

SIMONS FOUNDATION

# Annual Report

2022 Edition

New York

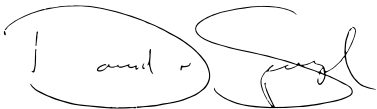
Thank you for your interest in the  
Simons Foundation's 2022 annual report.

In 1994, Jim and Marilyn Simons established the foundation in New York City to advance the frontiers of research in mathematics and the basic sciences. Ever since, the Simons Foundation has been a proud NYC philanthropy. We feel fortunate to call this city home.

This year, we take the opportunity to highlight just a few of the ways the Simons Foundation contributes to the city's fabric, intellectual life and worldwide reputation. From supporting NYC STEM teachers and engaging the public with science to funding local universities and hosting large-scale convenings, we are eager to contribute to the rich ecosystem of learning and knowledge that surrounds us. We hope you enjoy reading about how New York has enabled us to do amazing things and how we're giving back to this incredible place.

For additional media related to these stories, please visit this report's digital edition at **[simonsfoundation.org/report2022](https://simonsfoundation.org/report2022)** or scan the QR code below.

For more information on the Simons Foundation, please visit **[simonsfoundation.org](https://simonsfoundation.org)**.



David N. Spergel, Ph.D.  
President



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## LETTER FROM THE PRESIDENT

New York City is a *happening*. It's a place that welcomes us all. Someone once asked me, "If the Simons Foundation were a person at a party, who would it be?" My answer was that the foundation would be the host, and that we would be connecting interesting partygoers to new people. The Simons Foundation holds hundreds of meetings, workshops and conferences each year in fields ranging from pure mathematics to autism, bringing thousands of scientists to our buildings in Manhattan's Flatiron district.

With a mission to advance the frontiers of basic science, the Simons Foundation operates nationally and internationally — science is a global endeavor. Our past annual reports focused outward on the cutting-edge work of our grantee scientists and programs around the world. This year, we focus on our work here in NYC. This city is our home, and we thrive because of it. And we believe we help New York to thrive, too.

New York is an unrivaled place for scientific collaboration. The foundation invests in New York's great scientific institutions at the city and state levels, including Cold Spring Harbor Laboratory, Rockefeller University and Stony Brook University. In 2016, the foundation launched its own research entity, the Flatiron Institute. Located across the street from our grantmaking offices, the institute is already a leading center for computational science. As former director of its Center for Computational Astrophysics, I can say with confidence that the Flatiron Institute's breakout success would not have been possible without our partnerships with local universities.

Based in one of the most diverse cities on the planet, the foundation is working to create a more diverse scientific workforce. We reject the 'pipeline' view of STEM education with just one point of (early) entry to becoming a scientist — with those who exit that pipeline considered 'leaks.' Rather, science must be inclusive and regarded as a 'pathway,' with frequent on-ramps and connections to a wide range of careers. Our programs in NYC and beyond support students along their unique pathways from grade school through graduate school so they don't fall away from science due to lack of access or support.

Our largest such program supports more than 900 New York City middle and high school STEM teachers through Math for America, which the National Science Foundation is now using as a model for a planned national effort. In this report, you'll also read about BEAM, an organization that opens pathways into science for students throughout the city. Stony Brook University recently admitted the first class of Simons STEM Scholars — undergraduates from underrepresented backgrounds who will receive full financial and academic support. Additionally, we support many programs that broadly assist people from underrepresented backgrounds seeking Ph.D.s, including the American Institute of Physics' TEAM-UP program and the National GEM consortium.

We strive to further integrate science with culture and society by serving people outside science pathways through outreach. We publish the Pulitzer Prize-winning *Quanta Magazine*; support diverse cultural and educational programs in New York and beyond through our Science Sandbox program; and produce science documentaries through Sandbox Films, whose documentary *Fire of Love* was nominated for a 2023 Academy Award and awarded a 2023 Peabody Award.

As a native New Yorker born in Rochester, raised on Long Island and living in Manhattan, I am proud to lead the Simons Foundation's funding of basic science. It's a labor of love to support NYC as a great science city and to strengthen science and mathematics across the state. The Simons Foundation was one of the first scientific organizations to reopen its doors after COVID shutdowns, bringing staff back and resuming operations. We know it's important to be here.

Putting together this report was a fantastic reminder of how fortunate we are to be a New York organization. We hope you enjoy reading about how we're giving back to this incredible place.

David N. Spergel, Ph.D.  
President





## LETTER FROM THE CO-CHAIRS

Advancing the frontiers of knowledge through basic science is essential to human progress. Only through basic science can we gain the fundamental understanding of natural phenomena that enables innovation. But basic science takes time, and it requires a determination to persevere despite the uncertainty of achieving consequential results. Guided by curiosity and beauty, fundamental research pursues knowledge with the optimism that today’s insights may lead to impactful solutions for tomorrow’s conundrums.

The Simons Foundation understands the importance of investing in fundamental research. In 1994, when we started the foundation, we had little idea that we were establishing ourselves in one of the most fertile and collaborative cities for science. New York City — with its universities, research institutions, hospitals, science nonprofits and biotech startups — was already an influential science hub, rich in expertise and broad in talent. Over the years, New York’s scientific landscape has only continued to grow, providing a stimulating and productive milieu for fulfilling the mission of the Simons Foundation.

Today, thanks to New York City’s easy accessibility, the foundation has the ability to act as a convener, a role we relish, attracting outstanding scientists to meet, collaborate and do research. Thanks to New York’s remarkably large and diverse population, the foundation is able to draw inquisitive audiences with a craving for scientific learning. This 2022 annual report highlights just a few examples of the Simons Foundation’s efforts to build upon New York City’s legacy as a great city for science.

We hope you enjoy reading about our work!

Marilyn Hawrys Simons, Ph.D.  
Co-Chair

Jim Simons, Ph.D.  
Co-Chair

### CHAIRS’ 2022 RESEARCH CALLOUTS

Three fascinating, although further afield, projects to note this year are the Simons Array and Simons Observatory; the Simons Collaborative Marine Atlas Project (CMAP); and the ForwArd Search Experiment (FASER).

- The Simons Array in Chile has been collecting robust data on cosmic microwave background radiation for over a year. The Flatiron Institute’s Center for Computational Astrophysics has begun analysis of those data; published findings will follow. Construction of the adjacent Simons Observatory continues apace. Other countries have joined in supporting its construction, increasing the power of the instruments.
- The Simons Collaborative Marine Atlas Project (CMAP) seeks to identify environmental drivers affecting microbial life in our oceans. CMAP hosts an open-source data portal that provides access to all Simons-supported cruise data and model output, as well as biogeographical and biogeochemical data from numerous other sources, such as time-series and satellite products. Data are uniformly indexed by location and time, which enables co-localization of features across datasets, facilitating efforts to characterize the biogeography of marine microbes at basin and seasonal scales.

- FASER (ForwArd Search Experiment) aims to discover new particles, such as ‘dark photons,’ predicted by some of the dark matter theories. FASER is a device that can fit into a box 1 meter by 1 meter by 5 meters. The device was built in 2019–2020 and placed in CERN’s Large Hadron Collider (LHC) tunnel 100 meters under the Franco-Swiss ground border near Geneva. Copious data were collected by the FASER team before the LHC’s maintenance shutdown, and much more data will soon be collected. These data could help solve the mystery of dark matter!

These are just a few examples of the interesting research projects across the globe supported by the Simons Foundation. If you’d like to learn more, please visit [simonsfoundation.org](https://simonsfoundation.org).





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## Broadening Pathways to STEM Careers in NYC

Producing transformative science in New York City requires fostering a scientific workforce that reflects the city's incredible diversity. "If the only people working on science are drawn from a narrow community, we're missing out on tremendous talent," says Simons Foundation president David Spergel. The foundation's programs promoting diversity run the length of the STEM career pathway. Grade school programs support NYC students in mastering math and science. Collegiate initiatives such as Stony Brook University's Simons STEM Scholars Program help students from underrepresented backgrounds attain degrees and launch careers. Further down the pathway, post-graduate programs increase the diversity of up-and-coming research leaders. The Simons Foundation deeply believes that diversity among scientists promotes scientific innovation and excellence.



# BEAM IS BRIDGING THE STEM EDUCATION GAP IN NEW YORK CITY

Growing up in Brooklyn’s Bed-Stuy neighborhood, Jayden Gines knew he wanted to broaden his horizons, but he didn’t know how. Most kids from his neighborhood stay in Bed-Stuy after high school rather than going away to college. Gines recalls that when asked what he wanted to be when he grew up, he used to say, “I don’t know exactly ... but I want to be successful.”



Jayden Gines (right) attends a BEAM class in 2015. Gines went on to earn a degree in computer science from the University at Buffalo.  
*Credit: BEAM*

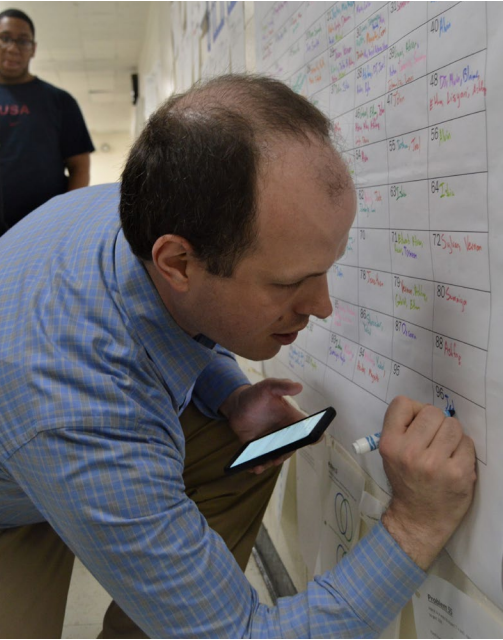
Gines is now well on his way to achieving that goal. After graduating from the State University of New York at Buffalo in the spring of 2023, Gines started as a software engineer at the preeminent investment company BlackRock in New York City. Reflecting on his journey from gifted teen to software engineer, he credits the Bridge to Enter Advanced Mathematics (BEAM) program, where he attended camp in 2015 and which has supported his journey in many ways since, including helping him land a BlackRock internship last summer.

“BEAM emphasized the route you have to take in order to build a career in STEM. Most people think you just go from middle school to high school to college, and that’s it, but they don’t tell you about the stuff in between, like the internships,” Gines says. “I feel like BEAM changed my mindset on things.”

Over the last 12 years, BEAM has served over 1,500 students like Gines. For over half that time, the Simons Foundation’s Science Sandbox has been a core supporter of BEAM in its mission to level the playing field by giving historically marginalized and low-income students the opportunity to learn advanced mathematics and ultimately become scientists, mathematicians, engineers and computer scientists.

## Shining a Light on BEAM

“I really think that we as a society have not been intentional about opening the doors to STEM achievement for students from marginalized backgrounds. That’s what BEAM tries to do,” says BEAM founder and director Daniel Zaharopol. After leaving a mathematics Ph.D. program to work in education, Zaharopol faced two unsatisfying options: “Go and use my math skills, but then I’d mostly be working with affluent kids, or work with kids from marginalized backgrounds, but then all the programs were remedial work.”



BEAM founder Daniel Zaharopol keeps a record of the 100 Problem Challenge at BEAM Discovery. Students earn a badge for completing a problem from the list of intriguing puzzle-like conundrums.  
*Credit: BEAM*



Instead, he taught classes online to get by, while conducting research on how to start an equity-focused math initiative focused on underserved students. Then in 2011, remembering his own math camp experiences, he started BEAM, a three-week camp outside the city with 17 seventh graders from nine partner schools. At these camps, BEAM students take advanced math classes and enjoy plenty of “open math time.” That self-directed time allows students to experiment with summer challenge problems and personal math explorations.

BEAM students — rising seventh graders from underserved partner middle schools — demonstrate aptitude and curiosity about math via an admissions challenge and teacher recommendations. In 2016, the program added a larger monthlong summer day program of math classes and activities for sixth graders curious about math, some of whom continue on to the more intensive sleepaway camp. The program’s alums receive continuing support, which includes tutoring, office hours, resume coaching, internship placements, college admissions advising and college support, and weekend SAT and life-skills classes.

As BEAM grew, John Ewing, director of Math for America, which is supported by the Simons Foundation, told Zaharopol about the foundation’s Science Sandbox program, which supports science in culture, especially in historically underserved communities. BEAM became a Science Sandbox grantee in 2016.

“The support from the Simons Foundation communicates volumes to the people who take this work really seriously,” Zaharopol says. “Often, when I’m



A BEAM faculty member leads students in a Rock, Paper, Scissors tournament to evaluate whether strategies can help you win at the seemingly chance-based game. Credit: BEAM

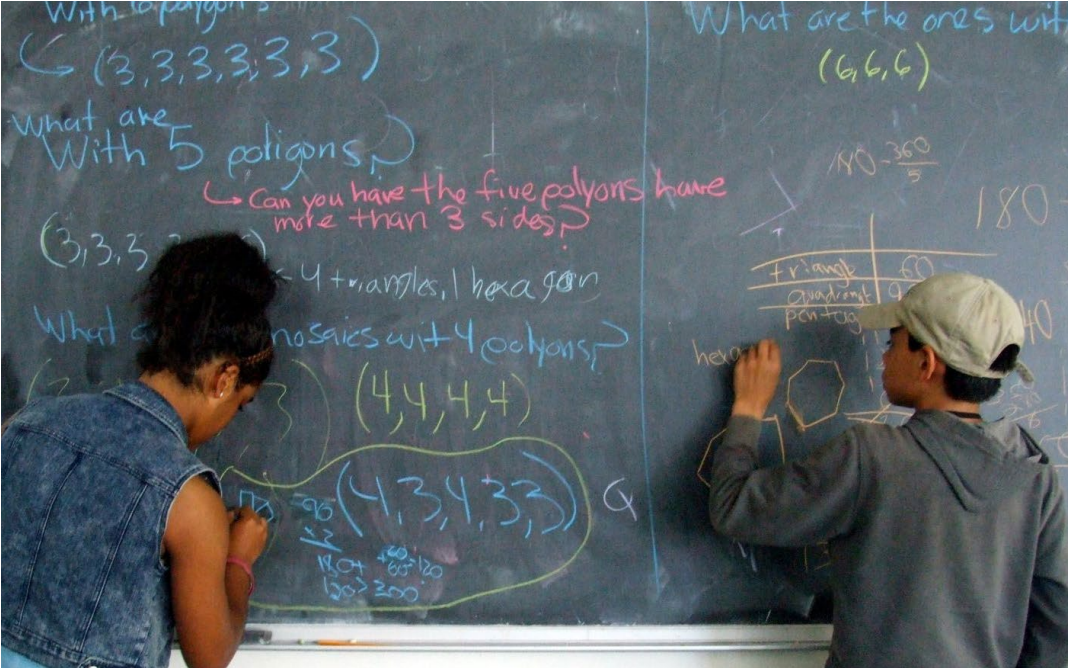
talking to a potential donor, they’ll ask if we’ve gotten support from the Simons Foundation. Being able to say yes gives them confidence in giving to us, too.”

BEAM faculty choose their subjects based on what is “fun math,” subjects such as number theory, logic and digital communications. “We’re not here to try and get them into geometry in eighth grade. We explore beyond what they’re going to see in school,” says Ruthi Hortsch, who went straight from finishing her math Ph.D. to working at BEAM. “You can only create space for students to push as far as they can if you have teachers who understand the possibilities beyond curricular topics.”

Exposing students to new ideas pays off. BEAM alumna Aisha Lhabaik, now in her final year at Northwestern University as a physics and mechanical design major,



BEAM Discovery students work together on problems during open math time. Credit: BEAM



Students at BEAM Summer Away learn about Archimedean tilings. Unlike regular tilings that can repeat a single shape (like a square or hexagon) to completely fill a surface, Archimedean tilings employ more than one regular polygon, with each meeting point having the same configuration. Credit: BEAM

took an electrical engineering course last year that closely tracked the seventh grade camp class that had inspired her career trajectory. In a full-circle moment, she spent a summer as a BEAM counselor and teaching assistant, an exemplar of the program’s effectiveness.

BEAM also helped Lhabaik apply to a top high school, the Manhattan Center for Science and Math, an hour-long commute from her Bronx home. Guiding students through the byzantine process of getting into a New York City public high school is crucial for families unfamiliar with testing requirements, application essays and the offerings of different schools.

“That’s where I think BEAM is very important,” says Gines, who attended the top-rated public college preparatory school Bard High School Early College thanks to BEAM. Many New York City high schools focus on pushing students through Algebra II, a state requirement for graduation, and only half offer calculus. Attending the prep school meant that Gines could take calculus as a high school junior and graduate college in three years with a computer science degree.

Over the years, BEAM’s scope has widened, expanding first to Los Angeles in 2017 and then nationwide in 2020. Wherever BEAM goes, its impact ripples beyond its alums to the educational ecosystem as a whole, says Queens math teacher Xavier Jackson, who teaches at BEAM in the summers. “This idea that you can bring kids into a challenging experience and get them working on something that they don’t know how to do is a thing that I bring from BEAM to my classroom,” Jackson says. “BEAM genuinely has had a direct influence on the way that I run my own classroom and the way that I connect with students.”



