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SCIENTIFIC LEADERSHIP
MPFI Honored with Lifees Award at eMerge Americas

RESEARCH HIGHLIGHTS
The New SLENDR Technique: Protein Labeling in the Developing Brain by Genome Editing

FOUNDATION NEWS
A Legacy of Transformational Gifts
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On the cover: Fluorescent image of the cerebellum showing granule cells, Purkinje cells, and interneurons. Image courtesy of Samantha Amat, Mechanisms of Synaptic Signaling and Computation, MPFI.

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Institute Names Inaugural Peter Gruss Young Investigator Recipient

California Institute of Technology neuroscientist honored for collaboration, creativity, and curiosity-driven research in neuroscience

Dr. Viviana Gradinaru, a neuroscientist at the California Institute of Technology, was announced this year as the inaugural Peter Gruss Young Investigator Award recipient. Paying homage to Prof. Dr. Peter Gruss, former Max Planck Society president, the biennial accolade recognizes young neuroscience investigators for significant contributions to the scientific community.

“The nominee pool was both impressive and competitive – much consideration was given to each candidate,” said Dr. David Fitzpatrick, MPFI CEO and Scientific Director. “Dr. Gradinaru has made multiple significant landmark contributions throughout her early career – benefiting the scientific community; she truly exemplifies Dr. Gruss’s legacy.”

Gradinaru is Assistant Professor of Biology and Biological Engineering and Heritage Principal Investigator at the California Institute of Technology. Dr. Gradinaru’s work focuses on developing and using optogenetics and tissue clearing to better understand brain circuitry underlying neurological disorders such as Parkinson’s Disease. She was nominated by Dr. Karl Deisseroth, Howard Hughes Medical Institute Investigator, 2013 Brain Prize Winner, and 2016 Breakthrough Prize in Life Sciences Winner – whom she studied under while completing her neuroscience doctorate at Stanford University.

“I cannot imagine a more compelling, deserving and meritorious recipient of the Peter Gruss Young Investigator Award,” said Dr. Karl Deisseroth, D.H. Chen Professor of Bioengineering and of Psychiatry and Behavioral Sciences at Stanford University. “Her dedication and leadership will continue to benefit the global neuroscience community.”

Dr. Rafael Yuste, Director of the NeuroTechnology Center at Columbia University, wrote in a letter of support for Dr. Gradinaru’s nomination, “Viviana has a stellar career, with brilliance at every step of the way,” remarking that her current research could go on to revolutionize the treatment of brain diseases using molecular therapies.

“The selection committee was truly inspired by Dr. Gradinaru’s groundbreaking work and success in developing tools to help us better understand brain circuitry in disease and disorder,” said Dr. Ryohei Yasuda, MPFI Scientific Director. “We are confident she will continue to make crucial advances in neuroscience and the technologies we use to study the brain.”

Earlier this year, Dr. Gradinaru was honored by President Obama as one of the recipients of the Presidential Early Career Awards for Scientists and Engineers, the highest honor bestowed by the United States Government on science and engineering professionals in the early stages of their independent research careers.

The Peter Gruss Young Investigator Award was presented to Gradinaru during MPFI’s Sunposium conference, February 13-14, 2017 at the Palm Beach County Convention Center. As the award recipient, Dr. Gradinaru was invited to deliver a plenary lecture at the Sunposium 2017 conference.

Dr. Gradinaru also received a monetary award underwritten by Ms. Raquel Rodriguez of Miami, Florida. Ms. Rodriguez, a long-time supporter of MPFI and the life science industry, has contributed the award in honor of Dr. Peter Gruss’s legacy.
One of the great challenges the scientific community takes on in its effort to advance our knowledge of how the brain works is the technological limitations of visualizing structure and function in neurons. Much like gazing up at the stars or down into the ocean, advanced technologies in imaging and visualization are needed to gain true insights into worlds we cannot see with our eyes alone.

As our imaging technologies and techniques advance, so do our experimental capabilities — we can see neuronal structures across different spatial scales, image function for longer periods of time or in faster sequences, and analyze activity of neuronal proteins and structures during activities such as learning and memory formation.

MPFI is passionate not only in its pursuit of developing technologies allowing the scientific world to gain new knowledge on the inner workings of the brain, but also in developing new platforms and opportunities to share these technologies and techniques with scientists from around the world. To that end, MPFI was excited and honored to host its first Neuroimaging Techniques course in January 2016: an intensive, two-week course with special lectures and hands-on workshops highlighting novel neuroimaging techniques from leaders in the field, featuring Max Planck Society scientists and guest faculty and lecturers (including Eric Betzig, Ph.D., a 2014 Nobel Prize recipient for his work in super-resolution fluorescence microscopy).

Advanced imaging topics included a technique combining fluorescence resonance energy transfer (FRET) and fluorescence lifetime imaging microscopy (FLIM) — known as FRET/FLIM — which was pioneered by MPFI Scientific Director, Ryohei Yasuda, Ph.D. The imaging technique combining FRET and FLIM gives scientists the power to view biochemical dynamics of proteins with high spatial and temporal accuracy, while also allowing them to calculate the minuscule distances between molecules in real time.

Also featured in the course was correlative light electron microscopy (CLEM). As its name suggests, this technique combines two traditionally separate forms of microscopy to glean the benefits of both. Light microscopy allows larger fields of view with the ability to obtain functional information from living cells, but with limited resolution, while electron microscopy provides much higher resolution images, up to molecular dimensions, but only over specific regions of a cell at a time and not in living cells. It was not until recently, after the advancement in various related techniques and technologies, that CLEM could be applied to neuroscience research in a meaningful way. Naomi Kamasawa, Ph.D., an industry leader in this technique, heads the institute’s electron microscopy core facility and serves as faculty for the course.

The highly-competitive course accepted 13 students from 7 different states and 3 countries:

- Baylor College of Medicine
- Boston Children’s Hospital
- Harvard University
- Janelia Research Campus
- Johns Hopkins University
- Korea Advanced Institute of Science and Technology
- Max Planck Florida Institute for Neuroscience
- RIKEN Brain Science Institute
- Scripps Research Institute
- Seoul National University College of Medicine
- Texas Tech University Health Sciences Center
- The City College of New York’s Institute for Ultrafast Spectroscopy and Lasers
- University of California, Santa Cruz
- University of Florida
THANK YOU TO OUR 2016 NEUROIMAGING COURSE SPONSORS who are dedicated to supporting the education and training in advanced neuroimaging techniques for the advancement of science and research:

- Andor
- Applied Scientific Instruments
- Bruker
- Chroma
- Hamamatsu
- Spectra-Physics
- Thorlabs
- Zeiss

STUDENT SPONSOR

One of the 2016 imaging course students from the University of Florida was supported through the Max Planck Florida Scientific Fellowship Program, a state-sponsored initiative that promotes and enhances scientific training and education.
Max Planck Neuroscience launches research and news site for scientific community

From the world’s most progressive researchers on the cusp of scientific discovery, the Max Planck Neuroscience (MP Neuro) website now brings the future of neuroscience to our fingertips.

“This brand new digital hub presents all neuroscience content from the entire Max Planck Society network,” says Dr. David Fitzpatrick, CEO and Scientific Director for Max Planck Florida Institute for Neuroscience. “MPFI is proud to have spearheaded the initiative and maintains oversight and management of the MPNeuro website from our institute here in Florida.”

The MPNeuro research and news site, which made its unveiling at the 2016 Society for Neuroscience conference, thoroughly explores thought leadership and discoveries in all facets of brain science, including:

- Brain Disorders and Injury
- Cognition
- Development
- Integrative Physiology and Behavior
- Language and Communication
- Motivation and Emotion
- Motor Systems
- Neural Excitability, Synapses, and Glia
- Sensory Systems
- Techniques
Representing the Max Planck Society culture of fostering the collaborative exchange of scientific ideas, the MPNeuro website provides a portal for research findings to be shared publicly with scholars, universities, and other organizations around the globe. Only with this necessary foundation of knowledge can researchers develop treatments and cures for brain disorders such as autism, schizophrenia, Parkinson’s disease, and Alzheimer’s disease.

MPNeuro – more than meets the mind
The Max Planck Society brings together hundreds of neuroscience researchers throughout the world, equipping them with the best tools and resources to explore some of the most complex issues facing all facets of brain science. This collective knowledge and expertise promotes creative, interdisciplinary approaches – allowing Max Planck scientists to make significant advances in the field and develop innovative technologies and techniques to advance neuroscience research across the globe.

To learn more about Max Planck Neuroscience or sign-up for news, research, and training updates, visit maxplanckneuroscience.org
Continuing International Outreach for MPFI Research and Programs

MPFI attended two international conferences in 2016 to promote their research and training programs. The 10th Federation of European Neuroscience Societies’ (FENS) Forum held in Copenhagen, Denmark and the 2nd Federation of Latin American and Caribbean Neuroscience Societies (FALAN) conference held in Buenos Aires, Argentina. Attending international conferences such as these is crucial in promoting the world-class research and training programs MPFI carries out in Palm Beach County and helps attract the best and brightest scientists from around the world.

