



**ENHANCE**  
MICROALGAE



**Interreg**  
**Atlantic Area**  
European Regional Development Fund



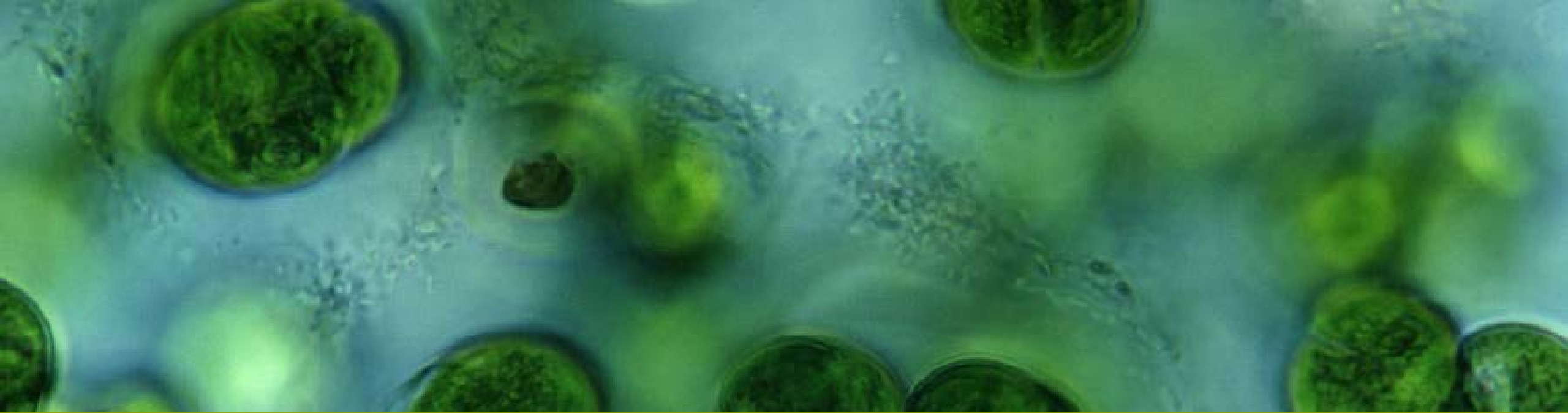
EUROPEAN UNION

# EnhanceMicroAlgae Project

High added-value industrial opportunities for microalgae in the Atlantic Area

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Giovanna Romano – Stazione Zoologica Anton Dohrn



# Microalgae biotechnology research at the Stazione Zoologica Anton Dohrn



# Microalgae biotechnology research at the SZN



## Stazione Zoologica Anton Dohrn

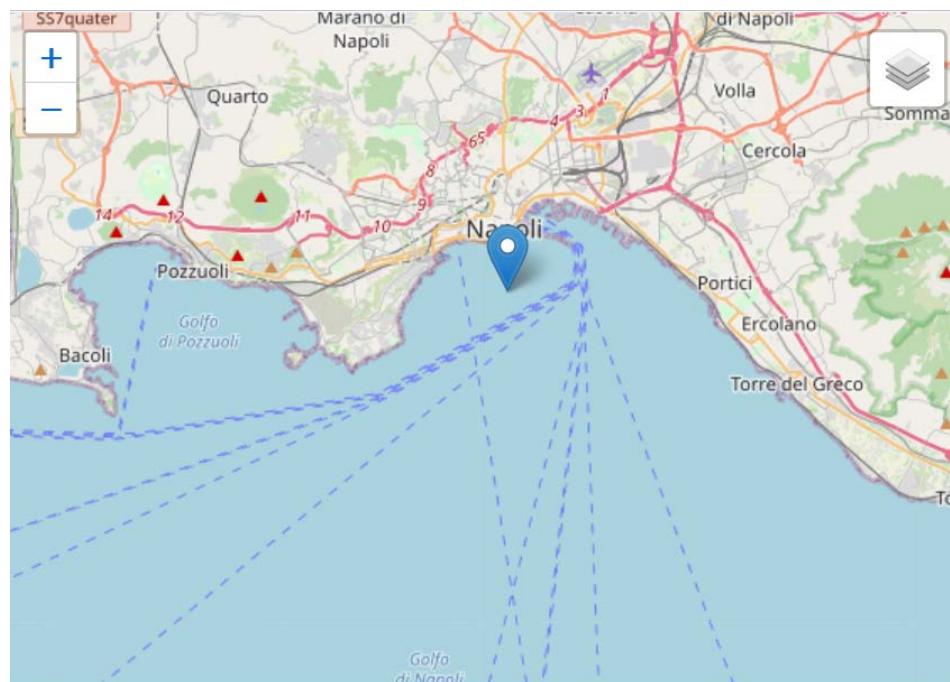


New Department  
MARINE BIOTECHNOLOGY

## ILTER Marechiara

Site Status: Operational

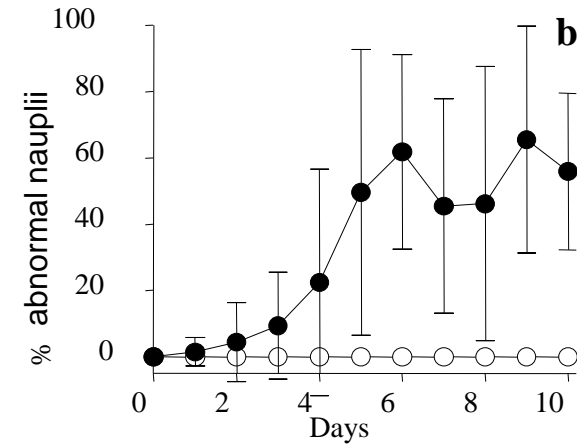
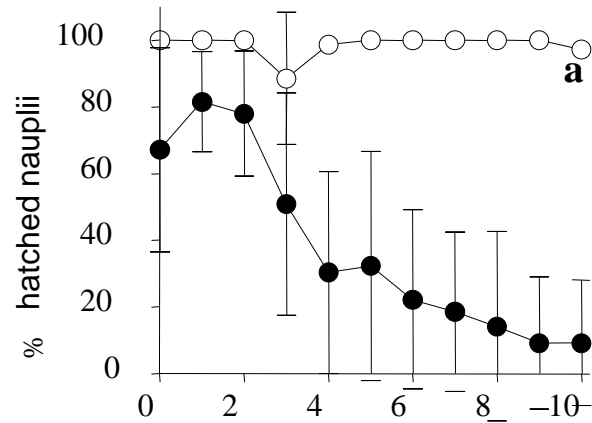
Year Established: 1984



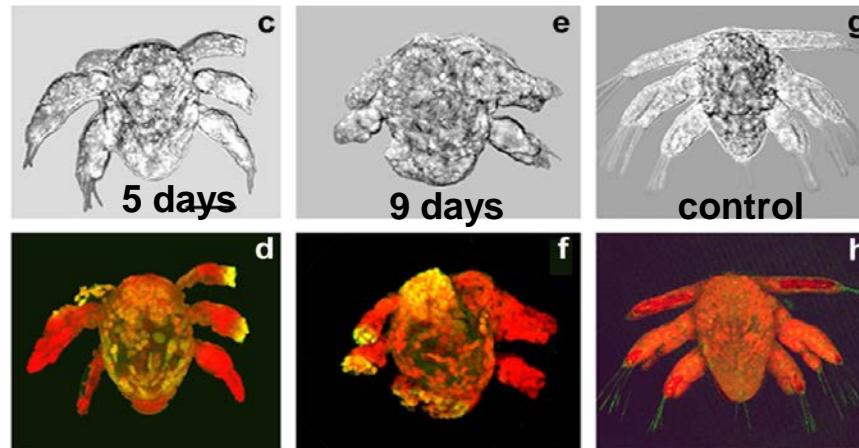
### Observed properties

ecosystem parameter				water parameter				chemical parameter		biological parameter	
algae species abundance	algae species presence	alpha diversity	animal species abundance	available phosphorus	dissolved organic carbon in water	oxygen saturation	photosynthetically active radiation intensity	sea surface temperature			
animal species presence	bacillariophyceae abundance	bacillariophyceae biomass	bacillariophyceae biovolume	chlorophyll content of water	nitrogen content	secchi depth	water temperature				
bacillariophyceae presence	bacillariophyceae species richness	bacteria abundance	bacteria presence	conductivity		oxygen concentration	water depth	water transparency			
bacterial diversity	microbial biomass carbon	photosynthetically active radiation intensity	phytoplankton abundance	carbon to nitrogen ratio	chlorophyll a content in water	beta diversity	biological diversity				
beta diversity	phytoplankton biomass	species group abundance	species list	dissolved nutrient	inorganic carbon content	cell size	community structure				
community composition	species abundance	species presence	zooplankton abundance	inorganic nitrogen content	nutrient concentration	oxygen saturation	community pattern	microbial biomass carbon			
diversity index	species composition	species richness	zooplankton biomass	inorganic nutrient content	pH value of water		environmental parameter	genetic parameter			
							seasonal change	DNA sequence			