# MATH FOR AMERICA INSPIRES STUDENTS BY SUPPORTING INSPIRING TEACHERS

When the movie *Interstellar* was released in 2014, New York City biology and earth science teacher Benjamin Rivera showed his students a scene from the film about time dilation, a key component of Einstein’s theory of special relativity. He didn’t know it at the time, but the movie and the in-depth classroom discussions that followed would be remembered by some of his eighth grade students long afterward. Two students in that class even returned years later to tell Rivera that they had gone on to study astronomy and astrophysics in college.

“It was a great surprise to me,” Rivera says. “It reminded me how hands-on research, labs and class debates help students cultivate a passion for learning these topics more rigorously.”



Math for America Master Teacher Dwaina Sookhoo (second from left) teaches mathematics at the NYC Lab High School for Collaborative Studies in Manhattan. With support from Math for America, Sookhoo fosters racial equity in her classroom, school and community.

Over the years Rivera has found many ways to bring science to life: through movies, interactive experiments and excursions outside the classroom. He didn’t develop all of these techniques on his own, but rather in conjunction with New York City nonprofit and Simons Foundation grantee Math for America (MfA). MfA supports a diverse cohort of the city’s highly accomplished mathematics and science teachers, including Rivera, who receive four-year fellowships across various career stages that come with a teach-

ing stipend as well as access to grants, hundreds of professional development workshops and leadership opportunities. In return, these teachers bring what they learn at MfA back to their classrooms to influence hundreds of thousands of students in the city.

In 2017, Rivera was awarded an MfA Master Teacher Fellowship, which gave him the tools and resources to find new ways to inspire his students and broaden their pathways to STEM careers. “One of my goals is to help my students find the joy in learning science using a range of media,” Rivera says. “MfA’s workshops and my collaborations with other MfA teachers have given me new ideas to share in my classes.”

Rivera counts himself lucky to have seen so many of his students explore careers in STEM. Indeed, many of his former students cite their time in Rivera’s classroom as instrumental in their continued pursuit of science. For Rivera, there is no higher praise.

“It brings me great joy to know that students are using the theoretical lessons taught in class to encourage them to dive into the practical work this world needs today,” Rivera says.

In New York City, MfA provides a professional community for STEM teachers, with a goal of sharing and leveraging their combined skills. This paradigm increases teachers’ impact in the classroom — and beyond — but, importantly, also helps keep them in the classroom. Since 2004, the organization has invested more than \$300 million in the city’s teachers.

The professional development program consists of a variety of courses and workshops that are predominantly led by MfA’s own Master Teachers. This approach comes with key benefits: In addition to providing new resources and strategies, it allows teachers to build an active community with peers who share their passion for STEM education.

“Eighty-seven percent of the courses that we’ve offered this fall were led by Master Teachers in the program, which is an all-time high,” says Michael Driskill, MfA’s chief operating officer.

Through the turmoil of the COVID-19 pandemic, this peer-oriented programming has helped MfA’s teachers navigate a particularly trying time. For Dwaina Sookhoo, a 10-year veteran of the classroom and an MfA Master Teacher, MfA has been a lifeline. “I don’t think I’d still be teaching if it wasn’t for MfA and the community the program fosters,” Sookhoo says.

Sookhoo was first accepted into the MfA program in 2014 as an Early Career Fellow. She has taken and led a wide range of workshops applicable to her field and pedagogical interests through MfA. Through the early days of the pandemic, Sookhoo and her MfA colleagues led discussions and workshops about making remote learning more equitable. Now that in-person classes have



Math for America Master Teacher Shakira Provasoli of the Upper West Side’s PS 333 received the Presidential Innovation Award for Environmental Educators for her work on environmental science education.

resumed, Sookhoo is focusing on equity within the classroom through ‘complex instruction,’ an approach that leverages group work and cooperative learning to enhance education and social skills.

The MfA courses experienced by Manhattan primary school teacher and MfA Master Teacher Shakira Provasoli were also crucial to her teaching. This year she was asked to pivot from teaching environmental science across several grades to taking on all subjects in a single classroom of second graders. For years, Provasoli has used maps showing which areas of New York City have the highest temperatures to teach her math students about environmental racism. After taking an MfA workshop explaining how trees can be used to teach about the intersection of ecology and equity, Provasoli expanded and deepened her lesson, making it accessible to her second graders, which helped them see connections between tree placement and temperature.

“In the end, it can be so simple to show a map and ask a student what they notice,” Provasoli says. “Even a second grader can see colors on a map.”

As of October 2022, there are 909 teachers and 155 emeritus teachers in the MfA community, bringing the total corps size to 1,064. MfA teachers represent approximately 10 percent of the New York City STEM teaching population. About half of the MfA incoming cohort are teachers of color, building on MfA’s commitment to diversity, equity and inclusion.

Though MfA operates exclusively in New York City, its influence is expanding nationwide. In 2022, a pilot program modeled after MfA received federal funding approval for \$60 million annually over 10 years as a part of the CHIPS and Science Act, signed into law in August. Starting in 2023 with some 3,000 teachers in regional programs around the country, the program will offer professional development programs and teacher stipends. Eventually, the program plans to scale up to 50,000 teachers across America.

“We’re looking forward to seeing the pilot program up and running,” says John Ewing, president of MfA. “We hope we can continue to provide advice and consultations based on the wealth of experience we have running Math for America.”

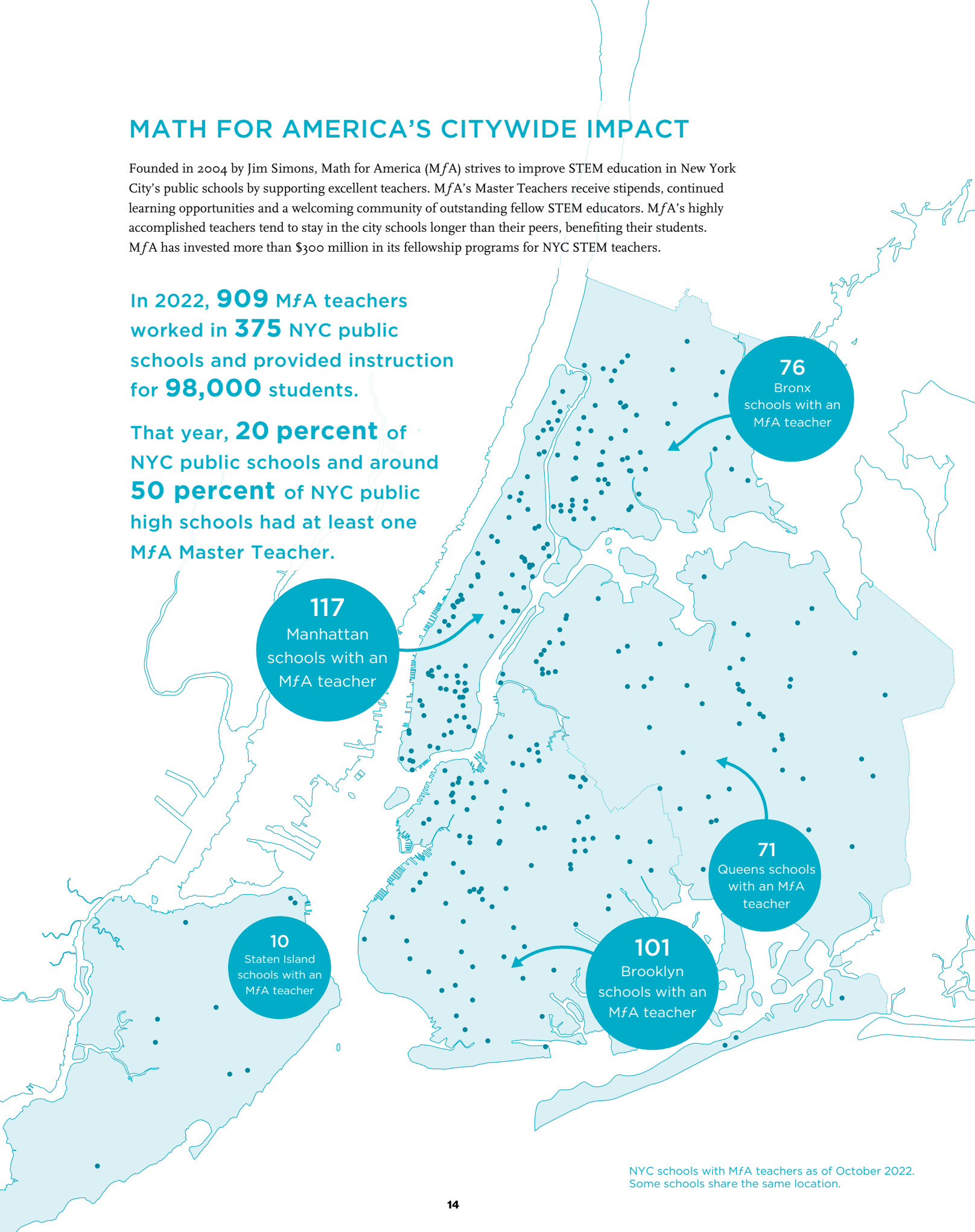


## MATH FOR AMERICA'S CITYWIDE IMPACT

Founded in 2004 by Jim Simons, Math for America (MfA) strives to improve STEM education in New York City's public schools by supporting excellent teachers. MfA's Master Teachers receive stipends, continued learning opportunities and a welcoming community of outstanding fellow STEM educators. MfA's highly accomplished teachers tend to stay in the city schools longer than their peers, benefiting their students. MfA has invested more than \$300 million in its fellowship programs for NYC STEM teachers.

In 2022, **909** MfA teachers worked in **375** NYC public schools and provided instruction for **98,000** students.

That year, **20 percent** of NYC public schools and around **50 percent** of NYC public high schools had at least one MfA Master Teacher.



# 2

## Engaging the Public With Science

"Why?" That single question can launch a lifetime of discovery. Why is the sky blue? Why do we sleep? Why are bubbles round? The Simons Foundation provides opportunities for anyone in the city to experience feelings of awe, wonder and curiosity about our world, and to forge lasting connections with science. The foundation's programs here in New York City — and beyond — have reached tens of millions of people and have received numerous accolades, including *Quanta Magazine's* 2022 Pulitzer Prize for explanatory reporting and Sandbox Films' Oscar nomination and Peabody win for its 2022 documentary *Fire of Love*. Science can and should play a central and meaningful role in our society and day-to-day lives. Sometimes all it takes is a new perspective on that foundational question: "Why?"



# QUANTA MAGAZINE’S 2022 PULITZER PRIZE WIN (A BACKSTORY)

In May 2022, *Quanta Magazine* editor-in-chief Thomas Lin and deputy editors Michael Moyer and John Rennie were meeting at the online publication’s offices in New York City’s Flatiron district when Moyer suddenly began messing with his phone. Lin assumed it was “breaking news or something,” but in fact, Moyer was frantically fact-checking a text he’d received from *Quanta* writer Natalie Wolchover, who was sick at home.

“She messaged from Queens, ‘Um, I think I just won a Pulitzer?’” Moyer laughs. “She felt confused because she was in a COVID fog. But I Googled it, and Pulitzer had tweeted it out. We were in shock.”

The *Quanta* team was stunned by the announcement that they, and notably Wolchover, had won the Pulitzer Prize for explanatory reporting. Months before, Lin had submitted to the Pulitzer committee *Quanta*’s coverage of the James Webb Space Telescope (JWST), which laid out the 30 years of hopes, funding mis-haps, delays, construction and research goals of the \$10 billion project.

“I think the best part about *Quanta* being awarded the Pulitzer is that this award is part of mainstream culture; it means recognition of science by society at large,” says Marilyn Simons, co-founder and co-chair of the Simons Foundation. “It means that not just a few people are interested in science. Anyone would be curious to know about the James Webb telescope and what we hope to learn from it.”

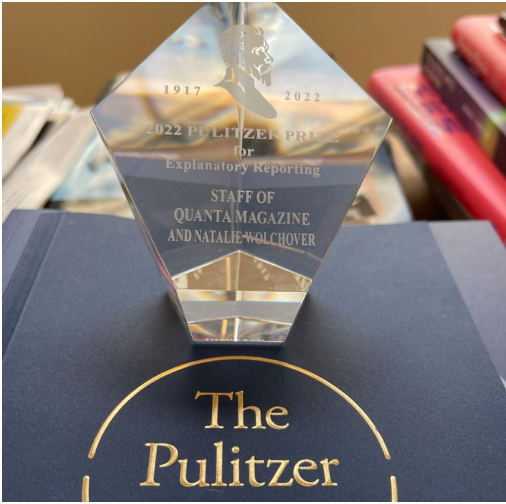
### *Quanta Magazine: a New York Story*

A deep dive into the complexities of the JWST’s development was a natural fit for *Quanta*. The editorially independent online publication of the Simons Foundation doesn’t shy away from tough topics in its mission to “illuminate science.” That ethos applied to the magazine’s predecessor at the foundation, Simons Science News, launched in 2012 also by Lin, who was previously a senior producer for *The New York Times*’ online science section. Initially, the staff included just Lin, Wolchover and web producer Aaron Biscombe.

Marilyn Simons, who at the time oversaw the foundation’s education and outreach programming, had long wanted the Simons Foundation to share the beauty of the scientific enterprise with non-scientists. She was particularly fond of the accessible reporting of the New York Academy of Science’s magazine *The Sciences*. To help realize that goal, she oversaw Lin’s transformation of Simons Science News into *Quanta Magazine* in 2013, with Emily Singer joining the team to cover biology.

*Quanta* covers fundamental science and mathematics — topics important to the Simons Foundation that receive little mainstream media coverage. “The idea was that a high-quality magazine that independently covered the areas of fundamental science would serve both the scientific community and also the public,” Lin says. “Obviously, the foundation cares a lot about these disciplines, and yet the public knows very little about them.”

Even when covering challenging topics such as high-temperature superconductors, number theory or a cutting-edge space telescope, the magazine’s staff keeps the content accessible and engaging to non-experts. Ten years after Lin started his journey with the Simons Foundation, *Quanta* now boasts 18 full-time staff and several dozen contributing writers.



The 2022 Pulitzer Prize for explanatory reporting presented to *Quanta Magazine* for an article about NASA’s James Webb Space Telescope written by Natalie Wolchover.



# A BRIEF HISTORY OF QUANTA MAGAZINE'S NATALIE WOLCHOVER

## The Story Behind the Story

The idea for what would become the 10,000-word JWST story arose organically while Wolchover was vacationing in the summer of 2021. “For years, every time I talked to researchers who had anything to do with astrophysics or cosmology, they would invariably bring up JWST as this upcoming — but constantly delayed — major game-changer,” recalls Wolchover, now a senior editor at *Quanta*. “Whatever they happened to be studying, it was always, ‘When we get JWST out there, we’ll be able to answer this question, or we will have data that will weigh in on this question.’ It suddenly occurred to me that this very obvious story existed.”

But because the telescope’s launch would be such a big deal, other media outlets would undoubtedly cover the story. The team needed to determine if and how *Quanta* should cover it. Moyer recalls asking, “When our mission is to share the journey of science with the general public, if the general public already knows about something, why should we write about it?”

So instead of just covering the new developments, the team resolved to create a definitive account of the telescope, from the project’s conception to its research potential. Through her reporting, Wolchover identified three main storylines: the engineering of the telescope, the history of exoplanet research and that of early-universe cosmology. Then she and Moyer figured out how to weave these three stories together into a six-section article. Then—senior video editor Emily Buder suggested creating a short documentary to accompany the long-form article, so she joined the project. The team was rounded out by then—graphics editor Samuel Velasco on infographics, web producer Caroline Lee on historical photos and then—art director Olena Shmahalo on visual direction.

After interviews with JWST’s lead engineer and many scientists involved with the project, Wolchover pored over documents, meeting minutes, white papers and written accounts dating back to the 1970s. She devoted six full weeks to the project. She knew she wanted readers to “be on the edge of their seats” for the telescope’s launch on Christmas Day 2021, which meant her article needed to be published before then.

“As I started my research, I quickly realized that the whole project was actually a huge risk: The telescope might not even work. It was an extremely expensive and bold project that could totally fail,” Wolchover says. “But it was also a high-risk, high-reward situation that I wanted people to fully appreciate.”

From an early draft of the story, Buder identified five interviewees for the documentary and flew to NASA’s Goddard Space Flight Center in Maryland, the University of California, Santa Cruz, and the Lick Observatory for background footage. Although she’d usually have brought a photographer with her, Buder, hired two years prior to build out *Quanta*’s video department, was so crunched for time that the team simply extracted stills from her video footage for the article’s photos.

With footage in hand, Buder crammed video editing, music and sound editing into one month so that the documentary could be released with the article. “Really, you need at least three months for something like that, so there were a lot of late nights and a lot of long weekends working on this,” Buder recalls.

At the same time, Velasco, with decades of experience under his belt, crafted four infographics that delve deeper into the universe’s history and the telescope’s engineering. “If somebody for some reason decided not to read the article and only look at the graphics, we want them to be understandable” by themselves, Velasco explains. “Graphics should be self-sufficient.”