MPFI’s Helena Decker, Ph.D. discusses institute programs with conference attendees.
MPFI Attends Society for Neuroscience’s 46th Annual Meeting

Over 30,000 attendees from 80 countries convened in San Diego for the world’s largest neuroscience conference, the Society for Neuroscience (SfN) Neuroscience 2016 Conference. The meeting provides a forum for neuroscientists from around the world to present their research, collaborate with peers, explore new tools and technologies, and advance careers.

MPFI scientists presented their research, the institute hosted a booth promoting their research and programs, and MPFI’s new podcast Neurotransmissions held interviews on the exhibition floor.

THE FOLLOWING SCIENTIFIC POSTERS WERE PRESENTED BY THE MPFI DELEGATION:

- **Kellner V**, Schummers J: Dual-color calcium imaging of astrocytes and neurons in the ferret visual cortex.
- **Lee K-S**, Wilson DE, Fitzpatrick D: Synaptic organization of ON and OFF inputs within the dendritic field of individual layer 2/3 neurons in tree shrew primary visual cortex.
- **Mikuni T**, Nishiyama J, Sun Y, Kamasawa N, Yasuda R: Scalable, high-resolution mapping of subcellular localization of endogenous proteins in the mammalian brain by SLENDR.

San Diego, California
Oberlaender M*, Egger R, Rojas-Piloni G, Narayanan RT, Guest JM, De kock CPJ, Udvary D: Relationships between sensory-evoked synaptic input and long-range target-related spiking output of cortical layer 5.
Scholl B*, Wilson DE, Fitzpatrick D: Synaptic architecture of visual space in ferret visual cortex.
Sederberg AJ*, Zheng HJ, He BJ, Stanley GB: Brain state and spatiotemporal representations of tactile stimuli in sensory cortex explored with genetically expressed voltage-sensor imaging.
Smirnov MS*, Yan L, Yasuda R: Ribbon imaging: high-speed scanning of specialized 3D ROIs fitted to neuronal structures using an electrical tunable lens.
* Presenter

Neurotransmissions podcast host and MPFI researcher Joe Schumacher, Ph.D., interviews NPR’s Jon Hamilton at SfN 2016

Max Planck Florida Institute for Neuroscience’s Global Event Moves to Palm Beach County Convention Center to Accommodate Larger International Audience

Once again, several of the world’s most esteemed researchers will gather in Palm Beach County to speak at the Max Planck Florida Institute for Neuroscience’s (MPFI) international conference highlighting many of the most complex issues at the forefront of understanding neural circuits. The highly attended event, known as Sunposium™, repeatedly attracts the brightest global minds in neuroscience to a unique – and enjoyable – winter educational event in the South Florida sunshine.

Two years ago, the two-day meeting was held at the PGA National Resort and Spa in Palm Beach Gardens, Florida, and attended by more than 270 scientists and students. Back in 2013, The Breakers on Palm Beach Island was the site for the inaugural Sunposium™. To accommodate an audience expected to be significantly larger than in the past, 2017’s
“Wave” by Barbara Grygutis at the Palm Beach County Convention Center, West Palm Beach, Florida. Artwork commissioned by the Palm Beach County Art in Public Places Program.

meeting will take place on February 13-14, at the Palm Beach County Convention Center in West Palm Beach. “The neuroscience researchers who travel to Palm Beach County and present at Sunposium™ empower global strategies that are critical for developing new treatments for brain disorders,” said Dr. David Fitzpatrick, Scientific Director and CEO of MPFI. “We are greatly encouraged by their enthusiastic support, which has necessitated our 2017 re-location to the Palm Beach County Convention Center’s larger venue.”

The 2017 event will feature 20 notable speakers including Nobel laureates Dr. Thomas Südhof and Dr. Susumu Tonegawa. Also presenting will be Vice President of the Max Planck Society, Dr. Bill Hansson and 2015 Breakthrough Prize in Life Sciences winner and one of TIME magazine’s 100 most influential people in 2015, Director of the Max Planck Institute for Infection Biology, Dr. Emmanuelle Charpentier.

Educational forums like Sunposium™ encourage a collaborative, problem-solving approach to multiple aspects of brain function that include the neural basis of sensory processing, motor control, learning, and memory. Comprehending the functional organization of neural circuits and how their activity mediates behaviors provides the knowledge base that is critical for advances in treating neurological and psychiatric disorders.

“Hosting such a prestigious conference as Sunposium™ has dual benefits, as it showcases the world-class scientific research and educational assets available in The Palm Beaches, and our increasing capabilities as a convention and international congress destination,” said Jorge Pesquera, President and CEO for Discover The Palm Beaches, the official tourism marketing corporation for Palm Beach County. “It’s exciting that the conference’s international audience has grown exponentially, and this coincides with our developing downtown Convention, Arts and Entertainment District in Central Palm Beach County. Renowned researchers from all over the world will see first-hand what makes The Palm Beaches the best way to meet in Florida.”

Last year’s biennial Sunposium™ was the largest to date, with four educational sessions featuring an impressive panel of 24 national and international leaders in neuroscience research including Nobel laureate Eric Betzig. Undergraduates in attendance, supported by the Max Planck Florida Scientific Fellowship Program, traveled from Florida State University, the University of Florida, the University of Miami, and NOVA. Even more students are expected in 2017 thanks to the larger venue. The Max Planck Florida Scientific Fellowship program is made possible by a Florida state appropriation.

“Hosting Florida students in varying stages of their educational journeys and then observing these young individuals gain inspiration from this unprecedented group of world-renowned researchers is always rewarding. MPFI is delighted to be able to introduce young minds to the excitement of cutting-edge science, and to plant the seed for tomorrow’s discoveries,” said Fitzpatrick.
Neuroscience stories from the lab and life

Max Planck Florida Institute for Neuroscience (MPFI) researchers Ben Scholl, Ph.D., Joe Schumacher, Ph.D., and Misha Smirnov, Ph.D. host MPFI’s new neuroscience podcast, Neurotransmissions, launched during Brain Awareness Week, 2016. The podcast offers a look inside the neuroscience research world, exploring current research topics and emerging technologies, public health issues in the domain of biomedical science, the intersection between science and society, and unique perspectives and experiences across generations of neuroscientists.

In the spirit of Brain Awareness Week, a global campaign to increase public awareness of the progress and benefits of brain research, the first episode of Neurotransmissions focused on the significance of basic brain research in addressing brain disorders and disease and advancing our world’s base of scientific knowledge. The featured guest for the series premier was David Fitzpatrick, Ph.D., Scientific Director and CEO of MPFI and basic research advocate.

Other guests from 2016 include Nobel laureates Eric Betzig, Ph.D. and Bert Sakmann, Ph.D., Society for Neuroscience (SfN) President, Hollis Cline, Ph.D., and National Public Radio’s (NPR) award-winning science journalist, Jon Hamilton.

Listen to Max Planck Florida’s Neurotransmissions Podcast at www.maxplanckflorida.org/podcast
MPFI was proud to host BioFlorida’s Palm Beach County/Treasure Coast Chapter Industry Event: Florida’s Neuroscience Nexus – a wonderful and inspiring evening with much excitement surrounding the future of life science research and education in Palm Beach County.

The event’s program included: How to Effectively Communicate and Advocate for Research and Academic Initiatives with Karen Moore, CEO and Founder of Moore Communications Group; An Inside Look at MPFI’s Science, Training, and Outreach Programs with Barbara Suflas Noble, VP for Advancement at MPFI and President of the Max Planck Florida Foundation; and Thought Matters at FAU Brain Institute with Dr. Randy Blakely, Executive Director of the Florida Atlantic University (FAU) Brain Institute. The event was sponsored by Jupiter Medical Center, MPFI, and FAU’s Jupiter Life Science Initiative.

BioFlorida is the voice of Florida’s life science industry, representing nearly 6,000 establishments and research organizations in the biopharmaceutical, medical technology, and bioagriculture sectors that collectively employ nearly 83,000 Floridians.
NIH Awards $1.4 Million to MPFI and NYU Scientists Supporting National BRAIN Initiative

Work will focus on developing new optogenetic technologies to understand learning and memory functions

A $1.4 million, three-year grant from the National Institute of Mental Health (NIMH) of the National Institutes of Health (NIH) has been awarded to Dr. Ryohei Yasuda, Scientific Director at the Max Planck Florida Institute for Neuroscience (MPFI) and collaborator, Dr. Wenbiao Gan, Professor in the Department of Neuroscience and Physiology at the NYU Langone Medical Center, to develop new optogenetic tools to analyze protein activity in neurons during synaptic and behavioral plasticity – a key process in understanding learning and memory in the brain. This NIH grant was awarded as part of the federal Brain Research through Advancing Innovative Neurotechnologies® (BRAIN Initiative). This federal initiative dedicates funds to the most promising researchers and projects with the potential to revolutionize our understanding of the human brain.

