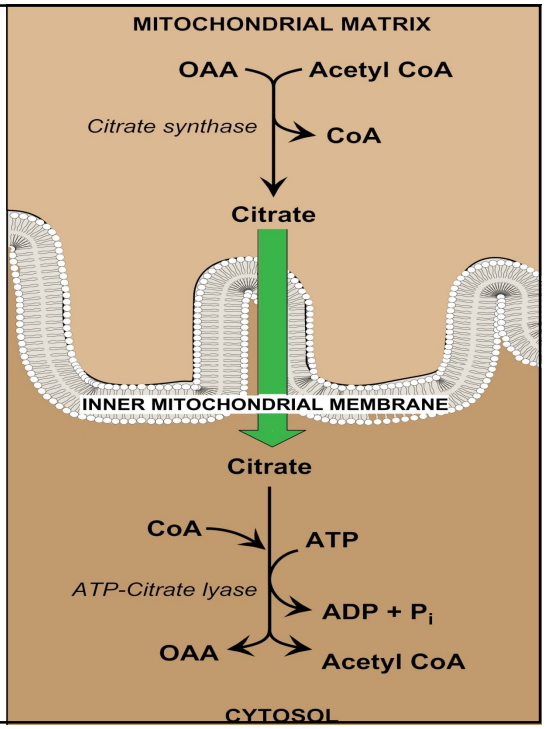
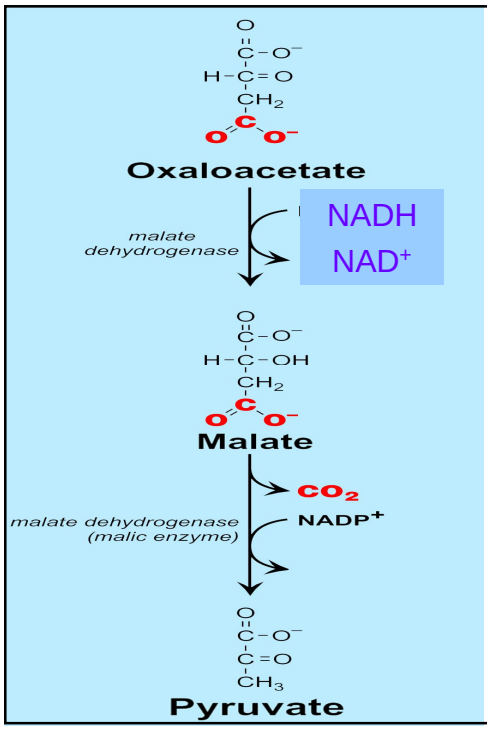
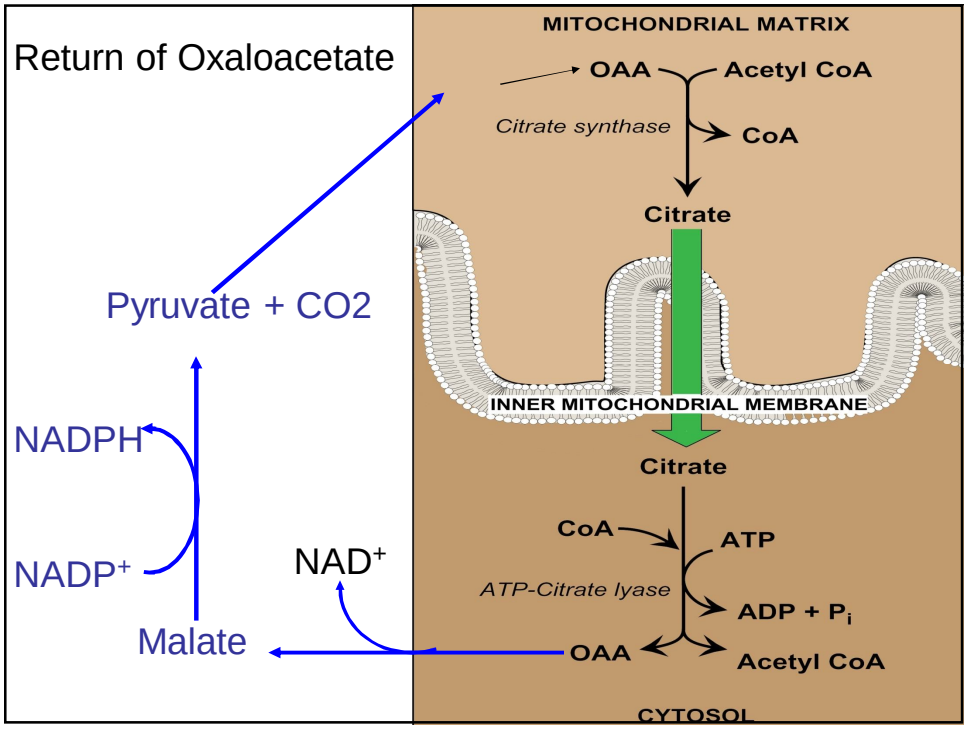
# Production of Cytosolic Acetyl CoA for FA Synthesis

