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# Microbial approaches againts bovine mastitis in dairy COWS

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AGRO  
CAMPUS  
OUEST



# Microbial approaches against bovine mastitis in dairy cows



STLOpen Days  
19-21 March 2019



Sergine EVEN- STLO



## Food quality & safety



Develop safe, healthy, sustainable and hedonic fermented foods



## Food spoilage



Reduce health risks and food losses and waste



# Microbial approaches against bovine mastitis in dairy cows

## Animal health



Offer alternatives to antibiotic treatments (probiotics)

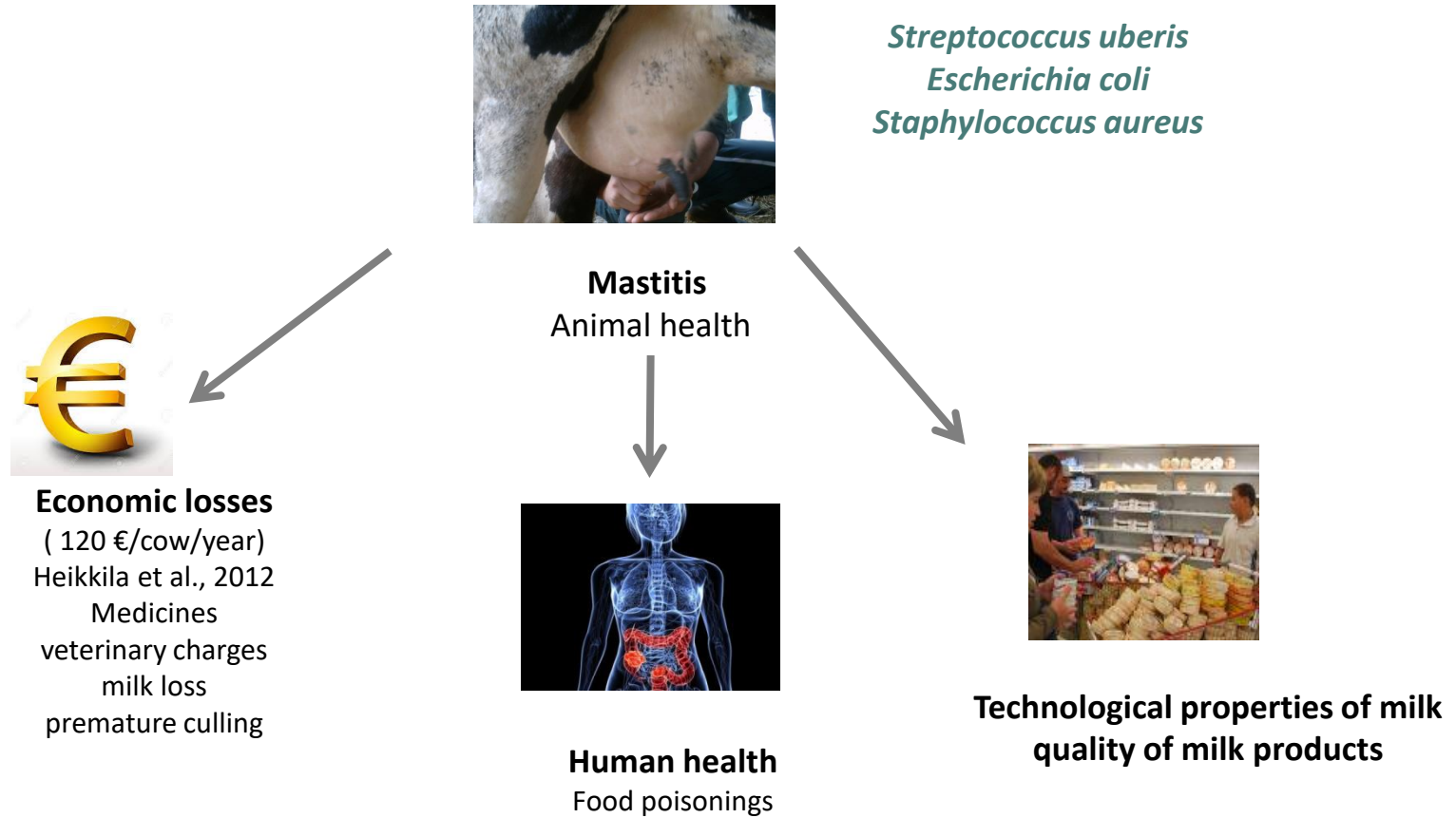
## Health & wellbeing



Develop functional and designer food against modern lifestyle diseases



# Mastitis



# Prevention and treatment

hygienic procedures



Vaccines



Not effective

Antibiotics



- Not always effective
- Dissemination of antibiotic resistance

Massive use of antibiotics

- ~ 150 tons/year for bovine in 2014-15 (ANSES, 2016)
- during lactation: 89.8 intra-mammary treatments / 100 cows during lactation
- drying period: 57.3% dairy cows



