We are interested in neddylation of synaptic proteins

We study the mechanisms that regulate the regeneration of nerve cells

Matteo Bergami
CECAD & Institute for Genetics
We study the molecular mechanisms underlying aging and age-related neurodegenerative diseases.
We study the neural mechanisms underlying the generation of locomotion

making a leg step:

„local“ decision making: stepping or searching for foothold

Berg EM et al., Current Biology (2015)
We investigate the molecular mechanisms of axon branching and CNS synapse formation.
We study mechanisms underlying information processing in motor control in health and disease.

**Methods:**

- **Experiments:** EEG/MEG; fMRI; TMS
- **Development of data analysis tools:** Methods for the analysis of functional/effective connectivity; Machine Learning
- **Mathematical modeling** and numerical simulations

*Silvia Daun, FZJ & Institute of Zoology*

*Rosjat et al., Neuropsychologia (2018)*
We study synaptic function and plasticity under physiological and pathophysiological conditions.

We study the development and impact of neurodegenerative pathology with regard to the network architecture of the brain.

Multimodal imaging of neurodegeneration

- Tau-pathology in Alzheimer's disease
- Hypometabolism in Alzheimer's disease
- Functional connectivity network

Hönig et al., Brain (2018)
We unravel the mechanisms that underlie the generation of diversity in the dopaminergic system.
We study synaptic transmission in energy homeostasis

Henning Fenselau
MPI Metabolism Research

We investigate the cellular and molecular mechanisms that drive dynamic plastic changes in the nervous system of the developing and adult animal.

Gaia Tavosanis
LIMES, DZNE

Stümer et al., Development (2019)
We study cortical reorganization after stroke assessed by fMRI and models of connectivity combined with non-invasive brain stimulation.
We are working on the neurobiological foundation of value-based decision making

We study how the plethora of extracellular pain stimuli integrates intracellularly to change pain sensitivity in peripheral nociceptive neurons.

Loeser et al., Europ J Pain (2019)
We analyse and model complex brain dynamics at various temporal and spatial scales to improve understanding of normal brain functions and epileptic processes.

We strive for solving the mystery of selective neuronal vulnerability to neurodegeneration.

Natalia Kononenko
CECAD

We decipher the interplay between different cellular and network mechanisms in the mammalian brain that encodes perception and trigger behavioral responses.

We investigate neuronal circuits generating innate behaviors, incl. feeding-related behaviors, focusing on hypothalamic neuronal circuits.

GABA cells in the LH mediate arousal and increased food intake.

Tatiana Korotkova
MPI Metabolism Research & Institute of Vegetative Physiology

We develop computational models of neuronal circuits by combining functional and structural imaging in fish, frogs, and mice.

Kevin Briggman

caesar

Ding et al., Nature (2016)
We study evolution, structure, expression, function and downstream neuronal circuits of olfactory and gustatory receptors in vertebrates.

Sigrun Korsching
Institute for Genetics

We focus on neuron microglia interaction in health and disease, performing cutting edge in vivo imaging.

2P-STED in vivo imaging of spines in the hippocampus.

Martin Fuhrmann
DZNE

Pfeiffer & Poll, eLIFE (2018)
We investigate the impact of the hypothalamic melanocortin system on energy expenditure and energy uptake.

Neuroendocrine control of energy homeostasis in zebrafish

Löhr et al., Cell Rep (2018)

Matthias Hammerschmidt
Institute of Zoology

Adult zebrafish

Hypothalamic axons projecting to pituitary

Tg(otpb:GFP)
Tg(prl:RFP)
We characterize neuronal circuits orchestrating olfactory driven social behaviors as well as the circuit alterations associated with epileptic seizures.

Martin Schwartz
UKB

Bürgers et al., Neurophotonics (2019)
We investigate biological principles of vertebrate and invertebrate brain function and their use for artificial intelligence systems.
We study neuronal input-output computations and mechanisms of cognition in health and disease.

Neuronal computations in-vivo and behavior

Input-output computations in single neurons

Pabst et al., Neuron (2016)
We investigate the evolution of neuroendocrine systems in insects and develop mass spectrometric methods for detection of neuropeptides.
We ask whether extracellular vesicles contribute to spreading of disease pathology in Parkinson’s disease.

Anja Schneider
DZNE, UKB

Induction of a-synuclein aggregate formation by CSF exosomes from patients with Parkinson’s disease and dementia with Lewy bodies.

