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БИОГИБРИДНЫЕ МНОГОФУНКЦИОНАЛЬНЫЕ НАНОКОМПЛЕКСЫ ДЛЯ ПРИМЕНЕНИЙ В ТЕРАНОСТИКЕ

BIOHYBRID MULTIFUNCTIONAL NANOCOMPLEXES FOR THERANOSTICS APPLICATIONS

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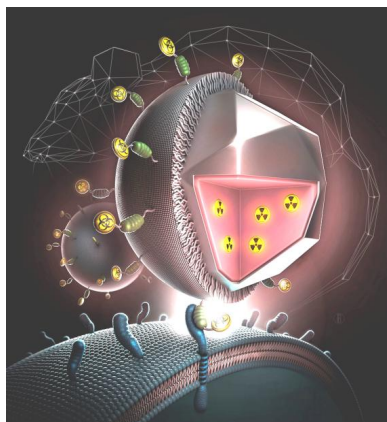
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Development of new approaches for diagnosis and therapy of tumours (taken together, termed theranostics) - one of the most dynamic areas of the life sciences, where new nanomaterials afford new opportunities. In virtue of their unique optical properties, fluorescent nanodiamonds¹, nanorubies and upconversion nanoparticles (UCNP)² proved useful and even indispensable in cell and live animal imaging, as it will be demonstrated in this talk. We developed facile modular strategies of surface functionalisation and coupling with functional biomolecules, such as solid surface peptide binding³, which enabled targeted delivery of these nanoparticles and made theranostics applications conceivable. Attachment of therapeutic vectors Killer Red, Rose Bengal³ to UCNP proved effective for photodynamic therapy (PDT), as well as UCNP photosensitisation of FDA-approved Riboflavin (Vitamin B2)⁴, and even endogenous chromophors⁵, were demonstrated effective for PDT. A combination of agents, a bacterial exotoxin PE40 genetically fused with targeting protein DARPIn and radioactive beta-emitter ⁹⁰Y was demonstrated to exhibit a profound super-additive therapeutic effect in excess of 2×10^3 in cells and live animal models⁶. A surprisingly large biodegradable inorganic drug delivery vehicles based on vaterite (CaCO₃) sub-micrometre particles was demonstrated to deliver and release a high-payload of drugs to the tumour sites enabling ablation of cancer cells. Nanotoxicology aspects of the developed biohybrid nanocomplexes will be discussed and their application prospects outlined.

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References

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6. Guryev, et al. *Proceedings for the National Academy of Sciences of the United States of America* **2018**, in press.



A graphical representation of UCNP(⁹⁰Y)-PE40-DARPIn biohybrid multifunctional complexes binding specifically to SK-BR-3 breast cancer cells. These enable optical labelling and combined therapy demonstrated in cells (front plane) and animals (background plane). Reproduced from Ref 6.