

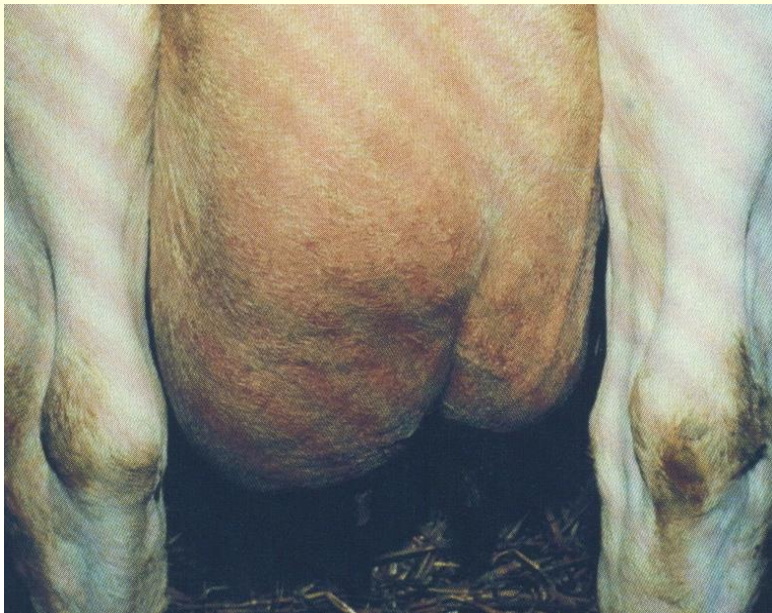
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The Cow

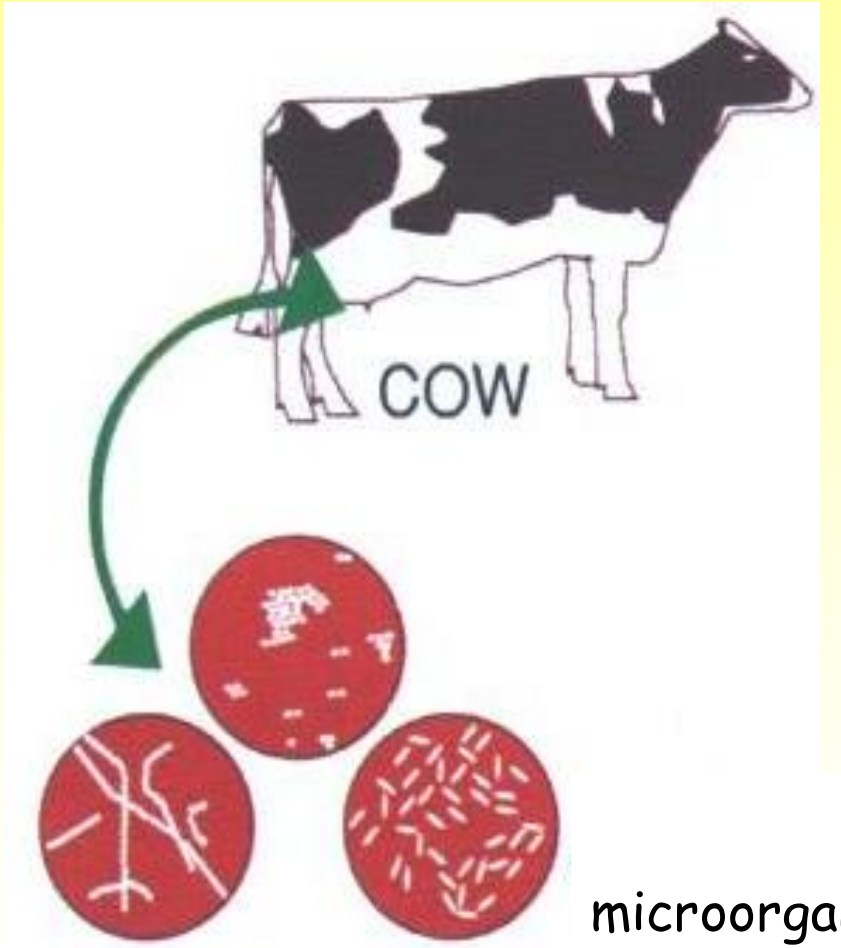
Understanding

Mastitis





Objectives



microorganisms

- This module explains the causing process of mastitis and how it is affected by various factors (milking routine, environment).

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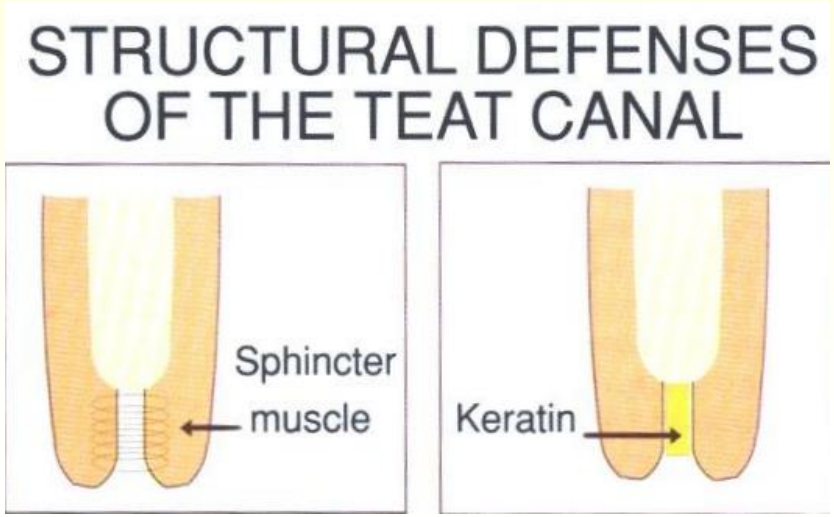
Review

- Mastitis is the inflammation of the udder, generally caused by microorganisms.
- Microorganisms enter the teat canal and get into the udder.
- Cow reacts against microorganisms by sending chemical substances **and white blood cells** to the udder.
  - Changes in the udder and in milk lead to **signs of the inflammatory process.**

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Cows' defense against microorganisms

- Tissues surrounding the teat canal form the primary barrier against bacteria.
  - ✓The muscles surrounding the canal maintain closure between milkings, preventing bacterial penetration.
  - ✓The skin lining the teat canal produces a gummy like substance named 'keratin', which blocks the teat opening and serves as a barrier.



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How can microorganisms breach the teat canal?

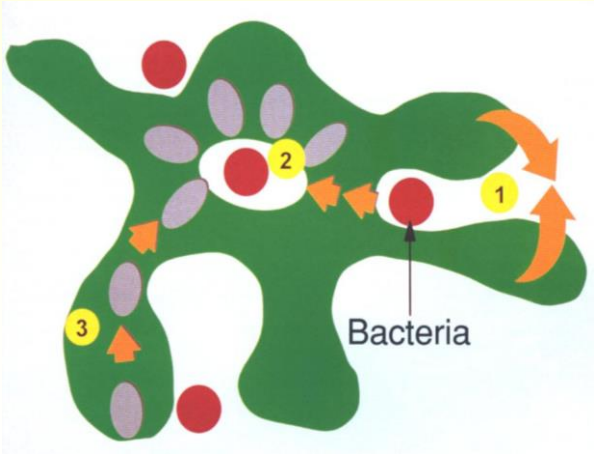
- Between milkings, bacteria may pass through the teat canal by:
  - ✓Multiplying inside the teat canal
  - ✓Physical movement resulting from pressure placed on the teat end as the cow moves about

- During machine milking, microorganisms may be propelled into or through the teat canal and into the teat cistern:
  - ✓Via droplets impacts against the teat end
  - ✓During full insertion of an antibiotic infusion cannula

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Cows' defense against microorganisms

