Unit : Bovine Mastitis
Lesson : 2

# Immune system of Udder and pathogenesis of mastitis

**Dr. C.S.Arunaman, M.V.Sc., Ph.D**

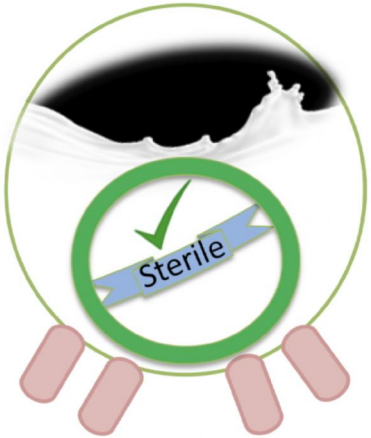
Assistant Professor
Department of Clinis, Madras Veterinary College,
Chennai - 600 007. Tamilnadu

# Immune system of Udder and pathogenesis of mastitis

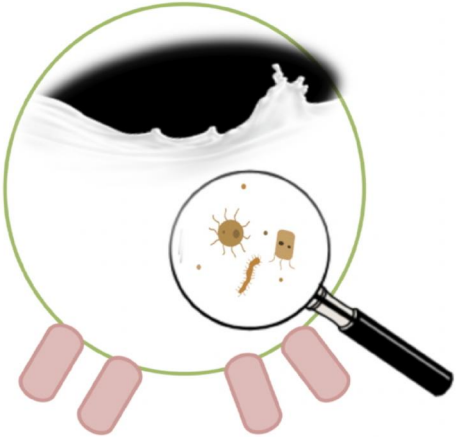
- Microbiota of udder
- Immune system of udder
- Pathogenesis of mastitis

# Microbiota of Udder

## HISTORICAL THOUGHT




## CONCEPT OF MICROBIOTA



# Udder Microbiota

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### Teat Apex Microbiota

Acinetobacter, Aerococcus, Corynebacterium, Enterobacter, Facklamia, Lactobacillus, Lactococcus, Micrococcus, Propionibacterium, Staphylococcus, and Streptococcus, among which non-aureus staphylococci (NAS) have gained the greatest attention.

### Teat Canal Microbiota

- More than 165 isolates
- Lactococcus and Lactobacillus
  - ⇢ Hydrophobic
  - ⇢ Autoaggregation
  - ⇢ Colonization capacity
  - ⇢ Immunomodulatory

- **Milk and Colostrum Microbiota**
- **Firmicutes, Proteobacteria, Bacteroidetes, and Actinobacteria are main bacterial phyla shaping the structure of milk microbiota.**

**Normal milk microbiota-** Staphylococcus, Ruminococcaceae, Lachnospiraceae, Propionibacterium, Stenotrophomonas, Corynebacterium, Pseudomonas, Streptococcus, Comamonas, Bacteroides, Enterococcus, Lactobacillus, and Fusobacterium obtained from clinically healthy quarters (Bhatt et al., 2012; Kuehn et al., 2013; Oikonomou et al., 2014; Ganda et al., 2016, 2017; Bonsaglia et al., 2017).

Colostrum microbiota- Staphylococcus, Prevotella, Ruminococcaceae, Bacteroidales, Clostridiales, and Pseudomonas (Lima et al., 2017).

# Udder Microbiota

**Teat Apex Microbiota**

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**Teat Canal Microbiota**

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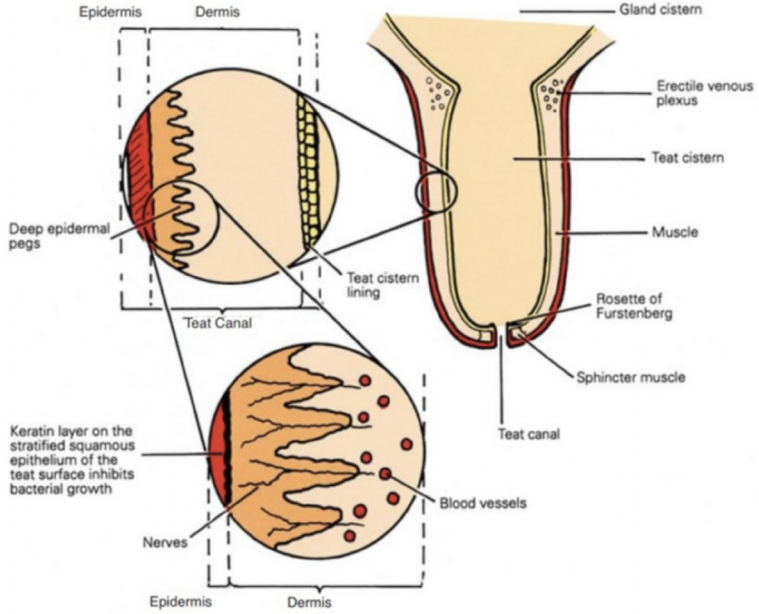
# Mammary Gland Defense Mechanisms

