

Dissecting the Mammary Gland: Understanding Udder Health and Milk Quality



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Outline

- **Introduction to Mammary Gland Anatomy and Physiology**
- **Understanding Udder Health and Milk Quality**
- **Udder Dissections**



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Anatomy and Physiology of Lactation

• Mammary Gland

- Gland that is responsible for lactation
- Dairy cow has four functionally distinct glands (quarters)
 - Milk is not shared between quarters
 - Each quarter has its own blood supply
 - Each quarter responds to local factors, but also systemic factors
- **400-500 units of blood to pass through the udder for each unit of milk synthesized**

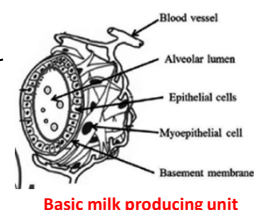
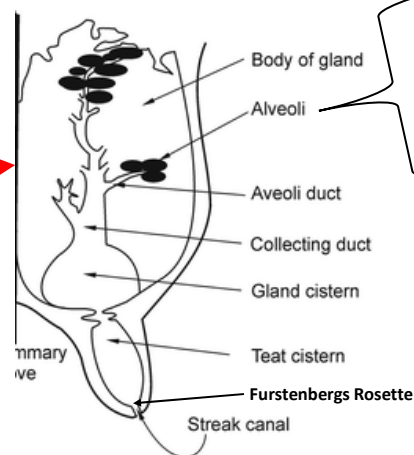
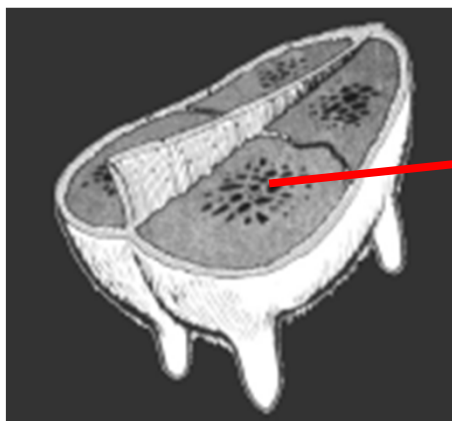


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Anatomy - Macrostructure



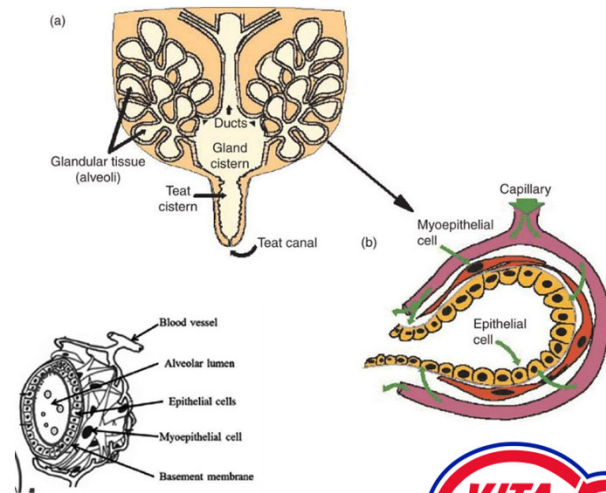
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Alveoli

- **Basic milk producing unit**
- **The mammary gland of the dairy cow contains millions of alveoli**
- **An alveolus is lined with epithelial cells which synthesize and secrete milk and surrounded by myoepithelial cells which contract in response to oxytocin**



Nickerson and Akers, 2011

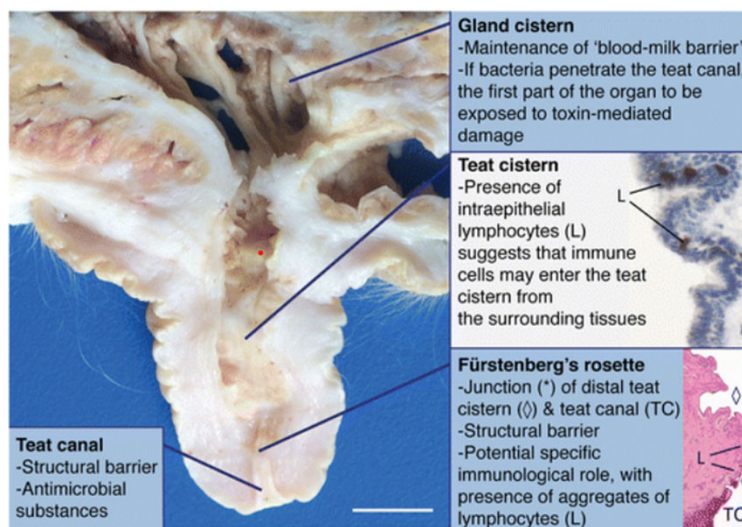
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Udder Health: Cow's Own Defenses



