



## Protective cultures in Arla

Where and why we use them

Anders Hauge Okholm

Food Microbiology – Arla Innovation Centre



# What's the essence of life?

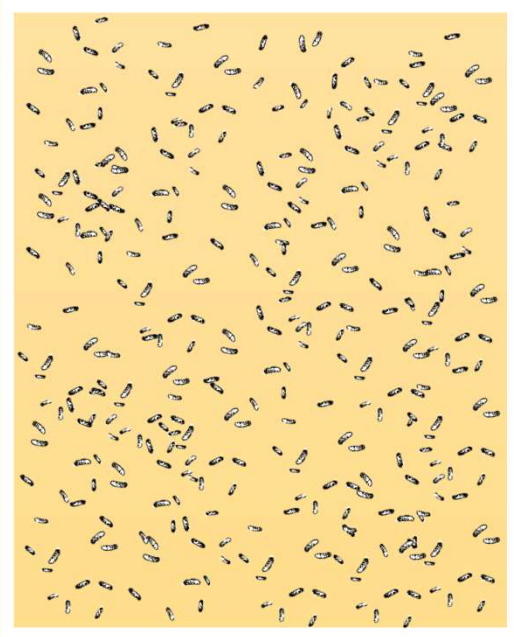
Family Chaos Reproduction

Profit Milk Religion Love

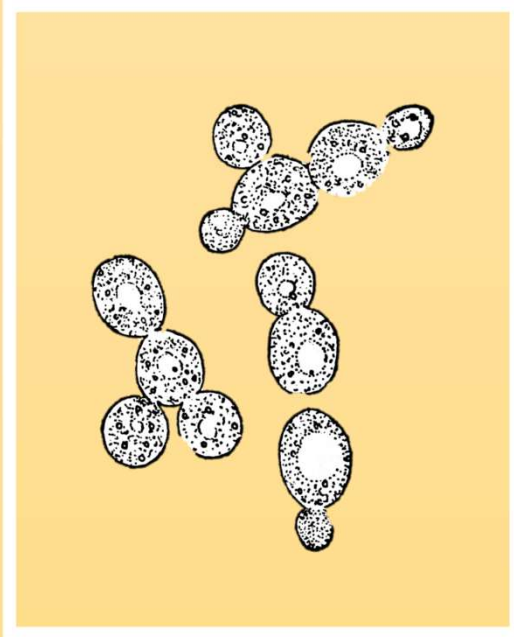
Companionship Competition

Peace Dinosaurs Interactions

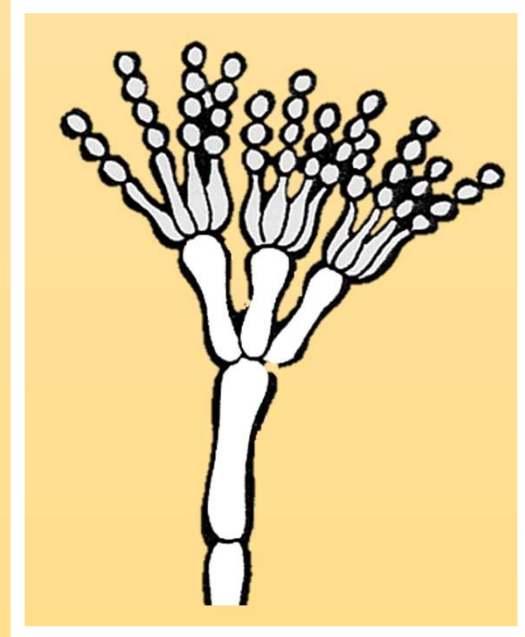
Bacteria

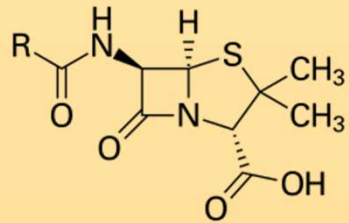


Yeast



