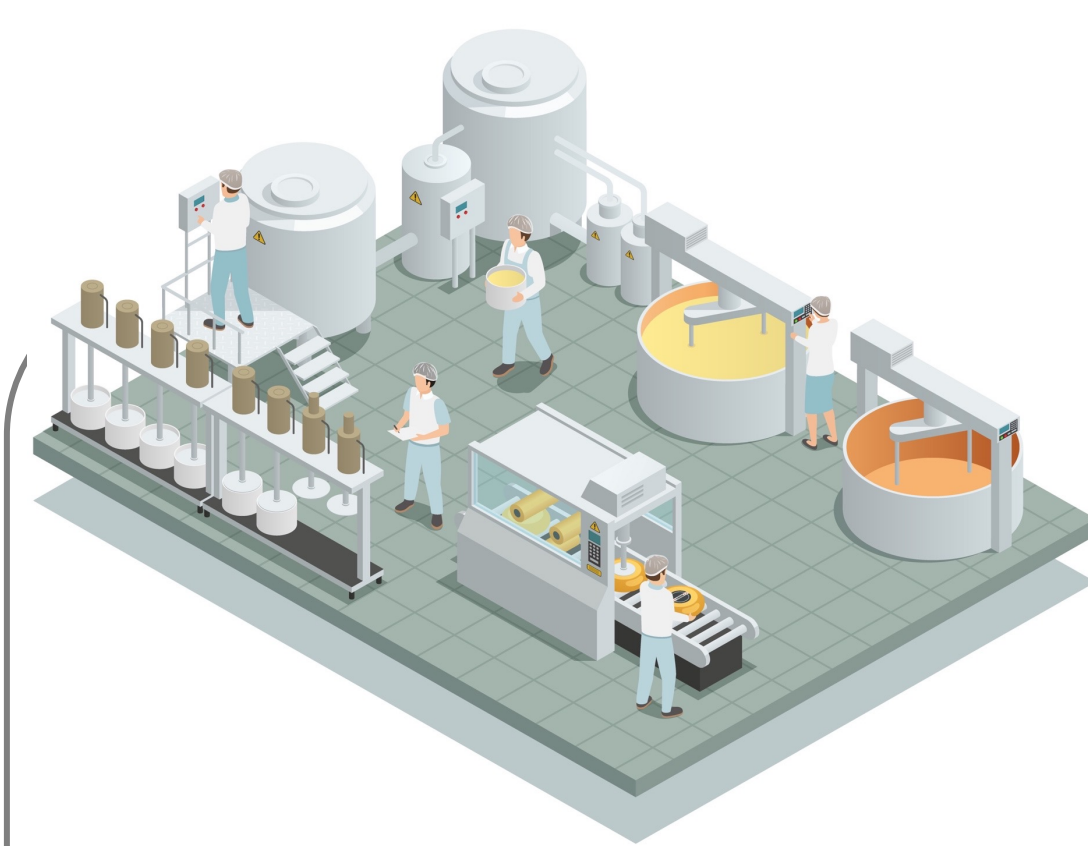


The effect of biomimetic surfaces on single- and dual-species biofilms of *Escherichia coli* and *Pseudomonas putida*

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Biofilm development on food contact surfaces

Food spoilage and contamination

Financial losses and health risks

SUPERHYDROPHOBIC BIOMIMETIC SURFACES

Artificial surfaces that imitate the microstructure and properties of a natural biological surface



SELF-CLEANING LEAVES

Brassica oleracea (Cauliflower)
Brassica oleracea capitata (White cabbage)

Introduction

Biofilm formation by pathogens and food spoilage microorganisms is a widely recognized concern in the food processing sector, leading to severe economic losses for processors and health hazards for consumers.

