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Cantilever array sensing of tumor cells

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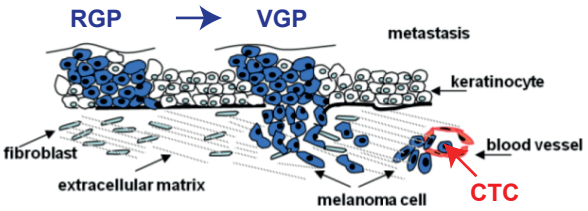
Introduction

Melanoma represents one of the most difficult tumors to treat. The occurance of circulating tumor cells (CTCs) in blood of patients with metastatic melanoma indicates poor prognosis. The early detection of CTCs can provide a powerful tool for diagnostics and prognosis of cancer, assessment of drug efficacy and thus, personalization of anticancer therapy.

Melanoma CTCs are usually rare (~10 cells/1 ml blood), thus highly *specific* and *sensitive* approches are required for their reliable detection. The strategy we are following includes the capture of melanoma cells with antibodies recognizing melanoma-specific markers.

***Aim:* • Development of a reliable procedure for specific capture of melanoma cells on the cantilever surface**
• Development of a cantilever-based sensor for detection of small amounts of melanoma cells in a mixed cell population

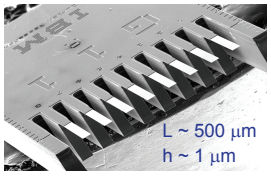
Origin of melanoma circulating tumor cells (CTCs)



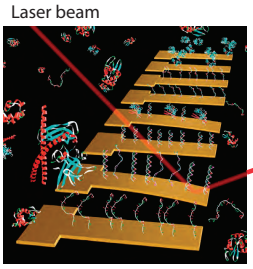
RGP: Radial Growth Phase / VGP: Vertical Growth Phase

Cantilever sensing technique: static mode

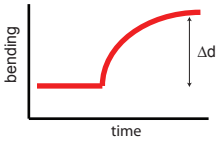
Eight-cantilever Si array



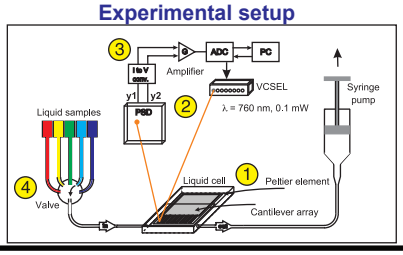
- coated on one side with Au (20 nm)
- functionalized with receptors:
  -proteins (antibodies) or DNA



Binding of analyte molecules generates *surface stress change* and thus *bending of the cantilever*



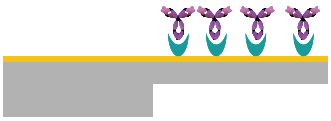
Experimental setup



Capture of melanoma cells (Me275)

High Molecular Weight Melanoma-Associated Antigen (HMW-MAA) is a membrane bound proteoglycan highly expressed on melanoma cells.

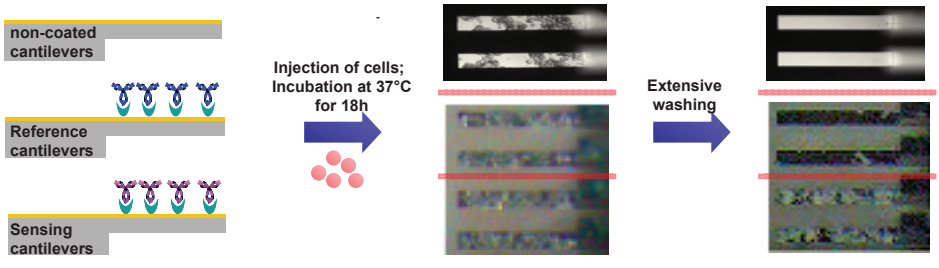
Cantilever functionalization



"towards solvent" orientation of antibodies

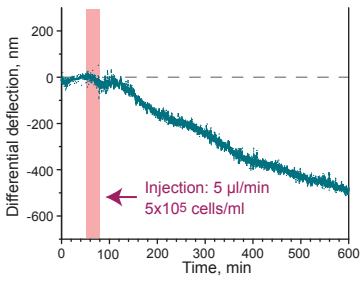
cross-linking molecule
HMW-MAA-specific antibody (Mel-14)
non-specific antibody (12CA5)

Specificity of melanoma cells capture



Preliminary static mode results:

Binding of Me275 cells to HMW-MAA -specific antibody



Sensor cantilever: antibody Mel-14 (HMW-MAA-specific)
Reference cantilever: antibody 12CA5 (non-specific)

Conclusions

- Cancer cells are able to bind to functionalized micromechanical cantilevers and stay there alive enabling further analysis.
- The established antibody immobilization protocol enables specific capture of melanoma cells and can be used for measurements performed with a static mode cantilever array setup.