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Designing nanoparticle based immunomodulators and vaccines: The intriguing link between inflammation and immune-suppression

The immune system is continuously challenged by micro and nanoparticles in environmental pollutants and microorganisms. Our studies over the last decade have identified some of the basic physicochemical principles by which diverse key antigen presenting cells (APC) of the immune system, dendritic cells (DC), macrophages and myeloid derived suppressor cells (MDSC), recognize differentially a range of particles, and subsequently promote different types of immune responses. This understanding has led to the development of new types of nanovaccines, capable of inducing high levels of CD8 T cells and antibodies, with protection shown against cancers, as well as viral, bacterial and parasitic diseases; as well as alternate nanovaccine types, that preferentially induce high levels of CD4 T cells or antibodies, but not CD8 T cells. The long lasting nature of the immune responses induced by such vaccines was recently found to be due to their 'inert/stealth' nature, which by avoiding the induction of conventional inflammatory responses, also fail to induce the suppressive immune controls which normally would limit a beneficial immunity. Specific types of nanoparticles (as defined by size, material, shape and surface charge) were also found to offer a novel imprint on lung immune cells, rendering lungs resistant to viral challenge, whilst also being substantially less prone to damaging immune reactions, such as those elicted by allergens. Nanoparticles promoting such healthy 'homeostatic' lungs further offer a new concept to fight the increased prevalence of asthma and COPD in urbanized regions of the world.

Biography

Magdalena Plebanski leads the Vaccines and Infectious Diseases Unit at the Department of Immunology, Monash University, Australia. She is a NHMRC Senior Research Fellow and the inaugural co-Head of the Immunotherapeutics Division at the newly established Monash Institute of Medical Engineering (MIME). Her qualifications include: BScHon (UNAM, Mexico); MBA (Deakin University, Australia); PhD (Bristol University, UK). She published >125 peer-reviewed papers (plus numerous conference abstracts), with >5000 citations, including high-profile: Lancet, Nature Biotechnology, Science, Nature, Immunity, Nature Medicine, Plos Pathogens, Nature Communications, Clin Cancer Res. Her 5 families of PCT patents have progressed to commercialisation nationally and internationally. Her research interests include vaccines, adjuvants, cancer, malaria, asthma, regulatory T cells (Treg), inflammation, lung and antigen presenting cells (APC).

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