PhD IN NEUROSCIENCES

"RELEVANCE OF DISCONNECTOME APPROACHES FOR PROGNOSTICATION FOLLOWING ISCHEMIC CEREBRAL INFARCT"

Location: **University of Bordeaux, FRANCE**
Doctoral school: **Health and life sciences**
Specialty: **Neurosciences**
Research lab: **Neurocentre Magendie INSERM U1215 & Neurofunctional imaging group (UMR 5293)**
Mentors: **Thomas TOURDIAS, MD, PhD & Michel THIEBAUT de SCHOTTEN, PhD**

Funding and dates

From 01-09-2022 to 01-09-2025
PhD salary funded by **Idex Université de Bordeaux** under the program IMPACT (Imaging for personalized medicine within a collaborative translational program). The student will be an employee of **Université de Bordeaux**

Keywords

Magnetic resonance imaging, Stroke, prediction, connectivity

Project description

Stroke is the first cause of acquired handicap in adults with enormous burdens for society. Rapid prediction of capacity to recover can guide therapeutic strategies and inform on new therapeutic targets. More than solely the infarct itself, disruption of networks and disconnection of remote areas are likely to play a significant role in the outcome. However, a predictive tool based on the connectivity - disconnectivity is still lacking. In this project, we will combine two innovative approaches: *(i)* the disconnectome that indirectly estimates the remote effect of a focal lesion *(ii)* the capacity to quantify remote alterations with imaging sensitive to iron that can accumulate in disconnected areas.

Our general objective is to provide **accurate and personalized symptom predictions** (both functional and cognitive outcome) for any stroke location in the brain thanks to new quantification of the severity of disconnection induced by the infarct.

We will take advantage of different stroke databases that are already collected and available. We will use local databases (~500 patients) in which stroke patients have been explored with subacute advanced MRI methods, and followed longitudinally up to one year with a detailed battery of clinical outcome including functional and cognitive scores. We will also use a national cohort from clinical routine of French Stroke centers (~4000 patients) in which acute / subacute MRI and functional outcome at 3 months are available. We will use a first set of these database (training set) to link the severity of brain disconnection induced by stroke and estimated through approaches developed by us (http://www.bcblab.com/BCB/Disconnectome.html) with clinical outcome. From these approaches we will derived morphospaces that will associate the localization of disconnection with the clinical outcome (cognitive morphospace and functional morphospace). We will test the

relevance of such derived morphospaces to improve prediction of long-term clinical outcome in a second independent set of the databases (validation set). We will compare this approach with another one that consists in quantifying remote disconnection according to iron accumulation (as measured with R2* in MRI) in the disconnected areas. Finally we will take advantage of a new ongoing clinical study in which stroke patients will receive a neuroprotection strategy to possibly avoid neurodegeneration of the disconnected areas. We will use the tools developed above to predict the natural evolution expected outcome of these patients which will be compared to the actual outcome with the neuroprotective strategy.

Five references from the group related to the project

1/ “A novel stroke lesion network mapping approach: improved accuracy yet still low deficit prediction”. Pini L, Salvalaggio A, De Filippo De Grazia M, Zorzi M, Thiebaut de Schotten M, Corbetta M. **Brain Commun**. 2021 Nov 13;3(4):fcab259.

2/ “Cerebral Small Vessel Disease MRI Features Do Not Improve the Prediction of Stroke Outcome”. Coutureau J, Asselineau J, Perez P, Kuchcinski G, Sagnier S, Renou P, Munsch F, Lopes R, Henon H, Bordet R, Dousset V, Sibon I, Tourdias T. **Neurology**. 2021 Jan 26;96(4):e527-e537.

3/ “Brain disconnections link structural connectivity with function and behaviour.” Thiebaut de Schotten M, Foulon C, Nachev P. **Nat Commun**. 2020 Oct 9;11(1):5094.

4/ “Neurodegeneration of the Substantia Nigra after Ipsilateral Infarct: MRI R2* Mapping and Relationship to Clinical Outcome”. Linck PA, Kuchcinski G, Munsch F, Griffier R, Lopes R, Okubo G, Sagnier S, Renou P, Asselineau J, Perez P, Dousset V, Sibon I, Tourdias T. **Radiology**. 2019 May;291(2):438-448.

5/ “Thalamic alterations remote to infarct appear as focal iron accumulation and impact clinical outcome”. Kuchcinski G, Munsch F, Lopes R, Bigourdan A, Su J, Sagnier S, Renou P, Pruvo JP, Rutt BK, Dousset V, Sibon I, Tourdias T. **Brain**. 2017 Jul 1;140(7):1932-1946.

Details on the thesis supervision and working environment

The candidate will work at our Insitut of Bioimaging (IBIO) at Bordeaux University. He/she will be co-supervised by Pr Thomas Tourdias (team INSERM U1215) and Michel Thiebaut de Schotten (UMR 5293). He/she will be integrated in a dynamic working environment with other PhD students and post-doctorates involved in imaging in humans. Bordeaux University promotes a new program named IMPACT (Imaging for personalized medicine within a collaborative translational program) with scientific animations, education and strong collaborations among the actors of in vivo imaging. The candidate will be integrated into this stimulating environment.
The project will start with data that are already collected and new prospective data are currently collected and will be analyzed at the end of the PhD program.

Profile and skills required

- Previous experience in MRI and image analysis
- Programming skills.
- Good written and oral English language skills.

Please send CV and motivation letter to **thomas.tourdias@u-bordeaux.fr**