



UMR 1253 STLO  
Science & Technology of Milk and Eggs  
*Bioactivity & Nutrition*

# The Hypotriglyceridemic Effect of Sciadonic Acid is Mediated by the Inhibition of $\Delta 9$ -Desaturase Expression and Activity

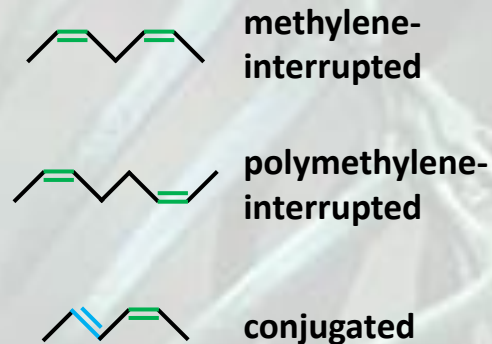
*Frédérique Pédrone*



Valencia May 24-25<sup>th</sup> 2018

# Sciadonic acid : a $\Delta^5$ -olefinic acid

## Double bonds

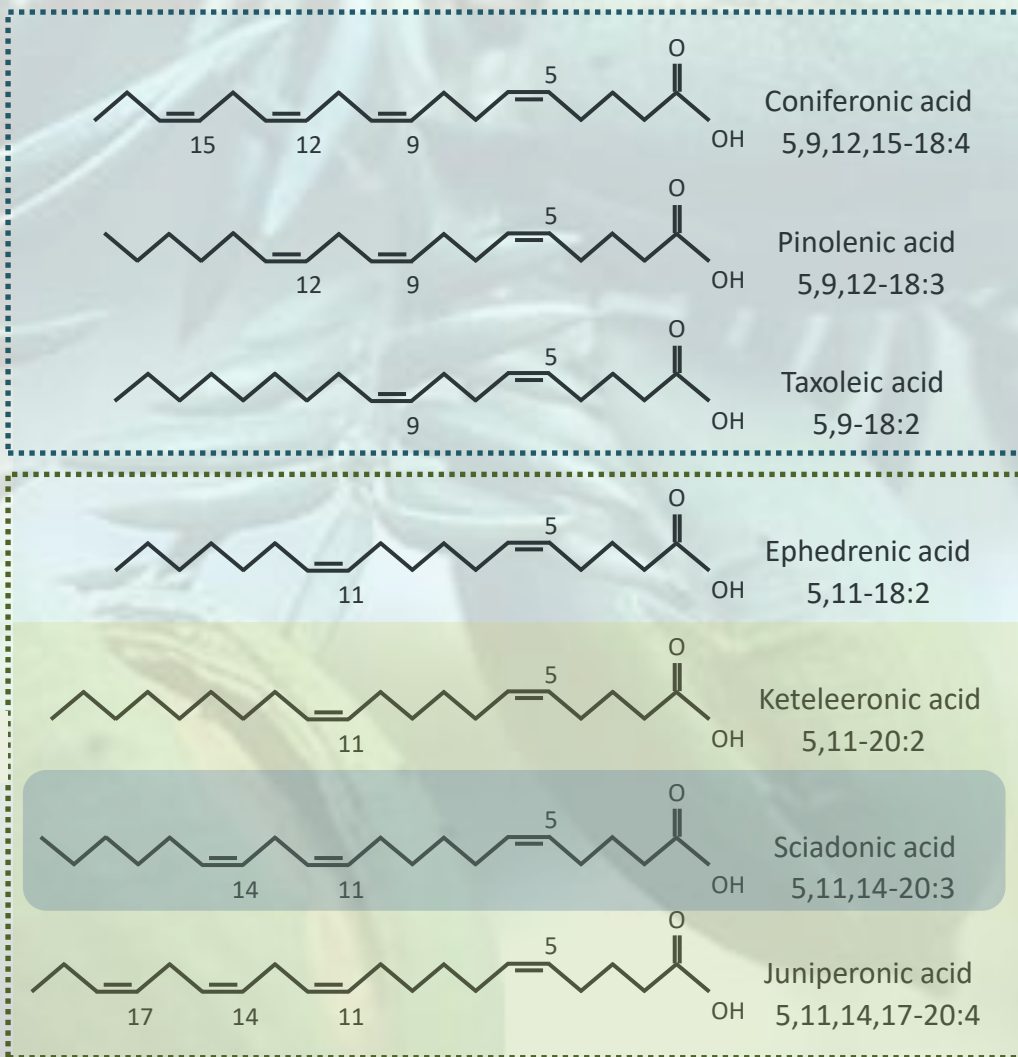


## Gymnosperms



$\Delta^5,9$

$\Delta^5,11$



C18

C20

# Sciadonic acid : a $\Delta^5$ -olefinic acid

Slime moulds : Myxomycetes

Scia 0.5% of total FA



*Trichia favoginea*



*Trichia varia*

Rezanka *Phytochem* 1993

5,9-16:2  
5,13-20:2

Sponges

Marine invertebrates

Scia < 0.5% of total FA



*Mytilus galloprovincialis*



*Patinopecten yessoensis*

Barnathan *Biochimie* 2009

5,13-20:2  
5,13,16-20:3  
5,14,17-20:3  
5,13,16,19-20:4  
5,9-26:2  
5,9,19-26:3  
5,9,21-28:3  
5,9,21-30:3  
5,9,23-30:3  
5,9,25-30:3

