Natural Selections

A NEWSLETTER OF THE TRI-I COMMUNITY

FEB 2024: SCIENCE FOR HUMANITY

Cover Illustration by Marina Schernthanner

Portrait by Katarina Liberatore

Letter from the editor

IN THE LIGHT OF NATURAL SELECTIONS

-Audrey Goldfarb

"Nothing in Biology Makes Sense Except in the Light of Evolution." - Theodosius Dobzhansky

The staff of Natural Selections is pleased to present the February 2024 issue after nearly two years on hiatus. A student-run newsletter is an essential community builder, voice of the student body, and a record of institutional culture. Having learned from our near-extinction event during the COVID-19 pandemic, we have rebuilt with a mind to sustaining community expression and growth.

Rockefeller's graduate program was born in 1955, but Natural Selections didn't emerge until 2003. Student newspapers of our peer universities—Harvard, MIT, Stanford, and Berkeley, among others—were established in the late 1800s by undergraduates, decades before biology graduate programs were founded. At Rockefeller, a graduate-only university, Natural Selections had a late start and a relatively small student body to draw from. Our newsletter is aptly named, as Natural Selections endured, metaphorically speaking, many of the evolutionary challenges that face any small population.

Rockefeller's small, world-class scientific community fosters collaboration, innovation, and discovery, all which will contribute to the quality of content in Natural Selections. However, our membership has ebbed and flowed throughout the last twenty years in response to institutional, political, and social change. None has been so intense as the period between 2020-2021. Natural Selections suffered a devastating blow as the COVID-19 pandemic weakened our entire community, both personally and professionally, and constricted the regular influx of new members that the paper needed for survival. For the first time in its history, the newsletter went dormant.

The influx of adaptive genetic material into small populations, termed "gene flow," increases adaptability and evolutionary potential. While still housed at Rockefeller, Natural Selections has expanded to include members from Weill Cornell and MSK, garnering an influx of diversity and creating an organ for communication among sister species in the Tri-I community. No longer stymied by social distancing, we have assembled a staff of over thirty members who have already demonstrated promising talent, motivation, and ability to collaborate.

In addition to elevating our fitness, we aspire to constantly improve the quality of our content.

The focus of Natural Selections is on science and medicine, but we have the freedom to diversify and deepen our scope as it benefits our staff and readership. Our content is not constrained by specific ideologies, politics, institutional interests, or the need to always act with editorial consensus. We can be effective without always agreeing, therefore enabling diversity of thought and expression.

Groundbreaking science is built on open-mindedness and risk-taking in the pursuit of novel and impactful insights. The road to discovery is paved with failure, and the journey to understanding begins and ends with ignorance. But in science, as in life, being wrong can be scary and, at times, has potential to do harm. As a community of intellectual pioneers, we need each other's support to make those mistakes safely, to serve each other and benefit scientific, medical, and social evolution. As scientists, we appreciate the importance of diversity and the potential of unfiltered voices to shine new light on old problems. Natural Selections will serve as a vessel for those voices.

We wish to thank Rockefeller's Dean's Office for making this revitalization possible with their responsive and enthusiastic support. Additionally, we extend our appreciation to all previous Natural Selections editors and contributors, especially our last editor-in-chief, Dr. Megan Elizabeth Kelley, who was instrumental in kick-starting the reboot. Finally, to Natural Selections' readership, we are grateful for the opportunity to share our work with you and are thrilled to continue Natural Selections' tradition of serving our community, sowing personal and professional relationships, and sparking discussion.

DIRECTORY

CHECK OUT OUR WEBSITE!

HENRIETTA LACKS' IMMORTAL STORY: WHEN SCIENCE FORGETS HUMANITY

By Lola Neal

Research and reporting by Kenny Bradley, Jeannie Carreiro, Colin Burdette, and Sarthak Tiwari

Imagine you notice a persistent, painful lump on your cervix. You consult your doctor, who asks your permission to conduct a diagnostic tissue biopsy. You have access to information about this procedure from your doctor, other medical professionals, and online forums. You agree to the biopsy, and the tissue is collected and sent to a pathologist for analysis. Your results are returned within the week, your doctor discusses them with you, and your care team formulates a treatment plan that prioritizes your physical health and well-being. Standard.

This is not what happened in 1951 to Henrietta Lacks, a Black woman with cervical cancer who was exploited by the physicians and scientists at Johns Hopkins Hospital responsible for her care. Henrietta's biopsy forever changed modern biology without her even knowing it.

Henrietta Lacks was born in Virginia in 1920, where she was raised by her grandparents and worked as a tobacco farmer from an early age. In her early adulthood, she married her cousin David "Day" Lacks and soon after moved to Baltimore to raise their five children: Deborah "Dale" Lacks, Lucile "Elsie" Lacks, Zakariyya Bari Abdul Rahman (born Joseph Lacks), David Lacks Jr., and Lawrence Lacks. During and after Henrietta's fifth pregnancy with Joseph, her health problems began to arise—excessive vaginal bleeding, feeling a "knot" inside of her, and a lump on her cervix. She began to seek treatment, without her family knowing, at Johns Hopkins Hospital.

Henrietta Lacks's tumor cells were obtained without consent during a treatment for her cancer. Dr. George Gey and his assistant Mary Kubicek isolated cells from Henrietta's sample and discovered that, unlike any other cells they'd tried to culture, Henrietta's never ceased dividing. Her cell line, referred to only as "HeLa," was immortal, and had enormous potential to transform scientific research. HeLa cells were a dream come true for biologists studying cell biology and cancer, and they revolutionized tissue culture practices in the U.S. and abroad, including in labs here in the Tri-I. Research using HeLa cells has resulted in three Nobel Prize awards in Physiology and Medicine, and over 100,000 publications to date. Following the inception of the HeLa cell line, medical professionals and scientists were quick to forget the woman from whom HeLa cells were unethically derived. The Lacks family was left completely uninformed and excluded as Henrietta's DNA was exploited for academic and financial profit.

The Journey to Immortality and Growth of the HeLa Machine

The Early 1900s

In 1912, Rockefeller Institute scientist Alexis Carrel shocked the scientific community by claiming to have developed a tissue culture technique to keep cells alive indefinitely. The chicken heart tissue he began culturing that year continued to proliferate until 1946, according to Carrel's published papers—defying all prior knowledge about the lifespan of cells. His Nobel Prize-winning work was touted as groundbreaking until the 1960s, when it was revealed that other scientists were unable to replicate his experiments.[1,2] In the wake of this scandal, scientists relaunched efforts in the late twentieth century towards achieving and maintaining cellular immortality.

Carrel's research was rooted in the culturally pervasive belief in eugenics. He saw his work as something to benefit only the healthiest members of society and believed in the euthanization of people with certain racial/ethnic backgrounds, mental and physical abilities, and criminal histories. This deep-rooted tradition of eugenics in science and medicine, which both pre-dated and was promoted by Carrel, shaped the way in which scientists continued to view Henrietta Lacks as a research subject and subsequently decided who benefitted from the use of HeLa cells. The lack of consideration and respect for Henrietta and the Lacks family's humanity was a reflection of the cultural norms and opinions of the time.

The Collection

Race relations in the United States at the time of Henrietta Lacks's medical treatment provide insight into the less-than-ideal experience she had at the Johns Hopkins Hospital. Maryland, like the other Southern states in the U.S., enforced Jim Crow laws[3] until they were overturned in 1965. Black

individuals were prohibited from attending the same schools, going to the same hospitals, or using the same restrooms as their White counterparts. State and national laws legitimized the use of brute police force to punish perceived infractions. Jim Crow policies blocked access to equitable healthcare for Black people like Henrietta in the Baltimore area and beyond. Her only option for receiving any healthcare was at the Johns Hopkins Hospital, which was established in 1889 to "provide care to anyone, regardless of sex, age or race."[4]

Despite this pledge to provide equitable care, deeply ingrained cultural beliefs that Black people were inferior resulted in medical care that was apathetic, cold, and often cruel. A common belief by scientists who worked in public wards at this time was that "it was fair to use them [African-Americans] as research subjects as a form of payment."[5,6] This mentality was consciously or subconsciously brought to Henrietta's examination room that day in 1951, when the doctors neglected to ask for Henrietta's consent to remove tissue from her body, which they stored in the lab's "Colored" freezer.

It was only during Henrietta's autopsy in October of 1951 that the scientists who had been working with her cells acknowledged her humanity. "It hit me for the first time that those cells we'd been working with all this time and sending all over the world, they came from a live woman," Mary Kubicek later said. "I'd never thought of it that way."[6]

The Early Use

At the height of the polio epidemic in 1952, scientists needed a vessel to grow large amounts of poliovirus for research purposes. Cue HeLa cells, whose susceptibility to poliovirus and ability to grow at rapid rates made them the perfect tool to test vaccines. The idea of a "HeLa factory" became a reality, being established at the Tuskegee Institute in the early '50s as an opportunity to provide jobs to Black individuals. These jobs and this research benefited predominantly White people suffering from polio. This polio research using a Black woman's cells was occurring at the same time as and within the same institute that was conducting one of the most notably unethical and dangerous experiments in the United States, The Tuskegee Syphilis Experiment[7].

In the years following the polio research, the usage of HeLa cells expanded. One of the first experiments done to understand the impact of X-rays on human cells was conducted using HeLa cells in 1956[8]. The same year, HeLa cells were used to establish a method for characterizing cell growth that is used to diagnose cancerous cells to this day[9]. The cells were also the perfect model to investigate the benefits of drugs that treat blood cancers or sickle cell anemia[10]. Henrietta's cells even traveled to space in the same year, 1964, where NASA scientists used them to study the effect of radiation and space travel on human cells[11].