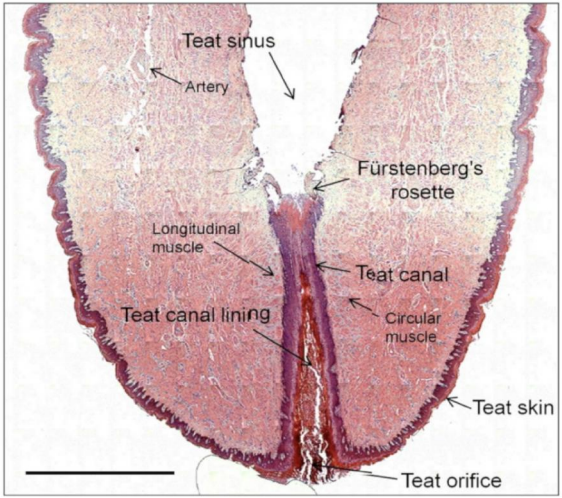
- Anatomical defense barriers First line of defense
- Teat skin
- Teat sphincter muscle
- The teat canal
- Keratinized epithelium and
- Teat cistern
- Innate immune response
- Macrophages located in the alveoli phagocytize bacteria that enter the mammary gland
- Activated macrophages release cytokines
- Neutrophil recruitment from the blood stream to the site of infection

# Teat skin

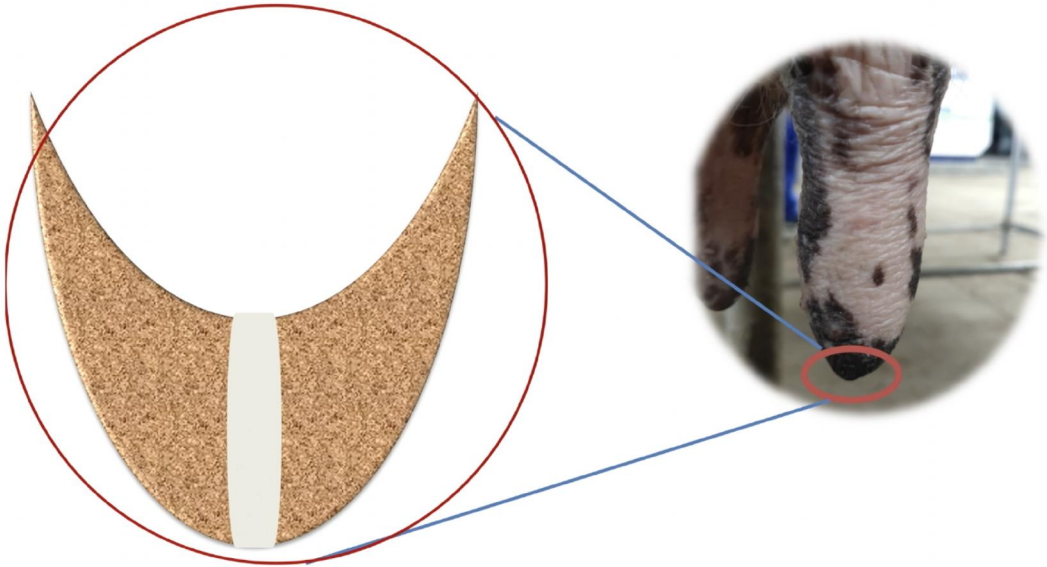

Epidermis
Dermis
Gland cistern
Erectile venous plexus
Teat cistern
Muscle
Deep epidermal pegs
Teat cistern lining
Rosette of Furstenberg
Teat Canal
Sphincter muscle
Teat canal
Keratin layer on the stratified squamous epithelium of the teat surface inhibits bacterial growth
Blood vessels
Nerves
Epidermis
Dermis

