2019 YEAR IN REVIEW

MAX PLANCK SOCIETY NAMED NUMBER ONE BIOMEDICAL RESEARCH NONPROFIT IN THE WORLD

RESEARCH HIGHLIGHTS
MPFI Holds Largest Neuroscience Conference in its History

INSIDE THE INSTITUTE
State Allocates $1.6 Million for Max Planck Florida Training Programs
## Contents

**Letter from the CEO**  
1

**Highlights**

2  
**Sunposium™ 2019 - MPFI Holds Largest Neuroscience Conference in its History**

5  
**Max Planck Society Named Number One Biomedical Research Nonprofit in the World**

6  
**MPFI Welcomed Two New Research Group Leaders**

**Scientific Leadership**

8  
**Max Planck Florida Showcases Programs at Society for Neuroscience Conference**

10  
**MPFI Names Two New Max Planck Research Fellows**

11  
**Dr. Yasuda Receives $2.9M National Institute of Health Grant**

11  
**MPFI Head of Education Outreach Wins STEM Innovation Award**

**Inside the Institute**

12  
**2019 Awarded Grants and Fellowships**

12  
**2019 New Team Members**

13  
**2019 Scientific Publications**

14  
**Research Highlights**

15  
**Innovative Technique for Labeling and Mapping Inhibitory Neurons Reveals Diverse Tuning Profile**

16  
**MPFI Researchers Develop Newly Devised Strategy that Allows the Linking of Phenotype to Genotype**

18  
**Collaboration and Innovation: Uncovering the Presynaptic Distribution and Profile of Mitochondria**

20  
**Employee Spotlight: Eric Washburn**

21  
**Highly Successful Neuroimaging Techniques Course**

22  
**State Allocates $1.6M for Training Programs**

**Future Researchers**

24  
**Palm Beach County High School Students Get Hands-On Science Career**

26  
**MPFI Welcomes High School Interns**

27  
**What it’s Really Like in MPFI’s Postbac Program**

**Community Outreach**

28  
**MPFI Celebrates Science and Music Through Free Public Lecture Series**

32  
**MPFI Scientists Collaborate on “Journey Through the Human Brain”**

33  
**Palm Beach County Students Compete in MPFI’s Brain Bee Challenge**

34  
**International Exhibit of Max Planck Scientific Images Comes to Seattle’s Pacific Science Center**

**Advancement**

36  
**Brain Trust Celebration at the South Florida Science Center and Aquarium**

38  
**Mindfulness: An Everyday Tool to Improve Brain Health**

30  
**How Donors Impact Our Science**

40  
**Max Trust Members Catalyst Council Members**

42  
**Brain Trust Members**

44  
**Board of Trustees**

45  
**Corporate Partners in 2019**

---

**On the cover:** Whole reconstructions of synaptic terminals labeled with mitochondria using serial block-face scanning electron microscopy. Image courtesy of the Electron Microscopy Core, MPFI.
Letter from the CEO

Dear Friends of MPFI,

I would like to welcome you to the 2019 Year in Review, an annual publication that showcases the impact our institute has been having both on the world of neuroscience, and on our community here in Jupiter, Florida.

2019 was an exciting and successful year at Max Planck Florida Institute for Neuroscience (MPFI). We made great strides in our research, embarked on strategic national and international collaborations, and our outreach initiatives have impacted our community with training programs that benefited hundreds of future scientists. In short, MPFI has achieved a reputation as an outstanding place to do cutting-edge science that is creating a fundamentally new understanding of the fundamental processes that underlie brain function and disease.

This past year held many bright spots for our institute: our largest and most successful Sunposium™ conference to date; significant grants and recognition from the NIH; and of course, the moment that we learned that the Max Planck Society was named the #1 Biomedical Nonprofit of the Year. We also engaged hundreds of high school students in our community through neuroscience education events, including Scientific Career Day and the BrainBee. Not only was this an opportunity for these students and teacher to learn about the brain, it allowed them to meet and interact with our scientists and gave them real life models that could help them envision their own careers in research. Our impact truly spans all ages and career levels, a fact that we are very proud of, and as a friend of MPFI, I hope you share in this pride.

What makes MPFI so special is our focus on the scientist. We invest in people, taking the most talented and creative minds in science and provide them with the funding, resources, and freedom they need to make cutting-edge discoveries. I am grateful for the help of our Board of Trustees, donors, government officials, and community members whose support allows us to strengthen our curiosity-driven science to expand our ability to reach the scientists of tomorrow.

With gratitude,

David Fitzpatrick, CEO and Scientific Director
More than 400 neuroscientists from around the world gathered at the Palm Beach County Convention Center for Sunposium™, a three-day international neuroscience conference hosted by MPFI. Sunposium™ took place March 4 through 6, 2019 and featured 30 international speakers including Nobel Laureates Eric Kandel and Linda Buck. More than 120 students and researchers presented cutting-edge findings at a two-day poster session. This is the fourth year that MPFI has hosted the biennial event since the institute was founded.

“It is an enormous privilege to host some of the leading neuroscience researchers at Sunposium™. This was by far our most successful event to date, and I am proud of the role that Max Planck Florida played to bring together the most passionate and talented minds of the neuroscience community,” said MPFI CEO and Scientific Director David Fitzpatrick.

During the conference, Dr. Gloria Choi of MIT’s McGovern Brain Institute was awarded the Peter Gruss Young Investigator Award, which 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 outstanding achievements, it also serves to support research, inspire young scientists, promote collaboration, and acknowledge the outstanding legacy that Dr. Peter Gruss built throughout his honorable career at the Max Planck Society. In addition to a plaque and commemorative art piece, Dr. Choi was awarded an honorarium underwritten by Dr. Raquel Rodriguez of Miami, Florida.

Dr. Choi also took part in a panel discussion focusing on career advice and support of women in science. In addition to Dr. Choi, panelists included Dr. Yingxue Wang, research group leader at MPFI, and Stanford University professor Dr. Carla Shatz, who was the first woman to receive a degree in neurobiology from Harvard University. Panelists discussed work-life balance, advocacy and mentorship, and answered questions from the audience. The event was organized by MPFI’s newly formed chapter of the Network for Women in Science (NWIS) and moderated by NWIS co-chairs Dr. Juliane Jaepel and Dr. Gabriela Rodriguez.

As part of MPFI’s commitment to educating the future generation of scientists, more than 30 students from six universities throughout Florida were awarded “Florida Fellowships” which included registration and lodging to attend the conference. “It was a great experience, and I feel honored to have been able to sit amongst so many brilliant researchers and graduate students. It was awe-inspiring to hear about some of the incredible new cutting-edge research currently being done in the field of neuroscience,” said Cailey Weaver, one of the Florida Fellows who studies Behavioral Neuroscience Research at NOVA Southeastern University.

In addition to hearing about the latest findings in research, Sunposium™ participants were able to enjoy the West Palm Beach scenery through participation in a variety of tours, including a catamaran cruise, a trip to Peanut Island and a VIP tour of the Max Planck Institute in Jupiter.

The 2019 Sunposium™ event was the largest in MPFI’s history and attracted participants from throughout the United States as well as Canada, South Korea, Germany, Japan, China, Costa Rica and the United Kingdom. Held every other year, the next Sunposium™ is scheduled for March of 2021. Additional details will be made available on suposium.org.

THANK YOU
MPFI is grateful for the generous support and presence of these partners that further enhanced the Sunposium™ 2019 experience:

Sunposium Partners
- Lumencor, Neurescence, NKT Photonics

MPFI Corporate Partners
- Bruker, Spectra-Physics, Thorlabs, Inscopix
Max Planck Society Named Number One Biomedical Research Nonprofit in the World

Germany’s Max Planck Society, the research powerhouse that includes the Max Planck Florida Institute for Neuroscience (MPFI), has been ranked as the top biomedical nonprofit organization in the world by Nature Index. The rankings examine prominent research institutions and scientists across the world whose publications profoundly impact biomedical research. In addition to taking the top spot among nonprofit/NGO institutions, the Max Planck Society ranked fifth overall when compared to all research organizations, including major universities and government health agencies.

The Max Planck Society’s unique ‘science-first’ core values create an environment for unparalleled research excellence. “We are proud to be a part of the leading nonprofit research organization in the world, and to represent the Max Planck Society in the United States,” said David Fitzpatrick, CEO and Scientific Director of MPFI, the only Max Planck Institute in North America. Besides the one in Jupiter, Florida, the Max Planck Society operates another 85 institutes, most of them in Germany, one in Luxemburg, two in Italy, and one in the Netherlands. Since its establishment in 1948, 18 Nobel laureates have emerged from the ranks of Max Planck Society scientists.

As the first U.S. institution, MPFI brings together exceptional neuroscientists from around the world to answer fundamental questions about brain function and development and to advance new technologies that make groundbreaking scientific discoveries possible.