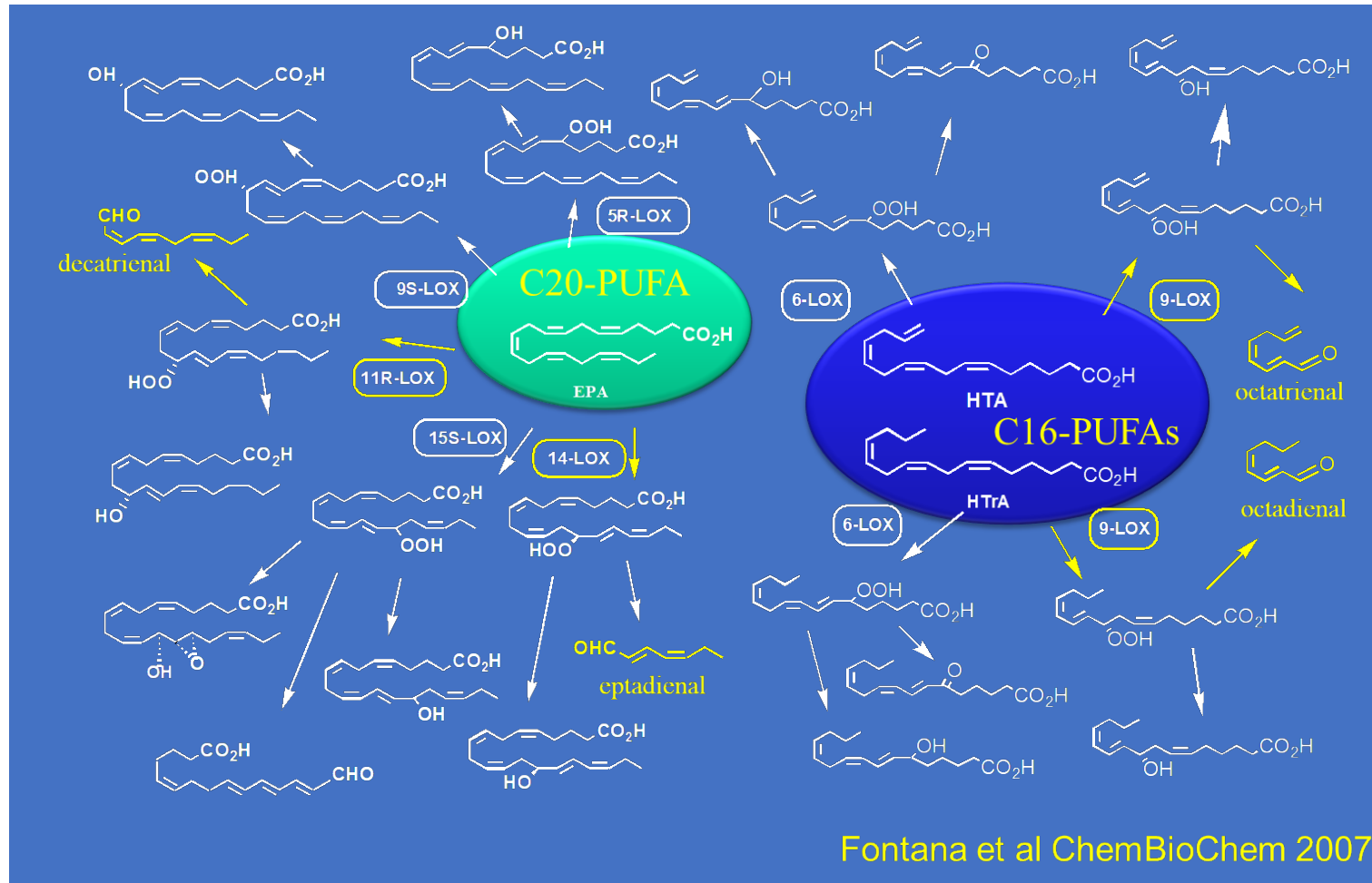
## The insidious effect of diatom diet on the copepod *Calanus helgolandicus*



Teratogenic effect

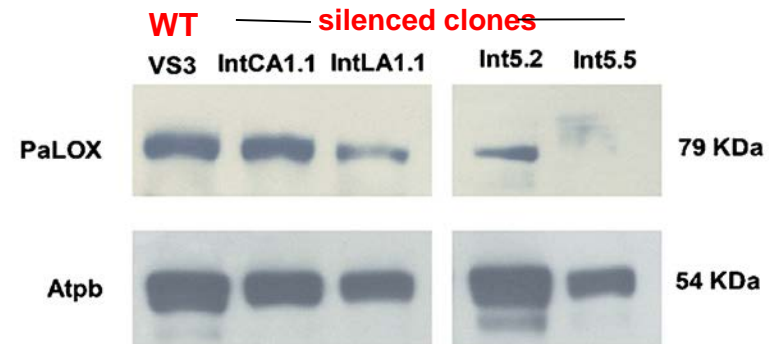
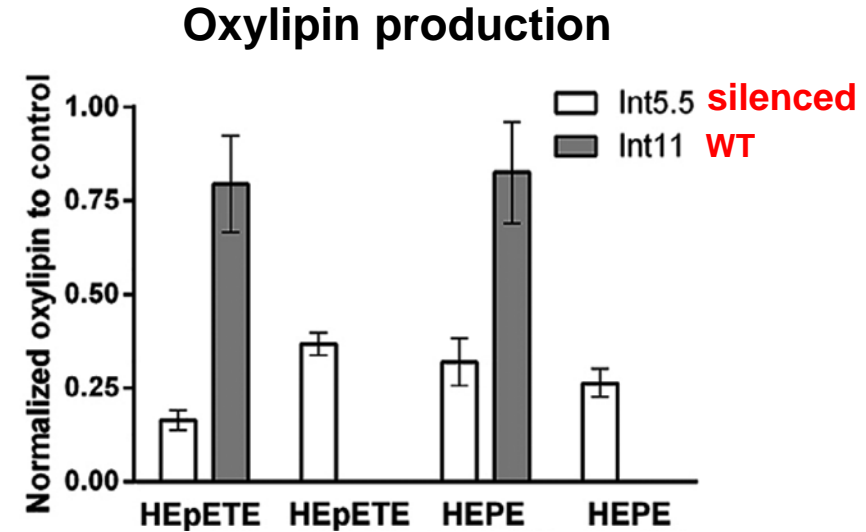
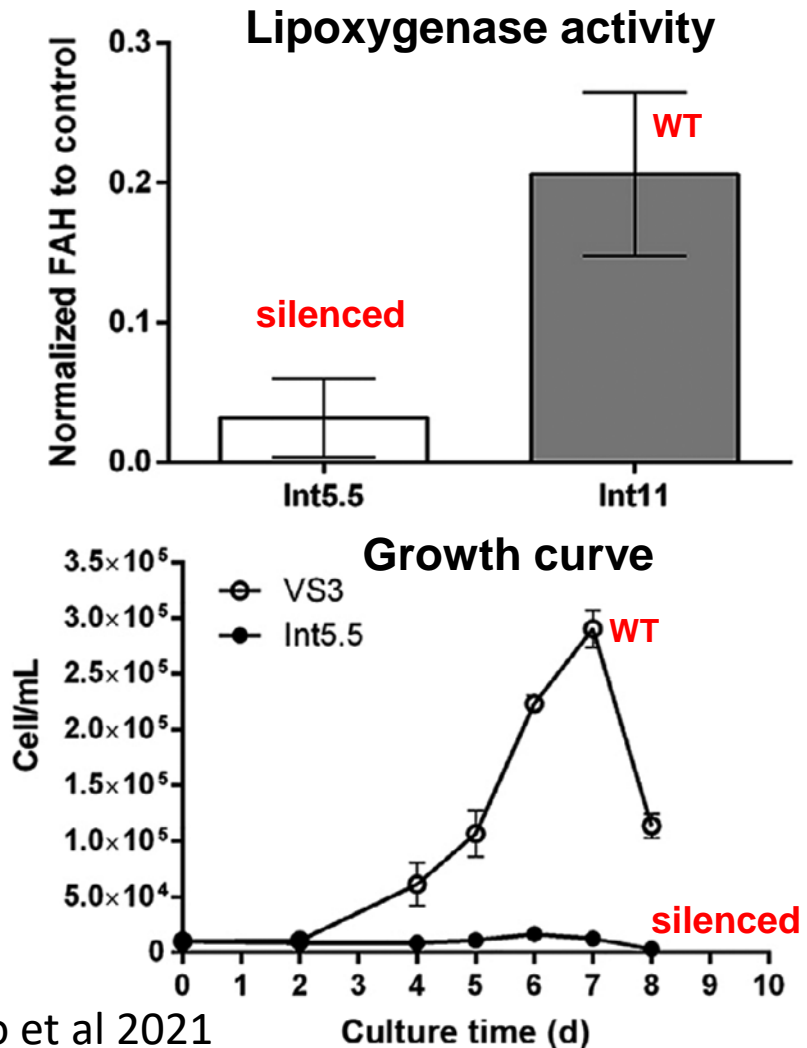


