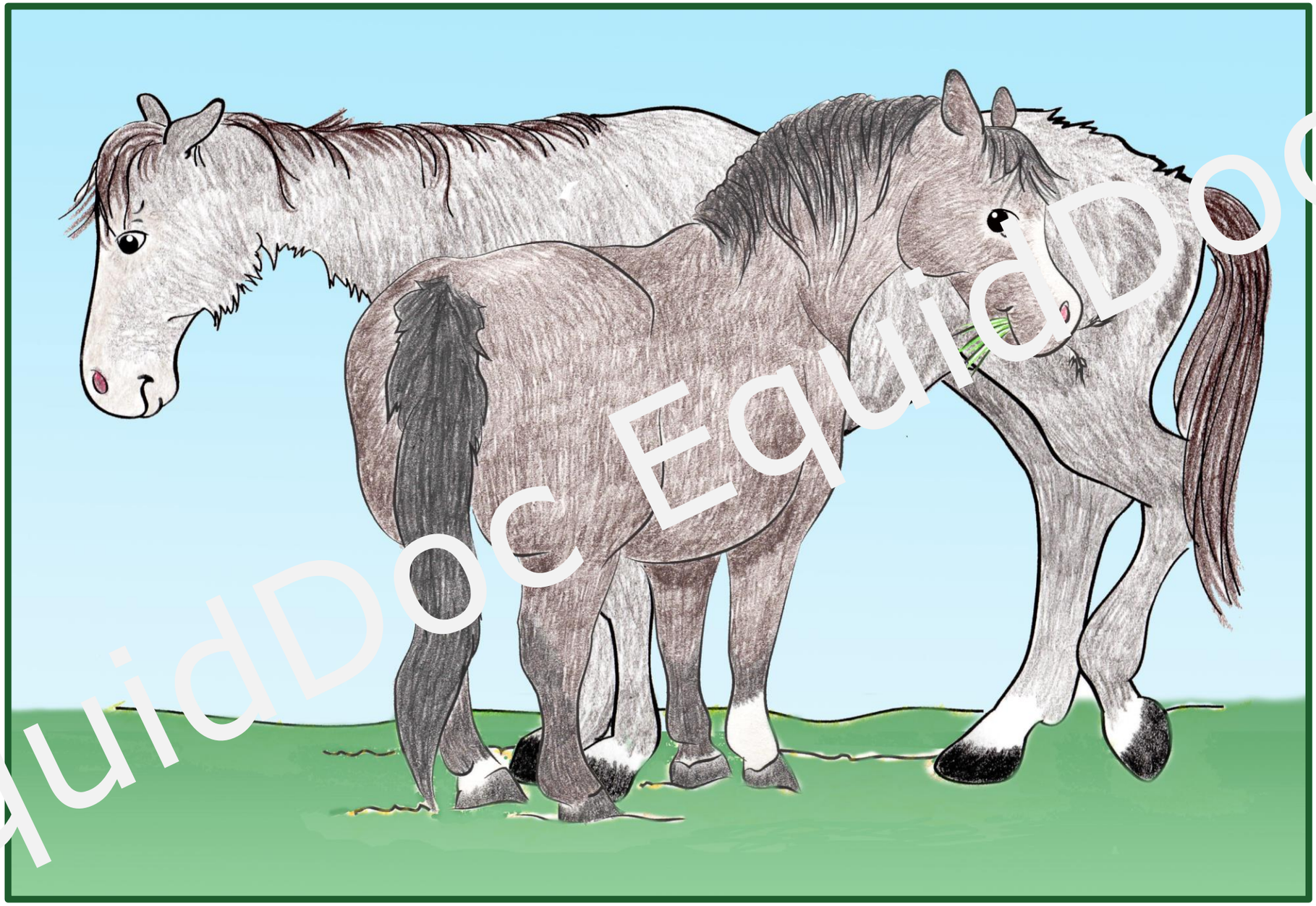
Metabolic Disorders in Horses



Cushing's Disease (PPID) & Insulin Resistance

EquidDoc
VETERINARY SERVICES LLC

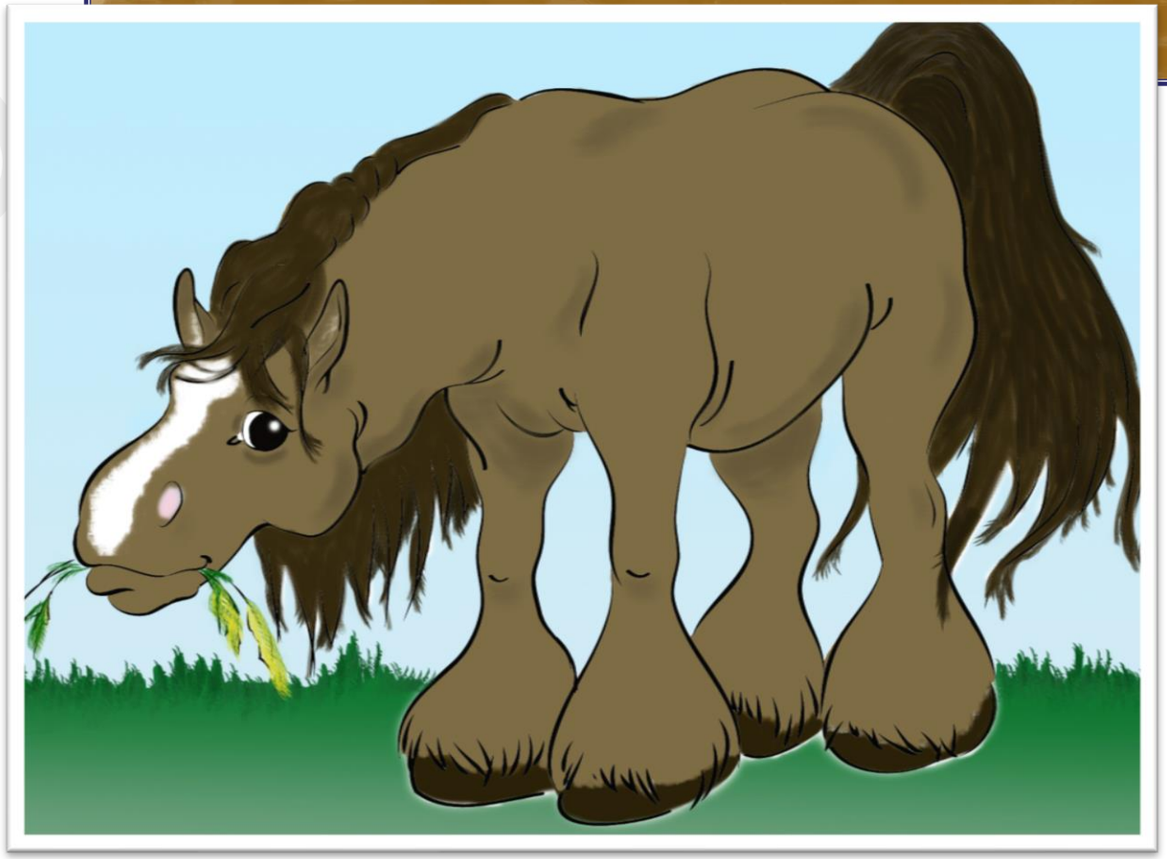
Introductions

- Dr. Caitlin Eaton
- Dr. Jen Cassano
- Renee Gregoire
- Jackie Gosselin
- Kara Kirchherr from Boehringer Ingelheim
  - Thank you!

EquidDoc VETERINARY SERVICES LLC

Overview

1. Review of BCS and principles of nutrition
2. Equine Metabolic Syndrome
3. Pituitary Pars Intermedia Dysfunction (PPID)