“There are very few effective cures for neurological and neuropsychiatric disorders,” said Walter J. Koroshetz, M.D., Director of NIH’s National Institute of Neurological Disorders and Stroke. “By pushing the boundaries of fundamental neuroscience research, NIH BRAIN Initiative scientists are providing the insights researchers will need to develop 21st century treatments.”

Synaptic plasticity, learning, and memory are all regulated by protein signaling in the brain – a complex process that is still not yet fully understood. Many forms of learning disabilities and other mental diseases are caused by abnormal protein signaling. To even begin to address these brain disorders and diseases, it is crucial to understand the underlying processes within the brain on a molecular level that are involved in learning and memory.

“Synaptic plasticity is thought to be a basis of learning and memory of the brain,” said Dr. Yasuda. “The work supported by this grant will improve our knowledge of the biochemical events that underlie synaptic plasticity and will provide significant insights into what happens in our brain on a molecular level when mental disorders occur.”

In October 2015, Dr. Yasuda was awarded the NIH Pioneer Award which recognizes scientists who have demonstrated creativity and groundbreaking approaches in biomedical or behavioral science. The prestigious award was given to only 13 scientists in the country.

The NIMH is the lead federal agency for research on mental disorders. The mission of NIMH is to transform the understanding and treatment of mental illnesses through basic and clinical research, paving the way for prevention, recovery, and cure.
Kuo-Sheng Lee Receives Ph.D. Fellowship Supported by the Farris Foundation

Foundation’s continued support of MPFI’s training programs provides fellowship for new graduate program

The Max Planck Florida Foundation has announced that The Celia Lipton Farris and Victor W. Farris Foundation has continued its commitment to MPFI through the support of a Ph.D. fellowship in the Institute’s new International Max Planck Research School (IMPRS) for Brain and Behavior. IMPRS is a first-of-its-kind collaboration among MPFI, Florida Atlantic University (FAU), University of Bonn (Bonn, Germany), and the Center for Advanced European Studies and Research (Bonn, Germany).

“Students in the Institute’s IMPRS program will have the opportunity to learn from an international team of investigators at the cutting edge of brain research,” said Dr. David Fitzpatrick, CEO and Scientific Director at MPFI. “Providing an excellent catalyst for future discoveries, this program creates an environment to help participants ignite their future scientific careers. We are excited that The Farris Foundation has continued its support of the institute through this program – recognizing the value it brings to both the students and our community.”

The Farris Foundation’s Ph.D. Fellowship will support the research of IMPRS graduate student, Kuo-Sheng Lee, whose investigations into neural maps in the primary visual cortex will help to better understand how the brain processes visual information.

“Kuo’s research accomplishments over his relatively short graduate career thus far have been extraordinary. He has proven to be a persistent, dedicated, and creative researcher with a remarkable ability to face challenges and overcome obstacles,” said Dr. McLean Bolton, Chair of Graduate Studies at MPFI. “He is truly deserving of this fellowship and we’re excited to see his work and career continue to develop as a graduate student in the IMPRS for Brain and Behavior.”

The Farris Foundation’s previous support of innovative training opportunities at MPFI allowed for the creation of the MPFI Scholars Undergraduate Internship program, a competitive program providing undergraduates with intensive laboratory research experience to complement their undergraduate science curriculum. Now, the new IMPRS for Brain and Behavior Fellowship marks the second new educational initiative introduced due to The Farris Foundation’s support. The Foundation also supports the MPFI High School Summer Internship Program.

“The Celia Lipton Farris and Victor W. Farris Foundation seeks to support projects that provide the structure, encouragement, and incentive that enable people to help themselves lead more successful, inspired, and fulfilling lives,” said Christine Koehn, Ph.D., Executive Director of The Celia Lipton Farris and Victor W. Farris Foundation. “We are particularly interested in funding projects that stimulate innovation and can demonstrate a sustainable impact on participants, like the IMPRS for Brain and Behavior, and are excited to continue our partnership with MPFI to further our shared goals by sponsoring a fellowship in this new, world-class program.”

With its U.S. headquarters located in South Florida, IMPRS for Brain and Behavior offers students a competitive, world-class Ph.D. training and research program that explores how sensory information is encoded in neural circuits and ultimately transformed to behavior. IMPRS for Brain and Behavior aims to recruit outstanding doctoral students and immerse them in a stimulating environment with new technologies that will illuminate their understanding of brain circuits and help guide them to develop the critical and creative mindset required in this field.
2016 Scientific Publications

ARTICLES


BOOK CHAPTERS


MPFI Honored with Lifees Award at eMerge Americas in Miami

Award recognizes MPFI’s commitment to helping students succeed and developing the South Florida life sciences industry.

The Max Planck Florida Institute for Neuroscience (MPFI) received the Life Sciences South Florida (LSSF) Lifees Award at the 2016 eMerge Americas in Miami, which brings together top government officials and business leaders from around the world to explore how public-private partnerships can leverage technologies to transform our communities. The Lifees Award honors organizations, like MPFI, that are leaders in the life sciences and have demonstrated a commitment to furthering the industry through education and collaboration.

“Enriching science education is an important component of the Max Planck Society philosophy around the world,” said Dr. David Fitzpatrick, MPFI CEO and Scientific Director. “MPFI is committed to offering programs and activities to enhance interest in and foster understanding of bioscience research at all levels of education. We also seek opportunities, like taking part in Florida Atlantic University’s Jupiter Life Science Initiative, where we can collaborate with higher education and other life science institutions to further the industry’s efforts both locally and worldwide. The pioneering basic research performed at MPFI is laying the framework for tomorrow’s great discoveries, and we are proud to have been recognized as a leader among our peers. We look forward to continuing to cultivate this culture of education and collaboration within the life sciences in South Florida.”

MPFI has demonstrated an immense commitment to the development of our South Florida life sciences industry. The opportunities MPFI provides our local students and the research they conduct sets them apart, creating a large impact on our community.”

Saif Ishoof, Vice President for Engagement at Florida International University (FIU)
biotechnology, pharmaceuticals, diagnostics, and information technology.

Among the programs listed during MPFI’s recognition is its partnership with Florida Atlantic University (FAU) in the creation of a doctoral program in Integrative Biology with a concentration in Neuroscience. The program, known as IBAN (Integrative Biology and Neuroscience), provides students the opportunity to explore cutting-edge questions in neuroscience through the integration of multiple disciplines, different model systems, and a broad spectrum of technologies. In addition, the award recognized MPFI and FAU’s collaboration with University of Bonn (Bonn, Germany) and the Center for Advanced European Studies and Research (Bonn, Germany) to globalize education in brain research with an all-new International Max Planck Research School (IMPRS) for Brain and Behavior.

Finally, MPFI’s community engagement through events, like the Brain Bee Challenge and public lectures at local high schools, were highlighted as examples of how the institute is sharing its wealth of knowledge and furthering scientific education among even the youngest aspiring scientists.

Award program recognizes the essential role maintenance and engineering departments play in the safe, sustainable, and efficient operation of the nation’s institutional and commercial facilities

The MPFI facility, operating 24 hours per day, 7 days a week, is a 109,960 gross square foot building with three floors plus mechanical penthouse equipment space. Designed to reduce energy consumption and use materials wisely, MPFI set a high standard for sustainable laboratory design in South Florida, consuming the least amount of energy possible, which resulted in the U.S. Green Building Council’s Leadership in Energy and Environmental Design for New Construction (LEED-NC) Gold Certification. Some of the features contributing to the certification include an air-conditioning zoning strategy that reduces demand load within the space and mechanical systems with state-of-the-art energy recovery wheels to capture usable energy from building exhaust.

In 2016, MPFI was awarded the Facility Maintenance Decisions (FMD) Achievement Award in the Sustainability category, the most recent of many awards in green building projects received by the Institute.

MPFI’s most recent sustainability project highlighted by FMD involved conserving water consumption by the facility’s air conditioning system by recycling of moisture (condensate) removed in the process of dehumidification.

The MPFI facilities team had found that limitations in the current system were causing up to 85% of the collected condensate to be unused and sent to city sewer in lieu of cooling towers as intended. They collaborated internally and with multiple outside contractors to address the issue and have experienced great success after the project’s completion, now with the system sending 100% condensate return back to the cooling towers. In 2016, MPFI recycled over 2.4M gallons of water and has experienced a reduction in overall water utility cost of nearly 25% per month.

The MPFI facilities team responsible for the project were: David Hader, Head of Facilities; Corey Pine, Facility Manager; Fausto dos Santos, HVAC lead; John Schirmer, Electrician; and Mike Mitchell, Plumber.
Research motivated by an intense curiosity and a desire to explore the many realms of natural phenomena in our environment reveals fundamental principles at work in the world around us. It is this basic research that provides the very backbone needed for future medical and technological breakthroughs.

