**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*) by* ***January 8th, 2018***

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

**PI(s) of MSM U01: C. Alberto Figueroa, Adam L. Dorfman, Seungik Baek**

**Institution(s): Univeristy of Michigan, Michigan State University, Nationwide Children’s Hospital**

**MSM U01 Grant Number: 5U01HL135842**

**Title of Grant:** Image-based Multi-scale Modeling Framework of the Cardiopulmonary System: Longitudinal Calibration and Assessment of Therapies in Pediatric Pulmonary Hypertension

**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*

2: Integration of organ-level (cardiopulmonary) and mesoscale-level chemo-bio-mechanical growth&remodeling (G&R) to test and predict responses to drug and acute vasolidatory therapies

3: Modeling principles will be used to generate hard-to-acquire anatomical and hemodynamic data for the human vasculature

4: We’ve developed models for automatic global and local blood flow regulation which could be used for subject-specific surgical planning

6: Our MS model of the cardiopulmonary circulation has defined a data-acquisition protocol for both Pulmonary Hypertension (PH) and control subjects, for both hemodynamic (short time scales) and tissue G&R simulations (long time scales)

8: Our MS models entail non-linear Partial Differential Equations solved with the Finite Element Method. Therefore, simulations of short and long time scales require access to High Performance Computing

10: We use Bayesian schemes for model calibration. The goal is to obtain robust parameter estimation for patient stratification

15: Our MS model of cardiopulmonary hemodynamics and G&R seeks to explore system-level response to PH therapeutic interventions

18: Our project will develop patient-specific models of the cardiopulmonary system for diagnosis and therapy planning

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

*You may insert images by copying and pasting below*

 Yes. We are currently exploring machine learning methods for automatic image segmenation

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

*You may insert images by copying and pasting below*

 We are currently developing two novel methodological aspects: 1) Definition of a homeostatic state for an entire vascular tree. Previously, this had only been defined for a single vessel. 2) Definition of a formal MS framework to couple short time scale stimuli with long time scale G&R responses

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*

 We are currently developing a protocol to assess form and function in the micro-vasculature of the pulmonary circulation using electron microscopy techniques on both animal and human data. Originally, our project relied on clinical data acquired for the heart and large vessels only. A proper definition and calibration of a MS model of hemodynamics and vascular G&R also necessitates MS data. Thus, bigger emphasis on techniques for MS data acquisition combining different experimental modalities applied to different scales and levels of the model is needed and must be addressed by the MSM Consortium.

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

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

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