EquidDoc VETERINARY SERVICES LLC

BODY CONDITION SCORING
FEEDING 101

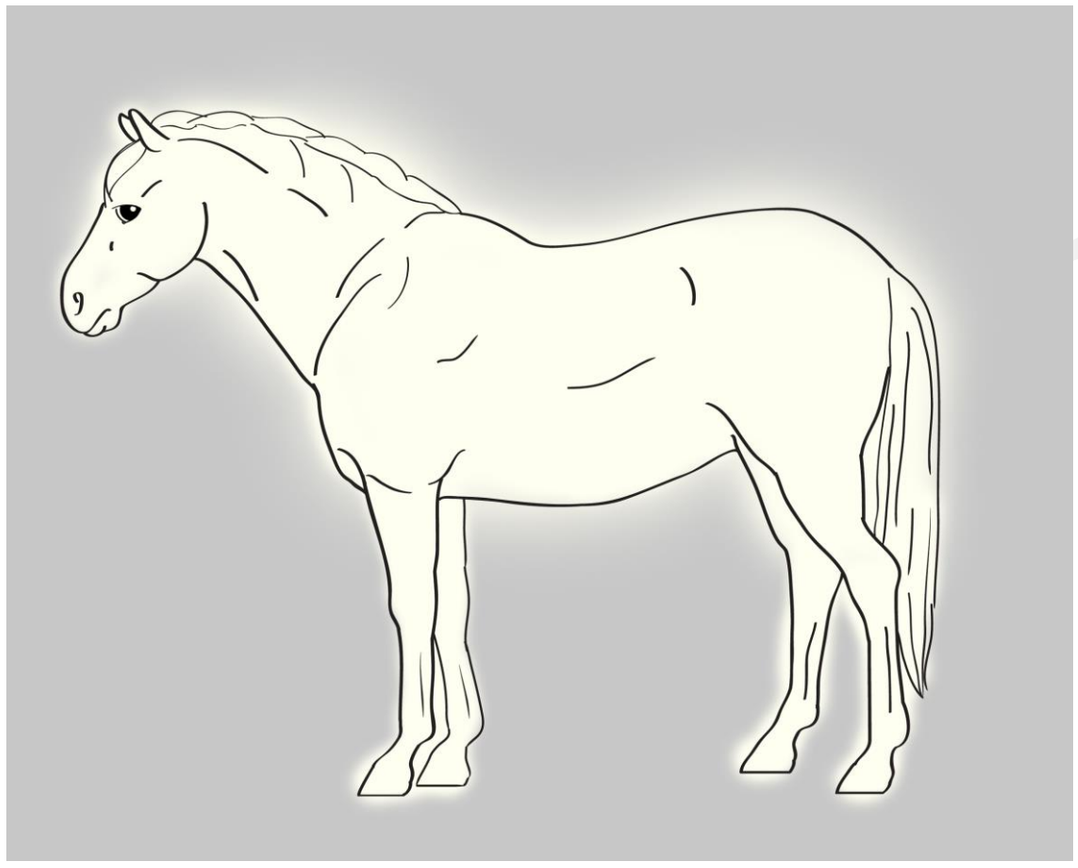
- How do I assess body condition

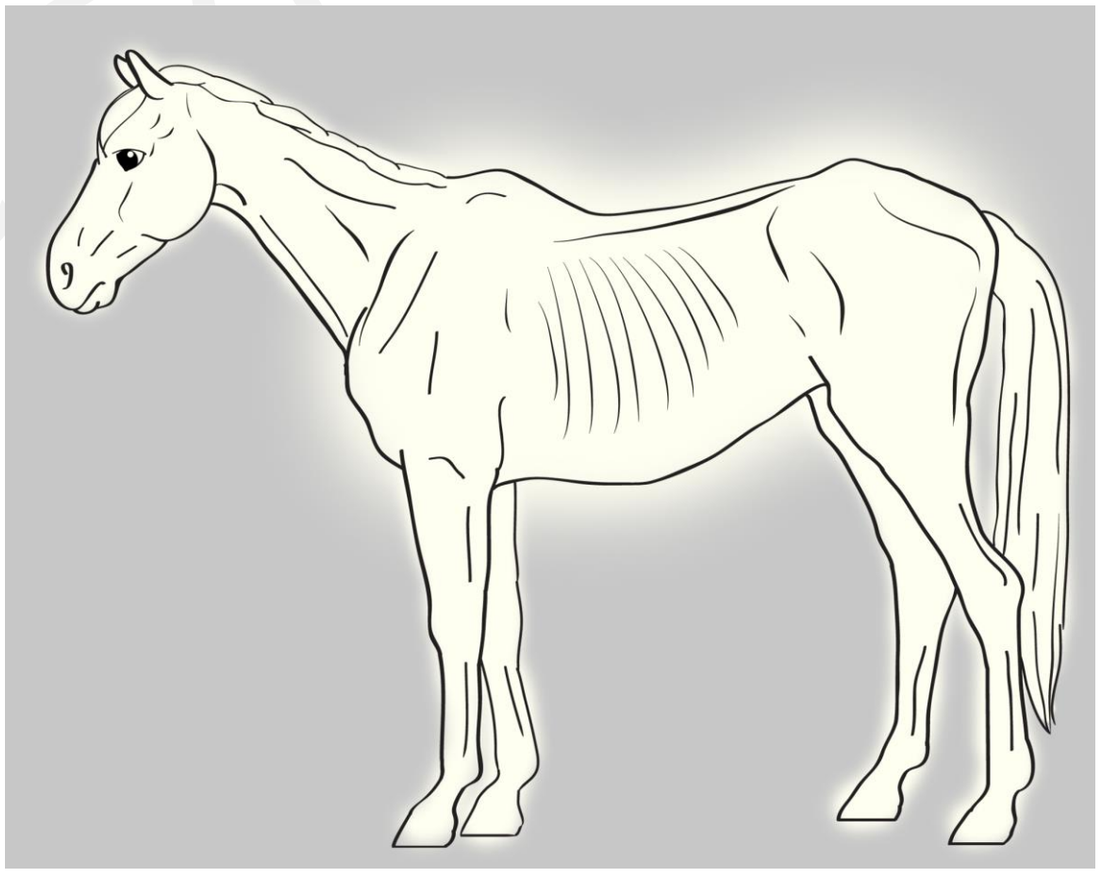