Inner mitochondrial membrane is immpermiable to Acetyl CoA






# Regulation of FA Oxidation & Synthesis

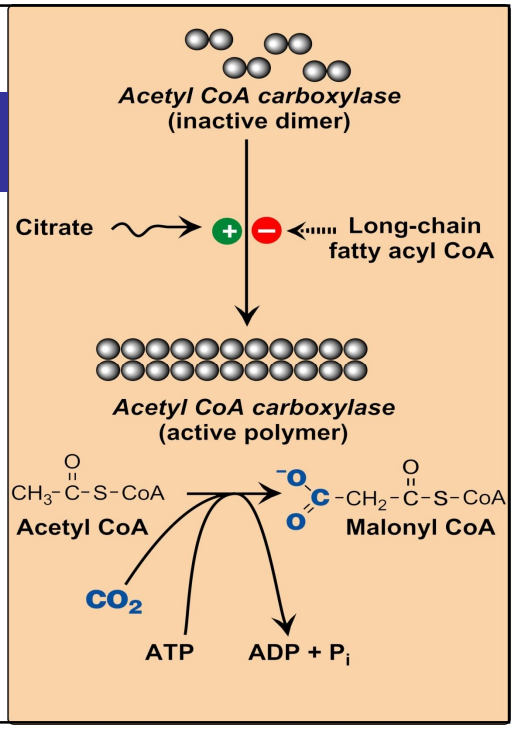
**OXIDATION**

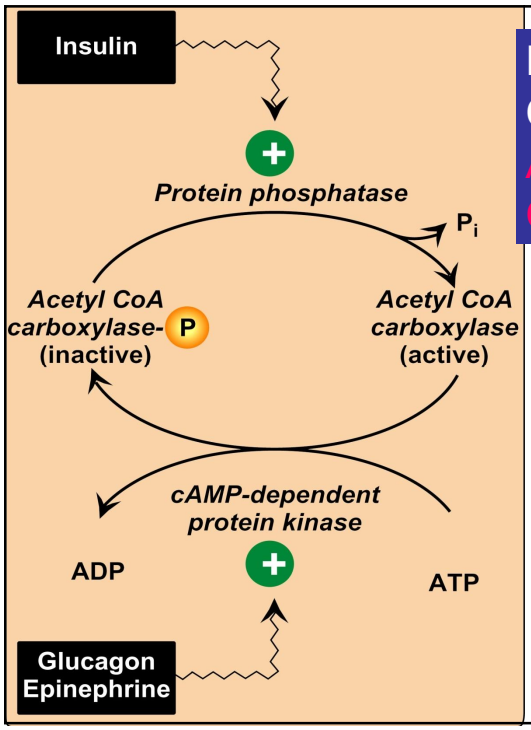
- **Supply of Fatty Acids**
  **-Hormonal Control**
- **Entry into Mitochondria**
- **Availability of $NAD^+$**

**SYNTHESIS**

- **Regulation of AcCoA Carboxylase**
  **-Allosteric Mechanism**
  **- Phosphorylation**
- **Amounts of Enzymes**

