Non-invasive electromagnetic micro-stirring device

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The process of mixing reagents on a microscopic scale is of significant interest and of use in everyday biological laboratory work and research. It is of particular importance in the areas of bio-medical applications for drug delivery, DNA hybridisation and PCR amplification that rapid homogeneous mixing is achieved [1]. Thus it is of little surprise that there is a vast amount of devices and techniques produced to perform micro-mixing of biologically relevant materials. Despite this being a seemingly simple task it has only been in recent years where most developments have been made with a significant emphasis on electromagnetic devices [2]. Most research now focuses on the development of lab-on-a-chip based technologies with the mixing of fluids in micro-channels due to efficiency and reduced reagent waste. However, very few developments have been made with devices that deal with individual particle movement on the cellular level.

We report the suitability of passive electro-magnetic methods for non-invasive micro-stirring of cells and particles suspended in solution. The devices are based upon current carrying wires located within a chamber slide adjacent to the sample. Widefield and laser scanning microscopy methods were applied to investigate this effect and these will be discussed along with the implementation of appropriate image analysis techniques.

To determine the most efficient materials for the micro-stirring device and to assess design strengths, simple image analysis techniques using Metamorph (v7.0, Universal Imaging) were applied. This allowed for individual cell velocities to be measured for a series of wire samples. Figure 1 shows the velocity of a T-cell tracked over time in the presence of a current carrying steel wire achieving a maximum velocity of 1.1 mm/sec. The substantial cell velocities achieved show great promise for this technique in life science applications.

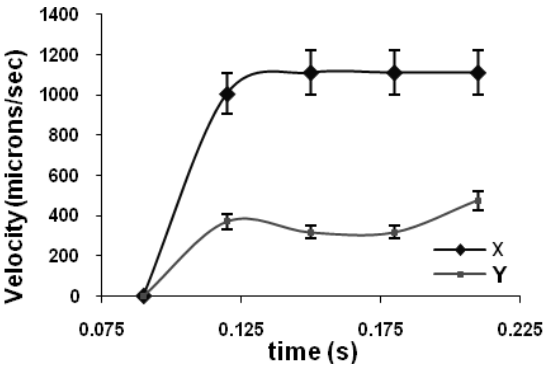

Figure 1- Velocity of a T-cell over time in device

References

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