Leaning Into a Changing World

SfN ANNUAL REPORT / FY 2024

SOCIETY *for* NEUROSCIENCE

Society for Neuroscience
Mission

Advancing Scientific Exchange

Advance the understanding of the brain and the nervous system by bringing together scientists of diverse backgrounds, by facilitating the integration of research directed at all levels of biological organization, and by encouraging translational research and the application of new scientific knowledge to develop improved disease treatments and cures.

Supporting the Neuroscience Community

Provide professional development activities, information, and educational resources for neuroscientists at all stages of their careers, including undergraduates, graduates, and postdoctoral fellows, and increase participation of scientists from diverse cultural, ethnic, and geographic backgrounds.

Educating and Engaging the Public

Promote public information and general education about the nature of scientific discovery and the results and implications of the latest neuroscience research. Support active and continuing discussions on ethical issues relating to the conduct and outcomes of neuroscience research.

Advocating for the Field

Inform legislators and other policymakers about new scientific knowledge, recent developments, and emerging opportunities in neuroscience research and their implications for public policy, societal benefit, and continued scientific progress.

SfN
SOCIETY *for* NEUROSCIENCE

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Donor *Spotlights*

Stacy Pagos Haller
President and CEO, BrightFocus Foundation

"BrightFocus Foundation is proud to partner with SfN to champion early career investigators and advance diversity in science. By investing early in cutting-edge science, we sow the seeds of tomorrow's transformative scientific discoveries. Working together, our collaboration with SfN propels science forward, empowering visionary scientists to thrive, and accelerate the pace of innovation."

Kenneth Maynard
Director, Global Program Team Effectiveness, Takeda Development Center Americas, Inc.

"When I started my postdoctoral fellowship, my PI told me that I needed to join SfN. That was almost 35 years ago, and it remains one of the best decisions of my career! I continue to serve SfN in any way that I can, because it is the premier global professional neuroscience society and because I always get more in return for whatever I contribute. That includes my financial support of the Friends of SfN Fund. To me, giving back to SfN in a comprehensive way means contributing time and money to ensure that it is around to celebrate its 100th anniversary and continuing to add value to the work of neuroscientists and support their careers."

Li-Huei Tsai
Director of the Picower Institute for Learning and Memory, Picower Professor of Neuroscience, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology

"I'm a longtime member and dedicated supporter of SfN for many reasons. In particular, I value its role in creating a welcoming, inclusive, and nurturing community in which we can create and extend opportunities for young students and scientists to flourish. Giving in support of travel awards for trainees to attend the SfN annual meeting is one way that I've been proud to aid the brilliance and commitment of trainees as they seek to make their science known, to learn from their peers, and to advance their careers in the field."

Message From the *President*

Marina Picciotto
SfN President

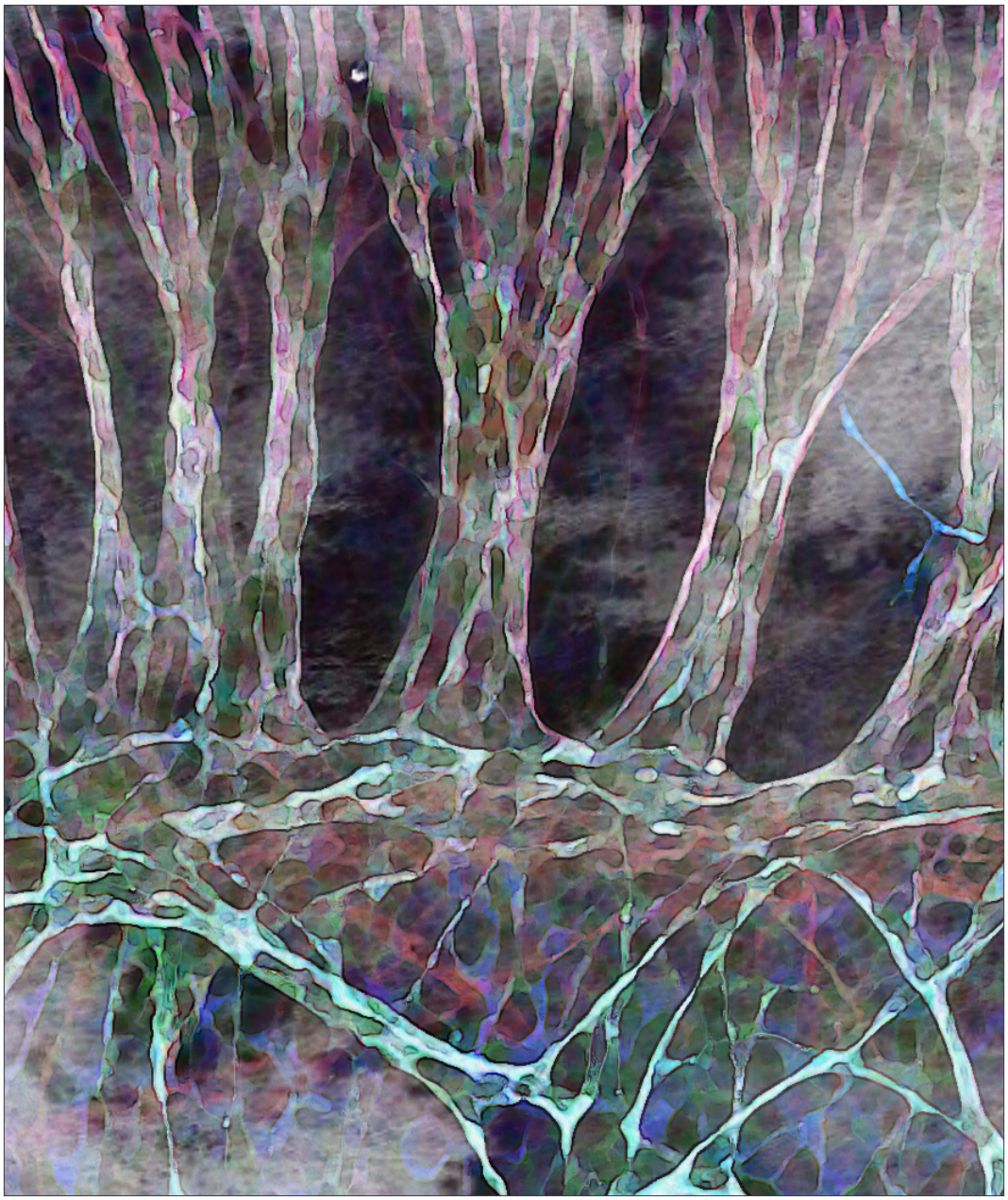
Over the 30 years I've been associated with SfN as a member and volunteer, I've become increasingly aware of how much the Society relies on generosity. Now, this is not immediately obvious when you're wandering the poster floor of the annual meeting or reading an article in *JNeurosci* or *eNeuro*. If you take a step back, however, you'll find that everything our community has come to expect from SfN originates from individuals and organizations committing their time and/or money to something greater than themselves.

That is why this Annual Report, alongside a review of the Society's recent activities, highlights those that enable our community to thrive. The enclosed individual and organizational spotlights offer insight into why so many offer so much to the Society. Everything that SfN does depends on the enormous commitment of time from hundreds of volunteers who serve on its committees and Council, as journal reviewers, as speakers at the annual meeting, and in other capacities. We thank and celebrate each of those volunteers.

Through the work of many, SfN is able to make a difference and become a leader in the field. Neuroscience 2023 proved that in-person gatherings are here to stay and will continue to evolve alongside the annual meeting's virtual aspects. A new public outreach event, BrainFacts LIVE, brought neuroscience to bar patrons during the annual meeting. Similarly, a congressional briefing on Capitol Hill during Neuroscience 2023 connected policymakers to leading neuroscientists in the field of post-traumatic stress disorder. *JNeurosci* and *eNeuro* remain in demand with strong submission numbers, and *eNeuro* began a search for the journal's second editor-in-chief. Due to record-setting generosity from individuals, organizations, and Council, 447 neuroscience trainees received a Trainee Professional Development Award (TPDA) to participate in the annual meeting.

In the pages that follow, read about the great work being done by our Society and those who lend themselves to our collective efforts. I encourage you to reflect on whether you too can share of yourself in supporting the work of SfN.

Advancing Scientific Exchange



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Neuroscience 2023: A *Return to* Washington, D.C.

Neuroscience 2023 enticed 25,808 neuroscientists — and one princess — from 76 countries to gather in Washington, D.C., November 11–15. The annual meeting was the largest gathering of neuroscientists since 2019 and marked SfN's first return to the city since 2017.

Connecting With Peers, Policymakers, and a Princess

Attendees took full advantage of the concentration of neuroscientists at the Walter E. Washington Convention Center by using many tools to connect with one another. The Neuroscience 2023 Mobile App enabled users to share contact information and submit questions to lecturers, symposium and minisymposium presenters, and featured panelists. Networking opportunities were seemingly everywhere, with 27 SfN-Sponsored Socials, 10 Neuroscience Meet-Ups, and 55 satellite events. Back for a second year and available for 30 days after the in-person programming concluded, the Neuroscience 2023 Virtual Component offered virtual attendees a screen into 41 livestreamed lectures and other sessions. It also provided a place for all abstract presenters to share their work before the meeting kicked off and long after their in-person poster or nanosymposium session concluded.

Bringing a touch of regality to the proceedings, Her Royal Highness Princess Marie of Denmark visited the annual meeting to express her strong interest in neuroscience. The visit was facilitated by the Danish Neuroscience Center.

Sponsoring a Network of Innovation

The meeting was not just a convergence of minds, but also a showcase of groundbreaking products

Her Royal Highness Princess Marie of Denmark is greeted by SfN President Oswald Steward at Neuroscience 2023.

12k+ ABSTRACT PRESENTATIONS	25k+ ATTENDEES	472 EXHIBITING COMPANIES
1 PRINCESS	41 LIVESTREAMED LECTURES AND PANEL SESSIONS	76 COUNTRIES

and innovations. Anchoring the center of the packed Exhibit Hall of nearly 500 companies, the new Product Theater provided exhibitors with more space to showcase their latest research methods, platforms, and tools.

Offering another location to purchase ever-popular SfN products, SfN introduced a pop-up store by Attendee Services. Rather than requiring attendees to find the SfN booth in the Exhibit Hall, new arrivals could quickly pick up their meeting badge and SfN merchandise — including a free tote bag — next to each other. Rounding out any shopping trip was the Art of Neuroscience, a dozen booths hosting neuroscience-inspired clothing, paintings, jewelry, needlework, and more.

