OMICS Group Conferences
Accelerating Scientific Discovery

International Conference on
Emerging Cell Therapies

October 1-3, 2012 DoubleTree by Hilton Chicago-North Shore, USA

Novel integrative nuclear signaling module for neuronal development and regenerative medicine

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Our long-term mission is to understand the principles of brain development that operate at the interface of genomic and the epigenetic information, with the implications for developmental- and aging-related diseases. Ontogeny requires coordinated regulation of multi-gene programs by a plethora of extra- and intra-cellular signals. The integrative network modules that execute the cell cycle and pleuripotency gene programs have been identified in part. Our studies have revealed an analogous universal regulatory module, Integrative FGFR1(R1) Signaling (INFS)] that executes further stages of the cell development1. Central to this mechanism is the nuclear translocation of newly synthesized R1and interaction with CBP, pp90RSK1 and chromatin. Our studies show how stochastic molecular collisions among nuclear proteins can lead to coordination of gene activities that enable neuronal development by diverse neurogenic signals. A new technology has been developed allowing direct INFS control of neuronal differentiation without the need of the external neurogenic signals. A recombinant form of R1 has been engineered to reside exclusively in the nucleus and switch on neuronal differentiation1,2. Nanotechnology-based transfection of such recombinant genes into the subventricular zone and recently identified therapeutic agents that target INFS offer unprecedented means to reactivate robust neuronogenesis in the adult brain2. Thus targeting the INFS module could potentially revolutionize treatment strategies of a broad range of neurological disorders.

Biography

Michal K. Stachowiak has completed his Ph.D from the Gdansk Medical University, Poland, in 1980, and postdoctoral studies at the University of Pittsburgh. He is the director of Molecular and Structural Neurobiology and Gene Therapy Program and of the Western New York Stem Cell Engraftment and In Vivo Analysis Core. He has published more than 95 papers in reputed journals. His recent book: "Stem Cells - from Mechanisms to Technologies" (World Scientific Publishing) describes fundamental mechanisms in the biology of stem cells and their therapeutic utilization.

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