SAND2015-6195C

New Mexico EPSCoR

Effects of Reorientation on the Photosynthesis of Poplar Leaves

Michael Bennett
University of New Mexico
Summer 2015

NEW MEXICO TECH
SCIENCE • ENGINEERING • RESEARCH UNIVERSITY

THE UNIVERSITY of NEW MEXICO

Sandia National Laboratories

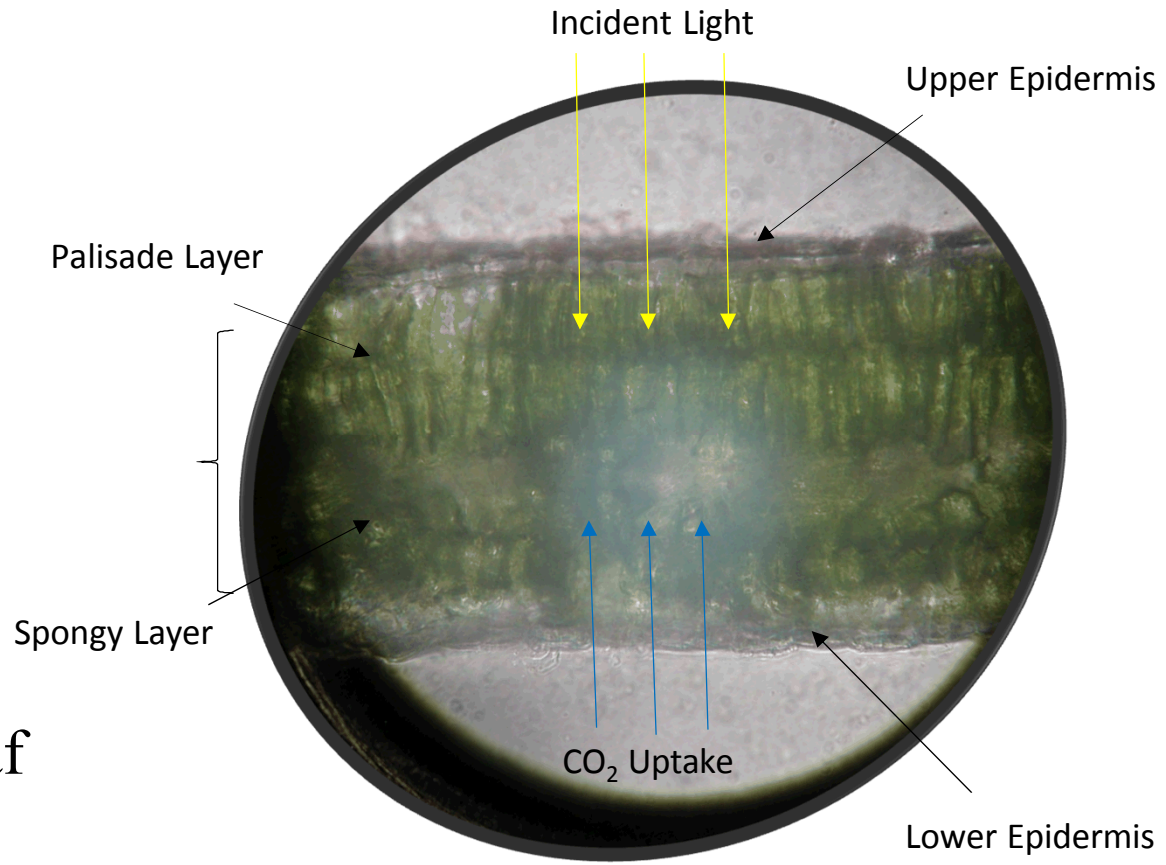
National Nuclear Security Administration

Background/Motivation

Leaf anatomy and biochemistry work together to benefit the leaf.

Leaf anatomy consists of:

- Upper Epidermis – Thin, waxy cells
- Palisade Layer - Compact cells
- Spongy Layer – Scattered cells
- Lower Epidermis – Protects underside of leaf and contains pores known as stomata

