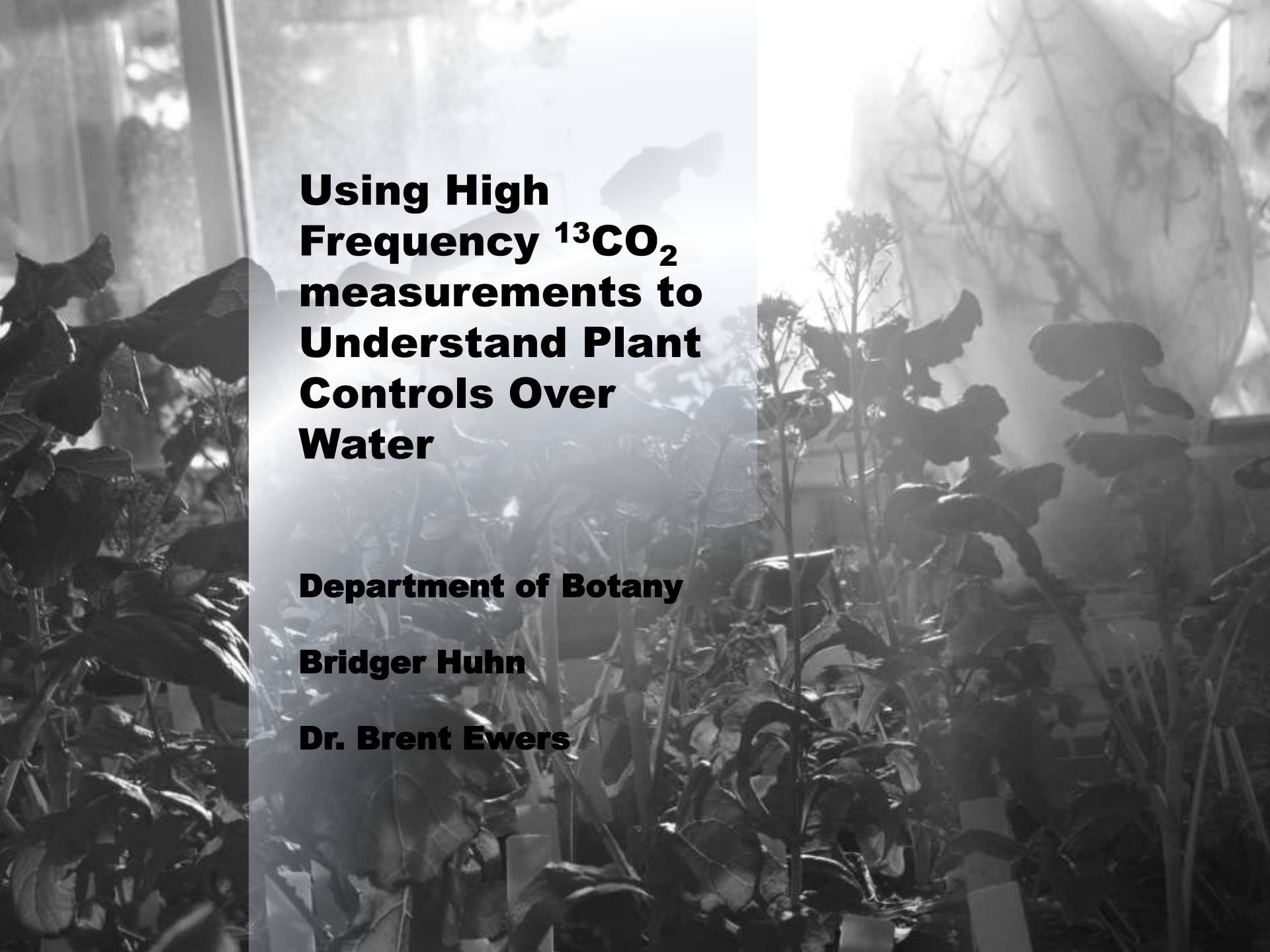


Using High Frequency $^{13}CO_2$ measurements to Understand Plant Controls Over Water