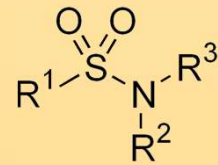
Mould





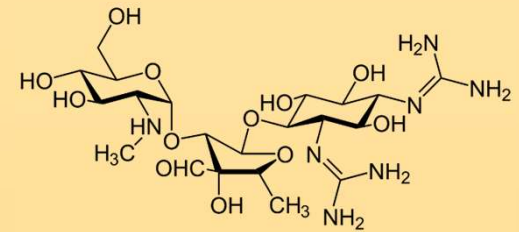
Penicillin

1933

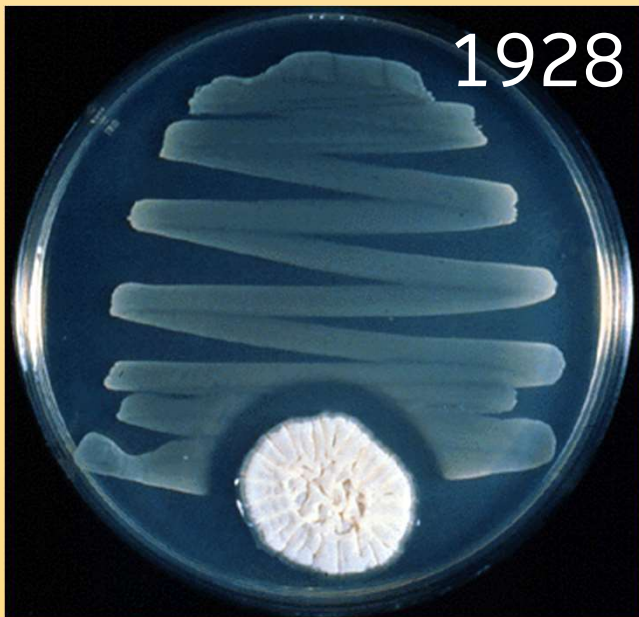


Sulfonamides

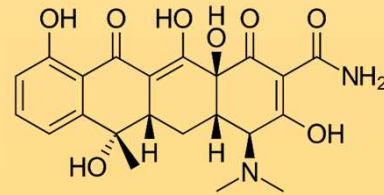
1943



Aminoglycosides



1945

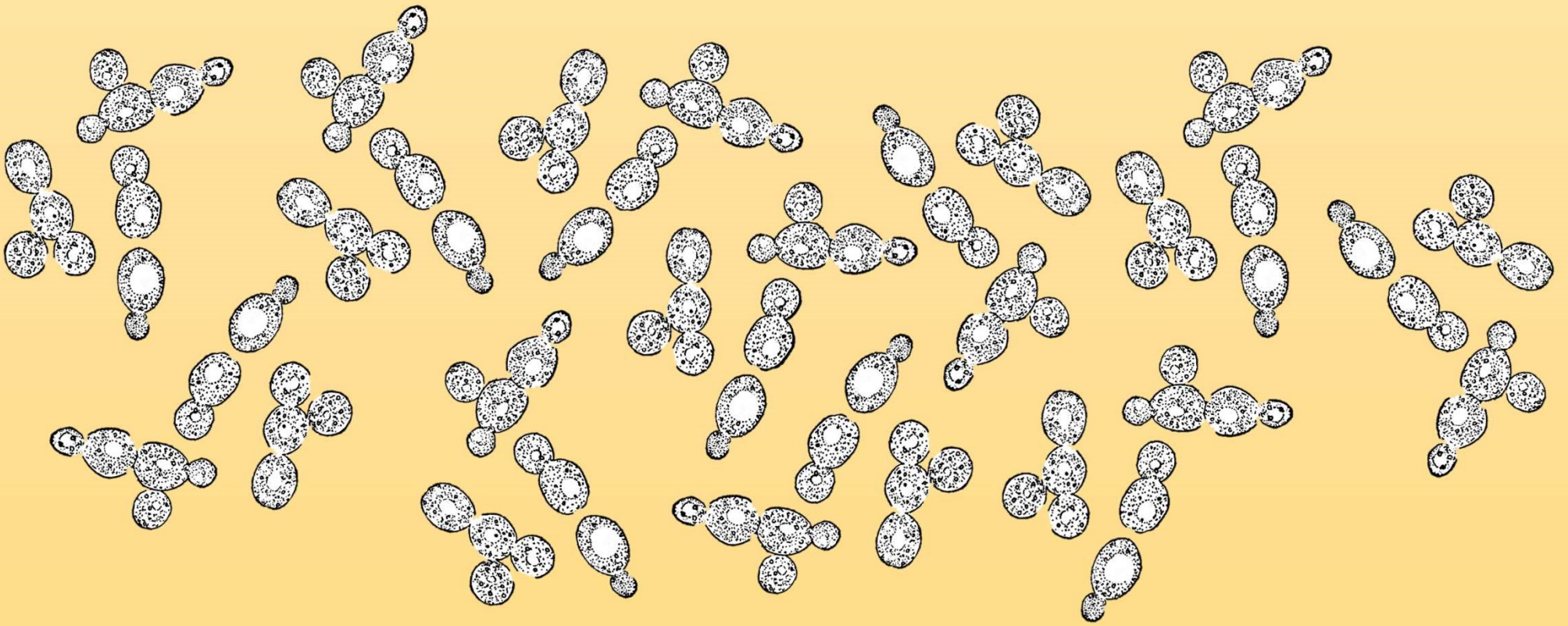


Tetracycline

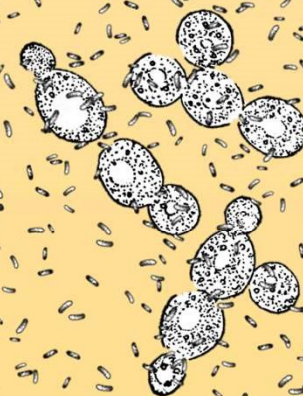
1947



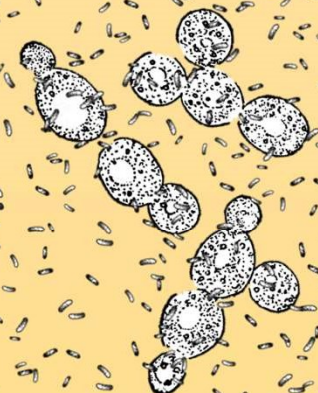
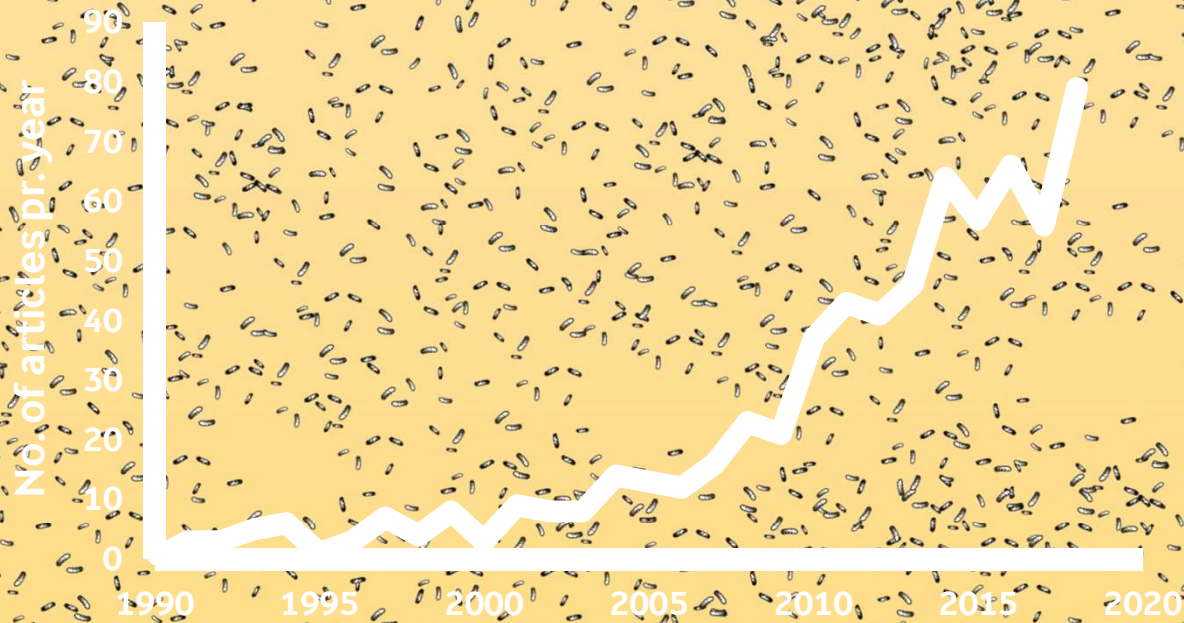
Chloramphenicol