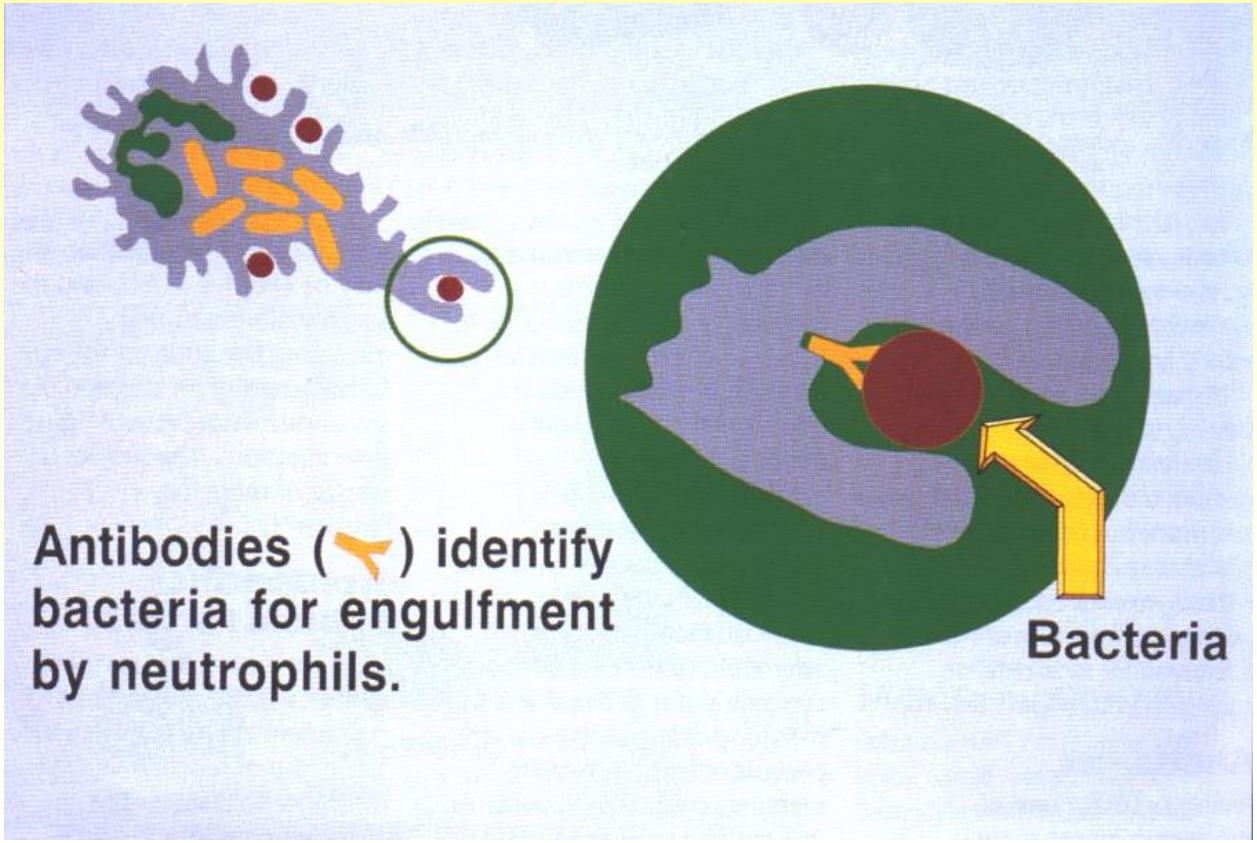
- After bacterial breach the teat canal, white blood cells or leukocytes in milk serve as an important defense mechanism.
- Types of leukocytes include:
  - ✓Neutrophils (most active)
    - Engulf bacteria (1), and
    - Store them in digestive sacs (2) in which
    - Bacteria are destroyed by enzymes (3) which migrate to the digestive sac
  - ✓Macrophages
  - ✓Lymphocytes



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Cows' defense mechanisms

- Antibodies are chemical defenses in milk that are directed against mastitis causing bacteria.



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Review: Clinical Mastitis

- Characterized by visible abnormalities in the udder or milk.
  - Quarters may be red or swollen, hard to the touch.



  - Milk may contain clots, flakes, clear serum-like or bloody secretion.

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Review: Sub-Clinical Mastitis

- Is 15 to 40 times more prevalent than the clinical form.
- Is not detected by visual observation, but by:
  - Tests for the presence of microorganisms
  - Tests for somatic cell count (SCC)
    - ✓ California Mastitis Test (CMT)
    - ✓ Other SCC test methods

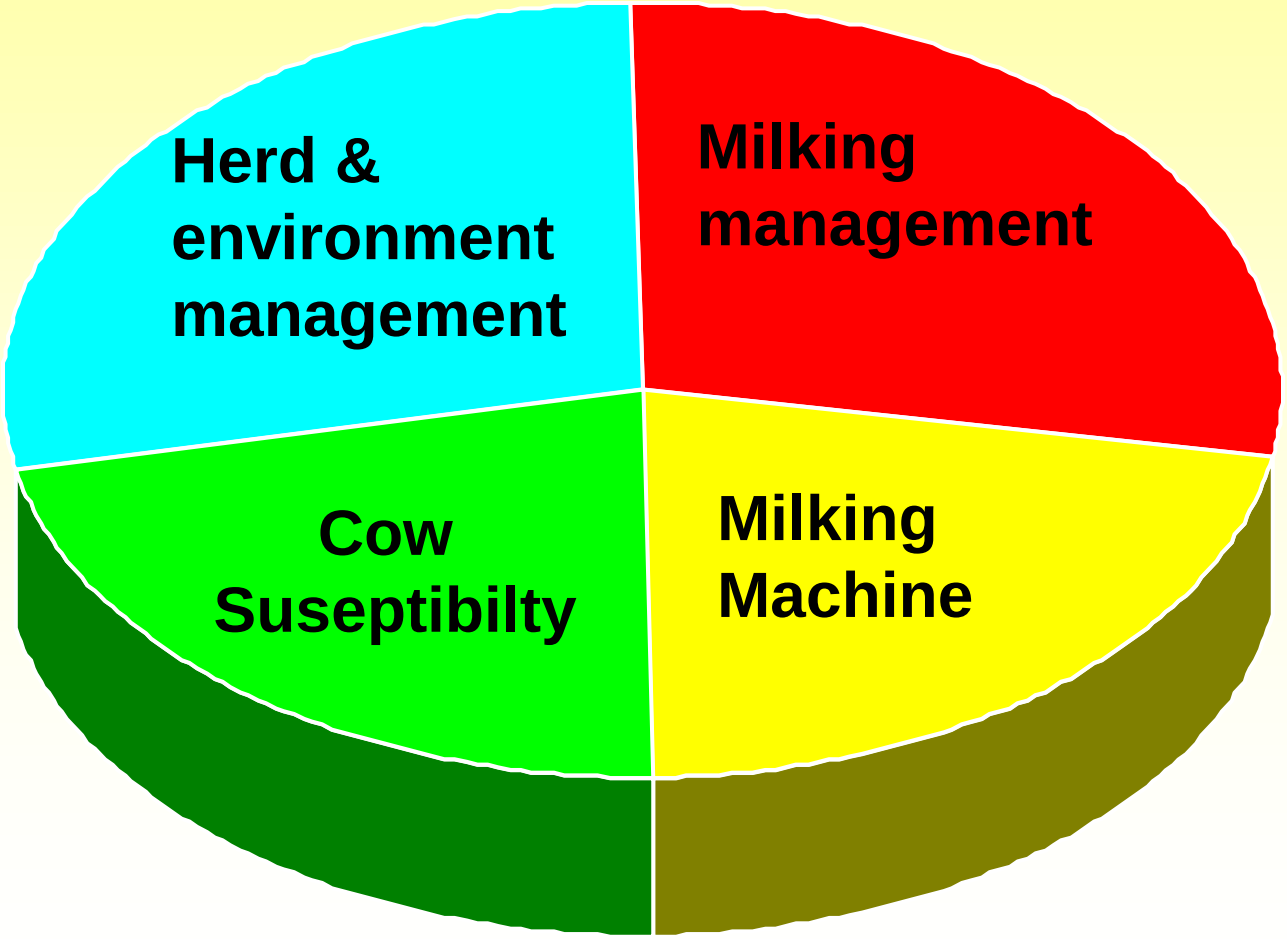


CMT: a type of test to detect sub-clinical mastitis

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What affects Mastitis occurrence?

- Mastitis occurrence is affected by ….