2-Photon imaging generates data in research on orientation selectivity of neurons in the visual cortex.
From Retina to Cortex: An Unexpected Division of Labor

Neurons do a remarkable job of translating sensory information into reliable representations of our world that are critical to effectively guide our behavior. The brain regions responsible for vision have long been center stage for scientists' efforts to understand the rules that neural circuits use to encode sensory information. Years of research have led to a fairly detailed picture of the initial steps of this visual process, carried out in the retina, and how information from this stage is transmitted to the visual part of the cerebral cortex, a thin sheet of neurons that forms the outer surface of the brain. We’ve also learned much about how neurons represent visual information in the visual cortex, and how different this representation is from the information initially supplied by the retina. Scientists are now working to understand the set of rules – the neural blueprint – that explains how these representations of visual information in the visual cortex are constructed from the information provided by the retina. Using the latest functional imaging techniques, MPFI scientists have recently discovered a surprisingly simple rule that explains how neural circuits combine information supplied by different cell types in the retina to build a coherent, information-rich representation of our visual world.

Vision begins with the spatial pattern of light and dark that falls on the retinal surface. One important function performed by the neural circuits in the visual cortex is the preservation of the orderly spatial relationships of light versus dark that exist on the retinal surface. These neural circuits form an orderly map of visual space where each point on the surface of the cortex contains a column of neurons that each respond to a small region of visual space— and adjacent columns respond to adjacent regions of visual space. But these cortical circuits do more than build a map of visual space: individual neurons within these columns each respond selectively to the specific orientation of edges in their region of visual space; some neurons respond preferentially to vertical edges, some to horizontal edges, and others to angles in between. This property is also mapped in a columnar fashion where all neurons in a radial column have the same orientation preference, and adjacent columns prefer slightly different orientations.

Things would be easy if all the cortex had to do was build a map of visual space: a simple one to one mapping of points on the retinal surface to columns in the cortex would be all that was necessary. But building a map of orientation that coexists with the map of visual space is a greater challenge. This is because retinal neurons do not distinguish orientation in the first step of vision. Instead, information on the orientation of edges must be constructed by neural circuits in the visual cortex. This is done using information supplied from two distinct types of retinal cells: those that respond to increases in light (ON-cells) and those that respond to decreases in light (OFF-cells). Adding to the complexity, orientation selectivity depends on having individual cortical neurons receive their ON and OFF signals from non-overlapping regions of visual space, and the spatial arrangement of these regions determines the cell’s orientation preference. Cortical neurons that prefer vertical edge orientations have ON and OFF responsive regions that are displaced horizontally in visual space, those that prefer horizontal edge orientations have their ON and OFF regions displaced vertically in visual space, and this systematic relationship holds for all other edge orientations.

So cortical circuits face a paradox: How do they take the spatial information from the retina and distort it to create an orderly map of orientation selectivity, while at the same time preserving fine retinal spatial information to generate an orderly map of visual space? Nature’s solution might best be called ‘divide and conquer’. Using imaging technologies allowing visualization of the ON and OFF response regions of hundreds of individual neurons, Kuo-Sheng Lee and Sharon Huang in David Fitzpatrick’s lab have discovered that fine scale retinal spatial information is preserved by the OFF response regions of cortical neurons, while the ON response regions exhibit systematic spatial displacements necessary to build an orderly map of edge orientation. Preserving the detailed spatial information from the retina in the OFF response regions is consistent with evidence that dark elements of natural scenes convey more fine scale information than light elements, and that OFF retinal neurons have properties that allow them to better extract this information. Lee et al. also show that this OFF-anchored cortical architecture enables emergence of an additional orderly map of absolute spatial phase - a property that hasn’t received much attention from neuroscientists, but computer vision research has shown contains a wealth of information about the visual scene that can be used to efficiently encode spatial patterns, motion, and depth. The work was published in the April 2016 issue of Nature.

While these are important new insights into how visual information is transformed from retina to cortical representations, they pose a host of new questions about the network of synaptic connections that performs this transformation, and the developmental mechanisms that construct it, questions the Fitzpatrick Lab continues to explore.

This work was supported by grants from the National Institutes of Health and funding from Max Planck Florida Institute for Neuroscience and Max Planck Society.
Researchers at the Max Planck Florida Institute for Neuroscience uncover important organizational features of axonal excitability in a near synapse-by-synapse manner.

- Neurons are the basic information processing structures in the brain and consist of three parts: dendrites, responsible for receiving information; axons, responsible for sending information; and the soma, the cell body that contains the nucleus.
- For communication between neurons to occur, an electrical impulse, called an action potential, must travel down an axon to its synaptic terminal.
- A major technical challenge impeding the direct examination of this process, axonal excitability, is the small diameter of a typical axon – less than 500 nanometers.
- Max Planck Florida Institute for Neuroscience researchers have now optimized optical and electrophysiological recordings from single neurons to study axonal excitability with unprecedented detail.
- These sophisticated approaches allow for the further understanding of basic principles of neuronal communication.

Advancing the understanding of integrative features of the nervous system

There are three main functions of the nervous system: sensory function, which detects changes in the body; integrative function, which makes decisions based on information it receives; and motor function, which carries electrical impulses to stimulate a response. In particular, the integrative functions of the brain bring sensory information together, add to memory, produce thoughts, and make decisions.

The cerebellum, part of the brain that is responsible for motor control, serves as an optimal model system to study the integrative features of the nervous system at both the cellular and network level. The circuitry of the cerebellum is strikingly simple when compared with other regions of the brain, with a regularly repeating cellular organization across its outer layer. In addition, cerebellar-dependent tasks have been well-mapped to particular anatomical sub regions. Therefore, the cerebellum offers a unique opportunity to study the dynamics of how information is transferred and transformed within and between neurons to control motor behavior.

Neurons are divided in three main parts: dendrites, axons, and the soma. While dendrites receive and integrate synaptic input, axons transmit the resultant, compiled synaptic information to specific sites in the form of action potentials. Even within these structures there is sub-special-
ization; dendrites often support functional domains, or dendritic spines, multiplying their computational capacity. And axons achieve a high-degree of specificity in the organization and functional influence of sodium and potassium channels, despite the simplistic classical view of action potentials as monotypic binary pulses transmitted throughout the entire extent of an axon.

In their June 2016 publication in Neuron, researchers Matthew J.M. Rowan, Ph.D., and Jason M. Christie, Ph.D., describe how they overcame a major technical challenge precluding direct examination of axonal excitability. Because of its small diameter – less than 500 nanometers – the typical axon can’t be examined by the conventional electrophysiological recordings. However, using optically-guided subcellular patching, in combination with organic actuators of neural activity, the scientists were able to sample targeted sub regions of axonal membrane including both presynaptic boutons and their attached axon shafts. This recording configuration allows for the direct assessment of the distribution and biophysical properties of ion channels and receptors expressed along an axon. And, in conjunction, it allows for the direct recording of neural signals including action potentials and subthreshold synaptic activity.

Notably, this study demonstrated that action potentials, often viewed as invariant pulses, are instead quite dynamic with their shape varying with subcellular location. The varicose geometry of boutons, alone, does not impose striking differences in spike duration. Rather, this physiology depends on the differential influence of potassium channel subtypes as well as a clustering of fast-activating potassium channels at presynaptic locations. The organizational feature described by this study allows axons to multiply their adaptive properties by tuning excitation in one axonal domain independent of other domains on an exquisitely local spatial scale, including between neighboring sites of release.

**Future directions**

According to Dr. Rowan, the clustered arrangement and variable expression density of potassium channels at boutons are key determinants underlying compartmentalized control of action potential width in a near synapse-by-synapse manner. Such organization yields a powerful adaptive property allowing individual release sites to locally inform the duration of a propagating spike, dependent on the local abundance of channels, and separate of other sites. Dr. Christie’s research team will further investigate how spike signaling within axons is organized and modified, and the computational value of this organization to cerebellar microcircuits.

This work was supported by Max Planck Society, Max Planck Florida Institute for Neuroscience, and National Institutes of Health grants NS083127 and NS083894.

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**The New SLENDER Technique: Protein Labeling in the Developing Brain by Genome Editing**

Researchers at the Max Planck Florida Institute for Neuroscience have created a new scalable, efficient and cost-effective method to accurately and rapidly locate proteins within brain cells.

Ryohei Yasuda, Ph.D., Scientific Director, and his team at the Max Planck Florida Institute of Neuroscience (MPFI) are working to understand the way cells in our brains change as we learn and form memories. But research in this area has been limited due to a lack of techniques that allow scientists to locate and visualize individual proteins within a single...
neuron. Current imaging methods do not provide specificity, contrast, and resolution powerful enough to see distinct proteins. Plus, they are time consuming and expensive; it can take a year or two to develop the engineered models. But when research fellow, Jun Nishiyama, M.D., Ph.D., and post-doctoral researcher, and Takayasu Mikuni, M.D., Ph.D., read about CRISPR/Cas9, a breakthrough DNA editing technique developed in 2014, they had an idea.

