# AMPHIPHILIC MOLECULAR BRUSHES: TOWARDS SYNTHETIC DENDRITIC CELLS FOR CANCER IMMUNOTHERAPY

Elaine Barnard[a], Bert Klumperman, Rueben Pfukwa

Department of Chemistry and Polymer Science, Stellenbosch University, Stellenbosch,
Email: ebarnard@sun.ac.za

## ABSTRACT

Cancer immunotherapy, which utilizes the innate immune system to treat cancer, represents one of the most rapidly advancing classes of treatment and one of the most promising avenues of cancer research to date. Among the various cell types of the innate immune system, the dendritic cell (DCs), which are known as the most potent professional antigen-presenting cells (APCs) are of prime importance and plays a critical role as the initiator and modulator of the immune response. Clinical studies have so far shown the potential of natural DCs as an autologous vaccine for cancer immunotherapy, however isolation and growth of *ex vivo*-generated DCs proved to be both time-consuming and costly with varying quality. To overcome the aforementioned inefficiencies of autologous APCs, the design of artificial APCs (aAPCs) have been investigated as an alternative. The use of artificial Dendritic Cells (aDCs) requires the development of biomimetic nanoscaffolds to which the appropriate information for T cell activation is attached.[1]

This studies main objecive is to develop a novel synthetic dendritic cell based on amphiphilic hetero-arm molecular brushes (AMBs). The brushes were synthesized via free-radical alternating copolymerization of N-alkylated anhydrides and oligo-ethylene oxide (oEG) functional vinyl ethers, of which a fraction are azide functional. The effect of alkyl chain lengths (hydrophobic chains) on the morphology and size of the self-assembled AMB will be investigated in order to determine the ideal AMB aggregate. Subsequently, alkyne functional streptavidin will be attached, before finally functionalizing with biotinylated anti-CD3 and anti-CD28 antibodies to yield the desired synthetic dendritic cell based on molecular brushes. The efficiency of this approach will be explored via in-vitro assay: all initial experiments will be carried out with anti-CD3 antibodies as a simplified mimic for T cell receptor stimulation (mimics for the MHC/peptide complex).

**Acknowledgements: This work is based on the research supported by the National Research Foundation (NRF) of South Africa.**

**References:**

1 Eggermont, L. J., Paulis, L. E., Tel, J. & Figdor, C. G. Towards efficient cancer immunotherapy: advances in developing artificial antigen-presenting cells. Trends Biotechnol. 2014, 32, 456–465.

2 Mandal, S. et al. Therapeutic nanoworms : towards novel synthetic dendritic cells for immunotherapy. Chem. Sci.2013, 4, 4168–4174.

3 Ballestrero, A. et al. Immunotherapy with dendritic cells for cancer. Adv. Drug Deliv. Rev.2008, 60, 173–183