Stevens Institute of Technology

Nanotechnology Graduate Program

Exploring nanobiointerface to understand and mitigate nanotoxicity

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Professor P. Somasundaran

Langmuir Center for Colloids and Interfaces, Columbia University

Nanoparticles are increasingly used for a variety of clinical and commercial purposes. Examples of use include fluorescent quantum dots as markers in biological imaging, gold and carbon nanoparticles for drug delivery metal nanoparticles in fuel cells and oxide particles in cosmetic and personal care products. While utilizing their beneficial functions, possibilities of engulfment of nanoparticles by biological cells and resultant toxicity must also be taken into account. The uncertainty of nanotechnology, especially potential environmental risks of nanoparticles cannot be ignored lest we have another asbestosis to deal with. Results suggest that depending on their surface chemistry, size, surface area, crystallinity and surface charge, nanoparticles can produce toxicity on cells via different mechanisms. Since traditional techniques are not quite valid at the nano level, we have developed new spectroscopic and adsorption based techniques to quantitatively evaluate the hydrophobicity of the nanoparticles and to correlate with their effects on bacteria cells. Based on these findings we explore ways to mitigate the nanotoxicity so that we may reap the full benefits of nanotechnology.

Professor Somasundaran received his M.S. and Ph.D. from the University of California at Berkeley and his Bachelor of Engineering from the Indian Institute of Science. Before joining Columbia he worked for the International Minerals and Chemical Corporation and Reynolds Industries. He was appointed the first La von Duddleson Krumb Professor in the Columbia University School of Engineering and Applied Science, the first Director of the Langmuir Center for Colloids & Interfaces, and the founding director of the National Science Foundation Industry/University Cooperative Center for Advanced Studies in Novel Surfactants. He was inducted in l985 into the National Academy of Engineering, and later to the Chinese, Indian and Russian National Academies. His awards include the Antoine M. Gaudin Award (1982), the Robert H. Richards Award (l987), the Arthur F. Taggart Award for best paper (1987) of AIME, and the "Most Distinguished Achievement in Engineering" award from AINA. In addition, he was awarded the "Ellis Island Medal of Honor" in 1990 (past recipients include four former US Presidents, U.N. Ambassador Thomas Pickering and Danny Thomas), the Leadership citation from the NJ Senate in 1991, and the Engineering Foundation's 1992 Frank F. Aplan Award. He was the Chairman of the Board of the Engineering Foundation (1993-95) and currently on the board of the new United Engineering Foundation. He is the author/editor of fifteen books and of over 400 scientific publications and patents. He is the honorary editor-in-chief of the international journal "Colloids and Surfaces". His research interests are surface and colloid chemistry of minerals, materials and microbes, molecular interactions at surfaces using advanced spectroscopy, polymer and surfactant adsorption, flocculation/dispersion, biosurface phenomena, environmental engineering (waste treatment), enhanced recovery of oil and coal cleaning.

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