**CONCEPT:** FATTY ACID OXIDATION

● Fats are used for energy and water storage, and can be broken down into glycerol and fatty acids

    □ Glycerol can be converted to DHAP (G3P) to enter glycolysis; yields 1 ATP and 2 NADH (nonfermentable sugar)

    □ Fatty acids undergo ß-oxidation to enter the Citric Acid Cycle as acetyl-CoA (or succinyl-CoA in some cases)

        - Fatty acids are activated by converting them to fatty acyl-CoA (costs "2 ATP", or 2 acid anhydride bonds)

        - Transported into mitochondrial matrix bound to carnitine via antiporter that moves carnitine into cytosol

        - Carnityl acyl transferase I attaches carnitine to fatty acyl-CoA and carnityl acyl transferase II removes it

CYTOSOL   MATRIX
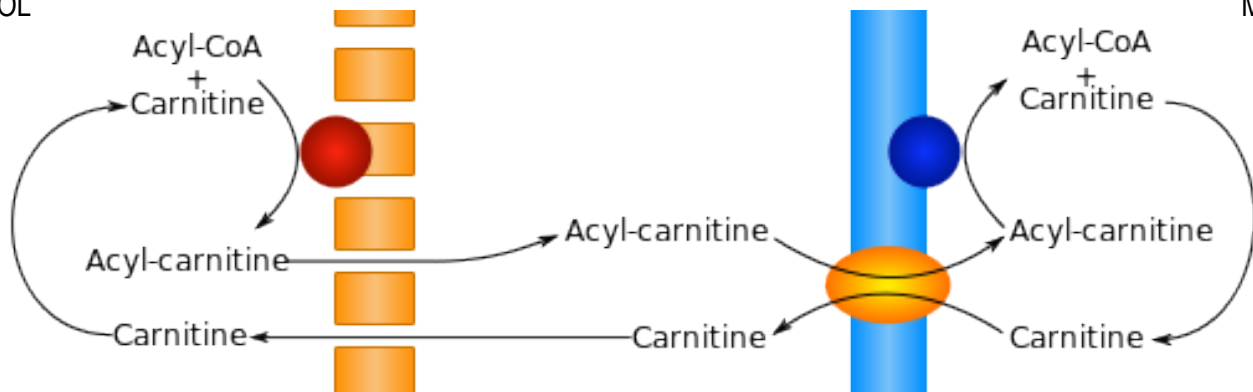
● ß-Oxidation – removes 2 carbon units at a time, as acetyl-CoA, from fatty-acyl-CoA; occurs in mitochondrial matrix

    1. Oxidation of an –ane to –ene (acyl-CoA dehydrogenase); FAD→FADH$_2$, like succinate dehydrogenase

    2. Add water to –ene to form alcohol (enoyl-CoA hydratase); like fumarate to malate

    3. Oxidize alcohol (beta-hydroxyacyl-CoA dehydrogenase); NAD$^+$→NADH, like malate dehydrogenase

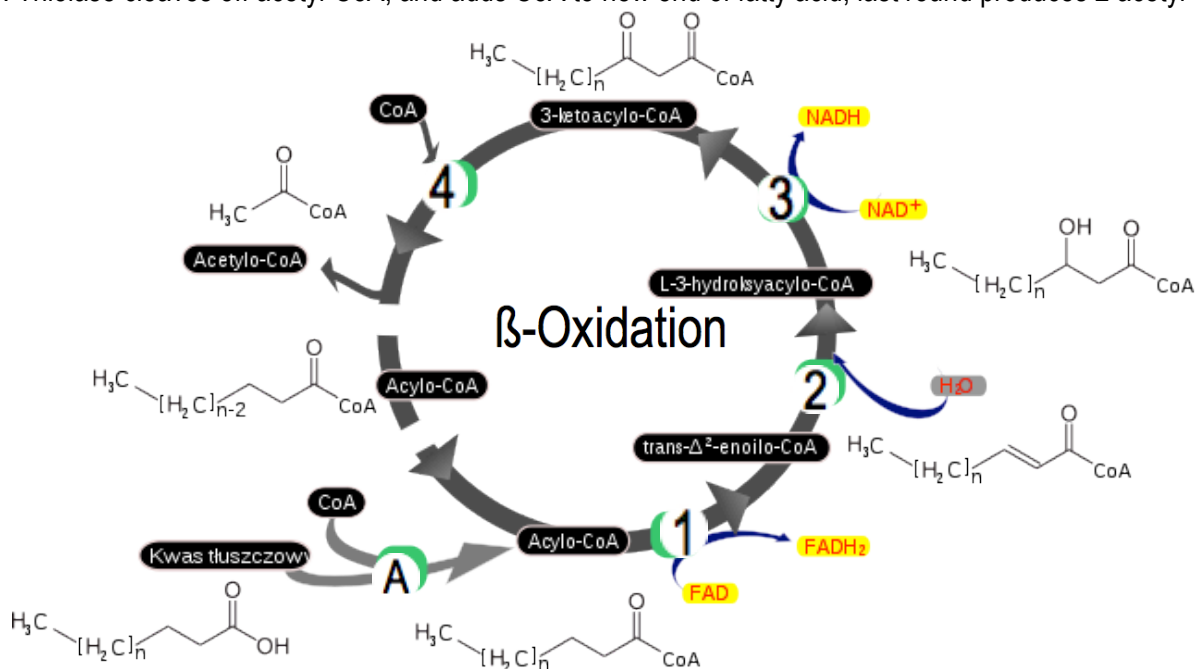   4. Thiolase cleaves off acetyl-CoA, and adds CoA to new end of fatty acid; last round produces 2 acetyl-CoA*

