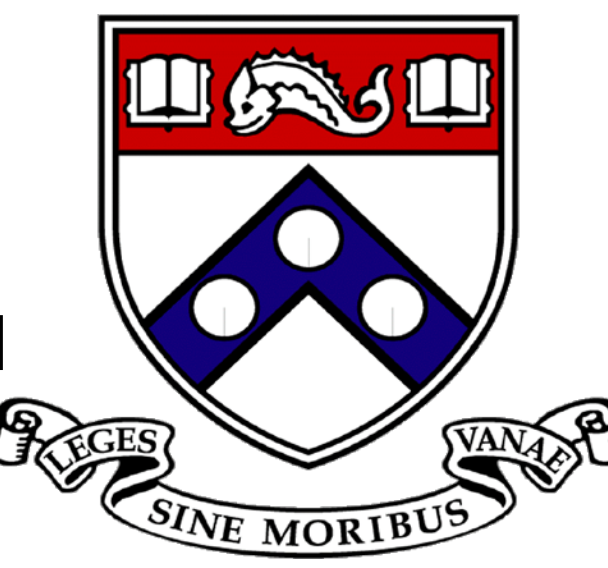


# Credibility Plan: Multiscale Analysis of Trauma

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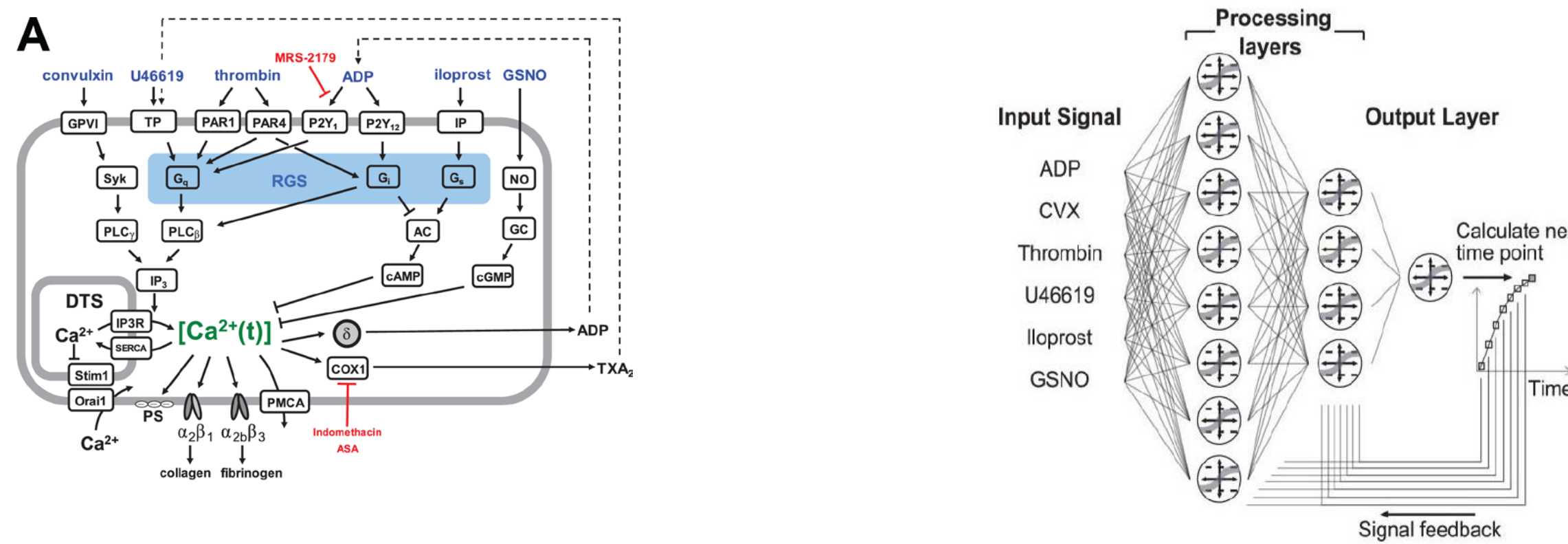
## Component and Scale

## Credibility

## Reusability

### Platelet Signaling

NN (Machine Learning)



Neural Network Available online

Matlab code available ([www.seas.upenn.edu/~diamond/software.html](http://www.seas.upenn.edu/~diamond/software.html))

