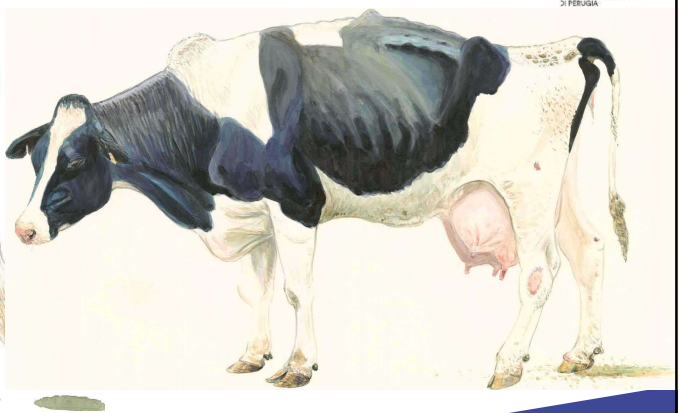
# Early detection of disease in Cows


*Filipe Silva*
*fsilva@utad.pt*
*DCV- UTAD*

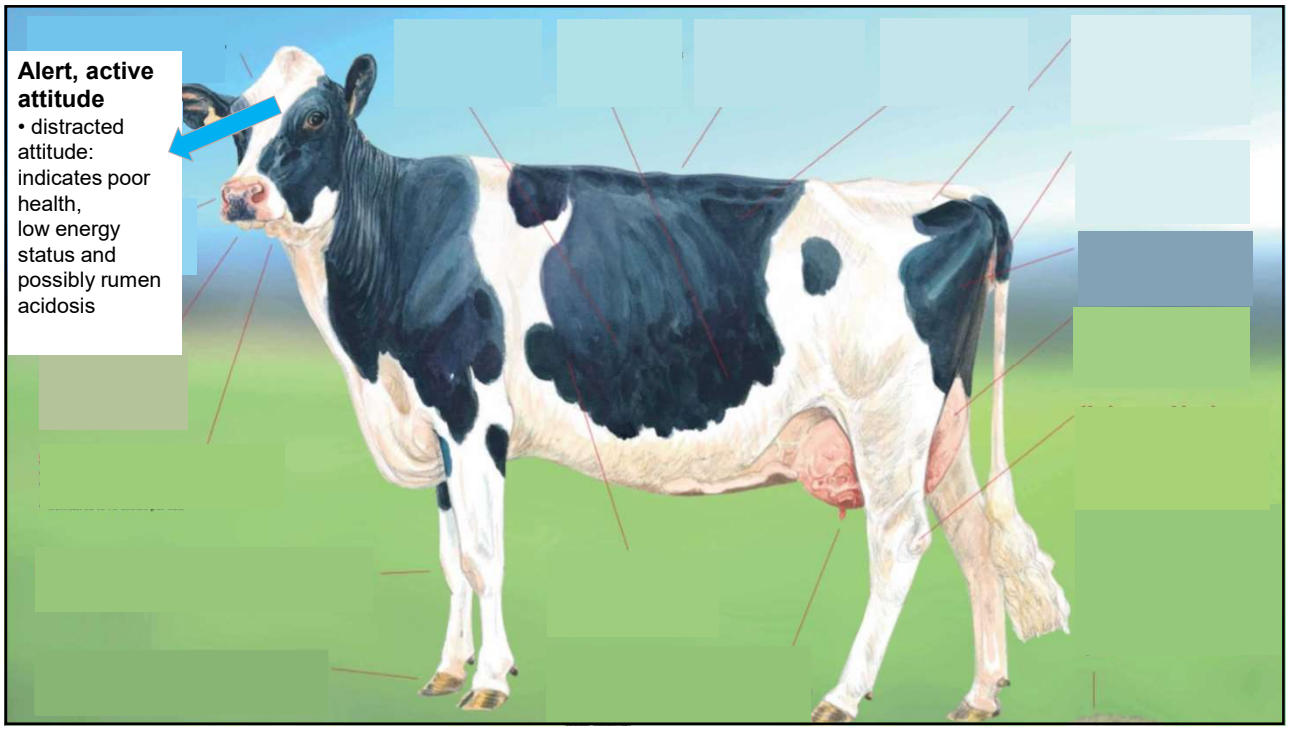


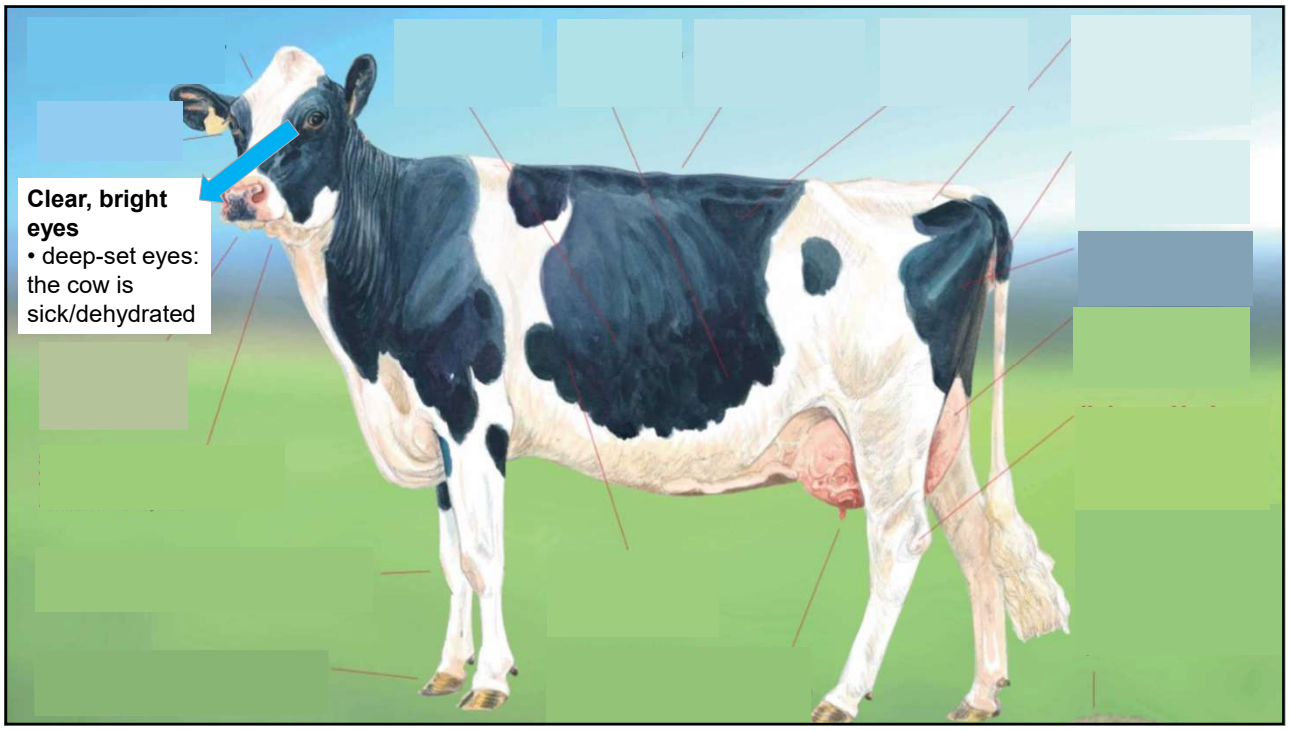
use cow signals to optimize your farm's profitability.

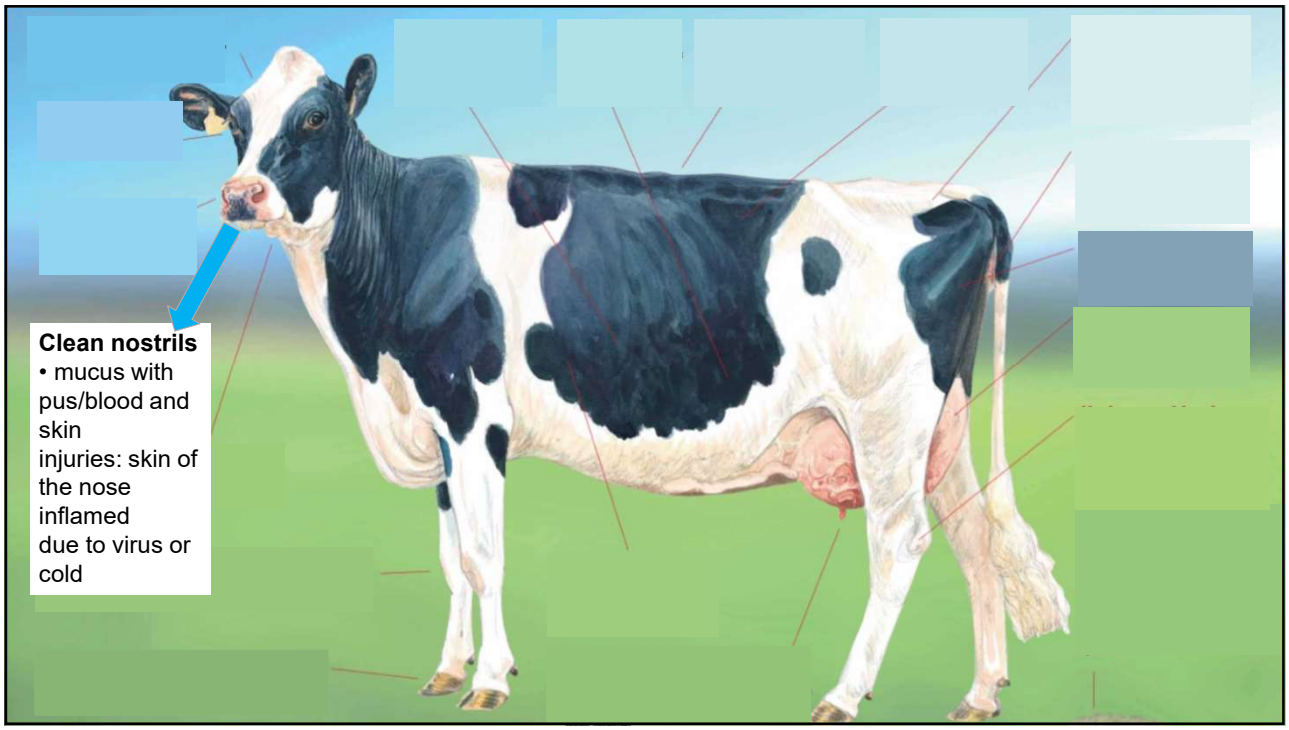
The challenge is to pick up as many **signs** as possible **before** real problems occur, to evaluate risks **before** they claim victims, and to notice symptoms **before** the disease fully shows itself.

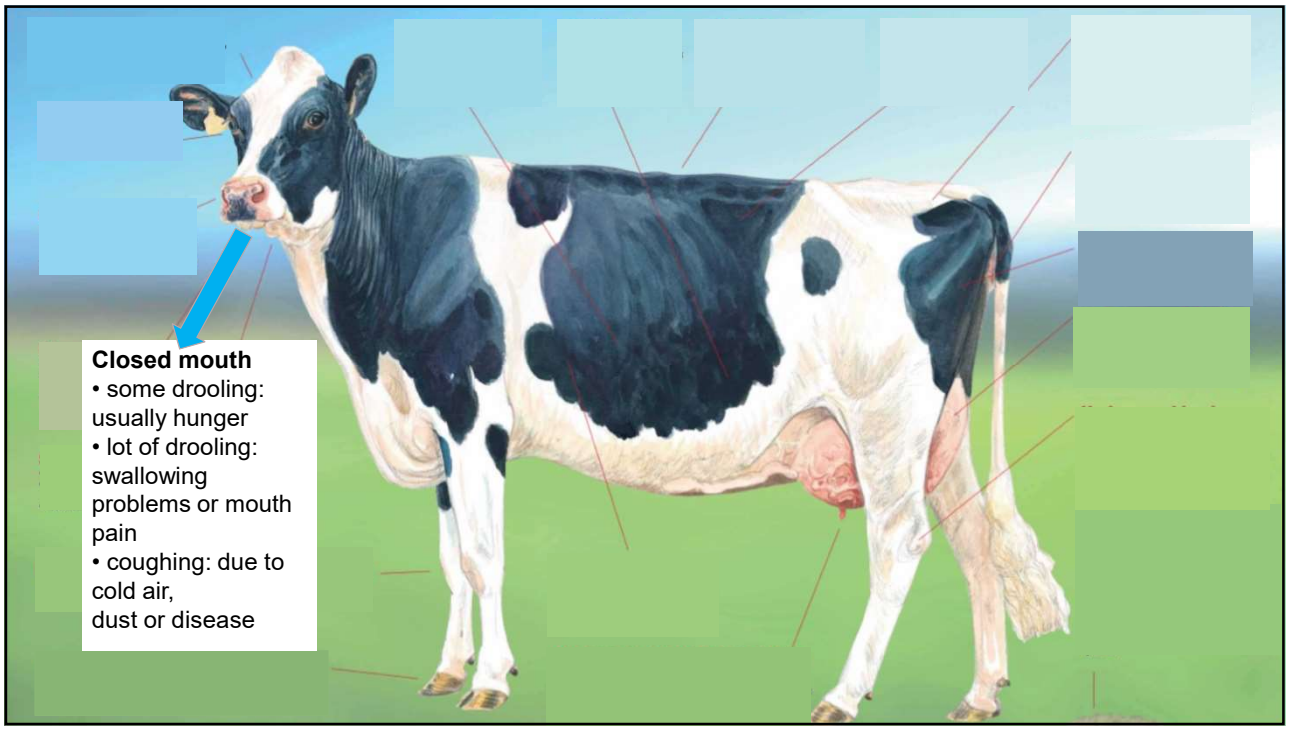
**Be aware of the danger of 'farm blindness'**

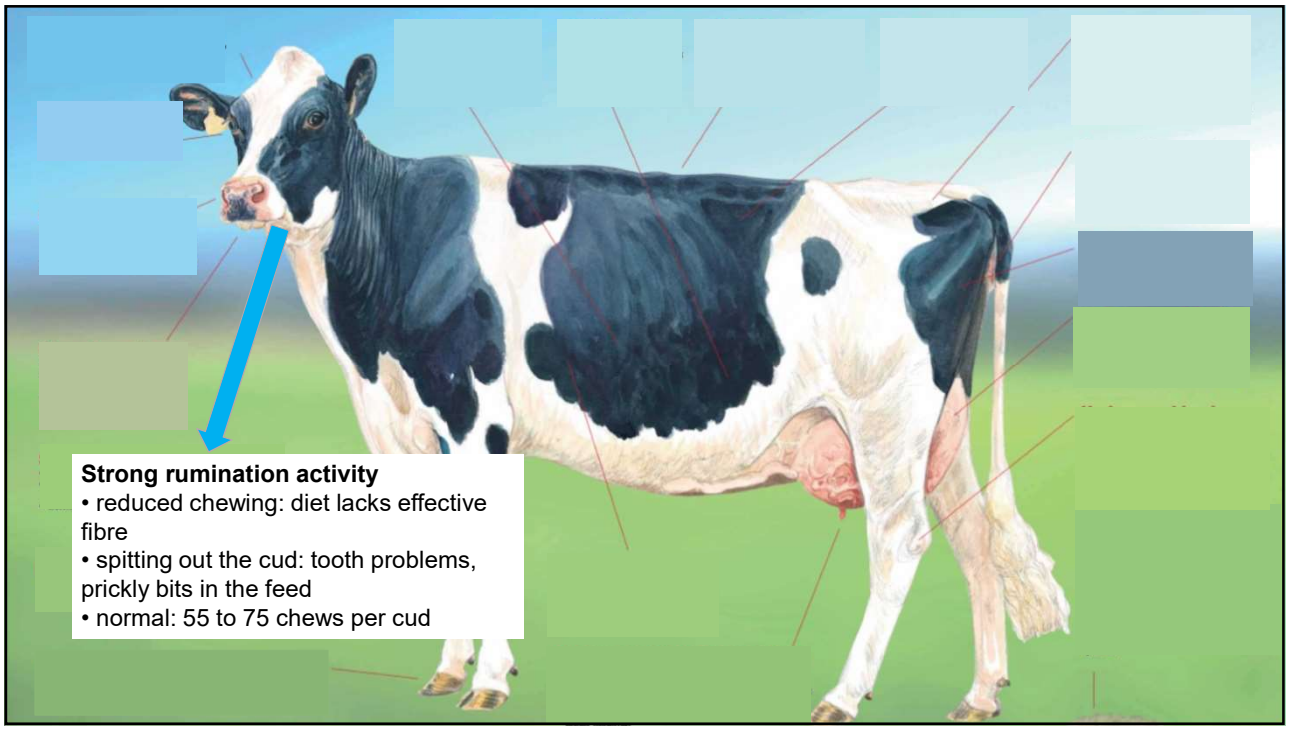
Don't look→ observe!

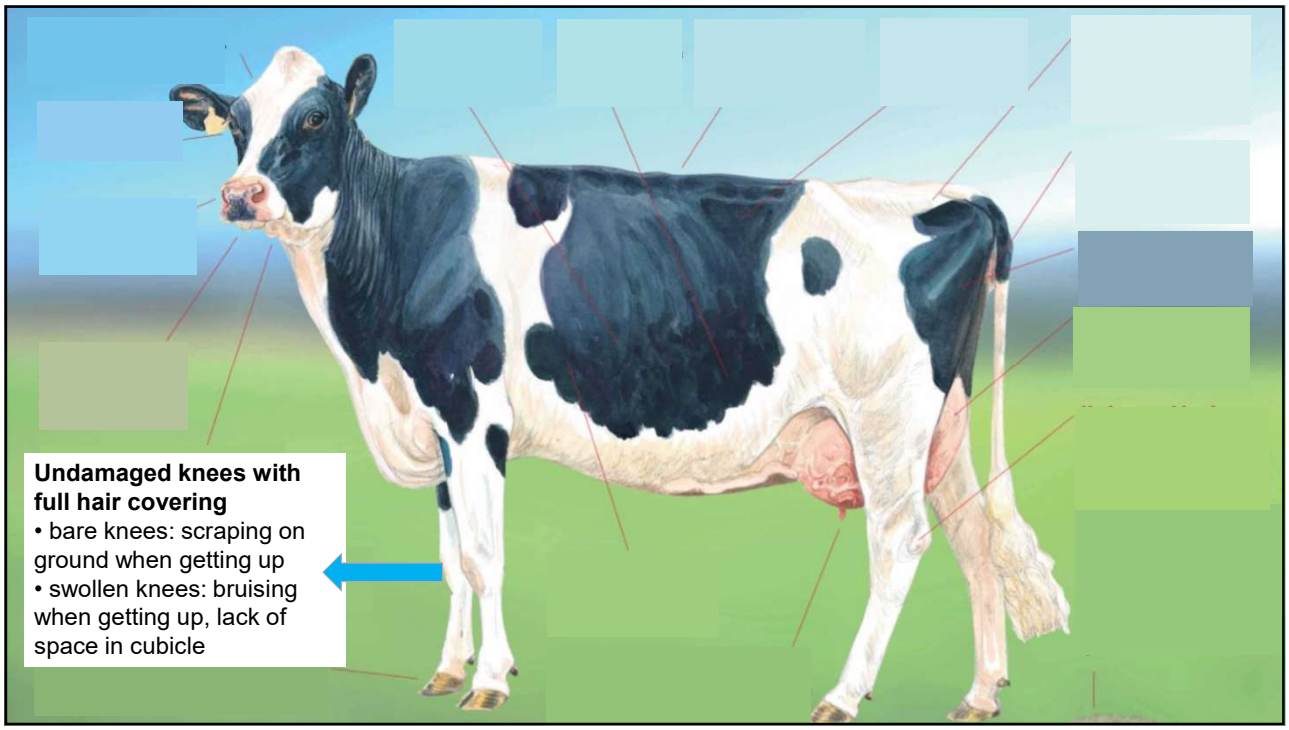


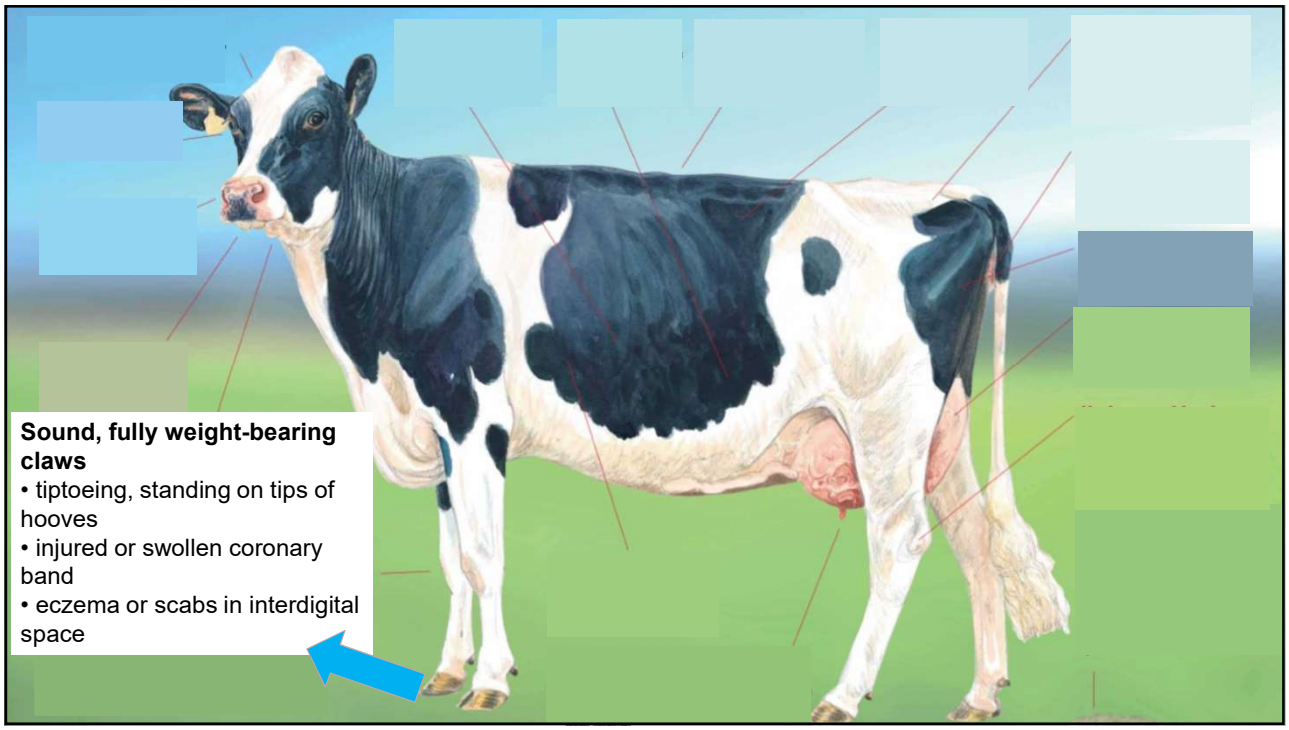

**Clear, bright eyes**
• deep-set eyes: the cow is sick/dehydrated

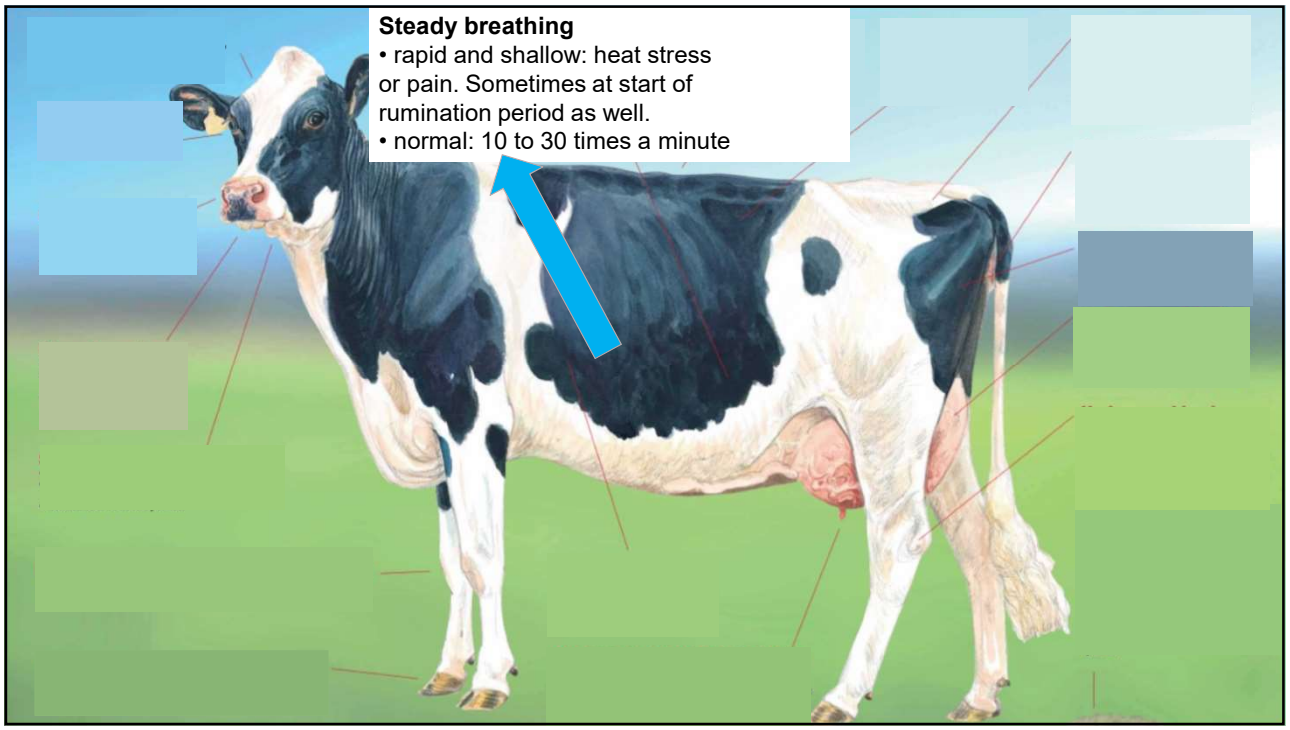

**Clean nostrils**
• mucus with pus/blood and skin injuries: skin of the nose inflamed due to virus or cold

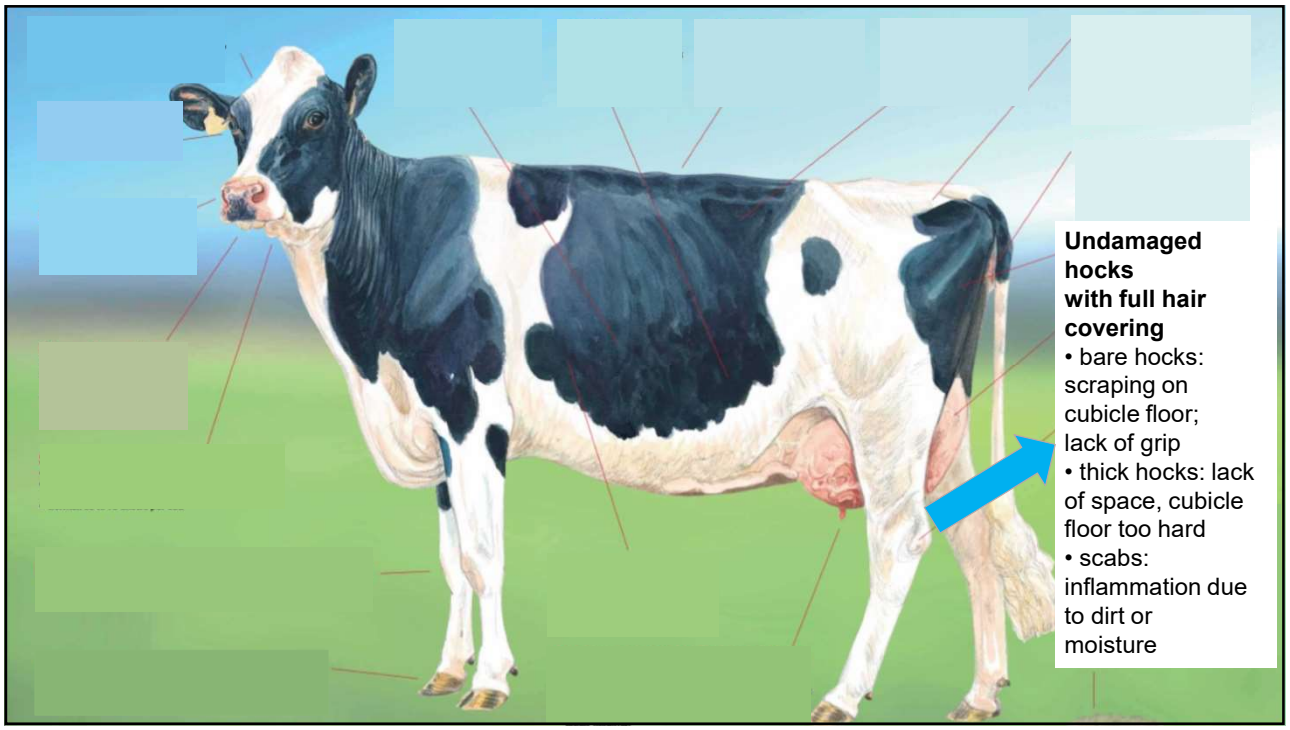

**Closed mouth**
• some drooling: usually hunger
• lot of drooling: swallowing problems or mouth pain
• coughing: due to cold air,
dust or disease

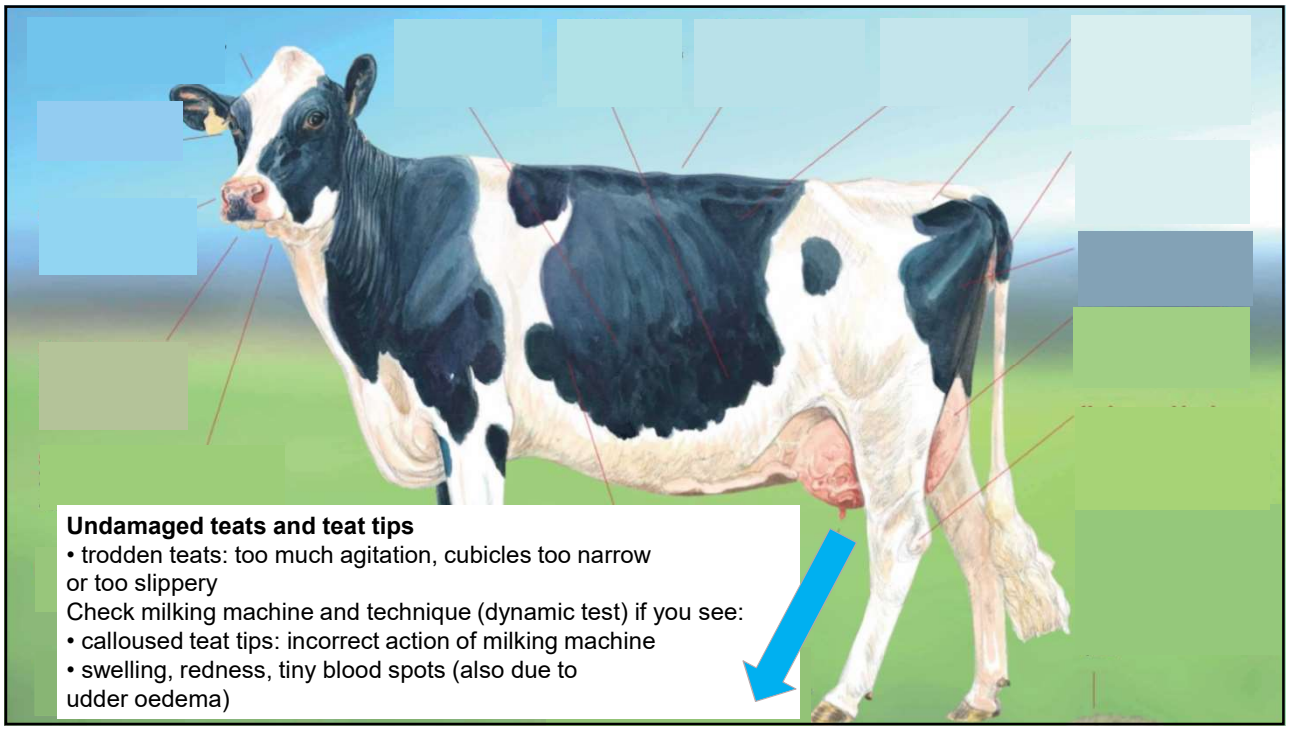

**Strong rumination activity**
• reduced chewing: diet lacks effective fibre
• spitting out the cud: tooth problems, prickly bits in the feed
• normal: 55 to 75 chews per cud