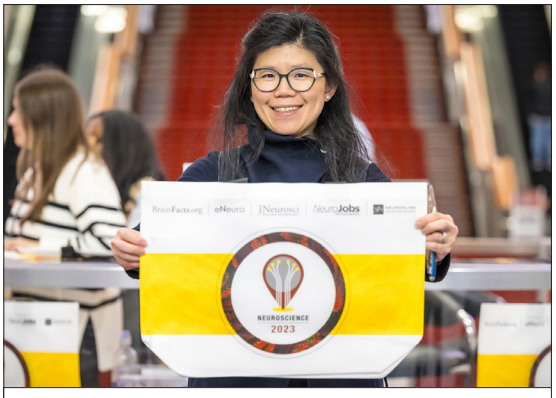
Annual meeting advertisers, supporters, and sponsors played an important role in Neuroscience 2023's success. The support from one Gold (Janssen), three Silver, and three Bronze sponsors elevated the overall quality of Neuroscience 2023, while 30 sponsors enabled individual lectures, events, and awards.

Press Coverage Amplifies Neuroscience

The impact of Neuroscience 2023 extended far beyond the convention center's halls. Over 150 journalists and reporters registered to document cutting-edge science on the poster floor, in session rooms, and in the 10 press-only events. Coverage in outlets such as *Scientific American*, *Nature*, *The Economist*, and elsewhere served to bring the exciting developments in neuroscience to a broader audience.

"I think the greatest value I get out of [the annual meeting] is talking to people at the poster sessions. The one-on-one connection with the presenter... you can follow up for collaboration, networking, or employment opportunities."

Utsav Gyawali, PhD
Postdoctoral fellow, Rutgers University



Free Neuroscience 2023 tote bags were a popular item with meeting attendees.

SfN Journals *Celebrate* Major Milestones

***JNeurosci* launched new initiatives to improve transparency, rigor, and reach, while *eNeuro* celebrated its 10-year anniversary with a new blog series and special collection.**

JNeurosci's Open Exchange and Broadened Scope

JNeurosci launched a new, open peer review model in 2023. As outlined by *JNeurosci* Editor-in-Chief (EiC) Sabine Kastner in her editorial, all editorial feedback (e.g., editorial decision letters, anonymized reviews) and authors' responses to critiques are published alongside the paper unless the reviewers and authors opt out.

Research often occurs at the intersections of different subfields, and *JNeurosci* has adjusted its publishing structure to better reflect this reality. Published content will now be organized by article type (e.g., research articles, reviews, and journal clubs) instead of subfield. *JNeurosci* has also expanded its scope by accepting papers in computational and theoretical neuroscience. The journal added several experts in these fields to the editorial board and hosted a webinar to share best practices for submitting authors.

Recruiting Early Career Researchers

In late 2023, *JNeurosci* created its first Early Career Advisory Board currently composed of six members. This opportunity allows young researchers to gain hands-on experience in the editorial leadership of a journal and scientific publishing by working with current journal editorial leadership. The popular Journal Club added a mentoring component to guide graduate students and postdoctoral fellows as they write scholarly reviews of *JNeurosci* articles they believe deserve special attention. Additionally, the publication fee for Journal Club articles was eliminated.

JNeurosci EiC Sabine Kastner borrows eNeuro EiC Christophe Bernard's cowboy hat at Neuroscience 2023.

At Neuroscience 2023, SfN journals and Elsevier launched the first of four in-person and virtual events in a collaborative effort to acquaint early career researchers with the world of scientific publishing. After the first in-person event, three webinars took place on Neuronline, SfN's online platform for learning and discussion.

Reflecting on the Past, Looking Towards the Future

In an editorial, *eNeuro* founding EiC Christophe Bernard wrote about his ten years with the journal and its unique role in supporting the research community. As his EiC term comes to a close, Bernard joined *JNeurosci* EiC Kastner on Neuro Current, the official podcast of SfN's journals, to discuss the future of peer review and scientific publishing. *eNeuro* recently published a special collection that "delve[s] into questions that are seldom addressed in mainstream neuroscientific discourse." Another new series led by *eNeuro* Editor Robert Calin-Jageman, an expert in statistical analysis, outlined the latest methodological innovations and offered tutorials on how to improve scientific rigor.

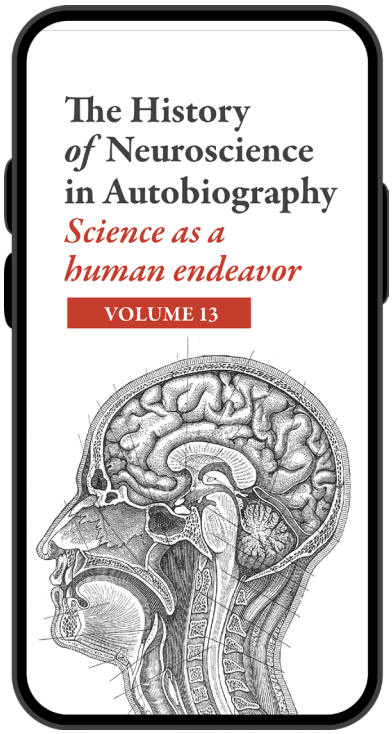
Reaching beyond the past decade, the 13th volume of *The History of Neuroscience in Autobiography* was published. With autobiographies from more than a dozen neuroscience trailblazers, *History of Neuroscience* allows the researchers of today to draw on lessons from the past. Meanwhile, *JNeurosci*'s spotlight, a curated list of some of the most groundbreaking papers of 2023, demonstrates just how far the field has come.

GROWTH IN SUBMISSIONS, 2022–2023

3%	4%
ENEURO SUBMISSIONS	JNEUROSCI SUBMISSIONS

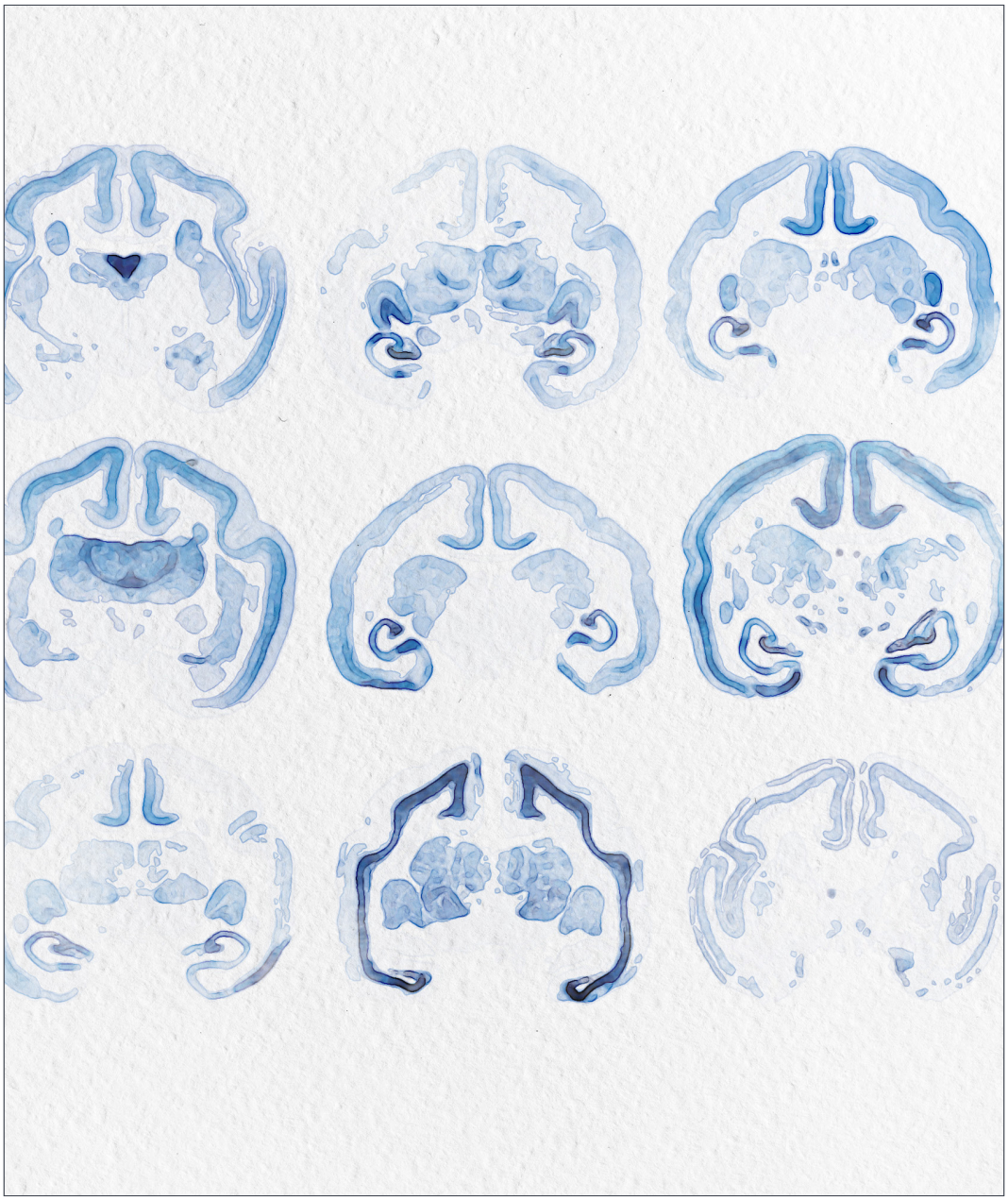
"The idea is that we improve transparency and fairness in a process that is centered on our authors."

Sabine Kastner
Editor-in-Chief, JNeurosci



SfN published the 13th volume of The History of Neuroscience in Autobiography.

Science in *Progress*



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Science in Progress

The Road to *Healing* the Damaged Spinal Cord

Oswald Steward's journey has taken him from basic science, using rodents and cells, to person-centered clinical work.

The growing brain develops at breakneck speed. For decades, neuroscientists believed that brain development came to a screeching halt once it reached maturity. We now know the mature central nervous system — which includes the brain and spinal cord — is a dynamic system that can grow and change in health, and after injury.

"When I started graduate school, everyone thought that the brain was static, that it couldn't grow at all in the adult organism," says Oswald "Os" Steward, director of the Reeve-Irvine Research Center at the University of California (UC), Irvine, whose nearly 40 years of research has upended such belief and is offering hope to people with spinal cord injuries.

As many as 500,000 spinal cord injuries (SCIs) occur globally each year. In the U.S., people are injured at an average age of 42 and face millions of dollars of medical bills over their lifetime, which is likely to be significantly shortened. A solution has appeared out of reach for decades because the spinal cord — the 10-mm-wide nerve nexus connecting the brain and body — stubbornly resists repair.

