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The role of lipids-nucleic acids interactions in nuclear pores assembly and in Alzheimer's disease origin

During the study of the ternary complexes-TC: nucleic acids - liposomes from zwitterionic lipids, in the presence of a number of divalent metal cations- (Ca, Mg, Fe, Co, etc), the author concluded about the uniqueness and widespread prevalence of such complexes in the cell. They are more labile than lipoplexes-complexes of cationic lipids with DNA, in addition have a more diverse structure and are more dynamic, capable of creating various organelle-like structures, or contacts between organelles in eukaryotes. In addition, TCs are not toxic to cells, unlike lipoplexes. The author suggested a possible scheme for the formation of nuclear pores involving liposomes from zwitterionic lipids and double-stranded DNA or triple-stranded hybrids DNA /low molecular weight RNA (lmw RNA), which, when untwisted in pore annuli, give one or two chains of ssDNA. The thermo-stability of DNA/lmw RNA triple helix is lower than the same sequence of DNA. That specifies preferential attachment of three-stranded hybrids to membrane vesicles.


The ssDNA in the pore annulus is the reason for the enhanced transcription of the genes attached to nuclear pore what shown only now, but we are written about that fact 30 years ago.

The ssDNA is attractive site not only for DNA polymerase but also is target for beta -amyloid (β A) too. For example, β A binding to ssDNA of nuclear pore prevents template activity of enzymes on the ssDNA. The β -amyloids concentrating in area ssDNA (pore annulus) result in the β A aggregates appearing. Lipids environment (nuclear envelope) as it known support the aggregation of β A. With time in pore annulus forms β A plaque, which could prevent RNA transport from nucleus to cytoplasm. Therefore, exist at least two unknown way of influence of nuclear pores on the regulation of cells gene activity resulting to Alzheimer's disease.

Speaker Biography

Vasily Kuvichkin is a Senior Staff Scientist in Laboratory of Mechanisms of Reception, Institute of Cell Biophysics of the Russian Academy of Sciences, Russia. His research interests include biophysics, molecular biology, lipid-nucleic acids interactions, spectroscopy (UV-VIS and fluorescence), microscopy (EM and fluorescent), nuclear pore assembly, system biology, evolution, aging. He has received many awards such as "Vanguard of Knowledge" by pharmacy company "Astra Zeneca" in the year 2012; Winner of Grant of the European Science Foundation: "Epitope map" from University College of Dublin, Ireland in the year 2011; Winner of Grant of the DAAD, Berlin, MDC-Buch, Germany in the year 2009; Winner of Japan Society for Promotion of Sciences grant by Shizuoka University, Japan. He has published many research articles and is an active member of many International Conferences.

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