

Creating Value

in Challenging Times



SOCIETY *for*
NEUROSCIENCE



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NEUROSCIENCE

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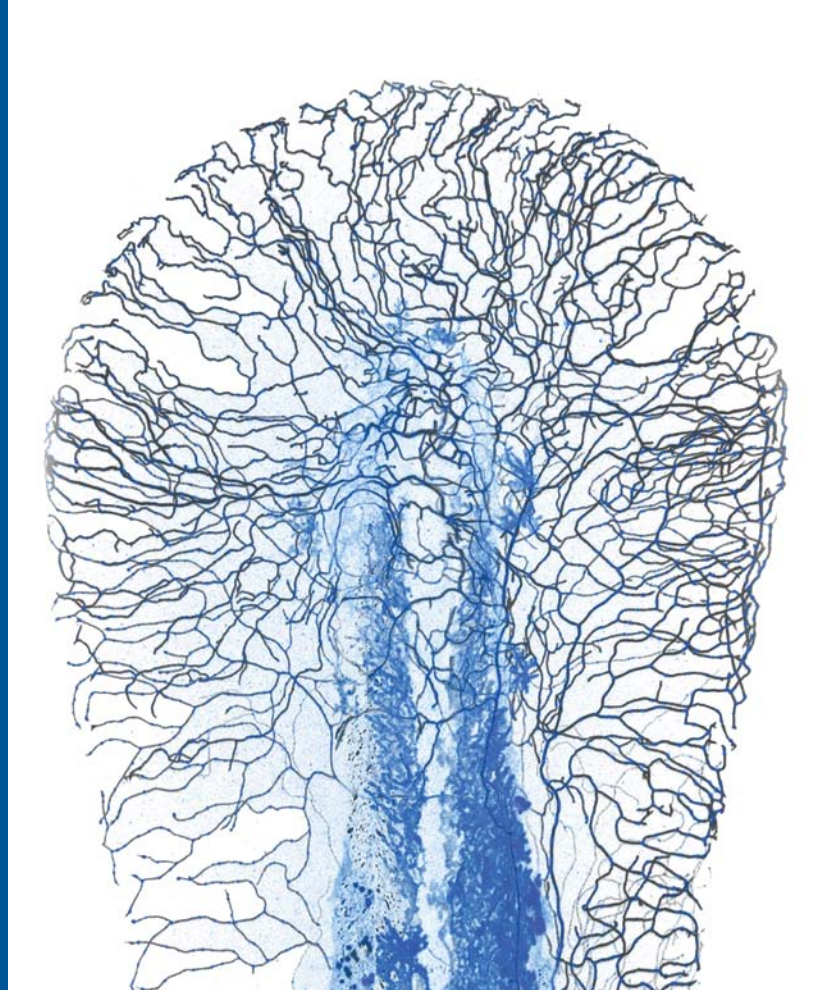
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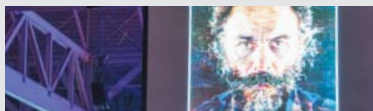
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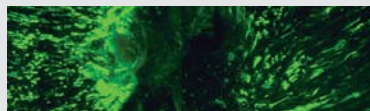
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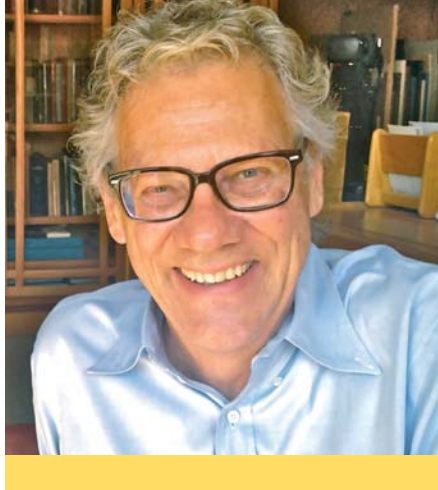
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Message From the President

There has never been a more exciting time to be an explorer of the brain, and SfN programs played a catalytic role in supporting advances in the field in FY2013. Neuroscience is advancing into uncharted territories, including proteomics and epigenomics, and every passing day deepens our understanding of complex brain circuits for cognition, action, and emotion. As many of the best and brightest scholars are choosing to dedicate their lives to answering fundamental questions about brain function, it is a field that is growing at the speed of thought. SfN program innovations this year made it easier to bring scientists together for learning and debate, brought new training and communications resources to support scientists at every career stage, and saw the rapid growth of public engagement about the wonders of the brain and mind.

Advancing the Field Through Opportunity and Challenge

Neuroscience is on the cusp of revolutionary advances, and it is heartening that in the last year many governments have begun urging greater neuroscience investment to help address looming trends in health care and society. In the United States, Europe, Canada, China, and elsewhere, major new potential investments would advance fundamental understanding of the brain and accelerate discoveries to improve the health and quality of

life for the more than 1 billion people worldwide suffering from 1,000 brain diseases and disorders.

Along with this exciting news comes the stark reality that political and economic circumstances are making it harder to secure funding for research. Sequestration in the United States and continued economic distress in Europe and Japan are constraining scientific enterprise across the globe. As U.S. President Obama noted while announcing the BRAIN Initiative, funding cuts are “threatening to set us back before we even get started.”

In FY2013, SfN prioritized advocacy and education in the United States and on a global scale, reminding policymakers and the public that scientific research is not a luxury or an expense, but rather an investment that is fundamental to scientific knowledge and to freeing humanity from costly and debilitating illnesses. In the United States, SfN mobilized thousands of letters to Capitol Hill from scientists and brought young and established scientists to Washington, DC, for advocacy days. Globally, SfN worked to strengthen partnerships with the Federation of European Neuroscience Societies and the International Brain Research Organization to activate greater advocacy by national societies and scientists across the globe. The new *BrainFacts.org* site exceeded its goals, reaching more than 1 million page views in just its first year, with more than 50 percent of visitors from outside the United States.

Meeting the Needs of Neuroscientists

In both good and difficult times, we can rely on the strong neuroscience community and networks to add value to our science and professional lives. I often mention that I have been to all 42 SfN annual meetings, and I firmly believe that the SfN annual meeting remains the single best venue to learn, find inspiration, grow professionally, and build powerful connections with other neuroscience researchers and stakeholders. The 2012 meeting featured workshops, symposia, and lectures that brought neuroscience to life for nearly 30,000 attendees from 80 different countries. New technologies for displaying posters and navigating the meeting made the event even more rewarding. The meeting also offered professional development workshops, meet-the-experts sessions, a mentor program, and a sold-out graduate school fair to help young neuroscientists learn about options.

For neuroscientists at any career stage, SfN added new resources in its online NeuroJobs Career Center, including informational videos and career profiles, along with tools to help get papers published and find mentors. SfN launched its first live online programming, addressing the critical issue of gender and diversity bias in hiring, promotion, and tenure, with more to come. All of these resources are available on a new website, SfN.org, which was launched in February 2013 and is on a path to become a major hub of neuroscience information for the field.

The Journal of Neuroscience remains an invaluable resource for both furthering careers and advancing the study of the brain. In FY2013, the most-cited peer-reviewed publication in the field launched a new mobile strategy, including a mobile app and mobile website. *The Journal* publishes 50 weeks a year, producing nearly 18,000 editorial pages of emerging science.

Commitment to the Future

Neuroscience increasingly has the attention of the world, with some comparisons suggesting that brain research will be this century's moon landing or genome project—only much more challenging. But we cannot be complacent about the future or this success. Without effective support for the field's scientific dialogue and its professional and field development, as well as strong public and policymaker support, the desired progress will be constrained.