- **Mammary gland is an exocrine gland and is exposed to environment – so it has its own defenses:**

- Physical barriers
- Humoral and cellular defenses
 - Macrophages
 - Lymphocytes
 - Polymorphonuclear neutrophil leukocytes

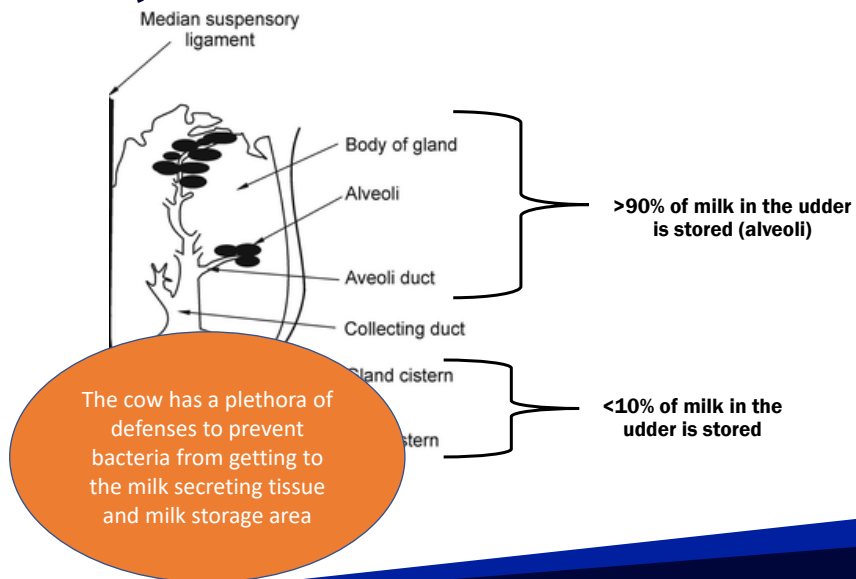
Hughes and Watson, 2018



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Anatomy - Macrostructure

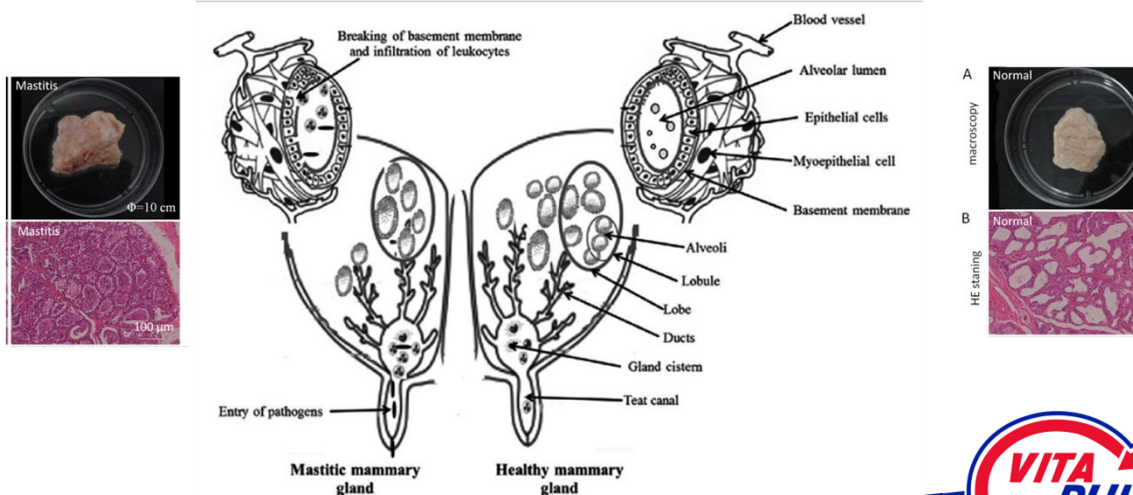


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What happens when udder health is compromised



Chen et al., 2016
Hussien and Dang, 2018

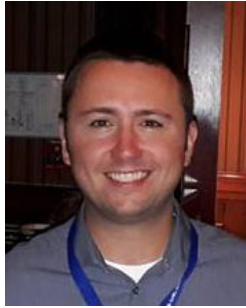


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Udder Health & Milk Quality



Kolby McIntyre, DVM
Randolph, WI

- Milking Equipment
- Mastitis Data
- Parlor Data
- Training
- Action Items

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Udder Health & Milk Quality

- Defining Milk Quality
- A Common Enemy
- What is a Somatic Cell?
- Natural Defenses
- Human Impact