# Streak canal

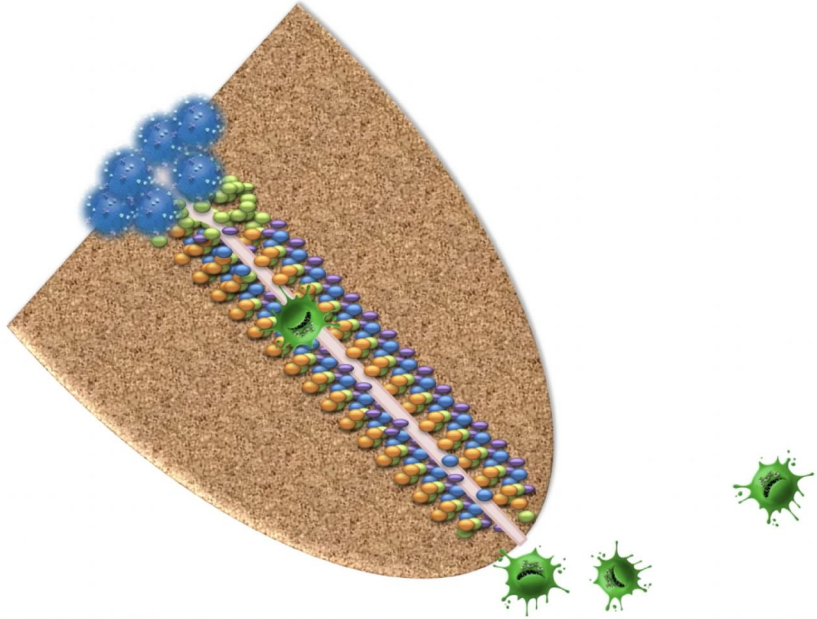
- **The streak canal - lined by keratin and covered by thin layer of lipid seals the canal and prevent entry of pathogens.**



