Course Title: Neuroimaging

Identification number	Workload	Credit points	Frequency of occurrence	Duration
M-Neuro-AM6 a-b	270h	9CP	WS	One Semester

	Type of lessons	Contact times	Self-study times	Intended group size
1	a) Lecture (L)	a) 30h	240h (preparation and post-processing of the lectures, term paper, presentation)	a) about 10 to 20 students

2 **Aims of the module and acquired skills**

The main aim of the course is to learn about the advantages and limitations of the different imaging methods that are currently used in neuroscience. The emphasis is on the traditional imaging methods (e.g., MRI, PET etc.) and electrophysiological imaging methods (e.g., EEG, MEG) as well as on neuro-modulation by non-invasive brain stimulation (NIBS). In addition to the use of these methods in basic and translational neuroscience, the course also covers the clinical applications of these imaging methods.

After completing this course, the students have achieved a sound and critical understanding of the imaging methods, including in-depth-knowledge of two imaging methods of choice (by the presentation and by the term paper). Moreover, the student has encountered exemplary approaches how these imaging methods are applied in a scientific and clinical context.

3 **Contents of the module**

- biophysical foundation and principles of *structural* imaging methods, including MR-morphometry, diffusion-weighted MR (DTI), and lesion mapping
- biophysical foundation and principles of *functional* imaging methods, including (task-based) functional MRI, resting state fMRI
- biophysical foundation and principles of *metabolic* imaging methods and neurotransmitter imaging, including PET and multimodal imaging
- biophysical foundation and principles of *electrophysiological* imaging methods, including EEG and MEG
- imaging in animal models and non-invasive brain stimulation (e.g., TMS)
- imaging applications in neurology and psychiatry

4 **Teaching/Learning Methods**

Seminar/lecture, presentation by students, term paper

5 **Requirements for Participation**

Enrollment in the Master's degree course "Experimental and Clinical Neurosciences" at the University of Cologne

Basic knowledge in neuroanatomy and neurophysiology as well as statistics are helpful.

6 **Type of module examination**

Presentation of scientific (original) paper and term paper (both will be graded by the respective lecturer)

7	**Requirement for the allocation of credits** Regular and active (!) participation in the course as well as thorough preparation of the lectures (by carefully reading of the to be discussed papers), presentation and term paper
8	**Compatibility with other Curricula** None
9	**Significance of the module mark for the overall grade** In the Master´s degree course "Experimental and Clinical Neurosciences": 9% of the overall grade (see also appendix of the examination regulations)
10	**Module coordinator:** Professor Peter H. Weiss-Blankenhorn, Cognitive Neurology, Department of Neurology (Peter.Weiss-Blankenhorn@uk-koeln.de) **Lecturing tutors (for WS 2019/2020, in alphabetical order):** Markus Aswendt, Jürgen Dammers, David Elmenhorst, Xiaochen Hu, Bojana Kuzmanovic, Paola Mengotti, Charlotte Nettekoven, Thomas Schüller, Ralf Tepest, Marc Tittgemeyer, Thilo van Eimeren, Kai Vogeley, Peter H. Weiss-Blankenhorn
11	**Additional Information** Venue: Library of the Department of Neurology (Room 1.124, 1st Floor, Building/ Haus 30) **Selected Literature:** Filippi, M., & Agosta, F. (2016). Diffusion tensor imaging and functional MRI. Handb Clin Neurol, 136, 1065-1087. doi:10.1016/B978-0-444-53486-6.00056-9 Polania, R., Nitsche, M. A., & Ruff, C. C. (2018). Studying and modifying brain function with non-invasive brain stimulation. Nat Neurosci, 21(2), 174-187. doi:10.1038/s41593-017-0054-4 Rorden, C., & Karnath, H.-O. (2004). Using human brain lesions to infer function: a relic from a past era in the fMRI age? Nature Reviews Neuroscience, 5, 813-819.