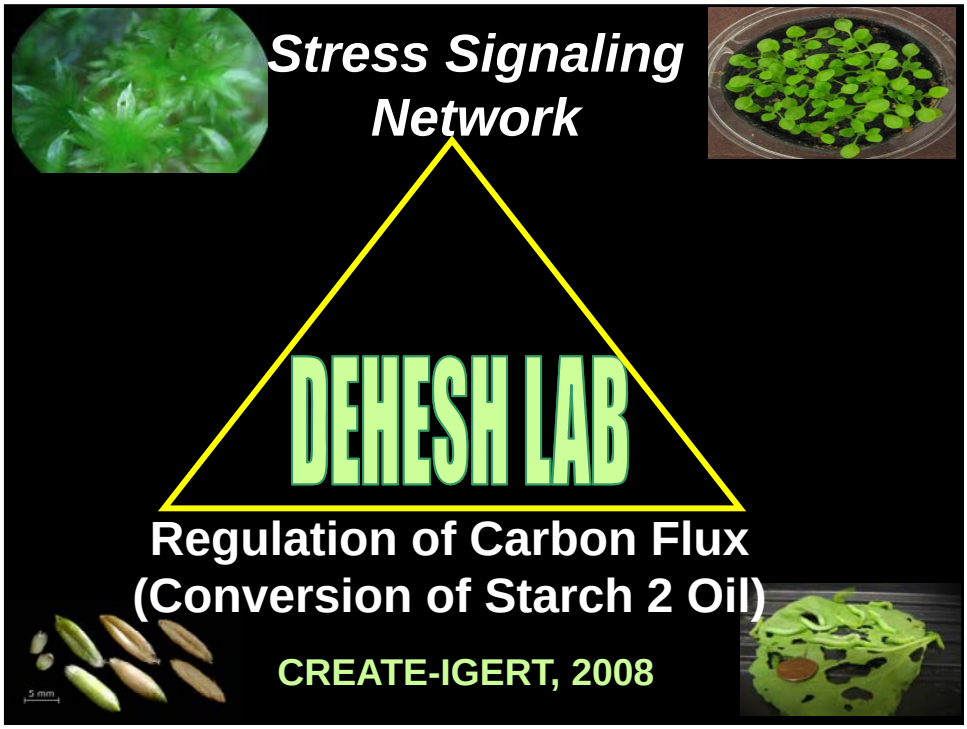
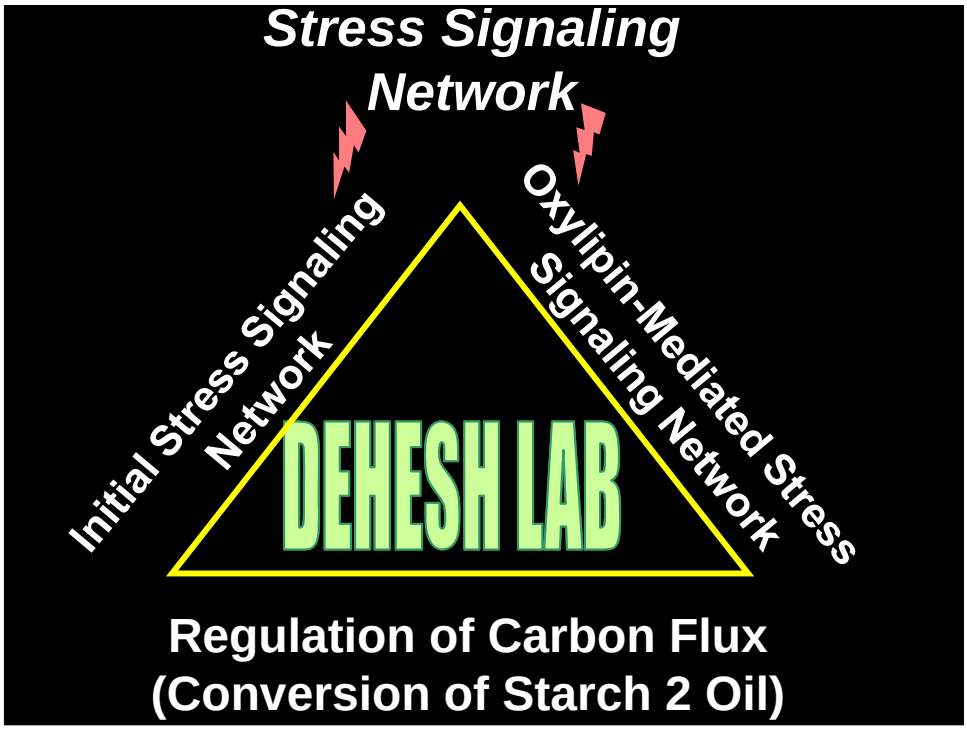
