**REQUIREMENTS**

**Semmelweis University, Faculty of Medicine**
**Name of the managing institute (and any contributing institutes):**
**Department of Anatomy, Histology and Embryology**

**Name of the subject:** Systems Neuroscience VI. Brain imaging: from normal to pathological

**in English:** Systems Neuroscience VI. Brain imaging: from normal to pathological

**in German:**

**Credit value: 2**

**Number of lessons per week: 28 lecture: 0 practical course: 3 seminar: 25**

**Subject type: compulsory course elective course optional course**

**Academic year: 2019/2020. academic year II. semester**

**Subject code: AOSANT560_6A**

*(In case of a new subject, it is filled by the Dean's Office, after approval)*

**Name of the course leader: Dr. Gerber Gábor**

**His/her workplace, phone number: 53653**

**Position: Vice Chairman of the dept.**

**Date and registration number of their habilitation: 04/2019**

**Objectives of the subject, its place in the medical curriculum:**
This part of the course begins with an introduction of the physical and physiological background of fMRI and DTI, then we will continue with the basics of data acquisition and classical generalized linear model (GLM) based analysis, paradigm design for brain mapping, dynamic connectivity (dynamic causal modelling, DCM) analysis and data-driven methods (independent component analysis, ICA), with a focus on basic research and clinical applications.

**Place where the subject is taught (address of the auditorium, seminar room, etc.):**
library room, Department of Anatomy, Histology and Embryology

**Successful completion of the subject results in the acquisition of the following competencies:**

**Course prerequisites:**
Medical biophysics, Biostatistics and informatics, Anatomy and Physiology. Grade point average (GPA) of 3.0 in the last semester.

**Number of students required for the course (minimum, maximum) and method of selecting students:**
min. 5, max. 7; on the first-come first-served basis

**How to apply for the course:**
Neptun

**Detailed curriculum:**
*(Theoretical and practical lessons shall be given separately by numbering the lessons (by weeks). Please provide the names of the teachers of the lectures and practical lessons and indicate guest lecturers. Do not use attachments!*

*Always attach a CV for guest lecturers!)*

**Lajos Rudolf Kozák, MD, PhD, EDiNR, guest lecturer**
**Theoretical lessons**

Seminar 1. Introduction to magnetic resonance imaging, physical and biological background of measurements I.
Seminar 2. Introduction to magnetic resonance imaging, physical and biological background of measurements II.
Seminar 3. Types of MRI sequences, and their applications I.
Seminar 4. Types of MRI sequences, and their applications II.
Seminar 5. Types of MRI sequences, and their applications III.
Seminar 6. Diffusion imaging, diffusion tensor imaging, high angular resolution diffusion imaging. Theory, research and clinical applications. I.
Seminar 7. Diffusion imaging, diffusion tensor imaging, high angular resolution diffusion imaging. Theory, research and clinical applications. II.
Seminar 8. Diffusion imaging, diffusion tensor imaging, high angular resolution diffusion imaging. Theory, research and clinical applications. III.
Seminar 9. fMRI: theory, research and clinical applications I.
Seminar 10. fMRI: theory, research and clinical applications II.
Seminar 11. fMRI: theory, research and clinical applications III.
Seminar 12. fMRI: theory, research and clinical applications IV.
Seminar 13. fMRI: theory, research and clinical applications V.
Seminar 14. Connectomics with DTI and fMRI in health and disease I.
Seminar 15. Connectomics with DTI and fMRI in health and disease II.
Seminar 16. Practical sessions of fMRI and DTI analysis on anonymized clinical cases using free tools I.
Seminar 17. Practical sessions of fMRI and DTI analysis on anonymized clinical cases using free tools II.
Seminar 18. Practical sessions of fMRI and DTI analysis on anonymized clinical cases using free tools III.
Seminar 19. Practical sessions of fMRI and DTI analysis on anonymized clinical cases using free tools IV.
Seminar 20. Practical sessions of fMRI and DTI analysis on anonymized clinical cases using free tools V.
Seminar 21. Student presentations, discussion I.
Seminar 22. Student presentations, discussion II.
Seminar 23. Student presentations, discussion III.
Seminar 24. Test
Seminar 25. Test

**Practical lessons:**

1. fMRI analysis with SPM on example cases
2. DTI analysis with ExploreDTI on example cases
3. Visit to the MRI Unit (optional)

**Consultations:** personally with the actual course leader

**Other subjects concerning the border issues of the given subject (both compulsory and optional courses!). Possible overlaps of themes:**

**Special study work required to successfully complete the course:**
*(E.g. field exercises, medical case analysis, test preparation, etc.)*

**Requirements for participation in classes and the possibility to make up for absences:**
**Total absence allowed:** 25% of the course hours

**Recovering missing hours:** studying the material provided by the course leaders, consultation

**Methods to assess knowledge acquisition during term time:**
(E.g. homework, reports, mid-term test, end-term test, etc., the possibility of replacement and improvement of test results)
Exam on the last day of the course
Additional occasions to be arranged by the teacher for improvement

**Requirements for signature:**
Succesful written test

**Type of examination:**
colloquium

**Requirements of the examination:**
(*In case of a theoretical examination, please provide the topic list; in case of a practical exam, specify the topics and the method of the exam)*
Verbal and electronic etc. material provided by the lecturers. Syllabus is available upon opening the program on the web page**.**

**Method and type of evaluation:**
(*Method of calculating the final mark based on the theoretical and practical examination. How the mid-term test results are taken into account in the final mark.)*
Grades are given after obtaining points as follows: 0-50% fail, 51-60% pass, 61-75% fair, 76-90% good, above 90% excellent.

**How to register for the examination?:**
Neptun

**Possibilities for exam retake:**
2 occasions arranged by the teacher

**Printed, electronic and online notes, textbooks, guides and literature (URL address for online material) to aid the acquisition of the material:**

Scott A. Huettel, Allen W. Song, Gregory McCarthy (2014). Functional Magnetic Resonance Imaging. Third Edition. Sinauer Associates, Inc., Sunderland, MA, USA
Russell A. Poldrack, Jeanette A. Mumford, Thomas E. Nichols (2011). Handbook of Functional MRI Analysis. Cambridge University Press.
Peter Bandettini (ed.): 20 Years of fMRI – Special Issue (2012). NeuroImage 62(2):575-1324, available at: http://www.sciencedirect.com/science/journal/10538119/62/2
Stephen Smith (ed.): Mapping the Connectome – Special Issue (2013). NeuroImage 80:1-544, available at: http://www.sciencedirect.com/science/journal/10538119/80

**Web resources:**
1) http://www.fmri4newbies.com/
2) http://www.fil.ion.ucl.ac.uk/spm/course/slides14-may/
3) http://fsl.fmrib.ox.ac.uk/fslcourse/
4) https://www.youtube.com/channel/UCZ7gF0zm35FwrFpDND6DWeA

**Signature of the habilitated instructor (course leader) who announced the subject:**

Signature of the Director of the Managing Institute:

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| **Hand-in date:** |

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| **Opinion of the competent committee(s):** |
| **Comments of the Dean's Office:** |
| **Dean's signature:** |