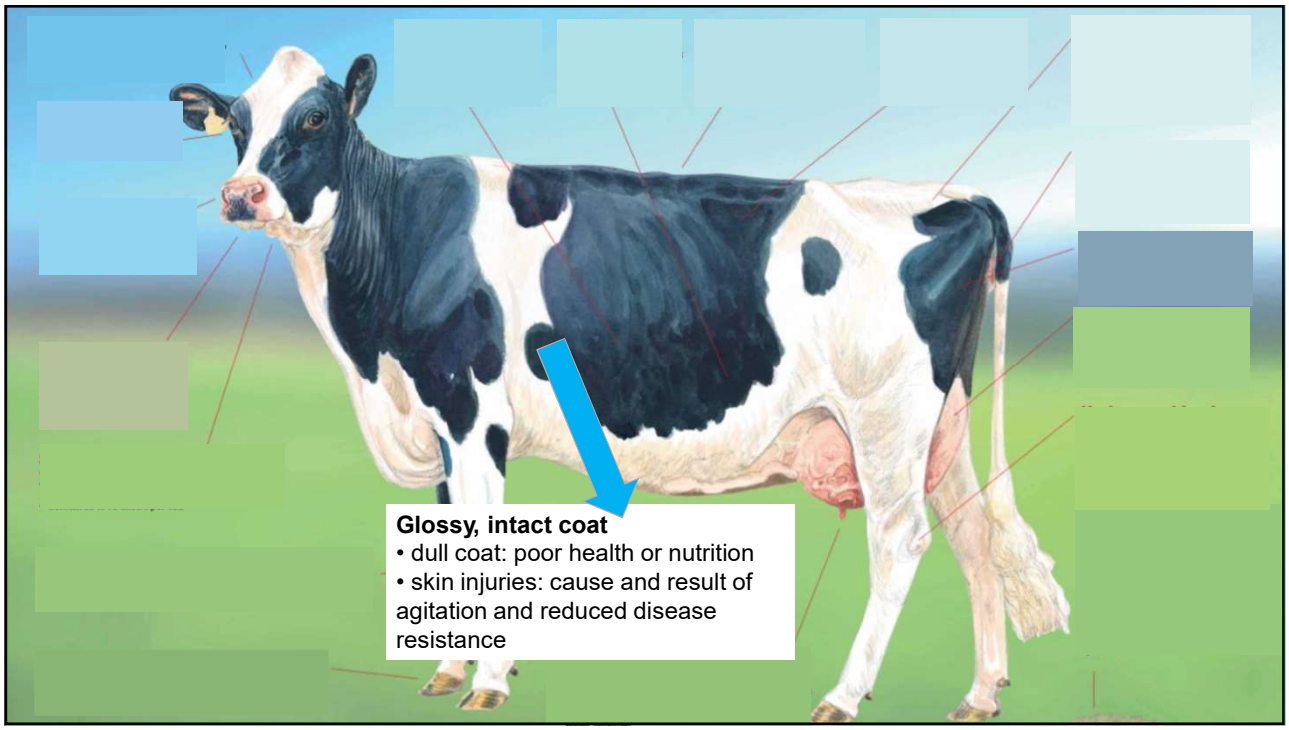

**Undamaged knees with full hair covering**
• bare knees: scraping on ground when getting up
• swollen knees: bruising when getting up, lack of space in cubicle

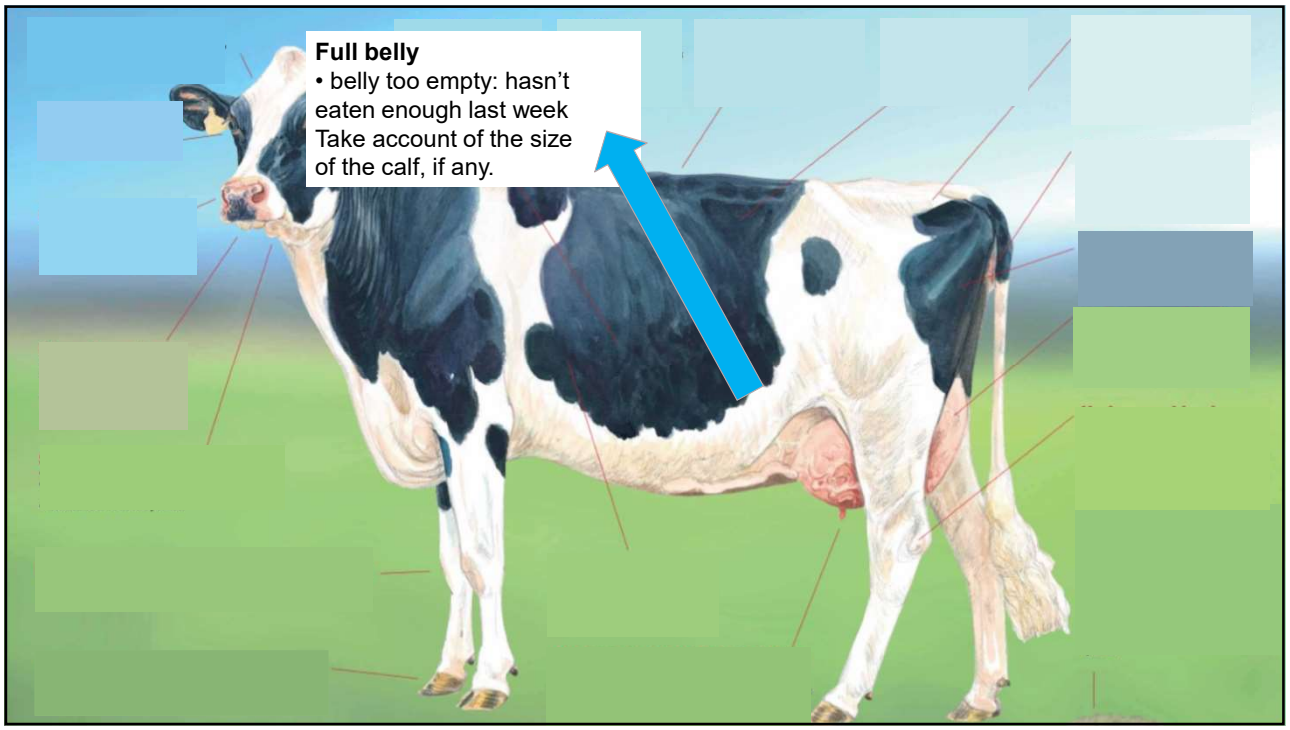

**Sound, fully weight-bearing claws**
• tiptoeing, standing on tips of hooves
• injured or swollen coronary band
• eczema or scabs in interdigital space

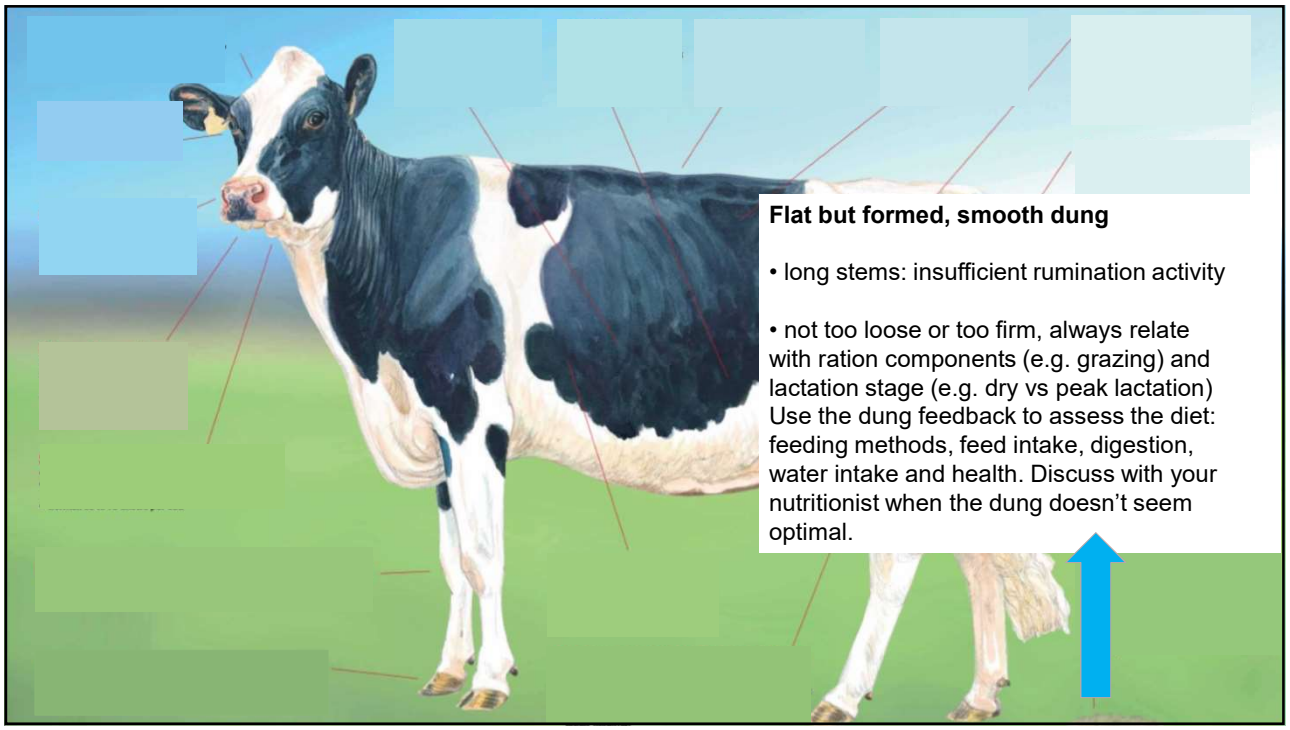

**Steady breathing**
• rapid and shallow: heat stress or pain. Sometimes at start of rumination period as well.
• normal: 10 to 30 times a minute

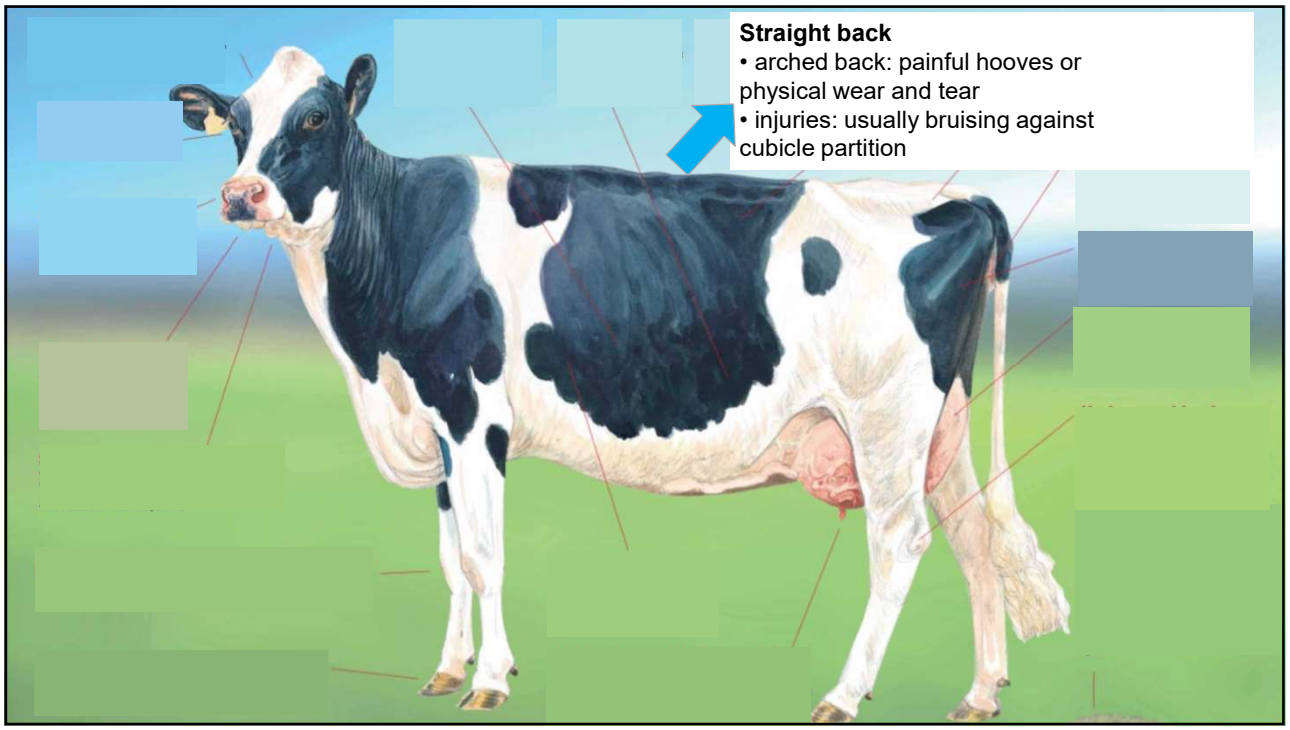

**Undamaged hocks with full hair covering**
• bare hocks: scraping on cubicle floor; lack of grip
• thick hocks: lack of space, cubicle floor too hard
• scabs: inflammation due to dirt or moisture

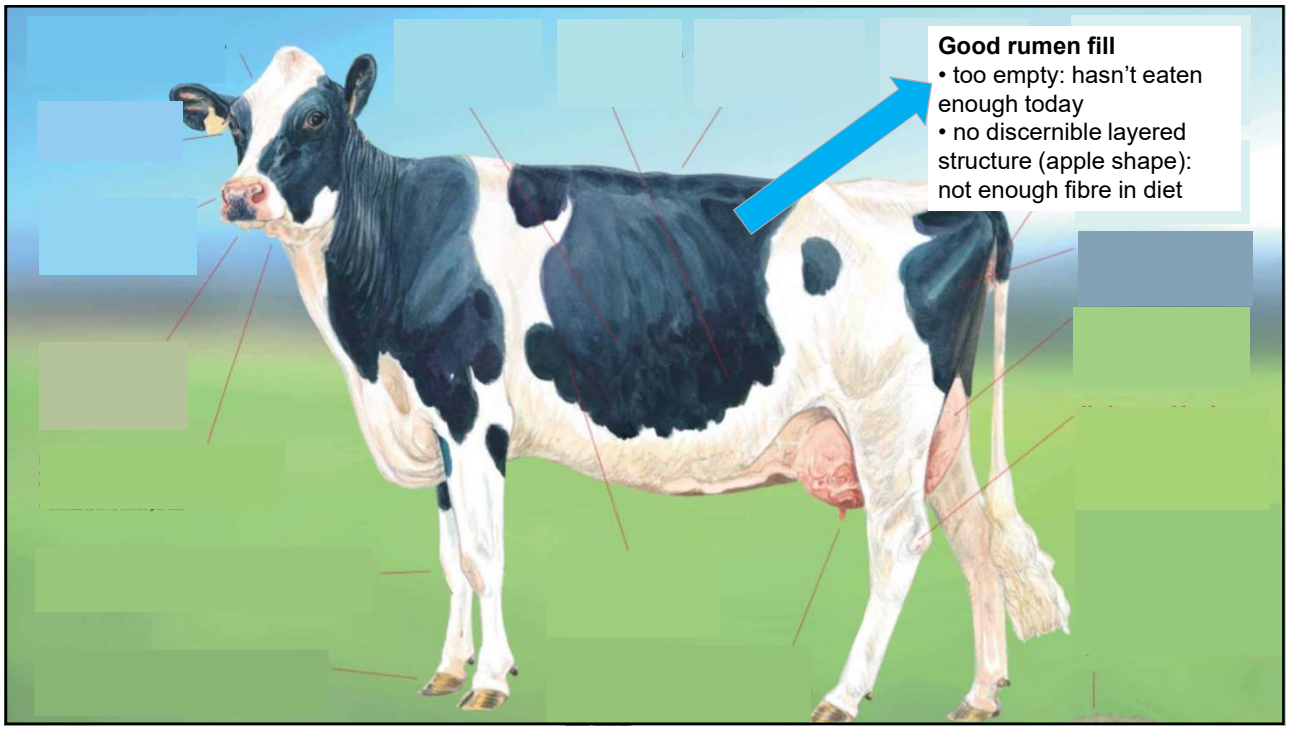

**Undamaged teats and teat tips**
• trodden teats: too much agitation, cubicles too narrow or too slippery
Check milking machine and technique (dynamic test) if you see:
• calloused teat tips: incorrect action of milking machine
• swelling, redness, tiny blood spots (also due to udder oedema)

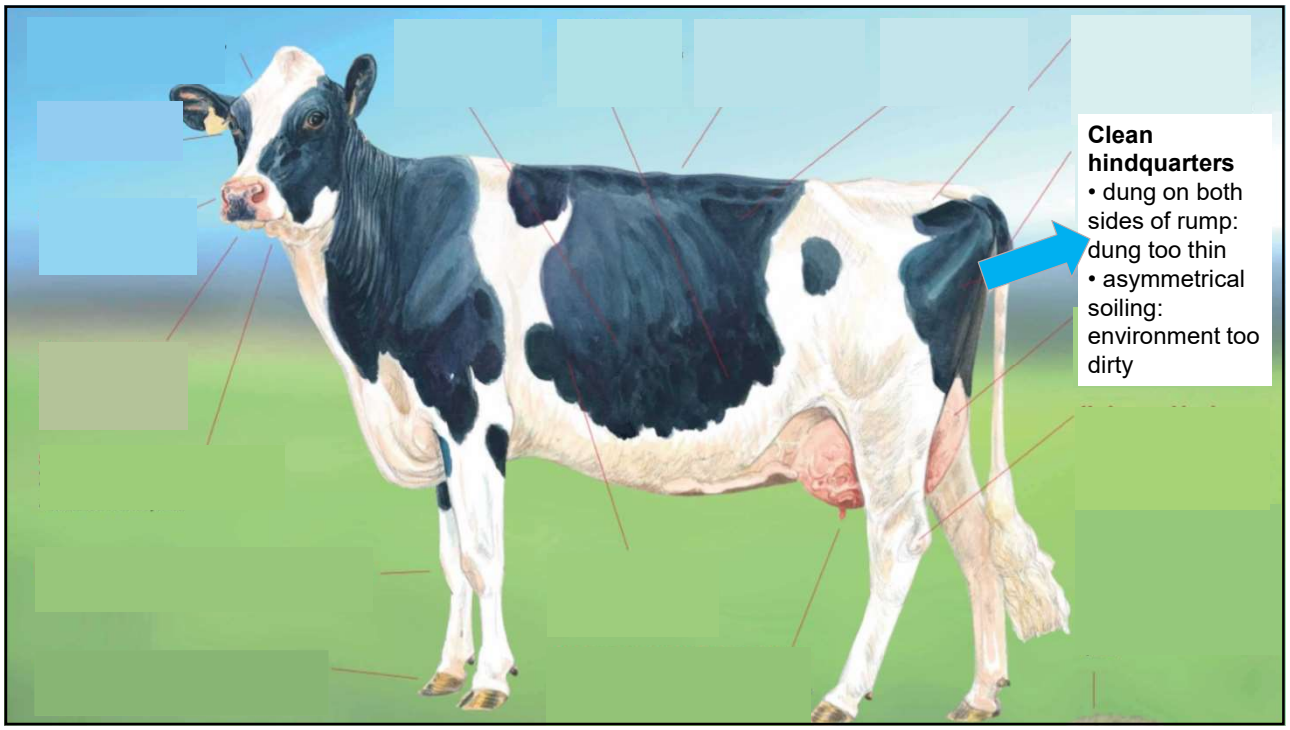

**Glossy, intact coat**
• dull coat: poor health or nutrition
• skin injuries: cause and result of agitation and reduced disease resistance

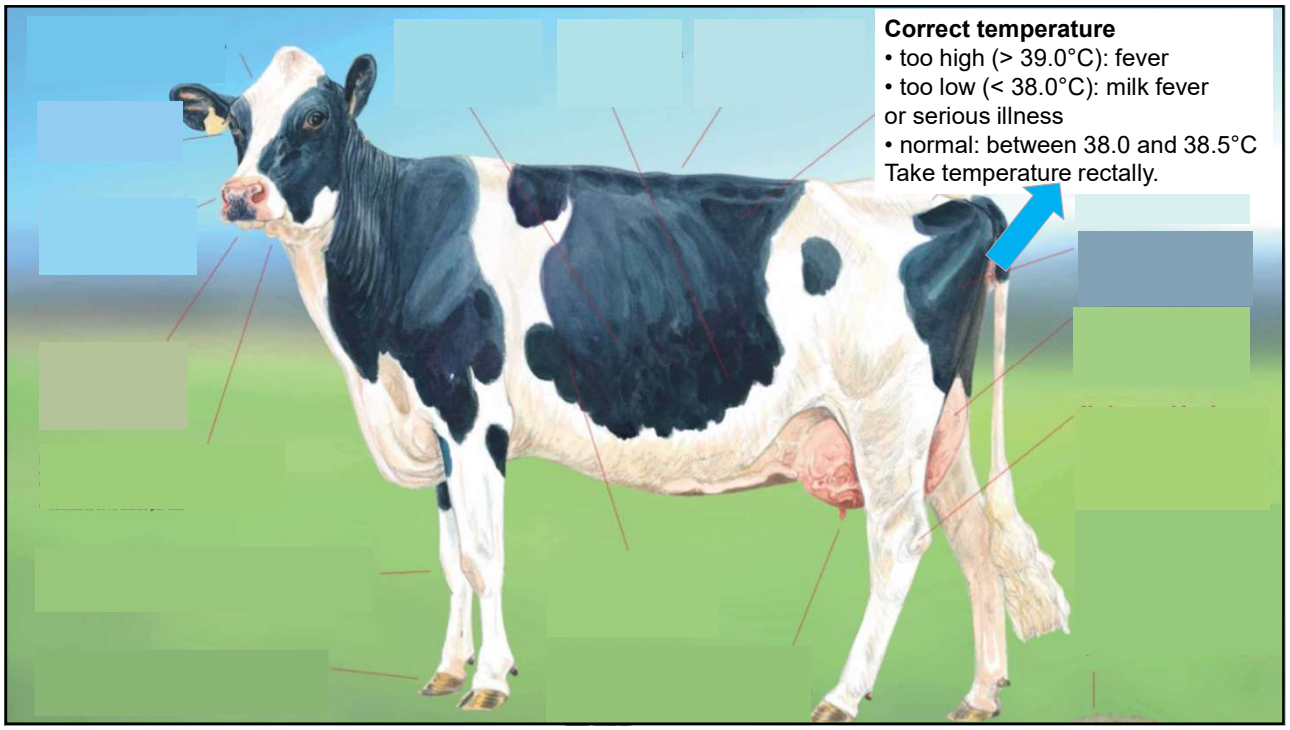

**Full belly**
• belly too empty: hasn't eaten enough last week
Take account of the size of the calf, if any.

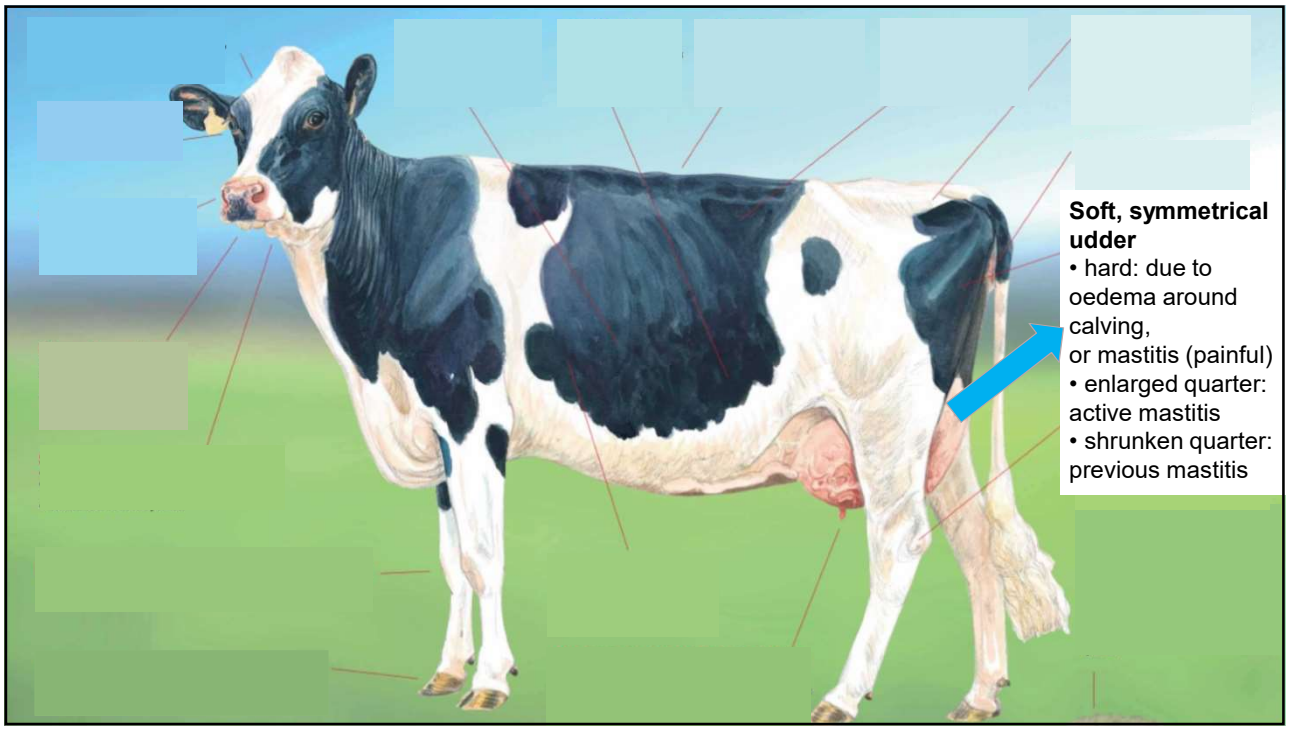

**Flat but formed, smooth dung**
• long stems: insufficient rumination activity
• not too loose or too firm, always relate with ration components (e.g. grazing) and lactation stage (e.g. dry vs peak lactation)
Use the dung feedback to assess the diet: feeding methods, feed intake, digestion, water intake and health. Discuss with your nutritionist when the dung doesn't seem optimal.


**Straight back**
• arched back: painful hooves or physical wear and tear
• injuries: usually bruising against cubicle partition

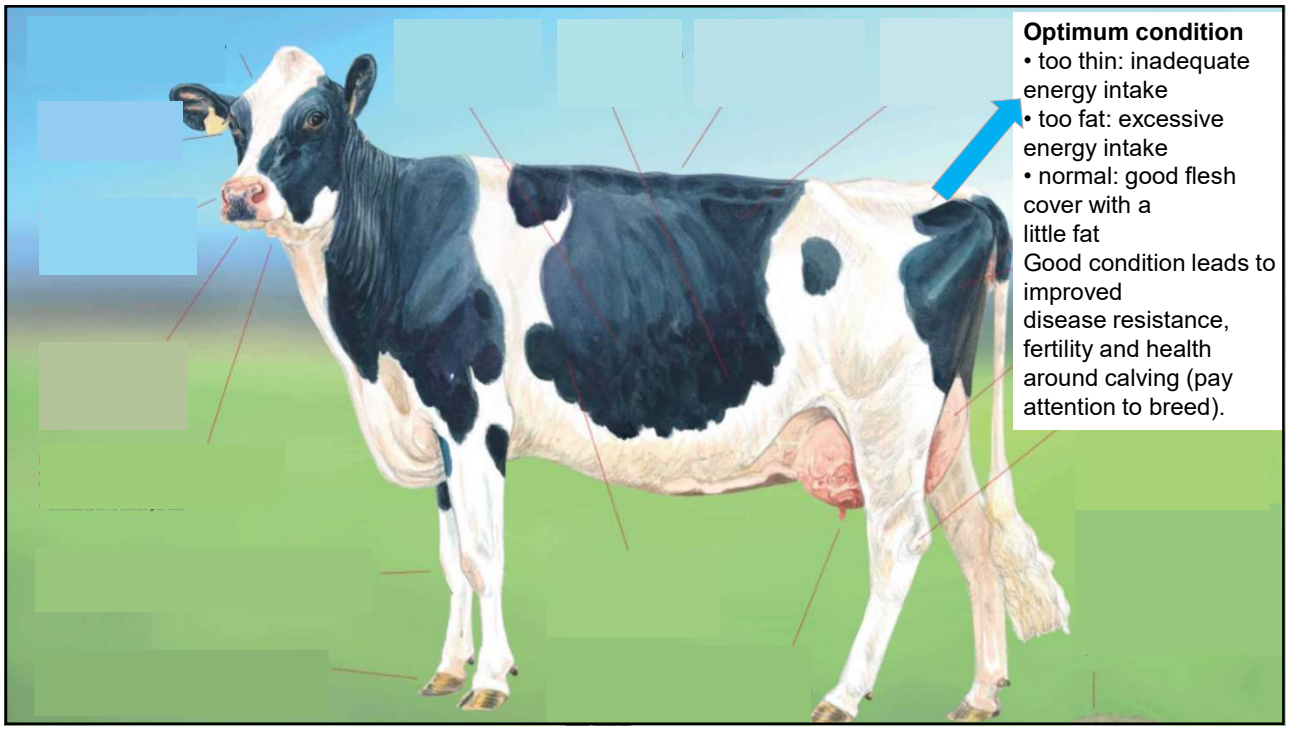

**Good rumen fill**
• too empty: hasn't eaten enough today
• no discernible layered structure (apple shape): not enough fibre in diet


**Clean hindquarters**
• dung on both sides of rump: dung too thin
• asymmetrical soiling: environment too dirty


**Correct temperature**
• too high (> 39.0°C): fever
• too low (< 38.0°C): milk fever or serious illness
• normal: between 38.0 and 38.5°C
Take temperature rectally.

