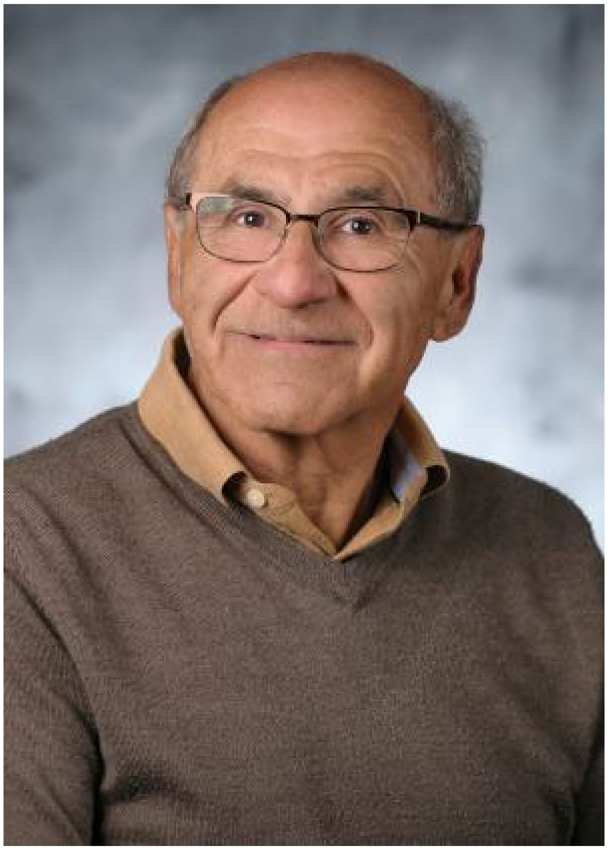
UC SANTA BARBARA
Chemistry and Biochemistry



MARTIN MOSKOVITS Distinguished Professor

EDUCATION

Professor Moskovits has degrees in Physics and Chemistry from the University of Toronto. He co-founded OHM Distributers and manufacturers Ltd., an electronics company in Toronto in 1966 which was sold in 1969. He returned to the University of Toronto to complete a PhD in chemical physics (1971). From 1971-73 he was employed as a materials scientist by Alcan Research and Development in Kingston Ontario. He returned to take up a faculty position in the department of chemistry at the University of Toronto. Promoted to professor in 1982, he was Chair of that department (1993-1999).

BIO

In 2000 he moved to UCSB as Worster Dean of Science. From 2007-2010 he was Chief Technology Officer of API Technologies in NY; and from 2011-2012 Provost at the City College of New York. In

2008 he co-founded Spectra Fluidics, a company that combines SERS with microfluidics to develop high-sensitivity molecular sensing.

Moskovits is Fellow of the American Association for the Advancement of Science; Fellow of the Optical Society of America; Fellow of the Royal Society of Canada; former member, and past Vice Chair of the US Department of Energy's Basic Energy Sciences Advisory Committee 2001-2010. He was Guggenheim Fellow in 1987; 1993 Gerhard Herzberg Award of the Spectroscopy Society of Canada; 1993 Royal Society of Chemistry (London) award in Surface and Colloid Science; 1995 Johannes Marcus Marci Medal of the Czech Spectroscopy Society; 2008 NanoTech Briefs, Nano 50 Innovator award; 2010 Ellis Lippincott Award of the Optical Society of America.

RESEARCH

The research carried out in our group falls into two broad categories: (i) plasmonics and surface-enhanced Raman spectroscopy (SERS), and (ii) nanowire synthesis and nanowire-based sensing. In plasmonics we have two major goals: the first is to create plasmonic analogs of photovoltaics and photosynthetic systems. Recently, for example, we produced the first device ever reported which uses the electrons resulting from the decay of plasmons in gold nanorods to reduce hydrogen ions in water, and the positive charges left behind to oxidize water to oxygen gas. The device is a free running cell floating in water with light as its sole energy source. (Surface plasmons are collective conduction electron excitations in that occur in nanostructured metals and some other conductors.) SERS is also a plasmonic phenomenon. The excitation of plasmons concentrate electromagnetic radiation in nanometer-sized volumes – so-called hot spots. Molecules located in such hot spots can produce enormously enhanced spectra. Collaborating with colleagues in engineering, and especially the group of Professor Carl Meinhart, we pursue a number of research avenues often by combining microfluidics with SERS spectroscopy. For example, we have created very bright nanotags that can contain a peptide or an aptamer that can interact either with an analyte or the surface of a cell. The very bright SERS spectrum of the nanotag is then used to pick out, for example, cancer cells from among non-cancerous cells flowing in the microfluidic stream; or to detect and identify small analyte molecules at very low concentrations entering the microfluidic stream from the ambient atmosphere.

Our research work with semiconductor nanowires attempts to understand the transduction process that converts chemical events at the surface of nanowires, and especially nanowires functionalized with catalytic nanoparticles, to the electrical conductivity of the nanowire. Most often such nanowires are configured as field-effect transistors and the Gate voltage, that controls the electric field across the nanowire, is used to tune the nanowire's "chemical potential", thereby providing what is in essence an electronic means for functionalizing the nanowire's surface.

Our most recent work draws a great deal of its inspiration from biomimetics, as we attempt to fabricate nano-electronic analogs of olfaction, both by creating nanowire-array-based electronic nose equivalents and multi-receptor SERS arrays that use the very highly sensitive character of SERS to look at the overall spectroscopic changes produced by small molecules interacting with aptamers linking plasmonic nanoparticles, then using data analysis paradigms to connect the observed changes to a specific analyte, in analogy to the manner in which the mammalian cognitive apparatus relates the pattern of the activation of the olfactory receptors with a given fragrance.