As a graduate student in the early 1970s working under the tutelage of UC Irvine researchers Gary Lynch and Carl Cotman, Steward and his mentors noted that some cells in the rat brain responded to injury with tentative regrowth, a process called "sprouting." This

SfN President Oswald Steward kicks off Neuroscience 2023.

was, says Steward, "really quite controversial. We were often told, 'No, that can't possibly happen.'"

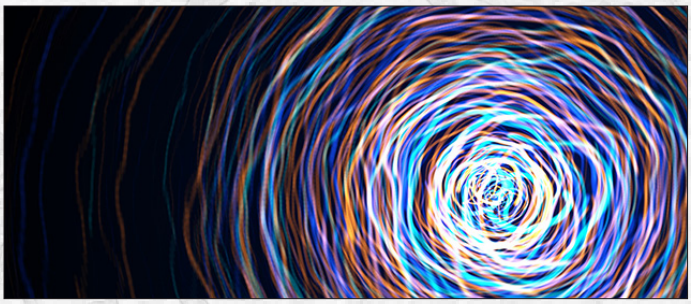
Over the next decade, however, other researchers were won over. "If you keep telling the story and showing the data, and it's convincing, people start to believe you," says Steward.

Most SCIs result from trauma like traffic accidents or serious falls. Initially, SCIs cause crush damage to axons — long tendrils carrying the brain's electrical signals — in the spine. It is, in part, the body's response

Science in Progress

"If you keep telling the story and showing the data, and it's convincing, people start to believe you."

Oswald Steward
Director of the Reeve-Irvine Research Center at the University of California, Irvine



SPINAL CORD INJURY (SCI) STATISTICS

500k	42
SCIs GLOBALLY EACH YEAR	AVERAGE AGE OF INJURY

to this acute damage that makes long-term functional recovery in SCI difficult to achieve.

Two to three weeks after an SCI, a scar forms out of the core of the connective tissue or immune cells. Bordering this core is a layer of neuronal support cells called glia. The glia found here are called astrocytes. Surrounding this glial scar is undamaged axonal tissue. The neural circuits in this tissue shift and reorganize in the aftermath of an SCI in a process called neuroplasticity, which can contribute to some recovery following injury. Glial scars are thought to help balance inflammation after an injury. In the long run, however, the scar impedes the regeneration of damaged axons past the injury.

Healing Connections

By the early 1990s, Steward's work had begun to focus on how neurons send electrical and chemical signals to other cells. While his work focused on the rodent brain, Steward's grant applications always pointed to potential uses in humans. "The introductions were always saying that someday this work might be relevant for brain and spinal cord injury," he says. "I remember vividly writing that same section [of the grant proposal] and thinking, 'I've been saying that for a couple of decades now. If I just keep doing what I'm doing, is it going to be anything that has any significant impact?'"

To translate his work to humans, Steward focused his efforts on the axons that ferry information from the brain's movement centers to the body's muscles via the spinal cord. Healing these connections could make a huge difference for people living with SCI. "The image of recovery at that time was people getting out of the wheelchair and walking. My image of recovery was somebody with a cervical SCI being able to reach out and pick up a glass of wine and drink it," says Steward.

Recruited in 1999 to lead the Reeve-Irvine Medical Center, Steward bolstered SCI research progress by hiring Hans Keirstead and Aileen Anderson, researchers who later pioneered the use of stem cells for SCI. A 2005 paper showed how these cells, which can be biologically manipulated to mature into different cell types, could replace cells damaged in SCI.

Science in Progress

Steward's own work explored genetic changes capable of restoring the spinal cord's regenerative ability. At a conference in 2008, Steward heard a lecture by Zhigang He — now a lab leader at the Harvard Stem Cell Institute — on regeneration in the optic nerve. By deleting a gene called PTEN, He had been able to enhance nerve cell repair. A resulting collaboration produced a 2010 *Nature Neuroscience* paper showing the regenerative potential of PTEN deletion in the rodent spinal cord. A huge academic achievement; but for Steward, it wasn't enough.

These experiments offered an exciting clue as to how scientists might intervene in SCI. PTEN is expressed in every cell of the body and serves as a tumor suppressor. Any effort to turn off PTEN would need to specifically target the damaged nerve cells. Steward has been exploring a gene therapy using a virus to spread the beneficial mutation through cells in the central nervous system — a technique that could one day help millions living with SCI.

Meeting People's Needs

What has defined Steward's work in this area is a focus on both the cellular minutiae of the damaged brain, and a widescreen view of what people living with SCI need.

In 2000, Steward recruited Kim Anderson-Erisman as a postdoctoral fellow to work with him at the Reeve-Irvine Medical Center. Today, she is the director of the Northeast Ohio Regional SCI Model System at the MetroHealth Rehabilitation Institute.

"There's a handful of researchers in Os's class who really understand what the problem is with the disease that they're researching in the real human realm," says Anderson-Erisman, who happens to be living with an SCI. She points to town hall sessions she co-organized with Steward when she was at Reeve-Irvine, which gave scientists the chance to meet with people living with SCI.

"Up until that point, researchers weren't really talking to people with SCI," explains Anderson-Erisman. She says that these discussions showed that many researchers placed too high a value on restoring walking ability in SCI, which meant other functions vital to people living with SCI were overlooked.

Anderson-Erisman surveyed nearly 700 people with SCIs in a 2004 study. Individuals living with paraplegia said their priority was not to walk again, but to be able to have sex or regain their bladder control. In the decades since, new techniques have been developed to help repair SCIs. Steward acknowledges that eye-catching interventions — such as brain electrodes that restore walking ability — have pushed the field forward, but he notes that the intensive exercise regimen and surgery required to use these tools are too onerous for many people living with SCI. According to Anderson-Erisman, although work on bowel and bladder use has ramped up in the last two decades, research into restoring sexual function is still limited.

A successful intervention for SCI, concludes Steward, will not only need to be scientifically rigorous but also meet people where they want help the most.

Supporting the Neuroscience *Community*

See the original image >

A Year-Round *Commitment* to Community

The neuroscience community's strong desire for networking, training, and professional development opportunities is showcased through the number of year-round programs offered by SfN.

In-Person Professional Development

A wide selection of programming at Neuroscience 2023 offered attendees numerous ways to fulfill their career-related needs. The Responsible Conduct of Research Short Course, which covered neuroscience-related topics, such as healthcare, publishing and reviewing manuscripts, and AI, sold out weeks before the annual meeting. The growing Graduate School Fair attracted 100 programs to interact with attendees looking to take the next step in their neuroscience education. More than a dozen Professional Development Workshops offered discussions on diverse topics such as careers outside of academia; promoting diversity, equity, and inclusion within neuroscience education; and science writing. The Career Development Networking event featured 56 professionals representing different neuroscience career paths leading discussions with trainees about their line of work.

SfN established a new Memorandum of Understanding with the Chinese Neuroscience Society (CNS), which commits SfN and CNS to supporting their members in attending each other's annual meetings. This new partnership extends the list of bilateral agreements SfN has with other neuroscience organizations, including the Federation of European Neuroscience Societies (FENS), the International Brain Research Organization (IBRO), the Canadian Association of Neuroscience (CAN), and the Japan Neuroscience Society (JNS). All these organizational relationships facilitate the international exchange of ideas and community members.

Connecting via Virtual Programming

Neuronline, SfN's online home for learning and discussion, contains ever-evolving content on diverse topics and in numerous formats. SfN produced 31 webinars, including some with organizational partners such as the American Physiological Society, FENS, and Elsevier. Complementing the webinar lineup, Neuronline published a number of written articles, including a reflection of a Deaf graduate student on her experience in the scientific community. The Neuronline Community Leaders program, composed of SfN members who lead conversations on the

In a short video, Gallaudet University Graduate Student Melody Schwenk describes her interdisciplinary research into language and neuroscience.

Neuronline Community forum, provided direction on how to best use the discussion platform and engage SfN members in meaningful discussions.

SfN's Foundations of Rigorous Neuroscience Research (FRN) program wrapped up this year as a five-year grant from the National Institute of Neurological Disorders and Stroke (NINDS) ended. The grant funded 70 online training and educational resources, developed by SfN and partners such as NIH and CellPress, including podcasts, videos, lectures, online courses, and journal articles. Many of these resources can be found on Neuronline and are open access.

Gathering Neuroscience Trainees

The Neuroscience Scholars Program (NSP), a two-year training program for graduate and postdoctoral neuroscience researchers from diverse backgrounds, continues to empower emerging leaders. In August, 120 NSP Scholars, NSP Alumni, and special speakers traveled to Washington, D.C., for a three-day Next Generation Leadership conference. There, participants discussed identity and leadership, changing culture, and grant writing, while creating additional opportunities for professional development, networking, and community building. At Neuroscience 2023, 36 fellows showcased their work and toured NIH campus, getting to meet several different research labs. NSP celebrated a record number of applications for the 2024 cohort as a measurable example of the program's impact. These NSP activities were supported by grants from NINDS and the Chan Zuckerberg Initiative.

Members of the NSP community gathered for the Next Generation Leadership conference in Washington, D.C.