## Oxylipins from Diatoms



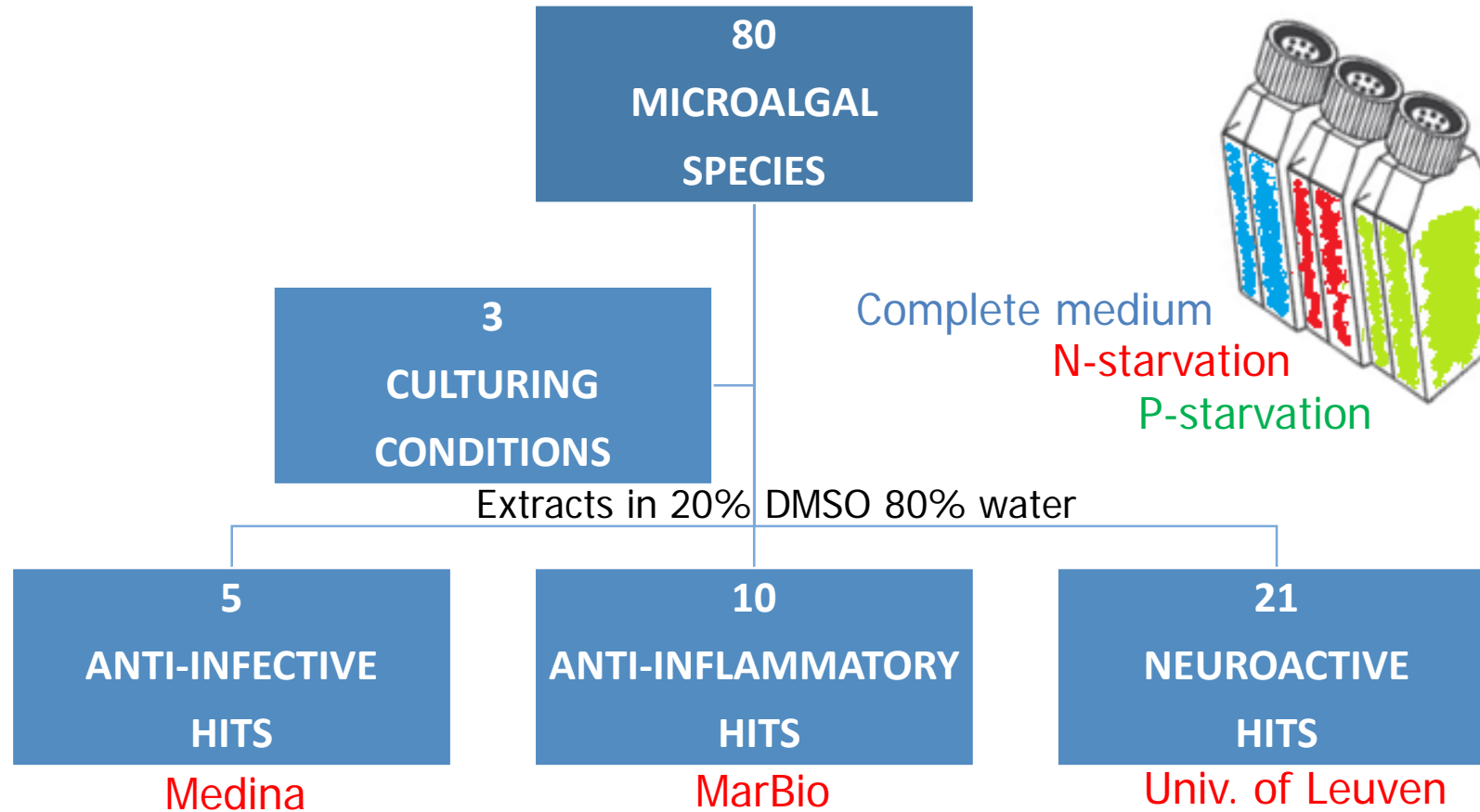
Fontana et al ChemBioChem 2007

## Silencing of a *Pseudo-nitzschia arenysensis* lipoxygenase transcript



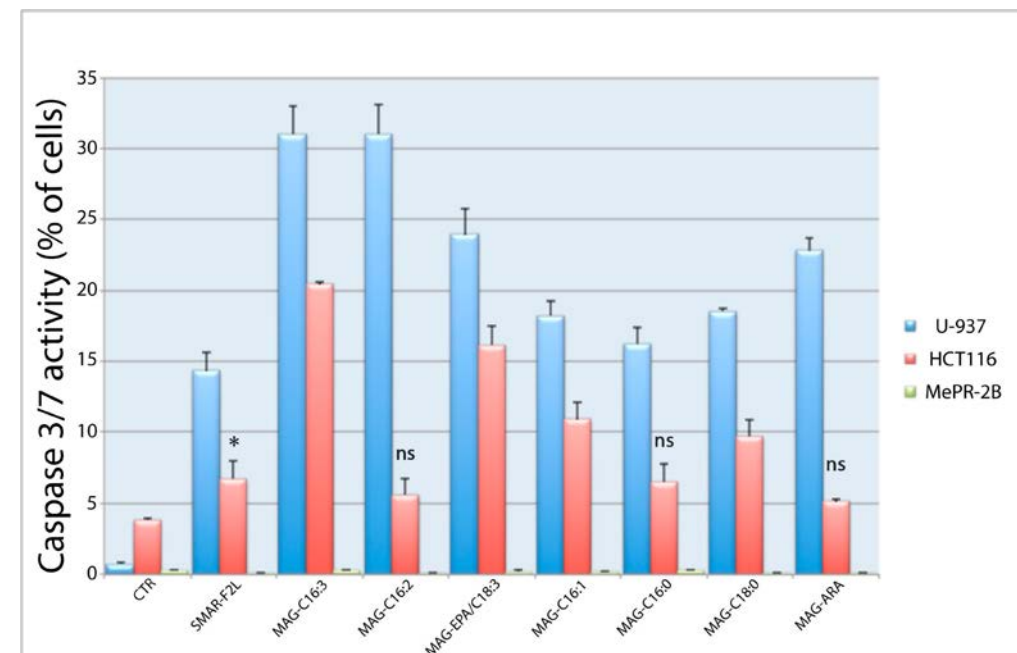
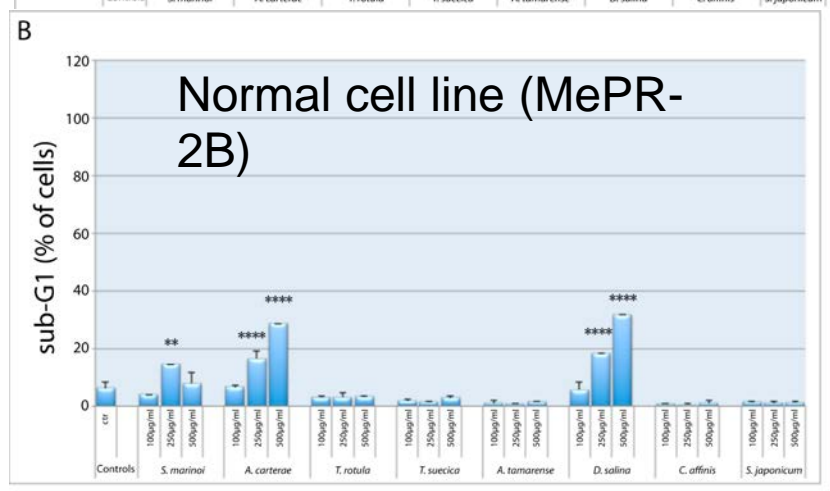
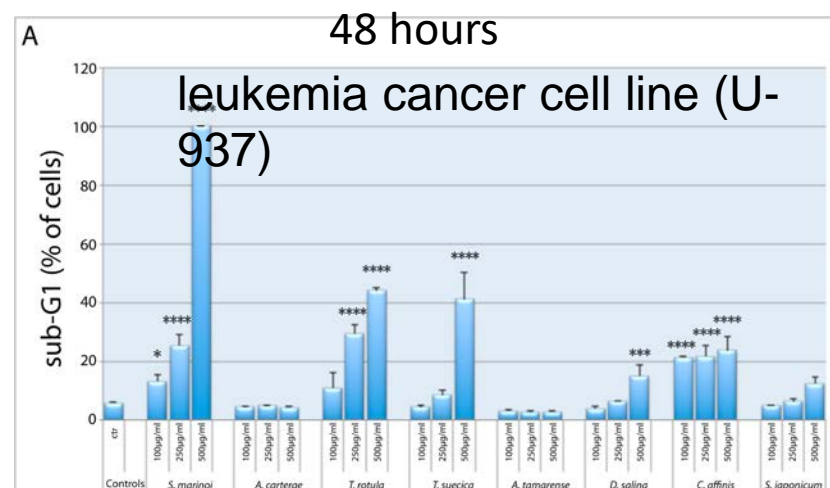
Western blot analysis on silenced clones of *Pseudo-nitzschia arenysensis*

## Bioactivity screening of microalgae from SZN culture collection



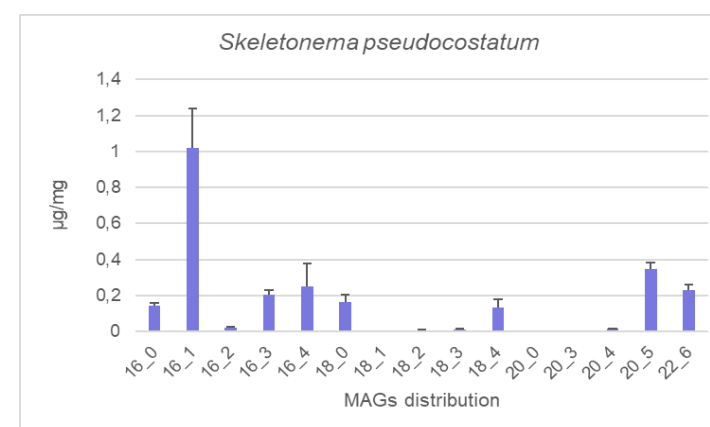