CRISPR is a tool built into the DNA of bacteria that the single-cell organisms use to fight infections. When a virus invades and attempts to insert its infectious DNA into that of a bacterial cell, a special section of the bacterial DNA, called CRISPR, cuts the viral DNA and renders it unable to wreak havoc. Scientists have begun using CRISPR/Cas9 to damage specific genes in cells and organisms other than bacteria. When this damage is done, there are two methods that the cell uses to repair its DNA. One is homology-directed repair (HDR), the other is non-homologous end joining (NHEJ). HDR is much more precise and rebuilds or replaces the damaged gene, whereas NHEJ degrades the damaged gene and reattaches the ends of what’s left, often deleting the expression of the damaged gene, but not replacing it.

If a cell uses HDR to repair itself, scientists can include a desired gene in the CRISPR system that will be inserted into the DNA to replace the damaged gene. Many researchers believe that once a cell stops dividing, it usually uses NHEJ, instead of HDR, to repair any broken DNA.

Despite the impressive power of the CRISPR system, there has been little success in manipulating DNA in brain cells, because by the time the brain has formed, its cells are no longer dividing. While scientists can use CRISPR relatively easily to knock out certain genes in the brain, the lack of cell division has made it very difficult for them to knock in desired genes, through HDR, with reliable precision.

Yasuda and his team developed a method, which they call SLENDR (single-cell labeling of endogenous proteins by CRISPR/Cas9-mediated homology-directed repair), that can be used to precisely modify neuronal DNA in living samples. In experimental models, the team used in utero electroporation, a technique that allowed them to insert the CRISPR/Cas9 system into prenatal brain cells that are still developing and dividing. Thus, the broken DNA are still being repaired via HDR, allowing the researchers to add a gene that made a protein of interest visible under the microscope. They were even able to reliably label two different proteins with distinct colors at the same time in the same cell. The researchers used a variety of imaging methods as well as DNA sequencing to confirm that the SLENDR method had truly and precisely knocked in the genes. Their work was published in the 2016 June issue of Cell.

While testing the new technique, the team observed a previously undescribed behavior of the α isoform of protein kinase C. Early in development, about 7 days after birth, it was found clustered at the membrane of the cell, suggesting it was highly active, whereas a month after birth, it was spread diffusely throughout the cell, suggesting that it did not remain highly active later in development.

“I believe that SLENDR will be a standard tool for molecular and cellular neurobiology,” said Yasuda. “SLENDR provides a valuable means to determine subcellular localization of proteins, and will help researchers to determine the function of these proteins.”
Two New Studies Uncover Key Players Responsible for Learning and Memory Formation

Researchers from Max Planck Florida Institute for Neuroscience, Duke University, and collaborators have identified a novel signaling system controlling neuronal plasticity.

One of the most fascinating properties of the mammalian brain is its capacity to change throughout life. Experiences, whether studying for a test or experiencing a traumatic situation, alter our brains by modifying the activity and organization of specific neural circuitry, thereby modifying subsequent feelings, thoughts, and behavior. These changes take place in and among synapses, communication junctions between neurons. This experience-driven alteration of brain structure and function is called synaptic plasticity and it is considered the cellular basis for learning and memory.

Many research groups across the globe are dedicated to advancing our understanding of the fundamental principles of learning and memory formation. This understanding is dependent upon identifying the molecules involved in learning and memory and the roles they play in the process. Hundreds of molecules appear to be involved in the regulation of synaptic plasticity, and understanding the interactions among these molecules is crucial to fully understand how memory works.

There are several underlying mechanisms that work together to achieve synaptic plasticity, including changes in the amount of chemical signals released into a synapse and changes in how sensitive a cell’s response is to those signals. In particular, the protein BDNF, its receptor TrkB, and GTPase proteins are involved in some forms of synaptic plasticity, however, very little is known regarding when and where they are activated in the process.

By using sophisticated imaging techniques to monitor the spatiotemporal activation patterns of these molecules in single dendritic spines, the research group led by Dr. Ryohei Yasuda at Max Planck Florida Institute for Neuroscience and Dr. James McNamara at Duke University Medical Center have uncovered critical details of the interplay of these molecules during synaptic plasticity. These exciting findings were published online ahead of print in September 2016 as two independent publications in Nature.

A surprising signaling system within the spine

In one of the publications (Harward and Hedrick et al.), the authors identified an autocrine signaling system – a system where molecules act on the same cells that produce them – within single dendritic spines. This autocrine signaling system is achieved by rapid release of the protein, BDNF, from a stimulated spine and subsequent activation of its receptor, TrkB, on the same spine, which further activates signaling inside the spine. This in turn leads to spine enlargement, the process essential for synaptic plasticity. In other words, signaling initiated inside the spine goes outside the spine and activates a receptor on the external surface of the spine, thereby evoking additional signals inside the spine. This finding of an autocrine signaling process within the dendritic spines surprised the scientists.

What are the consequences of the autocrine signaling within the spine?

The second publication (Hedrick and Harward et al.) reports that the autocrine signaling leads to activation of an addi-
tional set of signaling molecules called small GTPase proteins. The findings reveal a three-molecule model of structural plasticity, which implicates the localized, coincident activation of three GTPase proteins Rac1, Cdc42, and RhoA, as a causal feature of structural plasticity. It is known that these proteins regulate the shape of dendritic spines; however, how they work together to control spine structure has remained unclear. The researchers monitored the spatiotemporal activation patterns of these molecules in single dendritic spines during synaptic plasticity and found that all three proteins are activated simultaneously, but their activation patterns differed significantly. One of the differences is that RhoA and Rac1, when activated, spread beyond the stimulated spine to the surrounding dendrite, which facilitates plasticity of surrounding spines. Another difference is that Cdc42 activity was restricted to the stimulated spine, what seems to be necessary to produce spine-specific plasticity. Furthermore, the autocrine BDNF signaling is required for activation of Cdc42 and Rac1, but not for RhoA.

Unprecedented insights into the regulation of synaptic plasticity
These two studies provide unprecedented insights into the regulation of synaptic plasticity. One study revealed for the first time an autocrine signaling system and the second study presented a unique form of biochemical computation in dendrites involving the controlled complementation of three molecules. According to Dr. Yasuda, understanding the molecular mechanisms that are responsible for the regulation of synaptic strength is critical for understanding how neural circuits function, how they form, and how they are shaped by experience. Dr. McNamara noted that disorder of these signaling systems likely underlies dysfunction of synapses that cause epilepsy and a diversity of other diseases of the brain. Because hundreds of species of proteins are involved in the signal transduction that regulates synaptic plasticity, it is essential to investigate the dynamics of more proteins to better understand the signaling mechanisms in dendritic spines.

Future research in the Yasuda and McNamara Labs is expected to lead to significant advances in the understanding of intracellular signaling in neurons and will provide key insights into the mechanisms underlying synaptic plasticity and memory formation and brain diseases. These insights will hopefully lead to the development of drugs that could enhance memory and prevent or more effectively treat epilepsy and other brain disorders.

These studies were supported by grants from the National Institutes of Health (F31NS078847, R01NS086840, DPINS086787, R01NS05621, RO1MH080047, RO1DA08259, RO1HL08351, PO1HL096571, and RO1NS030687), the Wakeman Fellowship, Human Frontier Science Program, JSPS KAKENHI, JST PRESTO, the Wakeman Fellowship at Duke University (S.C.H.) and Max Planck Florida Institute for Neuroscience.

Visualization of Newly Formed Synapses with Unprecedented Resolution

Researchers from Max Planck Florida Institute for Neuroscience optimized a spatiotemporally controlled method that induces and visualizes the formation of synapses in cortical neurons.

- Proper cell-to-cell connection is a fundamental mechanism for normal brain function; abnormal connections result in various forms of brain disorders or death.
- Synapses are the functional connections between neurons. Synapses are either excitatory or inhibitory depending on the type of influence they initiate.
- The spatial arrangement of synapses has a critical role in neuronal function.
but the rules that govern this precise synaptic localization remain unknown.

Max Planck Florida Institute for Neuroscience researchers have identified mechanistic and functional elements that govern synapse formation and have established new insights about how synapses are formed in cortical neurons in early postnatal stages.

Advancing our understanding of how proper connections are formed in the brain

The formation of excitatory and inhibitory synapses between neurons during early development gives rise to the neuronal networks that enable sensory and cognitive functions in humans. Inhibitory synapses decrease the likelihood of the firing action potential of a cell, while excitatory synapses increase its likelihood. Remarkably, both excitatory and inhibitory synapses are formed on dendrites of cortical neurons with high temporal and spatial precision, and it is believed that the spatial arrangement of synapses determines the functional consequences of excitation and inhibition of neuronal activities. However, studying the general mechanisms of synapse formation and distribution in dendrites has been challenging due to a lack of reliable methods that trigger and monitor synapse formation.

