Aiding Nature's Organelles: Artificial Peroxisomes Play Their Role

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 2332520
Author(s) Tanner, Pascal; Balasubramanian, Vimalkumar; Palivan, Cornelia G.
Author(s) at UniBasel Palivan, Cornelia ;
Year 2013
Title Aiding Nature's Organelles: Artificial Peroxisomes Play Their Role
Journal Nano Letters
Volume 13
Number 6
Pages / **Article-Number** 2875-83
Keywords polymer nanoreactor; artificial organelle; antioxidant enzymes; reactive oxygen species; peroxisome; triblock copolymer vesicles; polymersome nanoreactor; cells; macropinocytosis; integration; chemistry; dismutase; proteins; lipids; size
A major goal in medical research is to develop artificial organelles that can implant in cells to treat pathological conditions or to support the design of artificial cells. Several attempts have been made to encapsulate or entrap enzymes, proteins, or mimics in polymer compartments, but only few of these nanoreactors were active in cells, and none was proven to mimic a specific natural organelle. Here, we show the necessary steps for the development of an artificial organelle mimicking a natural organelle, the peroxisome. The system, based on two enzymes that work in tandem in polymer vesicles, with a membrane rendered permeable by inserted channel proteins was optimized in terms of natural peroxisome properties and function. The uptake, absence of toxicity, and in situ activity in cells exposed to oxidative stress demonstrated that the artificial peroxisomes detoxify superoxide radicals and H2O2 after endosomal escape. Our artificial peroxisome combats oxidative stress in cells, a factor in various pathologies (e.g., arthritis, Parkinsons, cancer, AIDS), and offers a versatile strategy to develop other "cell implants" for cell dysfunction.
Publisher American Chemical Society
ISSN/ISBN 1530-6984 ; 1530-6992
edoc-URL https://edoc.unibas.ch/63376/
Full Text on edoc No;
Digital Object Identifier DOI 10.1021/Nl401215n
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/23647405
ISI-Number 000320485100092
Document type (ISI) Journal Article