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Crossing domains of nanotechnology, microbiology and analytical chemistry

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This is the era of nanotechnology, whose very success relates to the fact that it closely envelops the main stream research areas such as chemistry, physics and engineering blending human welfare related streams such as biology and medicine. Here, I would touch upon areas which I have been closely associated with, for the past two decades- nanotechnology, microbiology and analytical chemistry. Currently, my lab works on microbiological analysis from environmental and clinical samples using nanoparticle-assisted MALDI-MS technique. Here we combine nanotechnology, microbiology and an analytical technique such as MALDI-MS. My first contribution in this area was the rapid analysis of Gram-positive bacteria in water via membrane filtration coupled with MALDI-MS. We have also traced the Invivo growth kinetics of Staphylococcus aureus, pathogenic bacteria in animal model using mice. We have synthesized ZnO, Ag and TiO_2 nanoparticles inhouse and used them as affinity probes in bacterial studies for enhanced MALDI-MS detection. We have for the first time reported the degradation of bacterial extrapolysaccharides (EPS) using Quantum dots. We have also reported the use of mass spectrometry as a bacterial biosensor using TiO_2 NPs assisted MALDI-MS. I have coupled my experience in NPs and microextraction technique into microbiology in a project where we use Pt nanoparticles combined with Ionic Liquid to extract bacteria from Plasma via single drop microextraction. Another key area, where I have been working on is the introduction of nanoparticles and quantum dots for the detection of proteins, peptides, biomolecules and drugs. Recently, we have reported the use of functionalized quantum dots modified with dopamine as matrix for the quantification of efavirenz in human plasma and their rapid identification using MALDI-TOF-MS. At present we are working on the introduction of nanoparticles for detection of cancer cells using MALDI-MS. All these studies show the successful implementation of nanotechnology into analytical chemistry for microbiological analysis. Since all research and development is oriented towards human health and welfare, contributions such as these lay foundations to future implementation in clinical and medical studies.

Biography

Hui-Fen Wu received her Ph.D. degree from the University of Texas at Austin, USA in 1994. Followed by postdoctoral appointments at University of California at Berkeley, she went back to Taiwan as an Associate Professor (1996-2001) and Professor (2001-2006) in the Department of Chemistry, Tamkang University. She moved to the Department of Chemistry, National Sun Yat-Sen University in 2006 as a Professor and since 2006 her research work has focused on Nano-Biomedicine using Nano-based Mass Spectrometric techniques. Basically, an analytical chemist, she has diversified her research interests to the application of nano-based biological mass spectrometry in bacteriology, mycology, biotechnology, oncology and molecular biology. Her research diverges into areas such as proteomics, lipidomics, glycomics and metabolomics. To date, she has more than 100 publications. In National Sun Yat-Sen University, she is also associated with the Doctoral Degree Program in Marine Biotechnology (2009~), Center for Nanoscience and Nanotechnology (2008~), Institute of Technology and Medical science (2011~) and Center for Cross Research (2011~). She also serves as the editorial board member in Journal of Analytical Methods in Chemistry, American Journal of Analytical Chemistry, Journal of Biotechnology & Biomaterials, Journal of Biochips & Tissue Chips and Chemistry (the Chinese Chemical Society, Taipei) and also as an associate editor in Journal of Integrated OMICS. She is currently the director of Taiwan Society for Mass Spectrometry and delegated as review committee member of the Expensive Instrument Project, National Science Council.

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Bacterial cell surface display: Its medical and environmental applications

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Cell-surface display is the expression of peptides and proteins on the surface of living cells by fusing them to functional components of cells which are exposed to the environment of cells. This strategy can be carried out using different surface proteins of cells as anchoring motifs and different proteins from different sources as a passenger protein. It is a promising strategy for developing novel whole cell factories. Surface engineered cells have many potential uses in Biotechnology. Utilization of the surface of living cells is attractive in different microbiology and molecular biology applications. This technology allows displaying of different size of protein molecules, from small to large and from single-subunit proteins to hetero-oligomeric multi-subunits. In this presentation, we focus on the principles and some applications of surface display technology in Biotechnology fields.

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