Multifunctional Architectures based on Lipid Assemblies and Magnetic Nanoparticles

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Amphiphilic self-assemblies are inherently responsive to slight variations of control parameters, such as pressure, temperature, ionic strength, and seemingly subtle changes can produce cascade effects from the molecular scale to the mesoscale. The possibility to induce such transitions remotely and locally, e.g. through application of magnetic fields, has sparked the interest in architectures as magnetoliposomes, where superparamagnetic nanoparticles (SPIONs) are embedded in the bilayer, in the internal pool of liposomes, or bound to their surface. When exposed to alternating magnetic fields, a local temperature gradient is produced which can induce liposomal leakage, without disruption of the lipid vesicle. This feature lends itself to application of these hybrid architectures in fields such as targeted drug delivery.

Here we extend this concept to the design of more complex architectures, where we include hydrophobic and/or hydrophilic nanoparticles in lamellar and non lamellar mesophases, such as bicontinous lipid phases, and in natural extracellular vesicles.

The structural arrangement at the nanoscale is assessed through Small Angle Scattering Techniques, such as the effects on thermotropic properties. The diffusion of lipids and of confined guest molecules is followed by Fluorescence Correlation Spectroscopy, which allows demonstrating the on-demand release of hydrophobic or hydrophilic payloads.

A. Salvatore, C. Montis, P. Baglioni and D. Berti, Multifunctional Magnetoliposomes for Sequential Controlled Release, *ACS Nano*, 2016, 10, 8, 7749-7760.

C. Montis, B. Castroflorio, M. Mendozza, A. Salvatore, D. Berti, P. Baglioni, Magnetocubosomes for the delivery and controlled release of therapeutics, *Journal of Colloid and Interface Science*, 2015, 449, 317-326

M. Bonini, D. Berti, P. Baglioni, Nanostructures for magnetically triggered release of drugs and biomolecules”, *Current Opinion In Colloid & Interface Science*, 2013, 18, 459-467.