Nanotechnology and vibrational spectroscopies are poised to shape the future of healthcare

E. Fazio, C. Corsaro

Dipartimento di Scienze Matematiche e Informatiche, Scienze Fisiche e Scienze della Terra, Università di Messina

Vibrational spectroscopy is a non-destructive identification method that measures the vibrational energy in a compound. As each chemical bond has a unique vibrational energy, each compund will have a unique fingerprint which can be used to identify and to characterize compounds. For such features, vibrational spectroscopy is a rapidly growing field and it has found applications in industries including material science, pharmaceutical manufacture, food and drug safety, and process monitoring on production lines. Based on the non-invasive features, interest in clinical spectroscopy is analogously rising rapidly as a non-invasive tissue diagnosis tool while, in clinical pathology, vibrational spectroscopy is widely employed in cancer detection, the pathology of micro-organisms, *in vivo* spectroscopy, and imaging. However, many questions remain open. For example, the details of characteristic peak frequencies and their relationship to the specific functional groups present in the biological tissues have not been fully understood, requiring theoretical and modelling efforts. This talk reports:

a) the use of molecular networks consisting of entire bacteriophage structure, displaying specific peptides, assembled with Ag nanoparticles as a new SERS probe for U937 cells identification *in vitro* or to capture and detect low bacterial concentration present in biological samples.
b) a multivariate analysis of Multiple Myeloma subtype plasma cells coupled with Raman spectroscopy to differentiate between sensitive and resistant multiple myeloma cell lines.
c) potential therapeutic effectiveness of Au@LCCs as an anti-inflammatory agent at the intestinal level.
d) evaluation of biological response induced by molybdenum oxide nanocolloids on *in vitro* cultured NIH/3T3 fibroblast cells by micro-Raman spectroscopy.