Research Topic for the ParisTech/CSC PhD Program

**Subfield:** Biology, Neurosciences

**ParisTech School:** AgroParisTech

**Title:** Deorphanization of honeybee olfactory receptors

**Advisor(s):** Frédéric Marion-Poll ([frederic.marion-poll@agroparistech.fr](mailto:frederic.marion-poll@agroparistech.fr)) website: [http://www.egce.cnrs.gif.fr/?page_id=4056](http://www.egce.cnrs.gif.fr/?page_id=4056) and Jean-Christophe Sandoz ([jean-christophe.sandoz@egce.cnrs.gif.fr](mailto:jean-christophe.sandoz@egce.cnrs.gif.fr)) website: [http://www.egce.cnrs.gif.fr/?page_id=4052](http://www.egce.cnrs.gif.fr/?page_id=4052)

**Short description of possible research topics for a PhD:**

Worldwide, the honeybee *Apis mellifera* is the most important pollinator for agriculture. The economic impact of pollinators is estimated above 150 billions €, around 10% of worldwide agricultural production. This pollination service is gravely endangered by honeybee colony losses, which have systematically increased during the last decade through a multifactorial process involving biological agents, environmental factors, agricultural practices and pesticides. Intensive research currently aims at understanding the deleterious effects of these factors on honeybee health and behavior. Comparatively, little research is dedicated to improving honeybee reproduction by acquiring a thorough knowledge of their reproductive behavior. Mating in bees takes place at so-called drone-congregation areas, places high in the air where male bees (drones) fly around and mate in dozens with single virgin queens. One main queen-produced olfactory signal – a component of the queen pheromone (9-ODA) – is known to attract the drones. However, the drone brain presents not one but four conspicuous pheromone-specific units (macrogomleri) in its primary olfactory center, the antennal lobe. The possible role of additional queen components and of male-produced pheromonal signals in bees' sexual behavior is still unknown. The possible role of drone-produced odours is substantiated by our recently demonstration that drones are attracted to the odor bouquet of other males on a locomotion compensator (Brandstäetter et al. 2014). In this project, we aim to deorphanize (i.e. determine the odor ligand of) the putative sexual pheromone olfactory receptors of the honeybee, which were shown to be overexpressed in honeybee drones. To this aim, individual olfactory receptors will be expressed in the *Drosophila* empty neuron system, and receptor activation will be evaluated by screening queen- and drone-emitted volatiles. Activation of antennal lobe macrogomleri will be checked using *in vivo* optical imaging of the drone brain. Drone attraction will be assessed in the laboratory using our locomotion compensator and within drone congregation areas using odor-laden baits.

**Required background of the student:** Neuroscience or Chemical Ecology

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


**Subfield:** Biology, Neurosciences

**ParisTech School:** AgroParisTech

**Title:** Deorphanization of honeybee olfactory receptors

**Advisor(s):** Frédéric Marion-Poll (frederic.marion-poll@agroparistech.fr) website: http://www.egce.cnrs-gif.fr/?page_id=4056 and Jean-Christophe Sandoz (jean-christophe.sandoz@egce.cnrs-gif.fr) website: http://www.egce.cnrs-gif.fr/?page_id=4052

**Short description of possible research topics for a PhD:**

Worldwide, the honeybee *Apis mellifera* is the most important pollinator for agriculture. The economic impact of pollinators is estimated above 150 billions €, around 10% of worldwide agricultural production. This pollination service is gravely endangered by honeybee colony losses, which have systematically increased during the last decade through a multifactorial process involving biological agents, environmental factors, agricultural practices and pesticides. Intensive research currently aims at understanding the deleterious effects of these factors on honeybee health and behavior. Comparatively, little research is dedicated to improving honeybee reproduction by acquiring a thorough knowledge of their reproductive behavior. Mating in bees takes place at so-called drone-congregation areas, places high in the air where male bees (drones) fly around and mate in dozens with single virgin queens. One main queen-produced olfactory signal – a component of the queen pheromone (9-ODA) – is known to attract the drones. However, the drone brain presents not one but four conspicuous pheromone-specific units (macrogglomeruli) in its primary olfactory center, the antennal lobe. The possible role of additional queen components and of male-produced pheromonal signals in bees’ sexual behavior is still unknown. The possible role of drone-produced odours is substantiated by our recently demonstration that drones are attracted to the odor bouquet of other males on a locomotion compensator (Brandstä tter et al. 2014). In this project, we aim to deorphanize (i.e. determine the odor ligand of) the putative sexual pheromone olfactory receptors of the honeybee, which were shown to be overexpressed in honeybee drones. To this aim, individual olfactory receptors will be expressed in the *Drosophila* empty neuron system, and receptor activation will be evaluated by screening queen- and drone-emitted volatiles. Activation of antennal lobe macrogglomeruli by candidate ligands will be checked using *in vivo* optical imaging of the drone brain. Drone attraction will be assessed in the laboratory using our locomotion compensator and within drone congregation areas using odor-laden baits.

**Required background of the student:** Neuroscience or Chemical Ecology

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