Rat milk

Scia 0.1% of total FA



# Sciadonic acid : biological activity

## *In vivo*

Modulation of hepatic enzymes

FA *de novo* synthesis

FA oxidation

Serum and Liver TAG



Endo et al *Nutrition* 2006

Endo et al *Biosci Biotech Biochem* 2007

Endo et al *Biosci Biotech Biochem* 2009

## *In vitro*

Scia incorporation



↘ 20:4n-6 esterification in PL

→ 16:2n-6

*peroxisome*

→ 18:2n-6

*microsome*

Tanaka et al *Eur J Biochem* 2001

Tanaka et al *FEBS J* 2007

Tanaka et al *Lipids* 2014

## *In vitro*

Scia incorporation



Anti-inflammation

↘ PGE<sub>2</sub>, NO, TNF $\alpha$ , COX2

epithelial & microglial cells, macrophages

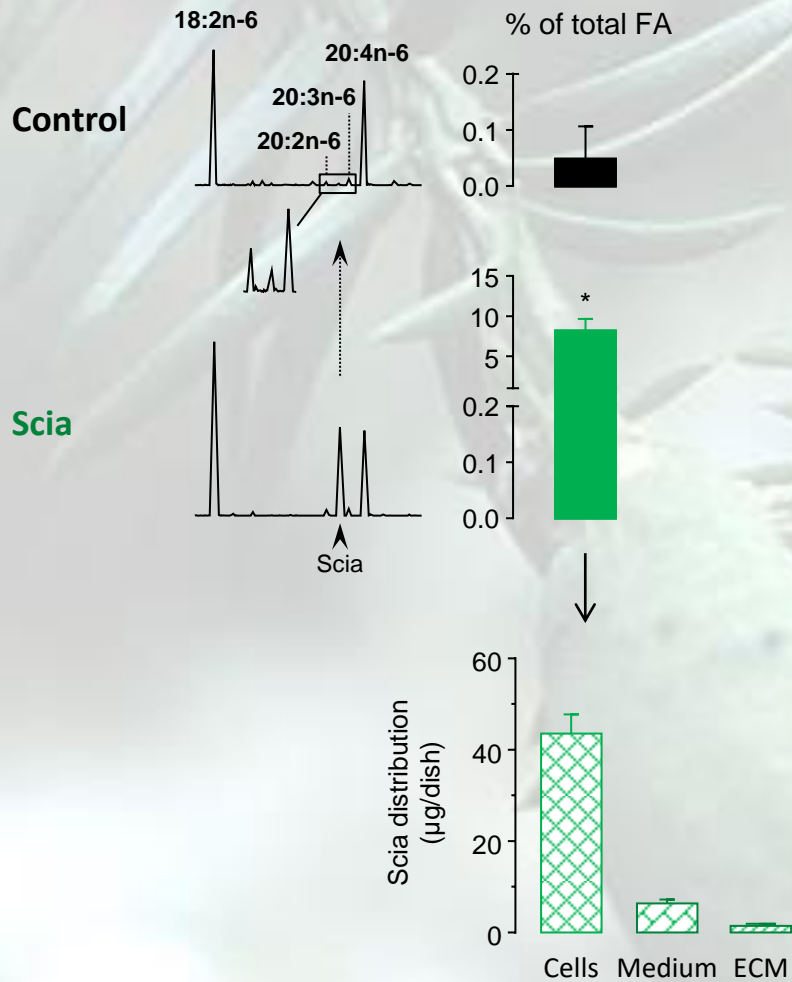
Chen et al *Inflammation* 2012

Chen et al *Food Chem Toxicol* 2012

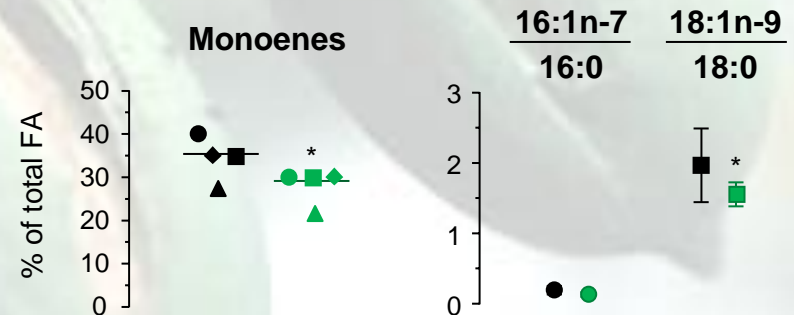
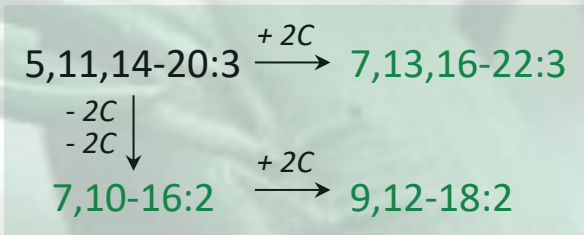
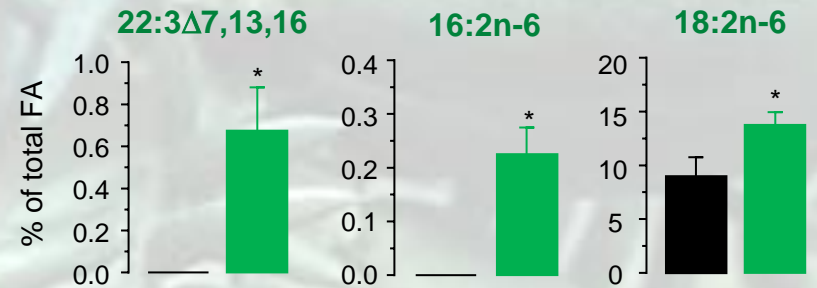
Ells et al *Prostaglandins Other Lipid Med* 2012