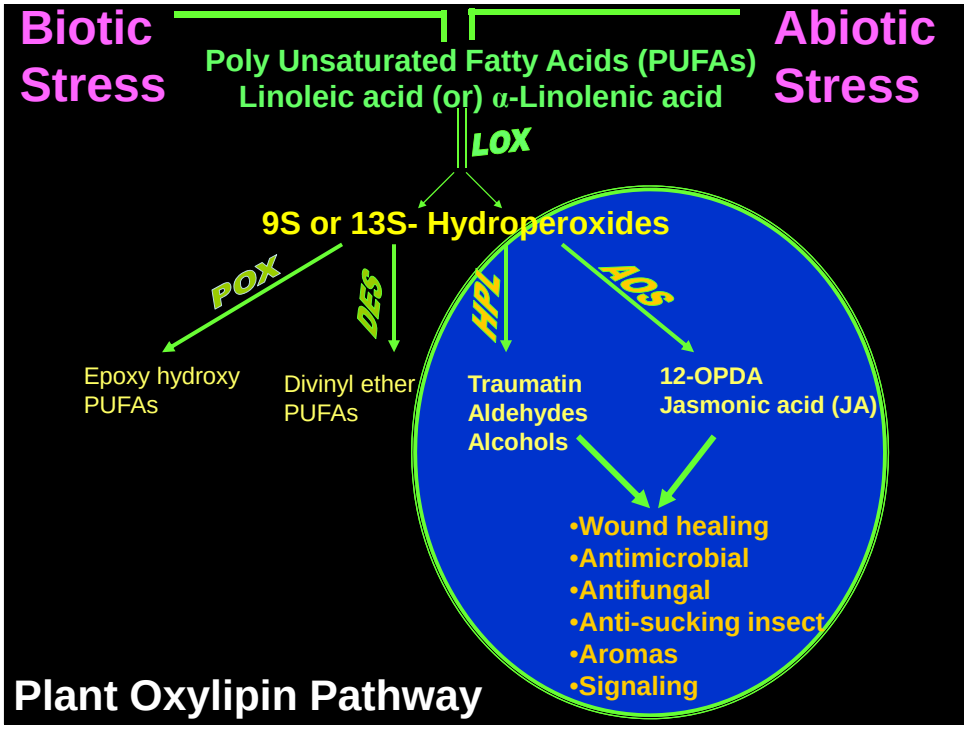
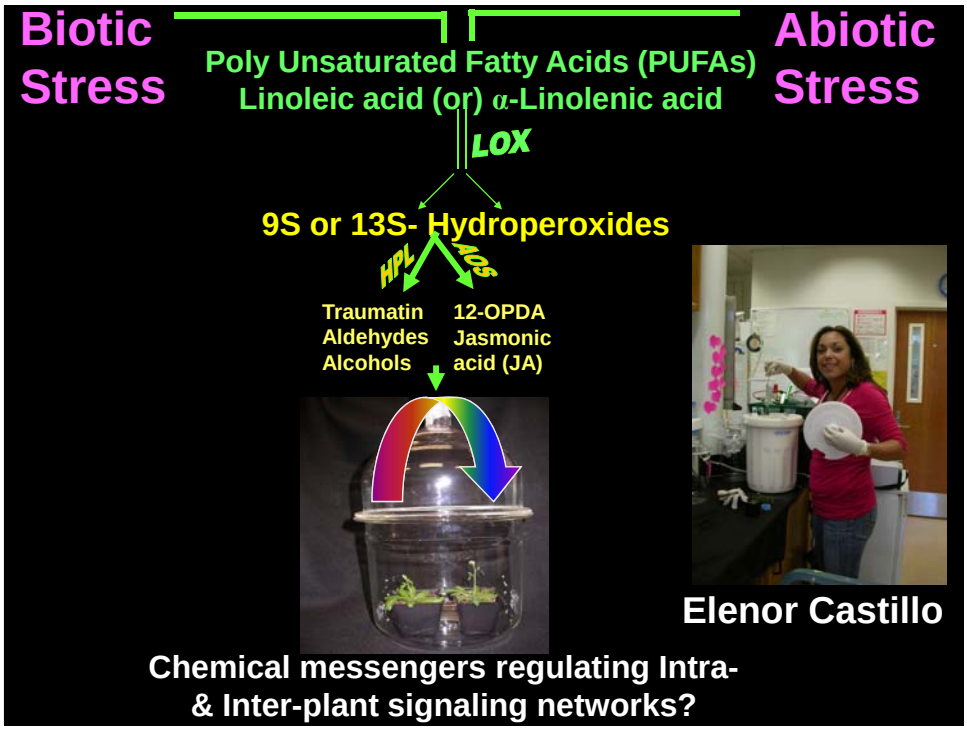

