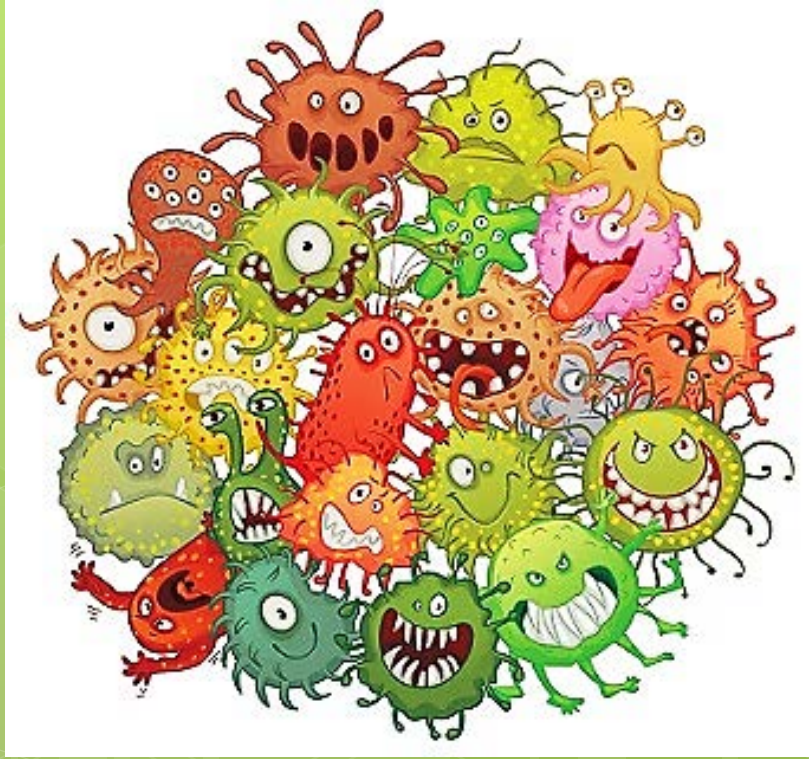


TFDA

Biofilm image analysis

Laboratorio di Botanica e Biologia delle Alghe

Napoli 27 Febbraio 2019

Università degli Studi di Napoli *Federico II*
Dipartimento di Biologia
Laboratorio di Biologia delle Alghe

- Prof. Antonino Pollio
- Prof. Gabriele Pinto
- Dr. **Antonino De Natale**
- Dr. Angelo Del Mondo
- Dr. Mariagioia Petraretti

Biofilm image analysis

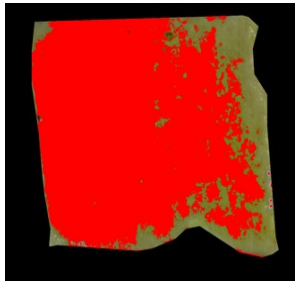
Topics

- Macro Photography
- Optical Microscope
- Metallurgical Microscope
- Phluorescence Microscope
- Confocal Laser Scanner Microscopy
- X-Ray Tomography
- TEM
- SEM