# Sciadonic acid : FA metabolism in rat primary hepatocytes

## Sciadonic acid incorporation in hepatocytes

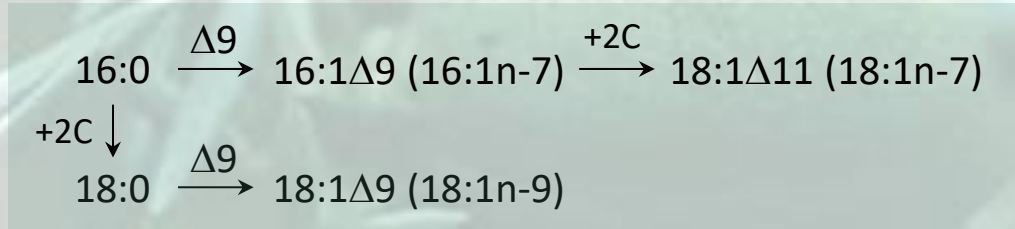
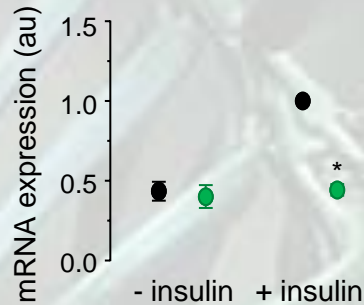


## Sciadonic acid metabolism in hepatocytes

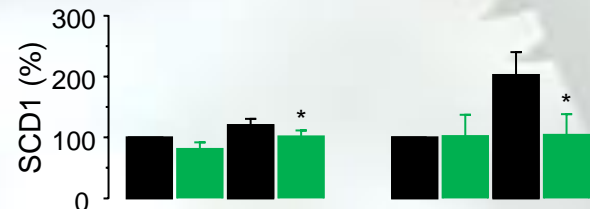
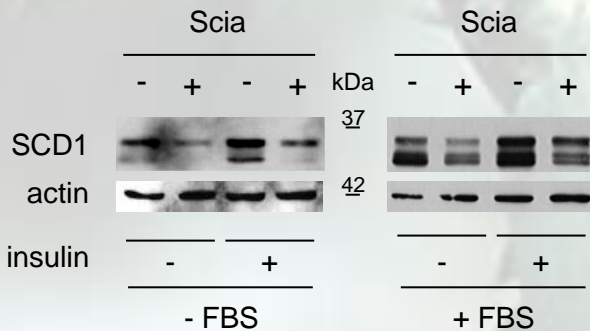