SfN is playing a critical role in creating value for our members, the field, and the public across all of these areas. In these uncertain times, I hope you share my appreciation for the value of SfN, and I encourage you to explore how SfN programs are advancing our dynamic and growing field. It has been my great honor to serve as president throughout this time, and I look forward to continuing to serve the field, helping to enable humankind to take another giant leap forward through brain research.



Larry W. Swanson
PRESIDENT

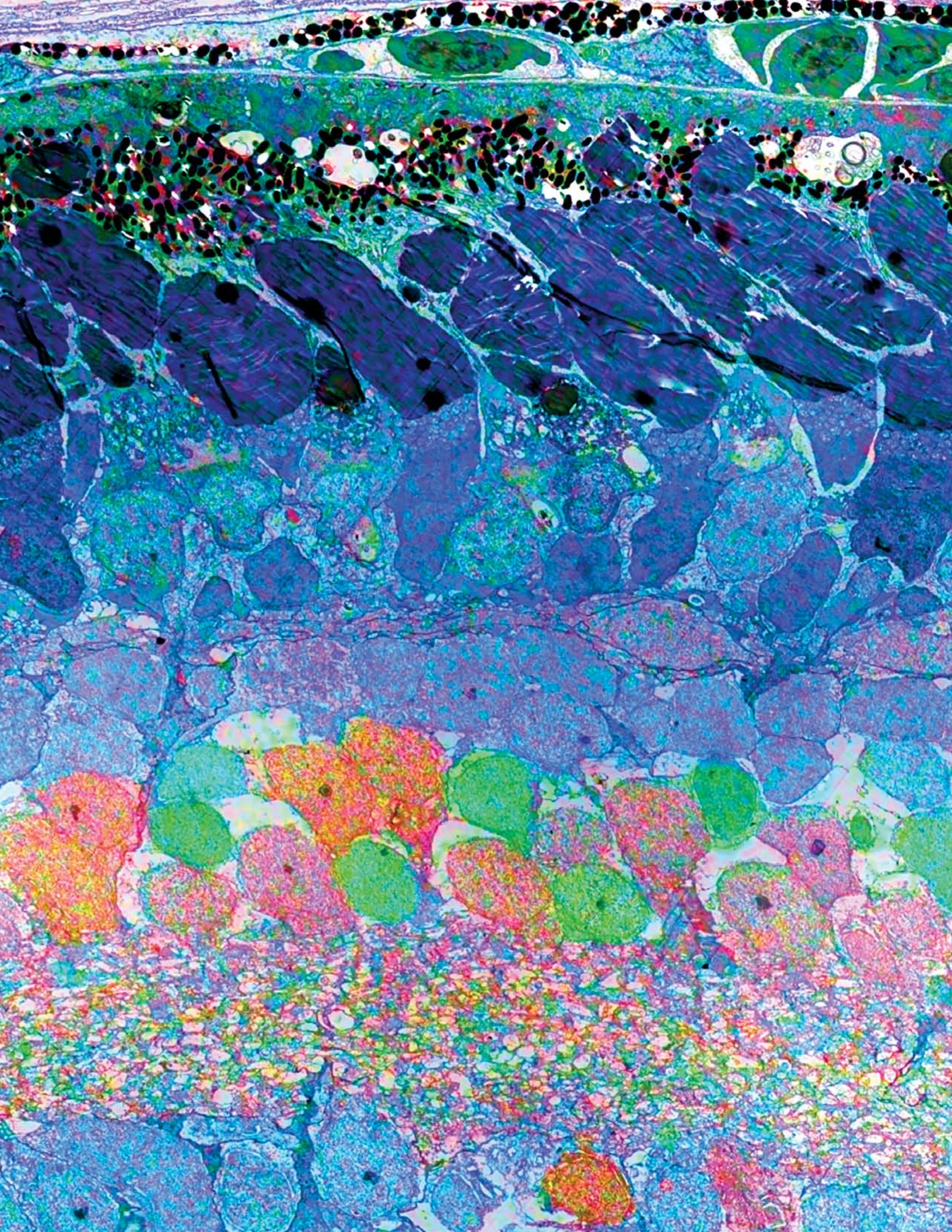
SfN Mission

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.

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.

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.

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.



Creating Venues for Great Science

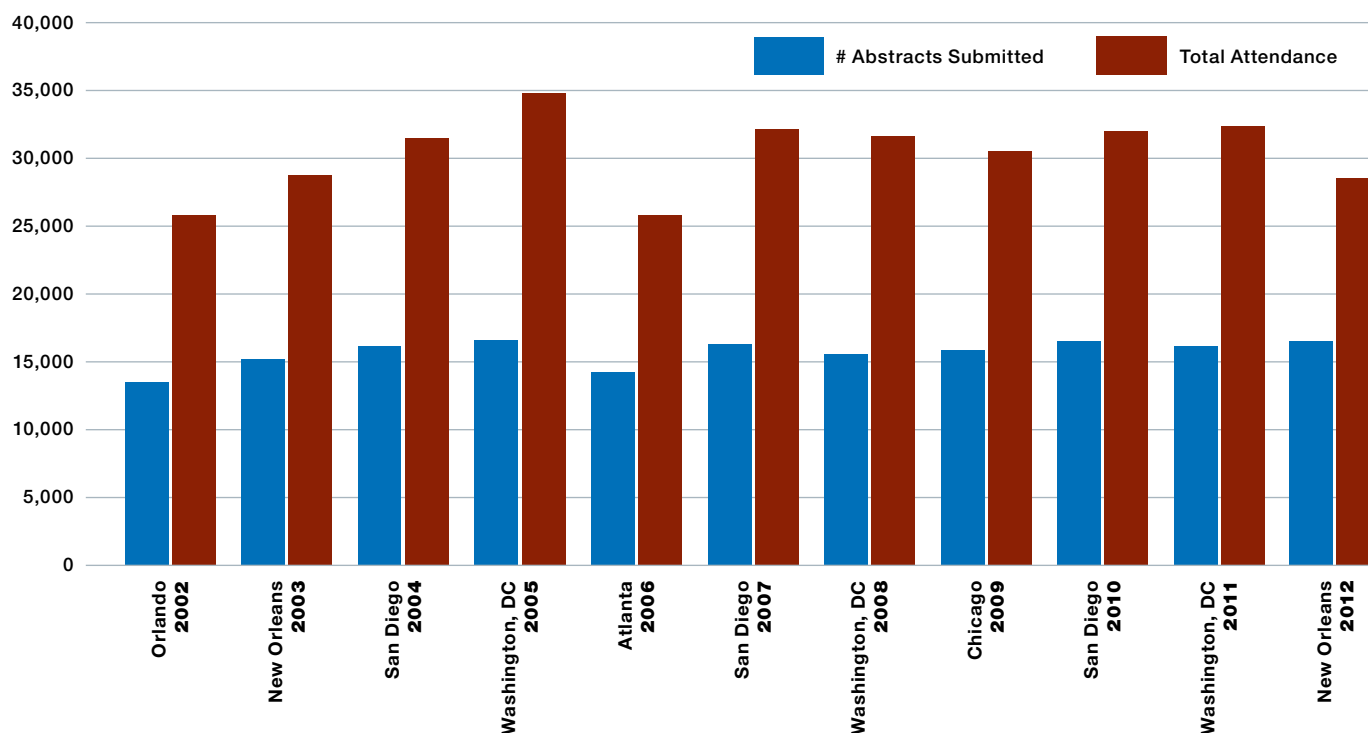
The Society for Neuroscience continues to serve as a leading convener and catalyst for neuroscience discovery by providing unparalleled venues where researchers can share, discuss, and debate emerging findings. The SfN annual meeting and *The Journal of Neuroscience* each played vital roles in shaping the field in 2012, and innovations within both activities are serving the evolving needs of the neuroscience community.