# PROTECTIVE CULTURES



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## REQUIREMENTS

Part of fermentation  
Alive in product  
Gas production allowed

## BENEFITS

Antifungal effect  
Extension of shelf-life  
Clean label



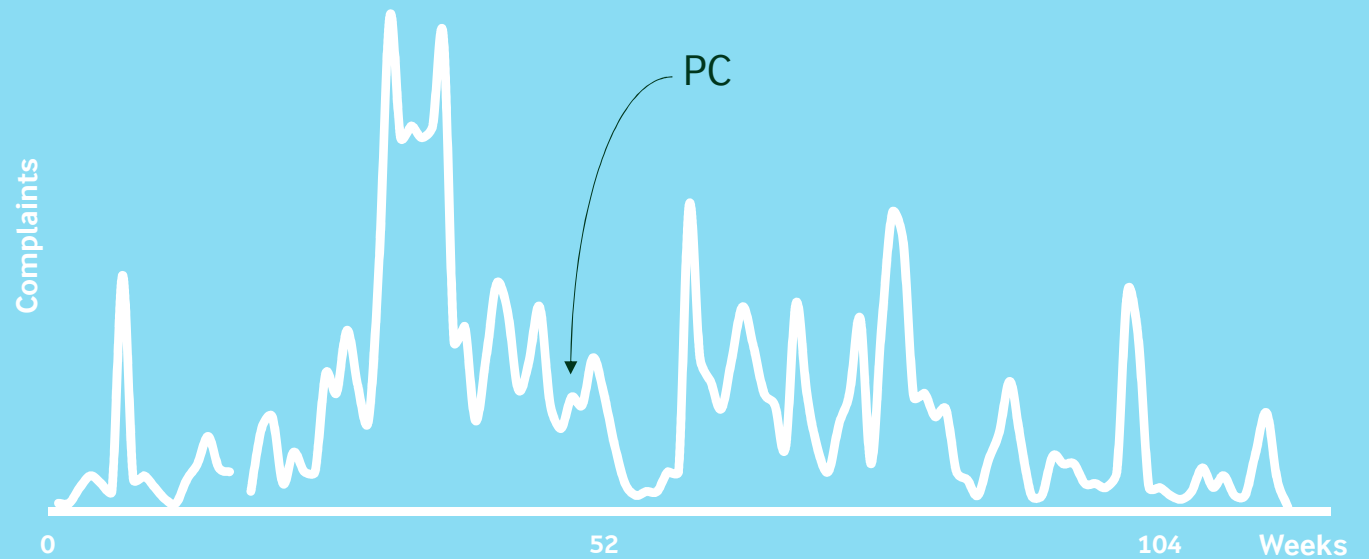
# DO WE USE THEM?



