

NEUROSCIENCE

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Q U A R T E R L Y

“Research moves nations forward, gives patients hope, and directly serves the long-term health and economic needs of all nations.”

– Michael E. Goldberg,
SfN President

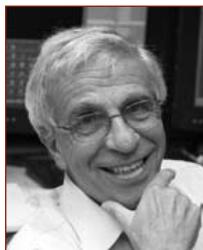
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Message from the President

If We Are Not for Science, Who Will Be for Us?



Michael E. Goldberg,
SfN President

The outlook for scientific funding in the year ahead is fraught with uncertainty. On one hand, we are living through a time of unparalleled scientific opportunity. On the other, we are facing deep economic stresses and unrelenting competition for limited resources. This is a hard truth not just in America, but throughout the world.

In these times, there is a demonstrable risk that science will be forced to shelve or delay potentially game-changing progress. Labs could disband, or turn away the next generation's great minds. It could mean flat or falling employment for the broader scientific enterprise — scientists, plus the technicians, machinists, administrators, and support staff who make it all possible.

As an SfN member, you have potential to help change this scenario although scientists do not control the federal purse. The answer is sustained communication, advocacy, and action. To be sure, we face tough head winds and a lot of competition. But what will each one of us do today to create a world where flat funding of science is eventually impossible? Where every nation strongly invests in science as a force for better knowledge and more progress?

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Inside Science

Optogenetics: Researchers Shed Light on Neuron Function

Inside Science is a new series featuring emerging research across the field, reflecting SfN's commitment to showcasing great science. In each issue, Inside Science explores topics highlighted by press conferences at SfN's annual meeting. Press conference topics were selected by SfN volunteer leadership, with input from the Program Committee on exceptional meeting abstracts.



Researchers described new applications for optogenetics during a press conference at Neuroscience 2009.

In a 1979 article, Francis Crick described methods needed by the neuroscience community to crack the mysteries of the brain. He specifically called for technology that could control specific subsets of neurons, leaving the rest of the brain unperturbed. Thirty years later, researchers have answered the call with a technology called optogenetics.

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It is essential that each of us in the science community be a messenger for the compelling necessity of science in ways large and small — whether in the halls of national capitols, the aisles of your local supermarket, at your child’s school, or in your university centers.

RESEARCH: MAKING THE CASE FOR HEALTH AND ECONOMIC GROWTH

In many ways, this is a perfect time to make the case for science. President Obama, as well as other national and global leaders, is increasingly vocal about science as a vital part of ensuring better health and economic growth, top priorities in any national agenda. In the United States, Congress and the Administration sent that message loud and clear with the American Recovery and Reinvestment Act (ARRA) last year. Their forward thinking was a major victory for the innovation enterprise, and the U.S. public broadly supports strong investments in science.

“At such a difficult moment, there are those who say we can’t afford to invest in science, that it’s a luxury at a moment defined by necessities. I could not disagree more. Science is more essential for our prosperity, our security, and our health, and our way of life than it has ever been.”

— President Barack Obama

But in the face of a budget crisis, some voices are claiming that the United States and other nations cannot afford to fund research at the levels it needs to sustain scientific momentum. Here in the United States, SfN, along with others in the community — particularly the leading advocacy voice Research!America — is committed to refuting those claims and asserting the power of science. We advocate that nations should increase levels of scientific investment or make short-term stimulus permanent, especially right now. Innovation is an essential part of the team of strong horses that will pull budgets out of bad times, strengthen long-term health and wellness, and create long-term economic vitality.

The basic idea underlying the stimulus package was that the money will jump-start the economy, which will then

become self-sustaining. If the Goldberg widget factory gets some ARRA money to retool, it will then make better widgets, which more people will buy. In two years, my factory will be self-sustaining, and my employees will keep their jobs and buy widgets produced by others. This will get the economy rolling again.

But the jump-start metaphor doesn’t fully describe how science works. The Goldberg lab, working independently but alongside many others, will produce important new ideas and findings. These will form part of the essential foundation for continued scientific exploration — as well as new targets for health and disease treatments and the robust biomedical, biotechnology, and biopharmaceutical industries that depend on them. But the lab will never be self-supporting in the sense that the widget factory is. Science — especially the basic, serendipitous science that has been essential to scientific progress and nearly every health breakthrough — will always depend on government investment to drive research and discovery on which industry can later capitalize.

ARRA’s historic infusion in infrastructure, labs, people, and broadly applicable foundational discoveries will go for naught unless the level of government funding remains at the ARRA level — science is most efficient if it gets consistent investment. That enables our field to increase innovation, advance translation, and spark new basic discoveries, all of which spur new treatments, drug targets and pharmaceuticals, jobs, biotechnology applications, and even whole new industries.

Congress and the President face a stark choice: sustain the research momentum of ARRA or let it fall off a cliff. If the level of funding established by ARRA falls to the previous NIH and NSF base, labs will be disbanded, technicians and fellows lose their jobs, and the skills learned and the projects begun during the two years of ARRA funding will wither. For instance, will we lose the progress that could be made through federally funded research on new IPS cell lines, or progress into the basic science of autism, just to mention 2 out of 5,000 ARRA-funded grants? Will nations choose to defer scientific potential, slow the translational pipeline, and delay development of therapeutics that generate hope and economic growth?

In the immediate term, will we potentially lose high-wage jobs in communities nationwide? Estimates suggest ARRA directly created or preserved 50,000 jobs in the United States, in communities across the country. That doesn’t include the jobs generated or preserved in support of industries and companies. In addition, we risk driving away the next generation of scientists who may not see a future for

themselves if they do not feel confident about their future job prospects and funding.

ADDING YOUR VOICE IN A UNITED MESSAGE

As scientists, our natural inclination may not be toward advocacy or outreach. But if the research community is not capable of picking up this charge, who is?