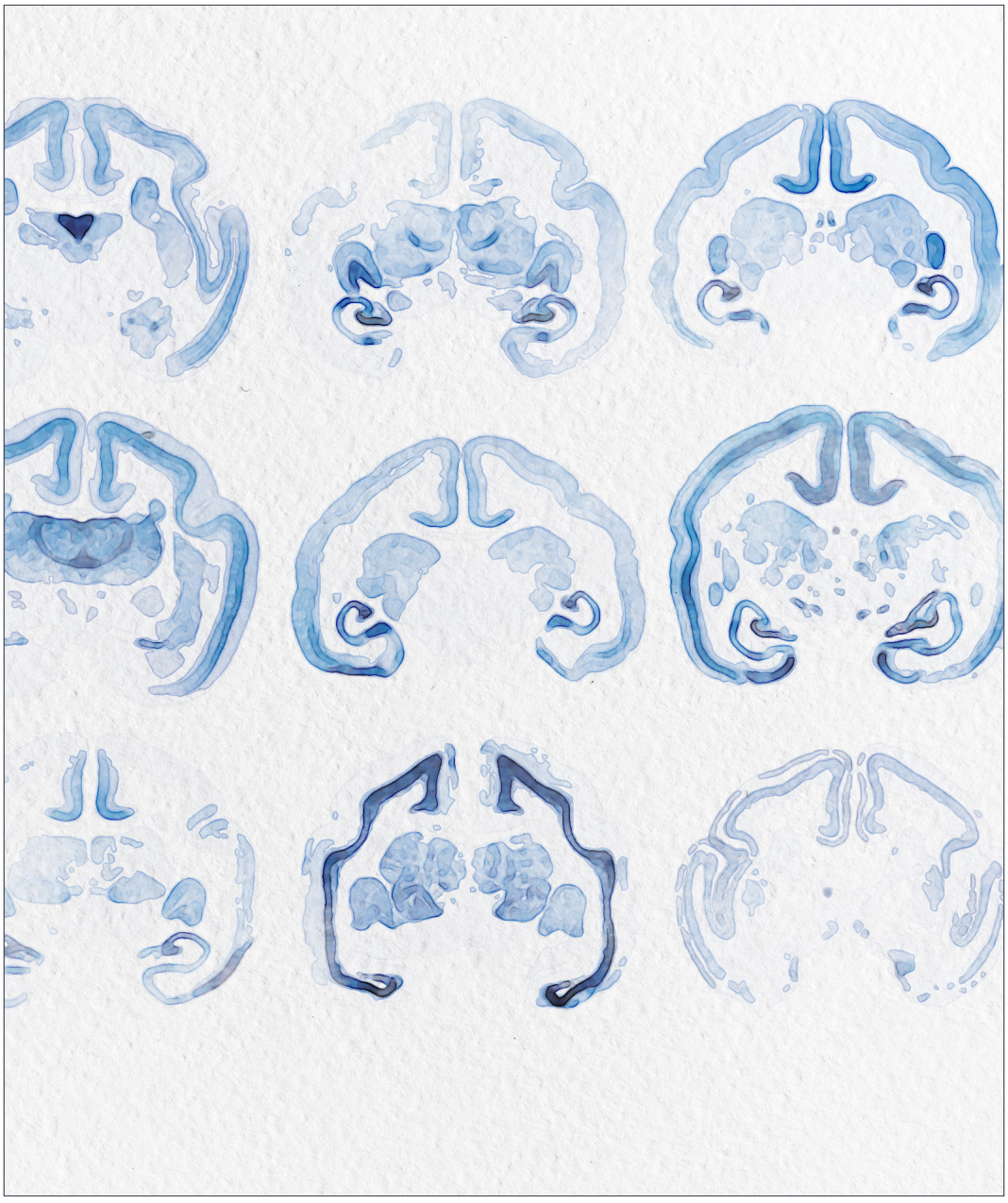
> ***It's almost like [Neuronline] was launched for me because I read everything. I read guidance on how to speak to members of Congress; how to be a better mentor, researcher, and doctor; and how I can give back."***
>
> **Valéria Muoio**
> *Neurosurgeon, University of São Paulo*

Reaching another record, the Trainee Professional Development Award (TPDA) program, which offers awards to promising early career researchers seeking to attend the SfN annual meeting, raised $519,000. As a result, 447 trainees took advantage of complimentary meeting registration and award funds to facilitate their participation in Neuroscience 2023 and access to a year-long array of virtual professional development resources. The John I. Simpson Fund, a new endowment established at SfN in 2023, contributed $51,000 to the TPDA program this year and is structured to continue providing funds in perpetuity. Organizations that each contributed $25,000 to the TPDA program were the Burroughs Wellcome Fund, The Gatsby Charitable Foundation, BrightFocus Foundation, Eli Lilly and Company Foundation, and Rainwater Charitable Foundation. Individual SfN members and other donors contributed $38,000 to the Friends of SfN Fund to support the TPDAs. SfN Council provided $214,000 in matching funds.

NEUROSCIENCE COMMUNITY AT A GLANCE

447	31	176
TPDA AWARDEES	WEBINARS	NSP APPLICATIONS

Science in *Progress*



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Science in Progress

Tapping Into the Brain's *Natural Systems* for Controlling Stress and Pain

Huda Akil's research on pain and stress illuminates the brain's own resources for combatting physical and mental distress.

Mental illness — be it depression, anxiety, or substance abuse — has many battlefronts in the brain. It's a lesson that neuroscientist Huda Akil remembers learning when she examined the inner workings of the brains of people who had died while depressed.

In the early 2000s, Akil, the Garden C. Quarton Distinguished University Professor of Neuroscience at the University of Michigan, was part of a cross-institutional consortium studying how mental illness could change gene expression in the brain. In postmortem research of people with depression diagnoses, Akil and her colleagues found that a family of molecules — called fibroblast growth factors, or FGFs — were highly changed in depression. One in particular, FGF2, was significantly reduced in the brains of depressed people relative to the control brains.

Back then, FGFs were primarily known for their role in skin and brain development. Now, they have been added to the growing list of molecules and pathways, from neurotransmitters to hormones, linked to depression. Her research also found changes in the activity of many genes occurring in several brain regions. The finding made Akil realize that "the problem is everywhere," she recalls. "Almost every part of the brain is altered" in depression.

Akil and her collaborators would later show how some FGF2 can enhance mental resilience — helping vulnerable rodents become more adventurous and less stressed.

Akil and her team injected one-day-old rats genetically inclined to depression and anxiety with a single dose of FGF2. Rats who received FGF2 were less anxious and much more prone to exploration than their genetics would have predicted. What's more, the behavior changes lasted for the life of the animal.

The environment really matters as well. Raising genetically vulnerable animals in an enriched

Science in Progress

environment can increase their natural FGF2 levels and produce resilience.

This work is part of a growing body of research unveiling the many resources human and animal brains can draw on to soothe distress. Studying these natural stress-management strategies could lead to new treatments and a deeper understanding of what makes people vulnerable to depression, how to prevent it, or how to intervene early to minimize its impact. For this work, Akil was awarded the 2023 Gruber Neuroscience Prize.

Discovering The Natural Pain Control System

When Akil became a PhD candidate at the University of California, Los Angeles, in 1969, no one knew about endorphins — the brain's pain-managing hormones.

Akil didn't start her career as a mental illness specialist. As a freshly minted graduate candidate she focused on pain — the kind you can get from sticking your hand on a hot plate. She and her lab mates were electrically stimulating parts of the brain to see where pain is processed. One day, they stimulated a particular brain region, and noted, to their surprise, that the animal no longer seemed to feel any pain or distress.

The team realized that rat brains possessed a natural system that worked like morphine. It was the first time anyone had found a natural neural network that blocked pain in the brain. Eventually, other researchers would name the molecules in this pain control system 'endogenous opioids' — or endorphins for short.

Neuroscientists have become fascinated with this system. One theory as to why the brain would have evolved its natural opiate system to block pain was that it was adaptive: it would allow the individual to cope with stress even under highly painful situations,

"So the question is — why do our natural systems fail?"

Huda Akil
Garden C. Quarton Distinguished University Professor of Neuroscience at the University of Michigan

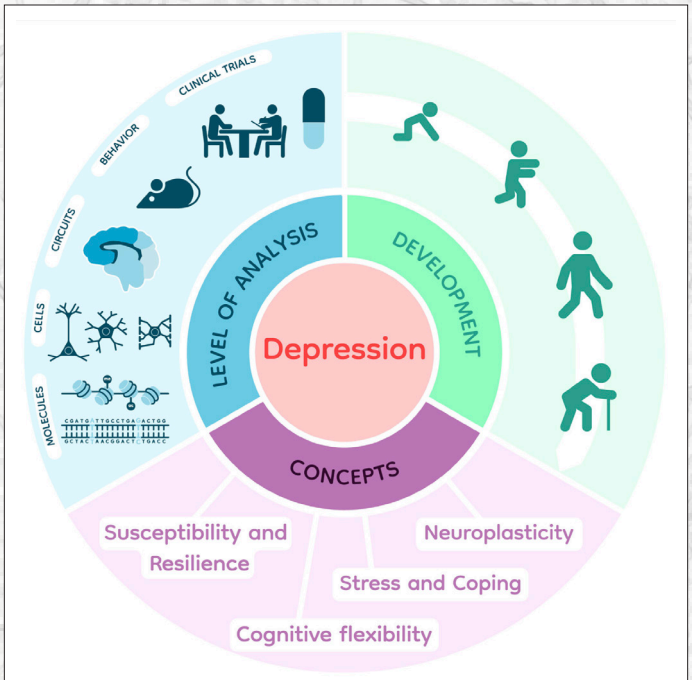
Huda Akil at the Peter and Patricia Gruber Lecture: "The Emotional Brain: Embracing the Complexity," November 12, 2023, at Neuroscience 2023 in Washington, D.C.

to ensure survival — fight or flight. Cloning results showed that a gene that codes for one of the endorphins also codes for a stress hormone. "It was like a message from the heavens saying: 'Yes, these two systems are very closely intertwined,'" Akil recalls. "Suddenly, I was in the stress business." Given that stress plays a role in several psychiatric illnesses, including depression, anxiety, and addictive disorders, Akil's research currently covers all these areas.

Accounting for Risk Factors

After all, "we all have these inner resources to counter pain and anxiety," says Akil, "So the question is — why do our natural systems fail?"

Science in Progress



Framework for studying stress, depression, and other mood disorders. The figure highlights the importance of utilizing broad-based experimental approaches across several levels of analysis, across the lifespan, and across species to delineate the biological basis of stress susceptibility vs. resilience and of human stress disorders.

Depression often decreases people's ability to respond to negative experiences. FGF2 can help young rats ward off depressive symptoms, suggesting that the lack of FGF2 may reduce the brain's ability to make changes in nerve cells, says Marina Picciotto, professor of neuroscience and pharmacology at Yale University. While rats are different from people, these studies are "important in that they point to nerve cell plasticity as an important target for new therapies," she says.

This doesn't mean, however, that FGF2 medications will be deployed against depression anytime soon. FGF2 is a growth-promoting molecule and is therefore related to cancer risk. While it might be tempting to inject people who are genetically predisposed to depression and anxiety with a curative shot of FGF2, genetics isn't everything.

