Functional liposome arrays based on natural nanovesicles

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Natural vesicles produced from genetically engineered cells with tailored membrane receptor composition are promising building blocks for sensing biodevices /1/. This is particularly true for the case of G-protein coupled receptors (GPCRs) present in many sensing processes in cells, whose functionality crucially depends on their lipid environment. However, the controlled production of natural vesicles containing GPCRs and their reproducible deposition on biosensor surfaces are among the outstanding challenges in the road map to realize practical biomolecular devices based on GPCRs.

Dealing with membrane receptors is challenging due to the fact that they are difficult to produce, in comparison with other biomolecules, such as, for instance, soluble proteins or oligonucleotides. Besides, their activity on a substrate depends crucially on their orientation and functional conformation, which is largely determined by the lipid membrane environment fundamental to retain their tertiary structure and functional integrity. Current strategies developed for biosensing applications with membrane receptors include immobilization into supported lipid bilayers or into lipid vesicles (liposomes), made from artificial /2/ or native membranes /3/ as well as their inclusion into free-standing lipid bilayers lying on nanoporous substrates /4/. Isolation of native membrane fractions from a cell source, which integrate membrane receptors artificially expressed in the cell line, constitutes one of the preferred approaches as it provides the same lipidic environment found in the native cell, thus preventing the protein denaturation during the insertion into an artificial membrane.

The development of practical biomolecular devices based on membrane receptors integrated in native membrane fractions requires, among other aspects, a strict control of the relevant parameters determining the membrane fraction characteristics and the surface coverage achievable under practical conditions, as well as, of the integrity and morphology of the deposited membrane receptors containers. Such information is almost absent in the current literature. We present the production and characterization of membrane nanovesicles containing heterologously expressed olfactory receptors - a member of the family of GPCRs - and study their deposition onto substrates used as biosensor supports/5,6/.

References

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