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Factors that affect Mastitis occurrence

- Environment to which the herd is exposed
- Types of mastitis organisms present in the herd and environment
- Management practices being employed
- People responsible for managing milking

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Sources of bacteria that cause Mastitis

- Environment
- Surface skin of udder and teat
- Contaminated milk from infected udder

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Mastitis can be classified by Two Major Categories of Invading Organisms

Environmental Mastitis

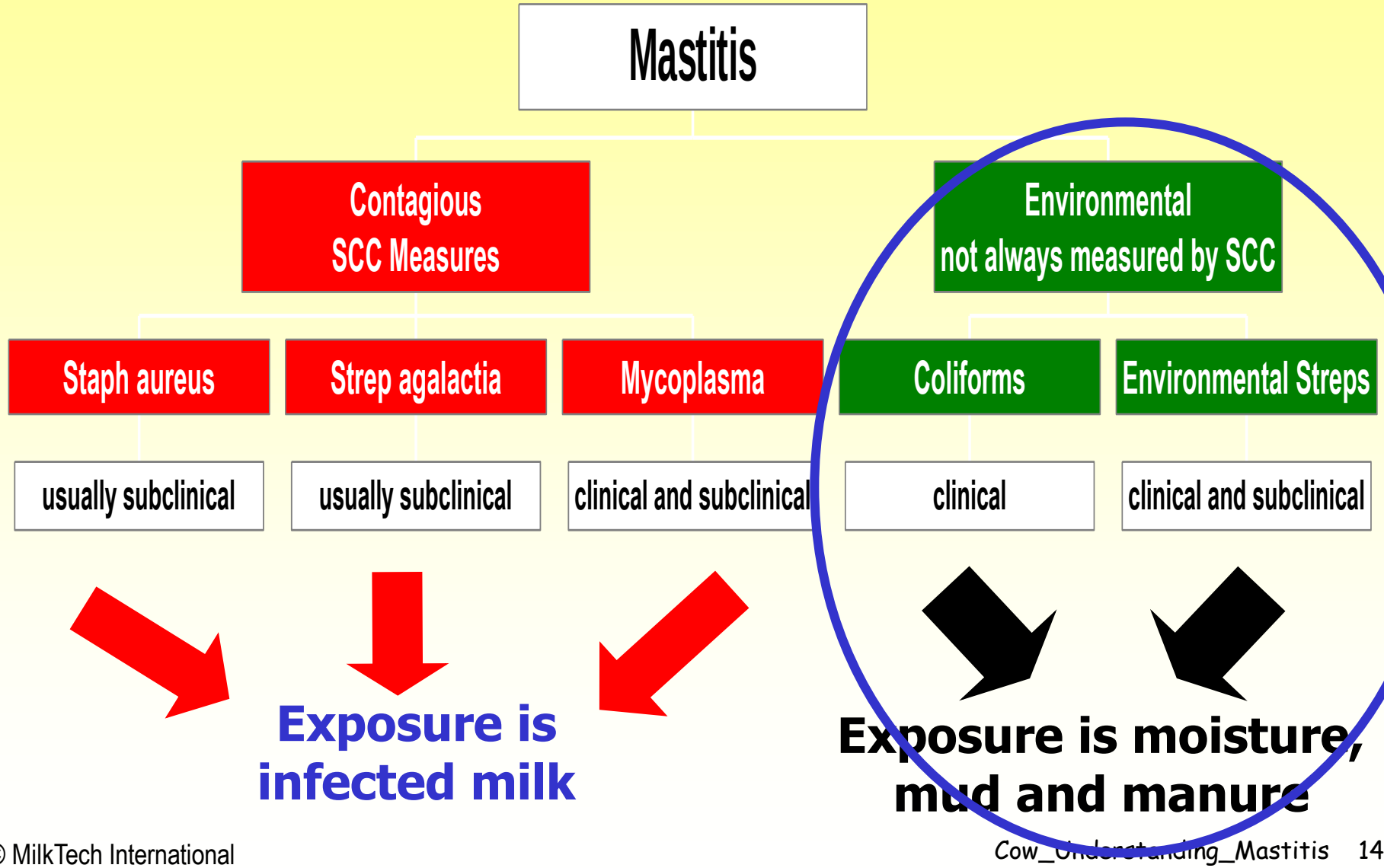
- Typical Environmental Organisms
  - ✓ Escherichia coli
  - ✓ Streptococcus sp
  - ✓ Streptococcus uberis
  - ✓ Kiebsiella species
  - ✓ Citrobacter species
  - ✓ Enterobacter species
  - ✓ Enterococcus foecali
  - ✓ Enterococcus faeium

Contagious Mastitis

- Typical Contagious Organisms
  - ✓ Staphylococcus aureus
  - ✓ Streptococcus agalactiae
  - ✓ Corynebacterium bovis
  - ✓ Mycoplasma bovis

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Types of Mastitis



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Environmental Mastitis



E. coli

Env. streps

Klebsiella

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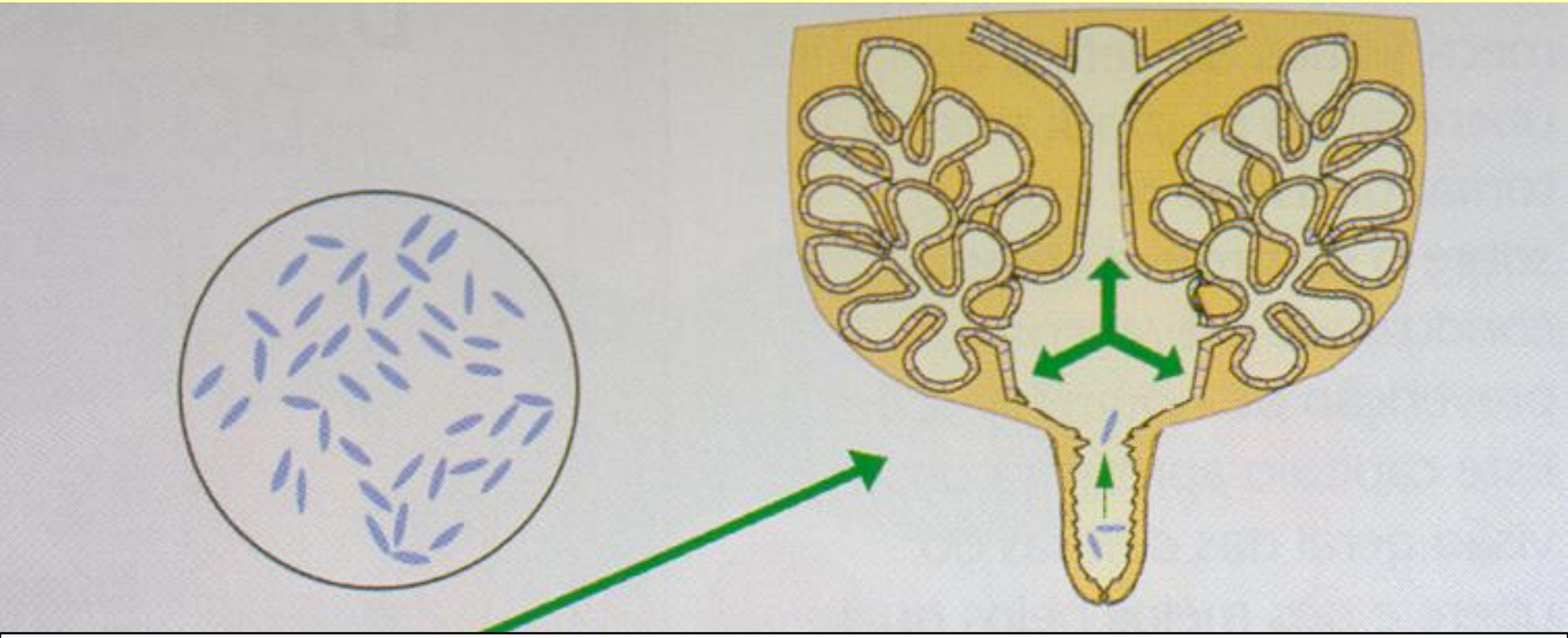
Environmental Mastitis

- The primary point of exposure to environmental mastitis pathogens is often outside of the milking parlor.
- Reservoir is environment
- Often spread between milkings
- Cannot be eradicated
- Can cause severe clinical cases
- Main agents are:
  - *Escherichia coli*
  - *Klebsiella*
  - Environmental *Streptococcus*

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Escherichia coli



Endotoxins released as a function of the death of bacteria, causing a rapid increase in somatic cell count.

