To exploit the fermentative capabilities of *Escherichia coli* to produce hydrogen gas, we performed P1 transduction on strain FMJ39 from JW1228-1 to produce the desired triple mutant with the necessary metabolic flux to hydrogen production. In the fermentation process *E. coli* converts glucose into various intermediate states to generate energy. The transduction of the adhE knockout found in JW1228-2 to FMJ39 will produce a triple mutant with the following genes deleted: ldhA, pflB, and adhE. From these deletions insertions of mhpF, pyruvate decarboxylase, and ferredoxin oxidoreductase will result in a more direct metabolic line towards hydrogen production.

### Future Projects

- Test the fusion protein with acetaldehyde dehydrogenase and ferredoxin oxidoreductase in the FMJ39 *E. coli* strain.
- Test each of the two separate genes for activity.
- Test other fermentative pathways for comparative analysis.
- Design a photo-fermentation pathway and pair with the dark-fermentation pathway designed here. Photo-fermentation is capable of breaking down small organic acids to potentially produce more hydrogen.
- Design a pathway for efficient breakdown of cellulose to glucose. Inclusion of this step will yield a complete system capable of producing hydrogen from raw cellulose.

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### References