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Ultrasonic 3D cell culture for cancer immuno-therapy

Professor Martin Wiklund

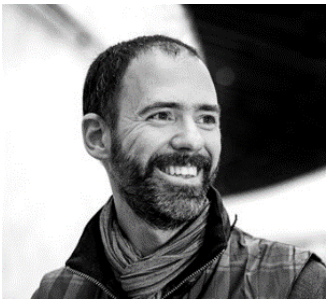
Royal Institute of Technology(KTH)

Date: Wednesday, 17th July, 2019, 15:00-16:30

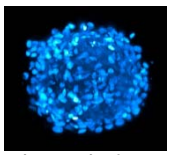
Venue: 31A, 3F Faculty of Engineering Bldg. 2

Abstract:

In this talk I will present our recent research activities in solid tumor micro-engineering for immuno-therapy applications based on ultrasound-supported three-dimensional (3D) cell culture, developed in my lab at the KTH-Royal Institute of Technology, Stockholm, Sweden. The method is gentle and can be used for producing various tissue-mimicking 3D structures in parallel. It is based on ultrasonic-standing-wave particle manipulation (acoustophoresis) inside micro-wells in a multi-well microplate. We analyze and optimize the driving parameters of the ultrasound transducer attached to the microplate, and we demonstrate the production of various micro-engineered models of solid tumors, such as liver, renal, thyroid, and melanoma tumor models, as well as co-culture tumor models with cancer cells and fibroblasts.



The solid tumor models are characterized on-chip by high-resolution 3D confocal and light-sheet microscopy compatible with thick samples, and off-chip with fluorescence activated cell sorting (FACS). Furthermore, we have developed an image analysis-based method for structural and functional characterization of individual cells within a 3D tumor. With this method, we can quantify the number, position, volume and DNA density of individual cell nuclei in the tumor models.



We have also studied protein expression in tumor models by FACS, comparing 2D and 3D cultures. The selected proteins for the analysis are relevant ligands for natural killer (NK) cell immuno-recognition. Our results show differences in protein expression levels between 2D and 3D cultures. This is of interest for understanding the signalling mechanisms in tumor immune-recognition and for optimizing treatment protocols in NK cell-based cancer immuno-therapy.

Biosketch:

Martin Wiklund is a professor in Applied Physics at KTH-Royal Institute of Technology, Stockholm, Sweden. After undergraduate studies at LTH-Lund Institute of Technology, Lund, Sweden (M.Sc. in Engineering Physics, 1999; Profile: Biomedical Optics), Wiklund received a Ph.D. in Physics in 2004 from KTH-Royal Institute of Technology (Topic: Ultrasound-enhanced immuno-assays). Between 2004 and 2005, Wiklund was a postdoctoral fellow at the Fraunhofer Institute for Biomedical Engineering (IBMT), Berlin, Germany (Topic: Dielectrophoresis for cell handling). Since 2006 Wiklund works at the Dept. of Applied Physics, KTH, where he was promoted to full Professor in 2016. His research interests are in the fields of acoustofluidics and specifically in using acoustophoresis in miniaturized systems for applications in immuno-therapy. His Google Scholar profile is found here: https://scholar.google.se/citations?user=KjhKxZkAAAAJ&hl=sv&oi=ao. In addition to research, Wiklund is Program Director of the five-year degree program in Engineering Physics at KTH-Royal Institute of Technology, and he is Vice-Chair of the Dept. of Applied Physics, KTH.

Profile webpage at KTH: https://www.kth.se/profile/bmw

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本件連絡先: 東京大学大学院工学系研究科機械工学専攻 教授 髙木 周
GMSI事務局 E-mail: office@gmsi.t.u-tokyo.ac.jp Phone: 03-5841-0696