2021 YEAR IN REVIEW

MAX PLANCK FLORIDA ANNOUNCES COLLABORATIVE PARTNERSHIP WITH INTERNATIONAL MICROSCOPY MANUFACTURER

RESEARCH HIGHLIGHTS
MPFI Debuts New Science Web Series

SCIENTIFIC LEADERSHIP
Wang Lab Receives $2.4 million NIH Grant to Study Memory
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Dear Friend of MPFI,

Welcome to our 2021 Year in Review, an opportunity to share some of the incredible accomplishments that our institute has achieved in the past year. Despite being in our second year of the COVID-19 pandemic, Max Planck Florida thrived – thanks to the dedication of our staff, and the support from members of our community like you.

This year, Max Planck Florida researchers had 16 high impact papers, bringing our institute’s total to 178 since we were founded. From understanding how synapses learn, to mapping how cortical circuits view the world, our researchers made great progress in our goal of understanding the structure and function of the brain.

During 2021 our research groups were awarded more than $8 million in grants and funding, including a nearly $2.4 million NIH RO1 grant awarded to the Wang Lab. Other prestigious awards this year include the Inagaki Lab’s $250,000 Klingenstein-Simons fellowship, and the Stern Lab’s $300,000 One Mind Eating Disorders Rising Star Award.

But publications and grants are just one of the ways that Max Planck Florida researchers stand out. What’s harder to quantify are the impacts made when our scientists share their exciting work with the community, or when a student is inspired to imagine a career in science. We cannot calculate the value of learning new information about the world around us, and we can’t measure the hope that comes when we make even more progress understanding how the brain works. These are the results of a curiosity-driven culture, one where we seek understanding and aspire to share our knowledge with the world.

2022 will mark the tenth year since we opened the doors of the Max Planck Florida Institute right here in Jupiter, Florida. We are proud of all that we have accomplished – both measurable and intangible – and are excited about what the future holds for all of us at Max Planck, and for you, our dedicated supporters. Thank you for all that you do to advance curiosity-driven science and discovery!

Sincerely,

David Fitzpatrick, CEO and Scientific Director
MPFI’s Dr. Naomi Kamasawa (left) and Dr. Nicolai Urban (right) are world recognized leaders in scientific imaging.
Zeiss and Max Planck Florida Announce Collaborative Partnership

In January 2021, Max Planck Florida announced that it has formed a research collaboration partnership with international microscope leader Zeiss. This partnership builds upon MPFI’s relationship with Zeiss, who named the institute as a labs@location partner in 2019. By providing MPFI with the most advanced imaging capacity, researchers will be able to more accurately visualize and understand tiny connections in the brain, leading to a greater understanding of how it works.

Using an LSM 980 NLO next generation confocal microscope supplied by ZEISS, MPFI will investigate using implanted GRadient INdex (GRIN) lenses in combination with the Airyscan 2 area detector for deep brain functional neuroscience research.

Airyscan 2, an area detector with 32 concentrically arranged detection elements, provides a unique combination of gentle super-resolution imaging and high sensitivity. Combining Airyscan with GRIN lens technology enables increased resolution and signal-to-noise while imaging regions of the brain that are unreachable with traditional in vivo microscopy.

“We are excited to announce this new collaborative research partnership, which will provide ZEISS equipment to MPFI researchers for explorative research for publication and IP generation,” said Joseph Huff, ZEISS Microscopy’s Head of Marketing, North America. “The partnership will increase both partners’ application and methodology know-how and best practices. In addition, information gained will be used to inform ZEISS’s solution and product creation process.”

Max Planck Florida is known for bringing together exceptional neuroscientists from around the world to answer fundamental questions about brain development and function and to develop new technologies that make groundbreaking scientific discoveries possible. According to Dr. Nicolai Urban, MPFI’s Microscopy Specialist, “The Airyscan 2’s impressive boost to speed and sensitivity has greatly benefited our research in multiple areas. Working together with ZEISS experts will allow us to explore and push the boundaries of implementing this technology in equally daunting and exciting imaging conditions.”

Max Planck Florida is part of the world-renowned Max Planck Society, and the only institute of its kind located in North America. The organization’s imaging core is internationally recognized as a leader in cutting-edge neuroscience microscopy.

As part of the partnership, ZEISS and Max Planck Florida will co-sponsor, host, and support academic research workshop activities and internal training focusing on deep brain functional imaging using ZEISS Airyscan and other ancillary technology. Max Planck Florida research staff will present lectures about their ongoing research and best practices for functional neuroscience imaging.

MPFI and Zeiss Partner Training Events 2021

Building on Max Planck Florida’s partnership with Zeiss Max Planck Florida co-hosted three advanced imaging training events, featuring MPFI imaging experts Naomi Kamasawa, head of MPFI’s Imaging Center and Nicolai Urban, Head of Light Microscopy.

Dr. Urban shared his expertise and workflows using state-of-the-art Zeiss Imaging technology to an international audience of scientists. The webinar took place on Tuesday, April 20, 2021 and explored the basics of a hybrid imaging approach, explained the workflows involved in recording head-fixed data using a ZEISS LSM 980 confocal microscope, and showed multispectral volumetric and functional data recorded using this method.

In October, Dr. Kamasawa presented “Correlative microscopy workflows to link functional spine imaging and volume EM” sharing her practical tips and personal experiences to achieve optimal results.

The following month, Dr Urban, presented a talk entitled “Enhancing miniscope recordings of freely behaving animals with high-resolution, multicolor Airyscan imaging”.

The focus of these workshops centers on the unique workflows developed by MPFI’s imaging experts and how these techniques can be applied to deep brain functional imaging using ZEISS Airyscan and other ancillary technology.

MPFI is grateful to Zeiss for their generous ongoing support of our research infrastructure and look forward to continuing to share our expertise to help educate a wider audience.
Max Planck Florida Launches “Curiosity Meets Discovery” Series

It’s rare to get a glimpse of the life-changing research that takes place in one of the 86 world-renowned Max Planck Institutes but now the Max Planck Florida Institute for Neuroscience (MPFI) is shining a light on the talented scientists who drive this research forward. “Curiosity Meets Discovery, a new monthly web series, debuted September 15, 2021. The series features a Max Planck researcher sharing their science with the public, followed by a discussion of the topic hosted by MPFI CEO and Scientific Director Dr. David Fitzpatrick.

The Germany-based Max Planck Society has 86 institutes worldwide, and its researchers have won the Nobel Prize a staggering 29 times, including two in 2022 alone. Max Planck Institutes take on groundbreaking research across the entire spectrum of the sciences, using a curiosity-driven approach to discovery and encouraging high-risk projects that have the potential to yield high rewards. Max Planck Florida, which is the only Max Planck Institute in North America, conceived of the series to help bring the latest Max Planck discoveries to a larger, international audience of science enthusiasts.

“There is such incredible work being done in the Max Planck Society by some of the most talented and creative thinkers of our time. It has been a tremendous pleasure to talk with these scientists and learn about their discoveries. I can’t wait to share these conversations with a wider audience,” said Fitzpatrick.

In its inaugural season, “Curiosity Meets Discovery” featured researchers from a variety of disciplines who study topics like moral courage, aging, and climate change. The series even included a special episode with 2020 Nobel Prize Winner Reinhart Genzel discussing his award-winning research on black holes.

CURIOSITY MEETS DISCOVERY: SEASON ONE:

1 | Anna Baumert – The Science of Moral Courage
Wednesday, September 15, 2021

Anna Baumert is Professor for Social and Personality Psychology at the University of Wuppertal and head of the Max-Planck research group “moral courage” at the Max-Planck Institute for Research on Collective Goods in Bonn. Currently, she is associate editor for Personality Science and elected member of the Executive Committee of the European Association for Personality Psychology. She embraces and promotes the values of inclusivity, openness and transparency in science.
Dario Riccardo Valenzano leads a research group at the Max Planck Institute for Biology of Ageing and at the CECAD in Cologne, Germany. He studied neuroscience at the Scuola Normale Superiore in Italy and did a postdoc at Stanford University in the USA. His research focuses on understanding how species in nature evolved to have varying lifespans and investigates the role of commensal gut microbes during the aging process. His main model system is the naturally short-lived turquoise killifish which he studies in his lab in Cologne and in its natural habitat in the African savannah.

In this episode we were honored to welcome Nobel Laureate Prof. Reinhard Genzel who stunned the world with his research proving that black holes do exist in the universe. Dr. Reinhard Genzel is a director and scientific member at the Max Planck Institute for Extraterrestrial Physics. He studied physics at Bonn University and earned his doctorate at the Max Planck Institute for Radioastronomy. Dr. Genzel worked as a Postdoctoral Fellow at the Harvard-Smithsonian Center for Astrophysics before becoming Associate Professor of Physics and Associate Research Astronomer, at the Space Sciences Laboratory, of University of California, Berkeley.
where he later became Full Professor. He joined the Max Planck Institute for Extraterrestrial Physics in 1986, while continuing his affiliation with the University of California and pursing his work understanding the Galactic Center. In 2020, Reinhard Genzel was awarded the Nobel Prize for Physics together with colleagues Roger Penrose and Andrea Ghez for their revolutionary work into black holes.

4 | Bjorn Stevens – Understanding Climate Change
Wednesday, December 15, 2021

Bjorn Stevens is Director of the Max Planck Institute for Meteorology (Hamburg, Germany), where he heads the Atmosphere in the Earth System Department. He holds a professorship at the University of Hamburg and was formerly Professor of Atmospheric Sciences at the University of California, Los Angeles (UCLA). He chairs the Climate Change committee of the BBVA Foundation Frontiers of Knowledge Awards. He holds the Clarence Leroy Meisinger Award of the American Meteorological Society and in 2009-2013 served as a lead author of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC).

5 | Alex Rutherford – Myths About Automation and Present-Day Work
Wednesday, January 19, 2022

Alex Rutherford is a Senior Research Scientist and Principal Investigator at the Max Planck Institute for Human Development in Berlin. He is the Principal Investigator for the research theme on Machines and the Future of Work. In addition to academic training at Warwick University and University College London in the UK, Alex worked as a data scientist in UN headquarters in New York.

6 | Nicole Dubilier – Living Together in the Dark: Symbioses between Bacteria and Marine Animals
Wednesday, February 16, 2022

Prof. Dr. Nicole Dubilier’s is a Director at the Max Planck Institute for Marine Microbiology. Her research has fueled a major change in our understanding of the importance, diversity and function of symbiosis in marine environments. In this presentation she will share the questions that her lab explores as well as the toolkit of methods they use to understand the ecology and evolution of these fascinating host-microbe associations.

