The Science Behind Future Anti-Cancer Vaccines

Case Study

Bruno De Geest is a Professor of Biopharmaceutical Technology at Ghent University, Belgium, and the leader of his own research group at the Department of Pharmaceutics.

His interdisciplinary lab works on the interface between materials chemistry and life science to design novel drug delivery systems and to investigate how these interact with living cells and tissues in vitro and in vivo. Bruno's work follows three main themes: a) Self-assembled polymeric multilayer thin films, b) Particulate vaccine delivery and c) Anti-cancer therapy.

Some of Bruno's latest work has been published in "Advanced Functional Materials", "Angewandte Chemie International Edition" and "ACS Nano". In these papers Bruno et al described different approaches to efficiently incorporate vaccine antigens into polymeric capsules and deliver these to dendritic cells. The goal of this research is to promote the induction of cytotoxic T cells, which can kill malignant cancer cells. These new methods can help develop future anti-cancer vaccines.

Bruno's group uses a wide range of molecular and cellular techniques as well as cutting edge imaging to gain insight into natural biological processes as well as to assess the success of novel vaccines and anti-cancer therapies. One of the key tools used in his lab is the Andor Revolution DSD2 a laser free confocal image system. The Andor Revolution DSD2 allows a fast multi-color image acquisition at high speed and in multiple dimensions. Therefore it is particularly well suited for us to investigate the interaction between nanoparticles and living cells, including dendritic cells and cancer cells.

Biography

Bruno graduated as Chemical Engineer in 2003 from Ghent University where he obtained his PhD in pharmaceutical sciences in 2006 on 'Polyelectrolyte Multilayer Capsules for Pharmaceutical Applications'. For his Phd work he was awarded the graduate student award for pharmaceutical technology from the AAPS and the Andreas Deleenheer award from Ghent University. After 2 years of postdoctoral research at Utrecht University (The Netherlands) he returned to Ghent University at the Department of Pharmaceutics. He moved to his current position at Ghent University in October 2012.

Research Papers

- Bio-Hybrid Tumor Cell-Templated Capsules: A Generic Formulation Strategy for Tumor Associated Antigens in View of Anti-Cancer Immune-TherapyLybaert, L.; De Vlieghere, E.; De rycke, R.; Vanparijs, N.; De Wever, O.; De Koker, S.; De Geest, B.G. **Advanced Functional Materials**, in press
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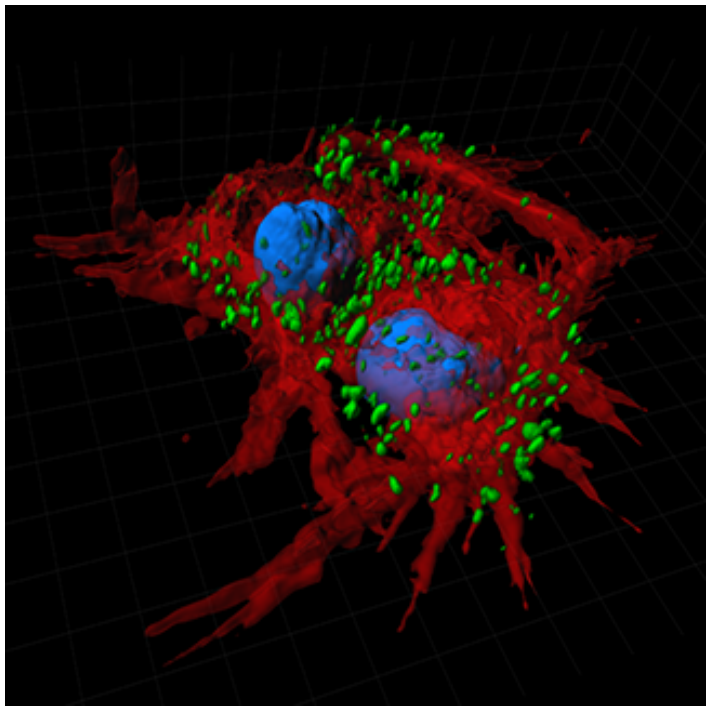
- Nanoporous polyelectrolyte vaccine microcarriers - in vitro and in vivo evaluation De Koker, S.; Fierens, K.; Dierendonck, M.; De Rijcke, R. Lambrecht, B.N.; Grooten, J.; De Geest, B.G. **Journal of Controlled Release**, in press

- Thermoresponsive hyaluronic acid nanogels as hydrophobic drug nanocarrier to macrophages Fernandes Stefanello, T.; Szarpak-Jankowska, A.; Appaix, F.; Louage, B.; Hamard, L.; De Geest, B.G.; van der Sanden, B.; Vataru Nakamura, C.; Auzély-Veltya, R. **Acta Biomateriala**, in press
- Hydrogen bonded Multilayer Films based on poly(2-oxazoline)s and tannic acid Sundaramurthy, A.; Vergaelen, M.; Maji, S.; Auzely-Velthy, R.; Zhang, Z.; De Geest, B.G.; Hoogenboom, R. **Advanced Healthcare Materials**, in press
- Spray-Dried Polyelectrolyte Microparticles in Oral Antigen Delivery: Stability, Biocompatibility and Cellular Uptake De Smet, R.; Verschuere, S.; Allais, L.; Leclercq, G.; Dierendonck, M ; De Geest, B.G. ; Van Driessche, I. ; Demoor, T.; Cuvelier, C.A. **Biomacromolecules**, in press
- Fast and accurate partial hydrolysis of poly(2-ethyl-2-oxazoline) into tailored linear polyethyleneimine copolymers De la Rosa, V.R.; Bauwens, E.; Monney, B.D.; De Geest, B.G.; Hoogenboom, R. **Polymer Chemistry**, in press
- Just spray it - next generation of electrostatic assembly Dierendonck, M.; De Koker, S.; De Rijcke, R.; De Geest, B.G. **Soft Matter**, 2014, 10, 804-807.
- Straightforward RAFT-procedure for the synthesis of heterotelechelic poly(acrylamides) Wallyn, S.; Zhang, Z.; Driessen, F.; Pietrasik, J.; De Geest, B.G.; Hoogenboom, R.; Du Prez, F.E. **Macromolecular Rapid Communications**, 2014, 35, 405-411.
- Dual pH- and temperature-responsive RAFT-based block co-polymer micells and polymer-protein conjugates with transient solubility Zhang, Q.; Vanparijs, N.; Louage, B.; De Geest, B.G.; Hoogenboom, R. **Polymer Chemistry**, 2014, 5, 1140-1144.



Mouse dendritic cells. The cell membrane is labeled with cholera toxin subunit B that is conjugated to AlexaFluor555. The cell nucleus is stained with Hoechst and nanoparticles were labeled with AlexaFluor488. Image captured on a DSD2 connected to a LeicaDMI6000 and a 63x 1.4 NA oil immersion objective.