tumor spheroid and are captured in 3D using lightsheet (Zeiss Z.1) microscopy mid-treatment with an experimental nanoparticle drug delivery vehicle shown in cyan. The "3D revolution" expresses the important rise in use of 3D models to incorporate tumor complexity in early drug development. Together with drug-loaded nanoparticles developed by a multidisciplinary team, this research seeks to tackle the challenge of brain cancer targeting and change the outcome for patients in the future.

Fluorescent image has been thresholded and pseudo-coloured for optimum color compatibility suitable for all viewers. Glioblastoma tumor cell nuclei are labeled with DAPI (emission in blue), whereas cell membranes are labeled with CM-DiI (emission in yellow/green, altered to orange) and nanoparticles with Cy5 (emission in red, altered to cyan). The tumor spheroid has been projected in 3D using Arivis imaging software.

Do you have something you would like to share? We want to see!

A cool cell, critter, media, substrate, a painting, a craft, etc.
Email hcanaj@rockefeller.edu with your image for submission, include your name, your affiliations and position, and a small blurb about the image - how it was acquired and what's shown.

PETS OF TRI-I, ELSA AND WOODY: RETIRED FROM RESEARCH AND EM-BARKING ON LIFE

By Audrey Goldfarb

This spring I had the pleasure of meeting two adorable pups, Elsa (age 9) and Woody (age 3). The pair moved in with Dr. Erin Norris in Ossining, NY—Elsa first, then Woody—after retiring from careers as research beagles. Now, the only timepoint they're invested in is dinner. As Elsa put it, "We've done our duties!" Luckily, they were willing to sit for an interview as long as it was buffered by long naps on either end.

Audrey Goldfarb: It's a pleasure to meet you, Elsa and Woody! I understand that you're no longer engaged in academic research, but that you keep very busy with zoomies and chew toys. How do you manage a healthy work-life balance in your retirement?

Woody: Our days consist of walks in the neighborhood, patrolling our property by watching out windows for cars and people, and being mischievous especially when our humans aren't home.

Elsa (R) and Woody (L); photo courtesy of Erin Norris

Elsa: But our absolute favorite thing to do is sleep!

AG: How do you like life in Ossining?
E: We LOVE life in the 'burbs. Lots of great smells and wildlife – at first, we were scared of everything, but now we realize it's fun to try to chase squirrels, groundhogs, and bunnies. The deer still scare us though...

AG: It's great that you've acclimated well to the great outdoors, but I assume you still enjoy the comforts of home. What are your favorite indoor hobbies?
E: I like to dissect plush dog toys. Woody favors chewing on his rope toys, snuggling, and making big messes by getting into garbage cans, Lego sets, and crayon boxes!
W: Elsa also has a beautiful singing voice, and often accompanies Erin and her other daughters when they play the piano. I'm still developing my tonality, but I chime in when I'm feeling confident!

AG: Woody, it sounds like you're somewhat of a troublemaker. What mischief have you gotten into lately?
W: Oh boy. Well, I LOVE getting into the garbage. And whenever my mom leaves for a few hours, I ALWAYS find something to chew up. A box of donuts set too close to the edge of the table, my sisters' toy, Christmas decorations, the carpet—you name it, I've chewed it! Also, I hate it when someone walks Elsa without me, so I cry and whine at the door and have even learned how to open the door to let myself out. I was very proud of myself, but my humans seemed upset...

AG: It's a good thing that your humans are so patient! But do you ever get on each other's nerves?
W: Absolutely! Elsa isn't a big snuggler, so she often moves to another spot when I get onto a bed to cozy up with her.
E: On a different note, Woody doesn't like it when I get attention. He is extremely jealous and comes running whenever he hears my name or sees that I'm getting tummy rubs without him.

AG: Woody, are you able to get enough snuggles from your humans when Elsa isn't in the mood?
W: Yes!!! I get to sleep in bed with them and want to be up against them all night long to feel protected and loved.

AG: Snuggles and tummy rubs are pretty hard to beat, but was the transition out of your lab life difficult at first?
E: It was very difficult to move from a lab space full of cages and other dogs on a strict routine. I had a hard time getting used to life with grass and blankets and garbage trucks, but I mastered it after a while.
W: I transitioned more easily, probably because I had Elsa to show me how to be a dog!

AG: Woody, although the transition was less intimidating for you, slowing down is sometimes challenging for former academics. Do you ever struggle to feel relevant in your retirement?
W: I have never doubted how important and relevant I am!

AG: Wow, it sounds like you've had a great experience leaving academia! Do you have any advice for other academics, canine or otherwise, who are currently struggling with burnout?
W: Hopefully they are working in labs that partner with adoption/rescue organizations so they can earn their new leash on life, which they definitely deserve!! It's a stressful time, being in the lab and moving out of it since everything is new...but be patient because life with a loving family is incredible!

AG: I'm so inspired by your experience of finding fulfillment with a loving family. I wish my lab partnered with a rescue organization! But anyways, enough about me... How can the Tri-I community support and advocate for research beagles?
E: The community can help encourage labs that use beagles in research to work with animal rescues so that other beautiful creatures like us can be rehabilitated and rehomed (rather than euthanized). There are several foundations in the tri-state area. You can check out BeFreegle Foundation online for more information on how this works!

AG: Elsa, you're a great big sister for showing Woody the ropes! It must have been difficult for you to go through the process alone.

E: Yes, it was a bit. I was very confused as to what was going on since I didn't have another dog to help me transition. But my family was patient with me and made me realize how much they loved me and how important I am to them.

Do you have a **cuddly, fluffy, crawly, scaly, water-dwelling, amphibious, or photosynthesizing** best buddy?!

We want to "interview" your pet(s) for the newsletter about life in NYC, their day-to-day activities, and more! Fill out this survey to let us know about your pets :)

CLICK HERE

THANK YOU, AND UNTIL NEXT TIME ...

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