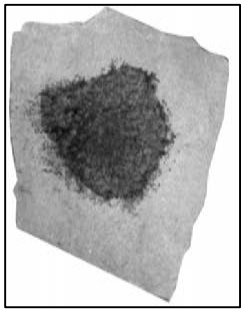
Image clastering

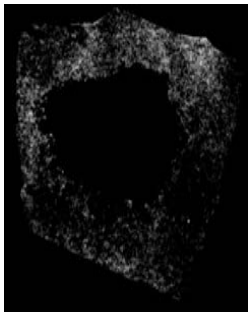
Macro and micro photography

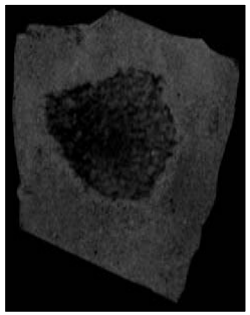
Colour threshold



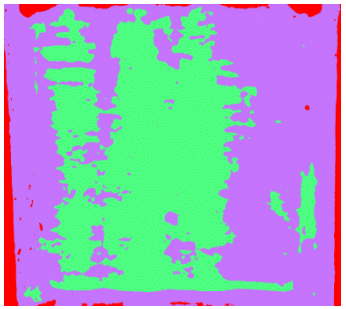
PCA



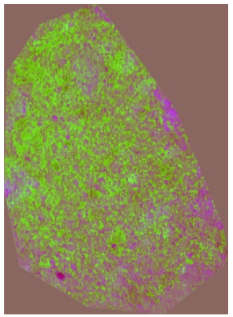


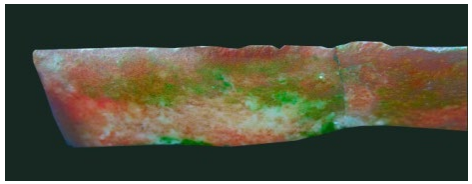


Colour classes



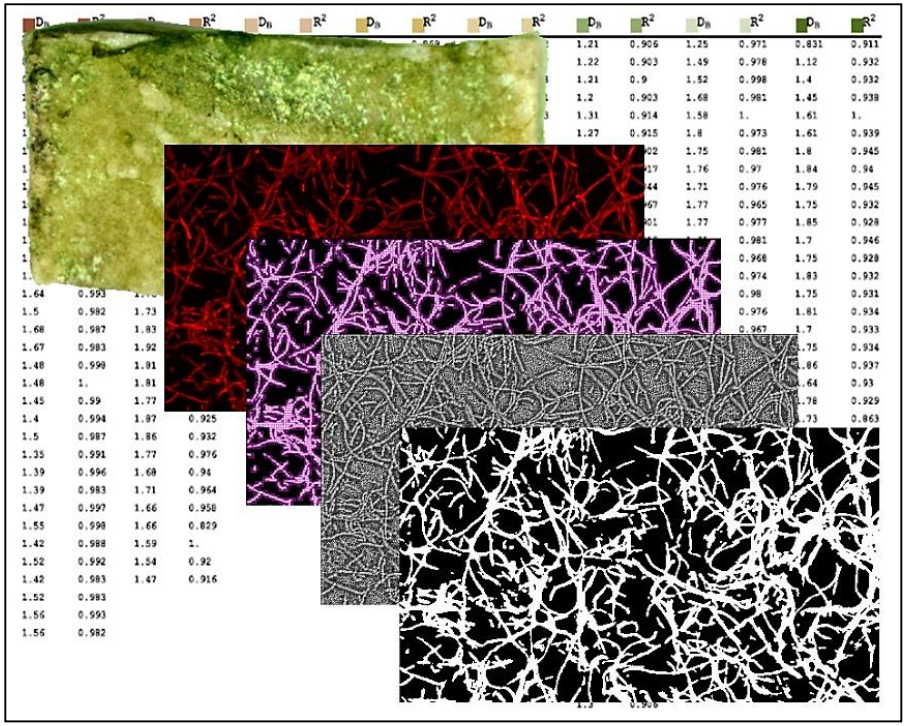
Hidden evidences

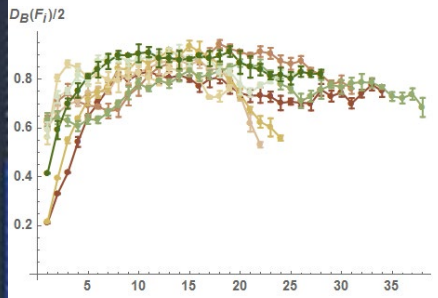


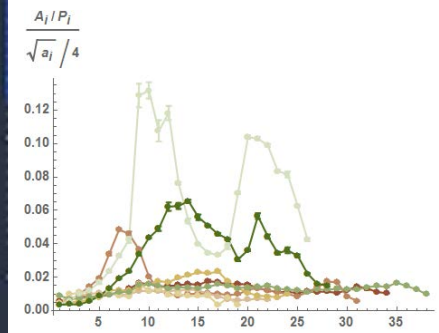


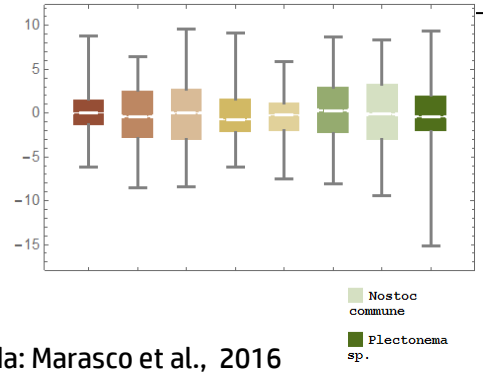
Z-stcks analysis (2D)

Confocal Laser Scanning Microscopy

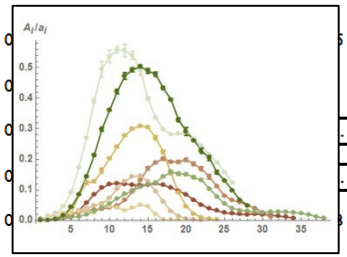








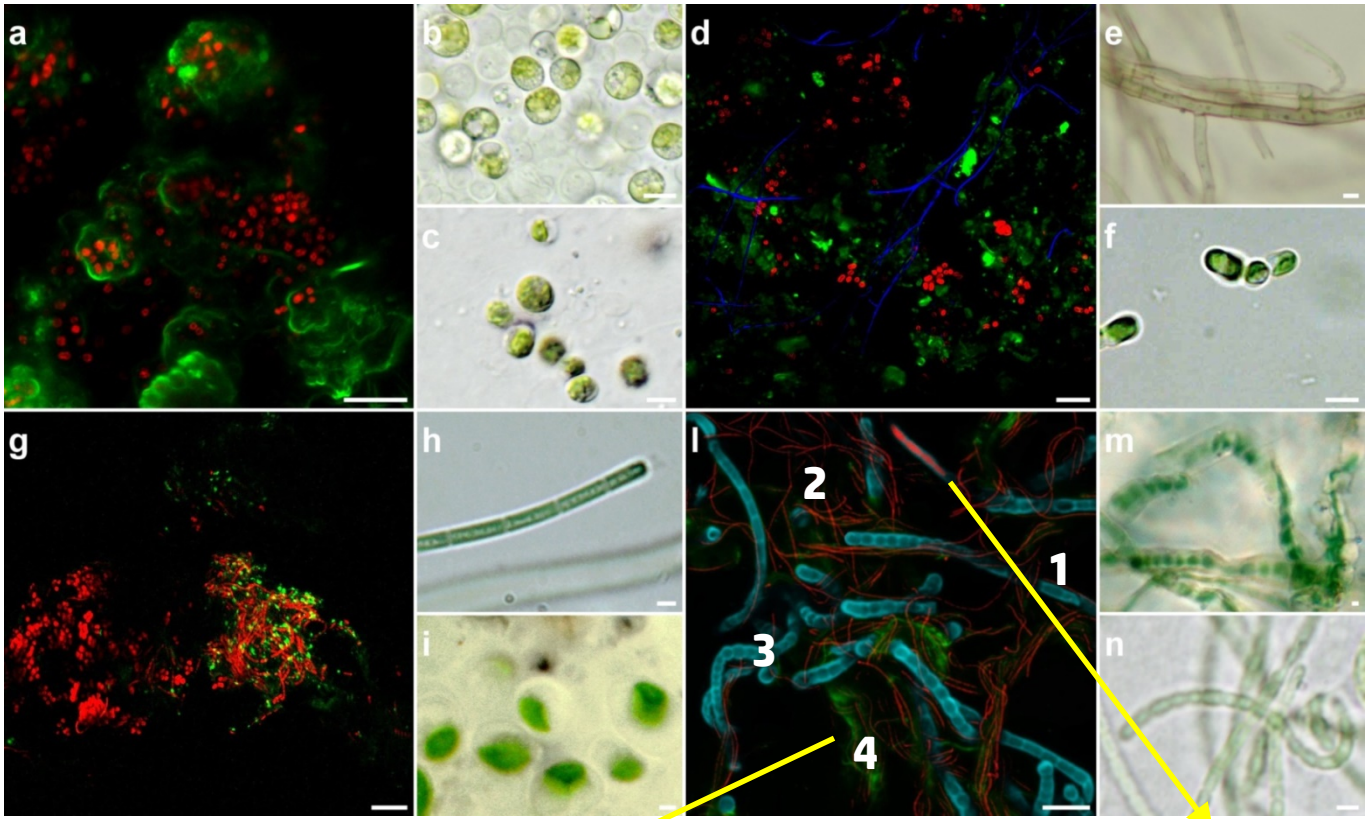
	Calothrix membranacea	Coelastrella rubescens	Fischerella ambigua	Microchaete diplosiphon	Microcoleus autumnalis	Nodularia sphaerocarpa	Nostoc commune	Plectonema sp.
Calothrix membranacea	1.	0.17	0.96	< 0.05	< 0.05	< 0.05	0.15	0.066
Coelastrella rubescens	0.17	1.	0.44	0.49	0.63	< 0.05	0.084	0.55
Fischerella ambigua	0.96	0.44	1.	0.15	0.08	0.11	0.32	0.52
Microchaete diplosiphon	< 0.05	0.49	[illegible]	[illegible]	[illegible]	< 0.05	< 0.05	0.057
Microcoleus autumnalis	< 0.05	0.63	[illegible]	[illegible]	[illegible]	< 0.05	< 0.05	0.53
Nodularia sphaerocarpa	< 0.05	< 0.05	[illegible]	[illegible]	[illegible]	1.	0.19	< 0.05
Nostoc commune	0.15	0.084	[illegible]	[illegible]	[illegible]	0.19	1.	0.12
Plectonema sp.	0.066	0.55	[illegible]	[illegible]	[illegible]	< 0.05	0.12	1.



