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PROSEMINAR UHH-66-518 BIO/NANO-ELECTRONICS – BLICK GROUP

Nanoscale Strategies for Single-Molecule and Single-Cell Analysis

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[CHyN, Rm.-301, 02. July 2024, 13.15h,
hybrid: Zoom-999-4554-8884, 894-335-73]

Dr. Alex Ivanov is Associate Professor at the Department of Chemistry, Imperial College London. the Department of Chemistry. His research focuses on the innovation of novel nanoscale sensors and platforms for single-molecule detection and delivery, which enable the study of fundamentally important molecules in chemistry, biology, and medicine. Examples include tunnelling nanopore platforms for high-resolution DNA fragment sizing and sequencing Nano Letters (2011), ACS Nano (2014), Nature Communications (2021A), Science Advances (2022), optical/plasmonic nanopore platforms Nano Letters (2013, 2015); ACS Nano (2015A), methods for on-demand delivery of single molecules ACS Nano (2015B), single-molecule detection in ultra-dilute (fM) samples Nature Communications (2016), nanopore/field-effect transistors for selective bioanalyte sensing Nature Communications (2017A), zeptolitre confinement of single molecules Nano Letters (2017, 2018), multiplexed single-molecule protein detection in human serum, Nature Communications (2017B, 2019,2021B), Nature Nanotechnology (2023), single-molecule nanotweezers that can extract single DNA, proteins and organelles from living cells, Nature Nanotechnology (2019) to name a few.

Content of the talk:

There is a significant drive to deliver nanotechnology-based solutions that enable the analysis of the fundamental components of life at the single-molecule and single-cell scale. In this talk, I will present nanoscale sensors and platforms that we have recently developed to address central challenges both for single-molecule and single-cell analysis.

The first part of my talk will discuss nanopore-based single-molecule techniques that offer high sensitivity and selectivity for detecting trace analytes in biological fluids through DNA and nanoparticle-based molecular carrier probes that have implications for next-generation biomarker analysis. [1-8]

I will also report on nanotweezers capable of trapping and extracting single entities such as DNA, RNA, and single organelles from live cells that could help better understand the fundamentals of cellular processes and how these processes occur in real time. [9-10] This work bridges the gap between single-molecule/organelle manipulation and can ultimately enable a better understanding of living cells and their intricate processes.

References

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2. Wang et al. *JACS*, **2023,** 145, 11, 6371
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8. Sze et al., *Nat. Commun.* **2017,** 8, 1552
9. Nadappuram et al., *Nat. Nanotechnol.* **2019** 14**,** 80
10. Kwan et al. *Circ. Res.* **2023,** 133, 944