Distribution with N-patients

In Progress

Neural Network for Healthy Control Population

Matlab Code / Lee et.al, PLOS Computational Biology, 2015

### Clotting in Flow

Microfluidic Tests



Data Posted Online

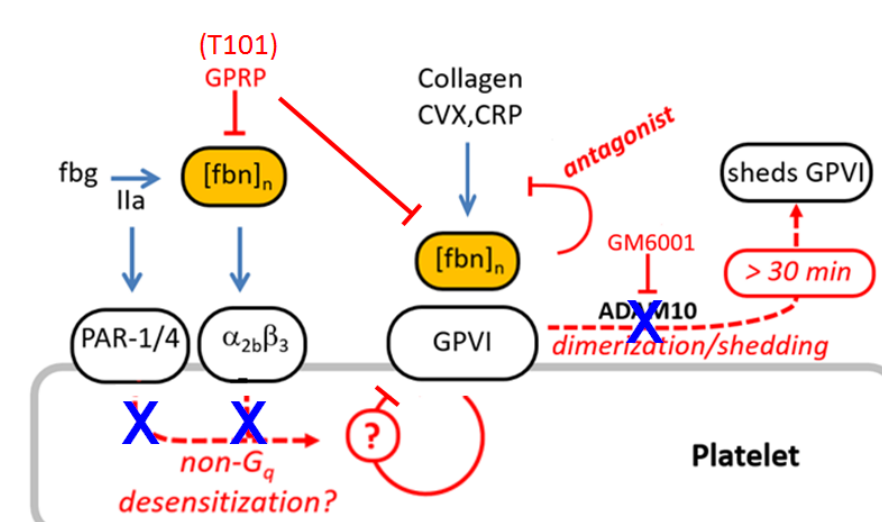
Excel file

Distribution with N-patients

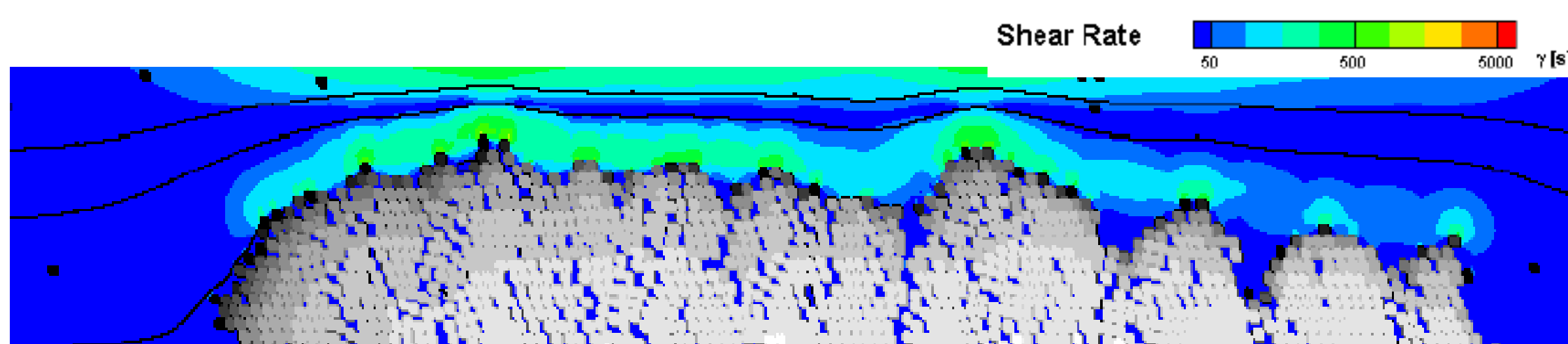
Li et.al, J. Trauma, 2016

### Clot-Flow Simulation

Hypothesis Generation



Full Simulation



Soluble Fibrin inhibits GPIIb/IIIa

Verni et.al. J. Thrombosis. Haemostasis, 2017

New Hypothesis (DD blocks GPIIb/IIIa)

New Hypothesis (TF/tPA blocks GPIIb/IIIa)

