Optimization of superparamagnetic particles for tumor cell capture

Background

Metastasis, which means a tumor has spread to other parts of patient's body, is the main cause of cancer related deaths. Many people are working on liquid biopsy techniques to achieve an early diagnosis[1,2]. A possible solution lies in the capture of circulating tumor cells (CTC). These cells have detached from the patient's tumor and travel through the bloodstream. By invading another organ they are the main cause of metastasis. By detecting and characterizing these CTC it could be possible to detect the patient's tumor as early as possible while also predicting the effectiveness of different treatment options.

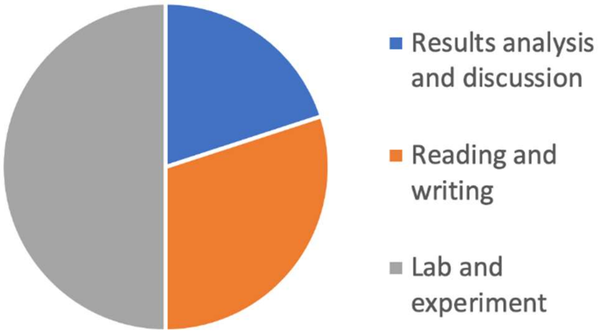
Introduction

The CellSearch system is the first device approved by the FDA to capture CTC. This system captures CTC from 7.5 ml of blood samples from patients, but usually it is difficult to capture sufficient CTC for analysis due to the rareness of CTC.
Therefore, our purpose is to develop a wearable device that can connect to the blood vessels to continuous capture CTC in the blood.
Inside the device, we use surface-modified superparamagnetic particles to bind with tumor cells by antigen-antibodies reaction, and then separate them from the blood through magnetic force. An issue in this regard is the non-specific binding of these particles to healthy cells, causing some of these to be captured as well.

Assignment

Within the MCBP-group a new type of magnetic particles is being developed that combines a high magnetic force with a uniform silica outside shell. The purpose of these new particles is to be able to minimize the non-specific binding while maintaining binding sensitivity and specificity.

The student will assess different antibody binding techniques as well as surface modifications in relation to (non-)specific binding of cells. Performance of methods will be done via fluorescence microscopy, photo-spectroscopy and flow cytometry. Student will need to be able to perform, evaluate and optimize the concentrations used in biochemical coating procedures.



Reference

1. Siravegna, G., Marsoni, S., Siena, S. et al. Integrating liquid biopsies into the management of cancer. *Nat Rev Clin Oncol* 14, 531–548 (2017).

2. Alix-Panabières, C., Pantel, K. Clinical Applications of Circulating Tumor Cells and Circulating Tumor DNA as Liquid Biopsy. *Cancer Discov* 6, 5, 479-491 (2016).

For more information, please contact: Peng Liu, p.liu-2@utwente.nl