A giant type I polyketide synthase participates in zygospore maturation in *Chlamydomonas reinhardtii*.

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Abstract

Polyketide synthases (PKSs) occur in many bacteria, fungi and plants. They are highly versatile enzymes involved in the biosynthesis of a large variety of compounds including antimicrobial agents, polymers associated with bacterial cell walls and plant pigments. While harmful algae are known to produce polyketide toxins, sequences of the genomes of non-toxic algae, including those of many green algal species, have surprisingly revealed the presence of genes encoding type I PKSs. The genome of the model alga Chlamydomonas reinhardtii (Chlorophyta) contains a single type I PKS gene, designated PKS1 (Cre10.g449750), which encodes a giant PKS with a predicted mass of 2.3 MDa. Here, we show that PKS1 is induced in 2-day-old zygotes and is required for their development into zygospores, the dormant stage of the zygote. Wild-type zygospores contain knob-like structures (~50 nm diameter) that form at the cell surface and develop a central cell wall layer; both of these structures are absent from homozygous pks1 mutants. Additionally, in contrast to wild-type zygotes, chlorophyll degradation is delayed in homozygous pks1 mutant zygotes,

indicating a disruption in zygospore development. In agreement with the role of the PKS in the formation of the highly resistant zygospore wall, mutant zygotes have lost the formidable desiccation tolerance of wild-type zygotes. Together, our results represent functional analyses of a PKS mutant in a photosynthetic eukaryotic microorganism, revealing a central function for polyketides in the sexual cycle and survival under stressful environmental conditions.

Beteiligte Forschungseinheiten

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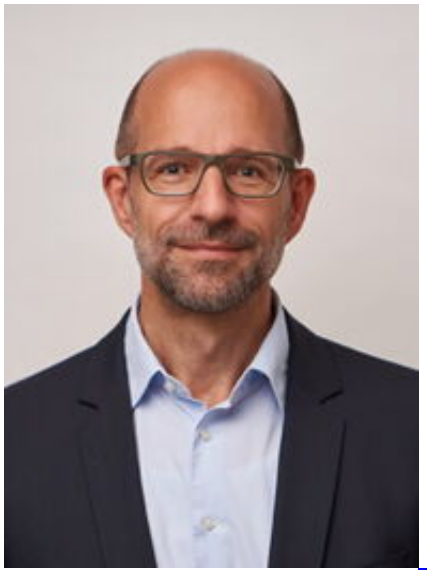

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