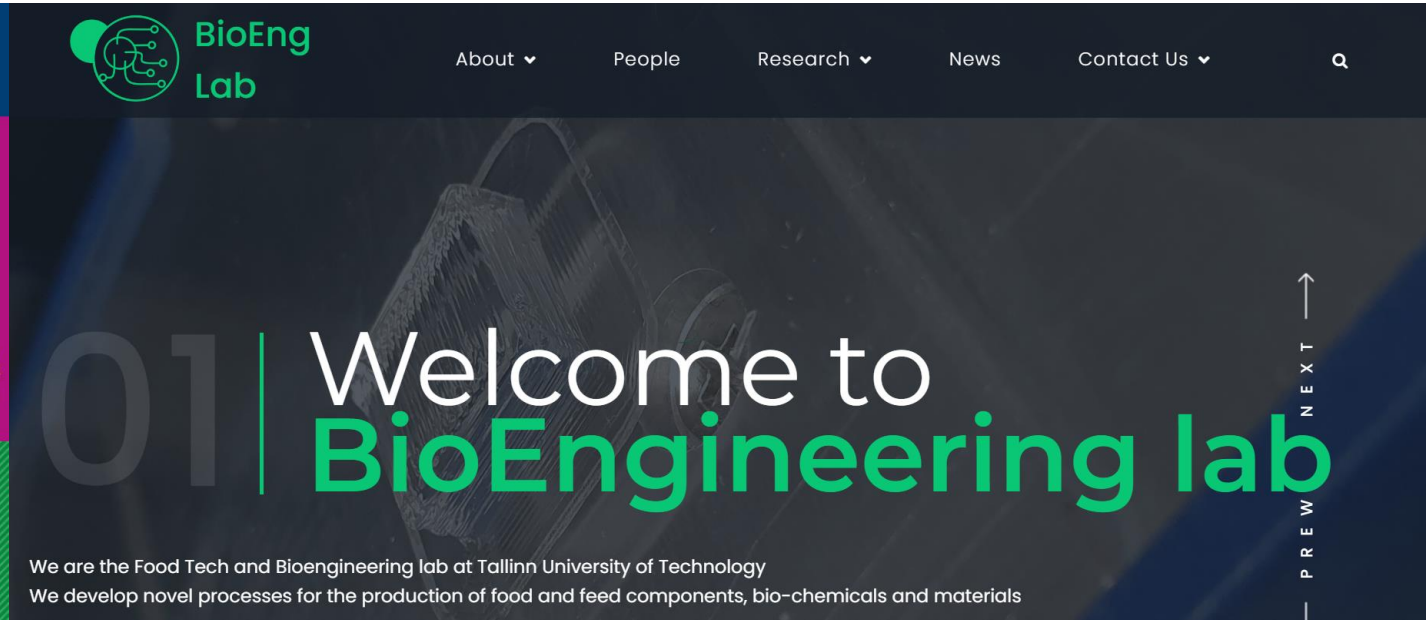
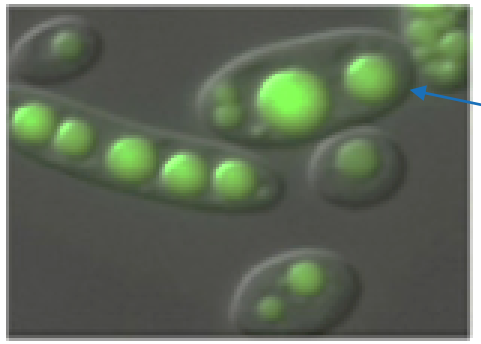
Greener ingredients – biotechnology aspect

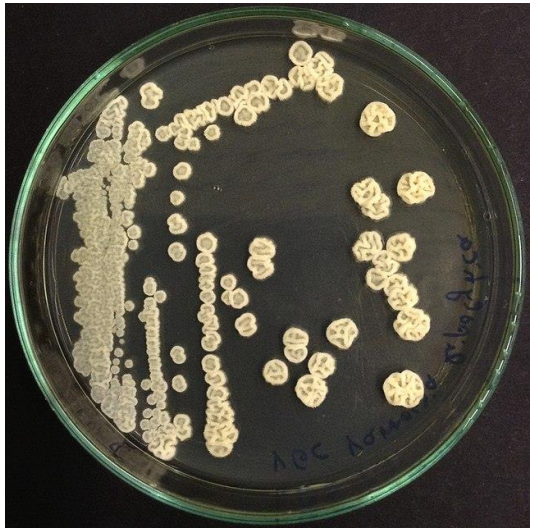


Microbial platforms – producer species

- Non-conventional yeast
- Safe-to-use (GRAS, QPS status)
- Oleaginous – high lipid accumulation



