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Poster presentation

P17-03. Nanoengineered layer-by-layer capsules as a novel delivery system for HIV vaccines

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Background

Overlapping Gag peptides have demonstrated potential in stimulating T cell immunity and slowing the progression of AIDS. However, peptides administered alone are poorly immunogenic and rapidly degraded in vivo before they can reach antigen presenting cells (APCs). Hence, novel technologies that can efficiently deliver antigens to APCs are desperately needed to create safe and effective vaccines. Nanoengineered Layer-by-Layer capsules represent a novel technology for the delivery and protection of protein/peptide antigens. The flexibility and multi-functionality of this technology allows for fine-tuning of the capsules to facilitate efficient delivery to APCs and optimize immune responses.

Methods

Capsules were assembled from biodeconstructible polymers that ensure the cargo is only released from the capsules once within cells. Model protein/peptide vaccines were encapsulated and assessed for internalization, DC activation and T cell stimulation in vitro and in vivo using human blood, murine models and macaques.

Results

Whole proteins and small peptides were successfully encapsulated within biodeconstructible capsules. Capsules were internalized by important APCs such as dendritic cells (DCs). Furthermore, DCs that associated with capsules demonstrated an increase in activation markers (CD86, CD83 and MHC-II). Protein/peptide loaded capsules administered to mice activated CD4 and CD8 T cells. Administration of capsules containing SIV peptides to SIV infected macaques demonstrated re-activation of SIV-specific CD4 T cell responses and to a lesser extent CD8 T cell responses.

Conclusion

These results demonstrate proof of concept for this novel vaccine delivery technology and pave the way for future experiments encapsulating overlapping SIV peptides for the vaccination of macaques to assess the immunogenicity and protective efficacy of this approach. Work is underway to further optimize this technology through surface functionalization to specifically target DCs and by incorporating adjuvants. This multidisciplinary project represents a novel and exciting advance in vaccine delivery that could have a major impact on HIV/AIDS.