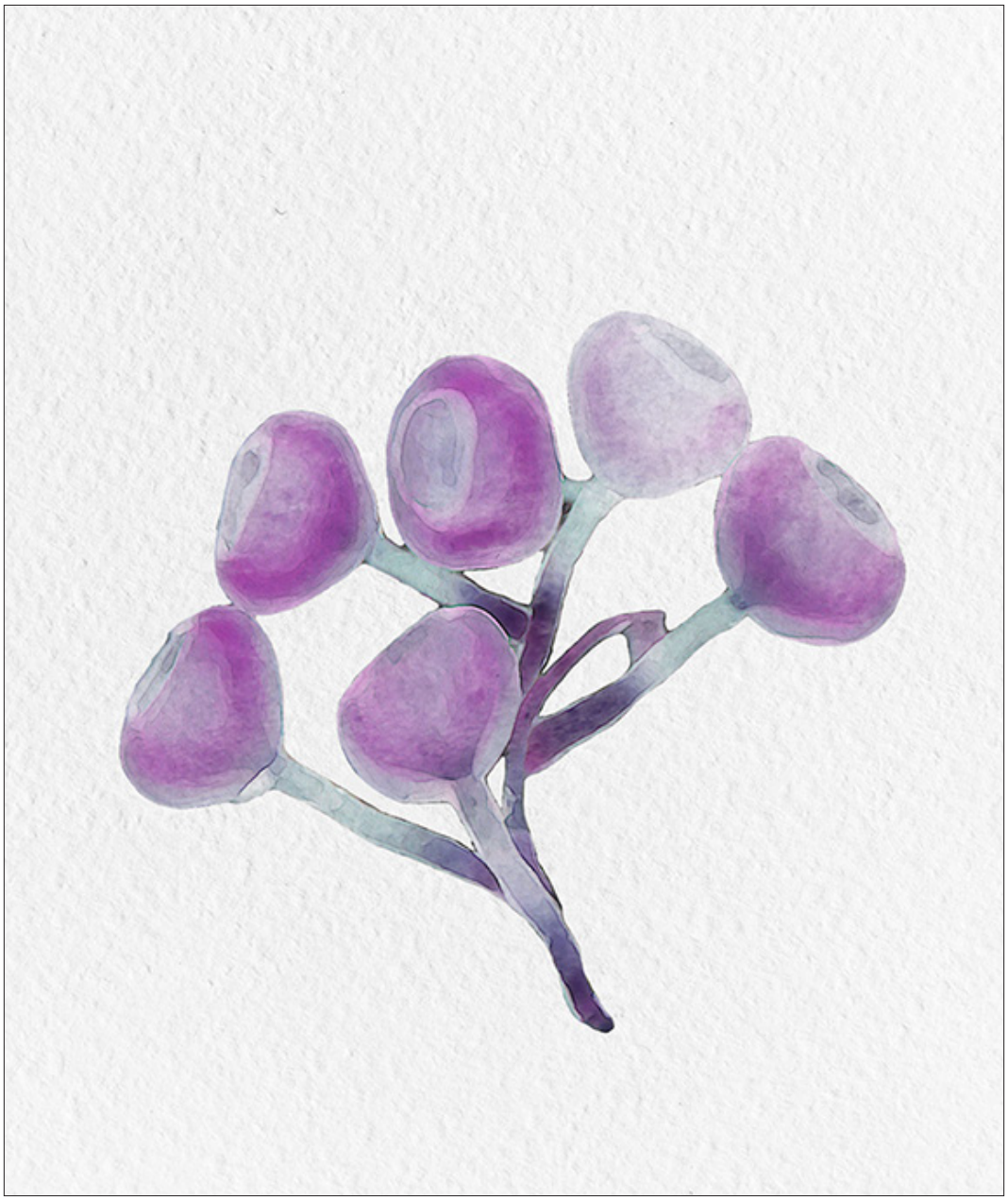
Starting in 2016, Akil and her team began recruiting freshmen at the University of Michigan in an effort to work out the main risk factors for developing mental illness when first confronting the stress of a major new life challenge: starting college. Before the COVID-19 pandemic, the team showed that the genetic risk for depression was somewhat predictive of who would emerge from their freshman year with one or more episodes of depression or anxiety. When COVID lockdowns struck the United States, depression rates in the freshman cohort skyrocketed. To their surprise, the team found that the usual correlation between genetic risk and depression dissolved. Instead, the students' mindset or emotional makeup going into the freshman year was a much better predictor of who suffered most during lockdown.

The study is a reminder of how many factors — be they genetic, environmental, or psychological — play a role in mental illness. "I watched the field try to come up with a simple hypothesis that explains everything," she says. "And the brain laughs at us and says to us: 'You fool! That's not how that works.'"

The use of FGF pathways to develop treatments is "in early stages, but remains very much a high priority," says Eric Nestler, Nash Family Professor of Neuroscience, and director of the Friedman Brain Institute at the Icahn School of Medicine at Mount Sinai.

There are also non-pharmaceutical ways to tap into these pre-installed networks. In one study, Akil and her colleagues found that raising rats in an environment filled with toys helped activate the FGF2 systems in their brains. Resilience, says Akil, "is an active process that we can biologically understand and enhance."

Educating and *Engaging* the Public



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BrainFacts' *Journey* to the Inner Cosmos

BrainFacts' outreach efforts, supported in part by the Dana Foundation, take neuroscience out of the lab and into the pub, the classroom, and beyond.

Suds and Science

Since joining the editorial board in 2019, BrainFacts Editor-in-Chief (EiC) Richard Wingate has been eager to reach out to the public during the annual meeting. During Neuroscience 2023, he got his wish. After the scientific programming concluded on Sunday, BrainFacts went live at Right Proper Brewing Company. SfN Public Education and Communication Committee (PECC) Chair Damien Fair spoke on mental health, BrainFacts Editorial Board Member Susana Martinez-Conde illustrated how we perceive the world, and New York University Professor Joseph LeDoux performed with his neuroscience-themed band, the Amygdaloids. The more than 150 attendees of the first-ever BrainFacts LIVE explored the "Universe Between Our Ears" over pints of brain-inspired beer.

Attendees of the first-ever BrainFacts LIVE explored the "Universe Between Our Ears" over pints of brain-inspired beer.

For Brain Awareness Week (BAW), BrainFacts tapped into the pub trivia movement by providing brain-related trivia questions to test public knowledge of the brain and nervous system. From March 10 to 16, more than 16 pub trivia organizations across the United States incorporated BrainFacts-provided trivia into multiple sessions of their standard programming.

During Neuroscience 2023, the Brain Awareness Campaign Event focused on celebrating neuroscience outreach and understanding the impact of outreach efforts. Manuella Olivera Yassa, director of outreach and education at the Center for the Neurobiology of Learning and Memory, University of California, Irvine, gave the keynote address discussing how evidence-based approaches can amplify the value of science outreach programming beyond those attending. In addition, SfN honored the winners of BrainFacts' Brain Awareness Video Contest. The videos this year covered artificial intelligence, brain-computer interfaces, perception, and more.

Re-Engaging the Science Teaching Community

BrainFacts returned to the National Science Teaching Association conference for the first time since 2019, offering educational materials to help teachers bring neuroscience to their students. SfN member Emma Bleakman presented a workshop on teaching neuroscience at the elementary school level, offering ready-to-use lesson plans that are available on BrainFacts.org.

In partnership with LabXChange, an online learning community within the Open edX platform, BrainFacts launched its first learning pathway based on the Neuroscience Core Concepts. Guided by BrainFacts Associate Editor Charles Yokoyama, the new pathway offers an engaging way for students and science-curious individuals to learn the fundamentals of neuroscience.

Coverage of Neuroscience 2023 and Beyond

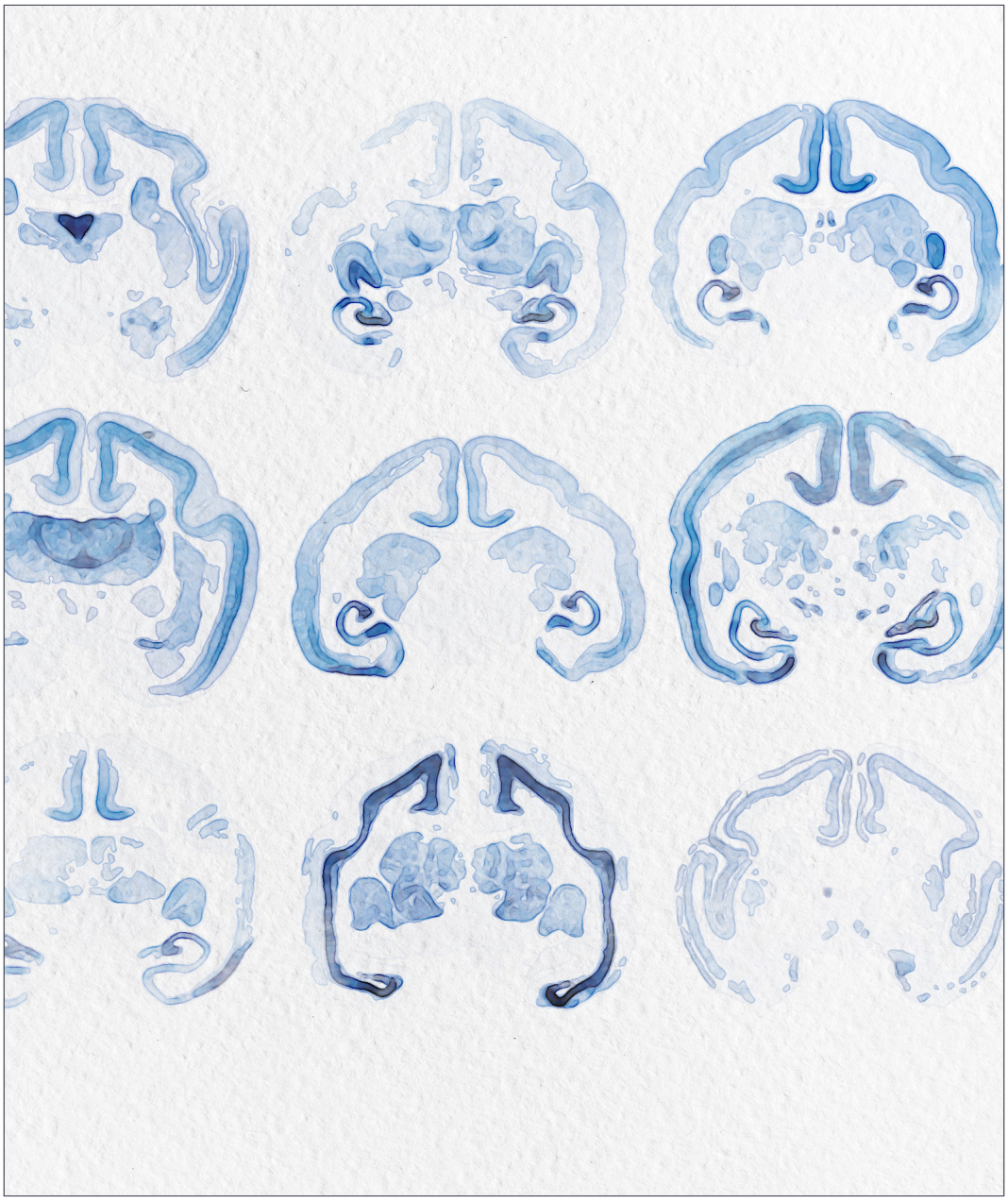
BrainFacts captured some of the exciting science presented at Neuroscience 2023. Through BrainFacts, scientists and non-scientists alike can learn about blood-based tests to detect Alzheimer's disease, the COVID-19 pandemic's influence on adolescent brains, the effect of wildfire smoke on cognition, and more. Beyond the annual meeting, BrainFacts has continued its animation series. The top content of 2023 highlights the creative content and fascinating discoveries on the site, which owes its success to funding from SfN and the Dana Foundation.