Lipid droplet

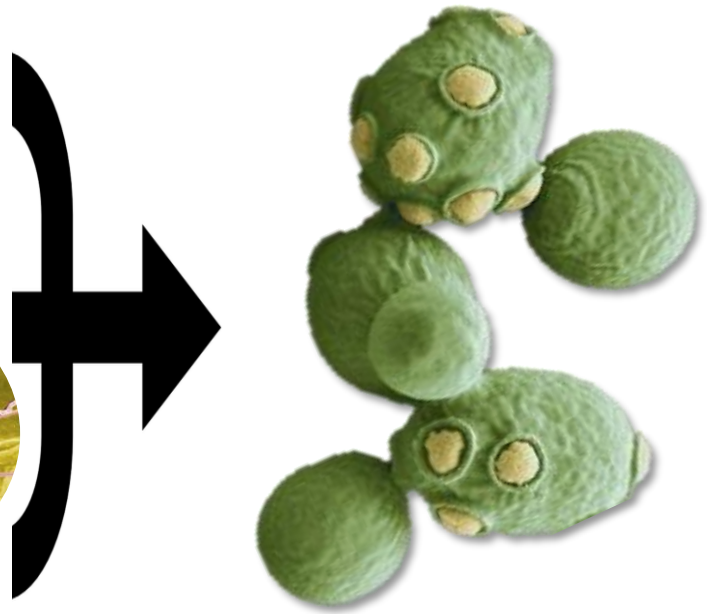


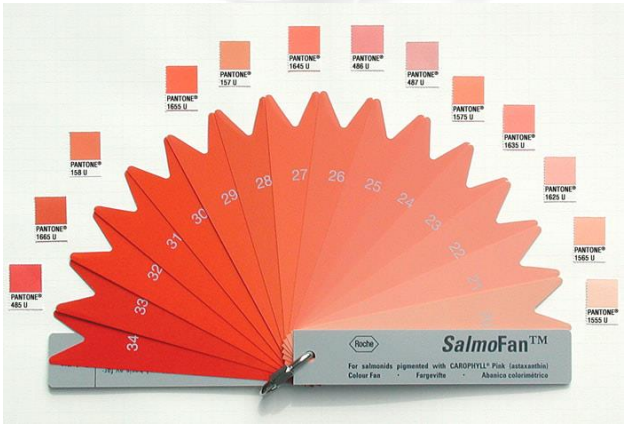
Yarrowia lipolytica

Rhodotorula toruloides

From waste to products

2nd generation biofuels, biochemicals, nutraceuticals, novel food and feed





Real-life process - example

https://aio.bio/

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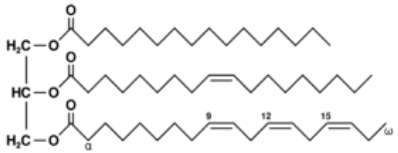
Terpene production in oleaginous yeasts



Fatty acyl-CoA → **Triacylglycerol**

Lipid synthesis

Acetyl-CoA

ERG10 ERG13 HMG1 → Mevalonate → *ERG12 ERG8 ERG19* → IPP ⇄ *IDI* ⇄ DMAPP

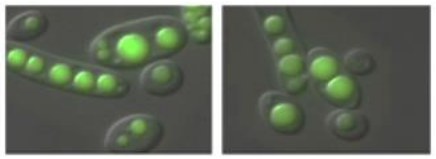
MVA pathway

IPP + DMAPP → *ERG20* → GPP → *ERG20* → FPP → *GGS1* → GGPP

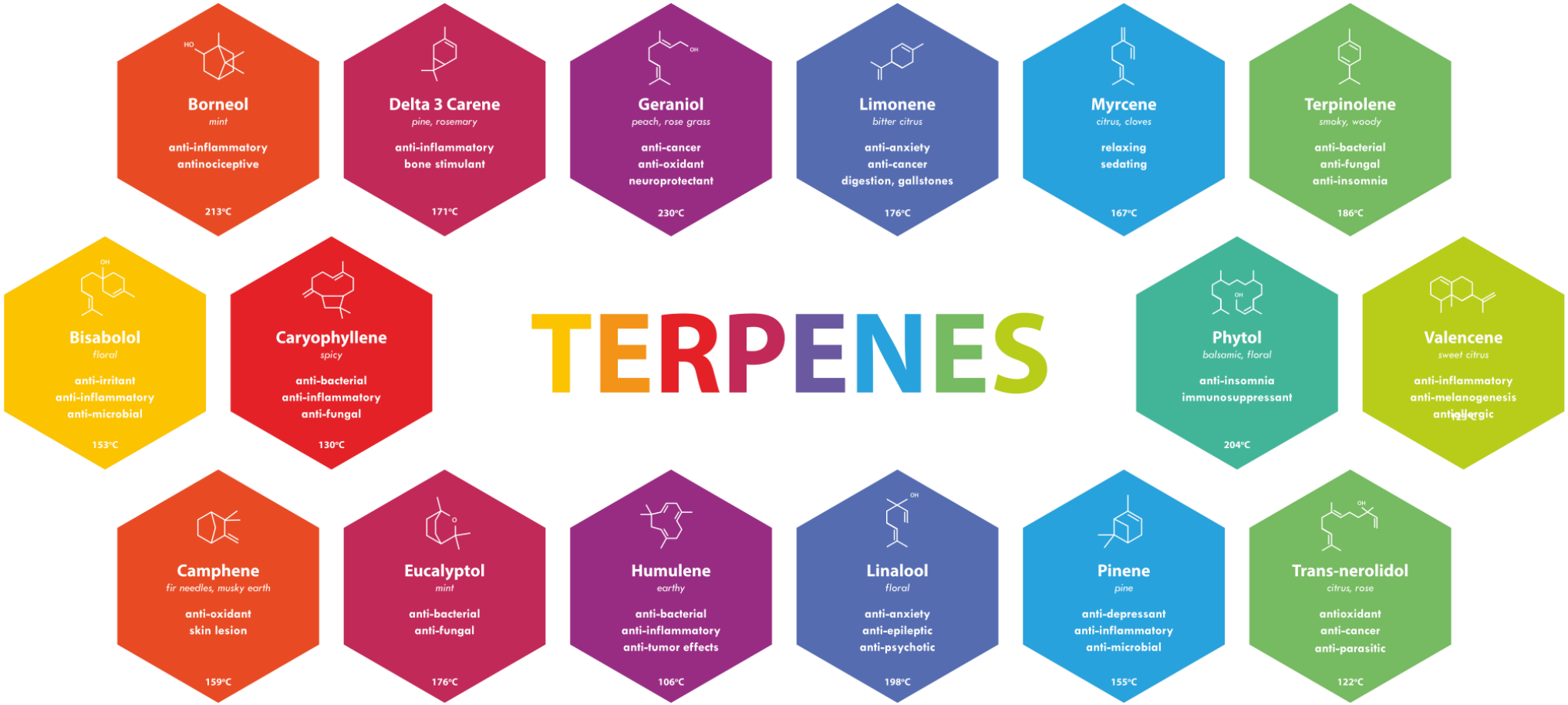
Monoterpene (GPP)

Sesquiterpene Triterpene (FPP)

Tetraterpene (GGPP)