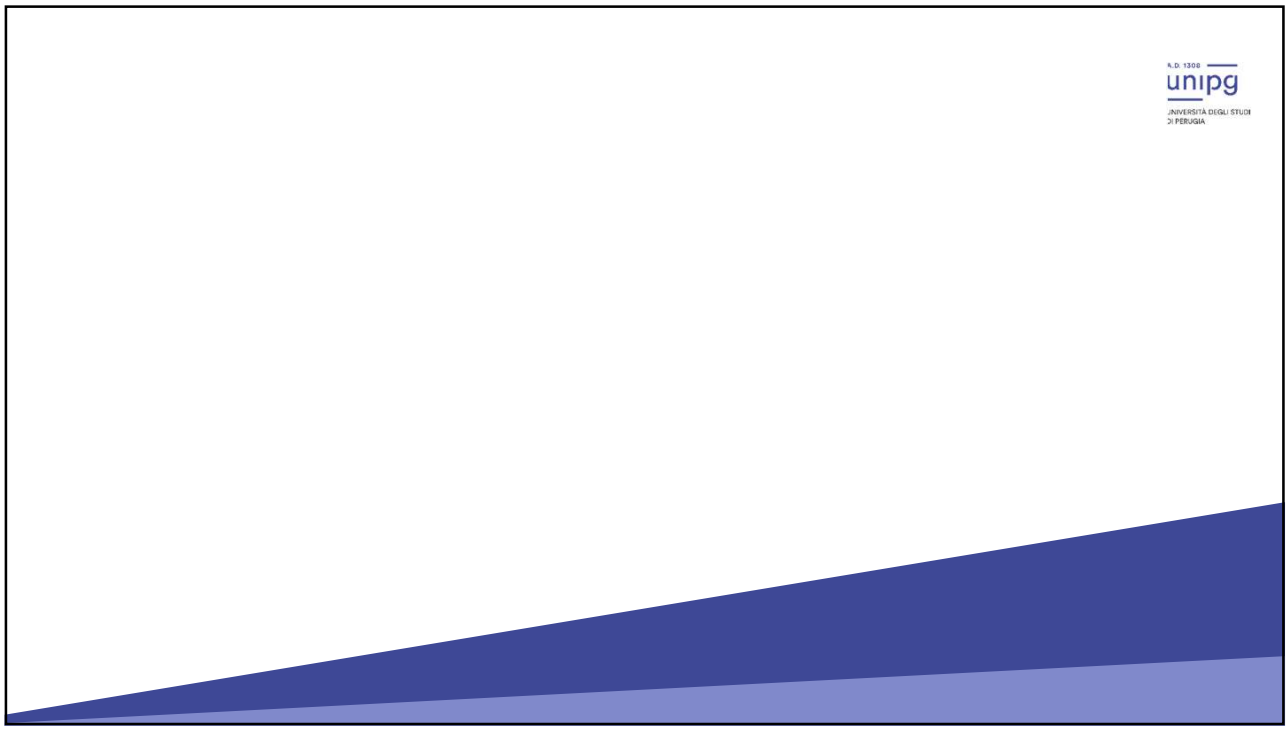


**Soft, symmetrical udder**
• hard: due to oedema around calving, or mastitis (painful)
• enlarged quarter: active mastitis
• shrunken quarter: previous mastitis



**Optimum condition**
• too thin: inadequate energy intake
• too fat: excessive energy intake
• normal: good flesh cover with a little fat

Good condition leads to improved disease resistance, fertility and health around calving (pay attention to breed).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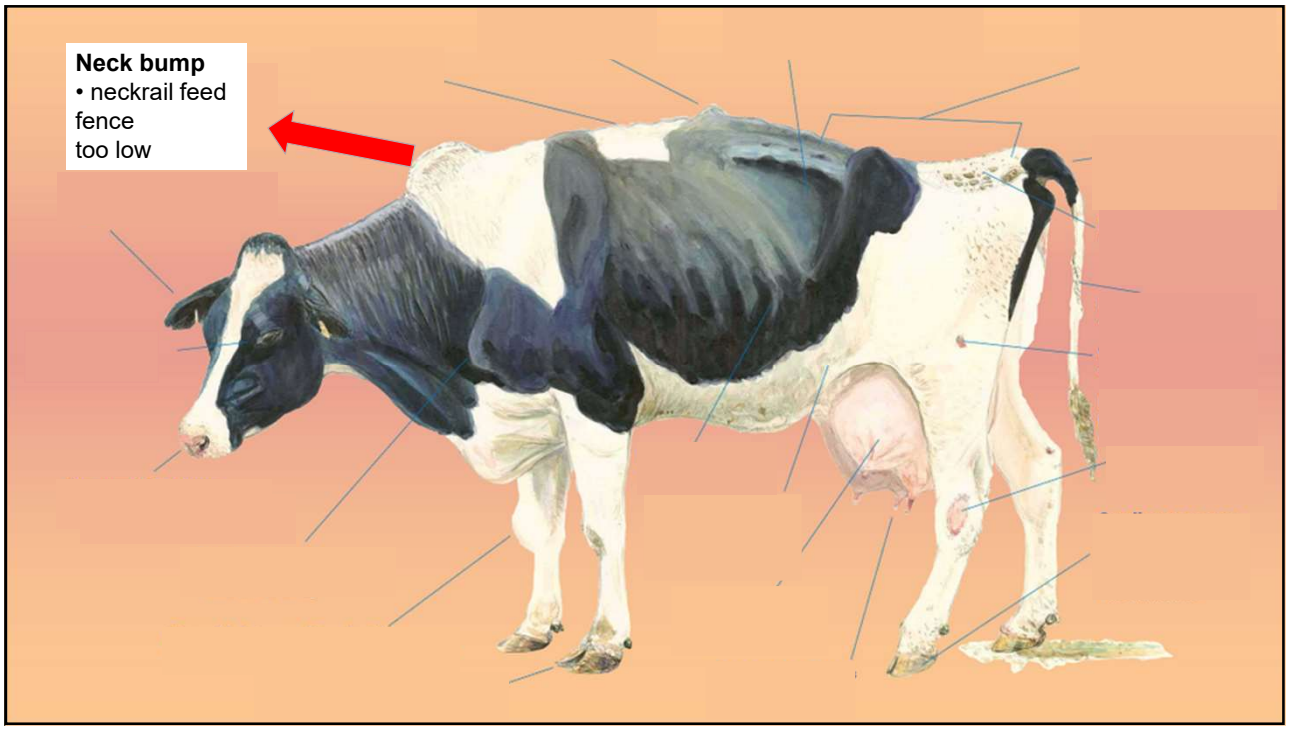
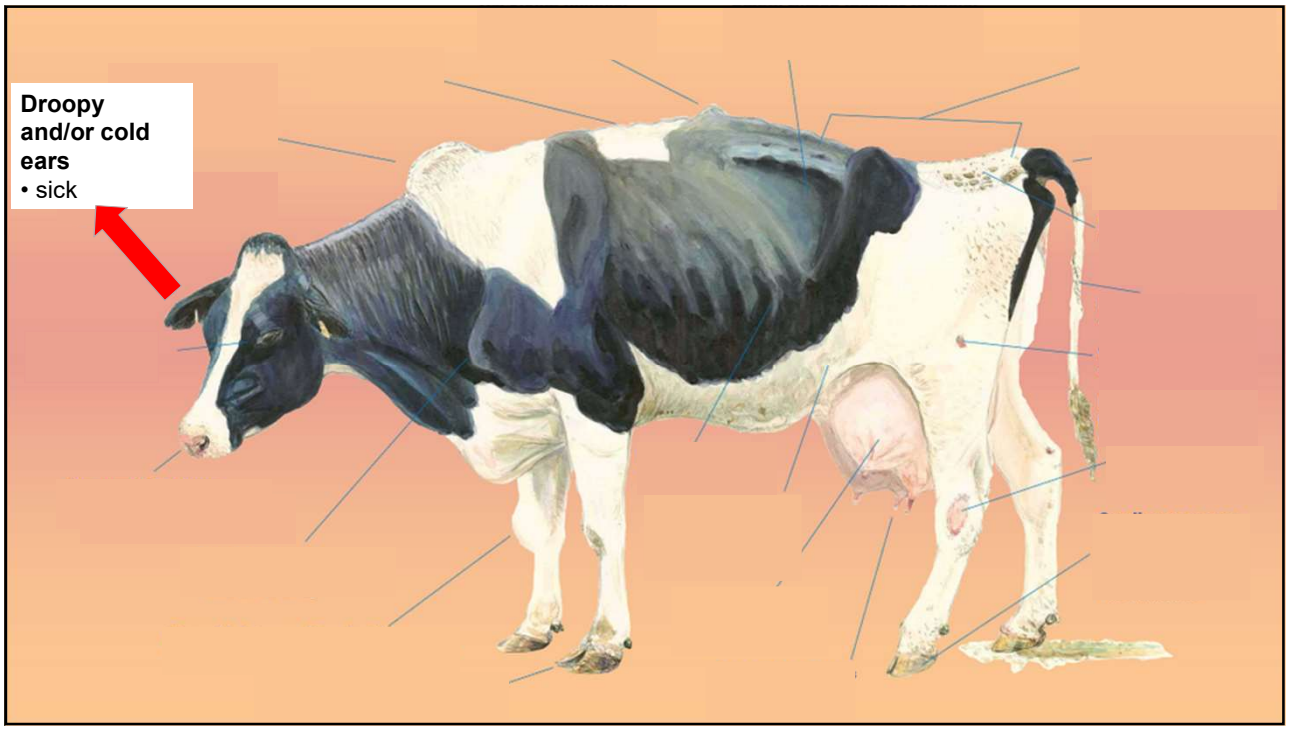
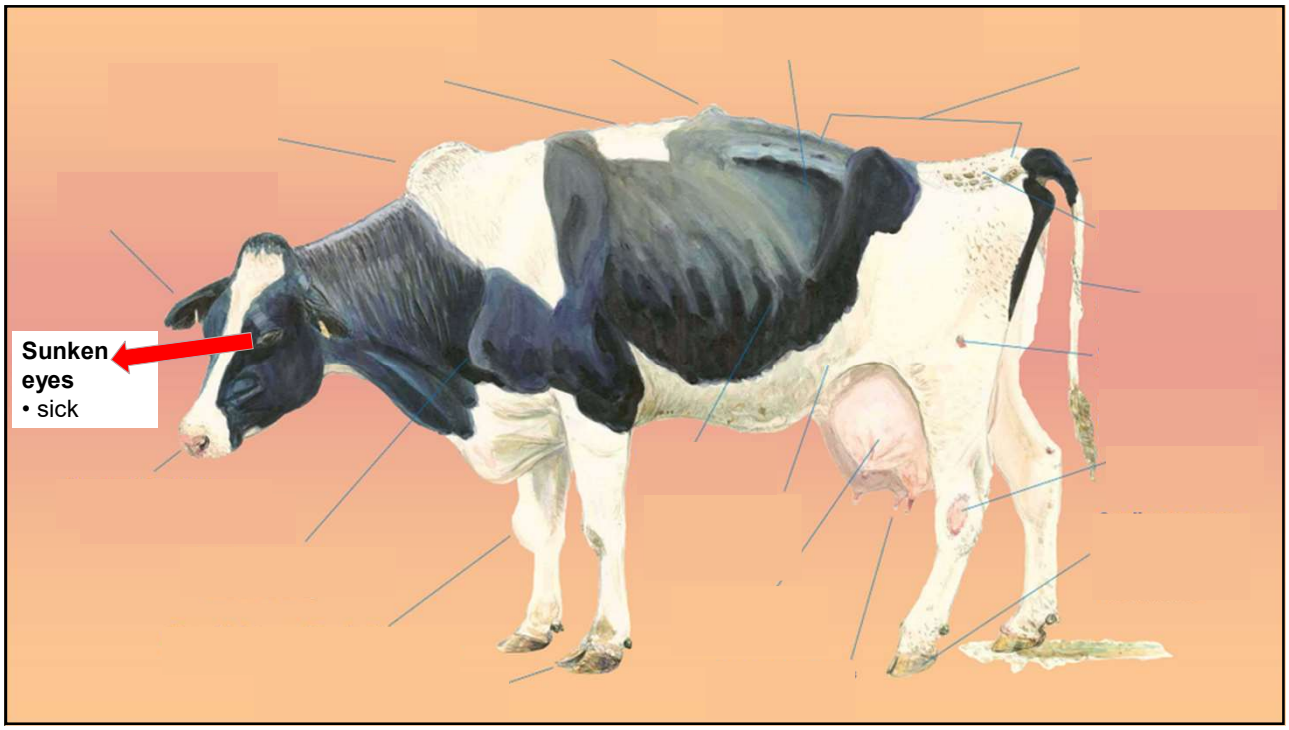
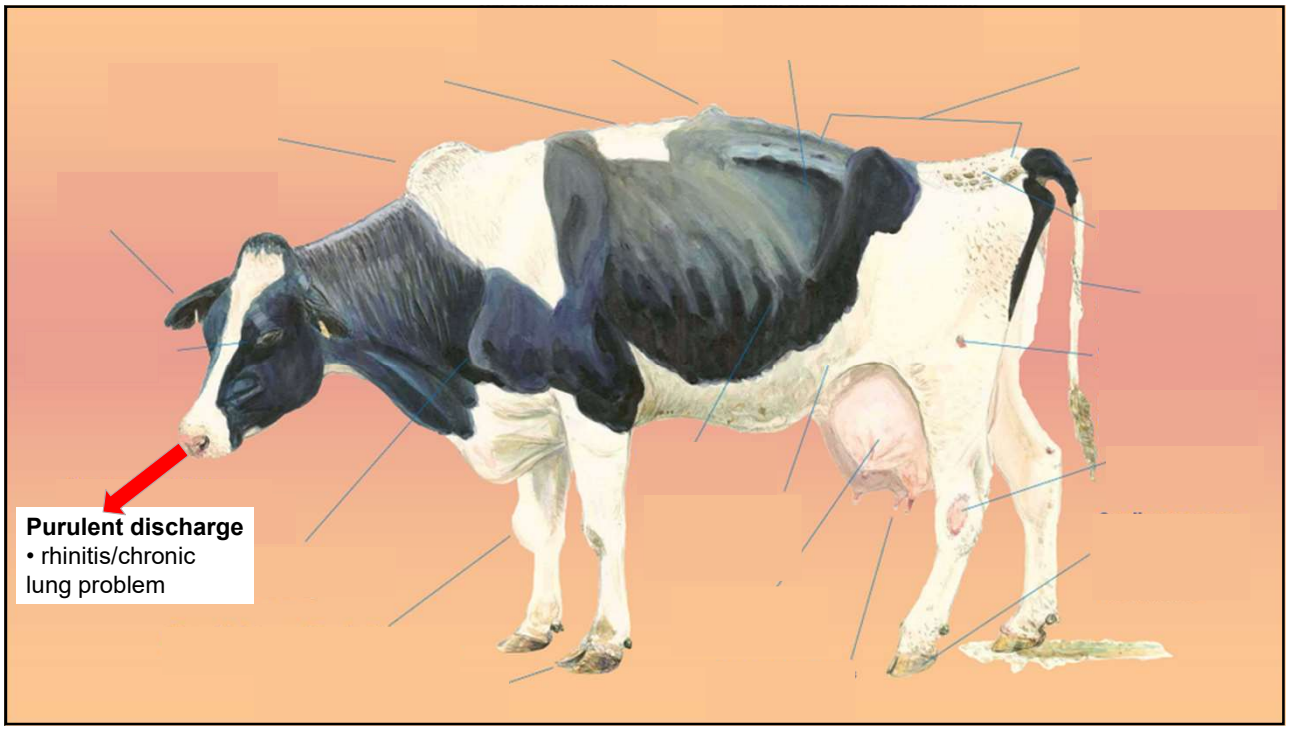
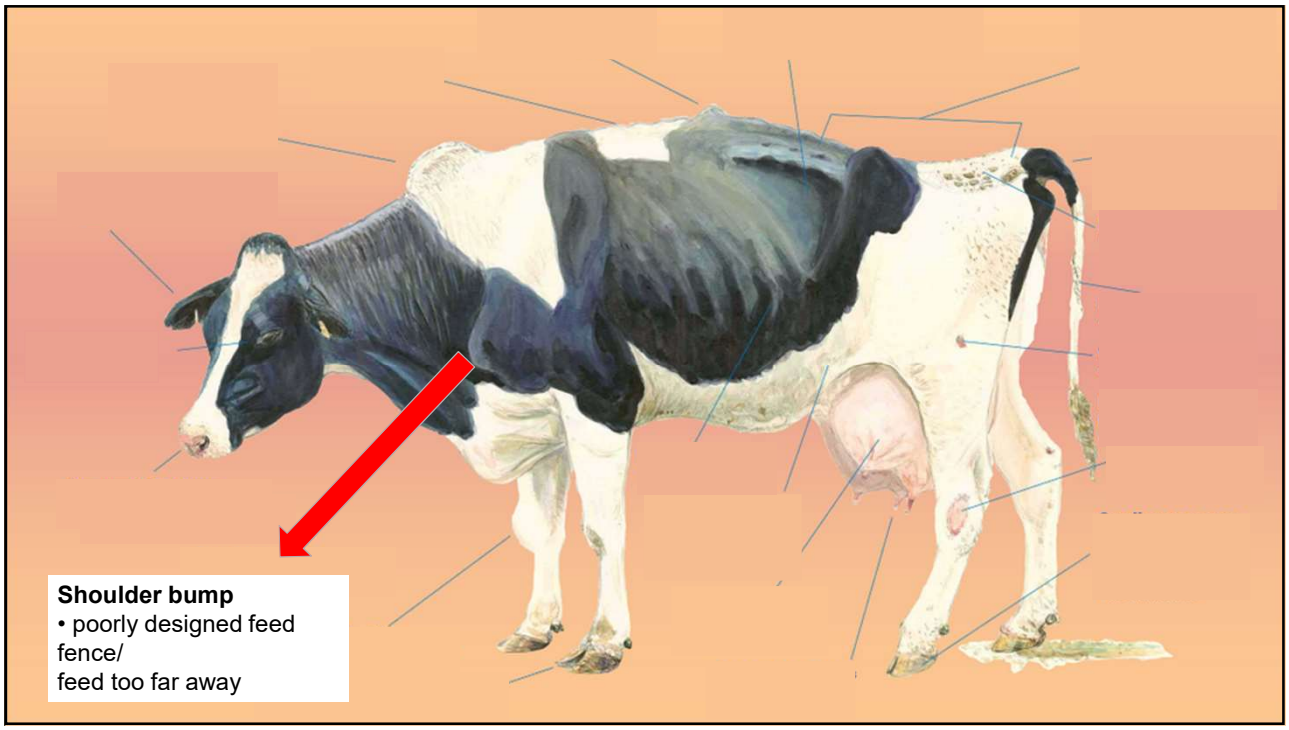
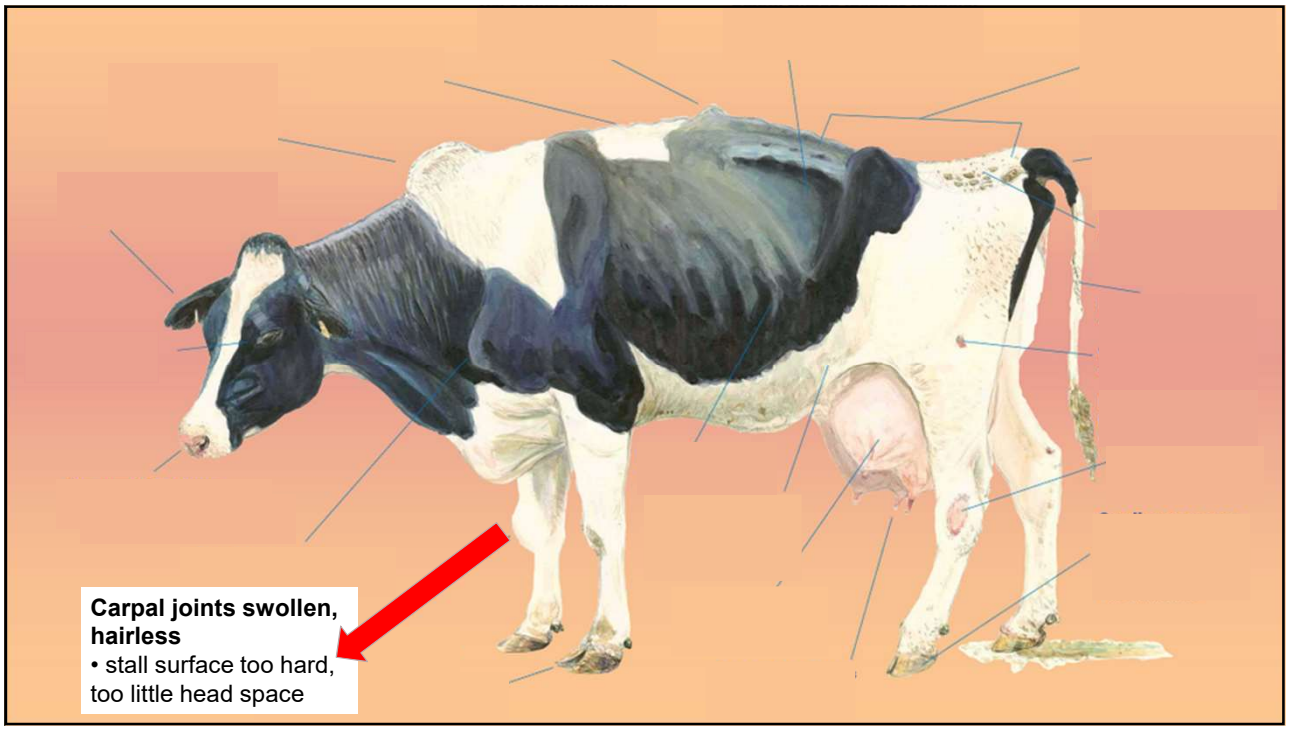

