

Beaufort Undergraduate Internship Programme 2011
PROJECT NO. 3

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Project Title: Micro-bioreactors Controlled with Photonic Ionogel Actuators

Duration of Project

From: 11 June 2012

To: 14 September 2011

Project Description:

Since last decade the interest in ionogels, ionic liquids (ILs) incorporated in polymer matrixes, is growing significantly, motivated by the unique properties of ionic liquids such as tunable hydrophobic and hydrophilic nature, chemical and thermal stability, low vapour pressure and high ionic conductivity¹. They have been used in many fields, such as electrolyte membranes, drug delivery, optics as well as catalysis and separation². Ionogels, incorporating photoswitchable materials, have been found to be ideal actuators for micro-fluidic valve applications³. The physical properties of the ionogels and so the actuation mechanism, can be altered using light as external stimulus.. Applications of valves in micro-fluidics include: flow regulation, on/off switching and sealing of liquids, gases or vacuums⁴.

This project will be focused on the incorporation and characterisation of autonomous photo-responsive ionogels in hybrid polydimethylsiloxane (PDMS)-glass micro-bioreactors, Figure 1. The ionogel structures will be fabricated using novel materials consisting of a polymeric structure incorporating benzospiropyran units and phosphonium ionic liquids. After fabrication, the actuation of the microvalves will be investigated and characterised applying localised white light irradiation using fiber optics.

The final micro-bioreactor will be used, in collaboration with the Centre Nacional de Microelectronica (<http://www.imb-cnm.csic.es/index.php?lang=es>) at University Autonoma de Barcelona, to study cell growth at micro-scale.

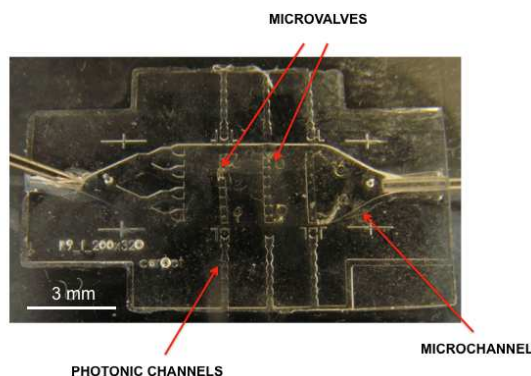


Figure 1: Picture of the PDMS-glass micro-bioreactor.

References:

1. K. J. Fraser, E. I. Izgorodina, M. Forsyth, J. L. Scott and D. R. MacFarlane, *Chemical Communications*, 2007, 37, 3817-3819.
2. A. Vioux, L. Viau, S. Volland and J. Le Bideau, *Comptes Rendus Chimie*, 2010, 13, 242-255.
3. F. Benito-Lopez, R. Byrne, A. M. Răduță, N. E. Vrana, G. McGuinness and D. Diamond, *Lab on a Chip*, 2010, 10, 195.
4. C. Zhang, D. Xing and Y. Li, *Biotechnology Advances*, 2007, 25, 483-514.