Group : Active Organic Surfaces
Project : **Optimized exosome antibody conjugation for on-chip cancer diagnosis**
Supervisors : Pepijn Beekman and Han Zuilhof

Keywords: Surface modification, Lab-on-a-chip, cancer, exosomes, silicon nitride, smart sieves, personalized medicine

Introduction

Metastasis is the cause of death in 90% of cancer-related deaths. To colonize distant sites, cells detach from primary tumors and travel through the bloodstream during which time they are known as circulating tumor cells (CTC). The number of CTC present in the bloodstream is a measure for the probability of survival of the cancer patient. CTC are very small in number (10^{-3}-10^{3} per ml of blood), so sensitive technology is required such as that employed by the (industry golden standard) CellSearch system, developed by prof. Leon Terstappen.
Exosomes shed by CTC are more abundant. Exosomes are nanoscale vesicles, of which the properties reflect those of the tissue of origin and as such can be used in diagnosis. Given their size (30-130 nm), exosomes are currently very difficult to detect and characterize, so methods are needed to maximize the information that can be extracted from blood samples.

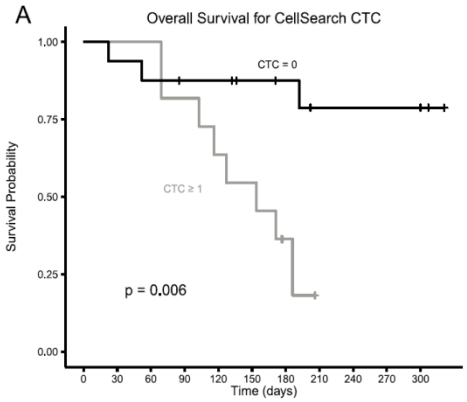


Figure 7: Survival probability vs time for patients with and without CTC detected

Goal

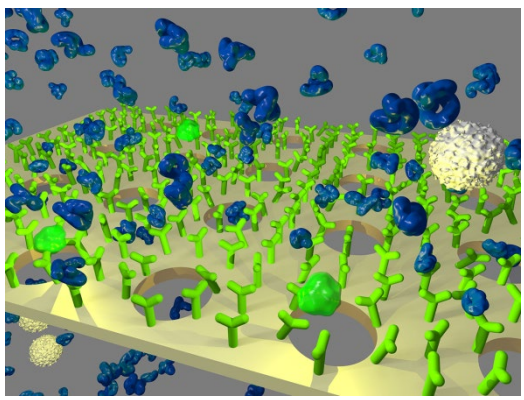
A microfluidic chip is being developed for the filtration of whole blood, the capture of CTC-derived exosomes, and the enumeration and characterization of the captured vesicles. Nano-fabricated Microsieves®, developed by prof. van Rijn, are surface-modified for the conjugation of antibodies to selectively capture CTC-derived exosomes. The so-formed smart sieves are to allow passage of biomatter found in blood while retaining the particles of interest. Eliminating the need for extensive labwork will allow for quick adaptation of cytostatic therapy: realtime diagnostics for personalized medicine.

Topics to be studied

Antibody conjugation on glass or silicon nitride is achieved by grafting a self-assembled monolayer on the surface. A student project can aim for the optimization of the packing density of the monolayer, and/or the orientation efficiency of the ligands. A more bio-related project can revolve around improving the binding efficiency and specificity of the antibody, e.g. by doing some experiments in the lab at the University of Twente. Or you can just stop by to see how we can tailor the project to your expertise and interests.

Techniques to be used

Silanization/SI-ATRP surface modification. Characterization e.g. by contact angle measurement, AFM, XPS, MS, reflectometry, SPR, SEM, Raman, fluorescence microscopy, nanoparticle tracking analysis.



Information

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