Stress Signaling Network
DEHESH LAB
Regulation of Carbon Flux
(Conversion of Starch 2 Oil)
CREATE-IGERT, 2008


Stress Signaling Network
Initial Stress Signaling Network
Oxylipin-Mediated Stress Signaling Network
DEHESH LAB
Regulation of Carbon Flux
(Conversion of Starch 2 Oil)


Biotic Stress
Poly Unsaturated Fatty Acids (PUFAs)
Linoleic acid (or) α-Linolenic acid
Abiotic Stress
LOX
9S or 13S- Hydroperoxides
POX
DES
HPL
AOS
Epoxy hydroxy PUFAs
Divinyl ether PUFAs
Traumatin
Aldehydes
Alcohols
12-OPDA
Jasmonic acid (JA)
•Wound healing
•Antimicrobial
•Antifungal
•Anti-sucking insect
•Aromas
•Signaling
Plant Oxylipin Pathway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Jasmonic acid (JA)
Elenor Castillo
Chemical messengers regulating Intra- & Inter-plant signaling networks?

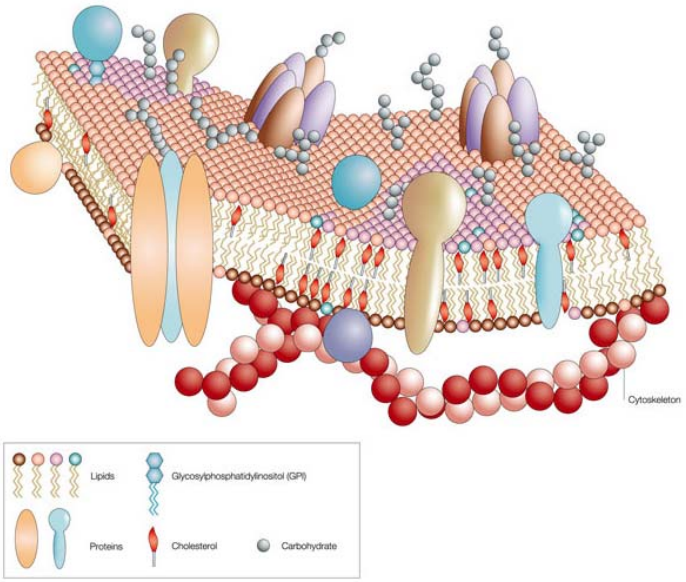
HPL-derived Metabolites as a Vehicle for Production of Superior Stress Tolerant Plants