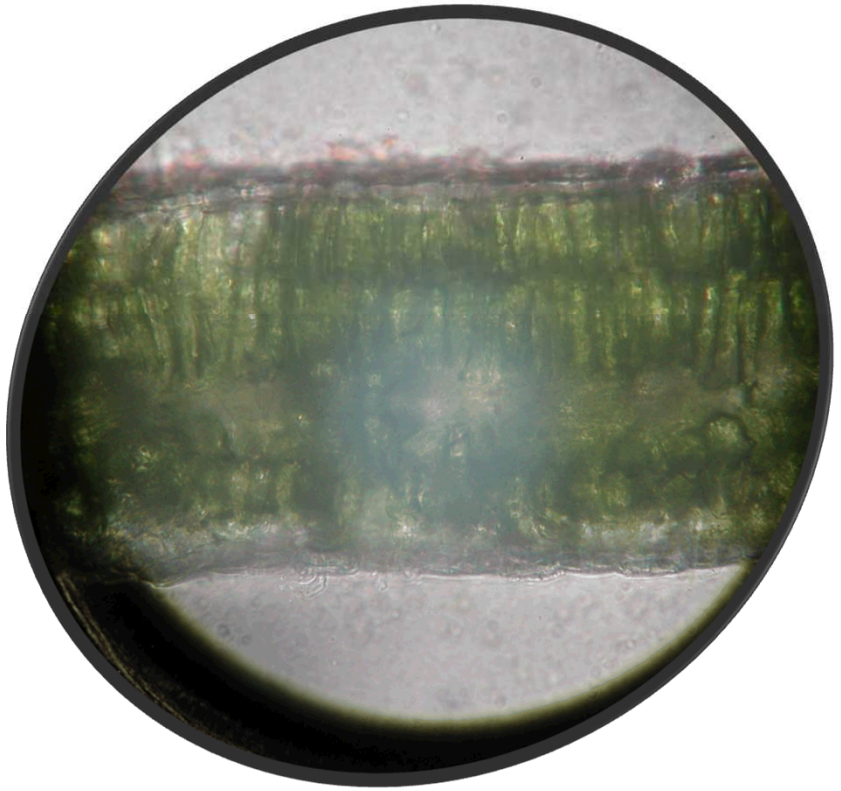


Hypothesis

New Mexico EPSCoR

- By reorienting the leaf, its biochemistry would alter, but the anatomy would remain the same.

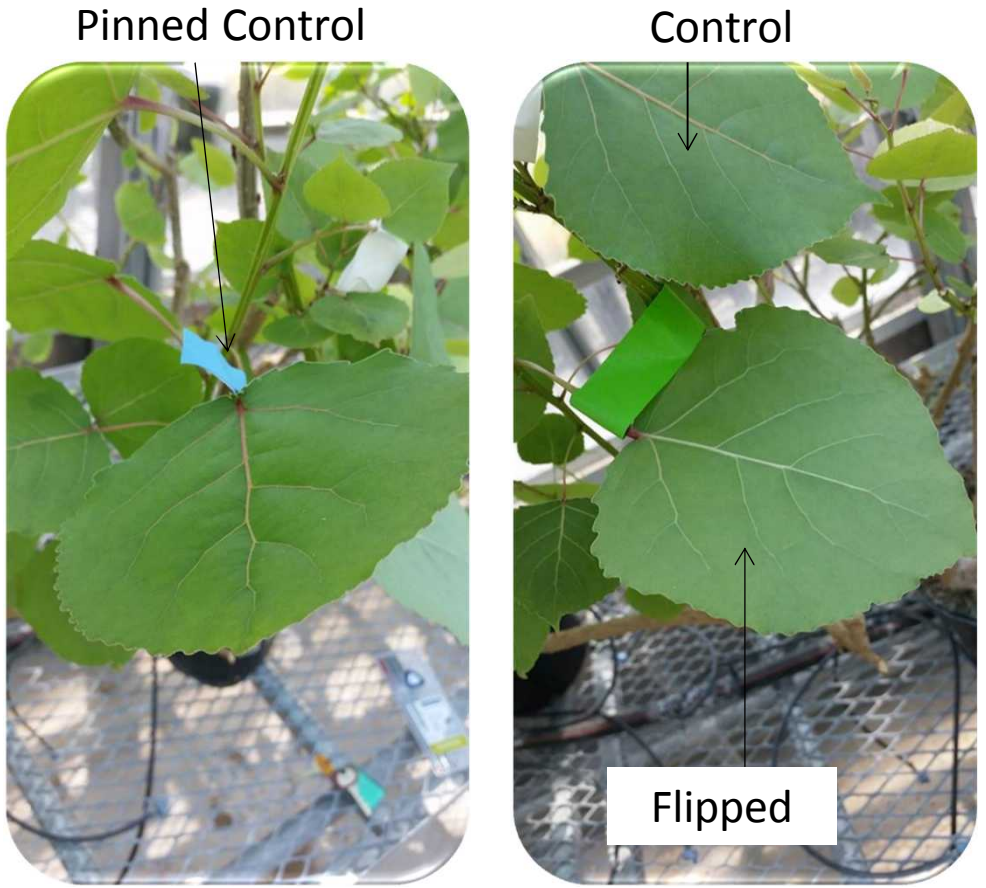
- Can we perturb the relationship between leaf biochemistry and anatomy?



