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Synaptic proteins are shown that exhibit different expression levels following exposure of mice to the enriched environment housing.

Detecting new proteins in behaving mice

the complexity of living things is driven, in large part, by the huge diversity of cell types. Since all cells of an organism share the same genes, the diversity of cells must come from the particular proteins that are expressed. Cells in the brain are generally divided into neurons and glia. Within these two categories, however, lies a large diversity of cell types that we are only beginning to discover. The diversity of cell types in brain and other tissues has recently been expanded by new techniques, like RNA-sequencing, that identify and measure the mRNAs present in a cell ("the transcriptome"). Although mRNAs are the template for proteins, the transcriptome is a poor proxy for proteins that a cell actually makes ("the proteome"). Alvarez-Castelao et al. now developed new methods to detect real-time changes in the proteome. They report their findings in a recent edition of *Nature Biotechnology*.

Building on prior technology, developed by the Schuman Lab and collaborators David Tirrell from Caltech and Daniela Dieterich (Magdeburg University), Beatriz Alvarez-Castelao and colleagues took advantage of a protein "metabolic" labeling system in which proteins during synthesis are "tagged" with a modified building block (amino acid), which is, under normal conditions, not present in these cells. In order to label proteins in a particular cell type exclusively, the research team used a mutant methionyl tRNA synthetase (MetRS) that recognizes the modified amino acid. They then created a mouse line in which the MetRS can be expressed in specific cell types. When the non-canonical amino acid is administered to the mutant MetRS mice via the drinking water, only proteins in cells expressing the mutant metRS are labeled.

The proteins labeled in cells can be visualized and recognized with antibodies or can be extracted and identified using mass spectrometry. Alvarez-Castelao: "We used the technique to identify two different sets of brain proteins, those present in excitatory neurons in the hippocampus, a brain structure important for animal navigation and learning and memory, and inhibitory neurons in the cerebellum, a structure involved in motor behavior."

continued

A particularly striking feature of this technology is that one can detect directly changes in brain proteins in response to a modified environment. Mice that were raised in an enriched sensory environment with a labyrinth, running wheel, and toys of varied textures showed significant changes in the proteome in the hippocampus, particularly in proteins that work at neuronal synapses. **Schuman**: "We think that, by combining this mouse with other "disease" mouse models, this method can be used to discover the proteins in particular cell-types and how proteomes change during brain development, learning, memory and disease."

Thinking of others at our Institute's Winter Party

the Winter Party of the Max Planck Institute for Brain Research on December 7 was a great event. The theme was „celebrating our diversity“, which was explored by making a movie with interviews of our institute members recounting holiday traditions as well as displaying their wishes for the future on pieces of paper on display in the central reception area of our Institute. We thank all the MPI people, as well as the Minerva Bistro, for making this happen, in particular the members from the **Schuman** Lab for organizing this great party.

The institute people also collected money and gifts for two charities. Like in previous years, it was possible to support girls from the Fem Mädchenhaus by buying individual gifts selected for each girl. A new charity initiative was for the German Alzheimer Association raising money via a silent auction of decorated Christmas Trees. Every department of the MPI „adopted“ one of the small trees and decorated them in a creative way. The institute's members could then compete to buy one of the trees via a silent auction, where the highest bidder bought the tree and could keep it at the Institute or take it home. Via this great initiative, we were able to raise more than 500 Euro for the German Alzheimer Association.



Left: Holiday wishes from the institute's people



Right: Three of the many beautifully decorated Christmas trees on auction in order to raise funding for the German Alzheimer Society



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Friends of the Max Planck Institute for Brain Research

Prizes and awards at the Institute

also in the second part of 2017, researchers at the Max Planck Institute for Brain Research received many prizes and awards:

Max Planck Research Group leader **Julijana Gjorgjieva** (Computation in Neural Circuits) received the 2017 NARSAD Young Investigator Award to study spontaneous activity in various stages of the developing mouse brain.

Tatjana Tchumatchenko, who is heading the Theory of Neural Dynamics Group at the MPI for Brain Research, was awarded the MainCampus Educator Award by Frankfurt-based the Polytechnic Foundation. This award aims to support young scientists in combining excellent science and child care responsibilities and will be used to investigate how spiking neurons encode and decode incoming signals and how neuronal spiking mechanisms determine the coding capacity.

