Processing of odor-evoked neural activity in the olfactory cortex

Benjamin Roland*[1], Dara Sosulski[2], Assunta Diodato[3], Kevin Franks[4], and Alexander Fleischmann†[1]

[1]Centre interdisciplinaire de recherche en biologie (CIRB) – Inserm : U1050, CNRS : UMR7241, Collège de France – 11 place Marcellin Berthelot 75005 Paris, France

[2]University College London - London's Global University (UCL) – Gower Street - London, WC1E 6BT, United Kingdom

[3]Centre interdisciplinaire de recherche en biologie (CIRB) – Inserm : U1050, CNRS : UMR7241, Collège de France – 11 place Marcellin Berthelot 75005 Paris, France

[4]Duke university [Durham] (Duke) – Durham, NC 27708, United States

Abstract

Olfactory behaviors require the identification of odors across a large range of different concentrations, yet are exquisitely sensitive to changes in odor concentrations. To accomplish this seemingly paradoxical task the olfactory system must generate odor representations that are, at once, both concentration-dependent and concentration invariant.
We have used in vivo two-photon microscopy to characterize odor-evoked activity in the olfactory bulb and piriform cortex of mice. We find that the density of odor-evoked activity in the olfactory bulb scales with odor concentration. In contrast, piriform odor representations are largely concentration invariant, indicating substantial normalization of olfactory bulb output by piriform microcircuits. We have identified parvalbumin-expressing interneurons, a subpopulation of piriform inhibitory neurons, as a candidate cell type to mediate piriform concentration invariance.

Our results provide important new insights into the computations performed by olfactory neural circuits.

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*Speaker

†Corresponding author: alexander.fleischmann@college-de-france.fr