Max Planck Society research is shared publicly with scholars, universities and other organizations around the globe, providing the necessary foundation of knowledge to develop treatments and cures for brain disorders such as autism, schizophrenia, Parkinson’s disease and Alzheimer’s disease. For more information, visit mpfi.org.

For more information, visit mpfi.org.
Dr. Vidhya Rangaraju,
Research Group Leader of the Neuroenergetics Lab at MPFI

Dr. Hidehiko Inagaki,
Research Group Leader of the Neural Dynamics and Cognitive Functions Lab at MPFI
MPFI Welcomed Two New Research Group Leaders

MPFI welcomed two new research group leaders who started their labs at the institute. Dr. Hidehiko Inagaki joined the institute to study the neural dynamics and cognitive functions and Dr. Vidhya Rangaraju to study Neuroenergetics.

“Our behaviors heavily depend on information internal to the brain, which we call internal states. For example, even when we look at the same food, depending on how hungry we are, our response can be totally different,” Inagaki explained. “In addition, even without watching the clock, we can make surprisingly accurate timed movements by following our internal timer. I am interested in how these ‘internal states’ affect our decision making and behavior.”

Dr. Inagaki’s research focuses on understanding cellular and network mechanisms underlying cognitive functions in mice, such as decision making and time perception. He was the winner of the Max Planck Society Free Floater Competition. The competition invites leading postdoctoral fellows to apply for the opportunity to become a research group leader at a Max Planck Institute. As the winner, Inagaki could choose any of the more than 80 Max Planck Institutes in the world. Dr. Inagaki chose MPFI for its interactive and collaborative environment.

Dr. Inagaki completed his Ph.D. under the mentorship of Dr. David J. Anderson at the California Institute of Technology. For his graduate work, he studied the neuronal mechanism of internal states in Drosophila. For his B.S., he worked in Kei Ito’s lab at the University of Tokyo, where he studied the anatomical and physiological properties of mechanosensory neurons in Drosophila.

MPFI also welcomed Dr. Vidhya Rangaraju as research group leader in January 2020. The Rangaraju group studies the energy use and supply of biological processes in neurons.

Prior to this appointment, Dr. Rangaraju was an EMBO and Marie Curie Postdoctoral Fellow in the group of Dr. Erin Schuman at the Max Planck Institute for Brain Research in Germany. During her postdoc, she uncovered the presence of local mitochondrial compartments of energy that fuel local translation during synaptic plasticity. She completed her Ph.D. in the lab of Dr. Timothy Ryan at Weill Cornell Medicine in New York. During her graduate work, she developed a novel optical reporter of the energy-carrying molecules and elucidated the link between the activity of neurons and the synthesis of these molecules.

She is the recipient of numerous awards including the Vincent DuVigneaud Award of Excellence, The Lindau Nobel Laureate Meeting Award, and the MPIBR Scientific Discovery of the Year Award.

Rangaraju cites the exceptional resources as her reason for choosing to start her lab at MPFI, saying “Max Planck Florida is a place where scientists can focus undividedly on their research, contributing to the advancement of human health. This has been made possible by the many committed people in all the different departments, from HR to core facilities, and creates an implicitly fostering environment that has given me a head start on the journey of seeing our lab’s vision become reality.”

For more information about the Inagaki and Rangaraju Labs, visit mpfi.org/our-labs
Max Planck Florida Showcases Programs at Society for Neuroscience Conference

Representatives from MPFI attended the Society for Neuroscience's 50th annual conference, October 19-23, 2019 in Chicago, IL. This annual event is the largest global neuroscience conference.
Plans to promote new MPFI recruitment opportunities at next year’s conference are already in progress. SfN’s Neuroscience 2020 will be held October 24-28 in Washington, DC.

MPFI attended the 50th annual Society for Neuroscience conference, held October 19 through 23, 2019 in Chicago. More than 27,000 people were in attendance to hear the latest research, attend networking events and learn more about the latest technology and collaborations in the exhibitor hall. The MPFI Events and Communications Team represented the institute at the SFN trade show, handing out information about upcoming workshops and training programs, such as the IMPRS Ph.D. program, MPFI’s postbaccalaureate program, and postdoctoral opportunities.

MPFI’s Neurotransmissions Podcast recorded multiple interviews, including Kurt Thoroughman from the National Science Foundation; NINDS Program Director, Lauren Ullrich; Greg Gage from Backyard Brains; Marina Picciotto from the Journal of Neuroscience, and more.

On Monday, October 21, MPFI held a VIP social for Max Planck representatives, alumni and past course participants at The Fremont, Chicago. The social was sponsored by ThorLabs, SpectraPhysics and Inscopix, who gave away raffle prizes to the hundreds in attendance. Following the social, the MPFI team transformed the Fremont into a late-night dance party that attracted more than 400 conference attendees and helped spread the word about Max Planck Florida.

SCIENTIFIC POSTERS PRESENTED BY THE MPFI DELEGATION:

A disinhibitory microcircuit to gate climbing fiber-mediated learning

The contribution of SST-expressing interneurons to the PTEN model of autism spectrum disorder
*T. W. HOLFORD, M. BOLTON

Functional synaptic organization of ocular dominance within the dendritic field of layer 2/3 neurons in ferret visual cortex
*C. TEPÖHL, B. SCHOLL, D. FITZPATRICK

Apical intercalated cell cluster: A novel sensory regulator in the amygdala
D. ASEDE, D. DODDAPANENI, A. CHAVEZ, J. OKOH, S. ALI, *M. BOLTON

Imaging compartmentalized and isozyme-specific PKC activity during plasticity

SpineYOLO: A web-based, deep learning tool for identification of dendritic spines
*M. S. SMIRNOV, B. SCHOLL, E. GONZALEZ, J. M. CHRISTIE, R. YASUDA

In vivo imaging of the coupling between neuronal and CREB activity in the mouse brain
*T. LAVIV, B. SCHOLL, P. PARRA-BUENO, B. FOOTE, C. ZHANG, L. YAN, J. CHU, R. YASUDA

*M. SEDIGH-SARVESTANI, K.-S. LEE, S. F. LIU, N. C. SHULTZ, R. SATTERFIELD, D. FITZPATRICK

*Presenter
MPFI Names Two New Max Planck Research Fellows

MPFI announces the appointment of two Max Planck Society Fellows, Drs. Michael Halassa and Yi Zuo. The Fellows Program is supported by Germany’s Max Planck Society to promote cooperation between outstanding university professors and Max Planck Society researchers for a five-year period.

The Fellows Program is a longstanding hallmark of Max Planck Society collaborations, with more than 100 fellows being placed into collaborations with Max Planck Institutes around the world since the program began in 2005. Dr. Hallassa and Dr. Zuo are the first researchers to be awarded a Max Planck Society Fellows Award at the Max Planck Florida Institute for Neuroscience, which was established in 2010 as the first and only Max Planck Institute in North America.

Michael Halassa is an associate investigator at the McGovern Institute for Brain Research at MIT and an assistant professor in the department of brain and cognitive sciences. As part of his award, he will focus on research that provides new insights into the functional organization of the neural circuits underlying higher cognitive function that will have a significant impact on the field, and may be relevant for understanding conditions such as autism and attention deficit disorder.

Dr. Halassa is a well known for his pioneering work on the neural circuits that give rise to cognitive processes like attention and executive function. His work focuses on understanding the role of the thalamus in cognition. He is the recipient of numerous awards and prizes, including the 2017 Vilcek Prize for Creative Promise in the Biomedical Sciences and the 2015 Daniel X. Freedman Prize for Exceptional Research in Basic Brain & Behavioral Science. He was also awarded the 2017 Takeda/New York Academy of Science Innovator Award, was recognized as the 2017 NYU Langone Medical Center Next Generation Star and was named the 2015 Allen Institute Next Generation Leader.

Dr. Yi Zuo is a professor in the Department of Molecular, Cell and Developmental Biology at the University of California, Santa Cruz. She will work with MPFI researchers to develop and apply microscopy techniques to study how synaptic plasticity and brain circuits are affected in mouse models of mental illnesses and stress. The projects addressed through this Award are expected to provide new insights into the molecular and cellular mechanisms underlying synaptic reorganization during learning and in neuropsychiatric disorders.

Dr. Zuo is a distinguished neuroscientist and one of the pioneers of chronic imaging of synapses in live animals. She is internationally recognized for her work on synaptic remodeling in development and learning. Over the past three years, Dr. Zuo has worked closely with Max Planck Florida Institute for Neuroscience in developing and organizing the advanced course “Neuroimaging Techniques” together with Dr. Yasuda. In addition to teaching the course, Dr. Zuo has initiated a collaboration with Dr. Fitzpatrick and Dr. Yasuda to develop new technologies for correlative light- and electron microscopy (CLEM). Dr. Zuo is the recipient of numerous awards and prizes, including the 2007 award from the Ellison Medical Foundation and the American Federation for Aging Research (AFAR). She was also a 2015 National Award finalist for the Blavatnik Awards for Young Scientists.
Dr. Ryohei Yasuda Receives $2.9 Million National Institute of Health Grant

Dr. Ryohei Yasuda has received a grant by the National Institute of Mental Health of the NIH. The award is for $2.9 million over 5 years and will continue the funding of Yasuda’s work with Rab proteins.