Social demand for the reduction of antibiotics in veterinary medicine

- **early diagnostic**
- **alternative strategies**

Antibioresistance dissemination

Genetic selection

Phage therapy

**Microbial approaches**

**Use of beneficial microbes**

Homeopathy

New antibacterial molecules (lysostaphine)

Essential oils

# Microbial approaches against mastitis in dairy cows

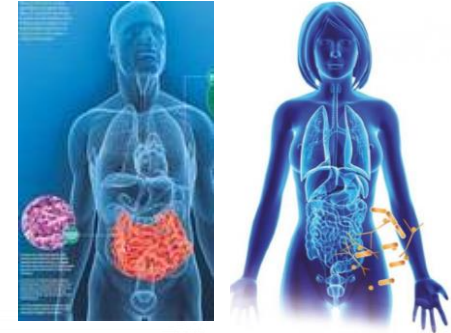
## Pathosystem

Pathogen  
*S. aureus*

Mammary gland



Microbiota  
LAB

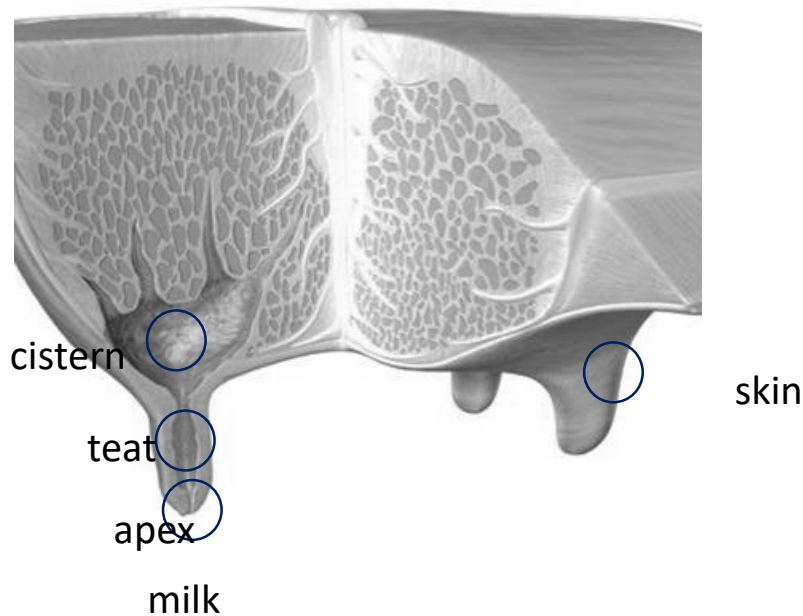


Health  
Inflammation  
Immune system maturation  
Mucosa maturation  
Barrier role

**Dysbiosis**

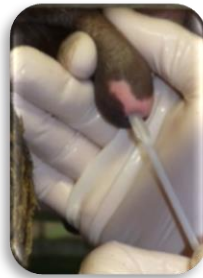
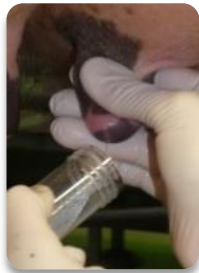
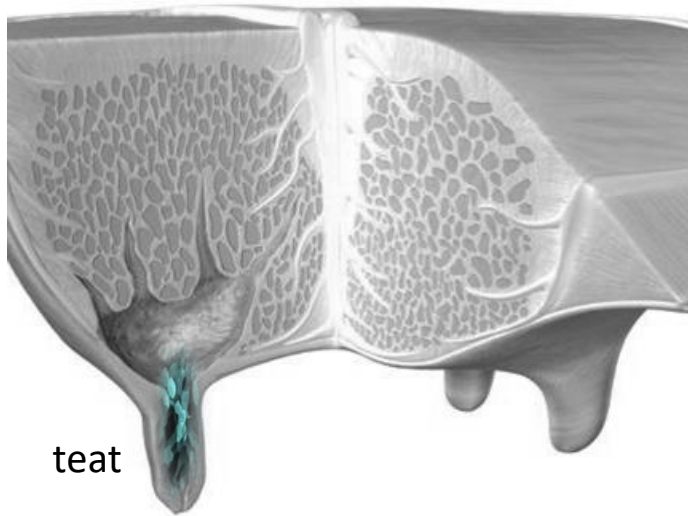
Exploration of the bovine mammary gland microbiota in relation to health