In the 1950s, Dr. Chester Southam, an immunologist and oncologist at Memorial Sloan-Kettering and Weill Cornell, used HeLa cells for a particularly egregious set of experiments that would certainly be illegal by today's standards. Southam was interested in injecting live HeLa cells into individuals to understand how tumors proliferate[12]. He began by injecting millions of HeLa cells into patients with leukemia who came into his office, under the guise of testing their immune systems. These patients were completely uninformed about the injection of malignant cells into their bodies, and therefore obviously unable to consent. Within a week, the patients developed aggressive tumors like the ones that plagued Henrietta. Southam then moved to another frequently exploited group: prisoners. In total, Southam injected HeLa cells into over 600 people. Later scrutiny of his problematic medical activities revealed that his work was comparable to the medical war crimes conducted during the Holocaust and prosecuted in the Nuremberg trials[13]. Southam was found guilty of fraud and unprofessional conduct. His punishment? Probation for a year.

The Mortal Family Living Alongside the Immortal Cells

Where was Henrietta's family during all of this? What did they know about the scientific legacy Henrietta had left after her death? While transformative research was being conducted using the HeLa cell line, her family had no idea that their mother's cells had been kept, nor did they have the scientific knowledge to understand the prospect of cell culture and how cells could be used for medical advancements.

Henrietta's children lived in poverty, suffered at the hands of abusive caretakers,and experienced food insecurity and incarceration. Like many Black Americans, the Lacks family was effectively ignored by legal and social systems in the United States. This truth feels paradoxical because the cells that were being used to revolutionize so many aspects of science held the same DNA as the individuals whose lives were generally deemed as unimportant, unless for monetary gain.

It wasn't until 1973 that Henrietta's daughter-in-law became aware that Johns Hopkins had the cells. Naturally, the family began contacting Hopkins for more information. In response, Hopkins doctors misled the family into agreeing to donate blood by telling them it was to test for cancer. In actuality, the HeLa cell line had been discovered to be contaminating many other cell lines in laboratories across the globe, and scientists wanted more nearly related samples so they could better identify the original cells. Following the collection of multiple family members' blood samples, Hopkins ghosted the family—no contact, no explanation, no follow-up.

What followed was years of miscommunication, misinformation, and the continued erosion of trust in the scientific and healthcare systems. The family was unaware that since the 1960s, the American Type Culture Collection (ATCC) had sold HeLa cells for almost $300 per vial, or that other companies like Invitrogen were making significant amounts of money off of the cells extracted from Henrietta. The family became aware early on that research intended to help people was being done in the HeLa cell line, but once they realized how profitable the cells had become—there are over 11,000 patents associated with the line—they began to pursue financial compensation[14].

As the Lacks family's awareness about the use and commercialization of the HeLa cell line developed, the kinds of research being done in the cells continued to expand. Many labs in the Tri-I continue to use the line, citing the ease of use, wide variety of usage, and low cost as primary reasons for their decision to use the cells in their research. for example, work utilizing HeLa cells built the foundation of Titia de Lange's research program in the early 2000s. The lab continues to use the cells today. Many other labs in the Tri-I also work with HeLa cells, citing ease of use, wide variety of usage, and low cost as primary reasons for this decision.

Although the scientific community had grown familiar and comfortable with the cells of Henrietta Lacks, her family had never even seen them. In the early 2000s, the Lacks family finally received an invitation to see the cells that changed the world, the cells of

their beloved Henrietta. Christoph Lengauer at Hopkins explained to Henrietta's adult children how HeLa cells were kept alive and used in experiments, and allowed them to see the cells from their mother with their own eyes. Lengauer explained to the family how the cells still held Henrietta's genetic material, even after all of this time. He also advised the family to pursue compensation for the use of their mother's cells. Until this point, the Lacks family had been completely excluded from all conversation and decision-making about their mother's cells. This lawsuit would become the family's first opportunity to redress the historic wrongdoing against Henrietta Lacks.

The Lawsuit

Following the publication of Rebecca Skloot's The Immortal Life of Henrietta Lacks in 2010, there was revitalized interest in this story of unethical treatment and the commercialization of biological materials. Henrietta's family raised concerns that their genetic material was publicly available, as HeLa genomes had been made accessible through years of research without their consent. In 2013, the family came to agreements with the NIH that restricted access to HeLa cell genomes. "It was shocking and a little disappointing, knowing that Henrietta's information was out there... It was like her medical records are just there to view with the click of a button," said one of her relatives. "They didn't come to the family... It was like history was repeating itself." The agreement states that any future genomes produced of HeLa cells cannot be published unless the family allows it,[15] a big win in terms of being included in scientific conversation as members of the general public.

In terms of financial compensation, the family decided to pursue legal action when lawyers and scholars noted the "discrepancy in status and financial stability" that the descendants of Henrietta Lacks have experienced, contrasted with the massive compensation packages received by biotech companies profiting off the cell line. With the assistance of Ben Crump, a civil rights attorney mainly focusing on cases surrounding racial injustices, the family sued Thermo Fisher and received a $9.9 million settlement. Though a large amount of money, $9.9 million is but a fraction of the over $26 million the CEO of Thermo Fisher received in 2023. Do these corporations pay because they understand the wrongdoing, or to hush any complaints?[16]

How Do We Remedy This Story as Scientists?

Henrietta Lacks is most often honored through symposia and awards that bear her name, but does this absolve us of what happened to her? When research institutions do acknowledge her story, it's often watered down and confined to a page, or even a single paragraph. What can we do as scientists who are at the bench, carrying out the work described in this article? How do we prioritize humanity in our research? How can we continue to honor Henrietta Lacks? Here are some actionable ideas:

Continue to conduct ethical research

Remember that people are people—just because an experiment is blinded doesn't mean a subject's right to respect does not exist

Engage in unclouded discussion of the honest history that takes into account the goals of the science at the time

Acknowledge the problematic state of scientific research at the time, mostly driven by the problematic nature of society at the time—this increases awareness of contexts that people may not be aware of. This also allows people to view what they thought they knew in a new light.

It is unlikely that the large-scale, corporation-driven use of HeLa cells will be eradicated in our lifetimes, due to the cost of research and the established science that has come from them. But on the individual level, you can ask yourself some questions:

Am I educated on the origins of the tools I am using in the lab?

Is the research I am involved in aimed at benefiting humanity through knowledge or care?

Is the research I am doing or contributing to something that could exclude or other people?

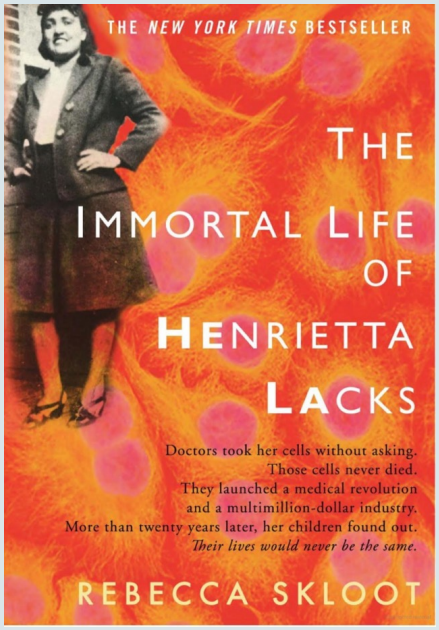
Often, we bench scientists can hyperfixate on the nitty-gritty details of our experiments, lacking awareness of the context in which our work has even been made possible. When we forget to look outward, or we choose to remain ignorant of the ways that science has failed others, we remain stunted. From this stuntedness, we run the risk of allowing a story like Henrietta Lacks's to be repeated—a story in which science forgot about humanity.

Book Recommendations (more on p11 & p13)

-Lola Neal

2024 is upon us, and many of us have set our reading goals for the year. If you need some help getting started, look into these informative, entertaining, and thought-provoking picks.

The Immortal Life of Henrietta Lacks by Rebecca Skloot will walk you through the history of one of the most important, and often misunderstood or forgotten, stories in modern biology. Henrietta Lacks was a Black woman living during the height of segregation and unregulated biological research, whose cells were taken without her consent – cells that became the first immortal human cell line. Revolutionizing tissue culture methods and research ethics forever, Henrietta's story and that of her family and the scientists involved are told in this accessible and in-depth book. Join Skloot on a journey beginning in the early 20th century that still continues to this day.



POETRY

By Kenny Bradley

Like Hela Cells

For Henrietta Lacks

if i die mid experimentation working with tuberculosis will I be used like Henrietta Lacks if it's not written on a document does the brain lose its privacy as if rotted thoughts cannot still be trapped by skull before my body fuses with mother earth will my cells be enslaved by latex gloves pretending to hide white hands will my stem cells proliferate more melanin begin to paint an institution in night help nature create this "Blackface" granting them funds for incorporating my color in their bigger picture watch how useful i can become when my breath is snuffed and my cells begin to divide into

diversity/equity/inclusion

Do not excavate my organs I do not concede my blobs of tissue to wipe your face clean your tears for a Nobel Prize for tagging my culture as an asterisk I do not grant my unconsented name to be worn as a mask I do not auction my body to be remembered for your science's immortality let me denature when I die have only the covers of 8th grade science textbooks and the occasional park bench remember me let my discoveries inspire unheard voices before my cells become controversy

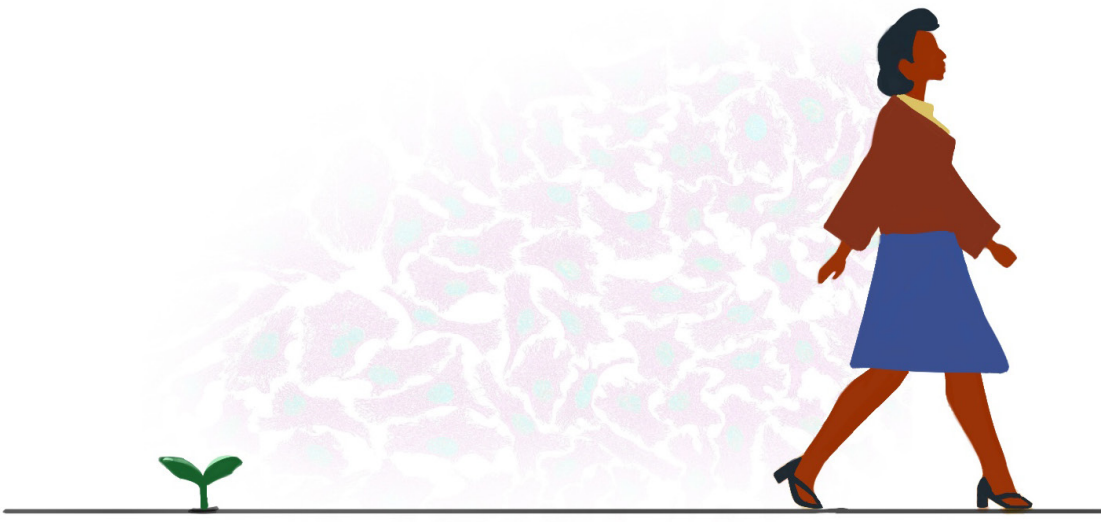


Illustration by Bokai Zhang

HEALTH EQUITY AMIDST THE GENE EDITING REVOLUTION

By Angel Feliz

From the characterization of the double-helix structure of DNA, to the development of the first chimeric recombinant DNA in 1972, to the mapping of the human genome in 2001, technological improvements have historically led to advances in conceptual understanding of molecular and cellular biology. These conceptual advances in turn inform the next generation of technology.

