Introduction

Among the leading causes of death in males in the United States, Prostate Cancer claims 1 in 6 men\(^1\). Methods for the collection of tumor cells are invasive. With small numbers of available cancer cells, pharmacological study and patient treatment evaluation would use or destroy cells needed for future treatment assessment.

Few studies have focused on capture of cells from microfluidic devices\(^2\). The need for capture and release of targeted cancer cells allows labs to obtain viable cells for analysis. Use of fluid shear forces have been shown to be a simple and effective method of cell release\(^2\).

The Hele-Shaw flow device provides for cell adhesion using a range of shear stresses over the device length as a function of flow rate.

The use of desthiobiotin as a linker with the J591 mAb may provide a method for the capture of circulating tumor cells (CTCs) and allow for release of viable cells.

Method

Hele-Shaw cells provide a platform for associating cell collection for a corresponding shear stress.

- LNCaP cells, a line of prostrate cancer cells, are used for their high expression of prostate specific membrane antigen (PSMA).
- Flow target cells through the device that is functionalized with Biotinylated- or Desthinobiotinylated-J591
- Wash with PBS (Phosphate Buffered Saline)
- Image the process with an inverted microscope (Nikon TE 2000U)

Results

The data includes experiments with a negative control of NeutrAvidin terminated surface, the positive control of Biotinylated-J591 terminated surface, and the case of interest, a Desthiobiotinylated-J591 terminated surface.

- More cells are captured with biotinylated antibody due to the strong linking with the NeutrAvidin molecule and passing cells.
- The Desthiobiotinylated antibody captures lower numbers of cells due to the weak link between NeutrAvidin and Desthiobiotin.
- The NeutrAvidin (surface without an antibody) captured no cells over the device.

Conclusions

The negative control of NeutrAvidin terminated surface did not capture cells. This suggests that cells captured during experiments where attached to an antibody.

The Biotinylated-J591 mAb collected largest amounts of cells at lowest shear stress (.008-.013 Pa), however, (cells did not attach at a higher shear pressure (.015-.023 Pa). This trend seems to be abnormal because Biotinylated-J591 collects cells over the whole range of shear stress.

Desthiobiotinylated-J591 shows that cells are captured over the entire shear stress range displayed (.008-.023 Pa). Cell numbers at higher shear stress are low due to the fluid forces overcoming the Desthiobiotin-NeutrAvidin bond.

I have found that Desthiobiotinated-J591 may be useful in the capture and release of prostate circulating tumor cells.

References

2. B. Plouffe, M. A. Brown, R.K. Iyer, M.Radisic, and S. K. Murphy, lab chip, 9, 1507-1510