FAU AND MPFI PARTNER TO LAUNCH PROGRAM FOR HIGH SCHOOL STUDENTS

RESEARCH HIGHLIGHTS
Newly Identified Role for Inhibition in Cerebellar Plasticity and Behavior

INSIDE THE INSTITUTE
Tools of the Trade that Shatter the Resolution Barrier

ADVANCEMENT NEWS
Brain Trust Celebration: A Night at the Institute
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**On the cover:** CA1 neurons of the Hippocampus stained for cFos activation after a spatial navigation task. Image courtesy of Dr. Yingxue Wang, Research Group Leader, Neuronal Mechanisms of Episodic Memory, MPFI.
MPFI’s Brain Exploration Day Kicks Off National Brain Awareness Week in Palm Beach County

On Saturday March 10, as part of the Brain Awareness Week initiative, MPFI welcomed over 200 eager guests to an immersive, family oriented open house event like never before. Originally launched by the Dana Alliance for Brain Initiatives, Brain Awareness Week is an international campaign aimed at highlighting the critical need for brain related research and informing the public about impactful discoveries in neuroscience. Due to the week’s significance and special focus on community outreach, MPFI created an event that provided a more personal and educational experience. Unlike previous Neuroscience Discovery Days, a large annual open house event celebrating MPFI’s grand opening in 2012, the Brain Exploration Day was designed as a smaller more intimate gathering.

Featuring an in-depth tour of the state-of-the-art institute with presentations at each stop along the way and an immersive “Discovery Zone” filled to the brim with interactive stations, members of the local community had the exciting opportunity to see, touch, and hear about the exceptional science being done at MPFI. The intimate setting allowed attendees a chance to interact one-on-one with neuroscience researchers throughout the entire event; asking questions about the brain, topics of research, and the brain specific diseases studied at MPFI. In addition, attendees received a rare behind-the-scenes look at the advanced imaging technologies used every day by MPFI neuroscientists to expedite groundbreaking discoveries about the brain. About 80 percent of the Brain Exploration Day participants were visiting the Institute for the very first time.

In between learning at the educational stations, guests enjoyed fun, family-oriented activities like face painting, viewing images of the brain in virtual reality, family yoga classes, dress like a neuroscientist photo booth, and even conducting hands on experiments. With more than half of the institute staff volunteering, the event was a wonderfully interactive collaboration between the community and the scientists working right in their back yards.
Dr. Gloria Choi, Named Winner of the 2018 Peter Gruss Young Investigator Award

MPFI proudly announces Dr. Gloria Choi as the second recipient of the biennial Peter Gruss Young Investigator Award. Choi is an Assistant Professor at the McGovern Institute for Brain Research at the Massachusetts Institute of Technology in Cambridge, MA. Her research focuses on olfaction and social cues, as well as neuroimmunology and neural circuits.
“I am honored and deeply grateful. Being recognized with the Peter Gruss Young Investigator Award adds to my motivation to continue striving for good, exciting and important scientific research,” said Choi. Choi received her Ph.D. in Biology from the California Institute of Technology and was a postdoctoral researcher at the Center for Neurobiology & Behavior, Columbia University, New York, NY, in the laboratory of Nobel Prize-winning researcher Richard Axel. She is the recipient of numerous prestigious awards, including being named one of Cell Magazine’s 40 Under 40 in 2014. As the recipient of the 2018 Peter Gruss Young Investigator Award, Choi was honored with a special presentation and gave a talk at MPFI’s international Symposium conference, which took place March 4-6, 2019 in West Palm Beach, Florida. Choi received a monetary award sponsored by Ms. Raquel Rodriguez, a lawyer and the Managing Member of the Miami office of the law firm McDonald Hopkins LLC. Ms. Rodriguez, is a long-time supporter of MPFI’s work and the life science industry and supports the award in honor of Dr. Peter Gruss’s legacy.

“Gloria Choi’s achievements continue to push the boundaries of neuroscience forward, and her ability to bring her full focus, creativity, and intellectual curiosity to a question is clearly evident in the groundbreaking research that she has already published so early in her career,” wrote Robert Desimone, director of the McGovern Institute, who nominated Choi for this award. Desimone went on to say that Choi is a “creative and collaborative researcher who is certainly an inspiration to other young scientists.”

The Peter Gruss Young Investigator Award is given biennially to recognize a young neuroscience investigator for significant contributions to the scientific community through collaboration, creativity, and curiosity-driven research. In addition to recognizing exceptional achievements, it also serves to support research, inspire young scientists, promote cooperation, and acknowledge the outstanding legacy that Dr. Peter Gruss built throughout his distinguished career at the Max Planck Society.
FAU and Max Planck Florida Institute Partner to Launch the Only Program of its Kind in the World for High School Students

The brightest high school students interested in pursuing a career in STEM (science-technology-engineering and math), can now work side-by-side with preeminent scientists at one of the world’s leading neuroscience research institutions. The Florida Atlantic University Max Planck Academy on the John D. MacArthur Campus in Jupiter stands to redefine approaches to STEM education, not only in South Florida, but nationwide.

“Based on historical educational reform efforts, the FAU Max Planck Academy will be the most consequential shift in the delivery of education in the United States in decades,” said Joel Herbst, Ed.D., superintendent of FAU PK-12 schools and educational programs. “This is a significant pivot from the traditional model of delivering education. We are offering exceptional high school students an extraordinary opportunity to work alongside renowned scientists. As the only program of its kind in the world, the Academy will serve as the new model for STEM education.”

The FAU Max Planck Academy is the latest partnership between FAU, MPFI, and the Germany-based Max Planck Society, expanding on similar opportunities for FAU’s graduate and undergraduate students. This unprecedented program will open the laboratories of Max Planck to high school students, allowing them to participate in world-class research and scientific discoveries as part of their curriculum. Six high-achieving FAU High students currently were dual-enrolled in an Academy pilot program during the 2018-2019 School year, directly learning from scientists – including Nobel Laureates – and spending time in MPFI labs.

The Academy will be organized as a standalone extension of FAU High School – a nationally recognized, public “Blue Ribbon School” located on FAU’s Boca Raton campus that offers an accelerated pre-collegiate program where students work toward a cost-free bachelor’s degree and high school diploma simultaneously. The Academy in Jupiter will offer a unique and individualized program for students, starting in their junior year of high school. Enriched, honors academic pathways in STEM will be offered, including neuroscience, biological sciences, chemistry, engineering, and computer science. As an added benefit, students that matriculate through the Academy will gain priority admission into the undergraduate Max Planck Honors Program which was launched in spring 2018.

“The Max Planck Society has a long history of investing in the education of the next generation of scientists. Our ideal has always been to provide the most promising minds with state-of-the-art resources and opportunities. We have proudly educated thousands of junior scientists at the college, Ph.D. and postdoctoral level, and are now excited to extend the Max Planck model of scientific excellence to the high-school level,” said David Fitzpatrick, Ph.D., CEO and Scientific Director of MPFI.

Benefiting from the international presence of MPFI and the Max Planck Society, the Academy experience will lead to extraordinary international networking, mentorship, and study abroad opportunities.

Approximately 35-50 students will be admitted in the inaugural class, eventually scaling up to about 50 students. Beginning in 2019, the highly selective application process will target National Merit semifinalists, as well as the best STEM students from around the world. The first class is slated to begin in fall 2020 and to graduate in spring 2022. Students who successfully complete this exceptional program will earn a high school diploma embossed with both the FAU and Max Planck seals, and at least two years of accelerated college credit – tuition free – leading to elite research experiences and distinction through the FAU Max Planck Honors Program and accelerated bachelor’s degree at FAU.

For more information about the program and its application process, visit maxplanckacademy.fau.edu.
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Joel Herbst, Ed.D., superintendent of FAU PK-12
Max Planck Florida Showcases Programs at Society for Neuroscience Conference

Representatives from MPFI attended the Society for Neuroscience's 48th annual conference, November 3-7, 2018 in San Diego, CA. This annual event is the largest global neuroscience conference and attracted nearly 30,000 attendees from around the world.
Plans to promote new MPFI recruitment opportunities at next year’s conference are already in progress. SfN’s Neuroscience 2019 will be held October 19-23 in Chicago, Illinois.