# Sciadonic acid : monoene synthesis in rat primary hepatocytes

## Gene expression of *Scd1*

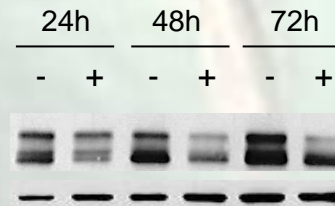


## Protein expression of SCD1



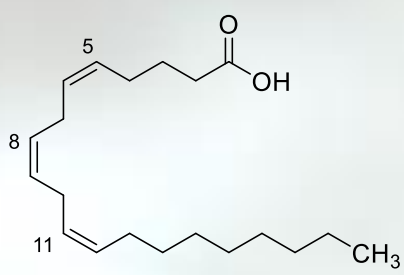
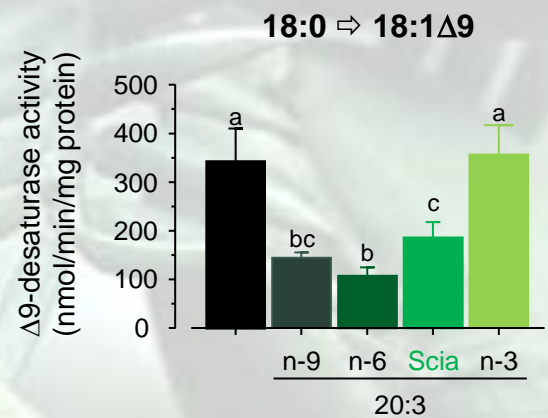
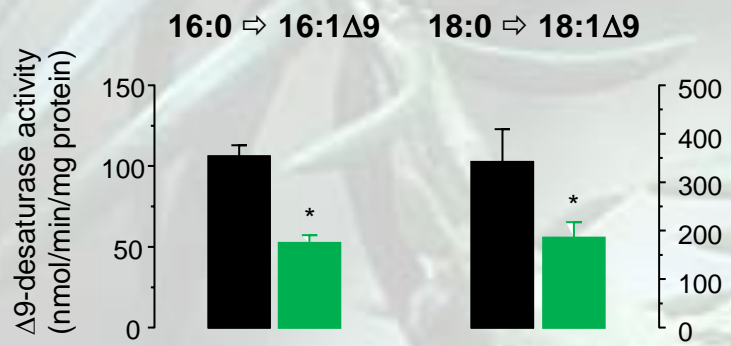
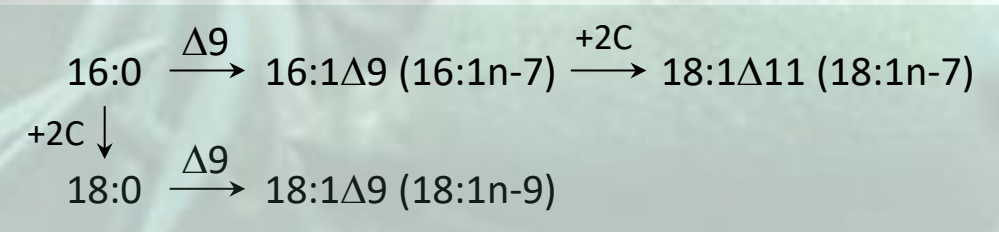
## Other FA synthesis genes

- ↔ *Acc* (AcetylCoA Carboxylase) acetylCoA → malonylCoA
- ↔ *Fasn* (FA Synthase) malonylCoA →→ 16:0
- ↘ *Elovl6* (Elongase 6) 16:0 → 18:0