Perhaps one of the most groundbreaking technologies to emerge from the mid-2000s were precise genome editing tools such as the bacteria-derived CRISPR/Cas9 system. Genome editing using CRISPR/Cas9 unlocked the potential for personalized therapy for human genetic diseases and infectious diseases. Recently, CRISPR has gained much attention due to the 2023 approval of a novel cell-based gene therapy for sickle cell patients by the US Food and Drug Administration (FDA). This approval provides hope for the many patients and families struggling with the limitations of the disease itself as well as limitations in current treatment options. Novel therapeutic approaches emerging from the genome-editing revolution have the potential to cure devastating inherited disorders while addressing diseases traditionally neglected by the pharmaceutical industry.

In the context of the American healthcare system, often riddled with systemic biases, how can we ensure that advances in biomedical tools remain accessible to underserved and historically marginalized patients? In an era where emerging biotechnologies are optimized at an ever-increasing pace, where do we as scientists find balance between scientific innovation and ensuring equitable health outcomes? As a community of scientists pursuing research for the benefit of humanity, it is important to examine personal, interpersonal, and institutional biases in the sciences and medicine to ensure an equitable and healthy future for all.

In this piece, I explore the future of genome editing technology like CRISPR/Cas9 through recent advancements in application, ethical considerations, relevant challenges, and future directions of the technology within the coming years.

Photo by Logan Myler

Curing Sickle Cell Anemia

According to the Center for Disease Control and Prevention (CDC), approximately 100,000 Americans are affected by sickle cell disease[1]. Among the populace, African Americans have a proportionally higher incidence of sickle cell disease with an estimated 1 in 13 Black or African American child being born with the blood disorder. Sickle cell disease is a group of inherited blood disorders characterized by a mutation in hemoglobin, a protein found in red blood cells, that alters the beta-globin fibers that provide structural support to red blood cells. The sickle-shaped red blood cells result in limited oxygen delivery and constricted blood flow that overtime can cause chronic pain and organ damage in what are known as vaso-occlusive crises (VOCs)[2].

Sickle cells live about 10 to 20 days while healthy red blood cells live for about 120 days before needing to be replaced, and it is this deficit that results in anemia for patients[3]. Sickle cell patients additionally suffer from vision problems, increased infection rates, and periodic episodes of pain in the chest, abdomen, and joints. Traditional approaches to treat sickle cell disease involve a bone marrow transplant. However, about 80% of sickle cell patients are unable to find a compatible donor in the United States[4].

Much excitement exists in the biomedical field due to the development of personalized cell-based gene therapies like the CRISPR/Cas9 gene-editing system that would circumvent the donor crisis. This new technology shows potential in effectively treating inherited genetic disorders such as Duchene muscular dystrophy (DMD) and, most recently, sickle cell anemia[5].

On December 8, 2023, the FDA announced the approval of two milestone treatments, Casgevy and Lyfgenia, for patients with sickle cell disease who are twelve years or older and present recurring VOCs within the last two years[6]. While Lyfgenia utilizes a lentiviral vector to deliver genetic modifications to the patients' blood stem cells, Casgevy is the first FDA-approved treatment to use CRISPR/Cas9. In both cases, the patients' own blood stem cells are collected, modified ex vivo, then transplanted in a one-time single-dose fashion. The primary outcome from phase trials show that patients treated with Casgevy were free of VOC episodes for at least 12 consecutive months during the 24-month follow-up period. Of the 31 patients who received adequate follow-up, 29 were free of VOCs for at least a year, resulting in a 93.5% success rate[7]. Furthermore, none demonstrated signs of transplant rejection. It is remarkable to see technology that has

only been around for about a decade make significant improvements for both physicians dedicated to curing inherited genetic disorders and patients with few therapeutic options. When viewed against the backdrop of the American healthcare system, these successes raise new challenges and questions about equitable access.

Bridging The Gap

To achieve fair and equitable health outcomes for all, it is necessary to recognize and address the underlying social determinants of health among individuals across diverse communities. Such disparities in health outcomes or access to healthcare services are often caused by social, economic, and environmental factors.

According to the Pew Research Center, 63% of Black adults surveyed cite lack of access to quality healthcare as the major reason why Black Americans face worse health outcomes[8]. Research shows that Black communities tend to have fewer primary care physicians, trauma centers, and pharmacies[9]. Limited access to primary care providers and healthcare facilities in predominantly African American communities can hinder timely and preventive care. This lack of access continues to exacerbate health conditions and increases long-term healthcare costs.

A report from KFF of coverage rates by race and ethnicity in 2022 determined that African Americans are more likely to be uninsured (10%) than their White counterparts (6.6%), which can result in delayed or foregone medical care thus leading to poorer health outcomes[10]. Even with health insurance, out-of-pocket costs such as deductibles, copayments, and premiums can pose financial barriers. The COVID-19 pandemic further exacerbated disparities between Black and other racial minorities compared to White Americans. In fact, data from the U.S. Census Bureau reveals a widening gap between the average life expectancy for Black and other racial minorities compared to White Americans[11].

For these new novel CRISPR-based treatments to be applied equitably, the cost per treatment must be made affordable to the patient. In an interview with 15-year-old Johnny Lubin, among the first ever treated for sickle cell anemia with CRISPR, CNN medical correspondent Meg Tirrell shared that this procedure could be very expensive with an estimated $2,000,000 dollars per treatment[12]. Cost of treatment remains a burdensome challenge overall to marginalized and low-income communities and is one among many determinants driving health inequity. While these social determinants of health remain largely unaddressed, equitable healthcare in the context of genome-editing therapeutic novelties will be a struggle.

CRISPR Twenty Years From Now

Looking ahead two decades from now, the trajectory of CRISPR technology promises ground-breaking advances and a broader range of applications beyond medicine. With so many advances in emerging technologies, what should we expect from CRISPR in the coming years? What kinds of diseases will be targeted with this technology?

According to Dr. Jennifer Doudna, co-founder of CRISPR, the answer lies in the gut[13]. More specifically, in the immense population of tiny microorganisms living in and on our bodies. During a TED talk event held this previous September, Dr. Doudna said that researchers can now use CRISPR "in a way that will allow us to go to the next level by editing genes beyond the individual organism." CRISPR provides us with the ability "to edit entire populations of entire microbes" like never before[14].

Unlike antibiotics, which affect the entire microbiome, new CRISPR technology allows for the targeting of specific genes within a microbe population. Termed "precision microbiome editing" by Dr. Doudna, this approach will allow scientists to uncover new insights into disease pathologies.

As technology advances, it becomes increasingly important to establish clear ethical guidelines that govern its applications. The issue of 'designer babies' and the fears that underpin the misuse of this technology is currently a hot topic in society. Consider the case of Chinese biophysicist Dr. He Jiankui, who created the first gene-edited children in an attempt to make them resistant to HIV. Chinese authorities sentenced Dr. He on December 30, 2019 to three years in prison for "illegal medical practices" in addition to being charged a ¥3,000,000 yuan fine (equivalent to about $420,000). This case demonstrates how striking a balance between scientific progress and ethical responsibility will be critical in addressing concerns about unintended consequences, potential misuse, and the societal impact of genome editing.

While the future of CRISPR holds great promise, it requires a cautious approach moving forward. Scientists must maintain ethical standards, overcome technical challenges, navigate legal complexities, and investigate novel applications concurrently as CRISPR usage continues to evolve.

Call for submissions

Advice Column
Looking for some advice? Ask Phoebe Finch, our resident advice expert here at Natural Selections. Please note, these submissions are intended to remain anonymous, and your submission to this form grants us permission to publish your question/concern in Natural Selections with minor editorial adjustments.
Like Rockefeller's Classifieds, but for life-style and/or science-related advice!

Examples of relevant topics:
What is the fastest way to get from MSK Faculty Club to Rockefeller's Faculty Club?
I'm a new research assistant at Rockefeller, just moved to NYC, and I'm not really sure how to meet other research assistants/make friends across the Tri-I? Any advice?
I'm a wheelchair user, and I have a hard time accessing campuses through main entrances ... any advice on how I can best get where I need to go?
https://forms.gle/oTMHwQtcqf3movA89

Listening In
What is your favorite type of music to listen to? When doing lab work - be it at the bench, computational, or while writing - do you listen to anything? Take this ~1 minute survey to let us know what music, podcasts, or audiobooks you tend to listen to most!
https://forms.gle/sTMFgcWW2YomgXNT7

Advice Column Submission QR

Listening In Submission QR

WILL ARTIFICIAL INTELLIGENCE REPLACE BENCH AND COMPUTER SCIENTISTS?