7 | Ursula Rao – Doing Algorithmic Governance
Wednesday, March 16, 2022

Dr. Ursula Rao, a Director at the Max Planck Institute for Social Anthropology, uses case studies from India’s vast experience in digital and biometric governance to explore the process of making functional new forms of algorithmic governance. She directs attention to the role of human imagination and techno-optimism as critical components of future-making and examines the critical importance of hope when struggling to improve technology for a brighter tomorrow.

To learn more about the series and to sign up for episodes, visit www.mpfi.org/curiosity.
1. Anna Baumert
   Max Planck Institute for Molecular Breeding, Germany

2. Turquoise killifish (Nothobranchius furzeri)
   - 3 weeks
   - 4 weeks
   - 6 weeks


4. Hydrothermal vents are the ‘zambeskis’ of the deep seas

5. David FitzPatrick
   Max Planck Institute for Molecular Breeding, Germany

6. Ursula Rao
   Max Planck Institute for Molecular Breeding, Germany

7. David FitzPatrick
   Max Planck Institute for Molecular Breeding, Germany
The CDC’s Autism and Developmental Disabilities Monitoring (ADDM) Network estimates that 1 out of every 54 children has been identified as being on the autism spectrum, but little is known about the neurological origins of this condition.

Dr. McLean Bolton, research group leader at MPFI studies neurological disorders such as autism, and has found interesting patterns that could one day lead to a better understanding of the causes of this neurodevelopmental disorder. Neurons are not all the same, and instead, have very specific functions that affect our day-to-day interactions. In the Bolton lab, researchers have identified neural circuits related to Autism Spectrum Disorder (ASD) and have developed techniques to isolate and manipulate individual neurons, using state-of-the-art imaging techniques. Through these methods, the Bolton Lab has been able to send signals, called action potentials, to directly alter behavior in mice models. Observing which cells impact behavior helps to create a “road map” of sorts, to help researchers better navigate which parts of the brain have specific neurological impacts.

Many projects of the Bolton lab focus on the amygdala, part of the brain associated with the formation and storage of emotional memories. Researchers want to know how adverse experiences and genetic variations can shape emotional characteristics of ASD, such as anxiety and interpersonal difficulties. The lateral amygdala receives sensory information from both the thalamus and cortex and can cause the brain to associate negative experiences with ones that would otherwise be neutral. When this occurs, these normal, everyday occurrences have the potential to be mistaken as sources of anxiety and stress.

Research like what is being done in the Bolton lab has never been done before and often relies on custom-built tools and emerging technology. But the work is important – as Max Planck once said, “Insight must precede application.” Understanding the basic building blocks of the brain is critical to learning how it works, and it’s not until we achieve this understanding that we can pave a way forward. But thanks to researchers like McLean Bolton, we are moving closer to that landmark every day.
Max Planck Florida Researcher Wins Klingenstein-Simons Fellowship Award

Hidehiko Inagaki, a research group leader at the Max Planck Florida Institute for Neuroscience, has been selected as a Klingenstein-Simons Fellowship Award Winner.

This prestigious award provides innovative, early-career neuroscientists with $225,000 in funding to pursue cutting-edge questions into how the brain works. This highly competitive award was established in 1981 by Esther A. and Joseph Klingenstein Fund, who forged a partnership with the Simons Foundation in 2013 to launch the Klingenstein-Simons Fellowship Award in Neuroscience. It is only given to a select number of researchers who are pursuing high-risk, high-reward projects and show exceptional promise to become leaders in the field of neuroscience.

Dr. Inagaki started his Research Group Leader position at the Max Planck Florida Institute for Neuroscience (MPFI) in September 2019 leading the Neural Dynamics and Cognitive Functions research group. His current research focus is to understand cellular and network mechanisms underlying cognitive functions, such as purposeful movement initiation and time perception, in mice. The Klingenstein-Simons Fellowship Award will specifically fund a project related to movement initiation.

“We study flow of information processing in the brain, which underlies initiation of planned actions. The proposed research could help explain paradoxical kinesis, where motor disorder patients experiencing difficulty in self-initiating actions can move smoothly in response to sensory events, a phenomenon which cannot be explained by existing models of motor control. Thus, our findings may serve as the basis to improve treatments of motor disorders,” said Inagaki.

In addition to the Klingenstein-Simons Fellowship Award, Dr. Inagaki is recipient of numerous honors including the Harold M. Weintraub Graduate Student Award, the Larry Katz Memorial Lecture Award, the Peter and Patricia Gruber International Research Award in Neuroscience, and the Searle Scholar Award.

To learn more about his research, visit https://www.mpfi.org/science/our-labs/inagaki-lab/

Rangaraju Lab Receives Grant from the Louis D. Srybnik Foundation

Max Planck Florida Institute for Neuroscience announces that Dr. Vidhya Rangaraju’s Neuroenergetics Lab has been awarded a grant from the Louis D. Srybnik Foundation, Inc. to study the underlying neuronal chemistry of mitochondrial function.

This grant will allow Dr. Ilika Ghosh, a postdoctoral scholar in the Rangaraju Lab, to expand on a new technique the lab developed to visualize a chemical called adenosine triphosphate (ATP) during synaptic plasticity.

The brain consumes a high amount of energy for cognitive functions such as learning and memory. Glucose is the primary brain fuel broken down by various biochemical pathways to produce the energy currency, ATP. A significant part of this happens in mitochondria in the brain.

How mitochondrial ATP synthesis is controlled during learning and memory is still not well understood, even though mitochondrial dysfunction is known to play a role in many age-related neurodegenerative diseases such as Alzheimer’s, Huntington’s, and Parkinson’s disease.

The Rangaraju Lab hopes to reveal the role of ATP in synaptic plasticity by using cutting-edge techniques to visualize and measure ATP in spines and dendrites. Identifying the energy sources and molecular factors that drive plasticity will provide essential insights into ATP regulation in memory formation.

Currently, in the US alone, over 6.2 million people above the age of 65 have Alzheimer’s disease, and by 2050, this number is estimated to rise to 13 million. Since mitochondrial dysfunction is a known cause of neurodegeneration and dementia, learning about the mechanisms that regulate mitochondrial ATP is critical to understanding memory formation and cognition.

“We are grateful to the Louis D. Srybnik foundation for their support. We hope that our results may lead to the development of future diagnostic and therapeutic strategies for the millions of people who suffer from the impacts of neurodegenerative disease,” said Dr. Ghosh.

To learn more about her research, visit https://mpfi.org/science/our-labs/rangaraju-lab/
Wang Lab Receives $2.4M NIH Grant to Study Memory

The National Institute of Neurological Disorders and Stroke of the NIH has awarded Max Planck Florida's Wang Lab an R01 grant in the amount of $2.4 million over 5 years. This funding will support the lab’s ongoing research to better understand how neural circuits within the hippocampus form episodic memories, and how these circuits are altered in conditions such as Alzheimer’s Disease and dementia where episodic memory is impaired.

Episodic memory is a unique type of memory that enables us to mentally travel back in time to re-experience specific episodes that have occurred in our lives. During memory encoding, continuous experience is encoded into episodes each containing a sequence of temporally organized events; however, little is known about the neural circuits that perform computations to parse experience and encode sequential events.

More than 6.2 million Americans suffer from Alzheimer’s disease, and the economic impact to the nation tops $350 billion, yet very little is known about the circuits in the brain that are affected by this devastating disorder.

“Revealing how the hippocampal circuits perform these computations will provide key insights into understanding episodic memory both in health and in pathological conditions such as dementia and Alzheimer’s disease where patients’ life quality is profoundly disrupted due to impaired episodic memory,” said Research Group Leader Yingxue Wang.

Dr. Wang joined the Max Planck Florida Institute for Neuroscience in February 2018 leading the Neuronal Mechanisms of Episodic Memory research group.

Before joining MPFI, Wang was a research scientist at the Janelia Research Campus of Howard Hughes Medical Institute, working with Dr. Jeffery Magee and previously with Dr. Eva Pastalkova. At Janelia, she studied the hippocampal neuronal activities that represent memory traces. In particular, she employed memory tasks that can reversibly toggle the influence of sensory inputs on and off and isolated neuronal activities associated with internally stored memory.

Dr. Wang was trained as an electrical engineer. She completed her graduate study under the mentorship of Drs. Shih-Chii Liu, Tobi Delbruck and Rodney Douglas at the Swiss Federal Institute of Technology Zurich (ETHZ). During her Ph.D. training, she designed brain-inspired computational systems on silicon chips. These fully reconfigurable systems incorporated electronic circuits of a network of neurons with dendrites and synapses. Using these systems as simulation tools, she also investigated the computational principles native to a neuron with active dendrites. Her current work combines electrophysiological, imaging, and optogenetic and chemogenetic approaches with computational modeling to reveal the details of neuronal circuits underlying our ability to remember, think, and plan.

“I am profoundly grateful for the support this grant provides, and with this funding I look forward to gaining critical insights into the neuronal circuits behind our ability to selectively encode daily experience into memory episodes,” said Dr. Wang.

This work was supported by the German Max Planck Förderstiftung (Max Planck Foundation) and Max Planck Florida Institute for Neuroscience. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the funding agencies.
MPFI Research Group Leader Awarded Multiple Grants to Study Eating Disorders

Max Planck Florida research group leader Dr. Sarah Stern has been awarded the 2021 One Mind – Donna Friedman Rising Star Eating Disorders Research Award. The One Mind Rising Star Awards identify and fund pivotal, innovative research on the causes of and cures for brain health conditions by supporting the most promising emerging leaders in the field of neuropsychiatry.

The $300,000 grant supports Dr. Stern’s work developing new behavioral models to identify the neural circuits underlying maladaptive feeding behaviors and help define molecular targets for therapeutic interventions.

In addition, The Brain Research Foundation has awarded Dr. Stern an $80,000 grant to advance her research into brain structures that regulate behavior related to eating habits. By better understanding how the brain interprets signals like hunger, we hope to one day be able to better understand devastating conditions such as anorexia and bulimia.