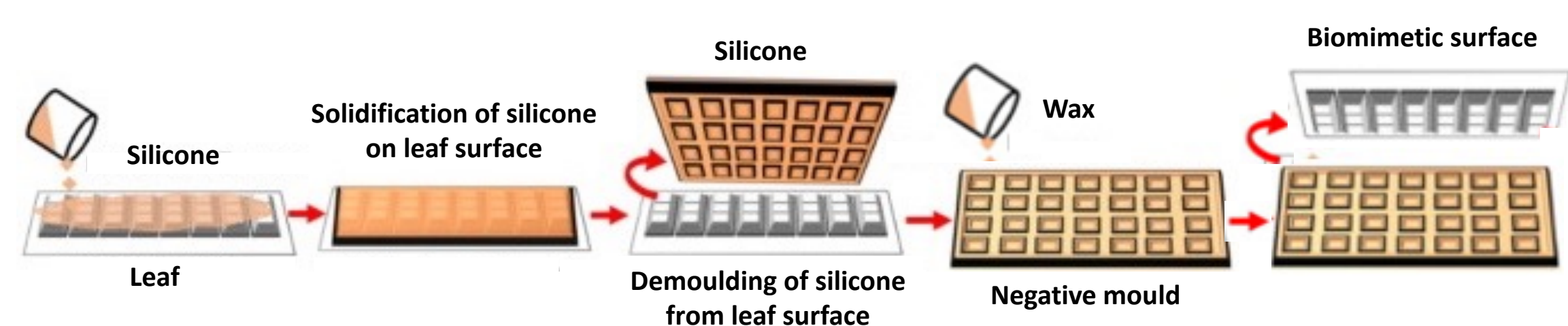
Bacteria in biofilms are more resistant to antimicrobial and cleaning agents. As such, the search for novel antifouling strategies to prevent bacterial adhesion and biofilm growth on food industry surfaces is necessary.

Objective

To reproduce the antifouling properties found naturally in plant leaves by replicating the self-cleaning surfaces of cabbages and testing them against multispecies biofilms.

Methodology

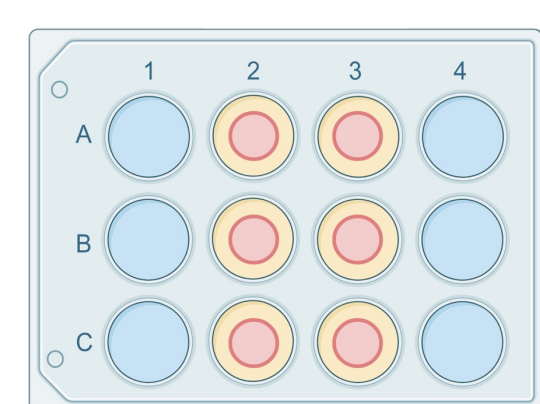
1. SURFACE PREPARATION



Control: Flat wax surface

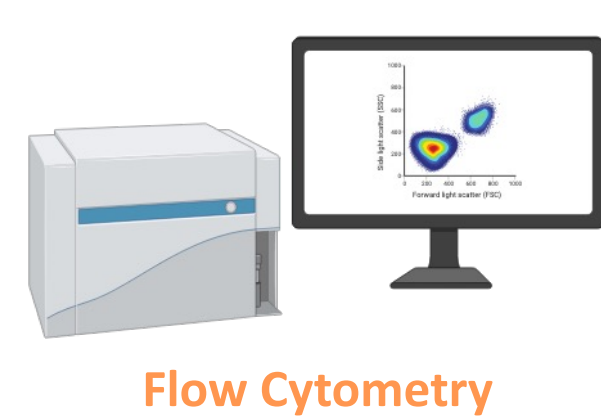
2. BACTERIAL STRAINS AND BIOFILM FORMATION

Escherichia coli
Chromosomally tagged with GFP
Pseudomonas putida
Chromosomally tagged with mCherry



Luria-Bertani (LB) medium; 24 h;
Single- and dual-species biofilms (1:1 ratio)

