

# Marine Biotechnology in the Fast Moving Consumer Goods Industry

Exploring marine biodiversity and bringing sustainable solutions to industry

Marine Biotech ERA-Net Stakeholder Meeting  
Brussels  
October 13<sup>th</sup> 2016



# ABOUT US

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## 2 BILLION

consumers use our products on any given day



## €48.4 BILLION

sales in 2014

## 172,000

employees worldwide



Our portfolio has four categories: Personal Care, Foods, Refreshment and Home Care. We have 13 brands with sales of more than

**AXE**



**LUX**



## €1 BILLION

# Unilever Sustainable Living Plan



**SOCIAL**

**ENVIRONMENTAL**

**ECONOMIC**

Raw Materials



+

Manufacture



+

Transport



+

Consumer Use



+

Disposal

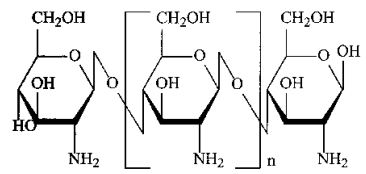
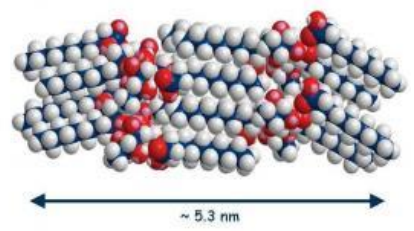
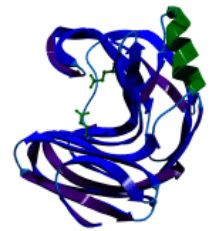
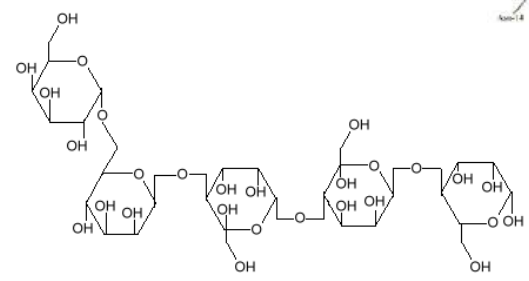
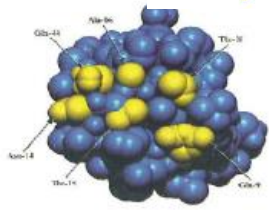
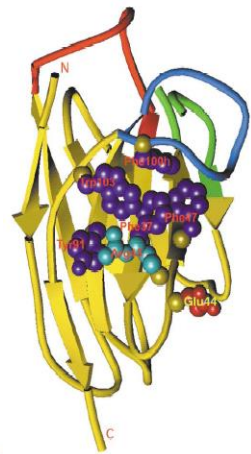
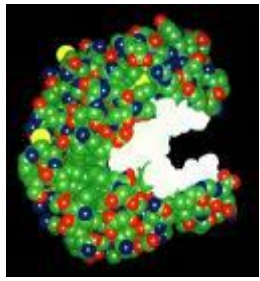
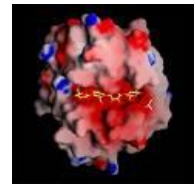


HELP  
**1 BILLION**  
PEOPLE IMPROVE  
THEIR HEALTH  
& WELL-BEING

**HALVE**  
ENVIRONMENTAL  
FOOTPRINT OF  
OUR PRODUCTS

SOURCE  
**100%**  
OF AGRICULTURAL  
RAW MATERIALS  
SUSTAINABLY

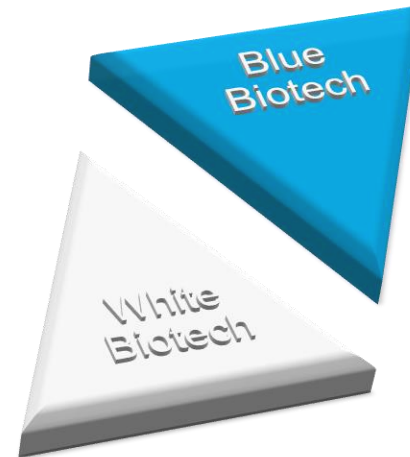
# Technology is a key enabler



*Where can biomaterials / biotechnology / green chemistry really make a big impact ?*

- \* New actives / New functionality*
- \* Raw material processing*
- \* New product formats*
- \* New compositions / formulations*
- \* New ways of working / partnerships / supply chains*

# Food Biotech – Peptides / Ice Cream



# Example 1: Ice cream structurants

## Key challenges

- Ice content and crystal size are critical for taste and texture of ice cream. Temperature abuse causes major quality loss.
- Need to replace the high calorific building blocks of ice cream (fats / sugar etc).



