Contributed talks II "Gustation" Monday 25 June

The (unfolded) mystery of starch detection in *Drosophila melanogaster*: tasteless but attractant.

Alexandra M,A Guigue[1] and Frédéric Marion-Poll[2]

[1]INRA, UMR 1272, Versailles, France
[2]AgroParisTech, INRA, UMR 1272, Versailles, France
alexandra.guigue@gmail.com

The understanding we have of insect taste perception is restricted to the detection of relatively simple chemicals. While starch, a polymer of glucose, is commonly found in the diet of *Drosophila melanogaster*, we do not know if and how flies are able to detect it. Using PER tests and binary food choice assays, we confirmed that starch is tasteless. In particular, in the choice assay, we found that starch (3%) is not consumed by flies. Interestingly, when starch is mixed with fructose (35mM), patches of fructose associated with starch are preferred over patches of fructose-only. One common hypothesis is that flies might be able to adjust their feeding according to the associated caloric reward. How such an association could be made between a post-ingestive information and a food with no particular taste was unclear to us. Results from Haj-Ahmad and Hickey (1982) indicate that feeding activities of flies induce a partial digestion of starch. Since the degradation of starch produces maltose, this suggests that starch-enriched food patches become sweeter than fructose-only patches. So as to test this hypothesis, we added an α-amylase competitive inhibitor, α-cyclodextrin (αC), in the food patches to prevent starch from being transformed. αC abolished the preference towards starch-enriched food patches. Similar results are obtained with *amy-null* flies. We also investigated if the taste system is involved in this process.

ΔGr64a[1] flies, that do not detect maltose, are unable to detect starch, whereas other taste-impaired mutants exhibited the same behaviour as control flies. The role of the "sweetness context" was also investigated. Taken together, these results indicate that flies pre-digest their food by releasing enzymes that dynamically change its taste. These results contribute to a better understanding of the subtle mechanisms by which insects perceive and interact with their environment.

Poster session I Poster #91

4D morpho-functional imaging of the honey bee brain

Albrecht Haase[1], Elisa Rigosi[2], Gianfranco Anfora[3], Giorgio Vallortigara[4], Claudio Vinegoni[5] and Renzo Antolini[1]

[1]University of Trento, BIOtech research center, Trento, Italy
[2]University of Trento/ Fondazione E. Mach, CIMeC/ IASMA, Trento, Italy
[3]Fondazione E. Mach, IASMA Research and Innovation Center, S. Michele all'Adige, Italy
[4]University of Trento, CIMeC, Centre for Mind/Brain Sciences, Rovereto, Italy
[5]MGH-Harvard University, Center for Systems Biology, Boston, United States
albrecht.haase@unitn.it

We set up a two-photon microscope for in-vivo imaging of insect brains. First experiments focused on the primary olfactory centers, the antennal lobes, of the honey bee (*Apis Mellifera*). The system allows both 3D-tomographic measurements of the antennal lobes' morphology and highly time-resolved in-vivo calcium imaging of their neuronal activity.

Morphological data could be acquired down to 400μm penetration depth, allowing precise in-situ measurements of the glomerular volume. Functional imaging permitted recording of glomerular response maps to external odour stimuli with 20ms temporal resolution. The applied technique exceed by far the spatial and temporal resolution and the penetration depth of conventional imaging methods, minimizing in addition the photo-damage. This provides a new tool for insect neuroscience, allowing to investigate e.g. the role of subsurface glomeruli, dynamical odour coding, or optical studies of morphology and activity at the single neuron level.