Project Franz Narberhaus Bacterial phospholipid biosynthesis enzymes

Background and preliminary work: The Narberhaus group has discovered several noncanonical phospholipid biosynthesis pathways in bacteria. Of particular interest are enzymes that produce phosphatidylcholine (PC), which is important for stress resistance and hostmicrobe interactions. Phospholipid *N*-methyltransferases in the <u>methylation pathway</u> operate at the phospholipid head group and convert the precursor phosphatidylethanolamine (PE) by threefold S-adenosylmethionine (SAM)-dependent methylation to PC. The <u>PC synthase</u> adds choline to the cellular phospholipid precursor CDP-diacylglyerol (CDP-DAG). In the <u>acylation</u> <u>pathway</u>, two fatty acids are attached to the substrate glycerophosphocholine (GPC).



Work planned: Building on our ongoing work, future projects aim at a detailed biochemical and structural characterization of enzymes involved in bacterial phospholipid biosynthesis in order to understand the mechanistic principles of these poorly studied enzymes. Specific goals are:

- (i) Structure-function analysis of phospholipid *N*-methyltransferases from plant-interacting and thermophilic bacteria.
- (ii) Biochemical characterization of acyltransferases involved in the formation of PC and other unusual bacterial lipids.

Selected references:

Moser R, Aktas A, Fritz C, Narberhaus F. 2014. Discovery of a bifunctional cardiolipin/ phosphatidylethanolamine synthase in bacteria. Mol Microbiol 92:959-972.

- Moser R, Aktas M, Narberhaus F. 2014. Phosphatidylcholine biosynthesis in *Xanthomonas campestris* via a yeast-like acylation pathway. Mol Microbiol 91:736-750.
- Danne L, Aktas M, Unger A, Linke WA, Erdmann R, Narberhaus F. 2017. Membrane remodeling by a bacterial phospholipid-methylating enzyme. mBio 8:e02082-16.
- Danne L, Aktas M, Grund N, Bentler T, Erdmann R, Narberhaus F. 2017. Dissection of membrane-binding and -remodeling regions in two classes of bacterial phospholipid *N*-methyltransferases. *BBA Biomembranes* 1859:2279-2288.
- Vasilopoulos G, Moser R, Petersen J, Aktas M, Narberhaus F. Non-canonical phospholipid biosynthesis pathways in the plant pathogen *Pseudomonas syringae*. Manuscript in revision.