Nanotheranostics based on light (LIGTHER)

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In the project, an integrated system for nanoparticle-based photothermal therapy and optical tomography is designed, developed and constructed. For the purpose, an optical tomography instrumentation based on pulsed laser - optical parametric oscillator (OPO) -system for providing light at adjustable wavelengths and state-of-the-art light measurements is developed and constructed. In addition, computational modelling and image reconstruction methods are developed for simulation of light propagation and absorption by tissue and nanoparticles, estimation of location and amount of light absorbers, and uncertainty quantification of the methodology. Furthermore, the activator, i.e. nanoparticle, fulfilling the requirements for both cancer therapy and imaging is developed. Therefore, tailored nanoparticles that 1) absorb infrared light of specific wavelengths and 2) turn it into heat, 3) destroy cancer cells through hyperthermia driven apoptosis under infrared light in vitro, 4) accumulate to the desired tissue types such as tumours through the EPR effect in vivo and 5) realise photothermal therapy of colon cancer model in vivo are developed. The developed methodology is tested by tissue-like phantoms embedded with the tailored nanoparticles.