Neck bump
• neckrail feed fence too low

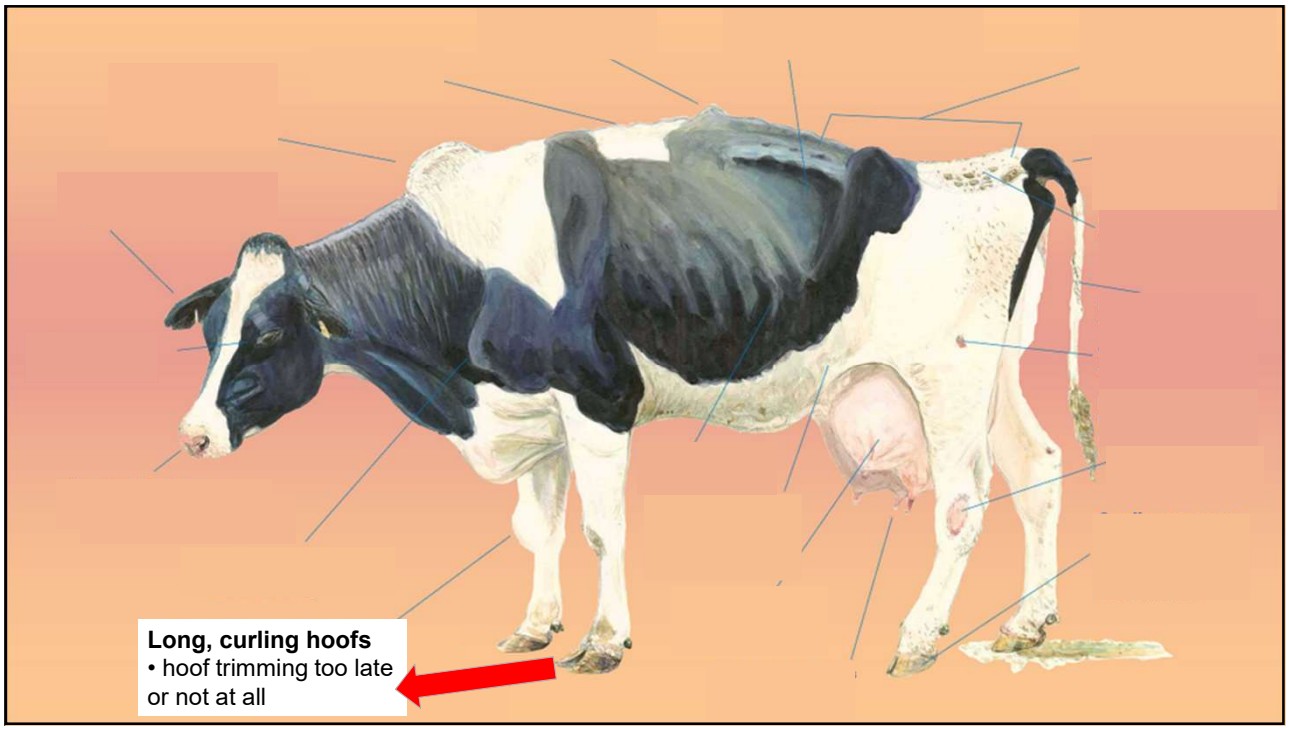

Droopy and/or cold ears
• sick

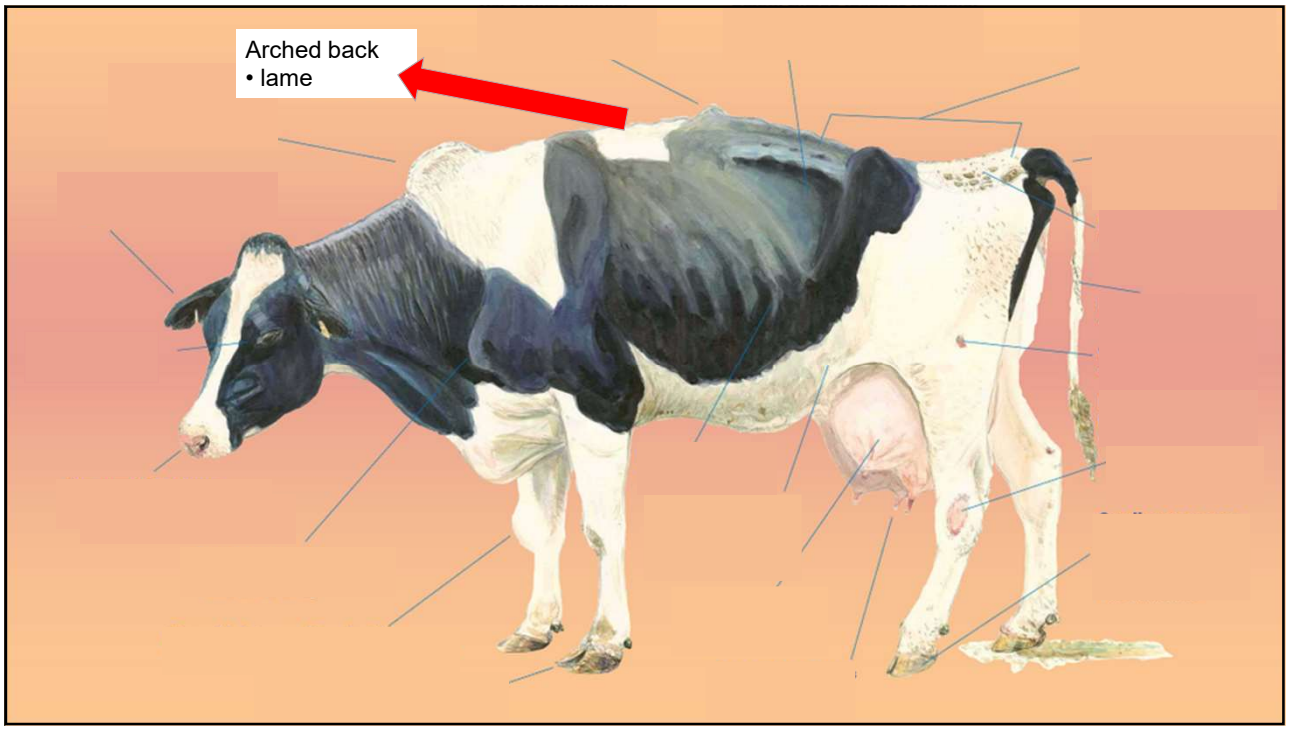

Sunken eyes
• sick

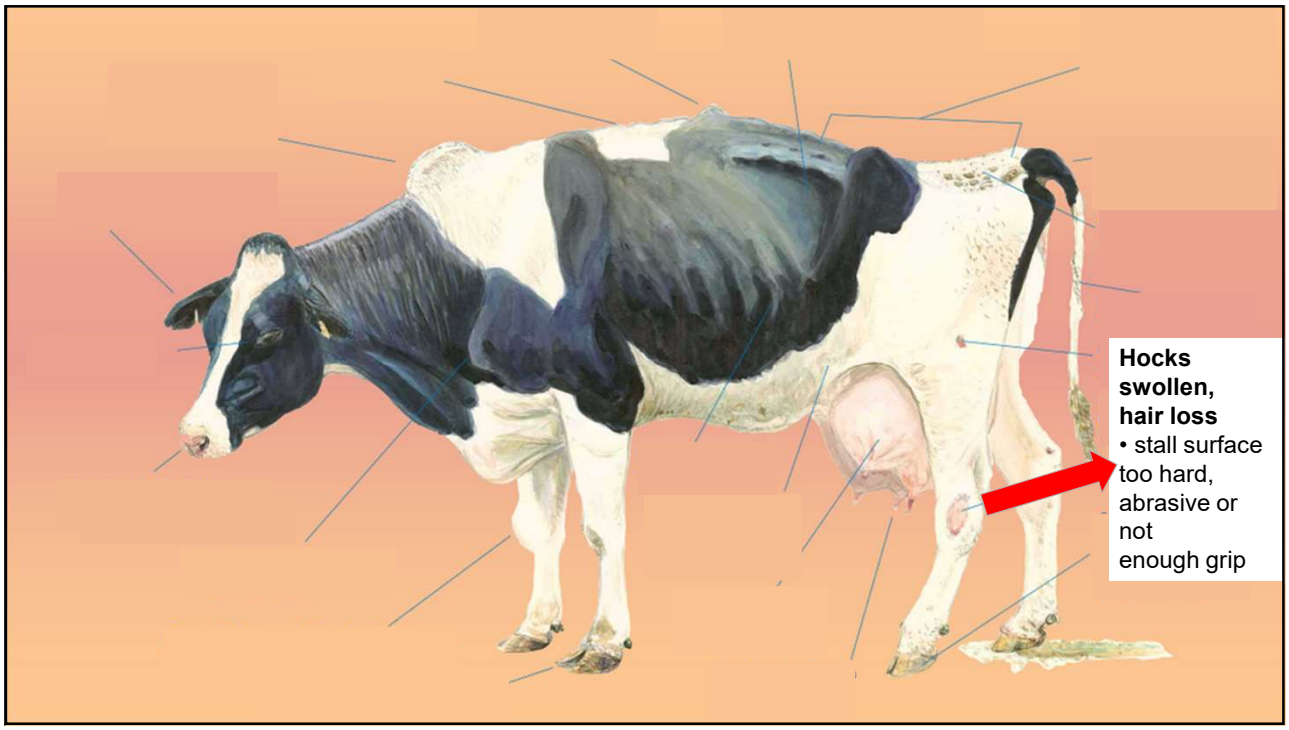

**Purulent discharge**
• rhinitis/chronic lung problem

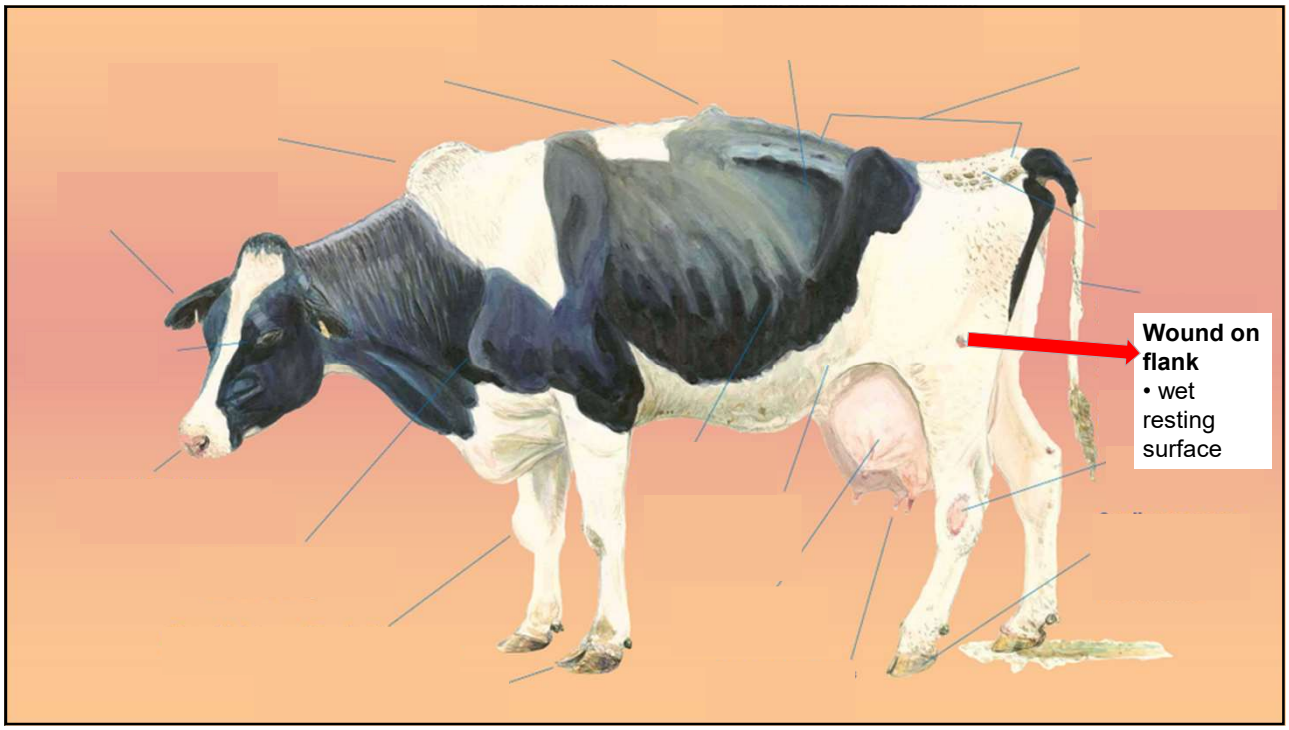

**Shoulder bump**
• poorly designed feed fence/
feed too far away

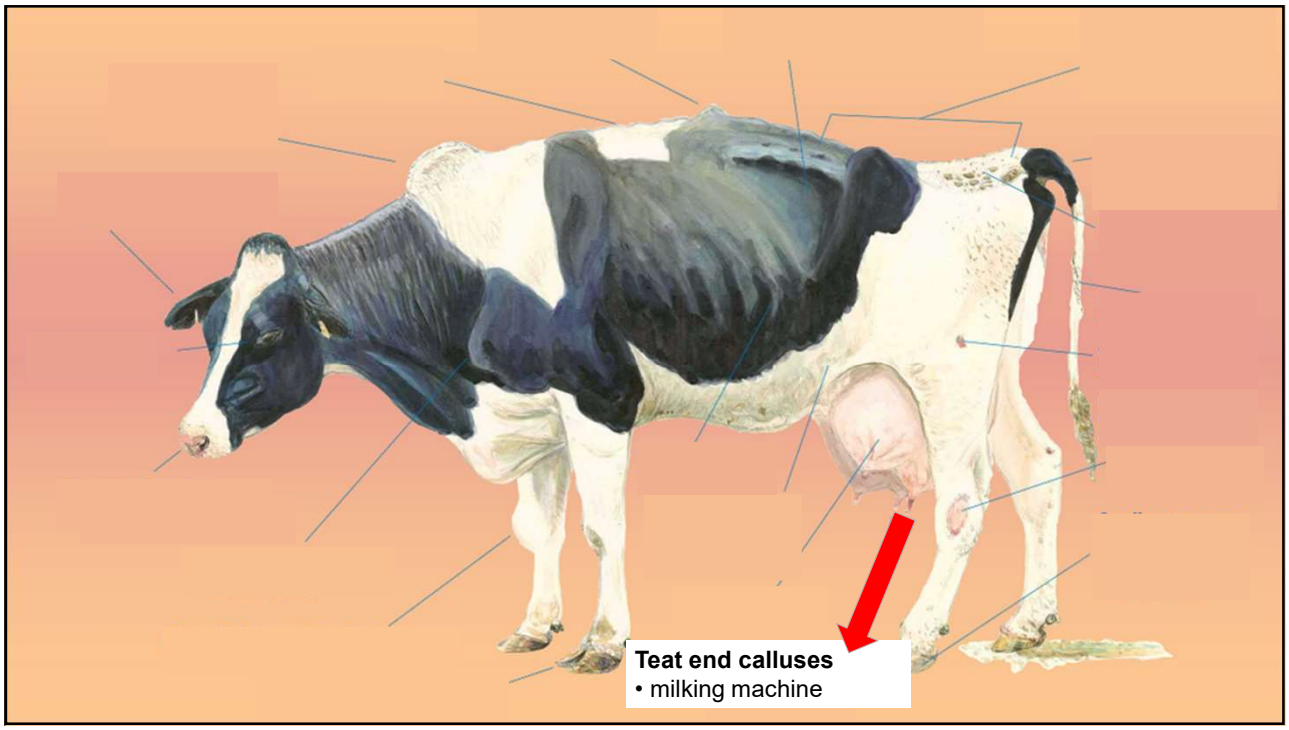

**Carpal joints swollen, hairless**
• stall surface too hard, too little head space

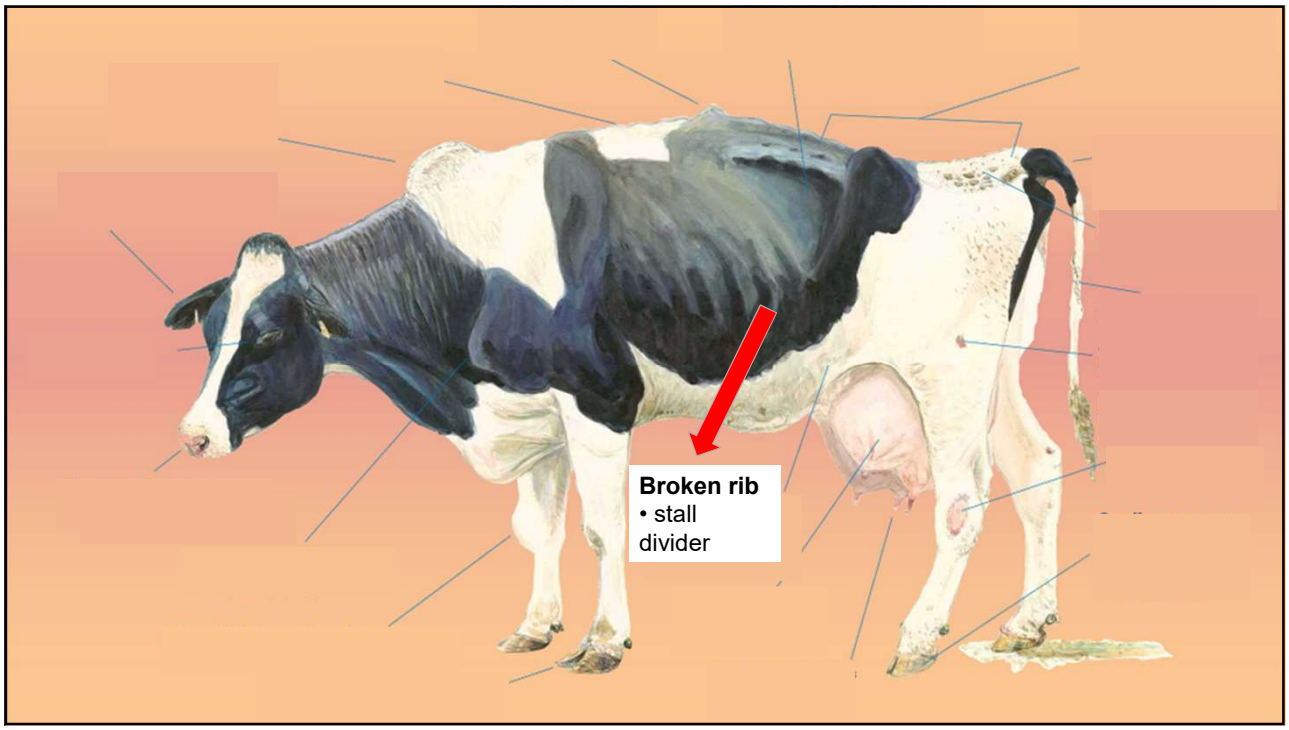

**Long, curling hoofs**
• hoof trimming too late or not at all

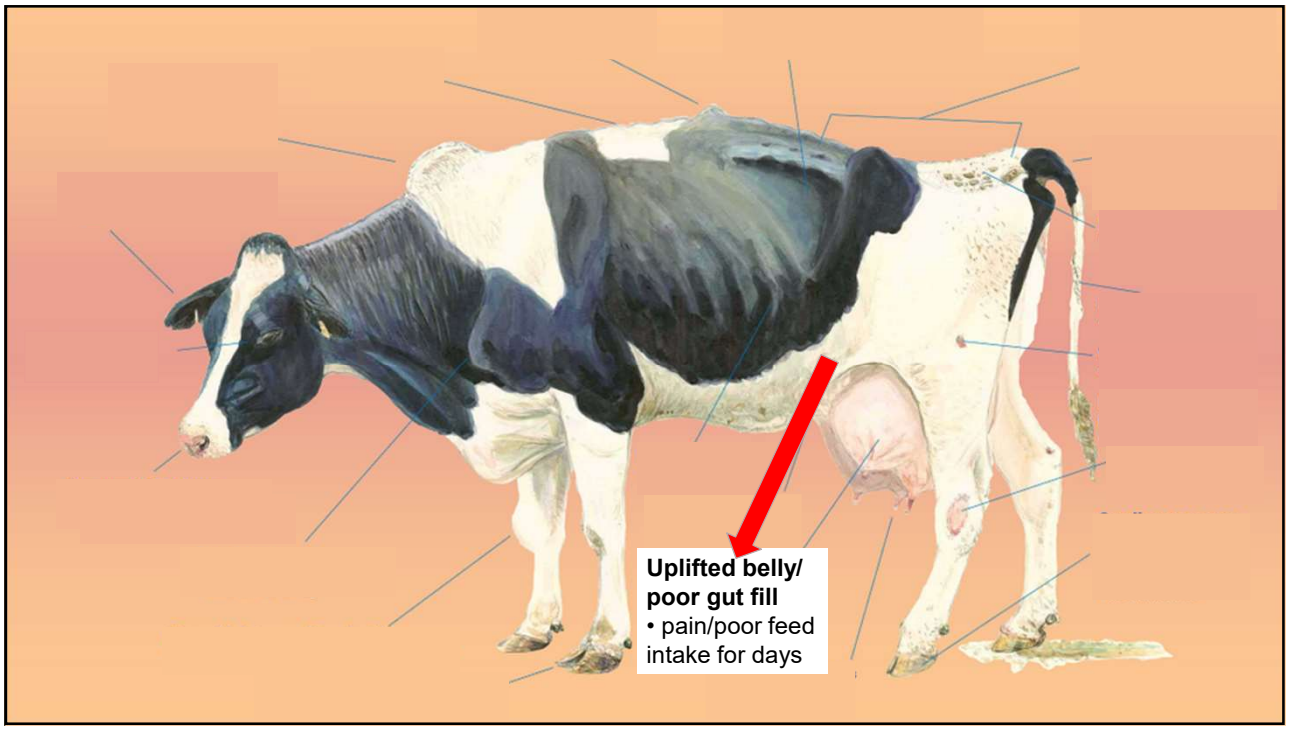

Arched back
• lame

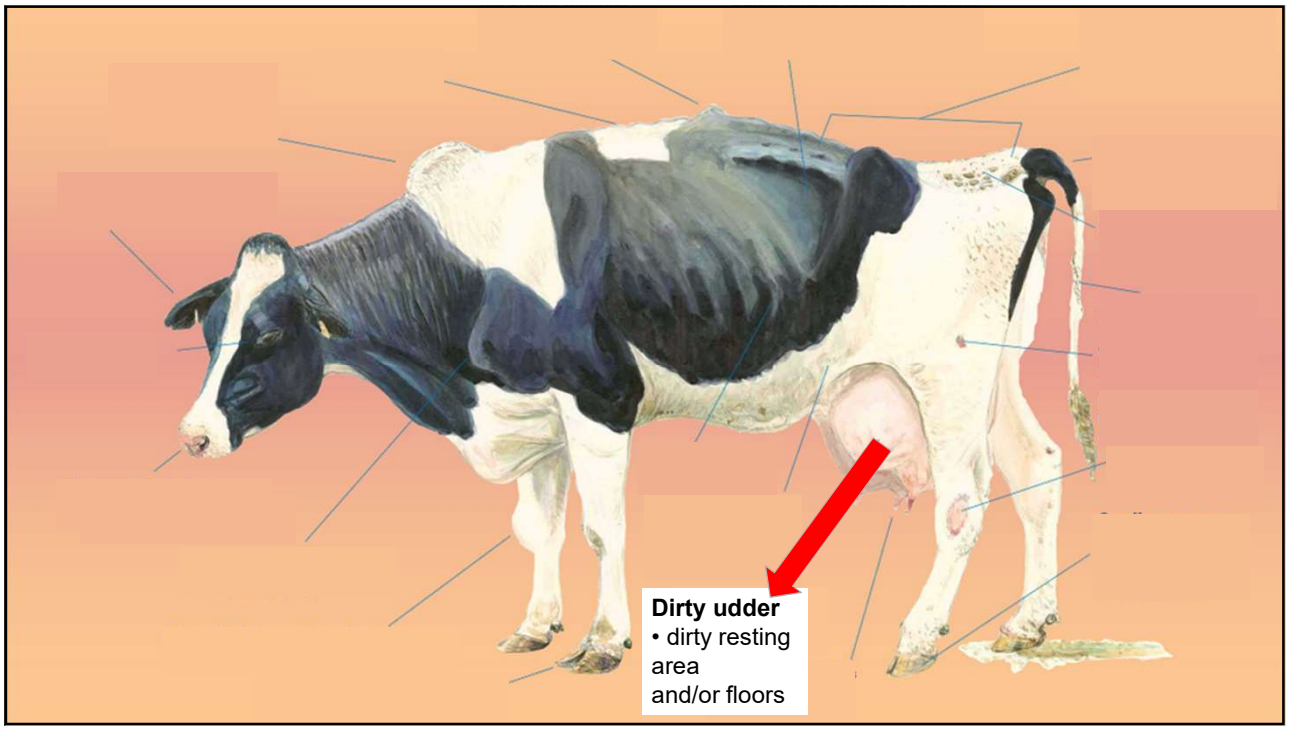

**Hocks swollen, hair loss**
• stall surface too hard, abrasive or not enough grip

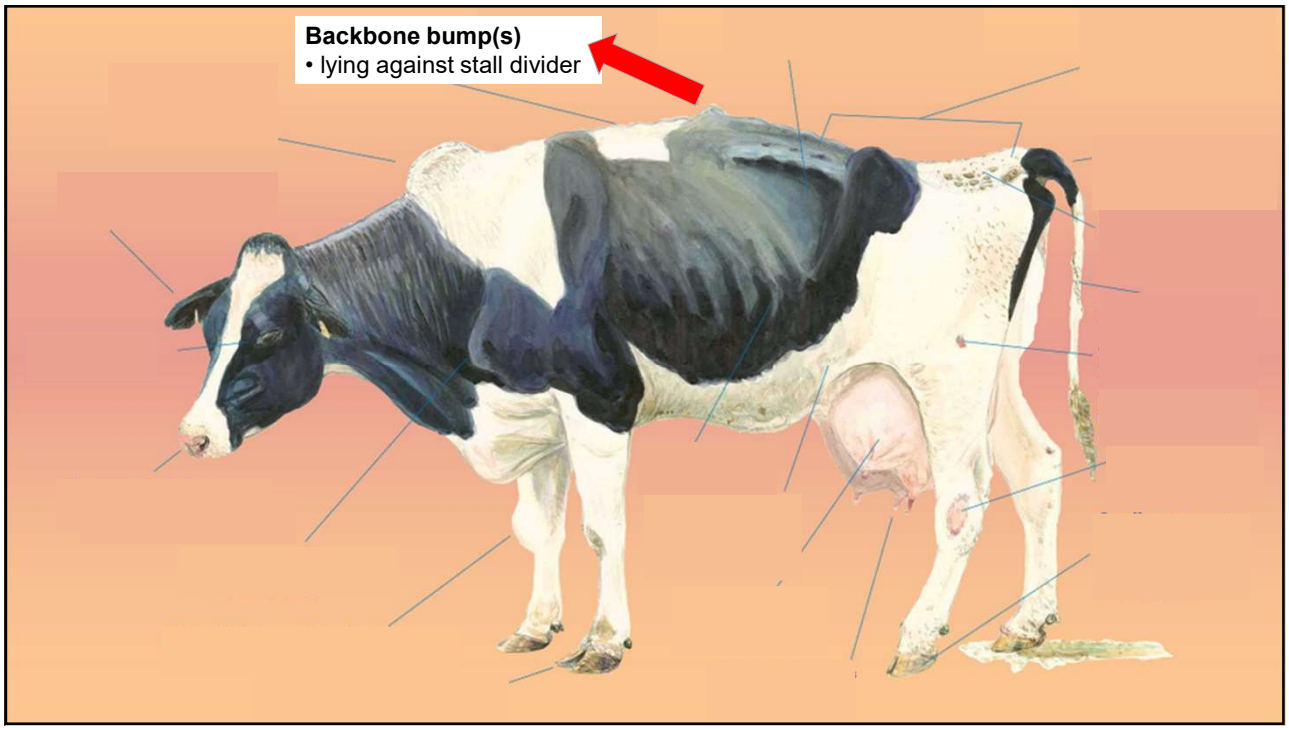

**Wound on flank**
• wet resting surface

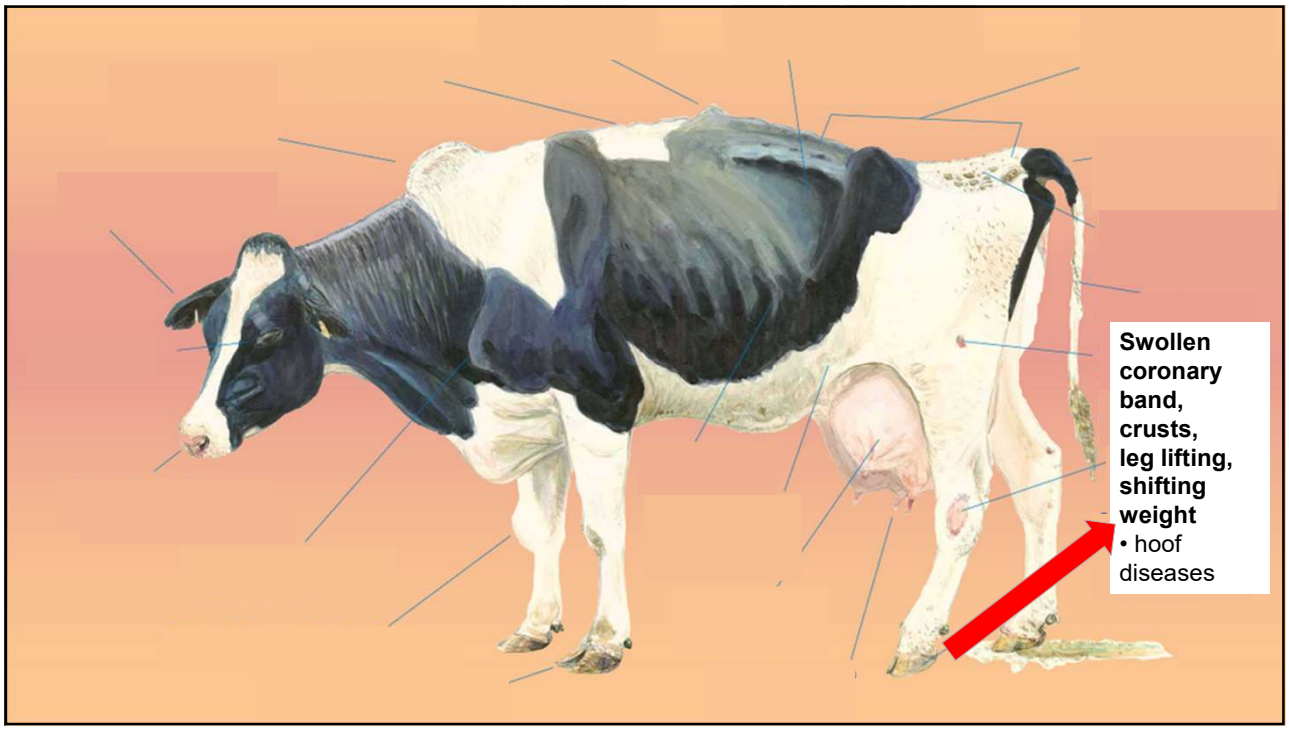

**Teat end calluses**
• milking machine

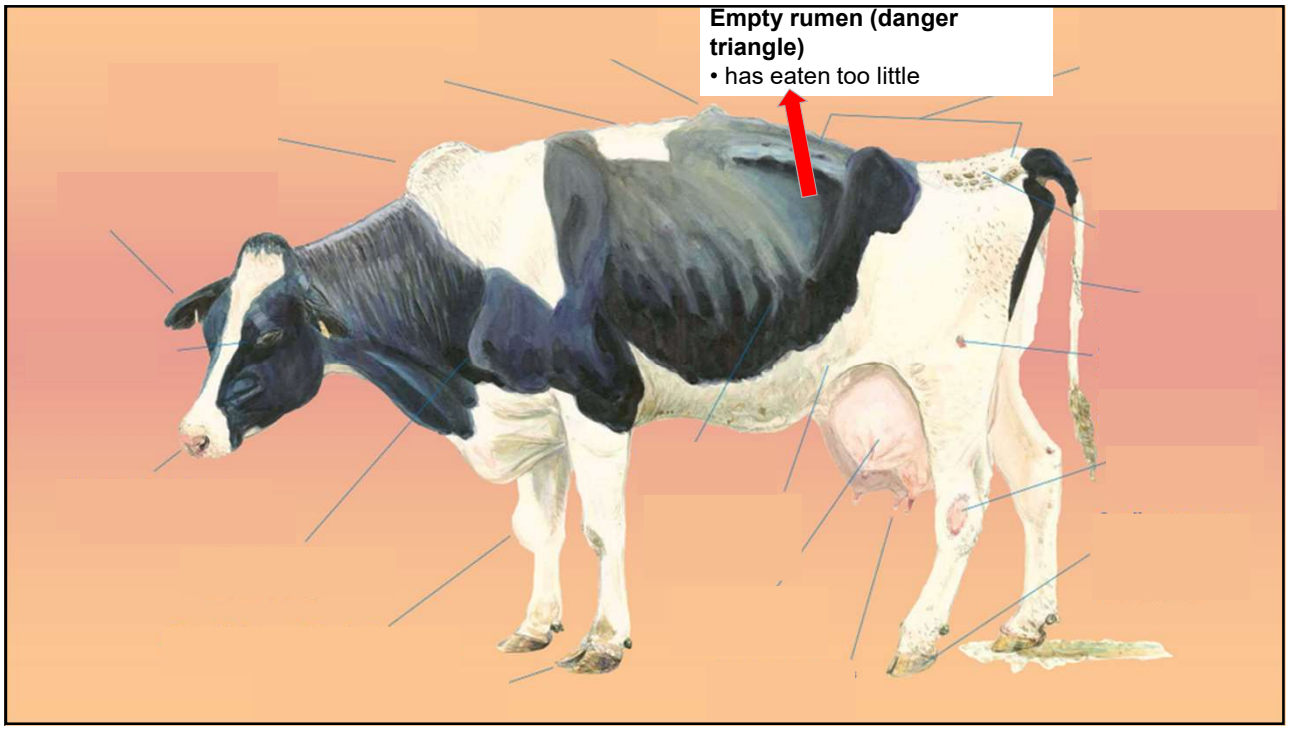

**Broken rib**
• stall divider

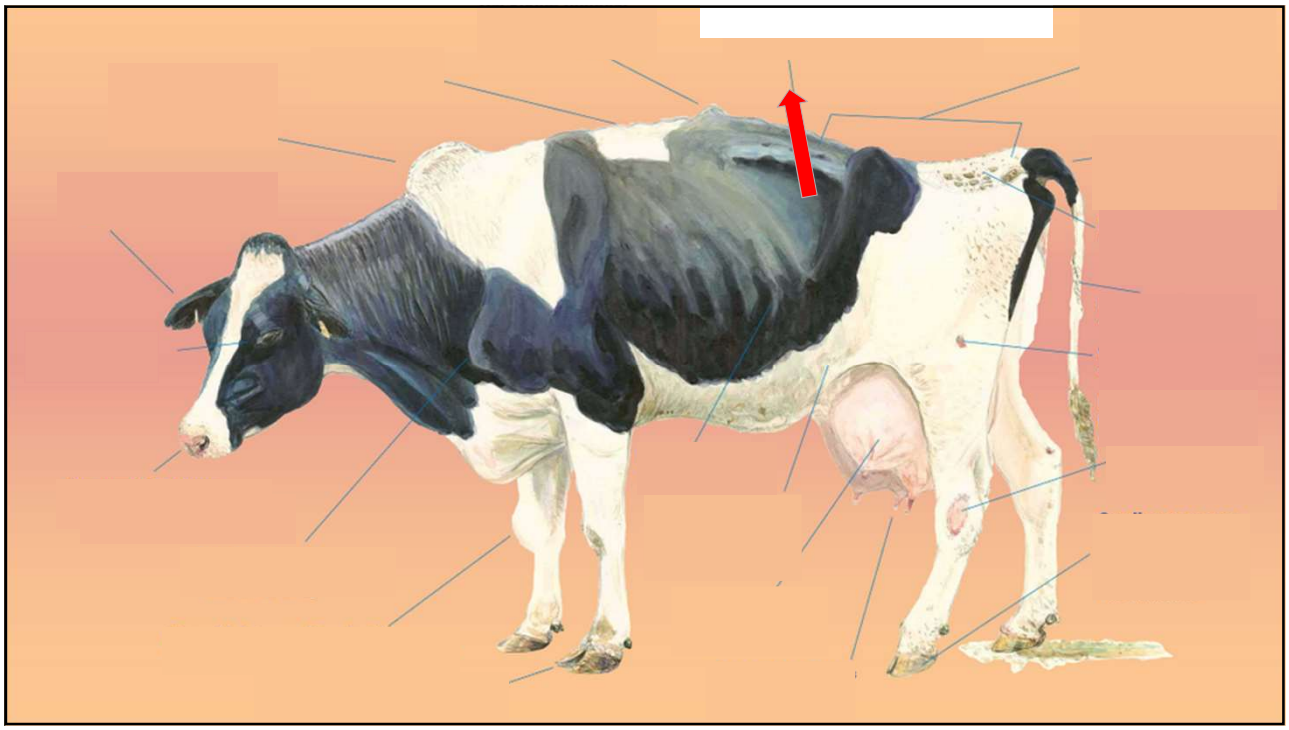

**Uplifted belly/ poor gut fill**
• pain/poor feed intake for days

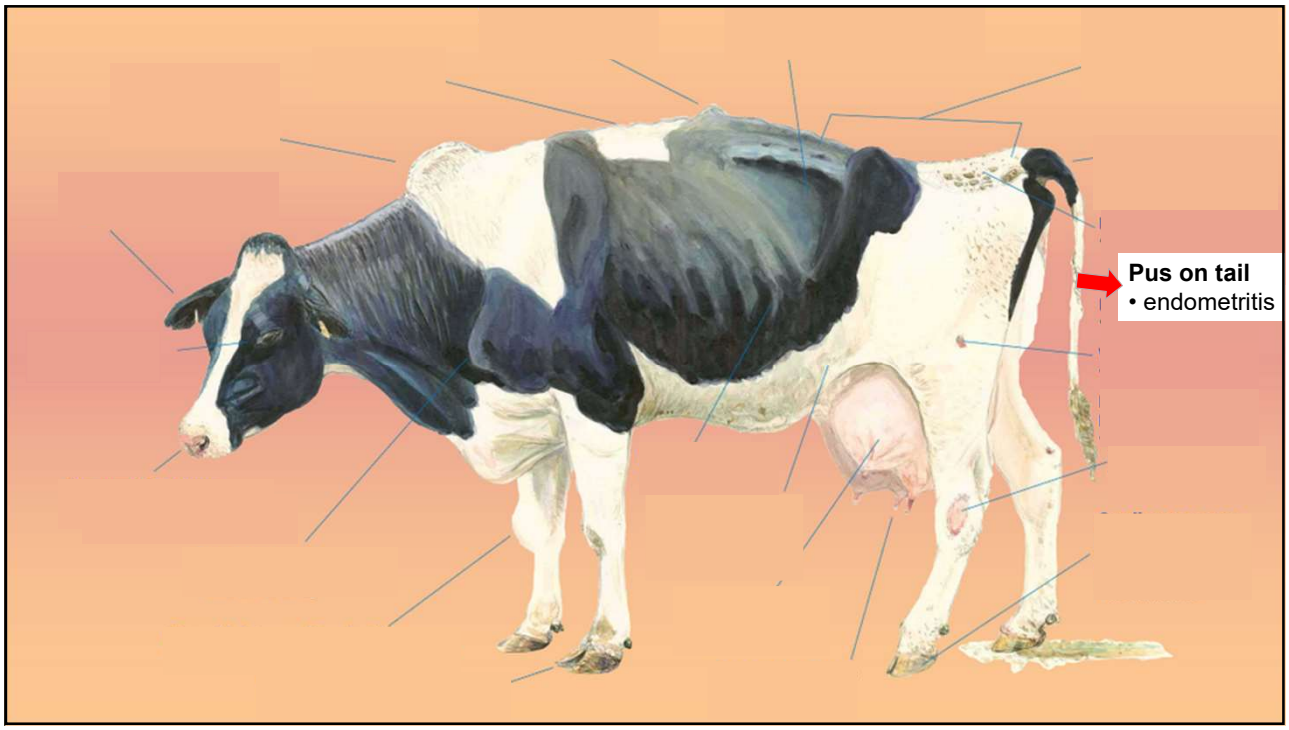

**Dirty udder**
• dirty resting area and/or floors

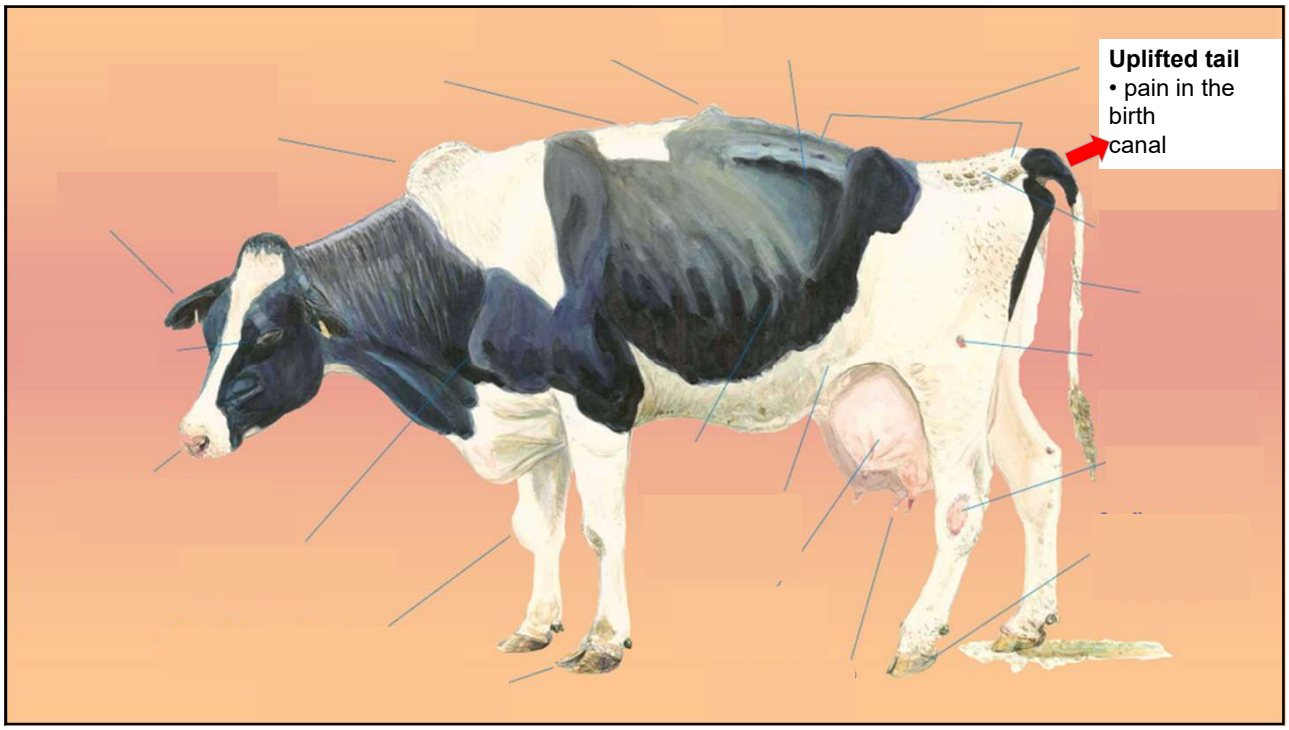

**Backbone bump(s)**
• lying against stall divider

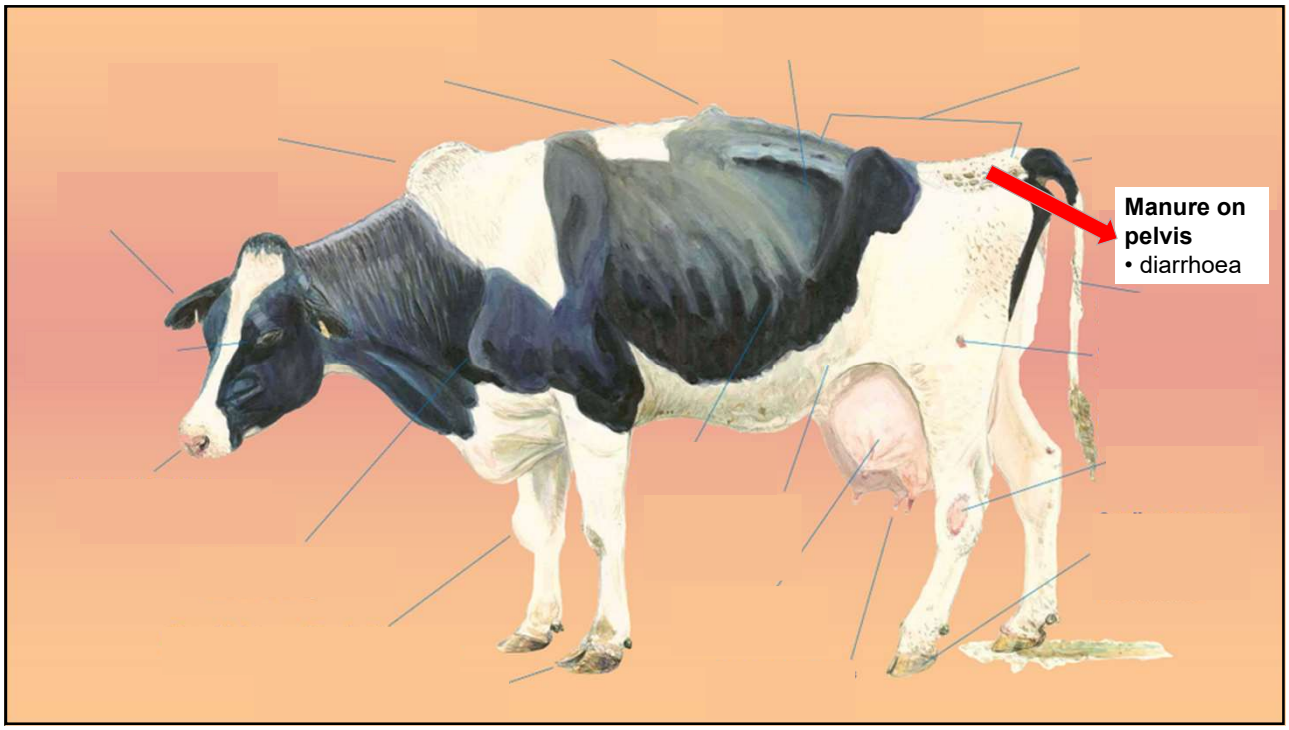

**Swollen coronary band, crusts, leg lifting, shifting weight**
• hoof diseases

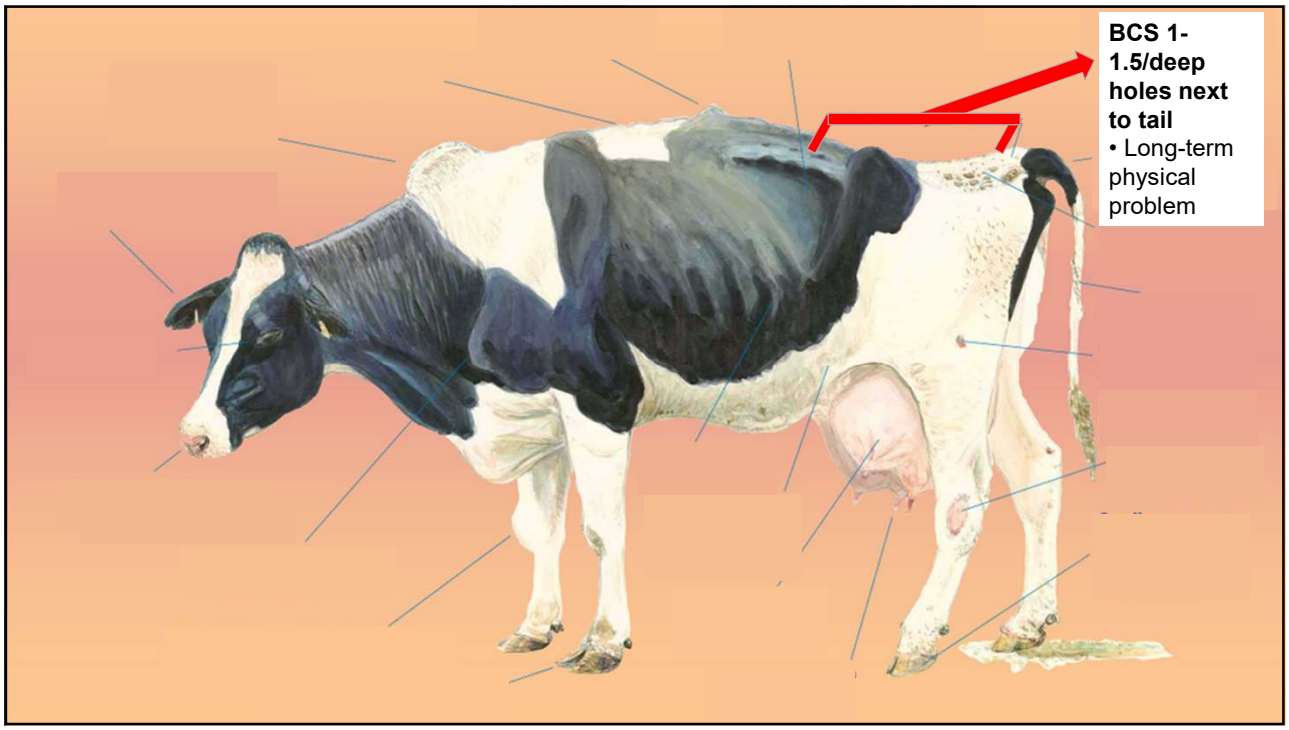

**Empty rumen (danger triangle)**
• has eaten too little

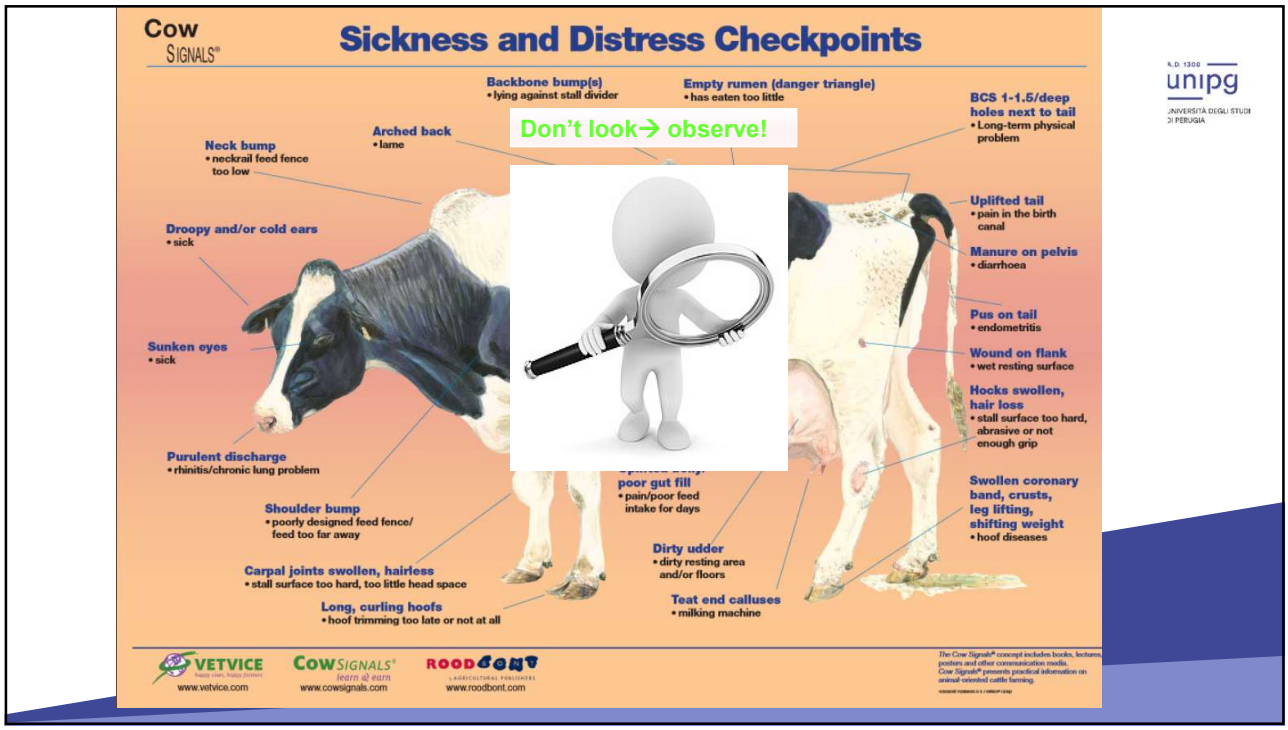



Pus on tail
• endometritis


**Uplifted tail**
• pain in the birth canal


**Manure on pelvis**
• diarrhoea


BCS 1-1.5/deep holes next to tail
• Long-term physical problem


Cow SIGNALS
Sickness and Distress Checkpoints
Backbone bump(s)
• lying against stall divider
Empty rumen (danger triangle)
• has eaten too little
Don't look→ observe!
BCS 1-1.5/deep holes next to tail
• Long-term physical problem
Arched back
• lame
Neck bump
• neckrail feed fence too low
Droopy and/or cold ears
• sick
Sunken eyes
• sick
Purulent discharge
• rhinitis/chronic lung problem
Shoulder bump
• poorly designed feed fence/ feed too far away
Carpal joints swollen, hairless
• stall surface too hard, too little head space
Long, curling hoofs
• hoof trimming too late or not at all
poor gut fill
• pain/poor feed intake for days
Dirty udder
• dirty resting area and/or floors
Teat end calluses
• milking machine
Uplifted tail
• pain in the birth canal
Manure on pelvis
• diarrhoea
Pus on tail
• endometritis
Wound on flank
• wet resting surface
Hocks swollen, hair loss
• stall surface too hard, abrasive or not enough grip
Swollen coronary band, crusts, leg lifting, shifting weight
• hoof diseases
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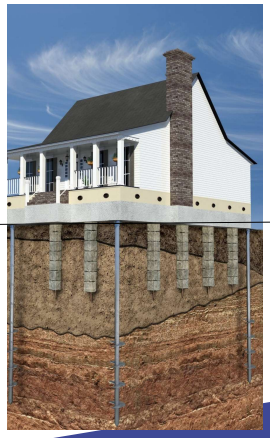
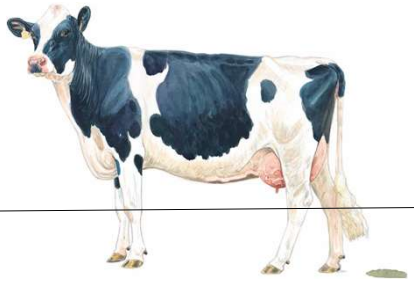
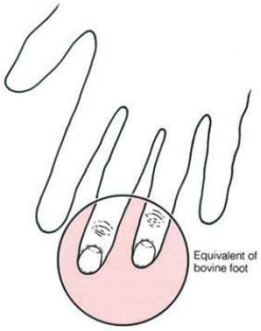
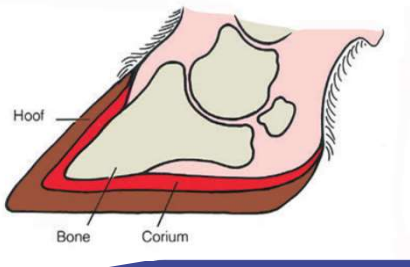


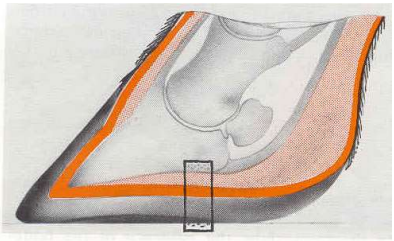


# Claw: protection and support

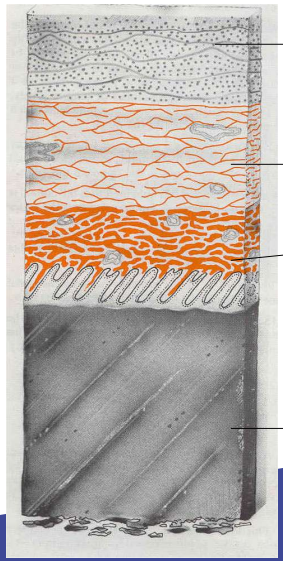
Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming



## Histology



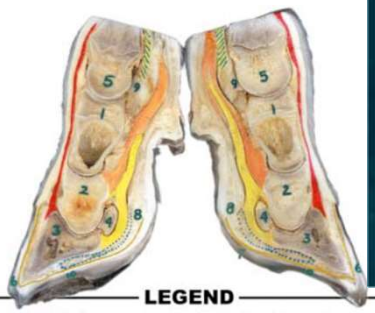
BoneDigital

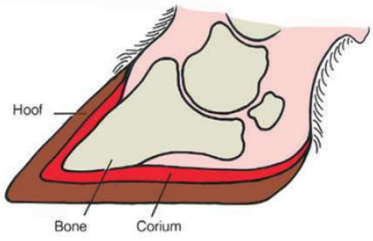
Digital cushing

Corion

Epidermis

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

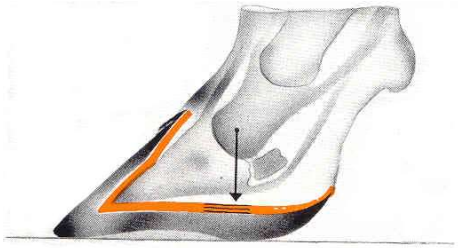