By Maria Sierra

One popular topic buzzing around laboratory corridors is the debate on whether artificial intelligence (AI) could replace hands-on bench work. While AI has proven its worth in various domains like economics, customer service, and climate science, it makes you think – what are the real limits to these technologies? To what extent will human work and expertise remain indispensable, especially in places like laboratories or hospitals?

Here I discuss how AI is pushing forward ongoing research and creating new fields of study. I also explore if research jobs are at risk of being replaced by these automated technologies, and I delve into predictions as to where AI is expected to make significant advancements in 2024.

Photo by Logan Myler

AI for the benefit of humanity:

We do not need to look too far to witness how AI is making a difference in health sciences and research. In March 2023, Weill Cornell Medicine unveiled the Institute of Artificial Intelligence for Digital Health (AIDH)[1]. This initiative aims to enhance patient care, drive discoveries, and improve teaching by integrating AI into healthcare practices. Likewise, the Englander Institute for Precision Medicine (EIPM) launched the AI-Extended Reality (AI-XR) laboratory to bridge augmented, virtual, and mixed reality with AI. Through this effort, scientists could visualize and interact with collaborators and the data in real-time just as if they were in-person.

Unlike traditional AI, which analyzes information and makes predictions based on predefined instructions and structured data, generative AI (Gen-AI) has the unique ability to transform the same data into entirely new outputs, such as more human-like creation of content through text or images (e.g. ChatGPT or DALL-E). Gen-AI can help alleviate the workload of medical practitioners by assisting with clinical documentation as well as by aiding radiologists and pathologists in efficiently navigating through large sets of results, facilitating the identification of patterns within the data, and ultimately producing diagnoses.

One example of applied Gen-AI is Augmedix. Produced in collaboration with Google, this technology captures the natural conversation between a physician and patient, transforming it into accurate and comprehensive medical notes[2]. Physicians can then review and transfer these notes in real time to the hospital's electronic health records, ultimately saving time, reducing burnout in clinicians, and enhancing overall patient care.

Another application commonly used by wet-lab scientists to aid in experimental design is BenchSci, which uses AI to screen literature for published antibodies testing different experimental variables. Recently, BenchSci launched the ASCEND platform in collaboration with Google to produce knowledge graphs pulling results from an extremely large number of experiments. These graphs enable scientists to depict and understand complex connections in biological systems such as biomarkers, detailed biological pathways, and interconnections among diseases.

These examples illustrate how advancements in AI are playing a pivotal role in driving significant improvements in the fields of science and medicine. But to what extent will humans remain indispensable? Can AI replace the workforce in laboratories and hospitals?

Domain of knowledge:

"If AI wants to make all my buffers and do mammalian and parasite cell culture, be my guest" says one Reddit user when asked if scientists should be worried about being replaced by AI.

There is concern that AI is going to put people out of jobs. "If you're still using your hands, you won't be doing science," said Max Hodak, the co-founder of the biotech company Transcriptic in an interview with Science[3]. "But the brain of the biologist won't be replaced anytime soon, simply because the natural world is so complex."

Other researchers agree: Domain knowledge, critical thinking skills, and human creativity are key to scientific research and cannot be replaced with AI. "You can't just blindly swing the latest computational method at

a problem, out of the box. It doesn't work. You have to model the problem based on the right assumptions. And for that, biological expertise is indispensable," said Dr. Dana Per'er, chair of the computational and systems biology program at Memorial Sloan Kettering[4].

AI cannot contextualize and interpret data as well as a human, but it can serve to streamline the research process and free up more time for critical thinking and decision making. "Individuals with data science expertise will have more time to understand and implement other strategic decisions, as AI improves efficiency and reduces errors by minimizing human intervention," says Prashant Mishra, a finance and technology expert[5]. Repetitive tasks, like pipetting or DNA extractions, are already automated by technologies developed by companies such as ThermoFisher or Opentrons. But these processes can be complemented with AI to uncover patterns within large datasets or provide advanced analysis. AI can also be used to predict genome-wide variants, functions of cis-regulatory elements, or the 3D arrangement of DNA[6,7]. "These tools can be used to enhance productivity, but with expert oversight," recommends Dr. Ulysses Balis, Professor of Pathology Informatics and Associate Chief Medical Information Officer at the University of Michigan, in an interview with the Critical Values magazine. "[AI models] are good at recognizing patterns that have already been seen, but in terms of carrying out the scientific method of hypothesis generation and further investigation to come to a real answer, we're not there yet."

Based on this, we can expect that AI will augment and accelerate the rate of discovery without replacing human researchers. But what are the areas where we expect to see significant AI advancements in 2024?

Predictions for 2024:

According to Google, 2024 will be the year of optimizing administrative work in healthcare. AI technologies are already moving from trials to real world applications in administrative work to assist clinicians. AI is also expected to continue to advance personalized and precision medicine and gene therapies. In many fields of medicine, AI will be used to analyze patient data, improve surgical precision, and enhance post-operative monitoring[8].

Generative models are already being used for habitat and species conservation. For example, scientists are using AI to track wildlife populations and understand social dynamics. In addition, AI is being used to integrate different data types such as sequence data, imaging, and metadata. An example of this is the recent development of facial recognition models created to discriminate between geese with the hopes to study migration patterns: "Birdwatchers will someday be able to snap a picture of a goose, ID it, and share its location with scientists," says Sonia Kleindorfer, director of the Konrad Lorenz Research Center for Behavior and Cognition in Vienna, Austria[9,10].

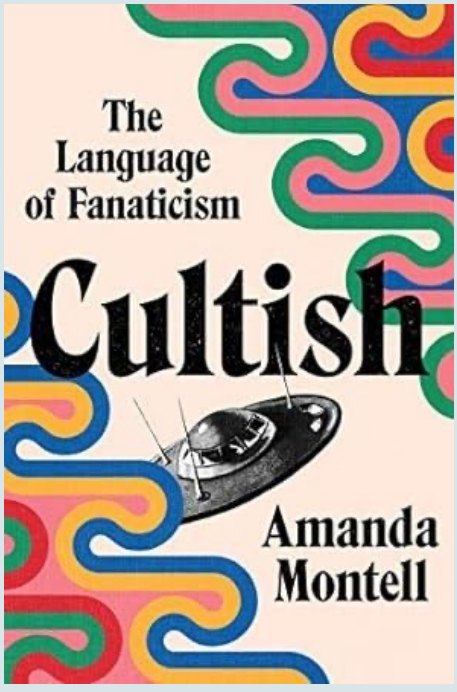
Likewise, Krista Ingram, a biologist at Colgate University in New York, developed the AI tool SealNet to identify individual harbor seals. Prior to this technology, "the only way to identify individual seals was by tagging them, but that was difficult." Now with SealNet, scientists just need a photo to ID seals with high accuracy, making it faster, easier, cheaper, and less stressful for the seals.

New language models like GPT-5 by OpenAI and Gemini by Google can further enable enhanced data curation by simultaneously filtering and reviewing thousands of research articles. AlphaFold by Google DeepMind is also anticipated to release their newest version in 2024, which is expected to more accurately predict structures for proteins, nucleic acids, small molecules, ions, and modified residues.

I believe that AI should be seen as a powerful tool capable of enhancing work, complementing and empowering research, and sparking new hypotheses and scientific discoveries. However, machines lack a fundamental quality that defines us: human ingenuity.

Book Recommendations (more on p6 & p13)

-Lola Neal



Cultish: The Language of Fanaticism by Amanda Montell answers your question as to why that SoulCycle class felt and sounded so so...right. Montell, the daughter of mosquito and fruit fly neuroscientist Dr. Craig Montell, will break down some of the most prolific instances of cult behavior in our recent history and show you how many of our modern joys follow similar frameworks. From the Jonestown Massacre to the "ascension" of Heaven's Gate to the crimes committed by the Manson Family, the language of each group will be assessed, compared, and contrasted. How does SoulCycle come in? Montell presents modern cases of "cult-ish" behaviors: fitness groups, multi-level marketing schemes, social media, and even Amazon. Yes, Amazon. If you need a refreshing, yet informative discussion on the human psyche and how we respond to words, check this one out.

NEW DIRECTOR MAY BRING POSITIVE CHANGES TO THE NIH

By Colin Burdette and Sarthak Tiwari

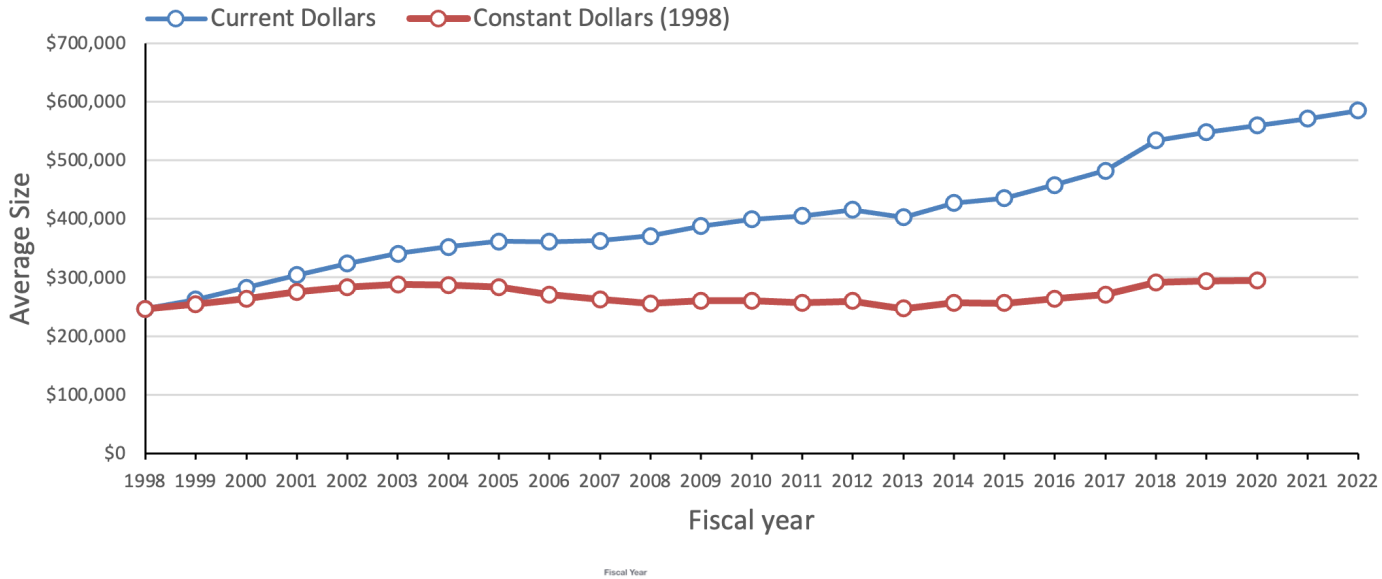
In 2023, the Tri-I received 1,056 grants—nearly $600 million in total—from the U.S. National Institutes of Health (NIH). While many members of the Tri-I community rely on such NIH funding, we represent just 1.5% of NIH-funded research. The NIH had a total budget of almost $48 billion last year, of which $40 billion was allocated for extramural research, while the rest was used internally. While there are certainly other sources of funding opportunities, common programs such as the NSF partition funding from a significantly lower total ($10 billion in 2023). These funds are critical for most biologically or medically oriented labs, but can we continue to rely on the NIH? How has the NIH changed over the last few decades, and what sorts of changes can we expect going forward?

