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# Surface Plasmon Resonance Imaging For the Characterization of Dual-Targeting-Peptides Liposomes

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## Extended Abstract

The blood-brain barrier (BBB) plays a key role for brain homeostasis, but at the same time it represents a major obstacle to the development of efficacious treatment for brain diseases. The application of nanomedicine to neurological disorders is one of the most promising strategies to improve the current therapies [1]. Liposomes (LPs) have been widely studied as therapeutic tools for the delivery of drugs to the central nervous system, demonstrating their ability to cross the BBB and to target specific brain sites. Some approaches for BBB crossing involve the surface modification of LPs with biologically active ligands and, among them, Apolipoprotein E-modified peptide (mApoE) has been used for the functionalization of several liposome-based nanovectors under investigation [2-3].

In this study, we propose a biophotonic technique, Surface Plasmon Resonance imaging (SPRi), for the characterization of dual--targeting-peptides LPs to be tested for the control of neuroinflammation and associated microglial dysfunctions in Glioblastoma and Alzheimer's disease. Indeed, LPs loaded with selected drugs were functionalized with mApoE to enable the BBB crossing and with a metallo-protease sensitive peptide to guarantee the localized release of the encapsulated drugs in diseased areas. SPRi is an optical detection technique used to monitor and analyze biomolecular interactions between an analyte in solution and ligands immobilized on a gold chip. Here, the SPRi analysis was performed in order to evaluate the binding affinity and kinetics between LPs and the receptors. In particular, mApoE targets were immobilized on a SPRi gold chip to verify and monitor the LP binding. The spotting procedure for ligands immobilization on the chip was carried out using a microspotter, and parameters like ligand concentration, buffer and spot diameter were optimized in order to obtain the most reproducible results.

We analyzed mApoE LPs and not functionalized LPs finding that mApoE LPs generated higher SPRi signals referred to the interactions between mApoE and its receptors. We also compared the interactions with the different selected receptors finding that LRP1 and VLDL-R are the receptors with whom the higher amount of LPs were able to interact. Moreover, a significant binding between LPs and VCAM-1 was observed, whereas LPs did not interact considerably with TRL2. Regarding the binding kinetics analysis, increasing concentration of LPs were incubated on the chip and the preliminary test between LPs and mApoE targets showed that mApoE LPs had a higher affinity compared to not functionalized ones.

The SPRi results confirmed not only the presence of mApoE on liposome surface, but also the preservation of the binding affinity, thanks to the specific interaction with the selected receptors. In conclusion, the high sensitivity and the multiplexing capability associated with the low volumes of sample required and the minimal sample preparation make SPRi an excellent and innovative technique for the characterization of liposomal formulations.

## References


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