Engineering Life: Kristala Prather - Synthetic Biology
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Intro:

- Describe one synthetic biology application that would be useful for your personal life and another application that would be useful for your research. Please be ready to present one of these.

Part 1: Introduction to Synthetic Biology & Metabolic Engineering

1. What is the definition of synthetic biology? How has it changed over the years?
2. What principles of engineering are used in synthetic biology?
    a. Map these onto another engineering process.
    b. How are these principles applied in other areas of biology research?
3. What principles were used in the example application of 'biological photography'? What would be a useful application of this tool?
4. What are some real-world applications of synthetic biology, particularly using hosts other than yeast and bacteria? What are additional challenges to implementing synthetic biology outside of the lab?

Part 2: Teaching an Old Bacterium New Tricks

1. What was the impetus for synthesizing glucaric acid?
2. What is the bioprospecting process? What techniques are needed to do this?
3. What is a synthetic biology device? Can you imagine different types of devices?
4. In this example, what is the inducer? What is the genetic inverter?
5. In summary, what are the three facets of synthetic biology that are optimized in the synthesis of glucaric acid?

Paper:

1. Summarize this paper using the 5-sentence structure that James Fraser outlined in our earlier class:
    a. What is the problem?
    b. What are the knowledge gaps that limit current solutions?
    c. What is the specific insight/technology used that will overcome this?
    d. How do they solve the problem using this technology?
    e. What is the next problem?
2. Many aspects of this artificial process needed to be checked or optimized. Pick **one** of these processes (listed below) and explain the experiments involved.
    a. substrate specificity (Fig. 2,3), avoidance of futile cycles (Fig 3),reducing products from shunts (Fig. 3), toxicity of intermediate metabolites (pg. 6), efficiency (Fig. 4), operon order (pg. 5).
3. How can this process be further optimized or iterated upon?

Outro:

- How do the methods and principles highlighted/used in this module relate to other modules we have covered? (eg: synthetic proteins, polyketide synthesis, protocells, bacterial diversity, etc)