Eating disorders involve learned behaviors, with symptoms exacerbated by associative cues. Dr. Stern hypothesizes that a specific brain circuit (connecting the insular cortex and the central amygdala) controls feeding based on learned information. This circuit may contribute to the development of maladaptive feeding behaviors, including those relevant for eating disorders. Using chemogenetics, transcriptomics, and in vivo calcium imaging techniques, Dr. Stern will investigate this brain circuit and test the hypothesis with behavioral tasks that measure anorexia-like behaviors in mice.

Sarah Stern is a Research Group Leader at the Max Planck Florida Institute for Neuroscience. Her research group focuses on elucidating the neural circuits underlying maladaptive feeding behaviors that lead to obesity and eating disorders. Prior to this, Dr. Stern was a Postdoctoral Fellow at Rockefeller University in the laboratory of Dr. Jeffrey Friedman, where she used her expertise in memory and rodent behavior to study the neural circuitry of how environmental cues lead to non-homeostatic overconsumption, as well as the intersection of stress and feeding relevant to anorexia nervosa.

Dr. Stern earned her Ph.D. in 2014 from the Icahn School of Medicine at Mount Sinai in the laboratory of Dr. Cristina Alberini, where she studied the role of Insulin and IGF-II on memory consolidation and enhancement, as well as the role of astrocytic lactate signaling on long-term memory formation and consolidation. Prior to that Dr. Stern conducted research with Dr. Joseph LeDoux as an undergraduate student at New York University, where she graduated magna cum laude, with honors. In 2020 she was named a “STAT Wunderkind” a designation for rising young scientists who are making a difference through innovation. In addition, Dr. Stern is the recipient of numerous honors including a K99/ R00 Pathway to Independence Award and a NARSAD Young Investigator Award.
2021 Awarded Grants and Fellowships

**NATIONAL EYE INSTITUTE, NATIONAL INSTITUTE OF HEALTH**
David Fitzpatrick
Organization and Development of Functional Maps in Visual Cortex
**TOTAL: $1,930,000**
01/01/2021 – 12/31/2024

**NATIONAL INSTITUTE OF DRUG ABUSE, NATIONAL INSTITUTE OF HEALTH**
Sarah Stern
Neural Circuit Mechanisms Controlling Non-Homeostatic Feeding
**TOTAL: $747,000**
1/1/2021 – 12/31/2023

**NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE OF NATIONAL INSTITUTE OF HEALTH**
Hiroki Taniguchi
Molecular Mechanisms Underlying Cortical Interneuron Synaptic Specificity
**TOTAL: $2,412,500**
01/15/2021 – 2/28/2022

**NATIONAL INSTITUTE ON DRUG ABUSE, NATIONAL INSTITUTE OF HEALTH**
Sarah Stern
Neural Circuit Mechanisms Controlling Non-Homeostatic Feeding
**TOTAL: $101,256**
1/1/2021 – 12/31/2023

**OHIO UNIVERSITY**
Hiroki Taniguchi
OSU MOU Research Project
**TOTAL: $138,414**
9/01/2021 – 2/28/2022

**ONE MIND RISING START EATING DISORDERS AWARD**
Sarah Stern
Insular Cortex Circuits Underlying Maladaptive Feeding Behaviors
**TOTAL: $300,000**
12/15/2021 – 12/31/2024

**BRAIN RESEARCH FOUNDATION SEED GRANT**
Sarah Stern
Cortical Processing of Interoceptive and Exteroceptive Signals
**TOTAL: $80,000**
6/1/2021 – 5/31/2023

**KLINGENSTEIN-SIMONS FELLOWSHIP AWARD IN NEUROSCIENCES**
Hidehiko Inagaki
Dissecting a Neuronal Pathway that Coordinates Multiregional Neuronal Dynamics to Initiate Actions
**TOTAL: $225,000**
07/1/2021 – 6/30/2024

**SRYBNIK FOUNDATION**
Vidhya Rangaraju/Ilika Ghosh
Investigating Mitochondrial Function in Synaptic Plasticity
**TOTAL: $10,000**
7/1/2021 – 12/31/2021

**2021 New Team Members**

In 2021, MPFI Welcomed the Following Postdoctoral and Research Fellows:
Ruolin Fan, Maria Jose Olvera Caltzontzin, Nino Mancini, Zhe Zhao, Timothy Holford, and Taisaku Ogawa

The following individuals joined new programs:

Our new Graduate Students were:
Monil Shah, Carolyn Von-Walter, Shaun Foutch, Juan Lopez, Akshay Naraine, Shouvik Majumder and Taddeo Salemi

Our new Postbaccalaureate Research Fellows were:
Kaitlyn Letourneau, Polina Rusina, Hanna Rula, Ojasee Bapat, Yang-Sun Hwang, Neha Bhagwat Sapkal, Darielle Lewis-Sanders and Carolina Manyari Diaz

New Undergraduates were:
Kate Maier, Seth Goldin, Aden Eagle, Anushka Mandalapu, Rhea Kulkarni, Skylar Anthony, Victoria Karaluz, Benjamin Bargeron & Richa Saxena
We also welcomed
Sarah Stern  
as Research Group Leader
Salil Sanjay Bidaye  
as Research Group Leader
Arani Roy  
as Sr. Research Associate
Divya Sthanu Kumar  
as Associate Scientist
Uri Ramirez Jarquin  
as Research Scientist II
Kazuma Murakami  
as Research Assistant II
Darielle Lewis-Sanders  
as Research Assistant I
Scott Gesch  
as Facilities Electrical Engineer
April Pitts  
as Purchasing Assistant
Paul Taylor  
as Animal Care Technician I
Luciana Walendy  
as Research Technician
Sabrina Perez  
as Research Technician
Daria Sokolova  
Lab Technician
Alana Ferguson  
Lab Technician
Jake Zur  
Lab Technician
Ritvik Teegavarapu  
Lab Technician
Samuel Breslin  
Mechanical Workshop Helper

2021 Scientific Publications


2021 Conferences

2021 Public Relations, Presentations, Speaking Engagements, Meetings, Community Outreach & Educational/Scientific Training Efforts

1st Quarter

MPFI continued the monthly scientific seminar series with 3 total presentations given in the first quarter

Speaking engagements by Institute Scientists during the second quarter included:

February 1st Dr. Hiroki Taniguchi presented “The assembly and organization of cortical inhibitory microcircuits” at Boston University in Boston, MA via Zoom

February 8th Dr. Audrey Bonnan presented “Cerebellar Circuits for Motor Learning” at CMBB Spring Research Seminar Series – FAU, Jupiter, FL

February 10th Dr. Salil Bidaye presented “Neural Pathways for Initiating a six-legged walk” at Drexel University in Philadelphia, PA via Zoom

February 25th Connon Thomas presented “EM analysis of functionally characterized synapses using inherent tissue features as fiducial markers” at Max Planck Bioimaging Core Unit Network Spotlight Lecture Series via Zoom

February 26th Dr. Vidhya Rangaraju presented “spatially Stable Mitochondrial Compartments Fuel Local Translation during Plasticity” at Mitochondria Series Workshops in Austin, TX via Zoom

March 4th Dr. Sarah Stern presented “Top-Down Control of Feeding Behaviors” at Michigan State University in East Lansing, MI via Zoom

March 5th Dr. David Fitzpatrick presented “Functional synaptic architecture of visual cortex” at Vanderbilt University in Nashville, TN via Zoom

March 11th Dr. David Fitzpatrick presented “Functional synaptic architecture of visual cortex” at Weil Cornell University in New York, NY via Zoom

March 11th Dr. Salil Bidaye presented “Neural Pathways for Initiating a six-legged walk” at John Hopkins University in Baltimore, MD via Zoom

March 23rd Dr. McLean Bolton presented about Research Activities at Wonder Women of STEM, FAU Honors College, Jupiter, FL via Zoom

March 23rd Dr. Hidehiko Inagaki presented “Frontiers in Neuropsychiatry” at Cornell University in Ithaca, NY via Zoom

March 25th Dr. Vidhya Rangaraju presented “Power the Brain: Dissecting the Energy Supplies of Synaptic Function” at Rutgers University, Robert Wood Johnson Medical School in Piscataway, NJ via Zoom

Education Outreach/Scientific Training events held during the first quarter included:

January 6th Dr. Ilaria Drago served as a virtual Judge for the Palm Beach Regional Science and Engineering Fair

January 12th Dr. David Fitzpatrick attended The Health Care & Wellness Committee Meeting for the Palm Beach North Chamber of Commerce in Palm Beach, FL via Zoom

January 26th Dr. David Fitzpatrick attended Virtual: Münchner Runde of the Biology and Medicine Section at the Administrative Headquarters (GV) in Munich, Germany via Zoom

February 4th & 5th The International Max Planck Research School (IMPRS) for Brain & Behavior Ph.D. program hosted a virtual Selection Symposium to interview 19 top ranking candidates around the world for Ph.D. student positions in laboratories at MPFI and FAU.

February – April Dr. Vidhya Rangaraju bi-weekly attended NeuroNex Grant Workshop at National Science Foundation via Zoom

Symposiums, Meetings, Exhibits, and Competitions held during the first quarter Included

January 11-13: Dr. Paul Evans exhibited at the Virtual Graduate School Fair hosted by the Society for Neuroscience (SfN) to promote MPFI’s training programs to prospective applicants.

January 12th Dr. David Fitzpatrick attended The Health Care & Wellness Committee Meeting for the Palm Beach North Chamber of Commerce in Palm Beach, FL via Zoom

January 26th Dr. David Fitzpatrick attended Virtual: Münchner Runde of the Biology and Medicine Section at the Administrative Headquarters (GV) in Munich, Germany via Zoom

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February – April Dr. Vidhya Rangaraju bi-weekly attended NeuroNex Grant Workshop at National Science Foundation via Zoom

2nd Quarter

MPFI continued the monthly scientific seminar series with 9 total presentations given in the second quarter.