## An Out-of-This-World Hit

When the video and article went up on YouTube and the *Quanta* site on December 3, 2021, they both quickly went viral. To date, the story has attracted 400,000 reads on the website, and the video has more than 2 million views.

Wolchover’s JWST story was just *Quanta*’s fourth long-form article, and the magazine now plans to publish one long-form article or series annually from each field it covers.

“It was really cool to see that this idea of *New Yorker*-style journalism — a story well told — about fundamental, basic research and math had appeal ... that there really was an audience out there looking for a deeper dive into developments that don’t necessarily have an application or relevance to their lives,” Wolchover says. “It turns out people are interested to know what scientists are figuring out about the universe.”

When she first picked up Stephen Hawking’s *A Brief History of Time*, 13-year-old Natalie Wolchover knew her life would involve physics.

“Within the first few pages, I was like, ‘This is what I care about,’” Wolchover recalls. “What captured my fancy was that the book gets at those deep questions physicists are ultimately trying to solve to come up with an all-encompassing theory of everything.”

Though she thought she’d become a career physicist like Hawking, Wolchover ended up becoming a top science writer. At *Quanta Magazine*, she has written over 200 articles that help non-scientists understand and follow developments in physics while celebrating the human stories that propel science. And in 2021, Wolchover wrote a Pulitzer Prize-winning article covering the history of time through the lens of NASA’s James Webb Space Telescope.

## The Early Cosmos

Wolchover’s writing conveys her sense of universality about people, a sense honed by a childhood at her family’s ranch outside Blanco, Texas, and summers

reading and exploring Europe with her father. These experiential extremes gave her an unusual perspective.

“It definitely shaped me to have two such different places and cultures that I was part of,” Wolchover says. “It gave me a sense of what aspects of humanity are innate versus what aspects are cultural or subjective, and maybe a sense of different modes of thinking in the world.”

Wolchover studied physics at Tufts University, and graduate school was the logical next step. But after four years at Tufts, with summers at the University of Oxford and the University of Bath, she needed a break from academia. So, she went to work on an organic farm in Texas, living in a tent. “The days were idyllic and focused on being outside and physical labor,” she says, but evenings were for applying to graduate school. The break paid off — Wolchover reported to the University of California, Berkeley the following year.



From left, *Quanta Magazine* deputy editor Michael Moyer, senior editor Natalie Wolchover, editor-in-chief Thomas Lin, art director Samuel Velasco, former director of video Emily Buder and senior engagement editor Matt Carlstrom at the Pulitzer Prize awards ceremony at Columbia University. Credit: Eileen Barroso/Columbia University



### Cosmic Expansion

Just a decade after her first encounter with physics, Wolchover had it made: She'd enrolled in the school of her dreams and was rubbing shoulders with world-class physicists. But on returning to Texas after her first semester at Berkeley, Wolchover had an epiphany. "I suddenly realized I didn't want to go back, and I didn't want to be a physicist. I wanted to be a physics writer." She stayed up that whole night researching science writing internships and agonizing over her decision. The next morning, she quit her graduate program.

By fall 2010, she'd moved to New York for an internship at *Popular Science*. There, the first piece to raise Wolchover's profile was an exploration of the 30-year history of the *Pioneer* anomaly. She wrote about how the *Pioneer* spacecraft were veering off course, explained the significance of the problem and dove into the scientists and their theories — not unlike in her eventual Pulitzer Prize-winning article on the James Webb Space Telescope. The *Pioneer* story helped her land her next gig at the website *Life's Little Mysteries*. Then she was recruited by the Simons Foundation for what would ultimately become *Quanta Magazine*.



Quanta editor-in-chief Thomas Lin (left) celebrates the magazine's Pulitzer win with Quanta senior editor Natalie Wolchover (center) and Simons Foundation president David Spergel (right).

"I remember having lunch with her and thinking that she is clearly very, very smart, very knowledgeable about physics, and had tremendous potential," recalls Quanta's founding editor, Thomas Lin. "I could see right away that she'd be great as our first staff writer."



Science journalist Natalie Wolchover.

### At Quanta Magazine

One of Wolchover's first *Quanta* stories explored a mathematical object called the amplituhedron that offers a geometric model of quantum field theory. The 2013 story went viral and was even referenced on Conan O'Brien's late-night talk show.

"One thing that I admire the most about Natalie is that she's fearless in terms of going into very difficult technical physics papers and really trying to understand them," Lin says. "She goes into very difficult intellectual territory and gives a firsthand report of what's happening on the frontiers of science."

Her writing has garnered many other awards: the 2016 Evert Clark/Seth Payne award from the National Press Foundation, the 2016 Excellence in Statistical Reporting Award from the American Statistical Association and the 2017 Science Communication Award from the American Institute of Physics. Her work has also appeared in *The Best Writing on Mathematics* and *The Best American Science and Nature Writing* annual anthologies.

Today, Wolchover is a senior editor at *Quanta* and lives in New York City with her wife and their toddler daughter. "To be a good science writer who's trying to explain really complicated things, you need a lot of empathy for readers, and what they know and don't know and what they care about," Wolchover says. "I think that that's my talent as a science writer, speaking to people in a language that they can understand. Maybe my life experience has helped me to do that."

## SIMONS FOUNDATION PRESENTS: COME FOR CONVERSATION, STAY FOR CONNECTION

Many Americans have never interacted with a scientific researcher because their worlds rarely intersect.

The Simons Foundation's Outreach, Education and Engagement (OEE) division is opening doors to new conversations with new people through Simons Foundation Presents, a series of discussions hosted at foundation headquarters in the Flatiron neighborhood of Manhattan. The events offer a fun, informal way for people to hear and connect with scientists personally. The scientists discuss their work before the audience and then hang out afterward at a reception, happy to chat with all the guests. The events tie science to society by putting researchers in discussion with artists, journalists or experts on social issues, drawing in people who may never have attended (or even been interested in attending) a science event before.

Simons Foundation Presents launched in 2018. "The series was initially created for the general public to engage with science in a way that might inspire them, or spark curiosity," says Elizabeth Simolke, OEE's program manager. Simons Foundation co-founder Marilyn Simons was a guiding force behind the program, Simolke says. "Her hope was that it would be a fun place for people to come on a Friday night — maybe even on a date night — just to start their weekend."

The presentations, which typically occur once a month, initially leaned more toward lectures by individual scientists explaining things like viruses, the solar system and the biology of love. Then, in early 2022, the foundation reimagined the series in its current format: the Simons Foundation's own community of researchers in dialogue with other experts.

Around a hundred people attend each event, and the events are not recorded or livestreamed in order to enable open discussion. And there is no longer a formal Q&A session. Instead, people casually chat, snack and exchange ideas during the post-panel receptions. "The reception is just as important as the conversation on-stage," says Ivvet Modinou, the Simons Foundation's vice president for outreach, education and engagement.

Among other things, Simons Foundation Presents events aim to humanize scientists and make science more approachable. An event in June 2022, titled "Labels and Lab Coats: Exploring Science Identity," aimed to counter stereotypes of scientists, instead presenting them as multidimensional people. One participant was Siavash Golkar, a physicist-turned-neuroscientist at the foundation's Flatiron Institute. "Growing up as an LGBT person in Iran is kind of rough," he says, and it was especially so for a teenager in the



From left, theoretical physicist Stephon Alexander, behavioral neuroscientist Aya Osman, computational neuroscientist Siavash Golkar and Simons Foundation vice president for outreach, education and engagement Ivvet Modinou during a June 2022 Simons Foundation Presents event called "Labels and Lab Coats: Exploring Science Identity."



1990s before the rise of online discussion boards. Today, he paints portraits in addition to working as a scientist. When young, he gravitated toward the artistic community as he felt that “the scientific community wasn’t as accepting of my entire self,” he says.

Golkar trained as a string theorist and says that when people think of string theory, they probably picture the nerdy Sheldon on *The Big Bang Theory*. He says the event’s goal was to communicate that scientists “are not this monolithic entity where we’re all science and nothing else.” He’d be happy if one attendee identified with someone on the panel, “or at least with the general struggles of people on the panel,” and felt less alone. “It would be fantastic if there was someone who said this is also possible for them.”



Poster House curator Angelina Lippert (left) demonstrates a button-making activation at the November 2022 Simons Foundation Presents event “Saving the Earth ... One Poster at a Time.” Credit: Arin Sang-Urai

Another event in October 2022, “Journeys Through Ciencia,” may also have helped recruit some future scientists. Examining the underrepresentation of Hispanic people in STEM, panelists Pilar Cossio, a Flatiron biophysicist; Delia Meza, an instructor at the New York Hall of Science; and Robert Fernandez, a biologist at Columbia University, Junior Fellow in the Simons Society of Fellows and co-founder of Cientifico Latino (see pages 26 and 50), discussed the importance of mentorship and family support. “I definitely want to attend others” as an audience member, he says of Simons Foundation Presents events, “because I like how they don’t go too heavy in the sciences. They talk about the human aspect of it.”



Simons Foundation Presents attendees mingle and converse during the drinks reception following the July 2022 “How Emotions Shape Our Memories” event. Credit: Arin Sang-Urai

Still other events show how science intermingles with culture and politics. The November 2022 event, “Saving the Earth ... One Poster at a Time,” explored a niche science communication format: posters. Abigail Bodner, a climate scientist at New York University and a Junior Fellow in the Simons Society of Fellows, discussed climate change research and how it’s been communicated over time. “As a scientist, I was really excited to do this,” she says. “I don’t have a lot of opportunities to branch out of my small scientific community.” She was joined by Angelina Lippert, the chief curator of Poster

House, a stunning museum and living archive of poster art and history in nearby Chelsea. Local comedian Kyle Marian Viterbo moderated the conversation.

Bodner thinks many people were drawn to the presentation for the art and then also ended up learning about science. Combining science and art isn’t easy, she says. But “I think they did a really good job of merging these two fields into what I felt was a cohesive story.”

Modinou highlights the uniqueness of the events. “This isn’t about what people are learning. This is about how people feel about science,” she says. “If you wanted to just learn facts, you can do that on the internet.” But the internet doesn’t put you face to face with scientists eager to discuss broader social issues over wine and snacks. Modinou notes one gauge of success indicating the events’ accessibility and broad appeal: people are coming back with friends.



Simons Foundation senior manager for diversity, equity and inclusion Craig Wesley (left), Simons Foundation diversity and inclusivity outreach manager for SPARK Jibrielle Polite (center) and child developmental scientist Brian Boyd (right) at the April 2022 “Black in Autism” Simons Foundation Presents event.



## ENGAGING EVERYONE WITH THE PROCESS OF MATH AND SCIENCE

A meaningful connection with science and mathematics doesn't have to originate in a classroom. From modern dance to boat building, dozens of projects supported by the Simons Foundation in New York City and beyond are inspiring people to reimagine the role science can play in their lives. Here's a look at just a few of those organizations.



**BioBus** operates mobile and brick-and-mortar labs that bring hands-on science to underserved students throughout New York City. Students from pre-K through 12th grade can peer into microscopes, participate in science projects on microplastic contamination and learn from practicing scientists. The Simons Foundation provided \$250,000 in funding for BioBus's 2022 programming. *Credit: BioBus*



Since opening in 2012, the **National Museum of Mathematics**, just across the street from Madison Square Park's north end, has welcomed visitors to enjoy exhibits and programs that stimulate inquiry, spark curiosity and reveal the mysteries of mathematics. In 2022, the Simons Foundation provided nearly \$1 million in funding to the museum. *Credit: National Museum of Mathematics (CC BY-NC-SA 2.0)*



**Rocking the Boat** gets youth in the South Bronx involved in activities with small boats on local waters — including boat building, sailing and environmental science — that serve as unique vehicles for teaching foundational STEM skills. The Simons Foundation provided \$100,661 in funding to Rocking the Boat for 2022 programming. *Credit: Rocking the Boat*



The **New York Hall of Science** (NYSCI) was erected in 1964 for the New York World's Fair. Since then, the Queens-based museum has become a world-class destination for learning and play. In 2017, with Simons Foundation funding (including \$499,999 for 2022 programming), NYSCI launched Queens 20/20, a multi-faceted initiative to provide STEM education opportunities to young people and families in Corona, Queens, a neighborhood that is home to many Latine immigrant families. The Simons Foundation also provided NYSCI with \$1.5 million in December 2021 to assist in its rebuilding after Hurricane Ida. *Credit: NYSCI*



Housed in a converted warehouse in Brooklyn's Red Hook neighborhood, **Pioneer Works** is a collaborative environment where artists, musicians, scientists and educators are given the opportunity to create together. With support from the Simons Foundation (\$537,533 for 2022 programming), Pioneer Works is rebuilding its science program development spaces and continues to host free live science events and publish podcasts. *Credit: Walter Włodarczyk/Pioneer Works*



**Sandbox Films**, a Simons Foundation spinoff, is a documentary studio in Manhattan's Flatiron district that seeks to illuminate the art and beauty of scientific inquiry. Its 2022 film *Fire of Love*, exploring the lives of volcanologists and lovers Katia and Maurice Krafft, was nominated for the Academy Award for Best Documentary Feature Film. *Credit: ImageEst*



Girls who participate in **STEM From Dance** choreograph a collection of technology-infused dances that awe and inspire, while learning about dance, computer science, electrical engineering and how they can all work together. STEM From Dance, based in Brooklyn, received \$136,000 in funding from the Simons Foundation for 2022 programming. *Credit: STEM From Dance*



The **Lewis Latimer House Museum** is located in the historic Queens home of Lewis Latimer, an inventor, an electrical pioneer and the son of people who escaped slavery. Latimer played a vital role in the electrical revolution, most notably by improving the manufacturing of lightbulbs. The museum's Tinker Lab Summer Camp offers hands-on science, technology, engineering, arts and mathematics education for the borough's families and students. The Simons Foundation awarded the museum \$46,600 in funding for 2022 programming. *Credit: LLHM*



## RESEARCHER ENGAGEMENT PROGRAM CONNECTS SCIENTISTS WITH SOCIETY AND CULTURE

Science doesn't take place in a vacuum. Although labs and what happens in them may seem abstruse and inaccessible to the general public, researchers are people and part of the world at large, influencing and influenced by culture. They have passions and draw from community and everyday experiences, and they hope to share widely what they discover. In this way, all of humanity is linked to, and part of, the scientific process.

That's the thinking behind the Researcher Engagement Program at the Simons Foundation. It's an initiative launched in 2022 to help scientists at the foundation communicate their work in new ways, and maybe even bring new people into computational fields. In its first year, the program has already produced some stunning works of art and helped several students from groups underrepresented in science apply to graduate school.

In 2021, Ivvet Modinou, vice president for outreach, education and engagement (OEE) at the Simons Foundation, and Elizabeth Simolke, OEE's program manager, surveyed members of the Flatiron Institute — the foundation's in-house research division, with about 200 researchers — to gauge their interest in outreach and found a strong appetite. Since then, the two have been meeting with researchers individually and in groups to identify what excites them about outreach and find good outlets for their enthusiasm.

A collaboration called "Sticky Settings" was one of the first projects out of the gate. Flatiron biophysicist Adam Lamson creates computer models of chromatin, the typical form our DNA takes inside our cells when wrapped around organizing proteins called histones. Life experiences can affect chromatin structure in a way that some scientists think affects the chromatin structure of offspring, altering gene expression across generations. For example, climate change and trauma might have such epigenetic effects.

The name "Sticky Settings" refers to the persistence of those epigenetic effects — in the form of small chemical additions that make some genes more



Flatiron Institute theoretical biophysicist Adam Lamson (far left) and attendees chat at the May 2022 Simons Foundation Presents event "The Sticky Space Between Art and Science." Credit: Arin Sang-Urai

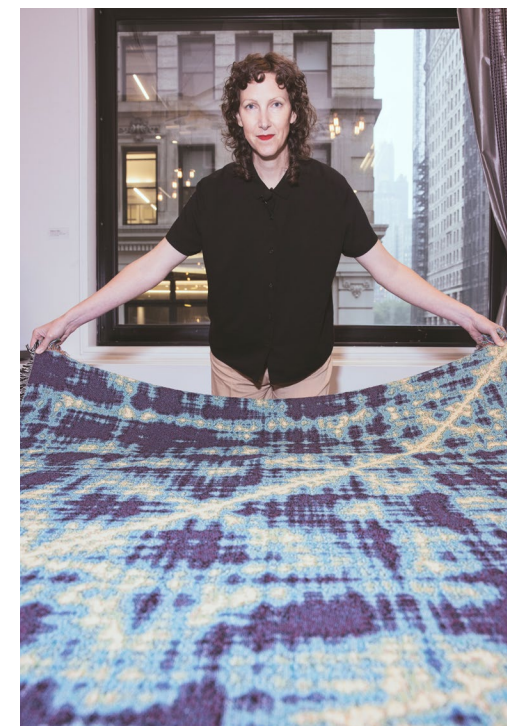
accessible than others — but also to the gooeyness or stickiness of biology. Artist Laura Splan playfully illustrates the processes of life, exploring computational translations and abstractions of the biological world. Modinou and Simolke paired Splan and Lamson over lunch, and they immediately hit it off.

