The Department of Neurology and its associated hospital department cover the entire spectrum of neurological disorders. The clinical service includes 89 beds with a 6 bed Stroke Unit and a 10 bed specialized Neurological Intensive Care Unit with about 2800 inpatients per year. The outpatient department cares for over 8000 out-patients and 2500 through the consultation service per year. Our specialties encompass neuroimmunological diseases (multiple sclerosis, autoimmune nerve and muscle disorders), degenerative neuromuscular disorders including integrated nerve/muscle pathology, cerebrovascular disorders, movement disorders, epilepsy, neurogenic pain and neurointensive care. The Department has integrated a Division of Clinical Neurophysiology, a Clinical Research Group for Multiple Sclerosis and Neuroimmunology, a Section of Developmental Neurobiology, and numerous experimental and clinical laboratories allowing translational research from molecular basics to the bedside. The Department holds 36 full time academic members, 88 on the nursing staff, 24 technicians and 11 employees in administration and special services. Additional 11 academics are supported by extramural grants. Two endowed professorships for „Neuroimaging“ (Bayer-Schering AG) and „Multiple Sclerosis, in particular Blood-Brain-Barrier“ (Teva und Sanoﬁ-Aventis) and one lecturership (Merck-Se rono) further support the research activities. The Department contributes to the Sonder- forschungsbereiche (Program Project Center Grants) 581 und 688. An intensive cooperation is established with the Research Institute for Clinical Neurobiology (Head: Prof. Dr. Michael Sendtner; see separate section) which had been transformed out of the Neurology Department from the previous integrated Clinical Research Group for Motor Neuron Disorders in 2000.

Major Research Interests

Multiple Sclerosis and Neuroimmunology (Clinical Research Group, previously BMBF, now University of Würzburg) (H. Wiendl, P. Rieckmann, G. Stoll, K.V. Toyka)

Pathogenesis of multiple sclerosis, polynевrits, myasthenia gravis and myositis in humans and experimental models (experimental autoimmune encephalomyelitis (EAE) und neuritis (EAN), transgenic mouse models); studies on immune regulation, effector mechanisms of immune-mediated tissue damage and new immunotherapies; analysis of endogenous mechanisms of immune tolerance in the periphery and the CNS compartment; role of regulatory and dendritic cells; contribution of cytotoxic T-cells in neuroinflammation and of specific potassium channels in T cell activation and neuronal responses to immune-mediated injury; molecular mechanisms of breakdown of the blood-brain-barrier; development of novel MR-contrast agents for more sensitive detection of demyelinating inflammatory lesions in the CNS.

Stroke and Neuroimaging

(G. Stoll, M.Bendszus, W. Müllges)

Molecular mechanisms of thrombus formation in experimental cerebral ischemia using pharmacological and transgenic mouse models; development of novel and safer treatment options in acute stroke by blockade of platelet receptors GP Ib, GP VI and the intrinsic coagulation cascade (Factor XII); functional infarct imaging by 17.6 T-high-field MRI (in cooperation with the Department of Physics V); development of novel MR contrast agents for in-vivo visualization of inflammation and nerve regeneration; participation in clinical stroke trials; studies on the aetiology of neurological complications during heart surgery.

Neuromorphology and Pain Research

(C. Sommer)

Role of pro- and anti-inflammatory cytokines in neuropathic pain; assessment in different lesion models and evaluation of underlying molecular signalling pathways; determination of cytokine profiles in patients with chronic neuropathic pain; establishment of new diagnostic procedures for small-fiber-neuropathies.

Experimental Developmental Neurobiology

(R. Martini)

Investigation of pathomechanisms underlying genetically-mediated demyelination in the central and peripheral nervous system using mouse mutants with spontaneous and genetically engineered defects of myelin and other nerve components as disease models. Morphological methods, such as confocal- and electronmicroscopy, combined with the assessment of molecular alterations are used for the analysis of neuronal and glial damage. Particular emphasis is on the role of disease-modifying mechanisms, like the
Neuromuscular problems and CNS disorders can be assessed and evaluated in human models of cortical plasticity; functional significance of neurological diseases in general and treatment strategies in the mouse models.

**Motor Control and Movement Disorders**

(J. Classen)

Human cortical physiology; development and evaluation of human models of cortical plasticity; functional significance of neuromuscular plasticity in inflammatory, ischemic and degenerative brain diseases; pathophysiology and treatment of disorders of motor control; deep brain stimulation in cooperation with the adjacent Department of Neurosurgery.

**Clinical Neurophysiology and Neuromuscular Center (NMC)**

(K. Reiners, K.V. Toyka)

Neuropathological investigations in patients with neuromuscular problems and CNS disorders (> 25,000 investigations per year); Co-Chairman of the Interdisciplinary Neuromuscular Center together with Prof. Dr. T. Grimm, Department of Human Genetics; morphological assessment of nerve and muscle disorders by magnetic resonance imaging and correlation with neuropathological parameters; validity of serial assessments of evoked potentials in the evaluation of multiple sclerosis and ALS.

**Autoantibodies in Neuroimmunological Disorders**

(K. Toyka, C. Sommer)

Studies on the functional role of humoral serum factors in immune-mediated neuropathies and on the pathophysiology of the anti-amphiphysin- and anti-GAD-associated stiff-person-syndrome; establishment of in-vivo models and cell culture systems; assessment by in-vivo- and in-vitro-electrophysiology (Patch-Clamp, reflex studies), STED-microscopy (in cooperation Institute for Clinical Neurobiology). The pathogenic role of thymus abnormalities in myasthenia gravis (in cooperation with the Institute of Pathology).

**Motor Neuron Diseases**

(K. Toyka, M. Beck)

Development of neurophysiological parameters for monitoring disease progression and treatment effects in amyotrophic lateral sclerosis (ALS). In 1996 an ALS data base has been established for collection of clinical data and samples; support of basic molecular and genetic investigations on disease modifying factors in sporadic and familial ALS (in cooperation with the Institute for Clinical Neurobiology).

**Laboratory Medicine**

(K. Toyka, A. Weishaupt)

Laboratory support of all groups and projects in neuromorphology, neurogenetics and neuroimmunology. Research focus: The role of autoreactive antibodies in the diagnosis and prognostic assessment of neurological diseases (anti-MAG-, anti-GM1, anti-aquaporin-4 antibodies, anti-acetylcholine-receptor-antibodies).

**Teaching**

In the lectures, seminars and mandatory courses of general neurology the basics in clinical neurology are taught accompanied by bedside teaching in small groups of students. The Department of Neurology moreover provides special seminars in differential diagnosis of neurological disorders, neuromuscular diseases and nerve/muscle pathology and participates in numerous interdisciplinary seminars (Anatomy, Physiology, Tumour Center, Pain-Curriculum, Psychology, Neurobiology, and all classes of the International Graduate School of Life Sciences). Teaching languages are German and English.

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**SELECTED PUBLICATIONS**


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**Fig. 1:** In-vivo imaging of macrophage infiltration by magnetic resonance imaging (MRI). After systemic application iron particle-containing MR contrast agents are phagocytosed in the circulation by macrophages. Upon migration into injured nerve tissue, the iron-laden macrophages can be identified microscopically as blue cells (arrows; on left). Iron leads to a signal loss on T2-weighted MRI. Infiltration of iron-laden macrophages can thus be visualized in-vivo along the course of the injured sciatic nerve as dark structure marked by white arrowheads (experimental nerve trauma model on right). This MR-technique is suitable for assessment of acute macrophage infiltration into tissues in general (Source: Bendszus & Stoll (2003) J Neurosci).