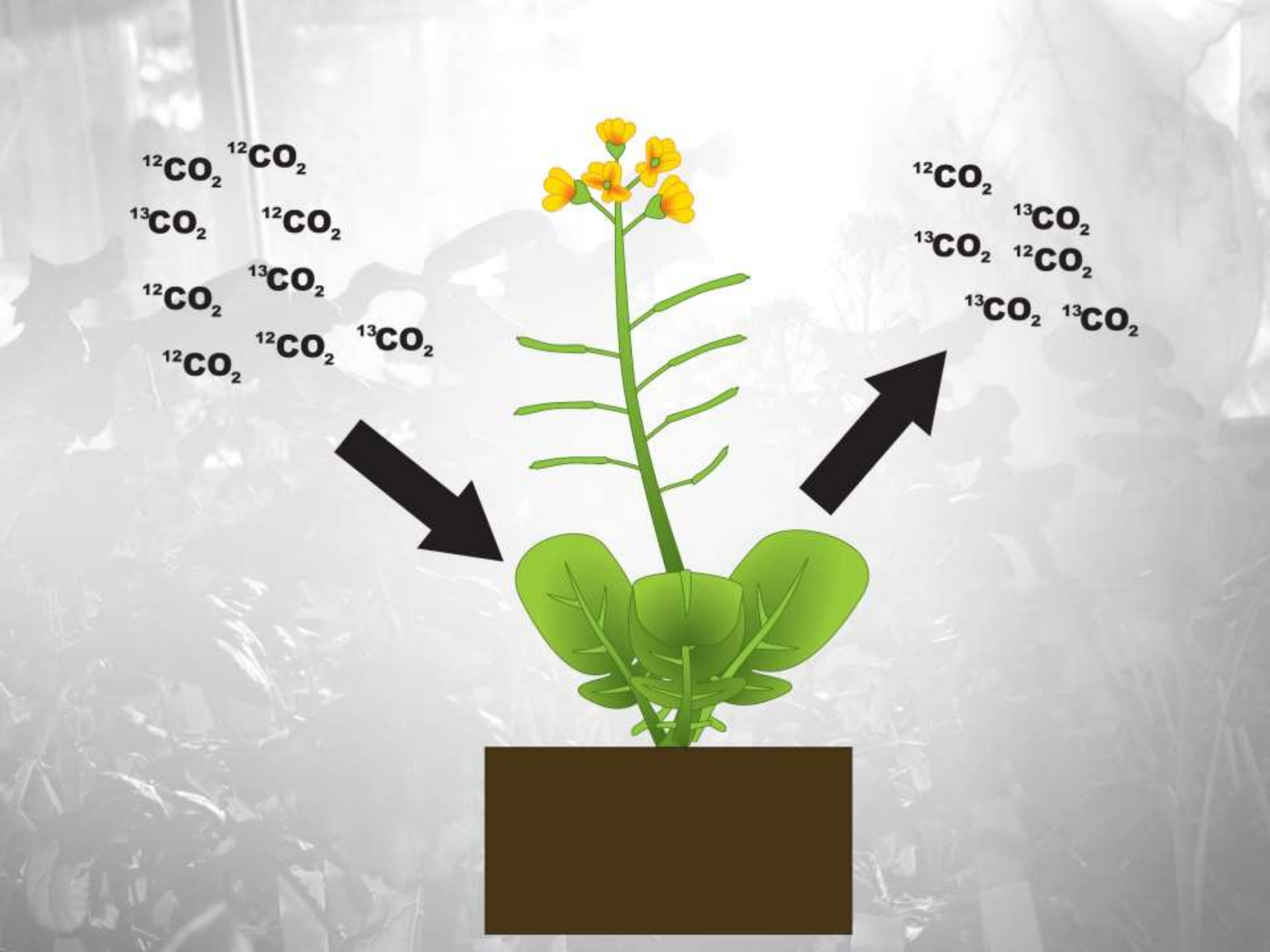
Department of Botany

Bridger Huhn

Dr. Brent Ewers

What is ^{13}C?

