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“Why does the catabolic organelle, mitochondrion, keep fatty acid biosynthesis?”

Plant cells appear to have at least two fatty acid forming systems, which occur in distinct subcellular compartments: plastids and mitochondria. The mitochondrial fatty acid synthase (mtFAS) is a type II enzyme system that utilizes four individual enzymes to catalyze the iterative reactions of the process, and acyl carrier protein (ACP) as the carrier of the intermediates. Many of the mtFAS components have yet to be identified, and physiological functions of mtFAS process are still poorly understood. I have identified four Arabidopsis genes encoding mtFAS components, including mitochondrial phosphopantetheinyl transferase (mtPPT), mitochondrial β-ketoacyl-ACP synthase (mtKAS), mitochondrial 3-hydroxyacyl-ACP dehydratase (mtHD), and mitochondrial enoyl-ACP reductase (mtER). The mtPPT enzyme is responsible for activating ACP by the addition of the phosphopantetheine cofactor, while mtKAS, mtHD, and mtER catalyze 3 of the 4 reactions of the acyl chain elongation cycle. In vitro kinetic assays indicate that recombinant mtKAS, mtHD, and mtER bear broad substrate specificity, suggesting that the mtFAS system may contribute the formation of acyl-ACP substrates of up to 18-carbon chain length. Mitochondrial octanoyl-ACP (C8-ACP) is the precursor for the synthesis of lipoic acid, which is the coenzyme of H-subunit of glycine decarboxylase, a key enzyme of photorespiration. Accordingly, T-DNA-tagged mutant alleles of mtKAS gene and RNAi knockdown alleles of mtHD and mtPPT genes exhibit morphological and metabolic phenotypes that are typical in photorespiratory deficiency. Lipid profiles in these mutants are also altered as a secondary effect of photorespiratory deficiency. In addition, mutant analyses indicate that mitochondrial 3-hydroxymyristyl-ACP (3-OH-C14-ACP) contributes to the synthesis of lipid A-like (LAL) molecules, suggesting a novel synthetic destination of mtFAS intermediates. RNA-seq transcriptomic analyses of mtKAS and mtHD mutant alleles are being evaluated to discover the regulatory network related to mtFAS functions. Taken together, our results demonstrate that mtFAS system has multiple functionalities and is crucial for plant metabolic homeostasis.

**Thursday, February 6, 2014**  
4:10 p.m.  1414 Molecular Biology Building  
HOST: Basil Nikolau  

BBMB GRADUATE STUDENTS ARE REQUIRED TO ATTEND!  
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