

UCSD NANOENGINEERING/CHEMICAL ENGINEERING

Jan B. Talbot Distinguished Lectureship

Monday, December 5th, 2022

Seminar Presentation: 11:00am - 12:00pm

SME room 248

*“Designing and translating biomaterials for therapeutics and ultrasensitive biosensing”*

Dr. Molly M Stevens, PhD

*Professor
Imperial College London*

Abstract: This talk will provide an overview of our recent developments in bio-instructive, self-assembling and gradient materials for applications in regenerative medicine with focus on establishing translational pipelines to bring our innovations to the clinic [1]. Our group has developed fabrication methods to engineer complex 3D architectures that mimic anisotropic and multiscale tissue structures and generate spatially arranged bioinstructive biochemical cues. I will discuss recent advances in our tunable nanoneedle arrays for multiplexed intracellular biosensing at sub-cellular resolution and modulation of biological processes [2]. I will talk about our portfolio of nanoparticle-based sensing probes for diagnosing and monitoring infectious and non-communicable diseases with integration to smartphone technology for mHealth approaches [3,4], in particular our CRISPR-based diagnostics, CrisprZyme, a new technology for detecting ncRNA without need for preamplification [5]. We are also advancing Raman spectroscopy characterisation techniques for high-throughput label-free characterization of single nanoparticles -SPARTA™ - which is becoming an integral tool for the design of advanced nanotherapeutics [6]. I will explore how these versatile technologies can be applied to transformative biomedical innovations.

[1] J. P. K. Armstrong... M. M. Stevens. “A blueprint for translational regenerative medicine.” *Science Translational Medicine*. 2020. 12(572): eaaz2253.

[2] C. Chiappini... M. M. Stevens, E. Tasciotti. “Biodegradable silicon nanoneedles delivering nucleic acids intracellularly induce localized in vivo neovascularization.” *Nature Materials*. 2015. 14: 532

[3] C. N. Loynachan... M. M. Stevens. “Renal clearable catalytic gold nanoclusters for in vivo disease monitoring.” *Nature Nanotechnology*. 2019. 14: 883–890.

[4] C. S. Wood, ... M. M. Stevens. “Taking connected mobile-health diagnostics of infectious diseases to the field.” *Nature*. 2019. 566: 467-474. 10: 1038

[5] M. Broto, ... M. M. Stevens. “Nanozyme-catalysed CRISPR assay for preamplification-free detection of non-coding RNAs.” *Nature Nanotechnology*. 2022. 10: 1038.

[6] J. Penders... M. Stevens. “Single particle automated Raman trapping analysis.” *Nature Communications*. 2018, 9: 4256.

Biosketch: Prof Molly M Stevens FEng FRS is Professor of Biomedical Materials and Regenerative Medicine and the Research Director for Biomedical Material Sciences in the Department of Materials, in the Department of Bioengineering and the Institute of Biomedical Engineering at Imperial College London. Her multidisciplinary research balances the investigation of fundamental science with the development of technology to address some of the major healthcare challenges. Her work has been instrumental in elucidating the bio-material interfaces. She has created a broad portfolio of designer biomaterials for applications in disease diagnostics and regenerative medicine. Prof. Stevens holds numerous leadership positions including Director of the UK Regenerative Medicine Platform "Smart Acellular Materials" Hub and Deputy Director of the EPSRC IRC in Early-Warning Sensing Systems for Infectious Diseases. She is a Foreign Member of NAE and the founder of several companies in the therapeutics and diagnostics space.

**The Chemical Engineering program at UC San Diego has established this named lectureship in honor of Jan Talbot, a faculty member in Chemical Engineering (now emeritus) and the director of the program at UCSD for about 20 years.*