The first thing expected to change is next year's funding. The NIH has requested $48.6 billion, an increase of about $1 billion from last year. However, the House and Senate have not agreed on any numbers so far, and the House voted on a resolution that only allocates $45 billion (a decrease of over 1%). The NIH also requested an additional $2.5 billion for a separate institution within the NIH, for different types of research funding. Concessions will likely be made, as lawmakers need to reach a budget agreement soon to avoid a government shutdown. Both houses of Congress have continually made short-term budget extensions to continue funding these agencies, but no clear guidelines have been established on NIH funding. As of January 2024, the Senate approved a 2% increase to the NIH budget, but it is unlikely that the House will agree to this. In the instance of a government shutdown, NIH funding for 2024 is at least guaranteed through March 7. Despite this lifeline, many government agencies along with the NIH will struggle to properly allocate funding, since it's unclear what the total budget will be.

The NIH comprises twenty-seven specialized institutes and centers, each focusing on different areas of health research. Once overall NIH funding is allocated to each of the twenty-seven institutes, each institute reviews and awards proposals related to its core research focus.

Dr. Monica Bertagnolli, M.D., was nominated by President Biden last May and approved by the Senate in October to lead the NIH. Dr. Bertagnolli grew up on a cattle ranch in Wyoming, and during her time as a researcher, she advocated for including rural populations and communities in clinical trials[1]. These areas are often under-serviced and offer unique environmental and cultural conditions that are not well studied or accounted for. Bertagnolli started as an attending surgeon near the Tri-I at the NewYork-Presbyterian Hospital in 1994[2]. She later became a professor of surgery at Harvard Medical School and faculty at the Dana-Farber Cancer Institute. She previously studied how inflammation drives colon cancer in mice[3]. This research led her to work on a large clinical trial for a Cox-2 inhibitor, a drug to reduce inflammation and potentially prevent polyps that could develop into colon cancer[4]. In 2022, she was appointed as the head of the National Cancer Institute (a subsection of the NIH)[5]. She revealed that she was a cancer patient herself when she was diagnosed with breast cancer just two months after assuming her position. Before heading the NCI, she had worked with the organization to facilitate the merging of several groups running cancer trials within the NCI. As NCI director, she unveiled new plans to cut cancer rates in half by 2047 and established a unit of the NCI to work on innovative approaches for clinical trials[2].

As NIH director, she aims to make the organization's research more equitable and accessible and make AI a bigger focus of future



Timeline of NIH R01-equivalent grants from 1988 to present. https://report.nih.gov/nihdatabook/report/158

biological research. In particular, she wants to build a learning health system that uses AI to find important patterns in Electronic Health Record (EHR) data. Currently, many labs conduct research using EHR data but often struggle with inaccessible or poorly formatted data[1].

Due to Bertagnolli's strong background in basic and translational science, as well as her previous work with the NCI, many people think she is a great choice for director. She was initially hesitant but decided to accept the role1. There are many internal problems at the NIH that Bertagnolli may address as she inherits this leadership role. Next year's funding is one of the organization's main priorities. Congress is unlikely to grant the NIH's request for a budget increase; in fact, its budget may decrease over the next two years. Another major challenge the NIH faces is postdoctoral research salary. In recent years, postdoc applications have slowed to a crawl6. While there are many factors, a major one is the massive pay disparity between postdoc positions and industry roles. Many labs want to pay more but are restricted by NIH policies. The NIH scale starts at $56,484 for the first year and increases by less than a percent each year[7]. This doesn't match inflation, and many industry positions can often pay two to three times as much. As more and more postdocs leave, valuable research goes unfinished. An internal report from the NIH recommends that the minimum salary be increased to $70,000; however, no action has been taken, and a 25% increase in the postdoc salary is unlikely given current budgetary constraints[8].

Another major issue that needs to be addressed is the award value of R01 grants. R01 grants are one of the oldest forms of grants used in the United States and fund everything from researcher salaries to lab supplies. While these are usually competitive, the grant amount has effectively not changed in over twenty years. An R01 grant equivalent in 1998 was worth $246,522. In 2020, the average size was $559,680[9]. Adjusted for inflation, this award size comes out to $295,014, an increase of effectively $50,000 over twenty years. Low award sizes may limit how many researchers can work on a project, ultimately lowering its scope. In the Tri-I, this award amount is slightly offset due to the abundance of cores and facilities that assist researchers without individual labs having to buy certain instruments. Nevertheless, increasing actual grant amounts should be a top priority of the NIH to promote larger-scope projects that reasonably prepare labs for the high costs of science.

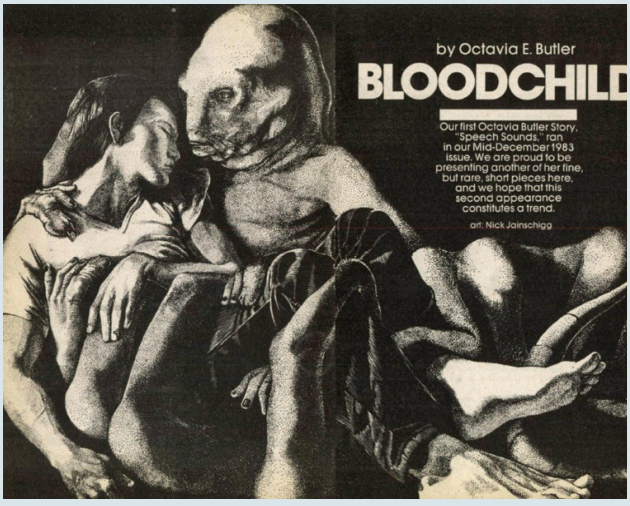
Another challenge the NIH currently faces is the allocation of funding regarding AI technology. AI is becoming increasingly important for biology research, and large databases are needed for training. On top of the data required, the model training process can also be prohibitively expensive without proper hardware. The NIH needs to decide how to allocate funds for these databases. There are many exciting prospects for future biomedical research, and the NIH will play a key role in helping to fund AI technology in a biological context.

While much is still uncertain about the NIH, a few things are clear. It will continue to be one of the largest sources of public funding in the U.S., especially in biomedical research. Because NIH policies and funding dictate the pace of research, understanding its position is crucial for understanding the research landscape. Current political tensions are particularly important for the NIH, and it is difficult to tell how this will affect future research projects and stipends. Bertagnolli has many difficult challenges to navigate, but her experience with science, clinical studies, and leading government agencies makes her a uniquely qualified leader who will play a major role in the direction of research in the U.S.

Under Bertagnolli's leadership, perhaps the NIH will undergo multiple positive changes that will enhance the capacity for groundbreaking fundamental and translational biomedical research. As for the near future, we can hope that researchers continue to seek and gain financial support from the NIH to conduct science for the benefit of humanity.

Book Recommendations (more on p6 & p11)

-Lola Neal



Bloodchild and other Stories, by renowned science-fiction writer Octavia Butler, will transport you into a world of fantasy where you can ask yourself, "what if those scientific 'what ifs' were true?" Explore symbiotic relationships between humans and aliens, a world with a cure for cancer but other dangerous genetic disorders run rampant, viruses that eradicate human speech, and a tale that finally addresses what the government will do in the presence of extraterrestrial life. Though these stories are mostly works of fiction, Bloodchild will draw parallels to our current world, our relationships with those perceived as "different", and what it means to develop treatments as scientists.

NEW WEILL CORNELL POSTDOC UNION TO BEGIN COLLECTIVE BARGAINING

By Alex Donatelle

On November 15th, 2023, postdoctoral fellows at Weill Cornell Medicine voted to unionize by a 99% majority of 328 to 4. Forming the union gives postdocs the legal right to engage in collective bargaining with the institution. Postdocs aim to use this right to improve workplace conditions through increased salary minimums, improved housing and childcare options, and guaranteed job security. Currently, the newly elected bargaining committee is collecting surveys to shape the union's priorities. They will then begin to negotiate their first collective bargaining agreement with the institution which will outline new employment rights and benefits.

Informal organization began in September 2022 among a small group of postdocs involved with the Postdoctoral Association (PDA) at Weill Cornell. In the past, postdocs have worked through the PDA to raise concerns with the Office of Postdoctoral Affairs. However, the institution is not required to bargain over issues brought forth by the PDA, which some postdocs believe has caused recent negotiations to proceed slowly.

"We felt we were voiceless," said Dr. Juan Rodríguez-Alcázar, a postdoc who helped form the union organizing committee. "With the union, the institution is legally obligated to negotiate the terms of our contract."

