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Circulating DNA as a source of novel types of cancer biomarkers

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An assesement of cell-free circulating DNA (cfDNA) fragments, or Liquid biopsy, is indeispensable for early diagnosi and non-invasing monitoring of cancer. However, the majority of the cfDNA studies aim at relatively simple search for cancer-driving mutations or particular variants associated with susceptibility and resistance to targeted therapy. Important, inderstudied properties of cfDNA may become either a treasure trove for mining of novel cancer biomarkers or even indicate that cfDNA, by itself, could be a therapeutical target. The fragmentation patterns of cfDNA are non-random. They reflect fragmentation of DNA during apoptosis, that in turn, may associate with epigenetic landscapes. Circulating nucleotide fragments copy number depends on the nucleosomal positioning in given DNA locus. PCR primer systems may be tuned to the regions that would produce higher DNA amplification outcomes. Sensitivity of detection can be increased by simultanious isolation of "free" DNA molecules and these adsorbed to cells' surface.The prevalence of certain DNA fragments may directly reflect nucleosome positioning within certain loci and serve as a proxy for gene expression levels. This opens a novel field in biomarker research, tentatively called "fragmentomics". Moreover, cfDNA fragments are biologically active as they are enriched in 8-oxo-dG. The oxidized DNA is a stress signal released in response to oxidative stress. It might contribute to systemic abscopal effects of localized irradiation treatments. The mass release of oxidized DNA that accompanies apoptotic and necrotic processes in radio- and chemotherapy treated tumors may aid survival of residual cancer cells and even instigate their resistance to further treatment. The selective removal of oxidized DNA from the bloodstream or the block of respective oxidized DNA-dependent signaling may be developed as an adjuvant treatment.Current research is funded by Russian Ministry of Science and Education under the project ID# RFMEFI60714X0098

Biography:

Dr. Ancha Baranova, a specialist in the area of functional genomics of complex human diseases, is an Associate Professor in the School of Systems Biology, College of Science, George Mason University in Fairfax, Virginia, USA, and Principal Investigator at Russian Centre for Medical Genetics, Moscow. Dr. Baranova's major academic contributions are in the field of personalized medicine. A significant part of Dr. Baranova's efforts is dedicated to *in silico* analysis of the publicly available datasets. Dr. Baranova employs a multidisciplinary approach in order to broaden research perspective in the genetics of complex human diseases.