UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2013 Mary Gates Hall

Online Proceedings

SESSION 2J

INFECTIOUS DISEASES

Session Moderator: James Mullins, Microbiology
254 MGH
3:45 PM to 5:15 PM

* Note: Titles in order of presentation.

Intravaginal Recruitment of Dendritic Cells Using DC Chemokines
Hunter R. (Hunter) Bennett, Senior, Bioengineering
Amgen Scholar, Levinson Emerging Scholar, Mary Gates Scholar
Mentor: Kim A. Woodrow, Bioengineering
Mentor: Renuka Ramanathan, Bioengineering

A significant challenge in intravaginal vaccination against mucosal pathogens concerns the immune privileged environment in the genital tract, which prevents migration of immune cells in the absence of inflammation. Dendritic cells (DC), the major antigen-presenting cell to T cells in lymph nodes, play a particularly important role in generating an effective immune response to vaccination. Our goal is to explore a new intravaginal vaccination strategy utilizing chemokines - short biological peptides that activate cells - to recruit DCs. We intravaginally administered CpG, MIP-3 Alpha and Beta-Defensin 2 to female C57BI/6J mice (Jackson Laboratories). Mice were euthanized after 24 hours and cells were isolated from both the spleen and reproductive tract. DCs were quantified using fluorescent activated cell sorting (FACS). We have demonstrated that DCs are actively recruited to vaginal mucosal tissues following intravaginal administration of the chemotactic peptides MIP-3 Alpha and Beta-Defensin 2. Future work will involve time course studies of DC recruitment and the delivery of nanoparticle encapsulated chemokines.

POSTER SESSION 4

MGH 241, Easel 163
4:15 PM to 5:45 PM

Synthesizing Lipid Nanoparticles for Point of Infection Drug and Vaccine Delivery
Will Lykins, Junior, Bioengineering
Mentor: Kim A. Woodrow, Bioengineering
Mentor: Renuka Ramanathan, Bioengineering

Because of its unique immune characteristics, the vaginal tract is highly susceptible to attacks from sexually transmitted infections (STIs) and other pathogens. Therefore, there is a need for vaccines that can be delivered directly to the vaginal mucosa and locally protect against STIs. Due to the high vascularization of the vaginal tract, free drug may traffic to other parts of the body before it has the ability to noticeably impact the mucosal immune environment. To address these challenges, we propose utilizing a vaccine encapsulating, lipid nanoparticle that is capable of storing drug, that can be retained in the vaginal tract until it directly interacts with local immune cells capable of mounting a strong local immune response. The Woodrow Lab (at the University of Washington Department of Bioengineering) has been working on developing a protocol to synthesize a stable, biocompatible lipid nanoparticle that can encapsulate a multicomponent vaccine. The particles are synthesized by cross-linking together concentric polar-lipid bilayers to form stable nanoparticles. The multi-bilayer cross-linked nature of these nanoparticles increases stability and allows them to be retained within the tissue longer than simple single-bilayer particle systems. Here we show that our particles exhibit better material efficiency and have the potential to encapsulate greater levels of drug than similar lipid particle platforms. Through electron microscopy we have demonstrated that our protocol successfully produces particles with the characteristic uniform multi-bilayer morphology that we expected. We are currently working on optimizing our production process for scale-up production of the particles for larger trials. In future experiments we plan to encapsulate vaccine in the particles and use *in vivo* mouse models to demonstrate that our particle-vaccine system creates a more potent and longer lasting immune response than free vaccine alone. This method of vaccine delivery may prove effective at preventing several STIs including herpes and HIV.