Speaking engagements by Institute Scientists during the second quarter included:

April 20th Dr. Nicolai Urban presented “High-resolution confocal imaging deep inside living mouse brains using head-mounted GRIN lenses at the Zeiss GRIN Webinar via Zoom
May 4th Dr. Vidhya Rangaraju presented “Pow- ering the Brain: Dissecting the Energy Sup-pplies of Synaptic Function” at Weill Cornell Medicine in New York, NY via Zoom

June 25th Dr. Yingxue Wang presented “Hippo-campal CA1 neurons perform experience seg- mentation during episodic memory encoding” at Friedrich Miescher Institute for Biomedical Research in Basel, Switzerland via Zoom

Symposiums, Meetings, Exhibits, and Competitions held during the second quarter included:

May 7th Dr. David Fitzpatrick attended BMS Section Meeting – Organismic Neurobiology at the Administrative Headquarter (GV) in Munich, Germany via Zoom

June 9th – 11th Dr. Vidhya Rangaraju attended High Risk High Reward Research Symposium at National Institute of Health via Zoom

June 21st Dr. Nicolai Urban attended the MPG Scientific Council Meeting via Zoom

June 23rd – 24th Dr. David Fitzpatrick attended BMS Annual Section Meeting – Complex Net-work Brain (3) at the Administrative Headquar-ters (GV) in Munich, Germany via Zoom

3rd Quarter

Speaking engagements by Institute Scientists during the third quarter included:

August 5th Dr. Tim Holford presented “Inter-calated Neurons: The gate keepers of the amygdala” at Florida Consortium on the Neurobiology of Cognition (FCNC) hosted by Florida International University in Miami, FL via Zoom

Education Outreach/Scientific Training events held during the third quarter included:

October 6th MPFI Science Career Panel. MPFI scientists answered career and science-related questions that the audience previously submitted via email via Zoom. The recording of the Zoom event was also shared with the Palm Beach School District

August 18th – December 15th Dr. McLean Bolton was the instructor for the “Teaching Journal Club” class at FAU, Honors College in Jupiter, FL via Zoom

Symposiums, Meetings, Exhibits, and Competitions held during the third quarter included:

June 5th – 23rd Several Inagaki & Stern Lab members: Allison Walsh, Zhe Zhao, Zidan Yang & Shouvik Majumder attended a Computational Neuroscience course at Neuromatch Academy on Zoom

August 4th Dr. David Fitzpatrick attended Advisory Board Meeting for NeuroNex Odor2Action Network at the University of Colorado Boulder in Boulder, CO via Zoom

August 15th Dr. Sarah Stern attended and organized the session “From Genes to Circuits: Mechanisms Underlying Cognition and Disease at Florida Consortium on the Neurobiology of Cognition (FCNC) in Miami, FL via Zoom

September 10th Dr. Sarah Stern was inter-viewed by One Mind Brain Waves
MPFI continued the monthly scientific seminar series with eight total presentations given in the fourth quarter.

**Speaking engagements** by Institute Scientists during the fourth quarter included:

- **September 23rd & 24th**: Dr. Matthias Haury attended Boehringer Ingelheim Fonds - Alumni Meeting via Zoom
- **September 23rd & 24th**: Dr. Matthias Haury attended Additive Manufacturing Specialist Module 4 - Implementation of additive manufacturing via Zoom
- **October 2nd**: Dr. Naomi Kamasawa presented "Correlative microscopy workflows to link functional spine imaging and volume EM" for a Zeiss Webinar on Zoom
- **October 21st**: Dr. Salil Bidaye presented "Building remote-controlled fruit flies to understand neural control of walking" at the Department of biology at Ashoka University in New Delhi, India
- **October 28th & 29th**: Dr. David Fitzpatrick attended Virtual BMS Section Meeting and Symposium at the Administrative Headquarters (GV) in Munich, Germany via Zoom
- **November 6th**: Dr. Naomi Kamasawa presented "Future applications of correlative light and electron microscopy in Neuroscience at IIRS via Zoom"
- **November 8th**: Dr. Tim Holford presented "Som-specific knockout of the ASD candidate gene PTEN results in elevated fear and anxiety and disrupts local circuitry in the central amygdala" at SfN 2021 in Chicago, IL via Zoom
- **November 18th**: Dr. Nicolai Urban presented "Enhancing miniscope recordings with multicolor Airyscan imaging at the Zeiss GRIN Webinar Part 2 via Zoom"
- **December 1st**: Dr. Ruolin Fan presented "Tracing the messengers in brain cells: from molecules to memory" at Jupiter High School in Jupiter, FL
- **December 2nd**: Dr. Matthias Haury presented "MPG Curiosity-driven Discovery at the German Embassy in Washington DC"
- **December 3rd**: Dr. Yingxue Wang presented "Internally generated sequences as substrates of episodic memory" at the Institute of Neuroinformatics, University of Zurich and ETH Zurich in Zurich, Switzerland via Zoom
- **December 20th**: Dr. David Fitzpatrick attended IBioBA Meeting via Zoom
- **November 17th & 18th**: Dr. Matthias Haury was a Panel Member at Leibnitz Lecture - Neuro-Immunology & Meeting DAAD, DFG & German Center for Research and Innovation in New York, NY
- **November – December**: Dr. Vidhya Rangaraju bi-weekly attended NervoNex Grant Workshop at National Science Foundation via Zoom

**Symposiums, Meetings, Exhibits, and Competitions** held during the fourth quarter included:

- **October 5th – 8th**: Dr. Salil Bidaye & Kazuma Murakami attended CSHL Meeting: Neurobiology of Drosophila at Cold Spring Harbor Laboratory in Cold Spring Harbor, NY via Zoom
- **October 25 – 29**: Dr. Paul Evans exhibited at the virtual annual meeting of the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) to promote MPFI’s training programs to prospective applicants.
- **November 7th & 9th**: Dr. Matthias Haury attended German MPG PR Networking Meeting at Harnack Haus in Berlin, Germany
- **November 8th – 11th**: Dr. Paul Evans exhibited at the virtual Graduate School Fair hosted by the Society for Neuroscience (SfN) to promote MPFI’s training programs to prospective applicants.
- **November 10-12**: Dr. Paul Evans exhibited at the virtual Annual Biomedical Research Conference for Minority Students (ABRCMS) to promote MPFI's training programs to prospective applicants.
- **November 17th & 18th**: Dr. Matthias Haury was a Panel Member at Leibnitz Lecture - Neuro-Immunology & Meeting DAAD, DFG & German Center for Research and Innovation in New York, NY
- **November – December**: Dr. Vidhya Rangaraju bi-weekly attended NervoNex Grant Workshop at National Science Foundation via Zoom
- **December 5th – 8th**: Dr. Sarah Stern attended the 60th Annual Meeting of the American College of Neuropsychopharmacology in Puerto Rico Convention Center in San Juan, PR via Zoom
- **December 8 – 10**: Nine Ph.D. students from MPFI and IMPRS for Brain & Behavior attended the annual BioFlorida Conference in Orlando, FL to learn about the local life sciences industry and career opportunities in the state.
### 2021 Scientific Talks

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Researchers at the Max Planck Florida Institute for Neuroscience (MPFI) have uncovered a surprisingly complex yet precisely ordered map of visual space in area V2 of the cortex. Challenging previously held beliefs, this novel organization redefines mapping of visual space and reveals a newfound flexibility not seen before.

**Cartography of the Visual Cortex: Charting a New Course for the Organization of Visual Space**
Requiring a discerning eye, mathematical precision, and keen sense of aesthetics, map making is a unique application of both art and science. Though the scale may differ, neuroscientists that study vision are like cartographers of the brain; investigating and mapping how our brain represents and makes sense of what we see in the world. The visual cortex, a specialized region responsible for visual processing, contains intricate neural circuits that evaluate information arriving from our eyes and preferentially respond to distinguishing visual features such as color, edges, motion, and location in visual space. Despite the sheer complexity of this information, our brains do a remarkable job of efficiently organizing neurons together, helping us to better understand our visual landscapes.

One major organizational property the visual cortex employs is called retinotopic mapping, where neurons within are arranged in an orderly way that preserves the spatial information arriving from the retina (light sensing portion of the eye). Much like the Mercator projection is to cartography, retinotopic maps in the visual cortex are thought to follow a widely adopted and well-characterized pattern. The prevailing theory is that brain areas like the primary visual cortex (V1) follow a smooth and simple method of mapping. What you see is what you get; objects in visual space that activate portions of the retina, will light up neurons in an identical pattern in the brain.

Despite the wealth of evidence in multiple species supporting this type of linear mapping, small hints and discrepancies existed within previous studies that suggested the possibility of other arrangements. The question remained, do additional methods of spatial mapping exist in the brain?

Shedding light on this question and challenging the prevailing theory, researchers in MPFI’s Fitzpatrick Lab have uncovered for the very first time a new type of spatial mapping within the secondary area (V2) of the visual cortex. Published recently in Neuron, the team employed a combination of single-cell functional imaging, computational modeling and connectivity studies, to reveal a sinusoidal or wavelike organization in area V2 of the tree shrew. Their surprising insight has deepened our understanding of neural representations of visual space and underlined the importance of precise retinotopic mapping in the visual cortex.

Madineh Sedigh-Sarvestani, Ph.D., a postdoctoral researcher at MPFI and first author of the publication, joined the Fitzpatrick lab interested in understanding the organization, function, and behavioral link of visual areas beyond the well-studied V1. Her investigation began in V1’s closely related neighbor, V2, a visual area that has been extensively studied in primates but less so in animals amenable to recent genetic tools developed in mice. The tree shrew perfectly fits this criterion, as it’s a close relative of primates and has a smooth brain ideal for imaging. Utilizing high resolution calcium imaging, Sedigh-Sarvestani expected to find a map of visual space very similar to V1’s golden-standard. Presenting tree shrews with visual stimuli that varied in position within the visual field, the team mapped the corresponding neurons in V2 that lit up in response to a visual stimulus’ location in space. What they discovered was two very distinct maps in V2. The map of an object’s elevation, how high or low it is, followed closely with the smooth linear map found in V1 but mapping the azimuth, its horizontal position left or right of center, revealed a dramatically different sinusoidal, or oscillating pattern. But why would simple spatial maps exist in V1 and more complex in V2, could
differences in the regions’ shapes play a role? To answer this question the MPFI researchers turned to computer modeling to recreate the conditions found within the brain, with the goal of producing a spatial map that optimizes coverage of the visual field. By varying only shape, the algorithm found that the optimal spatial map for the square V1 region followed the smooth, linear arrangement but for the thin, elongated V2, a sinusoidal map emerged corroborating previous results. Cementing this idea, the MPFI team, led by the lab’s histology coordinator Nicole Shultz, used colored dyes to trace the connections from V1 to the V2 region, finding that the neuronal projections from V1 perfectly aligned with the sinusoidal map in V2.

“Our results demonstrate that orderly organization of visual space in the brain, does not necessarily have to follow the guiding principles we are accustomed to thinking about,” notes David Fitzpatrick, Ph.D., CEO and Scientific Director of MPFI. “Though this organization may be less straightforward than we originally thought, it still has remarkable and beautiful order.”