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Environmental Streps: Effect on SCC and Clinical Mastitis

- Can cause both subclinical and clinical mastitis.
- Can increase SCC and become chronic in nature.



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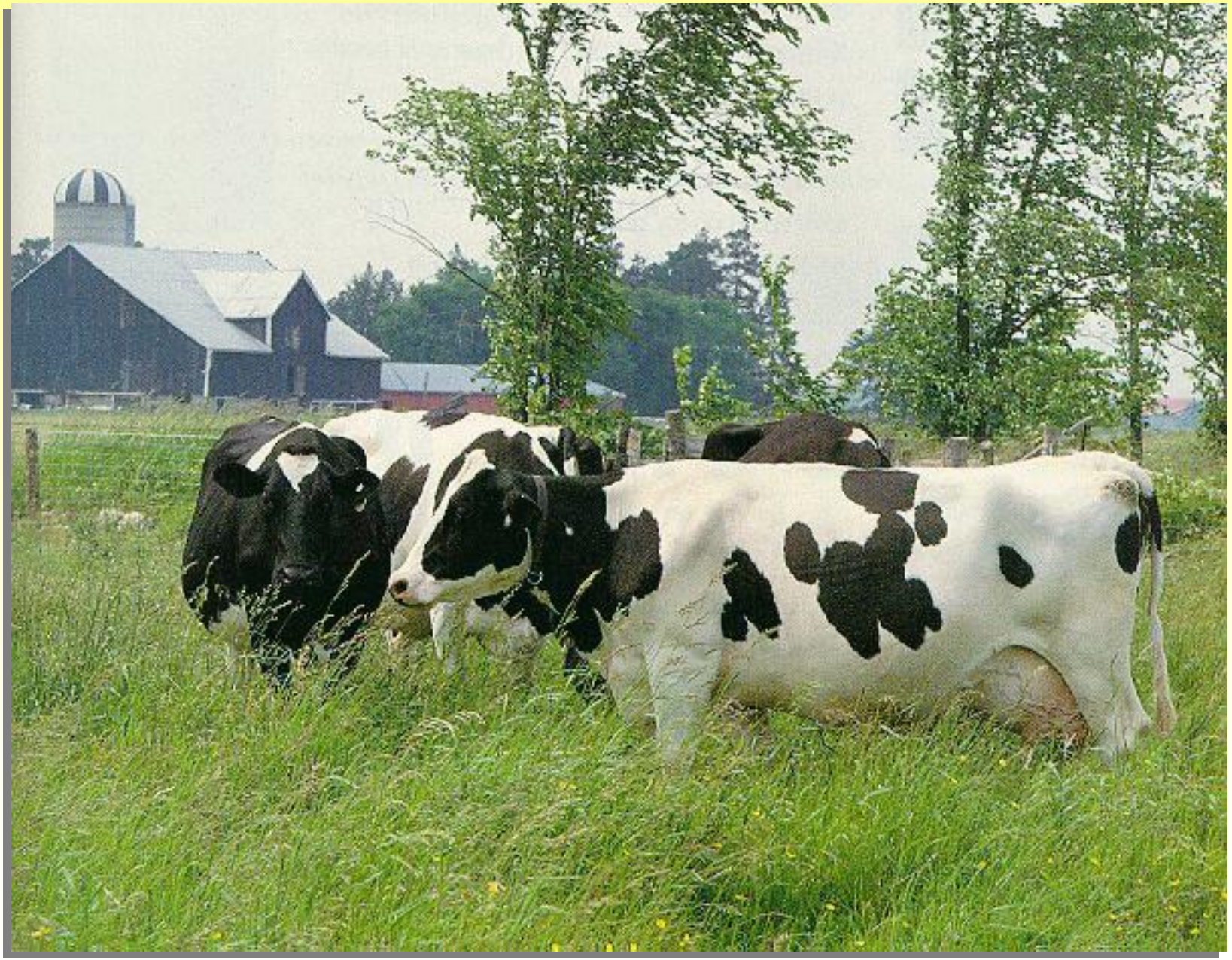


Factors Influencing Exposure to Mastitis Pathogens

- Housing, handling & nutritional management
- Animal size & conformation
- Premilking cow preparation



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Housing & Mastitis

- Exposure to environmental mastitis pathogens can occur while cows are in their housing area or traveling to the milking facility.

- Moisture, mud & manure in bedding are primary sources of exposure to bacteria.

- Manure handling, type of bedding and maintenance of cow beds all have major influences on hygiene.

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Housing Hygiene & Mastitis

- Overcrowding results in excessive deposition of manure in areas that are designed for fewer animals.
- Rapid movement of animals for handling or milking often results in splattering of manure.
- Hygiene of housing facilities has been related to amount of both clinical and subclinical mastitis.

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Bedding

- The presence of large numbers of bacteria in bedding (>106 cfu/g) often results in outbreaks of clinical mastitis caused by environmental pathogens.
- High amounts of organic matter and moisture in bedding can support large numbers of bacteria.
- Organic bedding sources tend to support more bacterial growth than inorganic sources, although significant exposure to Streptococci spp. and Klebsiella spp. may occur with sand bedding.
- Sand bedding that is low in organic matter usually has the lowest bacterial populations, but anything that increases moisture content or the amount of organic matter in bedding will increase growth and exposure to mastitis pathogens.