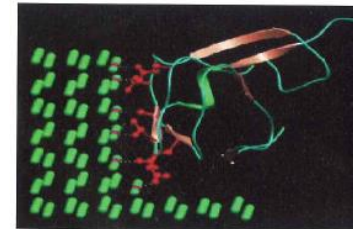
## Technology/ intervention

- Discovery of Ice Structuring Proteins (ISP) signalled that nature may offer a solution
- Limit crystal growth rate
  - Influence ice crystal morphology



## Hurdles to commercialise

- Significant R&D programme
- Key challenges**
- Sustainable source
  - Comprehensive safety dossier
  - Regulatory approval

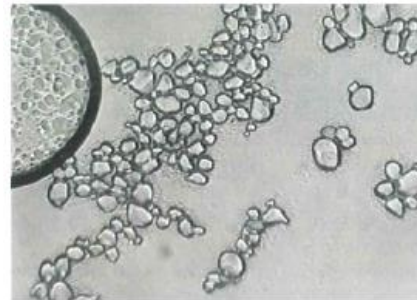


# Ice Structuring Peptide – function and effect

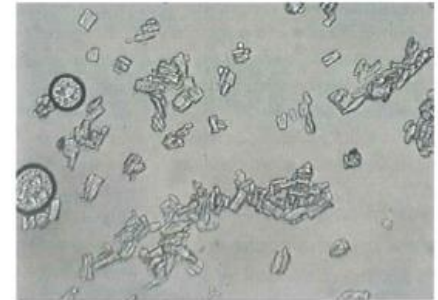


## ISP:

- Adsorbs preferentially and alters growth patterns of evolving ice crystal
- Impacts on size and shape of crystals formed
- Very weight effective material



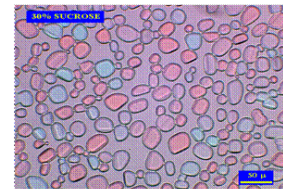
No ISP



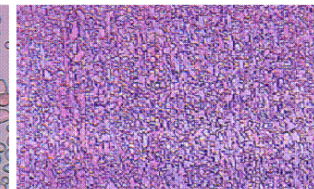
With ISP

## Benefits:

- Better stability on temperature fluctuation
- Sensory characteristics (feel, bite & creaminess)
- Facilitates production of great tasting low fat products
- Provides opportunity for novel textures



Normal



+ ISP



No ISP



With ISP

# Structural peptides – production and safety

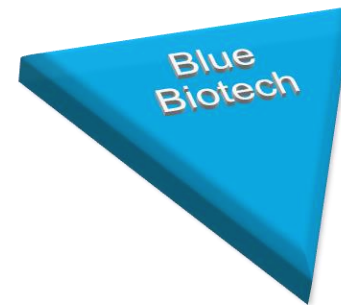


- ISP expressed in yeast *Saccharomyces cerevisiae*
- DSP ensuring yeast & DNA free
- Process common to many other food ingredients

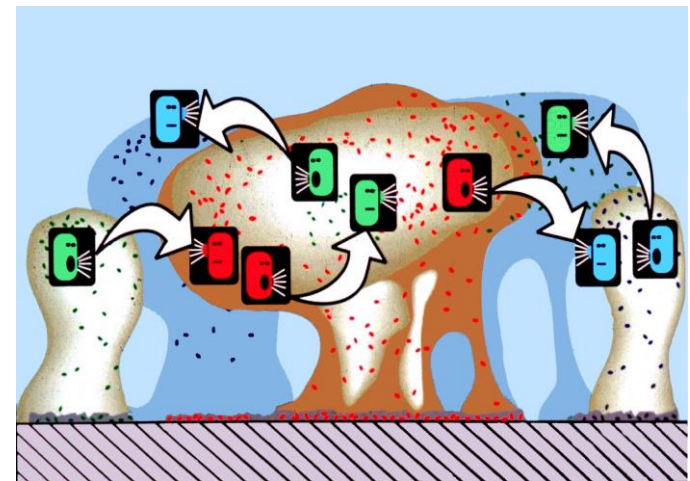
*“In line with Unilever’s stringent safety policies, safety was given the highest priority with the development of a very comprehensive toxicology package which has been scrutinised by many scientists and health professionals worldwide”*