- ↘ *Fads1 & Fads2* ( $\Delta 5$ - &  $\Delta 6$ -desaturases)

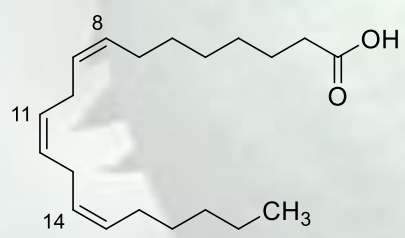


# Sciadonic acid : D9-desaturase activity measured with rat hepatic microsomes

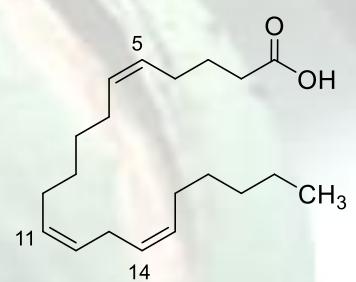
◦ *In vitro* activity of  $\Delta 9$ -desaturase



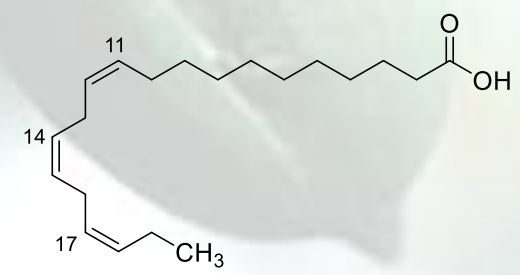
20:3n-9



20:3n-6



Sciadonic acid

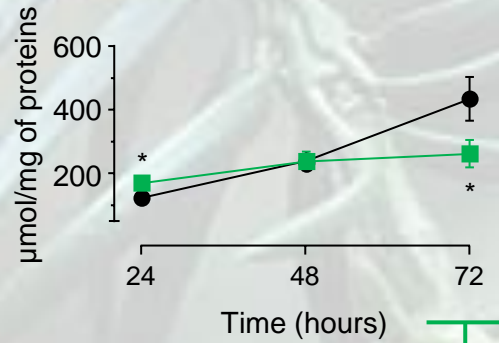


20:3n-3

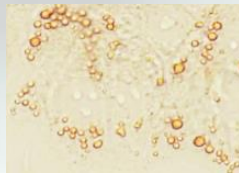
# Sciadonic acid : triacylglycerols synthesis and secretion in rat primary hepatocytes