Neuroscience 2012: An unmatched place to learn, debate, and explore

Even, and perhaps especially, in economically challenging times for many scientists around the world, SfN's annual meeting is an unmatched location where scientists converge from around the world to collaborate and share information about research that spans the discipline. In 2012, highlights from the scientific program include:

■ Famed artist Chuck Close, who suffers from prosopagnosia or face blindness, as well as other neurological conditions, recounted his unique neurological challenges in the Dialogues Between Neuroscience and Society lecture. He described his path to a career in painting large-scale portraits of the human face,

STRONG SCIENCE DRIVES STRONG ATTENDANCE



Neuroscience 2012 included strong attendance and abstract submission numbers, which showcase the value of SfN and the meeting to the neuroscience community.



Tamara Franklin, PhD, presents the findings of her research at a press conference on stress and PTSD at Neuroscience 2012.



Neuroscience 2012 featured more than 900 scientific sessions and 16,000 poster presentations on innovations and new tools and technology in the neuroscience field.

which he now does from a wheelchair following severe paralysis.

- The Presidential Special Lecture series opened with Simon Fisher's presentation on the impact of genome research on human speech and language. James Rothman's lecture on molecular mechanisms of synchronous neurotransmitter release followed, along with Carla Shatz's presentation on manipulating molecular circuits for possible treatments for schizophrenia or autism, and Janet F. Werker's lecture on the implication of prenatal exposure to language on language development.
- A special Presentation by Steve Hyman, director of the Stanley Center for Psychiatric Research at the Broad Institute of MIT and Harvard University, effectively illustrated how the field's increasingly complex "ecosystem" is evolving, raising questions for the field to address through training, policy, funding, and more.

- V. Reggie Edgerton chaired the Fred Kavli Public Symposium, bringing the public and the neuroscience community together to discuss pathologies associated with traumatic brain injury.
- News coverage for the annual meeting hit a new high, maintaining the meeting's role as the world's largest source for emerging news on brain science and health.

As in previous years, SfN introduced innovations to enhance the attendee experience:

- For the first time, SfN hosted a demonstration of dynamic posters at Neuroscience 2012. The multimedia presentation format allows presenters to display science on flat screens using animation, audio, video, and digital images. Attendees are able to engage and interact with the presentations and presenters. Nine dynamic posters were featured at the meeting, with plans to grow the number of offerings in the future.

Looking **Forward:**

- *The Journal of Neuroscience* will continue to increase its mobile offerings, expanding the JNeurosci app to the Android platform.
- SfN has established an ethics committee which will ensure the scientific integrity of SfN activities, such as addressing any allegations of misconduct in annual meeting abstracts and *The Journal of Neuroscience* submissions.
- Neuroscience 2013 in San Diego will include nearly 16,000 scientific presentations and 52 symposia and minisymposia, along with workshops and other networking opportunities.
- SfN will tweet information about the annual meeting using the @Neurosci2013 handle and #SfN13 hashtag. SfN's Facebook page, Facebook.com/SocietyforNeuroscience, will also feature an event page for the meeting.



- A mobile app made its debut at Neuroscience 2012, allowing attendees to look up sessions, create itineraries, and exchange contact information with other annual meeting attendees, all on their smart phones and tablets. More than 3,500 downloads made it easier to navigate the meeting and reduced the environmental impact of the meeting by lessening the number of printed daily program books.

Neuroscience 2012 featured more than 900 scientific sessions on issues involving cutting edge research, basic science, innovative approaches, and new tools and technologies across the field. The thematic lectures, symposia, poster sessions, and professional development and mentoring programs offered key resources for scientists at all career stages in all neuroscience specialties. Those presentations, along with opportunities to meet and network with colleagues and mentors, share information, and establish new partnerships, contribute to making SfN's annual meeting the premier event within the neuroscience community and a valuable professional resource.

The Journal of Neuroscience: Publishing cutting-edge neuroscience research

Under the strong stewardship of Editor-in-Chief John Maunsell, *The Journal of Neuroscience* remained the most widely cited journal in the field in FY2013, and a competitive and popular place to publish emerging findings. *The Journal's* content is guided by an editorial team comprised of eight senior editors and 29 reviewing editors from 33 institutions in six countries, and 145 associate editors. Other key facts include:

- Maintaining an acceptance rate of 34 percent in CY2012 and an impact factor of 6.9, *The Journal* expects to publish nearly 18,000 pages in CY2013.
- The average time from submission to first decision was 30 days, while the average time from acceptance to publication was 55 days.

Recognizing that members often access information through mobile devices and tablets, SfN launched a mobile strategy in 2012 to provide easier access to the latest neuroscience discoveries reported in *The Journal*, beginning with iPhone platforms and soon to expand to Androids. JNeurosci, *The Journal's* free mobile app, allows viewers to read the current issue and the five previous issues. In addition, JNeurosci provides searchable abstracts and full-text articles complete with side navigation and internal hyperlinks. Devices registered with an institutional subscriber can easily browse images, article sections, and references in text and downloadable PDF formats whether the subscriber is on or off campus. JNeurosci also tracks reading history and allows users to electronically share content from sections of *The Journal* with colleagues.

Moreover, *The Journal* remains an international source for reliable, accurate news about brain research. In FY2013, coverage of *The Journal* spanned the globe with more than 10,000 articles featuring content from *The Journal*. Online coverage constituted the majority of media coverage, and included The Huffington Post, *The New York Times*, *The Telegraph*, National Public Radio, BBC, *Indian Express*, Yahoo! News Japan, United News Bangladesh, and *The Daily Mail*.



***The Journal of Neuroscience* remains the most cited journal in the field of neuroscience.**

Surrounded by Strangers: The Science of Face Blindness

Imagine not being able to spot your loved one in a sea of faces. Or standing in front of a mirror but not recognizing the reflection staring back at you. For American artist Chuck Close and the estimated one in 50 people worldwide who live with face blindness (known as prosopagnosia), such scenarios can be a reality. During the 2012 Dialogues between Neuroscience and Society lecture, held each year to explore the intersection between neuroscience and everyday life, Close explained that he has refused to allow his face blindness and other neurological conditions to keep him from creating the gigantic portraits that have made him famous. (Video of the lecture is available in the multimedia library on BrainFacts.org.)

While some people fail to develop the ability to recognize faces, others, like Close, experience injury or disease that makes previously familiar faces suddenly unknown. Close can see fine, but cannot remember faces he has seen before.