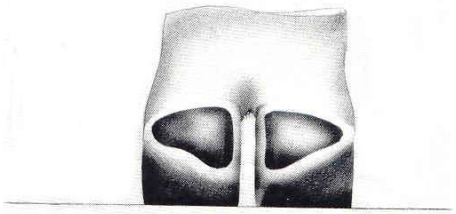


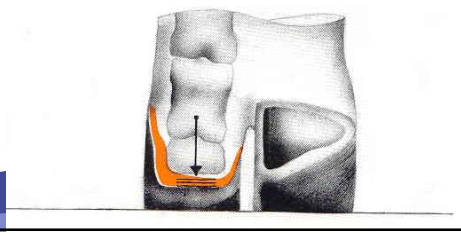

**LEGEND**

1. P1- proximal phalanx
2. P2 - middle phalanx
3. P3 - distal phalanx
4. Navicular- distal sesmoid
5. Metacarpus
6. Dorsal wall of claw
7. Heel
8. Heel retinaculum (pad)
9. Proximal sesmoid
10. Sole
- Extensor tendon
- Superficial Digital Flexor Tendon
- Deep Digital Flexor Tendon
- Suspensory Ligament
- Digital Cushion
- Corium

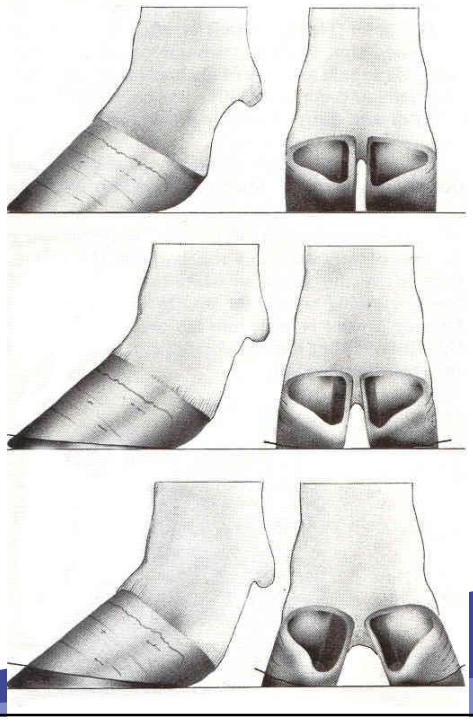






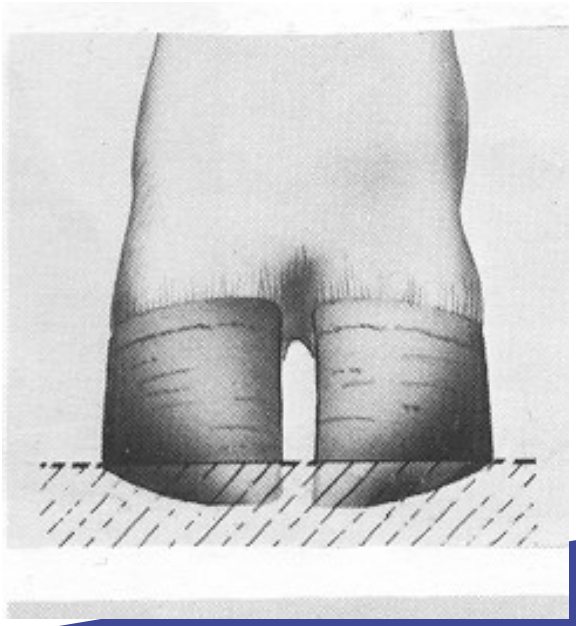


Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

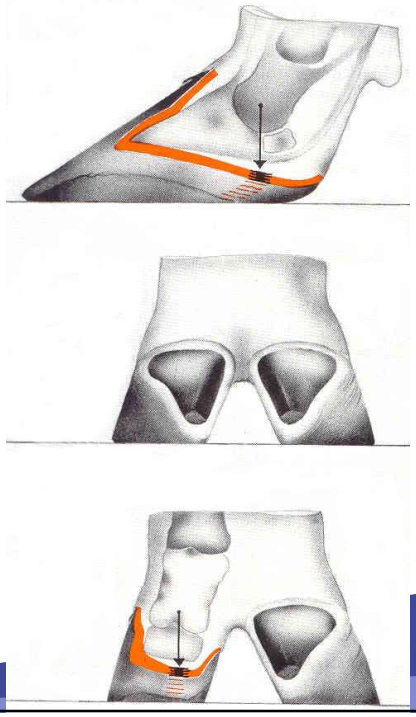


# Change in hoof position with hoof growth

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming



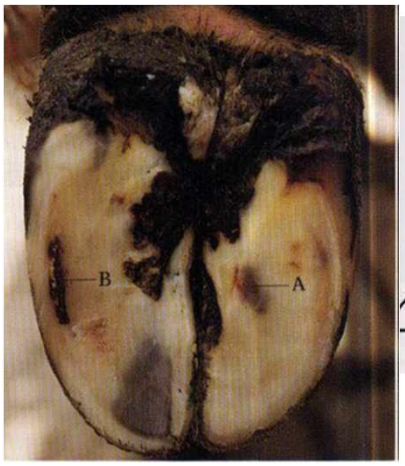
Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

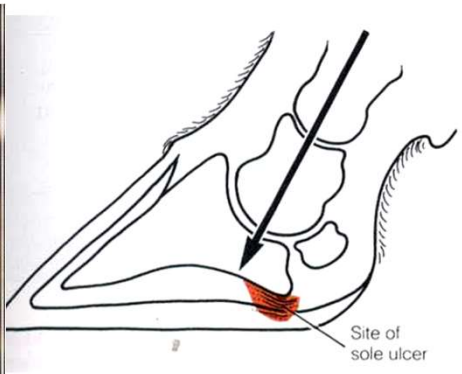


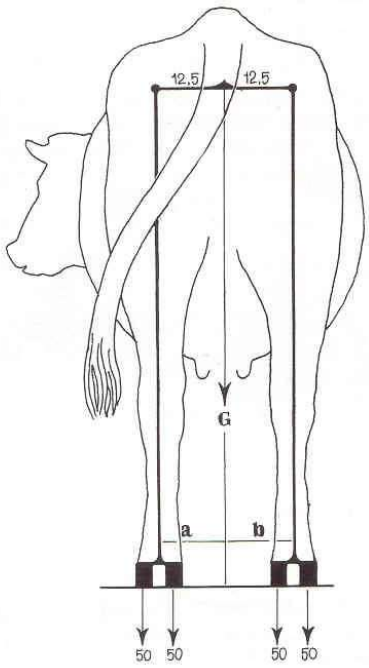
# Alteration of corium pressure points with claw overgrowth

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

Don't look→ observe!

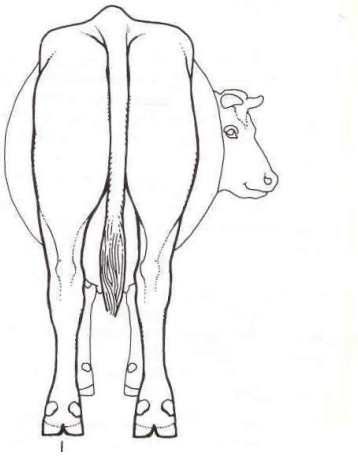


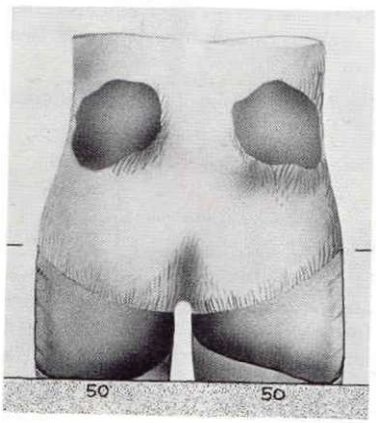





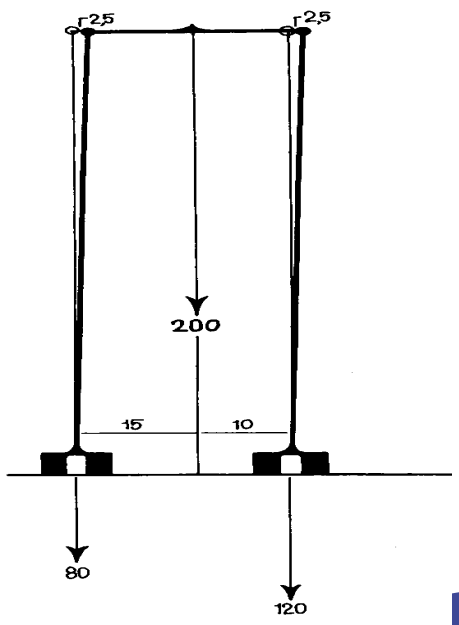

# Axes of forces applied on each Claw under ideal conditions

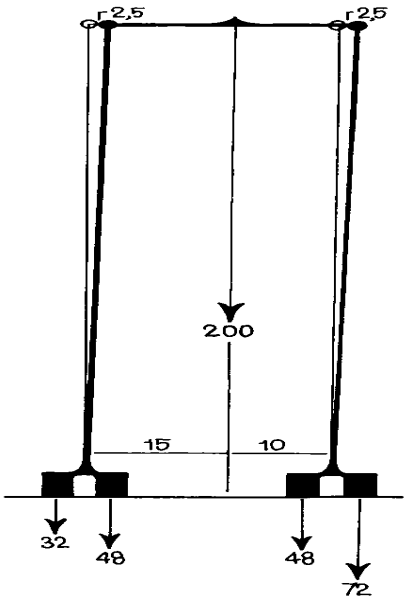
Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming



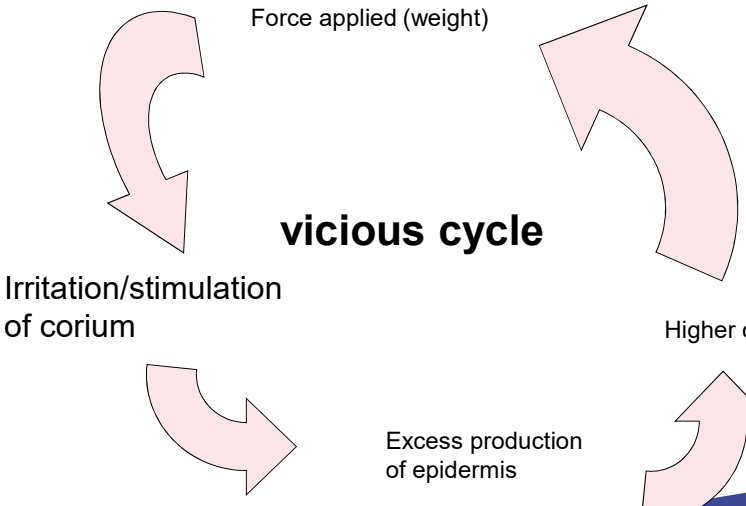


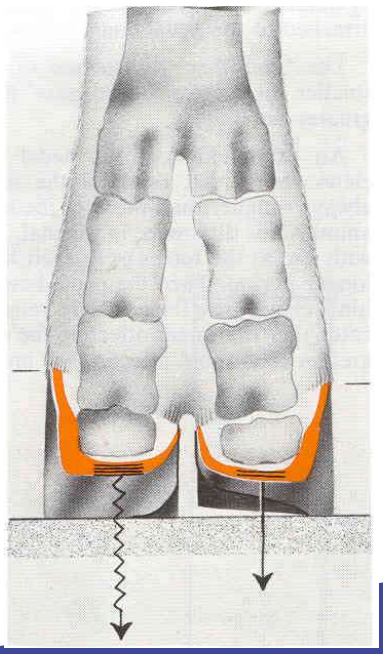

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming



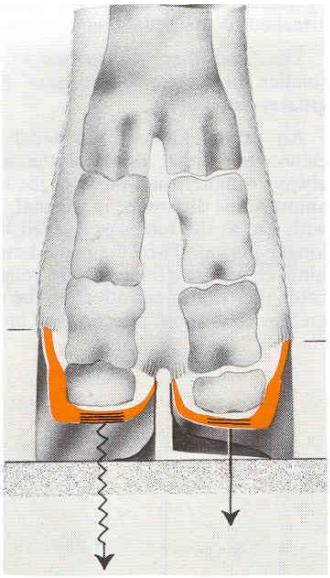

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

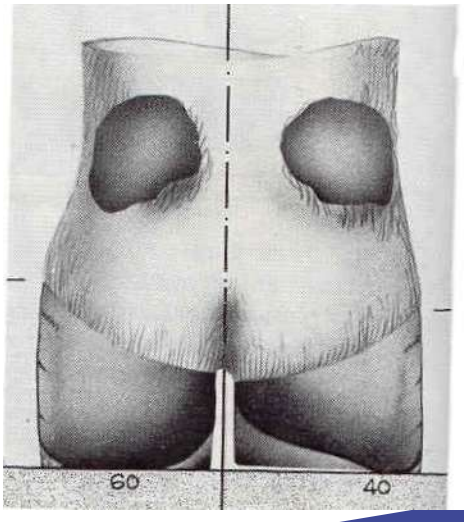


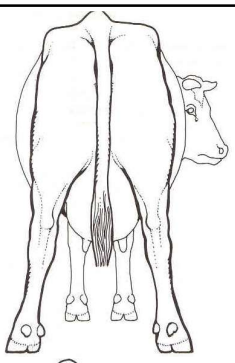


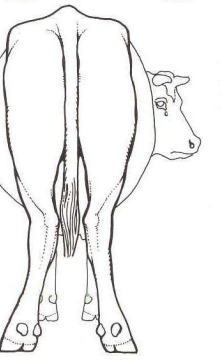
# Changing pressure points within the claw

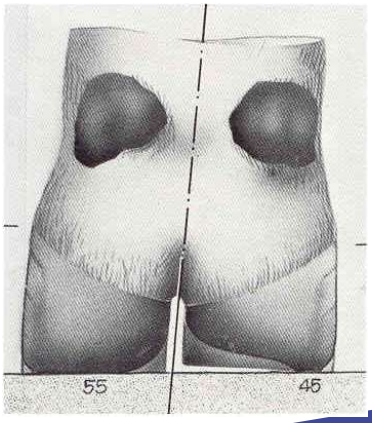
Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

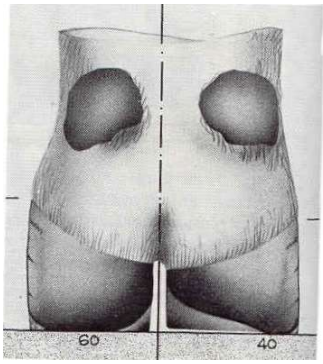








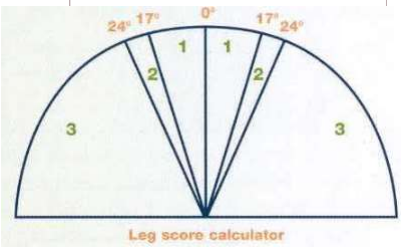


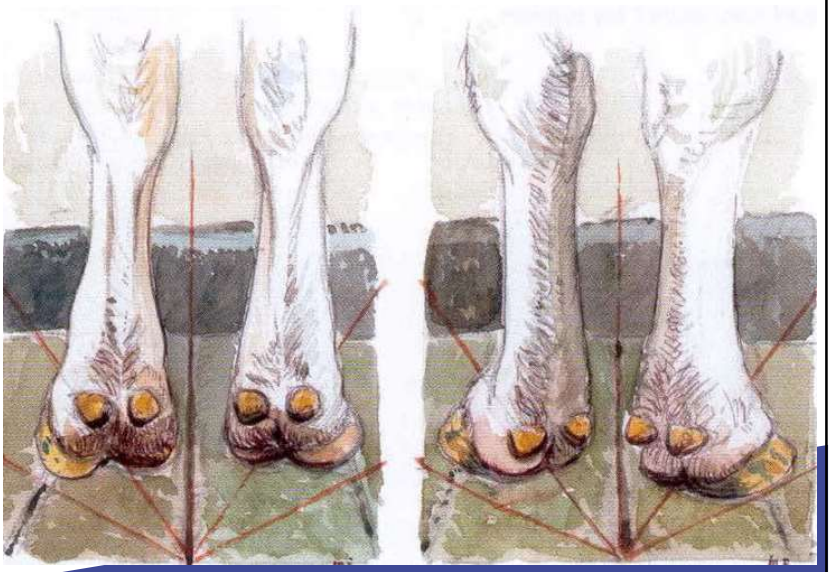




Don't look→ observe!

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

# Leg score



Don't look→ observe!

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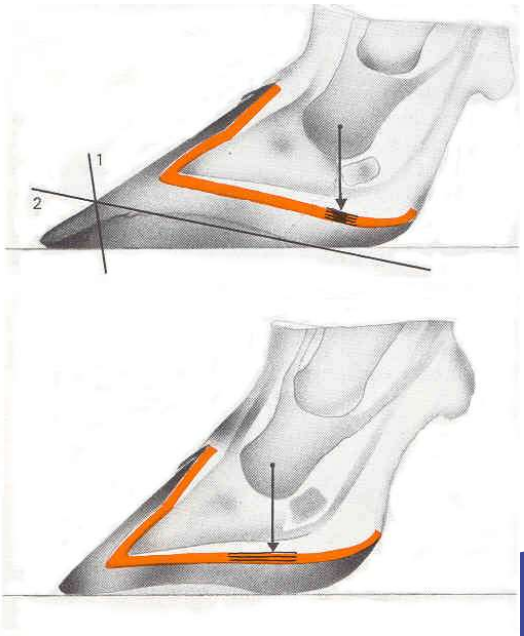
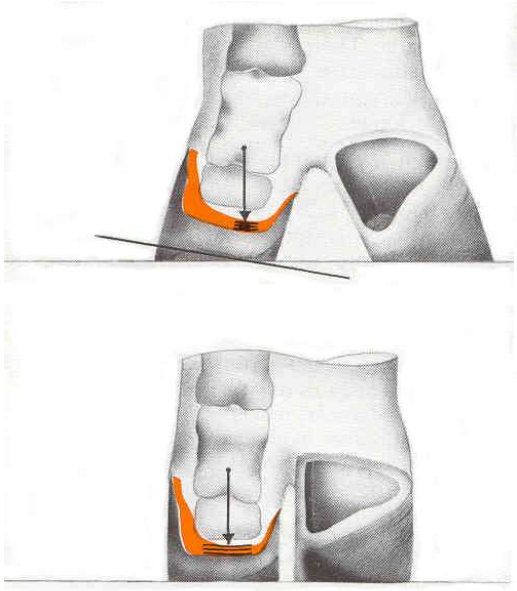



# Hoof trim effect

Lateral View

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming



# Hoof trim effect

caudal view

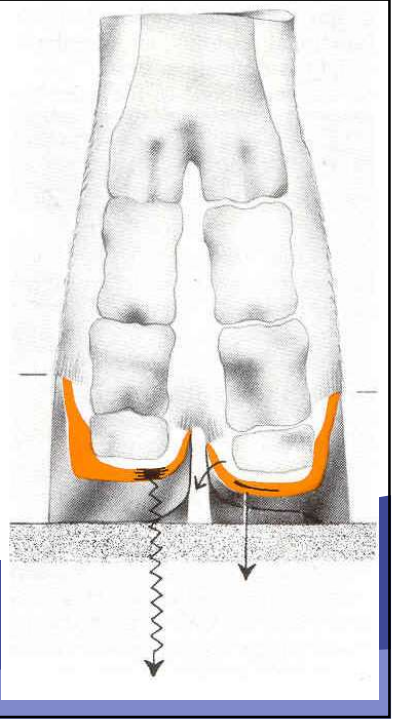
Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

Force applied (weight)

Irritation/stimulation of corium

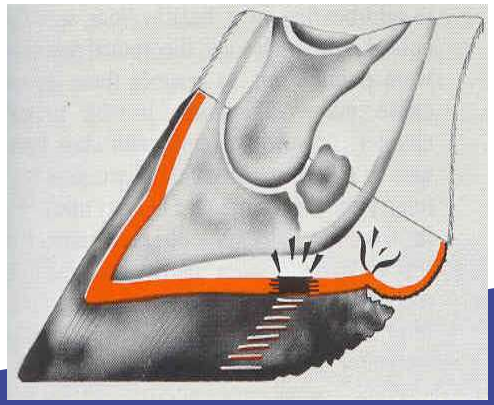
corium overload → **necrosis**

Excess production of epidermis



## *Podadermatitis asseptica circunscrita*

Ruztenhaus ulcer



Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

# Other claw diseases

Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

*Podadermatitis asseptica circunscrita*

*Pododermatites septica circunscrita*

*Pododermatites asseptica difusa*

F*issura ungulae*

*Erosio ungulae*

*Phlegmona interdigitalis*

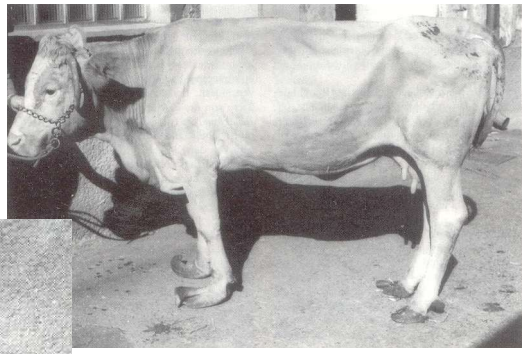
*Dermatites interdigitalis*

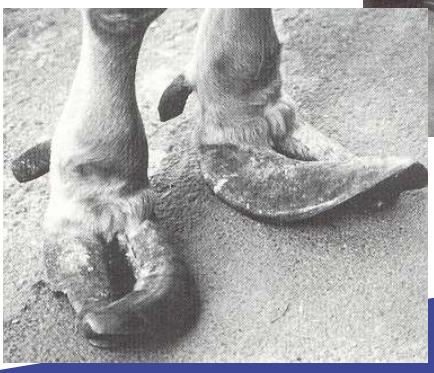
*Dermatitis digitalis*

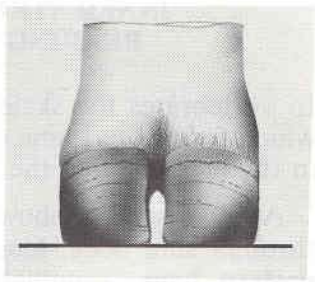
*Dermatitis verrucosa*

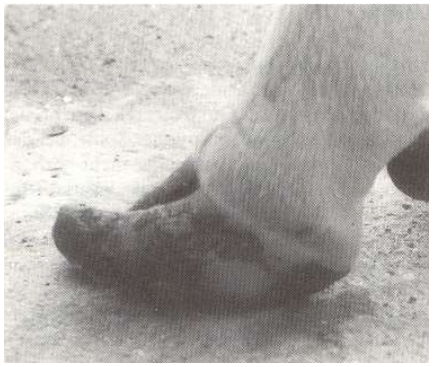
*Hyperplasia interdigitalis*

# Claws with poor conformation









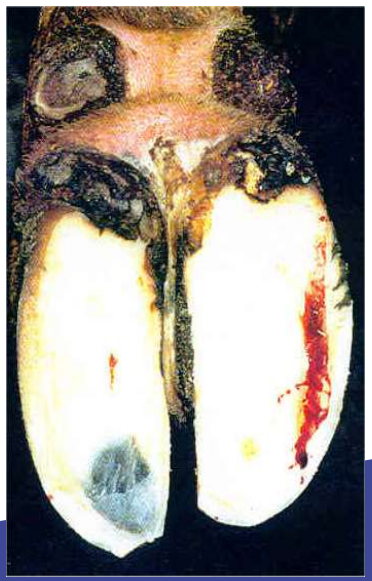
Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