Using cutting-edge imaging techniques, Dr. Yasuda is studying Rab proteins’ impact on learning and memory by tracking how molecules become activated and interact with each other. By better understanding how these proteins communicate with each other, scientists may one day be able to develop interventions for Alzheimer’s, Parkinson’s Disease and other brain disorders.

Dr. Yasuda is a Scientific Director of MPFI and leads the Neuronal Signal Transduction Lab. He has received many recognitions for his outstanding research in neuroscience, including the 2015 National Institute of Health’s (NIH) Pioneer Award, which recognizes scientists demonstrating creativity and groundbreaking approaches in biomedical or behavioral science. Dr. Yasuda was one of only 13 scientists in the country to receive the NIH Pioneer Award in 2015.

Additional awards include the Career Award at the Scientific Interface from the Burroughs Wellcome Fund, the Alfred P. Sloan Fellowship, the New Investigator Award from the Alzheimer’s Association, and Research Award for Innovative Neuroscience from the Society for Neuroscience.

Dr. Yasuda received his Ph.D. in Physics in 1998 from Keio University Graduate School of Science and Technology in Yokohama, Japan. From 2000 to 2005, he was a post-doctoral fellow at the Cold Spring Harbor Laboratory where he built an imaging device to monitor protein interactions in living cells with high sensitivity and resolution. From 2005 to 2012, he was an assistant professor of the Neurobiology department at the Duke University Medical Center where he developed a number of techniques to visualize signaling activity in single synapses. From 2009 to 2012, Dr. Yasuda served as an Early Career Scientist at the Howard Hughes Medical Institute before coming to MPFI in 2012.

MPFI Head of Education Outreach Wins STEM Innovation Award

Dr. Ilaria Drago was named the Rising Star Award recipient for the 2019 STEM Innovation Awards at a ceremony that took place on Saturday, September 7.

The STEM Innovation Awards is an annual program from the South Florida Science Center and Aquarium that recognizes leadership, service and collaboration in the field of Science, Technology, Engineering, and Math. The Rising Star Award is given to an emerging leader who has demonstrated leadership in developing STEM teams, providing guidance and leading STEM events and programs. This award recognizes achievements that inspire others to follow and improve STEM education.

Ilaria joined MPFI in June 2018. Among her many accomplishments in her first year in the education outreach department, are the MPFI’s Summer High School and Teacher Internship programs, MPFI’s Science Career Panel for more than 70 students and teachers, and the Brain Bee Challenge which brought in nearly sixty competitors and drew hundreds of live viewers online. This summer Ilaria, in partnership with the Machine Perception and Cognitive Robotics Lab at FAU, launched MPFI’s Machine Learning and AI Summer Camp. She also represents MPFI at STEM Education Councils and volunteers at science and career fairs at local schools.

In the last year, Ilaria worked closely with the Phillip and Patricia Frost Museum of Science for the “Max Planck: Images of Science” exhibit and with the South Florida Science Center and Aquarium for the “Journey through the Human Brain” exhibit.

Engaging the community in ways that ignite passion for science is a critical part of Max Planck Florida’s mission. Ilaria’s energy, creativity, and leadership have been the source of a number of wonderful experiences for students and educators in Palm Beach county and our institute as a whole.
2019 Awarded Grants and Fellowships

BRAIN & BEHAVIOR RESEARCH INSTITUTE (B&BR/NARSAD YOUNG INVESTIGATOR)
Andre Steinecke
Title: Calcium-dependent axon development in cortical Chandelier cells
TOTAL: $70,000
01/15/2019-01/14/2021

NATIONAL INSTITUTE OF MENTAL HEALTH, NATIONAL INSTITUTE OF HEALTH
Ryohei Yasuda
Title: Mechanisms of Ras signaling in single synapses
TOTAL: $2,875,913
03/01/2019-12/30/2023

NATIONAL INSTITUTE OF MENTAL HEALTH, NATIONAL INSTITUTE OF HEALTH
Mary Phillips
Title: Input-specific imaging and manipulation of synaptic plasticity underlying social memory
TOTAL: $198,690
07/01/2019-06/30/2022

SRYBNIK/F.O.R.E. FOUNDATIONS
Ryohei Yasuda
Title: Uncovering the Role of Insulin-like Peptides Signaling in Memory Formation
TOTAL: $50,000
07/01/2019-12/31/2019

2019 New Team Members

In 2019, MPFI Welcomed the Following Postdoctoral and Research Fellows:
Alexandra Gribizis, Tarun Kaniganti, Augusto Lempel, Mary Phillips, and Zhen Yang

Our new Graduate Students were:
Carina Arnold, Goksu Oz, and Zidan Yang

Our new Post Baccalaureate Research Fellows were:
Mariah Francheska Calubag, Kathryn Ippolito, Cody Loomis, Sowmya Narayan, Elizabeth Potts, Kylie Schmitt, and Petra Florina Szabo

New FAU-Max Planck Honors Students were:
Yilan Liu, Tejas Purimetla, Isis Sweeney, Devin Willis

New Undergraduates were:
Matthew Pacheco, Kevin Pena, Danielle Salick

New Data Science High School Students were:
Pedro Almeida, Manal Imran, Jennifer Mondonca, Ciara O’Neill, Sagan Potenza, Manasa Tallapaneni, Yasmine Zerrouki, and Chelsea Zuvieta

New Research Scientists:
Miho Inagaki, and Xiaoliang Zhao

New Research Technicians:
Elise Gonzalez, George Kreal, Carolyn Von-Walter, and Brandon Wisnicki

We also Welcomed
Hidehiko Inagaki as Research Group Leader
Rykkeyyia Delgado as IT Support Specialist
Matthew Morgan as IT Desktop Specialist
Nadia Hosein as Purchasing Coordinator
LaShunta Gaines as Accountant
Claire Beckey as Accounting Assistant
Christine Jackson as IACUC Coordinator
Hiroyumi Nishizono as Research Associate
Anant Jain as Scholar
Markenson Exantus and Jessica McCabe as Animal Care Technician
Jami Wells as Sr Animal Care Technician
Katherine Shirley and Ashley Cousin as Institutional Assistant
2019 Scientific Publications

ARTICLES


BOOK CHAPTERS


MPFi research was featured on the cover of a scientific journal for the second time in the Institute history

This image shows two volumetric electron microscopy reconstruction models of mitochondria within the calyx of Held and its axon from 7 (red) and 21 (blue) day old mice. Thomas et al., 2018, Journal of Neuroscience 39 (41).
This illustration shows the interaction between an excitatory neuron (in blue) and different type of inhibitory neurons (in yellow and pink) in the visual cortex.
Innovative Technique for Labeling and Mapping Inhibitory Neurons Reveals Diverse Tuning Profile

Researchers at MPFI uncovered a diverse palette of inhibition within layer 2/3 of the visual cortex, suggestive of a more complex functional connectivity that may allow for enhanced flexibility of neuronal responses.

Neurons are complex, highly connected cells engaged with multiple networks throughout the brain, and they exhibit a wide range of activity. As such, individual neurons can perform many functions. Neurons are generally classified as either excitatory or inhibitory based on downstream effects on other cells, with each cell receiving a diverse array of excitatory and inhibitory synaptic inputs that help shape that cell’s unique properties. In a recent study, researchers at MPFI revealed that inhibitory inputs to neurons in the visual cortex are more diverse than previously thought, suggesting that our current notion of neuronal connectivity may only reflect a part of the whole picture. The team of researchers explored how neurons are wired together and what effect these connections have on neuronal properties. Using genetic tools, imaging techniques, and optogenetics, they showed that inhibitory inputs onto single neurons can deviate from the canonical view of cortical circuits. The presence of this surprising, differentially-tuned inhibition suggests that cortical connectivity is more flexible than originally assumed, allowing for multiplexed computations.

Few studies have mapped inhibitory inputs onto neurons within intact brain circuits. Despite the wide variety of techniques to visualize excitatory connections, there are almost none readily available to study co-occurring inhibitory connections. Dr. Benjamin Scholl, Senior Research Scientist in the lab of Dr. David Fitzpatrick, and Dr. Daniel Wilson, now a postdoctoral researcher at Harvard Medical School, developed a strategy for labeling and mapping local inhibitory inputs onto a cell. They expressed a fluorescent protein specifically in inhibitory neurons, taking advantage of genetic markers to target only these cells, and combined whole-cell patch-clamp recordings with patterned stimulation of neurons to record their individual activity. In the same cells, they also measured their selectivity for different orientations of moving edges.