The prospect of losing the momentum from ARRA should motivate the scientific community to action or we have no claim to disappointment at the outcome. And we must engage, even without assurance of victory. If it is going to be an uphill battle even if we do mobilize thousands of voices, I assure you it will be impossible without them.

“If I am not for myself, then who will be for me? And if I am only for myself, then what am I? And if not now, when?”

— Hillel

In Washington, and in capitals around the globe, SfN member voices can be positive and powerful voices. We can translate the potential for science — showing how budget numbers, in black and white, have tremendous value.

To be more than a number on a page, we must do a better job educating and engaging the public, who will in turn reach out to their politicians. SfN has recently launched a series of short *Recovery Act Stories* about the vital research

underway funded by recovery grants, and is planning an ever larger Capitol Hill Day in March.

While SfN is active in Washington every day, it is YOUR voices that are essential to tell this story. As NIH Director Francis Collins said at the annual meeting in Chicago, the scientific community must communicate to the public and its leaders the compelling value of science. Science needs you talking about the promise of your lab to advance science and improve health, the jobs you create in your labs, the biotech companies your science has helped start, or the promising drug therapies that could be developed through your molecular targets.

SfN has made it easy for all of us to be involved and bring our messages to the Administration, Congress, and the public. Join us! Visit SfN's Web site www.sfn.org/advocacy where the Society provides easy-to-use tools to communicate with national leaders and guides for getting involved locally. If you are active with your SfN chapter, urge THEM to get involved. They can sponsor a congressional lab tour, add references to science funding in Brain Awareness Week activities, or join SfN in Washington for Capitol Hill Day. If you are a recipient of an ARRA grant or supplement, use SfN's site at www.sfn.org/recovery to report back to the public and policymakers. Then download the pages for your use and send friends and colleagues to learn more.

In today's environment, advocacy and communication are our new, permanent obligations. This winter, it is particularly critical as the momentum is so strong, and the potential for lost opportunity so large. But it must also begin to be infused, fundamentally, into our scientific culture as a permanent activity. Research moves nations forward, gives patients hope, and directly serves the long-term health and economic needs of all nations. You are the messenger. ■

SfN RECOGNIZES LEADERSHIP OF SENATORS SPECTER AND HARKIN

To recognize their visionary and unflagging leadership in support of the National Institutes of Health (NIH), U.S. Senators Arlen Specter (D-PA) and Tom Harkin (D-IA) were awarded the 2009 SfN Public Service Award. SfN President-elect Susan Amara, University of Pittsburgh, and Irwin Levitan, Jefferson Medical College in Philadelphia, presented the award to Sen. Specter on Dec. 10, 2009, in Washington. They also thanked him for his tremendous leadership in securing \$10 billion for NIH as part of the American Recovery and Reinvestment Act and discussed the outlook for post-ARRA funding. SfN will present the award to Sen. Harkin in early 2010. ■



SfN President-elect Susan Amara (left) and Irwin Levitan (right) presented the 2009 SfN Public Service Award to Sen. Arlen Specter (D-PA).

Council Round-Up: Fall 2009 Meeting

During Neuroscience 2009 in Chicago, the SfN Council (the Society's governing body) discussed the Society's recent achievements as well as issues facing the organization and the neuroscience community around the world. Summaries of discussions and decisions are below.

COUNCIL MEETING WITH DIRECTOR COLLINS

Council had the opportunity to meet with the newly appointed Director of the National Institutes of Health (NIH), Francis Collins, immediately following his presentation to the membership at Neuroscience 2009 in Chicago. The open dialogue was constructive and identified a number of areas for collaboration. In addition to his meeting with Council, Director Collins met with a group of postdoctoral fellows to discuss challenges they are facing in their research, institutions, and careers, and how NIH might be able to assist them with these challenges.

CONTINUATION OF NANOSYMPOSIA

In 2008, the Program Committee decided to create a new submission category that expands on the original concept of slide presentations. In the initial year, the nanosymposia proved to be quite successful and popular among abstract submitters and attendees. Based on the success, SfN will continue to use the nanosymposia format for Neuroscience 2010 in San Diego.

TIERED-PRICING

The Scientific Publications and Finance Committees established the Tiered-Pricing Working Group in November 2008 to develop a recommended tiered subscription pricing model for institutional subscriptions to *The Journal of Neuroscience*. At this past summer Council meeting, Council approved the tiered-pricing model, which will become effective in 2011. The purpose of the model is to stabilize subscription revenue by implementing a rationalized pricing structure as well as to establish a flexible foundation. This tiered-pricing model will allow a price decrease or freeze for the most price-sensitive groups and a somewhat higher price point for the group that can most afford it, while maintaining a subscription revenue neutral position for the next five years.

EXTENSION OF OPEN CHOICE

Council approved the recommendation to extend the open choice pricing option for subscriptions to *The Journal of Neuroscience* for two years. With this option, a publishing

author can pay an extra fee to have their published article available to the public immediately. In addition, with the implementation of the new License to Publish, all third party funding requirements are met for open access allowing additional authors to choose this option. Currently, SfN has a six-month waiting period before articles are freely released to the public.

INSTITUTIONAL PROGRAM MEMBER BENEFITS

As a result of the recent consolidation with the Association of Neuroscience Departments and Programs that created a new SfN membership category of Institutional Program (IP) members, Council approved several new IP member benefits for 2010 recommended by the Committee on Neuroscience Departments and Programs (CNDP). Among these benefits are reduced member registration fees for the annual spring neuroscience departments and programs conference, and access to SfN's student and IP member lists for communication purposes. A full list of IP member benefits is available online in the About Membership section of www.sfn.org.