Elenor Castillo

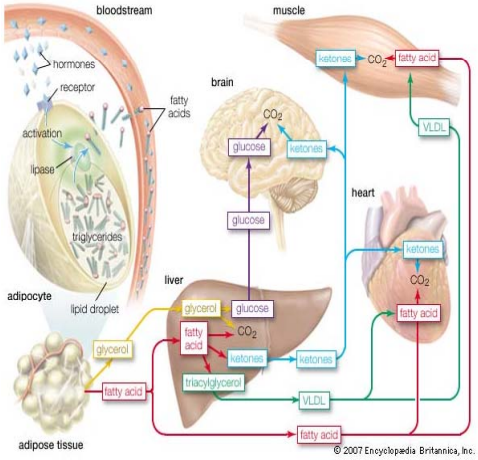
Plant Biology
University of California, Davis
Dehesh Lab

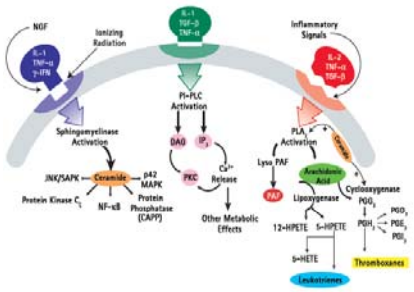
IGERT SYNPOSIUM
October 16, 2008

Membrane Lipids



Fatty Acids-mediated signaling in Human





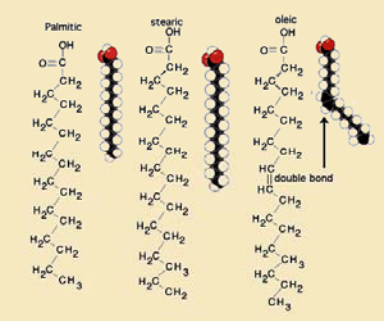
Stress Induces the Production of Oxygenated Free Fatty Acids in Plants