Over a year ago, the newly formed organizing committee began having what would become hundreds of individual conversations with other Weill Cornell postdocs to gauge interest in unionization and educate their peers on what the process would entail. They also began to assess the most important issues among postdocs for eventual bargaining. "Creating that network was the most difficult step," said Dr. Rodríguez-Alcázar. "It was a very slow process, but it was necessary."

The vote to unionize follows similar efforts by postdocs across the country. Unions at both Columbia University and the Icahn School of Medicine at Mount Sinai have offered guidance for the organizers at Weill Cornell. Following a successful authorization card campaign, the organizing committee notified the institution and registered with the United Auto Workers, a national union that represents more than 100,000 academic employees.

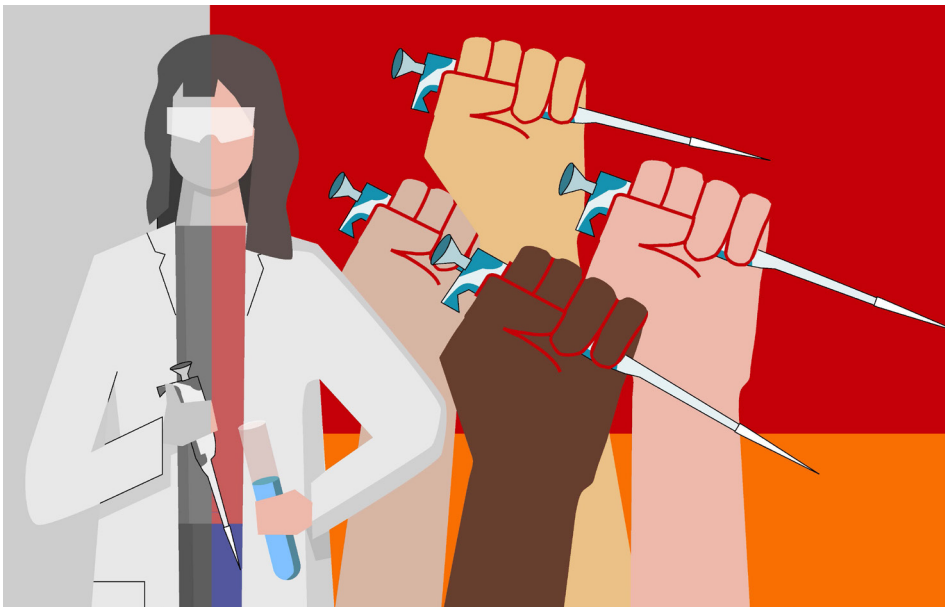


Illustration by Levan Mekerishvili

"As postdocs, the School often sees us as temporary, low-cost workers whose primary responsibility is to produce data and not as scientists with families and lives outside of the lab," said Dr. Caitlin Williams, a Weill Cornell postdoc seated on the union's bargaining committee. She emphasized that many of the issues the union hopes to address stem from the institution treating postdocs more as trainees than as full-fledged scientists.

Negotiating a higher institutional minimum salary will likely be a priority for the bargaining committee as it begins the process of drafting articles for a contract. Although Weill Cornell pays above the minimum established by the National Institute of Health, many postdocs find their wages to be insufficient to meet the cost of living in New York City. Unionized postdocs at Mount Sinai recently negotiated a collective bargaining agreement that established the highest minimum salaries for postdocs in the country. While postdocs can negotiate higher salaries with their supervisors on an individual basis, raising the institutional minimum salary would mean higher standards of compensation for the entire postdoctoral community.

Postdoc organizers active in the union also hope to improve housing and childcare options. Although Weill Cornell offers subsidized housing, many find that it is not affordable given the current salary minimum. Many parents find childcare options to be insufficient, particularly once children have reached schooling age and during school vacations. Weill Cornell guarantees postdocs only a minimum of 8 weeks of paid parental leave.

Organizers also aim to improve conditions for international postdocs, who must regularly fund their own travel in order to renew their visas. Other priorities include improving job security, lengthening contracts, and strengthening protections against harassment. The new union looks forward to the work ahead.

BRIEFING ON EZH2 RESEARCH IN THE TRI-I

By Eeshaan Rehani

Across a wide variety of cancer types, the overexpression of EZH2 is a well-documented phenomenon[1,2]. A type of histone methyltransferase, the EZH2 enzyme adds methyl groups onto specific residues on histones, the core proteins of chromatin coils. By methylating a specific type of histone, EZH2 inhibits the transcription of tumor suppressor genes, ultimately causing cancer cells to grow faster. Therapies that effectively inhibit EZH2 would be classified as epigenetic drugs. Rather than directly targeting individual factors that result in the growth and division of a cancer cell, epigenetic drugs target the gene expression mechanisms upstream of those factors. This allows the therapy to modify levels of cancer-causing factors without changing the patient's genetic sequence. However, epigenetic drugs are notorious for off-target effects, presenting a major challenge to current efforts in effective EZH2 inhibitor development.

Yaniv Kazansky

Dr. Rui Liang

In January of 2020, the FDA approved the EZH2 inhibitor tazemetostat for treatment of a rare type of soft tissue cancer, epithelioid sarcomas. However, tazemetostat has a few limitations: metastases to the central nervous system are unaffected by the drug, and the presence of certain orthogonal mutations desensitizes patients to the treatment. Recently, two Tri-I research groups demonstrated novel approaches to overcome these limitations, potentially improving the efficacy of EZH2 inhibition.

A project in the Tri-Institutional Therapeutics Discovery Institute (Tri-I TDI), led by Director of Medicinal Chemistry Dr. Rui Liang, identified a novel EZH2 inhibitor in 2022. Liang et al. used computational modeling and biochemical assays to discover an inhibitor that can cross the blood-brain barrier—a notable advancement, since the vast majority of pharmaceuticals can't cross the highly selective tight junctions that make up the barrier. This property is a result of altering the pyridone motif present in many EZH2 inhibitors. The compound Liang et al. developed is the first example of an EZH2 inhibitor that can enter the brain. Further experiments will be needed to optimize both their ability to cross the blood-brain barrier and their potency ahead of clinical trials.

Yaniv Kazansky is a Tri-I MD-PhD student researching drug-resistant cancer in Alex Kentsis' lab at Memorial Sloan Kettering Cancer Center. In a pre-print shared last December, Kazansky and colleagues provided insight into why some patients are resistant to tazemetostat. They identified specific mutations that underlie clinical resistance to tazemetostat using a functional genomics approach. Kazansky et al. found that mutations in the RB1/E2F pathway enabled cells to escape tazemetostat-induced cell cycle arrest in patients. The researchers then sought to target the mutated pathway to increase tazemetostat sensitivity using synthetic lethality: the principle that two drugs may be individually ineffective for a particular set of pathways, but effective when combined. Through the group's experiments, it turned out that the inhibition of three enzymes—CDK2, AURKA, and AURKB—improved tazemetostat's sensitivity in vitro. Their results showed that cell lines previously resistant to tazemetostat became responsive to tazemetostat used in combination with barasertib, an AURKB inhibitor. Kazansky et al.'s work helps pave the way for clinically validating what combinations of drugs are most effective to treat cancers that appear resistant to EZH2 inhibitors.

Recent research performed throughout the Tri-I has shown that EZH2 inhibition, although a promising treatment option for some cancer patients, will require further study and optimization. As many as 8% of soft tissue sarcomas metastasize to the brain, and Liang et al.'s research works to fill the gap in targeting this subset. In addition, cancer mutations rarely exist in isolation—Kazansky et al.'s work shows that resistance to EZH2 inhibitors often develops through mutations to the RB1/E2F pathway, but combination therapies leveraging this link show great promise for the future. Both of these groups are helping to push forward the field of epigenetic drugs for cancer.

PETS OF TRI-I: WE'RE NUTS ABOUT CASHEW

By Audrey Goldfarb

This month I had the pleasure of speaking with the adorable and rambunctious Cashew Carreiro, who took a pause from playtime to answer some questions about life at Rockefeller with her human mom, Jeannie.

Audrey Goldfarb: How did you and Jeannie meet?

Cashew Carreiro: My brother and I were getting ready to move out and decided to post a roommate request on Facebook. We were so excited! This city girl, Jeannie, took an interest in me and my brother. We decided to go our separate ways since I wanted a big city life, and he was looking for a suburban home. So, I packed my bags and moved in with Jeannie, my very own human!

AG: What's your favorite thing about living at Rockefeller University?

CC: I love to look outside while sitting on my tower! The view is beautiful—I see dogs at the park, boats on the water, and a tram crossing the bridge! Sometimes, if I am really lucky, a pigeon sits outside the window, and I get to tell them about my day.

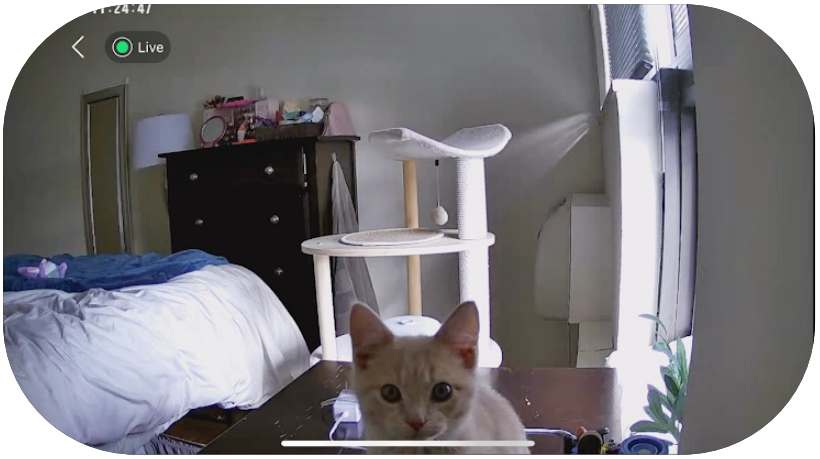
AG: Do you have a favorite toy?