Scholl and colleagues found that the selectivity of inhibitory inputs may parallel or completely diverge from that of target neurons, revealing a “diverse palette” of inhibition. Previously, it was thought that these inputs should all be co-tuned, with aligned functional preferences. Data from this study suggests that, depending on network activation, inhibitory cells with different tuning profiles are able to uniquely contribute and allow for flexibility of network responses. “These networks are highly interconnected and dynamic, and these studies are beginning to show us that the functional connectivity we hope to uncover is more complicated than we previously believed,” remarks Scholl. Further, understanding the anatomical connectivity, or “connectome,” may not be entirely sufficient to understand brain circuits, emphasizing the need to map and elucidate functional connectomes in the brain.

The rules governing neuronal tuning are in no way simple, with different stimulus conditions evoking different patterns of excitation and inhibition, and there is much more about the intricacies of the visual system that has yet to be uncovered. But advancements in labeling and imaging techniques such as that outlined in Scholl’s paper open the door for future examination of synaptic inputs to individual neurons. “We have to appreciate the full complexity of how individual neurons are engaged in circuits,” states Fitzpatrick. “The power of this paper lies in the technology that allows us to record from individual neurons while presenting a visual stimulus and selectively activating inhibitory neurons.” Scholl and the Fitzpatrick lab hope to understand how excitation and inhibition are used flexibly to encode information, including during early development. Subsequent studies may explore the role of experience in shaping neuronal networks and the varying impact of individual neurons under different stimuli or contexts. The lab also hopes to develop new techniques for better resolution imaging and precise stimulation of single cells to further characterize the role of inhibitory neurons in the visual cortex.

2019

INSIDE THE INSTITUTE

YEARS IN REVIEW

15
MPFI Researchers Develop Newly Devised Strategy that Allows the Linking of Phenotype to Genotype

The power and convenience of modern-day word-processing programs, like Microsoft Word, have revolutionized our daily tasks. Need to create a quick resume for a new job opportunity? Procrastinating on that final term paper due tomorrow? Even creating a quick grocery list. Most of us rely on word-processing programs as stewards of our written lives. The functionality is impressive and unlike its archaic predecessor, the type writer, just a few keystrokes can change, delete, or add words as the user desires.

For years researchers have been searching for ways to mimic these capabilities but on the genetic scale, in order to accurately and efficiently alter genetic information. Developing a “Microsoft Word of DNA”, would allow scientists the opportunity to better study the functioning of individual genes and the mutations that contribute to genetic disorders. With a single discovery, called CRISPR-Cas9, scientists were forever upgraded from DNA typewriters to a DNA word-processor; editing genes with the same ease, precision and versatility. The technology has gained immense traction and popularity due to its flexibility and customizable nature.

Though powerful, CRISPR is far from a perfect technique and like any other, has its drawbacks and limitations. One of its primary uses, involves precisely targeting and mutating a gene of interest so that it no longer functions within a specific type of cell. When

The scientists “reading” the DNA of CRISPR/Cas9-edited neurons serve as a metaphor for the newly devised strategy that allows the linking of phenotype to genotype. This method allows the study of CRISPR-mediated effects in cells while accurately ascertaining the exact DNA changes that caused them.
a gene is rendered nonfunctional, any characteristic changes to the cell (known as phenotypes) can be studied in order to get a better picture of what that particular gene does. But the way CRISPR mutates individual genes can pose a challenge to researchers. When placed in a cell, the CRISPR-Cas9 system precisely mutates a targeted gene by cutting the cell’s DNA. The cell then repairs its broken DNA predominantly through a process called nonhomologous end-joining (NHEJ). But this repair process is error prone and can cause variability in the repaired DNA; often leading to substitutions, deletions or additions to the genetic code. Adding to the challenge is that the efficiency of CRISPR can vary, acting to render both copies of a targeted gene nonfunctional or sometimes only one. These unknown CRISPR caused DNA changes can make it extremely difficult for scientists to interpret the underlying genetic cause of an observed phenotype; making the tool far less useful.

In a recent publication in Cell Reports, the Taniguchi Lab at MPFI have developed a new methodology that allows the linking of phenotype to genotype. Innovatively combining the cutting-edge technique of laser microdissection with single cell genotyping, the Taniguchi Lab has designed an experimental pipeline capable of studying CRISPR mediated effects in cells while accurately ascertaining the exact DNA changes that caused them. This novel protocol will open up new avenues of study for neurobiology and further upgrade the already powerful abilities of CRISPR.

“Though CRISPR precisely targets a gene of interest, due to NHEJ, its effects can be highly variable,” explains Andre Steinecke, Ph.D., Research Fellow and first author of the publication. “CRISPR can leave cells with either fully nonfunctional genes, weakened genes or sometimes even enhance their function. This isn’t such a problem when removing one that causes a very noticeable effect in cells because you can easily visualize the change and absence of the protein coded by the gene. But some, especially genes in the brain, don’t have strikingly obvious effects or are very difficult to visualize. Our goal was to create a widely applicable strategy, capable of reliably determining the exact genetic cause and correlate it to observed phenotype.”

To validate their strategy, the team at MPFI designed CRISPR technology to target a gene in pyramidal neurons encoding a critical structural protein, called Ankyrin-G (AnkG). Normally, the AnkG protein is confined to a specialized region of the neuron known as the axon initial segment (AIS), which is responsible for generating action potentials. When AnkG is removed, the AIS undergoes a noticeable thickening that can be detected using microscopy. With this characteristic feature, neurons that lack AnkG could be readily distinguished and their exact genotype could then be confirmed. They found that predominately, neurons transfected with their CRISPR probe exhibited a loss of AnkG as well as substantially thickened AIS. But a small portion of neurons transfected with CRISPR still exhibited AnkG levels and AIS thickness comparable with wildtype neurons; demonstrating the varying effects of CRISPR on different cells. To probe and confirm the underlying genetic causes, the team then used laser microdissection to isolate and extract individual neurons whose phenotype had already been characterized. Once extracted, the team sequenced each individual cell separately to determine the genotype. They found that their strategy could reliably and reproducibly link observed phenotype to genotype, where neurons lacking AnkG with thickened axons showed loss-of-function mutations in both copies of the gene whereas neurons with normal levels of AnkG either showed mutations in only one copy (neurons transfected with CRISPR) or normal genotypes (control neurons). The team then confirmed their strategy using two additional genes, MeCP2 and Satb2, finding that their process could once again effectively correlate observed feature to underlying genetics.

“CRISPR/Cas9-based gene targeting holds great promise for systematic understanding of the molecular basis underlying the assembly, function, and dysfunction of neural circuits,” notes Hiroki Taniguchi, Ph.D. “The perfect matching between genotypes determined by our single cell sequencing and those deduced from phenotype evaluation, suggests that our approach is a powerful new method capable of enhancing the reliability and expanding the applications of CRISPR-based techniques.”
Collaboration and Innovation: Uncovering the Presynaptic Distribution and Profile of Mitochondria

Scientists from MPFI and University of Iowa Carver College of Medicine (CCOM) develop new innovative methods for imaging and reconstructing mitochondria at the synaptic level.

The ability to hear relies on neurons to constantly transmit information at very rapid timescales. This rapid rate of information transmission results in intense energetic demands. Within our cells, microscopic power plants called mitochondria provide the main source of energy keeping our bodies moving. While mitochondria serve an essential function throughout the body, within the brain they play an especially crucial role; providing the tremendous amount of energy needed to facilitate synaptic transmission (the transfer of information between neurons).

In the auditory system there is a large presynaptic terminal called calyx of Held that is critical for binaural sound processing. Prior to the onset of hearing, immature calyx synapses, do not release neurotransmitter at very fast rates. But once mature, they reliably and rapidly release neurotransmitter to encode auditory information. However, how mitochondria support the energy-demanding activity of the mature synapse remained unknown.

In a recent study published in the Journal of Neuroscience, scientists from the MPFI and the University of Iowa CCOM have provided unprecedented insight into the presynaptic distribution and profile of mitochondria in the developing and mature calyx of Held.

“My lab investigates how synapses enable neural circuits to transmit a wide variety of information. In particular we are very interested in understanding the synaptic mechanisms that enable fast auditory signaling required for accurate identification and perception of sound information and their contribution to auditory deficits,” explains Samuel Young Jr., Ph.D., former Research Group Leader at MPFI and now Associate Professor in the Department of Anatomy and Cell Biology at the University of Iowa CCOM. “While we understand some of the general principles of how the calyx enables proper sound processing, many are still unknown. Therefore, we wanted to understand if there were mitochondrial changes at the subsynaptic levels. To answer our question, we needed the expertise of the EM core at MPFI. What started as a fledgling idea and a simple conversation turned into a fruitful collaborative effort.”

Due to their relatively small size, mitochondrial volume and distributions are often difficult to analyze using conventional methods and require 3D-electron microscopy to fully reveal their intricate structural details. To accomplish this the Young Lab created a helper-dependent adenoviral vector with the mitochondria-targeting peroxidase, mito-APEX2 and expressed it at the mouse calyx of Held. In addition to that, the MPFI EM team developed protocols to detect APEX2-labeled mitochondria by 3D-electron microscopy to carry out extensive analysis of the presynaptic mitochondria volume and abundance.

“Our biggest challenge was to develop protocols and workflows that would allow us to image mitochondria within the calyx in fine detail using the advanced 3D-EM technologies,” describes Connon Thomas, EM assistant at MPFI and first author of the publication. “After extensive optimization, we devised two strategies; the first used serial block-face scanning electron microscopy or SBF-SEM for short, which is a type of specialized EM that allows us to generate a large-scale set of 3D images in order to reconstruct and analyze mitochondria within the terminals. The second strategy used Automated Tape-collecting Ultra-Microtome serial section scanning electron microscopy (ATUM-ssSEM), which is a technique that produces higher resolution images which makes it easier to analyze fine sub-synaptic structures.”
Whole reconstructions of mature calyx of Held terminals contacting six principal cells of the medial nucleus of the trapezoid body using serial block-face scanning electron microscopy (SBF-SEM).

3D reconstructions of images taken with SBF-SEM revealed that mitochondrial volumes within the mature calyx and its surrounding axon were significantly higher than those found in its immature counterpart. It also seemed that mitochondria are selectively enriched within the mature calyx, containing higher volumes than the surrounding axon. This data affirms the idea that during development increased mitochondrial volumes support the higher energy demands of a more active mature calyx.

Using genetic tools developed by Young Lab and innovative new protocols developed by MPFI’s EM Core, their combined expertise has generated novel approaches with broad applications in neuroscience research. “The strong collaboration between our EM Core and the Young Lab was essential for the success of this work,” notes Naomi Kamasa- wa, Ph.D., Head of EM Core. Our collaborations will continue and will undoubtly bring exciting new developments.”

“The new protocols and applications developed for this work will have wide application for studying different circuits or different brain regions with combining genetic manipulation and electron microscopy,” explained Young.
What is your role at MPFI?
I maintain the environmental, health, and safety (EH&S) program, helping to ensure that we are safe at MPFI and that we comply with local, state, and federal regulatory agencies. The EH&S program includes all aspects of safety (i.e., biological, chemical, fire) and occupational health, among others. Some of regulatory agencies that I serve as the primary contact for include the NIH/ CDC, FL DOH, and the DEA.

What do you like most about your job?
I like the flexibility that working at a small institute offers. I am not restricted to any one area of EH&S and I am able to learn about all areas of EH&S from biological and chemical to fire and occupational health. I also like that I get to speak to every new employee about the overall culture of MPFI, above and beyond the safety culture. I am one of the first people they talk to when they walk through the door on their first day, so being able to help set the tone of the Institute is really nice. Finally, I like that I am able to interact with all types of people all day long. I can talk to Nobel Laureates, electricians, accountants, veterinarians, housekeepers...all in the same day. I think that’s pretty amazing. But mostly I like that I get to talk a lot about science.

What is a typical day like working at MPFI?
My typical day always starts off with a cup of coffee from our glorious Novak Druce Commons coffee machine that attracts a lot of patrons. While I am there I am able to talk with the best and brightest that MPFI has to offer. Eventually, I will steer the conversation towards safety related items and which gives me an opportunity to reinforce good practices with my coworkers. This also gets me geared up for the day ahead. After that I touch base with Susi, my amazing assistant, and then I sit down in my office to do paper work. My typical work day is constantly in flux, because there are quite a few areas that EHS has to watch over. I feel like I just constantly maintain the EHS programs, making sure that they are up to date and accessible. Of course, all of these programs are in place for the safety of MPFI personnel and the community, but we also need to follow the regulations. In addition to this, there are a smattering of other duties that have to be performed throughout the day, for example, moving air tables, setting up community lab spaces, and acting as a liaison between certain departments.

What do you consider to be your greatest achievement?
Family and work aside, I once ran 50 miles with 8000 feet of elevation gain in 10 hours 28 mins. Background: When I was working at the Vollum Institute in Portland, OR, one of my running buddies who also worked there gave me a book on long distance running, called “Born to Run.” This book really inspired me and changed my life. So, I ran with it. I started running longer distances. There is something about long distance running that really tests your mettle and makes you look at all aspects of your life from different angles. I trained for a year or so, ran the race, crossed the finish line and got an etched pint glass. This was 9 years ago...I still have that pint glass.

What have you learned since coming to MPFI?
When I came to MPFI in August of 2012, as a research technician in the Taniguchi Lab, it was still being built and most of the space was empty – including the lab I was working in. So, starting off, I learned how to set up a research laboratory from scratch. I left the research lab in 2016 for EH&S so I had to make the transition from lab life to admin life and learn about the culture shift that came with that.
Highly Successful Neuroimaging Techniques Course

From February 18 – March 02, MPFI hosted the fourth advanced Neuroimaging Course. The intensive and comprehensive laboratory-oriented program focused on applying imaging techniques to neuroscience research.

The objective of the course is for graduate students, post-doctoral students, and young investigators in the beginning of independent research careers to gain exposure to cutting-edge imaging tools from principles of optics to applications in modern neuroscience.

The two-week course included special lectures, collaborative discussions with distinguished scientists, and hands-on workshops highlighting novel neuroimaging techniques from leaders in the field, including Max Planck Society scientists, guest faculty, and lecturers.

Edvard Moser, Ph.D., Professor of Psychology and Neuroscience at the Kavli Institute for Systems Neuroscience, at the Norwegian University of Science and Technology (NTNU) in Trondheim, gave a special lecture. Dr. Moser was one of three joint recipients of the 2014 Nobel Prize for Medicine or Physiology for discoveries of cells that constitute a positioning system in the brain.
State Allocates $1.6 Million for MPFI Training Programs

The appropriation will continue to fund MPFI’s Scientific Fellows Program, which consists of neuroscience education and training initiatives at the undergraduate, post-baccalaureate, graduate and postdoctoral levels.
MPFI received $1,639,101 as part of the recently signed 2019-2020 State of Florida budget. The appropriation will continue to fund MPFI’s Scientific Fellows Program, in coordination with Florida Atlantic University (FAU), which consists of neuroscience education and training initiatives at the undergraduate, post-baccalaureate, graduate, and postdoctoral levels. In addition to training the next generation of neuroscientists, state funding also supports Sunposium, MPFI’s biennial neural circuits conference that brings together more than 400 scientists in West Palm Beach to share groundbreaking scientific findings. The conference has grown exponentially since it first began in 2015, and now attracts international speakers and multiple Nobel Laureates to discuss cutting-edge and often unpublished research on the brain.

"Training the next generation of researchers from Florida’s graduate institutions and beyond not only contributes to strengthening the supply of a highly educated workforce in Florida, but it is also pivotal for the nationwide recognition of the uniquely outstanding and internationally competitive scientific research and training environment at the Jupiter Life Sciences campus," said MPFI CEO and Scientific Director David Fitzpatrick. "We are grateful to Governor Ron DeSantis for recognizing the importance of these programs and funding them accordingly."

The Max Planck Florida Scientific Fellows Program, due to its international nature and the promotion of basic research, allows students to study alongside some of the world’s most renowned scientists, including several Nobel Laureates who regularly participate in MFPI events and conferences. The program provides critical support to researchers seeking to better understand how the brain works, which will ultimately help to cure some of the most devastating disorders and mental diseases affecting millions not only in Florida, but around the world.
Palm Beach County High School Students Get Hands-On Science Career Exposure at MPFI Event

MPFI hosted 70 local high school students and their teachers for Career Day, which took place on Saturday, September 21, 2019. Students and teachers enjoyed tours of MPFI facilities, and an interactive question and answer session. The 2019 panelists were Dr. Ken Dawson-Scully, Dr. Mary Phillips, and Melissa Ryan.

“Career Day” is an annual event that gives high school students the opportunity to meet and interact with Max Planck scientists. Panelists traditionally include scientists who are in different stages of their training, from post-baccalaureate students to principal investigators. 2019 Career Panel discussion explored many topics, including what inspired the scientists to choose a career in science, overcoming the challenges of balancing work and family, and what educational and research experiences got the researchers to the place that they are today.

The feedback from both teachers and students was overwhelmingly positive. “The lab tours and panel discussion are powerful tools to expose research pathways, triumphs and failures. It was amazing,” said Caitlin Holloway, a teacher from Santaluces High School. Student Sabrina Luu was also impressed with the event. “Being able to physically experience the technology and through sight and listening to established scientists’ accomplishments has made me more interested in neuroscience and engineering,” she said.

