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Autonomous self navigating nanovehicles-novel paradigm in targeted cancer chemotherapy

Low efficacy of targeted cancer nanomedicines in biological experiments enforced us to challenge the traditional concept of drug targeting and suggest 'addressed self-navigating vehicles' for drug-delivery. In these vehicles, affinity selected peptides targeting to the tumor vasculature are replaced by 'promiscuous' phages and their proteins able to migrate through the tumor-surrounding microenvironment, penetrate into the tumor and affect the diverse tumor cell population. The 'self-navigating' drug delivery paradigm can be used as a theoretical and technical platform in design of a novel generation of molecular medications and imaging probes for precise and personal medicine. In our partnership project with Dr. Vladimir Torchilin, the power of the new concept has been realized in the development of liposome- and micelle-based Phage-Programmed Anticancer Nanomedicines, such as "Phage-targeted paclitaxel-PEG-PE–micells", shortly—"P-micelles". Nanomedicines, which have been targeted to Breast Cancer cells by tumor-specific landscape phage fusion proteins, showed selective toxicity to target cancer cells *in vitro*. *In vivo*, they triggered a dramatic tumor reduction and extensive necrosis because of improved tumor delivery of paclitaxel. The enhanced anticancer effect of the phage protein-targeted micellar paclitaxel was verified by enhanced apoptosis and reduced tumor cell proliferation both *in vitro* and *in vivo*. The absence of hepatotoxicity and pathologic changes in tissue sections of vital organs, together with maintenance of overall health of mice following the treatment, support its translational potential as an effective and safe chemotherapy for improved breast cancer treatment.

Biography

Valery A. Petrenko, Professor in Auburn University; graduated from Moscow State University, U.S.S.R (1972); received PhD and D.Sc. degrees in chemistry from the Zelinski Institute of Organic Chemistry (1976) and Moscow State University (1988), Ranks of Senior Scientist (1984) and Professor in Bioorganic Chemistry and Molecular Biology (1992). He served as Senior Scientist (1977-1982), Laboratory Head (1982-1985), Associate Director of Research, Institute Director (1985-1989), Vice President of Research and Professor (1989-1993) in the Association "Vector" (Novosibirsk, Russia). In 1993 he joined the faculty of University of Missouri-Columbia as Visiting and Research Professor, and in 2000—the faculty of Auburn University as Professor. He is recipient (PI) of grants from the ARO, DARPA, NIH-NCI, Calvert Research, LLC, and AURIC. He is recipient of the Pfizer Animal Health Awards for Research Excellence (2006, 2011), Auburn University's Scholarship Incentive Award (2014), Auburn President's Outstanding Collaborative Units Award in Pharmaceutical Engineering. He is member of National Academy of Inventors Chapter (2013), Auburn University Research Initiative in Cancer (AURIC), National Cancer Institute (NCI) Alliance for Nanotechnology in Cancer (2009) and Phi Zeta Honor Society of Veterinary Medicine. His research interests include monitoring and detection of biological threats, diagnosis of infectious and cancer diseases and tumor targeting.

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