Department of Neurosurgery
Chair of Neurosurgery

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Research focus
- Functional neuronavigation and intraoperative imaging
- Neuroendocrinology
- Neurooncology

Structure of the Department
Professorships: 2
Personnel: 182
- Doctors (of Medicine): 21
- Scientists: 10 (thereof funded externally: 3)
- Graduate students: 34

Clinical focus areas
- Endocrine neurosurgery
- Neurooncology
- Scleral base surgery
- Epilepsy surgery
- Vascular neurosurgery
- Spine surgery
- Neurotraumatology
- Pediatric neurosurgery

Research
The scope of research of the Department of Neurosurgery is primarily clinical, with special focus on the field of intraoperative imaging, neuroendocrinology, and neuro-oncology.

Functional neuronavigation and intraoperative imaging
The research group "functional neuronavigation and intraoperative imaging" is divided in three subgroups that work in part independently, but all complement each other concerning therapeutic outcome and to define the relapse frequencies of sellar tumors, including different prognostic factors.

The field of neuroendocrinology within the Department of Neurosurgery was established in 2007 in the framework of an endowed professorship for clinical and experimental neuroendocrinology (Prof. Dr. C. Schön, now Department of Medicine 1). In cooperation with the Institute of Radiology, body composition, liver and muscle fat content are determined by MRI in patients with various hypothalamic-pituitary diseases (e.g. pituitary deficiency, acromegaly, and M. Cushing). The results are correlated with various metabolic characteristics and with novel parameters involved in the metabolic control. The aims of these studies are to obtain novel insights in the neuroendocrine control of metabolic and energetic processes.

Another translational scientific project involves the functional characterization of mutations of the metabotropic calciumsensing receptor (CaSR) that occur in patients with specific disorders of calcium homeostasis. The CaSR is also expressed in pituitary cells and in hypothalamic nuclei involved in the control of endocrine systems. In this project, the patients are screened for clinical evidence of neuroendocrine dysfunction, and clinical and in vitro data are correlated to define a potential genotypophenotype relation. Furthermore, agonists and antagonists of the CaSR are tested in vitro whether they can rescue the molecular defect of the mutated CaSR. This potentially offers a therapeutic approach specifically tailored to patients’ molecular CaSR defect (individualized medicine).

Further projects investigate various aspects of growth-hormone secreting human adenoma cells in vitro, like the expression of certain membrane receptors (e.g. somatostatin receptors) and the characteristics of signaling cascades (CaMP- and Ca2+-PI-signaling pathway). The in vitro data are related to various clinical data in order to extract potential prognostic factors concerning therapeutic outcome and to define potential new therapeutic targets.

Neurooncology
Gliomas are the most common primary tumors of the brain and about 70% of these tumors are malignant gliomas. Currently, there is no promising therapy for the treatment of malignant tu-
mors which targets the high proliferation and diffuse brain invasion. Therefore, investigation and characterization of the molecular mechanisms of glioma growth and invasion are essential steps in developing novel therapeutic strategies.

The neurooncology research group deals with the biology and therapy of brain tumors and could demonstrate that malignant gliomas secrete high amounts of the neurotransmitter glutamate which results in neuronal cell death in the peritumoral brain parenchyma and induces perifocal edema. These data correlate with a reduced quality of life of patients suffering from malignant gliomas.

Another focus of the group is to decipher the interaction of different brain cells and glioma proliferation. One candidate molecule for tumor-associated cell interaction is the protein MIF (macrophage migration inhibitory factor). This cytokine is secreted by glioma cells and interacts with the adjacent parenchyma. The aim of this project is the analysis of MIF effects on immune competent cells in the brain, such as microglial cells, and its role in glioma proliferation and invasion. Moreover, the preliminary data indicate that microglial cells participate at edema formation surrounding malignant gliomas.

**Teaching**

The Department of Neurosurgery is involved in the curricular teaching of Medicine and Dentistry with compulsory and elective subjects. In addition, the students are exposed to the practical aspects of neurosurgery within the framework of the block practical course system through guided tours in operating rooms during live surgery. A special aspect is the interdisciplinary nature of teaching within the framework of the neurosurgery/neurology block. The Department of Neurosurgery supervises Bachelor’s and Master’s theses as well as MD and PhD theses.

**Selected publications**


Chen D, Fan Z, Rauh M, Buchfelder M, Eyupoglu IY, Savaskan N. ATF4 promotes angiogenesis and neuronal cell death and confers ferroptosis in a xCT-dependent manner. Oncogene. 2017 Oct 5;36(40):5593-5608


**International cooperations**

Prof. DS Olsson, MSc, MD, PhD, University of Gothenburg, Göteborg: Sweden

Prof. Dr. JP Martinez-Barbera, UCL GOS Institute of Child Health, London: UK