REQUIREMENTS

Semmelweis University Faculty, Department:

Faculty of Medicine, Department of Anatomy, Histology and Embryology

Name of the course: Systems Neuroscience VI. Neural rhythms: normal and pathological. Brain imaging: from normal to pathological

Type of course: optional course-unit

code: AOSANT560_6A

credit: 2

Name of the responsible person: Dr. Gábor Gerber (Dániel Fabó, PhD, Lajos Rudolf Kozák, PhD)

Academic year: 2018/2019., second semester

Role of the course in the training of the Department:

During this course we set sail adrift brain waves to get better insight into the normal and abnormal functions of the brain. We proceed through wake and sleep oscillations to the pathophysiological features of epilepsy. We will see how these oscillations can be recorded in humans at various scales, beside the bed or within the operating room and we will glance at the exciting horizons opened by neuro-modulatory techniques such as deep brain stimulation.
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.

The program of the course:

1. Lecture: Physiological oscillations. Human brain anatomy I
2. Lecture: Physiological oscillations. Human brain anatomy II
3. Lecture: EEG basics I
4. Lecture: EEG basics II
5. Lecture: EEG basics III
6. Lecture: Oscillations during diseases. Sleep EEG basics.
7. Lecture: Oscillations during diseases. Sleep EEG and memory functions I
8. Lecture: Oscillations during diseases. Sleep EEG and memory functions II
9. Lecture: Oscillations during diseases. EEG in epilepsy I
10. Lecture: Oscillations during diseases. EEG in epilepsy II
11. Lecture: Physical and biological background of fMRI and DTI. I
12. Lecture: Physical and biological background of fMRI and DTI. II
13. Lecture: Physical and biological background of fMRI and DTI. III
14. Lecture: Principles of task based fMRI. I
15. Lecture: Principles of task based fMRI. II
16. Lecture: Principles of brain connectivity analysis using fMRI and DTI. I
17. Lecture: Principles of brain connectivity analysis using fMRI and DTI. II
18. Lecture: Principles of brain connectivity analysis using fMRI and DTI. III
19. Lecture: Brain mapping and connectivity analysis for medicine. I
20. Lecture: Brain mapping and connectivity analysis for medicine II
21. Lecture: Students' presentations, discussion I

22. Lecture: Students' presentations, discussion II
23. Lecture: Students' presentations, discussion III
24. Lecture: Written test
25. Lecture: Written test

Practical courses:
1. course: Visit to the long term video-EEG unit. Scalp EEG examination with a volunteer.
2. Course: Reviewing epileptic seizures and EEGs.
3. Course: Data acquisition, data pre-processing and fMRI analysis using free or open access research tools.

Consultations: personally with the actual course leader

Requirements of course participation and options to recover missed hours:

1. **Total absence allowed: 10% of the course hours**
2. **Recovering missing hours: studying the material provided by the course leaders, consultation**

Eligibility: US grade point average (GPA) of 3.0. Students with a GPA lower than 3.0 should inquire with the Directors on the possibility of a waiver.

Justification of absence from course hours or exams:
Hungarian medical certificate

Number and schedule of the examinations:

1 on the last day of the course

Requirements of the successful completion of the program:

written or oral test in each course material

Marks:

In case of a written test grades are given after obtaining points as follows: 0-50% fail, 51-60% pass, 61-75% fair, 76-90% good, above 90% excellent.

Types of exam: test, essay, verbal

Requirements of the examinations:

Verbal and electronic etc. material provided by the lecturers. Syllabus is available upon opening the program on the web page.

Registration for exams: NEPTUN

Rescheduling the tests:

N/A
Each student has to take an examination in each block of the course.

Justification of absence from the exam:

Hungarian medical certificate (see above).

List of useful literature (books, papers etc):

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/

Buzsaki G (2006). Rhythms of the brain. Oxford University Press, New York.

Milton J and Jung P (2003). Epilepsy as a dynamic disease. Springer, New York.