3. BIOFILM ANALYSIS

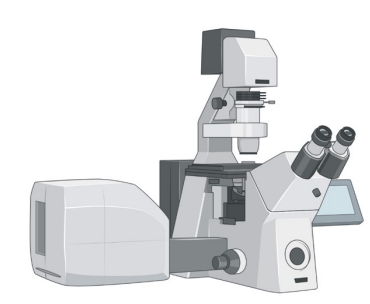


Total Biofilm Cell Count



Colony-Forming Unit (CFU) Count

Cell Culturability Percentage

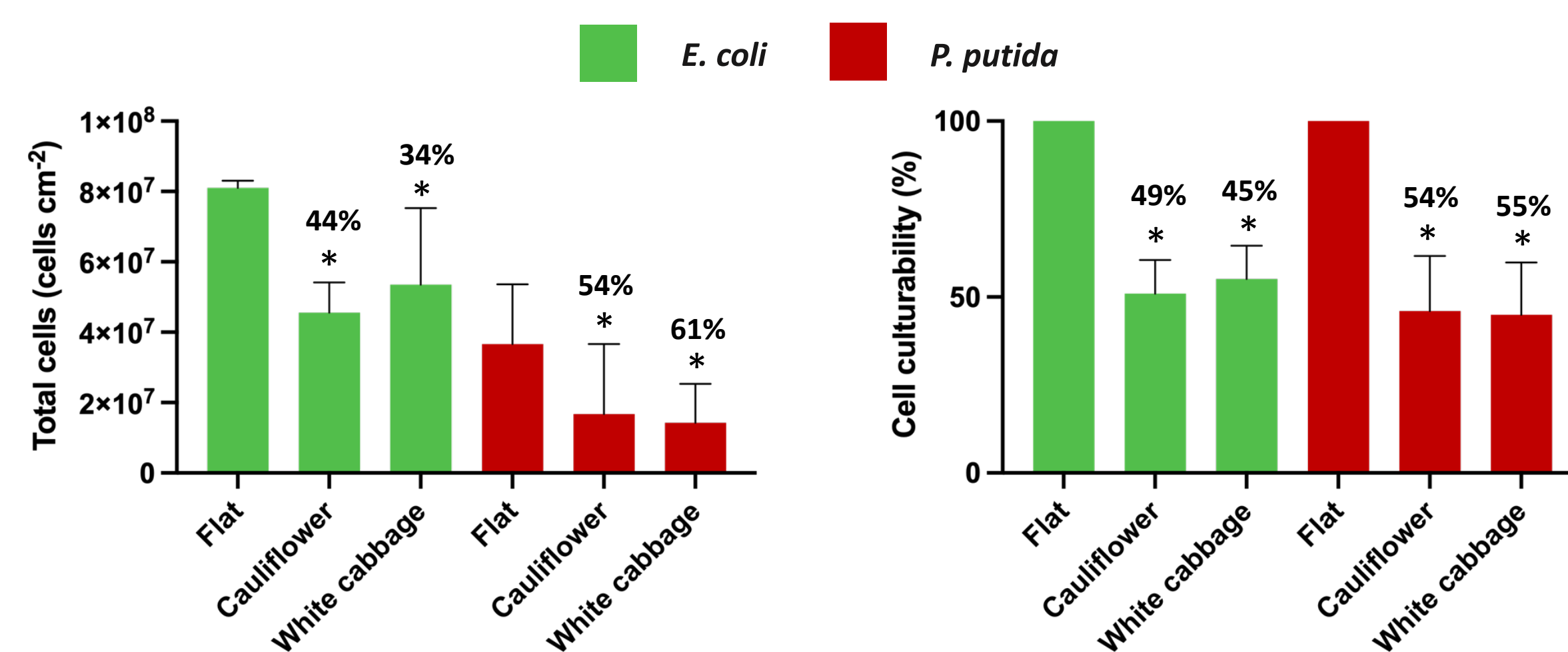


Confocal Laser Scanning Microscopy (CLSM)