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Bedding





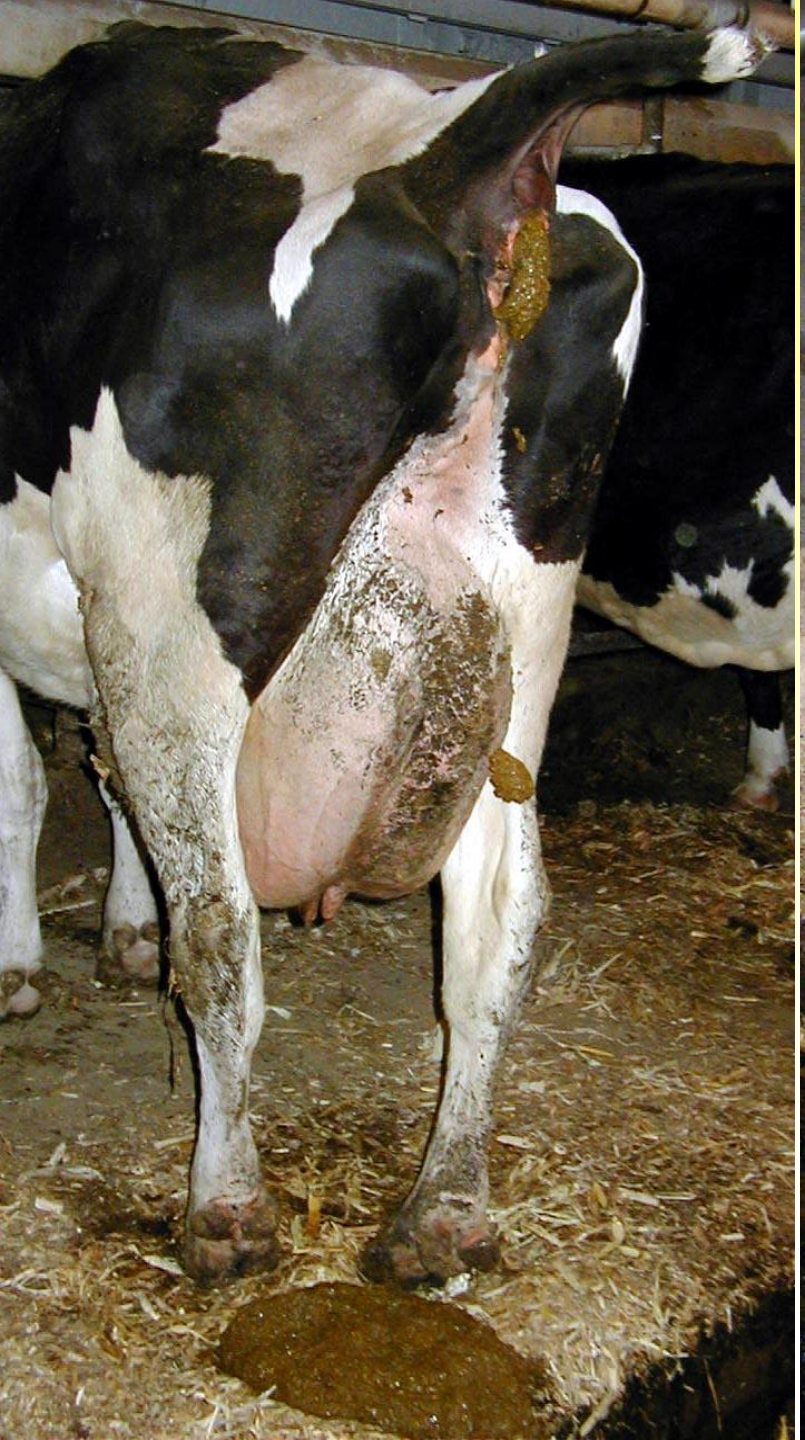
Animal Hygiene

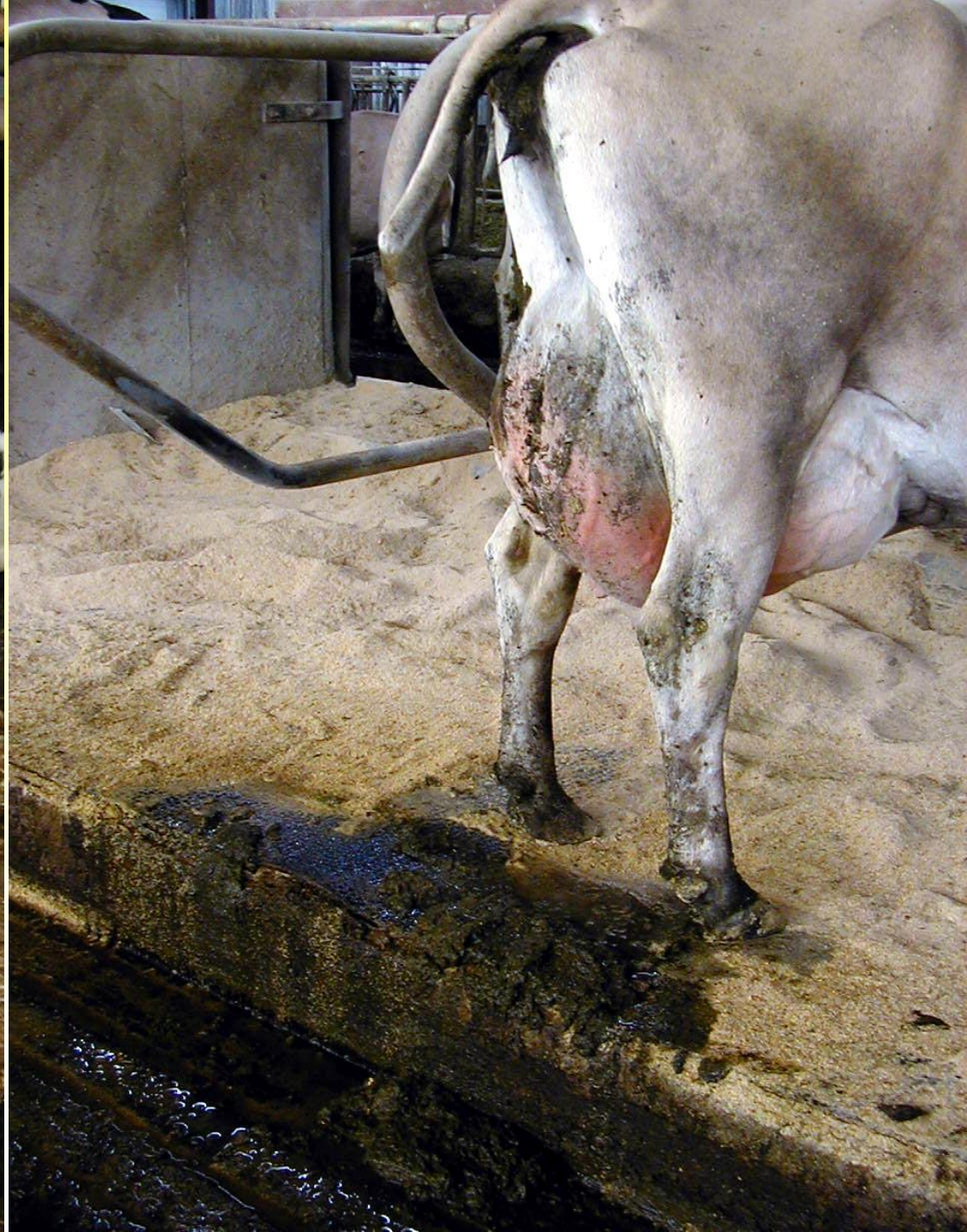
- Animal cleanliness is related to
  - Size of animal
  - Conformation
    - ✓ Udder & legs
  - Fit to stall
  - Fear of humans



- The most critical areas to keep clean are the udder & lower legs.

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Factors affecting Udder Hygiene

- Animal cleanliness is related to:
  - Use of freestalls
    - ✓ Cows that had access to outdoors were 2.5 times more likely to have dirty udders.
  - Cleanliness of walkways
    - ✓ Cows in barns with walkways that were clean were 1.3 times more likely to have clean udders.
  - Consistency of manure
    - ✓ The proportion of animals with loose manure increased the odds of having dirty udders.
  - Animal density
    - ✓ More dense cow populations reduced udder cleanliness.

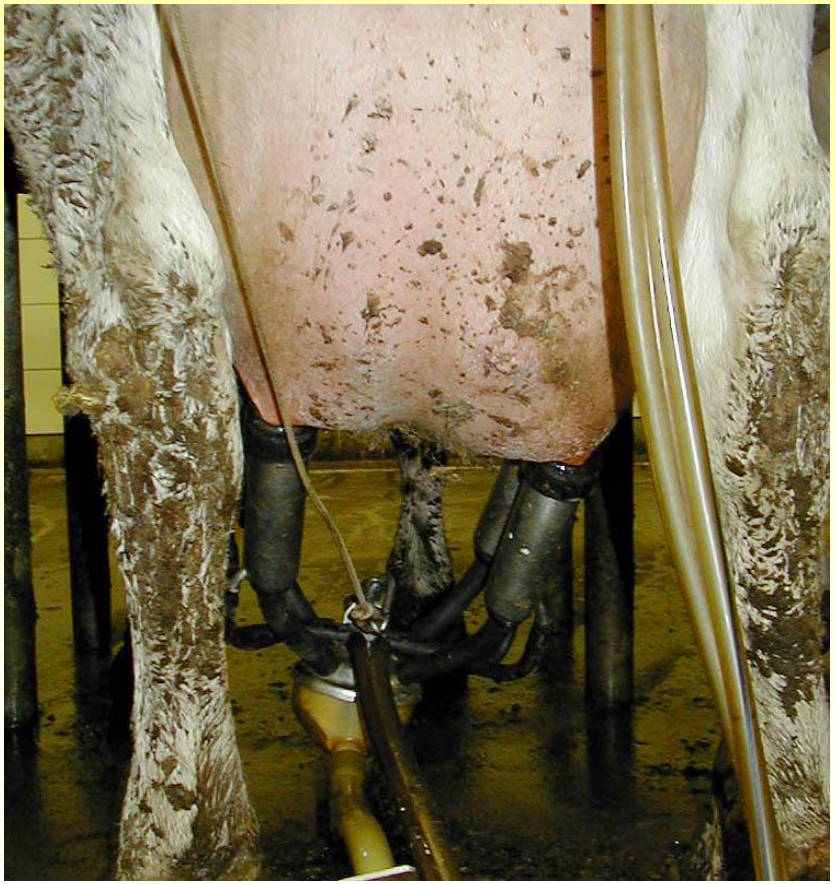
Salgado, De los Campos & Ruegg, in preparation