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 up to ten students to attend. The schools and teachers selected for 2019 included: Jessica Nadeau, Royal Palm Beach High School; Louis Harrigan, Boynton Beach High; Dr. Robert Ghassemi, Inlet Grove High School; Jennifer Munoz, Score Academy Palm Beach Gardens; Melinda Odgen, Atlantic Community High School; Dr. Ofelia Barletta Chacon, Palm
“Being able to physically experience the technology and through sight and listening to established scientists’ accomplishments has made me more interested in neuroscience and engineering,” Sabrina Luu, a student from Santaluces High School.

Beach Gardens High School; Caitlin Holloway, Santaluces High School; Michelle Lynne, Lake Worth High School; Floretta Barnes, Pahokee High School; and Renee Szeliga, The Benjamin School.
MPFI Welcomes High School Interns

This summer marked the 9th year of MPFI’s High School Internship program, which took place from June 10th to July 19th, 2019. The program received close to 100 applications for the six available spots in three different tracks: Neuroscience, Mechanical Engineering and Scientific Programming.

The six selected students were Lance Brown from William T. Dwyer High School, Ashley Cousin from The Benjamin School, Jose Delgado from Lake Worth High School, Eesha Shah from Spanish River High School, Katherine Shirley from Jupiter High School, and Brandon Wisnicki from Suncoast High School.

The students not only worked for six weeks in one of MPFI laboratories or core facilities, but they also had the opportunity to attend a light microscopy training, a pipetting boot camp and had hands-on experiences about electron microscopy and molecular biology. They also explored the Machine Shop, and had a fun team building activity at the Loggerhead Marinelife Center in Juno Beach.

For the first time ever, the high school interns presented in the Institute’s Journal Club, something that is usually led by graduate students or postdocs. Jose Delgado presented a research about a newly discovered neuronal circuit for mice social vocalization, while Ashley Cousin and Eesha Shah talked about a recent research dealing with memory function in the absence of experience.

The High School Summer Internship program is one of the staples of MPFI education outreach, and serves to inspire and give real hands-on research experience to excellent Palm Beach County high schoolers, that then go and study in the best universities of the Country. MPFI High School Alumni are indeed now studying in places like Harvard, MIT, John Hopkins, Duke, Yale, and . Dominic Russo, former Intern in the light microscopy core, is now part of the graduate program at UC Berkeley.

To learn more, visit 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.
What it’s Really Like in MPFI’s Postbac Program

Heather Holman was a member of the 2018-2019 Postbaccalaureate Research Experience Program at MPFI. Before coming to MPFI, Heather graduated from the University of Central Florida (UCF) with a double major in Biomedical Sciences and Sport & Exercise Science. She is attending the Medical University of South Carolina (MUSC) in the Medical Scientist Training Program (MSTP) where she is pursuing both an MD and Ph.D. with a focus on neuroscience.

Why was the MPFI Postbaccalaureate Research Experience program right for you?
I chose to apply to the MPFI program since I was looking for a postbaccalaureate program with a focus on basic neuroscience research and career development. MPFI was a perfect fit since I not only got the opportunity to be exposed to cutting-edge research, but I also learned coding and professional skills through the postbac meetings.

How has taking a year between undergrad and grad school helped your career focus?
Having the opportunity to pursue research full-time solidified my decision to pursue an MD/Ph.D. and conduct research throughout my career. The experiences I have gained through the PRE program have further developed my critical thinking skills and broadened my research knowledge which will certainly be beneficial during graduate school.

What experiences did you have in the Postbac program that stand out to you?
My year at MPFI has far exceeded my expectations. I have learned much more than I would have ever imagined. The equipment and resources available at MPFI are phenomenal, giving students the opportunity to utilize technology they probably would never be able to access anywhere else. The PRE meetings are led by researchers at the institute which gives students the ability to learn first-hand about what it is like to pursue a career in science and obtain useful advice about career development. Additionally, we were able to attend the Society for Neuroscience (SfN) Annual Meeting which exposed us to the latest neuroscience research and provided an awesome networking experience. We were also given the opportunity to take a course in Matlab coding which was not only useful for our projects in the lab but will also be helpful throughout our careers.

“I have learned much more than I would have ever imagined”
Heather Holman

Heather Holman, 2018-2019 Postbaccalaureate Research Experience fellow
MPFI Celebrates Science and Music Through Free Public Lecture Series
MPFI held three spectacular Science Meets Music Events in 2019, each drawing hundreds of guests to Benjamin Hall at the Benjamin School to hear from leading scientists and talented musicians.

The 2019 series began on January 9. MPFI CEO and Scientific Director Dr. David Fitzpatrick welcomed the audience of nearly 400 and outlined the evening’s themes of connections – between neurons in the brain, between music and science, and especially those between the audience and MPFI.

Dr. Moritz Helmstaedter, Scientific Director at the Max Planck Institute for Brain Research in Frankfurt Germany, was the evening’s speaker, and he astounded the audience with 3D models of neuronal networks that he has recently been able to map through crowdsourcing programs in his field of connectomics. He drew parallels between the worlds of computer-based artificial intelligence and neuroscience, sharing that technology in neuroscience has much in common with the growing field of AI and that the two fields are certain to be intertwined in the future.

The evening also featured music and lively commentary from the Palm Beach Symphony Chamber Ensemble, who performed selections from String Quartet in G Major, Op.77, No.1 by Joseph Haydn and movements from String Quartet in C Minor, Op. 18, No. 4 by Ludwig van Beethoven. Before each piece, cellist Claude Jaffé shared examples of how the brain reacts to music and even led the audience in interactive demonstrations that had everyone clapping and humming out loud.
Dr. David Poeppel, a director at the Max Planck Institute for Empirical Aesthetics, as well as professor of Psychology and Neural Science at New York University shared his research on how the brain processes music and language at the second Science Meets Music, which took place February 13. Using animations and humor, Dr. Poeppel gave fun and accessible explanations of the mechanics and vibrations of sound.

The Palm Beach Symphony returned to the stage to perform selections from the second movement from Cuatro Estaciones Porteñas (The Four Seasons of Buenos Aires) by Argentinian composer Astor Piazzolla as well as selections from Piano Trio No. 3 in B flat major, K. 502 by Wolfgang Amadeus Mozart.

Science met music yet again on April 10 in a very special family-themed evening of talks and performance. Hyungbae Kwon, scientific group leader at MPFI, was the featured speaker for the evening and his daughter, Seoyoung, performed on violin.

The theme of family was kicked off by CEO and Scientific Director David Fitzpatrick, who introduced his own family visiting from China, and announced – to the delight of the audience – that he and fiancé Debra Felber had married just days before. Dr. Fitzpatrick also recognized Nobel Laureate Edvard Moser, who was in attendance for the evening, and paid tribute to the late Bob Goldberg, Head of the Benjamin School who had passed away earlier in the month. Following the introductory remarks, the father-daughter duo of Hyungbae and Seoyoung Kwon took the stage.

Dr. Kwon spoke about his neuroscience research using light to identify and activate areas of the brain that are affected by emotion and experience. Showing fascinating videos, Kwon captivated the audience with his cutting-edge work understanding how the brain affects emotion and motivation, which earned him a prestigious NIH Pioneer Award earlier in the year. Seoyoung Kwon, accompanied by pianist Carina Inoue, performed works by Claude Debussy and Max Bruch with technical precision and passion, leaving the au-
Science Meets Music is a free event offered to the community each year as part of MPFI’s commitment to public outreach and community education. 2019 was the sixth year of the popular series, which began with a small audience in MPFI’s Elmore Auditorium and now draws several hundred attendees to the grandiose Benjamin Hall at the Benjamin Upper School. Music for the series is generously underwritten by Becky and Jimmy Mayer, longtime supporters of MPFI and its mission of engaging the community.
MPFI Scientists Collaborate on “Journey Through the Human Brain”

MPFI was part of the grand opening of “Journey Through the Human Brain” at the South Florida Science Center and Aquarium. Max Planck neuroscientists had the honor of working with our colleagues at the Florida Atlantic University Brain Institute and Scripps Florida on this fascinating project.

The Journey Through the Human Brain exhibit has a mission to inspire, educate, and provide hope for what can be accomplished through the ongoing neuroscience research taking place right here in South Florida.

You can visit Journey Through the Human Brain at South Florida Science Center and Aquarium, 4801 Dreher Trail North, in West Palm Beach from 9 a.m. to 5 p.m. Monday through Friday, 10 a.m. to 6 p.m. on the weekend.

For more information, call (561) 832-1988 or visit www.sfsciencecenter.org.
Palm Beach County Students Compete in MPFI’s Brain Bee Challenge

MPFI held its 8th annual Brain Bee Challenge Saturday, April 6, 2019. Nervous excitement filled the room as 57 Palm Beach County students readied themselves for a thrilling competition that would show which team knew the most about the brain. But the excitement was quickly replaced by confusion, when the first question was read: “What part of the brain is necessary for a Zombie to walk?”