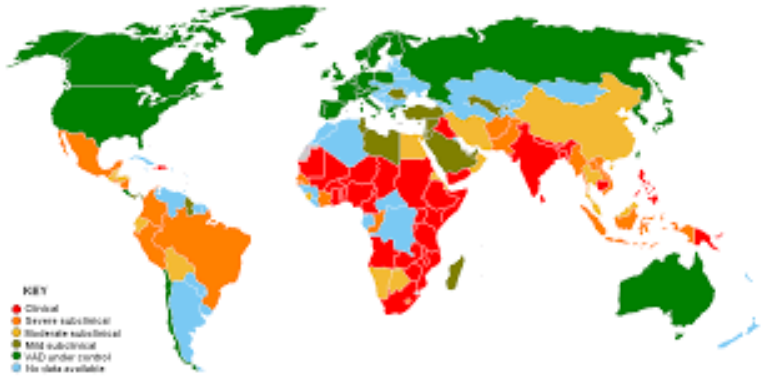


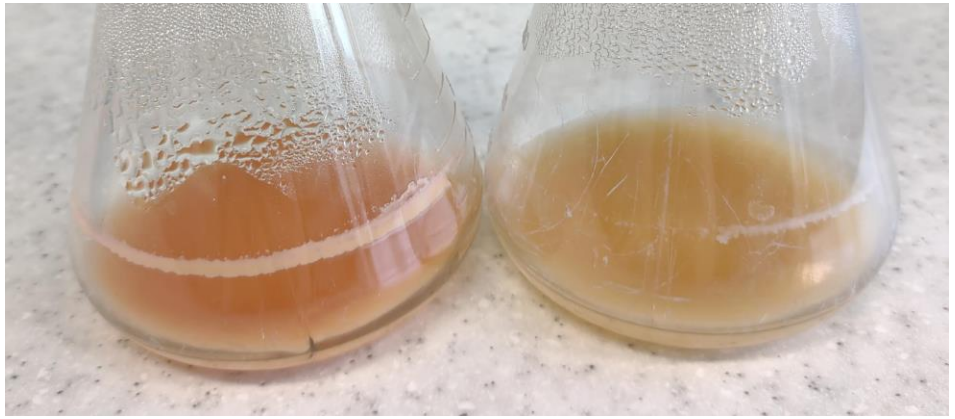
Application of terpenes: Flavors, Pigments, Binder, Bioactive compounds



*Pain/Stress reliever, Anti-cancer, Anti-inflammatory, etc. (Image from mgf.org.il)

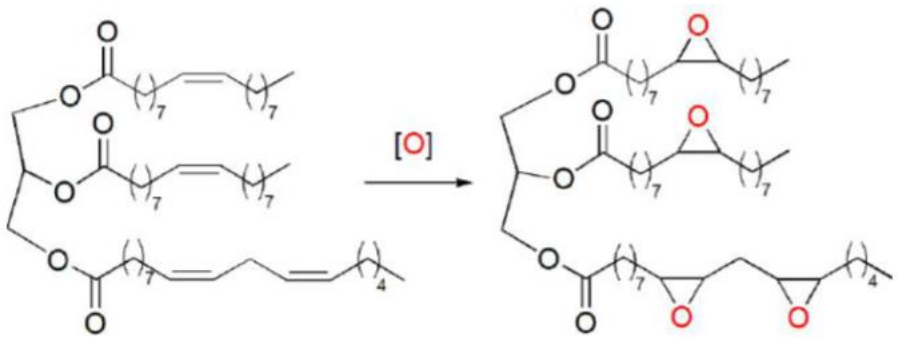
Solving multiple problems



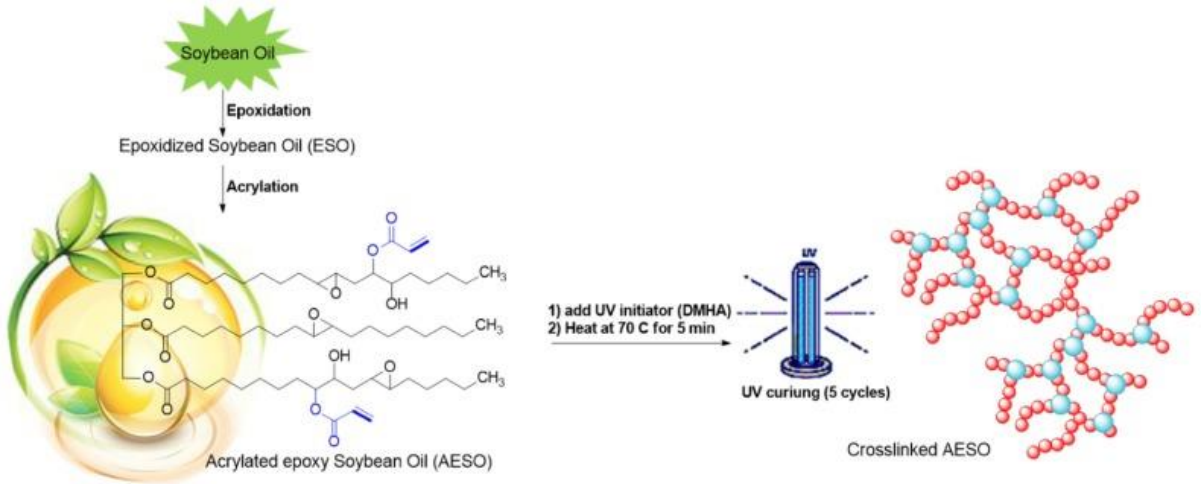


Soybean oil is up to 7.5% of plant (~20% of seed).
Microbial oil is up to 70% of microbial biomass.

