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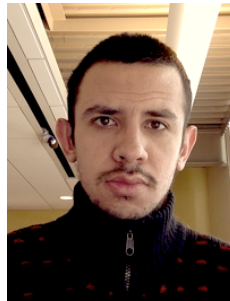
HARVARD MEDICAL SCHOOL

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Department of Medicine
Channing Division of Network Medicine

Channing Microbiome Seminar
October 10 (Tuesday), 2017, 10am @ 3rd-floor conference room

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Controlling microbial communities: a theoretical framework

What if we could control the microbial communities inside and around us as efficiently as we can control cars, robots, and aircraft? If possible, this would provide a way to restore disrupted microbial communities in our body and the environment, helping us to improve the well-being of humans and the ecosystems on Earth. In this talk, I discuss our recent work introducing a mathematically rigorous framework to control complex microbial communities. Our framework let us identify sets of "driver species" in a microbial community from which we can steer the whole community. We prove that these driver species can be identified from the topology of the ecological network underlying the microbial community, regardless of the dynamics that the community can have. We end showing how to systematically design the control strategies that need to be applied to these driver species in order to steer the community towards desired states. We illustrate our framework by simulation restoring the gut microbiota of mice from *C. difficile* infection.

This is joint work with Yang-Yu Liu (Harvard) and Claude Moog (L2SN, France).

Bio: Marco Tulio got his Dr.Eng. degree in Automatic Control from UNAM, México, in 2012. He was a Visiting Research Scholar (2014) and Postdoctoral Research Fellow (2015) in the Center for Complex Network Research (CCNR), Northeastern University, Boston. During 2015, he was also Sponsored Staff Collaborator in the Channing Division of Network Medicine, Harvard Medical School, and Brigham and Women's Hospital, Boston. In 2016, he joined the Institute of Mathematics, UNAM, as a CONACyT Research Fellow. His research interests are focused on understanding, diagnosing and controlling complex systems by blending Systems Theory (e.g., control theory and system identification) with Network Science. In particular, his research interests include rigorous methods for network reconstruction, control of microbial communities, and understanding the performance tradeoffs giving rise to the network structures we observe in nature.

Hosted by Yang-Yu Liu