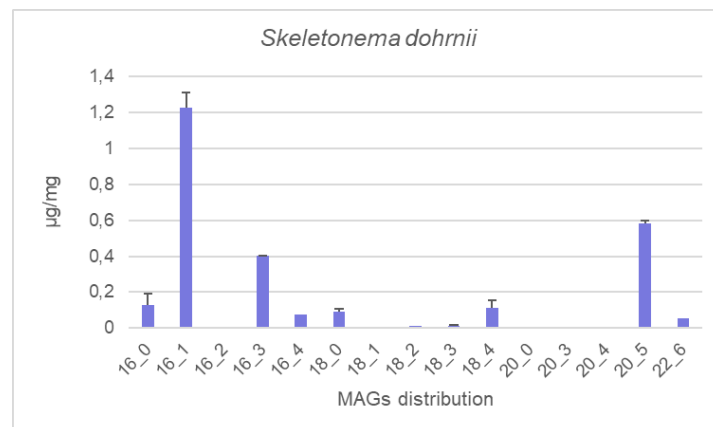
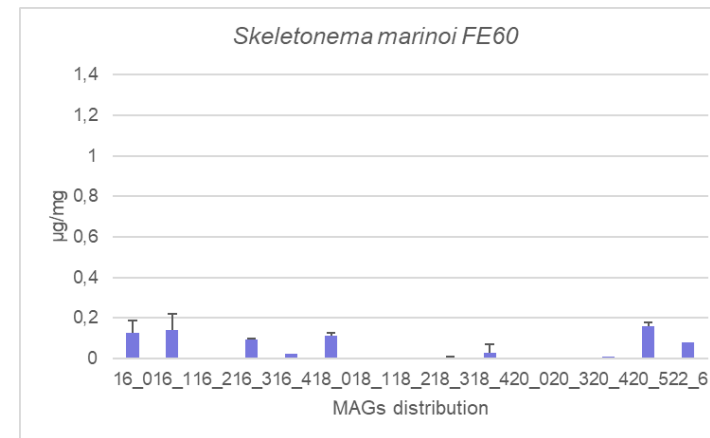
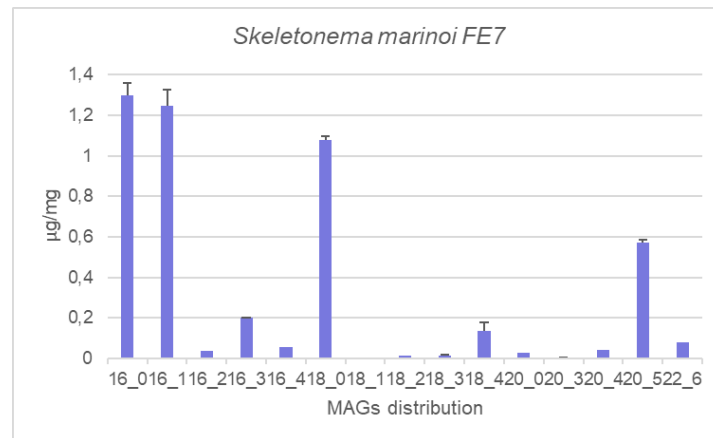


## Monoacylglycerides from the Diatom *Skeletonema marinoi* Induce Selective Cell Death in Cancer Cells

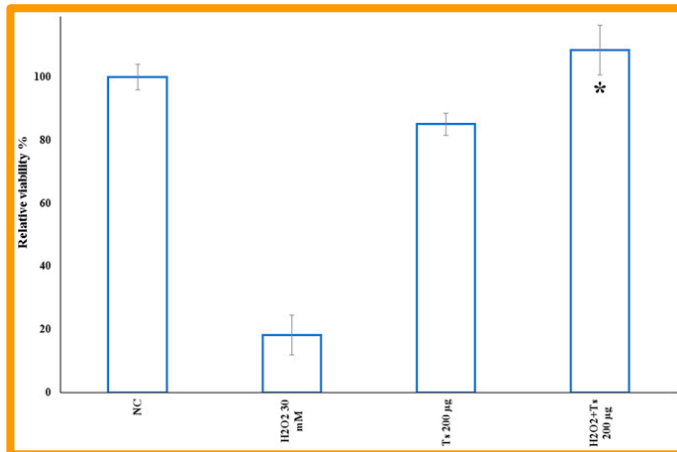


Caspase activation by MAG from *Skeletonema marinoi* in U-937 and HCT116 tumor cell lines compared to MePR-2B normal cell line