Beyond this intriguing finding, researchers in the Fitzpatrick lab made one more critically important discovery with broad implications for the field of visual neuroscience; neuronal preference for certain visual features is tied directly to the retinotopic map of visual space. Predominantly thought to be independent organizational principles, the MPFI team demonstrated their interconnectedness by studying the response properties of neurons in V2 for binocular or monocular stimuli. They found that the oscillating map of visual space completely overlapped with the functional feature map, illustrating that the sensitivity neurons have for visual features is not uniform but can vary depending on where the features are in visual space.

“This type of synergy between these two principles, preference for visual features and their location in space, starts to reveal unique information about the behavior or environment of certain animals,” describes Sedigh-Sarvestani. “The wiring of visual circuits that determine the patterns that end up in the brain are influenced by our visual experience; What you see and where you see it.”

In the future, Sedigh-Sarvestani plans to investigate if other visual features are tethered to mapping of visual space in different regions of the visual cortex and if this organization can be traced back to the retina and eventually, an animal’s native environment and their movements within that environment; leading to a more comprehensive understanding of visual perception.

“What we found really forced us to rethink how maps of visual space are formed and to recognize that neural circuits in the visual cortex can be functionally specialized for different regions of visual space,” explains Fitzpatrick. “Our findings open the door to a different way of thinking about how cortical circuits are organized, how they contribute to visual perception, and ultimately, behavior.”

This work was supported by the National Eye Institute of NIH, and the Max Planck Florida Institute for Neuroscience. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the funding agencies.

Reference:
A sinusoidal transformation of the visual field is the basis for periodic maps in area V2
Neuron, online now.
Researchers at the Max Planck Florida Institute for Neuroscience (MPFI) have developed a new imaging technique capable of visualizing the dynamically changing structure of dendritic spines with unprecedented resolution. By combining two cutting-edge types of microscopies, MPFI scientists now have the tools necessary to unravel the ultrastructural complexities of spines during the process of synaptic plasticity.

For most, the relentless snapping of camera shutters is an all too familiar sound associated with trips and vacations. When venturing to a new place, travelers everywhere are constantly on the search for that picture-perfect, Instagram worthy shot. Persevering through many takes, amateur photographers fight blurred backgrounds, closed eyes, and photo-bombing passersby all in search of that ever-elusive perfect picture.

As it turns out, neuroscientists are very similar to travelers in this regard, constantly developing and practicing new ways to take perfect, crystal-clear images. But instead of picturesque natural backdrops or striking city scenes, neuroscientists are interested in detailed snapshots of brain cells and their small-scale structures.

The Yasuda Lab at MPFI is incredibly well-versed in small-scale structures of the brain, focused on studying the dynamic changes to tiny synaptic compartments called dendritic spines. Robust changes in spine structure known as structural plasticity, allow synapses to robustly modulate their connection strength. By doing so, cells in the brain can actively strengthen important connections and weaken those that are less needed. This process is thought to underlie how we learn and remember. But revealing the fine structures of spines in detail during such a dynamic process is a difficult undertaking. Until recently, imaging methodologies lacked the capabilities to do so.

In a recent publication in The Journal of Neuroscience, researchers in the Yasuda Lab have developed a powerful new imaging strategy capable of visualizing the fine, ultrastructural changes to dendritic spines during structural plasticity. By modifying and building off an established imaging technique known as correlative light and electron microscopy (CLEM), MPFI scientists have harnessed the best that both imaging modalities can provide.

“Dendritic spines are such small-scale neuronal compartments, that it’s difficult to get an accurate picture of what’s actually occurring in terms of structural changes using traditional imaging methods,” explains Dr. Ryohei Yasuda, Scientific Director at MPFI. “Using more standard optical techniques like 2-photon microscopy, dendritic spines look like smooth spheres. In actuality, we know from using more powerful imaging methods, like electron microscopy, that the actual size and shape of spines are far more complex. So, we were interested in learning what changes occur during the various stages of structural plasticity, at a resolution where we could take a deeper look at the spine’s complexity.”

The MPFI team first induced structural plasticity in single dendritic spines using 2-photon optical microscopy and glutamate uncaging. The induced spine was then fixed in time at one of three distinct timepoints, representing the major stages of structural plasticity. In close collaboration with

A 3D reconstruction (left) and sequential electron microscopy images (right) of a dendritic spine after the induction of structural plasticity. The spine head is colored yellow and the interface between the spine and the synaptically connected axon is shown in green. Scale bar = 0.2 microns
MPFI’s Electron Microscopy (EM) Core, brain tissue samples containing the stimulated spines were cut into ultra-thin sections using a specialized device called ATUMtome. These sections were then re-imaged using the extreme resolving power of the Electron Microscope to reveal the ultrastructural details and reconstruct accurate pictures of the spine’s complex topography.

“When we started this project, our goal was to see if it was even possible to collect spines at various stages of structural plasticity, successfully relocate them, and resolve their ultrastructure using EM,” describes Ye Sun, Ph.D., former Graduate Student in the Yasuda Lab and first author of the publication. “Single, spine-specific forms of structural plasticity have never been imaged in this way before. Dr. Naomi Kamasawa, Head of MPFI’s EM Core, was instrumental in helping to establish and optimize our EM workflow for the project.”

Examining the reconstructed spine images, the MPFI team noticed unique changes to a protein-rich region of dendritic spines, called the postsynaptic density (PSD). This region is critically important for the spine, implicated in regulating synaptic strength and plasticity. MPFI researchers found that compared to control spines, the area and size of the PSD region was significantly greater in spines that underwent structural plasticity. PSD growth in these spines occurred on a slower timescale, needing hours to reach its maximal change. Interestingly while growth was on a slower scale, PSD structure in stimulated spines reorganized at a rapid pace. After the induction of structural plasticity, PSD complexity immediately increased, dramatically transforming in shape and structural features.

“Our imaging strategy synergizes the best of both optical and EM microscopies, allowing us to study spine structural changes never before seen in nanoscale resolution,” notes Dr. Yasuda. “For the future, our lab is interested in using this new protocol in combination with advanced molecular techniques, such as SLENDR, to study individual protein dynamics in tandem with finely detailed structural changes during spine structural plasticity.

This work was supported by the National Institutes of Health Grants, the Brain Research Foundation, and the Max Planck Florida Institute for Neuroscience. The content of this article is solely the responsibility of the authors and does not necessarily represent the official views of the funding agencies.

Reference:

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**Gold Digger:**
Neural Networks at the Nexus of Data Science and Electron microscopy

Researchers at the Max Planck Florida Institute for Neuroscience used machine learning to develop a new, fully automated way to search and identify gold particles markers in electron micrographs with near human-level accuracy.

From sample preparation to image acquisition, electron microscopy (EM) requires precise and time-consuming steps to produce the clarity and detail needed to visualize small cell structures with high resolution. Moreover, once EM images are created, extracting the biological information out of them through analysis can be an even more laborious and time intensive task. Especially because current EM analysis software often requires the skilled eye of a scientist to manually review hundreds of images.

With a bit of ingenuity and the application of cutting-edge neural networks, an interdisciplinary team of scientists at the Max Planck Florida Institute for Neuroscience (MPFI) have created a new powerful analysis software aimed at streamlining part of the lengthy process. In collaboration with the Electron Microscopy Core Facility and the Christie Lab, the project tasked two high school students with dramatically improving upon established computer-based techniques for the analysis of protein distribution in EM images. Unlike traditional light microscopy that uses fluorescent labeling, EM requires proteins to be labeled with gold nanoparticles in order to visualize them within a cell. Playfully named “Gold Digger”, the software uses a deep learning approach to identify gold particles bound to specific proteins of interest.

In their new publication in Scientific Reports, the MPFI team has engineered an adaptable, deep learning-based algorithm capable of accurately identifying different sizes of gold particles. This fully automated approach will speed up the counting process and generate more precise location information of protein distributions across a membrane, expediting new breakthroughs.

Deep learning or neural networks is a computational strat-
egy that allows software to progressively learn over time. Much like the human brain, these types of algorithms are able to deconstruct a visual scene into individual components and be taught to recognize certain aspects. By supplying pre-annotated “training data” the software learns how to copy and mimic human actions for a given task, something that computers weren’t able to do in the not-so-distant past.

“One of the challenges of the project, was figuring out a way to train our software to recognize only gold particles which appear dark on an electron micrograph, as opposed similarly looking shadows caused by the uneven surface of a cell; something that only trained EM experts could do previously” explains Dr. Michael Smirnov, Neural Data Scientist at MPFI and corresponding author of the publication. “We found that by feeding enough training data and correcting errors that pop up in our algorithms, our software could distinguish gold particles from these shadow artifacts with near human level accuracy. I think this really demonstrates the robustness and utility of our technique.”

This project started with the curiosity of two high school data science students, Diego Jerez and Eleanor Stuart, but quickly it developed into a more complex and interdisciplinary project. “I feel very lucky to get the unique opportunity to apply what we’ve learned in the classroom setting to real world scientific pursuit, and seeing first-hand how data science can help address scientific questions,” explained Diego Jerez, first author of this publication. “These young students showed a real aptitude for this type of coding and conceptual work and I couldn’t be more proud of what they have accomplished. I can’t wait to see the contributions they’ll make to the scientific community in the future,” describes Dr. Smirnov.

The small, compact architecture of the Gold Digger software was primarily used for freeze fracture replica EM, but it was specifically designed to be generalizable and compatible between various EM applications including changes in magnification, image area, cell type and gold particle size. The software will soon be distributed open source and include a user-friendly interface. Scientists everywhere will have the opportunity to take full advantage of and improve upon this innovative algorithm.

“The synergy of the collaborative work of our team was crucial to bridge the gap between these areas of expertise” explained Naomi Kamasawa, Ph.D., the Head of the Electron Microscopy Core Facility at MPFI. “But this is what the Max Planck Society does – bring together people who are passionately curious about a variety of subjects, and allow them to be creative together. When you do that, anything is possible.”

In a few sentences, describe what you do at MPFI?
I seek funding opportunities in alignment with the goals of our researchers, and coordinate proposal development and submissions for federal and private grants and fellowships. Our OSR team facilitates renewal applications and annual reports, meeting federal and private guidelines, and I manage the MPFI/FAU Responsible Conduct of Research training program.

