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SEMINAR II

Thursday, 18.9.2025, 13:00, Kolar's Lecture Hall

Development of a Neuropeptide Y-Functionalized Erythrocyte Membrane Carrier for Targeted Breast Cancer Therapy

Katarina Tomić , Jožef Stefan Institute

Current therapeutic strategies for breast cancer often lack tumor specificity, leading to significant off-target effects and systemic toxicity. The Y1 receptor (NPYR1), a subtype of the Neuropeptide Y receptor family, is a promising target for selective drug delivery due to its high expression in 100% of NPYR-positive breast tumors. We report the development of NPY-functionalized extracellular membrane vesicles (NPY-EMVs) as a novel biomimetic nanocarrier for enhanced receptor-targeted delivery.

NPY analogs for this system were initially designed using bioinformatic tools, and their theoretical binding was validated in silico. Our goal was to test this promising design in a real-world setting. A comparative analysis of fresh versus frozen erythrocytes revealed that the use of fresh cells is essential for preserving key membrane proteins, including CD47 and Band 3, which are necessary for vesicle integrity. In contrast, frozen erythrocytes led to significant protein loss, compromising the vesicles.

While our vesicles were successfully prepared and characterized, our attempts to conjugate the initial NPY analog via maleimide-thiol chemistry were unsuccessful. Our work revealed a critical difference between the theoretical design and its practical application, as the peptide's hydrophobicity prevented successful conjugation. We are currently working on an optimized design to improve its hydrophilicity, with the ultimate goal of developing an effective and specific delivery platform for breast cancer therapy.

Kindly invited.