

2nd International Summit on **Integrative Biology**

August 04-05, 2014 Hilton-Chicago/Northbrook, Chicago, USA

“Walking pathways” and personalized medicine

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Massive changes of expression of hundreds of genes as well as changes in genomic and epigenomic landscapes observed in human diseases often represent just an “echo” of relatively few causative molecular processes in the cells taking place during the transformation into the disease state, e.g. in cancer, during malignant transformation. Non-reversible structural changes in gene regulatory networks may cause transformation of the cell homeostasis switching it from the normal state to the disease state. We call such structural network changes as “walking pathways”. Analysis of this phenomenon helps us to understand the mechanisms of molecular switches (e.g. between programs of cell death and programs of cell survival) and to identify perspective biomarkers and drug targets of cancer. Such structural changes often happen due to epigenetic “evolution” of genome regulatory regions during realization of development programs. The structural plasticity of regulatory networks leads to formation of personalized variants of regulatory pathways in individual tumors, which requires reverse engineering and *de novo* reconstruction of pathways in each individual case and explains pure performance of the modeling efforts which are done on the basis of a single unified cancer pathway.

Biography

Alexander Kel received his PhD in Bioinformatics, Molecular Biology and Genetics in 1990. He studied biology and mathematics at Novosibirsk State University and obtained his M.S. in biology with special focus on mathematical biology in 1985. He worked for 15 years at the Institute of Cytology and Genetics, Russia (ICG) holding positions as a programmer, scientist, senior scientist and Vice-Head of the Laboratory of Theoretical Molecular Genetics. In 1995, he won the Academician Belaev Award. In 1999 he received an independent funding from the Volkswagen foundation and organized a Bioinformatics group at ICG. From 2000 to 2010, he has been the Senior Vice President Research & Development of BIOBASE GmbH, Wolfenbüttel, Germany.

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