Oil functionalization

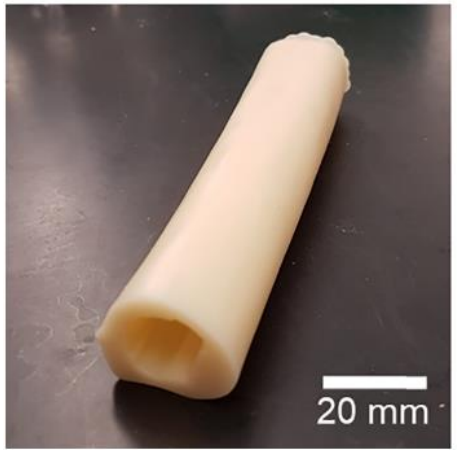


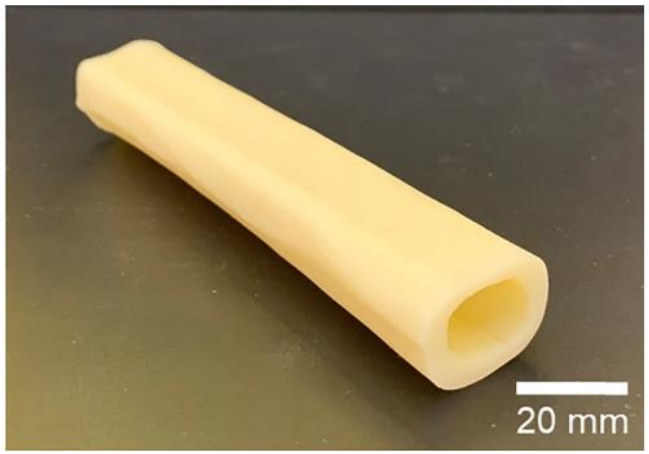
DOI:10.4038/RJS.V10I1.50



https://doi.org/10.1016/j.porgcoat.2022.107386

https://doi.org/10.1016/j.conbuildmat.2018.07.204





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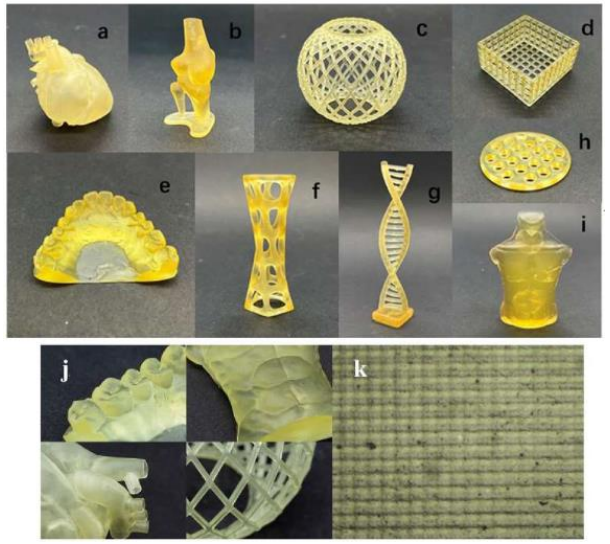
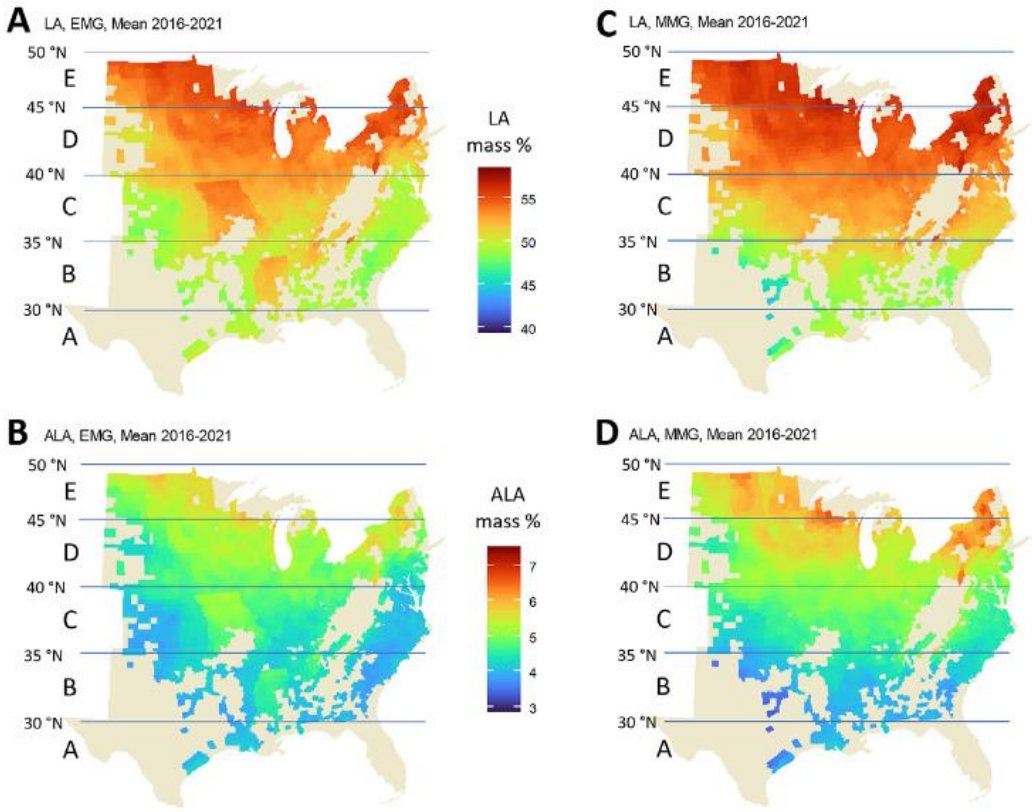
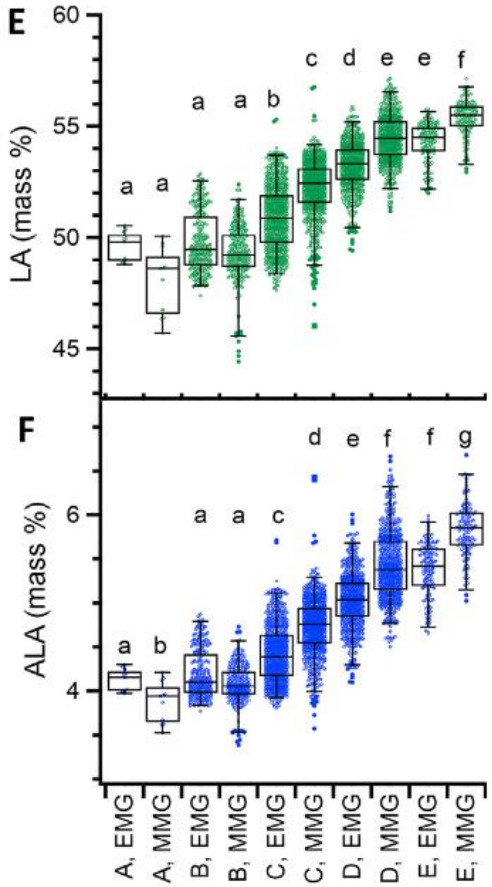
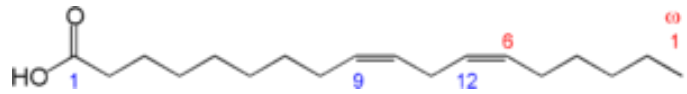