## ◦ Triacylglycerol synthesis

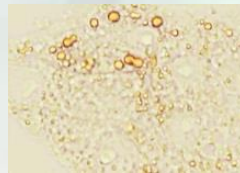
### Triacylglycerols in hepatocytes



Control

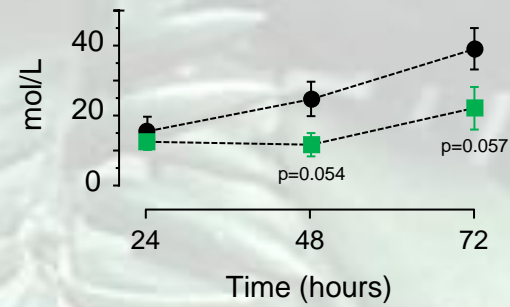


Scia

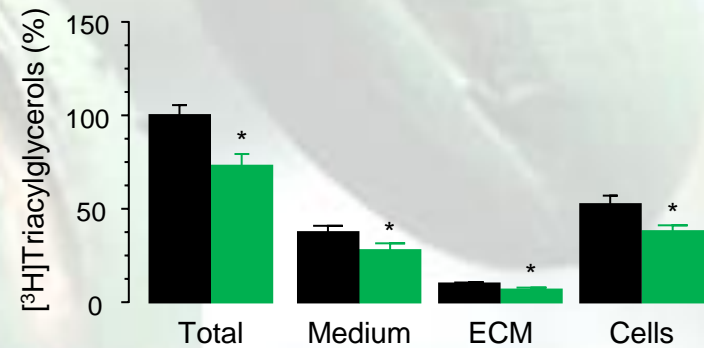


## ◦ Triacylglycerol secretion

### Triacylglycerols in culture medium



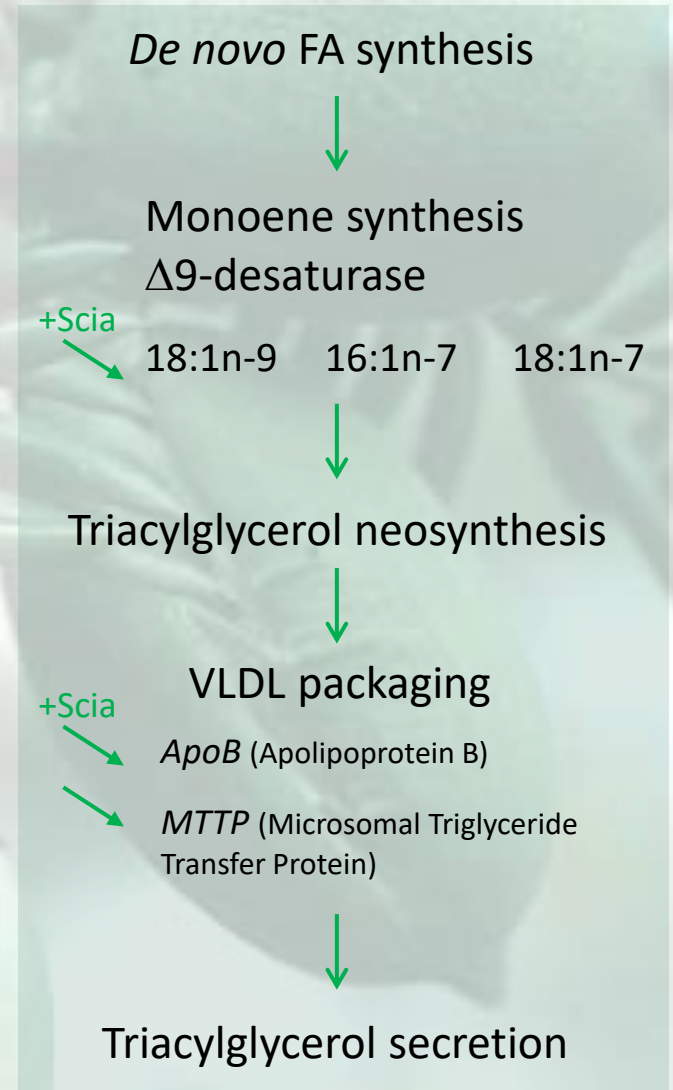