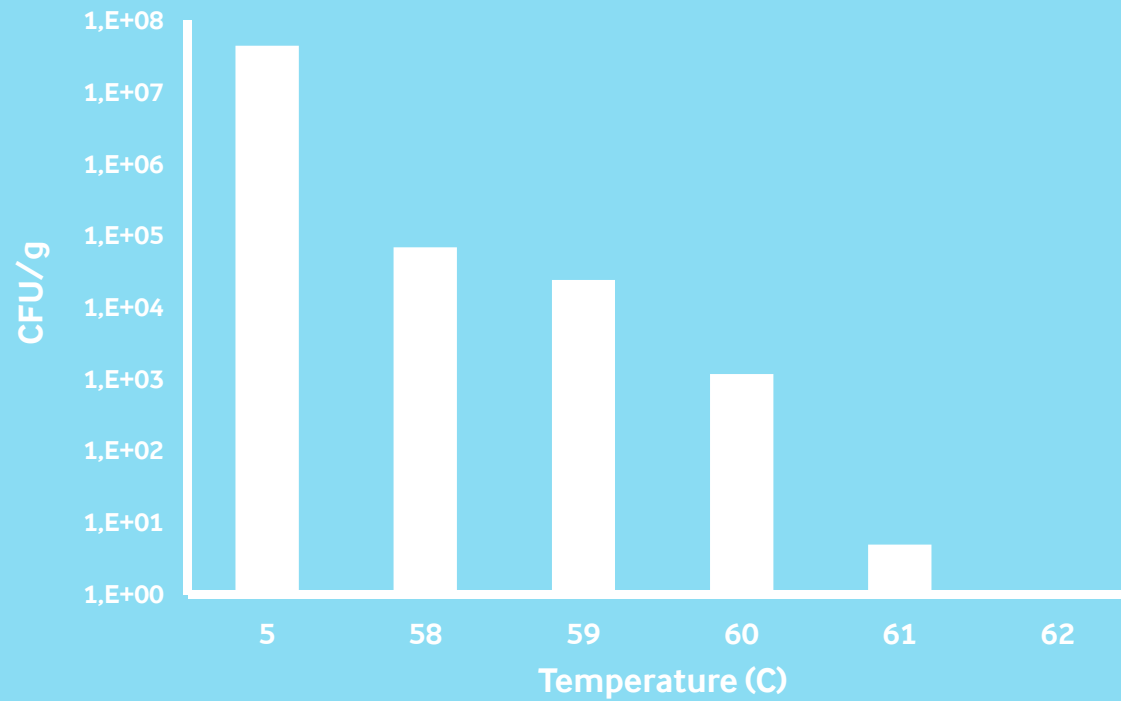
# Skyr



Complaints related to spoilage in skyr 2016-2018

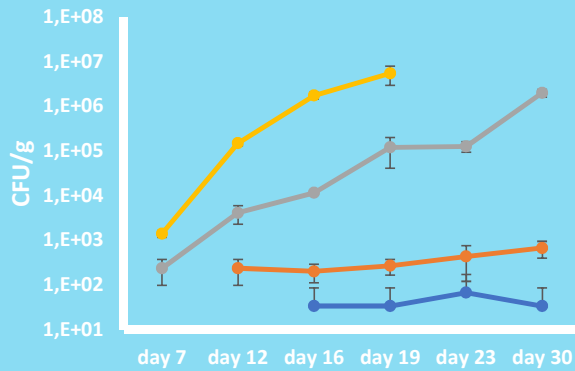


## Heat sensitivity of the protective culture

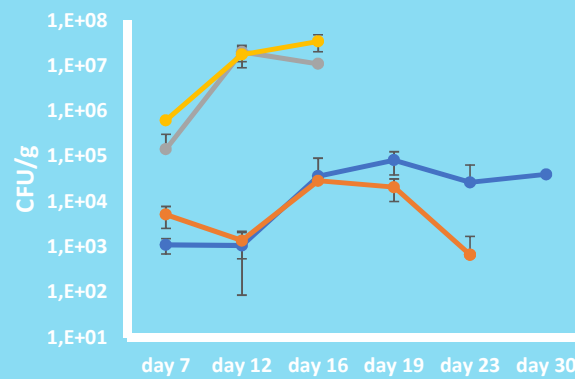


# Skyr

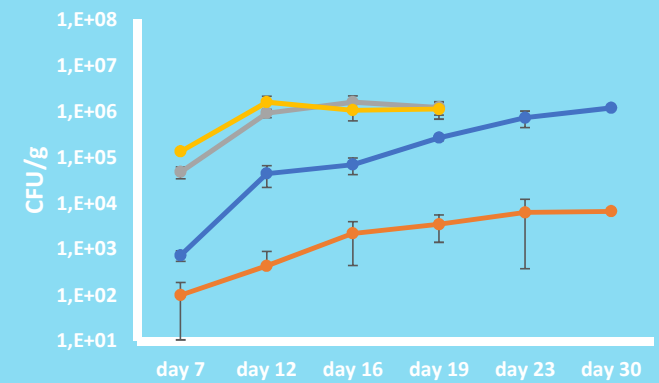
*Candida intermedia*



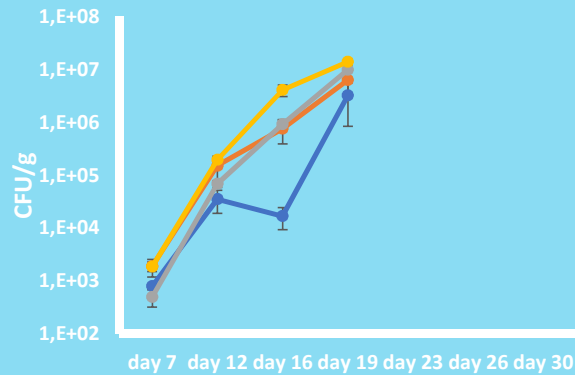
*Debaromyces hansenii*



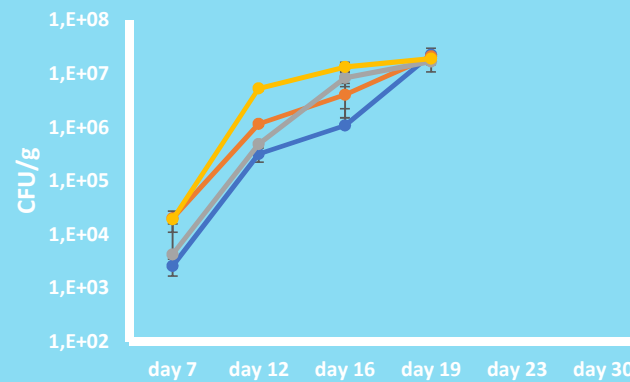
*Galactomyces geotrichum*



*Saccharomyces cerevisiae*



*Kluveromyces marxianus*



- Without PC
- Supplier 1
- Supplier 2
- Supplier 3



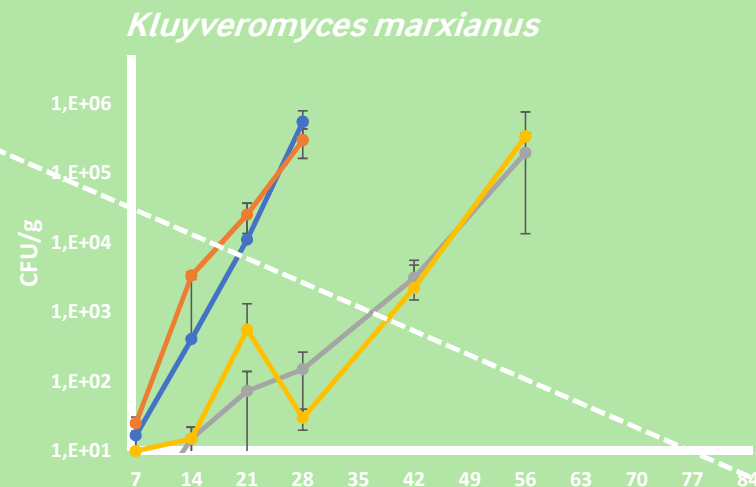
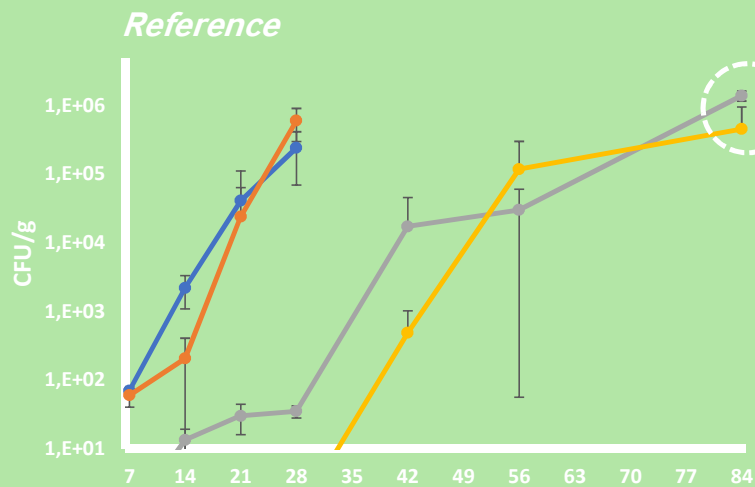
# White cheese

Introduced at Kruså 2014

66% reduction in annual complaints  
(2012 vs. 2017)

