A G protein signaling network co-operates with Ca^{2+}/MAPK signaling to regulate gene expression in the olfactory neurons of *C. elegans*

Lans H, Rademakers S, Jansen G
Dept of Cell Biology and Genetics, Erasmus MC, Rotterdam

The olfactory system of the nematode *C. elegans* is ideally suited to study the function and specificity of neuronal G protein signaling. Olfaction is mediated by two pairs of neurons, AWA and AWC. Each of these neurons expresses multiple G protein coupled odorant receptors, enabling *C. elegans* to detect and discriminate between many odorants. Furthermore, six Gα subunits are expressed in these neurons: GPA-2, -3, -5, -6, -13 and ODR-3.
Behavioral studies have shown that, for odorant detection, ODR-3 provides the main stimulatory signal, which is modulated by 2 stimulatory and 2 inhibitory Gα signals.
To study the function of the Gα subunits in neuron development and fate, we make use of the candidate odorant receptor *str-2. str-2* is stochastically expressed in either the left or the right AWC neuron, indicating a left-right functional difference. The initial decision for this asymmetry is regulated by axon contact, followed by Ca^{2+} and MAPK signaling. We determined *str-2::GFP* strength in different G protein mutant backgrounds. We found that a complex signaling network, involving multiple Gα subunits together with the Ca^{2+}/MAPK signaling pathway, regulates the initiation and maintenance of *str-2* expression, but not its asymmetry. In addition, we observed that GPA-5 co-operates with the cytoskeletal protein UNC-44 to establish and maintain *str-2* expression.

Hannes Lans, MGC- Dept. of Cell Biology and Genetics, Erasmus MC, POB 2040, 3000 CA Rotterdam, t 010 4087165, e-mail w.lans@erasmusmc.nl

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