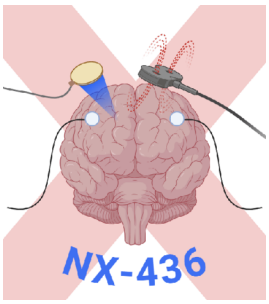
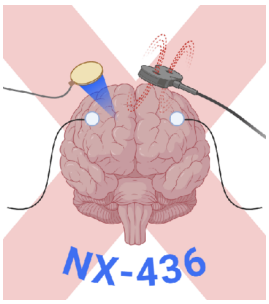


Nx-436: Lecture Topics, lecturer:

Week	Lecturer	Topic
Week1 10.09.2025	FH/TM	Introduction in the course (Organization, Requirements, Lectures-Exercises, Evaluation, Grading) Introduction into Neuromodulation. History of Neuromodulation
Week2 17.09.	FH	Neuromodulation of the vegetative system: Vagal nerve stimulation (VNS)
Week3 24.09.	FH	Neuromodulation of the peripheral nerve stimulation
Week4 01.10.	ER	Focused ultrasound neuromodulation
Week5 08.10.	FH	Spinal cord stimulation (invasive, non-invasive)
Week6 15.10.	FH	Transcranial magnetic stimulation (TMS) I (to determine brain functioning)
Week7 22.10.		no lecture
Week8 29.10.	FH	Transcranial magnetic stimulation (TMS) II (neuromodulation)
Week9 05.11.	FH	Transcranial electric stimulation (tES) I
Week10 12.11.	FH	Transcranial electric stimulation (tES) II
Week11 19.11.	VZ	Neuromodulation by optogenetics/chemogenetics
Week12 26.11.	FH	Deep brain stimulation (DBS) I: non-invasive
Week13 03.12.	MR	Deep brain stimulation (DBS) II: invasive
Week14 10.12.	FH	NIBS and multimodal imaging
Week15 17.12.	FH	Future outlook for neuromodulation: home-based, closed loop etc.



Learning Goals

- Brief overview about the history of brain stimulation
- Know the current methods for neuromodulation (non-invasive and invasive)
- Know the technological background, mechanisms of actions of them
- Know safety and regulatory aspects of them
- Know the challenges, limitations of these technologies that have to be addressed
- Know about non-personalized vs personalized neuromodulation, heterogeneity of response and how to address this
- Know the concept of state-dependent, closed-loop neuromodulation, challenges and opportunities
- Know the use of machine learning, AI for neuromodulation.
- Know about clinical applications, challenges and opportunities
- Know about home-based self-application, technological requirements, challenges, opportunity.

Lecturer

FH: Friedhelm Hummel, EPFL (https://www.epfl.ch/labs/hummel-lab/) friedhelm.hummel@epfl.ch

Guest Lecturer

ER: Estelle Raffin, EPFL, (https://lpnc.univ-grenoble-alpes.fr/fr/estelle-raffin), Estelle.Raffin@univ-grenoble-alpes.fr

VZ: Valerio Zerbi, UNIGE, Valerio.Zerbi@unige.ch

MR: Martin Reich, UKW (https://www.ukw.de/neurologie/team/neurologie-detail/name/reich-martin/#) reich_m1@ukw.de