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Postdoctoral position

Title: Energy constraints and brain dynamics of language and motor function during aging

Supervision : Pr Monica Baciu – Dr Marjorie Dole - Pr Corrado Cali

Localisation : Fonds de Dotation Clinatec & Laboratoire de Psychologie et NeuroCognition, Grenoble, France

Context and objectives

Brain ageing is characterised by a high interindividual variability, the underlying mechanisms of which remain largely unknown. Although numerous studies have investigated age-related reorganisation of brain activity, the dynamics of cerebral networks – reflecting their continuous reconfiguration over time – remain largely unknown. This project aims at identifying the electrophysiological dynamic markers underlying this variability, by examining two essential functions: language and motor function. It adopts an allostatic perspective of ageing, based on the hypothesis that brain reorganisation results from a global adaptation of the brain to energetic constraints imposed by the progressive decline of cerebral metabolism.
To characterize the spatio-temporal dynamics of neural networks, the project will rely on the analyses of open-access datasets, including cognitive and motor function measures, and electrophysiological measures (task and resting-state MEG). The aim will be to link the temporal organisation of cerebral networks using different metrics (stability, flexibility…) to their functional efficiency, making the assumption that certain dynamic configurations reflect optimised strategies under energetic constraints related to age. This will enable us to distinguish different ageing profiles, eg compensatory, fragile, resilient, etc, and to differentiate adaptive and efficient from inefficient dynamics in relationship with the cognitive and motor performance.

Technical description

The postdoctoral researcher will be responsible of the analysis of the MEG data, the characterization of brain dynamics, implementing and operationalizing the full methodological pipeline. In particular, the analytical pipeline will consist in:

- Dynamic states modeling using the Hidden Markov Models (HMM): identify recurring brain states, their duration and transition probabilities
- Dynamic metric extraction: flexibility, stability, transition dynamics, temporal fragmentation
- Multivariate modeling: relationships between dynamic MEG-derived metrics, age-related variables, behavioral performances

Applicant

Applicants must have a Ph.D. in cognitive neuroscience, computational neuroscience or related discipline.
The successful candidate will have:

- Strong background in electrophysiological data analyses (MEG, EEG, connectivity) and the related toolboxes (FieldTrip, MNE-Python, EEGLAB, Brainstorm…)
- Strong programming skills: Python, R, Matlab
- Experience with statistical modeling, multivariate statistical approaches, machine learning
- Ideally knowledge of dynamic brain modeling
- Excellent communication and scientific writing skills

Workplace

The position will be shared equally between the Laboratory of Pyschology and NeuroCognition (LPNC, UMR CNRS 5105, https://lpnc.univ-grenoble-alpes.fr/fr) and Fonds Clinatec (https://fonds-clinatec.fr/) in Grenoble, with approximately 50% of working time in each of the institutions. The LPNC is a research laboratory affiliated with CNRS and Université Grenoble Alpes, specializing in the study of cognitive processes and their underlying mechanisms, with strong expertise in computational modeling, brain network dynamics and cognition. The Fonds Clinatec is dedicated to translational research at the interface of neuroscience, biomedical technologies, and clinical applications, with the aim of developing innovative solutions for neurological disorders. Clinatec also hosts a MEG facility equipped with a new optically pumped magnetometer (OPM)-based MEG system, offering innovative opportunities for studying human brain activity.

Conditions

The candidate will have the opportunity to have an attractive 2-year post-doc grant.

Regular travel between the two laboratories is to be expected.

Annual gross salary: 33,000-45,000 depending on experience

Contacts

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