**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: Ross P Carlson, Michael Henson, Luke Hanley, Matthew Fields**

**Institution(s): Montana State University**

**MSM U01 Grant Number:** 1U01EB019416

**Title of Grant:** Predictive Multiscale Modeling of Microbial Consortia Biofilms

**Abstract**

***Competitive resource allocation to metabolic pathways contributes to overflow metabolisms and emergent properties in cross feeding microbial consortia***

Resource scarcity is a common stress in nature and has a major impact on microbial physiology in medical wounds. This poster highlights microbial acclimations to resource scarcity, focusing on resource investment strategies for chemoheterotrophs, including chronic wound isolates *Staphylococcus aureus* and *Pseudomonas aeruginosa,* from the molecular level to the pathway level. Competitive resource allocation strategies often lead to a phenotype known as overflow metabolism; the resulting overflow byproducts can stabilize cooperative interactions in microbial communities and can lead to cross feeding consortia. These consortia can exhibit emergent properties such as enhanced resource usage and biomass productivity which are both detrimental to patient health. The data presented here connects *in silico* analysis of temporally and spatially resolved consortia physiology with laboratory studies and ties the data together with ecological theories to better understand microbial stress responses and mutualistic consortia functioning.

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*

Challenges #1,3,4. The research project integrates data from microbiology, ecology and engineering to model, analyze and predict treatment schemes for multispecies wound biofilms. Monoculture bacterial data is plentiful but data for interacting bacterial species in a spatially resolved biofilm is data poor. The project integrates genome-scale models of individual bacteria with a reaction-diffusion analysis in a novel framework to provide temporal and spatial resolution of bacterial behaviors in wound biofilms.

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*

 A temporally and spatially resolved biofilm model of a chronic wound has been published. The model is informing the development of the experimental biofilm reactor system to validate the predictions.

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*

 Click or tap here to enter text.

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

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

 *Engineering, microbiology, systems biology, biofilm analysis, microbial consoritia, metabolic modeling: Ross Carlson, rossc@montana.edu; engineering, systems biology, reaction-diffusion analysis, computational biology -Michael Henson, mhenson@engin.umass.edu; microbiology, transcriptomics, microbial ecology, anaerobic biofilms -Matthew Fields, matthew.fields@montana.edu ; analytical chemistry, mass spectroscopy, proteomics, metabolomics -Luke Hanley, lhanley@uic.edu*

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