Experiment Design

New Mexico EPSCoR

- The experiment began by flipping a poplar leaf and leaving it for one week.
- Two different controls were prepared. One in its natural orientation, the other pinned so that it would remain fully in the sun.



Methods/Techniques

To see if photosynthesis change after reorientation, we did all manner of photosystem tests.

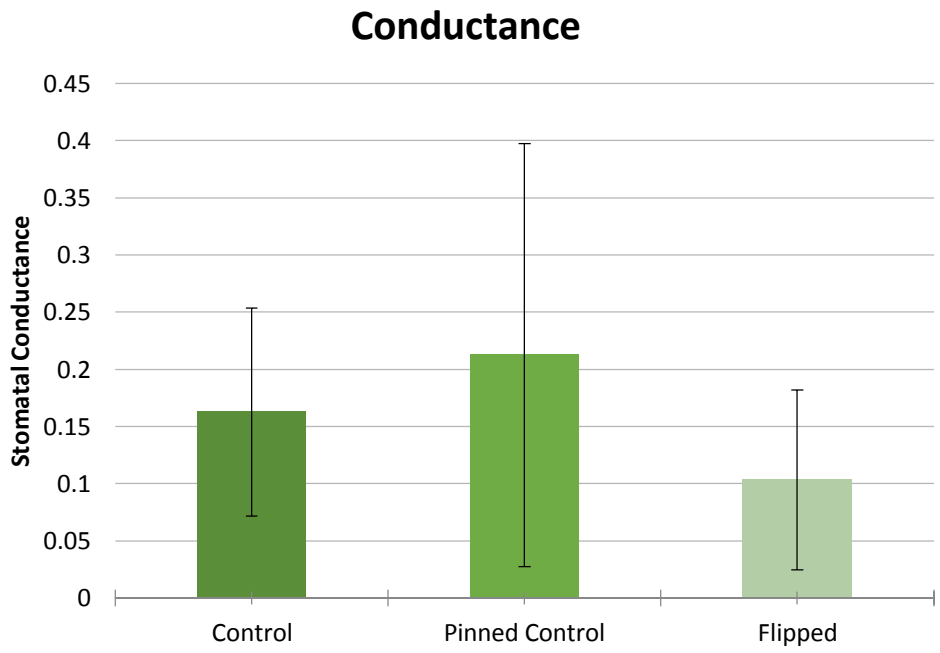
Li-Cor

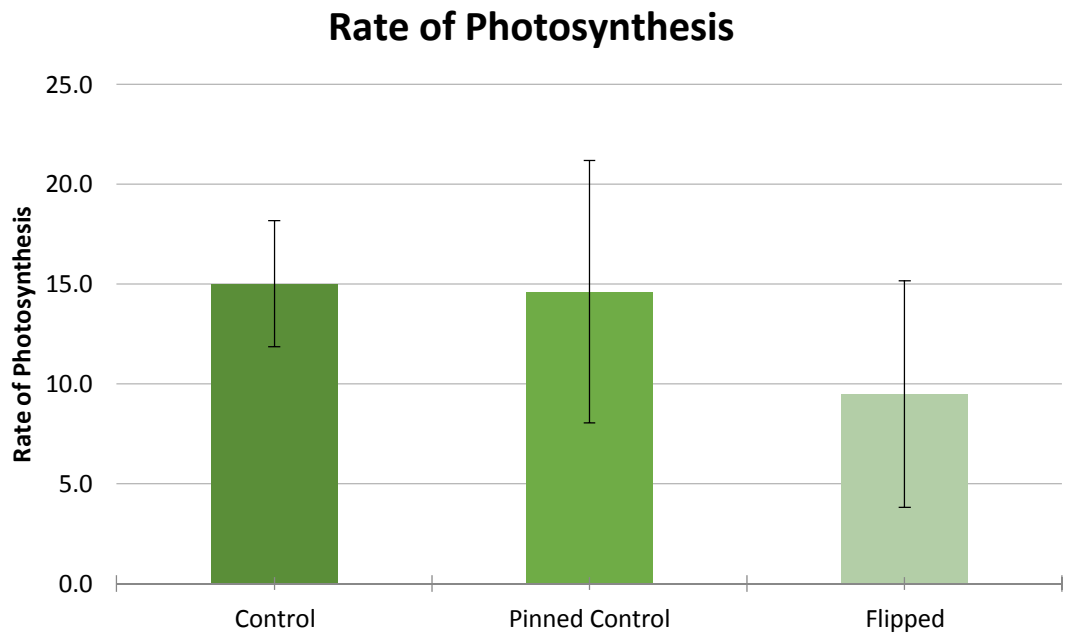
Chlorophyll Assay

PAM

Results

- Li-Cor Data

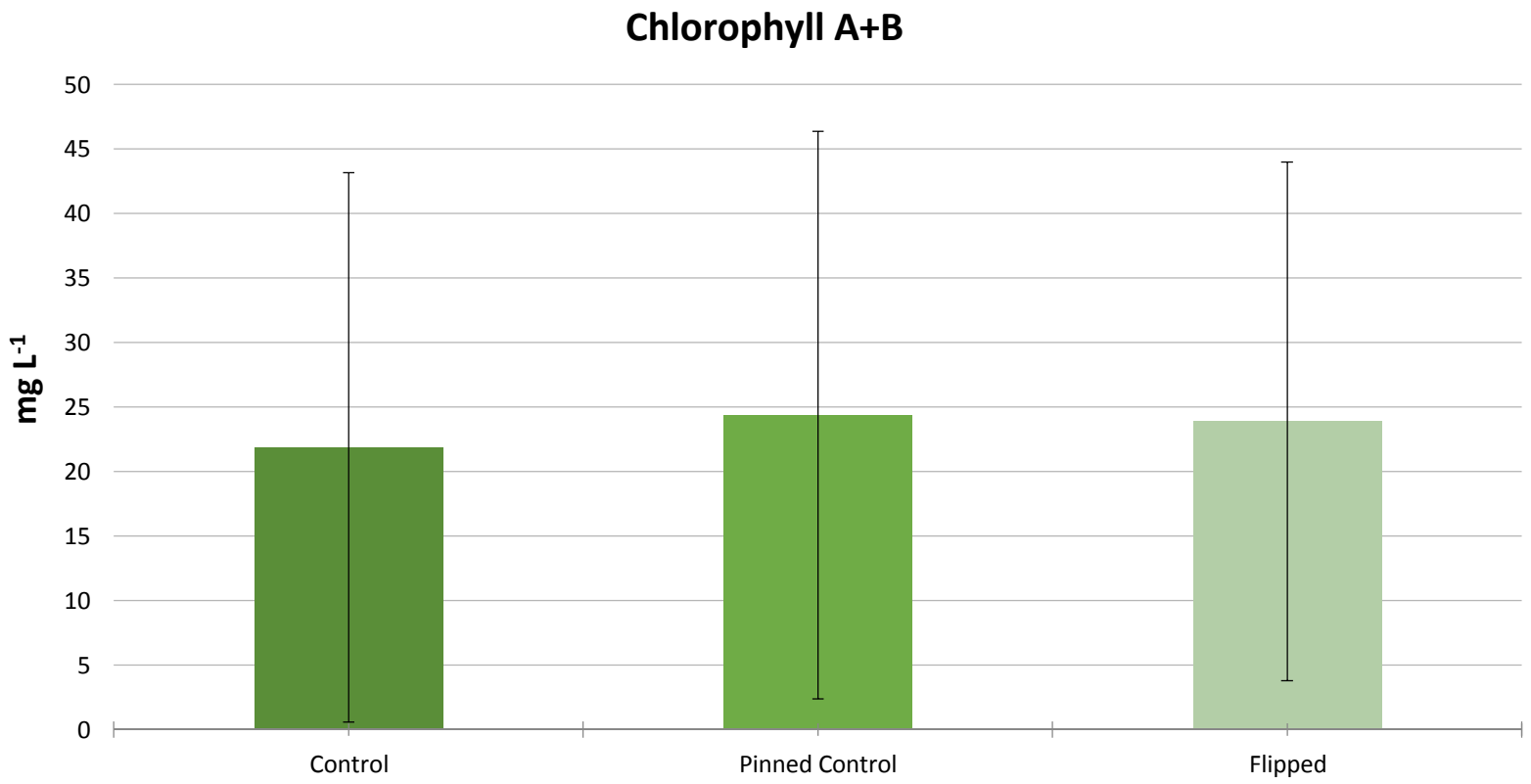




Results

New Mexico EPSCoR

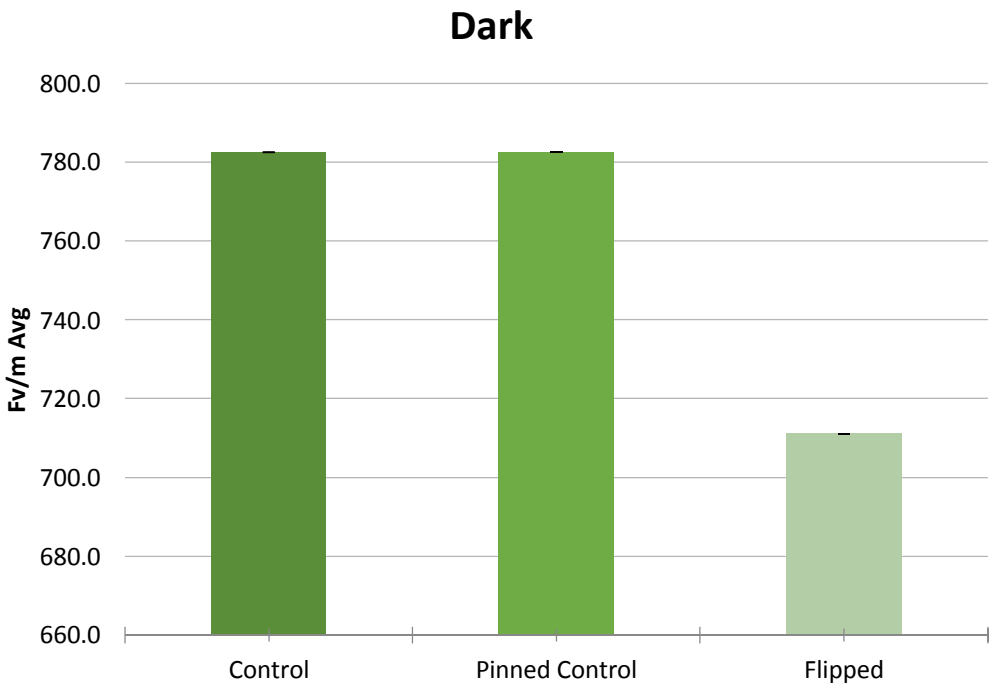
Chlorophyll Assay

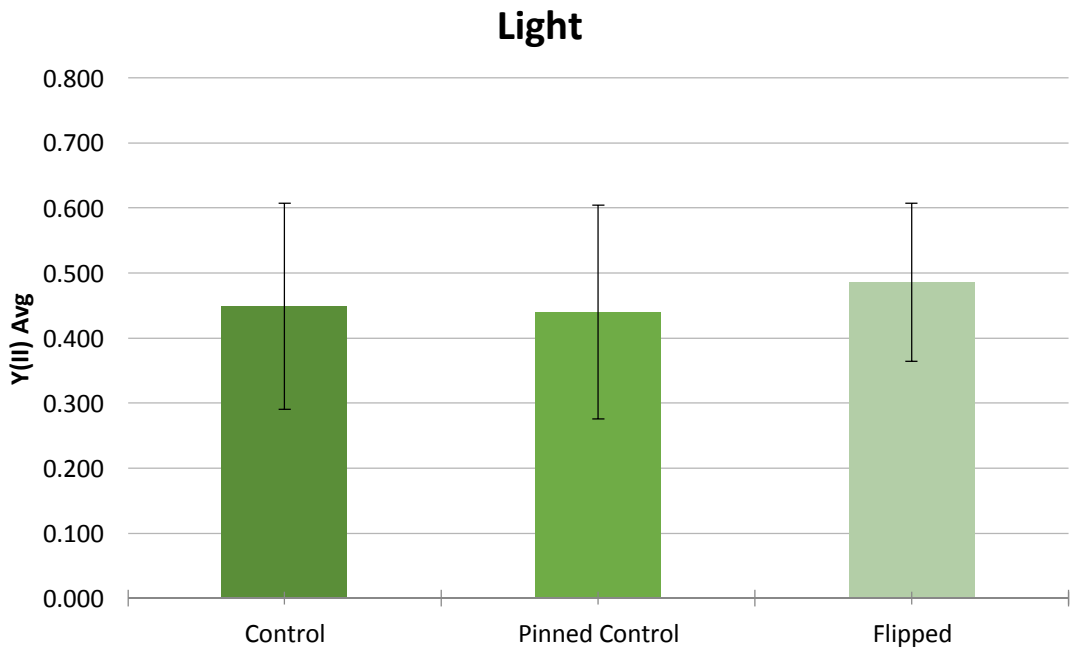


Results

New Mexico EPSCoR

