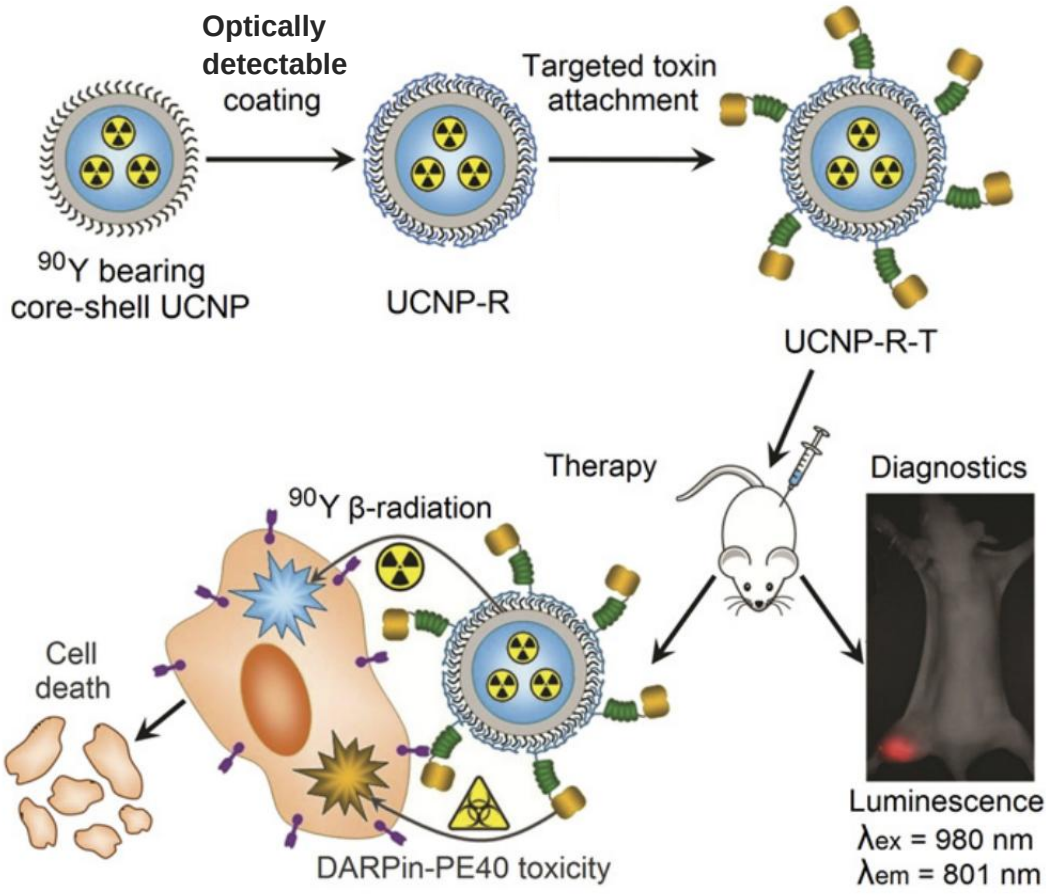
Research (What is it about?)	**Radionuclide-toxin nanocomplex for synergistic theranostics of cancer**
UNN authors	*Guryev E., Shilyagina N., Gudkov S., Balalaeva I., Volovetskiy A., Vodeneev V., Zvyagin A., Deyev S.*
We find (The result)	The multifunctional nanocomplex coupled to beta-emitting radionuclide and proteinic toxin has been created which provides the ***synergistic effect*** in cancer theranostics
Abstract	Targeted therapy makes use of high-affinity molecules as carriers of therapeutic agents, such as radioactive isotopes or toxins, to tumor cells. Targeted therapy drugs are often administered intravenously, eventually homing to target molecules on the surface of tumor cells. In this case, radioactive isotope or toxin molecules attached to high-affinity carrier molecules directly affect tumor cells. An emerging new-generation approach in biomedicine, called ***theranostics***, relies on the detection of a complex consisting of a carrier molecule and a toxic agent. The theranostics concept is realized by employing drugs with dual therapeutics and diagnostics functionality. We report combined therapy using upconversion nanoparticles (UCNP) coupled to two therapeutic agents: beta-emitting radionuclide yttrium-90 (^{90}Y) fractionally substituting yttrium in UCNP, and a fragment of the exotoxin A derived from *Pseudomonas aeruginosa* genetically fused with a targeting designed ankyrin repeat protein (DARPin) specific to HER2 receptors. The resultant hybrid complex ***UCNP-R-T*** was tested using human breast adenocarcinoma cells and immunodeficient mice, bearing xenograft tumors. The photophysical properties of the drug enabled imaging of the UCNP-R-T distribution in cells and animals. Specific binding and uptake of UCNP complexes in cancer cells was observed, with separate ^{90}Y- and exotoxin-induced cytotoxic effects. When both therapeutic agents were combined into UCNP-R-T, the synergetic effect increased markedly, ***~2200-fold***. The combined therapy with UCNP-R-T was demonstrated *in vivo*.

