

Building a Synthetic Microbiome for Duckweed: A System for Investigating Plant-Microbe Communication in Water Remediation

ILANA COHEN[1][2], Anna Kraebber[3], Eva Madell[4], Shelby Luster[5], Tess Flemming[1], Christian Hoyek[1], Theodore Muth, PhD[1]

1Brooklyn College, New York City, New York, United States

2CUNY Graduate Center, New York City, New York, United States

3Wellesley College, Wellesley, Massachusetts, United States

4University of California Santa Barbara, Santa Barbara, California, United States

5Scripps College, Claremont, California, United States

SUBMITTED (SHORTENED FOR CHARACTER COUNT WITH SPACES)

Duckweeds are small, fast-growing, aquatic plants that can remediate the water they inhabit by accumulating nutrients and breaking down environmental pollutants. Duckweeds are used in constructed wetlands to remove excess nitrogen from agricultural, municipal, and factory wastewaters and have a demonstrated potential to take up polluting antibiotics. Laboratory experiments suggest that the relationships between duckweeds and their microbiomes can be harnessed for improved bioremediation. This possibility can be explored by characterizing natural duckweed microbiomes, developing synthetic microbiomes, and challenging duckweed-microbiome systems with pollutants. The first steps in this process are to isolate bacteria from natural duckweed microbiomes and to develop synthetic communities that stably colonize duckweed. We have isolated more than 70 bacterial strains from duckweed microbiomes collected in and near New York state and here present our initial effort to construct minimal synthetic microbiomes stably cohabiting on duckweed plants. Our work includes 1) investigating the development and stability of a five-member synthetic microbiome using 16s sequencing to compare microbiome composition over time 2) comparing a microbiome of closely related bacteria to one composed of more distantly related bacteria and 3) challenging a stable synthetic microbiome with polluting levels of excess ammonia.

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