Microalgae cultures in microfluidics for the development of a multiscale model

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Microalgae, unicellular photosynthetic organisms, are avaluable source of bioactive compounds for both academic and industrial applications, including pigments, biofuels, and nutrition. Large-scale microalgal biomass production requires a stepwise cultivation process, progressing from laboratory conditions to industrial photobioreactors—a labor-intensive and costly transition. Variations in cultivation conditions across these different scales significantly affect microalgal growth and the synthesis of target compounds.
This project aims to investigate key culture parameters (nutrients, light, CO_2, pH, etc.) at multiple scales in order to develop a predictive model of microalgal growth. The model will be used to optimize cultivation conditions through simulations based on experimental data collected across various scales—from microfluidic systems to 285-liter industrial photobioreactors, including pilot-scale setups. This interdisciplinary approach will provide a deeper understanding of the underlying processes, paving the way for efficient and cost-effective microalgal production.

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