- WHAT – WHY and HOW of feeding

EquidDoc VETERINARY SERVICES LLC

Body Condition

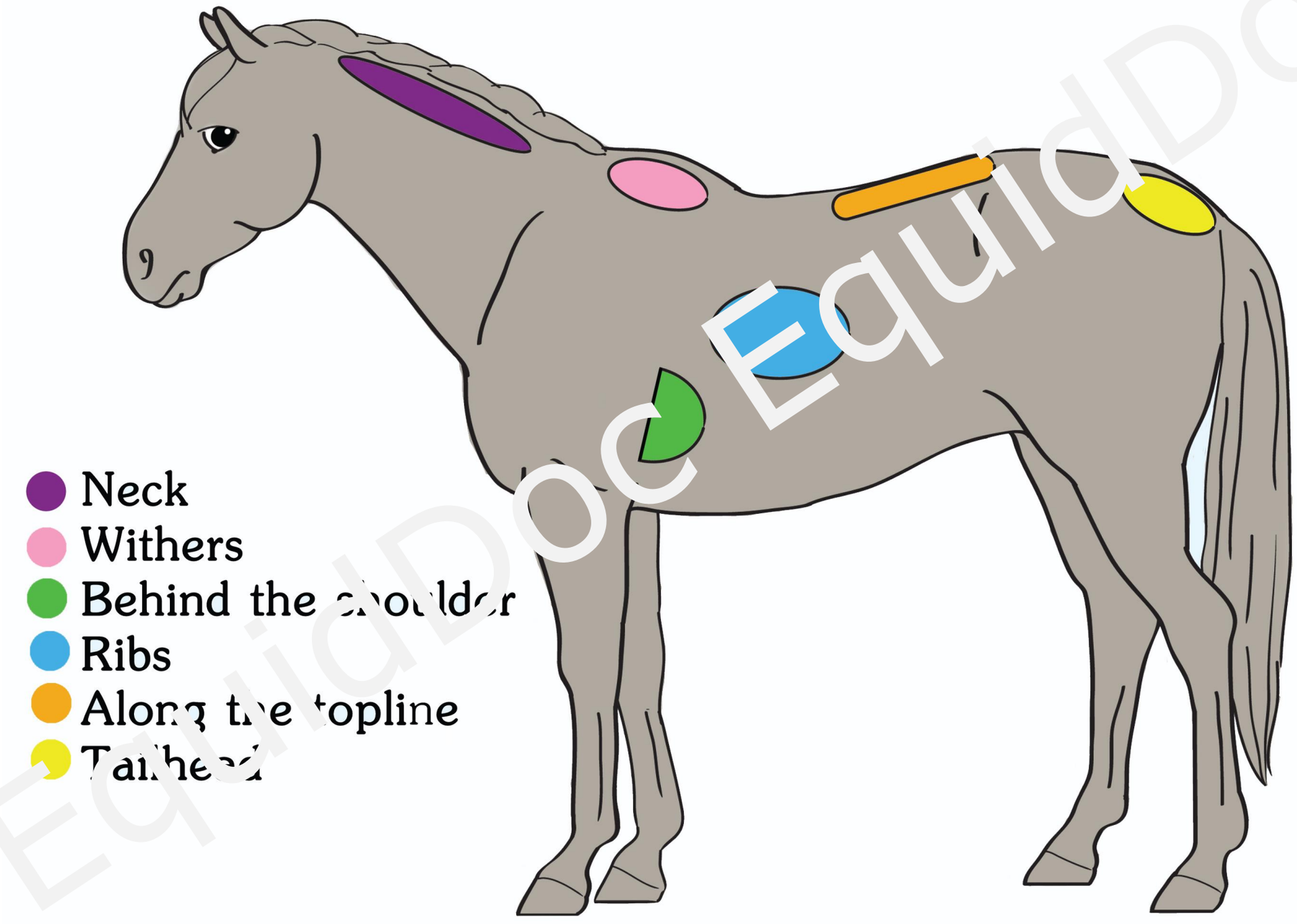
- Body condition score
  - What is body condition scoring
  - What does it mean





