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TEMASEK LIFESCIENCES LABORATORY

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The Auditorium (Level 1)

Improving growth with a hacked photosynthesis

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The most common carbon dioxide fixation pathway, the Calvin cycle, depends on the slow enzyme Rubisco. It has a fatal flaw: a competing reaction with oxygen. Land plants and cyanobacteria compensate for this by overexpressing it. The green nonsulfur bacterium *Chloroflexus aurantiacus* lives in hot springs and fixes carbon with a unique pathway that is insensitive to oxygen. We expressed the 13 enzymes constituting the pathway and demonstrated genetic function in *E. coli*. A bypass of photorespiration with the *Chloroflexus* pathway shows promise for increasing photosynthetic biomass production.

We devised an alternative-splicing based technology to minimize the number of transgenes for expression in multiple plant organelles. With gene-gun transformed plants expressing GFP, we have shown that we can direct expression to the chloroplast, the peroxisome, or both organelles. Initial tests suggest that plants engineered with a partial photorespiration bypass grow faster than their wild-type parents.

Dr Mattozzi earned his Ph.D with Jay Keasling at UC Berkeley's Joint BioEnergy Institute. Currently he works under Pam Silver at the Wyss Institute for Biologically Inspired Engineering at Harvard Medical School. His research focuses on engineering catabolic pathways for increasing biomass growth and formation of valuable bio-products.

Recent Publications:

1. Mattozzi M, Voges M, Silver P, Way J. 2014. Transient gene expression in tobacco using Gibson Assembly and the Gene Gun. Journal of Visualized Experiments (86):e51234.
2. Voges M, Silver P, Way J, Mattozzi M. 2013. Targeting a heterologous protein to multiple plant organelles via rationally designed 5' mRNA tags. Journal of Biological Engineering 8;7(1):20.
3. Mattozzi M, Ziesack M, Voges M, Silver P , Way J. 2013. Functional Expression of the pathways of the *Chloroflexus aurantiacus* 3- hydroxypropionate bicycle in *E. coli*: Toward autotrophic biofuel synthesis. Metabolic Engineering 16(2):130-39.