In their August 2016 publication in *Science*, MPFI researchers Won Chan Oh, Ph.D. and Hyung-Bae Kwon, Ph.D., describe how they precisely induced and visualized the formation of new synapses in real time in live animals. By using fine-scale optical techniques, they demonstrated that the local release of the inhibitory neurotransmitter, GABA, induces both inhibitory and excitatory synapse formation in the developing mouse cortex. The induction of synapses required signaling through GABAA receptors and voltage-gated calcium channels and the newly formed synaptic structures rapidly gain functions.

Future directions

The scientists optimized a spatiotemporally controlled method that induces and visualizes the formation of inhibitory and excitatory synapses in cortical neurons in vitro and in vivo. According to Dr. Oh, these findings suggest a model in which GABA is the common molecule that sets the balance between inhibitory and excitatory synaptic contacts in early postnatal stages. “Given that abnormal synapse formation causes various neurodevelopmental diseases such as autism spectrum disorders and epilepsy, understanding activity-dependent mechanisms of initial synapse formation will be important for developing new therapeutic strategies for these conditions,” explained Dr. Kwon.

This work was supported by grants from National Institutes of Health (MH107460, MH081935 and DA017392) and Max Planck Florida Institute for Neuroscience.

New Team Members

In 2016, MPFI welcomed the following Postdoctoral Fellows: He Zheng, Jui-Yun Chang and TingTing Duan. We welcomed Yasufumi Hayano as a Research Fellow and Tamara Radulovic, Christian Keine, Satoko Okayama, and Paul Evans as Scholars.

Our new Graduate Students were: Ingo Gotthard as an IBAN Student and Ke Zhang as an IMPRS Student.

Our new Post Baccalaureate Research Fellows were Matthew McCann, Amber Longo, Shani Peter, Xun Tu, David Mezey and Siddhant Pusdekar.

New MPFI Scholars were: Christine Ryan, Patrick Hannan, Eric Patino, Serena Sassi and Sohini Lahiri.

We also welcomed Felix Gunst as a Mechanical Workshop Trainee, Maritza Gamboa as a Purchasing Associate, Zhulieta Peeva as an Accountant III, Nicole Shultz as a Histology Coordinator, and Kaitlin Bell as a Surgery Technician.
How would you describe your job?
I oversee most of the equipment for the building, in particular, the heating, ventilation, and air conditioning (HVAC) system, which provides thermal control and acceptable indoor air quality. In our building, we don’t recirculate the air - 98% of the air is fresh. The air coming from outside passes through special filters to remove all the particles and through chilled coils to decrease the humidity. Because this process cools the air down to 52°F, the air needs to pass through hot coils to warm it back up to the desired temperature before being redirected to the labs and offices. Although the HVAC equipment is hidden in the pump room, chiller room, or above the ceiling, this system plays a critical role in our Institute, since numerous experiments depend on stable temperature, humidity, and water conditions. A subtle change in one of these conditions could interrupt or introduce some new variables to the scientific results.

How long have you been working at MPFI?
I’ve been working for MPFI for almost six years. Before joining MPFI, I was responsible for the air conditioning and other major equipment at the Florida Atlantic University (FAU), Jupiter campus. When I was recruited to work at MPFI, in the beginning of 2012, MPFI was still working in temporary facilities on FAU’s campus. The construction of its current facility started shortly after I...
joined the institute, and I supervised the installation of all the equipment, especially our sophisticated HVAC system, to make sure that it would be done properly and accessible for maintenance.

What has been your favorite project?
My favorite project without any doubts was the implementation of a water-saving system from Aqualogix in the beginning of 2016. This system maximizes the condensate re-use in the HVAC system, allowing us to collect the water used in the HVAC system to be used as tap water. With this new system, we are optimizing our water system performance and saving thousands of gallons of water per year. One aspect of my job that I am very proud of is the commitment to sustainability. We, as Leadership in Energy and Environmental Design (LEED)-certified building, are continuously implementing new strategies to use less water and energy.

What do you consider your greatest achievement?
I was raised in a tiny town in Southeast Brazil. My family had limited resources - we didn’t even have electricity or treated water in our house. These limitations didn’t affect me, on the contrary, they are probably the reason why I decided to work with indoor air quality control and energy and water-saving solutions. The greatest achievement of my career so far is gaining my position and work for MPFI, part of the Max Planck Society, one of the world's most successful research organizations. I am very happy to contribute as much as I can for the development and success of our Institute.

MPFI Establishes Corporate Partnership Program to Enhance Programs and Promote Industry Collaboration

In the spirit of collaboration in research and training excellence, MPFI has launched a robust Corporate Partnership Program that will help grow and enhance MPFI's scientific, educational, and community initiatives and connect MPFI faculty, scientists, and students with companies at the cutting edge of research tools, resources, and innovation. MPFI offers unique opportunities for companies looking to partner with the Institute in its mission of deepening our understanding of the brain. Through the Institute’s Corporate Partnership Program, companies who share MPFI's goal of advancing neuroscience research are recognized in a variety of ways to thank them for their support. These partners are also granted advanced and exclusive access to the “Friends of MPFI” program and provided ample opportunities to engage with the scientific community.

MPFI Corporate Partners help support
- Research Programs
- Advanced Courses
- Postdoctoral Training
- Graduate Training
- Education Outreach Programs
- Public Lectures
- Professional Development
- Neuroscience Conferences and Meetings

To learn more about MPFI's Corporate Partnership Program, email partner@mpfi.org.
Ten Palm Beach County High School Students Intern at MPFI for the Summer

100 students applied to the competitive program, which includes three tracks for neuroscience, scientific programming, and mechanical engineering.

Max Planck Florida Institute for Neuroscience (MPFI) selected ten local high school students seeking to further their knowledge of science and advanced technologies to participate in the 2016 class of its competitive summer internship program. The program, which ran from June 13 to July 22, 2016, offered a unique opportunity for high school students to work side-by-side with MPFI research scientists.

The students selected for the 2016 internship at MPFI were: Bernardo Hasbach, Alexander W. Dreyfoos School of the Arts; Roshni Patel, Atlantic Community High School; Lila Mish, American Heritage School; Phillip Taylor, Oxbridge Academy; Karrie Raymond, Spanish River High School; David Skelton, Spanish River High School; Chikaodinaka Nwosu, Lake Worth High School; Himani Gubbi, Suncoast Community High School; Scott Burstein, The Benjamin School; and Cameron Winslow, Suncoast Community High School.

The six-week internship is designed for students with an interest in brain structure, function, and development and advanced imaging techniques and technologies used in neuroscience. Internship tracks offered include neuroscience, scientific programming, and mechanical engineering. Interns participate in research projects alongside MPFI scientists, prepare a written scientific abstract based on their research project, and deliver a short presentation at the end of the program.

The MPFI internships set students up for success in higher education, evident by its 2015 interns who will attend prestigious institutions this fall including Yale University, Rice University, University of Notre Dame, and University of Florida.
Support for Young Scientists

THE CELIA LIPTON FARRIS AND VICTOR W. FARRIS FOUNDATION
FOR THREE YEARS, THE FOUNDATION HAS SUPPORTED SOME OF OUR MOST INNOVATIVE PROJECTS
promoting young scientists: from launching our Undergraduate Scholars Program to broadening our High School Summer Research Internship program.

THE J.M. RUBIN FOUNDATION
DEDICATED TO FURTHERING THE EDUCATION OF PALM BEACH COUNTY’S YOUNG PEOPLE
since 1973, The J.M. Rubin Foundation has been a partner in MPFI’s research and education programs since 2013.

Read more about their support in Foundation News on page 38.

THANK YOU FOR SUPPORTING YOUNG SCIENTISTS IN OUR COMMUNITY!
MPFI’s 2016 Science Career Panel

I want to thank you for including my students in the career panel discussion. One of my students, a very bright, curious young man, who comes from abject poverty, commented, ‘I’ve never been to a place like this. I feel as if I belong here.’ This is what truly makes your events worthwhile; opening windows of opportunity and awareness to students who otherwise may never have realized they could reach for a different kind of life.”

Carla Case-Sweeney, Biology and Geometry for ELL Teacher, Santaluces High School
New Partnerships in Institute’s 2016 Science Meets Music Series to Meet Overwhelming Demand

Institute’s popular lecture and concert series moves to The Benjamin School’s state-of-the-art performance venue, Benjamin Hall.

