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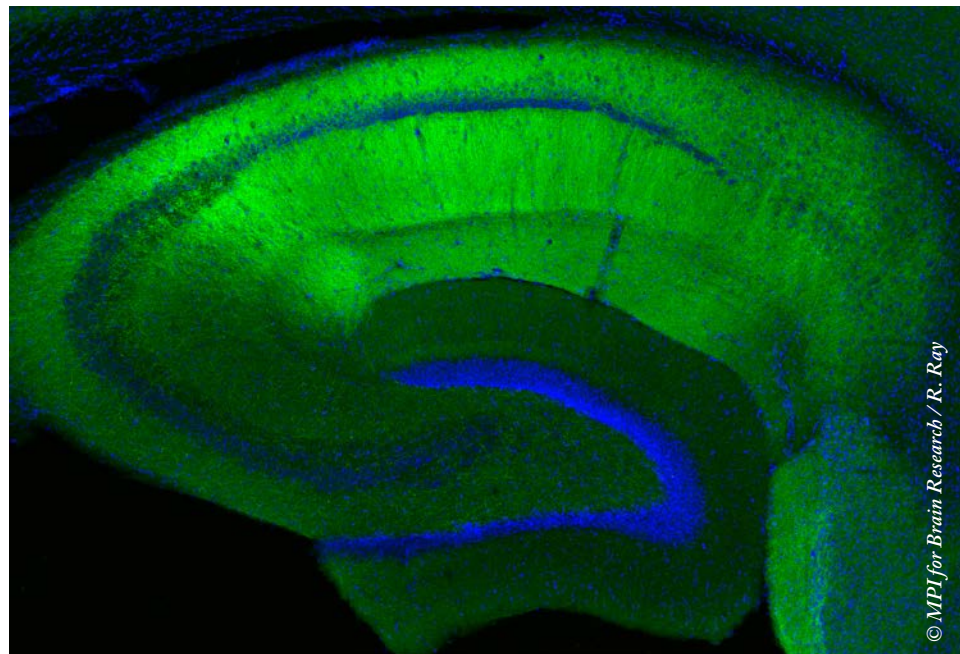
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Science News: A Molecular Atlas of the Hippocampus

scientists at the Department of Synaptic Plasticity at the MPI for Brain Research have mapped the molecular landscape of the mouse hippocampus, a region central to learning and memory. By combining RNA and protein profiling with advanced methods to isolate brain regions and synapses, the team identified thousands of molecules with distinct spatial patterns. The study, published in *Nature Communications*, shows how local protein production and synaptic diversity shape hippocampal function and provides a freely accessible resource for the research community.

The researchers combined RNA sequencing (RNA-seq) and liquid chromatography-tandem mass spectrometry (LC-MS/MS) with precision microdissection of hippocampal subregions and layers, as well as Fluorescence-Activated Synaptosome Sorting (FASS). This combination allowed them to systematically map more than 17,000 mRNAs and 10,000 proteins, uncovering thousands with distinct enrichment patterns, including receptors, ion channels, adhesion molecules, and metabolic regulators.

“Our atlas provides an unprecedented view of how RNAs and proteins are organized in the hippocampus. This opens up new opportunities to study how molecular diversity supports brain



Fluorescence image of a mouse hippocampal slice.

function and plasticity,” says co-lead author Eva Kaulich, Postdoctoral Researcher in the Schuman Lab. “By integrating transcriptomic and proteomic data at subcellular resolution, we can now better understand how neurons regulate their molecular machinery locally, especially at synapses,” adds co-first author Quinn Waselenchuk, graduate student in the labs of Erin Schuman and Julian Langer at the Max Planck Institute for Brain Research and the Max Planck Institute of Biophysics.

The atlas is publicly available through syndive.org.

How Blood Vessels Influence Brain Development

blood vessels are more than just pathways for oxygen and nutrients; they also host communicative processes that guide brain development and sustain its function. These vascular-neuronal interfaces are at the core of new research led by Max Planck Fellow Amparo Acker-Palmer, which will receive €1.25 million as a German Research Foundation (DFG) Koselleck Project.



*Amparo
Acker-Palmer*

Within blood vessels, specialized endothelial cells, which form the inner lining of all vessels, exchange signals with neurons and glial cells that decisively influence the formation of brain circuits and the development of brain architecture. Disruptions to this exchange can result in developmental disorders or neurodegeneration. In her newly approved, DFG-funded Koselleck Project, Prof. Amparo Acker-Palmer aims to explore the hidden functions of vascular-neuronal interfaces. Using cutting-edge imaging techniques, molecular profiling, and genetic models, she seeks to uncover where and how endothelial cells interact with neurons and other brain cells, as well as the principles by which these interactions shape brain connectivity and structure. A particular focus is on the cerebellum, which plays a key role in movement and certain cognitive processes, and on the role of blood vessels in brain folding, a process that diversifies and enhances brain functions. Defects in brain folding can lead to neurological disorders, including intellectual disabilities, epilepsy, and motor impairments.

