AFM Applications in Biomedical Research and Diagnostics

Wednesday, December 15th, 2021 | 13:00 GMT | 14:00 CET

Join us and our special guest speakers for this virtual webinar on **AFM Applications in Biomedical Research and Diagnostics**. Biomechanical mechanisms play a fundamental role in molecular and cellular processes and have important implications in the fields of molecular and developmental biology, physiology, and the pathogenesis and diagnosis of various diseases, such as cancer and fibrosis. The investigation of nanomechanical properties at the single-cell and single-molecule level is already advancing the development of new targeted diagnostics and therapies.

Atomic Force Microscopy (AFM), an advanced multi-parametric imaging technique, not only delivers high resolution 3D images of the topography of living biological samples in the nm-range, but also enables the characterisation of the nanomechanical properties of molecules, cells, and tissues, and the visualization of structural changes taking place at the molecular level.

Our guest speakers will provide insights into their work, using AFM to investigate biomechanics, and the impact it is having in biomedical research.

Program – Wednesday, December 15th, 2021 | 13:00 GMT | 14:00 CET

14:00 **Welcome & Introduction**
Carmen Pettersson, Carmen Pettersson, Marcom Manager EMEA

14:05 **The Impact of Drug Resistance on Ovarian Cancer Spheroids - Insights from the Biomechanical Phenotype**
Dr Lydia Powell, CEAT, Swansea University Medical School, Wales, UK

14:30 **AFM-based Assessment of Cardiovascular Risk**
Dr Nuno C. Santos, Institute of Molecular Medicine, Faculty of Medicine, University of Lisbon, Portugal

14:55 **Q&A Session**

15:10 **Closing**

Please don't hesitate to contact us at productinfo.emea@bruker.com if you have any questions.

Talk abstracts

The Impact of Drug Resistance on Ovarian Cancer Spheroids - Insights from the Biomechanical Phenotype
Dr Lydia Powell, Swansea University Medical School, Wales, UK

The presentation will detail the development of 3D spheroid specific image and force analysis undertaken in the research programme of the Cluster for Epigenomic and Antibody Drug Conjugate Therapeutics (CEAT) at Swansea University's Medical School, Wales. The examination of the morphological and mechanical properties of parental and cisplatin resistant ovarian cancer spheroids highlights new ideas as to how these properties effect their ability to invade into the peritoneum.

Dr Lydia Powell is a senior post-doctoral researcher, operating at the interface between life sciences and engineering. Having originally graduated in chemical engineering, Lydia then developed expertise in advanced characterisation techniques to understand the biophysical and mechanical properties of complex 3D multicellular aggregates. Using multi-disciplinary approaches, Lydia's research has provided pivotal understanding in this area that has been translated into the design and delivery of new therapies for cystic fibrosis and chronic wound bacterial biofilm-related infections, in collaboration with industry (AlgiPharma AS and Qbiotics).

In 2018, Lydia moved to Swansea University Medical School to accelerate her translational post-doctoral research as part of the CEAT project. Lydia is currently developing advanced bio-AFM based analysis approaches to complement epigenetic drug and antibody therapeutic platform development, alongside a host of national and multinational industry partners.

Her research interests are at the interface of cellular biophysics, mechanobiology, computer vision, and machine learning, with the strong aim of furthering the understanding of the biological processes involved in physiology and disease. The research carried out in her lab focuses on the cell's cytoskeleton, and in particular, the characterization of its organization and mechanical properties. To do so, her lab uses a broad cellular biophysics toolbox, which includes Atomic Force Microscopy, Traction Force Microscopy, high-throughput imaging, advanced image quantification pipelines and machine learning methods

AFM-based Assessment of Cardiovascular Risk
Dr Nuno C. Santos, Institute of Molecular Medicine, Faculty of Medicine, University of Lisbon, Portugal

Erythrocyte aggregation is an indicator of cardiovascular risk, which is influenced by plasma fibrinogen levels. Fibrinogen levels are elevated during cardiovascular diseases. Our main goals were to understand how fibrinogen-erythrocyte binding influences erythrocyte aggregation and how it constitutes a cardiovascular risk factor in different cardiovascular diseases, including chronic heart failure (CHF) and essential arterial hypertension (EAH). Fibrinogen-erythrocyte membrane and erythrocyte-erythrocyte adhesion measurements were conducted by atomic force microscopy (AFM)-based force spectroscopy. We found that upon increasing fibrinogen concentration, there was an increase in the work and force necessary for cell-cell detachment,

both for healthy donors and EAH patients. Nevertheless, higher values were obtained for the EAH patients at each fibrinogen concentration. Fibrinogen-erythrocyte (un)binding forces were higher in EAH and CHF patients, when compared with the control group, despite a lower binding frequency. Ischemic CHF patients showed increased binding forces compared to non-ischemic patients. Importantly, a 12-month clinical follow-up shows that CHF patients with higher fibrinogen-erythrocyte binding forces, probed by AFM at the beginning of the assessment, had a significantly higher probability of being hospitalized due to cardiovascular complications in the subsequent year. Our results show that AFM can be a promising tool for clinical prognosis, pinpointing those patients with increased risk for cardiovascular complications, for which special personalized medicine strategies should be envisaged.

Dr Nuno C. Santos, born in Lisbon, Portugal, in 1972, graduated in Biochemistry from the Faculty of Science, University of Lisbon, in 1995, and received his PhD in Theoretical and Experimental Biochemistry in 1999 from the same University, although all the experimental work was conducted at Instituto Superior Técnico (Technical University of Lisbon) and University of California (Santa Barbara). Currently, he is Associate Professor with Habilitation of the Faculty of Medicine, University of Lisbon, and Head of the Biomembranes & Nanomedicine Unit at the Institute of Molecular Medicine (iMM).

Among other distinctions, his research work was awarded with the Gulbenkian Prize for young researchers (2001), Dr. José Luis Champalimaud Prize – Basic Research (2004), Dr. José Luis Champalimaud Prize – Applied Research and Technology (2005) and the ULisboa – Caixa Geral de Depósitos Prize (2017). He is (co)author of 161 articles in per-reviewed international journals, which have received over 7500 citations (h-index 47 and i10-index 128, publishing since 1996), presenting a Web of Knowledge impact factor sum of 818.7 (average 5.1 per article). In addition to these publications, he (co)authored 10 articles in Portuguese scientific journals, 15 book chapters (mostly published outside Portugal, in English), 3 books (editor, published by Wiley, Springer and MDPI) and 2 international patents.

Among different National and International research projects, he was the coordinator of a consortium funded by the 7th Framework Programme of the European Union (FP7) which included 10 different research groups from Europe and Brazil. He has been the President of the Portuguese Biophysical Society (SPBf) since 2015, member of the Executive Committee of the European Biophysical Societies' Association (EBSA) since 2019, and Director of the M2B-PhD Doctoral Program in Medical Biochemistry and Biophysics (involving 5 different institutions) since 2016. He has supervised 11 completed PhDs, 8 as main supervisor and 3 as co-supervisor.