Representative articles 2017-2018, quartiles	1. *E.L. Guryev, N.O. Volodina, N.Y. Shilyagina, S.V. Gudkov, I.V. Balalaeva, A.B. Volovetskiy, A.V. Lyubeshkin, A.V. Sen, S.A. Ermilov, V. A. Vodeneev, R.V. Petrov, A.V. Zvyagin, Z.I. Alferov, S.M. Deyev.* Radioactive (^{90}Y) upconversion nanoparticles conjugated with recombinant targeted toxin for synergistic nanotheranostics of cancer. Proc. Nat. Acad. Sci. USA. **115**(39). 9690-9695 (2018).	Q1
	Q-index (Qi) for the result	**4**
		high blue

In collaboration	Moscow Regional Research and Clinical Institute (MONIKI), Moscow 129110, Russia Prokhorov General Physics Institute RAS, Moscow119991, Russia Sechenov University, Moscow 119991, Russia Center of Crystallography and Photonics RAS, Moscow119333, Russia Scientific and Technical Center "Amplitude", Zelenograd 124460, Russia Institute of Bioorganic Chemistry RAS, Moscow 117997, Russia Macquarie University, Sydney NSW 2109, Australia St. Petersburg Academic University, St. Petersburg 194021, Russia



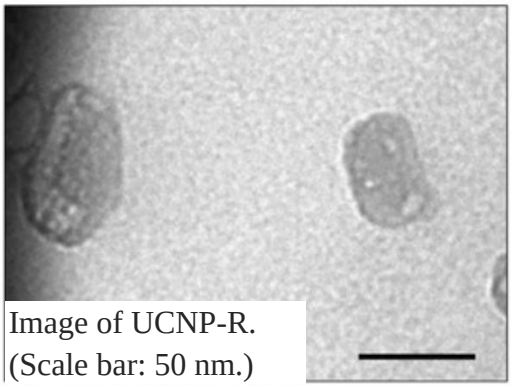


Image of UCNP-R.
(Scale bar: 50 nm.)

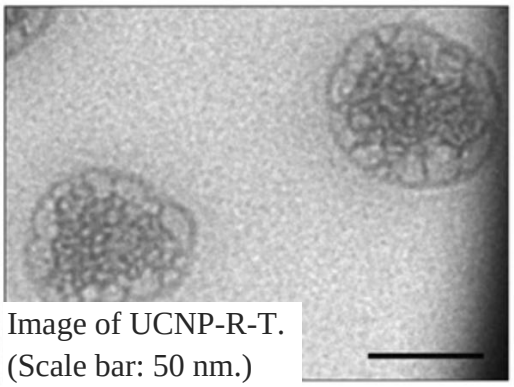
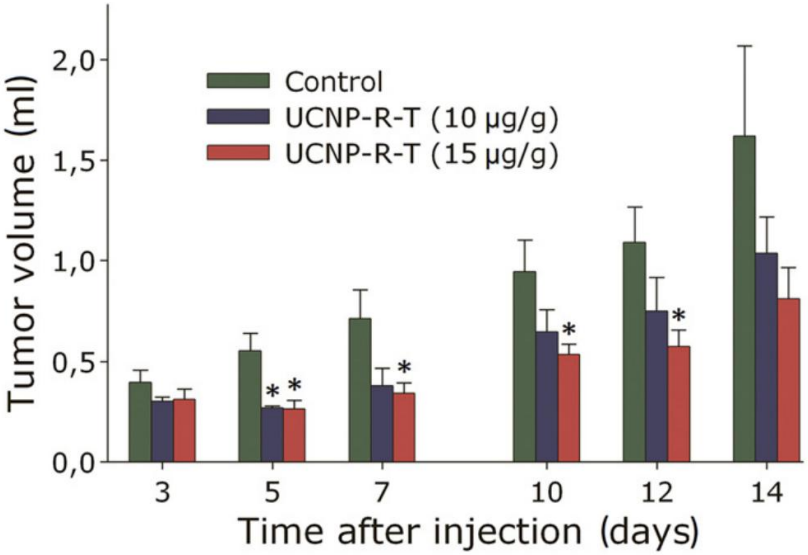


Image of UCNP-R-T.
(Scale bar: 50 nm.)



Therapeutic effect of UCNP-R-T