# Example 2: Anti-biofilm Technology

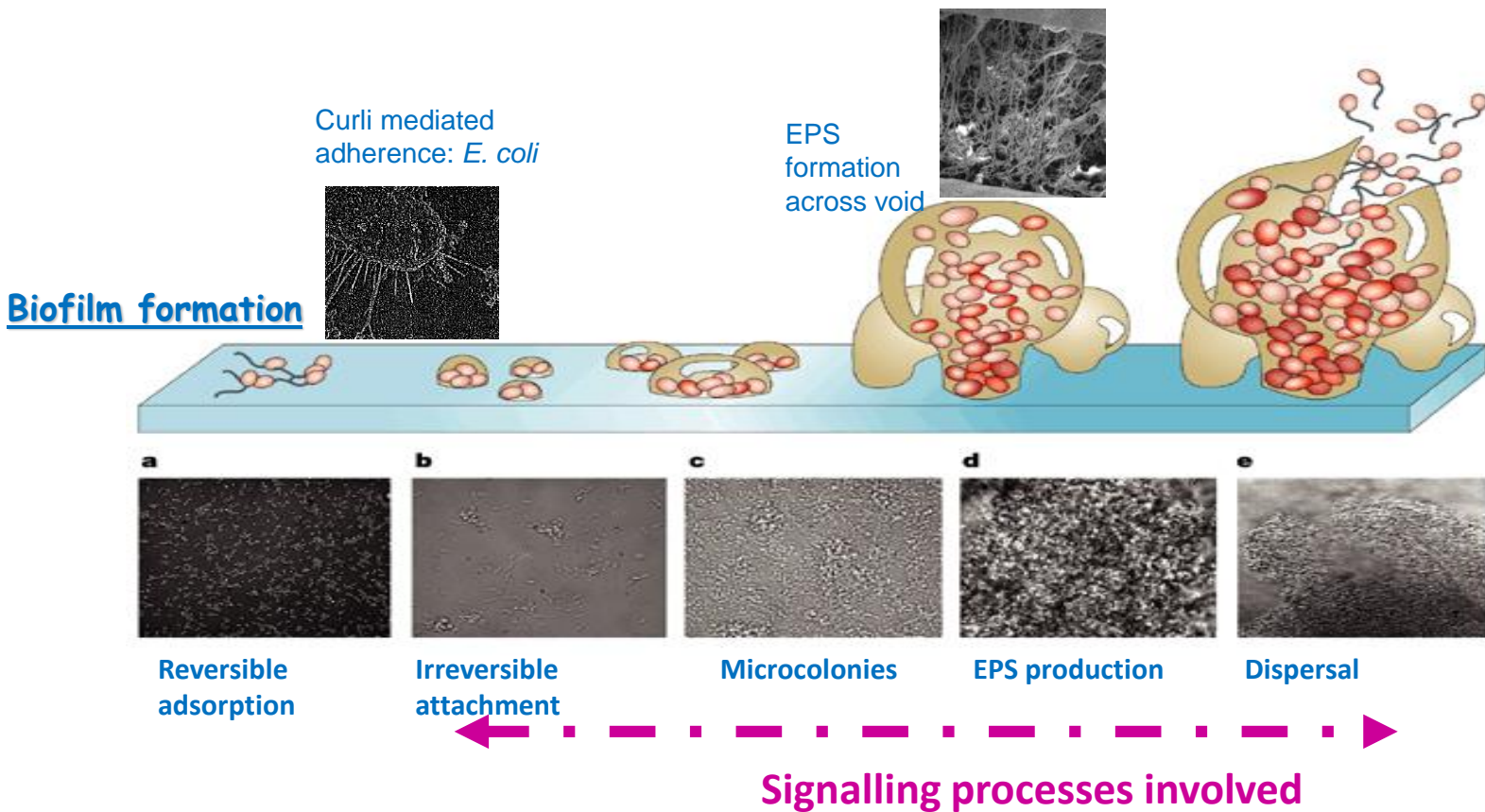


Red alga *Delisea pulchra*

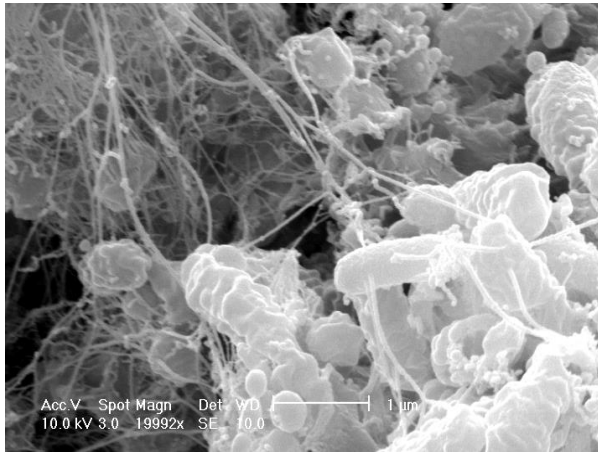


Quorum sensing

A bacterial biofilm is a community of bacterial cells that are attached to a surface and are protected by an extracellular polymeric matrix (EPS). Within a biofilm state, bacteria are exceptionally hardy and they present a tremendous obstacle for intervention.



# Inspired by Nature



Red alga *Delisea pulchra*

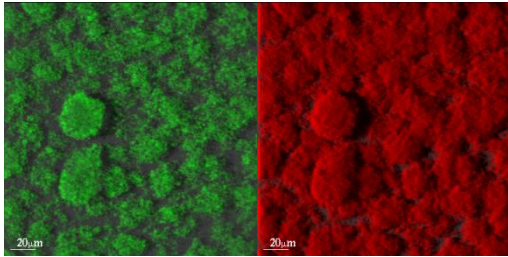
Marine organisms release compounds to prevent bacterial colonization, novel lactam materials have been identified that can:

- » Interrupt bacterial signaling
- » Prevent / limit biofilm formation
- » **Are non-biocidal – disrupt colonisation, do not lead to bacterial resistance**
- » Makes bacteria easier to remove and easier to kill
  - *Highly active at low levels (high dilution environments)*
  - *Works over a range of temperatures including cold water*
  - *Helps to increase the performance of anti-microbials (increased cell sensitivity)... synergy / additive effects.*

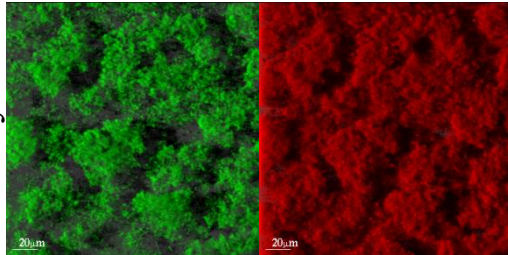
# Biofilm screens: anti biofilm compounds penetrate *P. aeruginosa* biofilms, shut down the quorum-sensing signalling systems and cause detachment