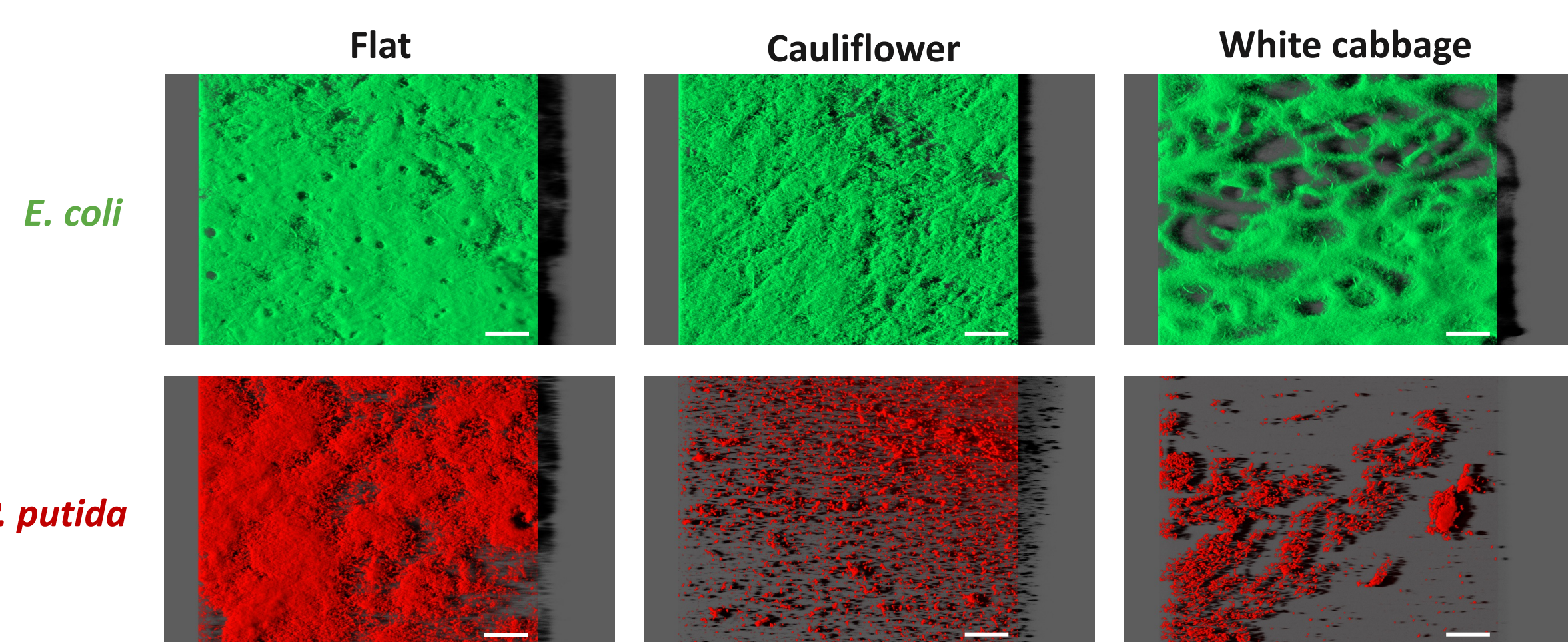
Biofilm Spatial Distribution and Architecture

Results

SINGLE-SPECIES BIOFILMS



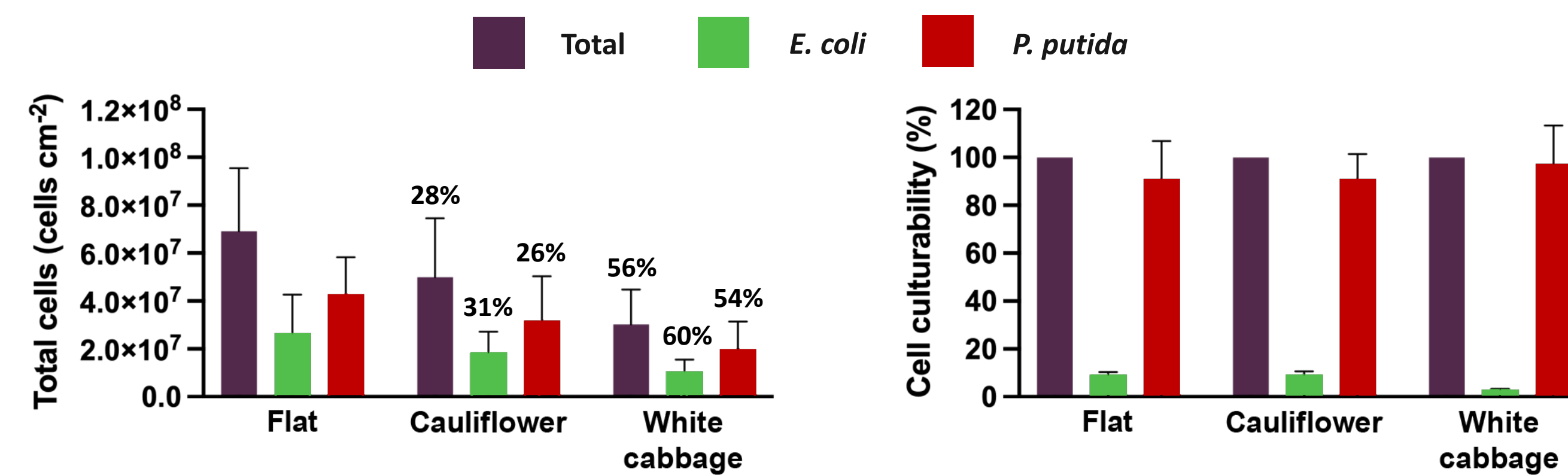
For both strains, single-species biofilms developed on the biomimetic surfaces displayed significantly lower total cell count and culturability ($p < 0.05$) compared to the control surface.



