

Department of Neurology

Chair of Neurology

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Research Focus

- Stroke research – clinical and experimental
- Neurocritical care
- Telemedicine and health services
- Epilepsy
- Neuroimmunology
- Pain and Headache
- Autonomic nervous system
- Neuromuscular diseases
- Dystonia and botulinum toxin therapy
- Neuro-oncology

Structure of the Department

Professorships: 3

Personnel: 312

- Doctors (of Medicine): 75
- Scientists: 12 (thereof funded externally: 9)
- Graduate students: 30

Clinical focus areas

- Emergency care
- Stroke
- Neurocritical care
- Epilepsy Center (EZE)
- Neuroimmunology
- Neuromuscular diseases
- Pain Medicine
- Neuro-oncology
- Autonomic nervous system disorders
- Neurophysiology
- Ultrasound
- Dystonia und botulinum toxin therapy
- Neurocognitive Disorders
- Telemedicine

Research

The Department of Neurology is one of the largest neurological centers in Germany treating 4.000 inpatients and more than 19.000 outpatients each year. The research activities of our clinic are shown in detail below. During the reporting period more than 200, some of them high-ranking publications could be published.

Stroke research – clinical and experimental

PI: Prof. Dr. H. Huttner, PD Dr. B. Kallmünzer, PD Dr. J. Kuramatsu
Each year about 7,000 patients are admitted to

our specialized neurological emergency room. After an immediate clinical examination, adequate diagnostic procedures and prompt specific emergency treatment are initiated, if necessary. The Department of Neurology thereby drives the development and improvement of innovative new therapeutic options for acute care and secondary prevention of stroke. It is involved in international, prospective clinical trials, while the screening and inclusion of individuals is managed directly on admission and during the patient's stay at the stroke unit. Additionally, scientific analysis are based on prospective clinical registries. The participation is offered also to patients, who are being transferred from the North-Bavarian telestroke network STENO. We treat more than 1,400 inpatients on our 14-bed monitored stroke unit. A very high level of medical care (iv-thrombolysis rate > 25%) is combined with advanced research, including clinical studies on thrombolysis, mechanical thrombectomy (annually > 200), and secondary prevention of cardioembolism.

Neurocritical care

PI: PD Dr. J. Kuramatsu, Prof. Dr. H. Huttner
At our dedicated 12-bed neurocritical care unit over 400 patients annually are managed using state-of-the-art neuromonitoring and treatment concepts. For patients with severe stroke, intracranial hemorrhage, meningitis, and status epilepticus the main therapeutic target is prevention of secondary brain injury which is supplemented by progressive clinical and translational research projects. Emerging concepts are validated by collaborative efforts involving multicenter studies and investigator-initiated trials that may and have influenced guidelines. Current research projects involve, large-sized individual participant data meta-analyses, randomized controlled trials, target-trial emulations, and biobanking.

Telemedicine

PI: PD Dr. B. Volbers
Since 2007, the Department of Neurology has been coordinating the Stroke Network using Telemedicine in Northern Bavaria (STENO), which includes 3 stroke centers and 18 regional hospitals. As the only telestroke-network of its kind, it has been certified in 2011 according to DIN EN ISO 9001:2008 for its network-wide quality management system. STENO is part of the medical standard care and ensures comprehensive stroke care for about 12.000 stroke patients per year in North Bavaria and southern Thuringia at the highest level. Scientific research covers diagnostic and therapeutic options in acute ischemic stroke, including thrombolysis, mechanical thrombectomy and secondary prevention, and in intracerebral hemorrhage, including secondary evolution of perihemorrhagic edema, as well as the impact and effects of STENO on stroke management in mainly rural areas.

Epilepsy

PI: Prof. Dr. H.M. Hamer, MHBA

The Erlangen Epilepsy Center ranks among the top five university epilepsy centers in Germany. Scientific hot spots include:

- 1) Electrophysiology of higher cortical function, including single units activity;
- 2) Epilepsy in CNS-malformations;
- 3) Automatic seizure detection;
- 4) Magnetoencephalography;
- 5) Neuropsychology/Cognition and invasive EEG;
- 6) Quantitative EEG in epilepsy and encephalopathy;
- 7) Drug monitoring;
- 8) Historical aspects of epileptology;
- 9) Socio-economic aspects of epilepsy.
- 10) Telemedicine

Funding: EU, DFG, Bavarian State Ministry of Health and Care

Neuroimmunology

PI: Prof. Dr. V. Rothhammer

The Neuroimmunology research group focuses on biomarker research and validation in clinical research projects in Multiple Sclerosis and other autoimmune inflammatory disorders of the nervous system. These projects are deeply embedded into preclinical experimental projects aiming at a deeper understanding of the relevance of environmental and microbial factors in their interaction with endogenous metabolism and CNS resident immune cells. Supported by national and international research grants (DFG Heisenberg Grant, ERC Starting Grant HICI, DFG SFB TRR274, IITs, among others), we aim to develop a deeper understanding of the role of glial cells in acute and chronic inflammation and their regulation by transcriptional and epigenetic mechanisms. Ultimately, we seek to develop novel therapeutic and monitoring strategies for hence untreatable forms of autoimmune diseases of the nervous system.

