Department of Otorhinolaryngology –
Head and Neck Surgery

Chair of Otorhinolaryngology

Address
Waldstraße 1
91054 Erlangen
Phone: +49 9131 85-33156
Fax: +49 9131 85-33833
www.hno-klinik.uk-erlangen.de

Director
Prof. Dr. med. Dr. h. c. Heinrich Iro

Contact
Prof. Dr. med. Christoph Alexiou
Phone: +49 9131 85-33142
Fax: +49 9131 85-34808
christoph.alexiou@uk-erlangen.de

Research Focus
• Ultrasound, endoscopy, and salivary glands
• Division of Phoniatrics and Pediatric Audiology
• Experimental Oncology/Nanomedicine (SEON)
• Cochlear implantation in the elderly
• Allergology/clinical immunology and rhinology
• Experimental otolaryngology
• Laboratory for sleep disorders/somnology

Structure of the Department
Professorships: 6
Personnel: 167
• Doctors (of Medicine): 42
• Scientists: 29
(thereof funded externally: 13)
• Graduate students: 28

Clinical focus areas
• Minimal invasive surgery of salivary glands
• Lancer surgery
• Cochlear implantat surgery
• Nose/Paranasal surgery
• Clinical and surgical treatment of voice disorders
• Pediatric hearing disorders
• Diagnosis and treatment of sleep disorders

Research
The Department of Otorhinolaryngology – Head and Neck Surgery is one of the largest hospitals in Germany and has a comprehensive research repertoire. In the clinical area, the focus is on ultrasound, the diagnosis/treatment of salivary gland diseases, tumor and voice disorders, vestibular and hearing impairments as well as somnology and allergology. These are reflected in the basic research area. Nanomedicine, which carries out translational projects as well as extensive basic research, is another highly interdisciplinary focus.

Ultrasound, endoscopy, and salivary glands
In modern ultrasound systems and endoscopy units, studies about sonographic imaging of head and neck malignancies and salivary gland tumors remain an important role of scientific efforts. Identification and classification of tissues using tissue harmonic imaging and compound imaging were evaluated in the neck area. The gland preserving surgery for benign salivary gland tumors is the main focus. The main topics are currently the long-term outcomes after limited, extracapsular resection in particular of pleomorphic adenoma and cystadenolymphoma of the parotid gland.

Combined endoscopic and open surgical procedures offer a new option for the treatment of obstructive, but also of further salivary gland diseases, such as traumatic duct injuries. The long-term results and subjective patient outcome of such a treatment were evaluated and published. The device that is already applied for the therapy of kidney stones has been used in the world-wide first treatment of salivary stones. The preliminary results of the first 44 treated patients were published in 2016. In 100% of the cases the patients were free of complaints, in 98% free of stones and in all cases the glands could be preserved.

Division of Phoniatrics and Pediatric Audiology
Our clinical research focuses on the development of new methods allowing for quantitative voice diagnostics. The major part is the objective analysis of endoscopic high speed recordings during voice production. Within our basic research we concentrate on physical interactions during voice production. We develop and analyze numerical models (Lumped-mass models, Finite-Volume-Models) and experimental models (synthetic silicon vocal folds and ex-vivo animal cadaver larynx models). We expect to gain more insight into the interaction between airflow, vocal fold dynamics and resulting acoustics for physiologic and pathologic voice production. Since 2016 we analyze the vocal fold tissue from the molecular-biological point of view. All these topics have the goal to enhance diagnostics and the treatment of our patients.

