From fullerenes to carbon nanotechnologies and to understanding of nanomedicine perspectives

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Past century science used various approaches based on intervention to the micro space of nature. Later X – ray crystallography was discovered as a tool for research and understanding of three dimensional organization of individual molecules or supra molecular structure of various subjects. During recent years nanoworld was discovered as highly organized space of human potential intervention. There many opportunities in a field of biology and medicine to use nanomaterials and nano devices for solution of many problems in treatment of human diseases.

Applications of nanotechnology for treatment, diagnosis, monitoring, and control of biological systems has recently been referred to as “nanomedicine”. Research into the rational delivery and targeting of pharmaceutical, therapeutic, and diagnostic agents is at the forefront of projects in nanomedicine. These involve the identification of precise targets (cells and cellular receptors) related to specific clinical conditions and choice of the appropriate nanocarriers to achieve the required responses while minimizing the side effects due to dramatic increasing of a specific targeting.

There are several key problems in infectious and cancer disease diagnostics and treatment:

1. Highly specific and super sensitive diagnostic of viral. Bacterial and cancer antigens.
2. Highly specific targeting of antiviral. Anti-bacterial or anticancer drugs.
3. Creation of highly effective vaccines against these diseases.

Nanotechnology provides excellent approaches for development highly specific diagnostics with the sensitivity on the level of single molecules or single infectious agents, using the same cognitive biological instruments as monoclonal antibodies or especially designed ligand. Nanotechnology devices provide outstanding tools for environmental health monitoring.

In a field of new vaccines nanobiotechnology already has outstanding achievements: nanovaccines are very attractive for immune system and induce strong immune response on the level of few nonograms of antigens. This is extremely important for development of vaccines against highly dangerous viruses like avian flu virus H5N1 and against cancer.

In the presentation three examples of successful application of nanotechnology in medicine will be provided and illustrated on laboratory data obtained in recent studies.