

Abstract Submission Instructions -- **SUBMIT BY FEBRUARY 20, 2020**

Anyone may submit an abstract. All abstracts will be reviewed by the Meeting Program Committee, and you will be notified of your abstract's acceptance by **March 1, 2020**.

All MSM U01 PIs are required to submit an abstract relating to their funded project.

Instructions for submitting your abstract:

1. Fill out the author information on the "Abstract Face Page".
2. Compose your abstract using the template and by following the guidelines.
3. Convert both pages to a **single two-page .pdf file**.
4. Upload your **two-page .pdf** file here on the [Submit Materials Page](#).

ABSTRACT FACE PAGE

1. Presenting Author's name: _____ Louis R Joslyn _____
2. Presenting Author's affiliation: _____ University of Michigan Medical School _____
3. Presenting Author's title: _____
4. Presenting Author's email: _____ louisjos@umich.edu _____
5. Presenting Author's gender (optional): _____
6. Presenting Author's race (optional): _____
7. Presenting Author's ethnicity (optional): _____
8. Presenting Author's affiliation sector: (check one or more)
 - Academia
 - Industry
 - Federal Employee/Contractor
 - Private Foundation
 - Other: _____
9. Presenting Author's Career stage: (check one)
 - K-12 student
 - Undergraduate student
 - Graduate Student
 - Post-doctoral Trainee
 - Young employee (within first 3 year of post-training position)
 - Mid-level employee (3-10 years of post-training position)
 - Senior-level employee (10+ years of post-training position)
 - Other: _____
10. Website / twitter handle / other public links (optional): _____ @LouisRJoslyn _____
11. Is this the research presented in this abstract supported by IMAG MSM-related U01 funding? Yes
12. If the Presenting Author is a trainee, who is the trainee's primary research advisor?

TRAINEE POSTER AND ORAL PRESENTATION COMPETITONS:

New to the meeting this year, we are holding *both* a [trainee poster competition](#) and a [trainee oral presentation competition](#)! If the presenting author is a trainee (i.e., a student at any level or a post doctoral trainee), he/she may enter his/her abstract in the trainee poster competition, the trainee oral presentation competition, or both competitions. Trainees may also submit more than one abstract to the meeting and enter more than one abstract in these competitions. Prizes will be given to the presenters of the top-ranked trainee oral presentation and the top-ranked trainee poster (judged during the meeting by the Program Committee).

13. If the Presenting author is a trainee, would the Presenting Author like to enter his/her abstract in the Trainee Poster Competition*? Yes

*Note: Trainees who enter the poster competition are expected to stand by their poster during the scheduled poster sessions and present them to the judges.

14. If the Presenting author is a trainee, would the Presenting Author like to enter his/her abstract in the Trainee Oral Presentation Competition? Yes**

**Note: The Program Committee will select the [top four abstracts](#) from trainees who elect to enter their abstract into the trainee oral presentation competition, these four trainees will be notified by Feb. 17th, and they will deliver their oral presentations (which will be judged) on the second day of the meeting after lunch.

MOVING TOWARD A WHOLE HOST MODELING FRAMEWORK FOR TUBERCULOSIS

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BACKGROUND: *Mycobacterium tuberculosis* (*Mtb*), the causative infectious agent of tuberculosis (TB), kills more individuals per year than any other infectious agent. Granulomas, the hallmark of *Mtb* infection, are complex structures that form in lungs, composed of immune cells surrounding bacteria, infected cells, and a caseous necrotic core. While granulomas serve to physically contain and immunologically restrain bacteria growth, some granulomas are unable to control *Mtb* growth, leading to bacteria and infected cells leaving the granuloma and disseminating, either resulting in new granuloma formation (local or non-local) or spread to airways or lymph nodes [1]. Dissemination is associated with development of active TB.

METHODS: It is challenging to experimentally address specific mechanisms driving dissemination from TB lung granulomas. Therefore, we develop a novel hybrid multi-scale computational model, *MultiGran*, that tracks *Mtb* infection within multiple granulomas in an entire virtual lung [2]. *MultiGran* follows cells, cytokines, and bacterial populations within each lung granuloma throughout the course of infection and is calibrated to multiple non-human primate (NHP) cellular, granuloma, and whole-lung datasets.

Next, we create a whole host model, by coupling *MultiGran* to two other compartments: lymph nodes and blood. We use an ordinary differential equation (ODE) model that tracks T-cell priming, proliferation, responses to specific antigens, and differentiation in lymph nodes together with an additional ODE system that tracks immune cell dynamics within blood. Together, this multi-scale and multi-compartment computational model allows us to represent a whole-body response to infection with *Mtb* and to explore vaccination.

RESULTS: We show that *MultiGran* can recapitulate patterns of *in vivo* local and non-local dissemination, predict likelihood of dissemination, and predict a crucial role for multifunctional CD8+ T cells and macrophage dynamics for preventing dissemination. Using this new tool together with vaccination and infection datasets, we develop a protocol for applying virtual clinical trials to predict the dynamics and effects of vaccine-derived T cells throughout the course of infection with *Mtb*.

CONCLUSIONS: Using a new multiscale modeling framework of *Mtb* infection within a whole host, we show a key role for multifunctional T cells, as well as the impact of immune memory on infection across time. This study highlights the power of a systems biology approach to advance a complex system by integrating multiple modalities and datasets.

REFERENCES:

- [1] Martin et al., mBio 2017, 8 (3) e00312-17; DOI: 10.1128/mBio.00312-17
- [2] Wessler & Joslyn et al., PloS Comp Bio 2020 (in revision). <https://www.biorxiv.org/content/10.1101/713701v1>