EquidDoc
VETERINARY SERVICES LLC

Regional Adiposity



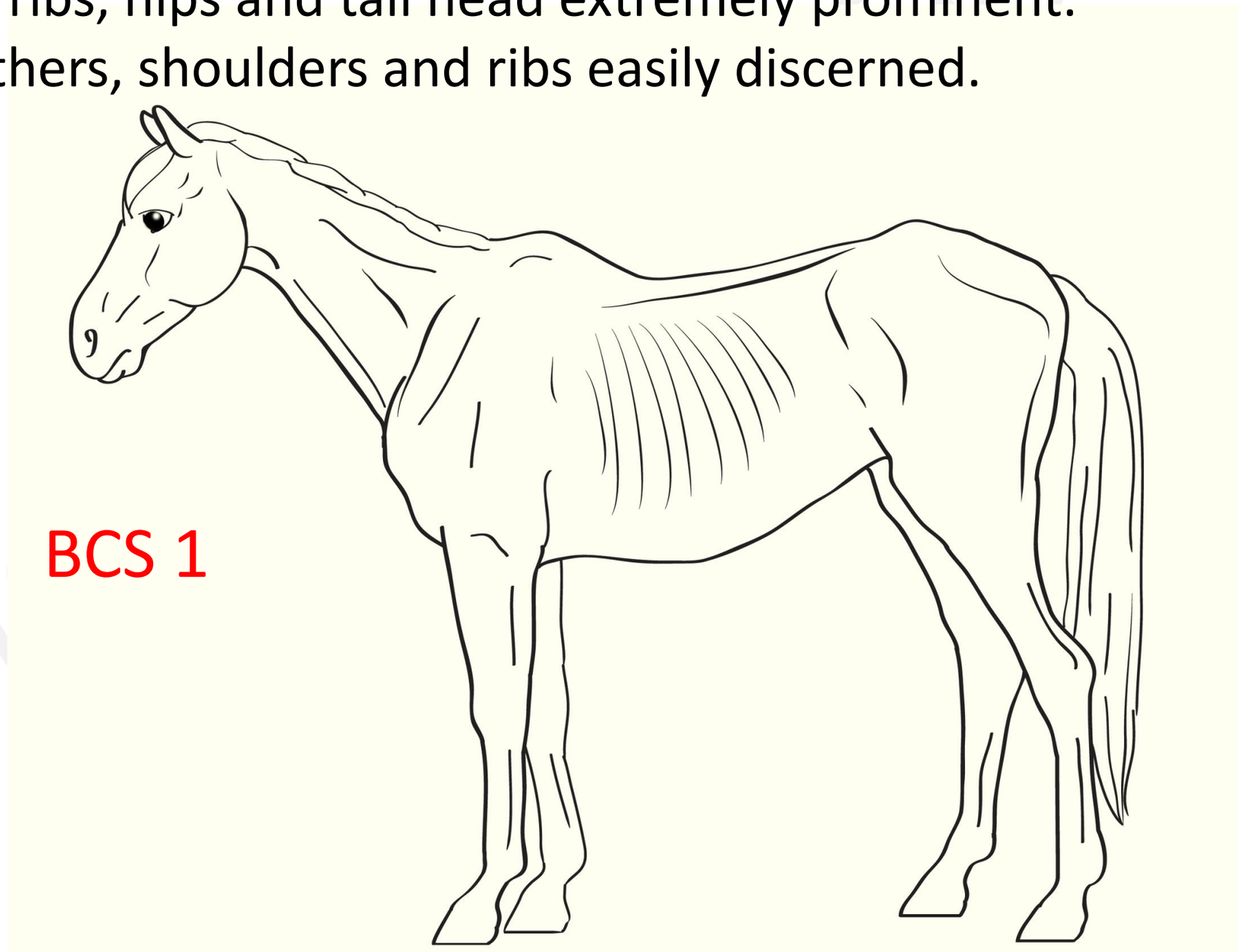
EquidDoc
VETERINARY SERVICES LLC

Assessing condition…

