Development of Nanoparticle Based Drug Delivery Vehicles for Brain Tumors

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**Location:** Mawson Institute, University of South Australia, Adelaide, Australia

**Project outline:**
Glioblastomas are the most prevalent forms of primary brain tumors in humans and are often described by aggressive growth and very poor prognosis. Apart from tumor resection, current therapies including radio-, chemo- and immunotherapies only produce moderate increases in average survival rates. In fact, for the most common form of glioblastoma (glioblastoma multiforme), the average life expectancy is less than a year despite aggressive therapeutic interventions. The development of more successful therapies for this incurable malignancy is hindered by the high motility of glioblastoma cells, their resistance to both radio- and chemotherapy and by apoptosis inhibition leading to failure of conventional therapy.

This project investigates biodegradable porous silicon nanoparticles as vehicles for localized delivery of chemotherapy drugs to human glioblastoma cells in culture and to glioblastoma grafts in mice. We are using porous silicon nanoparticles, which is loaded with therapeutic drug and functionalised with targeting antibodies (Figure 1). Release of the drugs from the porous silicon by diffusion and degradation of the porous matrix occurs over extended periods of time. Release kinetics can be easily tuned by changing porosity and surface chemistry of the porous silicon. Porous silicon films will be produced by electrochemical etching of monocrystalline silicon wafers. The loading and release of chemotherapy drugs will be studied using optical spectroscopies. Material topography will be characterized by electron and atomic force microscopy. Cytotoxicity will be evaluated using cell-based assays and fluorescence microscopy.

![Figure 1: Schematic showing vectorization of chemotherapy drug using porous silicon nanoparticles targeted towards cancer cells.](image)

**Methods & Equipment:**
Electrochemical etching, surface functionalisation, surface analysis, drug loading and release experiments, cell culture

**References:**


**About Adelaide:**
Adelaide is the capital of South Australia and offers a very high standard of living (top 5 most liveable city in the world according to a survey by “The Economist”), with great climate, food, wine, beautiful unspoiled nature and beach environments, in an inexpensive setting. Adelaide was also recently voted into the Lonely Planet top 10 cities in the world.

The Mawson Institute (MI) has recently been established at the University of South Australia, with strong support from the South Australian Government to research new manufacturing technologies. Manufacturing is an important and substantial part of South Australia’s economic base. The MI promotes a strategy based upon strong basic and applied research that encourages scientific and technological innovation within the manufacturing sector. Fundamental to this is the Institute’s multidisciplinary approach, building research teams in concentrations that encompass a diverse range of disciplines, and collaboration with partners from both academia and industry.

The institute is based in two new state-of-the-art buildings with outstanding research facilities (see photo of the MM building).

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