Pain and Headache

PI: Prof. Dr. F. Seifert, MHBA

This group investigates neural mechanisms of sensory, autonomic and cognitive processing in pain disorders (neuropathic pain, headache), stroke and multiple sclerosis. We use psychophysical and autonomic testing combined with functional and structural brain imaging methods (voxel-based lesion symptom mapping (VLSM), functional magnetic resonance imaging (fMRI), repetitive transcranial magnetic stimulation (rTMS).

Autonomic nervous system

PI: PD Dr. J. Köhn

The research group ANS focuses on the investigation of central and peripheral control mechanisms of the autonomic nervous system. By quantitative and qualitative testing of autonomic cardiovascular modulation, we evaluate possible pathologies due to structural CNS defects in patients with ischemic stroke, subarachnoid hemorrhage and epilepsy. In addition, quantitative sensory testing of thermal perception refines the

evaluation of small fiber neuropathies, and the value of automated pupillometry in neuro-ICU patients is being investigated.

Neuromuscular diseases

PI: Dr. M. Türk, Dr. C. Möbius

The Neuromuscular Disease Center is an interdisciplinary center providing a specialized outpatient clinic and a neurohistological laboratory for diagnostic biopsies and for the investigation of neuromuscular diseases. The neuromuscular research at the department of neurology focuses on:

- 1) ¹H and ²³Na MRI in muscle diseases
- 2) 3D-sonography in neuropathies
- 3) Registry studies and muscle sonography of motor neuron diseases

Dystonia and botulinum toxin therapy

PI: Dr. C. Möbius

Our main aim is to improve the diagnostic and therapeutic process for patients with dystonic movement disorders and spasticity. Other than participating in several multicenter clinical trials, our research focus lies in the early detection and treatment of post stroke spasticity and the identification of specific muscle patterns in cervical dystonia using ultrasound and ultrasound-guided electromyography.

Neurooncology

PI: PD Dr. M. Uhl

The goal of interdisciplinary neuro-oncology is the treatment of patients with brain tumors. Beside the daily routine patients we have the ambition to provide attractive clinical trials for all patients. A focus here are currently translational immune therapy studies of the phases II and III.

Teaching

Between everyday clinical practice and the teaching segment of our department the interdisciplinary clinical courses „Querschnittsfächer“ for immunology/infectiology, emergency medicine and pain medicine gained widespread recognition by the students.

Selected publications

Kuramatsu JB et al. Association of Surgical Hematoma Evacuation vs Conservative Treatment With Functional Outcome in Patients With Cerebellar Intracerebral Hemorrhage. *JAMA*. 2019 Oct 8;322(14):1392-1403.

Diener HC et al. Dabigatran for Prevention of Stroke after Embolic Stroke of Undetermined Source. *N Engl J Med*. 2019 May 16;380(20):1906-1917.

Campbell BCV et al. Extending thrombolysis to 4-5-9 h and wake-up stroke using perfusion imaging: a systematic review and meta-analysis of individual patient data. *Lancet*. 2019 Jul 13;394(10193):139-147.

Thomalla G et al. Intravenous alteplase for stroke with unknown time of onset guided by advanced imaging: systematic review and meta-analysis of individual patient data. *Lancet*. 2020 Nov 14;396(10262):1574-1584.

Tsaktanis T, Beyer T, Nirschl L, Linnerbauer M, Grummel V, Bussas M, Tjon E, Mühlau M, Korn T, Hemmer B, Quintana FJ, Rothhammer V. Aryl Hydrocarbon Receptor Plasma Agonist Activity Correlates With Disease Activity in Progressive MS. *Neurol Neuroimmunol Neuroinflamm*. 2020 Dec

24;8(2):e933.

Walther K, Volbers B, Erdmann L, Dogan Onugoren M, Gollwitzer S, Kasper BS, Kurzbuch K, Lang J, Schwab S, Schwarz M, Hamer HM. Psychological long-term outcome in patients with psychogenic nonepileptic seizures. *Epilepsia*. 2019 Apr;60(4):669-678.

International Cooperations

Prof. F. J. Quintana, Harvard Medical School, Boston, USA

Prof. Jorge Ivan Alvarez, University of Pennsylvania, Pennsylvania, USA

Prof. Bernhard Staeresina, University of Birmingham, Birmingham, UK

Prof. Simon Hanslmayr, University of Glasgow, Glasgow, UK

Prof. M. Grosse-Wentrup, University Vienna, Austria