The Reinhart Koselleck funding line is named after Reinhart Koselleck (1923–2006), one of the most important German historians of the 20th century and a co-founder of modern social history. Reinhart Koselleck Projects are awarded to “researchers distinguished by outstanding scientific achievements.”

Text: Dr. Anke Sauter



Blood Vessels : 3D reconstruction of blood vessels in the cerebellum of a mouse.

© Marta Parilla Monge and Jimena Redondo Nectali, AG Acker-Palmer

Friends of the Max Planck Institute for Brain Research

Outreach: A Summer of Discovery at the Max Planck Institute for Brain Research

this summer, 14 high students from Frankfurt High Schools joined the **Max Planck Junior Scholars Program** to explore the world of scientific research. Selected from MINT teacher nominations, the scholars - all with exceptional talent and a strong interest in science - represent a diverse group, including students from underrepresented backgrounds who may be the first in their families to pursue higher education.



The program combined a one-week Science Bootcamp with two weeks of hands-on lab internships at the Max Planck Institutes for Brain Research, Biophysics, and Heart and Lung Research, and Goethe University. During the Bootcamp, scholars explored the foundations of scientific work through lab tours, workshops, and discussions on topics such as brain imaging, mass spectrometry, scientific computing, and ethics in science. They then joined research labs, where they learned techniques, conducted experiments, and pre-

sented their findings at a festive closing ceremony on July 25.

Participant Laila Ajiou reflects: "The internship has been a truly exciting and enriching experience. It helped me understand what working in research is like. I'm grateful for the chance to explore new fields and better understand my own interests."

Erin Schuman, spokesperson of the program, explains the program's broader mission: "We are thrilled to have offered the Junior Scholar Program to

an immensely talented and diverse group of young Frankfurt students. We are grateful to the Körber Foundation for their recognition of the importance of educating and exposing young people to science in action – and for their financial support."

"It's inspiring to see how passionate young people are about science – and how important it is to make science accessible to them early on", emphasizes Program Manager, Irina Epstein.

Young Science Enthusiasts Compete at German Neuroscience Olympiad

on June 14, the Max Planck Institute for Brain Research in Frankfurt hosted the national final of the German Neuroscience Olympiad (DNO), marking the 15th anniversary of this unique neuroscience competition. Talented young participants from schools across Germany came together to demonstrate their knowledge of the brain in a series of challenging contests.

Open to students of all ages and backgrounds, the Olympiad offers young minds the opportunity to test their knowledge, connect with peers, and learn from experts in the field. The competition included four disciplines, such as patient diagnosis and neuroanatomy. Based on their combined results, the top ten participants advanced to a live podium round judged by a panel of neuroscientists.

"I was very impressed by the passion those children have for science. The questions were really hard and they were answering them very accurately," reflected jury member Dr. Jean Laurens (group leader at the Ernst Strüngmann Institute).

This year's national winner, Lina Duppe from Heidelberg, will represent Germany at the International Brain Bee, held virtually during the Society for Neuroscience Conference in San Diego in November 2025.

Thank you to the Friends of the MPI for Brain Research for financially supporting the 2025 Max Planck Junior Scholars Program and the National Competition of the DNO!



Friends of the Max Planck Institute for Brain Research

Two new Research Group Leaders join the MPI for Brain Research

in 2025 the Max Planck Institute for Brain Research welcomes two new Research Group Leaders: **Dr. Philipp Brand** and **Dr. Gregor Schuhknecht**. Their arrival expands the institute's research scope, *introducing new perspectives and model systems* to study how brains and behaviors evolve and function.

Philipp Brand will establish the *Evolutionary Neuroscience and Behavior Group* as of October 2025. His team will explore how evolution and ecology shape neural circuits and behaviors, focusing on the diversification of reproductive behaviors in *Drosophila* fruit flies. Using cutting-edge neurogenetic, ethological, and genomic tools, Brand's research aims to uncover the genetic and neural bases of behavioral variation across species.

"The vast diversity of animal behaviors we can observe in nature offers an exciting opportunity to understand how evolution tinkers with nervous systems to drive behavioral innovation", says Philipp Brand. "By combining evolutionary biology, circuit neuroscience, and behavioral ecology we hope to reveal how genes and neurons interact to generate behavioral diversity."

Philipp Brand studied Biology, Genetics and Evolutionary Biology in Düsseldorf and Bochum. He received his PhD from the University of California, Davis, where he investigated the genetic basis underlying the evolution of the sense of smell in insects and how it mediates the diversification of sexual signaling and speciation in orchid bees in the group of Santiago Ramírez. For his Postdoc, Brand worked with Vanessa Ruta at the Rockefeller University, New York, where he studied the role of environmental factors in controlling species-specific behavioral repertoires, leading to his discovery that food odors differentially regulate mating behaviors across species.