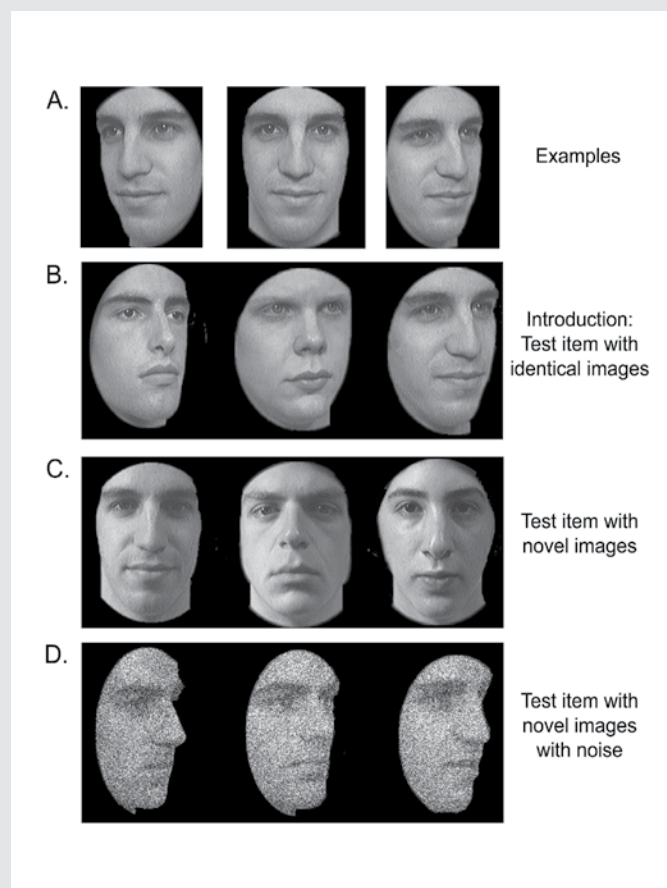
Scientists are interested in determining how the brains of people with face blindness differ from those of healthy people so they can better understand how the brain extracts key information from the faces of others. They hope such information will shed light on this disorder, which often leads to recurrent and negative social interactions for those affected.

About Face Recognition

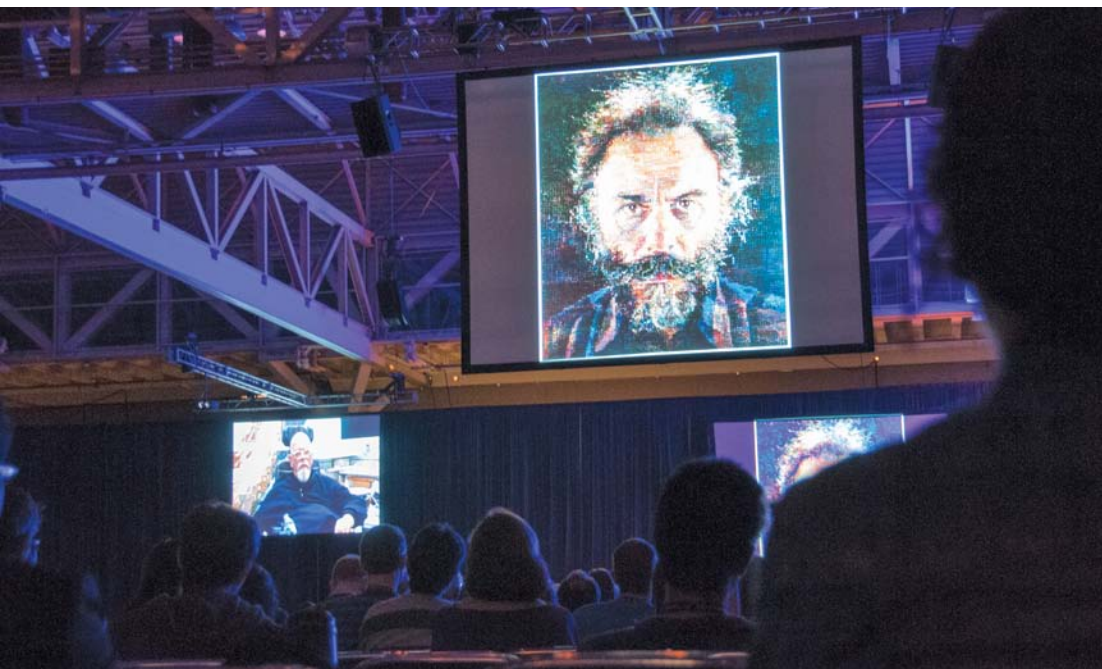
Face perception plays a vital role in the social interactions of humans as well as other species. In addition to serving as a primary means of recognition, studies show people have evolved to detect information about mood, focus of attention, and other cues from the faces of others.

Numerous studies of healthy people suggest the brain processes faces differently than other visual information. For example, people have a harder time recognizing or remembering faces when they are displayed upside down than they do recognizing other objects displayed upside

down. Other research finds people more accurately discern parts of faces, such as a nose, when they are presented in the context of the whole face than when presented in isolation. When people are asked to discern between the features of an object, such as the windows of a house, however, they do not need to see the entire house. Studies of people with face blindness, who are often able to recognize objects, also suggest the brain uses distinct mechanisms to recognize faces.



People with face-blindness have trouble identifying the faces in rows B, C, and D that match the person shown in row A.



At Neuroscience 2012, Chuck Close (in screen, bottom left) discussed his life with neurological disorders, including face blindness, and how they influence the creation of his iconic portraits.

Neuroimaging studies have pointed to regions of the brain that appear to be selectively involved in the perception of faces. When adults view faces, for example, a network of regions in the occipital and temporal lobes of the brain become more active than when viewing objects.

The Search for New Clues about Face Processing

While damage to the occipital and temporal lobes is often associated with the onset of face blindness, scientists are increasingly interested in the nature of the deficit in people who are face blind due to issues that arise in development.

Scientists hope that studying people with developmental prosopagnosia will lead to new insights about the mechanisms underlying face and non-face processing. For instance, early studies show people with developmental prosopagnosia tend to have family members who also struggle with face processing, suggesting there may be a genetic component to the disorder.

There is currently no treatment for face blindness, and people who are face blind often learn to compensate by focusing attention on other features, such as a person's hair style or body shape. For Close, who has no memory for a face in three-dimensions, coping with the disorder in his everyday work requires he flatten the three-dimensional face into a two-dimensional photograph that he then divides into grids. The strategy enables him to commit the face to memory so that he can paint the portrait in what has now become his signature style.

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BrainFacts.org

More information about the science behind face blindness is available at BrainFacts.org, a public information initiative of The Kavli Foundation, the Gatsby Charitable Foundation, and the Society for Neuroscience.

Supporting the Neuroscience Community

SfN membership represents a diverse and global community of neuroscientists that fuels new discoveries today and trains tomorrow's researchers and clinicians. In FY2013, SfN was honored to serve nearly 42,000 members in more than 100 countries, with non-U.S. members comprising 39 percent of the 2012 membership. Reflecting the tremendous interest in the field among young scientists, students and postdoctoral candidates totaled 42 percent of members — all eager to advance understanding of the brain and nervous system.

SfN's leadership opted to freeze 2013 and 2014 dues rates to reflect challenges facing many in the field. At the same time, SfN worked to enhance the value of membership through a range of new and long-standing programs that serve members at all career stages.

Resources for Careers Across the Professional Lifecycle

In FY2013, SfN volunteers guided the development of new resources that serve members' evolving professional development needs.

- To help members gain greater insight and guidance on a variety of career paths, SfN developed eight new online videos and six professional profiles, featuring leading scientists and mentors in the field



The University of Concepción hosted Brain Awareness Week events at the local Science Interactive Museum in Concepción, Chile.

and available on SfN.org. Other new resources provide important information about scientific ethics and tips for scientific publishing.

- Reflecting the role of effective mentoring in successful scientific career development, SfN expanded new mentoring resources and programs. Programs ranged from a new video on being a good mentor to a new “annual meeting mentor” program designed to help first-time attendees navigate the meeting while giving young scientists a chance to learn what it takes to be a good mentor.
- To expand professional connections and networking on a global scale, SfN expanded its social media presence through its online community *NeurOnLine*, as well as continued growth of its Twitter and Facebook activity. *NeurOnLine* continued to be a dynamic place for discussions about science, career challenges, and funding, and a new mobile app made it easier than ever to build a strong network of peers. Facebook “likes” approached 30,000.
- At the annual meeting, SfN continued a popular series of professional skills and career development events. These programs provided guidelines and best practices for getting published, applying for funding, meeting ethical obligations, obtaining a postdoctoral position, and exploring a career beyond the bench.