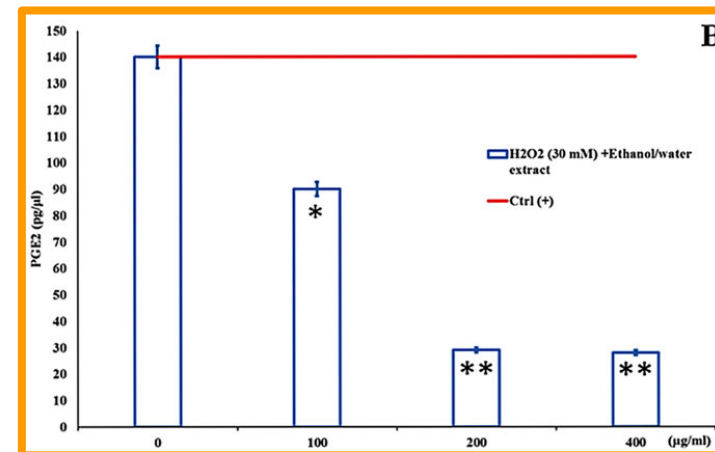
## Distribution of MAGs in studied *Skeletonema* species



## Potential of *Tetraselmis suecica* for developing new cosmetic products



Viability of EpiDerm<sup>TM</sup> skin model



PGE2 concentration (pg µl<sup>-1</sup>)

Strong antioxidant and cell repairing activity.



potential cosmeceutical application.




Spin-off company to develop new products from marine microalgae

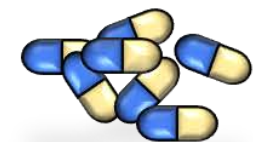
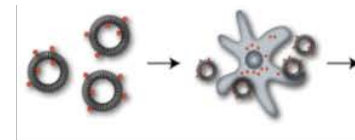
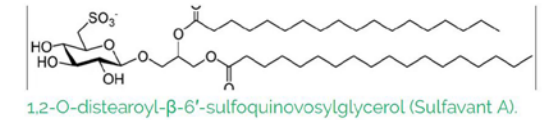
# BIOSEARCH

BioSEArch Srl (July 2016) - Spinoff company of the Stazione Zoologica Anton Dohrn and the National Research Council (CNR) to develop and exploit new molecule of marine origin for cosmeceutical applications, to treat inflammatory diseases and cancer

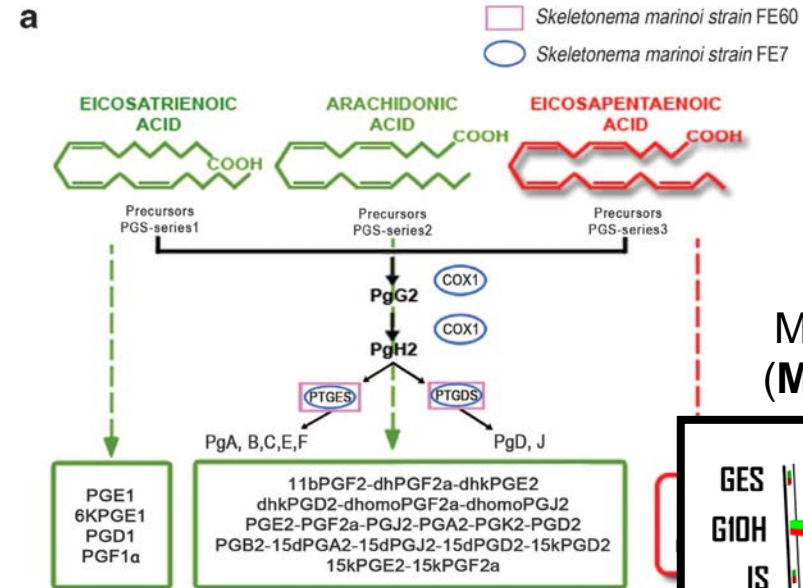
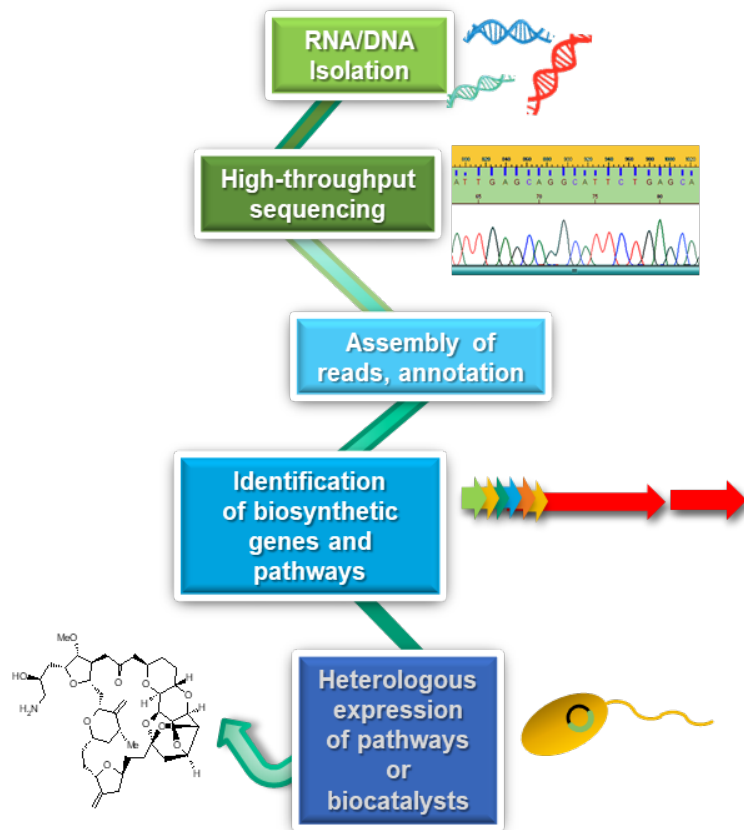


## BioSearch Product portfolio

- SULFAVANT**, a patented vaccine **adjuvant** from marine microalgae
- SKINREP**, a cosmeceutical microalgal extract with **skin regenerating** properties
- IMMUNOBLU**, a new nutraceutical microalgal product with **immunostimulant** properties
- GLICOX**, an autophagy inducer (**anti-tumor candidate**) (Patent in preparation)
- Two new antitumor candidates (pyroptotic activity and anti-angiogenic activity)