# Exploring bovine mammary gland microbiome



Microbacterium  
pediococcus  
Fusobacterium  
propionibacterium  
Acinetobacter  
Bifidobacterium  
pseudomonas  
staphylococcus  
streptococcus  
Lachnospiraceae  
Corynebacterium  
Bacteroides  
Enterococcus  
Ruminococcaceae  
Aerococcus  
Jeotgalicoccus  
Psychrobacter  
Enterobacter

# Exploring bovine mammary microbiome



## Relation between teat microbiome composition and history of mastitis (apart from infectious episode)

Herd of Méjusseaume (UMR PEGASE, Rennes)  
No mastitis on the ongoing lactation

31 quarters  
No inflammation at sampling time

Healthy (H)



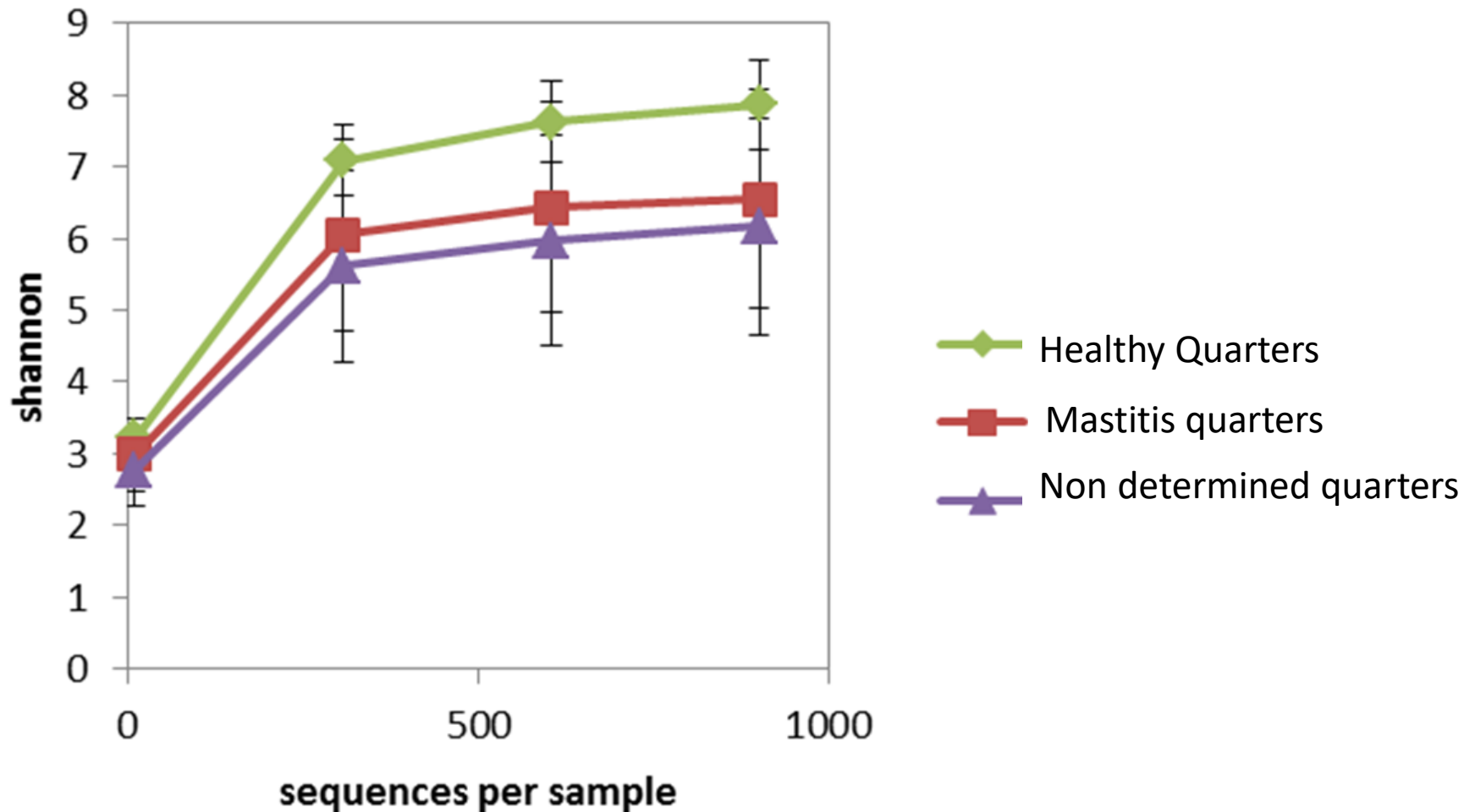
Quarters with history of mastitis (M)