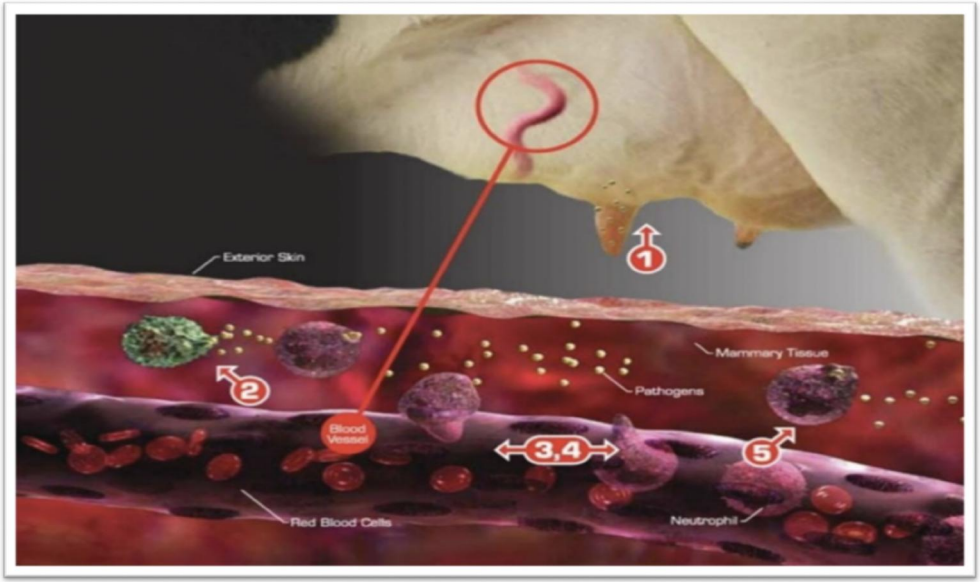
# Keratinand Wax Plug



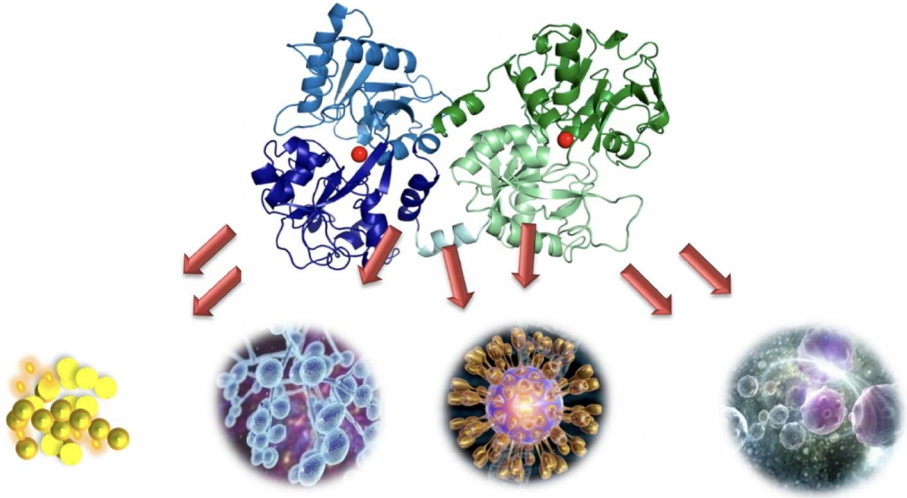
# Streak canal



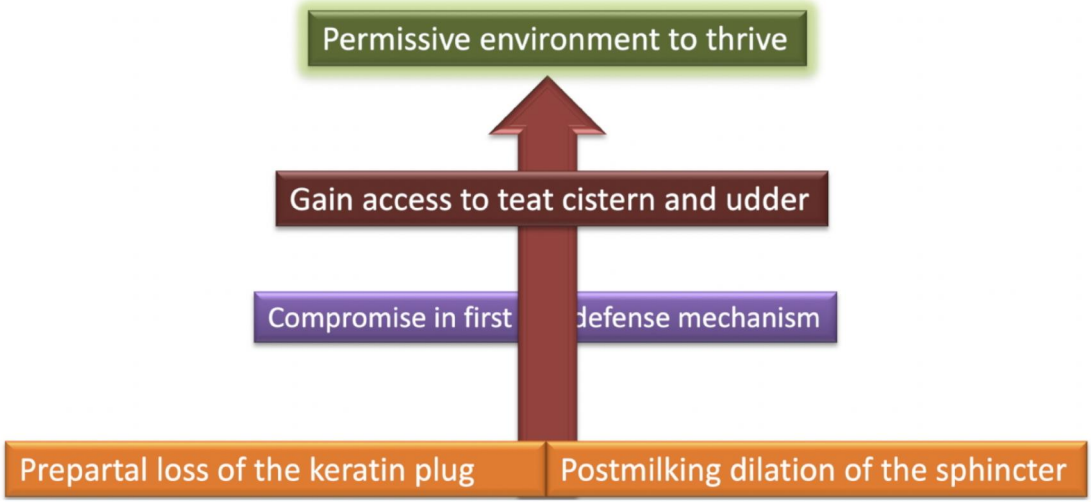
# Innate Immunity



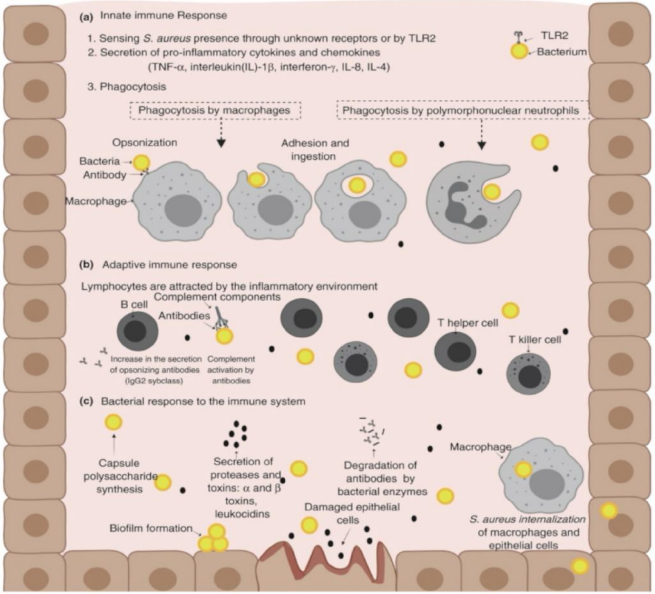
# Lactoferrin- The Red Protein



# Pathogenesis



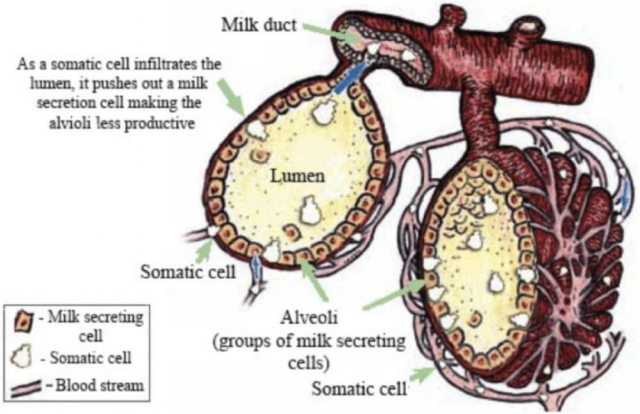
# Biofilm formation and Internalisation



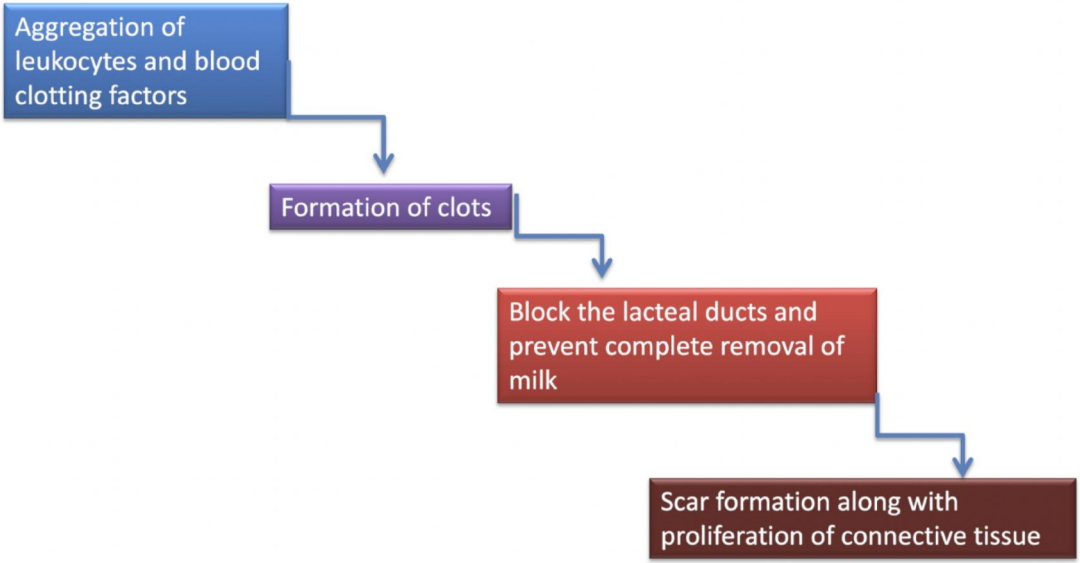

Zaatout, 2020

# Biofilm formation and Internalisation

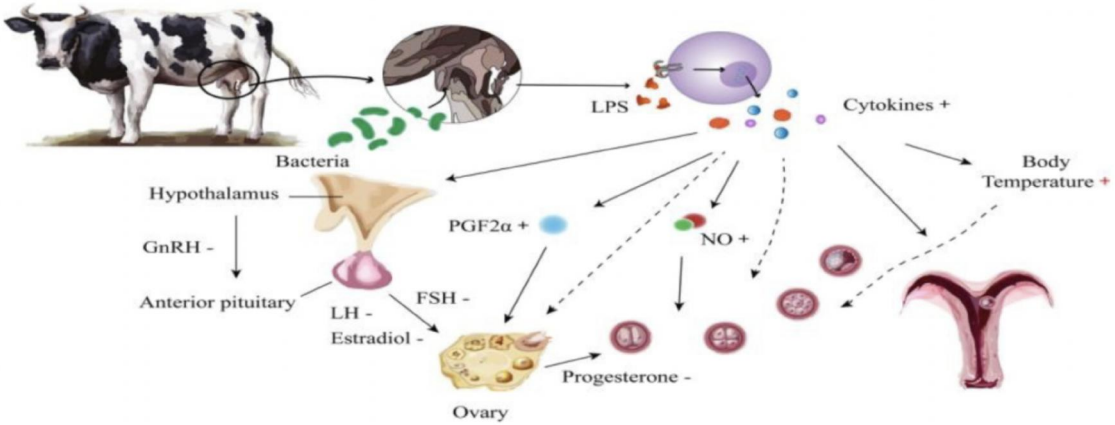
- As a result of mammary invasion by pathogenic species, masses of neutrophils pass between the milk secreting cells into the lumen of the alveoli, increasing the somatic cell counts besides injuring the secretory cells.
- The increase in the number of leukocytes in milk results in the increased number of somatic cells.



# Biofilm formation and Internalisation



# Mechanism by which mastitis affects reproduction in dairy cow




Wang et al., 2021

# Thank you