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

*Pre-Meeting Abstract Submission Form*

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**Institution(s):** University of Maryland School of Medicine, George Mason University

**MSM U01 Grant Number:** 1U01HL116321

**Title of Grant:** Multiscale Spatiotemporal Modeling of Cardiac Mitochondria

**Abstract**

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

Mitochondria regulate production of ATP from the breakdown of substrate in response to cellular signals linked to the cell’s metabolic demands. This process is central to many important questions in the cardiovascular, neuroscience, cell biology, and molecular biology/biochemistry fields (#1). The environment of the mitochondria within the cell can see large spatiotemporal fluctuations in these signals (calcium, ADP, NADH). This project seeks to combine multiscale modeling with experiment to understand the dynamic regulation of mitochondrial function. Mitochondrial function is thought to be tightly linked to the organelle’s crista nanoarchitecture. However, protein localization and signaling in nanocompartments within mitochondria are difficult to measure, making this a data poor scale. Leveraging information from physiological measurements of whole mitochondria and the cellular (data rich) environment through modeling enables us to explore these data poor scales (#3). The predictions of the model will inform which are the important experiments to do to constrain critical features of the models (#6, #9). The modeling computations will require high performance computing resources due to the computational complexity of the problem (#9). Platforms will be chosen that facilitate model sharing.

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

No

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

We have developed a multiscale model of mitochondrial crista structure and mitochondrial function, and have run simulations on Virtual Cell to enable sharing. We have gathered a variety of cardiac muscle mitochondrial structures that we can use to study the effect of crista structure on functions related to bioenergetics and calcium transport.

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

There are challenges in enabling and encouraging Multiscale Experimental Data Collection that could be a topic of discussion; we can further improve how we share modeling and algorithmic expertise, so we can benefit more from each other’s work.

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

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