Extreme emaciation.

Spines, ribs, hips and tail head extremely prominent.

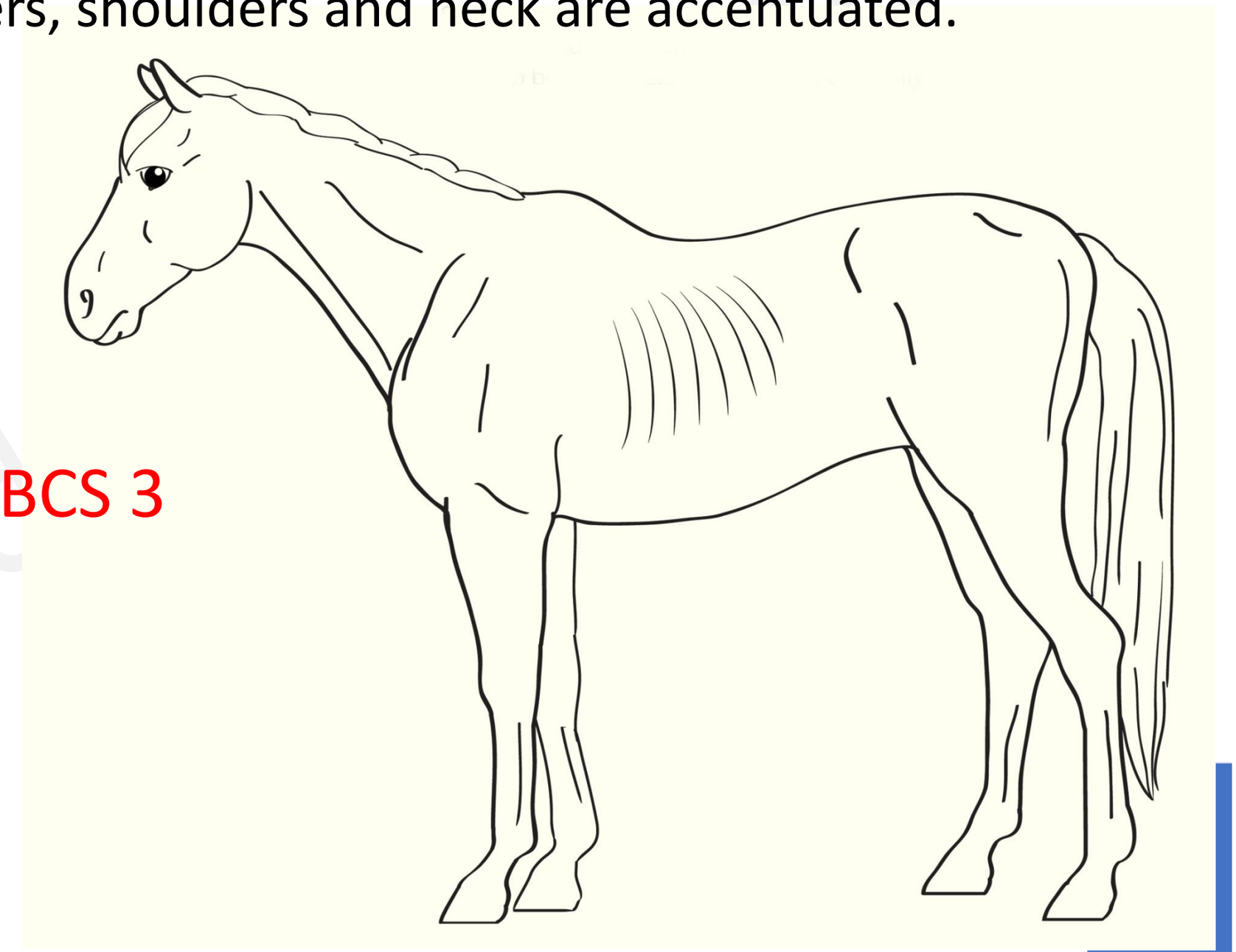
Withers, shoulders and ribs easily discerned.