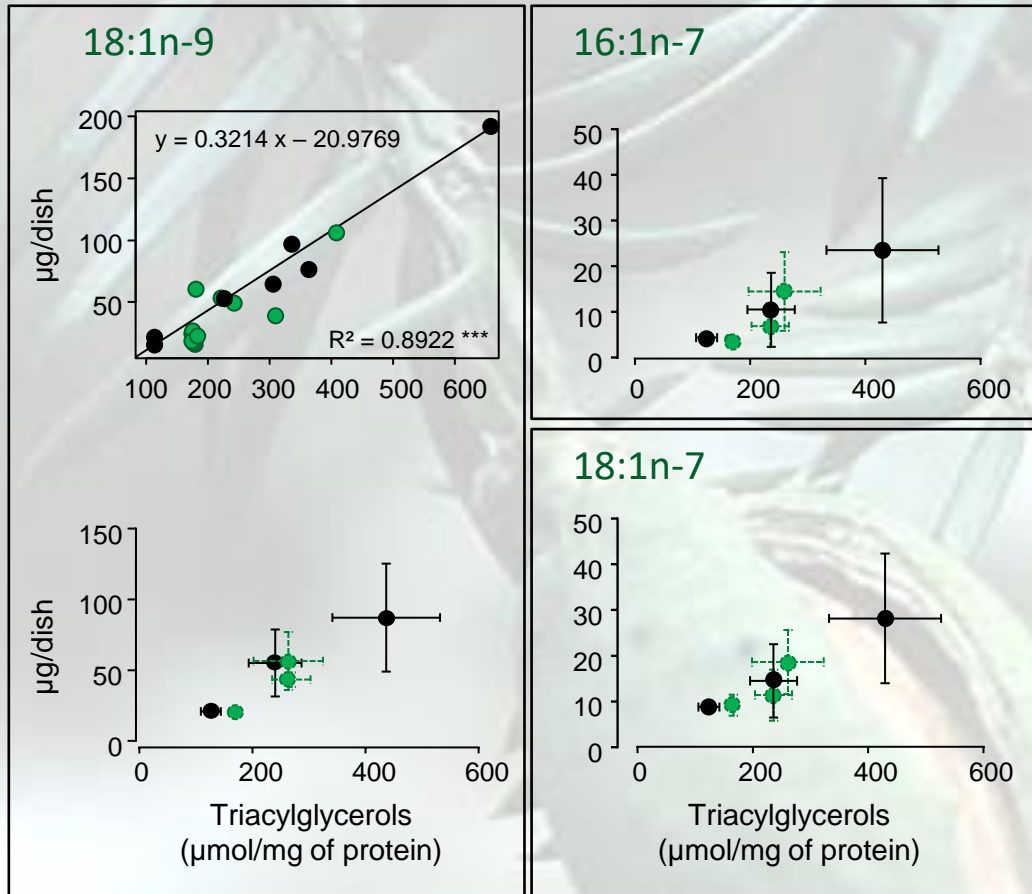
## ◦ [<sup>3</sup>H] Triacylglycerol synthesis and secretion





# Sciadonic acid : triacylglycerol versus monoenes in rat primary hepatocytes

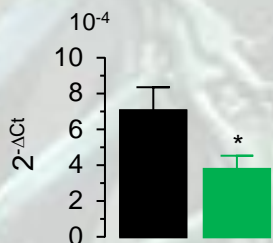
## ◦ Triacylglycerols and monoenes in hepatocytes