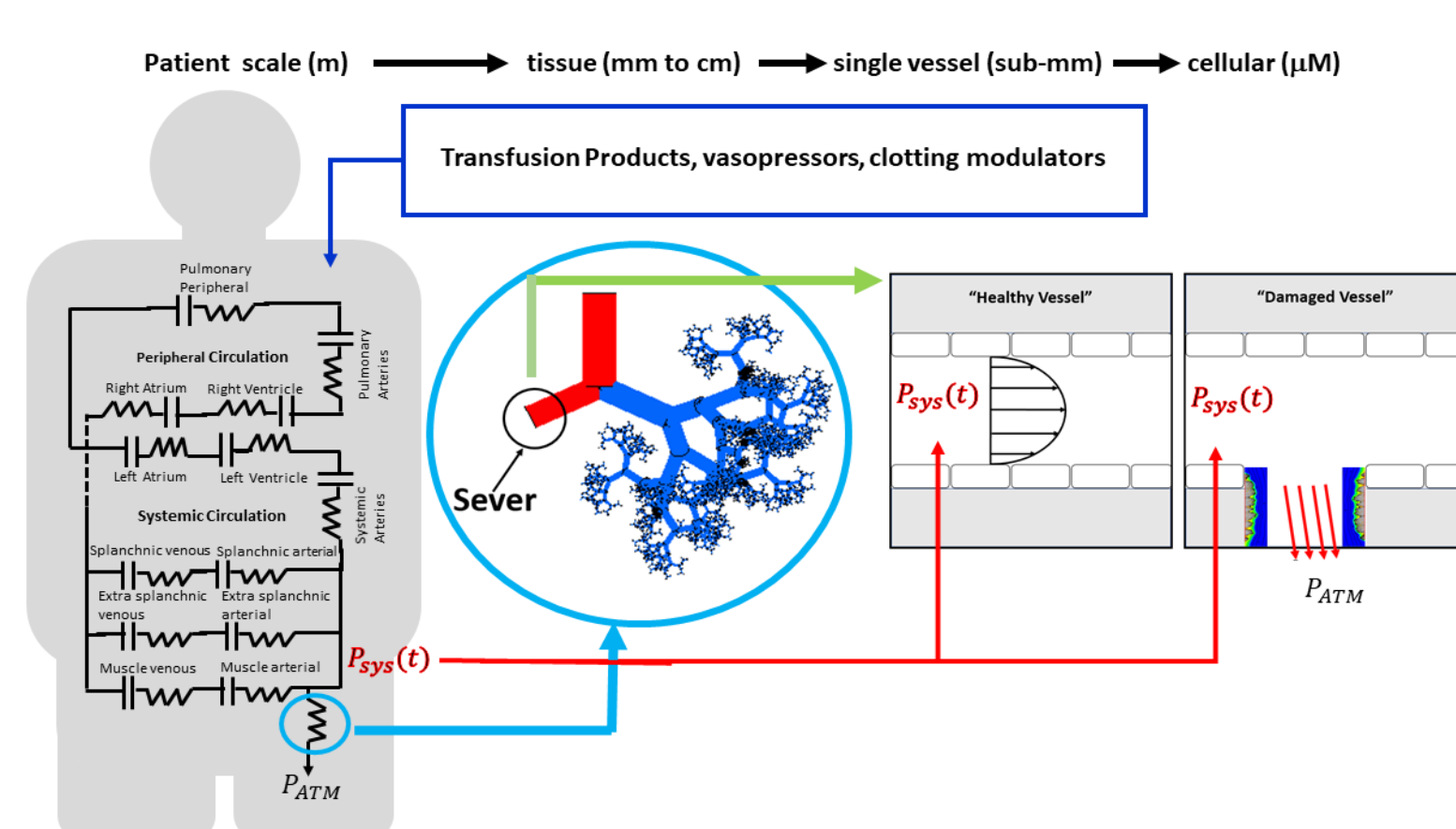
Test against n-patients -> distribution

Lu et.al, Math.Med.Bio, 2016

LB/NN/FEM/LKMC

Code available ([www.seas.upenn.edu/~diamond/software.html](http://www.seas.upenn.edu/~diamond/software.html))