APPROVAL OF NEW SfN CHAPTERS

SfN is excited to welcome four new chapters: Seoul, Korea; Suwon, Korea; Kelantan, Malaysia; and Brooklyn, NY. For information on forming or reactivating a chapter or to get involved locally, visit www.sfn.org/chapters.

NEWLY APPOINTED AUDIT CHAIR AND 2010-2011 PROGRAM COMMITTEE CHAIR

Council appointed SfN Councilor Howard Eichenbaum as incoming chair of the Audit Committee. Susan Amara, President-elect, announced her selection of Scott Thompson of the University of Maryland as the 2010-2011 Program Committee Chair. Dr. Amara believes Thompson's international experience will complement her desire to further develop international participation and membership in the Society.

SUCCESSFUL FY2009 AUDIT

Council was presented the 2009 audit results by the Audit Committee Chair Robert Malenka. The audit firm of Gelman, Rosenberg, & Freedman CPAs found the internal controls of the Society to be sound and strong. SfN received an unqualified opinion during the audit with no material weaknesses or significant deficiencies noted in the Society's internal controls. ■

SfN Highlights Great Science Funded by the Recovery Act

SfN is demonstrating to the public and policymakers the important scientific advances made possible by the American Recovery and Reinvestment Act (ARRA). The funding is creating scientific and economic momentum that the nation, and others worldwide, should sustain.

YOUR INPUT NEEDED

To communicate to Congress and the public the scientific advances and economic benefits made possible by ARRA, SfN is calling upon grantees to submit their grant stories online. Many primary investigators already have responded by uploading information on their grants' impact and goals at www.sfn.org/recovery.

More stories are needed! Please log on today to fill out the easy-to-use form to let policymakers know these funds are supporting groundbreaking research while preserving and creating jobs across the nation. Your contributions are crucial to long-term advocacy efforts to establish substantial, sustained increases in biomedical research.

SfN RECOVERY ACT STORIES

Once submitted, your grant information may be used in a new resource: *SfN Recovery Act Stories*. Newly available at www.sfn.org/recovery, these short and compelling documents provide descriptions, future implications, and human impact of SfN members' ARRA-funded grants. These stories will be distributed on Capitol Hill and to the Obama Administration, and made widely available through SfN's Web site. Each story links to a *Brain Research Success Story* to provide additional information about progress on neurological diseases and conditions made possible by federal support for research.

Many thanks to all who submitted their grant information as it is imperative that the scientific community share with Congress how ARRA funds are benefiting their communities and the health of the American people. View these stories today and share your own!

RECOVERY ACT FACT SHEET

A snapshot of the exciting neuroscience research supported through NIH ARRA funding is available in a new fact sheet at www.sfn.org/recovery. This one-page document highlights the investment made in institutes that make up the NIH Blueprint for Neuroscience Research. Download the fact sheet today to share with your colleagues and legislators.

BRINGING SCIENTISTS AND PATIENTS TOGETHER: THE AMERICAN BRAIN COALITION

The Society for Neuroscience is a founding member of the American Brain Coalition (ABC), a nonprofit advocacy coalition of some of the nation's leading neurological, psychological, and psychiatric associations and patient organizations. Its goals include better treatment, services,

and support to improve patients' quality of life, and a national commitment toward finding cures. Issues include federal research funding, improving care for those with chronic conditions, advocating for stem cell research, and supporting the ethical use of animals in research. Learn more at www.americanbraincoalition.org

For more information on resources, events, and Congressional outreach, visit www.sfn.org/advocacy. ■

ATTEND THE 2010 SfN CAPITOL HILL DAY

The time is now to engage in advocacy in support of strong research funding! With Congress making critical decisions about the future of science funding, meet your legislators and share the story of your research and its potential benefits. Join your SfN colleagues in Washington for the 4th Annual SfN Capitol Hill Day on March 25, 2010, to urge support for robust, sustained funding in FY2011 and beyond. E-mail advocacy@sfn.org for information.

CONGRESS FINALIZES FY2010 BUDGET, SfN ENGAGES PRESIDENT ON FY2011

FY2010 APPROPRIATIONS

Health care reform dominated work in Congress through the last months of 2009, but members of Congress were able to approve the FY2010 appropriations package, which the President signed into law on December 16. The final budget included \$31 billion for the National Institutes of Health (NIH), a 2.3 percent increase above last year, and \$6.9 billion for the National Science Foundation (NSF), which is a 6.8 percent increase above the previous year's level.

LOOKING AHEAD TO FY2011

The president's proposed FY2011 budget will be released Feb. 1, 2010. In November 2009, SfN members urged President Obama and his administration to prioritize NIH and NSF research funding in the budget as it is critical to improving health and strengthening economies.

SfN members responded with nearly 3,000 messages to the President. However, there is more work to be done in the coming year to ensure the nation sustains the scientific momentum generated by NIH and NSF funding and ARRA.

SfN will call upon its U.S. members at critical moments during the Congressional process and asks all members to engage lawmakers.

Tom Holder: Creating a Unified Voice for Animal Research

6



Tom Holder, Founder,
Speaking of Research

Tom Holder graduated from Oxford University in 2007. His time at university coincided with the escalation of violence and intimidation by animal rights (AR) extremists. Frustrated by the mounting climate of fear, he became instrumental in the formation of the original Pro-Test committee in January 2006. In March 2008, he moved to the United States to take on AR groups by founding Speaking

of Research (www.speakingofresearch.com). His project is supported by both Pro-Test and Americans for Medical Progress, and aims to mirror Pro-Test's grass-roots activities by generating student and faculty support for scientists conducting animal research. Holder returned to the United Kingdom in October 2008 and continues to assist with Speaking of Research as well as the UK organization Pro-Test.