Experimental Oncology/Nanomedicine (SEON)
Pt: Prof. Dr. C. Alexiou
Iron oxide nanoparticles offer several possibilities for application in medicine. For instance, they can serve as drug carriers delivering therapeutic to the desired area guided by a magnetic field. Furthermore, they can be used as contrast agents in MRI or magnetize cells for magnetic tissue engineering. The Section for Experimental Oncology and Nanomedicine (SEON) works in several interdisciplinary projects to promote the translation of iron oxide nanoparticles from bench to bedside. To guarantee biocompatibility guidelines for the immune toxicological investigation of nanoparticles for medical applications have been established (bilateral BMBF funding). Concerning environmentally relevant nanoparticles, the Bavarian State Ministry of the Environment and Consumer Protection supports the development of complex standardized assay systems (e.g. HET-CAM and zebra fish model) for nanotoxicology. For the Cluster of Excellence Engineering of Advanced Materials (EAM), SEON performs toxicological investigations of technical nanoparticles designed for particular applications. All in all, new equipment and the establishment of innovative methods enabled us to achieve substantial progresses in the nanotoxicology sector in the last years. In this context, SEON organized the symposium “Nanotoxicology – research for safe application of nanoparticles in biomedicine and assessment of environmental effects with several international participants. To understand the interplay of magnetic nanoparticles with biological matrices, SEON has been engaging for several years in the Priority Program SPP1681. Concerning tissue reconstruction, in cooperation with the Division of Phoniatrics and Pediatric Audiology we aim to develop a vocal fold implant by means of magnetic tissue engineering (funded by the German Cancer Aid) and we are also working on endothelialized scaffolds for heart and vascular surgery (DFG). A requirement for future clinical application is the translation of the nanoparticle synthesis from labscale to synthesis according to GMP guidelines which we want to address in cooperation with the pharmacy of UK Erlangen within the European FP-7 project “Nanaothero”. To finally apply magnetic nanoparticles for imaging and diagnosis of tumors, their suitability is also evaluated in Magnetic Particle Imaging (supported by the DFG). Furthermore, end of 2016 the new round of the Emerging Fields Initiative (EFI) of FAU was laun-
Cochlear implantation in the elderly
Cochlear Implants (CI) provide an efficient treatment of profound hearing loss and deafness. Due to the ageing of the population in developed countries, an increasing number of seniors with hearing problems will be asking for cochlear implantation. One important question is whether central auditory degeneration processes may hinder the restoration of the speech perception.

We developed a battery of electrophysiology as speech perception measures may hinder the restoration of the speech perception. We analyzed a battery of electrophysiology as auditory event potentials (AEP) and outcome measures as speech perception in noisy situations and bottom-up speech training to identify differences between elderly CI subjects above 75 years and regular CI listeners. In summary, CI provision in older subjects is still efficient for hearing restoration.

Allergology/clinical immunology and rhinology
Endonasal endoscopic sinus surgery and follow-up desensitization with ASS come into question as a treatment for NSAID-intolerant patients. A functional blood test to determine Eicosanoid-imbalance (FET-AIT®) is under investigation. In a retrospective study, the validity of FET-AIT® as a test for identification of patients with NSAID-intolerance is going to be evaluated compared to nasal and oral provocation as a standard procedure.

Experimental otolaryngology
Damage to the auditory system, e.g. due to noise trauma, does not only lead to hearing impairments, but may also cause subjective tinnitus. We could demonstrate in our (gap-noise) animal model that prophylactic as well as therapeutic treatment with EGB 761®, a Ginkgo extract, counteract both noise induced hearing loss (NIHL) and behavioral signs of tinnitus. In addition we propose a new model which relates the development of tinnitus to the attempt of the auditory system to compensate for hearing loss. According to the model, the auditory system generates internal noise which on the one hand is perceived as tinnitus, but on the other hand improves information transmission within the cochlear nucleus via stochastic resonance. The model is supported by clinical audiometric data demonstrating that patients with tinnitus show better hearing thresholds in the speech-relevant, low frequency range up to 3 kHz than those patients without tinnitus.

Laboratory for sleep disorders/somnology
Our sleep laboratory focuses on individual evaluation, management, and long-term care of sleep-related breathing disorders, like obstructive sleep apnea (OSA) and sleep-related hypventilation. These symptoms were investigated within a prospective, double-blind trial for their sensitivity, specificity, positive predictive and negative predictive value. Moreover we analyzed in a clinical trial the validity of different biomarkers from saliva and serum as a parameter for primary diagnosis or for monitoring the success of the treatment of OSA patients. In a further study the influence of total sleep time, sleep architecture, chronic intermittent hypoxia and apnea hypopnoea index on subjective and objective daytime sleepiness of OSA patients was assessed.

Teaching
The Department of Otorhinolaryngology, Head and Neck Surgery is involved in the curricular teaching of human and dental medicine with compulsory and elective subjects. Particularly the interdisciplinary teaching concerning medical technology, nanotechnology, toxicology and integrated life sciences has to be pronounced.

Bachelor’s and Master’s theses as well as MD and PhD theses are supervised.

Selected Publications

International Cooperations
Prof. R.R. Patel, University of Indiana, Bloomington: USA
S. E. McNeil, PhD, Nanotechnology Characterization Laboratory (NCL), Frederick: USA
D. Letournier, PhD, INSERM Laboratory, LVTS, Paris: France
Prof. Dr. Dr. Y. Temel, School for Mental Health and Neuroscience, Maastricht University, Maastricht: The Netherlands
Prof. Dr. N. Diller, ORL, Universitäts spitzz Zürich, Zurich: Switzerland