Magdalena Plebanski et al., J Nanomedic Nanotechnol 3:1
doi: http://dx.doi.org/10.4172/2157-7439.S1.01

OMICS Group Conferences
Accelerating Scientific Discovery

International Conference and Exhibition on
Nanotechnology & Nanomedicine
March 12-14, 2012 Omaha Marriott, USA

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Nanoparticles that can modify pulmonary dendritic cell function and prevent allergic airway inflammation

National Many ambient and man-made nanoparticles can promote lung inflammation, however, little is known about the potential immunomodulatory effects nanoparticles devoid of toxic chemicals. This is important to know, as lung delivery of drugs and vaccines using nanoparticle carriers is of strong practical interest. In our recent studies (J Immunol. 188:1431, 2012), we have shown that exposure to polystyrene not inflammatory 50-nm polystyrene nanoparticles which are taken up preferentially by dendritic cells (DCs) in the periphery (J Immunol. 173:3148, 2004), surprisingly, imprints the lung so that it becomes homeostatically resistant to allergic airway inflammation. Mechanistically, these nanoparticles did not impair peripheral allergen sensitization, but exerted their effect at the lung allergen challenge phase, by inhibiting expansion of CD11c+MHCIIhi DCs in the lung and draining LN, and allergen-laden CD11bhiMHCIIhi DCs in the lung after allergen challenge, and further suppressing the ability of CD11bhi DCs in the draining LN of allergen-challenged mice to induce proliferation of allergen-specific CD4+ T cells. New unpublished data now further suggests that such nanoparticles can also modulate inflammation reactive effector and regulatory T cells, as well as novel myelid derived stem cell subsets in the lung. The discovery that some nanoparticles can inhibit, rather than promote, lung inflammation via novel homeostasis promoting mechanisms opens the door to the discovery and use of other nanoparticles with exciting beneficial properties.

Biography

Professor Magdalena Plebanski. BScHon (1989, UNAM, Mexico); MBA (Deakin University, 2010, Australia); PhD (1993, Bristol University, UK); Fellow (1993, Oxford University, UK); Senior Fellow (1997, Oxford University, UK); Assoc.Prof. (Victoria University, Australia 1999); Assoc.Prof. Hon (Melbourne University, Australia 2006); Professor (Monash University, Australia 2007). Major awards: Howard Hughes International Scholar (HHMI, USA) 2000-2005. Current from 2003: Australian NHMRC Senior Fellow. Prof. Plebanski's primary interest is to develop practical and affordable vaccines against complex diseases, specifically malaria and cancer, and to this end she pioneered the use of synthetic non-inflammatory nanoparticles. Her nanoparticle studies recently opened to door to new nanotechnology applications to prevent allergic airways disease, and potentially asthma (*J. Immunol., 2012*). She has >100 publications (plus abstracts) cited >3200 times, including field changing findings in nanotechnology and vaccines (e.g. *Nature Biotech* 1997 cit=123 and *J.Immunol*. 2004 cit=97), and identified a number of key immune evasion mechanisms that can interfere with vaccine efficacy (>1500 citations e.g. *Science* 1998, *Nature* 1999, *Nature Medicine* 2004, *Plos Pathogens* 2009). Her 5 families of PCT patents have progressed to commercialization nationally and internationally.