https://doi.org/10.1016/j.indcrop.2023.117037

Variability in quality of plant-based oils







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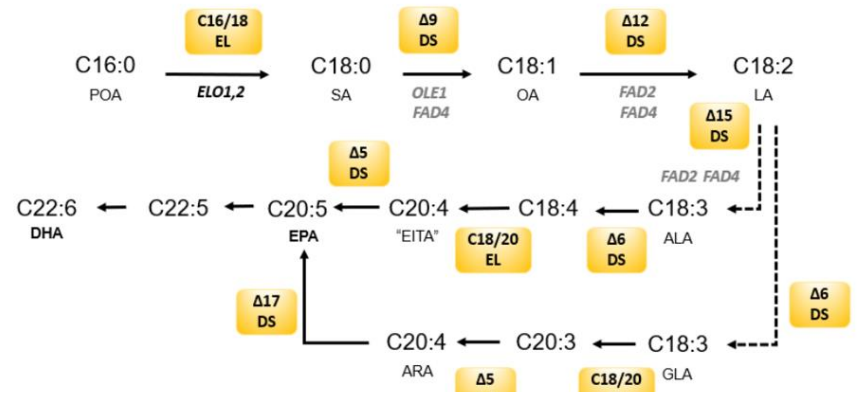
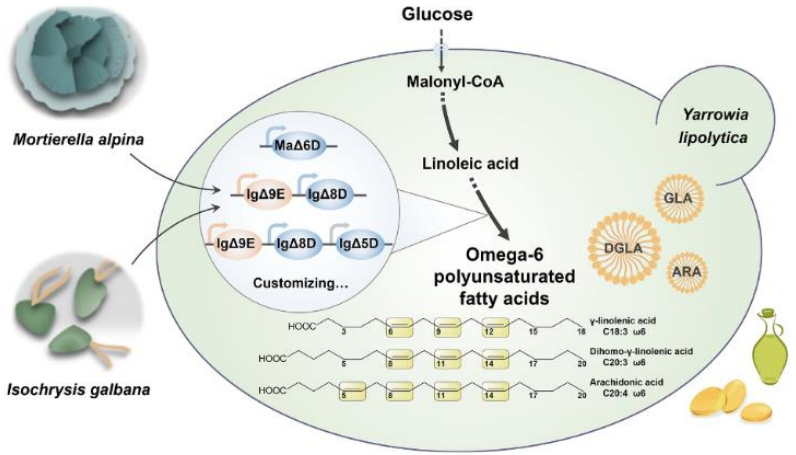
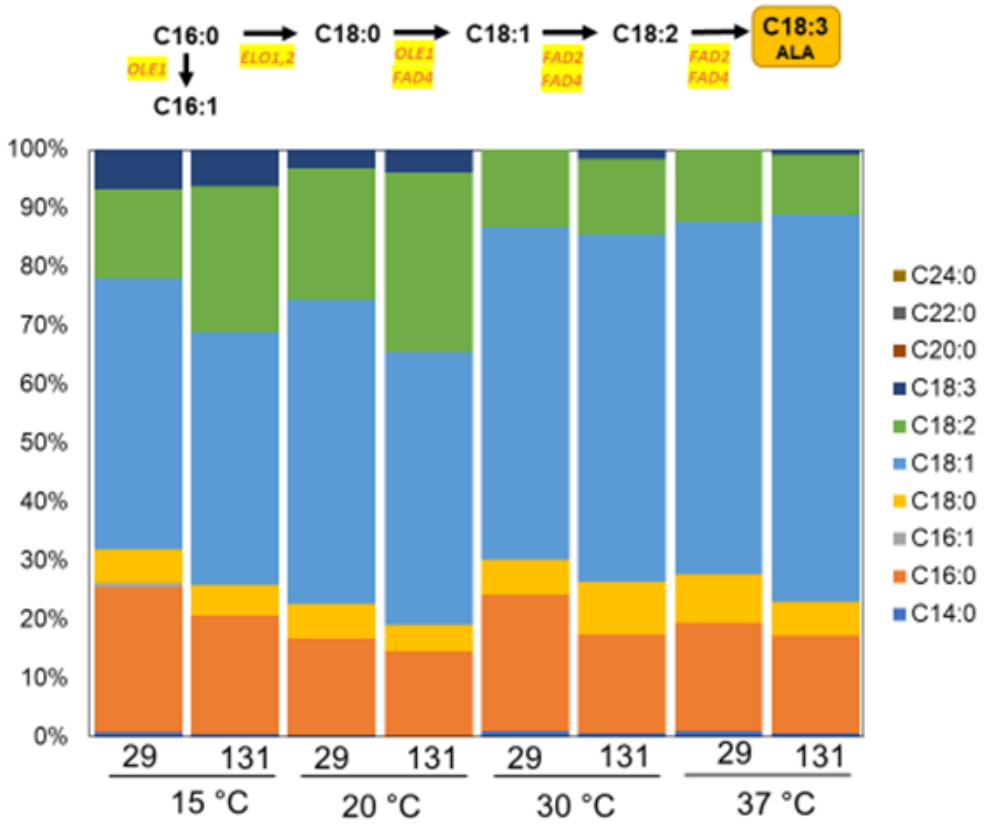
Manipulating fatty acids profile

