Instituts thématiques Inserm
Institut national de la santé et de la recherche médicale

UNIVERSITÉ FRANÇOIS - RABELAIS TOURS

Inserm UMR 930 Imaging & Brain | François-Rabelais University

PhD Thesis project
Development of ultrasound device for transcranial neurostimulation

Context: Structural and functional brain alterations are the main causes of several neuropsychiatric (*e.g.,* depression, autism) and neurodegenerative (*e.g.,* Parkinson disease) disorders. These brain alterations are related to an enhanced resistance to therapeutic molecules (*e.g.,* depression). In addition, these cerebral disorders do not all have effective and safe treatments. In this context, neurostimulation techniques using electric (Deep brain stimulation, DBS) or magnetic (repeated Transcranial magnetic stimulation, rTMS) fields have been proposed. If pilot studies showed promising results, these neurostimulation methods have strong limitations. Indeed, the DBS is an invasive method, which requires the intracerebral implantation of electrodes, thus limiting its clinical use. The rTMS is not able to stimulate deep brain structures. Recent investigations reported that the transcranial ultrasound neurostimulation (TUS) can modify the brain electric activities.

Problematic: The development of TUS in clinics requires the design of ultrasound device dedicated to this application and the development of effective and safe protocols.

Preliminary data: We designed a ultrasound prototype device for TUS of anesthetized mouse. We developed ultrasound sequences with an application to different brain areas results in the contraction of skeletal muscles located in various parts of mouse body (*e.g.,* tail, legs, mustaches).

Objectives: In this context, the PhD candidate will have to:

1. Develop and characterize dedicated ultrasound probe for the TUS of small animal;
2. Simulate the propagation of ultrasound beam through the skull and cerebral tissue;
3. Develop optimal parameters for TUS on small animal using an electromyography;
4. Evaluate the safety of TUS on small animal.

Candidate profile

- MSc (M2) or equivalent diploma;
- Skills in acoustics and electronics;
- Skills in modeling and programming (*e.g.,* Matlab);
- Synthesis and editorials skills are required;
- Fluency in English (oral and written) is required.

Salary

PhD grant from French Ministry of High Education and Research

Budget for bench fees

- Cross-cutting project of Inserm U930, cofunded by Inserm and University F. Rabelais;
- Inserm grant of J.M. Escoffre.

PhD supervisors – Dr. A. Bouakaz, Team leader (ayache.bouakaz@univ-tours.fr) & Dr. J-M Escoffre (jean-michel.escoffre@univ-tours.fr)

Send your application form to jean-michel.escoffre@univ-tours.fr

- 1 curriculum vitae;
- 1 cover letter;
- 2 referee letters.

Inserm UMR 930 Imagerie et Cerveau | Université François-Rabelais
10 boulevard Tonnellé | Bâtiment T. Planiol | BP 3223 | F-37032 Tours Cedex 1 | France
Tél: +33(0)2 47 36 61 62 22 | Courriel: u930@univ-tours.fr | www.u930.tours.inserm.fr