MPFI had both a booth showcasing graduate programs and an exhibitor booth at the conference trade show, and met with visitors to share MPFI’s mission, academic programs, and special events. MPFI representatives spoke with excited attendees about the upcoming Sunposium conference, available postdoc positions, and the increasingly-popular Max Planck Neurotransmissions Podcast, which has an established fan base of neuroscience enthusiasts. Meanwhile, at the graduate programs fair, a team from both Jupiter, Florida and Bonn, Germany recruited students for the institute’s International Max Planck Research School for Brain and Behavior (IMPRS), along with the Integrative Biology and Neuroscience (IBAN) graduate program with Florida Atlantic University.

Research Group Leader Hyungbae Kwon and Scientific Director Ryohei Yasuda gave featured talks at the conference. Dr. Kwon’s talk, “Dissecting Behaviorally Relevant Neurmodulation Circuits at Celluar Resolution” took place on November 5, 2018 as part of SFN’s “Innovative Approaches for Monitoring Neurmodulation with Light” minisymposium. Dr. Yasuda gave a special lecture on November 7, entitled “Biochemical Computation in Post-synaptic Compartments: Implications for Synaptic Plasticity, Learning and Memory."

MPFI once again hosted a highly-anticipated social event for neuroscience colleagues attending the Society for Neuroscience Conference 2018. The event was held at Cafe de Seville in San Diego’s Gaslamp District, and attracted more than 200 enthusiastic scientists who enjoyed refreshments, music and special prize giveaways courtesy of MPFI, and our corporate sponsors Inscopix, Thorlabs, and Bruker.

Scientific Poster Presentations by the MPFI Delegation:

**Deletion of NRXN1α disrupts specific elements in fear circuit**
D. Asede, A. Joseph, *M. Bolton

**SpineTracker: An open-source, broadly adaptable plugin for fully automated imaging and stimulation of dendritic spines**
*M. S. Smirnov, R. Yasuda

**Immediate perisynaptic membrane expansion after LTP induction visualized by correlated light and electron microscopy**
*Y. Sun, N. Kamasawa, R. Yasuda

**In vivo imaging of experience dependent CREB activity in the mammalian brain**

**Visualization of neurmodulation action at single synapse resolution**
*S. Kruesel, D. Lee, J. Hyun, H.-B. Kwon

**Integration of spatiotemporally distinct signals by PKC α during synaptic plasticity**

**Stripe-like organization of secondary visual cortex in tree shrew**

**A VI-recipient cortical area in the tree shrew contains direction selective neurons**
*M. Sedigh-Sarvestani, J. Schumacher, K. Maximov, R. Satterfield, N. Shultz, D. Fitzpatrick

**Mechanisms of Purkinje cell-dependent instructive signaling in the cerebellum**
*A. Bonnan, M. J. Rowan, C. A. Baker, M. Bolton, J. M. Christie

**The role of local inhibitory circuits in expression of cerebellar-dependent motor memories**
*M. J. Rowan, J. Christie, A. Bonnan

**MLI disinhibition relieves gating of climbing fiber-mediated learning in the cerebellum**

**Temporally precise labeling of oxytocin sensitive neuronal populations**
*N. L. Mignocchi, H.-B. Kwon

**Purkinje cell dendrites encode graded information dependent on the level of climbing fiber activity**
*J. M. Christie, S. B. Amat, M. A. Gaffield

**Mapping functional synaptic weights with in vivo spine imaging and correlated ultrastructural anatomy**
*B. Scholl, C. Thomas, D. Guerrero-Given, N. Kamasawa, D. Fitzpatrick

**Development of coherent orientation selective responses to monocular and binocular stimuli in ferret visual cortex**
*J. T.-Y. Chang, D. E. Whitney, D. Fitzpatrick

*Presenter
Max Planck Florida Shares Expertise Across the World

2018 was a year of international collaboration as Max Planck Florida Researchers traveled abroad to share their research and expertise with neuroscientists from around the world. In addition to the many talks they gave across the United States last year, MPFI scientists represented the institute at dozens of events in nine different countries, including Argentina, Canada, Chile, China, Germany, England, Italy, Japan, and Poland.
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<td>Montreal, Quebec, Canada</td>
<td>University of Montreal April 20, 2018 Ryohei Yasuda, “Biochemical Computation in Single Dendritic Spines”</td>
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<tr>
<td>Germany</td>
<td>Hamburg, Germany</td>
<td>FOR2419 Symposium Hamburg February 16, 2018 Ryohei Yasuda, “Biochemical Computation in Single Dendritic Spines”</td>
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<td>Poland</td>
<td>Warszawa, Poland</td>
<td>Nencki Institute of Experimental Biology May 24, 2018 McLean Bolton, “Cellular Resolutions Circuit Mapping in Mouse Models of Autism with Soma-Targeted Opsins”</td>
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2018 Brings Significant Grant Awards to Max Planck Florida

When it comes to prestigious National Institute of Health (NIH) Grants, 2018 was the most successful year on record for MPFI. Three scientists received grants totaling more than $11 million to advance their cutting-edge research on the structure and function of the brain.

In October 2018, Dr. Hyungbae Kwon, MPFI Research Group Leader was awarded a 2018 NIH Director's Pioneer Award for developing a new light-based technique that allows scientists to visualize and map out how emotions affect neurons. Dr. Kwon is one of just ten scientists to receive the Pioneer Award in 2018. He will receive $6.8 million over five years for his project entitled ‘Cracking the Neuromodulation Code at Single Cell Resolution.’ The grant is the largest in the eight-year history of MPFI, and marks the second time a MPFI researcher has been awarded a Pioneer Award.

In June 2018, Dr. Hiroki Taniguchi, MPFI Research Group Leader was awarded a $2,412,500 five-year grant by the National Institutes of Health (NIH).

Over the life of the grant the Taniguchi Lab will take a closer look at a class of brain cells known as inhibitory interneurons, studying how members of this diverse cell type assemble into specific circuits in various regions of the cerebral cortex affects things such as sensory perception, language, and cognition.

Through the support of this grant, scientists in the Taniguchi lab will be able to conduct research that will dramatically improve our understanding of cortical circuits as well as pioneer novel approaches for the diagnosis and treatment of prominent brain disorders.

In September 2018, Dr. Jason Christie, MPFI Research Group Leader was awarded a NIH grant of $2,082,074 over five-years.

With the support of this crucial funding, Dr. Christie’s research will provide a better understanding of how neural circuits in the cerebellum ensure accurate movement, turning the motor errors we make into reliable, adaptable and meaningful learning, laying the foundational science that will lead to tomorrow’s cures.

NIH Director’s Awards are prestigious awards that are given to exceptionally creative scientists proposing high-risk, high-impact research at all career stages. The awards were created to support unconventional approaches to major challenges in biomedical and behavioral research.

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The American Academy of Arts and Sciences Elects Dr. David Fitzpatrick to 2018 Class

MPFI’s CEO and Scientific Director inducted alongside with the former United States President and with world leaders to the 2018 class

Dr. David Fitzpatrick joins the ranks of exceptional scholars, leaders, artists, and innovators in the 2018 class of the American Academy of Arts and Sciences. Founded in 1780, the Academy is committed to recognizing and celebrating the excellence of individuals who are leaders in their field and innovatively address challenges facing the world.

The new members of the Academy were elected in 25 categories and are affiliated with over 125 institutions. Dr. Fitzpatrick was elected in the category of Neurosciences, Cognitive Sciences, and Behavioral Biology, and is accompanied by leading neuroscientists from Harvard Medical School, Boston University, and Massachusetts Institute of Technology.