NQ: Why did you decide to form Pro-Test, and, later, Speaking of Research? What is your goal and what strategies do the organizations pursue?

Speaking of Research (www.speakingofresearch.com), like Pro-Test (www.pro-test.org.uk), was founded on the knowledge that a small but dedicated group of activists and extremists could do untold damage to the future of medical research. Spiralling security costs created by animal rights extremists forced Cambridge University to abandon its new research facility. Threats and harassment by activists has forced many researchers (concerned for their families' wellbeing) to consider quitting their jobs, and some to follow through. Why? Because a small, but violent minority believes they have the right to coerce society into their way of thinking.

On Feb. 25, 2006, the Pro-Test committee helped organize an event in which almost 1,000 students, scientists, and members of the public marched through the streets of Oxford in support of lifesaving medical research. The impact in the media was huge. Not only did the mainstream media take an interest in the issue of animal research, opinion pieces, blogs, and TV documentaries also sprung up to bring this issue to the forefront of the public consciousness — bolstering support for the cause. Within three months, the Prime Minister Tony Blair had publicly backed a petition in support of animal research and had pledged to take on animal rights extremism.

For many years, the public has sat by idly watching the rise of animal rights extremism in their country. By using deceptive pictures and misconstruing science, AR groups have spread the seeds of doubt about the welfare conditions, and scientific validity of animal research. Speaking of Research

and Pro-Test have tried to address these public misconceptions head on in order to rally the public in support of research. This effort has moved to the United States, launching spring 2008, with a Pro-Test rally in 2009 drawing more than 700 pro-research advocates in Los Angeles.

NQ: Growing intimidation and violence has understandably caused many animal researchers to choose anonymity. However, more are joining with you and others to speak for research. What has been the reaction of researchers who have become involved in these movements?

Some people who have joined Speaking of Research have been happy to be publicly recognized as a supporter of animal research (e.g., SfN member David Jentsch). However, others have been more hesitant to risk the spotlight. AR extremists have long benefited from the fear of researchers, allowing them to spread misinformation about research without opposition from the scientific community.

Groups like Speaking of Research and Pro-Test allow scientists to spread the risk of being targeted — when 1,000 people hold a march the chances of being picked out by the AR community are greatly reduced — and the number of people willing to come to your support is much larger than if you try and speak up on your own. Speaking of Research and Pro-Test have provided new avenues and alliances for the many scientists who have been speaking locally, sometimes less visibly, and have encouraged others who were fearful to come forward.

NQ: The European research community has been confronting animal rights activism and violence for many years. What lessons can the global research community learn from the Europeans?

I have often heard people say that the United States is five years behind the UK in terms of animal rights activism — that while extremism has peaked and is now falling in Britain, the United States is still on a steady rise. If this is true, then the United States can expect a rise in number of arson attacks on cars and property, it can expect a rise in the threats, home protests, and economic sabotage, and it may have to expect worse.

As the British government clamped down on extremism in the UK (with the formation of the National Extremist Tactical Coordination Unit), animal rights activists moved to the rest of Europe and to the United States. Recently extremism peaked in other parts of Europe with the firebombing of Novartis Chief Executive, Daniel Vasella's, holiday home in Austria, and the desecration of his family's graves in Switzerland.

If the United States and other nations do not act now, then extremism will continue to rise to the sickening heights that have occurred across the Atlantic.

NQ: What do you think the research community's message should be and how should it effectively communicate this to increase support for animal research?

The scientific community's message must be three fold: to clearly show how animal research has been crucial to the medical developments of the past, present, and future; to show that animal welfare in labs is second to none; and to stand up to a violent minority who threaten the future of medicine. Researchers need to talk openly about their work to friends and family, and explain why the scientific community needs animals to advance our medical knowledge.

Every scientist who stands up and speaks about their research, every scientist who writes a blog about their research, and every scientist who offers to explain their research at their child's school or college plays a crucial role in combating the misinformation of animal rights activists. Speaking of Research regularly offers spots on its blog to guest writers to talk about why they use animals, but this shouldn't stop people being proactive in getting the message out themselves. Next time you see an anti-research letter in a newspaper, take five minutes to e-mail a reply! It's amazing how many people you can connect with.

NQ: As you are part of the next generation of science advocates, what would you say to your

peers about this issue and how should they engage their generation?

As in the UK prior to 2006, the AR community thrives off the eager and inquisitive minds of the younger generation. Social sites like Facebook, MySpace, YouTube, and Twitter are littered with groups, messages, and videos supporting the animal rights cause. On the other hand, the pro-science community has been slow to respond to the online generation, to counter the myths. However there is hope, the "Pro-Test – Supporting Animal Research" group on Facebook has over 4,000 members, and the Pro-Test rallies in the UK in 2006 attracted hundreds of young, keen-minded students.

If I could say a few words to many of my generation it would be "Look a little closer." It is easy to be convinced by the bite-sized arguments of the "anti-vivisection" community. Claims such as "450 methods exist to replace animal research" sound good, but on closer inspection, these claims turn out to be baseless (such non-animal methods are used alongside animal research, but science cannot yet replace all animal research).

It is imperative that scientists-in-training (undergraduate and graduate students and postdoctoral fellows) join the effort to promote the crucial developments stemming from animal research. Through formal opportunities to educate school children during Brain Awareness Week to less structured public outreach efforts (social networking, newsletters), young neuroscientists have a critical role in the endorsing their own work and that of others. ■

Enhancing Peer Review at NIH

As the National Institutes of Health (NIH) enhances the Peer Review Process, the agency reports that several changes will affect competing applications and resubmissions for Jan. 25, 2010 due dates and beyond. Restructured and shortened applications aim to reduce the administrative burden placed upon applicants and reviewers, while aligning the structure and content of the application with newly enhanced review criteria. NIH notes that shorter page limits and more strongly defined components focus on the essentials of the science, avoid information overload, and support continuous and manageable peer review.