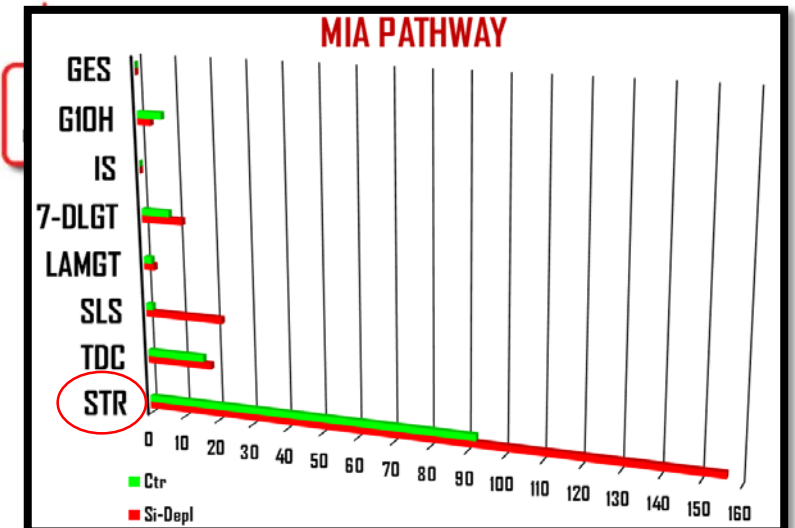


## Transcriptome mining



Prostaglandin biosynthetic enzymes

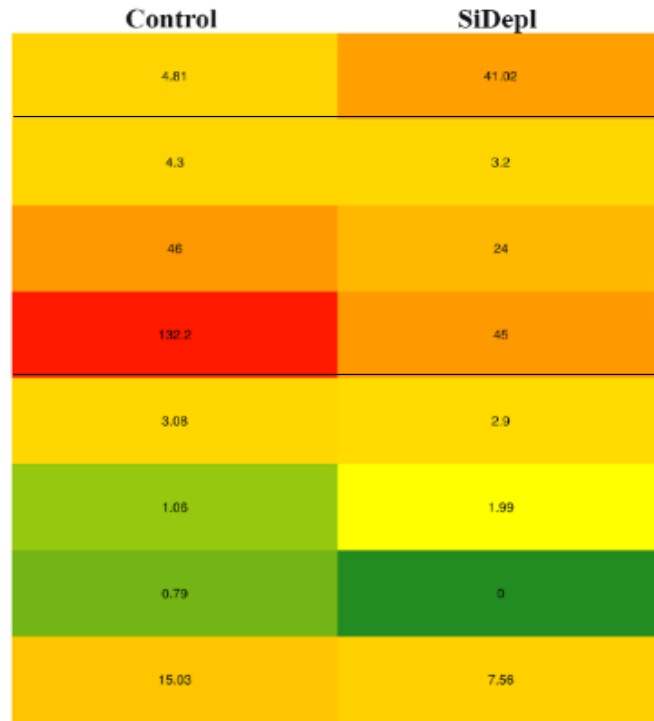
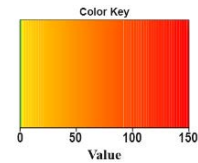
Monoterpene indole alkaloid (MIA) biosynthetic enzymes



STR: Strictosidine synthase

## In silico gene expression analysis

### Experimental validation

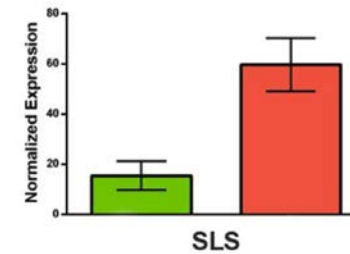


FPKM

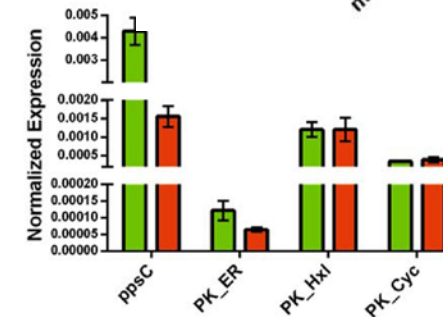
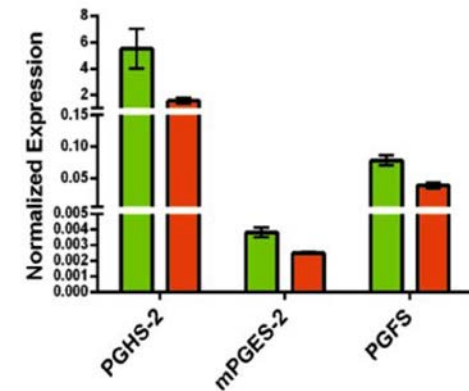
Secologanin Synthase } **Secologanin**

Prostaglandin E Synthase 2-like  
Prostaglandin F Synthase  
Prostaglandin GH Synthase 2 (COX) } **Prostaglandins**

Polyketide cyclase dehydrase and lipid transport protein  
Polyketide enoylreductase  
Polyketide hydroxylase-like  
Phthiocerol synthesis polyketide synthase type I } **Polyketides**

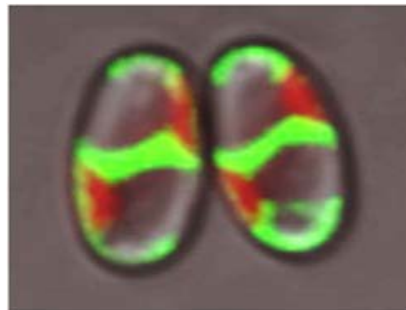


### Real time PCR validation

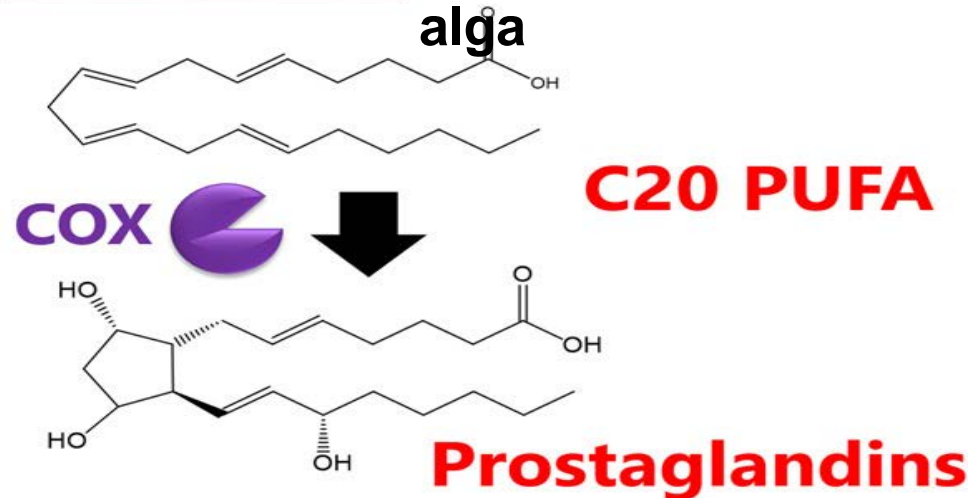


Prostaglandin production by *Fistulifera solaris* with heterologous expression of cyclooxygenase (COX)

