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View Abstract

CURRENT SYMPOSIUM: Undergraduate and Graduate Research in Biochemistry and Chemical Biology

CURRENT SESSION FORMAT: BIOL: Poster In-Person

CONTROL ID: 4280965

DIVISION: Division of Biochemistry and Chemical Biology (BIOL) : I only wish to participate in-person in Washington, DC.

TITLE: Disentangling methanogenic wastewater treatment bioreactor communities with probabilistic metabolic models

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ABSTRACT BODY:

Abstract: Every year, hundreds of trillions of liters of sewage are produced. This presents a defining challenge for cities to prevent disease transmission and environmental damage. The upcycling of these waste streams into useful chemicals, such as biomethane, are being explored to increase the utility of water treatment plants to the communities they serve. Methods of biologically digesting sewage into CO2 gas have been developed to neutralize this waste stream, however, fully oxidized carbon is not industrially useful. We are therefore developing a downstream process that reduces this CO2 , when combined with H2 from water electrolysis, into CH4 for applications as a fuel or chemical feedstock. The metabolic pathways that achieve this reduction and the contributions of each bacterial member in the digestive consortia, however, remain unknown, which hinders the optimization of these consortia for enhanced yield, purity, and stability.

We employed a new pipeline, leveraging metabolic modeling, to elucidate the metabolic pathways and ecological roles of each community member. This pipeline a) creates a genome-scale metabolic model (GEM) from each experimentally acquired 16S RNA sequence, b) assembles these GEMs into a single compartmentalized community model (cGEM) with the experimentally observed member abundances, and then c) simulating the cGEM via Flux Balance Analysis over the various media perturbations. The simulation results identify the critical members and pathways that reduce carbon in this system, thereby open the possibility for stably optimizing its purity and yield. These results and pipeline have broad implications for achieving a circular economy and enhancing basic understanding of microbial communities.

(No Image Selected)