

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM
(one page maximum)

Field: Life Science and Engineering for Agriculture, Food and the Environment

Subfield: Sensory Ecology

Title: Neural Processing of Pheromone Blend Ratio

ParisTech School: AgroParisTech

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Research group/Lab: Neuroethology of Olfaction (NEO), iEES

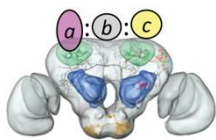
Lab location: INRAe Versailles

(Lab/Advisor website):

<https://ieesparis.ufr918.upmc.fr/spip.php?article244&lang=en>

<https://iees-paris.cnrs.fr/teams/neuroethology-of-olfaction/>

Short description of possible research topics for a PhD: Moth sex pheromones are chemical cocktails produced by females to attract males for mating. Diverge moth species share subsets of the same compounds in their pheromone blend – but in different combinations, roles and/or concentration ratios. To evoke attraction of the males of *Agrotis ipsilon*, the three components of the pheromone blend must all be present, and crucially, be present in certain proportions. **Ratio coding** is a fascinating example of the moth's unique



olfactory capability. While strengthening reproductive isolation, it also safeguards against large fluctuations in odor concentration that the moth faces during turbulent flight. We seek to identify how does the population-level network activity in the pheromone-processing centers of the moth brain compute the precise blend-ratio. We will employ behavioral, anatomical, electrophysiological and Ca²⁺ imaging-based methodologies to probe whether pheromone-evoked inter-glomerular synchronization play any part in ratio coding. In the end, results from this project will initiate the development of a network-level model of odor-integration which will be linked to organismal questions on adaptation.

Required background of the student: Neuroscience/ Biophysics/
Bioengineering/Biology

A list of 5 (max.) representative publications of the group:

- 1. A plant volatile alters the perception of sex pheromone blend ratios in a moth.** Hoffmann A, Bourgeois T, Munoz A, Anton S, Gevar J, **Dacher M, Renou M.** *J Comp Physiol A Neuroethol Sens Neural Behav Physiol.* 2020 Jul;206(4):553-570.
- 2. Automatic tracking of free-flying insects using a cable-driven robot.** Pannequin R, Jouaiti M, Boutayeb M, **Lucas P**, Martinez D. *Sci Robot.* 2020 Jun 10;5(43):eabb2890.
- 3. Reconfiguration of a Multi-oscillator Network by Light in the Drosophila Circadian Clock.** **Chatterjee A**, Lamaze A, De J, Mena W, Chélot E, Martin B, Hardin P, Kadener S, Emery P, Rouyer F. *Curr Biol.* 2018 Jul 9;28(13):2007-2017.e4.
- 4. Firing and intrinsic properties of antennal lobe neurons in the Noctuid moth Agrotis ipsilon.** Lavalie-Defaix C, Jacob V, Monsempès C, Anton S, **Rospars JP**, Martinez D, **Lucas P.** *Biosystems.* 2015 Oct;136:46-58.
- 5. Heterogeneity and convergence of olfactory first-order neurons account for the high speed and sensitivity of second-order neurons.** **Rospars JP**, Grémiaux A, Jarriault D, Chaffiol A, Monsempes C, Deisig N, Anton S, **Lucas P**, Martinez D. *PLoS Comput Biol.* 2014 Dec 4;10(12):e1003975.