Microfluidics allows manipulation of small volumes of fluids through channels with dimensions of tens to hundreds of micrometres. Microdroplet technology is a form of microfluidics in which small (10-200 μm diameter) monodisperse aqueous droplets are generated, manipulated and analysed in various ways. This multidisciplinary field provides an exciting new platform for single-cell studies of both eukaryotic microalgae and cyanobacteria, with considerable potential for enhancing algal biotechnology. Growth of several species of microalgae has been studied in detail using microdroplets, and new experimental platforms have been established that allow individual cells to be screened and sorted according to cellular chlorophyll fluorescence, lipid content or ethanol production. Here we provide an overview of the studies that the Microdroplets Group has done in the recent years regarding this matter, for example the study algal behaviour at the single-cell level, or the on-chip identification of transformed signal cells.

### Growing Microalgae and Cyanos in Microdroplets

**Microalgae: Chlamydomonas reinhardtii**

- Droplet storage in a reservoir
- Growth kinetics of C. reinhardtii

**Cyanobacteria: Synechocystis PCC 6803**

- Why microalgae and cyanobacteria in droplets?
  - High surface area-to-volume ratio
  - Lower sample requirement
  - Single-cell manipulations

Despite the cyanobacteria are smaller species when compared to microalgae, the autofluorescence can be used to create growth profiles accurately, allowing for a better understanding of these organisms at a molecular level.

### Screening and Sorting Microalgae and Cyanos in Droplets

**A Microdroplet Sorting Chip Based on Fluorescence**

- Microalgae: Label-free sorting based on native chlorophyll expression
- Cyanobacteria: Ethanol productivity screening in droplets

**Cyanos: Selecting species based on biomass growing**

- The chlorophyll-based screening platform developed has been used to screen cyanos with different growth rates (pseudo and PCC) showing the potential of the technique to screen and sort high biomass producers.

### References

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