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Gold base plasmonic optoacoustic contrast agents for preclinical research with optoacoustic tomography and sensing

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We present gold nanorods (GNR) and hollow gold nanoshells (HGNS) as contrast agents for optoacoustic (OA) imaging, sensing, and laser ablation. Published methodology for the synthesis and surface modifications of GNR an HGNS (by pegylation, conjugation with monoclonal antibodies, or silicanization) were optimized and improved. The analysis of the modification of gold based contrast agents for *in vivo* and *in vitro* applications is detailed for GNR. A novel protocol has been developed to replace hexadecyltrimethylammonium bromide on the surface of GNR with 16-mercaptohexadecanoic acid and metoxy-poly (ethylene glycol)-thiol, and the monoclonal antibodies (mAb): HER2/neu and CD33, which overexpressed human breast tumor and leukemia cells, respectively. The efficiency of the modifications was quantified through measurement of the average number of antibodies per gold nanorod. The conjugates were investigated for different cells lines: normal human and animals cells, breast cancer cells and human leukemia lines, and *in vivo* applications (nude mice). Cytotoxicity analysis, optical imaging, and laser ablation all confirm strong targeting. Gold nanoshells were used as a new contrast-enhancing agent for optoacoustic tomography (OAT). By varying the relative thickness of the core and shell layers, the plasmon-derived optical resonance of gold can be shifted in wavelength from the visible region into the infrared. Silica core GNR and HGNS significantly enhanced OA imaging *in vitro* in comparison with pegylated particles where OAT system was used. This system was developed by TomoWave Laboratories for major biomedical applications including visualization of modified gold nanoparticles and sensing.

Biography

Anton Liopo has a Ph.D. degree in Institute of Physiology from National Academy of Science of Belarus. His research interests in the past decade were focused on developing novel functional nanoparticles, which included gold nanorods, single-walled carbon nanotubes and polymeric nanoparticles, and their use for in vivo and in vitro applications. In TomoWave, his research interests focused on binding between bioactive molecules such as antibodies, peptides and high light absorption nanoparticles from different materials, shapes and constructions for cancer therapy, molecular and optoacoustic imaging and diagnostics. Now he has more than 50 peer-reviewed scientific articles.

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