Their resulting artwork currently consists of three elements. The first is a set of weavings reproducing 'contact maps' from Lamson's simulations — grids indicating how close each part of a folded-up chromosome is to each other part. The second is a pair of computer animations of chromosome segments floating in space, with the atoms or chromosomal units replaced by reflective pearl-like spheres. In one of the animations, the shiny atoms reflect a computer-generated mountain landscape. The third element is a soundscape in which they translated a contact map into a set of audio frequencies.

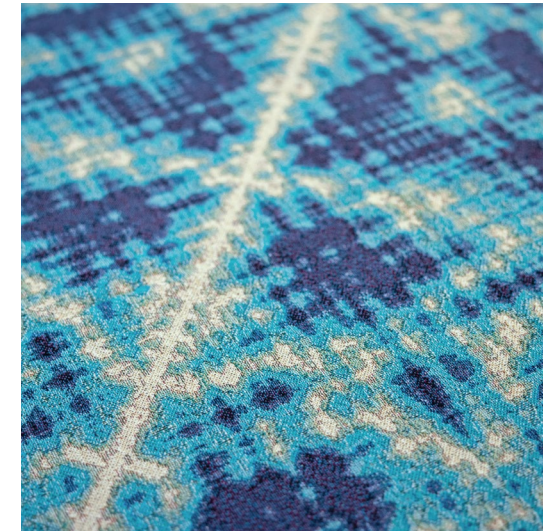
Lamson says people don't expect science-based work to please aesthetically. "Then you show them, and you get this kind of surprised, like, 'Wow, that's really beautiful.' And then I tell them this actually corresponds to my data. Then they ask what it means." It opens a window to talking about chromatin. The work has also advanced Lamson's own understanding of the science. Blowing up a contact map to wall-sized helped him notice a subtle feature, and the animations have given him a better intuition for the folding process.

Splan has a similar approach. "I'm interested in creating a sensory engagement with the biological world and creating something that piques people's curiosity," she says. The work allows her and Lamson to talk about the basic science of the project and explain why it matters.

In May, Lamson and Splan talked to a public audience about their project at a Simons Foundation Presents event. They went on to present an immersive animation and soundscape in Sydney in December at a surround-sound venue called the UTS Data Arena. The duo has also been interviewed for the podcast *Science Friday*, and they plan to show the project at the planetarium at the Vanderbilt Museum on Long Island. They want



Transdisciplinary artist Laura Splan holds up a "Sticky Settings" weaving.



A close-up of a woven scientific visualization generated from computational biology simulations created as part of the "Sticky Settings" science-art collaboration.

to share "Sticky Settings" even more broadly, but they're also still collaborating. According to Splan, "every time Adam and I meet, we come up with like a hundred new ideas."

To foster more such collaborations, Modinou and Simolke created a dinner series called Creative Collisions. They invite Simons researchers and local artists for an evening of exploratory conversation. So far, they've had three themed events: one on dance, one on poetry and one on data visualization. Modinou says they're informal, just six scientists and six creatives — and no agenda. It's a form of "professional match-making," she says, but "worst-case scenario, they have a great meal and they go home."

The second dinner led to a nascent collaborative project called Open Interval, in which two Flatiron scientists were paired with two choreographers affiliated with the nearby Gibney Dance. LaToya Anderson, an associate research analyst at the Flatiron's Center for Computational Quantum Physics, has begun conversations with dance and theater artist Raja Feather Kelly. Kelly is now developing a show called *The Absolute Future* about eclipses, both astronomical and metaphorical, and has learned a lot of new science from Anderson. "The more I get to talk with LaToya and other folks, the more my mind expands," he says. "It's a whole other chasm of information to draw from." Anderson, whose first bachelor's degree was in dance, sees science and art as deeply intertwined. "Because I've done both, I see how one can inform the other," she says. "We need all of these tools to help us process what's going on in our world."



Nine of the students who were mentored by Flatiron Institute researchers, SFARI scientists and Junior Fellows in the Simons Society of Fellows as part of the Científico Latino Graduate Student Mentorship Initiative. The initiative aims to help New York City students from underrepresented backgrounds get accepted into STEM graduate school programs.

The Researcher Engagement Program also aims to bring new voices into the scientific community. Program participants started working with a STEM organization called Científico Latino on its Graduate Student Mentorship Initiative (GSMI). In 2022, 11 Flatiron scientists guided underserved students through the application process for master’s and doctoral programs. Students also received help with paying fees for applications.

“I think it’s important to help students from different backgrounds to accomplish their academic dreams,” says Robert Fernandez, a biologist at Columbia University, a Junior Fellow in the Simons Society of Fellows and a co-founder of Científico Latino. Mentors gain something, too. In the post-event survey, one scientist said their mentee was “inspiring.” Natalie Sauerwald, a Flatiron computational biologist who worked with a senior at Hunter College applying to Harvard University, Princeton University and other schools, felt similarly. “Applying to grad school is a very complicated and daunting process, especially for first-generation kids, so I think it’s a really fantastic program,” she says. “It’s a great use of all the institutional knowledge that Flatiron has.”

# 3

## Supporting Cutting-Edge Research in New York

For science, New York City is a place like no other. The region’s depth, breadth and excellence in research are truly unmatched. For the Simons Foundation, a home in NYC enables us to attract exceptional talent, support cutting-edge research and do incredible things. From 2016 through 2021, the foundation provided more than \$300 million to the city’s top research organizations, academic medical centers and universities, and over \$460 million to science organizations statewide. And when the Simons Foundation was establishing its Flatiron Institute, an internal research division devoted to computational astrophysics, biology, mathematics, neuroscience and quantum physics, there was only one place that qualified: New York, city of dreamers and doers.



# FLATIRON INSTITUTE MACHINE LEARNING SUMMER SCHOOL TRAINS NEXT-GEN RESEARCHERS ON AI

Among the spectators at the Nathan’s Famous International Hot Dog Eating Contest on Coney Island last summer were a group of 10 graduate students. They had come to New York City from places like India, Germany and California for summer school at the Simons Foundation’s Flatiron Institute, and algorithms were on the agenda. And they had also come to experience New York — to see for themselves New York phenomena like the stunning and perplexing spectacle that is a hot-dog-eating contest.

The Flatiron Institute, the research division of the Simons Foundation, works to advance basic scientific research through computational methods. During the 2022 summer school session, students learned to use the cutting-edge data analysis methods known collectively as ‘machine learning’ to address some of today’s most pressing scientific problems.

Over the past 10 years, machine learning’s role in both science and everyday life has ballooned. With these methods, computers scan vast, complicated datasets looking for patterns that can help make predictions. The algorithms can look through so much data at once that

they see patterns other approaches would be likely to miss. Flatiron scientists create and use machine learning programs to study the human brain, the human genome, biological processes, quantum systems and even the universe. Private industry uses machine learning for everything from drug discovery to predicting battery life in electric cars to estimating the volatility of financial markets.

Still, because machine learning in science is so new, only a few universities teach it at the level needed for scientific research, giving patchy access to the next generation of scientists. “The Flatiron Institute has a special potential to drive change here,” says Shirley Ho, who spearheaded the summer school and is a scientist at the Center for Computational Astrophysics at the Flatiron Institute. Few places have the resources the Flatiron Institute has to offer: the number of interdisciplinary scientists with expertise in machine learning ready to teach, and sheer computing power. “We wanted the summer school to educate the next generation and also make contributions to research,” Ho says.



The students of the Flatiron Machine Learning X Science Summer School pose for a group photo with some of the program’s mentors and organizers.

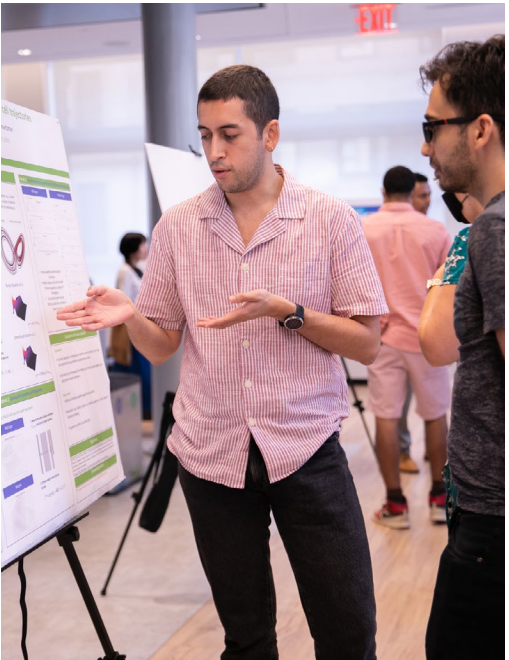


Ho organized the program with fellow Flatiron Institute scientists Miles Cranmer, Domenico Di Sante, Michael Eickenberg, Siavash Golkar and Natalie Sauerwald.

Cranmer, a Ph.D. student at Princeton University, describes the program’s goals as “giving science students exposure to machine learning, teaching machine learning methods specific to science, and getting computer programming students immersed in science.”

The students joining the 2022 summer school arrived at the Flatiron in June with a mix of academic backgrounds. Some, like Thomas Pfeil, a Ph.D. student at the Ludwig Maximilian University of Munich, were science students with little exposure to machine learning. Others, like Ameya Daigavane from India, a Ph.D. candidate at the Massachusetts Institute of Technology, knew machine learning but weren’t sure how to apply it in science. “I always wanted to be a scientist,” he says. “The summer school showed me what kind of scientific problems people are focusing on.”

Machine Learning Summer School opened with two weeks of lectures on topics ranging from the nuts and bolts of code writing to machine learning’s application in fields like astrophysics and genomics. “At the Flatiron, you have very different research projects in close proximity to each other, and they often mingle at a deep and meaningful level. It broadened the students’ perceptions of what they could do



Summer school student Jaime Cascante Vega of Columbia University (left) talks about his research with Siavash Golkar of the Flatiron Institute’s Center for Computational Neuroscience (right).



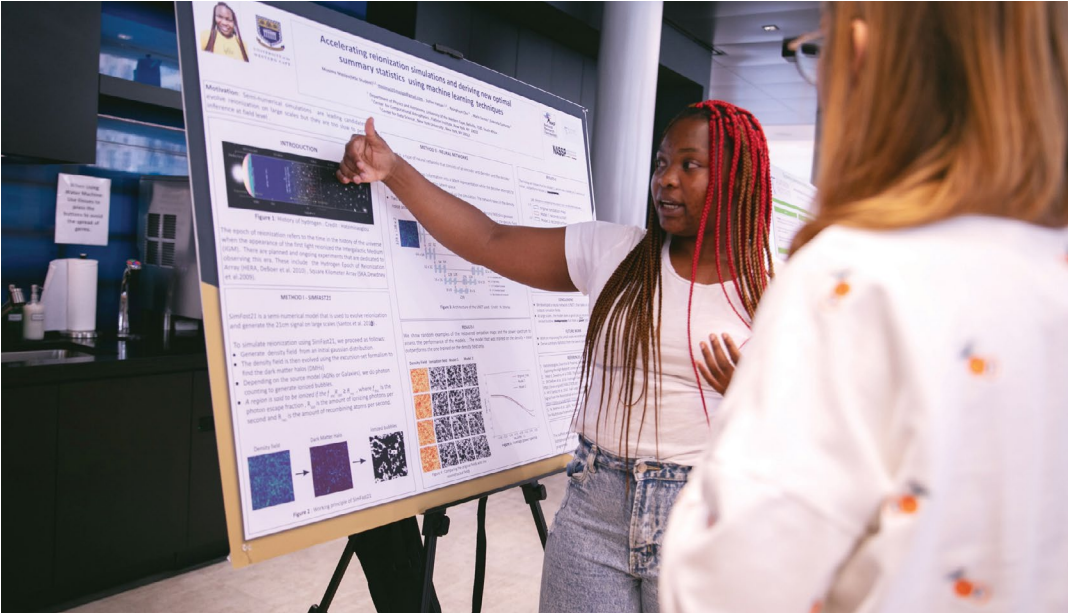
Summer school student Israel Biniam of the University of Maryland (left) chats with Simons Foundation president David Spergel (right).

with machine learning,” says Golkar, a scientist at the institute’s Center for Computational Neuroscience. After the two weeks of lectures, students spent six more weeks working on a research project with a New York City mentor, typically a scientist from the Flatiron Institute, including the school organizers.

“That was the highlight for me, seeing how machine learning was used to tackle different problems, like galaxy evolution,” says Mosima Masipa, a master’s student at the University of the Western Cape in Cape Town, South Africa, who left her home country for the first time to attend the summer school.

Organizer and mentor Sauerwald, of the Flatiron’s Center for Computational Biology, uses machine learning to pinpoint genetic factors behind disease. “Bringing diverse students and mentors together led to conversations that gave me a new perspective on my own research. I was able to better understand how to make a model that I’m working on more efficient,” she says.

At the end of the six weeks, students shared their research at a poster presentation, and several have even published research papers on projects they started at the summer school. Pfeil, for example, published an article on a machine learning method to model planet



Summer school student Mosima Masipa of the University of the Western Cape in South Africa presents her research at a poster session.

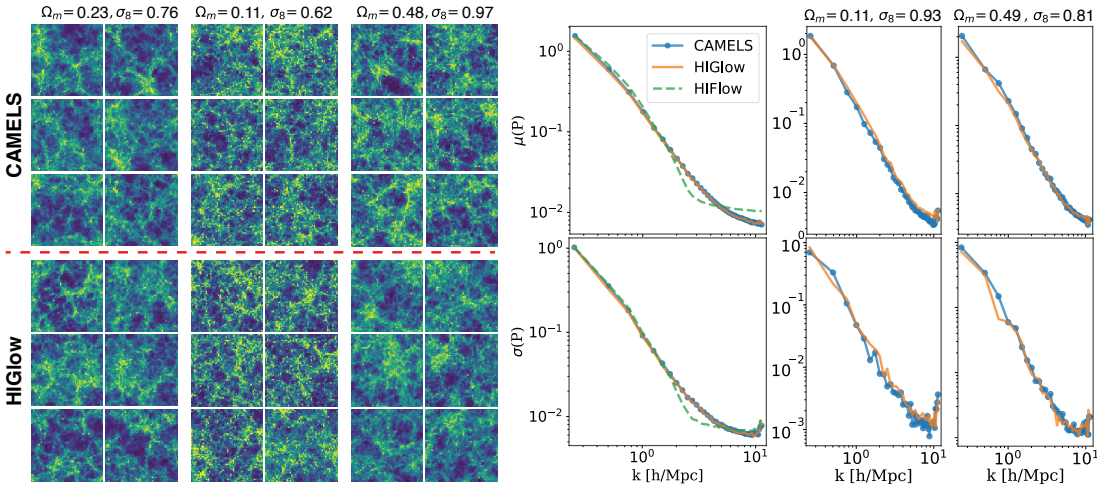
formation. “Earlier models had to leave out important details about the sizes of dust particles in order to run in a reasonable amount of time. Machine learning models can incorporate these details and run about 100 times faster,” Pfeil says. Daigavane published a paper on a method that could speed up simulations of systems with many interacting molecules. “Machine learning can be especially useful for understanding systems with many interacting parts, like when the different residues in proteins interact during protein folding, for example,” Daigavane says.

Outside of summer school, the students explored New York City via foundation-sponsored outings like a trip to the American Museum of Natural History and the

one to the hot-dog-eating contest. “New York City is vibrant, bustling, people are always out, there is something for everyone,” says Daigavane, who marveled at going shopping at a store devoted just to board games only a few blocks from the Flatiron Institute.

“Flatiron is a hub for research in the New York region,” Sauerwald says, “and the summer school brought even more scientists together.” “The school was great for the city and for science,” Ho says.

“This summer school was one of the most eventful times in my life, exploring the city together, visiting museums, Central Park and jazz clubs,” Pfeil says. “I would love to come back.”