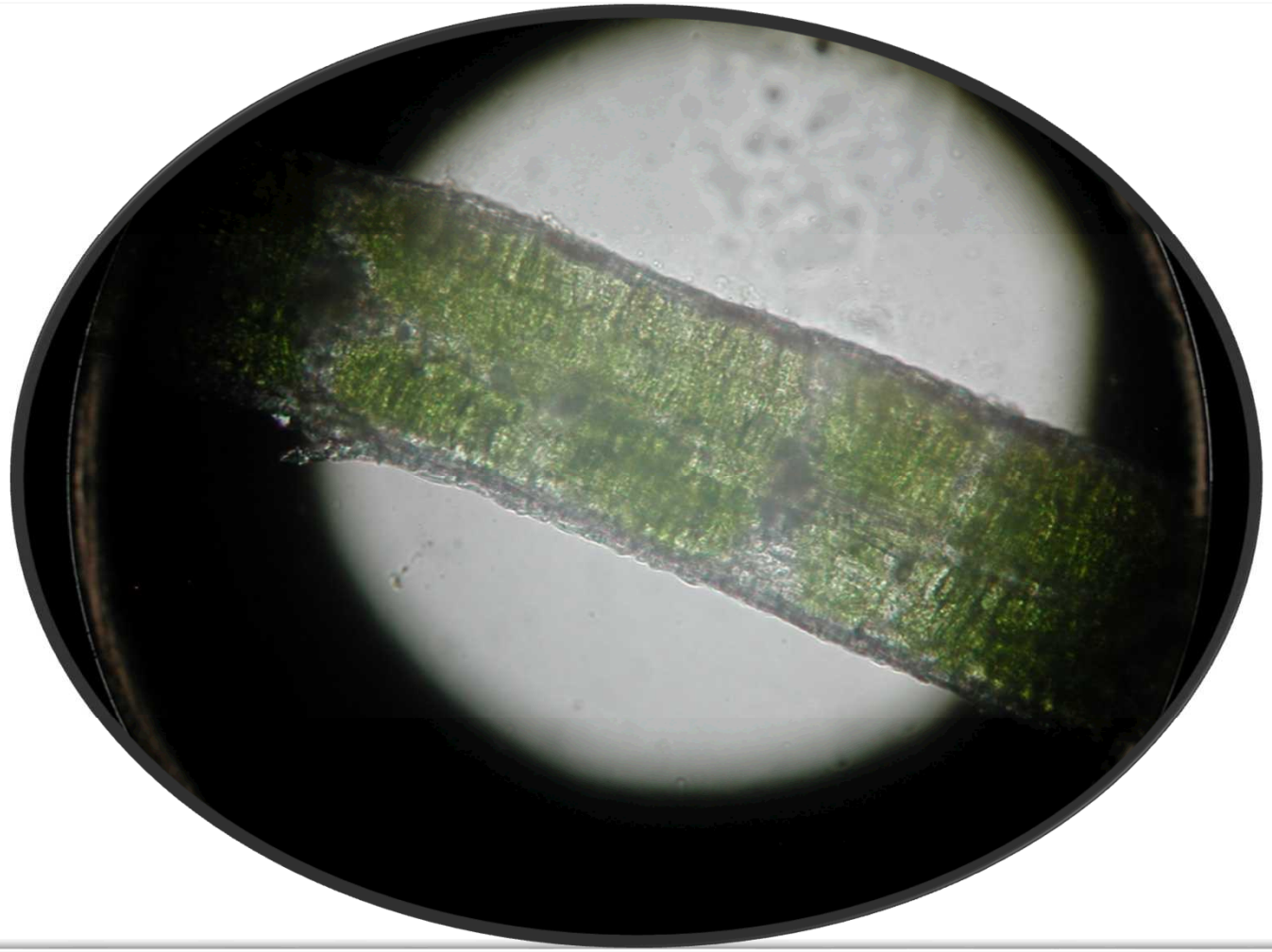
Pulse Amplified Modulator



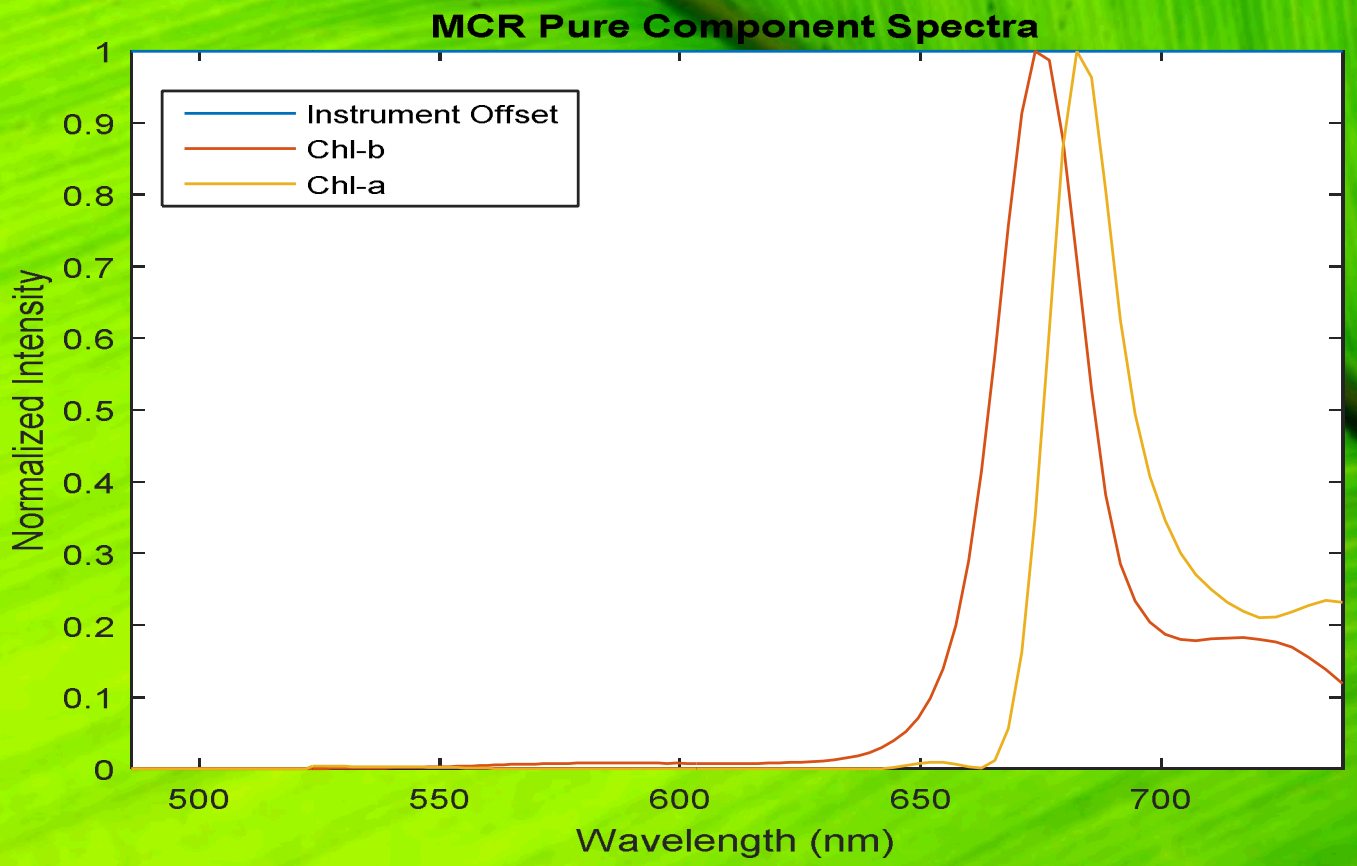


Cross Sectioning for Imaging

New Mexico EPSCoR



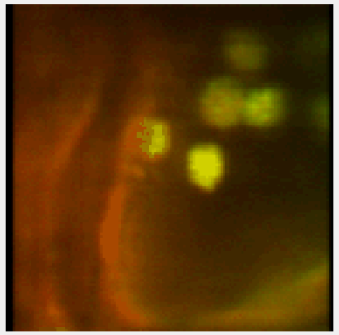
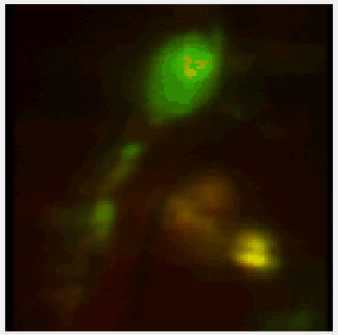
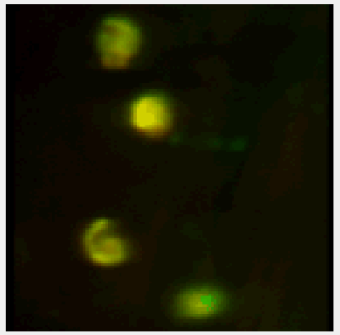
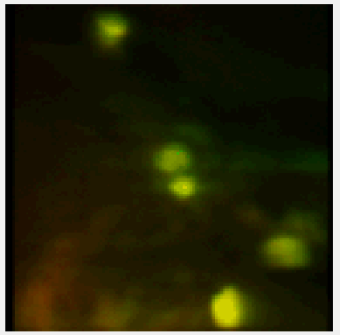
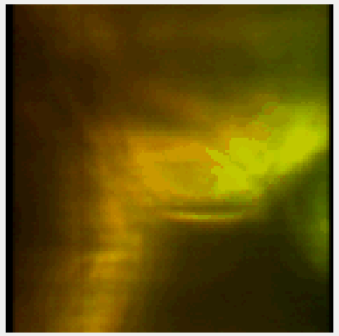
