Magnetic-Fluid-Loaded Liposomes (MFLs) for Selective Imaging and Treatment of Brain Tumors: example of combination of multi-scale approaches to validate *in vivo* magnetic targeting.

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Hybrid devices based on the association of iron oxides with lipid nanoscale particles play an increasing role for targeted delivery of chemotherapeutics, mainly due to their biocompatibility and intrinsic efficacy as contrast agents for *in-vivo* Magnetic Resonance Imaging (MRI). In this study, we aimed at demonstrating the targeting of glioblastoma, into the striatum of mice, using magnetic-fluid-loaded liposomes (MFLs). MFLs targeting was achieved with a magnetic field gradient, from a magnet placed onto the head of the mice.

In vivo MRI showed that MFLs were successfully delivered to glioblastoma cells via the vasculature. Brains were then processed for Transmission Electron Microscopy (TEM) and Chemical mapping using Energy-Filtered TEM (EFTEM). MFLs were identified as electron dense clusters of iron nanoparticles inside cells lining the vascular lumen or in the adjacent extracellular matrix space.

Challenge here was to localize 200 nm diameter particles randomly dispersed into a complex tissue (glioblastoma). To avoid looking for a needle in a haystack, we exploited the internal rhodamine labeling of MFLs to localize magnetic-fluid-enriched regions on 70 μm thick sections, prior to TEM or EFTEM preparation.

The results revealed MFLs as potent tools for selective targeting of malignant brain tumors, especially promising for therapeutic issue as it can be expected that healthy brain tissue will be spared upon treatments by deleterious anticancer drugs carried by MFLs.

Reference

Marie H. et al. 2015. *Superparamagnetic Liposomes for MRI Monitoring and External Magnetic Field-Induced Selective Targeting of Malignant Brain Tumors*. Adv. Funct. Mater. 25, 1258–1269. DOI: 10.1002/adfm.201402289.