**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 III. Microsystems to interface neurons

**in English:** Systems Neuroscience III. Microsystems to interface neurons

**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_3A**

*(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:**
The course provides comprehensive insight into the interdisciplinary field of neural microsensors and actuators relying on the recent advances in both material- and neuroscience. Operation principles, technological challenges will be addressed through real applications in the central nervous system.

**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 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!)*

**Zoltán Fekete, PhD, guest lecturer**

**Theoretical lessons**

Seminar 1. History of microscale implants for central nervous system research.
Seminar 2. Fundamental background in micro- and nanotechnology I.
Seminar 3. Fundamental background in micro- and nanotechnology II.
Seminar 4. Fundamental background in micro- and nanotechnology III.
Seminar 5. Fundamental background in micro- and nanotechnology IV.
Seminar 6. Soft neural implants: materials
Seminar 7. Soft neural implants: technology
Seminar 8. Soft neural implants: applications
Seminar 9. MicroECoGs in multimodal neuroimaging I.
Seminar 10. MicroECoGs in multimodal neuroimaging II.
Seminar 11. Integrated functions in multimodal microsystems I.
Seminar 12. Integrated functions in multimodal microsystems I.
Seminar 13. Drug delivery microdevices.
Seminar 14. Neural probes for optrogenetics
Seminar 15. Neural probes for infrared neural stimulation.
Seminar 16. Mechanical interaction between implanted device and neural tissue I.
Seminar 17. Mechanical interaction between implanted device and neural tissue II.
Seminar 18. Long-term stability and biocompatibility of neural implants I.
Seminar 19. Long-term stability and biocompatibility of neural implants II.
Seminar 20. Responsive neural implants.
Seminar 21. Discussion, Q&A
Seminar 22. Oral exam
Seminar 23. Oral exam
Seminar 24. Oral exam
Seminar 25. Oral exam

**Practical lessons:**

Lab visit in the clean room facility of the Microsystems Laboratory, Centre for Energy Research to learn micro- and nanofabrication processes to produce neural implants.

**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:**

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| colloquium |
| **Requirements of the examination:**<br>(*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)*<br>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:**<br>(*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.)*<br>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?:**<br>Neptun |
| **Possibilities for exam retake:**<br>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:**<br><br>K.D. Wise et al, Microelectrodes, Microelectronics, and Implantable Neural Microsystems, Proceedings of the IEEE 96 (2008) 1184-1202<br><br>Z. Fekete et al., Multifunctional soft implants to monitor and control neural activity in the central and peripheral nervous system: a review, Sensors & Actuators B-Chemical 243 (2017) 1214-1223<br><br>Z. Fekete, Recent advances in silicon-based neural microelectrodes and microsystems: a review, Sensors & Actuators B-Chemical 215 (2015) 300-315 |
| **Signature of the habilitated instructor (course leader) who announced the subject:** |
| Signature of the Director of the Managing Institute: |
| **Hand-in date:** |

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