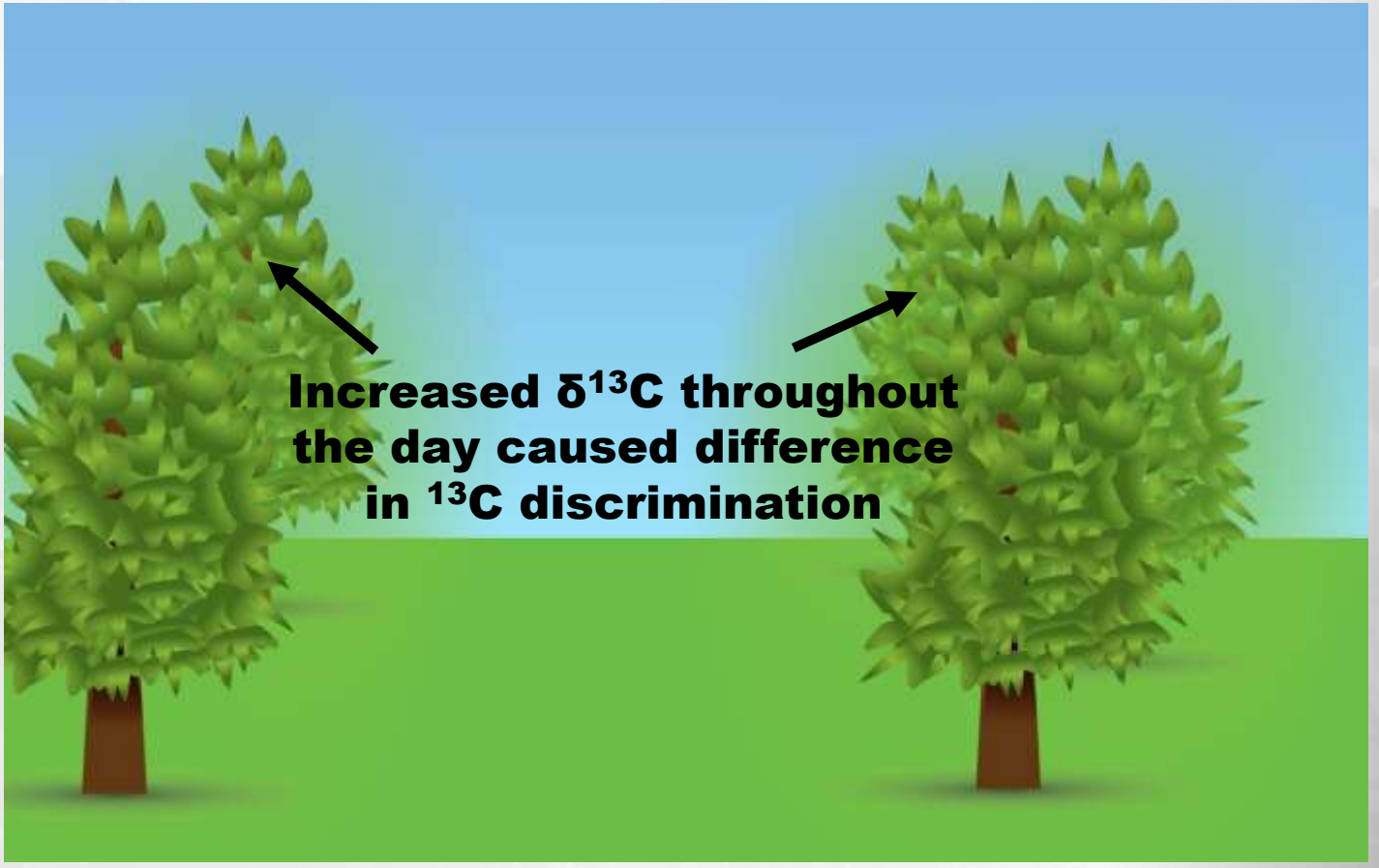
- **Heavy isotope of carbon**
- **Present in carbon dioxide**
- **Plants put a "label" on the gases they release in the form of CO_2**


$^{12}CO_2$ $^{12}CO_2$
$^{13}CO_2$ $^{12}CO_2$
$^{12}CO_2$ $^{13}CO_2$
$^{12}CO_2$ $^{12}CO_2$ $^{13}CO_2$
$^{12}CO_2$
$^{13}CO_2$
$^{13}CO_2$ $^{12}CO_2$
$^{13}CO_2$ $^{13}CO_2$

Comparison of Night to Day $\delta^{13}C$ values

Potosynthesis
+
Respiration

Respiration


Increased δ13C throughout
the day caused difference
in 13C discrimination

Specific Aims:

- **Find how water use efficiency in a plant is reflected in $\delta^{13}C$**

- **Find out how Carbon Processing by a plant is reflected in $\delta^{13}C$**

- **Determine if Respiration discrimination of ^{13}C is negligible when determining water use efficiency**