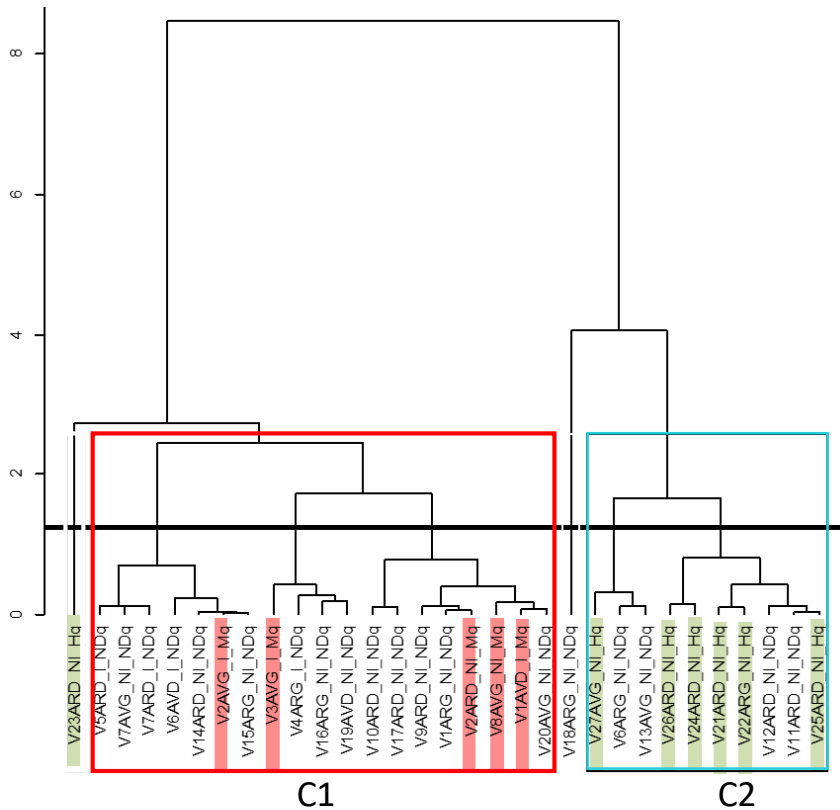
Non determined status (ND)