Editorial Board Comings and Goings

BrainFacts relies on its editorial board for context and guidance. The editorial board said goodbyes to Associate Editor Yokoyama, and board members BJ Casey and Robert Knight. New members Kevin Mitchell of Trinity College Dublin, Sarah Heilbronner of Baylor College of Medicine, and Nandakumar Narayanan of the University of Iowa offer expertise on a wide range of topics, from free will and motivation to neuroanatomy. In acknowledgment of ongoing opportunities in the BrainFacts and outreach areas, SfN Council voted to extend EiC Richard Wingate's term through 2026.

> ***"What I have learned... is the importance of centering epistemic equity. There is a tremendous amount of knowledge that exists in our communities and in the individuals that are participating in our programs."***
>
> **Manuella Olivera Yassa**
> *Director of Outreach and Education at the Center for the Neurobiology of Learning and Memory, University of California, Irvine*

Science in *Progress*



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Science in Progress

Putting Artificial *Neural Networks* to the Task

Using computational modeling, Kanaka Rajan builds neural networks to examine brain functions — and to understand how the brain solves problems.

Inspired by the human brain, artificial neural networks are at the heart of artificial intelligence. These machine learning algorithms are so adept at finding patterns in large volumes of data that they excel at singularly-focused yet mind-boggling tasks — from managing complex supply chains to diagnosing disease. Artificial neural networks can predict the words you plan to type or find the faces in a photograph, unlike the brain, which is not optimized for a single task.

Even though the brains of humans and animals may be more likely to make mistakes than purpose-built algorithms, they also generate far more complex behaviors. It is the origins of these complicated and imperfect behaviors that computational neuroscientist Kanaka Rajan, a faculty member at Harvard's Kempner Institute, wants to understand. She is using artificial neural networks to investigate some of the brain's most sophisticated functions, such as learning, decision-making, and social cognition.

"On the industry side, they have developed AI models by engineering them to do very specific things. For example, a whole bunch of data goes into specialized architectures that can then learn to predict language," says Rajan, who uses artificial neural networks and other types of models to better understand the brain. "But those specialized models can't do a whole lot else."

The artificial neural networks Rajan builds are computational models developed with data from real animal brains. Like the machine learning algorithms at the heart of most of today's artificial intelligence applications, they are made of simple, neuron-like units that organize themselves into information-processing networks when they are trained to do a task. They are different from more traditional models of neural circuits, which deliberately replicate the nervous system's anatomy or activity.

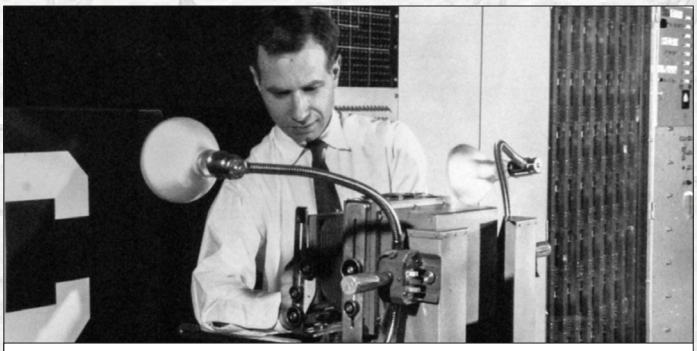
Kanka Rajan delivers remarks at the SfNova Lecture, "Connecting the Dots: What Artificial Neural Networks Tell Us About the Brain and Ourselves," November 11, 2023, at Neuroscience 2023 in Washington, D.C.

"Before, if you were building a computational model of the brain, you might take data about what we know about how neurons work and how they're connected and what activity patterns they have, and you would put that together to make this little

Science in Progress

model of how neurons connect to each other and how they produce their own activity," says Grace Lindsay, a computational neuroscientist at New York University (NYU).

Such models have helped explain the many fundamental properties of neural signaling, but unlike neural networks, they don't transform the input they are given to perform tasks. They can't produce movement or interpret sensory information, let alone form memories or learn new skills.



Frank Rosenblatt and an early neural network machine.

Staying on Task

The first trainable artificial neural network was constructed in the 1950s by psychologist Frank Rosenblatt at Cornell University, who built a bulky machine that could learn to discriminate between different visual patterns. Neuroscientists began experimenting with more sophisticated artificial neural networks in the 1980s, but Lindsay says they have emerged as a particularly powerful tool for neuroscience largely within the last decade, fueled by advances in both computing power and artificial intelligence.

Now that neuroscientists can train artificial neural networks to do things the brain does, researchers

> ***"That's what makes these models so exciting, because we might get to understand really how our brain works..."***
>
> **Kanaka Rajan,**
> *Faculty member at Harvard's Kempner Institute*

can study how those models handle their tasks, in the hopes that this will help explain how the brain accomplishes the same thing. Artificial neural networks can learn to recognize visual objects, identify odors, or move muscles. At NYU, Lindsay and her team are using them to study how paying attention helps us learn and perform more successfully.

As new technologies empower neuroscientists to glean more data from their experiments, modelers have been able to incorporate more biological details into their models and explore increasingly complex brain functions. Less than 20 years ago, neuroscientists who measured neuronal activity were limited to monitoring small clusters of neurons. Today, they can track the activity of thousands of individual cells, distributed across an organism's entire brain, sometimes recording more than a terabyte of data on neural activity in a single session. Experiments may continue for hours or days, with data collected at tens of thousands of time points. New technologies, such as automated video analysis, have enabled detailed tracking of animals' behavior during experiments.

Rajan says models are essential to make sense of this onslaught of data. Fortunately, more data means better models, and the data explosion is enabling Rajan to investigate processes that draw on many parts

Science in Progress

of the brain. Her artificial neural networks embrace biology's inherent complexity. Rather than modeling the activity of isolated groups of brain cells, they reflect the impact neurons in one part of the brain can have on the behavior of neurons elsewhere. Just as importantly, they acknowledge that unlike many forms of artificial intelligence, the brain has not been engineered to excel at one particular task. Rajan wants to understand the ways humans and other animals solve problems, mistakes and all.

Modeling Decision-Making

Rajan and her collaborators use data from a variety of organisms, from naked mole rats to humans, to investigate how animals learn, remember, and make decisions. For example, with data Karl Deisseroth's lab

Rajan has used data from zebrafish and other animals to build artificial neural networks, helping explain how their behavior evolves over time at the cellular level.

at Stanford University collected from across the brains of zebrafish, Rajan has built artificial neural networks that help explain at the cellular level how an animal's behavior evolves over time. With Peter Rudebeck at the Icahn School of Medicine at Mount Sinai, Rajan is modeling decision-making circuitry to make predictions about how the brain updates information about potential outcomes.

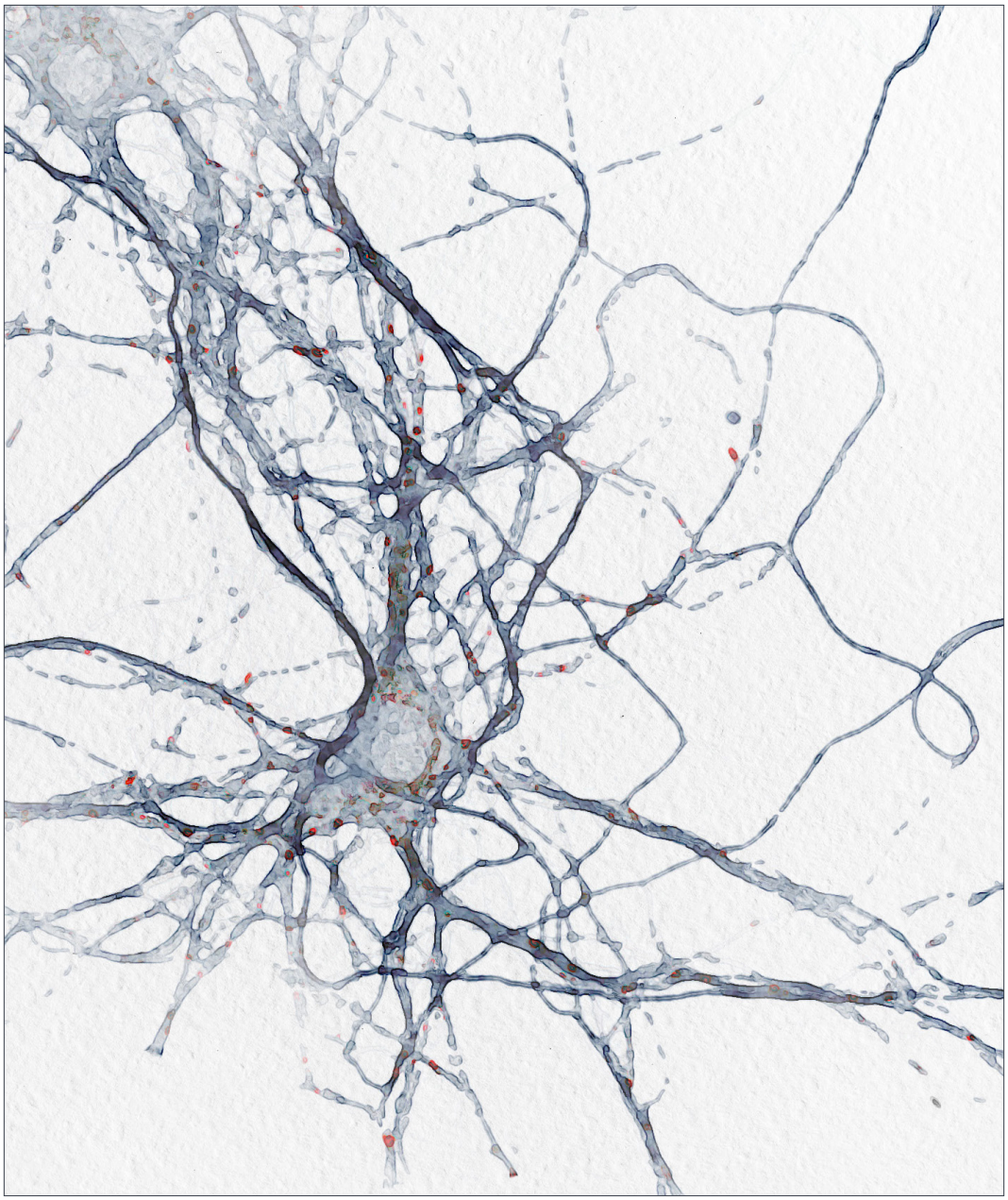
Her models are particularly powerful, Rudebeck says, because they are able to incorporate interactions between many parts of the brain. "Most of the ways that we understand the brain in the moment are just pairwise interactions: area one, area two, and how those talk to each other," he says. "That's what makes these models so exciting, because we might get to understand really how our brain works, which is not just two areas talking to each other — it's five or six or seven [or more]."