“I am honored to join the 2018 class of the American Academy of Arts and Sciences,” said Dr. Fitzpatrick. “Since its founding, the American Academy has served the nation as a champion of scholarship, civil dialogue, and useful knowledge, celebrating the creativity, ingenuity, passion, and determination that is at the heart of all artistic and scientific achievement. Now more than ever, it is critical to appreciate the crucial role that the arts and sciences play in addressing the enormous challenges facing our world.”

The 2018 Class also includes actor Tom Hanks; Netflix, Inc. CEO W. Reed Hastings, Jr.; Librarian of Congress Carla D. Hayden; 44th President of the United States Barack H. Obama; NASA climatologist Claire L. Parkinson; physicist David J. Pine; philanthropist and entrepreneur Laurene Powell Jobs; and Supreme Court Justice Sonia M. Sotomayor.

“Membership in the Academy is not only an honor, but also an opportunity and a responsibility,” said Jonathan Fanton, President of the American Academy. “Members can be inspired and engaged by connecting with one another and through Academy projects dedicated to the common good. The intellect, creativity, and commitment of the 2018 Class will enrich the work of the Academy and the world in which we live.”

Now more than ever, it is critical to appreciate the crucial role that the arts and sciences play in addressing the enormous challenges facing our world.”

Dr. David Fitzpatrick

The new class was inducted at a ceremony in October 2018 in Cambridge, Massachusetts, and joined the noteworthy Academy members who came before them, including Benjamin Franklin (elected 1781), Alexander Hamilton (1791); Ralph Waldo Emerson (1864), Maria Mitchell (1848), Charles Darwin (1874); Albert Einstein (1924), Robert Frost (1931), Margaret Mead (1948), Milton Friedman (1959), and Martin Luther King, Jr. (1966).
Max Planck Florida Institute for Neuroscience Enters into Prestigious Partnership with Zeiss

MPFI is excited to announce that a new “labs@location” partnership agreement between the MPFI Electron Microscopy (EM) Core Facility and Germany-based microscopy company ZEISS, known around the world for its advanced imaging technologies.

As a “labs@location” partner institution, MPFI will have access to state-of-the-art ZEISS technology before it becomes commercially available, providing researchers with the latest cutting-edge imaging tools that will empower their search for new insights into how the brain works. MPFI is one of only three institutions in the United States to earn the labs@location designation.

“ZEISS and MPFI have a long-standing, collaborative relationship—we have been working closely together to push the boundaries of visualizing the brain’s ultrastructure since MPFI’s establishment in 2012,” said Dr. Naomi Kamasawa, Head of EM Facility. “Though MPFI’s EM facility might not be as expansive as other institutions, our commitment to scientific excellence, insightful feedback on the latest technology, and passion to push boundaries in our research, made us an invaluable partner for ZEISS.”

Kirk J. Czymmek, Head of the Global ZEISS Microscopy Customer Centers praised the EM lab in his remarks, saying “The team at MPFI is a special one, and they are internationally recognized for their talent and expertise.”

MPFI and ZEISS partnership – established in October 2018 – was launched on January 17, 2019 at an event that included lectures focused on Correlative Light-Electron Microscopy (CLEM), facility tours, and a special partnership signing and reception held in MPFI’s Dreyfoos Atrium.

The first piece of equipment made available to MPFI scientists is known as the “Focal Charge Compensation module (FCC)”, which is integrated onto a Serial Block Face Scanning Electron Microscope system. The FCC introduces a local stream of nitrogen gas onto the sample inside the microscope, which absorbs unwanted electrical charges that interfere with imaging. “This new technology results in much higher quality images and allows us to collect data from even more challenging samples,” Dr. Kamasawa explained. “Anything that allows us to better visualize the structure of neurons and correlate it to their function will allow us to achieve a more complete understanding of neural networks, and ultimately, of the brain itself.” MPFI received the FCC
Dr. David Fitzpatrick Receives Notable Honor for his Leadership in Systems Neuroscience from Brandeis University

The recognition includes presentation of the inaugural John Lisman '66 Memorial Lecture in Vision Science

On Tuesday, April 10, David Fitzpatrick, Ph.D., CEO and Scientific Director of MPFI, delivered the inaugural John Lisman '66 Memorial Lecture in Vision Science at Brandeis University. The private research university, based outside of Boston and known for its excellent undergraduate education, presented the award to Dr. Fitzpatrick in conjunction with his distinguished lecture titled “Functional Synaptic Architecture in Primary Visual Cortex.” The award is in recognition of his work as a leader in systems neuroscience, investigating the functional organization and development of neural circuits in the cerebral cortex.

Formerly called the Jay Pepose 75’ Award, the prestigious honor was newly renamed to memorialize the late Dr. John Lisman, Ph.D, a graduate of and later professor at Brandeis University, known for his scientific creativity and renowned for his work on the molecular basis of memory.

“I am honored to receive the inaugural John Lisman ’66 Memorial Lecture in Vision Science,” said Dr. Fitzpatrick. “Dr. Lisman was a leader in neurosciences and an integral force behind the Pepose Award, from his work in selecting the recipients to his role as host of the lecture and dinner each year. I am truly thankful for both the opportunity and recognition.”

Dr. Fitzpatrick’s research has played a pivotal role in defining the functional organization of cortical circuits, exploring rules of intracortical connectivity, addressing mechanisms of neural coding, and probing the role of experience in the maturation of cortical circuits. His current research utilizes state-of-the-art in vivo imaging techniques to probe the functional synaptic architecture of circuits in the primary visual cortex. Dr. Fitzpatrick earned his doctorate from Duke University in Psychology and Neuroscience, where he later became The James B. Duke Professor of Neurobiology and Founding Director of the Duke Institute for Brain Sciences.

equipment in August of this year and was the first institution in the United States to use the technology after ZEISS made a number of significant improvements to the current commercially available model.

“The role of high-resolution imaging in unraveling the functional complexity of the brain cannot be overstated. This partnership is a great recognition of the unique know-how and research expertise provided by our electron microscopy facility. It underlines the importance of connecting core facilities, scientists and commercial partners, providing MPFI access to cutting edge technologies to push the boundaries of neuroscience research” said David Fitzpatrick.

“Science is transitioning to utilizing 3D data sets and correlative microscopy; to this end we are pleased to partner with MPFI. These types of relationships are vital for us to better understand the issues and advantages of our hardware and software,” said James A. Sharp, President, Carl Zeiss Microscopy LLC.

In attendance were: Abdel Barraj, Head of Sales at ZEISS Microscopy North America; Kirk J. Czymmek, Head of the Global ZEISS Microscopy Customer Centers; Geoff Perumal, Academia Life Science EM/XRM Specialist at ZEISS Microscopy; Roger Unger, Regional Sales Manager, ZEISS; Oliver Tress, Systems Specialist, 3D Imaging, ZEISS; Robert Celestine, Area Manager, MICRO OPTICS OF FLORIDA, INC.
2018 Awarded Grants and Fellowships

NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS & STROKE, NATIONAL INSTITUTE OF HEALTH
Jason Christie
Title: Regulation of Instructive Signaling in the Cerebellum
TOTAL: $2,082,074
09/01/2018-08/31/2023

NATIONAL EYE INSTITUTE, NATIONAL INSTITUTE OF HEALTH
Jason Christie
Title: Circuit-Level Substrates of ASD-Related Cognitive and Behavioral Impairments
TOTAL: $204,945
06/01/2018-02/28/2023

NATIONAL EYE INSTITUTE, NATIONAL INSTITUTE OF HEALTH
David Fitzpatrick
Title: Developing Cone-Dominant Retinal Disease Models as a Resource for Translational Vision Research
TOTAL: $515,746
09/30/2018-08/31/2023

NATIONAL INSTITUTE OF MENTAL HEALTH, NATIONAL INSTITUTE OF HEALTH
Hyungbae Kwon
Title: Cracking the Neuromodulation Code at Single Cell Resolution
TOTAL: $6,755,000
09/10/2018-06/30/2023