The Graduate School Fair, held at the annual meeting, allows prospective neuroscience graduate students to meet face-to-face with department and program representatives.

Ensuring a Diversity of Voices and Contributions

Realizing the promise of neuroscience requires diverse voices and perspectives. In FY2013, SfN made significant advancements in serving the needs of women and underrepresented minorities in neuroscience:

- SfN continued a leadership role to increase the role of women at every level of the scientific enterprise. The NSF-funded *Department Chair Training to Increase Women in Neuroscience (IWiN)* project

continued in its third year. Following successful hands-on trainings around the country in FY2012, the project focused in FY2013 on “lessons-learned” from those events and dissemination of information to the broader field.

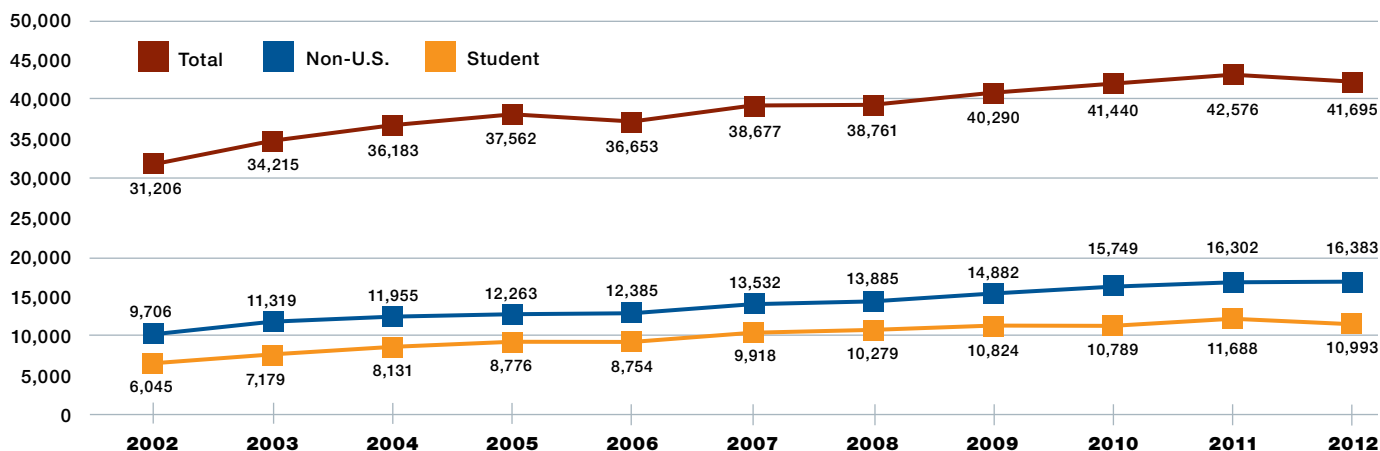
- SfN continued in the 31st year of its successful Neuroscience Scholars Program, which served 55 underrepresented minority trainees in 2012, with funding from the National Institute of Neurological Disorders and Stroke. A comprehensive 30th

anniversary report detailed the impact of the program on trainees over the years and how it is influencing diversity in the field.

Chapters Engage the Field and the Public

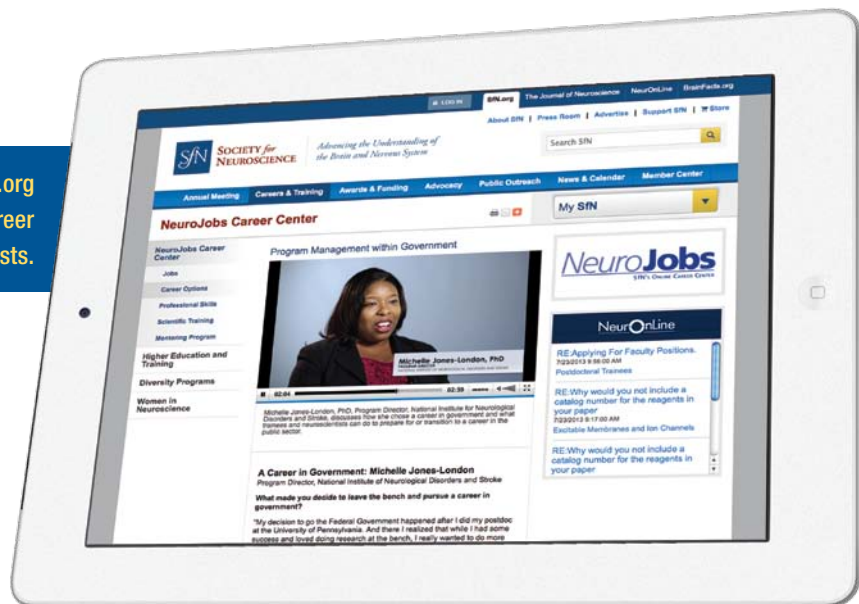
With 153 chapters around the world, SfN facilitates local engagement and creates opportunities for members to share the science and accomplishments of the field with colleagues, the public, and policymakers. Chapters support members in their communities and workplaces, helping to advance SfN’s mission. More than \$112,000 in grant funding was awarded to chapters in FY2013 to host professional

MEMBERSHIP TRENDS REFLECT A GLOBAL AND DIVERSE FIELD



SfN membership is global, with members at all career stages in more than 100 countries. Meeting the needs of this diverse and evolving membership is a strategic focus of SfN’s programs.

Online videos and other SfN.org resources highlight the variety of career options available to neuroscientists.



programs or engage and educate communities about neuroscience through Brain Awareness Week. Other chapter programs contribute to member engagement, such as grants for professional development to host workshops, activities, and the Distinguished Traveling Scientist Program, which allows chapters to host eminent guest lecturers.

Strengthening Training Worldwide

Helping to foster the next generation of neuroscientists is a critical function of SfN and its members. In 2012, Institutional Program membership increased by six percent to 201 neuroscience departments and programs across the United States and Canada. A directory of these programs is available on SfN.org and serves as a valuable resource for students seeking a career in the field.

New programming for neuroscience departments and programs included the second year of a

sold-out graduate school fair at the annual meeting, and a Neuroscience Program-of-the-Year Award, which recognizes best practices in training.

SfN also saw the growth of the online portal Educational Resources in Neuroscience, which provides peer-reviewed teaching resources and information sharing opportunities for neuroscience educators.

Globally, SfN's commitment to its growing international membership was reflected in the continued investments in training programs for young investigators in Latin America, Europe, and Africa. Many of these efforts were undertaken through collaboration with national societies and valued international

partnerships, including those with the Federation of European Neuroscience Societies and the International Brain Research Organization.

Sharing the Value of Membership

SfN recognizes the investment members make by supporting the organization's mission through dues. Ensuring members experience greater value from their membership was a driver to adoption of an updated "Enhancing the Member Experience" strategy as part of SfN's overall strategic plan. Initiatives will include continued monitoring of the evolving field and membership, providing a personalized experience, creating opportunities for engagement, and optimizing technology and data analysis to meet member needs. Key elements are incorporated into initiatives such as the new website, SfN.org, which provides access to preferences for news and e-alerts and includes an enhanced member center to easily access member account information. In addition, long-standing members who have been with the Society for 25 years or more will be recognized with the launch of a new member recognition program that rewards loyalty to SfN and to the field.

Looking **Forward:**

- As the field becomes increasingly global, SfN is expanding programs to serve greater numbers of members, including increasing online communications and tools.
- Dozens of educational and professional development resources and programs will be available at the SfN annual meeting, and increasingly throughout the year, through online dissemination and multimedia.
- Lessons about implicit gender bias, gained through the IWiN project, will be a continuing focus of webinars and other SfN-sponsored events.