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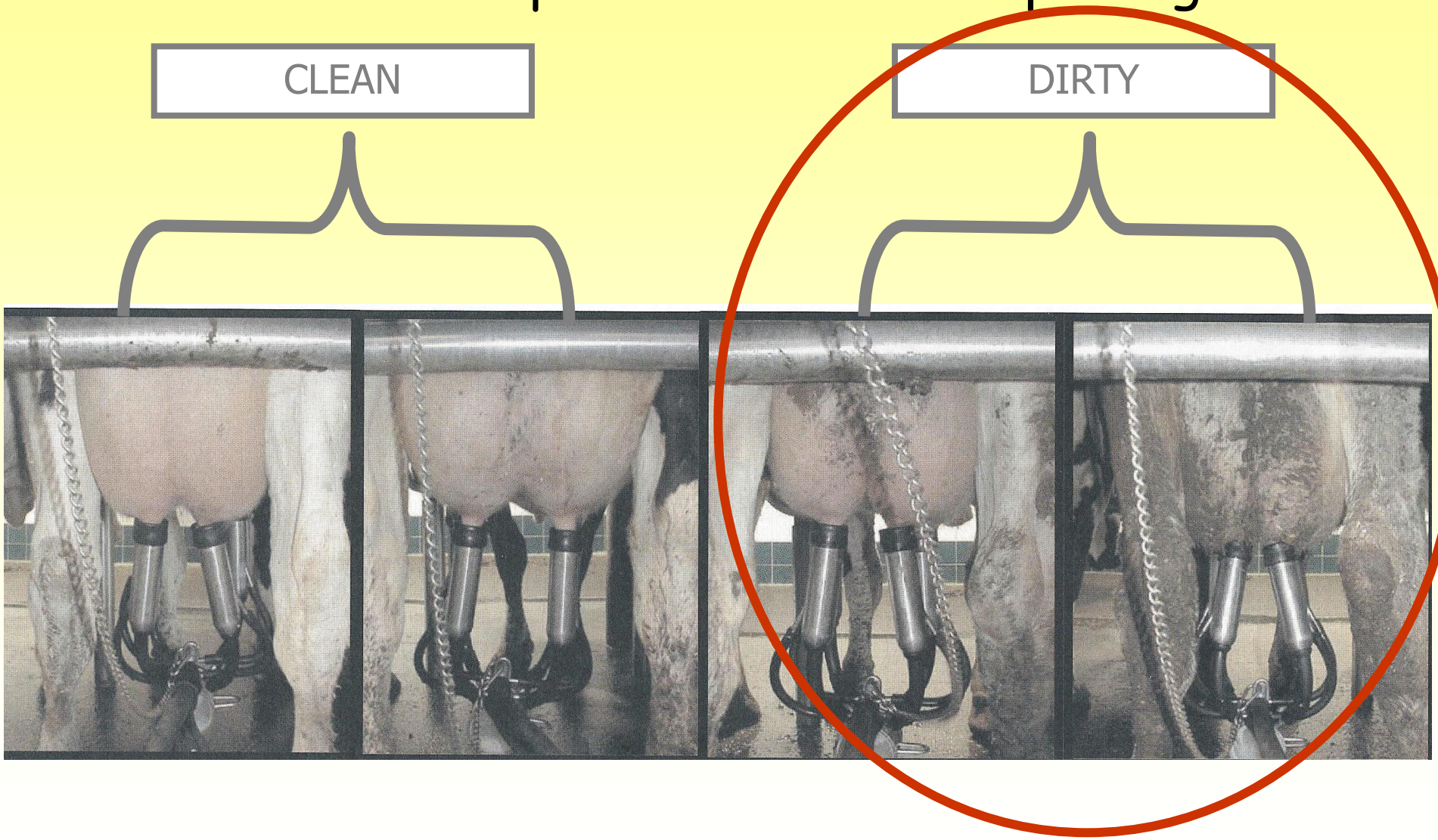
Premilking Udder Hygiene

- Last defense against
  - Exposure to environmental bacteria
  - Fecal pathogens



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Dirty cows reduce efficiency in the milking parlor and increase exposure to mastitis pathogens.



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Milking Routine & Mastitis

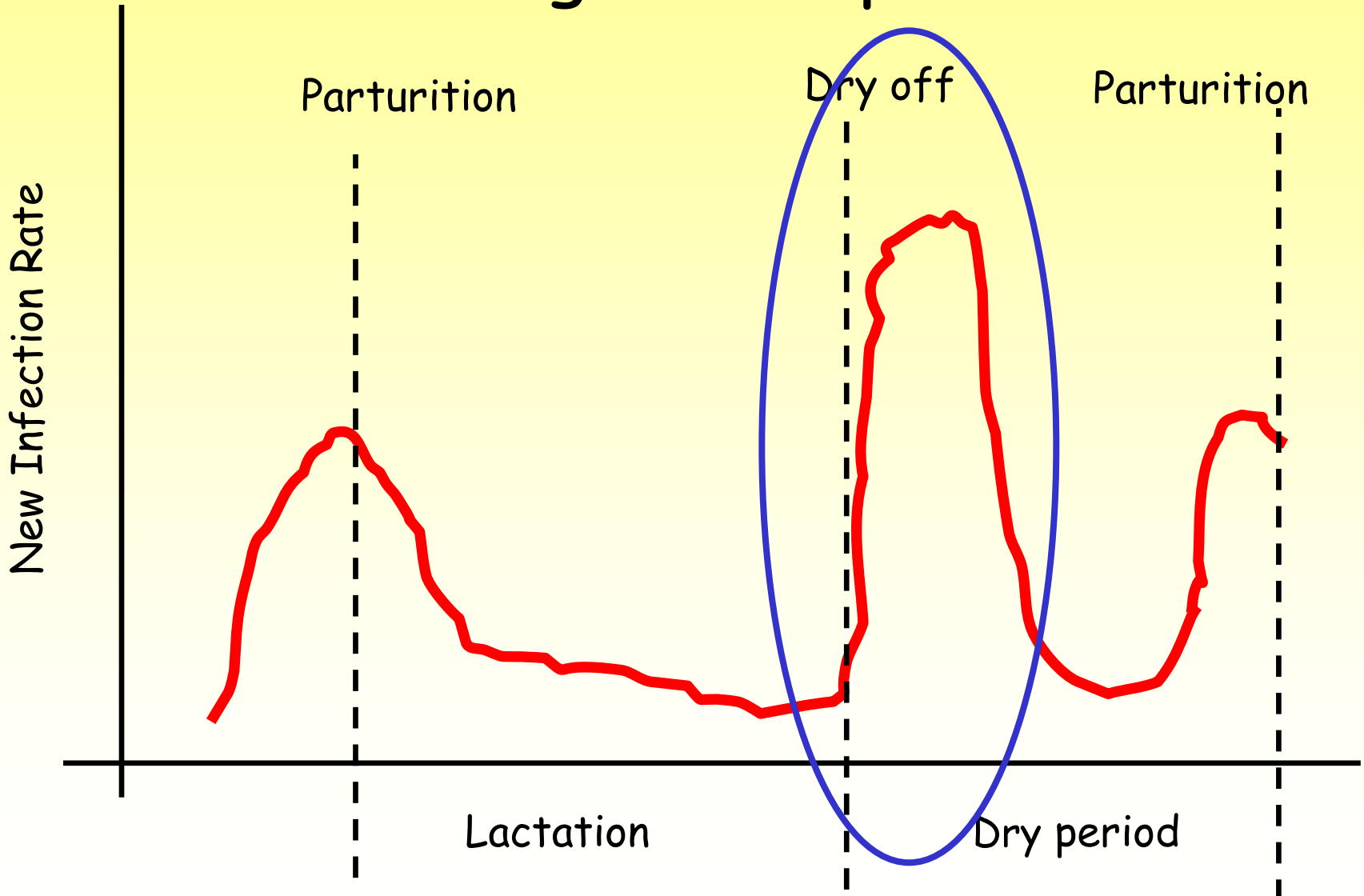
- Cleanliness of freestalls, cows and entry lanes impacts both speed and rate of new infections.



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Infections are often acquired
during the dry period.

