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In vivo flow cytometry for early diagnosis and prevention of infections

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Infections remain one of the main causes of death in the worldwide. The diagnosis of infections and other diseases begins with a common medical procedure: The examination of blood samples. The sensitivity of current blood tests is limited by the small volume of blood collected, in which no less than one disease-specific biomarker (e.g., pathogen) can be detected. This can miss many thousands of abnormal cells and biomarkers in the whole blood volume (~5 liter in adults), which can be sufficient for disease progression to difficult-to-treat if not already incurable complications (e.g., sepsis). This report summarizes our novel concept of early disease diagnosis with ~1000-fold improved sensitivity using *in vivo* non-invasive photoacoustic (PA) flow cytometry (PAFC) platform for identification and enumeration of rare circulating disease-associated biomarkers with intrinsic PA contrasts (e.g., hemozoinin malaria) or molecularly targeted with the functionalized gold nanoparticles. The principle of PAFC is based on the irradiation of the superficial blood vessels with near-infrared laser pulses followed by detection of laser-induced acoustic waves from single biomarkers with small ultrasound transducer attached to skin. In addition, the integration in real-time diagnosis and therapy (called theranostics) can eradicate circulating bacteria and viruses and thus can potentially prevent or at least inhibit deadly complications. Recent advances of this label-free theranostics platform is presented with focus on its pre-clinical and clinical trials associated with malaria, *S. aureus* and bacteremia.

Biography

Zharov Vladimir P is the Director of the Arkansas Nanomedicine Center at the University of Arkansas for Medical Sciences, USA. He has received his PhD and DSc degrees from the Bauman Moscow State Technical University (BMSTU) and completed his Postdoctoral Fellowship at Lawrence Berkeley National Laboratory at the University of California. He has served as the Chairman of Biomedical Engineering Department at the BMSTU and his record of innovative achievements include more than 200 publications (5 in Nature journals), 54 patents and 5 books. He pioneered photoacoustic and photothermal medical technologies, laser pulse nanotherapy of infections and cancer, laser-ultrasonic microsurgery and *in vivo* flow cytometry. He is the State Prize Winner, the most prestigious national award in Russia and the first recipient of the US Maiman Award, named after the inventor of the first laser.

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