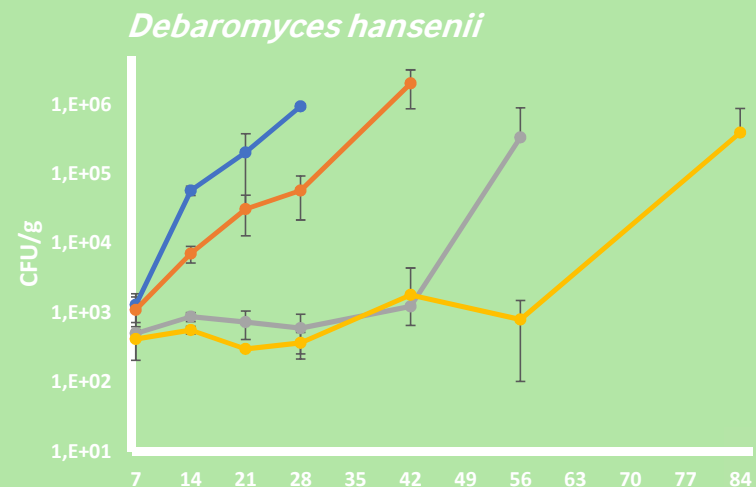
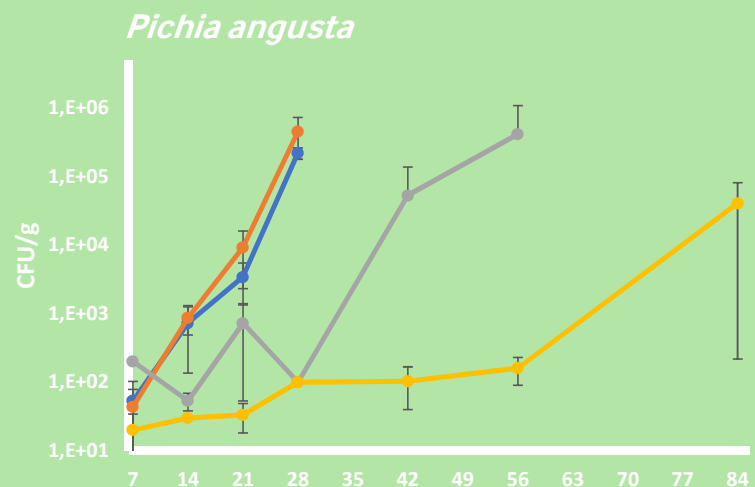


*...it can't be guaranteed that the effect of the PC in combination with a new starter culture will give the same effect.*



5°C

- Without PC
- 0.1X PC
- 0.5X PC
- 1X PC



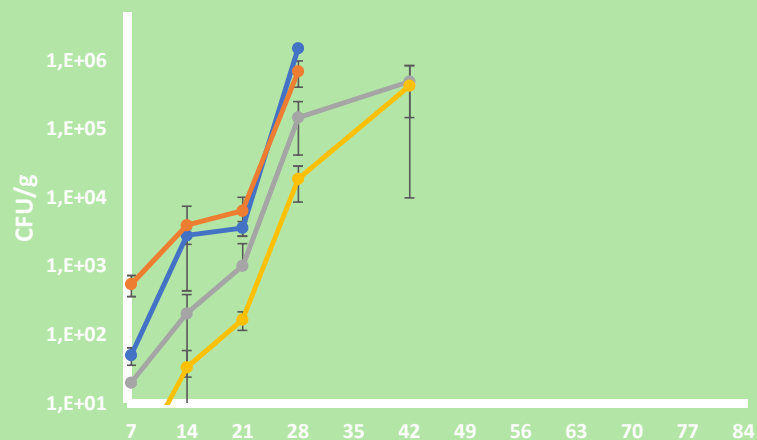
What's growing?  
*Yarrowia lipolytica*  
*Kluyveromyces lactis*