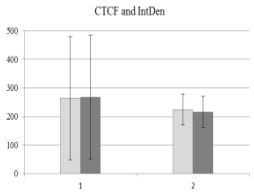
da: Marasco et al., 2016

Z-stcks analysis (3D)

Confocal **L**aser **S**canning **M**icroscopy



1. *Hyphae*
2. *Leptolyngbia* sp.
3. *Scytonema julianum*
4. EPS



2D analysis

Area
Perimeter
Length
Width
Measure angles
Particle Distribution
Fourier Shape Analysis
Fractal Dimension
Lacunarity

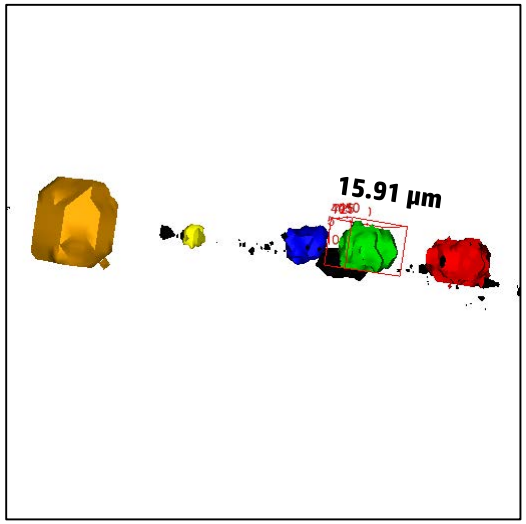
3D analysis

Biovolume
Surface
Thickness Mean
Thickness Min
Thickness Max
Roughness
Microcolonies substratum
Volume of microcolonies at substratum

