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Magnetotactic bacteria-liposome complexes as navigable microcarriers for drug delivery applications

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Efforts toward the targeted delivery of therapeutic agents to tumors remain an important challenge for clinical development due to severe side effects related to insufficient drug accumulation in solid tumors. Programmable magneto-aerotaxis *Magnetococcus marinus* MC-1 magnetotactic bacteria (MTB) carrying active substances for targeting and actively penetrating hypoxic regions exhibit unique capabilities, currently unattainable with existing clinical methods. We report a strategy for the direct covalent coupling of functionalized liposomes (~170 nm in diameter) to the MTB cell surfaces (MTB-LP) using carbodiimide chemistry. Flow cytometry, confocal microscopy, and scanning electron microscopy provide evidence for the efficient binding. The motility of loaded bacteria (~70 liposomes per MTB) under a directional magnetic field compared to bare MTB indicate the reduction of swimming velocity (from 110 μm/s to 80 μm/s), which is sufficient for drug delivery purposes. The biological characteristics such as cytotoxicity and uptake in cancerous (Colo205) and non-cancerous (NIH/3T3 and J774) cell lines reveal that the attachment does not inhibit liposomal uptake and that the MTB-LP formulation results in better biocompatibility than bare MTB. Acting like autonomous microrobots, the MTB-LP complex is being implemented as a mean to remotely control the biodistribution and delivery of therapeutic or diagnostic payloads to desire anatomical compartments, while reducing toxic effects by a magnetic guidance system.

Biography

Samira Taherkhani received her MSc degree from Iran University of Science and Technology (IUST). She is pursuing her PhD study at École Polytechnique de Montréal as well as McGill University. She has published more than 15 papers and two patents. Her research interests consist of drug delivery and targeting, biomaterial, bio-nanorobotics and bio-nanotechnology.

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