NATIONAL EYE INSTITUTE, NATIONAL INSTITUTE OF HEALTH
Madineh Sedigh-Sarvestani
Title: Thalamocortical Mechanisms in Primary Visual Cortex
TOTAL: $98,718
01/01/2018-06/13/2019

NATIONAL INSTITUTE OF MENTAL HEALTH, NATIONAL INSTITUTE OF HEALTH
Hiroki Taniguchi
Title: Wiring and Developmental Principles of Inhibitory Neocortical Circuits
TOTAL: $2,412,500
03/01/2018-12/31/2022

SCIENTIFIC INNOVATION AWARD, BRAIN RESEARCH FOUNDATION
Ryohei Yasuda
Title: Imaging Dynamics of Endogenous Protein Interactions in Single Dendritic Spines
TOTAL: $150,000
01/01/2018-12/31/2019

In 2018, MPFI Welcomed the Following Postdoctoral Fellows:
Juliane Jaepel, Chuljung Kwak, and Gabriela Rodriguez Gonzalez

Our new Graduate Students were:
Sarah Krussel and Clara Tepohl as new IMPRS student

Our new Post Baccalaureate Research Fellows were:

New FAU-Max Planck Honors Students were:
Abigail Chavez, Elise Gonzalez, Vineet Reddy, and Rebecca Urbonas

New MPFI Scholars were:
Abigail Chavez, Laura Kuperman, Samantha Laborde, Aaron McFarlane, Jessica Martin, and Luis Rivero

New Data Science High School Students were:
Noa Abiri, Olusola Fatade, Willow Hearne, Diego Jerez, Kiran Shirazi and Eleanor Stuart

New Research Technicians:
Daniela Moncaleano, Ivory Paulk, Nicholas Schappaug, and Una Sijercic


This cover illustration shows a Purkinje cell (in gray) surrounded by multiple molecular layer interneurons (MLIs). The different colors serve as a code for different levels of MLI activity and their impact onto the Purkinje cell activity is illustrated by different sizes of post-synaptic potentials (PSPs). The jumping gymnast features a complex motor behavior that involves cerebellum dependent motor learning. She uses the PSPs as platforms for her jump.
Newly Identified Role for Inhibition in Cerebellar Plasticity and Behavior

Researchers at the Max Planck Florida Institute for Neuroscience (MPFI) have discovered a new role for inhibition, regulating how and when motor learning is acquired in the cerebellum.

Almost everyone is familiar with the unique mixture of surprise and confusion that occurs after making a mistake during an everyday movement. It is a fairly startling experience – stumbling on a step or accidentally missing your mouth when taking a drink. These actions are so ingrained that any mishap is almost always followed by the question “Why in the world did I just do that?” This momentary bewilderment is due to the fact that our brains have an extraordinary capacity for learning skilled movements. So much so that our routine actions, such as climbing stairs, become second nature. For the most part we don’t even consciously think about them…that is until we make a mistake.

While mistakes (errors in motor performance) don’t occur very frequently once we have picked something up, they are the tool used by the brain to evaluate and adjust our movements in hopes that next time, we won’t stumble or spill our drinks so easily. As the saying goes “We learn from our mistakes,” but how do our brains turn the motor errors we make into meaningful and reliable learning?

In a recent publication in Neuron, researchers from the lab of Dr. Jason Christie, Research Group Leader at MPFI, have discovered part of the answer to this longstanding question. Uncovering a surprising new role for inhibition in the cerebellum, Dr. Christie’s team has broadened the current understanding of neural computation and provided fundamental insights into the mechanisms and principles underlying motor learning.

An anatomically unique region of the brain, the cerebellum plays a critically important role in regulating motor control and coordination. Despite its relatively small size—only about 10% of the entire brain—the cerebellum houses roughly half of our total neurons, around 50 billion. While receiving many inputs from various regions of the brain, the cerebellum integrates and sends refined information out through a single type of specialized neuron called a Purkinje cell. These cells receive two well-characterized excitatory inputs and a lesser studied inhibitory input, helping to guide motor behavior and facilitate learning.

“Thousands of excitatory inputs by parallel fibers, set the stage for Purkinje cell activation by providing sensory and motor context for actions,” describes Audrey Bonnan, a Postdoctoral Researcher in the Christie Lab and one of the publication’s first authors. “It’s these inputs that activate Purkinje cells and maintain normal coordination and movement. When we make a mistake however, a second excitatory input from a climbing fiber, arrives simultaneously and delivers an instructive signal. This new information detailing motor error, weakens the synaptic connections between parallel fibers and Purkinje cells, producing a change in behavior and ultimately allowing for learning to occur. But the function of inhibitory inputs in this process was still largely unknown.”

This alteration in synaptic strength, known as synaptic plasticity, is thought to be the mechanistic correlate of learning. Uncovering how inhibitory interneurons influence plasticity is the first step in gaining insights into their role in motor learning. To address this question, the team performed simultaneous electrical stimulation of the excitatory inputs encoding contexts and those encoding signaling errors, simulating the events that occur during learning. Using electrophysiology to record the output of the Purkinje cell, the researchers then precisely activated inhibitory interneurons by use of a light-based approach for neural stimulation (optogenetics). This approach benefited from a collaboration with MPFI’s Taniguchi lab that allowed optogenetic targeting of only molecular layer interneurons.

“We found that inhibition allows for an entire spectrum of outcomes,” notes Dr. Christie. “Without inhibition, Purkinje cells showed the expected synaptic weakening caused by co-activation of parallel fibers and climbing fibers. By strongly activating molecular layer interneurons, there was a complete reversal of plasticity where synapses were strengthened with the addition of inhibition. Surprisingly with weak activation of these interneurons, plasticity seemed to be negated where no change occurred at all.”

Dr. Christie notes that the work was a tremendous effort between first authors Matt Rowan, Ph.D., now an Assistant Professor at Emory University; Audrey Bonnan, Ph.D., and Ke Zhang, a graduate student in the International Max Planck Research School for Brain and Behavior, and that their surprising findings have opened up a whole new avenue of inquiry for the future.
Unconventional Connections: How Inhibition Hones Cortical Selectivity

Researchers at the Max Planck Florida Institute for Neuroscience discover a fundamentally new role for inhibition in the visual cortex, refining how neurons encode object motion.

Our brains do a remarkable job of encoding visual information about the world around us, providing an almost instantaneous report about rapidly changing conditions that is critical for guiding our behavior. Integral to the brain’s encoding mechanism is the presence of neurons that respond selectively to specific visual features, generating electrical activity that reliably signals properties such as the orientation of edges, their position in space, and their direction of motion. By using new tools to probe the principles of connectivity that neural circuits use to generate selective responses, scientists at the Max Planck Florida Institute for Neuroscience are gaining a host of new insights into the fundamental mechanisms underlying brain function.

Understanding how neural circuits build response selectivity poses an enormous challenge since a single neuron receives thousands of synaptic inputs derived from other neurons and these inputs can differ in their response properties and how they can affect the neuron. Some inputs are excitatory, making the neuron more likely to generate an electrical signal, while others are inhibitory, reducing the likelihood that the neuron generates a signal. Somehow a neuron integrates all of these excitatory and inhibitory synaptic inputs to generate responses that are selective, a mysterious ‘input/output transform’ that has been the subject of intense research interest.

Previous studies have suggested that there are some simple rules that govern excitatory and inhibitory functional connections. A prominent rule that has emerged for excitatory connections is the notion “like connects with like.” For example, in the visual cortex, neurons that respond selectively to a particular direction of motion are thought to receive their excitatory inputs from other neurons that respond selectively to the same direction of motion. An equally important rule has been postulated for inhibitory inputs: the idea that the properties of the inhibitory inputs a neuron receives match the properties of its excitatory inputs. Because of the “matching rule”, inhibitory inputs are thought to adjust the strength of the excitatory inputs, but not to alter the selectivity conveyed to the neuron by its excitatory inputs.