Educating and Engaging the Public

SfN's public outreach and advocacy efforts are keeping the brain at the forefront of all our minds. Interest about brain function and brain research continues to grow worldwide. Related topics are regularly featured in headlines, inspiring people to understand how to keep their brains healthy, learn about research that might one day help loved ones, and strive to know about the "universe between our ears." Meanwhile, many nations and millions of families are grappling with the economic consequences of more than 1,000 brain disorders.

BrainFacts.org Serves a Global Public

Following the May 2012 launch of *BrainFacts.org*, SfN has worked successfully to produce dramatic, sustained growth in traffic on the site, which is a public information initiative of The Kavli Foundation, the Gatsby Charitable Foundation, and SfN.

Among the site's successes:

- One month before its one-year anniversary, the site had already reached its first year goal of 1 million pageviews.
- The site is attracting an average of more than a thousand visitors each day, with more than 50 percent living outside the United States.
- Guided by a global editorial board of leading scientists, *BrainFacts.org* added more than 125 new articles and educator resources to the nearly 1,000 resources already available from SfN and its content partners.
- The site has developed an active social media community of more than 6,000 followers on Twitter who engage in daily conversations about new site content; it has nearly as many "likes" on Facebook.
- In its first year, the site welcomed new content partners, including the National Institute on Drug Abuse and TED, joining six founding partners, with more partnerships to come.

Public Education Programming Reaches Worldwide

SfN again played a major role in the Brain Awareness Week Campaign, March 11–17. In collaboration with the Dana Foundation, the founder of Brain Awareness Week, SfN members took part in hundreds of events worldwide to foster greater interest in brain science and health. To continue the spirit of Brain Awareness year-round, SfN organized another successful Brain Awareness Video Contest, generating dozens of creative videos about the wonders of the brain, and supported the Brain Bee, a neuroscience competition for high school students founded by Norbert Myslinski of the University of

Maryland, Baltimore. SfN hosted nearly two dozen promising young minds at the DC Brain Bee and sponsored lab internships for U.S. National and International Brain Bee winners.

This year, SfN was a major voice in shaping the inclusion of neuroscience in United States education. The new Next Generation Science Standards,



The Brain Bee is a competition for high school students showcasing their knowledge about the brain. SfN again hosted the DC Brain Bee, in addition to sponsoring lab internships for U.S. National and International Brain Bee winners.

which will guide essential primary and secondary science education topics, were released in draft form during the year. A group of neuroscientists recommended including neuroscience in the standards. As a result, the brain and the senses are, for the first time, featured prominently in the national standards, exposing students in grades 1, 4, and at the middle school level to the value of brain function and neuroscience research.

Working with the News Media to Advance Neuroscience

Media plays an invaluable role in transforming public awareness of and support for brain science, and the public's interest in and curiosity about the brain and brain science has exploded in recent years. SfN works year-round and across the globe to share brain-related discoveries and ensure accurate reporting of studies, including those in *The Journal of Neuroscience*. Moreover, reporters from news outlets such as the *Wall Street Journal*, BBC News, the Today Show, *Los Angeles Times*, and *Nature*, among others, look to SfN to arrange interviews and identify experts in brain science who can discuss the latest news and developments. Media are also encouraged to attend the annual meeting and cover emerging discoveries. At Neuroscience 2012 in New Orleans, media coverage set a new record, with more than 1,500 articles online, in print, and on the airwaves. The results reflect a growing trend in news demand and reinforce awareness that the SfN meeting is the world's largest source of emerging news about brain science and health.

Science Advocacy — Brain Research on the Global Stage

SfN's role in advocating for robust neuroscience investment and animal research has taken on added significance in the current funding environments around the globe. In the United States, funding cuts brought about by sequestration have had a negative impact on federal research grants. Tightening budgets due to economic pressures in other countries have similarly constrained funding for scientific research.

In the United States, SfN leaders were invited to the White House in April, when President Barack Obama announced the Brain Research through Advancing Innovative Neurotechnologies (BRAIN) Initiative, highlighting the importance of neuroscience in promoting biomedical research. The European Union is also investing 1 billion euros in the Human Brain Project. At the same time, unprecedented spending cuts threaten to undermine important work already taking place, with potentially global repercussions.

Sequestration Cuts Challenge U.S. Research

Many U.S. advocacy efforts focused on sequestration, the automatic, across-the-board federal funding cuts that took effect on March 1. In September 2012, SfN launched a call to action on sequestration, beginning with education via webinar, email, and in-person at the annual meeting. Members rallied around the issue, sending thousands of messages to Congress about sequestration's potentially devastating impact. Members also raised awareness through letters to the editor, op-eds, and blog posts.

NIH and NSF budgets were also the focus of SfN's seventh annual Capitol Hill Day in March. Members visited more than 60 congressional offices to advocate for neuroscience research. Since that time, several SfN members have "taken the Hill home" by inviting legislators to tour their labs and see first-hand the promising science being conducted in communities around the country.



SfN members and United States legislators spent time during Hill Day discussing the promise of neuroscience research and the importance of neuroscience funding. (L to R: Emanuel DiCicco-Bloom, PhD, Jessica Brooks (student), Megan Anderson (student), Rep. Jon Runyan (R-NJ), and Carol Ann Mason, PhD.)



NIH Director Francis Collins and NINDS Director Story Landis discussed the BRAIN Initiative at the June 12 Congressional Neuroscience Caucus briefing. The briefings allow Congress to gain a better understanding of the value of neuroscience research.

SfN's collaborations with coalition partners remain central to advocacy efforts. These coalitions collectively represent thousands of societies, patient groups, and institutions united in support of strong federal investments in research. In addition, SfN continues to work closely with the American Brain Coalition and the Congressional Neuroscience Caucus, which hosted several briefings for Congress on the value of neuroscience research.

Maintaining International Advocacy Efforts

SfN continues to work with global partners to advance neuroscience worldwide, emphasizing the international nature of scientific pursuits and recognizing that funding gaps in one part of the world can affect scientists everywhere. A joint advocacy grants program with the Federation of European Neuroscience Societies supported advocacy initiatives at

the national level across Europe with seven grants awarded in 2013. In partnership with SfN, a similar program is being developed with a global focus through the International Brain Research Organization Global Advocacy Committee. SfN also supports national advocacy efforts in Canada and Mexico.

Supporting Responsible Animal Research

Through collaborations with key partners, SfN creates and disseminates factual information about the importance of the responsible use of animals in research. SfN continues to highlight animal research on *BrainFacts.org* and *SfN.org*, adding resources for new audiences, including medical students and educators, funded by The Esther A. & Joseph Klingenstein Fund, Inc.

Looking Forward:

- SfN has been monitoring developments worldwide that impact animal research, such as recent efforts by animal rights extremists targeting airlines and other carriers that transport animals. SfN has been helping members contact these companies, informing them of the importance of animal models in lifesaving research.
- Many Hill Day participants in FY2013 were early career researchers who were able to provide a unique perspective about the future of neuroscience, and this emphasis will continue. The voice of the next generation of neuroscientists plays a central role in SfN's communications plans aimed at reaching policymakers.
- Major initiatives such as the United States BRAIN Initiative and the European Human Brain Project have potential to advance the field and position it to develop new tools and technologies that will have groundbreaking implications for the future of medical research.
- New features on *BrainFacts.org* continue to encourage greater public engagement and expand the international reach of the site, including the new *BrainFacts.org* blog, an option for subscribers to request email notifications when new materials appear on the site, and online promotional campaigns. Future plans include continuing to enhance the site's breadth of coverage across the field by partnering with additional content providers to raise the visibility of brain science and health.