Within the Research Plan, the Specific Aims section now asks applicants to briefly discuss the expected impact of the proposed research. This section has a new addition titled Research Strategy, which incorporates Background and Significance, Preliminary Studies/Progress Report, and Research Design and Methods. Page limits will be 6 or 12 pages, not including an additional page for Specific Aims.

The Resources component now requests applicants to explain how the scientific environment will contribute to the probability of project success. For early-stage investigators, the Resources section will require applicants to describe the institutional investment in the success of the investigator.

New Biographical Sketch instructions request personal statements from key personnel, discussing why their experience and qualifications make them well-suited for the project. The Biographical Sketch limits the number of references and specifies that only work related to the application should be included. The recommended list of publications or manuscripts should not exceed 15.

If a Funding Opportunity Announcement (FOA) page limits and instructions vary from the general application instructions, the FOA guidelines should be followed. For details on application changes and revised page limits, visit <http://enhancing-peer-review.nih.gov>. ■

Based on the pioneering work of Karl Deisseroth at Stanford University and his lab, optogenetics uses light to activate or inhibit genetically targeted brain cells and circuits. The technique takes advantage of light-sensitive ion channels (opsins) from unlikely sources — algae and archaeobacteria. Many of these opsins are sodium ion channels, such as channelrhodopsin 2 (ChR2), which responds to blue light. In neurons expressing ChR2, illumination with trains of blue light pulses causes an influx of sodium ions, activating the neurons with corresponding trains of action potentials. In contrast, yellow light inhibits (hyperpolarizes) neurons expressing another opsin called halorhodopsin (NpHR), a chloride pump.

Because these opsins are foreign to mammals, and most mammalian brain cells do not normally respond to light, the technique allows precise control of select neural populations. With the right combination of opsins and the proper wavelength of light, Dr. Deisseroth's group developed a way to turn individual neurons on or off.

No longer a nascent technology, optogenetics is now being applied to animal models of depression, narcolepsy, Parkinson's disease, blindness, addiction, and memory, among others. At a press conference at Neuroscience 2009 moderated by Dr. Deisseroth, researchers discussed new applications for optogenetics in animal research, from tracing brain circuitry and modifying behavior to potentially developing therapies for central nervous system diseases.

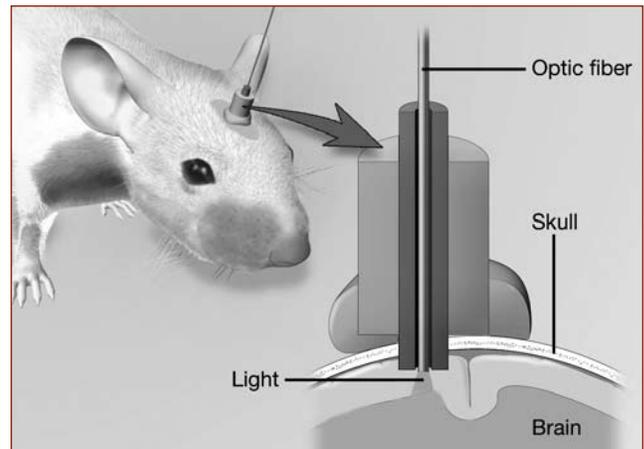
NEW TOOLS AND APPLICATIONS

Feng Zhang described new optogenetics tools developed in the Deisseroth lab. He reported the successful search for opsins with new kinds of functionality using genomic technology. The discovery of these proteins in the natural world drives home the importance of maintaining ecological diversity, he argued.

He also reported a system to deliver optogenetic control not just to a specific cell type, but to a specific projection from one defined cell type to another, using trans-synaptically transported genetic regulators. The combination of new optogenetic tools and new kinds of targeting enables increasingly refined and specific control of neural circuitry.

ANTIDEPRESSANT EFFECTS

Herbert Covington, a postdoctoral fellow working with Eric Nestler at Mount Sinai School of Medicine, showed that optogenetics can mimic the effects of antidepressants in mice. The medial prefrontal cortex is involved in depression in humans and other mammals. Mice, which normally engage in social behaviors, can be induced into depressive non-social states by exposure to stressful



Optogenetics can modify neural activity in awake, behaving animals. An optical fiber delivers light to genetically targeted neurons. Illustration by Ethan Tyler.

situations. Their “depression” can be lifted by antidepressant medications such as fluoxetine, and now we see, by optogenetic stimulation. When Covington and colleagues introduced ChR2 into neurons of the prefrontal cortex of the “stressed” mice and then stimulated the neurons with blue light, the mice recovered normal social behaviors. However, other behaviors were unaffected.

DECIPHERING BRAIN REWARD CIRCUITRY

Optogenetics is being used to study connectivity of brain regions associated with addictive-like behavior. Garret Stuber, working with Antonello Bonci at the University of California San Francisco's Ernest Gallo Clinic and Research Center, reported the targeting of glutamatergic cells of the basal lateral amygdala and their synaptic connections in the nucleus accumbens. This anatomic link is critically important for many types of goal-directed behaviors, but the specific connectivity has not been studied in detail with respect to addiction.

The researchers introduced ChR2 into neurons of the basal lateral amygdala. They saw in tests a few weeks later that the protein had made its way along the amygdala cell fibers to terminals connecting with neurons of the nucleus accumbens, thus confirming the link between cells of the two regions.