Now in a recent publication in Nature, researchers in Fitzpatrick’s Lab, Daniel Wilson, Ph.D., and Benjamin Scholl, Ph.D., have accumulated multiple lines of evidence that challenge both of these principles, providing a new perspective on how circuits in visual cortex employ excitation and inhibition to generate neuronal responses that are selective for an object’s direction of motion.

MPFI researchers first needed a better picture of the direction selectivity supplied by a neuron’s excitatory synaptic inputs. To do this they used in vivo two-photon microscopy to characterize the direction selectivity of individual excitatory synaptic inputs onto the dendrites of a neuron, comparing this with the neuron’s overall direction preference. Surprisingly, what they discovered goes against the grain of traditional thinking. Although, many of the synapses aligned with the overall directional preference of the neuron, a large number were found to respond best to the opposite...
(null) direction of motion, a pattern of connectivity that contrasts sharply with “like connects with like” rule. They also noticed a conspicuous mismatch between the strength of a neuron’s direction selectivity, and that predicted by its excitatory synaptic inputs. The degree of direction selectivity that the neurons exhibited was significantly greater than what would have been expected from such a broad range of excitatory inputs.

To further probe the factor(s) responsible for this puzzling difference between the neuron’s excitatory inputs and its output, they turned to a different set of experiments using in vivo whole-cell patch-clamp electrophysiology. This technique makes it possible to measure the total sum of synaptic inputs contributing to a neuron’s response and to compare the contribution of excitatory and inhibitory synaptic inputs. The results for the excitatory inputs were consistent with the two-photon imaging data confirming a significant amount of excitatory input for both the preferred and the null direction of motion. The results for inhibition provided the team with another challenge to traditional thinking and a potential explanation for the puzzling input/output difference: in fact, the tuning of the inhibitory inputs did not match the excitatory inputs. For many neurons the strength of inhibition was greatest for the null direction of motion, suggesting that excitatory synaptic inputs to the null direction were being selectively dampened through inhibition.

These findings predict that cortical inhibitory neurons make a substantial number of synaptic inputs to excitatory neurons that prefer the opposite direction of motion. The researchers applied two novel approaches to examine this question, first charting the anatomical connections of functionally defined inhibitory neurons, and then using optogenetics (selectively activating inhibitory neurons with light) to map the source of inhibitory inputs to single excitatory neurons. In tandem, these techniques confirmed that inhibitory connections to excitatory neurons often originated from neurons that preferred the opposite direction of motion.

Beyond disentangling the mechanism responsible for direction selectivity, these discoveries emphasize the flexible ways in which neural circuits can integrate excitatory and inhibitory inputs to build the variety of selective response properties critical for neural coding. Like doesn’t always connect with like and excitation doesn’t always match inhibition, but you can count on brain circuits to have evolved the combination of inputs necessary to ensure high levels of functional performance.

Convergence of Synaptic Signals is Mediated by a Protein Critical for Learning and Memory

Researchers at the Max Planck Florida Institute for Neuroscience show that Protein Kinase C is a novel information integrator, keeping tabs on the recent history of neighboring synapses while simultaneously monitoring local synaptic input.

Inside the brain, is a complex symphony of perfectly coordinated signaling. Hundreds of different molecules amplify, modify and carry information from tiny synaptic compartments all the way through the entire length of a neuron. The precise interplay of these proteins is critical for normal neuronal function; ultimately allowing the brain to achieve feats like cognition, decision making, and sensory perception.

Researchers from the lab of Dr. Ryohei Yasuda at the Max Planck Florida Institute for Neuroscience (MPFI), study the elaborate nexus of signaling proteins involved in learning and memory; looking at a unique process called synaptic plasticity, the innate ability of a neural synapse to either strengthen or weaken. Understanding how proteins behave during plasticity is key to unlocking how we learn and how memories are formed.

In a study published in Nature Neuroscience in July 2018, Dr. Lesley Colgan, a Research Fellow in the Yasuda Lab and leading author of the paper, delves into the role that Protein Kinase C (PKC) plays in synaptic plasticity. PKC represents an entire family of 12 distinct kinases, that propagate a biochemical signal through the phosphorylation of target proteins they interact with. While previously implicated in synaptic plasticity, engineering tools sensitive enough to study PKC in the brain has been a major challenge. Yasuda’s team developed a host of sensors that can track the activity of PKCs with unprecedented specificity and sensitivity, probing when and where activation occurs,
These newly developed sensors will have broad usage in neuroscience and cell biology alike, allowing the study of many complex signaling pathways that PKC has a hand in.

Dr. Colgan

Model of integration of TrkB and calcium signals to induce PKCα activation in paired and unpaired subthreshold stimulations. A subthreshold stimulus that was unable to induce plasticity was given alone (unpaired) or after a nearby plasticity-inducing stimulation (paired). Unpaired, the stimulus could not activate PKCα or induce plasticity. However, when paired with recent plasticity in a nearby spine, which induces a long-lasting, spreading TrkB activity, this same subthreshold stimulus led to PKCα activation and plasticity.

as well as how these enzymes turn on and off. With these powerful sensors, they have been able to look more closely at the role that PKC plays at the single synapse level.

One enzyme in the PKC family, PKCα, plays a direct role in facilitating synaptic plasticity. When PKCα activity is perturbed, plasticity is subsequently disrupted demonstrating that the protein is a critical first step in the initial molecular cascade. PKCα also has very robust activation and is rather spine specific, confining its activity to only the stimulated spine and not spreading to the surrounding dendrites.

A unique discovery of the study, found that PKCα acts to integrate two temporally distinctive signaling pathways both known to be critical for synaptic plasticity. The first is BDNF mediated, a slower, diffuse signal developing over minutes and the second, is NMDA receptor mediated calcium influx, a spine-specific signal occurring in a matter of milliseconds and necessary to begin the rapid molecular cascade of synaptic plasticity. Adaptably responding to both of these signals, PKCα is able to sample recent synaptic history and integrate it with current synaptic events, enabling complex processing of information at the single spine level.

Investigating these intriguing findings further, the team was able to successfully link molecules to memory, uncovering that PKCα is required for efficiency of learning. Mice with PKCα removed from the brain, take a significantly longer amount of time to become proficient at a learning task than counterparts containing intact PKCα protein. Despite this lengthier learning curve, if given additional training, mice lacking PKCα will eventually learn the task just as well as wild type mice, supporting the notion that PKCα is critical for encoding a memory but may not play a significant role in the recall of a memory once it’s established.

This work represents a substantial advancement in the field, providing integral tools that will enable the disentanglement of complex signaling related to learning and memory. According to Colgan, “These newly developed sensors will have broad usage in neuroscience and cell biology alike, allowing the study of many complex signaling pathways that PKC has a hand in.”
EMPLOYEE SPOTLIGHT
Marilena Fernandez
SPECIAL PROJECTS ASSOCIATE

How would you describe your job?
As a special projects associate I do a little bit of everything around the institute...well everything except for research, I leave that to the pros at MPFI that actually know how to use the really complicated microscopes. While I primarily work with the Events and Communications departments, my job gives me the unique opportunity of interacting with every department and lab here at MPFI. One of my main roles is to help coordinate aspects of events hosted at the institute. For instance, MPFI invites many guest speakers throughout the year to come share their research and I coordinate the catering for the post-lecture lunch. These luncheon events are great networking opportunities for our young trainees and gives them a chance to informally discuss their own research and interests with preeminent scientists in the field. I try to make sure there is plenty of food to keep the conversations going. In addition, some of my other responsibilities include: coordinating staff directory photographs for all new students and employees; coordinating volunteers for all of MPFI’s internal and public events; as well as managing the Max Planck Merchandise Store and Max Planck Library, to name just a few.

