

# RISING CO<sub>2</sub>: HOW IT AFFECTS OUR PLANTS

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## Introduction and Objective

Over the course of this past week, we explored the effects of elevated CO<sub>2</sub> on the Arabidopsis plant. By observing the area of mitochondria and chloroplasts per plant cell under both elevated and ambient CO<sub>2</sub> levels, we hoped to discover if there was a notable difference in the amounts of mitochondria and chloroplasts. Mitochondria and chloroplasts are critical to respiration and photosynthesis, which affects plant growth. With CO<sub>2</sub> levels rising, it is important to know what effect this could have on plant growth.

## Materials and Methods

2D Imaging: 40x Microscope Zeiss Axiovert M200

For the mitochondria we used 488 nm excitation and 520 nm emission

For the chloroplasts we used 488 nm excitation and 630 nm to 616 nm emission

The bright field image used blue halogen light with no excitation.

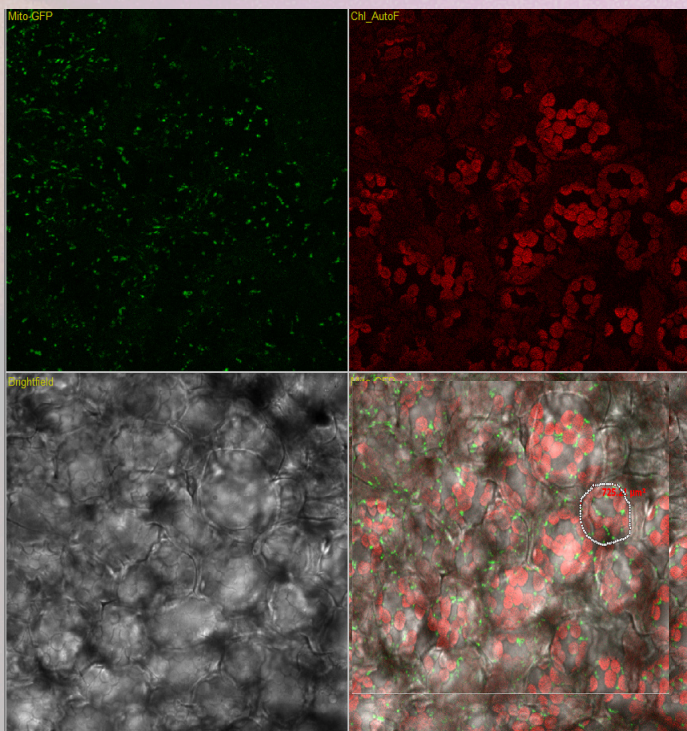
We used Axiovision to find the mitochondria, chloroplast, and cell area.

3D Imaging: Andor Spinning Disc Confocal

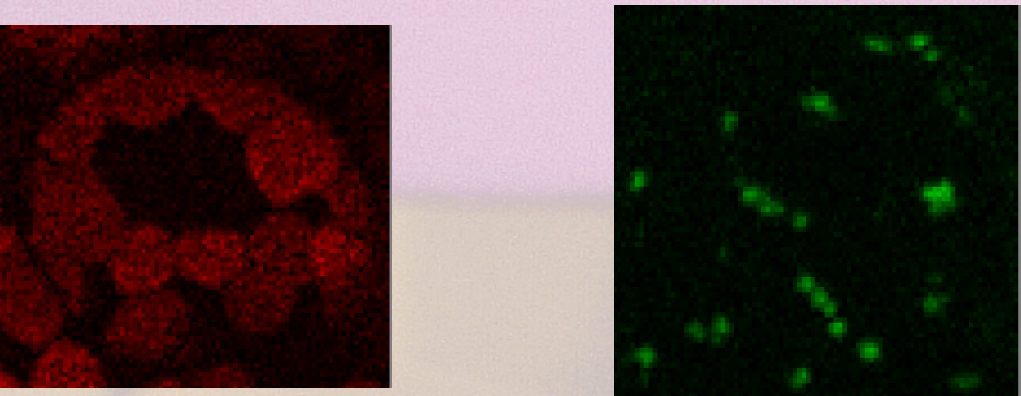
The light source was a laser with a 488nm wavelength.

We used the program IMARIS to create our 3D models.