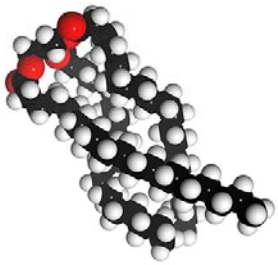
Insects

Wounding

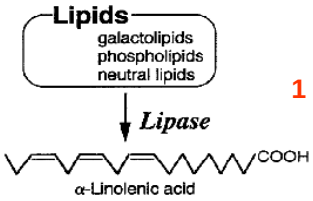
Pathogens

Plant Stress Responses Via Oxidation of Free Fatty Acids Derived from Membranes



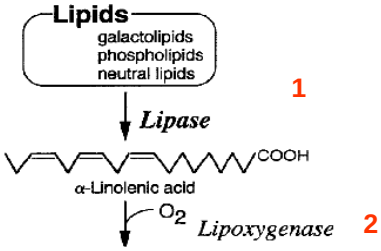


Oxylipin Pathway



1

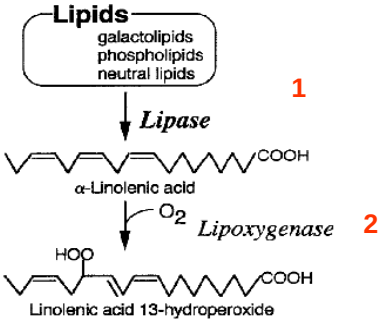
Oxylipin Pathway



1

2

Oxylipin Pathway

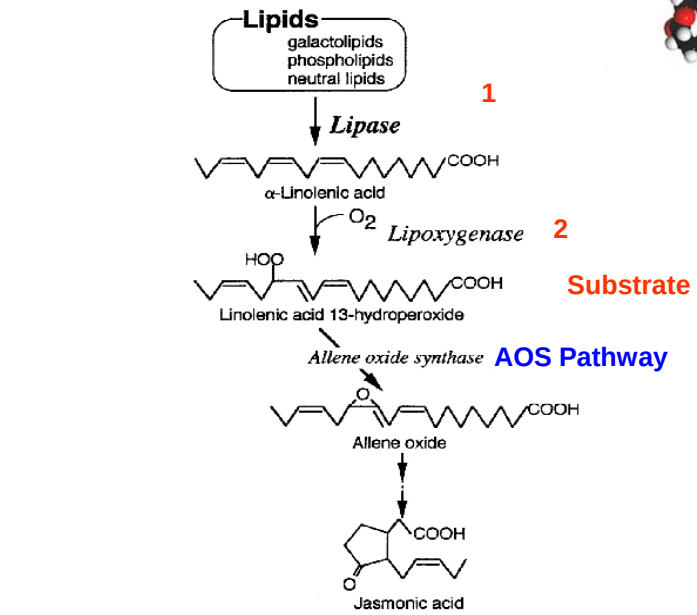


1

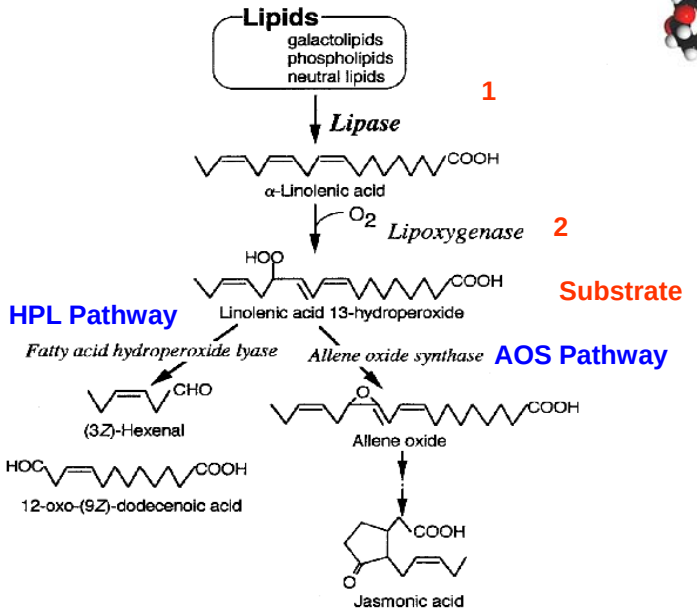
2

Substrate

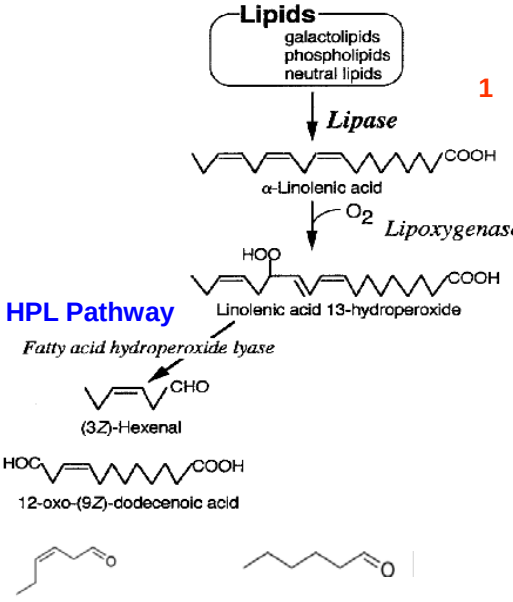
Oxylipin Pathway



Oxylipin Pathway

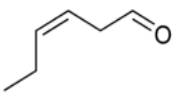


Oxylipin Pathway

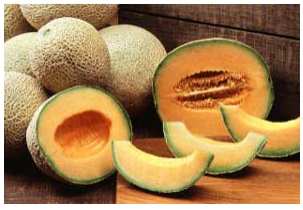


Hexenal is the Predominant HPL-Derived Metabolite

- Hydroperoxide Lyase Pathway (HPL)
- Chemical Focus:

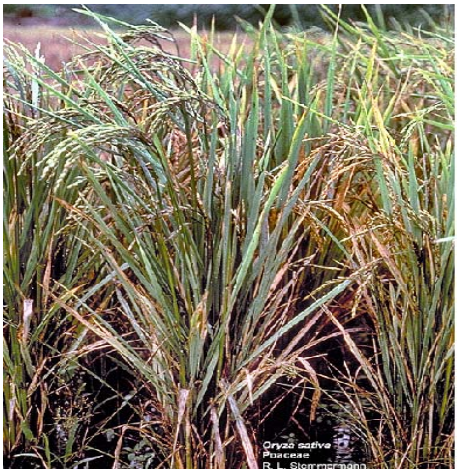


Hexenal



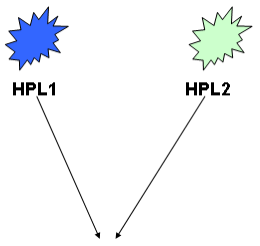
Model Organisms of choice

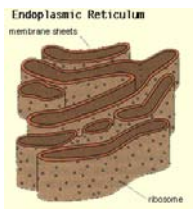
Oryza sativa ***Arabidopsis thaliana***

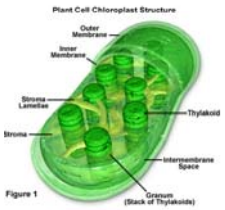


Model Organism
Oryza sativa

OsHPLs (1,2,3)

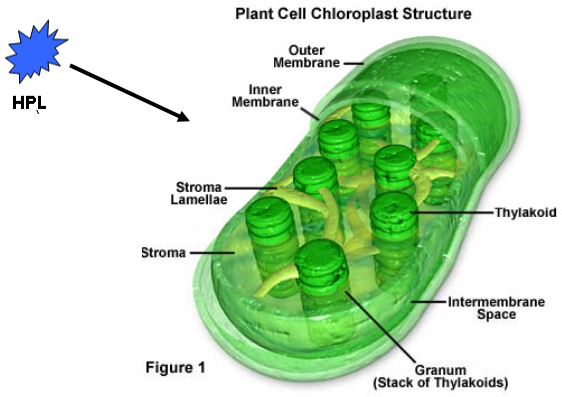






Model Organism
Arabidopsis

AtHPL



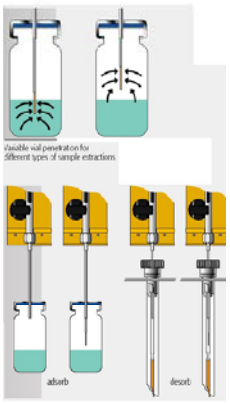
Model Organism
Arabidopsis
Genotypes

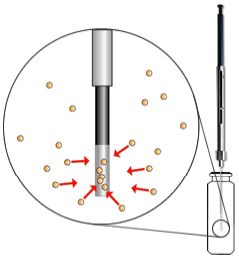
- ***Col-0:*** **a natural *hpl* mutant**
- ***Pro$_{HPL}$:HPL***
- ***Pro$_{AOS}$:AOS***
- ***ProHPL:HPL+ProAOS:AOS***

Analysis of Hexenal Levels

- Wounded vs Un-wounded
- GC/MS:
  Aldehyde Analysis
- Hexenal Levels

Extraction Method

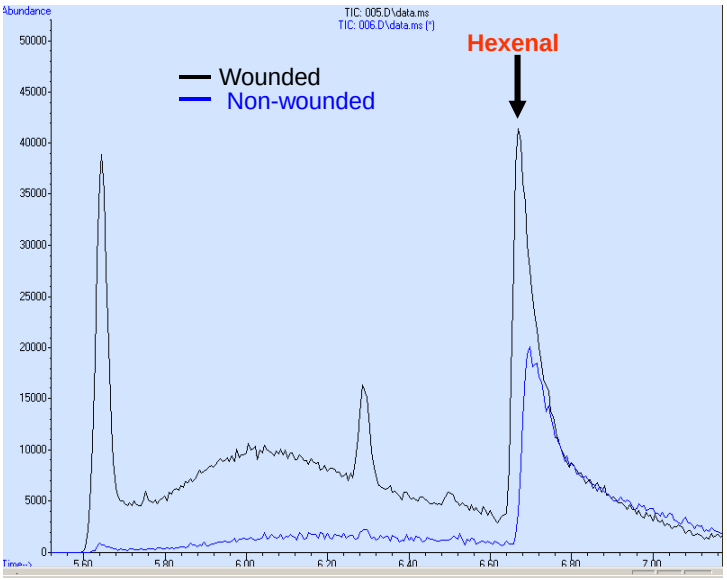




Solid Phase Micro-Liquid Extraction (SPME)