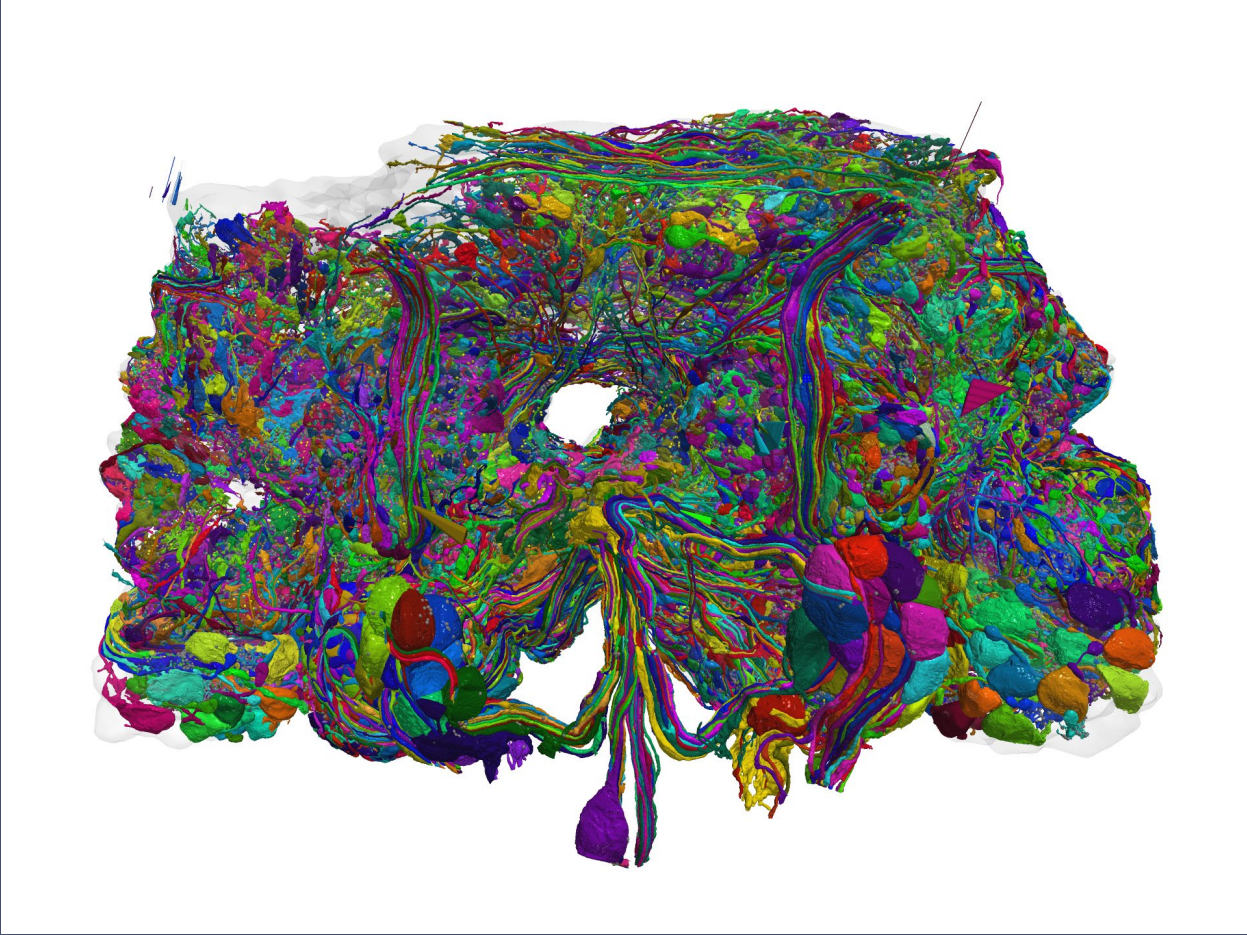


Summer school participant Roy Friedman and mentor Sultan Hassan used machine learning to efficiently predict the universe’s distribution of neutral hydrogen (one proton orbited by a single electron) on cosmological scales. Mapping neutral hydrogen is vital to reconstructing the universe’s structural evolution and understanding the nature of dark matter. Their model, HIGlow, agreed better than did an existing model called HIFlow with simulated universes generated by the Flatiron Institute’s CAMELS project. Credit: Roy Friedman, Sultan Hassan

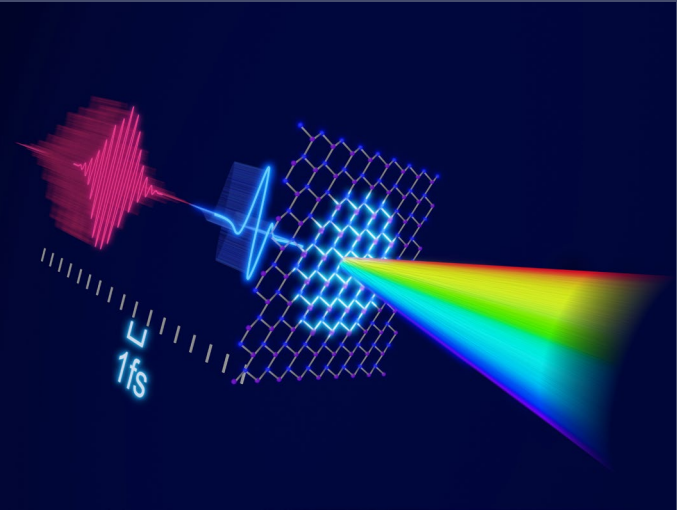


# A LOOK AT THE FLATIRON INSTITUTE'S GROUNDBREAKING RESEARCH

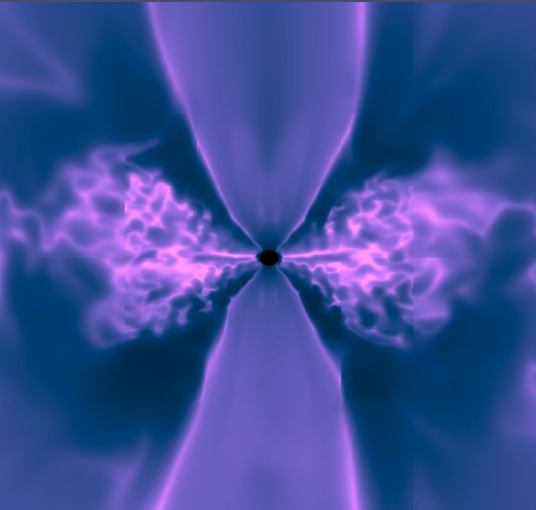
Around the globe, scientists are struggling to keep up with the enormous datasets research can generate. At the same time, computing advances offer unprecedented potential for discovery. In 2016, the Simons Foundation launched its in-house research division, the Flatiron Institute, to rise to those challenges and opportunities. The institute has since grown into a bustling hub for computational science, with hundreds of researchers working on problems in astrophysics, biology, mathematics, neuroscience and quantum physics. Located in Manhattan's Flatiron neighborhood, the Flatiron Institute is fast becoming an epicenter for leveraging computational methods such as data analysis, theory, modeling and simulation to drive discoveries and further the scientific endeavor.



A digital reconstruction of 2,000 randomly selected neurons in the brain of the miniature wasp *Megaphragma viggianii*, which has an estimated 8,000 neurons. (Humans, by comparison, have 86 billion neurons.) By studying the wasp's microscopic brain, researchers at the **Center for Computational Neuroscience** hope to identify working neural circuits, advancing our understanding of how brains work. *Credit: Connectomics Team/Neural Circuits and Algorithms Group/CCN*



'Quantum materials' hold tremendous promise, including for high-temperature superconductors and renewable energy. A line of research explored by the **Center for Computational Quantum Physics** involves manipulating quantum materials with ultrafast, ultrashort light pulses to alter their properties, for example by making them magnetic. In this illustration, a pulse of 1-trillion-hertz light (blue) hits a one-atom-thick lattice of hexagonal boron nitride. The light vibrates the lattice (blue glow), shifting the material's electrons. A subsequent infrared pulse (red) induces radiation (rainbow) that reveals information about those vibrations with femtosecond (quadrillionth of a second) accuracy. That information will help scientists exert even finer control over quantum materials in the future. *Credit: © Jörg Harms, MPSD*



Material (left and right) falls into the maw of a black hole (center), and plasma jets launch outward from the poles (top and bottom), in a new astrophysical fluid dynamics simulation developed by Christopher White of the **Center for Computational Astrophysics** and his colleagues. The simulation is the first to combine fluid dynamics, Einstein's theory of general relativity and a new radiation-tracking method into a unified computational framework. The freely available software will enable astrophysicists to model complex fluid dynamics in other scenarios, such as quasars. *Credit: C. White et al.*

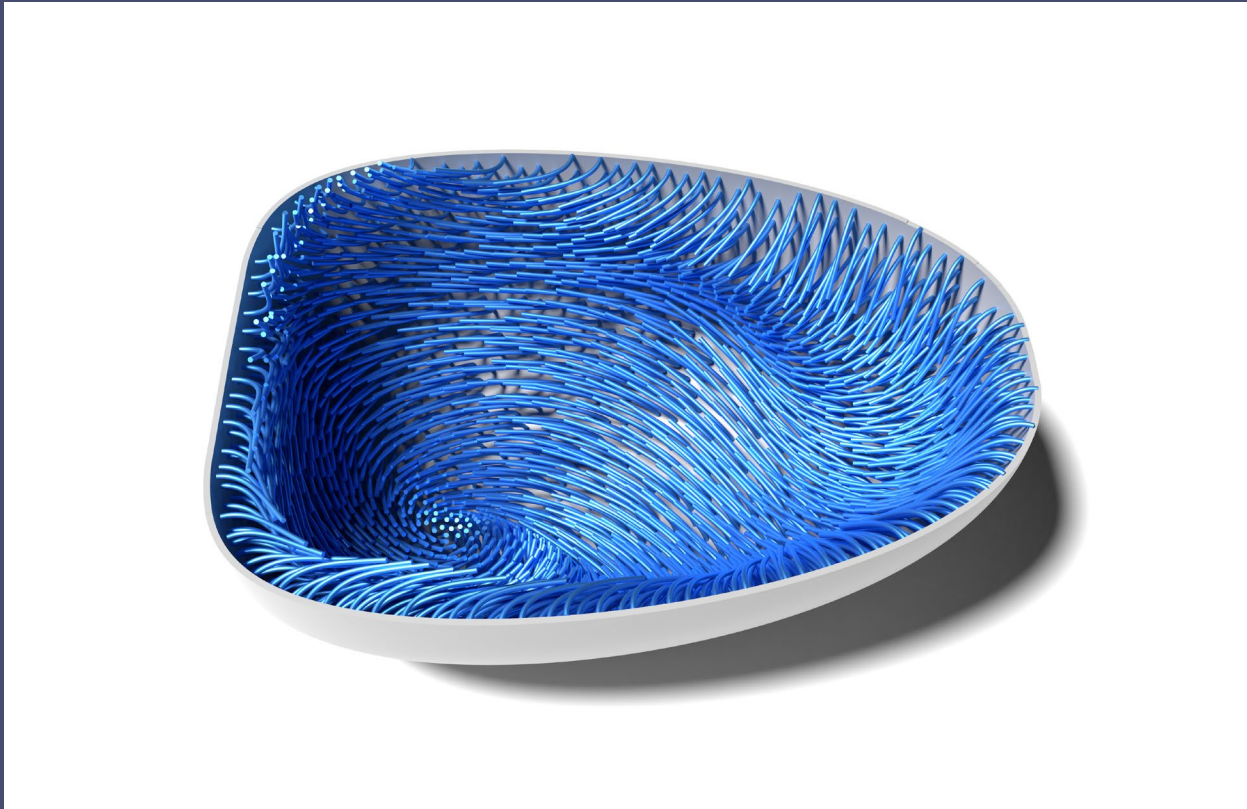


A solution of Euler's equations in a twisted knot shape known as a trefoil. Euler's equations describe the motion of fluids. Although such equations are essential to many fields, solving them requires lots of computing power. So researchers at the **Center for Computational Mathematics** employed a method that divides the shape into smaller pieces to simplify this process. The various colors denote areas with the same pressure. *Credit: Marsha Berger and Andrew Giuliani/CCM*





In November 2022, the Flatiron Institute's **Scientific Computing Core**, Lenovo and NVIDIA unveiled the most power-efficient supercomputer ever. The new supercomputer can churn out 65.091 billion floating-point operations (or 'flops') per second per watt of power. At 2.038 million billion total flops, the machine is also the 405th most powerful computer in the world. Flatiron Institute researchers will use the supercomputer to tackle thorny research problems.



Microtubules attached to the inner sides of an egg cell sway like seagrass in a tidal pool. This microtubule movement, caused by molecular motors called kinesins moving along the microtubules, is essential to how a cell's innards move and mix. At the **Center for Computational Biology**, researchers created SkellySim, a tool that can simulate a cell's complex fluid dynamics. Using SkellySim, researchers can better understand how cells divide, how bacteria swim and how nutrients trek across large cells. *Credit: Biophysical Modeling Group/CCB, Developmental Dynamics Group/CCB, Scientific Computing Core*





# SIMONS CENTER FOR GEOMETRY AND PHYSICS FLOURISHES AT INTERSECTION OF FIELDS

Early in his career as mathematics department chair at Stony Brook University, at the behest of Nobel Prize-winning physicist C.N. Yang, Jim Simons taught a seminar about differential geometry to physicists at the school’s Institute of Theoretical Physics. Interestingly, in order to learn the mathematical content, the researchers had to develop a dictionary to help them translate mathematics concepts into the language of physics and vice versa. For the rest of Simons’ career as an academic, the interface of geometry and physics was a fruitful field for him: He and mathematician S.S. Chern together produced the Chern–Simons form, which has found application in a number of areas, including string theory and topological quantum field theory.



Luis Álvarez-Gaumé, director of the Simons Center for Geometry and Physics (left), talks with physicist Domenico Orlando (right). Credit: Jean-François Dars

Inaugurated three decades later at Stony Brook, the Simons Center for Geometry and Physics (SCGP) — with its glass bridge connecting it to the university math department — was the natural outgrowth of the powerful alignment of math and physics that Simons experienced there. SCGP fills a needed niche supporting projects at the interface between mathematics and physics. “It is extremely hard — almost impossible — to get funding for a proposed activity at the edge between mathematics and physics because the math and physics research support structures are very different,” says Samuel Grushevsky, deputy director of the SCGP.

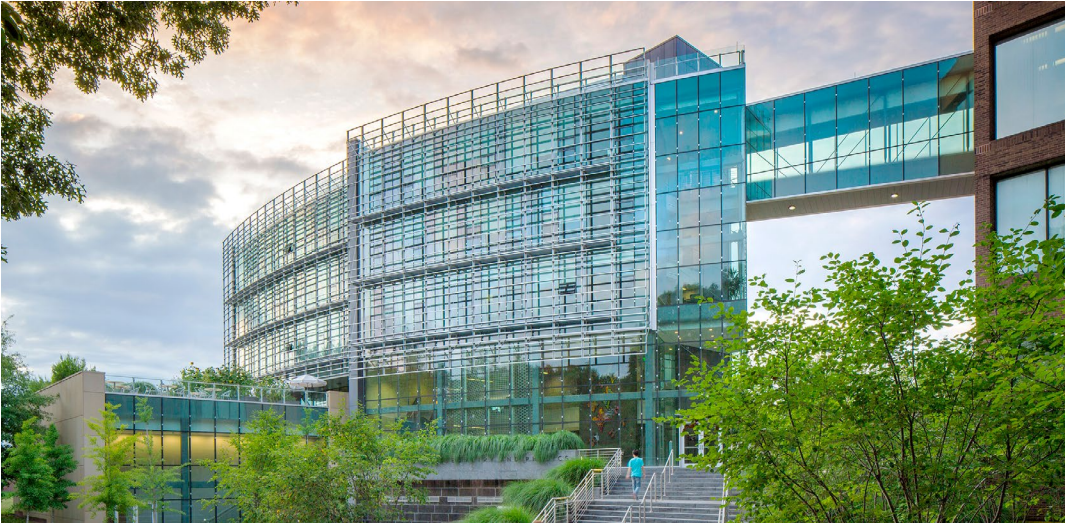
The SCGP was founded in 2008 and moved to its own building in 2011 under the direction of esteemed mathematician John Morgan, who steered the center to early success by hiring its first permanent faculty members and cultivating an enthusiastic, collegial research environment. In 2016, Morgan stepped down, and Luis Álvarez-Gaumé took the helm. Álvarez-Gaumé himself had earned his doctorate in physics at Stony Brook in 1981 before spending most of his career at CERN in Switzerland. “This is where I started my scientific career,” he says. “For me, it was like coming back home.”

Within a few years of its founding, the center became a desirable choice for strong and established researchers in mathematics and theoretical physics.

“In theoretical physics these days, SCGP is widely known as a top research institution,” says Avia Raviv-Moshe, a theoretical physicist who has been working as a postdoc at the SCGP for two years. When she was applying for jobs after earning her Ph.D., it was an easy choice to accept the SCGP’s offer, even though it meant moving her family to a new continent. “I feel lucky to be here,” she says.

From the beginning, the SCGP has supported research in mathematics and theoretical physics in important ways. “The Simons Center is a stool with three legs,” Álvarez-Gaumé says, and each leg is an important component of the center’s mission. The first leg is basic research in mathematics and physics. The two disciplines, at times difficult to disentangle from each other, have a long history of mutual development and inspiration. The SCGP has a small number of senior faculty members, who have joint appointments in the physics and mathematics departments at the university, and at any given time 15–20 postdoctoral researchers. The faculty members guide the day-to-day activities of the center and set its research agenda.

The second leg of the SCGP stool is service to the scientific community, in the form of the workshops and



The Simons Center for Geometry and Physics at Stony Brook University. Credit: Mark Weinberg

visiting scholar programs the center hosts. These activities bring roughly 1,000 researchers from around the world to the Stony Brook campus each year. “As a researcher in the Simons Center, you have plenty of opportunities to interact with people, initiate new collaborations and get to know other scientists from all over the world,” Raviv-Moshe says. With a full-time staff available to handle the logistics of running these workshops, participants are free to focus on the science itself. “They get to do contemplation, not administration,” Álvarez-Gaumé says. The constant hum of activity attracts talented students and improves the quality of their education, exposing them to a wide variety of interesting research areas early in their careers.