How long have you been working at MPFI, and what do you like most about your job?
Though I can hardly believe how timeflies, I have been working at MPFI for seven years now. I first started at the institute as an Executive Assistant, supporting members of the leadership team. But over time my roles and responsibilities have expanded and evolved; so much so that in 2018, my position was officially renamed to Special Projects Associate to reflect how much my job has changed since I started. One of the things I love most about my job is how dynamic it is. Each day I’m doing something different, jumping from project to project or getting assigned something completely new. It’s definitely fast-paced but very rewarding to be able to make an impact on so many different areas of the institute. I’m also a people person so I love that through the course of a single day, I get to interact with and get to know many different people. I’m pretty proud of the fact that I know at least a few people in every lab and department.

What do you consider to be your greatest achievement?
Ok so I’m going to separate my response here into two different categories. My greatest accomplishment in life, has to be raising my kids. I feel that one of the main reasons I was put on this earth was to be a mom and I am blessed to have two wonderful children. Everywhere I go, people always compliment me on how lovely my kids are or how great it was to speak with them and get to know them. I couldn’t be more proud of who they have become and their accomplishments. Professionally, I think my greatest achievement has been my transition from administration to special projects. This transition has allowed me to greater assist and do things that have a more significant impact on the institute. Just as MPFI has grown as an institute, I’ve been able to grow both personally and professionally in my position. I’m excited to see what the next seven years will bring!

What is something you have learned since joining MPFI?
While working at MPFI one of the most important things I’ve learned for my job and something that I apply to my life in general is that... no matter the hours of planning and preparation or amount of thought that went in ahead of time, things always happen that are out of your control and may not turn out how you expected. If you are inflexible it can easily derail you; but if you are flexible and adaptable most times, I’ve found that in the end, things tend to turn out even better than previously expected and your body will thank you for the lower stress levels.
Tools of the Trade that Shatter the Resolution Barrier

MPFI in partnership with Abberior Instruments America (AIA) and Nobel Laureate Dr. Stefan W. Hell, hosted an immersive STED workshop showcasing just how accessible super resolution is in modern day research.
On Thursday, June 21, students, post-docs and principle investigators alike gathered at MPFI for an all-inclusive experience diving into the world of nanoscale resolution. STED super-resolution microscopy is an advanced imaging technique capable of peering into cells and revealing the finest of details with remarkable clarity and resolution. Prior to STED’s development, light microscopes were once thought to have an insurmountable resolution limit, but STED was the first to go where no conventional light microscope could, shattering the barrier and establishing an entire new field of optics.

With the goal of showcasing everything this powerful technique has to offer, the one-day, advanced workshop featured lectures by STED experts, open demos with Abberior STED microscopes, hands-on, guided experiments and even informal meet and greet opportunities with Dr. Hell and guest lecturers.

Dr. Hell’s keynote was an inspiring look into the groundbreaking technique that would earn him the 2014 Nobel Prize in Chemistry. Hell explained how perseverance through adversity can be critical for a scientist as he himself faced lack of funding and doubt from his peers. Hell noted that the greatest advice he could give was to “Do what you like, what you are passionate about” because such adversity is encountered in any career, so why not love what you are doing?

The STED workshop, open to all life science researchers, hosted over 85 scientists and trainees from across the country came to participate and learn how STED microscopy could dramatically improve their biological research.
MPFI recruits visionaries in science to train talented, up-and-coming young investigators and students in modern optical techniques used to study the brain.

In February 2018, tangible energy and excitement filled the air of MPFI. A hustle and bustle of students and scientists from around the world could be seen hurrying between hands-on laboratory sections, special lectures by Nobel laureates, and even workshops detailing the design of advanced microscopes. Now in its third year, the MPFI Neuroimaging Techniques course is designed to give early career neuroscientists and student trainees a comprehensive crash course in the principles of modern imaging and the cutting-edge applications that are revolutionizing the way the brain can be studied.

Conceived by Dr. Ryohei Yasuda in collaboration with UCSC’s Dr. Yi Zuo, the Neuroimaging course provides trainees with a chance to learn microscopy from the basics to the daring. Course attendees build a strong foundation in modern optics attending instructional lectures by world renown experts, practicing principles through interactive projects, and integrating skills learned through collaborative discussions with distinguished scientists.

“The Neuroimaging course at MPFI is a perfect complement for all members of the neuroscience community”, described Dr. Ryohei Yasuda, Scientific Director at MPFI. “Equally benefiting experienced researchers wanting to further advance and refine their knowledge of modern microscopy or those brand new to the field that want exposure to the variety and versatility of the imaging techniques that can bring dramatic advancements to neuroscience research”.

The 2018 course was particularly unique in that it featured lectures from two Nobel Laureates, Drs. Stefan Hell and Eric Betzig. The ultimate goal of the course is to provide talented neuroscientists with the knowledge and skills necessary to fast track results and discoveries across all specializations of brain related research, expediting the basic science required for tomorrow’s cures.

Dr. Stefan Hell, 2014 Nobel Prize in Chemistry
Florida Atlantic University and Max Planck Team Up on First Joint Position

Ken Dawson-Scully Named Associate V.P. for Strategic Initiatives, Head of Institutional Partnerships at Florida Atlantic University (FAU) and MPFI

FAU and MPFI have combined forces to form the first jointly supported position between the two institutions. As of May 1, Dr. Ken Dawson-Scully, is newly appointed to the role of Associate Vice President for Strategic Initiatives and Head of Institutional Partnerships for FAU and MPFI. Joining FAU in 2008, Dawson-Scully served as Associate Director of the FAU Brain Institute and most recently as an Associate Professor of biological sciences and Associate Dean for graduate studies in FAU’s Charles E. Schmidt College of Science.

“For almost a decade, the close and synergistic partnership between Florida Atlantic University and Max Planck Florida Institute for Neuroscience has been undeniably beneficial for our institutions and Palm Beach County,” said FAU President John Kelly. “This latest initiative will foster tremendous returns on our co-investment for educational and research opportunities.”

In his new role, Dawson-Scully will work closely with the executive leadership team of both institutions to tackle crucial initiatives important to the two institutes including: enhancing visibility of current educational programs and developing new ones, student and faculty recruitment, identifying and securing joint funding opportunities, conducting research training, and fostering new collaborative partnerships.

“We are excited to further reinforce the flourishing relationship with our partners at Florida Atlantic University. Our joint efforts will continue to facilitate unique collaborative opportunities between our institutions and inspire a vibrant, creative space where groundbreaking innovations in science and technology will prosper,” said David Fitzpatrick, Ph.D., CEO and Scientific Director of MPFI. “This collaborative environment will allow us the opportunity to better tackle the areas of focus that are critical to the success of both of our institutions’ missions, goals and aspirations.”

For more information on the impactful research being done in the Dawson-Scully Lab visit http://biology.fau.edu/directory/dawson-scully/index.php. To learn more about Florida Atlantic University please visit http://www.fau.edu/.
MPFI Welcomes 70 Aspiring Students to Career Day

MPFI hosted 70 local high school students and their teachers for Career Day, taking place on Saturday, September 15, 2018. Students and teachers enjoyed immersive tours of MPFI facilities, a luncheon with scientists, and an interactive question and answer session. The 2018 panelists were Dr. Lesly Colgan, Dr. Michael Yetman, and Kate Maximov. The discussion was facilitated by Dr. Madineh Sarvestani.

Career Day is an annual event that gives high school students the rare opportunity to meet and interact with Max Planck scientists. Panelists traditionally include students and scientists who are in different stages of their training, from post-baccalaureate researchers to postdoctoral fellows. 2018’s Career Panel discussion explored important topics, including what inspired the scientists to choose a career in science, overcoming the challenges of being a woman in science, and what educational and research experiences lead the researchers to where they are today.

The feedback from both teachers and students was overwhelmingly positive. “It was an amazing experience I won’t forget as I move on in life. Hopefully, I’ll be back someday,” said student Doris Yang from Jupiter High School. Her teacher Shari Rogers added, “Thank you for your amazing community outreach!”