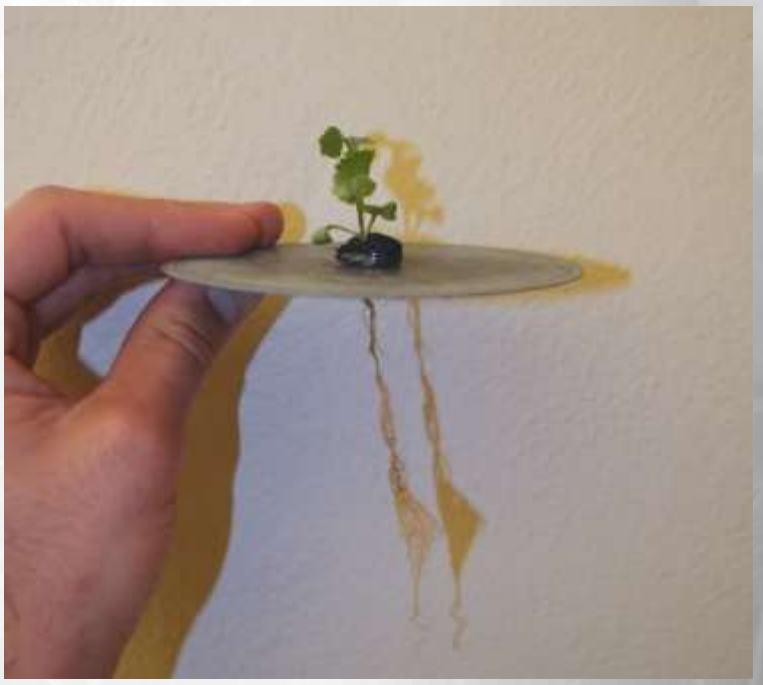
Significance

- **Estimating carbon isotope ratios in respiration with models based off wrong assumptions is problematic**

Methods

- **Elimination of all variables**
- **Hydroponic Design**
- **Use Licor 6400 to measure CO_2 concentrations**
- **Use Delta Ray™ to measure $^{12}CO_2$ to $^{13}CO_2$**