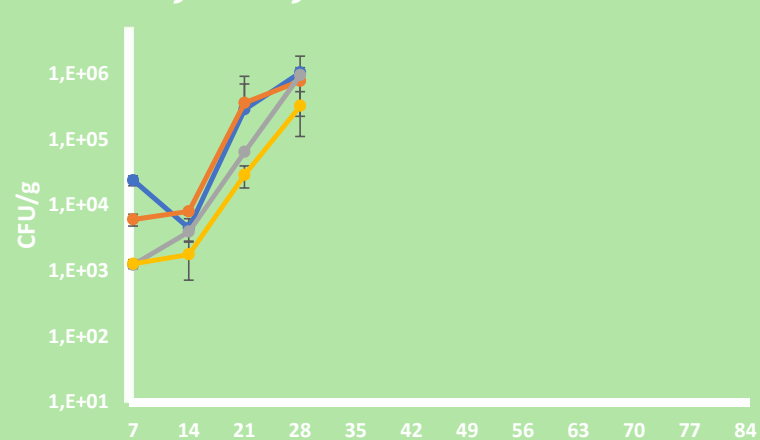
8 °C

- Without PC
- 0.1X PC
- 0.5X PC
- 1X PC

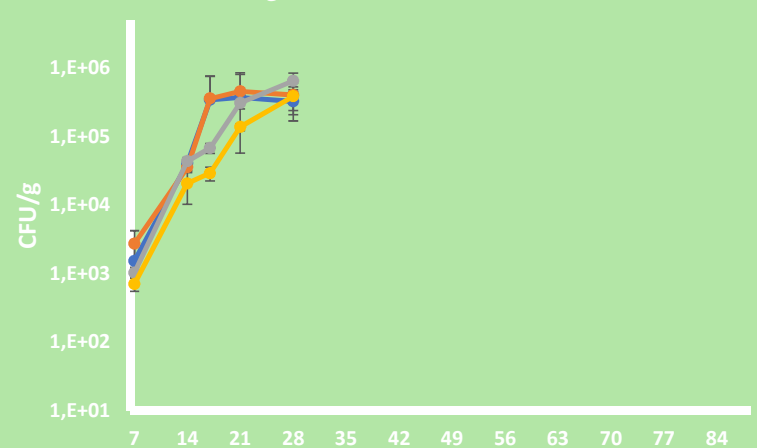
Reference



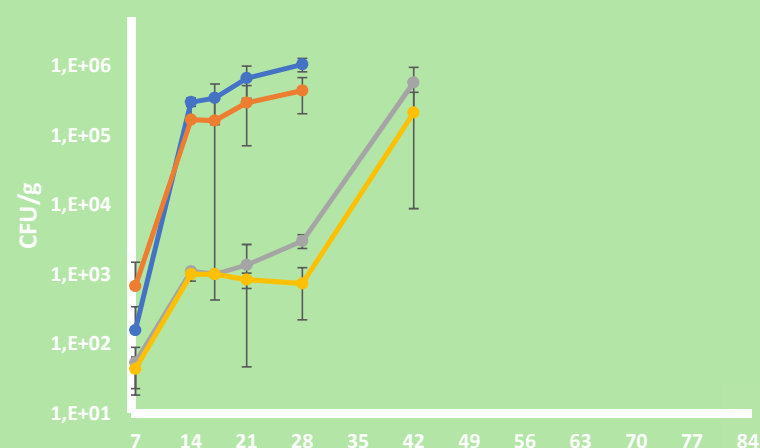
*Kluyveromyces marxianus*



*Pichia angusta*



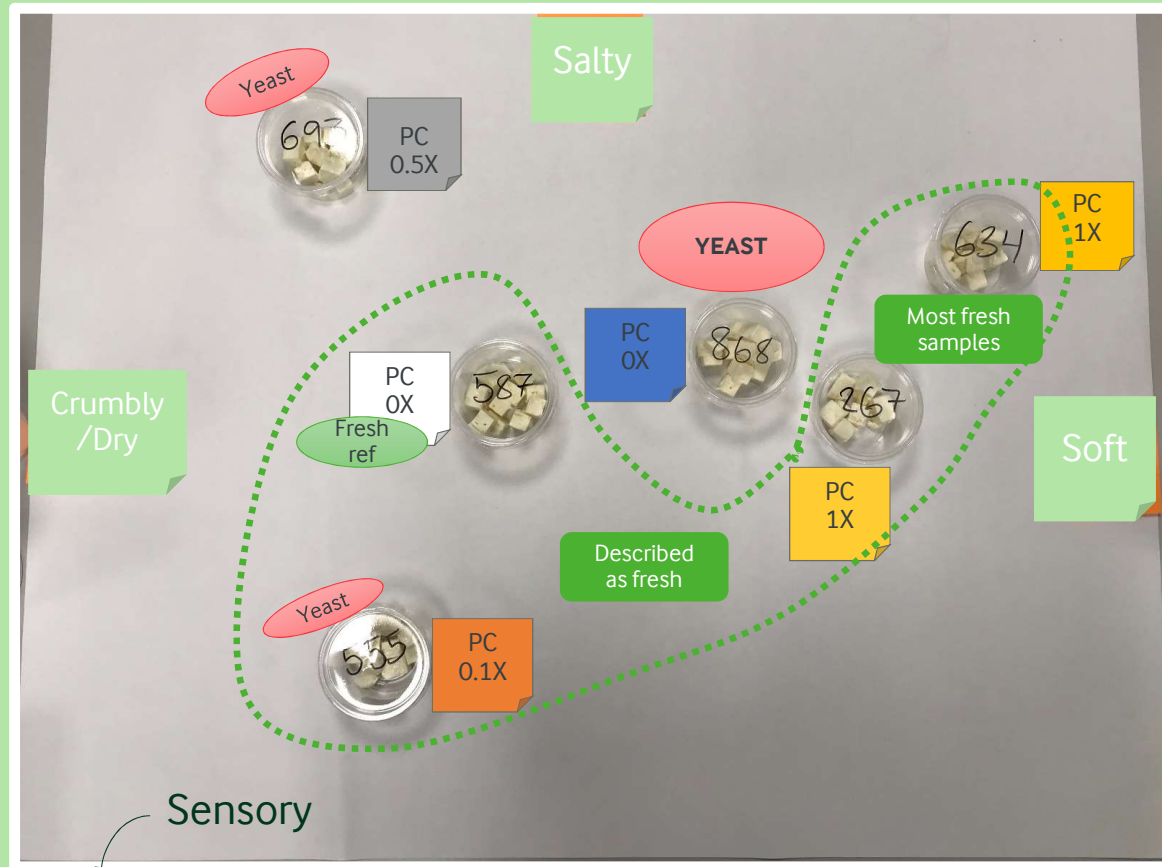
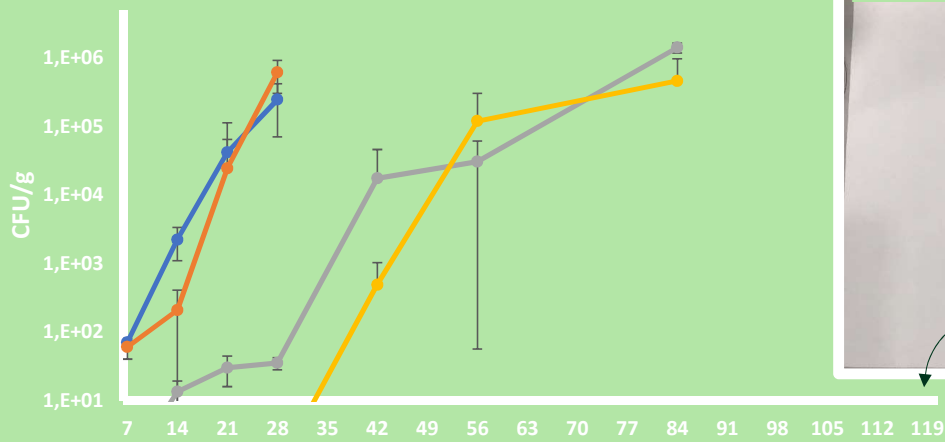
*Debaromyces hansenii*



# White cheese

- Without PC
- 0.1X PC
- 0.5X PC
- 1X PC

Reference

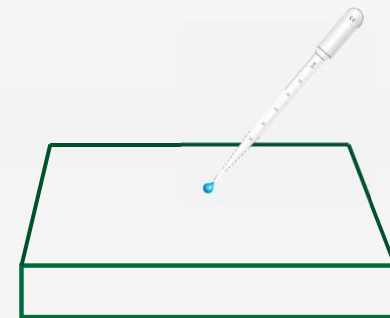
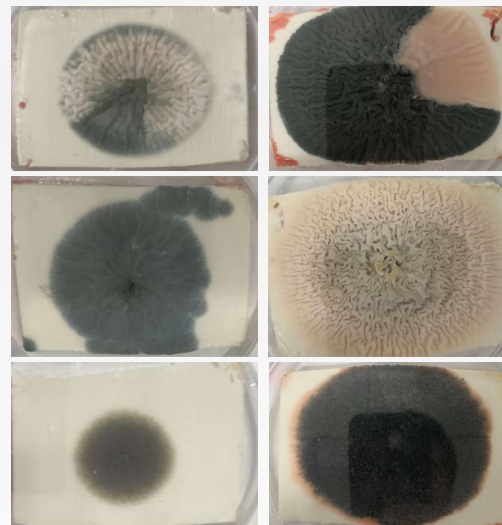