# A higher diversity in healthy quarters



# Clustering of taxonomic profiles

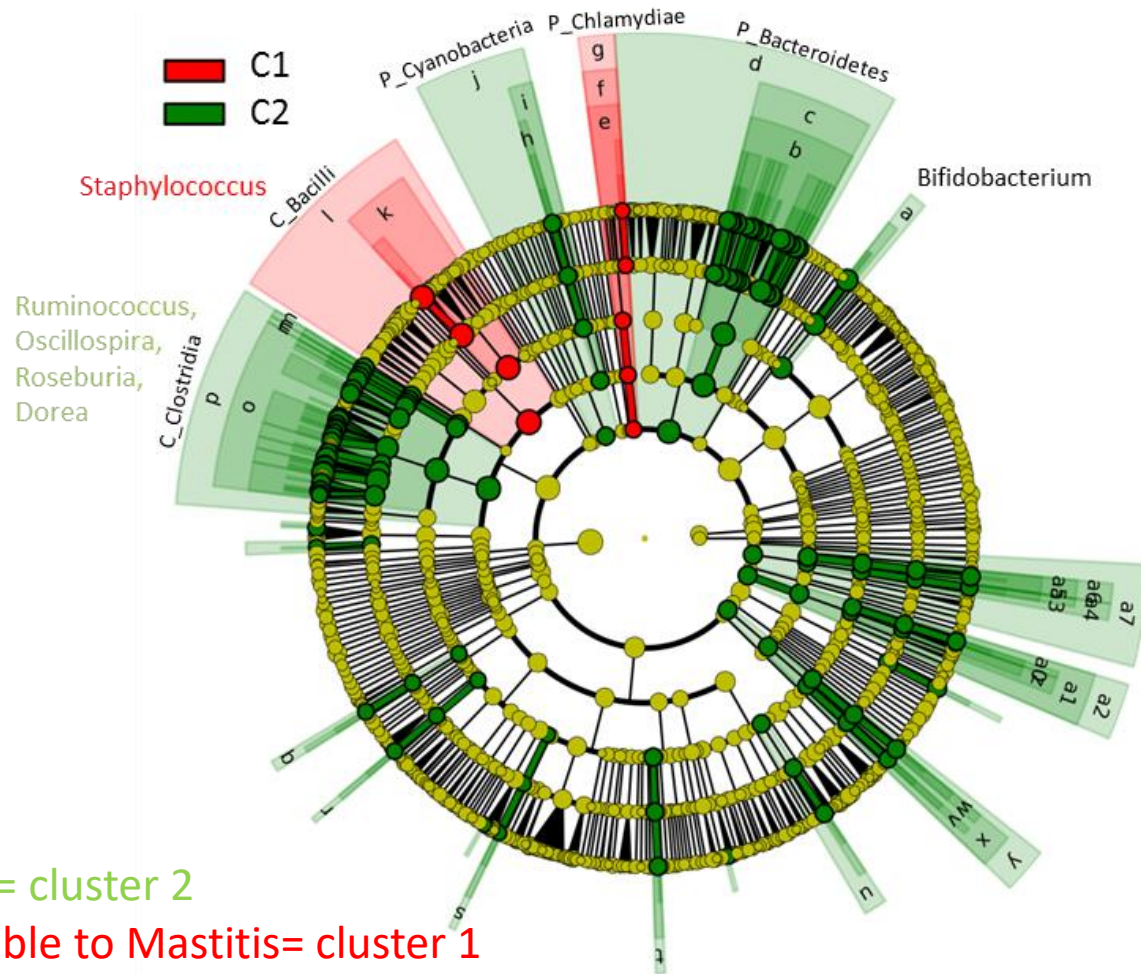


Separation between healthy quarters and quarters which have already developed mastitis



What are the taxonomic differences between Clusters 1 and 2?

# Taxonomic markers in relation to health status

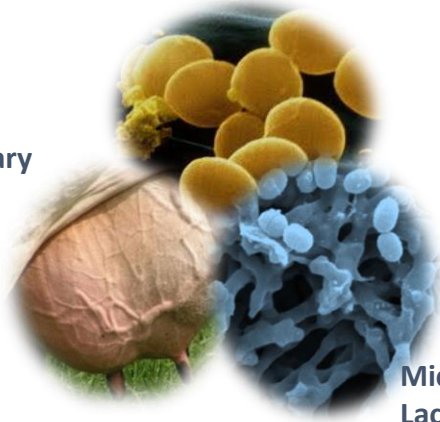


# Microbial approaches against mastitis in dairy cows

## Pathosystem

Pathogen  
*S. aureus*

Mammary gland



Microbiota  
Lactic Acid Bacteria (LAB)  
-GRAS  
-Efficient in other contexts



**Dysbiosis**

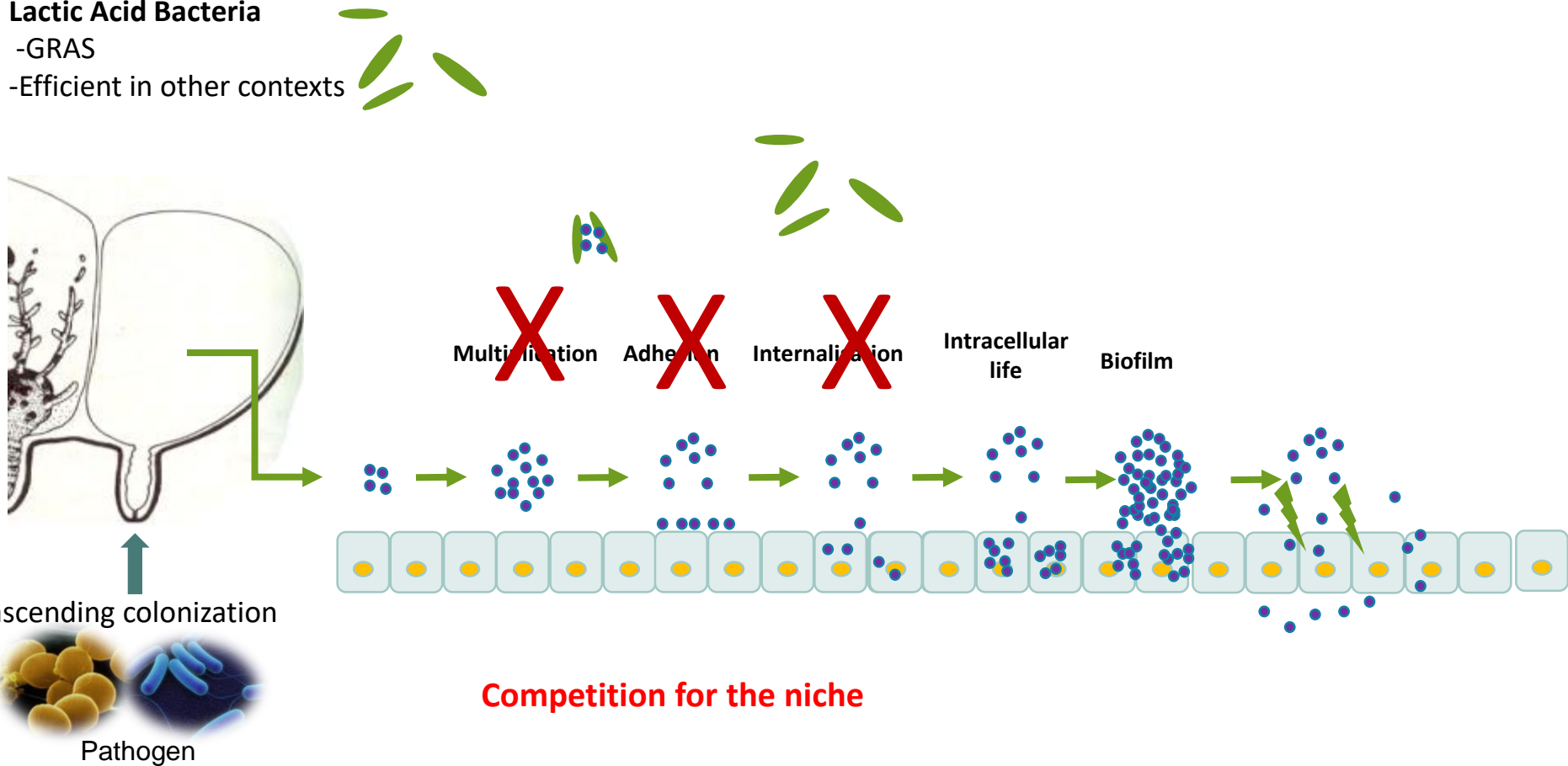
Health  
Inflammation  
Immune system maturation  
Mucosa maturation  
Barrier role

