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Liposomes-based Drug Delivery Nanosystems Activated by EM fields

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Liposome vesicles as biocompatible nanocarriers represent a promising tool to improve drug delivery systems, due to their easy production, targeting surface, ability to encapsulate both hydrophilic and hydrophobic cargos, and nanosized dimension to be used in passive and active targeting, enhancing drug bioavailability and therapeutic efficacy [1]. They can be modified to confer stimulus-responsive properties, whereby the encapsulated drug release can be achieved when internal (such as pH, redox and specific enzymes) or external stimuli (temperature, light, magnetic field, electric field or ultra-sound) are present. Recently strong effort has been put into the optimization of liposomes embedding magnetic nanoparticles (magnetoliposomes, MLs) and on the adoption of a magnetic field used as an external trigger to control the release of drugs from MLs [2], modifying the permeability of liposome membrane: a process called magnetic hyperthermia [3]. This approach exploits magnetic nanoparticles as nano-heaters to produce a temperature increase which modifies the bilayer physical state and consequently the permeability of MLs. More recently, attention has begun shifting towards the possibility to obtain controlled drug release from MLs even in non-heating conditions, using pulsed electromagnetic fields (PEMFs) [4, 5]. This approach represents an interesting alternative to the thermo-magnetic actuation: the tissues are affected neither by the temperature nor by the eddy currents induced by the field, thus preventing damage and safety secondary effects. In this work, authors present both techniques (Fig. 1) highlighting the pros and cons of each method also with respect to the state of the art of drug delivery applications.

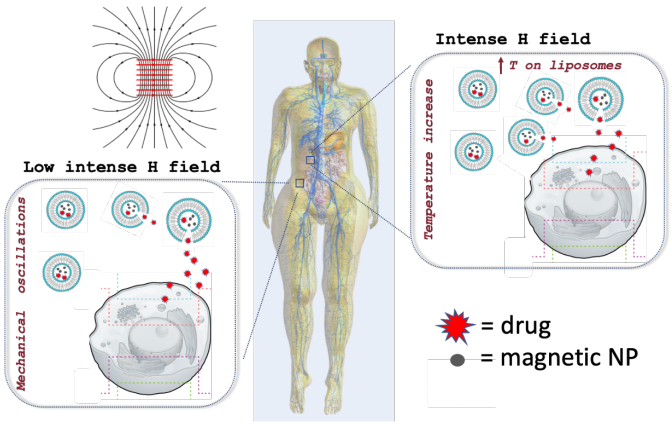

Figure 1. Schematic view of liposomes-based drug delivery applications controlled by EM fields. Two types of techniques are highlighted: a low intense magnetic field (left side); an intense magnetic field (right side).

References

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