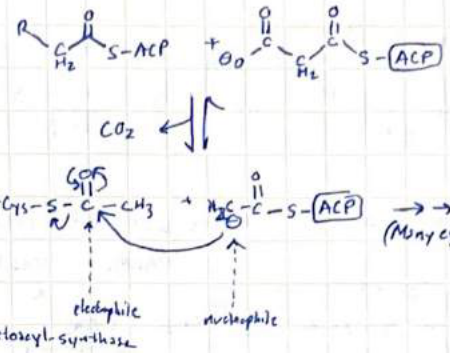
The Components of Fatty Acid Synthase:

(Abbreviated forms are given to more easily track subunits)

1) ACP - acyl carrier protein
2) The "condensing enzymes":
   a) MAT - malonyl/acetyl-CoA - ACP transferase
   b) KS - ketoacyl ACP synthase
3) KR - ketoacyl ACP reductase
4) DH - hydroxyacyl - ACP dehydratase
5) ER - Enoyl - ACP reductase
6) TE - thioesterase

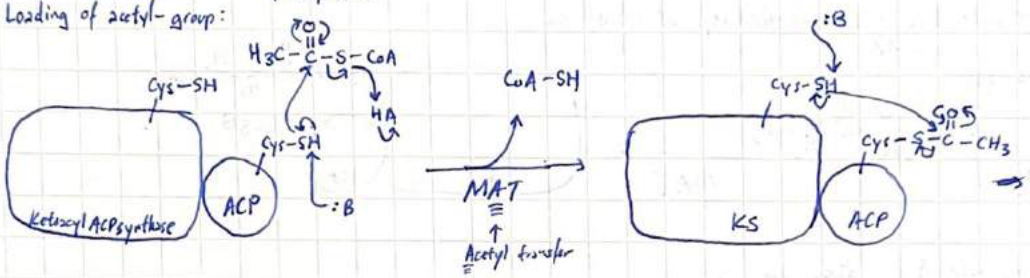
Condensation reaction of acyl & malonyl groups: overview



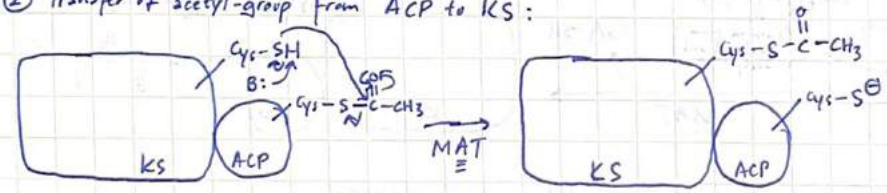
Detailed mechanism:

(Acetyl-CoA)

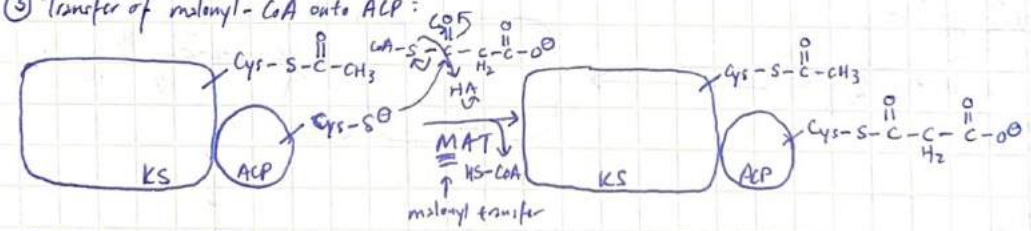
① Loading of acetyl-group:



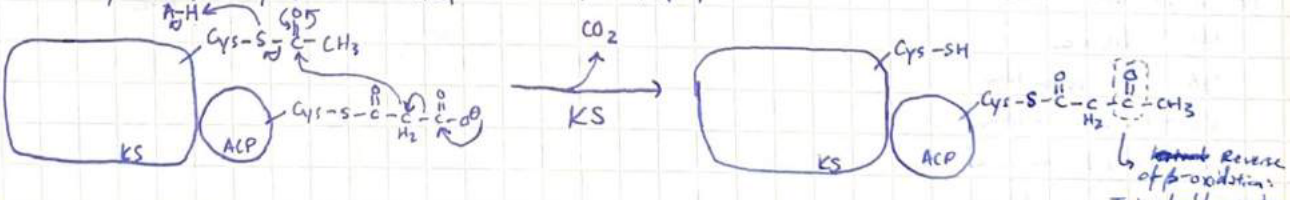
② Transfer of acetyl-group from ACP to KS:



③ Transfer of malonyl-CoA onto ACP:



④ Decarboxylation of malonyl group and nucleophilic attack of acetyl group:

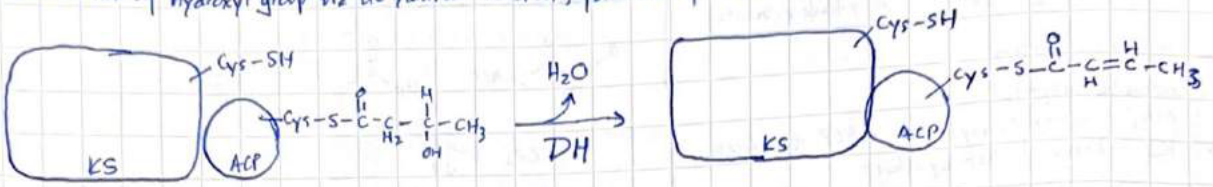


↳ ~~Reverse~~ Reverse of β-oxidation: This should now be reduced to CH_2

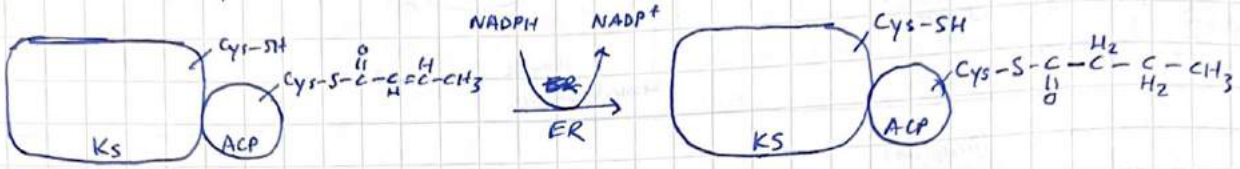
⑤ Reduction of β-carbon on ACP with NADPH and ketoacyl ~~red~~ ACP reductase:

(continued)

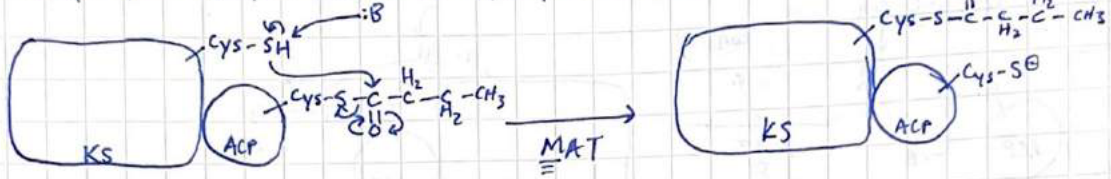
⑥ Elimination of hydroxyl group via dehydration reaction, formation of an enol:



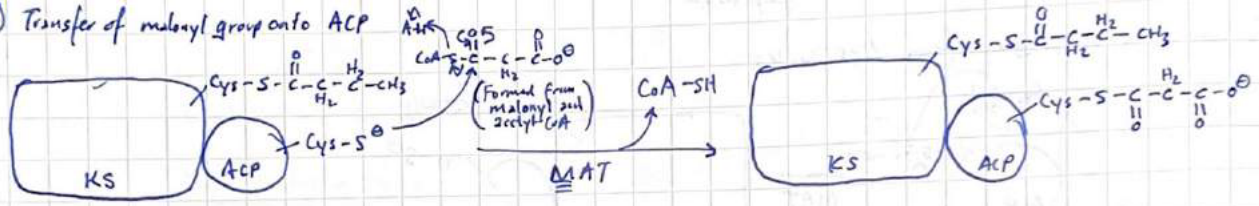
⑦ Reduction of enol by enol-ACP reductase with NADPH:



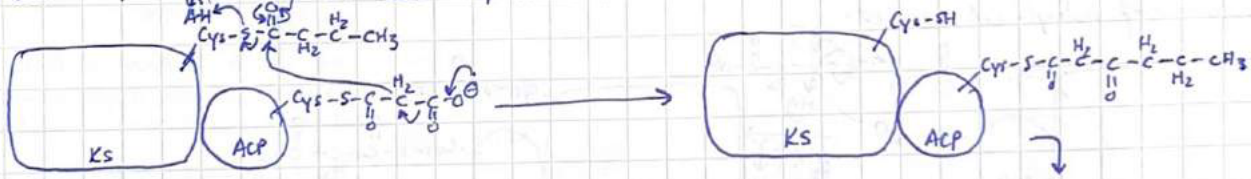
⑧ Transfer of ACP group to KS via Malonyl/acetyl-CoA transferase:



⑨ Transfer of malonyl group onto ACP



⑩ Decarboxylation of malonyl-CoA-ACP complex, nucleophilic attack of thioester of KS:



Overview of enzymatic activity

For one palmitate molecule:

MAT – Acts once

MAT – Acts seven times

KS – Acts seven times

KR – Acts seven times

DH – Acts seven times

ER – Acts seven times

TE – Acts once – when palmitoyl-ACP is formed with end