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**2-YEAR POSTDOCTORAL POSITION AVAILABLE  
AT NEUROSPIN/INM (PARIS, FRANCE)**

***Deep phenotyping of learning and decision-making  
7T MRI, MEG & computational modeling***

**Supervisor and contact**

Dr Florent MEYNIEL

<https://www.unicog.org/lab/the-computational-brain/>

**Duration and Dates**

- Initial duration: two years
- extension possible
- Full-time post
- Preferred starting date: January 2025

**Project description**

Learning and decision making are intertwined processes in many everyday situations. One example is when you decide where to have lunch: should you go to the nearby coffee shop or to the university cafeteria? Learning depends on choice, because you can learn which option you prefer by trying each option repeatedly, and decision making depends on learning, because you eventually want to select the option you have learned you like best. Uncertainty plays a key role in both learning<sup>1-4</sup> and decision making<sup>5</sup>, especially when the environment is not stationary (e.g., a new brand now runs the nearby coffee shop and you like it less).

In the CEA-funded EXPLORE+ collaborative project, we are interested in characterizing the neural representation of uncertainty<sup>6-8</sup> and value that emerge from learning and guide decisions. Our approach follows a deep phenotyping approach, attempting to characterize each subject with a large multimodal dataset. We collected data from 16 participants who participated in one behavioral session, two 7T fMRI sessions, and two MEG sessions. The large number of trials allows us to estimate and test different computational models of the decision and learning processes. The 7T MRI and MEG data provide access to the topographical organization of neural representations and their dynamics, respectively, to better understand learning and decision making.

One postdoc is currently working on the fMRI data, and we are looking for another postdoc for the MEG dataset. Both postdocs will work together to perform analyses informed by both modalities.

The EXPLORE+ project will continue with another previously funded project called BrainSync, which will collect data from 11.7 fMRI and intracranial recordings using the same task, providing an opportunity to extend the current work.

**Profile**

Ph.D. in neuroscience, machine learning or psychology, with good programming skills (ideally Python). Previous experience with ideally MEG, EEG or alternatively fMRI, computational modeling. You will be responsible for data analysis (mainly MEG, also fMRI-MEG in collaboration with Alexander Paunov, postdoc working on the fMRI part) and dissemination of results in internal seminars, international conferences and journal articles.

The working language of the lab is English. French is not required.

## Workplace and environment

Dr Florent MEYNIEL leads the Computational Brain team (more info [here](#)), which is located in two places.

- Institute of NeuroModulation ([INM](#)), Sainte Anne Hospital, Paris, France. The INM is part of the GHU Paris, Psychiatry & Neurosciences. The INM combines clinical activities and innovative clinical research in psychiatry with basic research in computational neuroscience. Team members spend most of their days here.
- [NeuroSpin](#), Paris-Saclay Campus, France. NeuroSpin is part of the CEA (Commissariat à l'Energie Atomique). Directed by Prof. Stanislas DEHAENE, NeuroSpin is a world-class brain imaging center equipped with a MEG system (Elekta, Neuromag) and several human MRI scanners (3T Prisma, 7T and 11.7T), all for research purposes only. The community at NeuroSpin is very stimulating, combining MRI physicists, machine learning experts, and cognitive neuroscientists. Team members go there to collect data and collaborate with their colleagues in the [Cognitive NeuroImaging Unit](#).

## Application procedure

Please send an email to Florent Meyniel ([florent.meyniel@cea.fr](mailto:florent.meyniel@cea.fr)) and Alexander Paunov ([alexander.paunov@gmail.com](mailto:alexander.paunov@gmail.com)):

- Your CV
- a research statement (what you like and want to do)
- the contact details of two referees

Applications will be considered on a rolling basis (positions will remain open until filled).

## Salary

According to CEA standards. According to experience.

## References

1. Meyniel, F., Schlunegger, D. & Dehaene, S. The Sense of Confidence during Probabilistic Learning: A Normative Account. *PLoS Comput Biol* **11**, e1004305 (2015).
2. Meyniel, F., Sigman, M. & Mainen, Z. F. Confidence as Bayesian Probability: From Neural Origins to Behavior. *Neuron* **88**, 78–92 (2015).
3. Foucault, C. & Meyniel, F. Two Determinants of Dynamic Adaptive Learning for Magnitudes and Probabilities. *Open Mind* **8**, 615–638 (2024).
4. Meyniel, F. Brain dynamics for confidence-weighted learning. *PLOS Comput. Biol.* **16**, e1007935 (2020).
5. Paunov, A. *et al.* Multiple and subject-specific roles of uncertainty in reward-guided decision-making. 2024.03.27.587016 Preprint at <https://doi.org/10.1101/2024.03.27.587016> (2024).
6. Walker, E. Y. *et al.* Studying the neural representations of uncertainty. *Nat. Neurosci.* 1–11 (2023) doi:10.1038/s41593-023-01444-y.
7. Bounmy, T., Eger, E. & Meyniel, F. A characterization of the neural representation of confidence during probabilistic learning. *NeuroImage* **268**, 119849 (2023).
8. Meyniel, F. & Dehaene, S. Brain networks for confidence weighting and hierarchical inference during probabilistic learning. *Proc. Natl. Acad. Sci.* 201615773 (2017) doi:10.1073/pnas.1615773114.

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Head of the Computational Brain team

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