Research (What is	Cytotoxic effects of upconversion nanoparticles
it about?)	
UNN authors	Vedunova M.V., Mitroshina E.V., Mishchenko T.A., Ponomareva N.V., Yudintsev A.V., Generalova A.N., Deyev S.M., Mukhina I.V., Semyanov A.V., Zvyagin A.V.
We find (The result)	We demonstrated that bare and polymer surface-coated upconversion nanoparticles (UCNPs) are toxic to dissociated hippocampal cells, evident through aberrant morphological changes, deviant variations of Ca ²⁺ activity, and cell death.
Abstract	Application of nanomaterials in biological allows to investigate not only intravital processes occurring in tissues at cellular and molecular levels but also actively adjust the metabolism of certain cell populations. Upconversion nanoparticles (UCNPs) is unique molecular probes which benefits are associated with excitation/emission falling into the biological tissue and therefore with the possibility to conduct imaging due to the minimized absorption and scattering of biotissue in near-infra-red spectral range (650–1300 nm), unlimited photostability, chemical inertness and physical stability of the solid core. Apart from that UCNPs hold promise for theranostics applications due to their unique optical properties, enabling imaging at the sub-centimetre depth in live biological tissue. In brain tissue, nanoparticle-aided optical imaging and treatment are deemed desirable. UCNPs surface-coated with several types of polymers commonly used in biological procedures, and UCNPs embedded in sub-micron polyacrylic spheres. In this regard, the question concerning cytotoxicity of UCNPs and their coatings, possible providing the specificity of nanoparticles interaction with certain surface proteins, is of particular importance. To this aim, we carried out cytotoxicity studies of UCNPs in primary hippocampal cultures. The most common core/shell UCNPs (NaYF4:Yb ³⁺ :Tm ³⁺ /NaYF4) were coated with amphiphilic polymaleic anhydride octadecene (PMAO); polyethyleneimine (PEI) or were produced as bare ones. Then UCNPs were incubated for 72 hours with primary hippocampal culture and exhibited noticeable cytotoxicity. Our studies showed profound morphological modification of all treated cells, respectively. The spontaneous calcium activity in cells treated with bare UCNPs, PMAO-UCNP dropped to 17%, 6% of its original level and was completely inhibited in the PEI-UCNP treated cultures.

Representative articles 2016-2017, quartiles	 Vedunova M.V., Mishchenko T.A., Mitroshina E.V., Ponomareva N.V., Yudintsev A.V., Generalova A.N., Deyev S.M., Mukhina I.V., Semyanov A.V., Zvyagin A.V. Cytotoxic effects of upconversion nanoparticles in primary hippocampal cultures. RSC Adv. 6, 33656-33665 (2016). Mitroshina E.V., Mishchenko T.A., Vedunova M.V., Yudintsev A.V., 	Q2
	Generalova A.N., Nechaev A.V., Deyev S.M, Mukhina I.V., Zvyagin A.V. The Influence of Different Types of Upconversion Nanoparticles Surface Coatings on Neurotoxicity. Sovremennye tehnologii v medicine 8 (4) 133-141 (2016)	-
	Q-index (Qi) of the result	1.5

In collaboration	Nizhny Novgorod State Med Acad, Nizhnii Novgorod 603005, Russia
	Russian Acad Sci, Shemyakin & Ovchinnikov Inst Bioorgan Chem, Moscow
	117997, Russia
	Lomonosov Moscow State Univ, Moscow 119454, Russia
	Macquarie Univ, Sydney, NSW 2109, Australia

UCNP



The NaYF4:RE cubic unit cell: Na (blue-green), RE (pink), and F (yellow). The spaces labelled with two colours can be occupied by either Na or RE elements (RE elements may be Er^{3+} , Tm^{3+} , and Ho^{3+} ions). The spaces labelled with two colours can be occupied by either Na or RE elements.

980 nm



A1 A2 (A1) and (A2)

The effect of the surfacemodified UCNPs on the astrocyte morphology. A simplified schematic diagrams of the astrocyte networks under normal UCNP-affected conditions.