

Nanotheranostics in the diagnosis and treatment of infectious diseases

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Abstract

Nanotheranostics is a recent approach that combines medicine, bioengineering and nanotechnology to create multifunctional, customised nanoplatforms with both excellent therapeutic and diagnostic capabilities to solve the most difficult medical problems in microbiology and oncology today.

This alternative approach can be successfully used against a variety of pathogenic organisms such as bacteria, fungi, viruses etc. and has already been found to be superior to conventional antibiotic therapy, which in the long term leads to creation of the antibiotic resistance mechanisms and a formation of the number of new multi-drug-resistant strains, such as Carbapenem-resistant *Pseudomonas aeruginosa* (CRPA), third-generation Cephalosporin-resistant *Escherichia coli* (3GCREC), Vancomycin-resistant *Enterococcus* (VRE), Methicillin-resistant *Staphylococcus aureus* (MRSA) or multi-drug-resistant *Mycobacterium tuberculosis* (MDR-TB) etc.

Presently proposed highly biocompatible, personalised theranostic hybrid nanoplatforms combine several physical, chemical or biological mechanisms to ensure dedicated drug transport to the affected site as well as its optimal release over time. This allows for higher specificity, sensitivity and overall efficacy of the treatment process with very limited side effects for the patients. Usually, they are stimulated by more than one external stimuli and use several mechanisms that allow for more effective diagnosis, treatment and assessment of therapy progress over time.

About the presenter

Dr Joanna Bauer is an Assistant Professor at the Department of Biomedical Engineering at the Wrocław University of Science and Technology, Poland. She received Ph.D. in Applied Physics (summa cum laude) as well as a MSc. Eng. in Management & Marketing and a MSc. Eng. in Biomedical Engineering (summa cum laude) from the same university.

She is an experienced academic researcher specialised in multidisciplinary biomedical engineering projects related to early diagnosis, personalised and preventive medicine, nano-biomaterials functionalisation and characterisation, infrared imaging, as well as pattern recognition and image analysis. Dr Bauer is a co-editor of three books published by

prestigious international publishing houses such as Imperial College Press, UK, IOP Publishing, UK, and Elsevier, as well as a co-author of more than 130 publications and 103 conference presentations, including 36 plenary and invited lectures. She has been a Research Fellow and Visiting Scientist in a number of scientific institutions worldwide.

Dr Bauer has over eighteen years' experience in carrying out national and international scientific projects within programmes such KBN, DAAD, ESF, FP6, FP7, and H2020. She has been awarded many times for her scientific activity. This includes prestigious awards for industrial and scientific excellence such as Grand Prix Innovation Radar Prize 2020 given by the European Commission to the best Europe's innovators, Siemens Research Prize for Outstanding Achievements in Technology and Science, Appreciation Certificates from the European Association for Predictive, Preventive and Personalized Medicine, Development Award in Technical Sciences for Young Distinguished Scientists from the Polish Minister of Science and Education, Distinction of the Polish Society for Biomedical Engineering, Wrocław University of Science and Technology Rector's Scientific Awards, etc.