Neurotrophins: From Perseverance to Progress

The life and career of the late-Nobel laureate Rita Levi-Montalcini illustrate perseverance, commitment, and the triumph of science through difficult times. If not for her determination to undertake research to clarify how nerve cells find their way early on in life, scientists' understanding of the family of proteins known as neurotrophins might not be as advanced as it is today. Progress in leveraging neurotrophins to promote cell survival and growth, and developing new therapeutics for neurodegenerative disorders, is largely due to Levi-Montalcini's early work. Levi-Montalcini passed away at age 103 in December, 2012. She discusses her work in a History of Neuroscience video on SfN.org.

Indomitable Quest for Answers

As a young researcher in Italy in the late-1930s, Levi-Montalcini found herself banned from academia under the Mussolini regime. Not to be deterred, she set up a secret lab in her bedroom at her parent's Turin home and later in a country home. As World War II raged on, she carried out experiments on chicken embryos, and began a lifelong quest working in the United States and Italy to understand how the nervous system develops under normal conditions.

Several decades would pass before Levi-Montalcini, together with researcher Stanley Cohen, could prove that the release of a protein called nerve growth factor (NGF) stimulates nerve growth in developing cells. Later studies would reveal that NGF supports the survival of a group of cells believed to play a key role in learning and memory. Wanting to understand more about NGF and the effects it has on cells in the brain, SfN Past President Moses Chao began searching for the cellular receptor upon which NGF binds.

In 1986, the same year Levi-Montalcini and Cohen were awarded the Nobel Prize in Physiology or Medicine for their work with NGF, Chao uncovered the first NGF receptor. By the time his team of collaborators identified a second NGF receptor a few years later, a second neuronal

growth factor called brain-derived neurotrophic factor (BDNF) had been discovered.

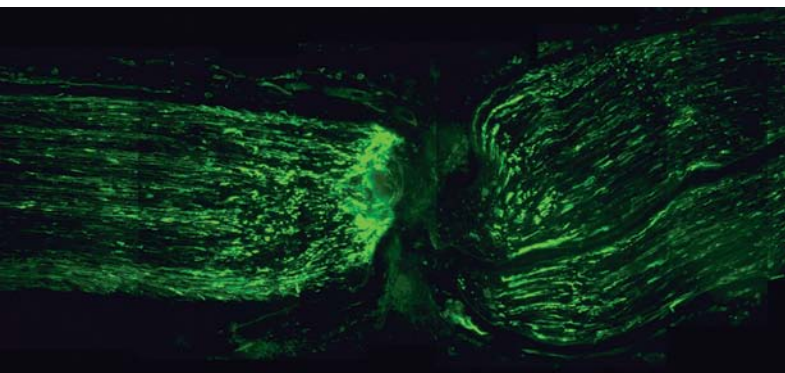
These findings allowed Chao and others to start looking for the cells in the nervous system that respond to growth factor proteins called neurotrophins, and explore their mechanism of action in the brain. As a result, researchers could also begin to explore how the proteins might be used to rescue cell loss and memory deficits commonly associated with aging.

NGF: Promoting Survival, Function

Since Chao's discovery, many neuroscientists have strengthened the case that neurotrophins help to keep certain brain cells healthy throughout life. Numerous studies show that NGF promotes the survival and function of cells in the basal forebrain. These cells are believed to be important to memory, and are greatly affected in Alzheimer's disease. Other studies find that BDNF helps the brain generate new



Rita Levi-Montalcini in her lab at Washington University in the early 1960s.



New studies of neurotrophins are providing clues to their therapeutic potential for disorders such as Alzheimer's and Parkinson's diseases. This image shows the accumulation of neurotrophin receptors in axons after injury.

neurons in the hippocampus and modifies synapses, the connections between brain cells.

Additional research has helped to clarify how changes in neurotrophins may be involved in neurodegenerative disorders, such as Huntington's disease, and points to new directions for future treatments. One study found that mice unable to use NGF as adults show memory loss and changes in the brain as they age that are characteristic of Alzheimer's disease. Conversely, administering NGF to these animals early on improves brain function and behavior.

Similarly, Chao and his colleagues recently showed that BDNF treatment could halt and reduce some of the brain changes that occur in rodent and primate models of Alzheimer's disease. Animals administered BDNF directly or that received a drug that led to higher production of BDNF performed better on many learning and memory tests. Other work shows BDNF has an antidepressant effect in several animal models of depression.

Overcoming Challenges

These and other recent studies highlight the therapeutic potential of neurotrophins for neurodegenerative disorders and psychiatric disease. However, translating the results from such animal studies into treatments for people will be challenging due to several obstacles.

Because neurotrophins are relatively large proteins, they are unable to move easily across the blood-brain barrier — a fairly impermeable barrier separating the brain from circulating blood. Additionally, research in people who have received neurotrophin treatments found several side-effects, including fever, pain, and gastrointestinal problems.

To get over these and other hurdles, scientists such as Chao are working to find clues about the changes that take place inside a neuron after a neurotrophin binds to its receptor. Through understanding of intracellular changes, scientists may be able to develop small molecules that can pass the blood-brain barrier and more specifically target neurons of interest.

Although Levi-Montalcini had no way of knowing her earliest experiments behind closed doors would someday guide efforts to treat diseases affecting millions worldwide, her refusal to back down in the face of significant challenges and her commitment to discovery-based research continues to inspire neuroscientists around the world who are dedicated to overcoming obstacles to advance basic research.

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BrainFacts.org

More information about neurotrophins is available at BrainFacts.org, a public information initiative of The Kavli Foundation, the Gatsby Charitable Foundation, and the Society for Neuroscience.

Financial and Organizational Highlights

Investing in the Mission

Thoughtful planning and management by SfN Council, Finance Committee, and staff resulted in solid SfN financial and organizational performance in FY2013. Given continuing economic uncertainty and research budget pressures in many countries, SfN has maintained a sound financial position, enabling selective, strategic investment to serve its members through challenging times. SfN also continued to leverage external funding to build member value.

Based on preliminary (unaudited) figures, in FY2013, consolidated net operating revenue totaled approximately \$300,000 on total revenue of \$29.7 million. The revenue was driven by the strong membership base and:

- Stable library subscriptions to *The Journal of Neuroscience*

- A successful annual meeting in New Orleans
- Ongoing income from 1121 Properties LLC, SfN's office building and headquarters
- Continued grant support from NIH and NSF
- Private grants, corporate support, and individual donations

Based on prudent financial stewardship principles and goals developed by Council, as well as strong market performance, the value of SfN's long-term investments increased to \$44.85 million as of June 30. The reserve fund's responsible growth over the last decade ensures SfN's ability to withstand unexpected external events and invest selectively in priority programs. It has been made possible through a disciplined, diversified investment strategy overseen by

an investment committee comprised of SfN leaders and three pro bono investment professionals.

Strengthening External Partnerships & Field Support

A growing stream of external funding through sponsorships and individual contributions supports initiatives not funded through SfN's operating budget. External funding sustains annual meeting events, awards and prizes, and support for initiatives such as *BrainFacts.org* and travel awards. In FY2013, external revenue totaled approximately \$1.4 million. In addition, SfN secured key multi-year commitments to fund prizes in FY2014 and beyond:

- A \$750,000 grant from The Swartz Foundation to provide long-term funding for the Swartz Prize for



Over the last three years, donations to the Friends of SfN Fund have made it possible for many young neuroscientists to travel to the annual meeting.

“I received a travel award allowing me to attend the annual meeting and gain valuable experience presenting my science in front of large audiences. It positively impacted my professional development in a significant way.”