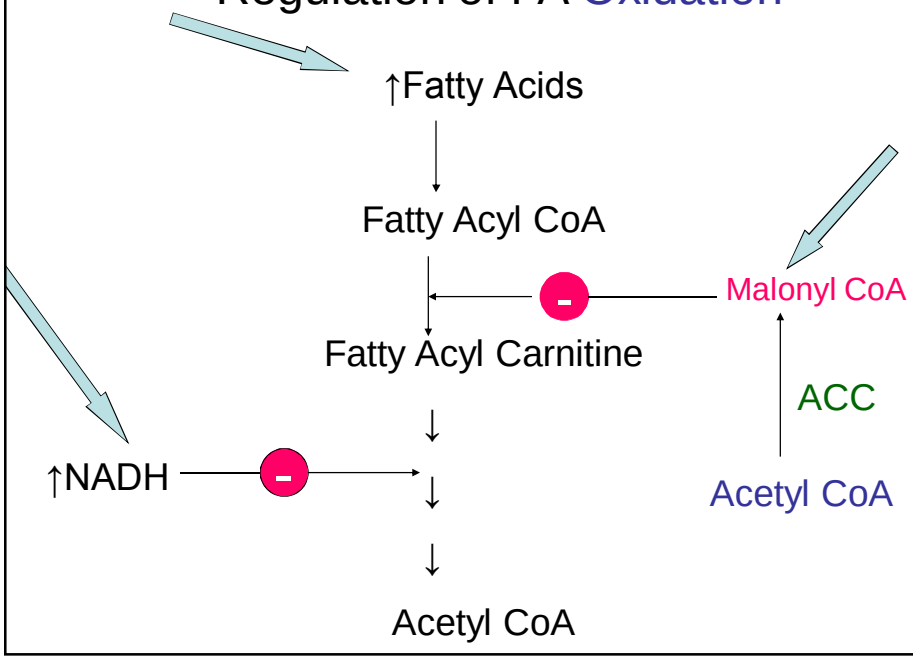
## Allosteric Regulation of Acetyl CoA Carboxylase




## Hormone-Mediated, Covalent Regulation of Acetyl CoA Carboxylase ACC

## Regulation of FA Oxidation




## Elongation of Fatty Acids

-in Endoplasmic Reticulum
- Similar Sequence of Reactions
- Different Enzymes

Malonyl CoA + Acyl $CoA_{(n)}$

↓

↓ 2NADPH + $H^+$

↓

↓ $2NADP^+$

Acyl CoA (n+2)

n = 16 or more carbons

Elongation of Fatty Acids
in Mitochondria

Acetyl CoA + Acyl CoA (n)

↓↑

↓↑ NADH + H+

↓↑ NAD+

NADPH

NADP+

Acyl CoA (n+2)

n = less than16 carbons

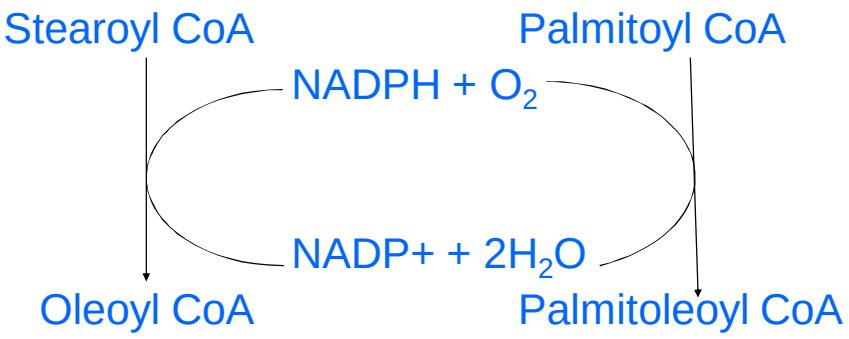
# Introduction of Double Bonds

- Synthesis of Monounsaturated FA

  - Oleic Acid 18:$\Delta^9$
  - Palmitoleic 16:$\Delta^9$

- In endoplasmic reticulum
- No double bond can be introduced beyond carbon 9 in human

## Introduction of Double Bonds (Cont.)




$\Delta^9$ Desaturase; Cytochrome $b_5$

## Introduction of Double Bonds (Cont.)

Formation and Modification of Polyunsaturated FA

-Elongation

- Desaturation

Additional double bonds can be introduced by:

$\Delta^4$ Desaturase

$\Delta^5$ Desaturase

$\Delta^6$ Desaturase

## Modification of Polyunsaturated FA

Linoleic $18:2\Delta^{9,12}$

↓ Desaturation

$18:3\Delta^{6,9,12}$ ω ?