What do you love about your job?
I love being part of MPFI’s international, supportive community, and the collaborative, creative process that results in the fulfillment of individual or team goals. Sharpening articulation of the researcher’s story, and helping each proposal reflect the unique research capabilities that we offer is very rewarding. I love reading about the groundbreaking science we are doing.

What does a typical day look like?
Early mornings I review documents for proposals or reporting. I might make some suggestions for text, talk with Eian Ramcharan, Head of Sponsored Research, our team, or a PI about a question on a proposal, or call/email a funding agency for details. I’ll check the calendar and update our database of opportunities, plan timelines, make a couple of meetings, glean info from webinars, seminars, and FOA’s, and take or make suggestions with PI’s, fellows, or trainees. A little time at MPFI’s coffee “altar” is always good – and necessary! Keeping communication open is extremely important to me. And of course, deadlines help me stay focused!

What have you learned since coming to MPFI?
We can’t assume that everyone understands our language. Our dialect may be general science, or it may be neuroscience, plasticity, neuroenergetics, or the circuitry of locomotion, etc. Each scientific dialogue has its jargon and inherent understanding – the goal is to communicate about science that brings all parties to a greater understanding. When speaking or writing, learn first about the audience, with respect to their level of understanding (not necessarily intellect). Always “tell your story”, emphasizing what’s important now, and why you are the one to do it. I’ve been reminded that life is a process. Joy comes from realizations and growth that occur along the way – which are sometimes much more than achievement of the goal.

What do you consider to be your greatest achievement?
My greatest achievements are not my own. They are my daughter’s – conquering her Eating Disorders; my son’s – breaking norms and living his life; Drs. Yasuda and Christie making perfect scores on their NIH grant submissions; our Research Group Leaders and trainees bringing in new federal and private grants and fellowships. I have lot of fun playing ladies doubles tennis – we won the Open Division of the Palm Beach County Women’s Tennis league and played in the USTA National Championships. Being married for over 25 years is an accomplishment. Maybe my greatest contribution has been to help others.
Breaking Boundaries
Through Collaboration

Max Planck Florida team develops new technique that results in unprecedented understanding of neuronal behavior

Scientists don’t ask bold questions because they’re easy—it’s the challenge that draws them in. Some questions can’t be answered, not because of a lack of interest or passion—but because the resources aren’t there to make it possible. At Max Planck Florida, our model focuses on eliminating those barriers by providing our scientists with the technology and expertise that helps them take on high risk, high reward projects.

Working in the lab of Dr. David Fitzpatrick, postdoctoral researcher Dr. Ben Scholl has been working to understand why certain neurons respond to stimuli that don’t illicit the same kind of response in other neurons. These incredibly complicated neuronal networks are made up of spines, dendrites and synapses of varying shapes and sizes, and it was unclear how these factors played a role in neuronal selection.

In order to solve this puzzle, Ben not only needed to observe and measure their size as they fired, he needed a way to fully view their complex structure. There are several ways to do this, but each has limitations and each requires a highly specialized skill set. Luckily, Connon Thomas of MPFI’s Electron Microscopy core shared his curiosity and the two teamed up to help uncover how unique structural properties in the brain affect signals in the brain.

Together, Ben, Connon and Dr. Kamasawa, Head of MPFI’s Imaging Center and Electron Microscopy Core Facility, came up with a plan to combine Light Microscopy with Electron Microscopy techniques in a way that took advantage of strengths of each method while minimizing their weaknesses. Connon clearly remembers the most exciting part of the project for him: “For me it’s when we created a 3D model from the electron microscopy images, which gives us very precise and high-resolution view of a neuron. Then we can pull up the light microscopy video next to it and see how it was firing in the brain—that’s really a ‘wow’ moment.”

This new workflow enabled the team to become the first to analyze not just one, but several cells with ultrastructural resolution. “Getting the first data was exciting for me,” Ben said. “After having so many discussions with the EM core facility, seeing how well technique worked was a great affirmation. I also enjoyed reconstructing the neurons from the electron microscopy images and getting to see the incredibly complex structure of the cortex.”

The next step was making sense of this massive amount of information, but that is where another one of Max Planck Florida’s advantages came into play. Melissa Ryan joined MPFI’s postbaccalaureate program in 2018 and after showing a talent for microscopy remained on for a second year to work in the EM core. The training and experience she received through the postbac training program combined with her natural talent and attention for detail tremendously helped the team and saved them critical amounts of time.

“I found it really interesting that, working on a collaborative CLEM paper, the perspectives of the scientists from each camp paralleled the type of data they collected. I think that these differences contribute to the success of this collaboration. The paper and my interactions with them were an education in the nuances of investigating form and function interactions in the brain,” said Melissa.

Collaboration at all levels of scientific training is part of MPFI’s core mission. It results in exceptional science, and drives forward ground-breaking discoveries like Ben’s, Connon’s and the entire EM core team.

“From my beginning here at MPFI, it’s been a great opportunity to grow professionally. It’s a very interesting situation where scientifically I have the freedom to pursue new directions that my findings open up,” Ben said. “If I come up with a new idea, or a new experiment or even a new collaborator, MPFI opens the doors to make these projects possible.”

The results of Dr. Ben Scholl, Connon Thomas, Dr. Naomi Kamasawa, Melissa Ryan, and Dr. David Fitzpatrick’s study are the focus of a new paper in the journal, Nature. Read more about this paper here. In addition, the novel technique developed by the team is the focus of a Microscopy and Microanalysis article, which can be found here.
Small Cluster, Big Implications: Specialized Inhibitory Cluster Gates Plasticity during Fear Learning

Researchers at the Max Planck Florida Institute for Neuroscience (MPFI) have uncovered a new role for a distinct inhibitory cell cluster in the amygdala, acting to dynamically modulate synaptic connections during fear learning.

Has your heart ever started to race at the thought of an upcoming deadline for work? Or has the sight of an unknown object in a dark room made you jump? Well, you can probably thank your amygdala for that.

The small almond-shaped brain structure is central to how we perceive and process fear. As we start to learn to associate fear with cues in our environment, neuronal connections within the amygdala are dynamically altered in a process called synaptic plasticity. Although this physiological mechanism is important for facilitating fear learning, it has mostly been studied in the context of excitatory neurons within the amygdala. Far less is known about the role inhibitory cells play.

In a recent publication in Cell Reports, MPFI scientists from the Bolton Lab delve deeper into a specialized portion of inhibitory circuitry in the amygdala, known as the apical intercalated cell cluster (apITC). Characterizing this small but distinctive cluster of cells, the Bolton Lab has discovered rich connectivity and a rather unique ability to modulate plasticity in the amygdala.

“What really grabbed our attention was the fact that relatively little was known about apITC function or connective circuitry,” explains Douglas Asede, Ph.D., first author and former postdoc in the Bolton Lab. “When working with a relatively unknown brain area, it’s a game of inputs and outputs. First, you have to identify what connects with the neuron cluster and what it connects to, then evaluate what functional role that circuitry plays.”

The Bolton Lab began its investigation by characterizing and functionally testing the incoming connections to the apITC. First, the team utilized a highly specialized technique called monosynaptic tracing to selectively identify the upstream presynaptic partners. Once identified, the researchers used a combination of presynaptic optogenetic stimulation (light activation) and postsynaptic electrophysiology to verify that the connections were functional.

“We were able to unravel a number of diverse inputs for this unique cell cluster, ranging from areas important for memory such as the entorhinal cortex to sensory processing regions such as the thalamus,” explains Dr. Asede. “Among this diversity, two notable inputs from the thalamus stood out because of their relative strength compared to other connections we tested as well as their origin in thalamic regions known for their involvement in fear learning.”

The strong connections to the apITC originated from two areas of the thalamus, the medial geniculate nucleus (MGm) and the posterior intralaminar nucleus (PIN). Previous work has shown the MGm and PIN to be important processing centers for auditory and somatosensory information, respectively. In the context of fear learning, inputs from the thalamus send fear-related sensory information to the amygdala, which then integrates and associates fear with particular cues from the environment.

To examine whether this sensory information flow through the apITC was important for fear learning, MPFI scientists studied the changes in these synaptic connections in mice directly after behavioral training. A group of mice underwent classical fear conditioning and behavior-driven changes and were then evaluated using pre and post-synaptic markers for plasticity. Interestingly, the team found significant signs of synaptic strengthening in the sensory inputs to the apITC after fear learning when compared to control animals.

“Typically, when synapses are important to a particular behavior, their connections are strengthened during learning, so our results really highlighted the importance of these sensory connections in fear learning,” notes Dr. Asede.

The LA is a region of the amygdala that is strongly associated with fear learning, fear-related sensory integration, and the formation of fear-based memories. The Bolton Lab used simultaneous electrical stimulation of thalamic sensory inputs and optogenetic stimulation of apITC cell inputs to the LA to reveal that activation of apITC acts as a gate to reduce incoming sensory-driven responses in the LA.

“Armed with the understanding that apITC is important for sensory gating and fear learning, we next looked at what type of downstream connections the apITC makes to give us a clue about possible functions the cluster has in the amygdala fear circuitry.”
Classically it’s been thought that inhibitory cells within the brain make very short-range, downstream connections, acting to dynamically modify circuits within their own local environments. Using axonal reconstruction, the Bolton Lab identified that while most apITC connections are local axon collaterals to neighboring apITCs or project to a close region within the amygdala called the lateral amygdala (LA). Surprisingly, they also identified a subset of relatively long-range connections to more distant brain structures, challenging classical thinking on inhibitory circuits.

“The apITC is one of several clusters of inhibitory neurons that surround the amygdala like a net. Each cluster has a unique role in regulating emotional processing in the amygdala by gating specific inputs,” notes Mclean Bolton, Ph.D. and Research Group Leader at MPFI. “The ITCs have receptors for many neuromodulators such as dopamine, opiates, and oxytocin so they may function as a barometer for sensing internal state and modifying emotions accordingly. This makes them a potential target for therapies to treat anxiety and PTSD, so understanding how each cluster contributes to amygdala function is important.”

MPFI Holds Virtual Career Day

While many students enjoy science, there is a lot unknown about pursuing a career as a scientific researcher. What classes are required? How much money do they make? How do you get lab experience? Questions like these and many more were addressed when MPFI held our annual career panel, once again in a virtual format, for students and teachers throughout Palm Beach and Martin Counties. The event took place Wednesday, October 6, 2021.

“What is your favorite part of your job?”

“How much money do scientists make?”