*Pododermatites septica circunscrita*

Ùlcera da sola de origem traumática

Fonte: Panhanha Sequeira Serrão. Contributo para o estudo da patologia podal da vaca leiteira

*Pododermatites septica circunscrta*



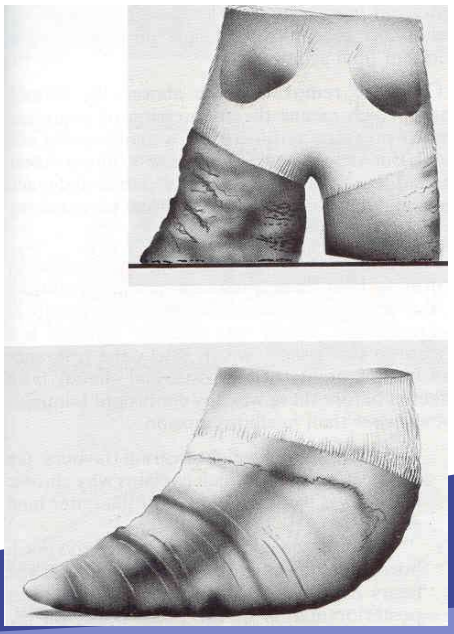
Fonte: Panhanha Sequeira Serrão. Contributo para o estudo da patologia podal da vaca leiteira

# Laminite

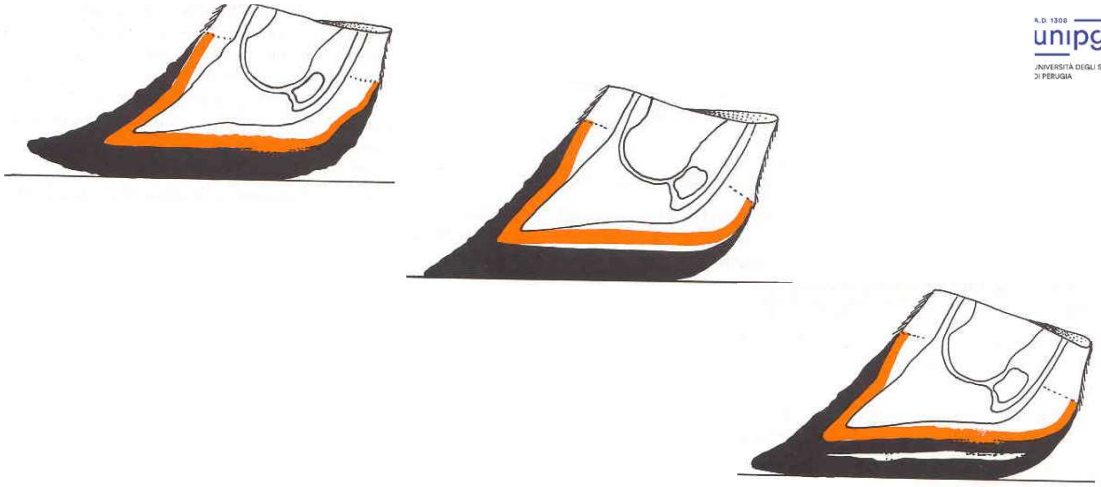
*Pododermatites asseptica difusa*

- Diffuse aseptic inflammation of the chorion of the claw

-Acute, sub-acute and chronic forms



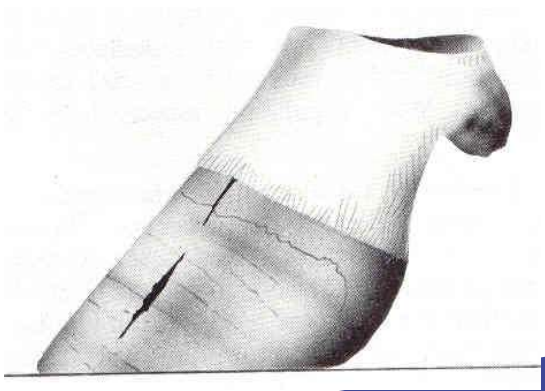
Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming



Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

## *Fissura ungulae*

**-Temporary total interruption of corneal formation**



Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

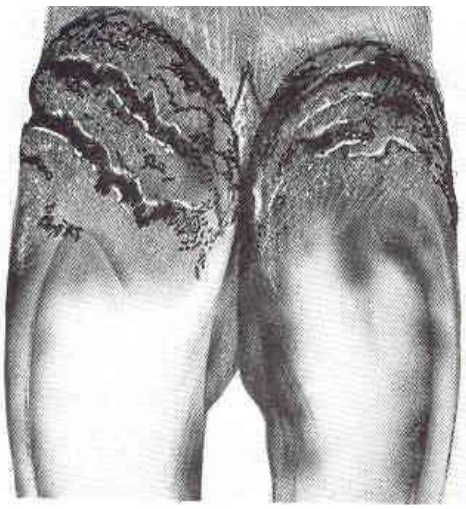
Fonte: Panhanha Sequeira Serrão. Contributo para o estudo da patologia podal da vaca leiteira

## *Erosio ungulae*

-Irregular loss of horn tissue from heel

Bacterial infection, chronic chemical irritation

-Secondary complications

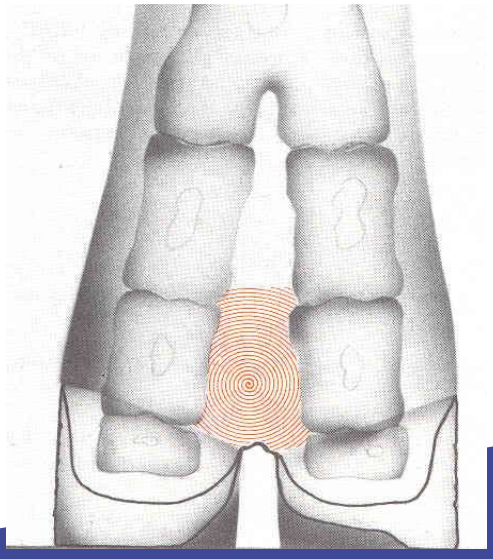


Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

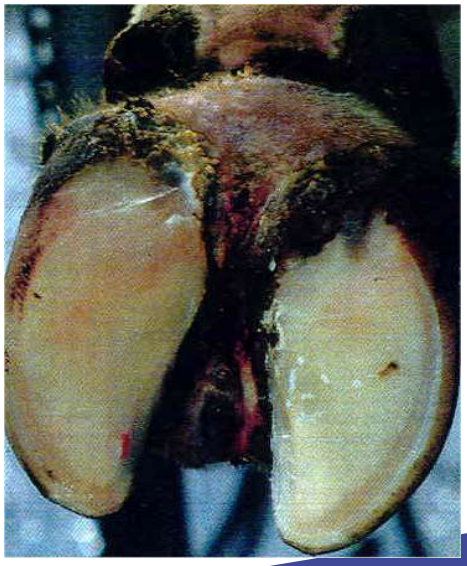
Fonte: Panhanha Sequeira Serrão. Contributo para o estudo da patologia podal da vaca leiteira

## *Phlegmona interdigitalis*

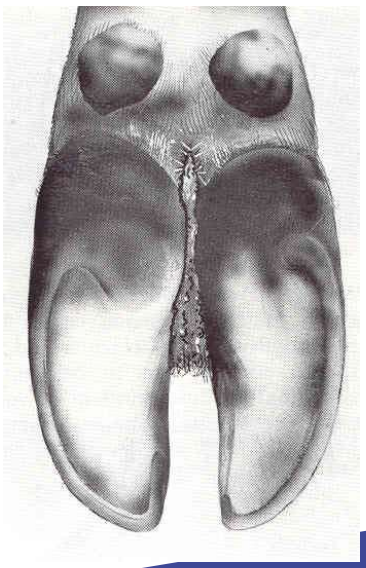
- Diffuse necrotizing inflammation of the subcutaneous connective tissue of the interdigital region
- ***Fusobacterium necrophorum*** and ***Bacteroides nodusus***
- Fissuration of the interdigital space

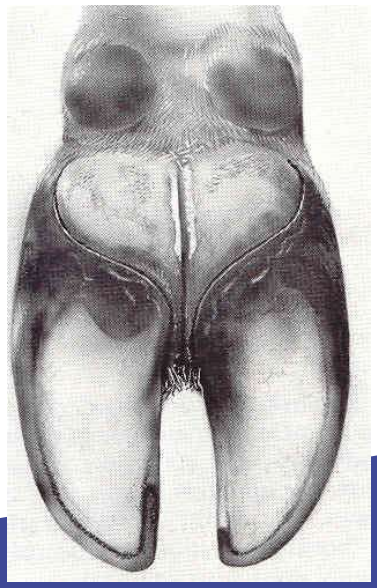


Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming



Fonte: Panhanha Sequeira Serrão. Contributo para o estudo da patologia podal da vaca leiteira





Fonte: E.Toussaint Raven. Cattle Footcare and Claw Trimming

## *Dermatites intertigitalis*

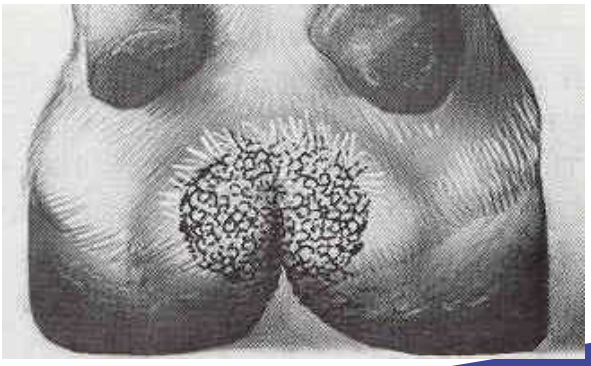
-Inflammation of the skin of the interdigital space without extension to the deep tissues

- ***Dichelobacter (Bacteroides) nodosus***
- ***Fusobacterium necrophorum***

Fonte: Panhanha Sequeira Serrão. Contributo para o estudo da patologia podal da vaca leiteira

## *Dermatitis digitalis*

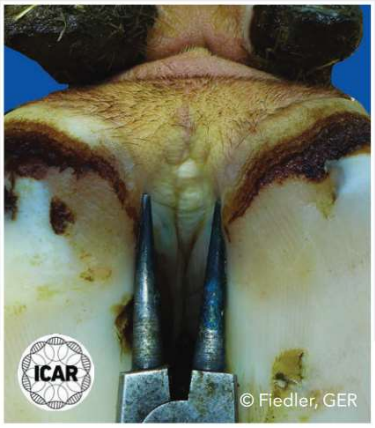
- Circumscribed superficial ulceration
- contagious (Spirochetes)

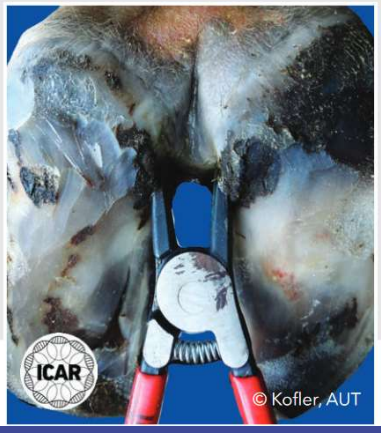


Fonte: Panhanha Sequeira Serrão. Contributo para o estudo da patologia podal da vaca leiteira

## M0 stage

Normal, healthy skin with no visible signs of DD infection or other skin lesions.




**ICAR Claw Health Atlas – Appendix 1**

**Digital Dermatitis Stages (M-stages)**

## M1 stage

Early-stage, small, focal active, red-grey circumscribed lesion less than 2 cm in diameter located on the skin of the plantar interdigital cleft (left) and on the skin of the interdigital cleft (right). The use of spreader forceps is shown to support the detection of M1 stages.



**ICAR Claw Health Atlas – Appendix 1**

**Digital Dermatitis Stages (M-stages)**

# M2 stage

Acute, bright red or red-gray ulcerative and painful lesion of a minimum of 2 cm in diameter located on the skin of the plantar interdigital cleft.

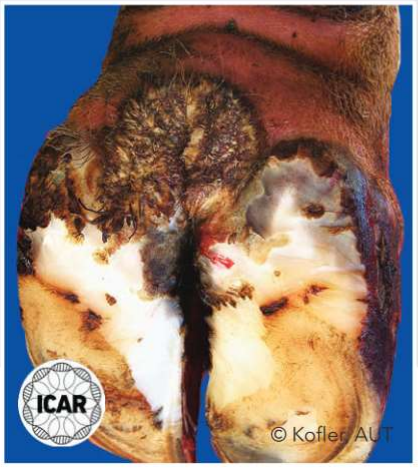


ICAR Claw Health Atlas – Appendix 1

Digital Dermatitis Stages (M-stages)

# M2 stage (proliferative)

Acute, bright red or red-gray ulcerative and painful lesion of a minimum of 2 cm in diameter located on the skin of the plantar interdigital cleft. There is an excessive hyperkeratotic epidermal growth in both these M2 lesions.





ICAR Claw Health Atlas – Appendix 1

Digital Dermatitis Stages (M-stages)

## M3 stage

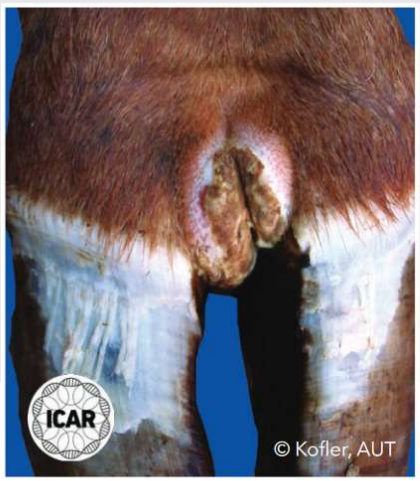
Healing, painless M3 lesion seen after topical treatment covered with firm, brown/ black scab material; the color of the scab depends on the topical medication applied.

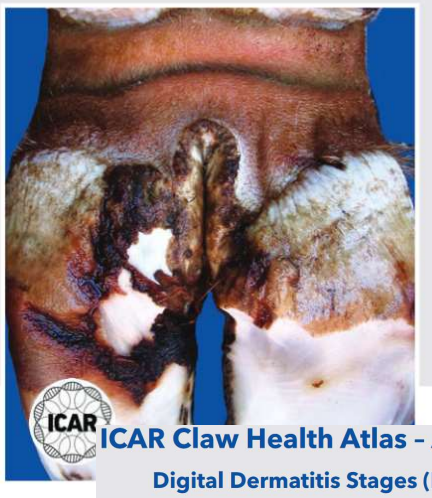

**ICAR Claw Health Atlas – Appendix 1**

**Digital Dermatitis Stages (M-stages)**

## M4 stage

Chronic stage characterized by a non-painful, clearly circumscribed lesion of various sizes showing dys- and hyperkeratotic overgrowths ('wart-like') of brown-gray color. M4 stages may also be characterized by a scab-like mass or hyperkeratotic proliferations, such as here on the dorsal (left) and the plantar interdigital skin (right).




**ICAR Claw Health Atlas – Appendix 1**

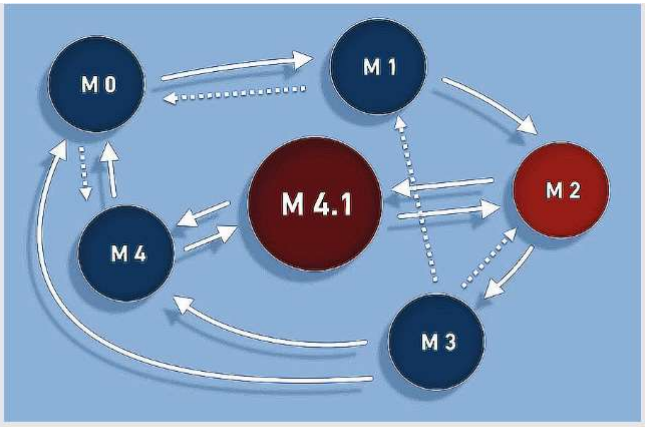
**Digital Dermatitis Stages (M-stages)**

# M4.1 stage

Chronic M4 stages showing a new red M1 lesion (circled) developing within the chronic hyper- and dyskeratotic M4 lesion located on the plantar interdigital skin.








DD cycle/Transition of DD stages (modified November 2019)
Source of the idea: D. Döpfer, Cattle Lameness 2013
Source of the layout: Tutorial video of TGD Tirol/Austria on digital dermatitis: *http://www.t-tgd.at/interessantes/film-mortellaro-krankheit*

# Reasons for early Hoof correction

- Animal Welfare
- Productive motives
- Reproductive motive

# Claw pathology Productive reasons

Pain → potent inhibitor of ruminal movements

→ Less food intake

→chronic stress factor

→weakened immune system

→Predisposition to infectious diseases

→ Loss of milk production

# Hoof pathology

## Reproductive reasons

- Genetic loss due to early culling of animals
- Increased calving interval due to reduced fertility

- Incidence of claudication:
  - 88% claudication associated with ungulate injury
  - Ideal less than 52 cases/100 animals/year (one claw – one case)
    - Less 1 case per week/100 animals

# productive losses


**milk loss**

Grade 3 → 5%

Grade 4 → 17%

Grade 5 → 36%

SOURCE: http://WWW.availa4.com

# genetic loss

degree of locomotion

3 to 5

→ Animal waste is 8x higher

→ 15x greater probability in increasing calving interval

SOURCE: http://WWW.availa4.com

# Problem Identification

- Early detection of lameness
- Monitoring of isolated animals and herd average

SOURCE: http://WWW.availa4.com

# Lameness score 0→ 3

Dairy Australia


Locomotion Score

# Main locomotion indicator

**degree of curving**

**from the back:**

**→ in movement**

**→ stacionary**

SOURCE: http://WWW.availa4.com

# Grade 1 Locomotion

**flat back stacionary and in movement**

SOURCE: http://WWW.availa4.com

# Grade 2 Locomotion

**flat stacionary and curved in movement**

SOURCE: http://WWW.availa4.com

# Grade 3 Locomotion

-Curved stacionary and curved in movement

-No lameness

SOURCE: http://WWW.availa4.com

# Grade 4 Locomotion

-Curved back stacionary and curved in movement

- Claudication with weight shift in one limb

SOURCE: http://WWW.availa4.com

# Grade 5 Locomotion

SOURCE: http://WWW.availa4.com

-Curved back stacionary

and curved in movement

- Claudication with suspension of a member

# Automatic Lameness detection

ELSEVIER

The Veterinary Journal
Volume 246, April 2019, Pages 35-44

Review

## Automatic lameness detection in cattle

Maher Alsaaod, Mahmoud Fadul, Adrian Steiner

**Kinematic methods**

**Image-processing technique**

**Pressure-sensitive walkway**

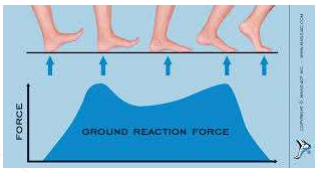
Accelerometers

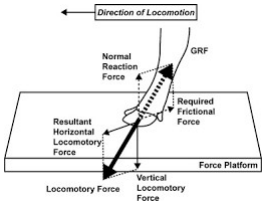
**Accelerometers with low frequency data collection**

**Accelerometer with high frequency data collection**

**Kinetic methods**

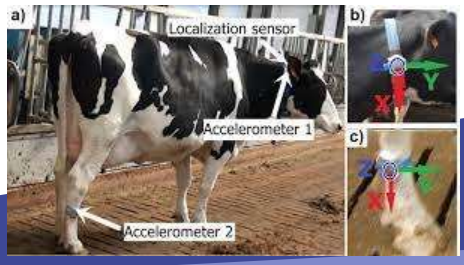
**Ground reaction force systems**




**Four-scale weighing platform**

**Kinetic variables of accelerometers**



**Indirect methods**

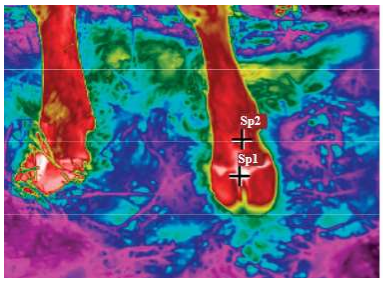
**Thermography**

**Feeding behaviour**

**Grooming behaviour**

**Automated milking system**

**Milk production**



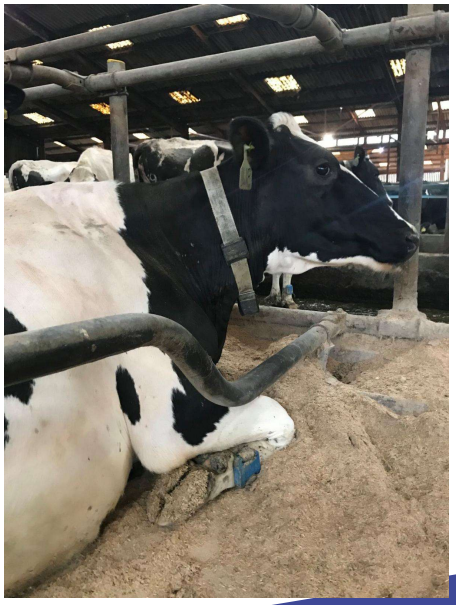

# Lying Comfort

Assessing cow **behavior** and cubicle **surface Check** whether the cows have **enough room** to stand, lie down and stand up in. Monitor large cows in particular. The **floor surface** must be **soft and dry** and provide **grip**.

Don't look→ observe!

**Cow Signals Checkbook**

**Text and Photography:**
Jan Hulsen, Vetvice®



**≤ 10% of the standing cows are standing with their legs outside the cubicle.**
**≥ 85% of the cows in the cubicles are lying down.**

Brushing the back of the hand across the surface should not cause cuts

Kneeling several time should not hurt

Don't look→ observe!

**Cow Signals Checkbook**

**Text and Photography:**
Jan Hulsen, Vetvice®

Hock and carpal (knee) joint score card Damage to the hocks and carpal (knee) joints tell us that the cubicle surface is too hard.

## Swelling is caused by landing on too hard surface




Swelling

Objective:
less than 20% of score 1;
0% score 2

Swollen hocks indicate that the lying surface is too hard, whereas hock rubs/hair loss suggests that the bedding (or lying surface) is too abrasive. Ideally less than 10% of cows should have hock damage.

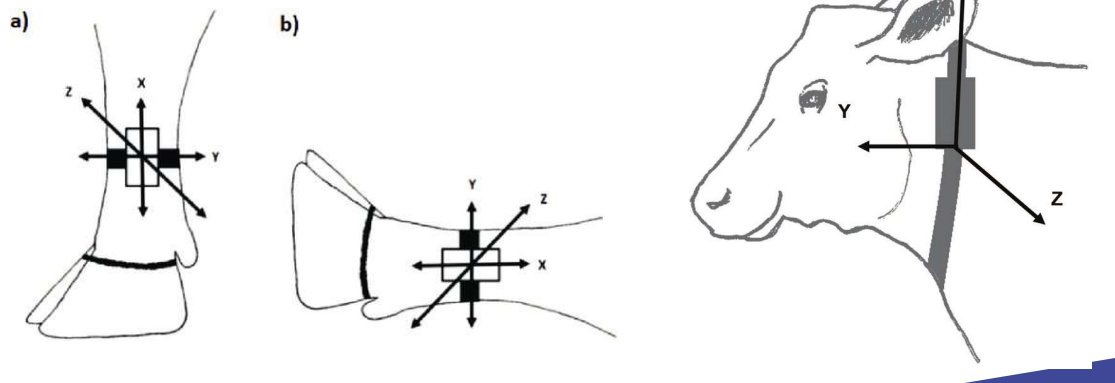

Hair loss and skin damage

Objective:
less than 30% of score 1;
less than 10% score 2

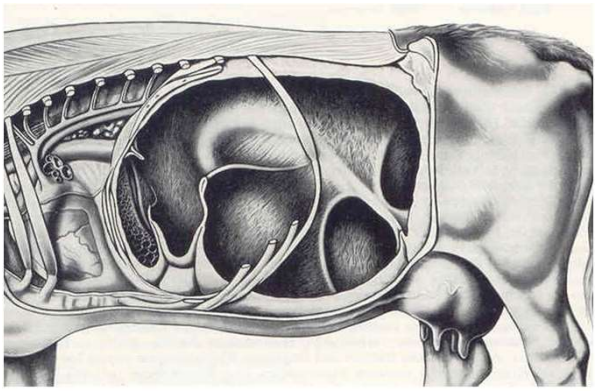
J. Dairy Sci. 103
https://doi.org/10.3168/jds.2019-17887


## *Graduate Student Literature Review:* Evaluating the appropriate use of wearable accelerometers in research to monitor lying behaviors of dairy cows*

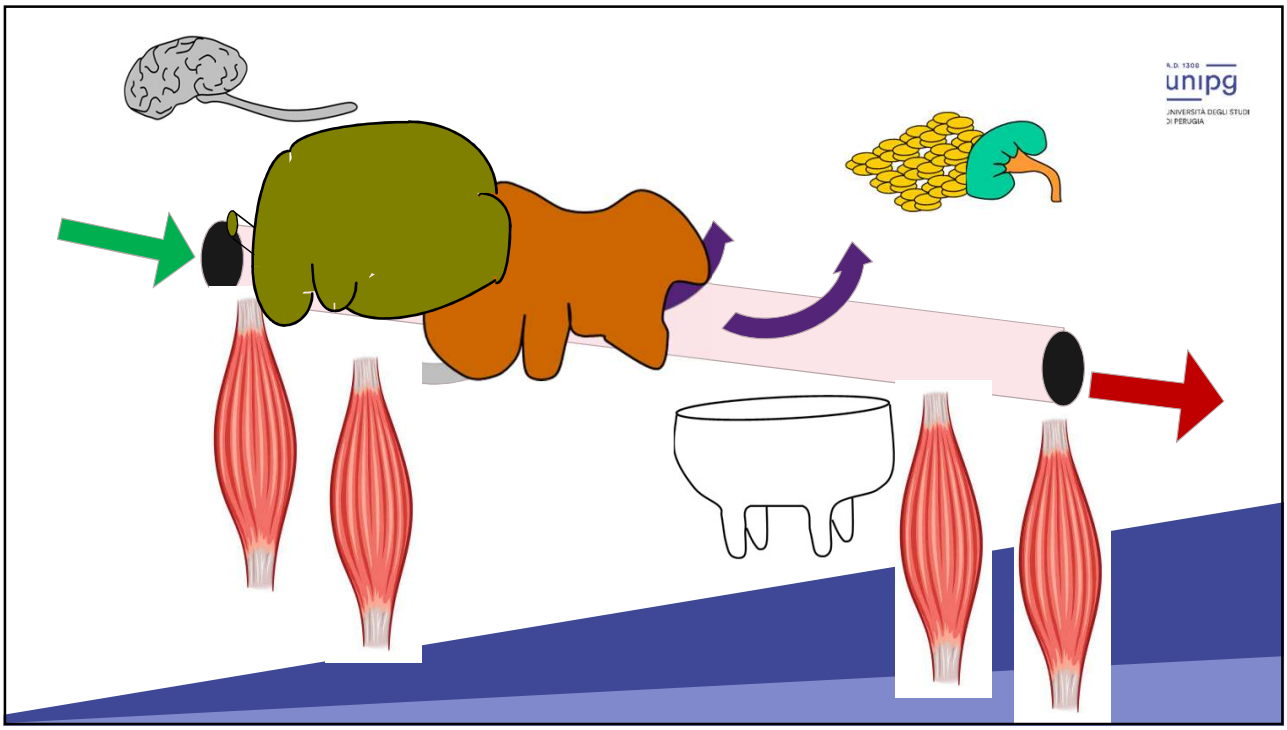
S. J. Hendriks,[1]† C. V. C. Phyn,[2] J. M. Huzzey,[3] K. R. Mueller,[4] S-A. Turner,[2]‡ D. J. Donaghy,[1] and J. R. Roche[2,5]§#
[1]School of Agriculture and Environment, Massey University, Palmerston North 4410, New Zealand
[2]DairyNZ Ltd., Hamilton 3240, New Zealand
[3]Department of Animal Science, California Polytechnic State University, San Luis Obispo 93407
[4]School of Veterinary Sciences, Massey University, Palmerston North 4410, New Zealand
[5]School of Biological Sciences, University of Auckland, Private Bag 92019, Auckland 1142, New Zealand

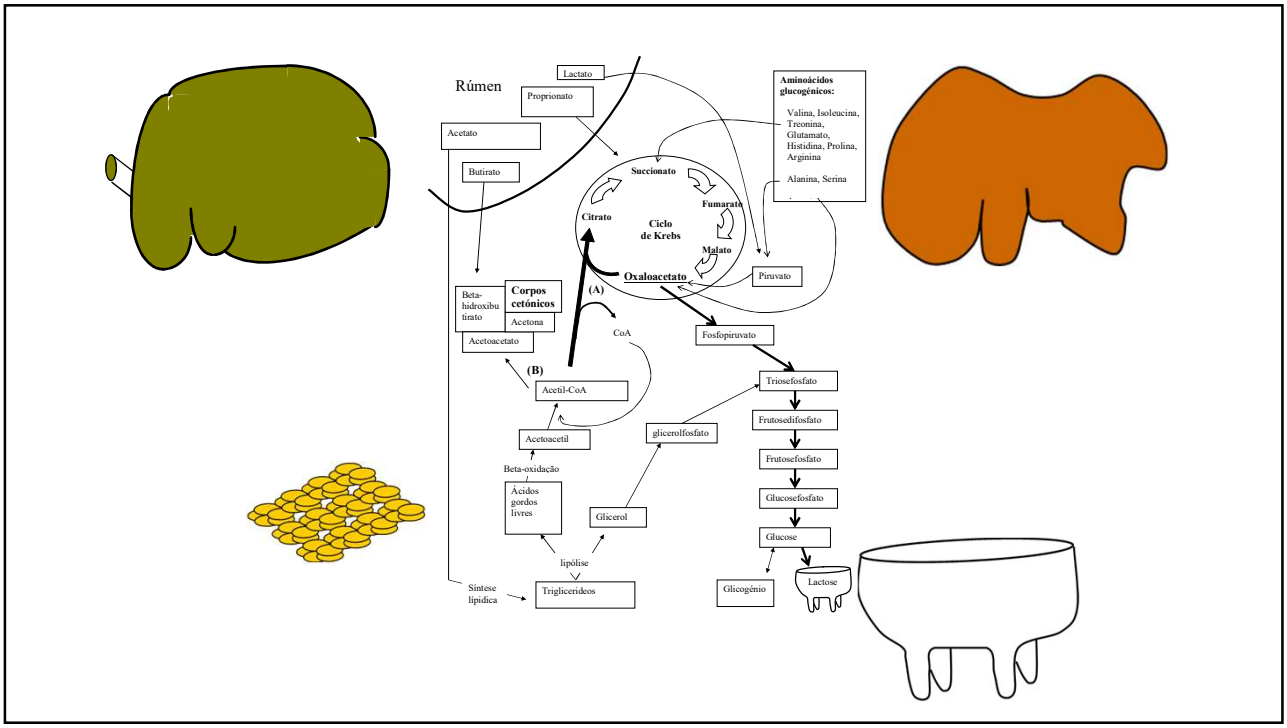



## Digestive signs

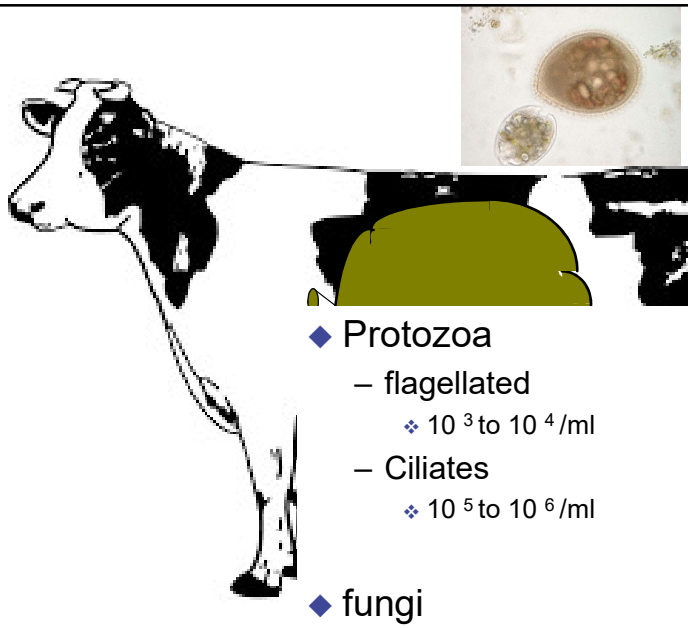


Rosenberger,1990

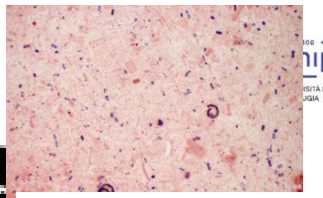



Rúmen
Lactato
Proprionato
Acetato
Butirato
Succionato
Fumarato
Citrato
Ciclo de Krebs
Malato
Oxaloacetato
Piruvato
Aminoácidos glucogénicos:
Valina, Isoleucina, Treonina, Glutamato, Histidina, Prolina, Arginina
Alanina, Serina
Beta-hidroxibutirato
Corpos cetónicos
Acetona
Acetoacetato
(A)
(B)
CoA
Acetil-CoA
Acetoacetil
Beta-oxidação
Ácidos gordos livres
lipólise
Triglicerídeos
Síntese lipídica
Glicerol
glicerolfosfato
Fosfopiruvato
Triosefosfato
Frutosedifosfato
Frutosefosfato
Glucosefosfato
Glucose
Glicogénio
Lactose