BCS 1

Assessing condition…

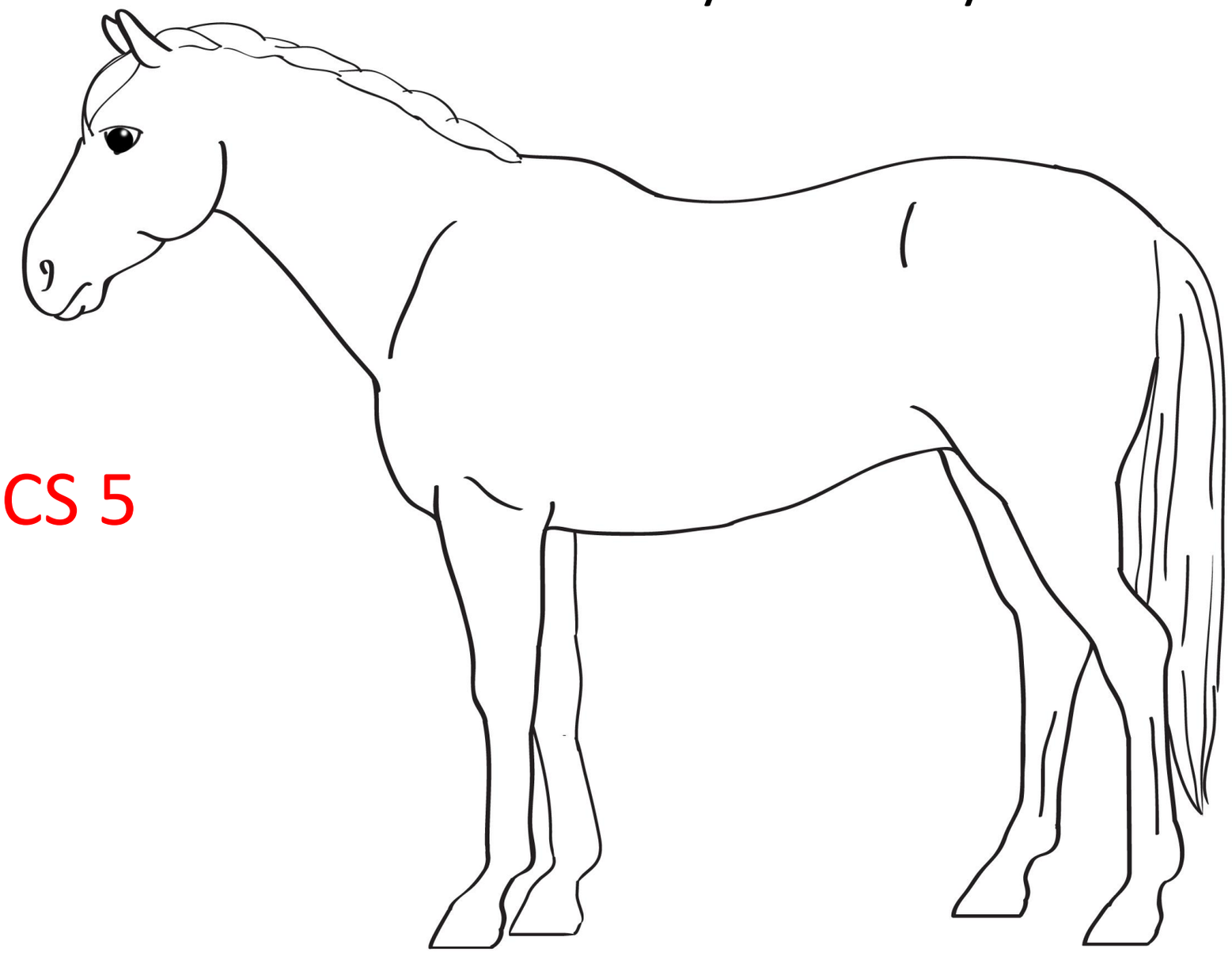
Spinous processes are readily discernible .
Hip bones are rounded but easily discerned.
Withers, shoulders and neck are accentuated.