Tatjana's postdoc **Andreas Nold** received an Add-on Fellowship for Interdisciplinary Science from the Joachim Herz Stiftung to model interactions between different types of cells in the brain causing multiple sclerosis (MS) in close collaboration with researchers from the University Medical Center of the Johannes Gutenberg University, Mainz.

In the **Schuman** Lab, postdoc **Anne Biever** was recently awarded a Humboldt Research Fellowship for Postdoctoral Researchers to study local specialization of ribosomes in dendrites of the hippocampus.

Paul Donlin-Asp, also from the **Schuman** Lab, was awarded a Peter and Traudl Engelhorn Foundation Postdoctoral Fellowship for his project "Probing the Spatial and Temporal Dynamics of Translation at the Synapse".

Selected recent publications

Alvarez-Castelao, B., Schanzenbächer, C.T., Hanus, C., Glock, C., tom Dieck, S., Dörrbaum, A.R., Bartnik, I., Nassim-Assir, B., Ciirdaeva, E., Mueller, A., Dieterich, D., Tirrell, D.A., Langer, J.D. and **Schuman, E.M.** (2017). Cell-type-specific metabolic labeling of nascent proteomes in vivo. *Nature Biotechnology* 35: 1196–1201. (see also *detecting proteins* article in this newsletter)

Herfurth, T. and **Tchumatchenko, T.** (2017). How linear response shaped models of neural circuits and the quest for alternatives. *Current Opinion in Neurobiology* 46: 234-240.

Richter, L.M.A. and **Gjorgjieva, J.** (2017). Understanding neural circuit development through theory and models. *Current Opinion in Neurobiology* 46: 39-47.

Shein-Idelson, M., Pammer, L., Hemberger, M., **Laurent, G.** (2017). Large-scale mapping of cortical synaptic projections with extracellular electrode arrays. *Nature Methods* 14: 882-890.

Staffler, B., Berning, M., Boergens, K.M., Gour, A., van der Smagt, P., **Helmstaedter, M.** (2017). SynEM, automated synapse detection for connectomics. *eLife* 6: e26414.



Thomas Olstinski

Postdoc Prize laureate Beatriz Alvarez-Castelao (right) received praise from Prof. Johannes Adolff.

2017 PhD and postdoc prizes awarded

using funds from the Friends of the Max Planck for Brain Research, the institute was able to award both a Scientific Discovery Award for the best doctoral student as well as the best postdoc of 2017. Both prizes were awarded at the Institute's Winter Party (December 7) by Prof. Johannes Adolff (Chair of the Institute's Board of Trustees) and went to postdoc **Beatriz Alvarez-Castelao** (Schuman Lab) for her ongoing research to find new methods to determine changes in the protein concentrations in neurons (see also *detecting proteins* article in this newsletter). Graduate Student **Manuel Berning** (Helmstaedter Lab) was awarded the prize for his efforts in finding new ways to assign individual neurons as well as their connections to other nerve cells in connectomics studies. We congratulate both young scientists on their great achievements.



Thomas Olstinski

Graduate Student Manuel Berning enjoying the Institute's Winter Party

2018 Upcoming Lectures

(all Lectures start at 11.00 hours at the Institute's Lecture Hall)

10.01.17 **Claudia Clopath** (Bioengineering Department, Imperial College London, UK) Neuroscience Lecture

17.01.17 **Kristian Franze** (Dept. of Physiology, Development and Neuroscience, University of Cambridge, UK) Neuroscience Lecture

24.01.17 **Susanne Schreiber** (Humboldt-Universität zu Berlin, Institute for Theoretical Biology) Neuroscience Lecture

21.02.17 **Yiota Poirazi** (Computational Biology Laboratory, Institute of Molecular Biology and Biotechnology, Heraklion, Crete) Neuroscience Lecture

21.03.17 **Kay Tye** (Dept. of Brain & Cognitive Sciences, MIT, Cambridge, USA) Neuroscience Lecture

04.04.17 **David Dupret** ((MRC Brain Network Dynamics Uni, University of Oxford, UK) Neuroscience Lecture

11.04.17 **Tatyana Sharpee** (Computational Neurobiology Laboratory, The Salk Institute, La Jolla, USA) Neuroscience Lecture

W: www.brain.mpg.de/news-events/lectures-and-other-events.html



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