2015’s standing-room-only and at-capacity crowds inspired a new partnership in the Institute’s popular public lecture and concert series, Science Meets Music. The Benjamin School’s new venue in Palm Beach Gardens, Benjamin Hall, allows MPFI to welcome more guests than ever before to experience its innovative series that brings together science and music for a night of exploration and entertainment.
Anastasia Kobekina, American Friends of Kronberg Academy performing at Benjamin Hall
Dr. Hyungbae Kwon, Research Group Leader, Max Planck Florida Institute for Neuroscience at Royal Poinciana Chapel
Held at Benjamin Hall, the first lecture of 2016, titled *Biology of the Blues*, featured a presentation by Dr. Alon Chen, Director at the Max Planck Institute of Psychiatry in Munich, Germany and Head of the Max Planck Society – Weizmann Institute of Science Laboratory for Experimental Neurogenetics in Israel. During his presentation, Dr. Chen explored how and why the brain responds to stressors, as well as the link between stress exposure and a variety of disorders. The evening also featured musical performances provided by the American Friends of Kronberg Academy. Cellist Anastasia Kobekina, a young soloist with Kronberg Academy studying under Frans Helmerson, was accompanied by Naomi Kudo on piano.

In the second lecture at Royal Poinciana Chapel in Palm Beach, MPFI’s Dr. Hyungbae Kwon explored how learning and experience influence brain development and circuitry. Dr. David Fitzpatrick, CEO and Scientific Director at MPFI, introduced Dr. Kwon as an exceptionally gifted young researcher, who joined MPFI from Harvard University. He described him as dedicated and kind, commenting, “Some people may even call Hyungbae a bit shy – but there is absolutely nothing shy about the type of research he does.” Dr. Kwon highlighted some of the exciting projects currently underway in his research group, including one that employs a novel technology in brain research called optogenetics – a technique that combines optics and light to manipulate and study brain activity. Guests also enjoyed a performance by the young, award-winning Mipmik Quartet of Lynn University’s Lynn Conservatory of Music.

The closing lecture and concert of 2016 featured world-renowned Alzheimer’s researcher, Dr. Eva Mandelkow, and the Woodwind Quintet from Florida Atlantic University’s Department of Music. During her lecture, Dr. Mandelkow of the German Center for Neurodegenerative Diseases and CAESAR (a Max Planck Society Research Center) described the major factors that cause Alzheimer’s disease, her team’s research and discoveries, and recent approaches in therapy. Her groundbreaking work has been recognized internationally with awards from organizations such as the American Academy of Neurology and the U.S. Alzheimer’s Association.

In addition, the FAU Woodwind Quintet, comprised of the finest woodwind musicians at the university, delighted guests with classical music performances preceding and following Dr. Mandelkow’s lecture. Members of the FAU Woodwind Quintet are Maryem Bendaoud on flute, Pharih Blanchard on oboe, Alexandar Petrov on clarinet, Michael Hollin on horn, and Patrick Montanari on bassoon. They are led by Professor Kyle Prescott, Director of Bands at FAU.

“The feedback we have received from the Palm Beach County community regarding the 2016 Science Meets Music series has been extraordinary,” said Dr. Fitzpatrick. “As support grows larger at every event, it’s becoming more and more evident how much our community values these opportunities to experience such impressive science and music in one evening. We look forward to hosting guests – both new and old – at next year’s events.”

All 2017 Science Meets Music events will be held at Benjamin Hall. Speakers will be Dr. Jens Brüning, Director of the Max Planck Institute for Metabolism Research, Dr. Sam Young, Research Group Leader at Max Planck Florida Institute for Neuroscience, Dr. Iain Couzin, Director of the Max Planck Institute of Ornithology, and Dr. Emmanuelle Charpentier, Director of the Max Planck Institute of Infection Biology, 2015 Breakthrough Prize in Life Sciences Winner, and one of TIME magazine’s top 100 most influential people of 2015.
Local Students Inspired through Neuroscience Saturday at Max Planck Florida and Scripps

World-class scientists interact and engage with local high school students and teachers from Title I schools

As part of their commitment to education, world-class scientists from the Max Planck Florida Institute for Neuroscience (MPFI) and the Florida campus of The Scripps Research Institute (TSRI) hosted the Fourth Neuroscience Saturday in January 2016 to inspire local high school students and teachers from Palm Beach County Title I schools. The event is just one example of how the two organizations collaborate—not only in the laboratory, but also in the community.

“As scientists and partners in STEM initiatives in our community, we have a unique opportunity to inspire students from all over Palm Beach County by sharing our excitement for research and discovery,” said Dr. David Fitzpatrick, MPFI’s CEO and Scientific Director. “Neuroscience Saturday is just one of the many ways we can introduce state-of-the-art technologies and research to students and teachers in our community. It has been rewarding to see this event thrive over the past four years, and I hope we can help some of these students discover their own passion for the scientific world.”

Neuroscience Saturday is an educational outreach program targeting underserved high school students and teachers from low-income communities to provide exposure to unique hands-on activities designed to spark interest in science through the wonders of the brain. Participating schools in this year’s event were Pahokee Community High School, Santaluces Community High School, Palm Beach Gardens Community High School, Inlet Grove Community High School, Forest Hill Community High School, and Village Academy.

At the all-day event, scientists from MPFI and TSRI led activities and lectures that gave students the opportunity to explore topics, such as brain structure and function, cutting-edge imaging techniques, and the importance of brain research for the advancing of medical treatments. All materials, lunch, and transportation were provided free of charge.

Neuroscience Saturday is an extension of other community-facing events, such as MPFI’s Neuroscience Discovery Day and TSRI’s CELLebrate, which enable the institutes to share their wealth of knowledge with local residents. It is their hope that events like this one will make a positive impact in the community and inspire the next generation of scientists in Palm Beach County.
The Benjamin School’s "Bucs", a team comprised of students Charlotte Barkdull, Geoffrey Moody, and Isaac Wendler, were named the winners of the Max Planck Florida Institute for Neuroscience’s (MPFI) Fifth Annual Brain Bee in February 2016. The students, who competed among 20 teams from Palm Beach County high schools, will receive $1,000 for their school’s science department and the opportunity to shadow some of MPFI’s top researchers.

During the competition, participants competed in teams of three to answer questions on neuroscience topics such as learning and memory, emotion, sensation, movement, aging, neurobiology, brain anatomy, and neural disorders. Prior to the competition portion of the event, all Brain Bee participants toured MPFI’s labs and facilities and participated in interactive neuroscience demonstrations with researchers.

The second and third place teams, Palm Beach Gardens High School’s “Dream Team” (Zayna Gichi, Supreme McCall, and Anh Nguyen) and West Boca Community High School’s “Brainiacs” (Grace Brown, Brittany Duffey, and Lauren Toler) also received $500 and $250, respectively, for their schools. Other schools represented at the all-day neuroscience competition include: Jupiter Community High School, Lake Worth Community High School, Oxbridge Academy, Palm Beach Central High School, Santaluces Community High School, Seminole Ridge Community High School, and William T. Dwyer High School.

MPFI’s Brain Bee was sponsored by the Mary and Robert Pew Public Education Fund. The Florida-based public education foundation have supported the event since its inception in 2012.

MPFI researcher speaks at Jupiter High School for Taras Foundation’s Meet the Scientist series

MPFI Postdoctoral researcher Joe Schumacher, Ph.D., presented Bird Brains and Growing Pains: How Development and Learning Change your Perception at the 13th annual Meet the Scientist series, a collaboration between the Taras Oceanographic Foundation, a non-profit organization founded in Jupiter, Florida, Jupiter High School, and the Jupiter Environmental Research and Field Studies Academy (JERF-SA), a four-year academic program focused on ecological principles and processes, environmental awareness, field studies and research, critical thinking, and leadership skills.

“Whether you’re playing the piano, talking with your friends, or scoring the winning goal in a soccer game, you’re doing something you were at one point unable to do,” explained Dr. Schumacher. “Our ability to learn new skills begins at birth, and is critical for shaping our perception and behavior later in life.”

Dr. Schumacher’s presentation focused on how the study of vocal learning in baby songbirds has provided new insights into how humans learn to communicate and current progress into understanding how adults learn to acquire new behaviors and perceptual abilities.
Institute Introduces New Art Exhibition:
At the Threshold to the Unknown

Max Planck Florida Institute for Neuroscience’s exhibit “At the threshold to the unknown” is an exploration into the creativity, curiosity, and wonder of brain research at MPFI. The exhibit demonstrates a unique collaboration between the scientist and the artist – each displaying a profound dedication and talent in their craft. The magnificent beauty that is found in science – often hidden from the naked eye – is brought to life through the scientist’s quest to advance the frontiers of research and technology and deepen our understanding of the brain.

THANK YOU to David and Nancy Auth for making this inspiring exhibit possible. This exhibit is dedicated in loving memory of John Whitney Payson.

