

## PhD position in the project ‘ReverseStroke’

The Laboratory of Clinical Neuroengineering, directed by Friedhelm Hummel (<https://www.epfl.ch/labs/hummel-lab>), has an open position for a PhD student on the topic of recovery of motor functions after a stroke. The PhD will focus on the characterization of underlying systems neuroscience mechanisms of recovery of motor functions in subcortical stroke patients from the acute to the chronic stage by multimodal neuroimaging, virtual lesions approaches and behavioural characterization (e.g., Koch *et al.* 2021 Brain; Evangelista *et al.* 2023 Stroke, Harquel *et al.* 2024 Stroke). The acquired understanding will provide the basis for novel interventional strategies towards closed-loop approaches for brain-spine interactions to enhance motor recovery.

### Project description:

Skilled upper extremity movements are the foundation of abilities, all of us rely on proficient use of hands for successful activities of daily life. More than 100 million people worldwide lost the functional hand and arm movements due to stroke and a large part suffers from long-term motor disabilities. 25% of the patients sustained a subcortical stroke that interrupts the cortico-spinal tract that provides motor commands for movements from the motor cortex to the spinal cord. These damages prime motor deficits that lead in a large part of patients to significant hand and arm impairment, which critical impact on professional and private daily life. Currently, there is no treatment strategy that restores movements and motor functions satisfactorily. To develop novel, efficient treatment strategies a deeper understanding of the changes in the brain after a subcortical stroke and the mechanisms of functional reorganization are critical. The brain undergoes substantial adaptation following stroke. Yet, this adaptation process following subcortical stroke has not yet been fully characterized for different stroke severities. Here we will perform a longitudinal study in patients who suffered from subcortical stroke to characterize the encoding of hand and arm movement attempts following stroke. We will perform this characterization at several post-stroke timepoints from the acute to the early chronic stage. These data will allow to determine where the cortical representation of attempted hand and arm movements migrates as a function of lesion severity and motor deficits and larger-scale network changes associated with recovery.

### PhD position:

Specifically, the project plans to characterize the changes of cortical representation of movements and the network changes after a subcortical stroke that are associated to recovery in groups of patients with different severity of impairment. To achieve this we will apply cutting-edge systems neuroscience methods such as s/fMRI, virtual lesion approaches and TMS-EEG based electrophysiology with a focus on connectomics, as well as a detailed functional behavioral evaluation (e.g., Koch *et al.* 2021 Brain; Evangelista *et al.* 2023 Stroke, Harquel *et al.* 2024 Stroke; Fleury *et al.* 2022 Front Neurol; Bigoni *et al.* 2022 JNE, Bigoni *et al.* 2023 MED). The PhD will add to the better understanding of motor functions, impairment, representation of movements and recovery processes that will pave the way to novel treatment strategies in subcortical stroke.

The ideal candidate should have a Master's degree (or equivalent degree) in neuroscience, medicine or psychology, computer science or engineering, be strongly motivated with a keen interest in translational systems neuroscience especially multimodal neuroimaging, TMS-/EEG-based electrophysiology, modelling, ML and AI and neurotechnology. (1) strong neuroimaging background, especially in MRI and or TMS, EEG, (2) Strong systems neuroscience background, (3) programming skills in machine learning and modelling or (4) previous research experience in human experimental translational neuroscience is a plus.



Neuro-x Institute (INX)  
Defitech Chair in Clinical Neuroengineering  
<https://www.epfl.ch/labs/hummel-lab>

### **Working environment:**

The successful applicant will join the EPFL Defitech Chair of Clinical Neuroengineering which is led by Prof. Friedhelm Hummel and focuses on translational human neuroscience and neuroengineering with a focus on learning and memory in healthy aging and in patients suffering from stroke, traumatic brain injury or dementia. The Lab hub critically relevant for this project is within an hospital environment in Sion in the heart of the beautiful area of Valais where we have established a strong collaboration with the local clinical partners to have optimal access to the patients. The second Lab hub is based in Geneva's beautiful Campus Biotech, right next to Lake Geneva. The Ph.D. candidate will be enrolled in the EPFL Ph.D program Neuroscience (EDNE). You will work in an interdisciplinary, international team of researchers and clinical partners. The PhD project is within a larger EU-funded EIC pathfinder project (ReverseStroke).

### **Start of position:**

Spring 2025

### **Application procedure:**

Interested candidates must submit their application to the EDNE doctoral school

(<https://www.epfl.ch/education/phd/edne-neuroscience/edne-how-to-apply/>)