Detailed analysis of Z-stacks

Confocal **L**aser **S**canning **M**icroscopy

Sphericity and density of the masses



3D analysis

Sphericity

Pore size: diameter

" " : area

" " : %

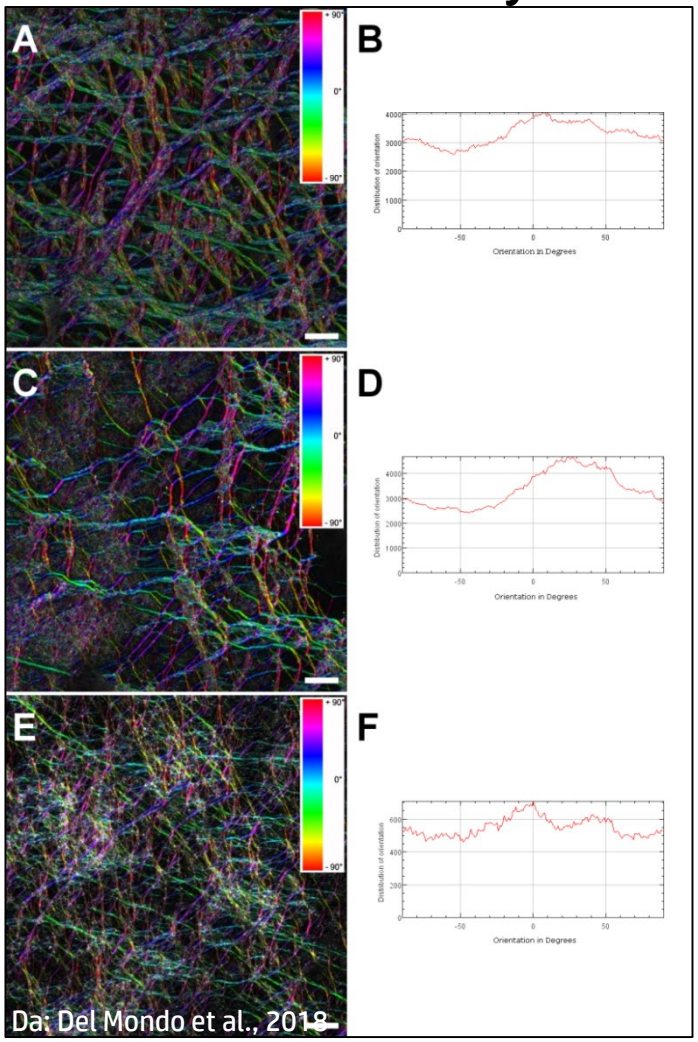
" " : n°

Filament: length

" : n° intersections