Even still, Rajan says, "We may be looking at the wrong scale of things." Most decisions, she says, are made by small groups of people or animals. So, she and collaborators have begun looking beyond individual brains to study how an animal's behavior is influenced by the behavior of others.

The plan, she explains, is to develop tiny robots powered by artificial neural networks, trained with data from real animals, and then allow small groups of them to communicate and cooperate in lifelike situations, such as foraging for food. The models will inform further experiments with real animals in similarly sized groups, so researchers can learn what drives social dynamics, as well as how interactions change when an individual is affected by conditions such as anxiety or autism. They might even be used to explore social engineering approaches to addressing mental health concerns, Rajan says.

Artificial neural networks won't explain the brain on their own, Rajan says. A continuous exchange of ideas with experimental biologists is vital. And it won't take one model, but many. "Biology is not idealized, it's gnarly," she says. "I think the way understanding is going to emerge is as a collective. We're going to need a huge pile of models and theories and discoveries."

Advocating for the Field



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NeuroAdvocates *Focus* on Washington, D.C.

Several policy areas were influenced by NeuroAdvocate engagement.

Making the Case for Neuroscience

While gathering for Neuroscience 2023, the Congressional Neuroscience Caucus (CNC), in cooperation with SfN and the American Brain Coalition, hosted a Congressional briefing on post-traumatic stress disorder (PTSD); this was the first time SfN organized a Congressional briefing during an annual meeting. Congressmen Earl Blumenauer (D-OR) and Morgan Luttrell (R-TX), co-chairs of the CNC, offered opening remarks. Neuroscience 2023 also featured the Animals in Research Panel, supported by the National Primate Research Centers. The topic focused on the successes in neuroscience research from bench to bedside and featured a patient advocate with a spinal cord injury.

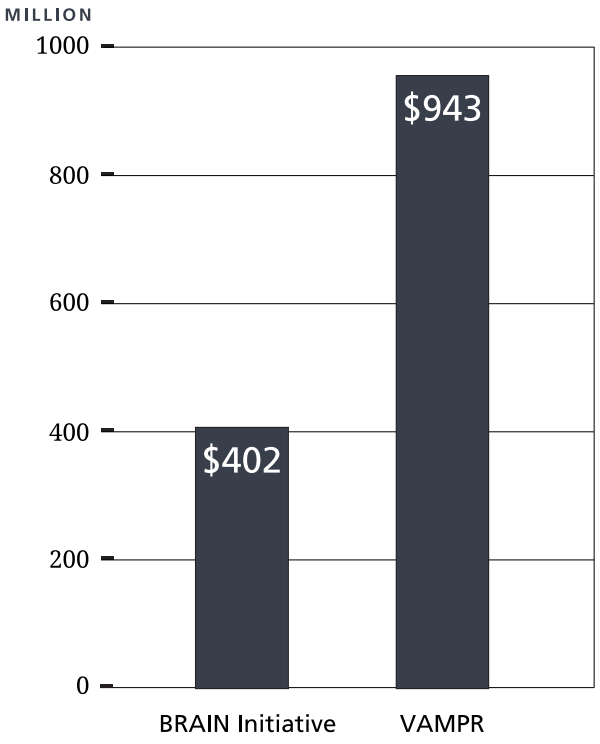
SfN's Government and Public Affairs Committee (GPA), the new class of Early Career Policy Ambassadors (ECPAs), other SfN members, and partner organizations gathered virtually for SfN Capitol Hill Days, March 12–14, 2024. A total of 46 participants held 53 meetings with members of the U.S. Congress and their staff representing 29 states. Hill Days participants delivered four "asks" centered on appropriations, the continued ethical and responsible use of animals in biomedical research, lab tours, and joining a neuroscience-related caucus. SfN Hill Days were held during Brain Awareness Week (BAW), and BAW was recognized on the floor of Congress by Congressman Luttrell on March 13.

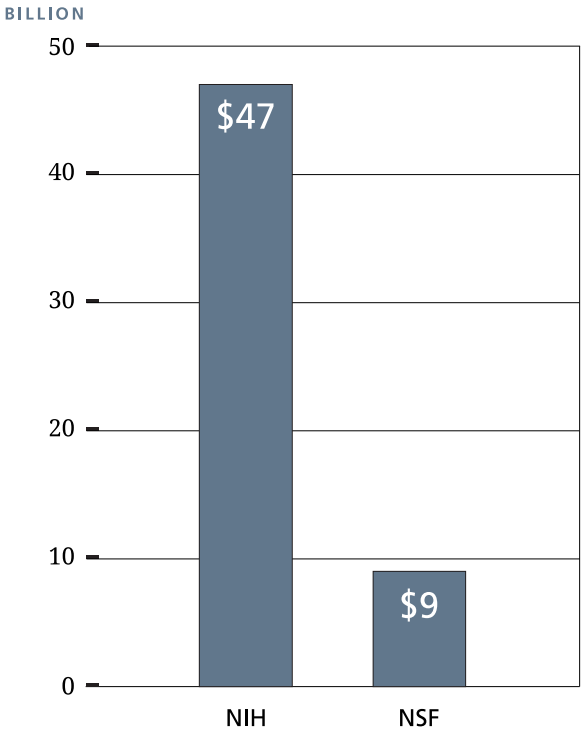
Neuroscience 2023 Congressional briefing speakers ahead of their remarks on Capitol Hill.

SfN CAPITOL HILL DAYS AT A GLANCE

46	53	29
PARTICIPANTS	MEETINGS	STATES

NEUROSCIENCE-FUNDING AGENCIES FY 2024 BUDGET





"Everything we do in Congress has to do with neuroscience."

Congressman Earl Blumenauer *(D-OR)*

To support the ECPAs and their year-long advocacy efforts, each ECPA was paired with a mentor from GPA to act as a source of advice related to advocacy efforts or larger career questions. These advocacy efforts included hosting lab tours for members of Congress and their staff, writing op-eds, and more. The ECPA program continues to grow in popularity, with a record number of applications received for the 10 spots in the 2024 class.

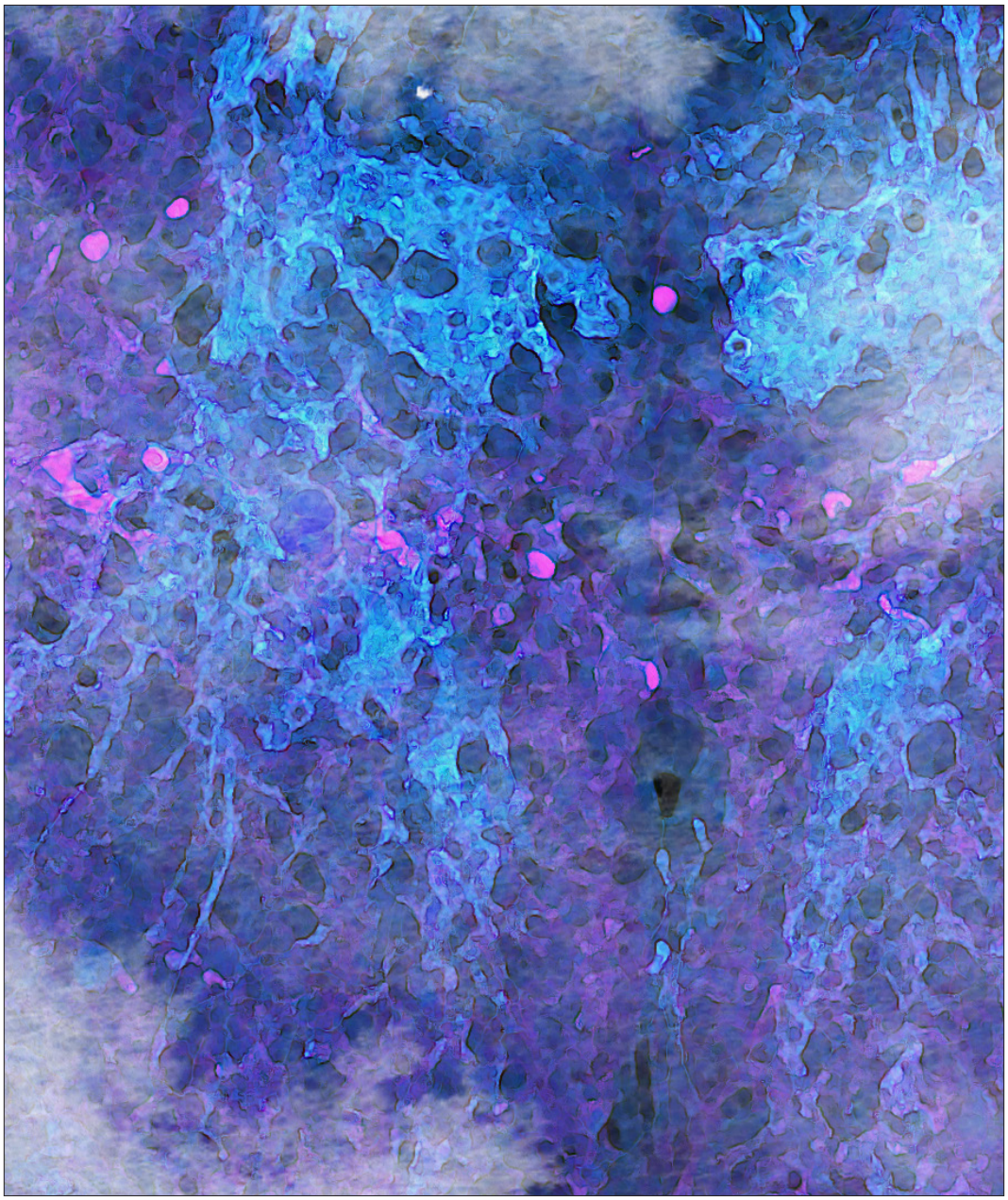
Defending Animal Researchers

SfN and its advocacy partners championed report language that was enacted in the final FY 2024 federal appropriations legislation. The language recognizes the irreplaceable value of unique animal models in biomedical research and urges NIH to fund meritorious research proposals using non-human primates (NHPs). SfN shared with NIH results from a survey of researchers who had experienced attacks from animal-rights groups.