The third leg is outreach at Stony Brook and in the surrounding area. SCGP members are passionate about the importance of advancing the frontiers of mathematics and theoretical physics, not only by conducting cutting-edge research, but by sparking public interest in that research. “We think that it’s very important to share what we do, and our vision, with the community at large,” Álvarez-Gaumé says. To that end, the center organizes the Della Pietra Lecture Series of talks by prominent scientists and mathematicians. Each speaker prepares three lectures: one for SCGP faculty, one for high school students and one for the general public. Topics have included the search for dark matter, the role of music in the development of modern science (a lecture that included performances of several works for piano and harpsichord) and the ways that modern geometry can be used to understand the shape of the universe.

The center also has a small art gallery, open to the public, that highlights creative work incorporating ideas from mathematics and physics. In 2021, the museum had a retrospective of the artwork of the Dutch printmaker M.C. Escher, whose mind-bending illustrations were often inspired by mathematics, and whose work in turn has inspired generations of mathematics students and elucidated some complex mathematical ideas.

As a partner of Stony Brook University and the Simons Foundation, the SCGP benefits from both the stability of a long-established public institution and the agility of private funding, which has enabled the center to host conferences on cutting-edge research more quickly than would have been possible otherwise. SCGP has also influenced the university’s culture itself. “The Simons Center has fundamentally changed the perception of the physics and mathematics departments at Stony Brook,” Grushevsky says. “It has solidified the reputation of Stony Brook as a worldwide center for geometry, very broadly construed, and physics.”

Even with all its intellectual heft, “this center is a very cheap investment, in the grand scheme of things,” Grushevsky says: Mathematics and theoretical physics do not require telescopes, particle accelerators or even much laboratory equipment. Yet despite their seeming removal from earthly matters, those fields have catalyzed important advances time and again throughout history. “Our research is not just in the service of curiosity; many breakthroughs in the development of humankind have had their origins in some purely theoretical thought,” Grushevsky says. “Continuing to make investments in pure science is fundamentally extremely important for society.”



# NEW YORK STRUCTURAL BIOLOGY CENTER DRAWS SCIENTISTS TO NEW YORK

Enormous magnets housed in steel cylinders dot the floor of what was once the indoor basketball court of the Park Building at the City College of New York’s Harlem campus. One level down, state-of-the-art electron microscopes, each the size of an industrial refrigerator, and still more gigantic magnets have replaced an indoor swimming pool and aquatics facility.

“With machines beautifully laid out in a remarkable building, the New York Structural Biology Center is a scene to behold,” says Hashim Al-Hashimi, a biochemistry and molecular biophysics professor at Columbia University. “After I saw it, I thought, ‘I’m going to come here’” and join Columbia University’s faculty to be close to the center.

Just one type of work could bring together precisely this assemblage of scientific instruments and researchers. “Scientists need to know what the subject matter of their

investigation looks like,” says Wayne Hendrickson, the scientific director of the New York Structural Biology Center (NYSBC) and a biochemistry and molecular physics professor at Columbia University. By “subject matter,” Hendrickson means biological molecules like proteins, DNA and RNA. Knowing what they look like — the essence of structural biology — requires the most detailed pictures possible of the molecules both when stationary and when in motion. Such images are critical for elucidating mechanisms of disease and developing disease-fighting drugs and therapies.

The NYSBC, a longtime Simons Foundation grantee, was the brainchild of its executive director Willa Appel. In the 1990s, she envisioned a center that would solve a pivotal problem facing New York’s biologists: How could they access the needed instruments for their cutting-edge research — instruments that were too big and expensive for any one institution? Appel led the charge to develop a facility that nine member institutions — eight in NYC and one in Albany — would share.

Today, 21 years after its doors opened in Harlem, the center has proven a boon for the New York research community. “Virtually every paper we write uses the magnets at the NYSBC,” says Arthur Palmer, a professor of biochemistry and molecular physics at Columbia University and director of the NYSBC’s Nuclear Magnetic Resonance (NMR) division. “If the center hadn’t come into existence, we would have been forced to leave New York.”

Since 2014, the Simons Foundation has provided roughly \$35 million in funding to the NYSBC, with additional funding now provided by Simons Foundation International.

When it first launched, the NYSBC focused entirely on NMR spectroscopy, using the magnets in the former basketball and aquatics levels to look at the shapes of molecules in motion. But soon after opening,



The innards of an electron microscope at the New York Structural Biology Center. The device can image incredibly small subjects such as the structural details of a protein molecule. Credit: NYSBC

the NYSBC took over two X-ray beamlines at Brookhaven National Lab on Long Island. A beamline blasts a molecule with X-rays, allowing NYSBC researchers to calculate a molecule’s 3D structure using a process called X-ray crystallography.

Then, in 2014, with funding from the Simons Foundation, the NYSBC made a major commitment to a third method of imaging biological molecules, called electron microscopy, establishing the Simons Electron Microscopy Center (SEMC). “The support of the Simons Foundation has established us as a world-class center for structural biology,” Appel says.



A researcher uses a cryo-focused ion beam at the New York Structural Biology Center. The device helps reveal cellular and molecular structures by firing a beam of electrons at a frozen sample. Credit: NYSBC

The vast array of the NYSBC’s instruments enables researchers to run experiments they couldn’t conduct elsewhere. For example, studies of how proteins change shape when interacting with other molecules can require up to four magnets of different strengths. The infrastructure and expertise needed to set up and maintain just one of these large magnets are beyond the reach of many institutions. “That’s when you see the real strength of a place like this,” Palmer says. The NYSBC has nine magnets of six different strengths, each sitting on a column of concrete that dampens vibrations from the city’s subway system that could interfere with the experiments.

“And it’s not just about using the instruments. The NYSBC is also innovating in instrumentation,” Al-Hashimi says. For example, he describes an apparatus that can rapidly change the pressure on a sample in solution. “There’s only one other like this, and it’s at the NIH” (National Institutes of Health).

Reducing variability is crucial in electron microscopy, as sample sizes are tiny — just a few nanoliters in volume (about a thousandth of a teardrop). Research at the SEMC helped develop a device to automate sample loading, dubbed “the chameleon.” The Simons Machine Learning Center (SMLC), part of SEMC, is also developing a method of data collection assisted by artificial intelligence that determines automatically what part of a sample to image. “What used to take six hours of operator time is now down to 10 minutes,” says SMLC head Tristan Bepler.

Scientists beyond the nine New York member institutions can also access the NYSBC. For example, Kevin Battaile, director of the NYSBC beamline at Brookhaven, describes a project he’s working on with researchers from the University of Kansas and Wichita State University. “We’re using X-ray crystallography to see how well a potential drug molecule binds to its target. The structures help to guide the chemists to change the molecule based on what we see, and then we’ll test it again.”



A researcher loads a sample into a device used for cryogenic electron microscopy at the New York Structural Biology Center. The machine can cool samples to frigid temperatures so quickly that crystals don’t form. Credit: NYSBC





Powerful magnets encased in steel cylinders stand tall on what used to be a basketball court at the City College of New York's Harlem campus. The magnets are used for nuclear magnetic resonance spectroscopy, which scientists employ to study the behavior of complex molecules such as proteins. *Credit: NYSBC*

To provide greater access to cutting-edge microscopy, the National Institutes of Health selected the SEMC to house two national electron microscopy centers that researchers from across the country can use. In April 2020, one of these national centers undertook several electron microscopy studies that helped determine the SARS-CoV-2 virus's spike protein structure and how antibodies bind to the protein.

“When scientists visit, they learn electron microscopy and cross-pollinate ideas in discussions,” says Ed Eng, a senior scientist and manager at the SEMC. The NYSBC’s 60 staff members provide educational courses and longer-term training. In addition, scientists visiting from out of town have access to an apartment on the City College campus.

“The NYSBC catalyzed interactions among institutions in the city and has been a model for other collaborative centers,” Hendrickson says.

Not only has the NYSBC made it possible for scientists to stay in New York, but it has also drawn a new generation of scientists, like Al-Hashimi, to the city, Palmer says. “In the worldwide structural biology community, the NYSBC is viewed as the flagship,” he adds.

# 4

## Promoting NYC as a Global Collaboration Hub

Science is a team sport. The Simons Foundation knows the value of bringing people together in person. Even a chat over a cup of coffee can lead to an important exchange of ideas, a new collaboration or — if you're lucky — one of those legendary “Eureka!” moments. In 2022, the foundation's programs brought thousands of researchers from across the United States and dozens of other countries to its New York City headquarters for scientific meetings. By convening researchers in such an exciting — and intellectually inciting! — place, the Simons Foundation spurs connections that forward our understanding of the world.



## BRINGING RESEARCHERS TOGETHER TO DRIVE DISCOVERIES IN AUTISM

In 2003, Jim and Marilyn Simons convened a group of outstanding scientists to brainstorm ways to advance autism research. Out of this ‘autism roundtable’ was born the Simons Foundation Autism Research Initiative (SFARI), which has since supported more than 750 researchers and created data repositories used by thousands more. SFARI’s efforts have been instrumental in the discovery of more than 100 autism risk genes and in deepening our understanding of how these genes influence neural circuits and behavior.

That initial roundtable discussion underscored the power of bringing together a diverse group of thinkers in one room. In the two decades since, SFARI’s leadership has built on that early lesson, hosting meetings that have brought hundreds of autism researchers to New York City to “dig deep into the science and guide our strategies,” says Kelsey Martin, executive vice president of SFARI and the foundation’s neuroscience collaborations. Although the COVID-19 pandemic temporarily put a damper on these activities, the program’s in-person meetings roared back in 2022.

In April, the initiative held its marquee event: the annual meeting of SFARI Investigators, the researchers SFARI supports around the world. With more than 200 attendees spread across two auditoriums, this conference was the largest SFARI has ever held. After two years of meeting virtually, the Investigators were “back with a vengeance,” says John Spiro, senior vice president and senior scientist of SFARI.

Bringing so many autism researchers together in New York City creates opportunities not just for preplanned exchanges of ideas but also for spontaneous synergies. At an Investigators meeting several years ago, for instance, Craig Erickson, an expert on the clinical treatment of the autism-related fragile X syndrome at Cincinnati Children’s Hospital, randomly sat down next to Carlos Portera-Cailliau, a neurobiologist at the University of California, Los Angeles. Their conversation sparked a collaboration that led to a *Nature Neuroscience* paper revealing new, circuit-level insight into atypical visual

processing often found in people with fragile X syndrome, a leading genetic cause of autism. Additional experiments in a mouse model of fragile X suggested that these aberrant circuits could be manipulated, perhaps even corrected — offering a potential avenue for improving sensory processing.

“There’s something irreplaceable about having people face to face,” Spiro says.



Executive vice president for SFARI and Simons Foundation neuroscience collaborations Kelsey Martin (right) speaks with SFARI Investigator Richard Hugarin (left) at the 2022 SFARI Spring Investigator Meeting.

### Accelerating Autism Therapies

In June, SFARI held another, more targeted meeting with a potentially deep impact on families of children with autism. Nearly 100 individuals came to New York for the second annual meeting of the International Angelman Syndrome Research Council (INSYNC-AS), a joint effort of SFARI and the Foundation for Angelman Syndrome Therapeutics. The council works to catalyze research and treatments for Angelman syndrome, one of the earliest discovered single-gene conditions related to autism.





From left, Alice Luo Clayton, Ted Abel, Pamela Feliciano and Michael Bolland speak in a panel discussion at the 2022 SFARI Spring Investigator Meeting titled “What’s Next in ASD Research: Perspectives From ASD Parent-Scientists.”

The gene underlying Angelman syndrome was identified more than 25 years ago, setting in motion a robust research program that is now moving to clinical drug trials in children. Most other single-gene autism conditions are at a much earlier stage of this process. “Some genes were just recognized as risk genes for neurodevelopmental disorders in the past year or two,” Spiro says. “So people are starting from scratch.”

Accordingly, INSYNC-AS dedicated much of the June meeting to discussing how the wisdom amassed by Angelman syndrome researchers and advocates can help to speed the development of targeted treatments for other neurodevelopmental conditions. The topic was a natural fit for SFARI because Simons Searchlight,

a SFARI initiative, has assisted families in forming communities for more than 150 autism-related single-gene conditions. “We want to avoid reinventing the wheel, so patient groups can benefit from the experiences of other groups that are further along in treatment development,” Spiro says.

The meeting included not just scientists studying neurodevelopmental conditions but also clinicians, regulatory and industry experts, and families. “It exemplified the benefits of learning from others’ experiences to accelerate translation of scientific discovery into therapies,” Martin says. “The meeting inspired a real sense of hope for families of children with neurodevelopmental disorders.”



Attendees pose for a photo at the October 2022 SynGO2 annual meeting, hosted at the Simons Foundation’s headquarters in New York.

### Annotating the Synapse

The INSYNC-AS meeting built on the comprehensive foundation SFARI Investigators have laid by identifying autism risk genes. In October, SFARI gathered together a second set of researchers who have built on this foundation in a different way. A group of about 50 experts assembled in New York for two days to discuss the next steps for SynGO, an evidence-based, curated database of genes that encode the proteins active in synapses, the junctions between neurons. Founded in 2015, the project has enlisted many of the world’s top synapse experts to systematically assess the evidence for each protein’s role in the synapse. Genes that encode synaptic proteins play a critical role in autism, schizophrenia and other neurodevelopmental conditions.



Executive vice president Kelsey Martin speaks during a social event hosted by the Simons Foundation at the Society for Neuroscience’s 2022 annual meeting in San Diego.

Up until recently, SynGO has considered each synaptic protein individually. But proteins often interact, activating each other or forming molecular machines that can have more than a dozen components. At the October meeting, participants discussed plans for an updated version of SynGO that will categorize the evidence for how different proteins collaborate to carry out functions in the synapse. “These complex interactions have not been annotated systematically until now,” says Matthijs Verhage of the Vrije Universiteit Amsterdam, who coordinates SynGO with his colleague Guus Smit.



SFARI senior scientist and SPARK scientific director Pamela Feliciano (right) chats with SFARI senior director of data and analytics Natalia Volfvsky (left) at the 2022 SFARI Spring Investigator Meeting.

The diversity of these protein interactions was mirrored in the diversity of the meeting’s attendees, who included not just synapse experts but geneticists, bioinformaticians, computer scientists and clinicians. “It was a whole blend of people with very different backgrounds but the same incentive, which is to understand how synapse dysfunction contributes to autism,” Verhage says.

“I brought some junior people, and for them, it was the first time in New York,” he recalls. The mood “was fantastic — almost euphoric, I would say.”

The meeting was the first time SynGO’s consortium had met in person since the COVID pandemic began. “There was a huge amount of enthusiasm in the room,” Spiro says. “There’s something magical about bringing people together in this kind of situation, to reinvigorate collaborations that for two years were taking place over email and Zoom.”

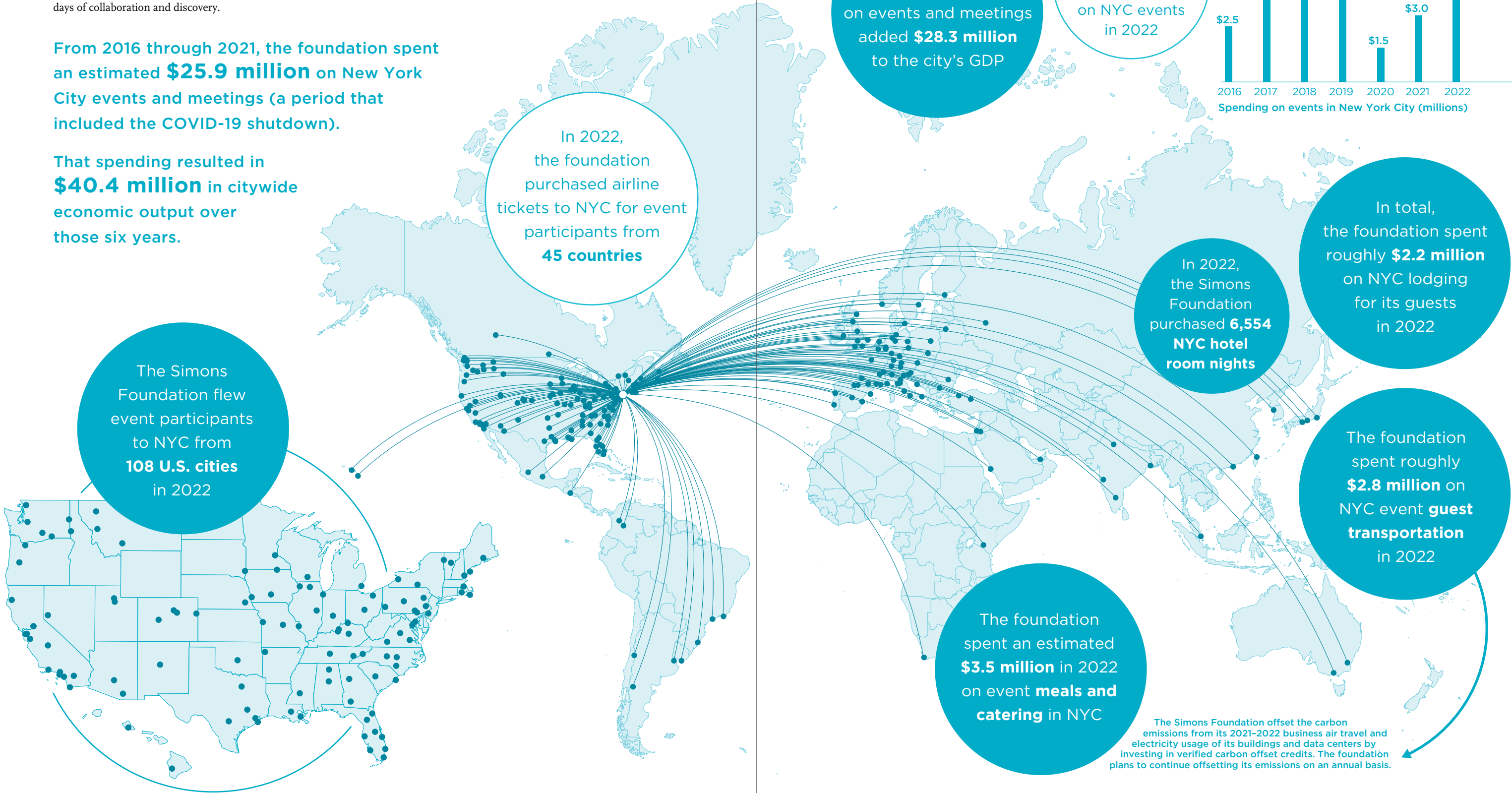


SIMONS FOUNDATION’S POWER OF CONVENING

The Simons Foundation knows the power and necessity of bringing people together to work on common goals. That’s why, in a typical year, the foundation hosts hundreds of events and scientific meetings here in New York City: 436 in 2022 alone! The amenities and charms of our standout city make it easy to draw top researchers for days of collaboration and discovery.

