**2018 IMAG Futures Meeting – Moving Forward with the MSM Consortium (March 21-22, 2018)**

*Pre-Meeting Abstract Submission Form*

*\*Please submit to the NIBIB IMAG mailbox (*[NIBIBimag@mail.nih.gov](mailto:NIBIBimag@mail.nih.gov)*) by* ***January 8th, 2018***

*\*Save your abstract as “MSM PI Last Name \_ 2018 IMAG Futures Pre-Meeting Abstract”*

**PI(s) of MSM U01: Victor H. Barocas and Beth A. Winkelstein**

**Institution(s): University of Minnesota and University of Pennsylvania**

**MSM U01 Grant Number: U01-EB016638**

**Title of Grant:** Multiscale Modeling of Facet Capsule Mechanobiology

**Abstract**

Which MSM challenges are you addressing from the IMAG 2009 Report and how?

<https://www.imagwiki.nibib.nih.gov/content/2009-imag-futures-report-challenges>

(indicate which challenge (#) you’re addressing)

*You may insert images by copying and pasting below*

6)    Multiscale models strongly coupled with standardized protocols for model-driven data collection: *An important feature of our model is the ability to translate macroscopic loads to microscopic loads, allowing a more relevant interpretation of macro-scale experimental data.*

8)    Problem-driven multiscale models that require high performance computing (see below for available advanced computational resources): *Our models use HPC to solve the multiple microscale problems concurrently and assemble the results to define the macroscale tissue behavior.*

15)  Models to explore underlying mechanisms of individual-, community-, or population-level preventive or therapeutic interventions: *An eventual goal of is to develop better guidelines for facet capsule injury prevention*.

18)  Predictive multiscale models to improve clinical workflow, standard operating procedures, patient-specific modeling for diagnosis and therapy planning: *An important feature of the multiscale modeling approach is the ability to incorporate patient-specific information at all scales as it becomes available through advancements in biomedical imaging.*

Are you using machine learning and or causal inference methods and how?

*You may insert images by copying and pasting below*

We are not using machine learning

Please briefly describe significant MSM achievements made (or expected).

*You may insert images by copying and pasting below*

We have developed a multiscale model of facet capsule mechanics, linking the tissue scale to the neuron scale at an unprecedented level of detail. We have also worked with Ahmet Erdemir to draw attention to the issues involved in sharing of multiscale biomechanical models by spearheading the publication of the editorial in the Journal of Biomechanical Engineering that will be published in February 2018.

Please suggest any new MSM challenges that should be addressed by the MSM Consortium moving forward.

*You may insert images by copying and pasting below*

As a community, we need to address the issue of computational speed vis-à-vis patient variability. How can we implement patient-specific models effectively when the model takes days or weeks to run? We also have not addressed the issue of expertise – can a multiscale model be converted into a form usable by the novice (so a clinician could eventually use it on his/her own) or must it remain in the hands of experts (in which case, data could be sent to it in the manner that physical samples are sent to a lab for expert analysis) ?

What expertise are on your team (e.g. engineering, math, statistics, computer science, clinical, industry) and who?

*Please list as “Expertise – Name, email”*

*Engineering – Barocas,* [*baroc001@umn.edu*](mailto:baroc001@umn.edu)*, Winkelstein,* [*winkelst@seas.upenn.edu*](mailto:winkelst@seas.upenn.edu)

*Computer Science – Mark Shephard,* [*shephard@rpi.edu*](mailto:shephard@rpi.edu)

*Theoretical Mechanics – Catalin Picu, picuc@rpi.edu*

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