Online Proceedings

Poster Session 2

MGH 241, Easel 142

1:00 PM to 2:30 PM

A Designed Self-Assembling Nanoparticle Vaccine for Parenteral Induction of Mucosal Immune Responses

Rose Fields, Sophomore, Pre Engineering
UW Honors Program
Mentor: Neil King, Biochemistry
Mentor: Karla-Luise Herpoldt, Bioengineering

Enteric diseases, or diseases of the Gastrointestinal (GI) tract, remain one of the most prevalent killers of children in sub-Saharan Africa. The most practical way to prevent such diseases is through vaccination, but antigens for enteric diseases need to be delivered directly to the GI tract to be most efficient, making vaccination difficult. Recent studies by the von Adrian group at Harvard University have found that both T and B cells are reprogrammed to home to the GI tract when they encounter retinoic acid, a metabolite of vitamin A. The King Lab at the University of Washington is working to develop a novel vaccine candidate using recently developed self-assembling protein nanoparticles, that can simultaneously package all-trans retinoic acid (ATRA) and multivalently display enteric antigens. Recent data indicate that preliminary versions of these nanoparticles can successfully elicit a mucosal immune response when delivered with free ovalbumin, an avian egg protein that is frequently used as a model antigen. We expect to elicit more potent immune responses when the antigen is multivalently displayed at high density on the nanoparticle. To accomplish this, I created a library of plasmid constructs combining ovalbumin and several nanoparticle subunits using a variety of different linkers. I expressed, purified, and evaluated these nanoparticles for their expression of the antigen using enzyme-linked immunosorbent assays, or ELISAs.

Session 2D

Microbiome and Vaccines

Session Moderator: James Mullins, Microbiology

MGH 234

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Vaccine for East Coast Fever

Brian Hyung Chan Kim, Senior, Biochemistry
Mary Gates Scholar, UW Honors Program
Mentor: Neil King, Biochemistry

East Coast Fever (ECF) is a tick-transmitted disease caused by *Theileria parva* in cattle that is detrimental to the economic well-being of Eastern and Southern Africa. Current disease control involves pesticides, antibiotics, and a commercial live parasite vaccine, but they are insufficient and thus developing an effective, affordable, and protective vaccine for ECF is a pressing need. Studies by the Nene group at International Livestock Research Institute have demonstrated that the *T. parva* sporozoite stage-specific surface coat protein p67 provides partial protective immunity to cattle when used as a subunit vaccine. Within the King group at the University of Washington, I generated novel p67C nanoparticle immunogens intended to induce more potent and durable immune responses in immunized cattle. I genetically fused the p67C epitope to a variety of self-assembling protein nanoparticle subunits and screened for stability and expression levels. Based on these data, I selected three best-performing p67C nanoparticles for larger-scale expression and purification: I32-19, I32-28, and I53-50. Each of them, with 60 copies of the p67C, was expressed, purified, and extensively quality-controlled to confirm monodispersity, purity, and low endotoxin levels for immunization studies. Immunogenicity data from the ILRI show that the nanoparticles with p67C induce a similar level of p67C-specific antibodies as a combination of HepB core antigen and mesoporous silica nanoparticles containing more than twice as much p67C antigen, and far higher antibody levels than p67C alone. It is an outstanding vaccine candidate to help those suffering from ECF. These preliminary results will be confirmed by parasite challenge studies in 2018.

Poster Session 3

MGH 206, Easel 174

2:30 PM to 4:00 PM

Business Case Assessment and Asset Valuation for Respiratory Syncytial Virus Vaccine Candidate

Jack Montana Lalonde, Senior, Bioengineering
CoMotion Mary Gates Innovation Scholar
Mentor: Lance Stewart
Mentor: Neil King, Biochemistry

Respiratory Syncytial Virus (RSV) is a common respiratory virus for which there is no vaccine. Over 60% of children are infected with the virus during their first season (winter months) and nearly everyone gets the virus before age 2, with reinfection occurring numerous times throughout life. In healthy individuals, symptoms are usually mild, but in young children, especially premature babies, and elderly (older than 65years old) adults, RSV can cause serious bronchiolitis and lead to hospitalization and death. While no prophylactic RSV vaccines are currently on the market, many are in development including the UW IPD Icosavax's protein nanoparticle vaccine which shows a strong humoral response with 8x better neutralizing antibody titers than antigen alone. A business case assessment and asset valuation for commercial development of the RSV nanoparticle vaccine for adults 65 years of age or older was performed. We calculated the current expected net present value for the asset based on RSV prevalence, the burden it creates, current vaccination practices, and industry standards. Gathering this information required extensive review of published literature and market reports, and the data was used to create a series of discounted cash flow valuation models. These models indicate that the vaccine asset is worth somewhere between $8M and $38M today, depending heavily on competition, public acceptance and vaccine coverage rates, and cost of goods. The valuation models can be used to facilitate conversation with potential investors and acquirers and plan future decision making to profitably operate Icosavax.