

JOINT EVENT

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Metal nanoparticles as a novel tool to fight microbial biofilm development and antibiotic-resistance emergency

Biofilms are three-dimensional structures that contains billions of genetically identical bacteria imbedded in a self-produced extracellular matrix, which shelter them from antibiotics. More than 85% of chronic and/or recurrent human infections are linked to bacterial biofilms, and every day the microbicide arsenal against them becomes more limited. Accordingly, nano-material science engineering is emerging as a promising alternative for reducing bioburden in healthcare facilities. Here, we present a novel TiO₂-coated copper and silver nanoparticles (CuNPs and AgNPs, respectively) with enhanced photocatalytic and antibacterial properties. The activity of CuNPs and AgNPs (MNPs) was measured against planktonic and sessile forms of the relevant cystic-fibrosis related *Pseudomonas aeruginosa* (CFPA) and methicillin-resistant *Staphylococcus aureus* (MRSA). The planktonic and sessile growth (measured as the final cellular yield at 600 nm and crystal violet staining, respectively) of both pathogens was severely inhibited by submillimolar concentrations of MNPs (95% of growth inhibition, $p < 0.01$). The anti-biofilm effect was exerted at a genetic level as revealed by the downregulated expression produced by the MNPs on transcriptional β -galactosidase and gfp-fluorescence reporter fusions to genes involved in an extracellular matrix synthesis. MNP-treatment of pre-formed CFPA and MRSA biofilms dramatically accelerated their disassembling and cellular death without dispersal cell formation. Interestingly, the emergency of MNP-resistant CFPA or MRSA after two-weeks treatment with sub-MIC concentrations of the microbicide was significantly lower ($p < 0.01$) than the emerged resistance after bacterial treatment with clinical antibiotics. The importance of the MNP treatment adoption as a safe alternative for reducing pathogenic bioburden will be presented.

Biography

Roberto Grau completed his PhD from National University of Rosario in Argentina and obtained his Post-doctoral studies from The Scripps Research Institute (TSRI), Department of Experimental Medicine at San Diego, California, USA. He is a Pew Latin American Fellow (San Francisco, USA), a Fulbright International Scholar (Washington DC, USA) and the Director of the Molecular Microbiology and Environmental Science Laboratory of the National Council of Scientific Research of Argentina (CONICET). He obtained many national and international awards, and published more than 30 papers in reputed journals.

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