Changes in Leadership and Funding

NIH welcomed Monica M. Bertagnolli as its new director in 2023. She became the first surgeon and second woman to hold the position. SfN and its advocacy partners had an opportunity to meet with Bertagnolli shortly after she was confirmed. In another change, a divided Congress resulted in a decrease in appropriations for most neuroscience-funding agencies in FY 2024 for the first time in several years. NSF saw a 5% cut to ~$9 billion. NIH was trimmed 1% to ~$47 billion, with the BRAIN Initiative suffering a 41% reduction to $402 million. One bright spot was the VA Medical and Prosthetics Research (VAMPR) program, which saw a 3% increase to $943 million.

Financial and Organizational *Highlights*



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Adapting to a New Fiscal Landscape

With Neuroscience 2023 exceeding attendance and exhibit projections, SfN journals maintaining revenue consistency, and membership slightly below projections, the Society's core mission pillars finished the fiscal year in a stronger position than anticipated, while the LLC is still seeing shortfalls.

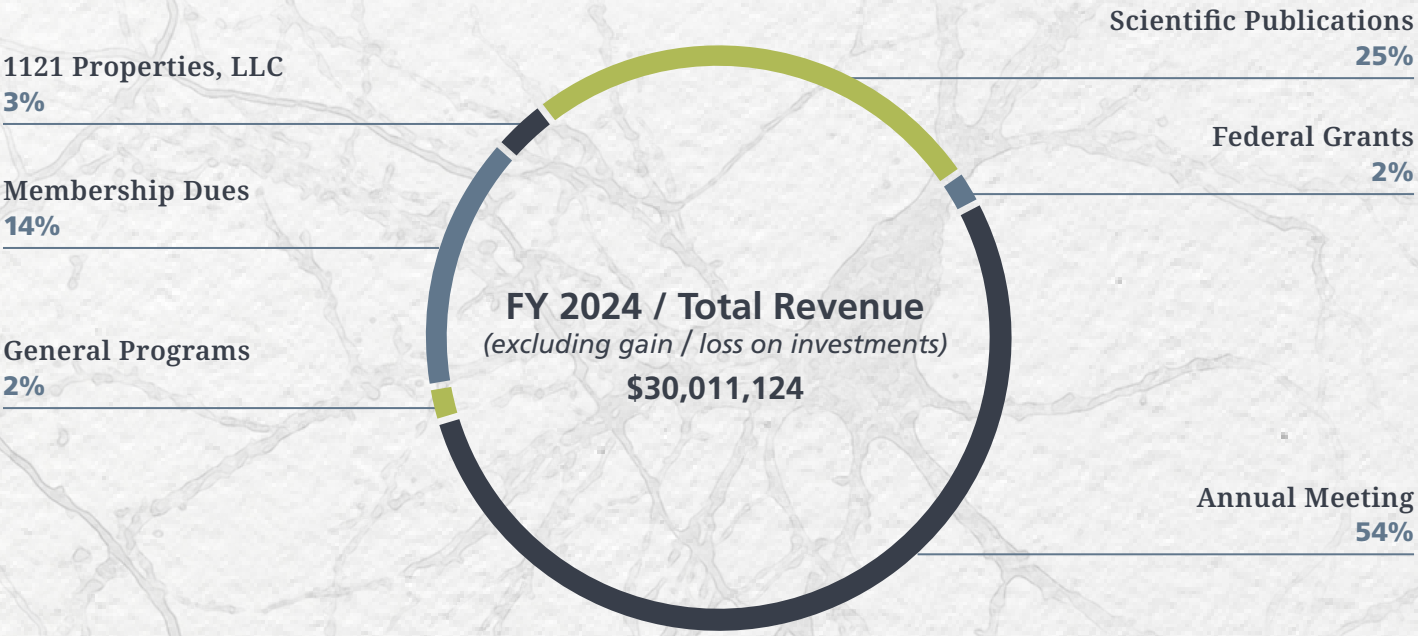
The neuroscience community's return to the in-person annual meeting — following pandemic-era restrictions — helped stabilize SfN's primary sources of revenue. While the near term is likely to have further financial ups and downs, SfN was able to pay off its lines of credit, taken out during the pandemic to meet cash flow needs, further enhancing the Society's fiscal stability. 1121 Properties, LLC continues to have revenue shortfalls due to challenges in the Washington, D.C., real estate leasing market. SfN continues to work with its legal counsel to resolve the outstanding insurance claims related to the 2020 and 2021 annual meetings.

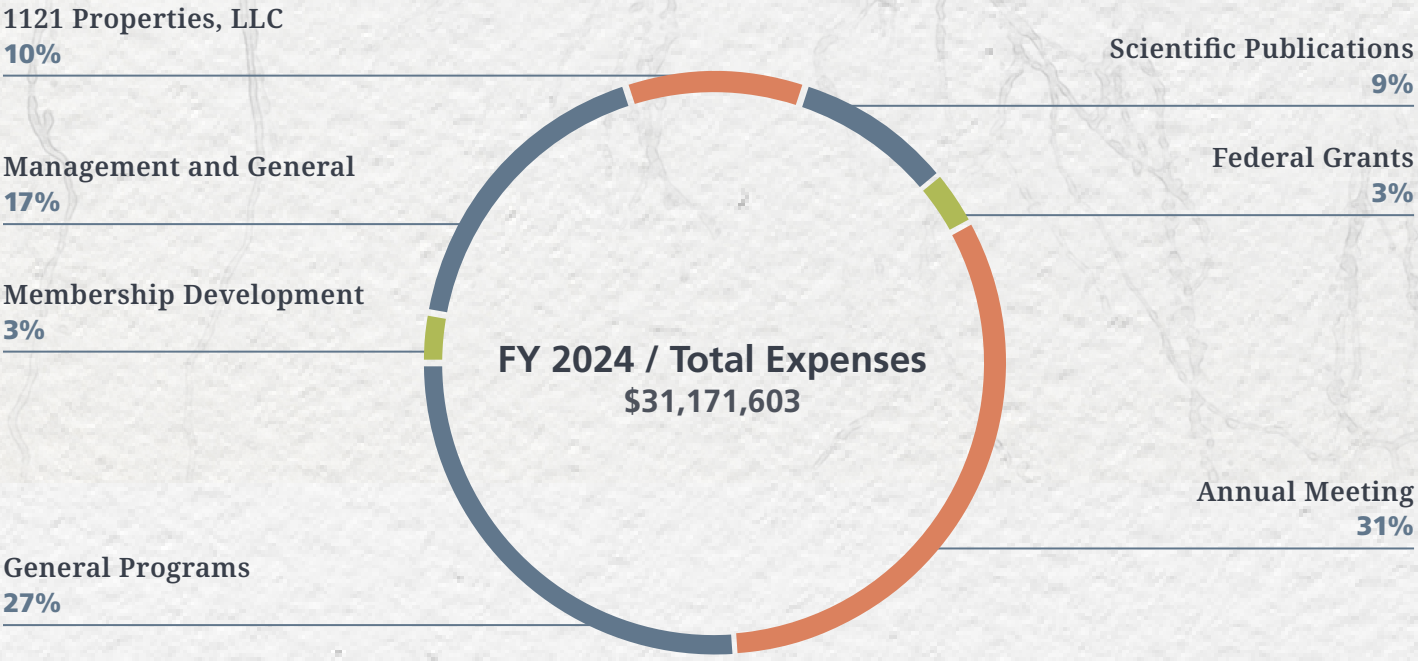
In recognition of the disruption the pandemic caused to two annual meetings, SfN's Strategic Reserve Fund is being expanded to include two years of cash outflows (up from the previous one year of cash outflows) and all restricted assets. To support the Fund's growth and ensure SfN's long-term stability, SfN Council approved a multi-pronged revenue modification strategy. At the same time, Council also approved an increase in the annual draw on the reserves to $2.5 million to support the Society's current programming needs.

SfN continued to prioritize investments in security and data privacy, recognizing the importance of safeguarding sensitive member information. The Society also worked to ensure that its staffing levels were appropriate for meeting members' needs.

Two bequests to the Society from long-time SfN members enabled Council to establish new endowments to support the neuroscience community. Educators John I. Simpson and James L. Roberts left unrestricted funds that have since been turned into endowments that will fund Trainee Professional Development Awards (TPDAs) in perpetuity. Council strives to honor the wishes of those who leave bequests to the Society and encourages those who are planning their estates to consider SfN.

With the recent evolution of SfN's fiscal landscape, Council has directed several strategic shifts. To better serve the field of neuroscience, which has expanded greatly over the last 10–15 years, Council created a working group tasked with revisiting the Society's individual membership model. Exploration of membership options could impact SfN's membership growth beyond the Society's traditional academic base.


1121 Properties, LLC
3%
Membership Dues
14%
General Programs
2%
Scientific Publications
25%
Federal Grants
2%
Annual Meeting
54%
FY 2024 / Total Revenue
(excluding gain / loss on investments)
$30,011,124


1121 Properties, LLC
10%
Management and General
17%
Membership Development
3%
General Programs
27%
Scientific Publications
9%
Federal Grants
3%
Annual Meeting
31%
FY 2024 / Total Expenses
$31,171,603

Donors

The Society for Neuroscience (SfN) gratefully acknowledges the generous contributions to SfN from the following organizations and individuals in FY 2024 (July 1, 2023–June 30, 2024). Donations to the Friends of SfN Fund support the Society's mission of advancing the understanding of the brain and nervous system.

Visit SfN.org/Support-SfN or contact development@sfn.org to learn more about the Fund and becoming a donor.

Program, Event, and Award Donors

The SfN Council thanks the following organizations and individuals who contributed support to or sponsored SfN's programs, events, and awards in FY 2024, including Neuroscience 2023.

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National Institute of Neurological Disorders and Stroke, NIH

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Kristen M. Harris, PhD
The Nemko Family
The James L. Roberts Fund
The John I. Simpson Fund
The Trubatch Family
The Waletzky Award Prize Fund and the Waletzky Family
The Nancy Rutledge Zahniser Fund

Friends of SfN Fund

The Society for Neuroscience (SfN) gratefully acknowledges the generous donations to the Friends of SfN Fund and to memorial funds in FY 2024. Donations support the Society's mission of advancing the understanding of the brain and nervous system.*

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