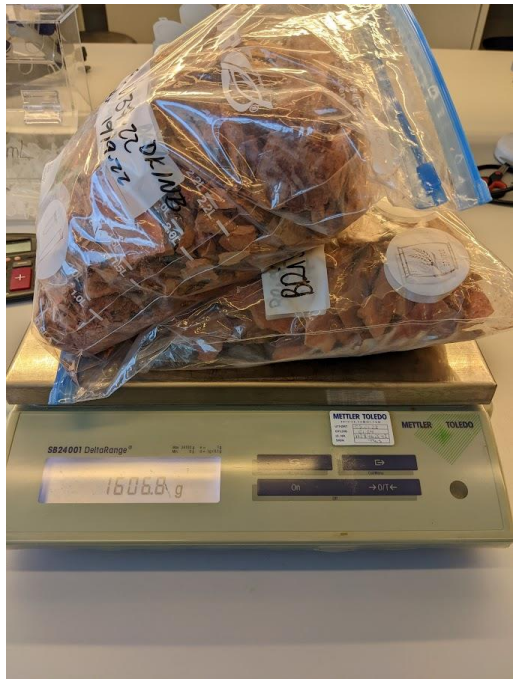


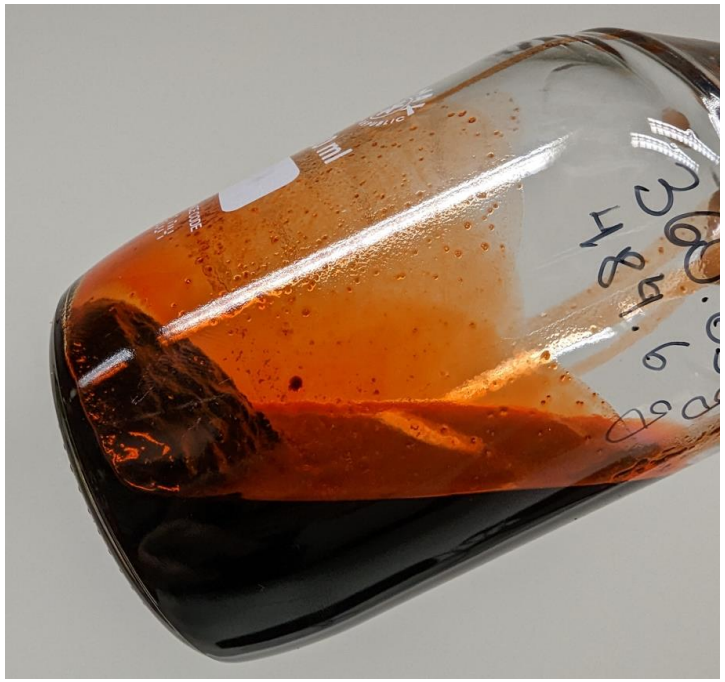




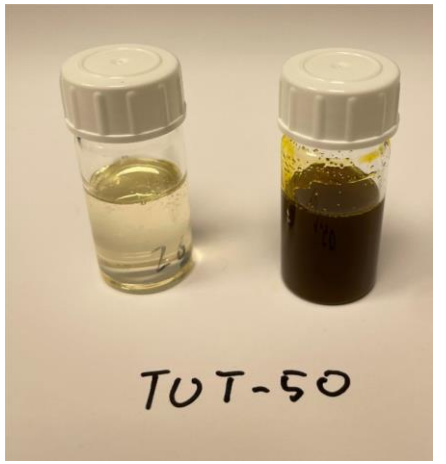
DOI: 10.1016/j.biortech.2023.129231

Oil based binders

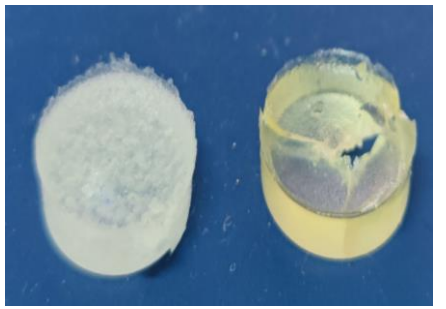




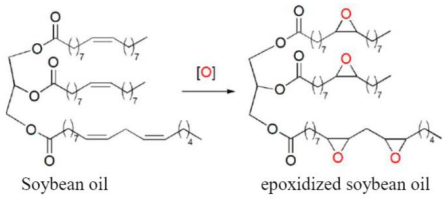
CRISPR-Cas9

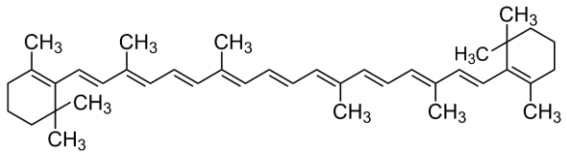


Epoxidized oil

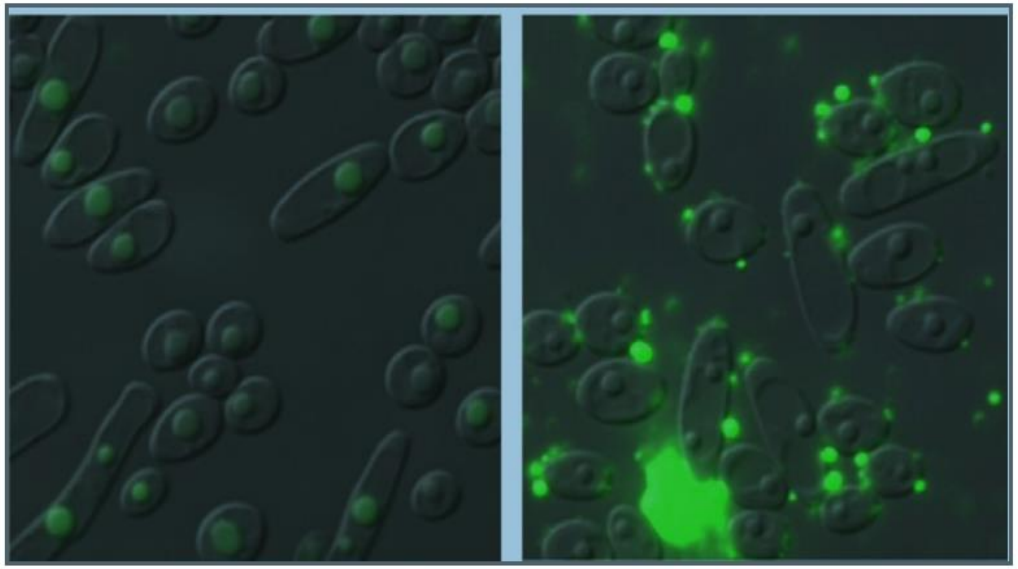


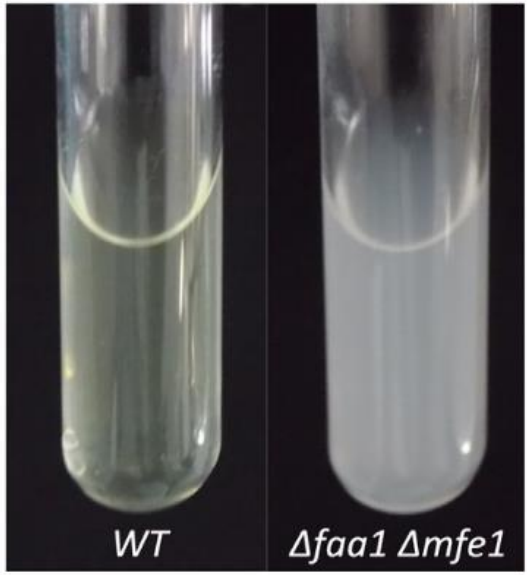
Oil derived binder



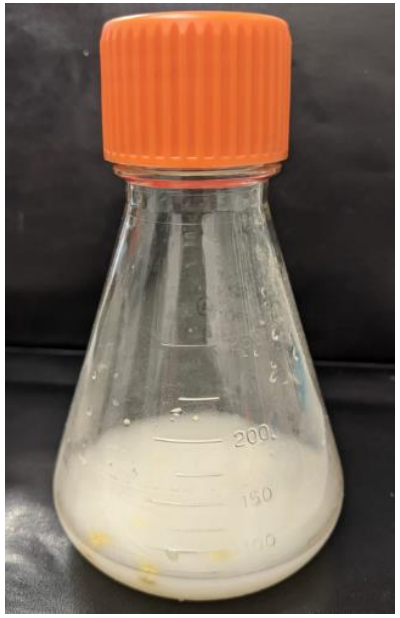


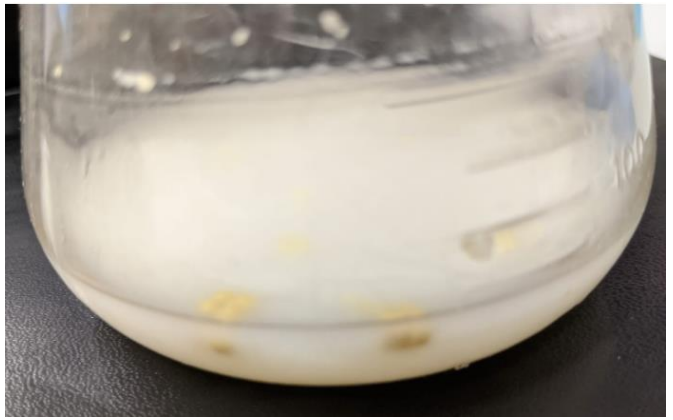
Free Fatty Acids production – secretion





