ABE591S Principles of Systems & Synthetic Biology

For class, we will be discussing 3 papers where the authors engineer microbial communities towards a common objective. ***Students are expected to read all three papers and be prepared to discuss the major lessons in the context of the course materials***. General principles from these papers are testable! To guide the conversation, each paper is assigned to a group of students along with some questions to lead the discussion. Groups can prepare any material they would like in advance (e.g. notes, slides, etc) to lead the discussion. You may want to consult the relevant supplemental sections for each paper for detail and/or cited papers (not provided) for further details. **Each group will lead discussion for 20 minutes**. This activity is graded as part of the Journal Club Discussions.

Discussion Questions (all papers)

1. What were the main objectives of the study?
2. What were the advantages of using a microbial community/consortia?
3. How do the approaches used relate to material discussed in class to date? This may include human practices/responsible synthetic biology
4. What were the main conclusions of the study? How did they achieve them?
5. Critically analyze the approaches taken. What was the motivation? What are the advantages? Limitations?
6. What are the general lessons that can be extrapolated here?

Groups

7. Tamsir, Tabor & Voigt. 2011. Robust multicellular computing using genetically encoded NOR gates and chemical 'wires'. ***Nature*** 469:212-215.

1. What is used for cell-cell communication? What system is it based on?
2. What is flow cytometry? What information does it get us?
3. Why do the authors exploit 'population averaging'? Based on discussions in class, what would another method be to solve this problem?
4. How do they implement complex logic?

8. Zhou et al. 2015 Distributing a metabolic pathway among a microbial consortium enhances production of natural products. ***Nat Biotechnol*** 33: 377-383.

1. Why is glucose not an ideal substrate for this process?
2. How do the authors overcome the challenge of microbial competition?
3. What factors are critical to optimizing community structure?
4. What metabolic engineering strategies did the authors use to optimize production?

9. Basu et al. 2005. A synthetic multicellular system for programmed pattern formation. ***Nature.*** 434: 1130-1134.

1. Discuss the general strategy used for pattern formation. How does one tune the high detect components? What are the 3 variants of cells/circuits used?
2. Describe the logic gate used to control GFP expression with $LacI_M$ and cI as inputs.
3. How were models used to aid in design? What did the models look like?
4. What does the 'toy' system simulate?