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Thesis project:

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Green genes: bioinformatics and modeling approaches for researching algal-bacterial symbiosis

Highlights:

- Microalgae are potential hosts for industrial biosynthesis of valuable compounds
- Key to algal biotechnology is understanding and improving the algal-bacterial symbiotic relationships
- **Bioinformatics and/or systems-biology** modeling of this relationship is crucial to facilitate algal engineering

Many species of microalgae produce hydrocarbons, polysaccharides, and other valuable products in significant amounts. To make these compounds commercially viable synthetic biology can be applied. However, in order to apply synthetic biology to microalgae a systems-biological understanding of algae metabolism and their symbiotic relationships with bacteria and other algae is needed. This project will focus on bioinformatics and/or systems-biology research that will be a key component of this understanding.

In this project, aims are to understand the symbiotic relationships of algae by, for example:

a) Understanding the underlying metabolism of microalgae on a pathway level
b) Understanding the underlying metabolism of microalgae on a reaction level
c) Identifying key components from potential symbionts that enhance the productivity and growth of microalgae, using bioinformatics and/or systems biology

a) Pathway knowledge of many microalgae that require bacterial symbiosis is currently insufficient for systems-biology purposes. Using the data available to us, we aim to understand and identify key pathways involved in algal metabolism

b) In order to identify the algal bottlenecks that require them to have symbiotic relationships with other species, we need to understand and identify the exact points in the metabolism of algae that prevents them from growing fast or producing large amounts of interesting metabolites.

c) To circumvent or fix the algal-metabolism bottlenecks, we need to identify which species are in a symbiotic relationship with microalgae, and which features of these species are beneficial for the microalgae. Subsequent modeling of these features, using bioinformatics or systems biology, will allow us to enhance algal biotechnology by growing the microalgae with the symbionts under the most efficient conditions, or even using synthetic biology to transfer the key genetic components of the symbionts to the microalgae.

Supervisors

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