—NANTHIA SUTHANA

Theoretical and Computational Neuroscience, which began in 2008

- A \$120,000 grant to provide long-term funding for the Bernice Grafstein Award for Outstanding Accomplishments in Mentoring, which began in 2009
- A three-year grant from the Nemko Family to support the new Nemko Prize in Cellular or Molecular Neuroscience

The Society launched a comprehensive annual fund campaign, the *Friends of SfN Fund*, to support key initiatives, and SfN gratefully acknowledges contributions from more than 600 donors. The campaign itself demonstrated 274 percent growth in the total number of gifts and more than 440 first time donors. Results also reflected SfN's impact worldwide, with 33 percent of donations from outside the United States.

Achievements in Communication and Technology

The new SfN.org website, launched in February, carries a new design, features, and functions, creating an expanding hub that enables members to access information and SfN programs through an easy to use interface. The site also features a new



Mobile applications for *NeurOnLine*, *The Journal of Neuroscience*, and the annual meeting provide members with easy access to SfN events and programs throughout the year.

SfN logo and colors, reflecting the opportunity to introduce a refreshed brand identity that makes the most of online presentation. Ongoing enhancements and ease of use make the site a central online location for the neuroscience community and a key source for neuroscience programs, resources, discussion, and engagement.

The organization's web strategies are one visible component of SfN's ongoing commitment to leverage technology to serve a large and increasingly international neuroscience community. Other high profile programs include the introduction of blogging and personalization features on the websites, the growing use of mobile applications, and the continuing upgrading of technology systems that power the annual meeting and *The Journal*. SfN also continues to make significant investments in data systems that will enable the Society to strengthen programs across the organization based on real-time analytics of diverse data sources, serving members and the public more efficiently and effectively in coming years.

Looking Forward:

- SfN is making significant long-term investments in technology to support programs across the organization, including professional development, membership services, communications, the annual meeting, and *The Journal of Neuroscience*.
- To improve the member experience, content mobility continues to be a priority. Building on applications created in FY2013, an Android app for *The Journal of Neuroscience* and an updated annual meeting app are under development.

Building Brain-like Computers

Computers have changed the way we live, work, and think. Today's "smart" machines can understand speech, play chess, and even beat some of the best champions at "Jeopardy!" But, for all computers can do, none of them are yet capable of fully outperforming their creators.

Scientists are constructing models that simulate what goes on inside the human brain to help better understand how the brain works and discover new ways to create computers and robots that act more like humans. Jeff Hawkins, inventor of the Palm Pilot, touched on this in his "Dialogues Between Neuroscience and Society" lecture in 2007.

Although the brain is sometimes compared to a computer, scientists working to build such models are quick to point out the differences between the two.

Hardware, software differences

First, the brain isn't wired like a computer, says theoretical neuroscientist Chris Eliasmith, of the University of Waterloo, in Ontario.

While the hardware of a computer is an elaborate collection of electric on-off switches, brain cell communication is more variable. Sometimes a cell will send a chemical message across a synapse — the junction between cells — and sometimes it won't. Instead of treating all incoming signals alike, as a digital circuit does, neurons can give added weight to pulses coming from a favorite source. This flexibility allows the brain to be less precise in its calculations, but more energy efficient than a computer, because it doesn't require as much energy per computation.

Unlike a computer, your brain is capable of continuously changing, or updating its hardware, in response to new experiences. Over time, the connections between some brain cells are strengthened, and in some cases, cells can be added or removed. Computers don't have this kind of flexibility. While updated software can instruct computers to perform in different ways, the hardware is unchanging.

Brains and computers both store and retrieve information, but they do so differently. Computers typically run a single software program that has access to all the memory inside the computer. In the brain, no single nerve cell has access to all information. Instead, individual cells communicate with hundreds of nearby cells to access information. Millions of nerve cells combine signals simultaneously, forming circuits to process information or plan a sequence of actions.

A more human model

In recent years, the way in which systems of neurons in the brain interact as a network has become the inspiration for massive parallel-processing architectures and models that process information in human-like ways.

Eliasmith designed a large-scale computer model he named Spaun (short for Semantic Pointer Architecture Unified Network). Using about 2.5 million simulated "nerve cells" that mimic some of the brain's physiological properties, a simulated eye that sees, and an arm that draws,



Computers are not yet fully able to mirror functions of the human brain.



Computer models that simulate what goes on inside the human brain may help us better understand how the brain works and discover ways to create computers and robots that act more like humans.

Spaun is able to recognize, process, and jot down numbers and lists of items when commanded.

Models such as Spaun empower scientists to screen theories about how the brain directs information through itself, Eliasmith says.

“Because we have access to all of the data that the model generates, we can record activity patterns that occur as [the model] performs various functions. We can then look in a real brain to see if the patterns of activity are similar across the two.”

Learning from experience

Building upon their current knowledge of computers, scientists are designing mobile robots that can detect, move, and lift objects. At the Technical University of Munich, scientists are developing models that run on massive parallel processors, allowing the robots to learn concepts that have not been pre-programmed but are based on their sensory experience.

Over the past two years, the team has seen signs that the robots can modify their behaviors in response to changes in the environment. In one study, a robot learned to adjust its position when lifting a glass, based on how much water was in the glass.

“In the near future I expect we’ll see more adaptive, flexible robots that can survive in a human world, not only in an environment that is prepared for robots,” says Jörg

Conradt, a neuroscientist working on the project. Information on the workings of such robots will also provide a better understanding of fundamental computing principles performed in brains, he adds.

Human Brain Project

In 2013, the European Commission awarded 1 billion euros to fund the Human Brain Project, a 10-year effort to build a new information and communications technology (ICT) infrastructure for brain-related research. A key component of the project is development of systems that emulate the brain’s computational capabilities.

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BrainFacts.org

More information about building computers that simulate the human brain is available at BrainFacts.org, a public information initiative of The Kavli Foundation, the Gatsby Charitable Foundation, and the Society for Neuroscience.



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Front cover: Two-color genetic fate mapping reveals the morphology and lineal relationships of distinct subclasses of neural precursors during mid-neurogenesis in the embryonic mouse forebrain.

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Inside Front Cover: Confocal image (inverted) of the zebrafish tail showing labeling of sensory axon membranes (black) and mitochondria (cyan).

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Page 4: Ultrastructural transmission electron microscope image of *Xenopus laevis* retina, with colors overlain to reveal GABAergic (red) and glycinergic (green) amacrine cells with their processes in the inner plexiform layer, as well as glutamatergic (blue) excitatory cell classes, including bipolar cells and ganglion cells.

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Page 16: Dr. Rita Levi-Montalcini in her lab at Washington University in the early 1960s. Levi-Montalcini, professor of zoology, and

her research team had recently discovered an anti-serum that selectively destroyed the sympathetic nervous system when injected into animals. The anti-serum was obtained by injecting purified extract of mouse salivary glands into rabbits. Levi-Montalcini and her co-researcher, Dr. Stanley Cohen, had previously discovered that mouse salivary glands and snake venom contained an agent that caused abnormal growth of sympathetic nerve fibers. The pair was awarded the Nobel Prize in 1986 for their discovery of that agent, named nerve growth factor (NGF).

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Page 22: A hippocampal pyramidal neuron (red) innervated by GABAergic axons (black) depicted in traditional Chinese watercolor. Elevation of neuronal activity rapidly increases the strength of these synapses, as well as the number of active contacts, through BDNF-dependent signaling. Artwork by Jiafeng Zhao of the Oriental Morning Post, Shanghai, China. *The Journal of Neuroscience* 30: Cover.

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