CONCEPT: FATTY ACID OXIDATION

● Unsaturated fatty acids use an isomerase to move the –ene if necessary; *trans* is ok, *cis* must be rearranged

  □ Will not generate $FADH_2$ from the oxidation of a point of unsaturation

  □ Multiple points of unsaturation may prevent rearrangement by isomerase

    - NADPH is used to reduce –ene if isomerase can't rearrange the double bond
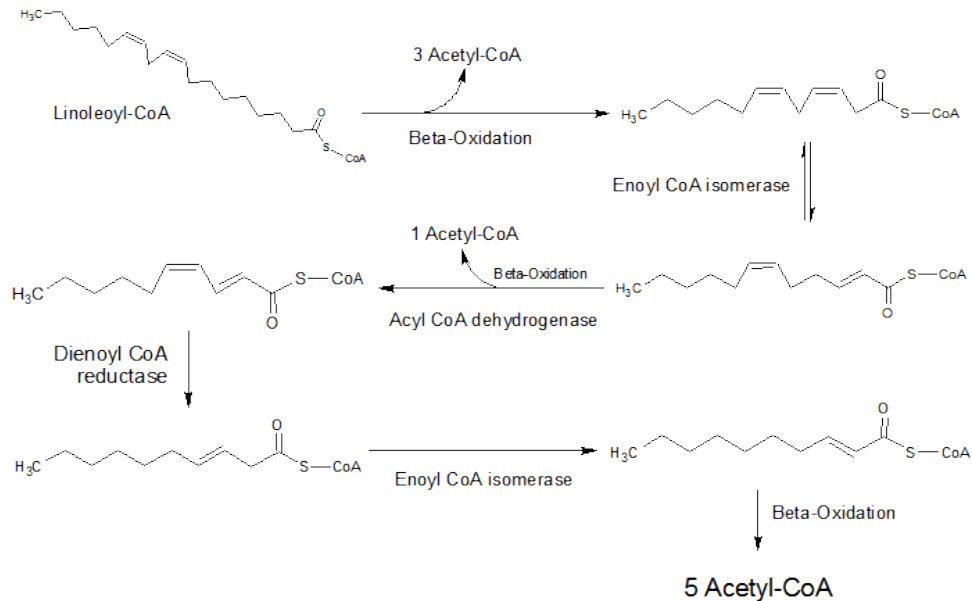
● Odd numbered fats generate acetyl-CoA and propionyl-CoA (3 carbons) in the last round of ß-oxidation

  □ Add CO_2 to propionyl-CoA, then isomerase rearranges into succinyl-CoA (used in step 5 of TCA)
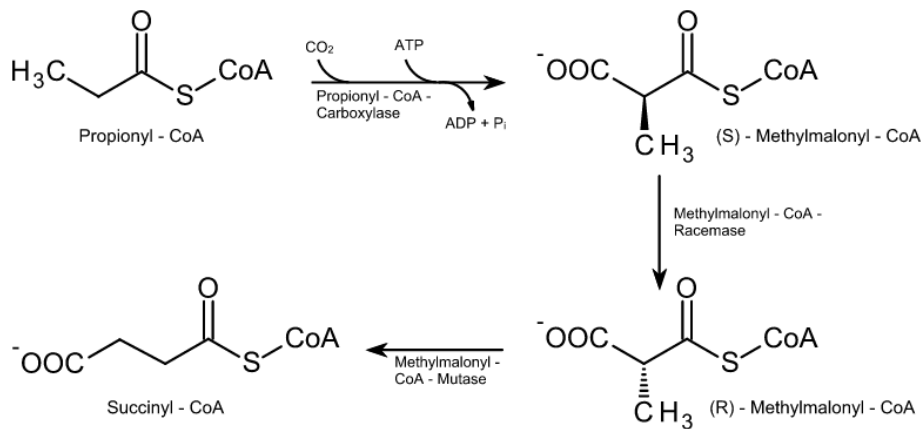
PRACTICE: How much ATP will the ß-oxidation of palmitic acid produce?

● ß-Oxidation

FADH₂: NADH:

● Citric Acid Cycle

FADH₂: NADH: