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Engineering the Nano-Bio Interface for Applications in Nanomedicine

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Abstract

The convergence of the fields of nanotechnology and medicine has resulted in innovative approaches for novel disease therapies, biomedical imaging and sensing, and numerous others. In particular, the use of gold nanoparticles in rapid diagnostics for infectious diseases has been emerging as an application with the potential to address some major challenges in global health. These assays are low-cost and can be used in rugged environments, hence they are attractive for widespread deployment for disease surveillance, quarantining, and treatment. One of the biggest challenges for effectively using nanoparticles in biological applications is the physical interface between the nanoparticles and its biological environment. Surface fouling and non-specific adsorption can lead to undesirable side effects, such as diminished targeting specificity and cell uptake, unfavourable bio-distribution, and toxicity. However, non-specific adsorption can actually be exploited for biological applications. We show how the unique properties of the nano-bio interface can be utilized for different medical applications, including disease diagnostics for dengue, zika, chikungunya, Ebola, and other pathogens. We will discuss the unique interface issues in lateral flow immunoassays, and also discuss how multi-coloured nanoparticles can impart new capabilities to the assays.

Biography

Dr Kimberly Hamad-Schifferli is an Associate Professor in the Department of Engineering at the University of Massachusetts Boston. She obtained her BSc in Chemistry from MIT in 1994 and PhD in Chemistry from the University of California, Berkeley in 2000 under the supervision of Professor A. Paul Alivisatos. Following this, she was a postdoctoral associate at the MIT Media Lab. She joined MIT in the Department of Mechanical Engineering and the Department of Biological Engineering as a faculty member from 2002-2012. From 2012-2015, she was at MIT Lincoln Laboratory in the Bioengineering Systems and Technologies Group. Since 2015, she has been a founding member of the Mechanical Engineering Programme at UMass Boston and holds a visiting scientist position at MIT. In addition, she has received an ONR Young Investigator Award and was named a Fellow of the Foresight Institute.



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