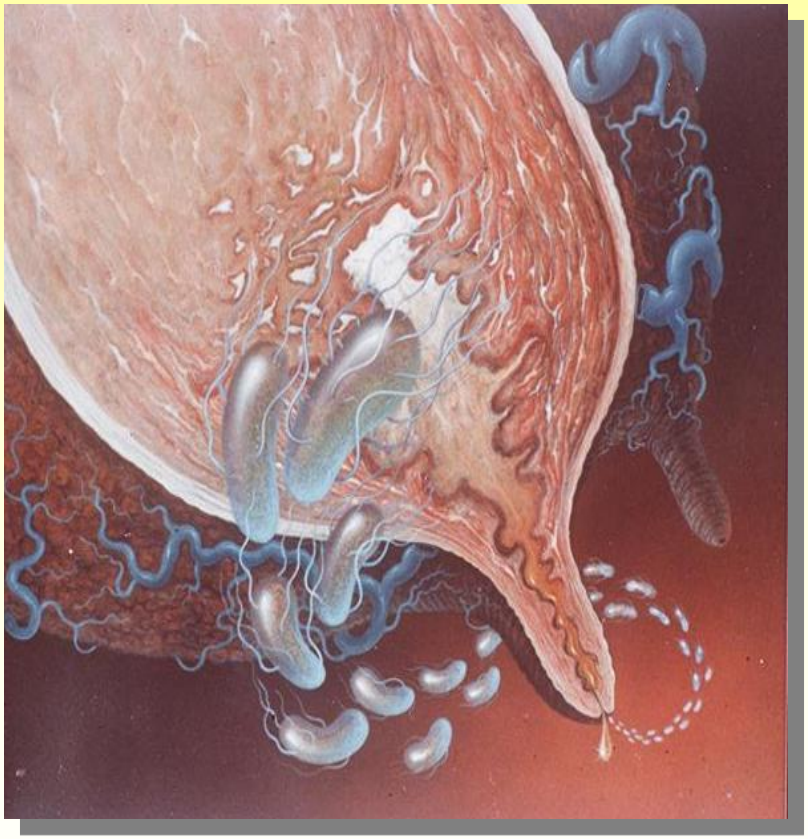
Risk of Mastitis occurrence according to the period



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Why are Dry Cows at higher risk?

- Important preventive practices are stopped:
  - Forestripping
  - Predipping
  - Postdipping
- Teat canal gets shorter.
- Cows immune system is depressed as calving approaches.



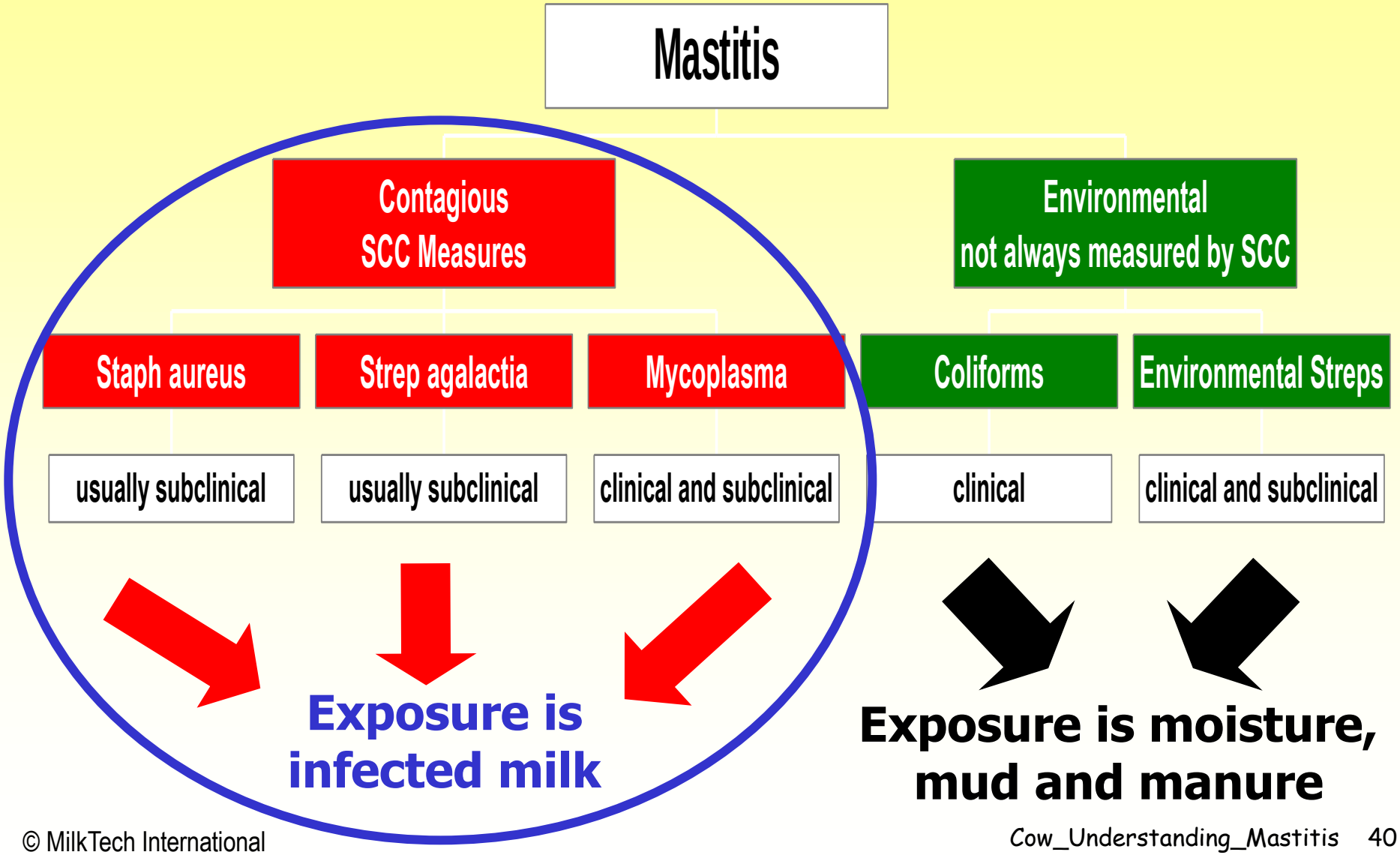
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General comments

- Control of mastitis depends upon hygienic standards.
- Current milk production systems impose some challenges for maintaining cow and facility hygiene.
- Emphasis on monitoring animal and facility hygiene is necessary to minimize the development of environmental mastitis.

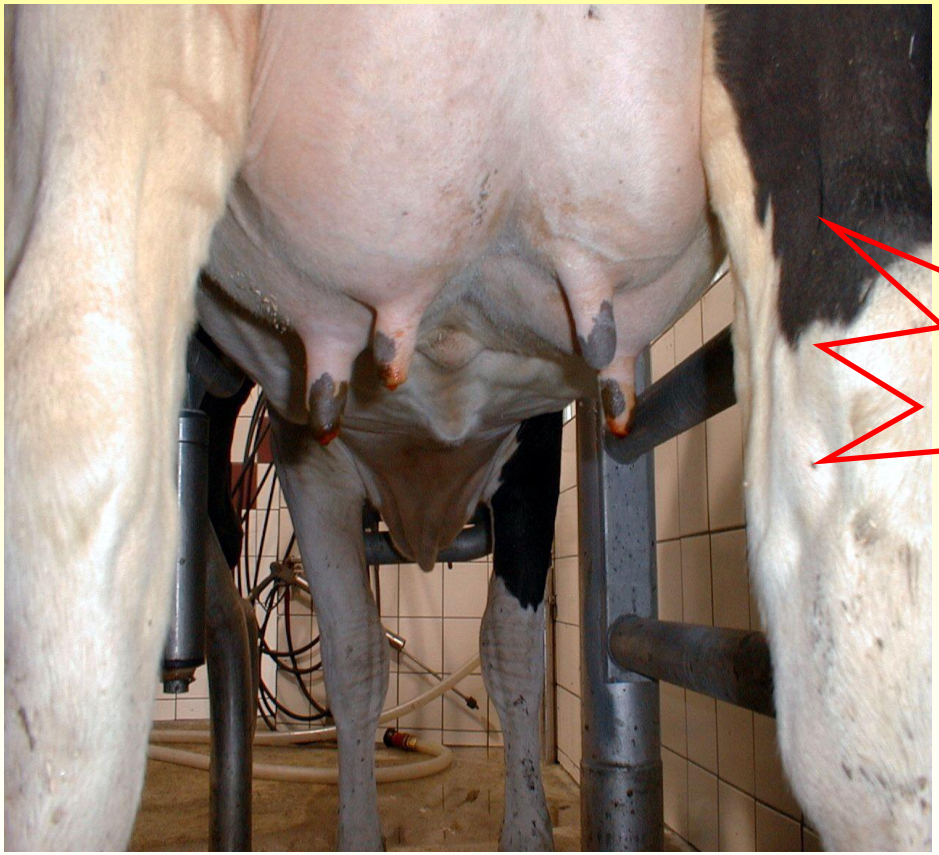
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Types of Mastitis



