



Newsletter of the University Research Priority Program Adaptive Brain Circuits in Development and Learning

Dear Reader,

As we approach half-time of our program, we are proud to highlight significant advancements in several research projects. In addition to this, we are delighted to introduce AdaBD member *Ruxandra Bachmann-Gagescu*, who has been appointed as Associate Professor for Developmental Genetics. Furthermore, you will find an interesting interview with *Nikita Vladimirov* on the fascinating journey of our mesoSPIM platform as well as information on a new interventional study.

A new professorship for Developmental Genetics

Ruxandra Bachmann-Gagescu is pediatrician, geneticist and long-standing basic researcher in the field of developmental biology. Her research focuses on the mechanisms underlying hereditary developmental disorders and combines human genetics with work in model systems, mainly zebrafish and induced pluripotent stem cells (iPSC)-derived neurons.

Starting October 1, 2023, Ruxandra has been appointed as **Associate Professor for Developmental Genetics**. This professorship has been **newly created with our financial support** at the Department of Molecular Life Sciences (DMLS) and is a double professorship at the Faculty of Science and the Faculty of Medicine. We are proud to have reached this milestone and look forward to successful years of research!



What is your scientific background, and what's your recent research about?

As a physician by training, I have channeled my fascination for developmental biology and genetics towards trying to understand the pathomechanisms underlying hereditary (neuro-)developmental disorders. A special focus of interest in my lab are primary cilia, quasi ubiquitous cellular organelles acting as cellular antennae that sense signals from the environment and transduce them to the cell to control cell behaviour. Dysfunction of cilia leads to a group of human disorders called ciliopathies, which often involve the central nervous system.

To study the role of cilia and the consequences of their dysfunction, we combine insights from human genetics with model systems such as zebrafish or, more recently, iPSC-derived models.

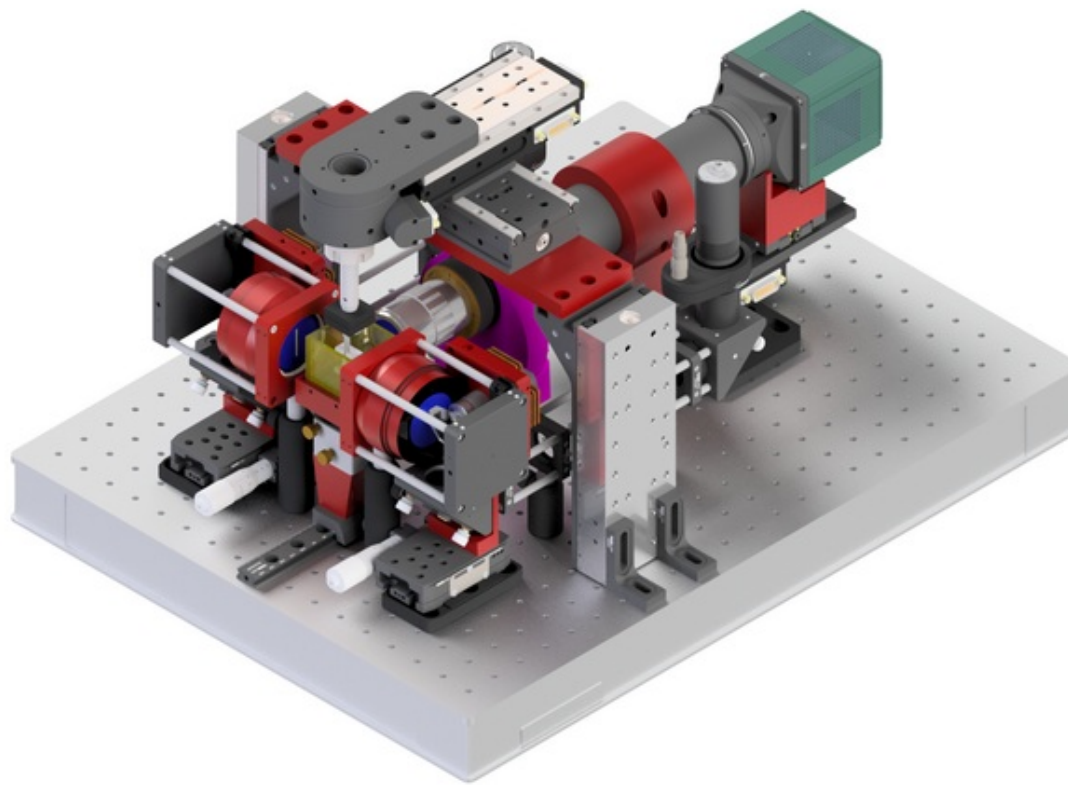
What are your visions for the future regarding working with iPSCs?