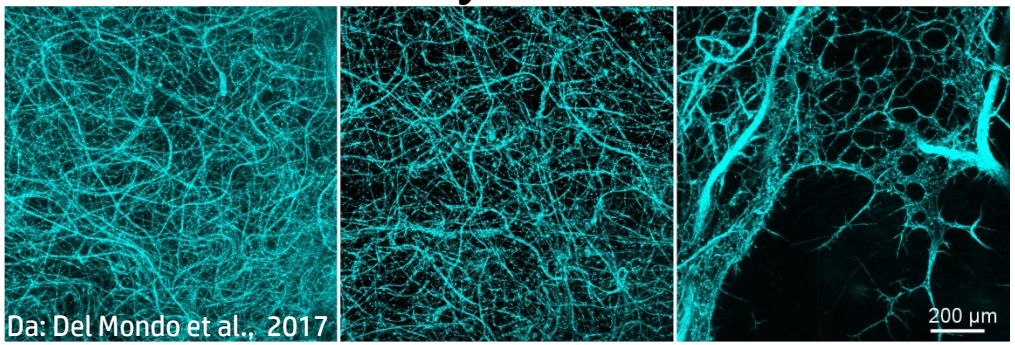
Directionality

Fiber directionality



Da: Del Mondo et al., 2018

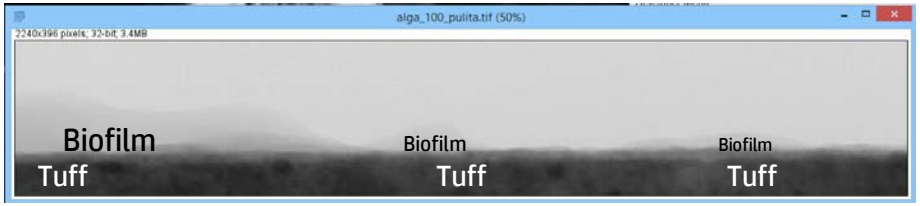
Cavity from MIP

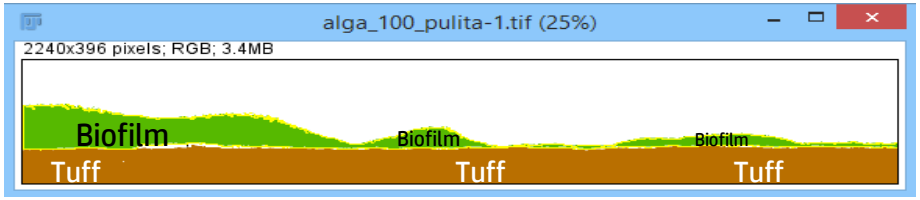


Da: Del Mondo et al., 2017

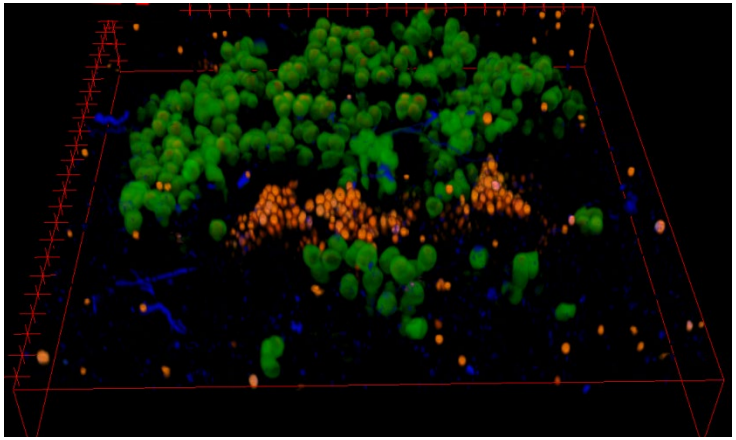
3D reconstruction