Probiotic potential of LAB isolated (or not) from mammary gland

# Beneficial properties of LAB in bovine mammary gland context

## Lactic Acid Bacteria

- GRAS
- Efficient in other contexts



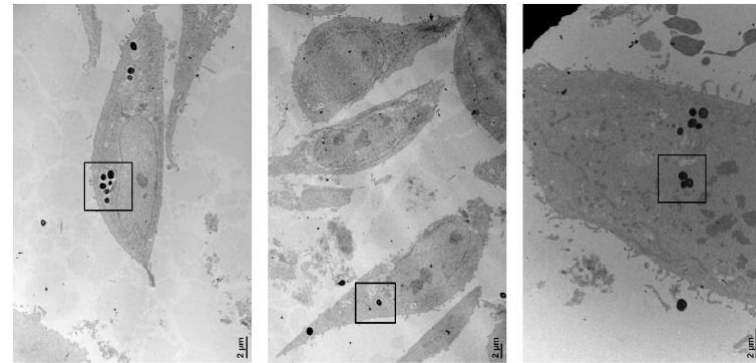
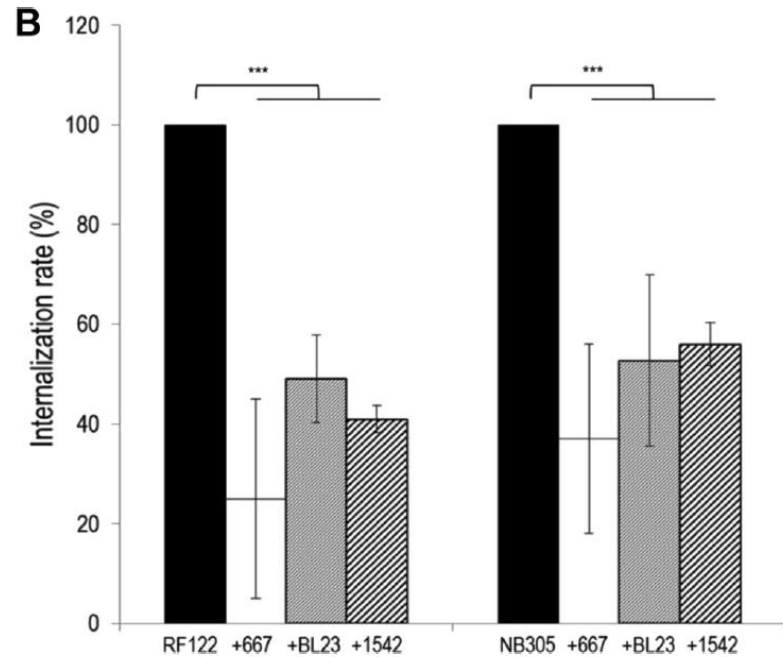
# Inhibition of *S. aureus* colonisation of bMEC

