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Role of DNA/RNA- lipids interactions in Nuclear pore assembly, Genome expression and Cancer cell degeneration

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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/lmwRNA triple helix is lower than the same sequence of DNA. That specifies preferential attachment of three-stranded hybrids to membrane vesicles. The triple helical hybrid unwinding during fusion of two membrane vesicles results in pre-pore formation: double-stranded DNA/lmwRNA hybrid and a ssDNA (R-loop), located on the outer diameter of fused vesicle of TC. This vesicle interacting with double nuclear membrane form channel between two membranes. During their fusion ssDNA and hybrid of DNA/lmwRNA shifts to pore annulus center and serve as template for nucleoporins binding and for gradually

pore complex formation. The ssDNA in pore annulus is the reason for the enhanced transcription of the genes attached to nuclear pore. The ssDNA located along the outer diameter of TC vesicles serve as sites of transcription initiation and their aggregates can be considered as "transcription factories".

Increasing of number nuclear pore during cancer progression means increasing of transcription of specific oncogenes in a cell. Pore can form cluster from 10-12 pores, which manifold increase a transcription of near to cluster genes. The presence in nuclear pores lmwRNA (small nuclear RNA or long non-coding RNA) give us possibility of their participation in changing activity of genes in cancer cells. Change of lmwRNA between cancer and normal cells allow these RNA induced cancer in normal cells by mechanisms of chains reaction. Many membrane tropic carcinogens increase transcriptional activity pore complex as their production and stability in cells.

Speaker Biography

Vasily Kuvichkin has completed his PhD at the age of 35 years at Moscow State University, Lomonosov's name, Russia. He is the chief of Group of lipids-nucleic acids interactions at the Institute of Cell Biophysics, Russian Academy of Sciences. He has over 120 publications that have been cited over 600 times. He is member of Biophysical Society, Japanese Society Molecular and Cell Biology and FEBS.

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