Philipp Brand

Gregor Schuhknecht

Gregor Schuhknecht will start the *Brain Algorithms and Circuits Group* in December 2025. His lab investigates how the synaptic circuitry of the vertebrate brain gives rise to the computational algorithms that animals use to solve real-world problems. Working with larval zebrafish, the group integrates behavioral experiments with functional imaging, electrophysiology, and connectomics to link neural circuits to flexible behavior.

"We want to understand how brains compute – how neural networks give rise to the algorithms that guide perception, decision-making, and action," explains Schuhknecht. "The zebrafish offers a unique window into this, because it has a vertebrate brain that offers exceptional experimental accessibility."

Gregor Schuhknecht studied Biosciences and Neuroscience in Heidelberg and Zurich, and obtained his PhD from ETH Zurich. At the Institute of Neuroinformatics, he studied the relationship of synapse anatomy and function, which resulted in a highly cited landmark *paper*. Schuhknecht was then a Postdoctoral Fellow with Florian Engert at Harvard University, where he related structure and function of neuronal circuits in the zebrafish brain – before being recruited to our institute.

Awards and Honors



Erin Schuman was elected as a Member of the National Academy of Medicine

Schuman is honored for her pioneering research revealing how local protein production shapes synaptic communication and brain function

Erin Schuman
@Marcus Gloger,
Körber Stiftung

Lea Dietrich received a Minerva Fast Track Fellowship

to set up her own group embedded in the Schuman Department of Synaptic Plasticity at the MPI for Brain Research



Lea Dietrich



The Animal Facility at the MPI for Brain Research received the Trainee Award 2025

The Max Planck Society honors the training facility for their commitment, creativity, and dedication, making outstanding vocational training possible.



Gilles Laurent

Gilles Laurent will receive the 2025 Karl Spencer Lashley Award

The American Philosophical Society recognizes Laurent for his "pioneering studies of information encoding and computation in populations of neurons in the central nervous system."

Friends of the Max Planck Institute for Brain Research

Erin Schuman will receive the 2026 Nakasone Award

The International Human Frontier Science Program Organization (HFSP) is honoring Erin Schuman for her breakthrough related to the function and plasticity of neuronal synapses, their mRNA triggered function, and change during memory formation.

Gilles Laurent was awarded the Louis-Jeantet Prize for Medicine in 2025

Laurent is recognized for his pioneering work on the operations of neurons and dynamics of neuronal networks.

PhD Graduations



Congratulations to **Hsing-Hsi Li** (Laurent Lab, IMPRS), **Theodosia Woo** (Laurent Lab, IMPRS), **Zahra Golipour** (Ito Lab, IMPRS), **Abdelrahman Khalifa** (Helmstaedter Lab, IMPRS), **Yufeng Zhang** (Fries Lab, IMPRS), **Yağmur Yener** (Helmstaedter Lab), and **Johanna Vogenstahl** (Acker-Palmer Lab, IMPRS) for obtaining their PhDs 2025!



Save the Date

Frankfurt hat Hirn Live 2026:
March 10, 2026, 6 pm

Jugend-Kultur-Kirche Sankt Peter
Bleichstraße 33
60313 Frankfurt

Selected publications

Kaulich, E.; Waselenchuk, Q.; Fürst, N.; Desch, K.; Mosbacher, J.; Ciirdaeva, E.; Juengling, M.; Ray, R.; Nassim-Assir, B.; Tushev, G. et al.:

An integrated transcriptomic and proteomic map of the mouse hippocampus at synaptic resolution.

Nature Communications 16, 7942 (2025)

Alvarez-Pardo, R.; tom Dieck, S.; Desch, K.; Nassim-Assir, B.; Olmedo Salinas, C.; Sivakumar, R. S.; Langer, J. D.; Schuman, E. M.; Alvarez-Castelao, B.:

Cell type-specific in vivo proteomes with a multicopy mutant methionyl tRNA synthetase mouse line.

LabAnimal (2025)

Fusco, C. M.; Staab, A.; Bourke, A. M.; Tushev, G.; Desch, K.; Moreto Lins, E.; Ciirdaeva, E.; tom Dieck, S.; Kaltenschnee, N.; Heckel, A. et al.:

Neuronal processes contain the essential components for the late steps of ribosome biogenesis.

Proceedings of the National Academy of Sciences of the United States of America 122 (31), e2502424122 (2025)

Ukrow, J.; Renard, M. D. M.; Moghimi, M.; Laurent, G.:

A computational pipeline to track chromatophores and analyze their dynamics.

eLife 14, RP106509 (2025)

Grijseels, D. M.; Banqueri, M.; Iyer, K.; Hanlin, L.; Ortiz Alvarez de la Campa, M.; Pagliaccio, D.; Rajaraman, B. K.; Schechtman, E.:

Ten simple rules for queer data collection and analysis by STEM researchers.

PLOS Computational Biology 21 (5), e1013091 (2025)

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