To participate in career day, teachers had to submit an application explaining how their students would benefit from the experience. Once selected, each school could choose ten students to attend. The schools and teachers selected for 2018 included: Steven Weber and Tamica Williams, Village Academy; Mary Paramore, Marie Dupuy and Dr. Robert Grassiemi, Inlet Grove High School; Shari Rodgers, Jupiter High School; Melinda Ogden, Atlantic Community High School; Marilyn Budensiek, Hobe Sound Christian Academy; Renee Szelaiga, Benjamin School; Mira Dohnd, the Conservatory School of North Palm Beach; and Ofelia Barletta Chacon, Palm Beach Gardens High School.

“It was an amazing experience I won't forget as I move on in life. Hopefully, I'll be back someday,”
Doris Yang from Jupiter High School
This year’s Career Day was held as a satellite event of the international Max Planck Society’s “Max Planck Day,” which was recognized throughout Germany in 2018 as a way to mark jubilee celebrations of the 100th anniversary of Max Planck’s Nobel Prize for physics, the 80th anniversary of the founding of the Max Planck Society, and Max Planck’s 160th birthday.

“Thank you for your amazing community outreach!”
Shari Rogers teacher at Jupiter High School
Local High School Students Complete Prestigious Max Planck Internship

MPFI’s summer internship program began June 11 and ended July 20 with students giving presentations on their scientific project, which included neuroscience, scientific programming, and mechanical engineering. The experience provides a rare chance to gain real-world lab experience outside of a high school setting and get a glimpse of what life would be like as a future scientist. “I learned a lot and it was great to be around a lot of science for six weeks,” Kwon said. “As an intern, you learn a lot about research and what a career in science will look like. It’s really different from your normal high school labs.”

The 2018 MPFI internship class included: Nikita Thomas, Suncoast Community High School; William Swann, Saint Andrews School; Subhash Kantamneni, Suncoast Community High School; Cameron Pirozzi, The Benjamin School; Eugenia Victoria Gomez, Spanish River Community High School; and Winston Cheung, Atlantic Community High School. The students were selected from a pool of more than 130 highly-qualified applicants who are entering their junior or senior year of high school. In addition to consideration of academic accomplishments, applicants had to submit two essays and provide two recommendations from past or present science teachers.

This is the eighth year that MPFI has offered the immersive internship program, which offers students a chance to learn about brain structure, function and development, and the advanced imaging techniques and technologies used in everyday neuroscience. Each student worked with MPFI scientists designing and implementing individual projects and contributing in a meaningful way to the research being done at the institute. In addition, interns prepared a written scientific abstract based on their research project and delivered a short presentation at the end of the program; giving them unparalleled hands-on academic and lab experience. Past Max Planck Florida interns are enrolled in prestigious universities including Yale, Stanford, MIT and the University of Florida.

Plans are already underway to continue the internship program in 2019.

To learn more, visit www.mpfi.org. The MPFI summer internship program is funded and made possible by the Gertrude E. Kelly Charitable Foundation, The J.M. Rubin Foundation, and The Max Planck Florida Brain Trust.
The 2018 Science Meets Music Series delighted audiences and showcased a broad repertoire of musical performances and scientific insights.
The season began on Wednesday, January 31, when MPFI welcomed 2014 Nobel Laureate Dr. Stefan Hell, Director of the Max Planck Institute for Biophysical Chemistry, who discussed the new field of imaging known as nanoscopy with his presentation entitled “The Resolution Revolution.”

According to Dr. Hell, this significant advancement in research, which earned his Nobel Prize for Chemistry in 2014, allows researchers to see things they’ve never been able to, like how molecules build connections between nerve cells in the brain or the interactions between proteins involved in Parkinson’s and Huntington’s disease.

Complimenting Hell’s presentation, guests enjoyed a musical performance by Finnish-Dutch cellist Jonathan Roozeman from the Kronberg Academy. In 2013, Jonathan was awarded a special prize at the Finnish National Cello Competition and won sixth prize in the 2015 International Tchaikovsky Competition – as the youngest participant ever. During the second part of the musical program, Jonathan was accompanied by his father – Robert Roozeman – on the piano. Jonathan has performed at numerous international chamber and music festivals and plays a cello by David Tecchler from 1707, which is on loan to him by the Finnish Culture Foundation.

On Wednesday, March 28, audience members were dazzled as the internationally renowned pianist, Sofiya Uryvayeva Martin took center stage performing the expressive “Warsaw” Concerto by Richard Addinsell,
followed by an exceptional lecture by one of MPFI’s distinguished Research Group Leaders, Dr. Jason Chirstie.

Sofiya’s precise and agile movements demonstrated the masterful technique of a virtuosic musician and in true Science Meets Music fashion, helped to illustrate the fascinating scientific lecture that followed her stellar performance. The lecture, titled “Muscle Memory: Improving Motor Performance by Training the Brain” was delivered by MPFI’s very own Jason Christie, detailing how skilled movements like Sofiya’s are encoded in the brain through the dynamic process of making and correcting mistakes while practicing.

Christie studies the specialized area of the brain called the cerebellum, which is involved in the coordination of motor movements and in the processing of motor learning. In his lecture, he described utilizing cutting-edge techniques to learn more about how specific cells in the brain encode activity patterns that modulate motor performance after we make mistakes. Through his research, Christie has uncovered a way to coax these activity patterns into the brain to improve motor performance without real life experience. This impactful discovery and basic understanding of the brain has important implications for the future treatment of those with debilitating motor impairments.

Continuing her impassioned and impressively difficult repertoire, Sofiya closed out the evening with the ever popular “Rhapsody in Blue” by George Gershwin and “My True Love” from the romantic composition, “Gone With the Wind” by Max Steiner.

The 2018 Science Meets Music Series concluded on Wednesday, April 18, where science and song took flight in Benjamin Hall. Closing out the fifth season of Science Meets Music, the Max Planck Institute for Neuroscience (MPFI) prepared a uniquely themed program centered around the beautiful and resonant melodies sung by birds.

Providing the scientific portion of the evening was special guest lecturer Dr. Manfred Gahr, Director of the Max Planck Institute for Ornithology, and expert in all things songbird. Gahr’s lecture titled “Seasonal Singing of Birds: From Gonads to the Brain” provided an interesting insight as to why sing-
ing is unique to male songbirds and why patterns of singing vary depending on the current season. Additionally, Gahr touched on the mechanisms involved in the development of song producing neural circuits, as well as areas of the brain in songbirds that are critical for learning different patterns of sound.

Perfectly accompanying Gahr’s captivating lecture, were superlative performances by musical guest, the Palm Beach Symphony Chamber Ensemble. In their bookending recitals, the masterful string quartet played movements from the well-known Vivaldi concerto “Spring”, part of the larger work “The Four Seasons”, as well as Haydn’s String Quartet in D major, Op. 64, No. 5 appropriately nicknamed “Lark.” Palm Beach Symphony principal cello, Claudio Jaffé provided enlightening commentary about the composers and their music before each piece. Guests in attendance were awed by the quartet’s musicianship, precision and uncanny ability to mimic the light, airy and vibrant nature of a songbird.

Science Meets Music is the signature community outreach program of MPFI. Music for these unique and memorable evenings is generously underwritten by Becky and Jimmy Mayer, longtime MPFI supporters.
Seventh Annual Brain Bee Crowns Atlantic Community High School Team as Champions

MPFI hosts Brain Bee to increase public awareness of the importance, progress and benefits of brain research

The MPFI campus was buzzing with excitement on April 7 as Palm Beach County High School students competed for the championship title at the seventh annual Brain Bee. Students in teams of three were challenged on topics such as learning and memory, emotion, sensation, movement, aging, neurobiology, brain anatomy, and neural disorders. Sponsored by the Mary and Robert Pew Public Education Fund, each student in the top three teams received a gift card. In addition, the first-place team, made up of Winston Cheung, David Young and Raghu Radhakrishnan from Atlantic Community High School in Delray Beach, received the opportunity to shadow an MPFI scientist for a day.