Stuber and colleagues implanted a cannula above the nucleus accumbens, inserted into it a fiber-optic cable for shining blue light, and tested whether stimulation of the synapses within the nucleus accumbens would elicit addictive-like behavior in the mice. The mice were given the opportunity to “nose poke” in order to receive the light stimulation, and, sure enough, the ones outfitted with the fiber-optic light poked at a far higher rate than control mice. In other words, the animals found the stimulation

of these synapses reinforcing. Stimulation of other glutamatergic projections did not elicit the same nose-poke response, demonstrating the power of optogenetics to tease out the unique neuronal influences on behaviors.

PROBING MEMORY

Memory is another area in which optogenetics is parsing out subsets of neurons involved in brain activities. Michael Häusser, University College London, reported at Neuroscience 2009 on preliminary data that shows the use of optogenetics to study memory storage and recall.

Memory storage appears to take place during learning as specific sets of activated neurons form a unique assembly. Further, it is thought that *recall* of that memory can be triggered by activation of a *subset* of the assembly. However, there has been no direct experimental evidence of these events, which optogenetics appears to be set to help establish.

Häusser and colleagues sought to reactivate subsets of neurons in the hippocampal dentate gyrus that earlier had been involved in the formation of a fearful association. They took advantage of the *c-Fos* gene, which only turns on in cells that are active. By driving ChR2 expression with the *c-Fos* promoter, they could use blue light to reactivate only those neurons that had been involved in the memory process.

The researchers trained mice to associate a tone with a noxious stimulus. Subsequently, when the mice heard the tone, they froze with fear. Later, the researchers found that blue light also caused the mice to freeze with fear, suggesting that it reactivated the subset of dentate gyrus cells involved in the fearful association in the absence of the tone or the noxious stimulus.

By including a fluorescent tag in the ChR2 preparation, the researchers were able to count the number of cells

responsible for the memory. They found that activation of a small subset of cells in the dentate gyrus (as few as 100 cells) was enough to trigger memory recall.

WHAT NEXT?

Although optogenetics has only been used in animal experiments thus far, its reach is wide and growing rapidly. More than 500 laboratories around the world are now using optogenetic tools in a broad range of animal models, brain regions, and cell types. Moreover, the field of optogenetics has the capability to not only help explain normal brain function, but also to help explain disease states, and possibly to help inform the development of novel therapeutic strategies for a variety of neurological and psychiatric disorders.

We already know that altering brain electrical activity can be used therapeutically. Deep brain stimulation (DBS) for Parkinson's disease and depression is a familiar example. In DBS, a metal electrode implanted into the brain delivers high frequency electrical pulses to all cells in its vicinity. In contrast, optogenetics is more spatially precise.

Interestingly, a recent study used optogenetics to study why DBS is an effective treatment for Parkinson's disease. In rodent models of the disease, researchers used light to trigger or inhibit discrete neural circuit components while simultaneously recording circuit activity. The findings may help refine treatment for Parkinson's disease patients.

Francis Crick might not have envisioned that optical technologies derived from microbes would be useful to basic or clinical neuroscience. But, as a technique for basic science discoveries and as a source for clinical insights, optogenetics clearly has risen to his challenge. ■

To view the video of the press conference and related slides, go to www.sfn.org/amhighlights.

PROPOSE A NANOSYMPOSIUM WITH YOUR COLLEAGUES



www.sfn.org/am2010

Submit an abstract for Neuroscience 2010 and you choose to present it as a poster or be considered for a nanosymposium. **A nanosymposium is a group of topically matched abstracts; each abstract is presented as a 15-minute slide-based talk.** Members can suggest a session by using the "Linking Group" feature within the abstract submission site. Space for nanosymposia is limited and competitive, and preference will go to group proposals. Collaborate with your colleagues now, and plan a strong nanosymposium. **Abstract submission opens on April 22, and the deadline is May 13.**

Neuroscience 2009 Proves a Success with Rich Scientific Content in Chicago



Scientists from around the world gathered in Chicago at McCormick Place for SfN's 39th Annual Meeting. Neuroscience 2009 fostered the exchange of cutting-edge scientific research with nearly 16,000 abstracts presented in poster sessions and nanosymposia. Held October 17–21, Neuroscience 2009 welcomed 30,547 attendees to the city of Chicago with rich scientific content, valuable networking opportunities, and numerous professional development resources.

MAGICIANS PERFORM AND DISCUSS THE ART OF MAGIC

In the opening presentation Dialogues Between Neuroscience and Society, internationally recognized magicians Apollo Robbins and Eric Mead amazed the audience with memory manipulation and sleight of hand tricks, demonstrating how the art of magic uses the mind's limitations to create illusion. After the magic, Robbins and Mead sat down with then SfN President Tom Carew and Susana Martinez-Conde, director of the Laboratory of Visual Neuroscience at Barrow Neurological Institute in Phoenix, to discuss the science behind magic and the strong academic component that lies within the field. Video of the discussion is available at www.sfn.org/amhighlights.

The magic performances prompted audience questions about the types of experiments that can be designed to answer what happens to the brain during attention manipulation and how such experiments could be essential in researching attention deficit disorders. Carew ended the Dialogues presentation by thanking Robbins and Mead for providing the audience with a "sense of wonder," but mostly for leaving the audience with "something to wonder about."

NIH DIRECTOR DELIVERS SPECIAL PRESENTATION

In a special presentation, National Institutes of Health (NIH) Director Francis Collins discussed his vision for NIH, and the key challenges and opportunities facing NIH and the broader scientific community. Collins highlighted the increases to NIH funding from the 2009 Congressional stimulus package, while placing a strong emphasis on the importance of participating in scientific and public policy that encourages basic, translational, and clinical research. Watch the video at www.sfn.org/amhighlights.



Nora Volkow, director of the National Institute of Drug Abuse, explored how neuroimaging technologies and behavioral research have improved knowledge of changes in the brain caused by addiction.