“It is a unique opportunity to peek behind the curtain and see the life of a scientist. The comment I get most often is, ‘I didn’t know scientists are normal people!’”
Head of Education Outreach Dr. Ilaria Drago describes Career Day as a cornerstone of MPFI’s outreach programs. “It is an excellent opportunity for me to interact with local students and hear about what’s on their minds. Many questions revolve around what to do in college, what career has a future, etc. I am grateful to have the opportunity each year to encourage them and to convey the message that they don’t need to figure everything out right now, and it is ok to explore different topics and passions before deciding what to do when they grow up,” she said.

2021 panelists included postdoc Illika Ghouse, Ph.D. Student Ingo Asbeck and master’s Student Connon Thomas who shared their experience pursuing a scientific career. Students were invited to email or submit questions through social media and had the opportunity to ask about anything including course life, work life balance and more. The 2021 Career Panel was released online so anyone curious about life as a researcher can benefit from the information and advice from our MPFI panelists.

“It is a unique opportunity to peek behind the curtain and see the life of a scientist. The comment I get most often is, ‘I didn’t know scientists are normal people!’ The image of science that our teenagers get from social media and tv is often a stereotype and talking to scientists can be a powerful tool to inspire new generations and show them the reality of being a researcher,” Drago said.

For more information about MPFI’s Science Career Day, please visit https://www.mpfi.org/community/education-outreach/science-career-panel/
MPFI Interns Get Hands-on Experience with Latest Technology

MPFI welcomed eight exceptionally talented students as part of our 2021 summer internship program. This year’s class consisted of Samuel Breslin, Atlantic Community High School; Douglas D’Amelio, Jupiter High School; Alana Ferguson, Suncoast Community High School; Amy Lazarte, Dreyfoos School of the Arts; Justin Ricketts, Suncoast Community High School, Daria Sokolova, Spanish River Community High School; Jake Zur, Benjamin School; and Ritvik Tegavarapu, American Heritage School.

The interns worked in all areas of the institute including labs, electron microscopy core, light microscopy core and the mechanical workshop. On July 30th they presented their work to their mentors and families, as well as a livestream audience of supporters.

Topics included machine learning, virtual reality, neuroenergetics, engineering, and more.

“This internship has gone on to solidify my love of science. We’ve gotten a lot of opportunities and experiences here at Max Planck,” said Alana Ferguson who interned in MPFI’s Microscopy core.

“I’ve been able to learn about new technology and how to use it, including the confocal microscope. I’ve actually been able to patch a few cells and that was really exciting for me,” said Daria Sokolva who interned in the Bolton Lab.

Open to high school students preparing to enter their junior or senior year, the Max Planck Florida Institute for Neuroscience (MPFI) Summer Research Internship offers aspiring scientists an immersive laboratory experience with MPFI researchers.

This six-week internship is designed for students with an interest in brain structure, function and development, and the advanced imaging techniques and technologies used in neuroscience. Interns participate in research projects alongside MPFI scientists, prepare a written scientific abstract based on their research project, and deliver a short presentation at the end of the summer. The MPFI High School Internship Program is generously funded by an anonymous donor.
Marilyn Magar Establishes Data Science Fellowship at MPFI

Max Planck Florida launched a data science fellowship program thanks to the generous support of Florida Representative Marylin Magar.

A Magar Fellow is a joint FAU Max Planck Data Science Student from FAU High that is pursuing research at The Max Planck Florida Institute for Neuroscience over the summer which will include a research fellowship of $3000 to support their efforts. This program is not only a wonderful opportunity for talented students, but a strong reminder of MaryLynn Magar’s unwavering determination and effort to create cohesive partnerships between FAU and Max Planck Florida.

Three students were selected as Magar Fellows for the inaugural class, all from FAU High School: Aden Eagle, Kate Maier, and Seth Goldin. Thanks to Representative Magar’s gift, these students have been able to gain hands-on data science experience working with some of the most exciting neuroscience research of our era.

MEET THE MAGAR FELLOWS:

Kate Maier
“During my time in the Fitzpatrick Lab this past summer, I evaluated dendrite and spine morphology to provide insight into the functional organization and development of neural circuits in the visual cortex. I am currently completing an internship in the Bidaye Lab, adapting data science tools to access and analyze neuroanatomical data from various connectome datasets to develop a better understanding of complex locomotor control in fruit flies.”

Seth Goldin
“This summer I worked in the Electron Microscopy Core under Dr. Naomi Kamasawa at the Max Planck Institute for Neuroscience, creating custom software for analysis of gold particles in freeze fracture replica images. This software is being utilized to determine how ion channels are distributed relative to synapses. I am continuing to work in the Electron Microscopy Core for the next school year and look forward to what the future holds.”

Aden Eagle
“As a Magar Fellow, I helped the Wang Lab to programmatically automate their mice training processes for use in learning and memory studies. I now work on building encoding and decoding models to relate neural activity to behavior and outside stimuli.”
The Postbaccalaureate Program at the Max Planck Florida Institute for Neuroscience (MPFI) provides recent college graduates who are planning to apply to graduate school an opportunity to spend one or two years performing full-time research at MPFI.

This additional experience makes the students more competitive and helps to increase their options for scientific education once they leave MPFI.

Postbaccalaureate Fellows (“Postbacs”) work under the mentorship of some of the world’s leading scientists, in an environment that exclusively focuses on basic neuroscience research. MPFI consists of eight research groups in a state-of-the-art research facility located in Jupiter, FL on the same campus as Florida Atlantic University (FAU) and Scripps Research.

In addition to exposure to cutting-edge neuroscience research, postbacs also participate in a wide range of career education and professional development activities including workshops on graduate school application preparation, poster and oral presentations, and other topics aimed at helping postbacs become well-rounded scientific professionals.

**HANNA RULA**

**Education:** BSc: Taras Shevchenko National University of Kyiv, MSc: University of Göttingen – **Future Goals:** A doctoral degree in Neuroscience related discipline.

What surprised me is that MPFI is not only on the cutting edge of neuroscience research, but it has amazing scientists with a sense of community. People who are passionate about what they are doing and willing to share and improve their experience. I enjoy working in a community where people are mindful and try to make changes toward more environmentally friendly and sustainable working space and advocating for equality and accessibility of science.
DARIELLE LEWIS-SANDERS

Education: Spelman College (BS), Morehouse School of Medicine (MS) – Future Goals: Currently pursuing an MD/Ph.D.

My favorite experience from the postbac program has been having regular meetings to gain assistance with my application materials.

YANG-SUN HWANG

Education: Chungnam National University (B.S.) and Korea Advanced Institute of Science and Technology (M.S.) – Future Goals: Ph.D

The postbac program has solidified my belief that I love science and have enough potential to keep doing it. The full support allows me to explore a wide range of neuroscience while collaborating with labs & institutes in the area. It’s made me see myself as a qualified young researcher who will be part of the science community in the future.

KELLY ELIZABETH SOUTH

Education: New College of Florida. Future Goals: Ph.D. in Neuroscience – Future Goals: Currently pursuing an MD/Ph.D.

Something that really surprised me about working at MPFI is how tightknit the community is and how easy it is to talk to anyone.
**Kaitlyn Letourneau:**

**Education:** UC Berkeley  –  **Future Goals:** Pursuing a degree in neuroscience

My favorite experience from the postbac program has been forging friendships with the other postbacs both in and outside of the institute. It is very cool to work with people who are so like-minded and building those relationships even further outside of work has been very rewarding.

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**Micaiah McNabb**

**Education:** University of Kentucky  –  **Future Goals:** Pursuing a Neuroscience Ph.D.

Everyone here is willing to go out of their way to help each other overcome challenges and encourage one another to explore new integrative perspectives. I have had the fortunate opportunity to experience first-hand how this is reflected in MPFI’s ability to consistently produce such high quality contributions to the neuroscience field.

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**Ojasee Bapat**

**Education:** B.Sc. Biotechnology - SIES College of Arts, Science and Commerce, Mumbai, India, M.Sc. Neuroscience - National Brain Research Centre, India  –  **Future Goals:** Ph.D. Neuroscience

Something that really surprised me about working at MPFI is how friendly the environment is! The inclusive work culture here makes it easy for a newbie to reach out to experts for help. It has truly been a fantastic experience!
POLINA RUSINA

Education: Moscow State University – Future Goals: Systems Neuroscience Ph.D.

My favorite experience from the post-bac program has been seeing how much of motivating power and inspiration comes from honest interactions with colleagues. Everyone has access to advance their scientific ideas and goals, while getting proper guidance to keep focus on preparing for graduate school.

CAROLINA MANYARI-DIAZ

Education: Universidad Peruana Cayetano Heredia – Future Goals: Ph.D. in Biomedical sciences

Something that really surprised me about working at MPFI is how science can bring people from different cultures, backgrounds, and nationalities together.

NEHA BHAGWAT SAPKAL

Education: Institute of Bioinformatics and Biotechnology, Savitribai Phule Pune University, India – Future Goals: Ph.D. in Neuroscience.

Being a part of postbac program has helped me consolidate my knowledge in neuroscience and has given me opportunities to share ideas with renowned scientists. Also, it’s amazing how the cultural diversity at MPFI never lets you feel alone and away from your country.
MPFI Data Science Fellows Organize Hackapalooza

When most people think of a hacker, they think of a shadowy figure using technology to wreak havoc. But there are many others that approach hacking to solve problems, create workarounds and develop new methods to use existing technology in more efficient ways.

And then there is somewhere in between, a place where creativity and even silliness shape programming projects just for the sake of learning.

Seth Goldin and Aden Eagle, data science fellows at the Max Planck Florida Institute for Neuroscience and officers of the FAU Google Developer Student Club, recently organized an event called Hackapalooza, a two-day self-proclaimed “programming extravaganza” where students attended workshops to learn coding techniques. Centered around a theme of “unnecessary hacks,” Hackapalooza encouraged programmers to use creativity to build fun coding projects that they found interesting or amusing.

“We wanted to help promote creative thinking for people who were just getting into programming. And that was the basis for making our topic about unleashing your creativity and developing the unnecessary. We supported unique uses of programming and creative approaches to programming and logic problems,” said Eagle.

Because Goldin and Eagle’s primary audience were students, they decided to create a format that allowed participants to build their skills in a way that interested them. In addition to the programming component, Hackapalooza featured training sessions which ultimately attracted students across the world, thanks in part to the Delta variant which prevented the event from being held in person.