“It is inspiring to see the talent and ability of the young students in our community who are interested in neuroscience,” said Dr. David Fitzpatrick, MPFI CEO and Scientific Director. “We truly enjoy offering programs and activities to our community members to enhance the interest in and foster understanding of bioscience research at all levels of education.”

In second place were Jenna Knobbe, Samantha Clayman, and Juliet Mola, from Jupiter High School; and in third place Ajay Desai, Noor Shirazi and Mohammed Khan, from FAU High School.

The list of schools that participated in the neuroscience competition included:

- Lake Worth Community High School
- Atlantic Community High School
- Santaluces High School
- Boynton Beach Community High School
- FAU High School
- Jupiter High School
- American Heritage School Boca/Delray
- Oxbridge Academy
- West Boca Raton Community High School

For more information about Max Planck Florida Institute for Neuroscience, and its community programs, please visit www.maxplanckflorida.org or call 561.972.9000.
International Exhibit of Max Planck Scientific Images
Comes to Miami’s Phillip and Patricia Frost Museum of Science

The Max Planck Florida Institute for Neuroscience and the Phillip and Patricia Frost Museum of Science in Downtown Miami’s Museum Park are proud to present the Images of Science Exhibit.

The exhibit features over 30 striking images captured during the course of scientific research and will be on view from Saturday, December 15, 2018 through the end of 2019 in the museum’s Feathers to the Stars exhibition in The Batchelor Foundation Gallery. Admission to Images of Science at the Phillip and Patricia Frost Museum of Science is included in all museum admission tickets.

Science often strives to push the boundaries of the known world to explore new topics and make the invisible visible. Though scientific images are captured in the pursuit of knowledge and discovery, surprisingly they can be aesthetically beautiful and visually astounding — abstract works of art from a world normally hidden to the human eye.

Each year, scientists from the more than 80 research institutes of the Max Planck Society enter images showcasing their work in an annual photography competition. The winning pictures form the basis of a traveling exhibit that provides a fascinating glimpse into the world of science. Images in the exhibition cover myriad areas of scientific research, from tiny neurons within the brain, to insights into the structures of the early universe and many more areas of earth science, biology, and even architecture. What unites the exhibition is the rare opportunity for visitors to experience exquisite details normally only viewable by scientists with cutting-edge imaging equipment. Images of Science is an unprecedented look at the smallest details that form the base of beauty and knowledge in our world. The exhibition has been shown with great success in a variety of locations, such as the Deutsches Museum in Munich, Ars Electronica in Linz, National Library of Russia in St. Petersburg and the German Science Centre in Cairo.

Max Planck Images of Science at the Phillip and Patricia Frost Museum is an initiative of the Max Planck Society in Germany as part of the Year of German-American Friendship 2018/19. The campaign “Year of German-American Friendship/Deutschlandjahr USA” focuses on dialogue, exchange, and cooperation between people and cultures, with the aim of establishing and expanding networks.

International Exhibit of Max Planck Scientific Images
Comes to Miami’s Phillip and Patricia Frost Museum of Science
Germany and the United States are bound by a centuries-long common history. German immigrants have helped shape the development of the United States, while the successful development of post-war Germany is inextricably linked to US involvement. The Year of German-American Friendship 2018/19 builds on this success story and aims to strengthen the already prospering transatlantic dialogue.

Max Planck Images of Science at the Phillip and Patricia Frost Museum is a collaboration of the Max Planck Society, the Phillip and Patricia Frost Museum of Science, and the MPFI. Sponsorship is generously provided through a comprehensive and collaborative initiative funded by the German Federal Foreign Office, implemented by the Goethe-Institut, and supported by the Federation of German Industries (BDI).
“A Night at the Institute” brought together Brain Trust members for a special evening of celebration and scientific immersion. The second annual Brain Trust Celebration was held in honor of the Brain Trust members who make innovation, advancement, and educational outreach possible.

As guests traversed two floors of the Institute, they experienced over eight exhibits and interactive activities organized by twenty-four MPFI volunteers. A fun time was had by all!
Brain Trust Celebration, Continued

Like something out of horror films or science fiction, guests were able to control the movement of scientists’ arms through electrical impulses, making them move in any way they chose. Another exhibit explored the brain in virtual reality placing viewers directly in a three-dimensional, giant neuron as they navigated through the neuron’s various parts and connections.

One hands-on activity challenged individuals to toss a bean bag at a target while wearing vision altering goggles. The next station introduced DNA extraction via strawberries. Guests performed the simple process of isolating the strawberry’s DNA and were able to take the samples home with them!

Elsewhere, researchers from the Fitzpatrick lab walked guests through the textbook-changing functional imaging techniques they use to study the function of many living neurons at once, something that was not previously possible.

Our most popular exhibit featured the STED microscope, a Nobel Prize winning technology developed by Dr. Stefan Hell. Guests saw the STED in action and were provided with an overview of how the microscope works and improves upon previous imaging technology.

During a brief presentation, MPFI CEO and Scientific Director Dr. David Fitzpatrick introduced Geoff Moody and Timothy Holford, two participants in MPFI’s signature training programs.

Geoffrey Moody, a graduate of The Benjamin School and a member of the Summer High School Intern Class of 2015, gave a heartfelt talk on the benefits his MPFI experience brought him as he concludes his first year as a pre-medical student at the University of Miami.

Tim, an International Max Planck Research School (IMPRS) graduate student studying in the Bolton Lab, shared the importance of perseverance, in both life, as well as in scientific research.

To conclude the evening, Marie Deckert expressed her sincere thanks to all members of the Brain Trust and acknowledged the immeasurable impact their contributions have had upon the Institute.

“We loved the Night at the Institute! Over the top clinics and seeing the STED, wow! A wonderful, imaginative job of making the community aware of the wonders that science can do for our future!”

Max Planck Florida Foundation recognizes the individuals and organizations most deeply invested in the advancement and future success of MPFI. Your transformational gifts make extraordinary discoveries possible and embolden our researchers to take risks, develop new technologies and pursue innovation.
Max Planck Florida Catalyst Council members spark discovery and shape the future of our scientific world. They impact brain research through contributions of $100,000 to $1 million for the advancement of Max Planck Florida Institute for Neuroscience.

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Members of the Max Planck Florida Max Trust truly revolutionize brain research. Their contributions of transformational gifts of $1 million or more significantly impact the Institute’s capabilities and drive innovation that will impact generations to come.

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Discovering the Power of Music and the Mind

In January, MPFI and Dr. David Fitzpatrick were honored to collaborate with renowned soprano, Renée Fleming for a special lecture titled, *Music and the Mind*.

The lecture, held at the Kravis Center, explored the role music plays in health – from music therapy, improving childhood development and our very understanding of how the brain works.

Following the lecture, guests were graciously welcomed into the home of MPFI trustee, Bonnie McElveen-Hunter for refreshments and a meet-and-greet with Ms. Fleming.

“Beyond its ability to enthrall and entertain, music offers a host of health benefits – from childhood development to therapeutic applications for Alzheimer’s disease, autism, PTSD, Parkinson’s disease and chronic pain,” said Ms. Fleming. “And close to my heart, singing can retrain the brain to use different neural circuitry, helping those who have sustained a traumatic brain injury or suffered a stroke regain the ability to speak.”

Thank You for Your Support

We would like to express our gratitude to our Board of Trustees for their continued leadership and support.

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MPFI offers unique opportunities for companies looking to partner with the institute in its mission of uncovering all that is unknown about the brain. Through the Institute’s Corporate Partner Program, companies who share our goal of advancing neuroscience research will be recognized in a variety of ways for their support. These partners are also granted advanced and exclusive access to our “Friends of MPFI” program and provided ample opportunities to engage with the scientific community.

MPFI’s Corporate Partners help support professional, educational, and community programs, such as:

- Research Programs
- Advanced Courses
- Postdoctoral Training
- Graduate Training
- Education Outreach Programs
- Public Lectures
- Professional Development
- Neuroscience Conferences and Meetings

Learn more about the many ways to join the MPFI Corporate Partners by contacting Partner@mpfi.org