CC: Jeannie makes the most wonderful toy out of recycled brown paper bags. She collects the twine handles and ties six of them together in one big knot! I call it my spider. It is so fun to play with, but she doesn't like me bringing it into bed at night (so annoying!).

AG: How do you keep yourself busy while Jeannie is away?

CC: I hate being alone. Jeannie has a camera that she uses to spy on me while she's away. I like to sit and stare at the camera, so she knows that I am unhappy she's gone and after some time she comes back—I think it's working.

AG: I understand you're afflicted by the "zoomies," a common but frequently disruptive hyperkinetic condition for cats your age. How do you handle a flare-up?



CC: Zoomies are much more manageable when both Jeannie and my best friend Izzy are around. They throw my toys so I can attack! Sometimes I attack their hands, but they forgive me, and we still have so much fun! My best advice for a case of the zoomies is to chase after a ribbon. A faster recovery is more likely if there's a bell attached to it!

AG: Have you been sticking to your New Year's resolutions?

CC: Since moving to New York, I have been wanting to explore the fashion scene. I recently got a few pieces to add to my closet and hope to expand my collection. In 2024, I hope to make it on the catwalk for my first ever fashion show! Wish me luck!

AG: Are you more of a rule follower or boundary pusher?

CC: I'm just a baby.

AG: Do you have any advice for newly adopted cats of the Tri-I community?

CC: Having a human is great. If you bite them, they give you toys. If you pluck the carpet, they give you scratch boards. If you hide under the bed, they give you a small cave to hide in—usually with a blanket. If you meow at your food bowl, they fill it. My advice is to get a human.

P.S. If your human has a pair of nail clippers in their hands the treat is not worth it! RUN. AWAY.

Call for submission

Pets of Tri-I

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 :)

https://forms.gle/xsURscT1k2gSUmMD9

Pets of Tri-I Submission QR

POETRY

By Kenny Bradley

A comfort poem after you finish an experiment

today is friday at 5pm, or imagine,
and i want you to remind your body
that it did a good day's work
today remind your body that it is enough
let every muscle fiber twitch down your knuckles
shock your nerve endings
marionette palms to your shoulder and hold yourself

feel comfort

embrace that you have made it again
and you made it again
and you made it again

feel comfort

today is friday at 5pm,
so i write an ode to living again
to the paycheck nestled behind the beeswax in my pocket
producing me honey

ode to the seagulls outside my window
diving for food in the east river who I share
dinner with, sorry in advance it
will taste like sewage

ode to the stillness bestowed only to
my body, interrupted by the brief
beginning of needle scratch
on vinyl so i may sing

and i have said it in a poem before
and i will say it again, ode to mug
of melted down hershey,
poorly drawn latte art,
and jet-puffed mini marshmallows
to revert to childhood

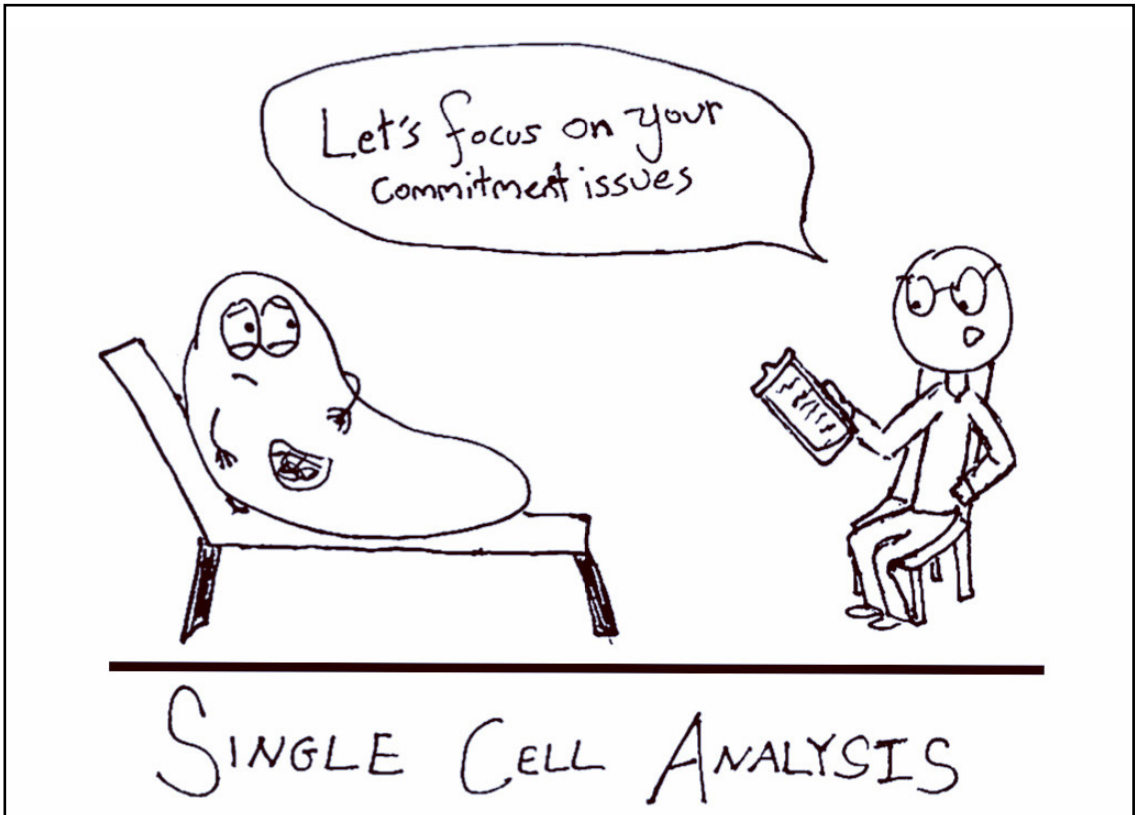
today is friday at 5pm, or imagine
and I

feel comfort

to just existing

Illustration by Bokai Zhang

THANK YOU, AND UNTIL NEXT TIME



Comic by Alex Stuart

2024 Feb Issue
Design & Layout by
Bokai Zhang

Editor-in-Chief: Audrey Goldfarb

Senior Editor: Izzy Seckler

Associate Editors:
Colin Burdette
Alex Donatelle
Lola Neal
Eeshaan Rehani
Angel Feliz
Maria Sierra

Webmaster
Sarah Foust

Design Team:
Bokai Zhang
Sarah Foust
Marina Schernthanner

Katherine Castillo
Ragavi Vijayakumar

Communications Managers:
Katherine Castillo
Lola Neal

Communications Team:
Ragavi Vijayakumar
Maria Sierra
Jeannie Carreiro

Copy Editors:
Angel Feliz
Eeshaan Rehani
Caroline Erickson
Charlotte Bell
Marina Schernthanner
Mia Haraguchi
Sarah Foust
Sofia Moraes
Lola Neal
Sarthak Tiwari

Interested in being part of our team? Reach us at naturalselections@rockefeller.edu!

REFERENCES

Henrietta Lacks' Immortal Story: When Science Forgets Humanity

In-text:

1. Alexis Carrel's Immortal Chick Heart Tissue Cultures (1912-1946) | Embryo Project Encyclopedia n.d.
2. Vernon 2019
3. Jim Crow and Segregation | Classroom Materials at the Library of Congress | Library of Congress n.d.
4. History of The Johns Hopkins Hospital n.d.
5. Baptiste et al. 2022
6. Skloot 2010
7. Tuskegee Study - Timeline - CDC - OS 2023
8. Puck & Marcus 1956
9. Puck et al. 1956
10. Young & Hodas 1964
11. Zhukov-Verezhnikov 1964
12. Mulford 1967
13. Hornblum 2013
14. Thaldar 2023
15. Ritter 2013
16. Skene & Brumfield 2023

Full:

Alexis Carrel's Immortal Chick Heart Tissue Cultures (1912-1946) | Embryo Project Encyclopedia. (n.d.). Retrieved January 31, 2024, from https://embryo.asu.edu/pages/alexis-carrels-immortal-chick-heart-tissue-cultures-1912-1946

Baptiste, D., Caviness-Ashe, N., Josiah, N., Commodore-Mensah, Y., Arscott, J., Wilson, P. R., & Starks, S. (2022). Henrietta Lacks and America's dark history of research involving African Americans. Nursing Open, 9(5), 2236–2238. https://doi.org/10.1002/nop2.1257

History of The Johns Hopkins Hospital. (n.d.). Retrieved January 31, 2024, from https://www.hopkinsmedicine.org/about/history/history-of-jhh

Hornblum, A. M. (2013, December 28). NYC's forgotten cancer scandal. https://nypost.com/2013/12/28/nycs-forgotten-cancer-scandal/

Jim Crow and Segregation | Classroom Materials at the Library of Congress | Library of Congress. (n.d.). [Web page]. Library of Congress, Washington, D.C. 20540 USA. Retrieved January 31, 2024, from https://www.loc.gov/classroom-materials/jim-crow-segregation/

Mulford, R. D. (1967). Experimentation on Human Beings. Stanford Law Review, 20(1), 99–117. https://doi.org/10.2307/1227417

Puck, T. T., & Marcus, P. I. (1956). Action of x-rays on mammalian cells. The Journal of Experimental Medicine, 103(5), 653–666. https://doi.org/10.1084/jem.103.5.653

Puck, T. T., Marcus, P. I., & Cieciura, S. J. (1956). Clonal growth of mammalian cells in vitro; growth characteristics of colonies from single HeLa cells with and without a feeder layer. The Journal of Experimental Medicine, 103(2), 273–283. https://doi.org/10.1084/jem.103.2.273

Ritter, M. (2013, August 7). Feds, family reach deal on use of DNA information. AP News. https://apnews.com/general-news-aebb5c9db32a4e208925a0f0e47917cb

Skene, L., & Brumfield, S. (2023, August 1). Family of Henrietta Lacks settles lawsuit against Thermo Fisher Scientific | AP News. https://apnews.com/article/henrietta-lacks-hela-cells-thermo-fisher-scientific-bfba4a6c10396efa34c9b79a544f0729

Skloot, R. (2010). The Immortal Life of Henrietta Lacks. Broadway Paperbacks.

