Self-Assembled Multifunctional Responsibilities and Opportunities

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The federal government incentive, the US National Nanotechnology Initiative (NNI), has given us the opportunities for novel fundamental discoveries but additionally established responsibilities. American parents are aware that this federal investment in a long run results into new employment opportunities and careers and thus expect strong educational pathways from academic institutions. Similarly our society recognizes the improved precision/quality with the nanotools and emphasizes the application to environmental issues such as accurate pollution control. Health diagnostics, especially with aging population, are expected to be developed for preventive care type applications like simple change detection and for early-early detection of disease markers. Nanotechnology's mission is to bring effective point-of-care detectors to doctor's office and to integrate the diagnostics with therapeutics using multifunctional nanomedicine for improved targeting and delivery.

Self-assembly of asymmetric molecules is a promising way to build multifunctional supramolecular arrangements applying the bottom-up approach. A good example is the membrane bilayer, essential for optimal function of the cells. The fundamental understanding of the role of surfactant molecules in building complexity during evolution was the interest of late Professor Eirich at the Polymer Research Institute at Polytechnic University. This fame has resulted in vast continuity from self-assembled mixed monolayers to multifunctional surfaces with imprinted nanocavities. Today this surface imprinting method has been applied in an antibody replacement manner to nerve gas and pesticide detection as well as to early detection of cancer markers.

Fascinating opportunities for nanomedicine are optimized with the use of natural phosholipids for building liposomal delivery systems and nanoreactors. These drug reservoirs have optimal bioavailability due to the size-control and nanogel support and have maximal targeting abilities with the easy build-up for multifunctionality. The understanding of small molecular assembly to large multifunctional entities will bring novel approaches such as supramolecular electronics to daily life.

Kalle Levon has been a professor at Polytechnic University since 1989, he was the department head for seven years during the transition period towards biofields (1995-2002) and served later as the vice dean for research and the vice provost for research till 2006. Presently he is the director of Polytechnic University's Bioinformatics program. Professor Levon has organized several symposia including the international Biochips conference at Polytechnic University in 2001 and has been pioneering the organizing of the Nanomedicine symposia, the 2nd organized in Brooklyn in 2004. He serves in the advisory board of the Drug Delivery and Nanomedicine Symposium. During the recent years Dr Levon has been closely involved with fundamental education organizing

Bionano summer camps at the high schools sites and was also an instrumental partner in developing the NYC Board of Education and the Gates Foundation funded Career Exploration Academy, a novel school combining both Middle and High Schools, with strong experience based summer programs.