Wait…Zombies?

While the first question was an ice breaker and a joke, the rest of the competition was no laughing matter as students in teams of three answered questions about learning and memory, emotion, sensation, movement, aging, neurobiology, brain anatomy and neural disorders.

In the end, two teams from FAU Henderson High School took the top two spots, with a third-place team coming from American Heritage School of Boca and Delray.

“We are so impressed with the number of young students in our community who are passionate about science and understanding the brain,” said Dr. Ilaria Drago, MPFI Head of Education Outreach. “Brain Bee is one of our signature events that we hold each year to raise awareness of the field of neuroscience and to help inspire the next generation of scientists.”

The 2019 Brain Bee Challenge also featured another competition as students, teachers, and parents tuned into a live webcast of the event hosted by the hosts of Max Planck Florida’s Neurotransmissions Podcast, Dr. Michael Smirnov and Dr. Joe Schumacher. The school with the most online participation won a 3D printer, courtesy of the Mary and Robert Pew Public Education Fund. More than 245 people watched the competition online, with Jupiter High School making up 60% of the online audience and winning the 3D printer.

The MPFI Brain Bee Challenge is held each year to increase public awareness of the importance, progress and benefits of brain research. The event is sponsored by the Mary and Robert Pew Public Education Fund. The Florida-based public education foundation has supported the event since its inception in 2012.

From left to right: Second place: Sajeev Sarkar, Mauricio Barba and Zachariah John (FAU High Team 2); First place: Sanjana Chandran, Noa Abiri, and Kiran Shirazi (FAU High Team 3); Third place: Nicolas Jo, Pavan Gudoor and Valentina Velasco (American Heritage School of Boca/Delray).
MPFI proudly exhibited the Max Planck Images of Science at the Pacific Science Center in Seattle Washington.

The exhibit features 16 striking images captured during the course of scientific research at several of the Max Planck Society’s more than 84 institutes. This was the second stop for the exhibition, which opened at Miami’s Patricia and Phillip Frost Museum of Science in December 2018. The Seattle exhibit was on display in the museum’s Ackerly Family Exhibition Gallery and Jeff and Alicia Carnevali Pavilion until January 2020.

Accompanying the exhibition was the “Images of Science” mini-documentary, which shares the perspectives of scientists from the Max Planck Florida Institute of Neuroscience who have seen beauty through the lens of their everyday scientific endeavors.

Science often strives to push the boundaries of the known world to explore new topics and make the invisible visible. In addition to purely scientific documentation of research objects, sometimes images are created that feature surprising aesthetic forms and structures — 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 from the most various research fields 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 the visitor 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 Pacific Science Center is an initiative of the Max Planck Florida Institute for Neuroscience, the Pacific Science Center and the Goethe Institute Pop Up Seattle, and was made possible through the generous
underwriting provided by Nancy and David Auth, and Raquel Rodriguez in memory of her parents. The exhibition was produced in collaboration with the Max Planck Society Germany, as part of 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. 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 engagement. The Year of German-American Friendship 2018/19 builds on this success story and aims to intensify the transatlantic dialogue.

The Max Planck Images of Science exhibition series highlights the successful collaboration between the Max Planck Florida Institute for Neuroscience, the Max Planck Gesellschaft, The Pacific Science Center, and the Goethe Institute, and was also supported by the German Federal Foreign Office, the Goethe Institute and the Federation of German Industries (BDI).
Brain Trust Celebration at the South Florida Science Center and Aquarium

Max Planck Florida Institute for Neuroscience honored members of its Brain Trust with a private reception that took place December 18, 2019. The event was held at the South Florida Science Center’s newest exhibition “Journey Through the Human Brain,” an interactive showcase of neuroscience designed to inform and entertain people of all ages.

Scientists from the MPFI played a major role in developing content for the exhibition, along with colleagues at the FAU Brain Institute and Scripps Research. Brain trust members enjoyed the 30 interactive exhibits and activities that the exhibit offers, making for an evening of both information and fun.

MPFI’s Brain Trust is a group of forward-thinking supporters who understand the complexities of brain disease and the importance of supporting the curiosity-driven research being performed by Max Planck Florida Researchers.

Max Planck Florida’s CEO David Fitzpatrick took the opportunity to thank those in attendance for their donations during 2019, which provided MPFI scientists with the freedom, technology and financial means to conduct creative, bold research that tackles the big questions about the mysteries of the brain.

Noting that donations from Brain Trust members played a major role in MPFI’s accomplishments, Dr. Fitzpatrick told guests “This evening is really a celebration of you, and all that our institute has accomplished because of your support. You have played a part in every achievement and every discovery, and as this exhibit shows us, when we share our knowledge it will inspire the next generation of researchers.”

“Journey Through the Human Brain” is a collaboration with Max Planck Florida Institute for Neuroscience, the Florida Atlantic University (FAU) Brain Institute, the University of Minnesota, Scripps Research, Florida, CareerSource, and several other national and international partners.

To learn more about Max Planck Florida’s Brain Trust, please visit mpfi.org/braintrust or call Martha Hafele at (561) 972-9027.
Mindfulness: 
An Everyday Tool to 
Improve Brain Health

The practice of mindfulness and meditation has been around for centuries, and now we have the ability to see how these practices change the wiring of our brains.

Dr. McLean Bolton is a familiar face among Max Planck scientists and donors. As a Research Group Leader, she studies disorders of neural circuitry and is an advocate for those with mental illness. She is a board member for the National Alliance on Mental Illness of Palm Beach County (NAMI/PBC), which provides education, support and advocacy to individuals living with mental illness and their families. She has written on mindfulness meditation as a way to calm your mind and gain greater control over executive functions, and there is compelling science to support it.

What is mindfulness? It is the practice of focusing your attention on experiencing the present without judgment from the past or worries about the future. Whereas it trains the brain to focus on sensory perception and motor behaviors as you experience them. Typically, this is done by intentionally breathing and introspective body scanning. Evidence suggests that mindful meditation changes the balance of brain activity between the higher-order cortical regions responsible for controlling attentional networks.

Studies with MRI, EEG, FMRI, and DTI show that long time practitioners of mindful meditation can better regulate the brain regions responsible for keeping the mind on rewarding topics and they show there is increased interconnectivity between the brain’s attentional networks that help to keep one focused. Over time mindfulness training can help change the patterns of brain activity because the synapses within the attentional networks can strengthen or weaken with use. Mindfulness can be used in the management of many mental illnesses such as depression, anxiety disorders, PTSD, and schizophrenia spectrum disorders, where runaway thoughts from within can prevent one from processing information from the world around you and accomplishing goals. There is evidence it can also improve cognitive abilities for anyone dealing with stress, intermittent negative emotions, or pain.

As mindfulness becomes increasingly popular in health clubs, apps, and schools, consider joining a class and train your brain to be present and maintain a calm state of mind.

About McLean Bolton’s Research at MPFI:

The goal of McLean’s research is to understand how neural circuits are altered in neuropsychiatric disorders, such as autism and schizophrenia. These complex behavioral disorders are caused by a combination of genetic and environmental factors. Studying the impact of these mutations on brain function may identify points of intervention to correct the circuit imbalances in these neuropsychiatric disorders. The Bolton Lab combines optogenetics, patch-clamp electrophysiology, 2-photon imaging, and behavioral studies to map local circuit and long-range synaptic connectivity in mouse models of these disorders and to relate these circuit changes to behavioral abnormalities and neuronal activity patterns during behavior.
How Donors Impact Our Science
A profile on MPFI’s
Dr. Ben Scholl

From my beginning here at MPFI, there’s been opportunity to grow professionally. It’s a very interesting situation where scientifically I can do whatever I want. If I come up with a new idea, or a new experiment or even a new collaborator, MPFI always makes resources available to make those projects come together.

When I began, I was able to take advantage of the resources already available in my lab, like developing unique viral vectors and testing out new optical equipment. But as my career progressed, I’ve been able to do even more, with independent collaborations with researchers both in and outside of the Max Planck Society. Even within MPFI, I’ve been able to work with our EM core to incorporate light microscopy into EM microscopy, which is something I never saw myself doing before I came to MPFI. But that’s the type of opportunity that just kind of comes naturally out of being here at MPFI.

The institute has been very generous in allowing me to bring new technologies to the institute and explore different dimensions that I previously didn’t think were possible. I’m currently working on building a custom two-photon microscope that has other capabilities that incorporate novel technology and that aren’t commercially available.

