COLLEGE DOCTORAL BRETAGNE SCIENCES DE LA VIE ET DE LA SANTE

Year 2022-2023

THESIS TOPIC

Subject N° (to be completed by the ED):	**FUNDING:** ☒ **Requested** ☒ **Acquired**	**Funding origin: INRAE AlimH (50% acquired) / Région Bretagne (50% requested)**
Thesis title: **Neurobehavioral and biological determinants of food addiction in patients with obesity: From the microbiota-gut-brain axis to interventions targeting eating behavior**		3 keywords: Behavior, Brain, Food Addiction
Research Unit / team: **NuMeCan INRAE 1341 INSERM 1317 Univ Rennes** **Team EAT (Control of Eating Behavior)**		
Director's name: **David VAL-LAILLET (Research Director)** Co Director's name: Ronan THIBAULT (PUPH, MD, PhD)		Phone number: 33 2 23 48 50 72 Email address: david.val-laillet@inrae.fr Year of HDR : 2013

Socio-economic and scientific context (approximately 10 lines):

In the fight against obesity, eating disorders (ED) or food addiction (FA), behavioral neurosciences and neuroimaging have a significant role to play in i) phenotyping diseased or at-risk people, ii) predicting what risk by looking for easily obtained biological markers (*e.g.* via blood/feces samples) that are correlated to neurocognitive profiles, and iii) developing new interventional strategies against obesity and FA. This thesis project aims primarily to combine clinical data, neuroimaging, eating behavior, psychology, metabolomics and 16S DNA sequencing data (microbiota) obtained from people suffering from obesity and AA (AddictO cohort). Secondly, it will be a question of exploring in this population the effects of an innovative intervention, neurofeedback by functional near infrared spectroscopy (fNIRS) (CadOb study). This thesis project, targeting major public health problems via a prevention, diagnosis and treatment approach, will be based on two clinical studies in progress at Rennes University Hospital, and for which some data are already available, which will allow rapid valorization of the project.

Working hypothesis and aims (approximately 8 lines):

1) Patients suffering from obesity and AA present abnormalities in cerebral functioning linked to anticipation of food pleasure and to inhibitory cognitive control correlated with specific metabolomic profile and/or intestinal microbiota;
2) Using functional near-infrared spectroscopy (fNIRS) and a dedicated human-machine interface, the goal of neurofeedback is to train subjects to increase the activity of their prefrontal cortex, the hypothesis being that this intervention will allow better inhibitory cognitive control with positive effects on eating behavior and certain clinical and biological markers (including metabolomic data and 16S DNA sequencing of the microbiota) associated with complications of obesity.

Main milestones of the thesis (approximately 12 lines):

Year 1.

- Joint analyses of clinical-biological data, functional magnetic resonance imaging (fMRI), metabolomics and 16S DNA sequencing data from the AddictO cohort already acquired via WGCNA model; Writing of a first original article on the multi-criteria phenotyping of this cohort;
- Neurofeedback-fNIRS and fMRI imaging over the inclusions of the CadOb study of obese patients with AA (N=40 subjects between 2023-2024);

Year 2.

- Analyses of behavioral and fNIRS and fMRI imaging data on the CadOb study of obese patients with AA; Writing a second original article;
- Writing of a review paper on AA and the various preventive/corrective interventions;

Year 3.

- Additional analyzes on the behavioral, nutritional and metabolic effects of neurofeedback (follow-up 3 months post-intervention); Writing a third original article;
- Depending on the progress of the work, contribution to the implementation of a new study in view of the thesis allowing to follow the evolution of the biological markers identified in year 1 according to the modes of intervention (*e.g.* neurofeedback vs. classic care pathway);
- Writing of the thesis manuscript and construction/anticipation of the post-thesis professional project.

Scientific and technical skills required by the candidate (2 lines):

The expected profile for this thesis is a profile of a biologist specialized in behavioral sciences and/or neurosciences. A strong interest in nutrition and neuroimaging approaches is essential. A good sensitivity towards statistical approaches will be appreciated.

3 publications from the team related to the topic (last 5 years):

A1. Coquery, N., Gautier, Y., Serrand, Y., Meurice, P., Bannier, E., **Thibault, R.**, Constant, A., Moirand, R., **Val-Laillet, D.** 2022. Brain responses to food choices and decisions depend on individual hedonic profiles and eating habits in healthy young women. *Frontiers in Nutrition / Nutrition, Psychology and Brain Health*. DOI: 10.3389/fnut.2022.920170.

A2. Godet, A., Fortier, A., Bannier, E., Coquery, N., **Val-Laillet, D.** 2022. Interactions between emotions and eating behaviors: Main issues, neuroimaging contributions, and innovative preventive or corrective strategies. *Reviews in Endocrine and Metabolic Disorders*. DOI: 10.1007/s11154-021-09700-x.

A3. Som, M., Constant, A., Zayani, T., Le Pabic, E., Moirand, R., **Val-Laillet, D.**, **Thibault, R.** 2021. Food addiction among morbidly obese patients: Prevalence and links with obesity complications. *J Addic Dis*, Jun 14;1-8. DOI: 10.1080/10550887.2021.1939630.

National and international collaborations:

International collaboration:

Eric STICE, Professor of Psychiatry and Behavioral Sciences, anciennement affilié à Oregon Research Institute, désormais à l'Université de Stanford, USA (Public Mental Health and Population Sciences).

National collaborations:

Elise BANNIER, Research Engineer (HDR), INRIA, CNRS, IRISA UMR 6074, Empenn U1228, Univ Rennes, Service de Ragiologie du CHU de Rennes, Plateforme Neurinfo, France.

Olga DAVIDENKO, Associate Professor, AgroParisTech, UMR 0914 PNCA (Physiologie de la Nutrition et des Comportements Alimentaires).