Fundamental Research

The molecular and cellular bases of neurodegenerative diseases are still poorly understood. In order to develop better therapies, scientists at DZNE investigate how nerve cells are damaged and which targets are most relevant for the development of new medicines. Most neurodegenerative diseases share the deposition of misfolded proteins. We therefore believe that unifying cellular mechanisms are characteristic.

Fundamental research at DZNE comprises various themes, including:

**Ageing and age-related cognitive impairment**
Age remains the main risk factor for neurodegenerative diseases such as Alzheimer's and Parkinson's disease. However, the biological links between ageing and neurodegeneration are largely unknown.

**The synapse and its dysfunction in disease**
There is a growing consensus that early disturbances in synaptic activity between nerve cells – i.e., glitches in the connections – are an early and possibly entirely reversible phase of neurodegenerative diseases. Therefore, much attention is focused on mechanisms of synaptic dysfunction. We approach this problem by studying physiological signalling and its alterations in rodent models and by researching into genetic and epigenetic regulators of synaptic plasticity.

**Inflammatory responses and their possible role in neurodegeneration**
The role of inflammation in the progression of neurodegenerative diseases and non-neuronal cells. Neurodegenerative diseases might be accompanied by inflammatory processes which activate mechanisms of this immune response.

**Protein dysfunction and axo-dendritic injury**
Prior to neuronal demise, neurodegeneration is associated with protein transport processes within the nerve cells and synaptic activity. We try to understand mechanisms leading to protein damage to axo-dendritic networks.

**Disease mechanisms in disease models**
DZNE scientists work with a variety of disease models to study disease mechanisms and neuroprotective mechanisms which may serve as promising therapeutic targets.
**Stem cells and regenerative medicine**
DZNE scientists carry out research on adult neurogenesis and use inducible mechanisms of plasticity, restoration, and compensation from extrinsic sources. We intend to apply insights from developmental neurobiology to the identification of potential novel treatment options.

**Epigenetics and genome-environment interactions**
While genetic factors play an important role in the aetiology of neurodegenerative disorders, critically, their pathogenesis also critically depends on the interaction between genes and environment. Thus, we try to elucidate the role of epigenetic modifications and genome-environment interactions in the pathogenesis of neurodegenerative diseases.