



Wilfried Weber

Title:

Extracellular Optogenetics – Novel Opportunities in Cell Engineering

Abstract:

Optogenetic technologies are providing fascinating insight into biological processes and are offering novel opportunities to control the fate and function of cells with unmatched spatial and temporal resolution, in a dose-dependent and multiplexed manner. While optogenetic switches were traditionally applied intracellularly, recently developed protocols for the gram-scale production of molecular photoreceptors have paved the way for the emergence of extracellular optogenetics. We will present two examples of our ongoing research on extracellular optogenetics. First, we demonstrate how purified photoreceptors can be used to activate transmembrane receptors in a light-dependent manner, or how hydrogels based on engineered photoreceptors can dynamically be formed and dissolved in microfluidic devices for the spatiotemporally controlled capture and release of cells in tissue engineering or analytical applications. Secondly, we describe the engineering of adeno-associated viral vectors (AAVs) to transduce primary cells and cell lines in a light dependent manner. To this aim, we replace the natural tropism of AAVs with an optically guided tropism. These optoAAVs enable the repeated transduction of cell lawns with different transgenes in a spatially controlled manner or the selective transduction of individual cells at single cell resolution.

Biography:

Wilfried Weber is professor of Synthetic Biology at the University of Freiburg, Germany. His research is positioned at the intersection of synthetic biology and materials sciences. He is a pioneer in molecular optogenetics and develops light-triggered switches to control cell signaling but also to steer the mechanical properties of synthetic extracellular matrices. He is applying such technologies towards the development of applications in drug delivery, tissue engineering, or point-of-care analytics. He is a founding spokesperson of the Centre for Integrative Biological Signalling Studies, CIBSS.