“We had an attendee from Spain, a couple of people from India, some people from Canada, students from other schools in the US, like Dartmouth or UT Austin, and some people from California. It was exciting because we had initially intended for this event to be FAU-only, but by moving it online, we ended up with a hackathon that was a lot more multicultural, bringing together people from diverse backgrounds who all share a common interest, no matter where they are,” said Goldin.

Hackapalooza’s workshops focused on several topics, including learning how to create Chrome Extensions, Discord Bots in JavaScript, Games in Python, and more. Additional training resources came from Google Cloud, who partnered with Eagle and Goldin to support the event. “We partnered with Google Cloud to put on a workshop in advance of the hackathon on building applications with Google Assistant. It was an awesome way for students to learn about another thing that they could use in their projects at Hackapalooza. And they also gave all our participants the ability to apply for free hosting in the form of cloud credits, which was very nice of them,” said Goldin.

Most of the participants developed their project idea utilizing the techniques they learned during the event, and in the end, awards were given for outstandingly creative, albeit not necessarily useful projects. The winning entries exemplify these qualities. First place went to “Waff.el,” an extension that adds a virtual waffle to a coding text editor. The waffle serves no purpose but is fun to look at and can be customized to the user’s preferred level of “doneness.”

Second place was awarded to a project titled “Stochastic L-Trees,” which generated random tree designs with leaves and branches using sto-
MPFI Receives Mary and Robert Pew Public Education Fund Grant to Expand Teacher Training

The Max Planck Florida Institute for Neuroscience has been awarded $23K from the Mary and Robert Pew Public Education Fund which will enable the institute to offer specialized training in laboratory methods to Palm Beach and Martin County educators.

Building on the success of MPFI’s many education and community engagement programs, the Pew award enables Max Planck researchers to provide educators with cutting-edge scientific skills through hands-on workshops. The TEACHs Program (Teaching Educators about Classroom and Hands-On Science) will offer a workshop focusing on microscopy and cell biology, and another one on genetics. All middle and high-school science teachers in both the Palm Beach and Martin Counties School Districts are eligible to apply for the TEACHs program, and a special emphasis will be made to recruit participants from traditionally underserved Title 1 schools.

Educators selected to participate in TEACHs workshops will work with Max Planck researchers to develop their hands-on lab skills and will also receive “Classroom Kits” that include microscopes as well as everything the teachers need to reproduce the experiments in their classrooms with their students.

“The impact of these workshops will not only benefit the teachers who participate, but the hundreds of students in their classes who will be able to recreate these experiments and carry that knowledge forward. We hope to inspire both teachers and students to pursue scientific questions that make an impact on the world around us,” said Dr. Ilaria Drago, Head of Education Outreach.

In addition to TEACHs, Max Planck Florida hosts numerous events for students and teachers, including summer internships, Career Day, and the Brain Bee, an annual competition that draws competitive teams from schools all over Palm Beach County. Max Planck Florida researchers also volunteer their time giving free public lectures and participating in special events with community partners.
Max Planck Florida scientist Dr. Anant Jain spoke to an audience of eager science enthusiasts as part of the Meet the Scientist Lecture Series on January 12, 2021. His topic was “What to Remember and What Not to Remember: Molecular Mechanisms of Information Processing in the Brain.” This event was hosted by The Taras Oceanographic Foundation.

The Meet the Scientist Lecture Series promotes and facilitates the pursuit of science, technology, engineering, and mathematics (STEM), and encourages communication between scientists and residents of the communities in which they live and work. Since its inception in 2004, this program has featured many Max Planck Florida scientists who volunteer their time to share their science with the general public.

Madineh Sarvestani, a postdoc in the Fitzpatrick lab gave a talk entitled “Sinusoidal transformation of the visual field on the cortical surface” at COSYNE, a virtual conference held in February. COSYNE (Computational and Systems Neuroscience Conference) is the leading computational conference in systems neuroscience. It is the primary venue for the exchange of information between experimentalists and theorists in systems neuroscience and fewer than 5% of applicants get selected to give a talk. Dr. Sarvestani shared her lab’s discovery of a new mapping of visual space in a visual area of the tree shrew.

Max Planck Florida research group leader Hidehiko Inagaki represented the institute and shared his research in virtual lecture hosted by the Philip and Patricia Frost Museum of Science in Miami. “Unlocking the Mysterious Memory” took place March 17, 2021 from 3 – 4 pm.

Dr. Inagaki’s lab’s research focus is to understand cellular and network mechanisms underlying cognitive functions. In this lecture, which was aimed for a general public audience, he discussed how networks in the brain affect our ability to recall information in the short term, and how this ability affects every day actions like movement. It was received by an enthusiastic audience who had many interesting questions for Dr. Inagaki.

On March 23, 2021 Dr. McLean Bolton was featured at a special event that showcased women in science. “Wonder Women of Science” was hosted by FAU and featured a panel of women in science.

Dr. Bolton shared her career journey with the audience, as well as her latest research into neuronal structures underlying disorders of the brain, such as autism.
Max Planck Florida is proud to be a part of Palm Beach County and to contribute to the thriving bioscience industry in South Florida. Recently, we were able to host some of our local elected officials who toured our facilities, learned about our research, and heard about the impact we make in the community. Visitors included Palm Beach County Commissioner Maria Marino; Rachelle Litt, Mayor, City of Palm Beach Gardens; Chelsea Reed, Vice Mayor, City of Palm Beach Gardens, and Whitney West from Palm Beach North Chamber of Commerce. We are grateful for the support of these community leaders.

Dr. McLean Bolton Speaks at Project Opioid Launch

On November 2, 2021 MPFI’s Dr. McLean Bolton was a panelist for the Business Development Board of Palm Beach County’s launch of Project Opioid, where she shared the importance of investing in basic research into the underlying physiological & genetic causes of addiction. Project Opioid aims to bring together community leaders from multiple disciplines to work together to overcome the devastating effects that addiction has on our community.

The panel discussion, led by Allison Kreiger Walsh of Advanced Recovery Systems, also featured Palm Beach County Commissioner Melissa McKinley, Steven Farnsworth of Florida Association of Recovery Residences, Dr. Brent Schllinger, Palm Beach County Medical Society’s Opioid Healthcare Response Initiative Chair and Maggie Lucas of Florida Blue.

The broad expertise of the panel highlighted the complicated issue of opioid abuse, trends in prescribing practices, housing issues for persons in recovery, and the stigma of seeking treatment for oneself or a loved one.

Dr. M. McLean Bolton started her research program at the Max Planck Florida Institute for Neuroscience as an independent Research Group Leader focusing on disorders of neural circuitry in January of 2011. Prior to this appointment, she was a Research Assistant Professor in the Department of Pediatrics, Division of Neurology at Duke University Medical Center (2008-2010).

The goal of Bolton’s research is to understand how neural circuits are altered in neuropsychiatric disorders, including mental health issues like addiction. “Addiction is a medical condition with tangible physiological causes, much like any other disease or disorder. By understanding the neural circuits that underlie these conditions, we can better understand how these devastating conditions occur and lay the foundation toward better treatments,” she said.

To learn more about Dr. Bolton’s work, visit https://www.mpfi.org/science/our-labs/bolton-lab/.
To learn more about Project Opioid, visit https://projectopioid.org/
Thank you to our generous donors for supporting innovative brain research in 2021. Your generosity is leading to a new understanding of what makes us who we are, why we behave the way we do, and how we’re affected by certain diseases, injuries, and disorders. Because of your support, we can follow our curiosity to answer some of the biggest questions in neuroscience and train the next generation of scientists.

While we couldn’t be together physically in 2021, we remain connected by our passion for cutting-edge science. Whether you donated, followed our social media channels, or raised awareness about our research, we are so grateful. Please know each contribution is deeply appreciated and we are inspired by your trust in our science and commitment to our mission.

We are tremendously thankful for you.

You Make the Difference
Advancement Highlights

Your gifts through Amazon Smile increased 59.4% in 2021.

We accepted our FIRST gift of Cryptocurrency in 2021.

Expanding Tribute Gifts in 2021. Donating in honor of someone special is a heartfelt way to celebrate a milestone or memorialize those who have made an impact on your life. Donate today online and let us know if your gift is in honor of or in memory of someone.

Grew our social media community. You can follow us on Facebook, Twitter, YouTube, Instagram, and Spotify for the latest research findings and learn about upcoming special events. Staying up to date has never been easier. If you would like to receive the Brainwaves eNewsletter please email news@mpfi.org or visit mpfi.org/email to sign up.

Have you visited the Institute? You can schedule an in-person tour to see how scientific discoveries are made possible through a tremendous amount of dedication, education, and your generosity. Visit mpfi.org/community/tours or email to learn more.

Scan here to learn more and to donate.
## Cultivating the Next Generation of Scientists

Our world-renowned scientific excellence and academic partnerships put us in the unique position to train brilliant young scientists who have the potential to become the scientific leaders of tomorrow.

MPFI developed the Max Planck Academy to spark the imaginations and train scientists at every stage of their careers. We inspire them to ask big questions, take risks, and push forward toward the next great discovery. To date, 333 trainees have contributed to 191 papers published while at MPFI - most of them in high-impact scientific journals such as Nature, Science, and Cell. The unique model of the Max Planck Academy has the potential to transform the standard of science education in the United States, and your support has a tremendous impact because the generation you help train today will help build a better tomorrow for us all.

### 2021 By the numbers:

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### 333 Trainees

Since MPFI opened in 2013

### 191 Papers

Papers published by MPFI – most of them in the highest impact scientific journals such as Nature, Science, and Cell. This would not have been possible without the support of our trainees.
THE AMBASSADORS OF THE MAX PLANCK ACADEMY

- Research Group Leaders: 11
- High School Students: 65
- Undergraduate Students: 67
- Postbac Fellows: 58
- Master Students: 2
- Graduate Students: 27
- Postdoctoral Fellows: 76

33% of Postbacs stay in or go to Max Planck Institutes for graduate studies
“I have had the chance to learn from numerous incredible scientists, use revolutionary technology, and perform countless experiments that I would have never gotten the chance to participate in without this amazing program.”

Daria Sokolova
2021 High School Intern

“The mentorships at MPFI have shaped my trajectory and I want to empower people to have similar experiences.”

Dr. Tim Holford
2021 Ph.D. Program Graduate

MPFI provides a culture that fosters this ability to actually be able to do science without these big constraints that make it so difficult in other settings.”

Dr. Sarah Stern
2021 Research Group Leader
2021 Board of Trustees and Leadership

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