Development of odorant sensor elements using insect cells expressing insect odorant receptors

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Currently existing odorant sensor elements are mainly fabricated based on metal-oxide semiconductor devices, quartz crystal microbalances, surface plasmon resonance methods or surface acoustic wave detectors. These elements have been studied for improving on various parameters, such as sensitivity, selectivity, and portability. However, it has been difficult to develop odorant sensor elements that incorporate a combination of desirable properties. In contrast, living organisms, especially insects, use numerous olfactory sensory cells, which express odorant receptors, to sensitively detect the environmental odorants in real time. Here, we report the development of odorant sensor elements that mimic olfactory sensory cells of insects. We introduced insect odorant receptors and the Or83b family protein as well as a calcium sensor protein, GCaMP3, into *Spodoptera frugiperda* Sf21 cells to construct sensor cell lines. When these cells were stimulated with a set of odorants in solution, intracellular calcium as monitored by fluorescence imaging showed sensitive responses in accordance to the ligand specificity of the expressed odorant receptors. These results suggest that our sensor cells can be applied to detect various kinds of odorants with high sensitivity and selectivity.