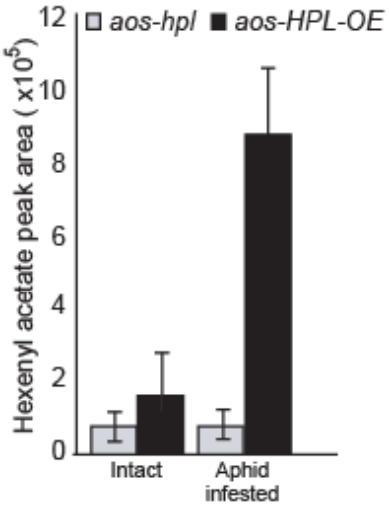
Gas Chromatography Mass Spectrometry (GC/MS)

Pro_{HPL}:HPL



Retention Time (min)

Aphid Infestation Induces Hexenal-acetate



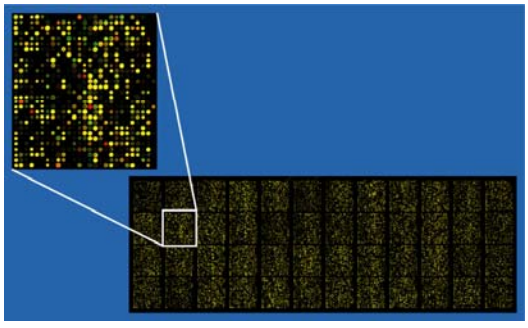
Aphidius colemani: Emerging

The C_6 aldehydes; hexenyl acetate are the predominant wound-inducible volatile signal that mediates indirect defense responses by directing tritrophic (plant-herbivore-natural enemy) interactions.

Wasp Figures From: [illegible] ; Dr. W. Joe Lewis, USDA-ARS

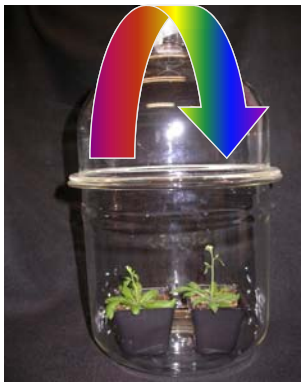
Proposal Objective #1: Intra-Signaling

- Examine the endogenous levels of the C_6 Aldehydes
- Intra-signaling mechanisms:
  - Global transcriptional profiling using microarray analysis

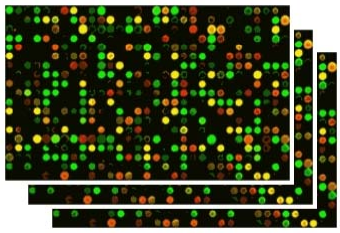


Proposal Objective #2:
Inter-Signaling

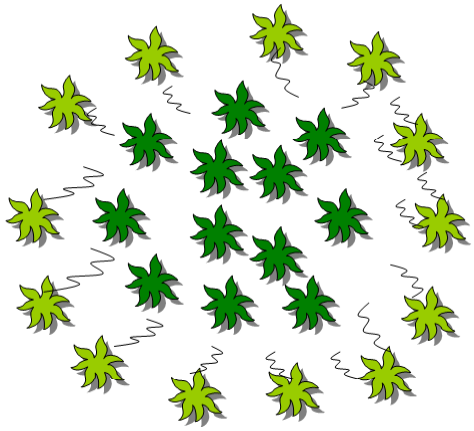
- Plant-Plant Crosstalk Analysis:



- Micro-array analysis



Broader Impact



Non-crop GMO vegetations producing hexenal as a chemical signal to alert (predispose) surrounding crop plants to environmental challenges.

Dehesh Lab

Katie Dehesh

Tanya

National Science Foundation
DGE- 0653984

Thank you!

Designated Emphasis in Biotechnology
University of California, Davis

University of California, Davis
Office of Graduate Studies
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SUMMER PROGRAM

QUESTIONS?