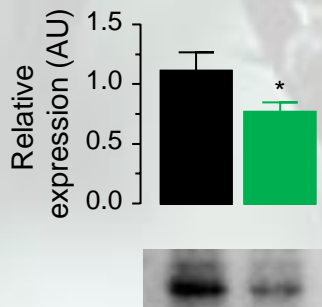
# Sciadonic acid in vivo

◦ Sciadonic acid *in vivo*

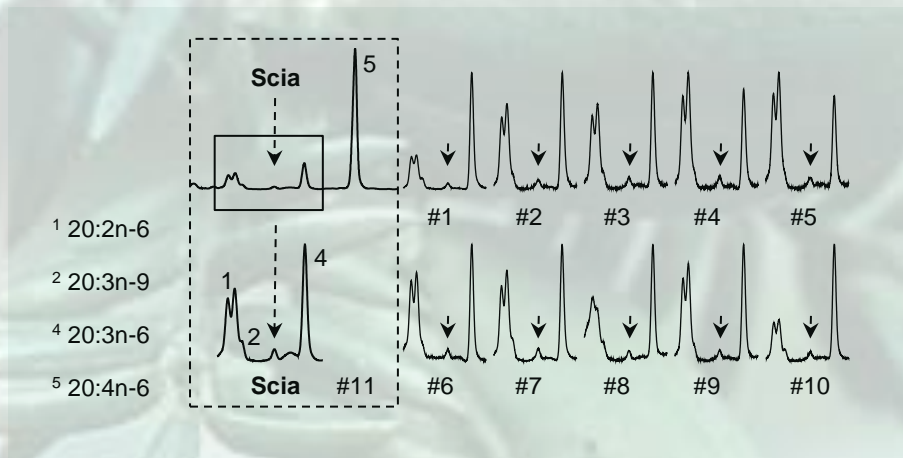
Gene expression of *Scd1*



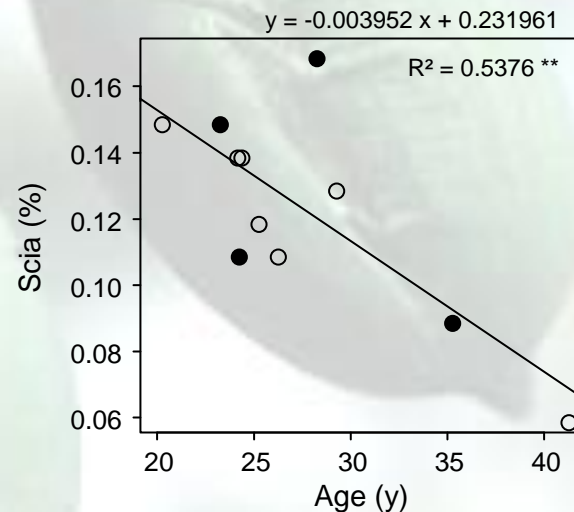
Protein expression of SCD1



◦ Sciadonic acid in the human serum



○ female  
● male



# Contributions

*Many thanks to*



Nathalie Boulier-Monthéan  
Françoise Boissel  
Jordane Osmond  
Françoise Lohézic-Le Dévéhat



Gildas Breton



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# Pine Nut Syndrome

**Dysgeusia of Pine mouth (bitter or metallic taste in the mouth)**

Involvement of *Pinus Armandii*

Destallats et al *J Toxicol* 2011

**Dysgeusia following consumption of pine nuts:  
more than 3000 cases in France.**

Flesch et al *Clin Toxicol* 2011

*Traditionnal pine nuts from*

*P. pinea*

*P. sibirica*

*P. koraiensis*

*P. gerardiana.*



# Sciadonic acid in vivo

## ◦ Sciadonic acid in rat tissues

