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Keynote Speaker

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Metabolic integration of organohalide respiration in Dehalococcoides-related Chloroflexi (Dehalococcoidia)

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Bacteria of the class Dehalococcoidia catalyse many reductive dehalogenation reactions and link them to energy conservation in organohalide respiration. Most reductive dehalogenases (RdhA) from Dehalococcoidia form a phylogenetically homogeneous group separated from RdhA proteins of other phyla. Also the overall metabolic integration of organohalide respiration is distinct. Most important for the metabolism in *Dehalococcoides* strains is the lack of quinones as electron mediator in the membrane with wide implications on the intracellular redox equilibrium, architecture of the respiratory chain and organization of the respiratory complex. In addition, the physiology of the organisms, the electronic coupling within the respiratory complex, the electron transfer onto the halogenated substrates, and the metabolic integration of electron flows is impacted. We argue that some of the striking biochemical characteristics of RdhA protein activities in Dehalococcoidia, such as reductive dehalogenation of vinyl chloride, chlorinated benzenes, biphenyls and dioxins, but also dihaloelimination reactions of vicinally chlorinated alkanes, are consequences of the respiratory architecture. We use our genomic and proteomic data from *Dehalococcoides*, *Dehalogenimonas* and marine sediment Dehalococcoidia single cell genome assemblies to correlate the genes encoding the respiratory complex proteins with the biosynthesis of specific cofactors and the principles of the central metabolism. For example, we analyse the unidirectionality of gluconeogenesis in Dehalococcoidia and the presence of a unique complement of special core genes encoding a core methionine synthase, Re-specific citrate synthase, bifunctional fructose 1,6-bisphosphate aldolase/phosphatase and dapL (LL-diaminopimelate aminotransferase). All these genes are representatives of a streamlined, strongly reducing metabolism aligned with quinone-free complex-bound organohalide respiration. All this also argues against a strong role of inter-class horizontal gene transfer in the genes encoding the core metabolic functions in Dehalococcoidia.

Biography

Lorenz Adrian is co-head of the Department Environmental Biotechnology at Helmholtz Centre for Environmental Research - UFZ in Leipzig and Professor for Biotechnology at Technische Universität Berlin, Germany. He works since many years on the microbiology, ecology, genomics and biochemistry of *Dehalococcoides* strains and Organohalide Respiration. In other research projects he studies anaerobic ammonium oxidation (Anammox), anaerobic transformation of antibiotics and conducted a variety of protein mass spectrometric and stable isotope analyses mostly with anaerobic microbial cultures. He was co-speaker of a Research Unit on anaerobic dehalogenation 2013-2020 and hosted the Dehalocon II in Leipzig in 2017.

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