From 2016 through 2021, the foundation spent an estimated **\$25.9 million** on New York City events and meetings (a period that included the COVID-19 shutdown).

That spending resulted in **\$40.4 million** in citywide economic output over those six years.



The 2021 full-year and 2016–2021 aggregate economic impact figures in this report were calculated in 2022 by NYC economic consulting firm Appleseed using the IMPLAN analysis methodology. The supplemental 2022 full-year figures are based on internal data.



# SIMONS SOCIETY OF FELLOWS CREATES COMMUNITY AMONG NYC EARLY-CAREER RESEARCHERS

As scientists in training move up the academic ladder, they often find themselves interacting with scholars in an increasingly narrow range of disciplines. By the time they are postdoctoral researchers, these interactions have often mostly dwindled to discussions with members of a single laboratory. Yet postdocs preparing for the big transition to independent research benefit enormously from connecting with scholars in disciplines distinct from their own.

That’s what Yuri Tschinkel found when, as a brand-new mathematics Ph.D. in the early 1990s, he was offered membership in the Harvard Society of Fellows, a small but diverse group of mostly early-career scholars who gathered weekly for lunches and dinners. So when Tschinkel became director of the Simons Foundation’s Mathematics and Physical Sciences division just over a decade ago, he and Gerald Fischbach, then director of the Simons Foundation Autism Research Initiative, decided to create a similar intellectual community for science and mathematics postdocs in New York City.



Simons Society of Fellows Junior Fellow Jaroslaw Blasiok explains his work at a chalkboard at the reception following an October 2022 Simons Foundation Presidential Lecture.

Founded in 2014, the Simons Society of Fellows welcomes a new cohort of around 10 outstanding early-career researchers each year, providing them with a three-year, fully funded fellowship at an academic institution in one of the five boroughs. A smaller group of Senior Fellows, all distinguished scientists also based in the New York City area, provide informal mentorship.

With diverse areas of expertise including mathematics, neuroscience, evolutionary biology and astronomy, Junior Fellows are free to pursue whatever research they wish, with no need to apply for grants. “It’s allowed me to pursue riskier science,” says Mijo Simunovic, a Junior Fellow at Rockefeller University from 2016 to 2019.

Fellows commit themselves to fully participating in the society’s activities, designed to foster camaraderie within the small circle. Each week, they attend the Simons Foundation’s Presidential Lecture and dine together. And then there’s an annual alumni symposium and a three-day retreat where the Junior Fellows present their work.

The weekly dinners in particular create a deep sense of community, says Kaia Tombak, a current Junior Fellow who is an ecologist and evolutionary biologist at Hunter College, City University of New York. “The postdoc stage can be isolating, because you don’t usually come in with a cohort. It’s really nice to have this collegial family.”

During their time together, Senior Fellows come to know each Junior Fellow well, giving them professional advice and coaching when they hit stumbling blocks in their research. In many areas of science, it’s rare for postdocs to have mentors outside their lab, says Tony Movshon, a Senior Fellow and neuroscientist at New York University. “We watch over the fellows in a way that’s not customary toward postdocs outside your own discipline.”

Since the Junior Fellows’ expertise varies so widely, dinner table conversations usually gravitate toward big-picture ideas, according to Tombak. The weekly conversations and lectures “feed your brain,” she says. “[They] give fodder for all kinds of connections that might come later.”

Tellingly, she and four other Junior Fellows, all evolutionary biologists, have started meeting together outside the weekly dinners to discuss some of the big issues in their discipline. “It’s an exciting way to do science,” she says.



Simons Foundation co-founder Marilyn Simons (left) speaks with Simons Society of Fellows Junior Fellows Pooja Viswanathan (center) and Jennifer Merritt (right) following an April 2022 Simons Foundation Presidential Lecture.

Other exchanges have sparked collaborations across widely different fields. During the course of the fellowship, Simunovic — a physicist by training who now studies how organisms grow and develop — started working with Junior Fellow Carlotta Ronda, a synthetic biologist at Columbia University, to understand communication between the human microbiome and developing fetal tissues. And together with neuroscientist Bianca Jones Marlin, a former Junior Fellow also at Columbia, Simunovic is studying whether Marlin’s discoveries of transgenerational stress mechanisms can be traced to the earliest stages of embryonic development.

“We found connections that could start a whole area of research,” Simunovic says. “These collaborations have completely reshaped my vision of research.”

## Waves of Impact

The program’s unique brand of cross-fertilization has effects that ripple out from the fellows themselves to the broader New York City community. Tombak’s fellowship, for instance, led her to teach a minicourse for Math for America, an NYC Simons Foundation grantee that provides fellowships to highly accomplished math and science public school teachers in the city (see page 12). And through local documentary film studio Sandbox Films (a Simons Foundation spinoff), she attended a retreat at which 15 scientists and 15 filmmakers talked to each other about their work. “We found we all had a lot of connections in terms of seeking truth and communicating truth,” she says.

When Columbia neuroscientist Robert Fernandez became a Junior Fellow in 2021, he found not just a terrific community of scientists, but also interest from the foundation’s Outreach, Education and Engagement division in the support program he runs for under-represented students in STEM. That program, Científico Latino, partnered with the foundation to form a New York City chapter of Científico Latino’s mentoring program, with mentors from the Simons Foundation and the foundation’s Flatiron Institute, together with three Junior Fellows. The Senior Fellows provided valuable guidance to Fernandez, he said. “I was happily surprised by how proactive they were when it comes to science outreach.”

Meanwhile, Ruth Angus, an astronomer and former Junior Fellow now affiliated with the American Museum of Natural History in New York City, remembers her strong bonds with other Junior Fellows as invaluable when she planned a museum event pairing scientists and playwrights. Carlotta Ronda participated in that event, as did one of Bianca Jones Marlin’s graduate students. “It’s very useful to have that broad network,” Angus says. “It’s made me much more aware of the general scientific landscape in New York City.”

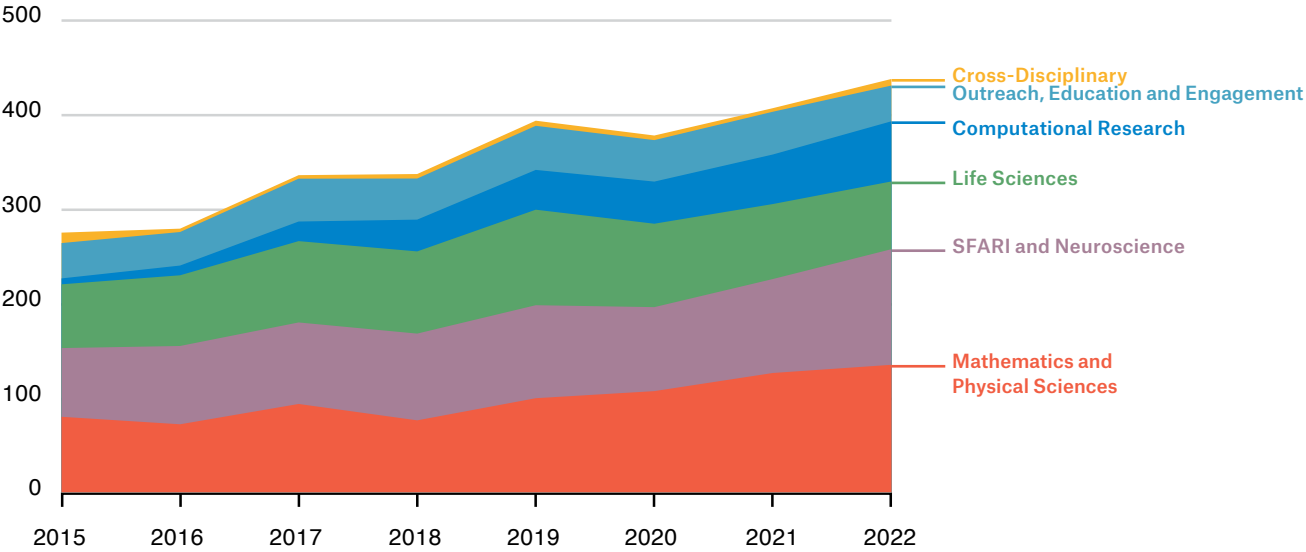
Although the society’s alumni have found their way to appointments at prestigious universities all over the world, quite a few have chosen to stay in New York after completing their fellowships. Simunovic’s collaborations with Ronda and Marlin made Columbia the natural landing place for Simunovic after the fellowship. “I wasn’t required to stay” in New York, Simunovic says. But belonging to the society “exposed me to all the excellent science all around New York City.”



FINANCIALS

TOTAL ANNUAL SPENDING

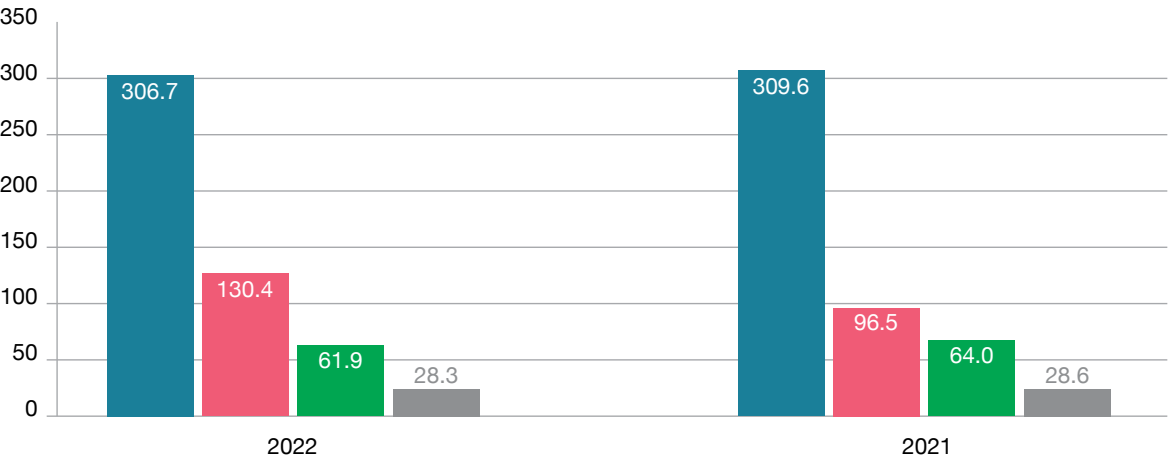
Grants and internal program expenses (by intellectual area by year, cash basis, \$'s in millions)



PROPORTIONS OF EXPENSES

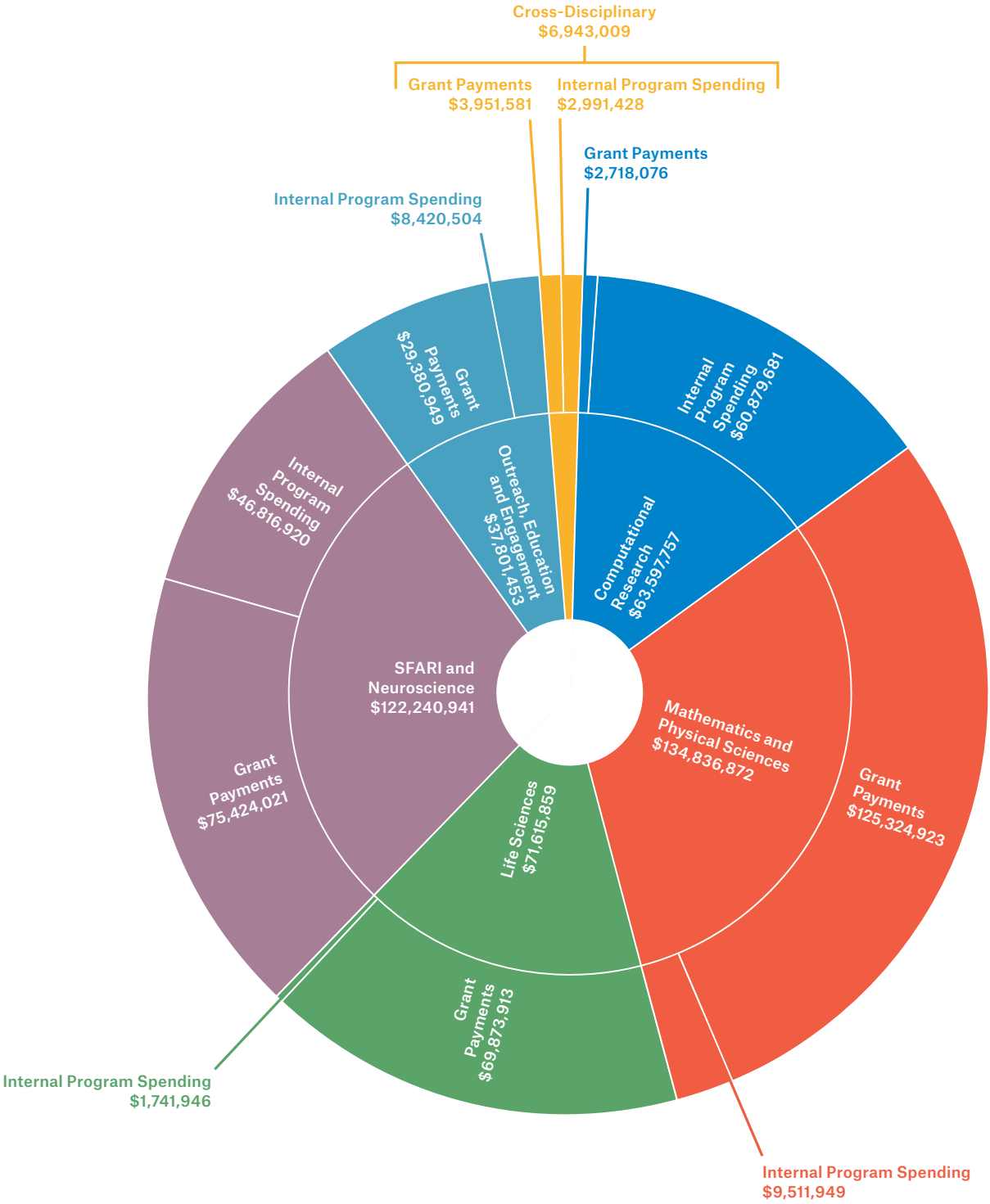
(Cash basis, \$'s in millions)

- Grant Payments
- Flatiron Institute, SPARK and Other Internal Program Expenses
- Management and General
- Capital Expenditures



2022 GRANT AND PROGRAM SPENDING BY INTELLECTUAL AREA

(Cash basis)





FINANCIALS

BALANCE SHEET

(Unaudited, in \$)

ASSETS	As of 12/31/22	As of 12/31/21
Cash and Cash Equivalents	1,142,768,926	297,469,205
Investments	3,276,210,495	4,445,138,704
Property and Equipment, Net	376,137,391	500,482,538
Right-of-Use Lease Assets	131,542,590	-
Prepaid Expenses and Other	28,450,836	18,601,317
Total Assets	4,955,110,238	5,261,691,764
LIABILITIES		
Accounts Payable	43,749,713	13,996,753
Grants Payable, Net	497,755,315	508,956,531
Mortgage and Lease Liabilities	356,526,111	345,603,216
Deferred Excise Tax Liability	14,833,737	14,833,737
Total	912,864,876	883,390,237
NET ASSETS		
Beginning Net Assets	4,378,301,527	3,541,153,789
Current Year Change in Net Assets	-336,056,165	837,147,738
Total	4,042,245,362	4,378,301,527
Total Liabilities and Net Assets	4,955,110,238	5,261,691,764