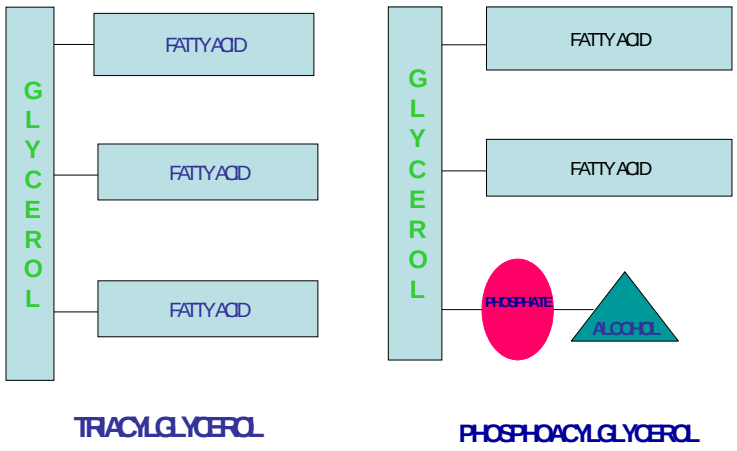
↓ Elongation

$20:3\Delta^{8,11,14}$ ω ?

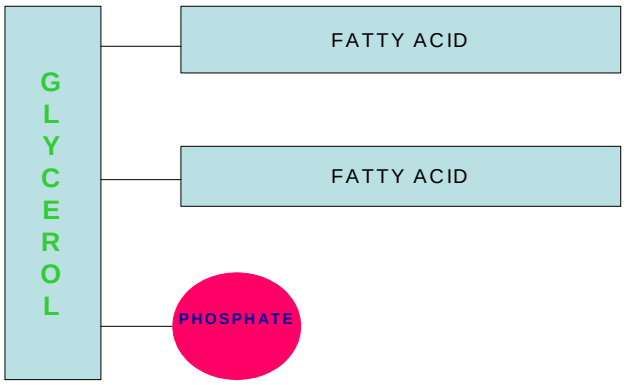
↓ Desaturation

$20:4\Delta^{5,8,11,14}$ ω ? Arachidonic

## Biosynthesis of Triacylglycerol & Phosphoacylglycerol



## Phosphotadic Acid is Common Intermediate




**PHOSPHOACYLGLYCEROL**

## Biosynthesis of Triacylglycerol

Requires

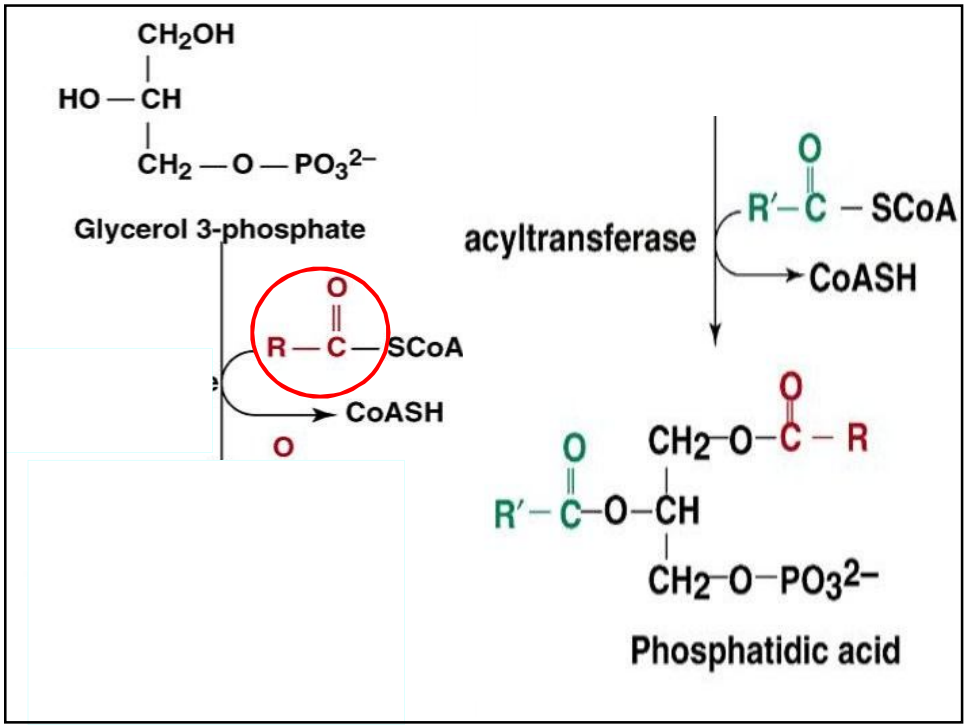