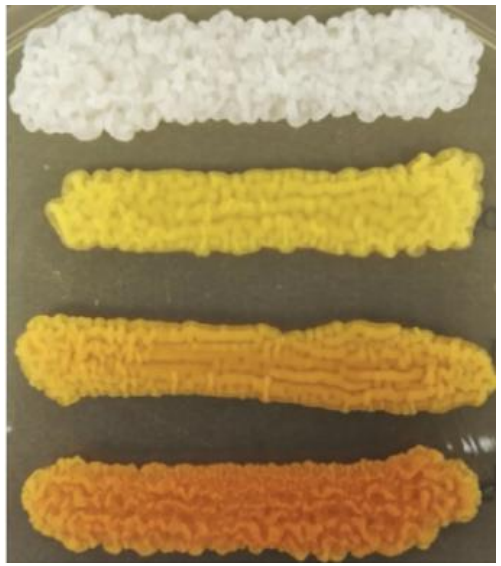
https://doi.org/10.1016/j.ymben.2016.06.004





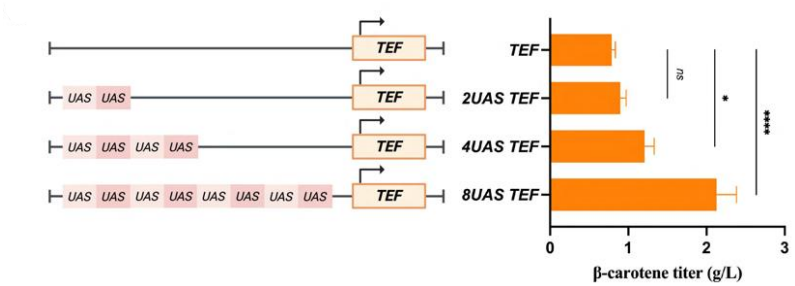
Recombinant technology for bio-based pigments production

Mevalonate ---▸ GGPP ---▸ β-carotene

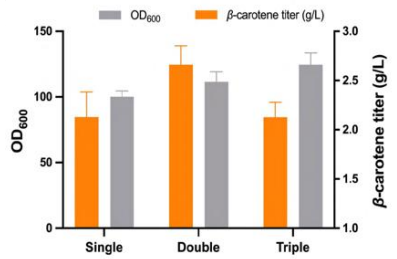


DOI: 10.1002/bit.26473

- Modulation of expression level by hybrid promoters



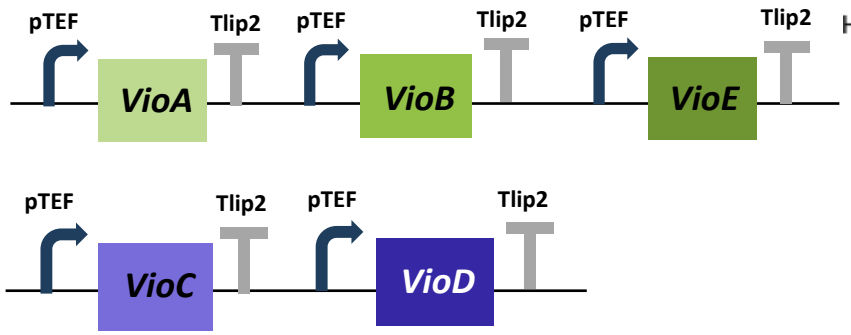
- Effect of multi-copy integration

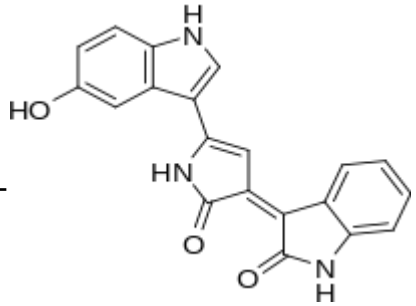


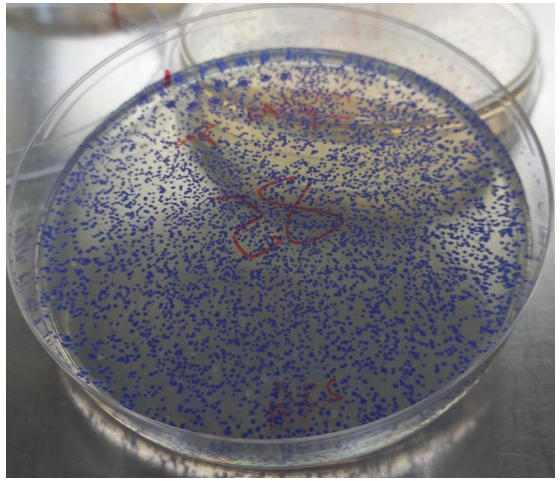
(Manuscript in preparation)