X-ray tomography

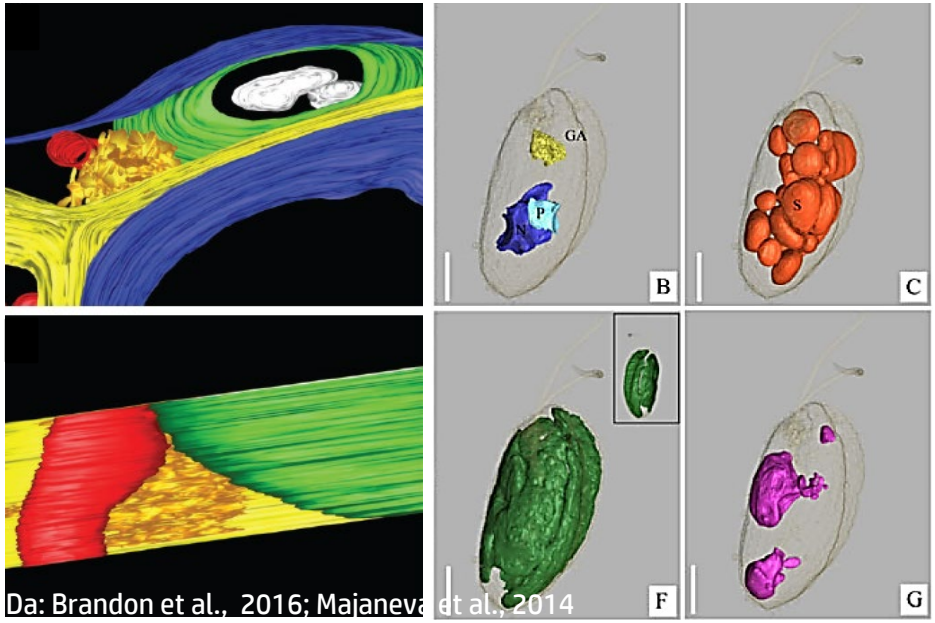




Confocal Laser Scanner Microscopy



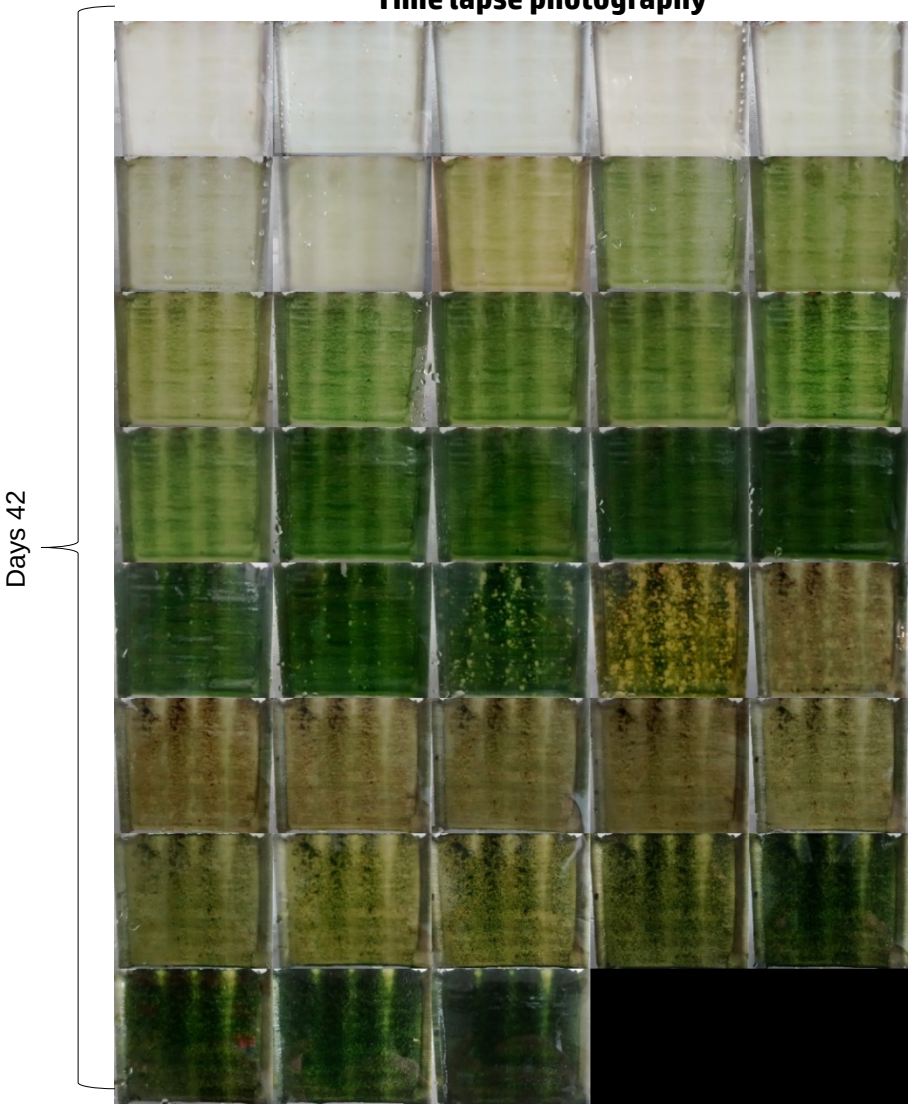
TEM



Da: Brandon et al., 2016; Majaneva et al., 2014

CIE Lab colorimetry fom photos

Time lapse photography



CIE Lab colorimetry fom photos