Collins focused on the research community's responsibility to communicate the scientific and health impact of grants funded through ARRA. Collins urged recipients of recovery dollars to communicate how research funding supports the community and why it is a positive national investment. Collins also highlighted the SfN Recovery Act Impact Form as an important tool for recording and educating lawmakers on the economic impact of funding for NIH research.



During the Dialogues Between Neuroscience and Society presentation, magicians and neuroscientists explored the science behind magic, including what happens to the brain during attention manipulation.



Prior to his presentation, NIH Director Francis Collins met with postdoctoral fellows to discuss challenges facing research, institutions, and scientific careers.

RICH SCIENTIFIC LECTURES IN THE WINDY CITY

The 2009 Presidential Special Lectures focused on the evolution of the changing brain in a changing world. Elizabeth Spelke discussed how humans apprehend concepts such as math while mapping the cognitive world of a changing brain through growth and development. Richard G. Morris explored learning and memory at a systems level while focusing on understanding neural mechanisms with the capacity to encode, store, consolidate, and retrieve information. Nora D. Volkow evaluated how advanced neuroimaging technologies and behavioral research have improved knowledge of changes in the brain caused by addiction. Eric Kandel discussed his work on long-term memory storage and current research findings on the protein CRB-3 in mice.

Additional Featured Lectures included the Fred Kavli Distinguished International Scientist Lecture by Daniel M. Wolpert; the Peter and Patricia Gruber Lecture by Michael W. Young, Jeffrey C. Hall, and Michael Rosbash; the David Kopf Lecture on

Neuroethics by Steven Laureys; the Albert and Ellen Grass Lecture by Robert H. Wurtz; and the History of Neuroscience Lecture by Larry W. Swanson. In addition to the Featured Lectures and 14 Special Lectures, emerging areas of the field were highlighted through dozens of symposia and minisymposia, including new developments in the genetics and pathogenesis of amyotrophic lateral sclerosis and the unexpected role of endocannabinoid mechanisms in brain disease.

THE DEBUT OF NANOSYMPOSIA

Introduced at this year's annual meeting, nanosymposia were a great success, fusing thematically coherent sessions by allowing abstract presenters to form and suggest the composition of their own sessions. Nanosymposia consisted of abstracts from multiple labs with a common topical interest and were considered to be an improvement over slide sessions held in the past. The collaborative nature of nanosymposia at the annual meeting unified themes and engaged younger scientists in the neuroscience community. Neuroscience 2009 offered 82 nanosymposia.

FIRST CHAPTER-OF-THE-YEAR AWARD PRESENTED AT NEUROSCIENCE 2009



Membership and Chapters Committee member Johannes Menzel (left) presented the Chapter-of-the-Year Award to Dwayne Godwin, past chapter representative for the Western North Carolina chapter.

The Western North Carolina chapter of SfN was recognized with the first annual Chapter-of-the-Year Award for outstanding achievements in public communication, outreach, and education. Presented at the 2009 Chapter Workshop, this new award recognizes outstanding chapters for their efforts and accomplishments across a broad range of activities.

ENHANCING THE MEETING THROUGH SOCIAL MEDIA

SfN announced an official Neuroblogging initiative for Neuroscience 2009. SfN members were encouraged to apply, and 11 individuals were selected to serve as official SfN Neurobloggers. The 2009 blogs served as an informative online resource for meeting attendees, while providing followers with highlights of research found on the poster floor and within the lecture halls. Neuroblogging is one of several initiatives

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... Neuroscience 2009, continued from page 11

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Attendees had the opportunity to explore the latest technologies, services, and products offered by exhibitors.

by SfN to enhance the annual meeting experience for attendees. The initiative also included the creation of an official SfN page on Facebook, which posted regular announcements keeping more than 4,000 fans up-to-date with special events, lectures, and annual meeting resources.

FOSTERING PROFESSIONAL DEVELOPMENT WITH ANNUAL MEETING RESOURCES

SfN's commitment to enhancing the professional development of neuroscientists at every stage of their career was evident through the training, networking, and related opportunities available to attendees.

In 2009, the Meet-the-Expert Series expanded to include eight experts speaking on a wide range of topics. Attendees received tips from research experts who described their personal techniques and accomplishments. Topics ranged from new frontiers in cognitive neuroscience to animal models of addiction. Other topics explored advances in neuroimaging and genetic approaches for dissecting GABA neurons. Meet-the-Expert, now in its sixth year, continues to provide young investigators with the opportunity to engage experts and network in an informal and intimate setting.

MAKING CONNECTIONS AT THE NEUROJOBS CAREER CENTER

For the first time, NeuroJobs, the premier online resource for neuroscience jobs, made job searches on the site freely available to all job seekers, members and nonmembers alike. This open access promoted increased activity, while still providing members-only features such as job alerts and resume posting. The NeuroJobs Career Center at Neuroscience 2009 provided neuroscientists and employers with access to private interview booths and computers for posting po-

sitions or resumes and scheduling interviews. In 2009, almost 300 on-site interviews were scheduled, fostering new relationships and opportunities for employers and job seekers.

NEUROBIOLOGY OF DISEASE WORKSHOP

The day-long Neurobiology of Disease Workshop, "The Neurobiology of Depression," featured a series of lectures and dialogues exploring depression as a brain disorder with identified molecular, cellular, and system-level substrates. The workshop began with descriptions of depression from a patient's perspective, and lectures throughout the day summarized recent research on the interaction of genes and environment, the molecular (including epigenomic) basis of depression, and neuroimaging and deep brain stimulation results that are mapping the circuitry of depression. The biology of suicide and emerging approaches and advances in treatment also were discussed. A reception at the end of the day allowed students and faculty to interact and explore remaining questions informally.