By providing this support to its researchers, MPFI’s goal is to expedite research and reward creative thinking. If you work hard, you can basically think outside the box because there isn’t really a restriction on what you can or can’t do here. In other settings, you are held back by time, or maybe a resource you need is going to take six months to arrive if you can get it at all. Here we have a lot of resources already in place and as long as you come up with an interesting idea, you can take it and run with it. That’s not to say that it makes the science easier, because in many cases you are doing things that are unknown to you - and often unknown to anyone. I had one idea that incorporated electron microscopy that was a little challenging to get everyone on board at first, but we worked on it, because we knew it was possible, and now it’s become a standard technique. And this was only possible because all the pieces were here, the equipment was available, the technology was here. We just had to think it through, put it all together, and make it work.

My time at MPFI has definitely shaped who I am as a scientist. Four years ago I couldn’t have predicted I would be working on the projects that I’m working on, thinking of the ideas that I’m thinking of, giving the talks that I’ve given... this environment has given me an explosive amount of transformation in my scientific aptitude and put me on a trajectory that I never imagined would be possible.

The MPFI environment has given me an explosive amount of transformation in my scientific aptitude and put me on a trajectory that I never imagined would be possible.”

Dr. Ben Scholl, Research Scientist in the Functional Architecture and Development of the Cerebral Cortex Lab at MPFI

"
THANK YOU!
We recognize 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.

$1,000,000 AND MORE

DAVID C. AND NANCY L. AUTH
ALEXANDER AND RENATE DREYFOOS
WILMA A*. AND GEORGE T. ELMORE
PATRICIA B. AND HOWARD M. LESTER*

*Deceased

$1,000,000 - $100,000

Bright Focus Foundation
The Celia Lipton Farris & Victor W. Farris Foundation
The David Minkin Foundation
Human Frontiers of Science Foundation
J.M. Rubin Foundation
Jana and Kenneth F. Kahn
Leonard and Norma Klorfine Foundation
Michael J. Fox Foundation
Jess R. and Victoria J. Santamaria
Carolyn and Richard Sloane
Whitehall Foundation
Thank You, Max Planck Florida Brain Trust Members
Your Annual Gifts Create a Legacy of Discovery

10,000+
Dr. Dirk & Rosemarie Basting
Mark W. Cook
Corporate Creations Foundation, Inc.
Freeh Group International Solutions
Jackie and John R. Hannon
J.M. Rubin Foundation
John H. and Mary Ann Johnson
Jana and Kenneth F. Kahn
Nasser and Yvonne Kazeminy
Hilary and Thomas Lynch
Becky and Jimmy Mayer
Bonnie McElveen Hunter
David Minkin Foundation
Gregory V. Novak and Tracy W. Druce
Mr. and Mrs. George J. Michel, Jr.
Donn Shapiro and Dolores Keating-Shapiro Charitable Foundation
Tracy Siani
Ryohei and Hiroko Yasuda

2,500+
Anonymous
Bill and Gail Boyan
Randell and Rebecca Doane
Mr. and Mrs. George J. Michel, Jr.
Donn Shapiro and Dolores Keating-Shapiro Charitable Foundation
Tracy Siani
Ryohei and Hiroko Yasuda

1,000+
Anonymous
Karol S. and Paul T. Costa
Marie and Ted Deckert
Margaret Donnelley
Dr. and Mrs. Robert A. Flucke
Gaynelle and Vernon Grizzard
Herme de Wyman Miro, International Society of Palm Beach
Helga and John Klein
Renee K. and William C. Lickle
Barbara and Michael Mitrione
Gretchen Schaefer
Dr. William and Nancy Schneider
Ardean and Doug Wessel
Susan Zuckert and Steve Rogers

$5,000+
David C. and Nancy L. Auth
Alexander and Renate Dreyfoos
George T. Elmore
David Fitzpatrick
Edward R. Griffin
Nancy Sale Frey Johnson Family Fund
Marsha and Henry Laufer
Milton and Tamar Maltz Family Foundation
Raquel Rodriguez
$500+
Anonymous
Robyne and Herb Camp
Regina Conlon and Jamie Conlon-Silverman
Joseph M. Considine
Elizabeth and James J. Craig, Jr.
D.W. Creed
Elissa Dini and John Stanzioni
Averell and Eileen Eisner
Janet Ellis
James and Maurine Falcone
Maureen Fitzpatrick and Gerry Neipp
Frank J. Folz, III
Ludmilla Goldberg and Michael Goldstein
Roy L. and Carole Haje
Theresa Halstead
Neen and William M. Hunt
Myriam and Nestor A. Kleer, M.D.
Judith Z. and Paul M. LaKind
Alex Magee
Marjorie S. Morely and Wes Annas
Barbara Sufias Noble
Perk and Irene Pedrick
William Pennell
John and Stephanie Pew
Lori Price
Rogers Family Foundation
Charles R. and Katherin Sakin
Dr. and Mrs. John A. Schaefer
Doug and Arianne Tepper
Joan and Dieter A. Thiemann
Arnold Utzinger
Arthur A. Vercillo
Renee and John Weisman

$250+
Anonymous
Susan Barasch and Richard Elliott
Best Horizons Foundation, Inc.
Dr. and Mrs. John Rodney Blair
Dr. John W. Arnold and Mrs. Gail W. Bolton
McLean Bolton
Emmy and Robert Buckman
John and Michelle Carr
Don and Michele Chattaway
Andrea and Ken Dawson-Scully
Debra Elmore/AK Consulting
William and Georgia Fike
Doris and Brian Forchheimer
William H. Gillas
Martha Hafele and Henry Mather
James N. Hauslein
Platt and Nancy Johnson
Florence Kaslow, Ph.D., ABPP
Olaf and Elaine Lieberg
Gary and Amy Ma
Maria E. Mamlouk
Mr. and Mrs. Paul W. Massey
John D. McKendrick
Bryan and Andrea Moody
Hon. Edward J. and Florence Mullarkey
Seymour Musiker
Katie and Andy Newitt,
A-1 Moving and Storage
Markus Nolfi
Timothy and Andrea Palmer
Tony and Lori Pasko
Angela Pica
Sarah Pietrafesa
Dilys and Lawrence Port
Joanne Rupers
Frank and Carole Salluzzo
Don and Karlyn Shapiro
Raj Shekhart
Joseph C. and Melanie Shugart
Diane Storin and Jerry Goldhuber
Elaine and Stephen Timbers
Carol and Jerry Trautschold
Dr. and Mrs. F. Van Poznak
Mark and Tina Veil
Linda Miller
Jenifer Wilbers
Judith M. Williams
Barbara Benson Wymer

In addition, we wholeheartedly thank our numerous donors who give less than $249 annually. Together we’ll provide a curiosity-driven research environment where creativity, innovation, and dedication drive tomorrow’s scientific discoveries.

As of January 1st our new donor recognition period will be July 1st through June 30th. To provide the appropriate donor recognition during this transition, this list reflects the generous donations received from January 1, 2019 through June 30, 2020. If you have questions about being recognized please contact giving@mpfi.org.
Board of Trustees

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

Dr. David C. Auth, Ph.D., P.E., NAE
Chairman and CEO, Coaptus Medical Corporation

Mr. Mark W. Cook
President, Royal Palm Management

Mr. George Elmore
Founder and President, Hardrives, Inc.

Dr. David Fitzpatrick
Scientific Director and Chief Executive Officer
Max Planck Florida Institute for Neuroscience

Judge Louis J. Freeh
Founder and Chairman, Freeh Group International Solutions, LLC Founder and Partner, Freeh Sporkin & Sullivan, LLP

Mr. Frank J. Folz, III
Managing Director, AE Capital

Professor Dr. Bill S. Hansson
Chairman of the Board of Trustees
Director, Department of Evolutionary Neuroethology
Max Planck Institute for Chemical Ecology

Mr. Erik E. Joh, Esq.
Special Council, Hinman, Howard & Kattel

Mr. Nasser J. Kazeminy
Founder and Chairman, NJK Holding Corporation

Mrs. Becky Mayer
Co-leader of the Good Life Seminars for personal advancement

Mr. Kenneth F. Kahn
President, LRP Publications

Hon. Bonnie McElveen-Hunter
CEO & Owner, Pace Communications

Mr. James R. Mellor
Chairman, USEC Inc.

Mr. Michael V. Mitrione
Co-Chair of Corporate Practice Group, Gunster, Yoakley & Stewart, P.A.

Mr. Gregory V. Novak
Vice-Chair Intellectual Property Group, Co-Chair IP Litigation, Polsinelli, PC

Ms. Jane Panattoni
Philotnropist and Nonprofit Leader

Mr. Bernard J. Poussot
Retired Chairman, Wyeth

Mr. John Sculley
Chairman, RxAdvance

Mr. Markus Schleier
Max Planck Society for the Advancement of Science

Dr. James N. Weinstein
Immediate past CEO and President, Dartmouth-Hitchcock Health

Professor Dr. Peter Gruss – Chairman Emeritus
President, Max Planck Society for the Advancement of Science (2002-2014)

Mr. Alexander W. Dreyfoos - Trustee Emeritus
Chairman, The Dreyfoos Group
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