*L. casei*  
CIRM 667  
BL23  
1542

*S. aureus*  
RF122 (acute)  
NB305 (chronic)



Bovine mammary epithelial cells  
(MAC-T)

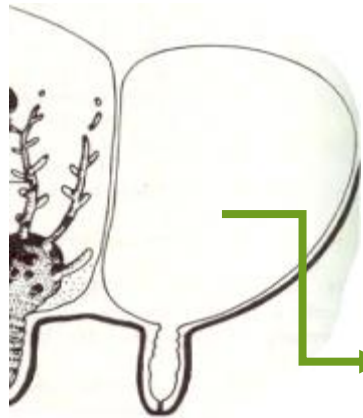


Bouchard et al. 2013, 2015  
Souza et al. 2017

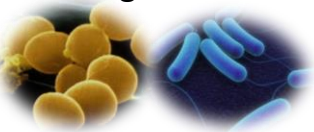
# Beneficial properties of LAB in bovine mammary gland context

## Lactic Acid Bacteria

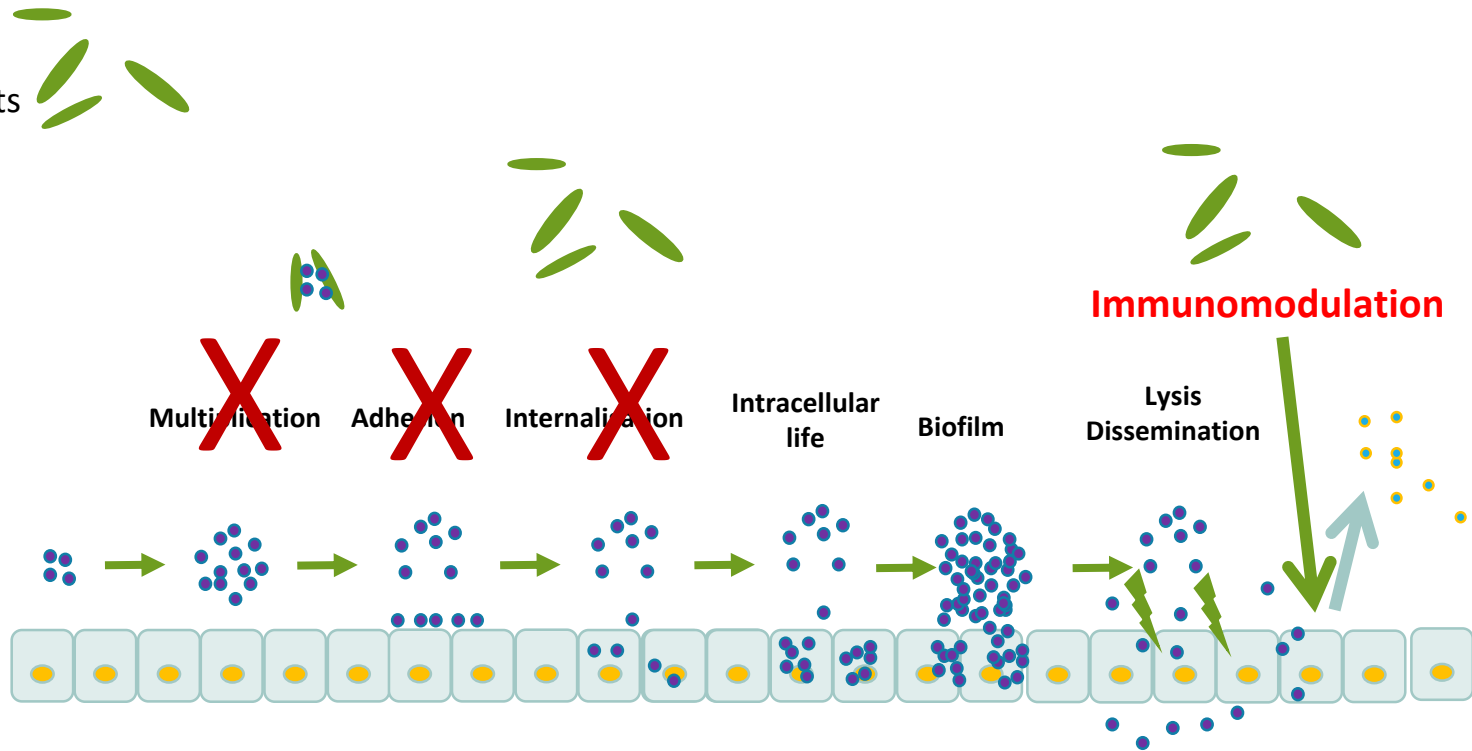
- GRAS
- Efficient in other contexts



↑  
ascending colonization



Pathogen

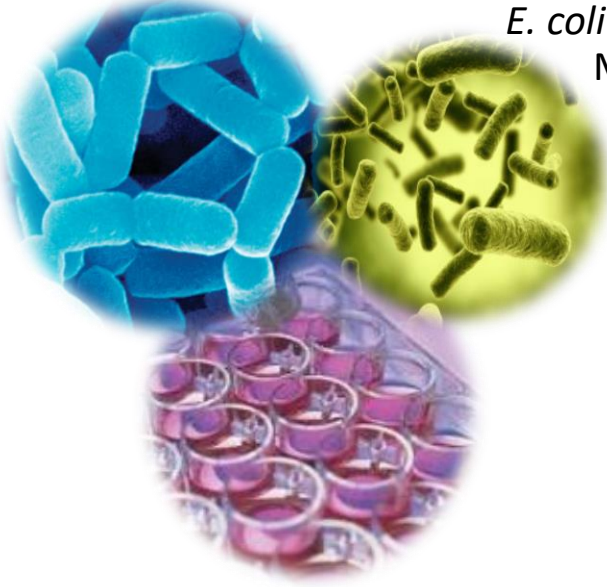


Competition for the niche

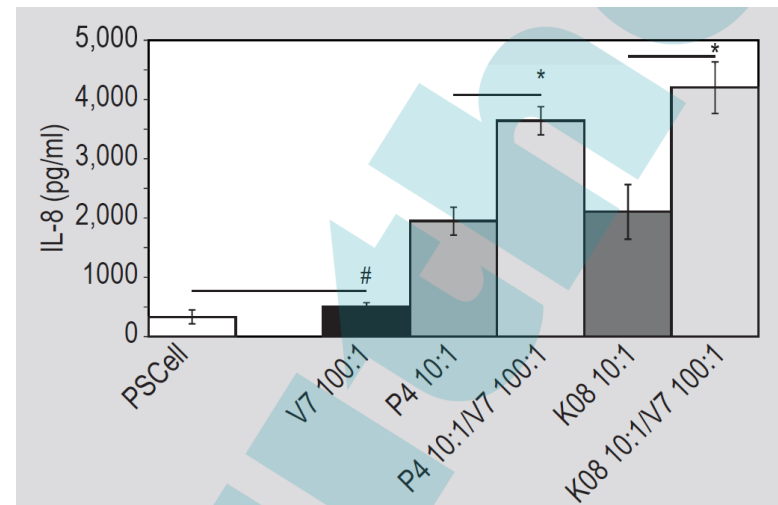
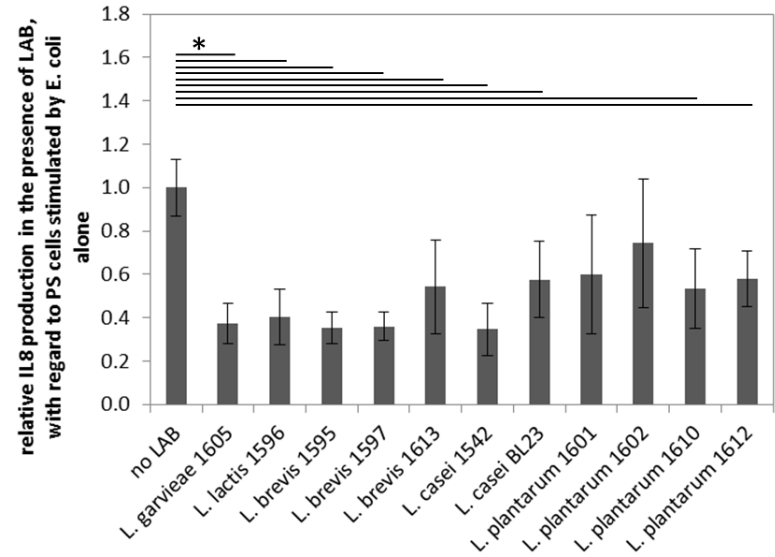
# Immunomodulation properties of LAB

LAB  
MOI= 100:1

*E. coli* P4  
MOI= 1:1



Bovine mammary epithelial cells  
(PS cell line)





# Take-home messages

**Mastitis : an old problem with new perspectives**

**Microbial approaches are promising strategies against mastitis**

**mammary gland microbiota**

early diagnostic

define a microbiota beneficial to health

**probiotics**

barrier effect

immunomodulation properties



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Lucie Rault  
Damien Bouchard  
Renata de Faria Silva Souza  
Bianca Seridan  
Vincent Peton  
Nadia Berkova  
Hélène Falentin

**MERCI**



**THANK YOU FOR  
YOUR ATTENTION**

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P. Germon

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