



Final Assessment: Multiple Choice Questionnaire (MCQ) Exam

At the end of the course, students will complete a comprehensive Multiple Choice Questionnaire (MCQ) exam to assess their understanding of the course content. This exam will cover all topics discussed throughout the semester, including the principles of neuromodulation, underlying mechanisms of neuromodulation technologies, and their clinical applications. The MCQ exam is designed not only to test recall but also to assess your ability to apply your knowledge and think critically about the course content.

Exam Guidelines:

- **Format:** The MCQ exam will consist of questions that may have single or multiple correct answers. You should read each question carefully and select the most appropriate response(s). Some questions may require students to select a combination of answers to reflect the complexity and nuanced understanding of the course material. It is important to consider all options carefully to choose the most accurate responses.
- **Content Coverage:** Questions will encompass the topics covered in the course, including:
 - Fundamental principles and mechanisms of action for various neuromodulation techniques.
 - Recent advancements and research findings in neuromodulation.
 - Clinical applications of neuromodulation in neurological and psychiatric disorders.
 - Key concepts discussed during lectures, journal clubs, and project presentations.
- **Preparation and Expectations:**
 - **Study Materials:** you are encouraged to review lecture notes, assigned readings, suggested literature, JC discussions, and key points from the group projects to prepare for the exam.

The MCQ exam will serve as a final measure of students' comprehension and engagement with the material, ensuring they have a solid foundation in the principles and applications of neuromodulation.

Evaluation Guidelines:

- **Percentage of the MCQ exam for the final grade: 50%**
- **Evaluation criteria:**
 - Wrong answers are not punished
 - If combination of answers is required, only the correct combination will be accepted as correct
- **Mock MCQ Questions : see below**

Exemples MCQ Questions

- 1) So far current non-invasive brain stimulation methods have largely targeted cortical areas despite the fact that several deep brain structures are critically important hubs for cognitive functions and significantly involved in the pathophysiology of a lot neurological and psychiatric disorders. What is the limitation of these current methods in this regard and which challenges have to be solved to reach deep brain structures in a focal manner
- A. Heterogeneity in treatment response
 - B. Steep depth-focality trade of current approaches such as TMS, tDCS or tACS
 - C. Develop technologies that provide enhanced focality in deep brain structures without stimulating overlying brain regions
 - D. Ability for self-application

Correct: B, C

- 2) Which central network node in the basal ganglia loop is used for neuromodulation therapy in Parkinson's disease?
- A. Caudate nucleus
 - B. Cerebellum
 - C. Fornix
 - D. subthalamic nucleus

Correct: D

- 3) Which methods have been recently experienced for imaging-guide approaches in deep brain stimulation programming?
- A. x-ray imaging
 - B. positron emission tomography
 - C. functional magnetic resonance imaging
 - D. computed tomography scan

Correct: C

- 4) When was the first application of non.invasive brain stimulation reported?
- A. 1985 when Barker presented for the first time focal TMS
 - B. By the reknown Neuroscientist and Nobel Prize winner Ivan Pavlov in 1904
 - C. By Giovanni Aldini during his milestone experiment in the 18th century
 - D. By Claudius Galen in the 2nd century AD

Correct: D

- 5) Which is the correct ranking of the spatial resolution of these different brain stimulation methods (from left to right reduced spatial resolution)?
- A. tTIS>rTMS>tRNS>optogenetic
 - B. rTMS>tACS> optogenetic>tRNS
 - C. tDCS>tFUS>TMS>tRNS.
 - D. Optogenetic>tFUS>TMS>tDCS

Correct: D

6) paired-pulsed TMS (ppTMS)

- A. provides the possibility to evaluate in humans GABA-ergic cortical interneuron function
- B. has a higher temporal resolution than single pulse TMS
- C. the effects of the ppTMS depend on the interstimulus interval between the 2 pulses (e.g., inhibitory vs excitatory)
- D. can only be applied during rest

Correct: **A, C**

7) Neuronavigated TMS

- A. Allows to apply TMS in topographically personalized way adjusted to the individual brain anatomy
- B. Can only be used if an CT of the head is available
- C. Cannot be applied in Alzheimer's patients
- D. Allows to apply TMS in a functionally personalized way adjusted to the individual brain activity

Correct: **A, C**

8) Transcranial Ultrasound stimulation (TUS) is FDA approved for:

- A. the treatment of essential tremor
- B. the treatment of depression and anxiety
- C. the treatment of Parkinson's disease
- D. motor stroke rehabilitation

Correct: **A, B**

9) Closed-loop TMS:

- A. Is an approach where TMS pulses are applied depending on ongoing brain activity
- B. The goal is to reduce the efficacy of an individual TMS pulse
- C. The goal is to reduce heterogeneity of individual responses to the TMS pulses
- D. Is an established, FDA-approved treatment for Addiction

Correct: **A, C**

10) Vagal nerve stimulation is applied :

- A. to reduce epileptic seizure in epilepsy
- B. to enhance stroke recovery
- C. to enhance anti-inflammatory effects in inflammatory bowel disease
- D. to reduce craving for smoking in smokers

Correct: **A, B, C**