

# Chemical Engineering Seminars – MT 2010

*Week 6, Tuesday November 16<sup>th</sup> 2010, 4:00PM-5:00PM  
Lecture Room 1, Thom Building, Engineering Science*

## **Superparamagnetic Nanoparticles for Drug Delivery**

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### Abstract

The use of magnetic fields for the delivery of chemotherapeutics bound to superparamagnetic nanoparticles offers a promising method for the non-invasive treatment of inoperable tumours. Studies of inflow magnetic targeting of superparamagnetic nanoparticles in plastic microcapillary films, representative of the human blood vessels, with different magnetic field geometries has yielded a computer model to optimise capture conditions [1]. We have demonstrated that superparamagnetic magnetite nanoparticles fabricated by an easily scalable method can be driven and tracked in real time at high velocities in vitro using MRI hardware [2]. Force balance calculations are consistent with the magnetic properties of individual 10 nm diameter particles that move collectively as micron sized agglomerates with hydrodynamic diameter similar to that inferred from zero-magnetic-field dynamic light scattering measurements. Magnetotactic bacteria are currently being explored as a potential future scalable source of monodisperse magnetic nanoparticles for therapeutic and biosensing applications.

1. Darton, N.J., B. Hallmark, T. James, P. Agrawal, V.H.B. Ho, and N.K.H. Slater, On the magnetic field architecture required to capture superparamagnetic nanoparticles in a microcapillary flow. *Journal of Nanoparticle Research*, 2010. 12(1): p. 307-317
2. Darton, N.J., A.J. Sederman, A. Ionescu, C. Ducati, R.C. Darton, L.F. Gladden, and N.K.H. Slater, *Manipulation and tracking of superparamagnetic nanoparticles using MRI*. *Nanotechnology*, 2008. 19: p. 395102-395106.

### Bio

Nicholas did his Biochemistry bachelors at Leeds University (1995-1998) and then his doctorate on HIV vaccines in the Department of Biochemistry at University of Cambridge (1998-2003). After a spell in Healthcare market research he began a postdoc (2006) in BioScience Engineering at the Department of Chemical Engineering, University of Cambridge, where he worked on magnetic nanoparticle linked therapeutic delivery with Prof. Nigel Slater. He currently works in the same lab funded by the BBSRC-BRIC (Bioprocessing Research Industry Club) investigating MicroCapillary Films as novel Chromatographic substrates. In 2010 he won two rounds of innovation prize funding as part of the EPSRC Bridging the Gaps initiative to investigate magnetic nanoparticle production in bacteria.