Recombinant technology for bio-based pigments production

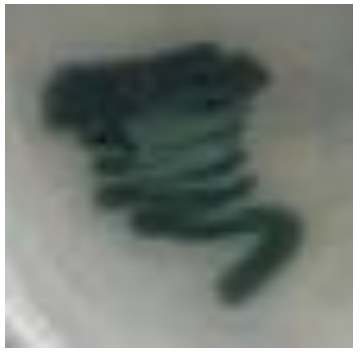
- Construction of expression cassette



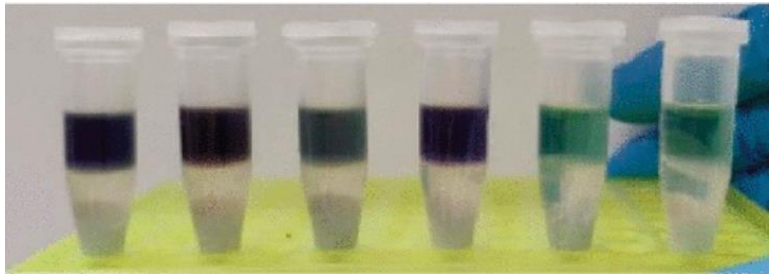




Tryptophan ---VioABE---> **Protodeoxy-violaceinic acid** ---VioCD---> **Violacein**



Y. lipolytica **WT + VioABE** **WT + VioCD** **WT + VioABE + VioCD**



https://doi.org/10.1021/acssynbio.0c00469

Synthetic biology Teams

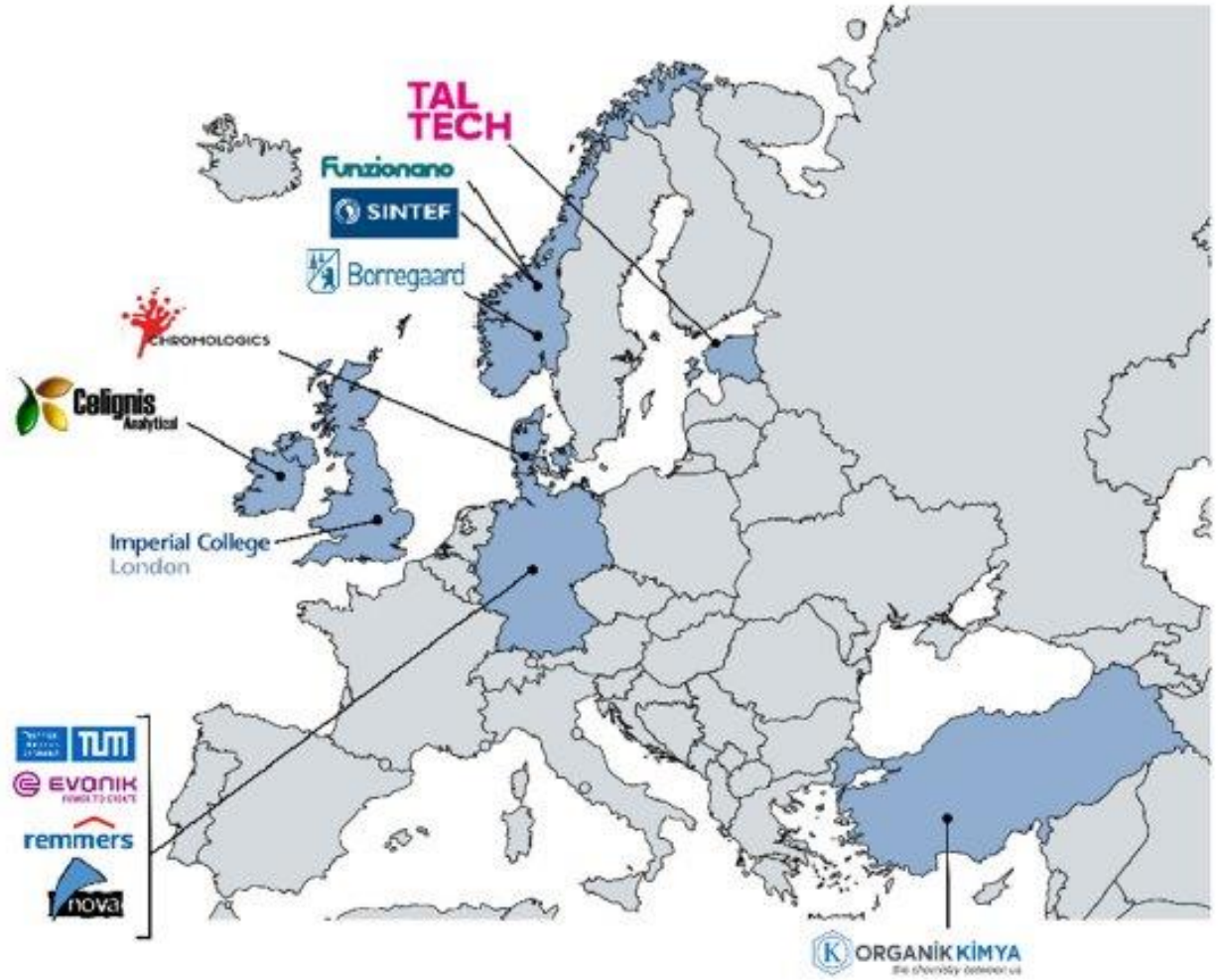
Imperial College London

Imperial College Centre for Synthetic Biology

TAL TECH

BioEng Lab

Acknowledgement



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