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Contagious Mastitis



S.aureus

Mycoplasma

Str. ag

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Contagious Mastitis

- Reservoir is cow udders.
- Very easily and often spread between cows at milking.
- Can be eradicated.
- Main agents are:
  - *Staphylococcus aureus*
  - *Streptococcus agalactiae*
  - Some environmental Streptococci

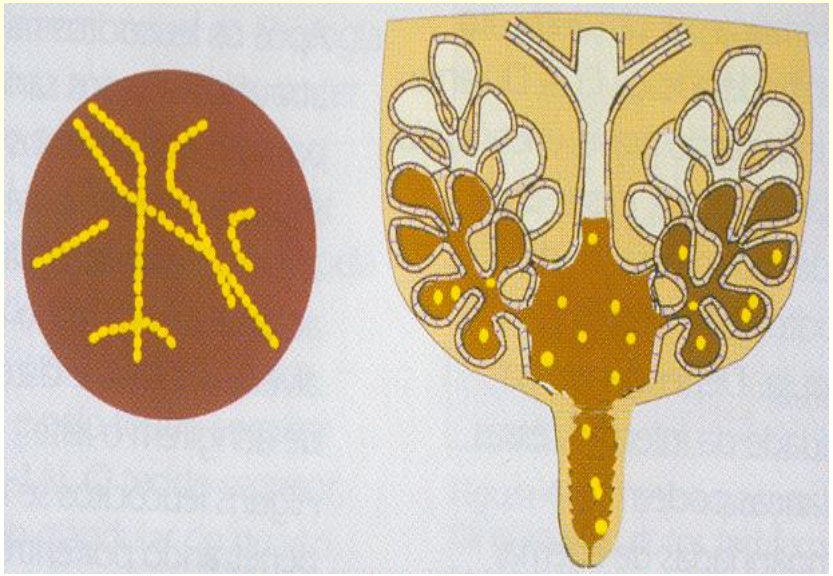
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Streptococcus agalactiae

- Very controllable.
  - Lives ONLY in infected udders of cows.
- Usually cause subclinical infection of long duration.
  - Causes high SCC in infected cows.
- Subclinical infections reduces milk production.
- Highly sensitive to penicillin based drugs.

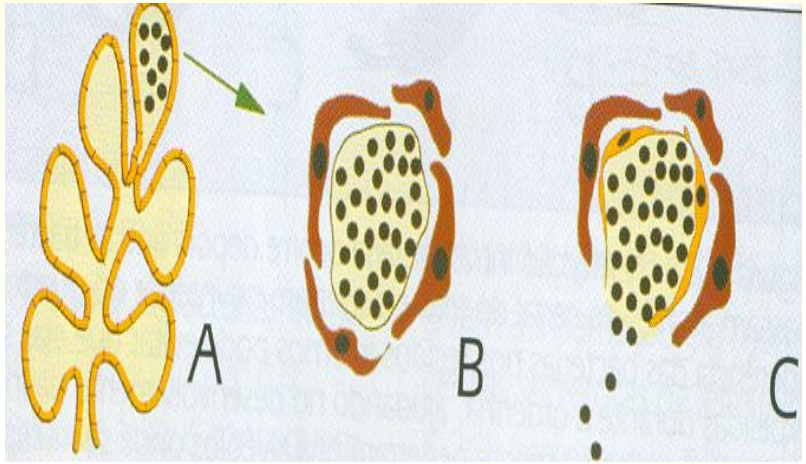


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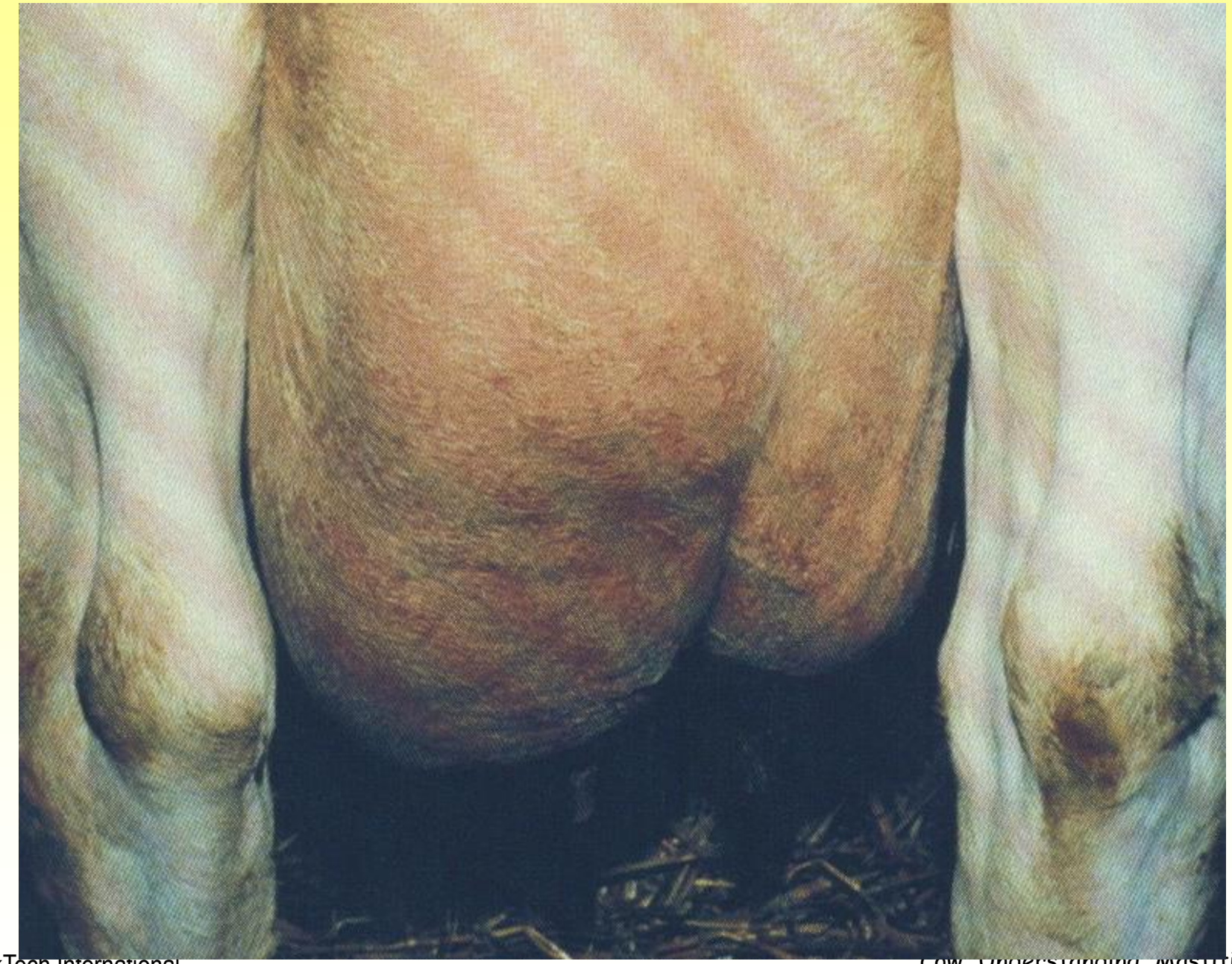
Erskine & Eberhart, 1990

Staphylococcus aureus

- Very resistant to treatment during lactation especially if chronic.
- Bacteria form small pockets of infection in udder that destroy milk producing tissue.
- Very difficult for antibiotics to reach pockets of infection.
- Forms scar tissue in udder.



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Thank you for taking this course!
We hope you got useful information about "Mastitis".

Your next step now is to take a short quiz to check what you learned.
Good luck!

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Source Material:

- Douglas Reinemann (UW-Madison)
  - Pamela Ruegg (UW-Madison)
- Norm Schuring (Westfalia Surge)

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