

Course title: Medical Imaging in Stereotactic Neurosurgery

Identification number	Workload	Credits	Frequency of occurrence	Duration
M-Neuro-AM7 a-d	180h	6 points	winter term	one term per year
1	Type of lessons a) lectures b) practice	Contact times a) 20h b) 14h	Self-study times 146h (preparation and reworking of lectures, practical and exam)	Intended group size a) a) ca. 5-15 b) b) ca. 5-15/ tutor
2	Aims of the module and acquired skills After completing the module, the student will be familiar with <ul style="list-style-type: none"> ✓ principles and application of X-ray, CT, PET and MR imaging for stereotactic neurosurgery ✓ software tools for the representation, processing and evaluation of medical images ✓ stereotactic coordinate systems and devices ✓ clinical interpretation of multimodal neuroimages ✓ advanced image analysis methods including tractography, radiomics and deep learning 			
3	Contents of the module <ul style="list-style-type: none"> • Introduction to medical imaging • Image formation and digital image processing: X-ray, CT • PET – physical basics, clinical applications • MRI – physical basics • MRI – diffusion imaging, tractography • Clinical interpretation of multimodal imaging • Physical principles of stereotactic procedures • Deep brain stimulation • Artificial intelligence, Deep Learning • Artificial intelligence, Radiomics • Practical MRI demonstration • Imaging applications in stereotactic neuro-oncology • Intraoperative imaging methods • Participation in a stereotactic operation (deep brain stimulation, biopsy) 			
4	Teaching/Learning Methods Lecture with practical exercises, participation in a stereotactic operation (deep brain stimulation, biopsy), participation in MR demonstration			
5	Requirements for participation: Enrollment in the Master’s degree program “Experimental and Clinical Neurosciences” at the University of Cologne, basic knowledge of upper secondary school physics and mathematics			
6	Type of module examination Written exam (multiple choice)			
7	Requirement for the allocation of credits Regular participation and active participation in the exercises Final exam (= module exam) after the module Exam content: material of the lecture and exercises			
8	Compatibility with other Curricula none			

9	<p>Significance of the module mark for the overall grade In the Master's degree program "Experimental and Clinical Neurosciences": 6% of the overall grade (see also appendix of the examination regulations)*</p>
10	<p>Module coordinators Prof. Dr. M. Kocher, tel. 478-82745, martin.kocher@uk-koeln.de Prof. Dr. M. Ruge, tel. 478-82788, maximilian.ruge@uk-koeln.de Lecturing tutors: Dr. P. Andrade-Montemayor, Dr. L. Caldeira, M.sc. M. Eichner, Prof. N. Galldiks, Dr. C. Hamisch, PD Dr. S. Hunsche, Dr. S. Jünger, Dr. J. Lindemeyer, PD Dr. P. Lohmann, M.sc. R. Loucao, Dr. A. Meissner, PD Dr. D. Rueß, Prof. Dr. M. Ruge, Prof. Dr. V. Visser-Vandewalle</p>
11	<p>Additional information Literature:</p> <ul style="list-style-type: none"> • P Suetens: Fundamentals of Medical Imaging. Cambridge University Press 2009 • JK Krauss, J Volkmann: Tiefe Hirnstimulation. Steinkopff Verlag Darmstadt 2004 • M. Jenkinson, M. Chappell: Introduction to Neuroimaging Analysis. Oxford University Press 2018 • S.R. Cherry, J.A. Sorenson, and M.E. Phelps. Physics in Nuclear Medicine. Elsevier Science, 2012 • D.W. McRobbie, E.A. Moore, M.J. Graves, M.R. Prince. MRI - From Proton to Picture. Cambridge University Press, 2017