**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:** Yasin Dhaher, PhD/Darryl Thelen, PhD

**Institution(s):** Rehabilitation Institute of Chicago/University of Wisconsin -Madison

**MSM U01 Grant Number:** 4U01EB015410-04

**Title of Grant:** A Multi-Scale Modeling Construct of Knee Mechanics following ACL Reconstruction

**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*

1)    Next-generation multiscale models that integrate between different scientific fields (e.g. cardiovascular and neuroscience) and predict integrated functions

4)    Novel methods to fuse biological and/or behavioral processes and mechanisms to model outcomes as a result of various interventions

8)    Problem-driven multiscale models that require high performance computing (see below for available advanced computational resources)

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

*You may insert images by copying and pasting below*

NO

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

*You may insert images by copying and pasting below*

1. Developed a frame work on model validation when experimental data is limited and heterogeneous, limited/ heterogeneous data is a key challenge in biomechanics - used the human knee as a model system. (published)
2. Developed a computational framework on employing uncertainty synthesis to inform surgical planning – used ACL reconstruction surgery as a clinical example. (published)
3. Developed a computational construct for coupling across the two different domains in mechanics; deformable and rigid body mechanics – prediction of internal joint variables during functional movement post ACL reconstruction surgery. (published)
4. Developed a computational framework linking motor control and joint mechanics – assessment of neuromuscular training post ACL reconstructive surgery. (published)
5. Established the first attempt to connect tissue level biology with the tissue aggregate mechanics – endocrinological effects on cartilage health after acute joint injury using the human knee as a model system. (partly published; in progress)

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

Better integrate engineering/ modeling approaches with fundamental biology and its approaches. There is a need for more integration between biology (as it is often taught in a Socratic method, and approached using qualitative focused/reductionist methodologies) and engineering/ systems approaches. There is a need for cross-talk on both ends, but often the language and approaches can be inaccessible. The goal is to develop funding mechanisms that enable this cross-disciplinary efforts.  These suggestions have been articulated by my colleague Professor Zaman and I to the steering committee as the co-leads of the biomechanics working group.

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

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

*Mechanical Engineer: Darryl Thelen -* [*dgthelen@wisc.edu*](mailto:dgthelen@wisc.edu)

*Mechanical Engineer: Yasin Dhaher –* [*y-dhaher@northwestern.edu*](mailto:y-dhaher@northwestern.edu)

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