Hydroponic Design

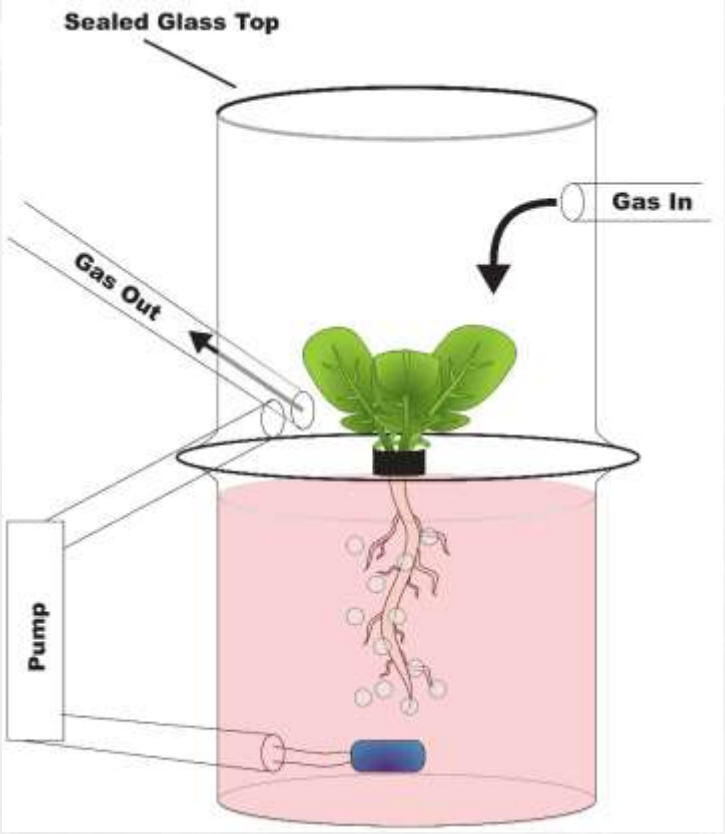


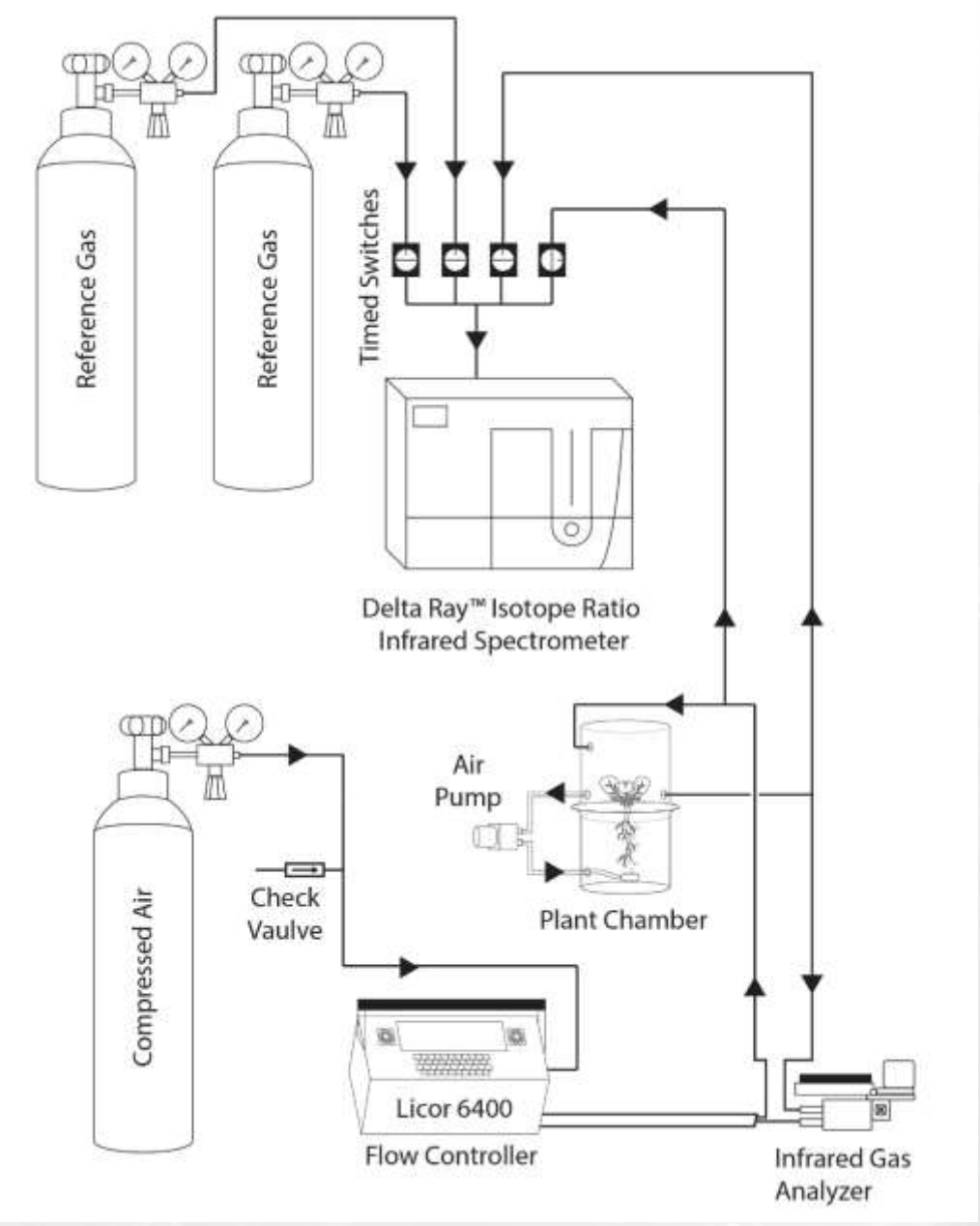
Plant Chamber

- Completely sealed
- Allows for air flow across plant

Plant Chamber

Plant Chamber




Reference Gas
Reference Gas
Timed Switches
Delta Ray™ Isotope Ratio
Infrared Spectrometer
Air
Pump
Plant Chamber
Compressed Air
Check
Vaulve
Licor 6400
Flow Controller
Infrared Gas
Analyzer

Methods

$^{13}C + {}^{12}C$
Starting
Air

+

$^{13}C + {}^{12}C$
Started
Plant

=

$^{13}C + {}^{12}C$
Product
Air

+

$^{13}C + {}^{12}C$
Assimilated
in
Plant

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