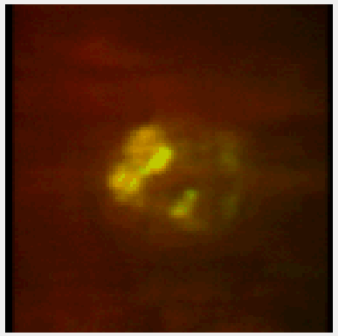
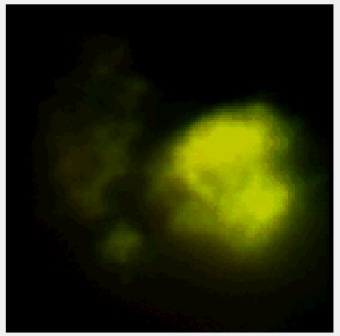
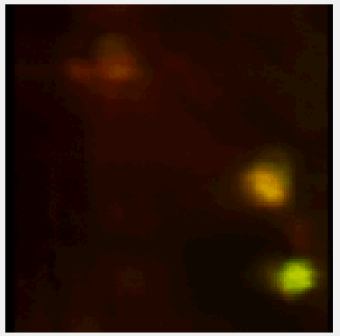
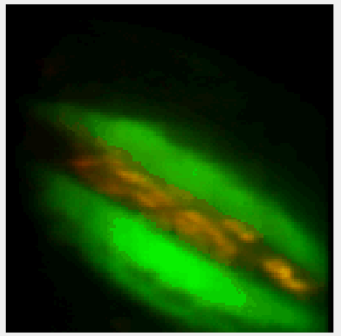
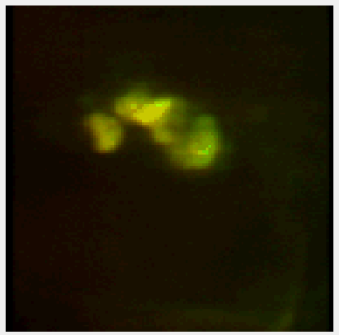
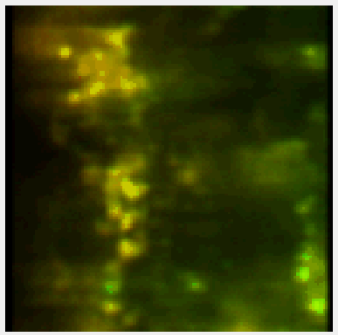
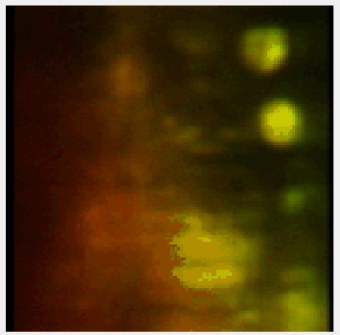
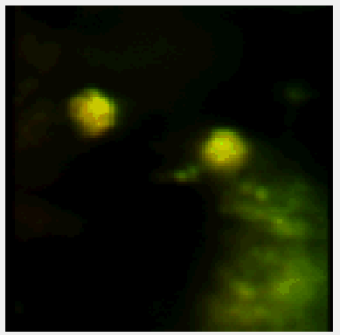
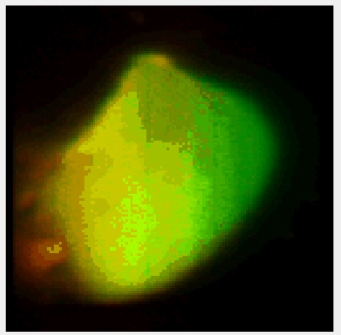
Pure Component Spectra Identified



>99% of the variance of the data is explained by this 3 factor MCR model

All Images are NOT on same color scale. It's autoscaled min to max for each image to highlight the differences between images

Green = ChlB, red= ChlA

RGB Overlay	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5
Control					
Pinned Control					
Flipped					

Picture Courtesy of Dr. Jerilyn Timlin and Sandia National Laboratories

Acknowledgements

- Dr. Hanson
- Dr. Timlin
- Dr. Lidke
- Dr. Ista
- Dr. Heagy

- John Roesgen
- Chelsea Chee
- Jennifer Thompson
- Lyndsay Ryan
- Shaleen Day

- **Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.**