no addition

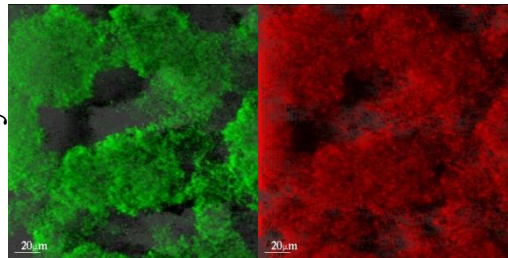
Day 1



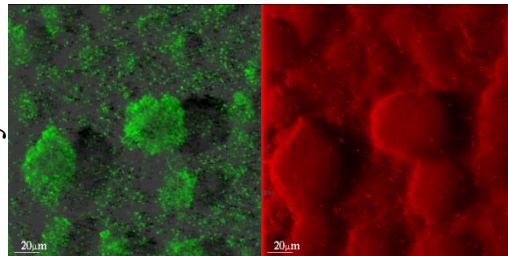
Day 4



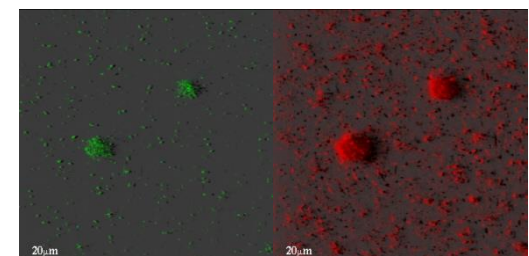
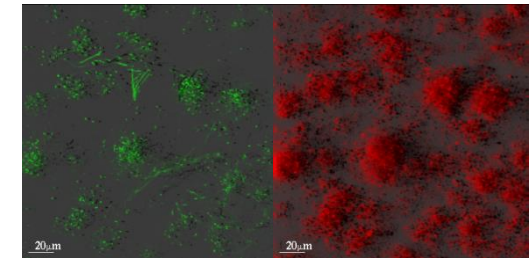
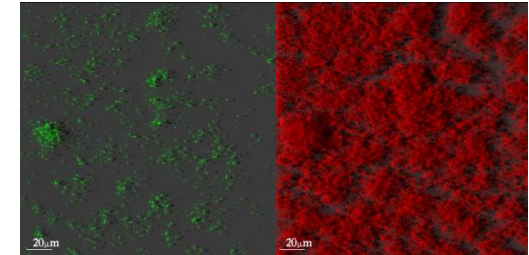
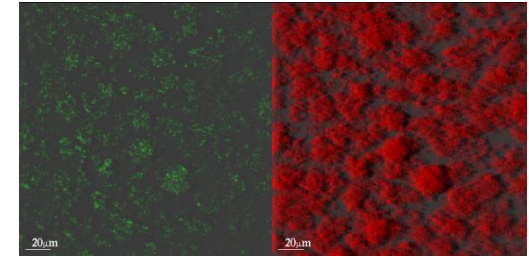
Day 6



Day 10



X1



Green: signaling activity  
Red: biomass

# Applications...

**Biofilms are everywhere !**



Contact lenses



Surface coatings



Manufacturing



Corrosion



Filters



Paper



Produce washing

Agriculture & ornamental



Drinking water



Dental restorations



Wounds & infections



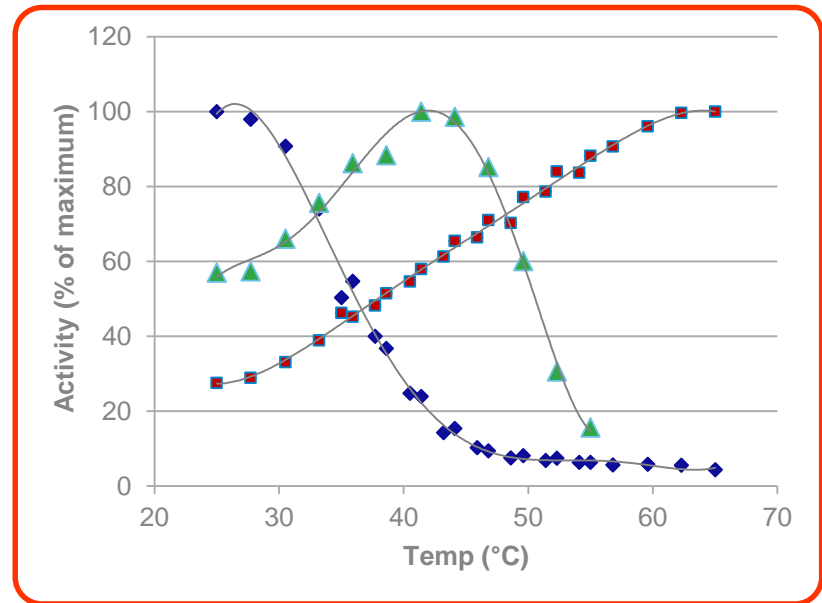
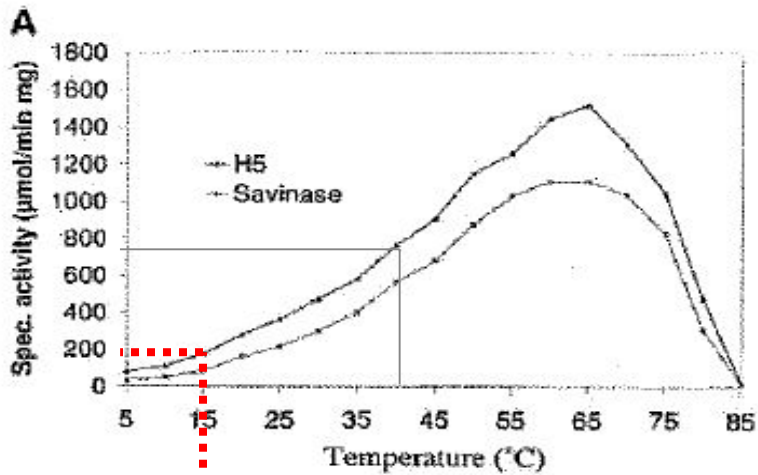
Medical implants



# Example 3: Low temperature laundry cleaning



Tinback et al, Protein Engineering, 17 (2) 149-156 2004



13 % of max performance at 15 C

**THANK YOU!**

