Josh Welch Dream Challenge Summer BD2K Project

**Respiratory Viral DREAM Challenge**: Discovering dynamic molecular signatures in response to virus exposure

**Registration Open:** May 6, 2016  
**Launch of Competitive Phase:** May 16, 2016  
**Completion of Competitive Phase:** September 14, 2016  
**Launch of Collaborative Phase:** October 2016  
**Workshop:** October 14, 2016

Respiratory viruses are highly infectious and cause acute illness in millions of people every year. However, there is wide variation in the physiologic response to exposure at the individual level. Some people that are exposed to virus are able to completely avoid infection. Others contract virus but are able to fight it off without exhibiting any symptoms of illness such as coughing, sneezing, sore throat or fever. It is not well understood what characteristics may protect individuals from respiratory viral infection. These individual responses are likely influenced by multiple processes including both the basal state of the human host upon exposure and the dynamics of host immune response in the early hours immediately following exposure. Many of these processes play out in the peripheral blood through activation and recruitment of circulating immune cells. Global gene expression patterns measured in peripheral blood at the time of symptom onset - several days after viral exposure - are highly correlated with symptomatic manifestation of illness. However, these later-stage observations do not necessarily reflect the spectrum of early time point immune processes that predict eventual infection. Because signal amplitude is small at these early time points, the ability to detect early predictors of viral response has not yet been possible in any individual study. By combining data collected across 7 studies and leveraging the state-of-the-art in analytical algorithms, this Challenge aims to develop early predictors of susceptibility and contagiousness based on expression profiles that were collected prior to and at early time points prior to, and following viral exposure.

This Challenge is designed to accomplish two complementary purposes. The first goal is to identify the most accurate, early predictors of infection with respiratory virus based on existing data sources. This will be achieved by inviting researchers from around the world to develop and submit predictors for comparative evaluation using the traditional DREAM Challenge framework ("Competitive Phase"). This challenge provides an exciting opportunity for the analytical community to compare performance across contemporary methods for dynamic modeling based on time-series data. The secondary goal of this project is to use the insights gained within this challenge to guide subsequent research directions and funding recommendations in this field. All Challenge participants are invited to join this effort by contributing to a community-based post-hoc analysis of Challenge outcomes ("Collaborative Phase") to run from approximately Oct - Dec 2016. These analyses will launch at a one-day workshop designed to bring Challenge participants together with biological and clinical domain experts to discuss Challenge outcomes and make recommendations regarding promising approaches to advance our ability to identify individuals that are resilient to infectious diseases.