

Project Title:

Breathing New Life into PQQ: Discovering Oxygen-Independent Biosynthesis of a Widely Marketed Dietary Supplement

Supervisor: PD Dr. Christiane Dahl

Institute/group: Institute for Microbiology and Biotechnology, RG Dahl

Webpage: <https://www.ifmb.uni-bonn.de/en/research/rg-dahl/research-focus>

Requirements: Interest in microbial physiology, biotechnology, molecular biology, and genetics

Skills to be learned: Growth experiments, genetics with a non-model organism, anaerobic techniques

Project Description (max. 150 words): Pyrroloquinoline quinone (PQQ) is a redox cofactor involved in electron-transfer reactions catalyzed by dehydrogenases. In addition to its metabolic role, PQQ has attracted considerable interest for its reported antioxidant, neuroprotective, cardioprotective, and anti-inflammatory properties. It is therefore used in dietary supplements marketed to support cognitive function, energy metabolism, and healthy aging, with additional applications in functional foods, cosmetics, and pharmaceuticals. Although PQQ is traditionally produced chemically, concerns about toxic by-products have increased interest in biological production using naturally PQQ-producing methylotrophic bacteria such as *Hyphomicrobium*. The known PQQ biosynthetic pathway requires molecular oxygen for four oxidative steps. We have now obtained strong evidence that the species *Hyphomicrobium denitrificans* also possesses an oxygen-independent PQQ biosynthesis pathway and have identified candidate genes potentially encoding the responsible enzymes. Our aim is to elucidate this pathway by generating targeted gene-deletion mutants and to evaluate its potential for biotechnological PQQ production.

Support concept (max. 75 words): Working hours are flexible and can be adapted to the individual study program. The exact project will be tailored to the student's interests. Close guidance by doctoral students and the group leader is guaranteed. Tight integration into the group is further strengthened through active participation in the weekly group seminar. The project can be deepened in lab rotations and a Master thesis. Attending conferences, presenting papers, and co-authoring publications will be encouraged and supported.

Interested to recruit and finance a suitable student by own funds: YES/NO