The dynamic neuron illustration depicting new insights into details of neuronal communication. MPFI scientists found action potentials, previously viewed as invariant pulses, were actually quite dynamic in shape and features varying along neuronal branches. Inspired by a 2016 publication from MPFI’s Christie Lab.
Outstanding Philanthropic Support for MPFI’s Research and Training Programs

In 2016, Max Planck Florida Foundation (MPFF) received several exceptional gifts that expanded upon generous partnerships that have grown for years. Four of these partners, The Celia Lipton Farris and Victor W. Farris Foundation, The David Minkin Foundation, The J.M. Rubin Foundation, and the Gertrude E. Skelly Charitable Foundation renewed commitments to MPFI’s research and training programs in 2016. Their continued generosity is a testament to not only Max Planck Florida, but to the impact philanthropy can make on a community and the world.

THE CELIA LIPTON FARRIS AND VICTOR W. FARRIS FOUNDATION
An inaugural fellowship grant of $225,000 to support a doctoral student in the International Max Planck Research School for Brain and Behavior (IMPRS) a pioneering, transatlantic graduate program.

THE DAVID MINKIN FOUNDATION
A steadfast partner of MPFI since its inception, their gift of $150,000 in 2016 supported the promotion of the Institute and its outstanding neuroscience. The David Minkin Foundation’s giving through MPFI’s history has been irreplaceable.

THE J.M. RUBIN FOUNDATION
Their heartfelt gift of $100,000 is one of many in recent years benefitting youth education and scientific programs. Mary Harper, J.M. Rubin Foundation President and CEO, shared they are proud to be “deepening their commitment to support world-class research and education initiatives at MPFI.”

THE GERTRUDE E. SKELLY CHARITABLE FOUNDATION awarded a grant directly supporting MPFI’s Summer High School Research Internship program. This gift is the most recent in a series given in support of various education programs for young researchers and future neuroscientists.

Max Planck Florida Partners with Wilmington Trust in Donor and Trustee Event, “Sight and Insight”

In January 2016, the Max Planck Florida Foundation and Wilmington Trust were pleased to co-host a unique private dinner event titled, Sight and Insight: Making Decisions About Our World. The theme for the evening was presented by Dr. Jason Kerr, Director of Center of Advanced European Studies and Research (CAESAR) and Dr. Luke Tilley, Chief Economist with Wilmington Trust, who addressed special guests at The Bears Club, founded in 1999 by golf legend Jack Nicklaus and his wife, Barbara, in Jupiter, Florida. Drs. Kerr and Tilley shared how our brains affect our decision-making processes, as well as world markets, drawing connections between the brain and economics that may not have previously been considered. Kerr and Tilley created a thoughtful program that emphasized the common threads their disciplines share.

Dr. Jason Kerr serves as the Director of Behavior and Brain Organization at CAESAR in Bonn, Germany and is a Scientific Member of the Max Planck Society. CAESAR is an integral member of International Max Planck Research School for Brain and Behavior, a pioneering graduate program designed in partnership between MPFI, Florida Atlantic University, CAESAR, and the University of Bonn. Dr. Luke Tilley is a member of Wilmington Trust’s Investment Strategy Team and develops U.S. and international economic forecasts and oversees macroeconomic forecasts for the organization.

Clients of Wilmington Trust joined MPFF donors and trustees in enjoying the professional insights and the inspired conversations that followed just a few short miles from the Institute. At the evening’s close, Dr. David Fitzpatrick, MPFI CEO and Scientific Director, addressed guests, “We thank Wilmington Trust and managing director, David Fritz, for their generosity this evening. It was a delight to collaborate on such an innovative and thought-provoking program. We look forward to presenting similar high-caliber programs together in the future.”

David Fritz, Luke Tilley, Ph.D., Jason Kerr, Ph.D., David Fitzpatrick, Ph.D.
How Do You Measure the Life of a Man Who Has Done so Much for so Many?

Alex Dreyfoos Wins 2016 Outstanding Philanthropist Award on National Philanthropy Day

This year, Max Planck Florida Foundation was honored to co-nominate MPFI Board Member, Alexander W. Dreyfoos for Palm Beach County’s Outstanding Philanthropist Award. National Philanthropy Day recognizes the great work of philanthropists along with organizations and businesses active in the philanthropic community who enrich our world. The Association of Fundraising Professionals’ Palm Beach County Chapter bestows these prestigious awards.

The landscape of Palm Beach County has been forever changed through the extraordinary efforts of Alex Dreyfoos. Due to his vision and dedication, Palm Beach County has blossomed from what he once called a “cultural wasteland” to a hub of science, industry, and the arts. His pioneering influence was instrumental in the formation of the Cultural Council of Palm Beach County, the genesis and realization of the Raymond F. Kravis Center for the Performing Arts, in enticing Scripps Florida and Max Planck Florida Institute for Neuroscience to establish in Jupiter, and the success of the Dreyfoos School of the Arts.

Mr. Dreyfoos was celebrated for his 47 years of dedication to the Palm Beach County community. After graduating from MIT, he served in the US Air Force and later formed, Photo Electronics Corporation, with which he holds several patents. After moving to South Florida, he purchased WPEC TV-12, the local CBS affiliate, which he owned from 1973 to 1996. A landmark donation to the Palm Beach County School District resulted in the establishment of a designated arts magnet school, thereafter known as the Alexander W. Dreyfoos School of the Arts. He has consistently put an emphasis on supporting the arts and sciences, believing fundamentally that they are “intrinsically entwined.”

In his remarks to the gathered crowd, Mr. Dreyfoos said, “I have tried to lead by example, not by magnitude, by getting behind an important initiative early-on, in hopes of motivating others to do the same. Both Renate and I have found that stepping forward early, and supporting causes that are good for all, is the best way we can help them to succeed.” Max Planck Florida is grateful that Mr. and Mrs. Dreyfoos were inspired to support MPFI in that same way, early and with full enthusiasm, as donors and as a member of the Institute Board of Directors.

Max Planck Florida Foundation President, Barbara Suflas Noble, shared, “Alex Dreyfoos’ legacy of discovery and innovation, culture and academic excellence, and transformative philanthropy will endure for generations. As Andy Warhol said, ‘The idea is not to live forever, but to create something that will.’”

THANK YOU, Mr. Dreyfoos, for your leadership and dedication to our community and Max Planck Florida.
The Max Planck Florida Brain Trust is a distinguished group of intelligent, like-minded individuals who have come together to leave a lasting legacy through their annual commitment and support of the world-class research at the Max Planck Florida Institute for Neuroscience.

In its inaugural year, members of The Max Planck Florida Brain Trust invested in the professional development of our scientists, whose idealistic and fresh perspectives will spark tomorrow’s great discoveries. Members continue to foster research and discovery at MPFI each year, helping to uncover all that remains unknown about the brain.

Thank You for being a vital member of our Max Planck Florida family.
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A Legacy of Transformational Gifts

Transformational giving acts as a catalyst for revolutionary neuroscience research at MPFI. These individuals, foundations, and corporations make extraordinary discoveries possible. Their support emboldens our researchers to take risks, develop new technologies, and pursue innovation.

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Throughout 2016, numerous individuals have also contributed to MPFI’s research and programs. **THANK YOU** for your support.

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Working Together to Make the World a Better Place

MPFI and the Max Planck Florida Foundation are exceptionally grateful to Patricia and Howard Lester for their unwavering support, invaluable leadership, and steadfast commitment to the advancement of neuroscience.

From the Institute’s very inception, Pat and Howard Lester have been essential champions of the research conducted at MPFI. Pat is a founding member of the Max Planck Florida Foundation’s Board of Trustees, and the board was honored to welcome Howard as a trustee in 2014.

“All of the advances in medicine and health over the last 20 to 30 years have been the result of basic research, and that’s exactly what MPFI does,” Mr. Lester said. “This is why it’s so important to us to support the foundation. This kind of research advances the world’s knowledge of science and moves us closer to cures for devastating neurological diseases that strike millions. We are helping to make the world a better place.”

In addition to their years of guidance and dedication, the Lester’s have made several transformational gifts to MPFI, as individuals and through the David Minkin Foundation. As a symbol of the Institute’s gratitude, the Institute lobby was named ‘The Minkin, Briger, Lester Family Lobby’ and our elevators were named in honor of The David Minkin Foundation. Their unwavering support throughout the Institute’s history has greatly shaped it’s future.

When they made their initial gift to Max Planck Florida Foundation, Pat shared, “not only did we recognize the significance of the research being conducted at the Max Planck Florida Institute, we saw the astounding opportunity it represented for our community, and we wanted to contribute to its success.”

Howard and Pat have been active in the Palm Beach County community for decades, offering their leadership and support to countless causes including the Palm Beach Opera, United Way of Palm Beach, and the Society of the Four Arts.

Max Planck Florida Foundation Board Chairman, George Elmore shared, “The Max Planck Florida Institute for Neuroscience and The Max Planck Florida Foundation have been remarkably blessed to have Pat and Howard Lester as partners since our launch. Their leadership and generosity have shaped MPFI into the thriving institution it has become and impacted the landscape of neuroscience research in our community.”

Pat and Howard Lester