# Ruminal dysbiosis

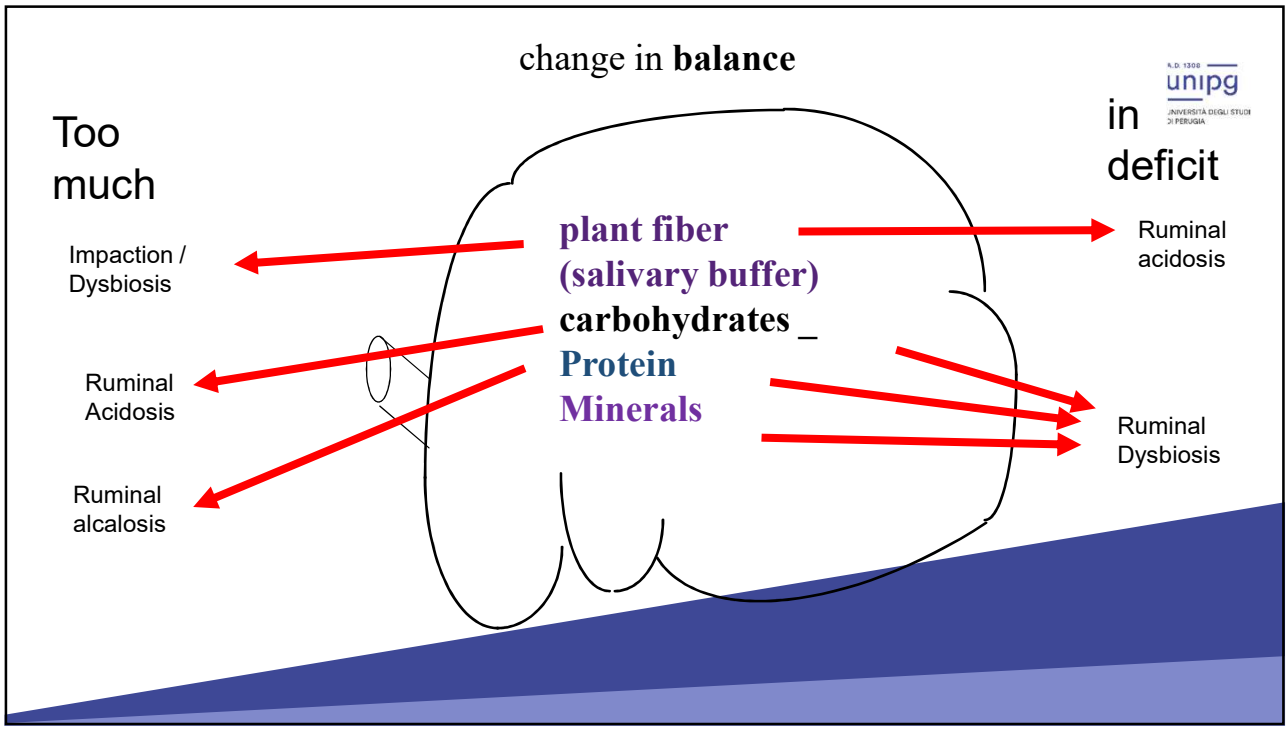




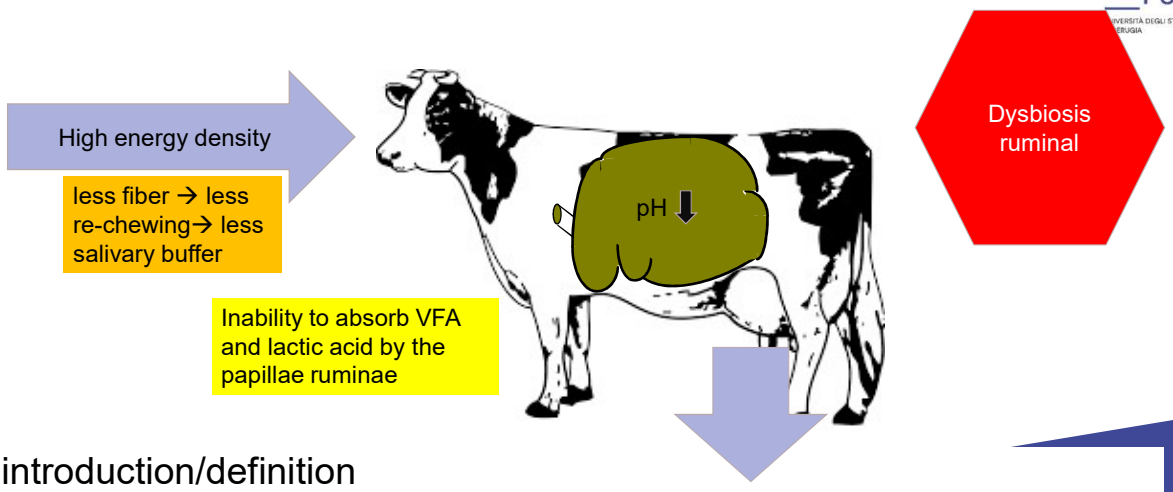


- Protozoa
  - flagellated
    - $10^{3}$ to $10^{4}$ /ml
  - Ciliates
    - $10^{5}$ to $10^{6}$ /ml
- fungi
- Mycoplasma

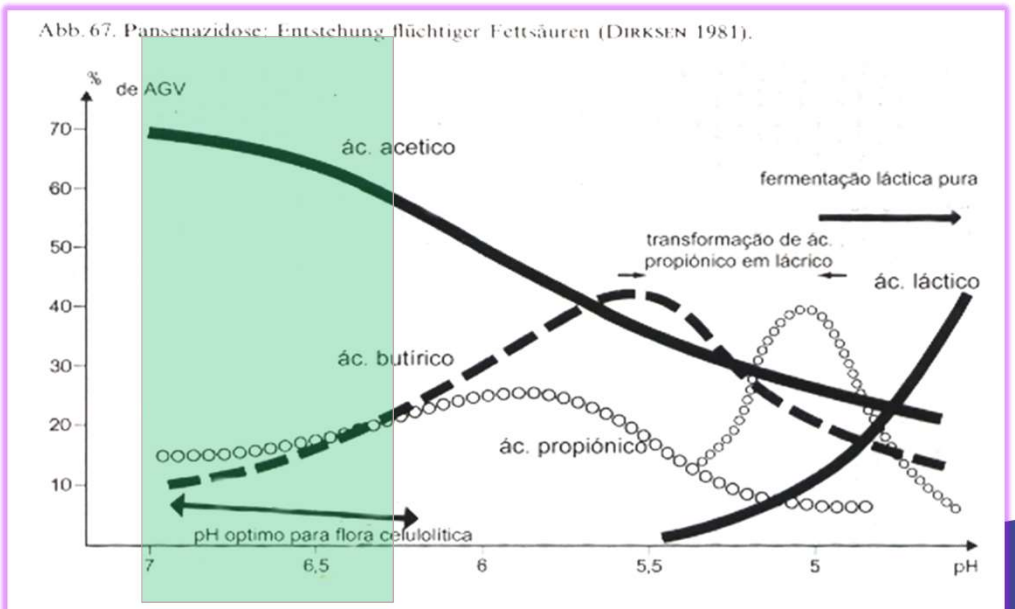
- Bacteria
  - 1x $10^{12}$ /ml
  - Cellulolytic
  - Hemicellulolytic
  - amylolytic
  - Proteolytic
  - methane producers
  - ammonia producers
  - Etc.




# SARA- Sub Acute ruminal acidosis




- introduction/definition
  - ruminal dysbiosis
  - ruminal pH that can normally recover without external intervention and without the onset of immediate critical illness but with economic consequences

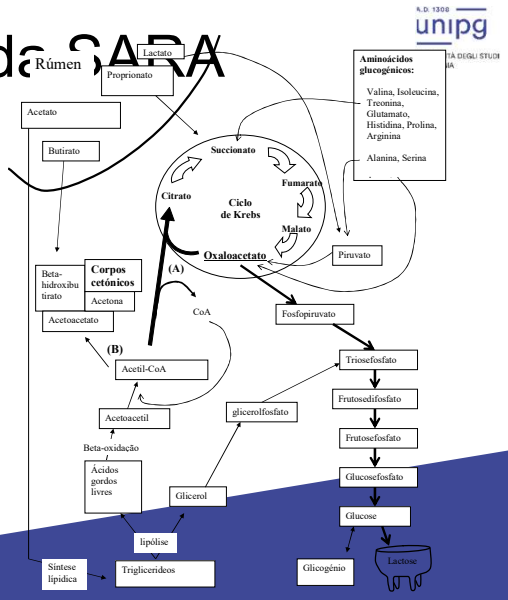



# Risk factors / Etiology

- Bad adaptation to the diet in the *postpartum* **with high energy density foods**
- Inadequate mixing of feeds that allows selection by the animal
- Cows in early lactation
- primiparous cows

# Consequências da SARA

- Decreased food intake
- Reduction of fiber digestion
- Reduction of milk fat
- Reduction in the amount of milk
- diarrhea
- Lameness (laminitis and pododermatitis)
- Poor sanitary condition




# Fat-protein ratio

| Fat-protein ratio in suspicion of acidosis | |
|---|---|
| 1,2 | Optimal ratio of fats and proteins |
| 1,0-1,1 | Increased risk of subacute acidosis (SARA) |
| <1,0 | The cow is more likely to have subacute ruminal acidosis (SARA), the risk of clinical acidosis is increased |

Don't look→ observe!

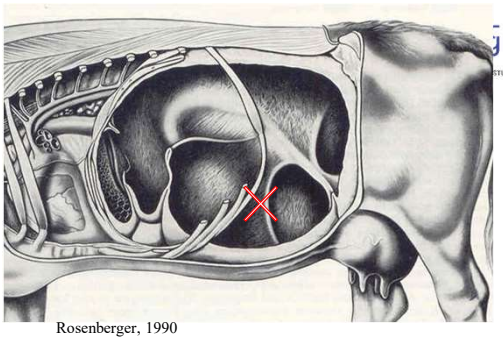
Milk fat/protein ratio

Ex:
Milk fat is **3.67%**
milk protein is **2.98%.**

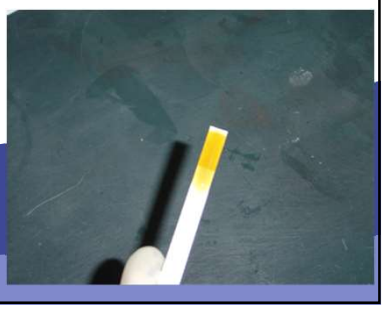
Milk fat/protein ratio = **1.23**

# Diagnosis

- food anamnesis
- Rumen
  - ruminocentesis
  - esophageal tube



Rosenberger, 1990




# Color

- Normal
  - olive green
  - brownish-yellow
- Change
  - lactic acidosis
    - milky gray
  - putrefaction
    - black-green

# Smell

- "aromatic"
- Indifferent
- Fetid → Putrefaction
- Acid → lactic acidosis
- “smell of abomasum”

# Viscosity

- Slightly viscous
- Spittle
- Aqueous
- frothy

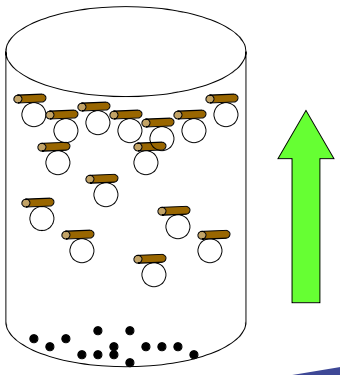
# pH

- 5.5 to 7.4
- Influenced by:
  - food intake
  - saliva


# pH


- rise:
  - 24 hours of fasting
  - ruminal alkalosis
  - rumen putrefaction
  - Saliva contamination
- decrease
  - lactic acidosis
  - abomaso-ruminal reflux

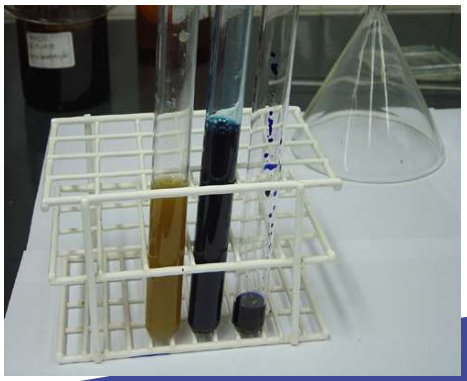
# Sedimentation/Flotation



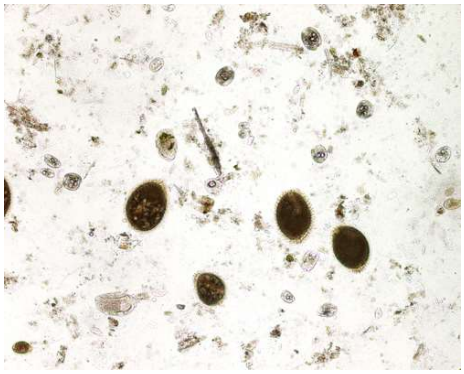
# methylene blue reduction

- 1 ml at 0.03%
- 20 ml ruminal fluid

- < 3 minutes – normal
- > 6 minutes – reduction of microbial activity



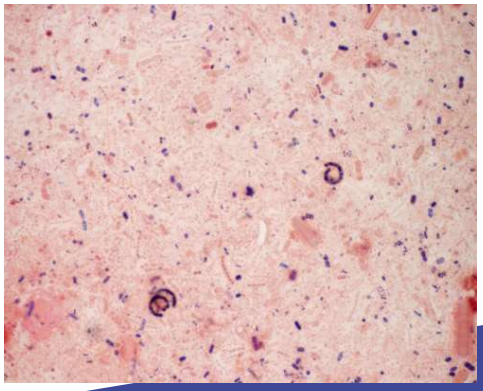
# Protozoa



- single drop
- Coloring with Lugol

# gram

- heterogeneous flora
  - gram negative
  - gram positive

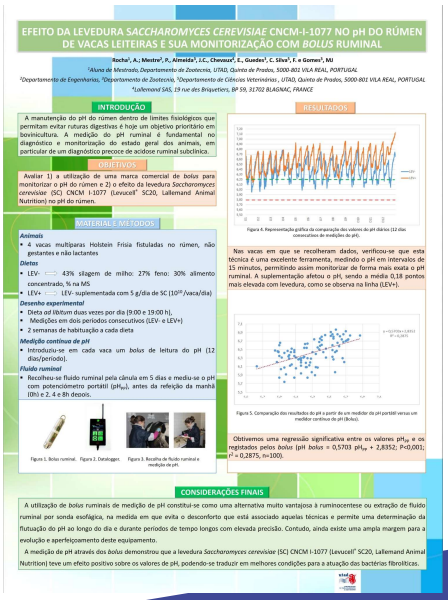


# CHLORINE

- < 30 mmol/l

- > 30 mmol/l
  - → abomasoruminal reflux
  - Excess of NaCl

unipg


EFEITO DA LEVEDURA *SACCHAROMYCES CEREVISIAE* CNCM-I-1077 NO pH DO RÚMEN DE VACAS LEITEIRAS E SUA MONITORIZAÇÃO COM *BOLUS* RUMINAL

Rocha[1], A.; Mestre[2], P., Almeida[3], J.C., Chevaux[4], E., Guedes[3], C. Silva[3], F. e Gomes[3], MJ

[1]Aluna de Mestrado, Departamento de Zootecnia, UTAD, Quinta de Prados, 5000-801 VILA REAL, PORTUGAL
[2]Departamento de Engenharias, [3]Departamento de Zootecnia, [3]Departamento de Ciências Veterinárias , UTAD, Quinta de Prados, 5000-801 VILA REAL, PORTUGAL
[4]Lallemand SAS, 19 rue des Briquetiers, BP 59, 31702 BLAGNAC, FRANCE

INTRODUÇÃO

A manutenção do pH do rúmen dentro de limites fisiológicos que permitam evitar ruturas digestivas é hoje um objectivo prioritário em bovinicultura. A medição do pH ruminal é fundamental no diagnóstico e monitorização do estado geral dos animais, em particular de um diagnóstico precoce de acidose ruminal subclínica.

OBJETIVOS

Avaliar 1) a utilização de uma marca comercial de *bolus* para monitorizar o pH do rúmen e 2) o efeito da levedura *Saccharomyces cerevisiae* (SC) CNCM I-1077 (Levucell® SC20, Lallemand Animal Nutrition) no pH do rúmen.

MATERIAL E MÉTODOS

*Animais*
- 4 vacas multíparas Holstein Frísia fistuladas no rúmen, não gestantes e não lactantes

*Dietas*
- LEV- : 43% silagem de milho: 27% feno: 30% alimento concentrado, % na MS
- LEV+ : LEV- suplementada com 5 g/dia de SC ($10^{10}$/vaca/dia)

*Desenho experimental*
- Dieta *ad libitum* duas vezes por dia (9.00 e 19.00 h),
- Medições em dois períodos consecutivos (LEV- e LEV+)
- 2 semanas de habituação a cada dieta

*Medição contínua de pH*
- Introduziu-se em cada vaca um *bolus* de leitura do pH (12 dias/período).

*Fluído ruminal*
- Recolheu-se fluído ruminal pela cânula em 5 dias e mediu-se o pH com potenciómetro portátil ($pH_{Port}$), antes da refeição da manhã (0h) e 2, 4 e 8h depois.

Figura 1. Bolus ruminal. Figura 2. Datalogger. Figura 3. Recolha de fluído ruminal e medição de pH.

RESULTADOS


Figura 4. Representação gráfica da comparação dos valores do pH diários (12 dias consecutivos de medições de pH).

Nas vacas em que se recolheram dados, verificou-se que esta técnica é uma excelente ferramenta, medindo o pH em intervalos de 15 minutos, permitindo assim monitorizar de forma mais exata o pH ruminal. A suplementação afetou o pH, sendo a média 0,18 pontos mais elevada com levedura, como se observa na linha (LEV+).


Figura 5. Comparação dos resultados do pH e pontir do um medidor do pH portátil versus um medidor contínuo do pH (*Bolus*).

Obtivemos uma regressão significativa entre os valores $pH_{Bol}$ e os registados pelos *bolus* (pH *bolus* = 0,5703 $pH_{Port}$ + 2,8352; P<0,001; $r^2$ = 0,2875, n=100).

CONSIDERAÇÕES FINAIS

A utilização de *bolus* ruminais de medição de pH constitui-se como uma alternativa muito vantajosa à ruminocentese ou extração de fluído ruminal por sonda esofágica, na medida em que evita o desconforto que está associado aquelas técnicas e permite uma determinação da flutuação do pH ao longo do dia e durante períodos de tempo longos com elevada precisão. Contudo, ainda existe uma ampla margem para a evolução e aperfeiçoamento deste equipamento.

A medição de pH através dos *bolus* demonstrou que a levedura *Saccharomyces cerevisiae* (SC) CNCM I-1077 (Levucell® SC20, Lallemand Animal Nutrition) teve um efeito positivo sobre os valores de pH, podendo-se traduzir em melhores condições para a atuação das bactérias fibrolíticas.

EFEITO DA LEVEDURA *SACCHAROMYCES CEREVISIAE* CNCM-I-1077 NO pH DO RÚMEN DE VACAS LEITEIRAS E SUA MONITORIZAÇÃO COM *BOLUS* RUMINAL

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Figura 1. Bolus ruminal. Figura 2. Datalogger. Figura 3. Recolha de fluído ruminal e medição de pH.

# Diagnosis ( continuation )

- Macroscopic evaluation of feces
- **lipopolysaccharide** (LPS) fecal
- Blood gas analysis (pCO2, pO2 and pH)
- acute phase proteins

http://www.nadis.org.uk/bulletins/nutrition-of-dairy-herds/part-2-sub-acute-ruminal-acidosis-%28sara%29.aspx

# Feeding behavior

# BCS

Original papers

# System specification and validation of a noseband pressure sensor for measurement of ruminating and eating behavior in stable-fed cows

Nils Zehner [a], Christina Umstätter [a], Joël J. Niederhauser [b], Matthias Schick [a]

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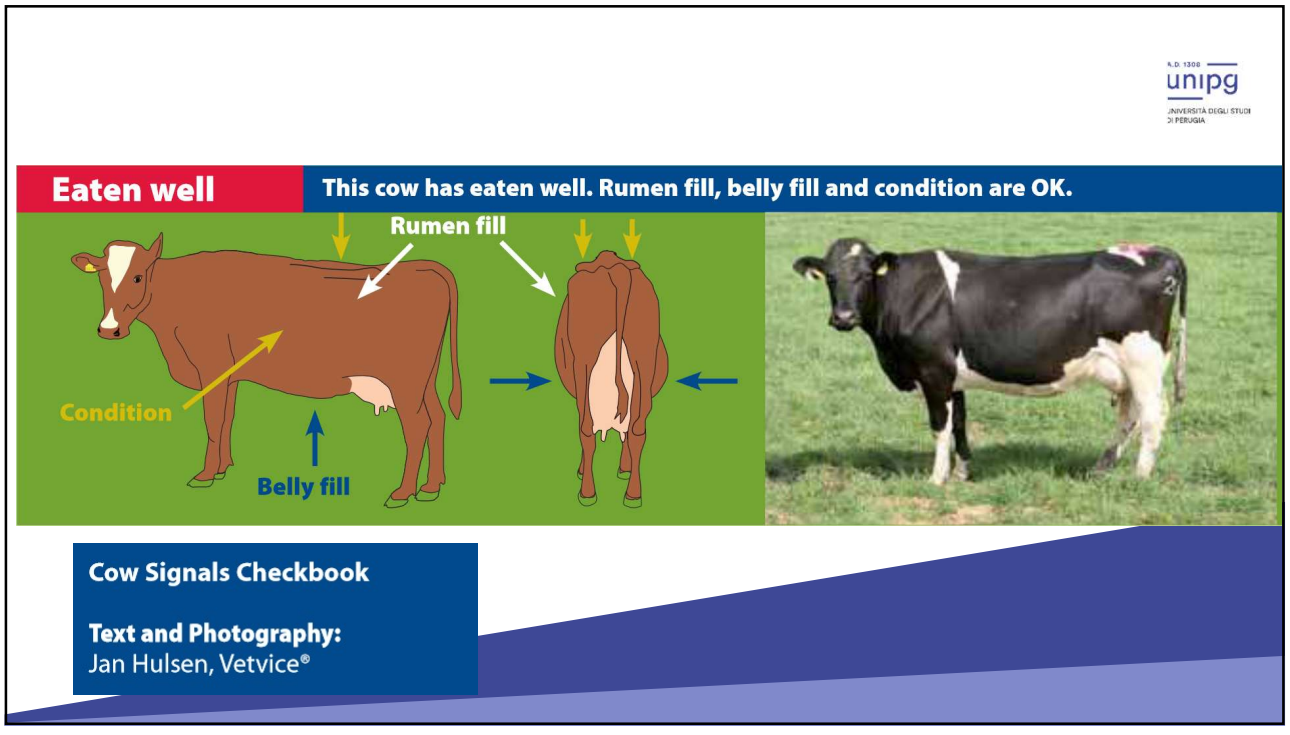
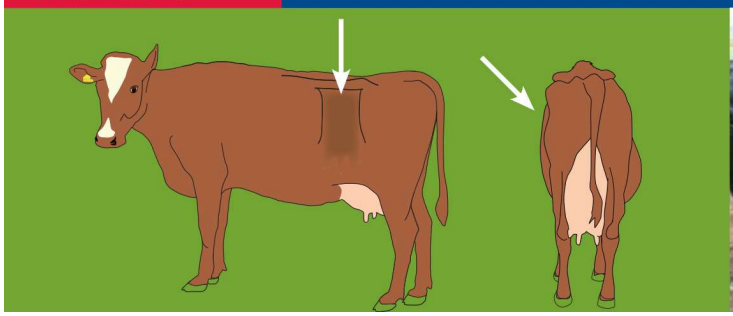


## Rumen fill

This cow has not eaten enough *TODAY.*

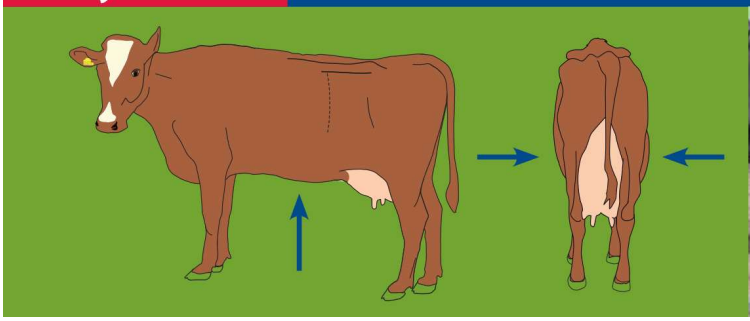


Cow Signals Checkbook

**Text and Photography:**
Jan Hulsen, Vetvice®

## Belly fill

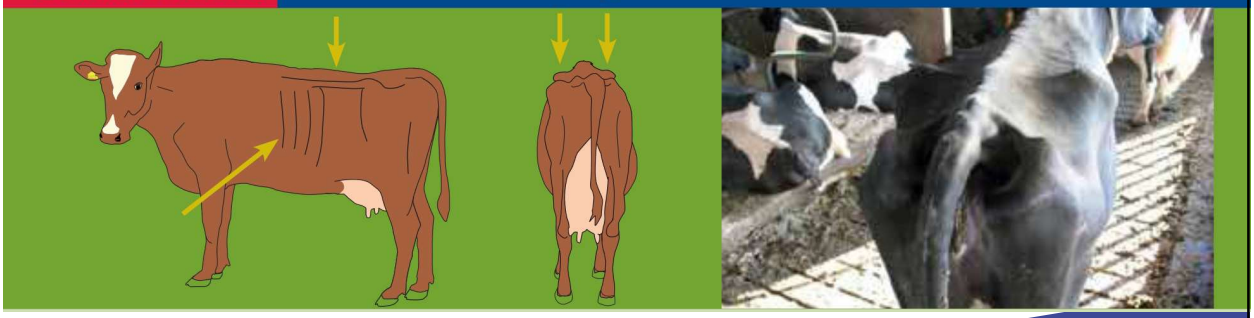
This cow has not eaten enough *THIS WEEK.*



Cow Signals Checkbook

**Text and Photography:**
Jan Hulsen, Vetvice®

**Condition Score** This cow has not eaten enough *THIS MONTH*.



**Cow Signals Checkbook**

**Text and Photography:**
Jan Hulsen, Vetvice®

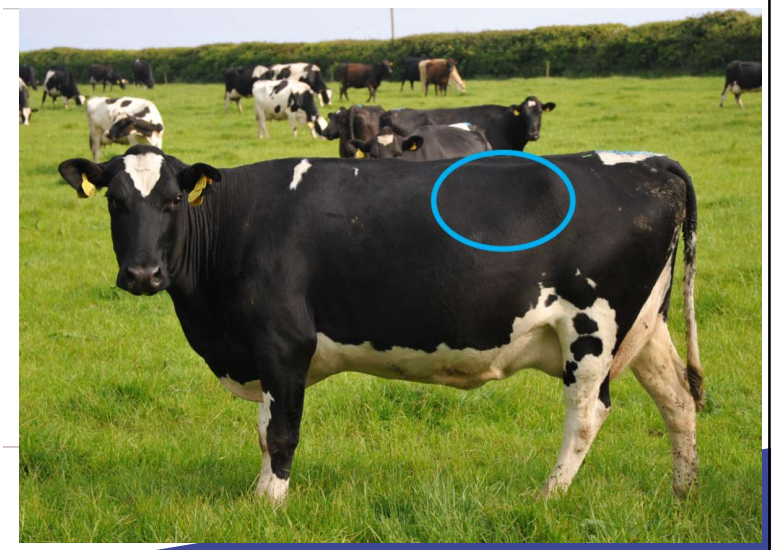
**Score 1** Deep dip more than one hands width. The skin curves under the vertebrae one hands width. Hollow shape is rectangular, indicating that the cow has not eaten in the last 24 hours.

**Score 2** Dip in the flank approx. one hands width deep and space under vertebrae is approx. half a hand's width. Hollow shape is triangular. Seen in 1st week after calving, but otherwise signifies a problem.

**Score 3** Slight, visible dip in the flank, small dip under the vertebrae approx. 1 hand's width before bulging out slightly. Correct score for milking cows.

**Score 4** No dip visible, slight bulge under vertebrae and moving downwards. Correct score for cows at the end of lactation and dry cows, also minimum score for pre-calving.

**Score 5** Flank is flat or bulging and curves outwards beneath the vertebrae. Skin may be tight over the belly and there is no visible transition between the flank and ribs, seen in dry cows.



## Score 1

## How to score

- Deep dip in left flank, more than one hand-width deep after rib.
- Skin curves under lumbar vertebrae one hand's width.
- Skin fold from hook bone falls vertically, so hollow shape looks rectangular.

***For example***

This cow has eaten nothing in the last 24 hours.

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Adapted from Dairy Veterinary Consultancy Ltd Rumen Fill Scorecard, 2014

Elanco

## Score 2


## How to score

- Dip in left flank, one hand width deep after last rib.
- Skin curves under lumbar vertebrae, half a hand's width.
- Skin fold from hook bone runs diagonally, so hollow shape looks like a triangle.

***For example***

Not unusual in 1st week after calving, but after that, it signifies a problem/too little intake.

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## Score 3

## How to score

- Slight dip visible in left flank, after last rib.
- Skin under lumbar vertebrae runs vertically down for one hand's width before bulging out slightly.
- Skin fold from hook bone is hardly visible.

***For example***

This is desired score for milking cows having sufficient intakes.

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## Score 4

## How to score

- No dip is visible in left flank, after last rib.
- Skin under lumbar vertebrae curves outwards.
- Skin fold from hook bone is not visible.

***For example***

This is correct score for milking cows at the end of lactation and through the dry period. It is the target minimum score for pre-calvers.

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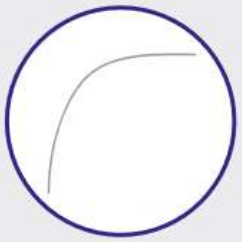
## Score 5

## How to score

- Skin is flat, or slightly bulging, on left flank, after last rib.
- Skin under lumbar vertebrae curves outwards, so that bones are not visible.
- The skin over the whole belly is quite tight, and there is no visible transition between the flank and the ribs.

***For example***

This score is often seen in dry cows.