INCOME STATEMENT

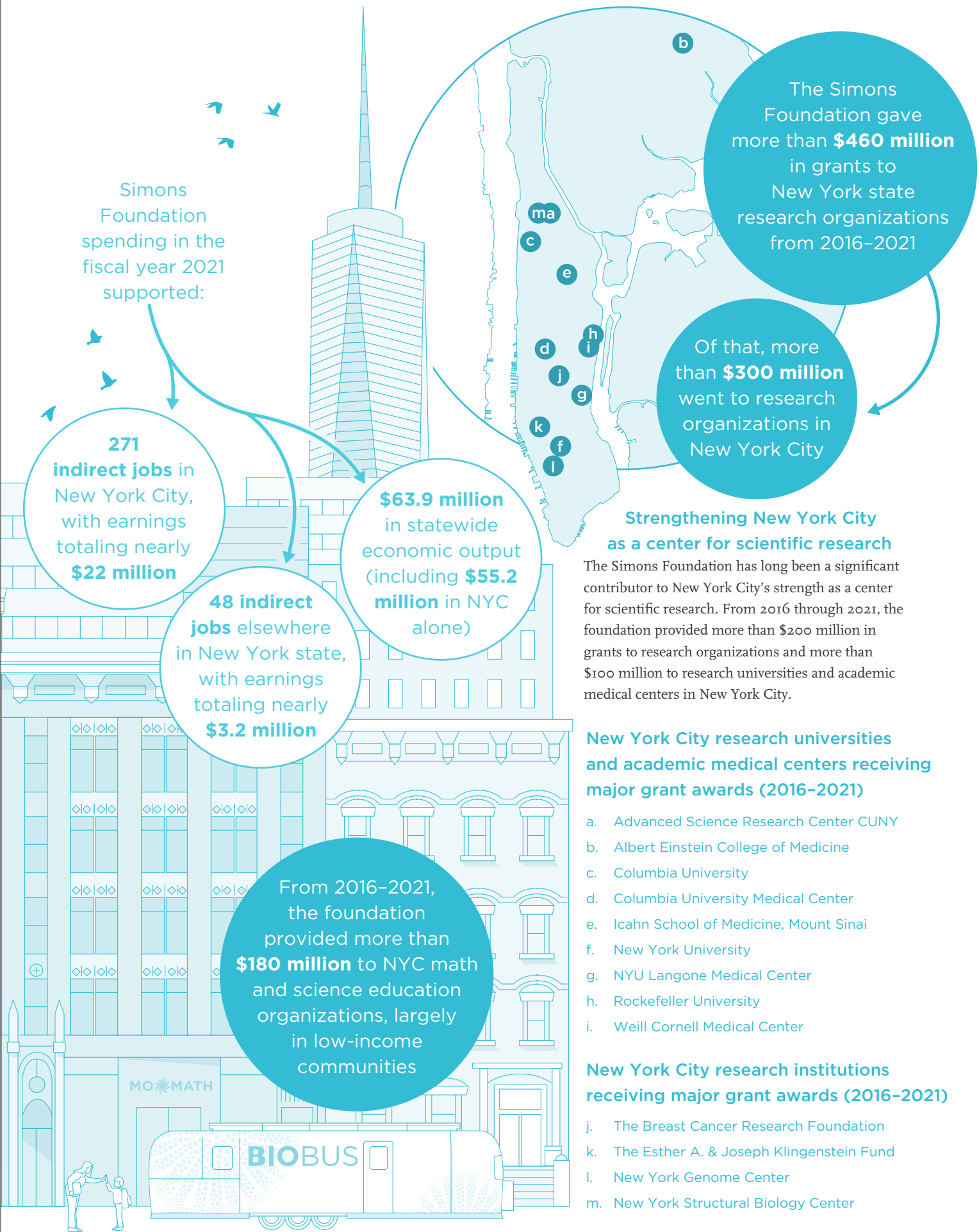
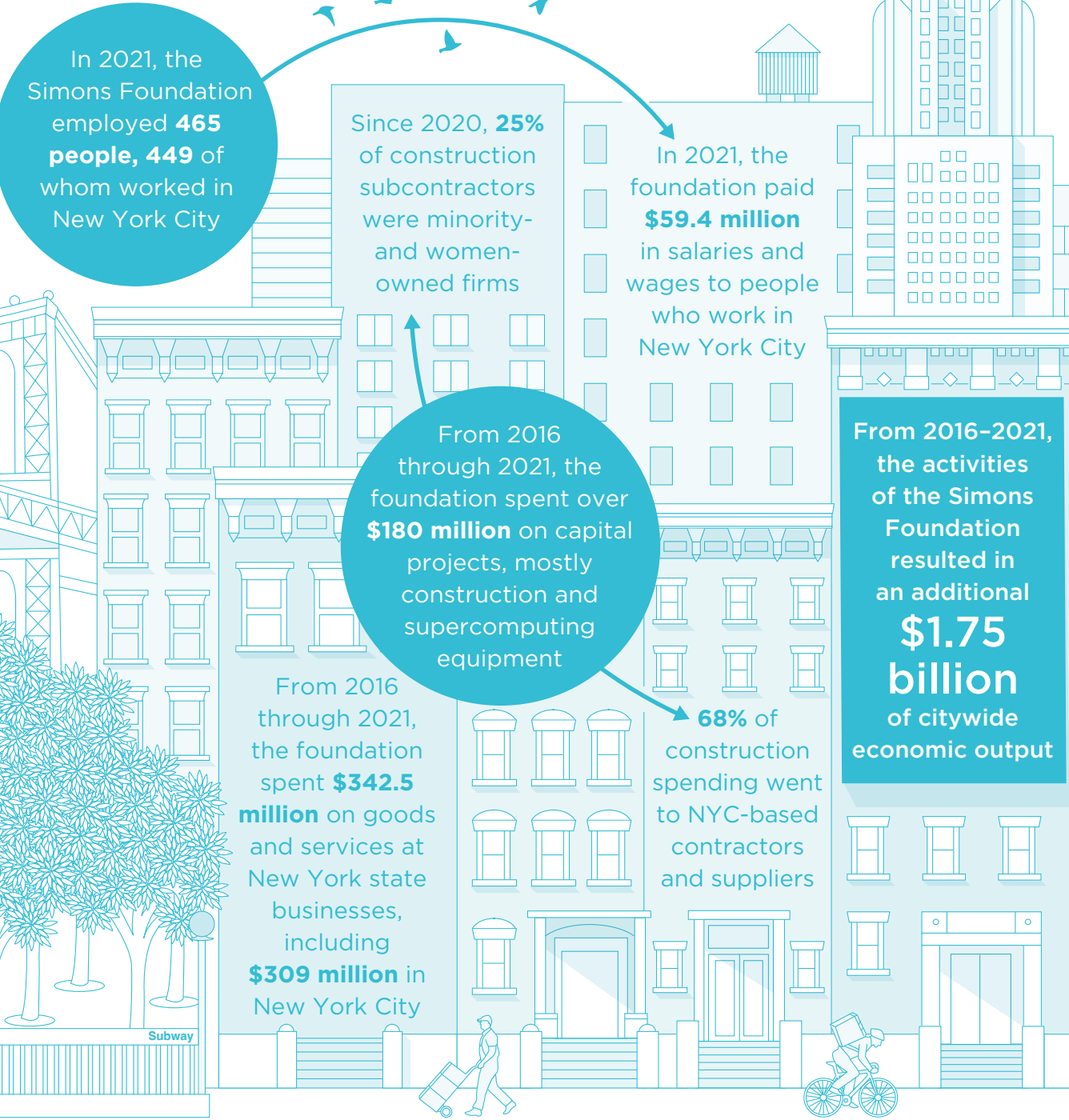
(Unaudited, in \$)

	For the Year Ended 12/31/22	For the Year Ended 12/31/21
REVENUE		
Investment Income	171,140,575	1,241,022,210
In-Kind Contributions	13,257,629	10,343,764
Rental Income	3,628,284	3,559,395
Other Program Income	1,890,212	1,361,746
Total	189,916,700	1,256,287,115
EXPENSES		
Program	476,165,542	356,188,778
Management and General	49,807,323	62,950,599
Total	525,972,865	419,139,377
Change in Net Assets	-336,056,165	837,147,738



# SIMONS FOUNDATION: AN ECONOMIC CONTRIBUTOR TO NYC

Every workday, Simons Foundation employees ride the subway to work, eat from local restaurants and otherwise contribute to New York City's economy. The foundation's grants to leading institutions in the region create jobs, drive innovation and attract spectacular talent. And foundation-supported organizations such as Math for America prepare young New Yorkers for careers in science and technology. Here are just a few ways the Simons Foundation's activities and investments in New York are helping build a stronger and more equitable economy.



The 2021 full-year and 2016-2021 aggregate economic impact figures in this report were calculated in 2022 by NYC economic consulting firm Appleseed using the IMPLAN analysis methodology.



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Simons Institute for the Theory of Computing (UC Berkeley)  
William I. Fine Theoretical Physics Institute (University of Minnesota)  
Universidade Estadual Paulista “Júlio de Mesquita Filho”

Simons Bridge for Postdoctoral Fellows

Centre de Recherches Mathématiques (Université de Montréal)  
The Fields Institute for Research in Mathematical Sciences  
Hamilton Mathematics Institute (Trinity College Dublin)  
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Institute for Computational and Experimental Research in Mathematics (Brown University)

Institute for Pure and Applied Mathematics (UCLA)  
Isaac Newton Institute for Mathematical Sciences (The University of Cambridge)  
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Mathematical Sciences Research Institute (MSRI)  
Perimeter Institute  
Simons Center for Geometry and Physics (Stony Brook University)  
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New York University  
Princeton University  
Rutgers University  
Stony Brook University

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Simons Collaboration  
on the Origins of Life

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Tanja Bosak  
Dieter Braun  
David Catling  
Irene Chen  
Jason Dworkin  
John Eiler  
Woodward Fischer  
Gregory Fournier  
John Grotzinger  
Wilhelm Huck  
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Ramanarayanan Krishnamurthy  
Sheref Mansy  
Karin Öberg  
Matthew Powner  
Didier Queloz  
Dimitar Sasselov  
Burckhard Seelig  
Sarah Stewart  
Roger Summons  
John Sutherland  
Jack Szostak  
Alexis Templeton  
George Whitesides

Simons Collaboration  
on Ocean Processes  
and Ecology

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Randelle Bundy  
Dave Caron  
Penny Chisholm  
Matthew Church  
Edward DeLong  
Bryndan Durham  
Sonya Dyhrman  
Zoe Finkel  
Michael Follows  
Nicholas Hawco  
Anitra Ingalls  
Andrew Irwin  
Seth John

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David Karl  
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Dan Repeta  
Oscar Sosa  
Benjamin Van Mooy  
Joshua Weitz  
Angelicque White  
Jon Zehr

Simons Collaboration  
on Computational Biogeo-  
chemical Modeling of  
Marine Ecosystems

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Christopher Edwards  
Zoe Finkel  
Michael Follows  
Jed Fuhrman  
Andrew Irwin  
Christian Müller  
Brian Powell  
Shubha Sathyendranath  
Joseph Vallino

Simons Collaboration  
on Principles of  
Microbial Ecosystems

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Andrew Allen  
Sebastian Bonhoeffer  
Otto X. Cordero  
Jeff Gore  
Jan-Hendrik Hehemann  
Terrence Hwa  
Naomi Levine  
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Victoria Orphan  
Christopher Reisch  
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Alison Buchan  
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Edward DeLong  
John Grotzinger  
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Jon Zehr

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Investigators in Marine  
Microbial Ecology  
and Evolution

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Hongdian Yang  
Michael Yartsev  
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Meg Younger  
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Moore-Simons Project  
on the Origin of the  
Eukaryotic Cell

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Mark Ellisman  
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Simons Collaboration on  
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Brain Investigators

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The BS/MS Program  
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Abigail Leyva  
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Andrew Sutter  
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Gabriella Boulting

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Neir Eshel  
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Rebecca Muhle  
Martin Munz  
Marino Pagan  
Kartik Pattabiraman  
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Gina Gibney Dance  
Imagine Science, YMCA of the USA  
Imagine Science Films  
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Letters to a Pre-Scientist  
Lewis Latimer House Museum  
Los Angeles Performance Practice  
Make the Road New York  
Media Art Xploration Inc.  
Metcalf Institute, University of Rhode Island  
MICRO  
MIT Museum  
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Museum of Science and Industry, Chicago  
The National Academies of Sciences, Engineering, and Medicine  
National Main Street Center  
The New Community Project Inc.  
New Museum of Contemporary Art  
New York Hall of Science  
New York Public Radio  
The Open Notebook  
Pioneer Works Art Foundation  
Portal (Flatiron Partnerships)  
Rochester Museum Science Center  
Rockaway Initiative for Sustainability & Equity (RISE)  
Rocking the Boat  
Science, Engineering and Mathematics Link Inc.  
Science Gallery Atlanta, Emory University  
SciLine (AAAS)  
Seattle Universal Math Museum  
Sing for Science  
Society for Science  
STEM Advocacy Institute

STEM From Dance  
STEM to the Future  
The Story Collider  
Story of ALMA (Chile Massachusetts Alliance Inc.)  
The Symposium: Academic Stand-Up (Scientists Inc.)  
Techbridge Girls  
Texas A&M University  
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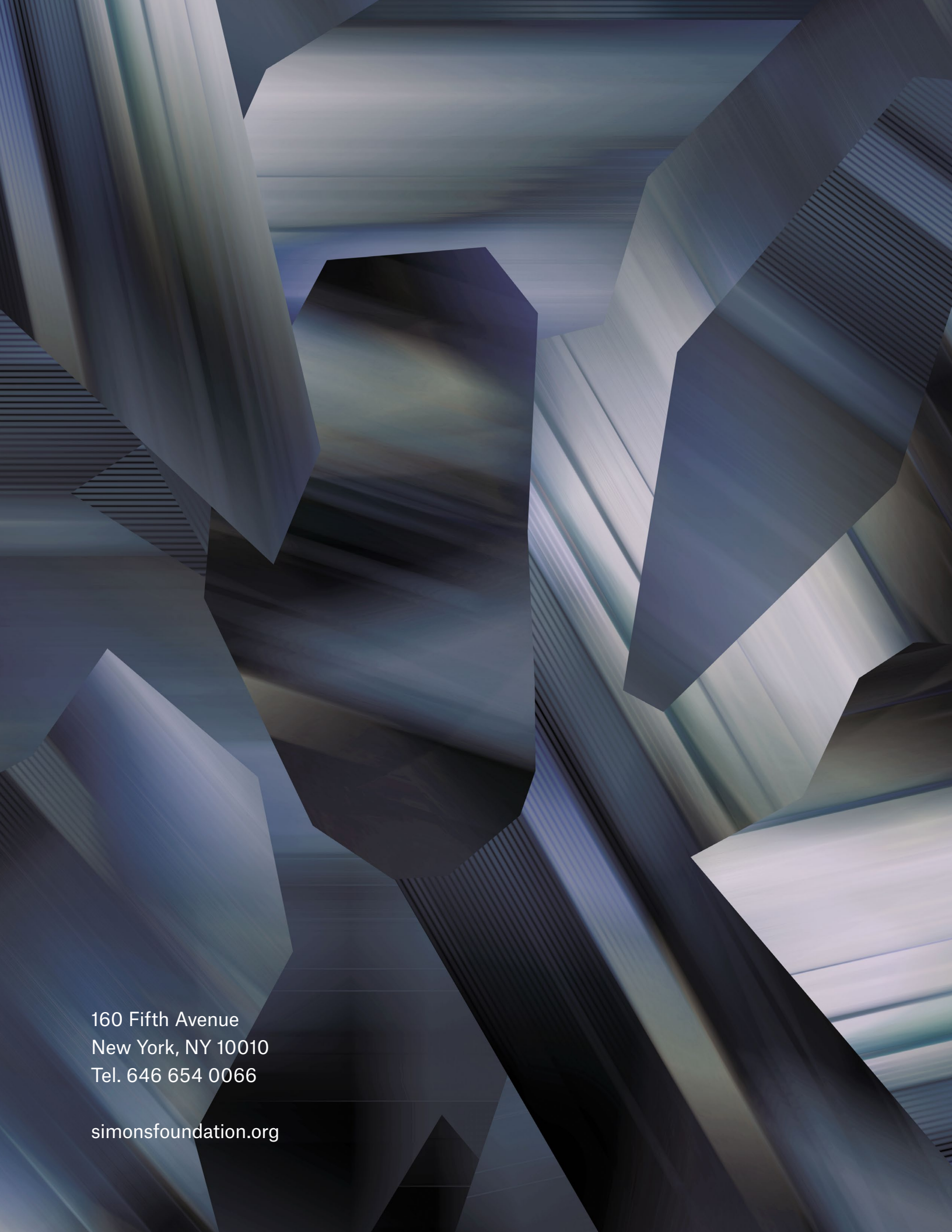


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