

## MASTER 2 Fundamental and Clinical Neurosciences

### Internship proposal 2026-2027

*(internship from January to June 2027)*

**Host laboratory:**

**Lyon Neuroscience Research Center (CRNL)** - CH Le Vinatier Bat. Neurocampus - UMR 5292 CNRS/Inserm/Université Claude Bernard Lyon1/Université Jean Monnet - 40 Avenue du Doyen Lépine - 69500 Bron

**in collaboration with:**

**Nutrition and Integrative Neurobiology Lab (NutriNeuro)** - INRAE/Université de Bordeaux Bat. UFR de Pharmacie - 146 rue Léo Saignat - 33076 Bordeaux

**Host teams:**

CRNL: ENES Team - <https://www.crnl.fr/fr/equipe/enes>

NutriNeuro: FoodCircus Team - <https://www.bordeaux-neurocampus.fr/team/foodcircus/>

**Internship supervisors:**

Dr. Gérard Coureaud DR2 CNRS [gerard.coureaud@cnrs.fr](mailto:gerard.coureaud@cnrs.fr) (CRNL)

Dr. Guillaume Ferreira DR2 INRAE [guillaume.ferreira@inrae.fr](mailto:guillaume.ferreira@inrae.fr) (NutriNeuro)

**Project title:**

Born to Smell: Early Odor Learning in Newborn Rabbits

**Project summary:**

Newborn rabbits rely heavily on their sense of smell to locate their mother's nipples and successfully feed during the species' remarkably brief daily nursing session (5 min). To achieve this, pups respond to olfactory cues emitted by the mother, including at least one pheromone - the mammary pheromone (MP) - as well as novel odours that they can rapidly learn. Notably, the MP can promote the extremely rapid (single trial) acquisition of new odours in newborns through experimental associative conditioning under experimental conditions. Yet, a key question remains unanswered: how do learning and memory operate in the ecological context of sucking under the mother? In the present project, the student will directly compare odour learning acquired through: 1. ecological learning, i.e., during normal nursing with the mother, within the naturally rich multisensory environment involving warmth, touch, sucking behaviour and milk intake, and 2. experimental learning, i.e., outside the nest, in absence of both the mother and sucking action, using both behavioural and neuropharmacological techniques. The efficiency and persistence of odour learning will be assessed across these two contrasting contexts using complementary paradigms, including direct memory (1<sup>st</sup> order conditioning) and indirect memory (sensory preconditioning).

The student will join a consortium at the forefront of research on neonatal olfaction and memory in rabbits, bringing together two senior researchers who have collaborated and published extensively in this field for over 15 years.

This project will further our understanding of how learning functions immediately after birth, how natural environments may shape memory better than simplified lab paradigms, and how early sensory learning supports feeding, adaptation and survival in mammals.

**3-5 recent publications :**

**Coureaud G.**, Colombel N., Duchamp-Viret P., **Ferreira G.** (2022) Higher-order trace conditioning in newborn rabbits. *Learning and Memory* 29: 349-354. doi: 10.1101/lm.053607.122

Colombel N., Sullivan R.M., **Ferreira G.**, **Coureaud G.** (2023) Dynamic developmental changes in neurotransmitters supporting infant attachment learning. *Neuroscience & Biobehavioral Reviews* 151: 105249. doi:10.1016/j.neubiorev.2023.105249

Ducourneau E.G., Colombel N., Helbling J.C., Potier M., Duchamp-Viret P., **Coureaud G.\***, **Ferreira G.\***. (2025) Noradrenergic modulation of pheromone-induced odor learning and brain activation in newborn rabbits. *Scientific Reports* 15:42794. doi: 10.1038/s41598-025-27093-8 (\* co-last and co-corresponding authors)

Ducourneau E.G., Duchamp-Viret P., Marsicano G., **Coureaud G.\***, **Ferreira G.\*** (submitted) Double dissociation in the involvement of noradrenergic and endocannabinoid systems in classical and higher-order conditioning in newborn rabbits. *Neurobiology of Learning and Memory* (\* co-last and co-corresponding authors)