Thaldar, D. W. (2023). Who would own the HeLa cell line if the Henrietta Lacks case happened in present-day South Africa? Journal of Law and the Biosciences, 10(1), lsad011. https://doi.org/10.1093/jlb/lsad011

Tuskegee Study - Timeline - CDC - OS. (2023, October 3). https://www.cdc.gov/tuskegee/timeline.htm

Vernon, G. (2019). Alexis Carrel: 'father of transplant surgery' and supporter of eugenics. The British Journal of General Practice, 69(684), 352. https://doi.org/10.3399/bjgp19X704441

Young, C. W., & Hodas, S. (1964). HYDROXYUREA: INHIBITORY EFFECT ON DNA METABOLISM. Science (New York, N.Y.), 146(3648), 1172–1174. https://doi.org/10.1126/science.146.3648.1172

Zhukov-Verezhnikov, N. N. (1964). Results of microbiological and cytological investigations on vostok type spacecraft (itogi mikrobiologicheskikh i tsitolo- gicheskikh issledovaniy na kosmicheskikh korablyakh tipa ' "vostok"'). http://archive.org/details/nasa_techdoc_19650002618

Navigating Health Equity Amidst the Gene Editing

1. Centers for Disease Control and Prevention. (2023, July 6). Data & statistics on Sickle Cell Disease. Centers for Disease Control and Prevention. https://www.cdc.gov/ncbddd/sicklecell/data.html
2. Sickle Cell Anemia News. (2022, July 18). Vaso-occlusive crisis. Sickle Cell Disease News. https://sicklecellanemianews.com/vaso-occlusive-crisis/
3. Mayo Foundation for Medical Education and Research. (2023, December 22). Sickle cell anemia. Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/sickle-cell-anemia/symptoms-causes/syc-20355876
4. CNN Health. (2023, December 8). FDA approves two gene therapies for sickle cell, bringing hope to thousands with the disease. https://www.cnn.com/2023/12/08/health/first-crispr-gene-editing-treatment-sickle-cell-disease-scn/index.html
5. Wang, Y., Huang, C., & Zhao, W. (2022). Recent advances of the biological and biomedical applications of CRISPR/Cas systems. Molecular Biology Reports, 49(7), 7087-7100.

FDA. (2023, December 8). FDA approves first gene therapies to treat patients with sickle cell disease. U.S. Food and Drug Administration. https://www.fda.gov/news-events/press-announcements/fda-approves-first-gene-therapies-treat-patients-sickle-cell-disease

6. U.S. National Library of Medicine. (2023, December 11). A safety and efficacy study evaluating CTX001 in subjects with severe sickle cell disease - full text view. ClinicalTrials.gov. https://classic.clinicaltrials.gov/ct2/show/NCT03745287
7. Pew Research Center. (2023, December 21). 5 facts about Black Americans and health care. Pew Research Center. https://www.pewresearch.org/short-reads/2023/12/21/5-facts-about-black-americans-and-health-care/
8. Gaskin, D. J., Dinwiddie, G. Y., Chan, K. S., & McCleary, R. R. (2012). Residential segregation and the availability of primary care physicians. Health services research, 47(6), 2353-2376.
9. Latoya Hill, S. A. (2024, January 11). Health coverage by Race and ethnicity, 2010-2022. KFF. https://www.kff.org/racial-equity-and-health-policy/issue-brief/health-coverage-by-race-and-ethnicity/
10. Nambi Ndugga and Samantha Artiga. (2023, April 21). Disparities in health and health care: 5 key questions and answers. KFF. https://www.kff.org/racial-equity-and-health-policy/issue-brief/disparities-in-health-and-health-care-5-key-question-and-answers/
11. CNN. (2023, December 8). Teen is one of the first ever to get his genes edited. why he says the process is "cool and freaky." YouTube. https://www.youtube.com/watch?v=0xv0CBujwZU
12. Kahn, J. (2023, September 19). CRISPR pioneer Jennifer Doudna has the guts to take

REFERENCES

on the microbiome. Wired. https://www.wired.com/story/crispr-jennifer-doudna-microbiome/
13. TED. (2023b, September 27). CRISPR's next advance is bigger than you think | Jennifer Doudna | Ted. YouTube. https://www.youtube.com/watch?v=HANo__Z8K6s
14. Normile, D. (2019, December 30). Chinese scientist who produced genetically altered babies sentenced to 3 years in jail. Science.org. https://www.science.org/content/article/chinese-scientist-who-produced-genetically-altered-babies-sentenced-3-years-jail

Will Artificial Intelligence Replace Bench and Computer Scientists?

1. Weill Cornell Medicine. (2023, March 10). Announcing the Institute of Artificial Intelligence for Digital Health. Population Health Sciences. https://phs.weill.cornell.edu/news/announcing-institute-artificial-intelligence-digital-health
2. Bevan, S. (2023, August 29). Improving clinician experiences: Augmedix collaborates with HCA Healthcare and google cloud to bring Generative AI to Hospitals. Augmedix. https://augmedix.com/resources/blog/improving-clinician-experiences-augmedix-collaborates-with-hca-healthcare-and-google-cloud-to-bring-generative-ai-to-hospitals/
Bohannon, J. (2017, July 5). A new breed of scientist, with brains of silicon. Science.org. https://www.science.org/content/article/new-breed-scientist-brains-silicon
3. Demsky, I. (2023, July 1). Fighting cancer with computers, math, and Artificial Intelligence. MSK News Summer 2023. https://www.mskcc.org/news/fighting-cancer-with-computers-math-and-artificial-intelligence
4. Mishra, P. (2023, June 24). Will artificial intelligence (AI) replace data science? really?. LinkedIn. https://www.linkedin.com/pulse/artificial-intelligence-ai-replace-data-science-really-mishra/
5. Williams, E. (2022, August 12). Meet Sei and Orca, the deep learning models used to predict DNA organization and function. Bioanalysis Zone. https://www.bioanalysis-zone.com/meet-sei-and-orca-the-deep-learning-models-used-to-predict-dna-organization-and-function/
6. Bates, S. (2018, December 3). Stanford researchers develop simple yet powerful model to predict DNA organization. Stanford News. https://news.stanford.edu/2018/12/03/simple-yet-powerful-model-predicts-dna-organization/
7. Mass General Brigham News. (2023, December 18). 2024 Predictions about Artificial Intelligence. Mass General Brigham. https://www.massgeneralbrigham.org/en/about/newsroom/articles/2024-predictions-about-artificial-intelligence
8. Kleindorfer, S., Heger, B., Tohl, D., Frigerio, D., Hemetsberger, J., Fusani, L., Fitch, W. T., & Colombelli-Négrel, D. (2023). Cues to individuality in Greylag Goose faces: algorithmic discrimination and behavioral field tests. Journal of Ornithology, 1-11. https://link.springer.com/article/10.1007/s10336-023-02113-4
9. BenchSci. (2023, May 25). BenchSci raises $95 million series D funding to enable drug discovery innovation at scale with its groundbreaking AI platform ascend. https://www.benchsci.com/benchsci-raises-95-million-series-d
10. Brumfiel, G. (2023, November 2). Enhance! HORNK! Artificial intelligence can now ID individual geese. NPR. https://www.npr.org/2023/11/02/1209948665/enhance-hornk-artificial-intelligence-can-now-id-individual-geese
11. Why AI won't replace laboratory professionals and pathologists. Criticalvalues.org. (n.d.). https://criticalvalues.org/news/all/2023/07/05/why-ai-won-t-replace-laboratory-professionals-and-pathologists

New Director May Bring Positive Changes to the NIH

1. Kaiser, J. (2023, November 22). Once reluctant, new NIH chief Monica Bertagnolli has embraced her leading role. Science. https://www.science.org/content/article/once-reluctant-new-nih-chief-monica-bertagnolli-has-embraced-her-leading-role
2. Stolberg, S. G. (2023, April 20). Biden Plans to Nominate Cancer Surgeon to Lead National Institutes of Health. The New York Times. https://www.nytimes.com/2023/04/20/us/politics/biden-monica-bertagnolli-nih.html
3. Steenhuysen, J. (2023, May 15). Biden picks cancer surgeon Monica Bertagnolli to head NIH. Reuters. https://www.reuters.com/world/us/biden-picks-cancer-surgeon-monica-bertagnolli-head-nih-2023-05-15/
4. Bertagnolli, M. M. (2007). Chemoprevention of colorectal cancer with cyclooxygenase-2 inhibitors: two steps forward, one step back. The Lancet Oncology, 8(5), 439-443.
5. NCI Press Release. (2022, October 3). Monica Bertagnolli becomes NCI director. National Cancer Institute. https://www.cancer.gov/news-events/press-releases/2022/bertagnolli-nci-director
6. Woolston, C. (2022, August 30). Lab leaders wrestle with paucity of postdocs. Nature News. https://www.nature.com/articles/d41586-022-02781-x
7. U.S. Department of Health and Human Services. (2022, May 4). "How much is NIH's annual stipend for a Postdoc with a fellowship award?" National Institute of Allergy and Infectious Diseases. https://www.niaid.nih.gov/grants-contracts/annual-stipend-postdoc-fellowship-award
8. Langin, K. (2023, December 15). NIH advisory group recommends $14,000 boost in postdoc pay. Science. https://www.science.org/content/article/nih-advisory-group-recommends-14-000-boost-postdoc-pay
9. U.S. Department of Health and Human Services. (n.d.). Research Portfolio Online Reporting Tools. National Institutes of Health. https://report.nih.gov/

Briefing on EZH2 Research in the Tri-I

The article is based on the following publications:

1. Kazansky et al - https://www.biorxiv.org/content/10.1101/2023.02.06.527192v2
2. Liang et al - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8919293/