Stuendl et al., Brain (2016)
We investigate neuronal activity changes in neurodegenerative diseases focusing on synaptic integration and behavioral state dependent neuronal activity patterns.

We analyze ciliary function in health and disease

Mukherjee et al., eLife, 2016
We study how epigenetic and transcriptional perturbations affect cell identity in neurodegenerative diseases.

Disease drivers / risk factors

Epigenetic mechanisms

Cell identity/fate alterations

Brain pathological conditions

Pathania et al Cancer Cell 2017
We are developing scalable deep-learning methods for the analysis of medical images

Wachinger et al., Brain (2016)
We aim to understand the mechanisms underlying axonal degeneration, a chronic process that plays an important role in several neurodegenerative diseases.

Mechanisms of axonal degeneration in hereditary spastic paraplegia

Mitochondrial dysfunction in neurodegeneration

*Elena I. Rugarli*
CECAD & Institute for Genetics

*Murru et al., Glia (2019)*
We investigate how the fly brain integrate sensory information with the internal state to control steering maneuvers during flight.

Schnell et al., PNAS (2014)
We study the properties of calcium channels and their modifications in neuropathological conditions.

Toni Schneider
Institute of Neurophysiology

Neumaier et al., Journal of Neurochemistry (2018)
We define the identity of cells that are recruited during pathological high frequency oscillations in temporal lobe epilepsy.

Ewell et al., Elife (2019)
We decipher the regulatory principles of neurocircuits controlling energy homeostasis from embryo to adult

Sophie Steculorum
MPI Metabolism Research

Steculorum et al., Cell (2016)
We study how glial cells impact normal brain function and the development of neurological diseases.
We study gephyrin structure and function at inhibitory synapses on a biochemical and cellular level with specific focus on disease related contributions.

Günther Schwarz  
Inst. of Biochemistry & CMMC

Mechanisms of postsynaptic clustering of inhibitory glycine and GABA<sub>A</sub> receptors in health and disease

Neurodegeneration in metabolic disorders of cysteine catabolism

Kumar et al., J Clin Invest (2017)
We unravel the contributions of glial and vascular changes in Alzheimer’s disease, stroke and vascular dementia.

We want to understand how neurons form an axon during development and how we can exploit this program to elicit axon regeneration after a CNS injury.
We study mechanical and physiological principles underlying locomotion of arthropods

- polypedal locomotion
- biting systems
- biomechanics and movement control

Tom Weihmann
Institute of Zoology

Neuroprotection by the 'sialic acid - Siglec' and the 'sialic acid – complement' axis

We study how neurons control innate immune reactivity

Harald Neumann
UKB

We quantify how freely moving mammals use vision to make decisions and analyze the underlying neural processes.

Wallace et al., Nature (2013)
We investigate how microglia change in Alzheimer’s disease

Annett Halle
DZNE

Plescher et al., Glia (2018)
We decipher the role of neuron-glia interactions for synaptic transmission and plasticity and for brain diseases.

Christian Henneberger
UKB

We study intersegmental and descending mechanisms of coordination between multiple identified neuronal oscillators in an invertebrate locomotor system.
We study how environmental factors such as different diets induce innate immunity and contribute to sterile inflammation in diseases including neurodegeneration.
We work on the immune system, microglia and peripheral cells, and study molecules regulating inflammatory responses and how they change with ageing.

Melania Capasso
DZNE

Hondares et al., PNAS (2014)
We study mitochondrial dysfunction and its role in selective death of dopaminergic neurons in the SNC.

Neuhaus et al. Brain (2014)
We develop optimal survival-prolonging therapies for different subgroups of glioblastoma patients.
We investigate how adaptive immunity contributes to neurodegenerative diseases.

Marc Beyer
DZNE

Schmideithner et al., Immunity. (2019)
We investigate the molecular genetic and cellular origin of SMA, including the search for therapeutic approaches.

Torres-Benito et al., Am J Hum Genet, (2019)
We unravel the pathophysiology of neurodegenerative diseases using multimodal neuroimaging.

Henning Boecker
DZNE, UKB

Martin et al., NeuroImage Clin (2019)
We bring single cell –omics technologies to basic, translational and clinical questions in chronic inflammatory diseases including neurodegenerative diseases.

Joachim Schultze  
DZNE, LIMES

PRECISE Platform for Single Cell Genomics and Epigenomics