# White cheese pt II



Moulds from product



# White cheese

Growth at 25 °C

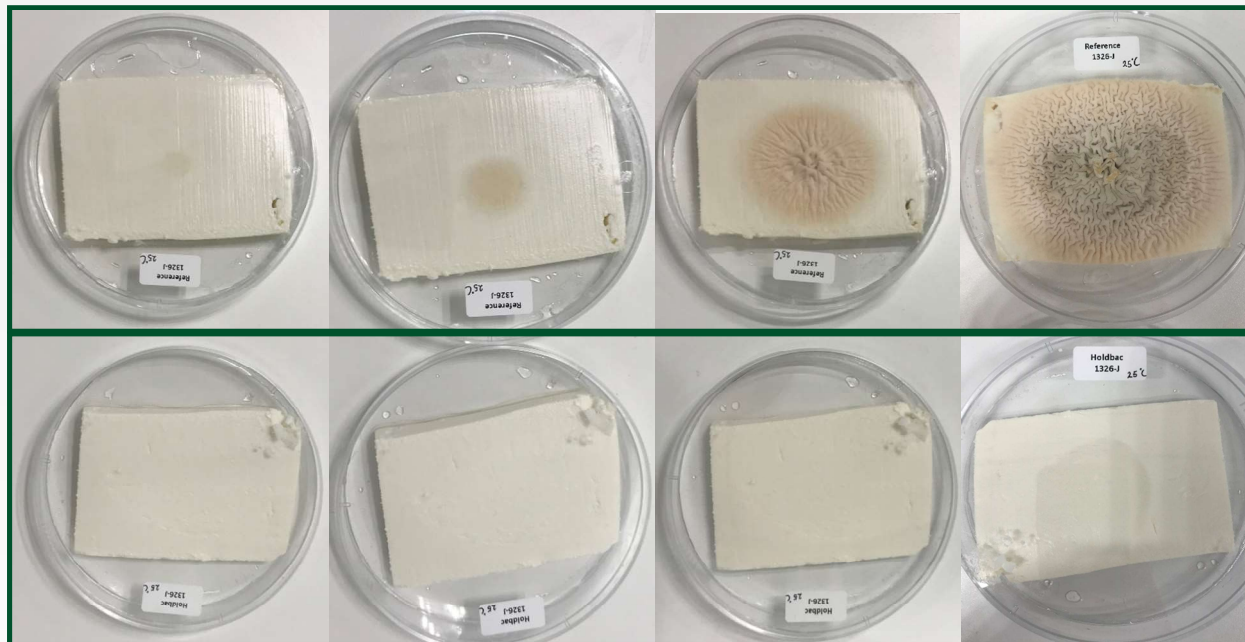
*Fusarium oxysporum*

7 d

9 d

14 d

21 d

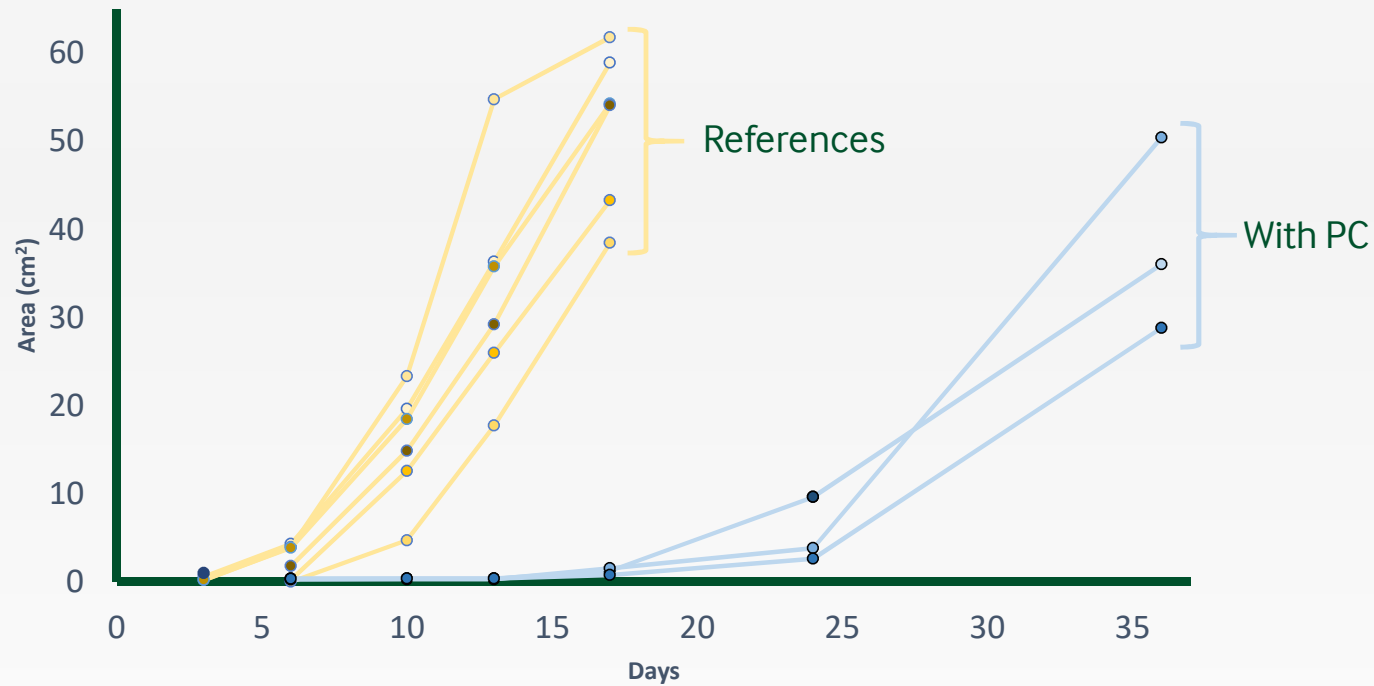


Reference

With PC

# White cheese

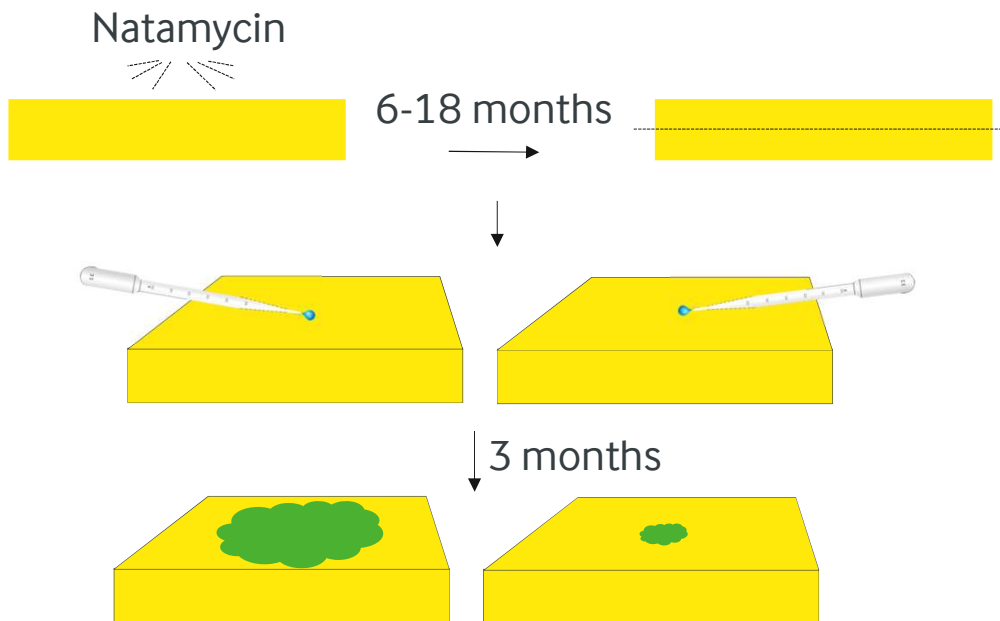
Growth at 25 °C – an overview



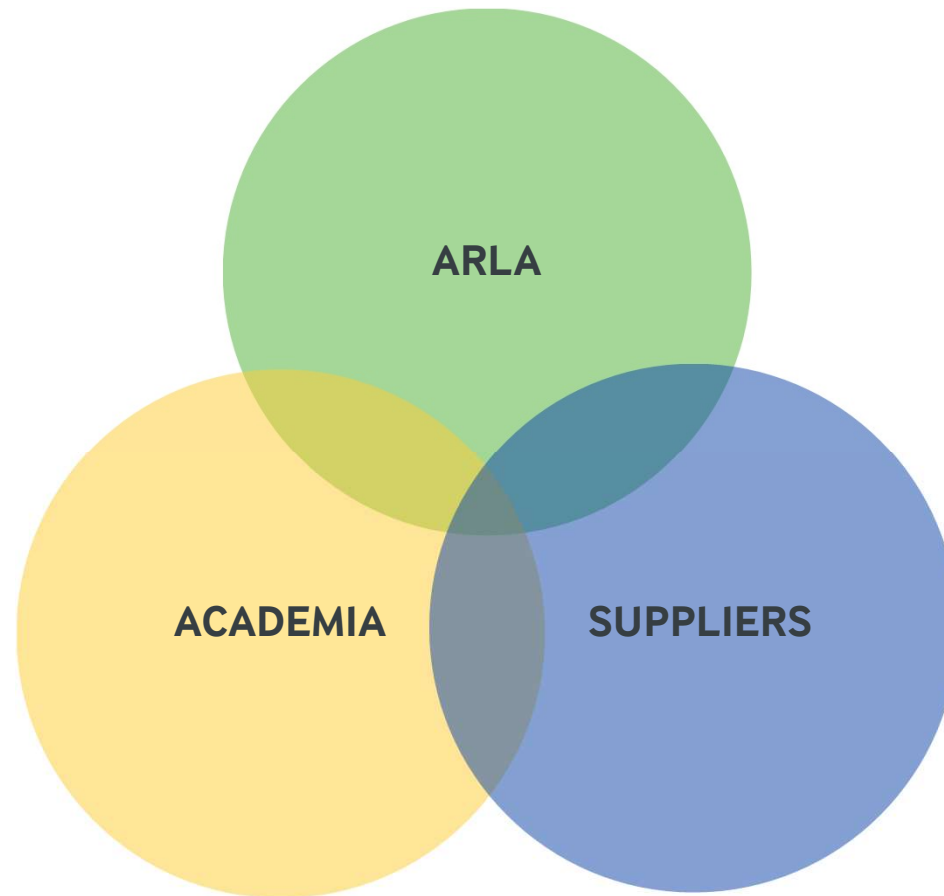
# FUTURE PERSPECTIVES & CONCLUSION

# How about yellow cheese?

So far, white cheese, and fresh fermented have been the major focus. Now we are starting to look at yellow cheese.



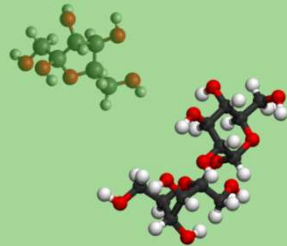
# How do they work?



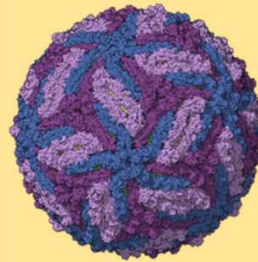
# Future Perspectives

Alternative natural preservatives

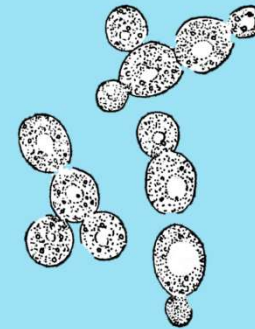
**FERMENTATES**



**MYCOVIRUSES**



**YEASTS**



# Conclusion

- Protective cultures provide antifungal effect with a clean label
- The level of antifungal effect differs from product to product
- Potential for new developments in natural antimicrobials is big, and the business is growing
- We make sure to understand the limitations and future perspectives for natural antimicrobials
- So we can continue to deliver the freshest products and reduce food waste
  
- When will a natural antimicrobial solution reduce the number of food spoilage cases in Arla to 0?





**Acknowledgements & Thank you!**  
ANOKH@arlafoods.com