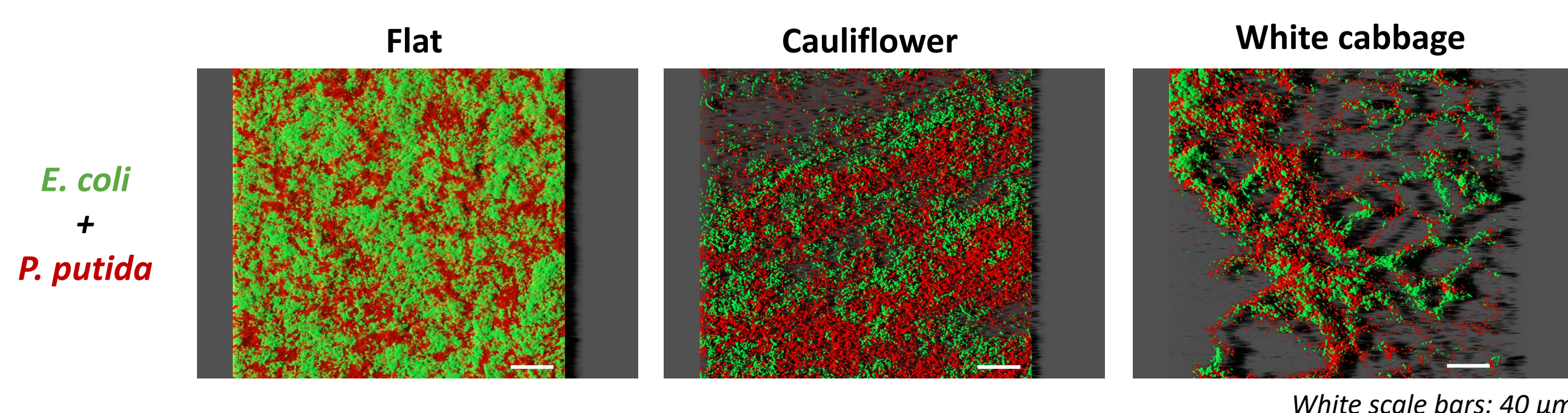
White scale bars: 40 μm

Biofilm three-dimensional CLSM reconstructions corroborate the total cell count results.

DUAL-SPECIES BIOFILMS



Dual-species biofilms developed on the biomimetic surfaces displayed lower total cell count compared to the flat surface. The replicate White cabbage surface showed the best antibiofilm performance. On each of the tested surfaces, *P. putida* had a higher biofilm cell count than *E. coli*.



White scale bars: 40 μm

CLSM reconstructions confirm the great antibiofilm performance of the White cabbage biomimetic surface.

Conclusions

The synthesized biomimetic surfaces showed great performance against biofilms formed by *E. coli* and/or *P. putida*, thereby validating their potential for application in the food industry.

Acknowledgements

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