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Magnetofection: The use of cationic lipid-like materials with magnetic core for gene delivery

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Small interfering RNA (siRNA) is a promising technology based on mRNA transcripts gene degradation for decreasing of protein synthesis level, for example apolipoprotein B, produced in liver, which correlates with several cardiovascular diseases. One of the perspective approach is to facilitate siRNA uptake during the endocytosis is encapsulation within non-viral nanoparticles such as Super-Paramagnetic Iron Oxide Nanoparticles (SPIONs). SPION, due to their magnetic properties that provides targeted delivery into the cytoplasm and might increase transfection efficiency by applying an alternating magnetic field (magnetofection). Lipid-coated (C12-200, DSPE, cholesterol and different modifications of PEG lipids) SPION with loaded siRNA ApoB were investigated for cell uptake. It was shown that SPION internalize into cells (HepG2, Huh7) after 20-30 minutes of incubation by clathrin-mediated endocytosis. Biological distribution of various types of SPION (cubes, spheres) *in vivo* shows significant level of accumulation in the liver which was observed already, 1 hour after the injection and maintained for 48 hours (MRI). Localization of nanoparticles was shown by histological staining in the liver *ex vivo*. Cubic nanoparticles with iron oxide core in range of 10 to 20 nm and hydrodynamic size less than 100 nm reach higher levels of accumulation in hepatocytes (more than 90%), whereas larger particles were absorbed by Kupffer cells. Accordingly, lipid-coated nanoparticles show promising potential as a platform for siRNA delivery to the liver.

Biography

Victoria Uvarova is a PhD student of the Chemical Enzymology, Department of Lomonosov, Moscow State University. Currently she has 8 reports at conferences, 5 awards, 2 patents in press and 2 internships in large Russian laboratories specializing in biotechnology and nanomaterials. She has participated in the project for new systems of delivery of nucleic acids by magnetic nanoparticles with a lipid coating in laboratory-biomedical nanomaterials (NUST MISiS).

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