

9th World Congress on

Chemistry and Medicinal Chemistry

May 13-14, 2019 | Prague, Czech Republic



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Rapid bacterial antibiotic susceptibility tests based on Simple Surface-Enhanced-Raman Spectroscopic Biomarkers

Rapid bacterial antibiotic susceptibility tests (AST) are important to help reduce the mortality of sepsis patients, the widespread misuse of antibiotics and the growing drug-resistance problem. We discovered that, when a susceptible strain of bacteria is exposed to an antibiotic, the intensity of specific biomarkers in its surface enhanced Raman scattering (SERS) spectra drops evidently in two hours. The discovery has been exploited for rapid antibiotic susceptibility test (AST) – dubbed SERS-AST, of bacteria cultured from the blood samples of sepsis patients. By applying 3~4 antibiotics to every clinical sample, a total of more than six hundred cases of SERS-AST was conducted; and the overall successful rate of identifying the bacteria's antibiotic susceptibility was 95.7%.

The biomolecules responsible for these bacterial SERS biomarkers have been identified as several purine derivative metabolites involved in bacterial purine salvage pathways. Using ultra-performance liquid chromatography/electrospray ionization-mass spectrometry (UPLC/ESI-MS),

the time dependences of the concentrations of these molecules were measured. Surprisingly, a single *S. aureus* and *E. coli* cell were found to release millions of adenine and hypoxanthine into a water environment in an hour respectively. The implications of these findings about the molecular origin of the SERS biomarkers to the emergent SERS-AST method will be addressed in conjunction with other emergent AST methods.

Speaker Biography

Yuh-Lin Wang, Dr. Physics, specializes in the creation and applications of novel nanostructures that are formed solid surfaces via constrained self-organization processes. He is a co-author of more than 150 papers and the recipient of several awards including the Prime Minister Award for Outstanding Contribution in Science and Technology, Taiwan and Academic Award, Ministry of Education, Taiwan. He is a fellow of American Physical Society, U.S.A. He is an adjunct professor of the department of physics, National Taiwan University, Taiwan.

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