Olfactory learning and memory in insects

Workshop at the 18th Annual Computational Neuroscience Meeting, 2009 in Berlin

Organisers:

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Summary: The neural circuit underlying insect olfaction and olfactory associative learning is anatomically and physiologically well-studied, calling for detailed computational models, which then can be challenged by the available knowledge of insect olfactory behaviour. We aim to facilitate this process by bringing together the researchers from the experimental and theoretical sides. On the 1st day, after an overview of the anatomy and the electrophysiology of the insect olfactory pathway, we will discuss the available models pertaining to this circuit; such discussion will be extended to pheromone processing as well. We will then consider the key behavioural phenomena, which such models need to account for- e.g. effects of odour-similarity, processing of odour-mixtures. On the 2nd day, we will evaluate the current knowledge on the sites and kinds of synaptic plasticity along the olfactory pathway as well as the available computational models. Finally, we will discuss the key behavioural phenomena, which need to be accounted for: effects of event-timing, memory dynamics, role of outcome expectation and motivation.

Program: (for further information also see:
http://homepages.inf.ed.ac.uk/jwessnit/pdfs/workshop_programme.pdf)

This workshop focuses on key issues in olfactory learning and memory research. Our aim is to bring together researchers from the experimental and theoretical fields investigating the functioning of insect olfactory systems. Our goal is to identify the key questions motivating interdisciplinary research, to map the range of theoretical frameworks, empirical techniques and technologies currently used, and to bring together theoretical and experimental researchers investigating insect olfaction. We want to address our research questions through conventional short presentations by invited keynote speakers, selected workshop participants, discussion/poster sessions. We encourage demonstrations of computer simulations giving the participants opportunities to use and evaluate these systems under the guidance of the designers.

July 22nd

9:15 – 10:00
R. Stocker (Universitaet Fribourg, Switzerland)
Adult and larval Drosophila: two simple, complementary olfactory model systems

10:00 – 10:45
J.-P. Rospars (INRA, Versailles, France)
Transduction in olfactory receptor neurons: from experiments to models

10:45 – 11:30
M. Louis (Centre for Genomic Regulation, Barcelona, Spain)
Integration of graded olfactory stimuli during larval chemotaxis

11:50 – 12:35
A. Strutz (Max Planck Institute for Chemical Ecology, Jena, Germany)
Structure and function of olfactory circuits in Drosophila

12:35 – 13:20
R. Galan (Case Western Reserve University, USA)
Neural dynamics in the antennal lobe: sensory coding and memory traces in the honeybee brain

15:00 – 15:45
M. Schmuker (Freie Universitaet Berlin, Germany)
High-dimensional processing in the olfactory system

15:45 – 16:30
T. C. Pearce (University of Leicester, UK)
Pheromone blend ratio dependent responses in a model of the antennal lobe macroglomerular complex (MGC).

16:50 – 17:35
R. Jortner (Max-Planck Institute for Neurobiology, Martinsried, Germany)
Linking Network Architecture and Neural Coding in the Locust Olfactory System

17:35 – 18:20
T. Nowotny (University of Sussex, Brighton, UK)
The different roles of sparse activity and sparse connectivity for pattern recognition in the olfactory system of insects

July 23rd

09:00 – 09:45
B. Gerber (Universitaet Wuerzburg, Germany)
Physiology and perception in Drosophila olfaction

09:45 – 09:55
C. Eshbach (Universitaet Wuerzburg, Germany)
Odour-mixture perception in Drosophila

09:55 – 10:40
J.-C. Sandoz (CNRS UMR 5169, Toulouse, France)
Odour similarity and odour-mixture processing

10:40 – 11:00
Coffee

11:00 – 11:45
P. Szyszka (Universitaet Konstanz, Germany)
Learning induced changes of odor representation in the honeybee antennal lobe

11:45 – 12:05
D. Galili (Max-Planck Institute for Neurobiology, Martinsried, Germany)
Odour trace memories in the fruit fly

12:05 – 12:50
A. Fiala (Universitaet Goettingen, Germany)
Olfactory learning in insects: current concepts

12:50 – 14:30
Lunch

14:30 – 15:00
Y. Aso (Max-Planck Institute for Neurobiology, Martinsried, Germany)
Individual dopaminergic neurons signaling punishment in aversive odour memory

15:00 – 15:45
A. Yarali (Max-Planck Institute for Neurobiology, Martinsried, Germany)
Event timing matters in associative learning

15:45 – 16:05

M. Schleyer (Universitaet Wuerzburg, Germany)
A behaviourally-inspired and neuroanatomically plausible model of chemosensation and chemosensory learning in larval *Drosophila*

16:05 –
General discussion, departure

References:

Bertram Gerber and Reinhard F. Stocker *The Drosophila Larva as a Model for Studying Chemosensation and Chemosensory Learning: A Review*. Chemical Senses 32:65-89, 2007.

Christiane Linster, Silke Sachse and C. Giovanni Galizia *Computational Modeling Suggests That Response Properties Rather Than Spatial Position Determine Connectivity Between Olfactory Glomeruli*. J Neurophysiol 93: 3410-3417, 2005.

Dominique Martinez and Noelia Montejo *A Model of Stimulus-Specific Neural Assemblies in the Insect Antennal Lobe*. PLoS Comput Biol. 4(8): e1000139, 2008.

Luca A. Finelli, Seth Haney, Maxim Bazhenov, Mark Stopfer, and Terrence J. Sejnowski *Synaptic Learning Rules and Sparse Coding in a Model Sensory System*. PLoS Comput Biol. 4(4): e1000062, 2008.

Fernando Guerrieri, Marco Schubert, Jean-Christophe Sandoz, Martin Giurfa *Perceptual and Neural Olfactory Similarity in Honeybees*. PLoS Biol 3(4): e60, 2005.