### In vivo hemodynamics



Model selection across scales

Tsiklidis et.al. Wires System Bio, 2018

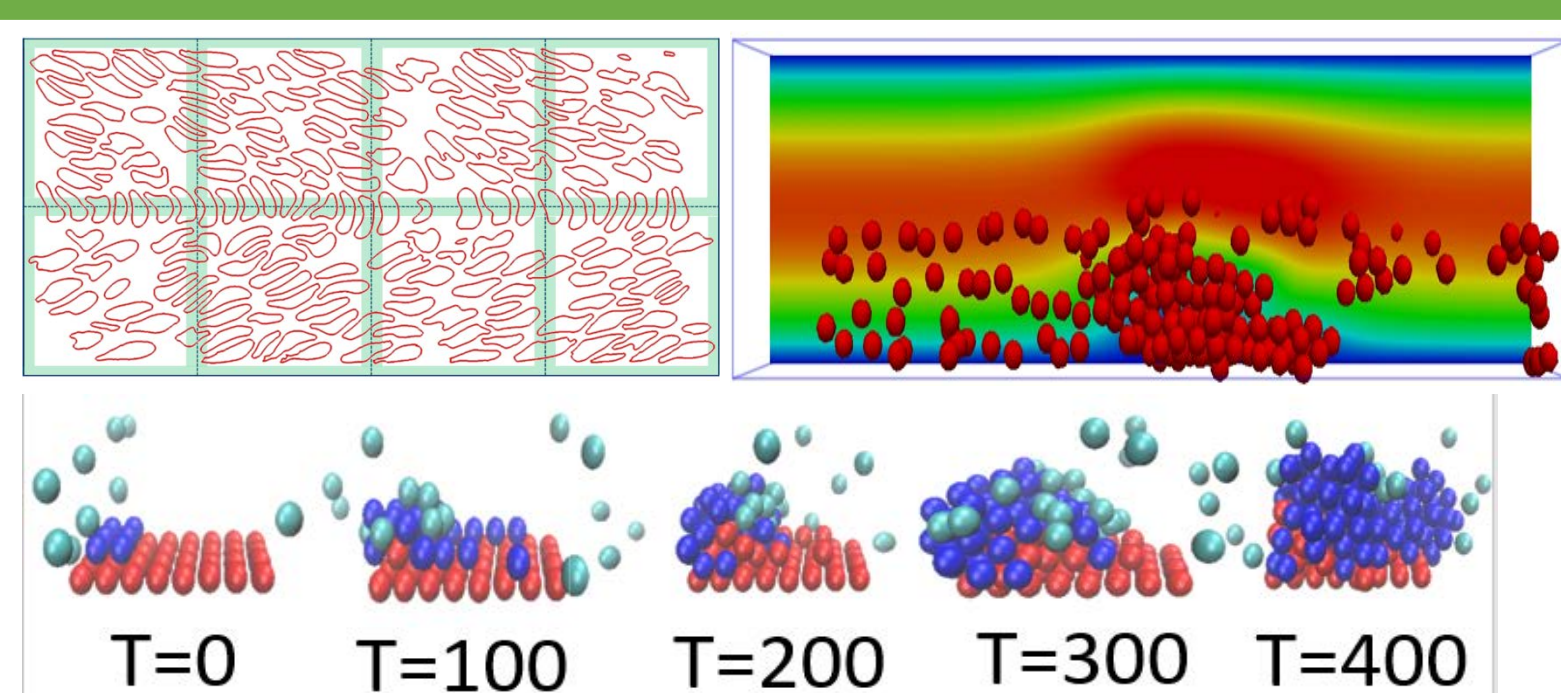
Define Unregulated Bleeding Space

In Progress

Epic Data Sets

In Progress

### Clot Mechanics



Validate for 2-phase blood viscosity

Code Posted (Palabos/LAMMPS)

Mechanism of shear induced NETosis

Tan et.al. J. Comp. Sci, 2018

Hypothesis generation : shear induced NETs

Yu et.al. J. Thrombosis. Haemostasis, 2018

Validate core-shell structure under flow

In progress

Validate clot deformation under flow

In progress

**Project:** Multiscale Analysis of Trauma  
U01-HL-131053, Start date: 5/01/2016, PI: Diamond SL (Univ. Penn.)  
**Context:** Help predict (a) risk, (b) optimized therapeutic choices, and (c) outcomes for traumatic bleeding by use of: blood biology diagnostics, hemodynamic readouts, and clinical/research data.  
**Intended audience:** Trauma Surgeons, Anesthesiologists, Medical Informaticists, Transfusion Units.  
**Credibility Plan:** Calibration with 50 well annotated trauma patients (Penn). Prediction of trauma trajectories for other trauma patient trials (eg. TACTIC consortium).  
**Timeline and Milestones (\*Code/data publically released):**  
Platelet NN model\* (calibrated to 10 healthy donors) - PLoS Comp Biol.  
Clotting simulations\* (calibrated against 3 drugs) - Math. Med. Biol.  
Trauma blood testing and Hypothesis Generation - J. Trauma, J. Thromb. Haem.  
Cell/Clot deformation model (Palabos/LAMMPS)\* - J. Comp. Sci.  
Model selection - Wires Sys. Biol.  
NETosis model\* - J. Thromb. Haem.  
Mouse penetrating injury data for model testing - J. Thromb. Haem.  
TF->thromb->Fibrin microfluidic data for model testing - J. Biol. Chem.  
**Challenges:** Annotating extracted EPIC data and anesthesiology record