*Fistulifera solaris*

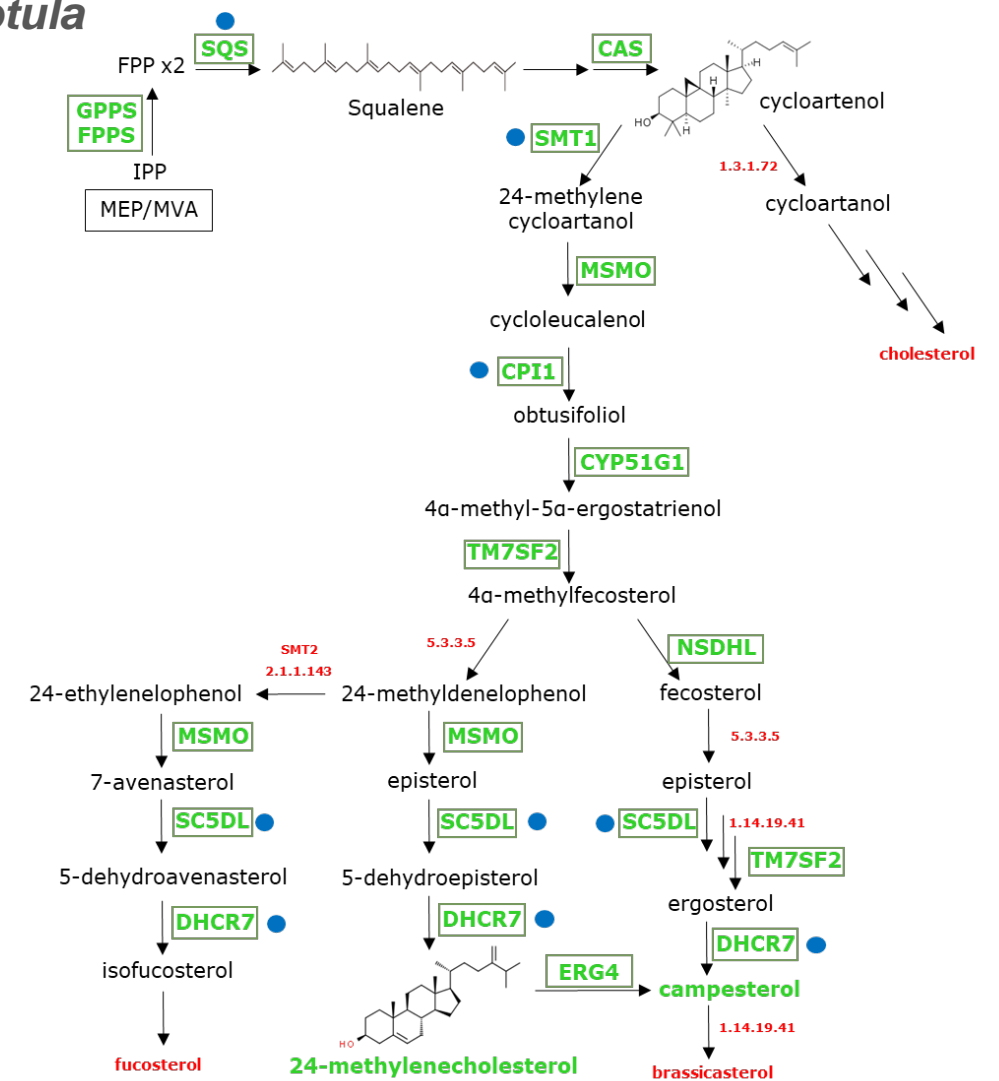
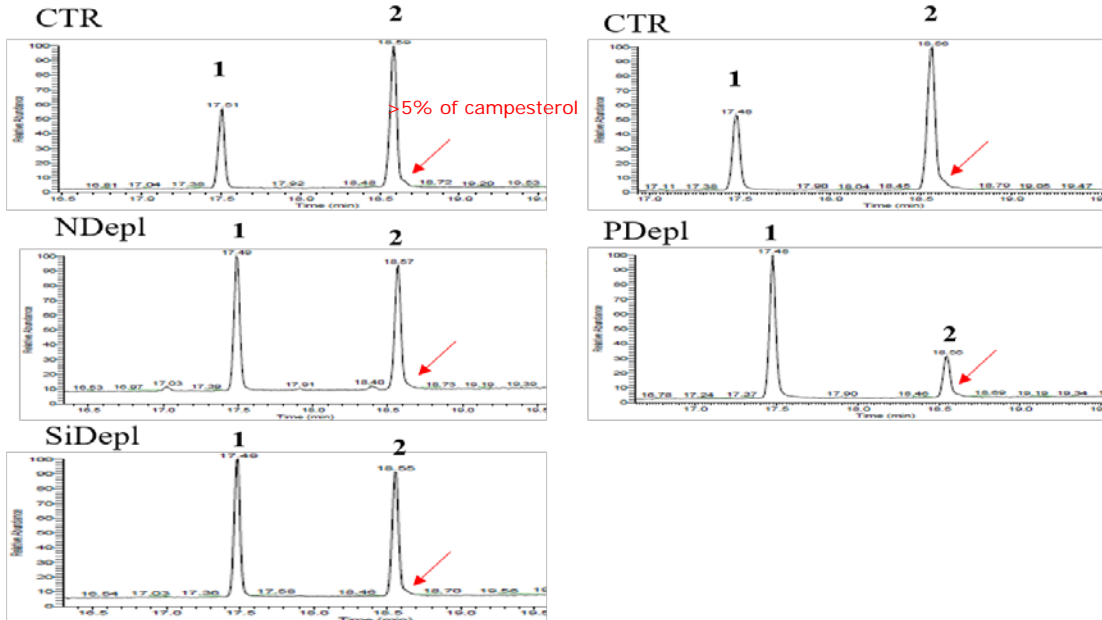
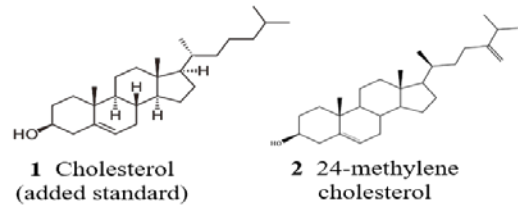


Genetically engineered  
microalga expressing  
cyclooxygenase (COX)  
derived from a red  
alga