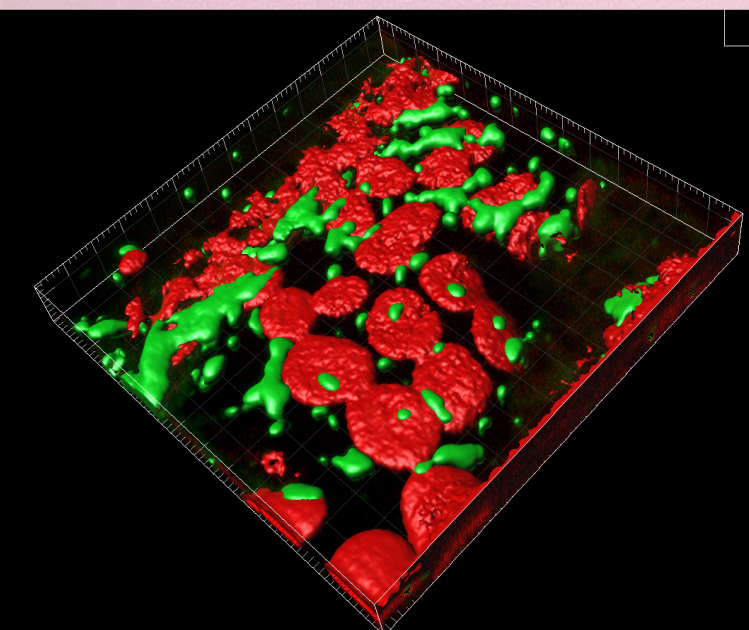
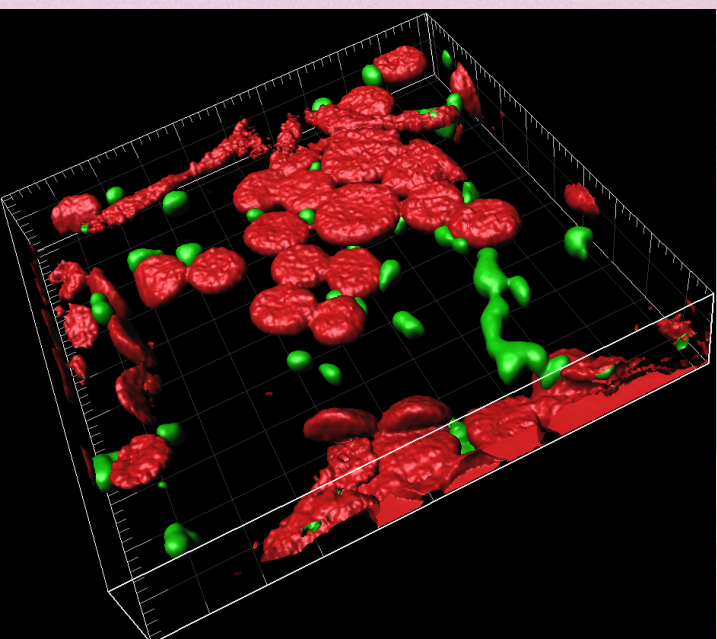
## Results



Mitochondria Channel (Top Left)  
Chloroplast Channel (Top Right)  
Brightfield Channel (Lower Left)  
Area of one cell (Lower Right)



Chloroplasts and mitochodia of one cell



3D images of chloroplast and mitochondria  
(Ambient CO<sub>2</sub>, Left; Elevated CO<sub>2</sub>, Right)

Using IMARIS Software

2D Image Analysis of mitochondria and chloroplasts, using Axiovision

Positions/Sample	Mitochondria Area μm <sup>2</sup>	Chloroplast Area μm <sup>2</sup>	Cell Area μm <sup>2</sup>	Mito per Cell %	Chl per Cell %
Ambient CO2					
Pos-1	188.13	144.30	725.21	25.94	19.90
Pos-2	65.91	192.55	1341.07	4.91	14.36
Pos-3	143.99	1097.60	1854.91	7.76	59.17
Mean	132.68	478.15		12.87	31.14
Elevated CO2					
Pos-1	79.51	345.51	2343.15	3.39	14.75
Pos2	30.72	212.18	2255.80	1.36	9.41
Pos-3	54.54	512.28	1272.21	4.29	40.27
Mean	54.92	356.66		3.01	21.47

## Discussion and Conclusion

Based on our results, we found that the area of mitochondria and chloroplasts per cell in elevated CO<sub>2</sub> conditions was lower than in ambient CO<sub>2</sub> conditions. The percentage of mitochondria area and chloroplast area per cell area was lower in elevated CO<sub>2</sub> than in ambient CO<sub>2</sub>. However, we cannot conclude anything from these results. We did not have many samples, and if one sample was in some way defective, our results could be greatly skewed. More experiments need to be done to come to a conclusion and predict the possible struggles farmers might experience in the future.

Thank you Shiv, Donna, Ria, Glenn, IGB, and Connie.