iPSCs provide the unique opportunity of studying human neurons derived from patients, which are otherwise not easily accessible. The past decade has witnessed a dramatic increase in the number of protocols available to generate a large variety of neuronal types in 2D and 3D culture systems. To fully harness the potential of this system, we now need to increase the throughput of the experiments, from the reprogramming of patient cells into iPSCs over the differentiation protocols all the way to the analysis pipelines. I believe that through generating larger scale experiments we can correct for the inherent variability of patient-derived cells and draw biologically meaningful conclusions.

What is your research focus within the URPP AdaBD?

Dysfunctional cilia can cause brain malformations and/or intellectual disability, suggesting an important role of this cellular antenna in neuronal function. Our primary interest is therefore to study how mutations in ciliary genes affect brain development, neuronal function and the establishment of neural circuits. Beyond this work in my lab, we also host the iPSC platform seed of the URPP, which aims at promoting the use of iPSC-derived neuronal models for neuroscience.

A new generation of mesoSPIM microscopes – 3D imaging of large samples with unprecedented quality



The “mesoscale selective plane illumination microscopy” (mesoSPIM) Initiative has reached new milestones this summer: A new portable microscope is ready to be used and the old microscope was equipped with improved optics to create 3D images of even higher quality than before. Since its inception in 2015, the project pioneered open source light-sheet microscopy of cleared tissues, freely sharing the knowledge on how to build own facility-grade instruments. Since 2021, the mesoSPIM project is integrated in the URPP AdaBD as a platform. The Coordinating Office of the URPP AdaBD discussed with Dr. Nikita Vladimirov, manager of the platform, the path and future of the mesoSPIM project. [Read the full text on our website.](#)

Human studies: We are looking for participants!

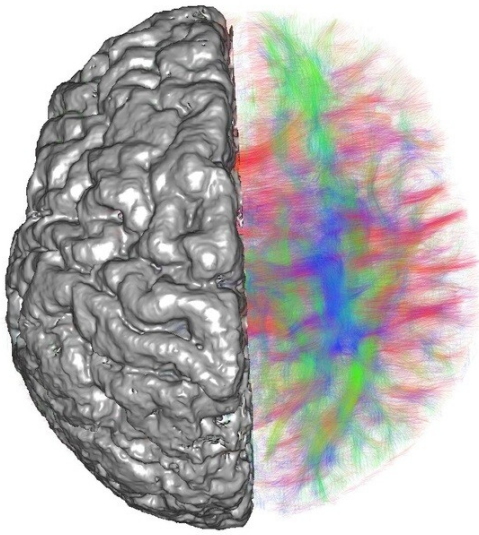
We started a **new interventional study** and are looking for participants with and without dyscalculia!



Dyscalculia is characterized by deficits in number processing and calculations and persists into adulthood. To date, no evaluated program exists that helps affected adolescents and adults to fill gaps in basic mathematical competences. The research project SMILE, a collaboration between AdaBD, the University Children's Hospital Zurich, and the Institute of Education of the UZH, develops such a support program and evaluates its effectiveness regarding math performance and neuronal changes in the brain. **We are currently looking for participants between 14 and 27 years of age with dyscalculia, who will participate in the support program and magnetic resonance imaging (MRI), as well as participants without dyscalculia, participating in MRI measurements only.**

[More information and registration here](#) (in German).

Upcoming event: Inaugural lecture by AdaBD member Prof. Andras Jakab



A Brain Odyssey: A Computational View of Brain Development

Saturday, March 9, 2024, 12:30 - 13:15

Rämistrasse 71, 8006 Zürich, KOL G 201

Aula

With Live-Stream

More information [here](#).

