* ODE Model
  + Murine data
  + Use of hanging states – ML approach(es)
  + Parameterization options
    - Setting from Ivan’s
    - Full within stable range
      * Compare BH, SA, DA
      * Compare ODE solver timings
      * Compare local minimizer timings
* Sensitivity Analysis
  + eFAST explanation – Taylor, Fourier, Laplace, sensitivity
  + Parameter visual sweeps
  + Slider interface
  + Selecting parameters
  + Metrics – often ignore statistical correlations
    - Target Cell Minimum (Survival proxy?)
    - Viral Peak
      * Not correlated to severity
    - Cytokine (AUC/Peak) which correlates to severity in clinical settings
      * IL-6, G-CSF, GM-CSF, IFN-G
  + Range
    - Stability points if found (check for zeros, ask TJ about stab analysis)
    - MCMC or memory-BH for parameter distributions, intercorrelations
    - Bootstrap datasets with BH, SA, or DA
    - Classic local (10-25%)/Within-CI (most bio relevant)
* Experimental Infection Data
  + Application: most defined datasets. Use to scale murine model to human infections with known parameters.
* Longitudinal Clinical Data – Flu09 and more
  + Application: ‘validation’ human data. Use human model and inferences.
  + Nasal wash cytokines and virus
  + Use of hanging/predictor states
  + Often missing start of infection or inferred zero-day
  + Dynamics often missing
    - Observational Clinical Data
      * Bounding for states, variance
      * Translation of lung:URT cytokine, cell levels (and host scaling)
* Virtual Patient Cohort Generation
  + Purpose: Find *n* parameter sets which lie within clinical variance
  + Target: Parameter sets can generate distinct regimes which correlate to Mild, Moderate, and Severe disease
  + Base disease severity on clinical correlates (poor) or ML approach
  + Predict disease outcome by ODE output (base parameters by patient limits?), then ^
  + Predict disease outcome based on current measurable profile and dynamics information
  + Create a likely, but individual and variable, patient outcome based on existing knowledge of infection trajectory without assuming underlying model mechanisms.

1. Significance
   1. Annual influenza mortality, morbidity, economic impact
   2. Generalized respiratory impacts
   3. Targeted impact on vulnerable groups
      1. Infection depends on multiple factors; which can we incorporate
      2. Reflection of individual differences on parts of the model (link to parameters, initial conditions, multiple system steady states)
2. Ideal Scenario/The Solution
3. Prior Work/steps towards the solution
4. Approach/current and next steps
   1. Data Sources and Uses
      1. Compartment concept of data
      2. Murine Data
      3. Experimental Infection Data
      4. Clinical Data
   2. ODE System Creation
      1. Parameterization/Discrimination/Information Theory
      2. Sensitivity Analysis/eFAST explainer/Metrics
      3. Structural Identifiability Analysis/Writing the caveats of discussion
   3. Virtual Patient Cohort
      1. Bound, variable parameter sets
      2. Clusters or regions of parameters lead to similar outcomes
      3. Prediction of disease severity and symptom score from dynamics
5. Conclusion