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Defining Milk Quality

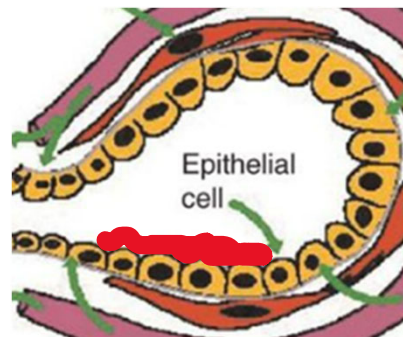
- Dairy
 - Financial Impact
- Processor
 - SCC, PPLC, LPC, COLI, PI, CRYO
- Cow
 - Measure of Udder Health

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A Common Enemy?

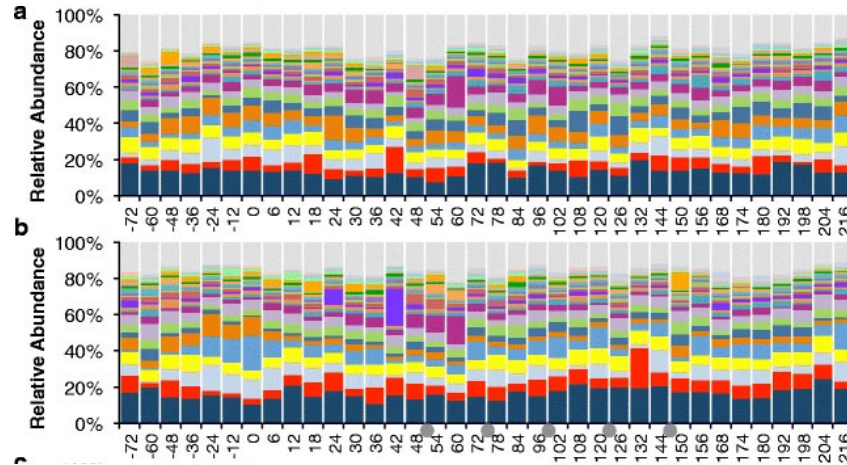
Bacteria

- Virulence Factors
- Competitive Inhibition
- Microbiome



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Udder Microbiome



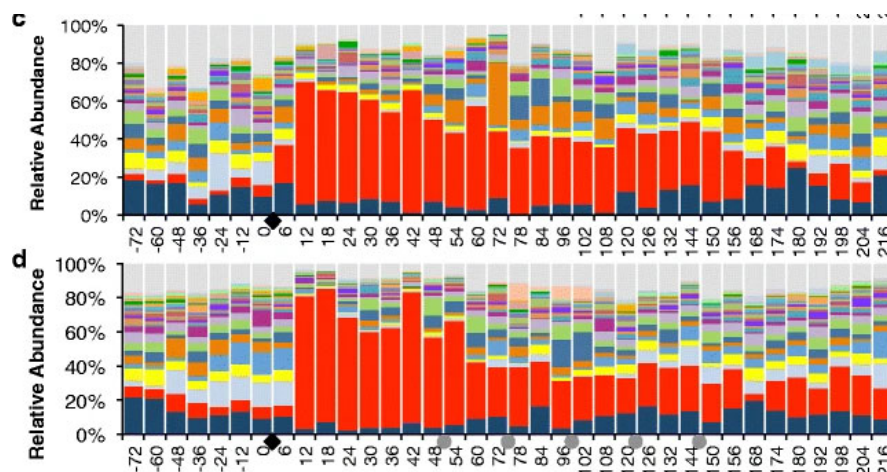
Marsh View
Veterinary Clinic

Ganda, E.K., Gaeta, N., Sipka, A. *et al.* Normal milk microbiome is reestablished following experimental infection with *Escherichia coli* independent of intramammary antibiotic treatment with a third-generation cephalosporin in bovines. *Microbiome* 5, 74 (2017). <https://doi.org/10.1186/s40168-017-0291-5>



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Udder Microbiome



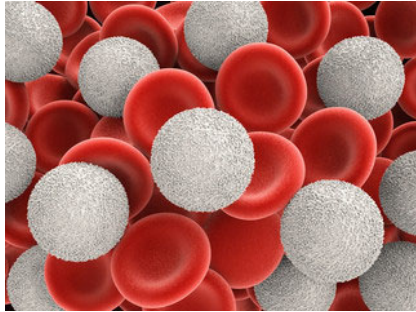
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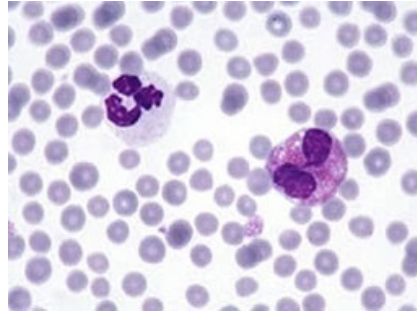


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What is a Somatic Cell?