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Original Research

# A Novel Chart to Score Rumen Fill Following Simple Sequential Instructions

Marie Schneider[1,2,*], Leonie Hart[1], Eva Gallmann[2], Christina Umstätter[3]

[1] Department of Competitiveness and System Evaluation, Agroscope, CH-8356 Ettenhausen, Switzerland
[2] Institute of Livestock Systems Engineering, University of Hohenheim, DE-70599 Stuttgart, Germany
[3] Thünen Institute of Agricultural Technology, Thünen Institute, DE-38116 Braunschweig, Germany

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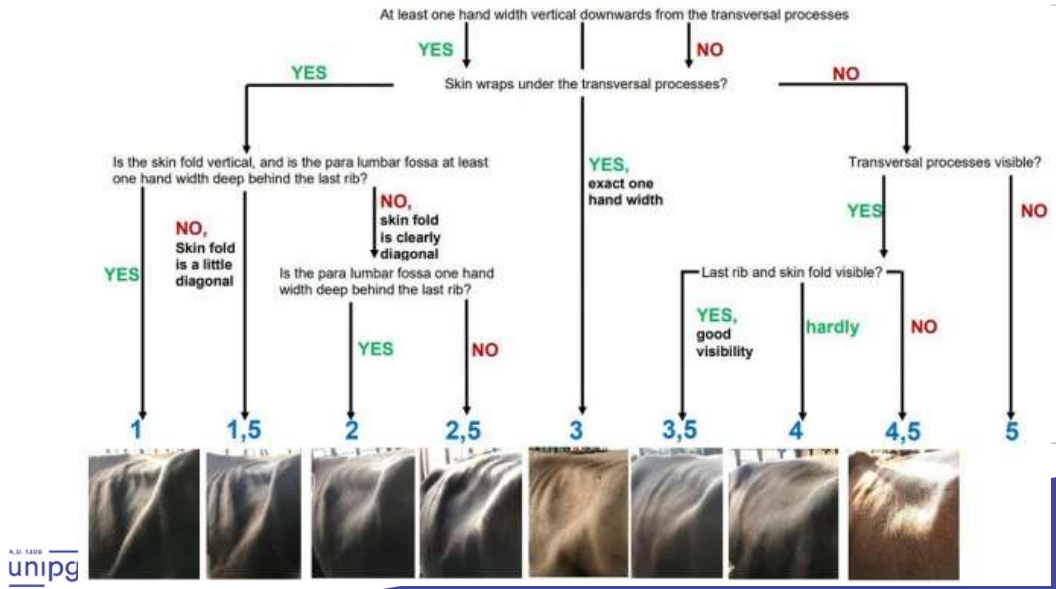
## Scoring Rumen Fill

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## Using Manure Evaluation as a Diagnostic Tool digestive problems

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## Manure

**food** is eaten

1 ½ TO 3 DAYS

passed as **MANURE**

# What your cow's manure is telling you?

**Consistency**

relates to the ratio of the amount of solid to the amount of water

**Level of Digestion**

(bits of undigested food)

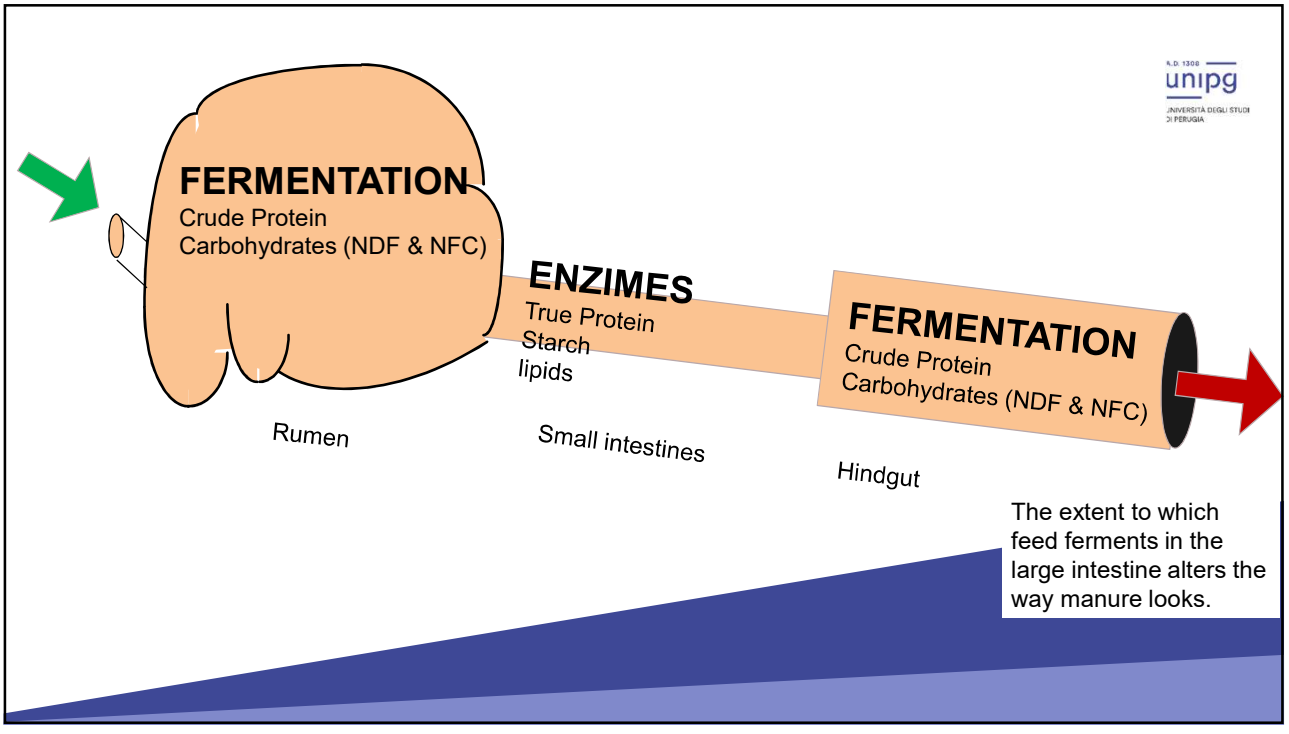
**Mucous**
(inflamation/disease)

**Colour**

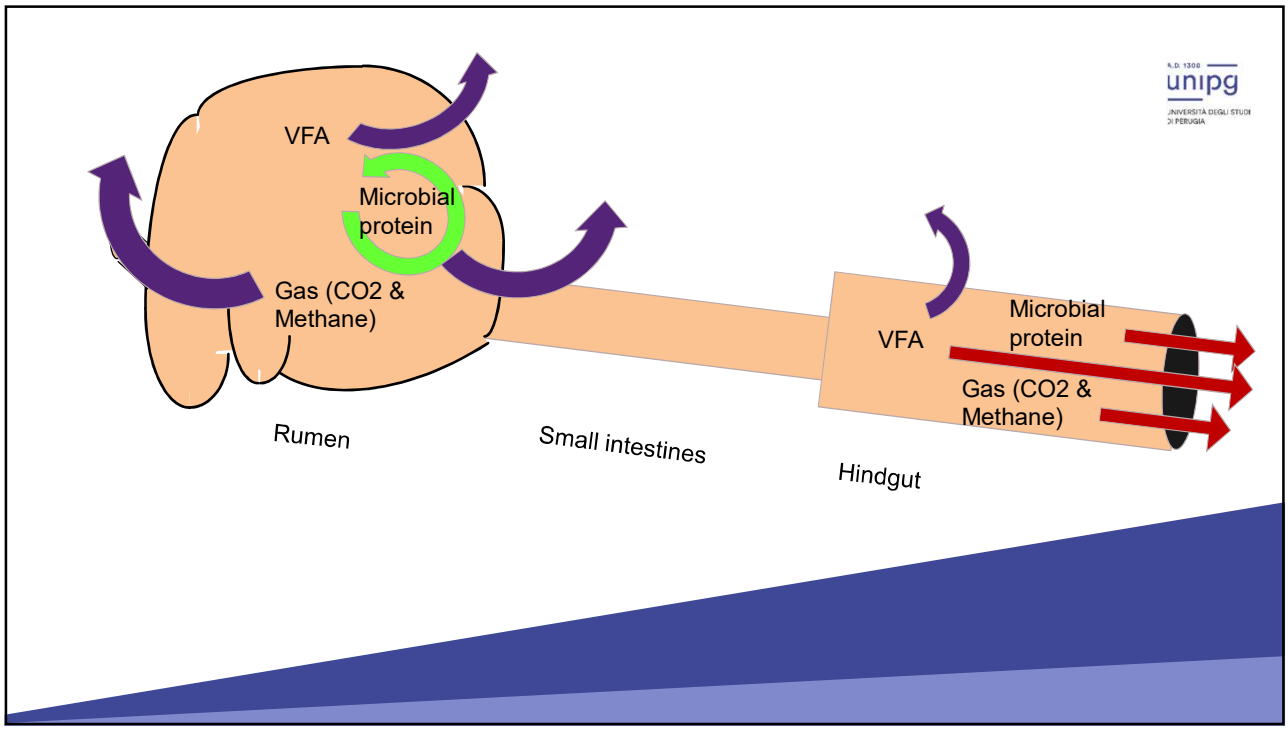
- Evaluating fresh, undisturbed manure
  - animals will almost always defecate when they stand up

- The rate of passage for
- the diet that you feed a beef animal takes about 36-72 hours for it to pass through the digestive tract

  - fresh fecal parts represents the undigested part of the diet fed in the last 2-3 days




The extent to which feed ferments in the large intestine alters the way manure looks.




**foamy manure** with the tiny pieces of grain in it shows what manure looks like when there is gas production from **too much hindgut fermentation**.


**Using Manure Evaluation as a Diagnostic Tool for Feeding Programs**

Mary Beth Hall
U. S. Dairy Forage Research Center
USDA - Agricultural Research Service
Madison, WI

recognizable **undigested feed** such as green grass, orange citrus pulp, or cottonseed with the lint still intact,

something is wrong with the rumen – it is not retaining feed for digestion like it should (often from **not enough effective fiber/too much starch**).


**Using Manure Evaluation as a Diagnostic Tool for Feeding Programs**

Mary Beth Hall
U. S. Dairy Forage Research Center
USDA - Agricultural Research Service
Madison, WI

| What the manure looks like | Possible dietary causes (not disease) |
|---|---|
| **Loose manure** | ●High protein (total or soluble); pasture<br>●Salts or magnesium oxide in ration<br>●High water intake (heat stress) |
| **Diarrhea** | ●Spoiled, moldy feed or silage<br>●Ruminal acidosis<br>●Increased hindgut fermentation |
| **Foamy manure or Mucin casts** | ●Ruminal acidosis<br>●Increased hindgut fermentation |
| **Large particles, undigested feed** | ●Cows are sorting feed; slug feeding<br>●Not enough chewable fiber/forage/feed<br>●Ruminal acidosis |
| **Manure variable in a feeding group** | ●Cows are sorting feed; slug feeding<br>●Spoiled, moldy feed or silage (spoilage does not usually mix uniformly) |


- Manure that is liquid or “soupy”
- “projected in a stream”
- extremely fast rate of passage and
- large feed particles
- stalks of undigested fiber (greater than 0.5” length)

occurs due to:
- disease
- not enough fiber
- abrupt introduction of excess starch, protein, urea, or minerals,
- early spring pasture,
- spoiled or moldy feed is present in the diet.


- manure is“loose”
- does not form a distinct pile, will splatter and spread on impact,
- less than 2,5 cm in height

occurs due to:
- High energy, high concentrate diets this category
- restricted amount of dry, long-stem fiber in the diet.
- Cows on lush green pasture


- Manure- optimal score!
- oatmeal-like appearance
- Will stack up to 3,5 to 5 cm hight
- concentric rings
- plopping sound when it hits concrete floor

This manure
tells you that the protein, energy, and fiber in the diet is balanced and the rumen microbes are fermenting properly


- Manure- is thicker and stacks up over 5 cm

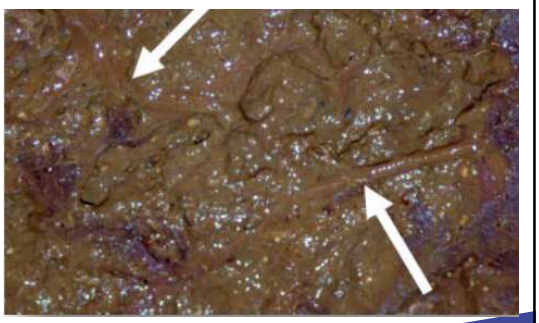
This manure
may reflect low quality forages
shortage of protein in the total and/or digestible feedstuffs,


- Manure- firm fecal balls (like horse manure)

This manure
- Indicates that a very non-digestible diet is being fed
- Likely protein deficient,
- Source of forage is of poor-quality
- Eventualy indication of salt deficiency and/or dehydration

**Manure Color:**

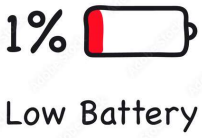
- **Dark green** is typical of pasture-based diets.
- **Brown** is typical of hay-based diets.
- **Gray** is typical of grain-based diets.
- **Pale** represents fast rate of passage (less bile present) and more water present.
- **Dark** represents slow rate of passage (more bile present) and less water present.
- **Black** (or tarry) indicates hemorrhage in the small intestine.
- **Red** streaks indicated bleeding in the rectum.
- **Bloody diarrhea** is associated with coccidiosis.
- **Foamy and liquidy** (with mucin casts) is associated with acidosis.

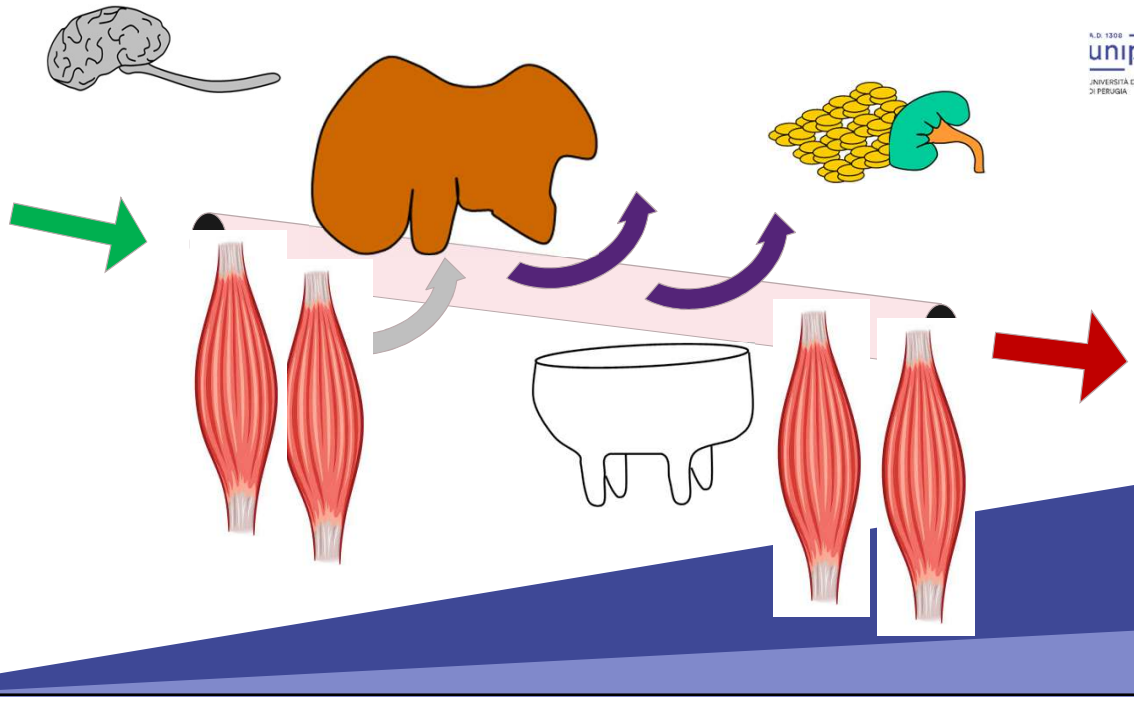


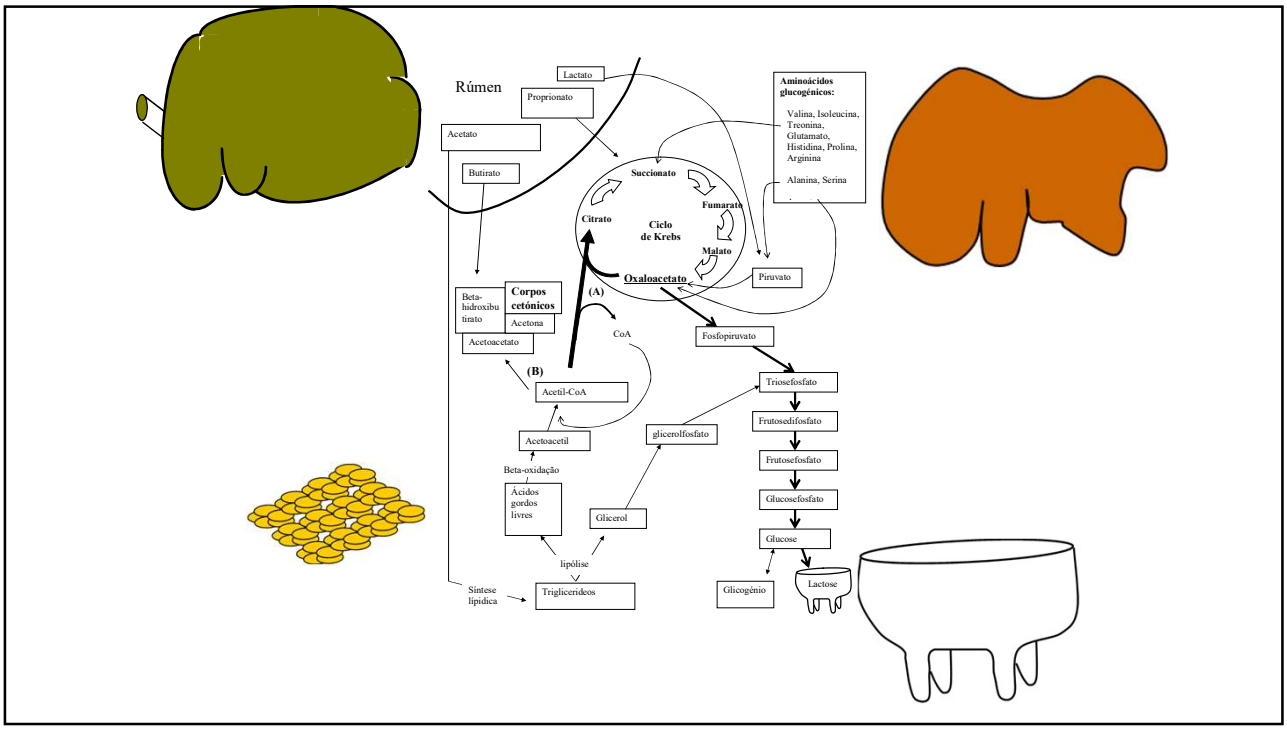

Don't look→ observe!

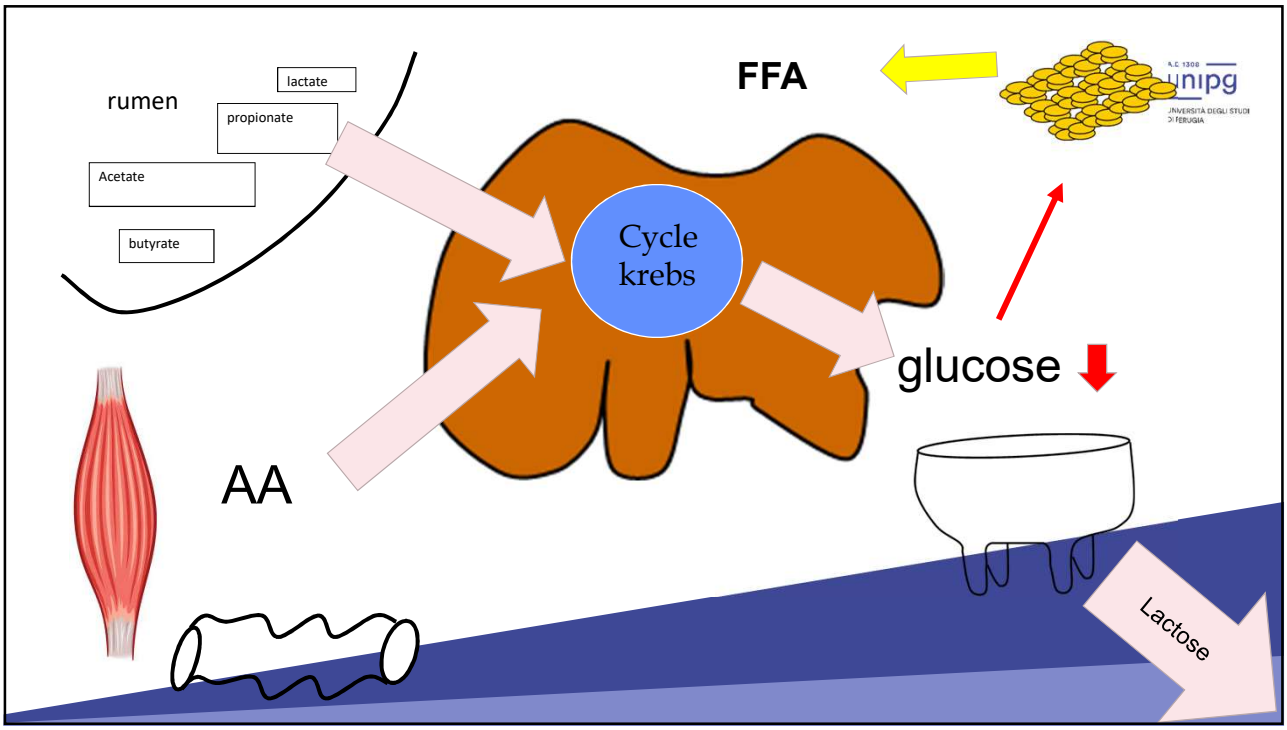
# Negative Energy Balance

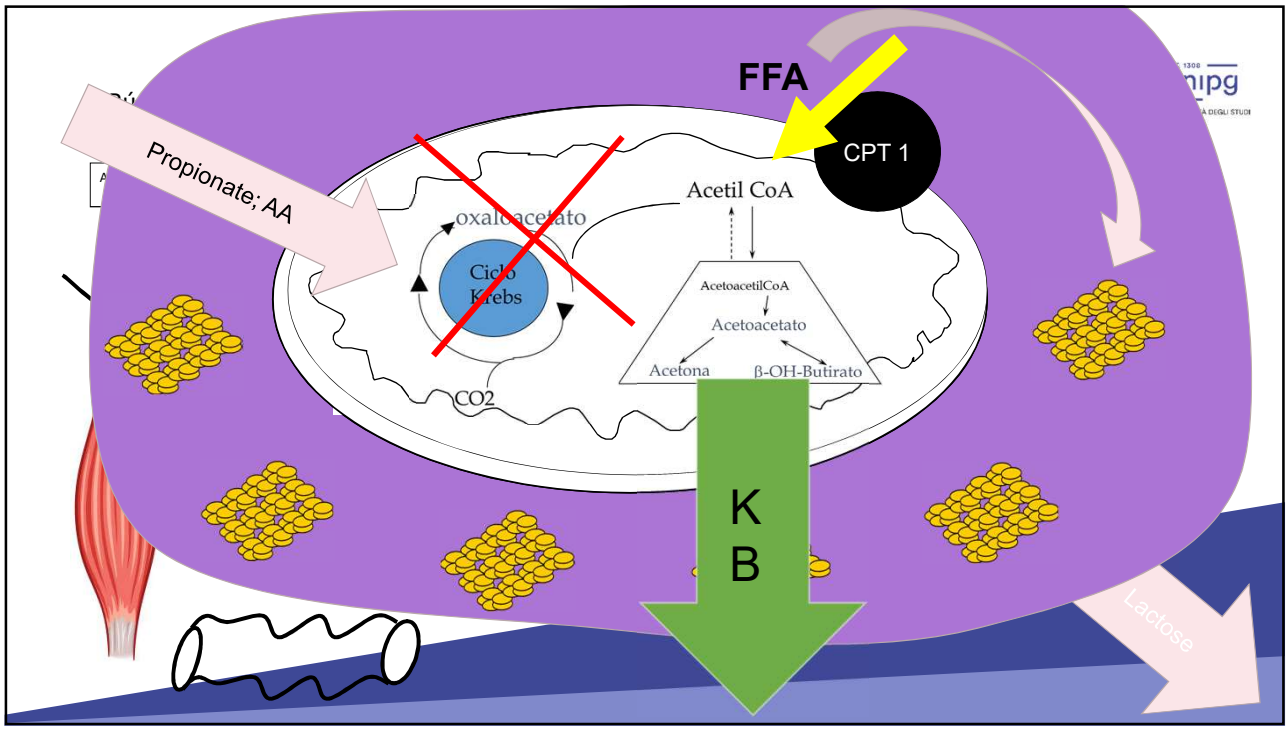
- ketosis
- fat cow syndrome
- pregnancy toxemia



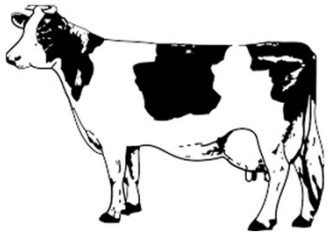




Rúmen
Lactato
Proprionato
Acetato
Butirato
Aminoácidos glucogénicos:
Valina, Isoleucina, Treonina, Glutamato, Histidina, Prolina, Arginina
Alanina, Serina
Succionato
Fumarato
Citrato
Ciclo de Krebs
Malato
Oxaloacetato
Piruvato
Beta-hidroxibutirato
Corpos cetónicos
Acetona
Acetoacetato
(A)
CoA
Fosfopiruvato
(B)
Acetil-CoA
Triosefosfato
Frutosedifosfato
Frutosefosfato
Glucosefosfato
Glucose
glicerolfosfato
Acetoacetil
Beta-oxidação
Ácidos gordos livres
Glicerol
lipólise
Síntese lipídica
Triglicerídeos
Glicogénio
Lactose


rumen
lactate
propionate
Acetate
butyrate
FFA
Cycle krebs
glucose
AA
Lactose




# KETOSIS



high ketone bodies
decreased appetite,
Weight loss
Reduction in milk production
Increased Endometritis Mastitis and Pododermatitis
reproductive changes
Abomasal Displacement Increase
nervous symptomatology

Dry Period

negative energy balance

Poor feeding and breeding management
Enlarged and more responsive adipose

= ketosis
lipomobilization
Hepatic steatosis
reserved prognosis
Sudden death

## HEPATIC LIPIDOSIS

# Fat-protein ratio in suspected Ketosis

| | |
|---|---|
| >1,4 | There is a high probability that a cow has subclinical ketosis, the risk of clinical ketosis increases |
| 1,3-1,4 | Increased risk of subclinical ketosis |
| 1,2 | Optimal ratio of fats and proteins |

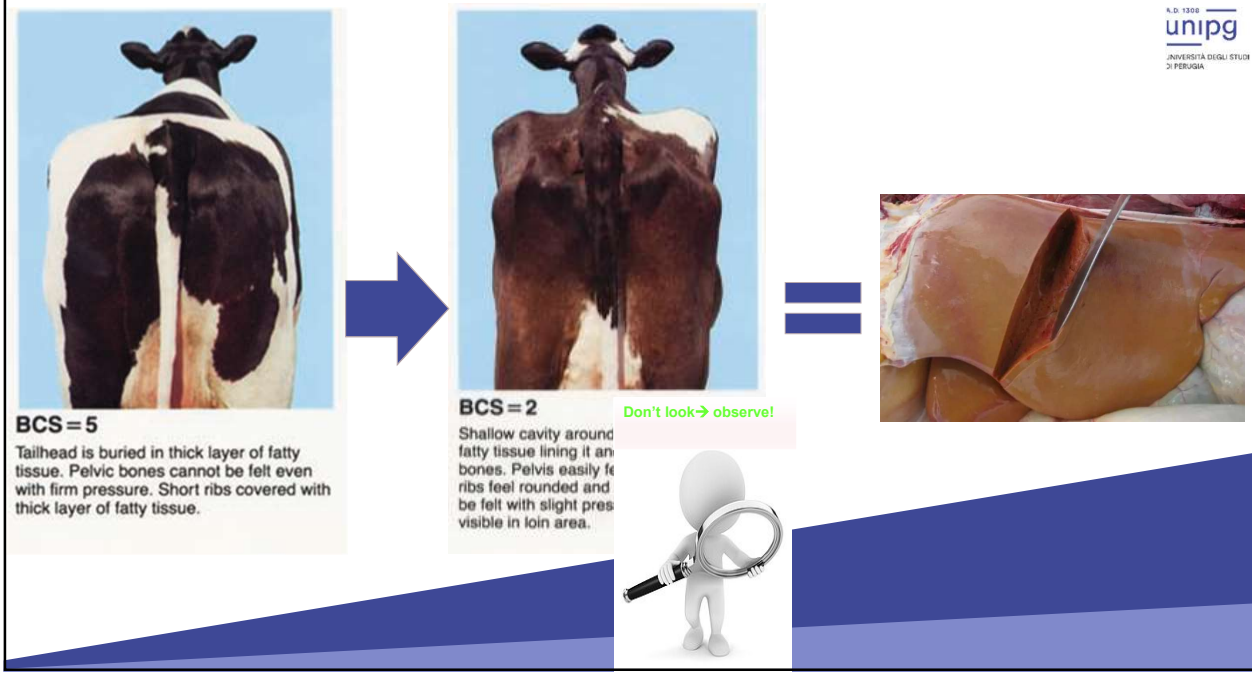
Milk fat/protein ratio

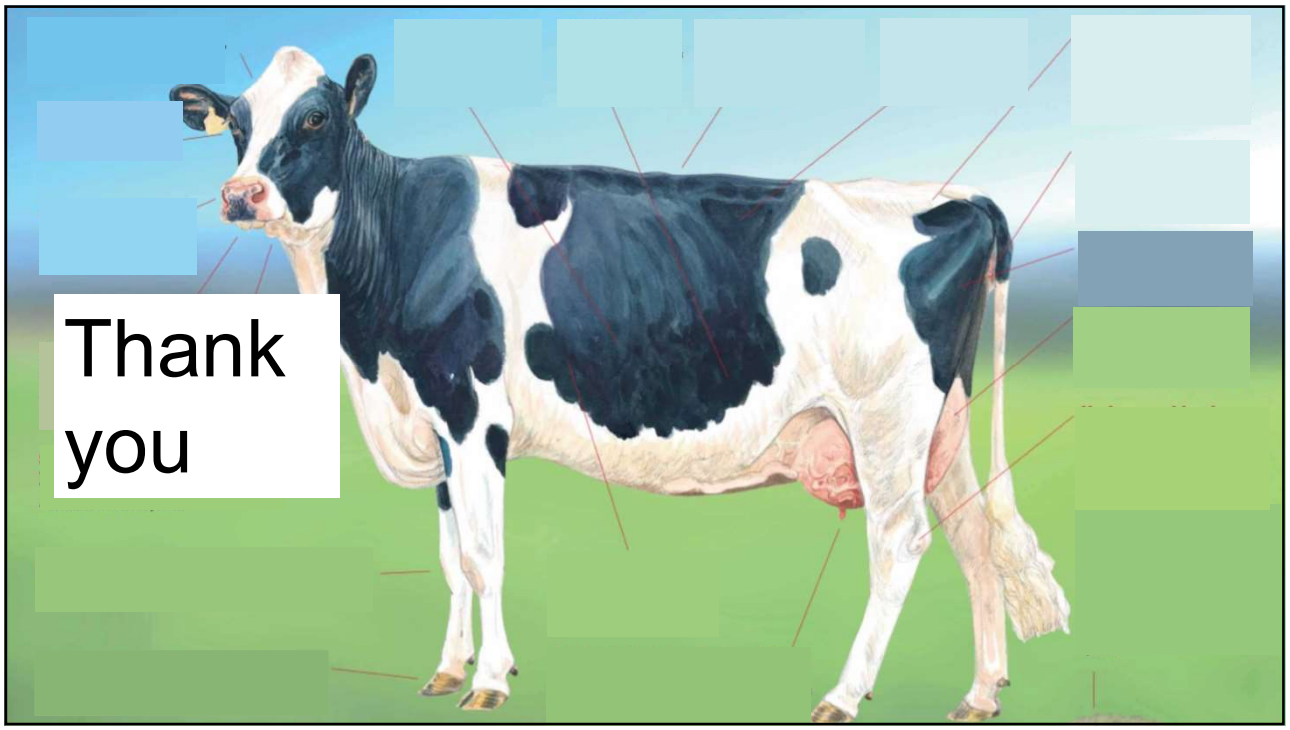
Ex:
Milk fat is **3.67%**
milk protein is **2.98%.**

Milk fat/protein ratio = **1.23**


# Ketosis diagnosis

- checking milk fat/protein ratio at 4th week of lactation,
- checking serum β- hydroxybutyric acid (BHBA) level at the 2nd week of lactation.




# Thank you