Microparticles as Vaccine and Adjuvant Delivery Systems
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Purpose
The aim of this project was to prepare a formulation for delivering vaccine and adjuvant. A suitable adjuvant for in-vivo anti-cancer studies will be selected based on CD40, CD86 and MHCII expression on dendritic cells.

Methods
Breast cancer vaccine was prepared by lysing 4TO7 murine breast cancer cell line. Microparticles containing lysate protein or adjuvant were prepared by spray drying along with enteric coating polymers using Buchi 290 spray dryer. Adjuvants used in combination with vaccine were Monophosphoryl Lipid A (MPL®), MF59®, Cholera Toxin, CpG, Resiquimod (R848®), Flagellin. Microparticles were characterized for size, shape, charge and content. Vaccine microparticles (250µg/well) and adjuvant microparticles (250µg/well) were incubated with dendritic cells for 16 hrs. Antigenicity of the vaccine microparticles and its combination with adjuvant was evaluated by carrying out nitric oxide release assay. To further characterize the immune response, dendritic cells were processed for estimating CD 86, CD 40 and MHC II expression. CD 40 and MHC II are important for binding to CD4+ T cells, whereas CD86 expression is important for binding to CD8+ T cells.

Results
Microparticles obtained after spray drying had a size range of 1-5µm. The charge on the particle was found to be 10±3.5mV. A combination of vaccine and adjuvant induced a higher nitric oxide release from dendritic cells compared to vaccine alone. Overall adjuvants were able to induce a higher CD40, CD86 and MHC II expression, but in particular MF 59 which is an o/w emulsion adjuvant gave a high response for both CD 40 and MHC II expression. As a result, it will lead to higher binding to CD4+ T cells. Adjuvants like cholera toxin and R848 induced high CD86 expression. Higher CD 86 expression will lead to better binding with CD8+ T cells. Vaccine or adjuvant given in microparticulate formulation induced significantly higher CD40, MHC II and CD86 expression compared to their solution groups.

Conclusion
Vaccine and adjuvant microparticles administered together show better immune response than vaccine alone. Based on the results we can select an adjuvant suitable for a CD8+ or CD4+ T cell response.