Fotolia



Merck Veterinary Manual

Udder Health & Milk Quality

- Defining Milk Quality
- A Common Enemy
- What is a Somatic Cell?
- Natural Defenses
- Human Impact

Natural Defenses

External

- Skin
- Sphincter
- Keratin Plug

Internal

- White Blood Cells
- Microbiome
- Abscess Formation
- Milk Expulsion

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Human Impact

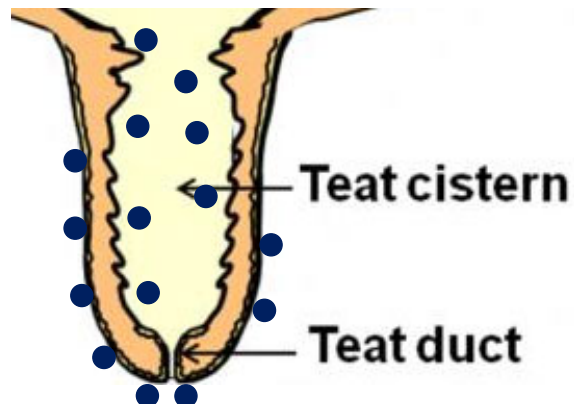
- Confinement
- Parlor
 - Prep Routine
 - Vacuum Equipment
- Short Term vs Long Term Effects

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Prep Routine

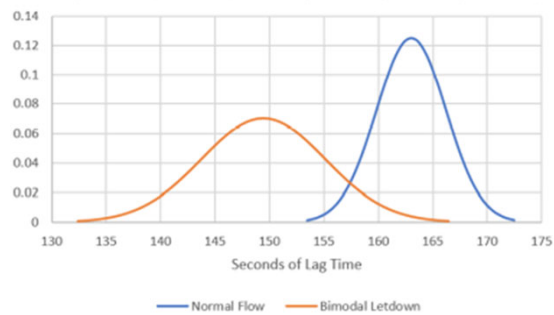
- Disinfection of Teat Skin
- Forestripping
- Stimulation

Prep Routine



Stimulation

- Letdown
- Unit on-time



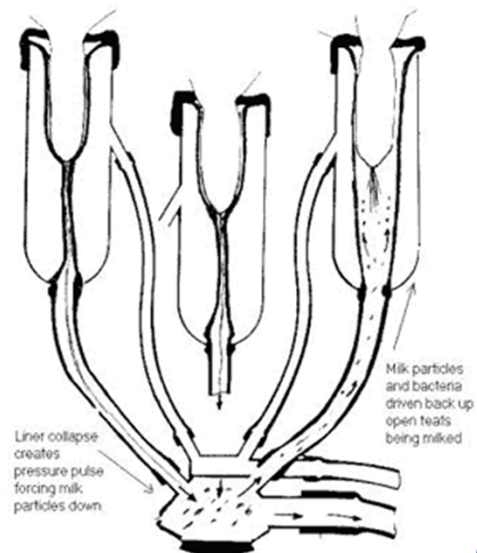
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Vacuum Equipment

- Attachment
- Pulsation



<http://copulsation.com/mastitis.htm>

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Effects on Udder Health

Short Term

- Edema
- Delayed Closure
- Mastitis



Effects on Udder Health

Long Term

- Hyperkeratosis
- Decreased Production
- Mastitis

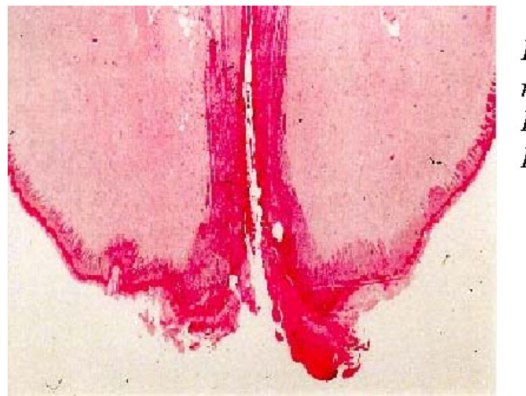


Figure 1. Microscopic view of a teat-end with a thick rough callosity ring (2C). Photo: Utrecht University.
Drs A. de Man, Dr Y.H. Schukken & Drs J.P. Koeman

Udder Dissections



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