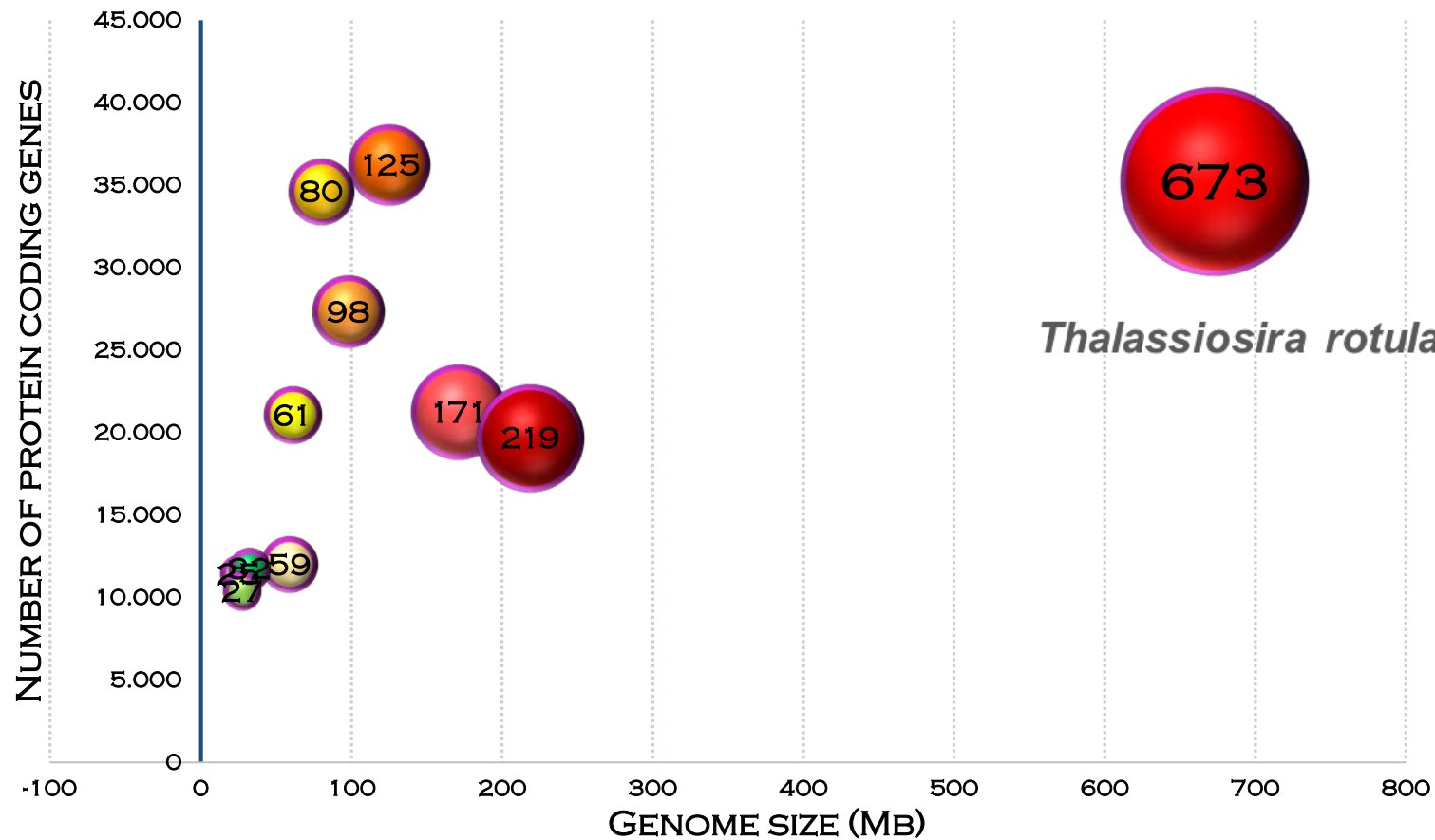




## Phytosterols biosynthetic pathway in *Thalassiosira rotula*



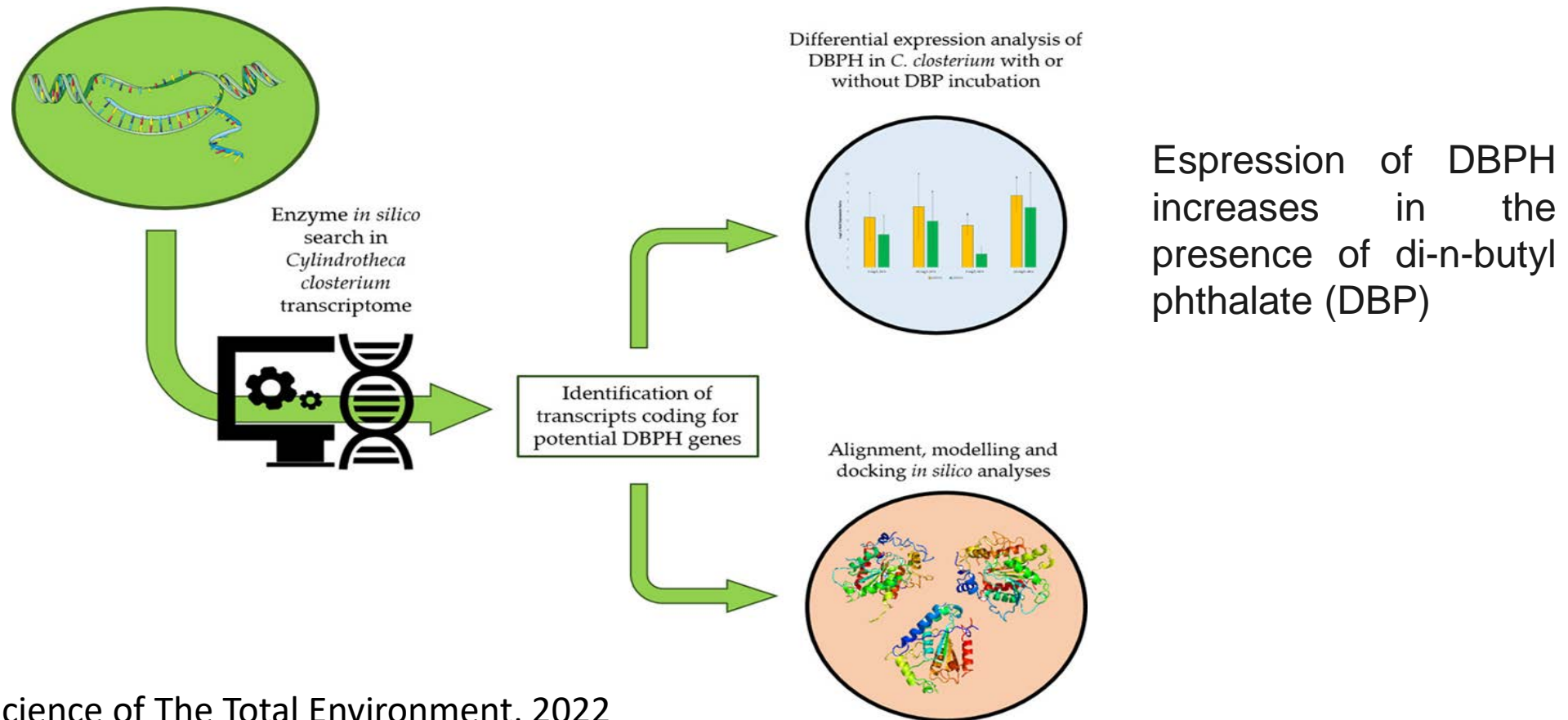
## Genome sequencing of *Thalassiosira rotula*



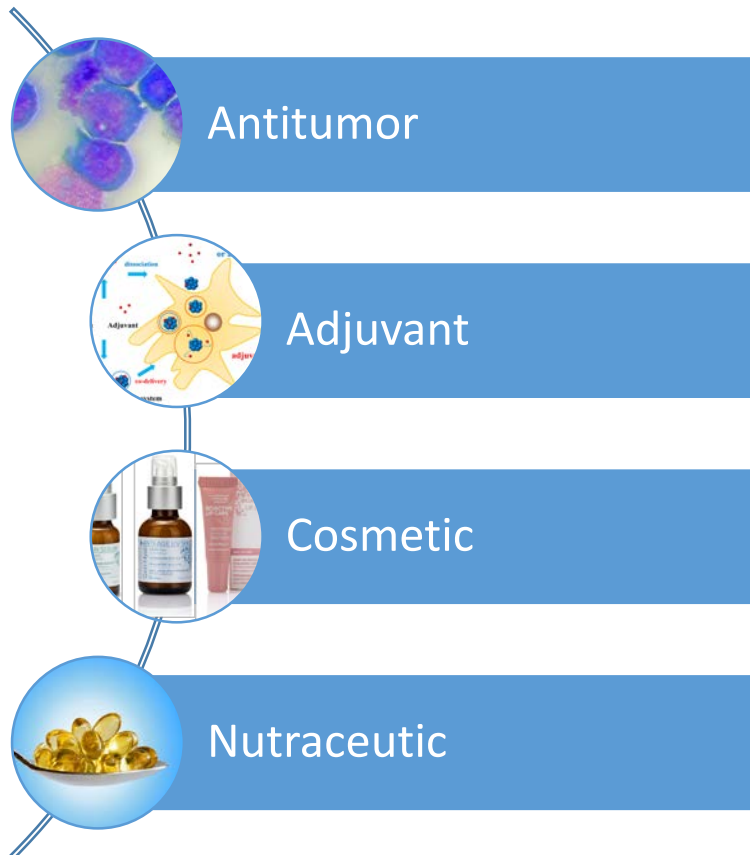
**2 Illumina sequencing**  
**2 PacBio sequencing**

*Thalassiosira rotula*

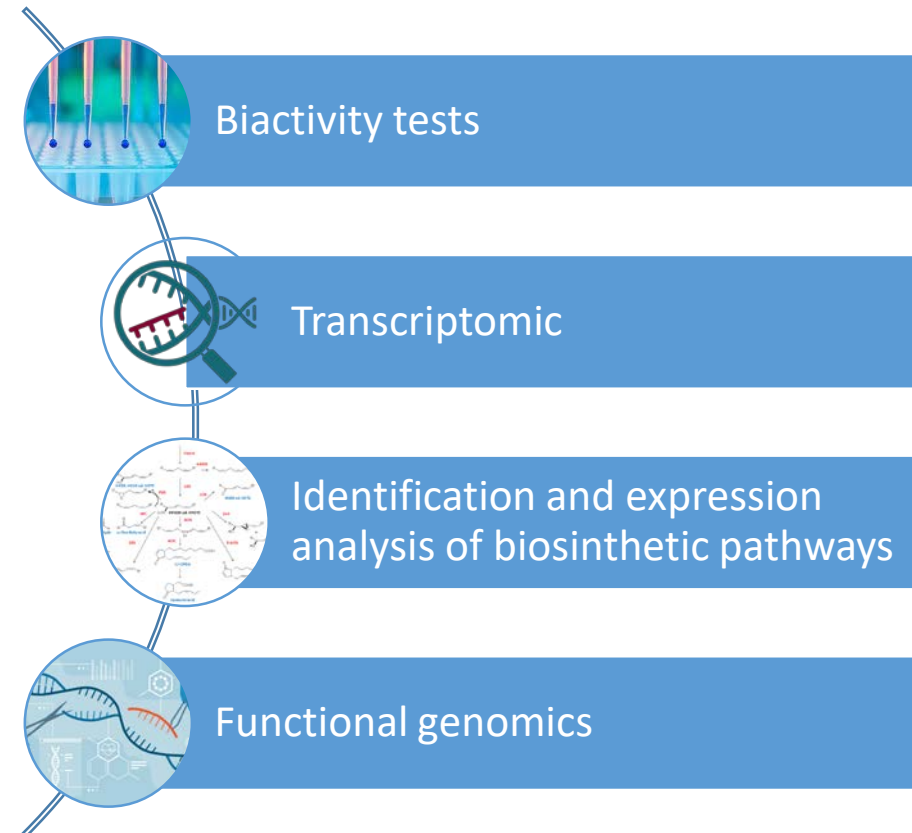
## Putative dibutyl phthalate hydrolases in the transcriptome of *Cylindrotheca closterium*



## Area of Application



## Technology and approaches



## Acknowledgements

### Stazione Zoologica

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Thank you!



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