SHORT COURSES

Three Short Courses were held at Neuroscience 2009, offering participants an in-depth look at specific topics and techniques in neuroscience research. Courses included "Epigenetic Control and Neuronal Function," "Rhythms of the Neocortex," and "New Frontiers in Live-Cell Imaging." Each day-long course consisted of lectures and slide presentations by leading experts, followed by informal breakout sessions.

PROFESSIONAL DEVELOPMENT WORKSHOPS

Nine workshops were held in Chicago on a wide range of professional development topics for all career levels. This year's offerings included



Attendees from around the world showcased their local education and outreach efforts during the Brain Awareness Campaign event.



Victoria Luine (right) was the first recipient of the Bernice Grafstein Award for Outstanding Accomplishments in Mentoring. Luine is pictured with Professional Development Committee Co-chair Jill Becker (left) and past SfN President Bernice Grafstein (middle). View all of the 2009 award and prize recipients at www.sfn.org/am2009/awardrecipients.

several new topics, including one on writing for Wikipedia that stemmed from SfN's Neuroscience Wikipedia Initiative and another on managing a research laboratory. Other workshops addressed careers for neuroscientists, using case studies to teach neuroscience, surviving as junior faculty, combining family and a neuroscience career, and research funding opportunities in Europe and the U.S.

CELEBRATING WOMEN IN NEUROSCIENCE

The yearly "A Celebration of Women in Neuroscience" luncheon featured Huda Zoghbi as the guest speaker, honoring her achievements as a neuroscientist. This year's event again showcased women leaders in neuroscience with a special slide show and explored the question, "How do you decide when to say yes and when to say no?" Managing personal and professional commitments as a female in the field was given special emphasis.

PROMOTING SCIENCE EDUCATION AND OUTREACH

The Annual Brain Awareness Campaign Event celebrated public neuroscience education and challenged scientists to recruit peers to participate in the 2010 Brain Awareness Week and other outreach campaigns. This year's event, featuring then SfN President Tom Carew, drew nearly 200 participants and showcased posters from around the globe that displayed local education outreach efforts to K-12 students and other audiences. Attendees were exposed to innovative tools and educational resources such as SfN's Neuroscience *Core Concepts*, NERVE (resource portal), and *Brain Facts* that can be used to inspire public education and outreach efforts.

INCREASING CHAPTER COMMUNICATION THROUGH TECHNOLOGY

More than 100 participants attended the 2009 Chapter Workshop, "Using

THE NMP IS AVAILABLE ALL YEAR LONG

Use the Neuroscience Meeting Planner (NMP) to browse abstracts and explore Neuroscience 2009 sessions after the meeting at www.sfn.org/nmp.

Top Five 2009 NMP Searches:

Boolean Search

1. Pain
2. Dopamine
3. Hippocampus
4. Memory
5. Schizophrenia

Simple Search

1. Autism
2. Kandel
3. Deisseroth
4. Pain
5. Schizophrenia

Social Networking and Technology to Enhance Chapter Communication and Outreach." The panel of chapter presenters shared practical information and examples for improving chapter communications with the use of social media and other Web-based technologies. Chapters were encouraged to use social media as a means to promote the exchange of chapter news, events, and information. Another workshop topic was developing effective chapter fundraising strategies, and five chapters shared posters displaying their neuroscience education outreach efforts.

IN SUPPORT OF CONTINUED SCIENCE FUNDING

The 2009 Public Advocacy Forum brought together a diverse panel from the academic, economic, and business communities. Moderated by Research!America President Mary Woolley, the panel discussed the importance of engaging in science advocacy by making the case that strong, sustained funding for biomedical research benefits national

... Neuroscience 2009, continued from page 13

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and local economies while simultaneously improving health. Panelists detailed the economic impact of NIH-funded research and provided attendees with information and tools for enhanced science advocacy.

SHARING SCIENTIFIC PROGRESS, ENGAGING STAKEHOLDERS

The Animals in Research workshop engaged participants in a discussion of developing new allies to promote responsible animal research. This workshop examined ways to “widen the tent” by involving patient groups, health care providers, industry, and others who have a vested interest in protecting responsible animal research. Attendees were encouraged to speak out about their own research to share the story of progress that is made possible through animal research.

SOCIAL ISSUES ROUNDTABLE

The 2009 Social Issues Roundtable, “Engaging the Public on Ethical, Legal, and Social Implications of Neuroscience Research,” moderated by Alan Leshner, was met with a packed room of attendees spilling into the corridor to hear about how new discoveries into the nature of the brain are prompting ethical questions relating to the self, the soul, free will, and what it means to be human. This roundtable discussed ways the scientific community can reach out and engage the public to find common ground and minimize potential tensions while maximizing progress. ■

STAY IN TOUCH YEAR-ROUND

Contact Neuroscience 2009 exhibitors offering products and services through My EXPO, a virtual directory of Neuroscience 2009 vendors. My EXPO is searchable by exhibitor names, products, or keywords. Visit www.sfn.org/am2009/myexpo.



Presenters focused on how the scientific community can engage the public to find common ground between science and society during the Social Issues Roundtable.

NEUROSCIENCE 2010 ABSTRACT SUBMISSION OPENS IN APRIL

Submit an abstract for a poster session or nanosymposium.

Opening of Abstract Submission:
Thursday, April 22

Abstract Submission Deadline:
Thursday, May 13, 5 p.m. EDT

www.sfn.org/am2010

The Journal Implements License to Publish

SfN's Council has approved a Scientific Publications Committee recommendation that returns copyright to authors and licenses only the limited rights needed to maintain *The Journal of Neuroscience* as a successful and highly respected scientific publication. The new License to Publish takes effect in January 2010 and replaces the current transfer of copyright to SfN and will make the reuse of scientific content easier for authors and third parties.

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