

Multi-Omics Platform

Charité Mental Health
Infrastructure Platform

Platform Leadership:

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Members:

Mazda Adli¹, Malek Bajbouj⁴, Dieter Beule², Eva Brandl¹, Hannelore Ehrenreich⁵, Roland Eils^{1, 2}, Thomas Frodl⁶, Eric Hahn⁴, Andreas Heinz¹, Christine Heim⁷, Michael Hummel², Stefan Gold⁴, Hans Grabe⁸, Josef Priller¹, Michael Rapp¹⁰, Stefan Roepke⁴, Dan Rujescu⁹, Gunter Schumann¹, Peter Uhlhaas¹¹

Participating Institutions:

- 1) *Klinik für Psychiatrie und Psychotherapie, Campus Charité Mitte, Berlin*
- 2) *Berlin Institute of Health, Berlin*
- 3) *Klinik für Psychiatrie und Psychotherapie, Universitätsklinikum Freiburg*
- 4) *Klinik für Psychiatrie und Psychotherapie, Campus Benjamin Franklin, Berlin*
- 5) *Max Planck Institute of Experimental Medicine, Goettingen*
- 6) *Universitätsklinik für Psychiatrie und Psychotherapie, Magdeburg*
- 7) *Institut für Medizinische Psychologie, Charité Universitätsmedizin Berlin*
- 8) *Klinik für Psychiatrie und Psychotherapie, Universitätsklinikum Greifswald*
- 9) *Poliklinik für Psychiatrie, Psychotherapie und Psychosomatik, Universitätsklinik Halle*
- 10) *Sozial- und Präventivmedizin, Universität Potsdam, Potsdam*
- 11) *Klinik für Psychiatrie, Psychosomatik und Psychotherapie des Kindes- und Jugendalters, Campus Charité Virchow, Berlin*
- 12) *Max Delbrück Centrum for Molecular Medicine (MDC), Berlin Department of Neuroscience*

PsychOmics

a platform synoptically facilitating genomic, epigenomic, metabolomic, proteomic, (auto)immunomic and phenomic research in psychiatry and psychotherapy

Aims:

The identification and characterization of biomarkers for psychiatric disorders are key to better understand their etiology and ultimately to the development of innovative and personalized treatment options. With this platform we aim to contribute to this endeavor by forming a collaborative network incorporating various fields of omics. These include (epi)genomics, pharmaco- and psychotherapy(epi)genomics, metabolomics, single-cell proteomics, cellular and molecular signatures, (auto)immunomics and environmental-/phenomics in a harmonized approach.

Expertise:

This platform brings together a plethora of methodological expertise as well as environmental, clinical and therapeutic data. We focus on established and to-be-established cross-sectional and longitudinal, as well as adult and adolescent omics-cohorts that are deeply phenotyped for a variety of psychiatric traits and treatment response parameters,

complemented by harmonized self-report and behavioural assessments within the RDoC framework as developed in the BMBF research network PD-CAN (PI Rapp):

- **Schizophrenia:** Ehrenreich, Priller, Ripke, Rujescu, Schumann, Uhlhaas
- **Bipolar Disorder:** Rapp
- **Anxiety, Obsessive-Compulsive Disorders:** Domschke
- **Major Depression:** Adli, Brandl, Domschke, Frodl, Gold, Grabe, Priller
- **Autism:** Ehrenreich, Roepke
- **Postpartum Depression:** Bajbouj
- **Post-Traumatic Stress Disorder, Borderline Personality Disorder:** Frodl, Roepke
- **Attention Deficit Hyperactivity Disorder:** Frodl
- **Alcohol Use Disorders:** Heinz, Rapp
- **Cross-disease signature of early-life adversity:** Frodl, Grabe, Heim

While data generation (e.g. genotypes, epigenetic marks out of DNA specimen) will be done at accomplished high-throughput facilities, follow-up bioinformatic data analyses will be performed within this omics platform.

Furthermore, we will benefit from the ancestral diversity in Berlin that allows us to study the mechanistic interacting influences of developmental programming, migration, urbanicity vs. rural environment, flight, trauma, developmental programming, and biology on psychiatric phenotypes applying longitudinal transcultural genomics/epigenomics studies. The world-wide collaborations with non-European psychiatric cohorts will be a valuable source for replication and meta-analyses (Ripke: diversity subgroup of the Psychiatric Genomics Consortium / Nigeria, Hahn: Vietnam, Schumann: GIGA consortium with cohorts in Europe, China and India).

Naturally, this platform will also offer service analyses to other research projects within the Charité Mental Health network.

Research Infrastructure:

The Multi-Omics Platform collects, processes and analyzes (epi-)genetic samples on a global level. All types of specimen will be collected and stored at the certified biobank 'ZeBanC', a permanent Core Facility of the Charité and Berlin Institute of Health. Regarding proteomics, the BIH/MDC platform provides expertise in mass spectrometry, offering the possibility of measuring thousands of proteins in a single run at the core facility. The available technologies allow for profiling of different biological states in cells, tissues and body fluids, measurements of protein interactions with other proteins, drugs and nucleic acids, as well as determination of spatial information and post-translational modifications of proteins. For deep phenotyping, the BMBF funded PC-CAN project provides standardized RDoC assessments, and the neuroimaging unit (BCAN) an internationally standardized, state-of-the-art neuroimaging platform for MRI and PET including two Siemens Prisma 128-channel 3-Tesla systems, a Siemens 3 Tesla PET/MR and a Magnetom 7-Tesla system..