Past Event: Scientifica 2023



Our exhibition booth at Scientifica 2023 was a huge success. The research groups of *R. Bachmann*, *M. Müller* und *E. Stoeckli* presented animal models, the group of *A. Jakob* provided an opportunity to explore a 3D reconstruction of the neural pathways in the human brain using virtual reality goggles and the groups of *S. Brem* and *N. Raschle* prepared several games for children, with the goal to explain them how our brain develops and learns. We thank all the participants for their contribution!

[Here](#) you will find some general impressions of the Scientifica 2023.



New Publications

2024

Han S, Helmchen F (2024) [Behaviour-relevant top-down cross-modal predictions in mouse neocortex](#) **Nature Neuroscience**

Ji H, Payette K, Speckert A, ..., Latal B, SPINA BIFIDA STUDY GROUP ZURICH, Jakab A (2024) [Thalamic connectivity topography in newborns with spina bifida: association with neurological functional level but not developmental outcome at 2 years](#) **Cerebral Cortex** bhad438

2023

Baum S, ..., Vladimirov N, Walsworth RL, Watanabe H (2023) [Mineral detection of neutrinos and dark matter. A whitepaper.](#) **Physics of the Dark Universe** 41: 101245

Hu J, Konovalov A, Ruff CC (2023) [A unified neural account of contextual and individual differences in altruism](#) **eLife** 12:e80667

Lewis CM, Hoffmann A, Helmchen F (2023) [Linking brain activity across scales with simultaneous opto- and electrophysiology](#) **Neurophotonics** 11(3):033403 Review

Payette K, Hongwei L, de Dumast P, Licando E, Ji H, ..., Jakab A (2023) [Fetal brain tissue annotation and segmentation challenge results](#) **Medical Image Analysis** 88: 102833

Royall LN, Machado D, Jessberger S, Denoth-Lippuner A (2023) [Asymmetric inheritance of centrosomes maintains stem cell properties in human neural progenitor cells](#) **eLife** 12:e83157

Wilhelm M*, Sych Y*, Fomins A, Alatorre Warren JL, Lewis CM, Serratos Capdevila L, Boehringer R, Amadei EA, Grewe BF, O'Connor EC, Hall B, Helmchen F (2023) [Striatum-projecting prefrontal cortex neurons support working memory maintenance](#) **Nature Communications** 14: 7016. (* equal contribution)

New Preprints

Calangiu I, Kollmorgen S, Reppas J, Mante V (2023) [Primate pre-arcuate cortex actively maintains persistent representations of saccades from plans to outcomes](#) **bioRxiv**

Ehrler M, Speckert A, Kretschmar O, Tuura O’Gorman R, Latal B*, Jakab A* (2023) [The cumulative impact of clinical risk on brain networks and associations with executive function impairments in adolescents with congenital heart disease](#) **medRxiv**

Holfeld A, Schuster D, Sesterhenn F, Stalder P, Haenseler W, ..., Picotti P (2023) [Systematic identification of structure-specific protein–protein interactions](#) **bioRxiv**

Noble A, Masek M, Hofmann C, Cuoco A, Kollmorgen S, Vladimirov N, Stoeckli E, BachmannGagescu R (2024) [Shared and unique consequences of Joubert-gene loss-of-function in the zebrafish central nervous system](#) **bioRxiv**

See our website for a list of all [publications](#).

Awards and Appointments

AdaBD member **Ruxandra Bachmann-Gagescu** has been appointed as Associate Professor for Developmental Genetics, starting October 1, 2023.

Postdoc **Melanie Ehrler** won the [UZH FAN Award](#) for outstanding scientific achievements.

Congratulations for the successfully completed dissertations in 2023

Matteo Egger: Rewiring of the Adult Hippocampal Mossy Fiber System.

Angeliki Damilou: The Impact of Cajal-Retzius Cell Death in the Development of the Cortical Circuit.

Daniel Gonzalez-Bohorquez: Metabolic Regulators of Brain Morphogenesis: Role of FASN-dependent de novo Lipogenesis in Cortical Development and Intellectual Disability

Welcome to new members of the Steering Committee

Ruxandra Bachmann-Gagescu as additional subproject leader.

Laura Zanetti from the coordinating office as outreach representative.



**Universität
Zürich**^{UZH}



The mesoSPIM gallery - mesospim.org: Rbp4Cre-YCX2.60 mouse brain cleared using passive CLARITY: L5 neurons and autofluorescence

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