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PROJECT TYPE ERC Starting Grant (FP7)

TITLE Olfactory perception in *Drosophila*: analysis of a novel iGluR-related family of odorant receptors

ACRONYM OlfactoryiGluRs

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BUDGET 1 500 000 €

Chemosensory systems permit organisms to perceive diverse chemicals in the environment signalling the presence of food, dangers, kin or mates. How a specific chemical stimulus is recognised and converted into neural activity that provokes the appropriate behaviour is a fundamental problem in neuroscience. I have investigated this question in the olfactory system of the fruit fly, *Drosophila melanogaster*, which exhibits sophisticated odour-driven behaviours under the control of a simple and genetically accessible nervous system. I have discovered a novel *Drosophila* olfactory receptor family, the Ionotropic Receptors (IRs). IRs are expressed in sensory neurons distinct from the previously described Odorant Receptor (OR) family. Strikingly, IRs are structurally similar to ionotropic glutamate receptors (iGluRs), a conserved family of ligand-gated ion channels present in animals, plants and bacteria. iGluRs are best characterised for their role in mediating synaptic communication in the mammalian brain as receptors for the neurotransmitter glutamate, but IRs have divergent ligand-binding domains. This project has investigated the function of the IRs and their sensory circuits in the recognition of, and behavioural responses to, olfactory stimuli through four specific aims.

Aim 1: Defining the molecular basis of IR/odour interactions.

Aim 2: Visualising the mechanisms of IR trafficking.

Aim 3: Mapping IR sensory circuits in the brain.

Aim 4: Exploring the behavioural responses mediated by IR olfactory pathways.

By combining genetic, cell biological, electrophysiological and behavioural approaches, this project has provided an integrated understanding of the function and evolution of these novel olfactory receptors and circuits. This knowledge is of significance to chemical detection mechanisms across diverse sensory systems in eukaryotes and prokaryotes, and of interest to chemical ecologists, neuroscientists, evolutionary biologists and biomedical researchers.