- Acyl~CoA (Active form of FA)
- Glycerol Phosphate

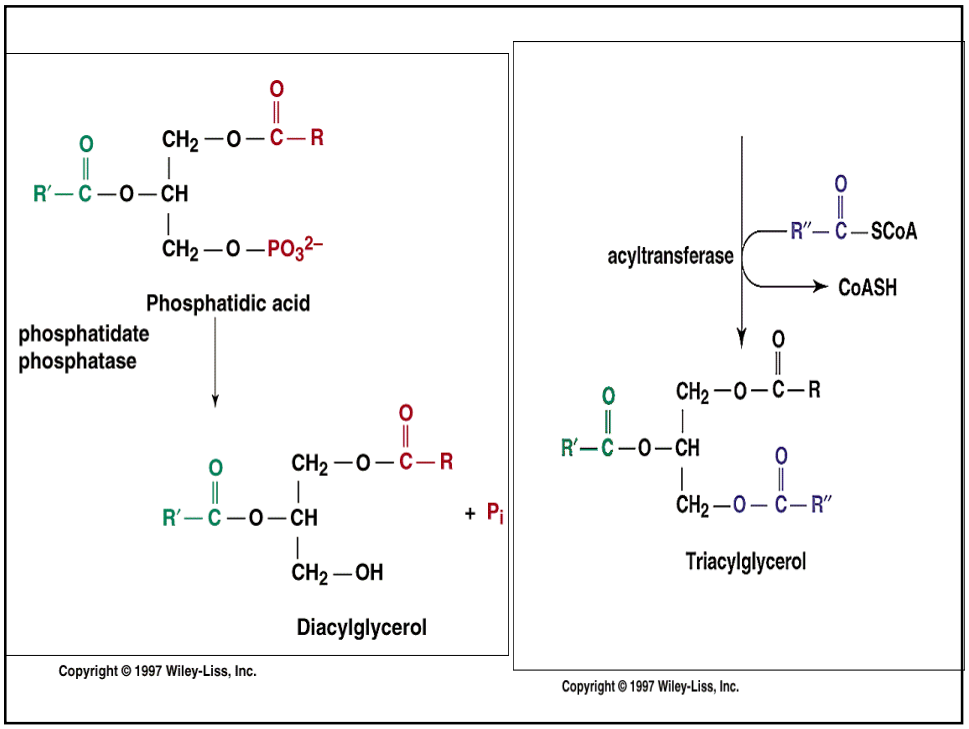
Why Active form?

$TAG + H_2O \longrightarrow DAG + FA \quad \Delta G$ –ve

$DAG + FA \longrightarrow TAG + H_2O \quad \Delta G$ +ve

$DAG + Acyl\sim CoA \longrightarrow TAG \quad \Delta G$ –ve



# Production of Glycerol Phosphate

- Glycerol + ATP ---→ Glycerol 3 Phosphate

Enz: Glycerol Kinase

Not in Adipose tissue