BCS 3

Assessing condition…

Ribs cannot be easily seen but can be felt .
Withers appear rounded over spinous processes.
Neck and shoulders blend smoothly into body.



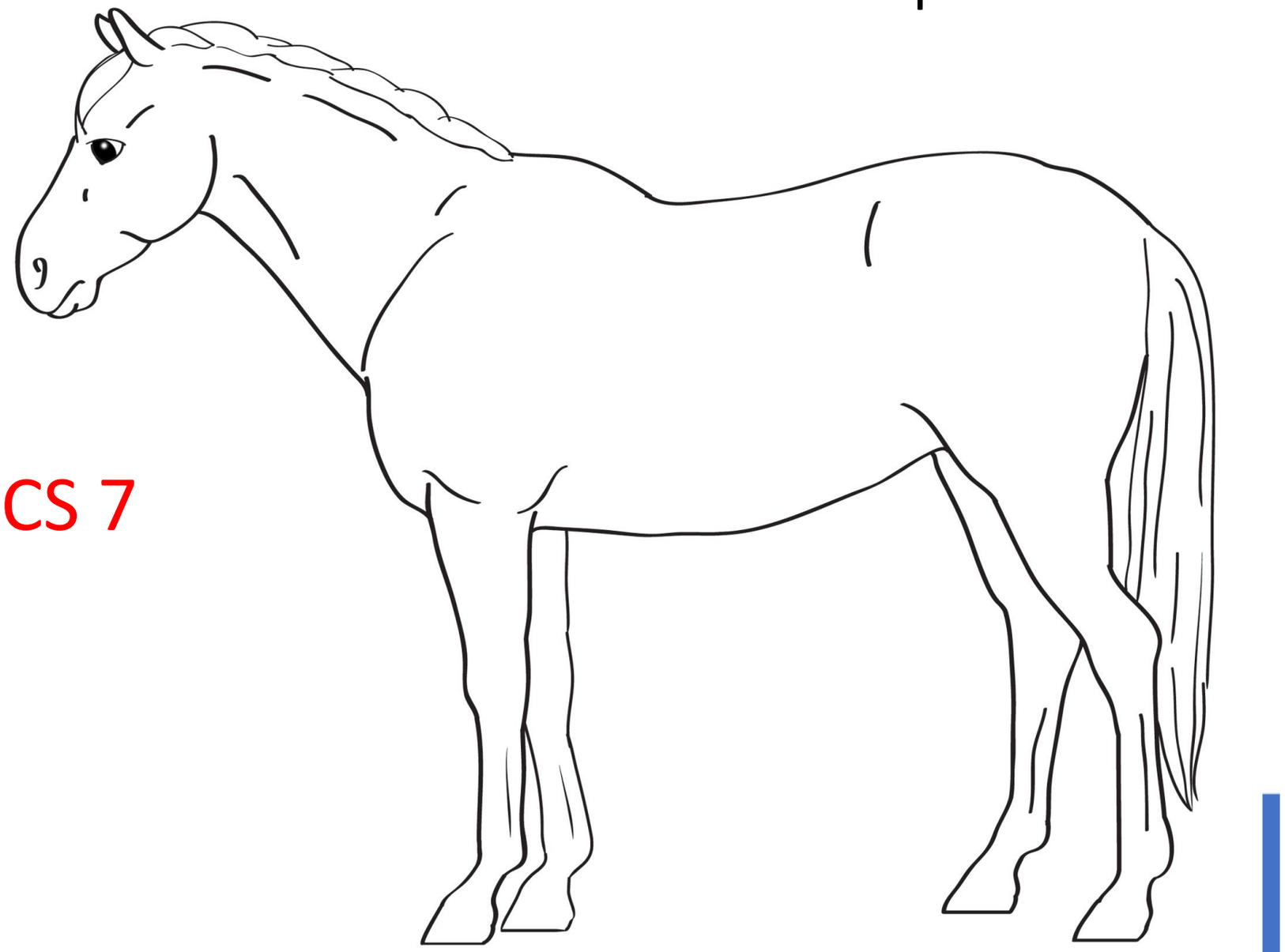
BCS 5

Assessing condition…

Ribs can be felt with deep finger pressure .

Back has a slight crease down its length.

Neck, shoulder and tail head show visible fat pads.



BCS 7

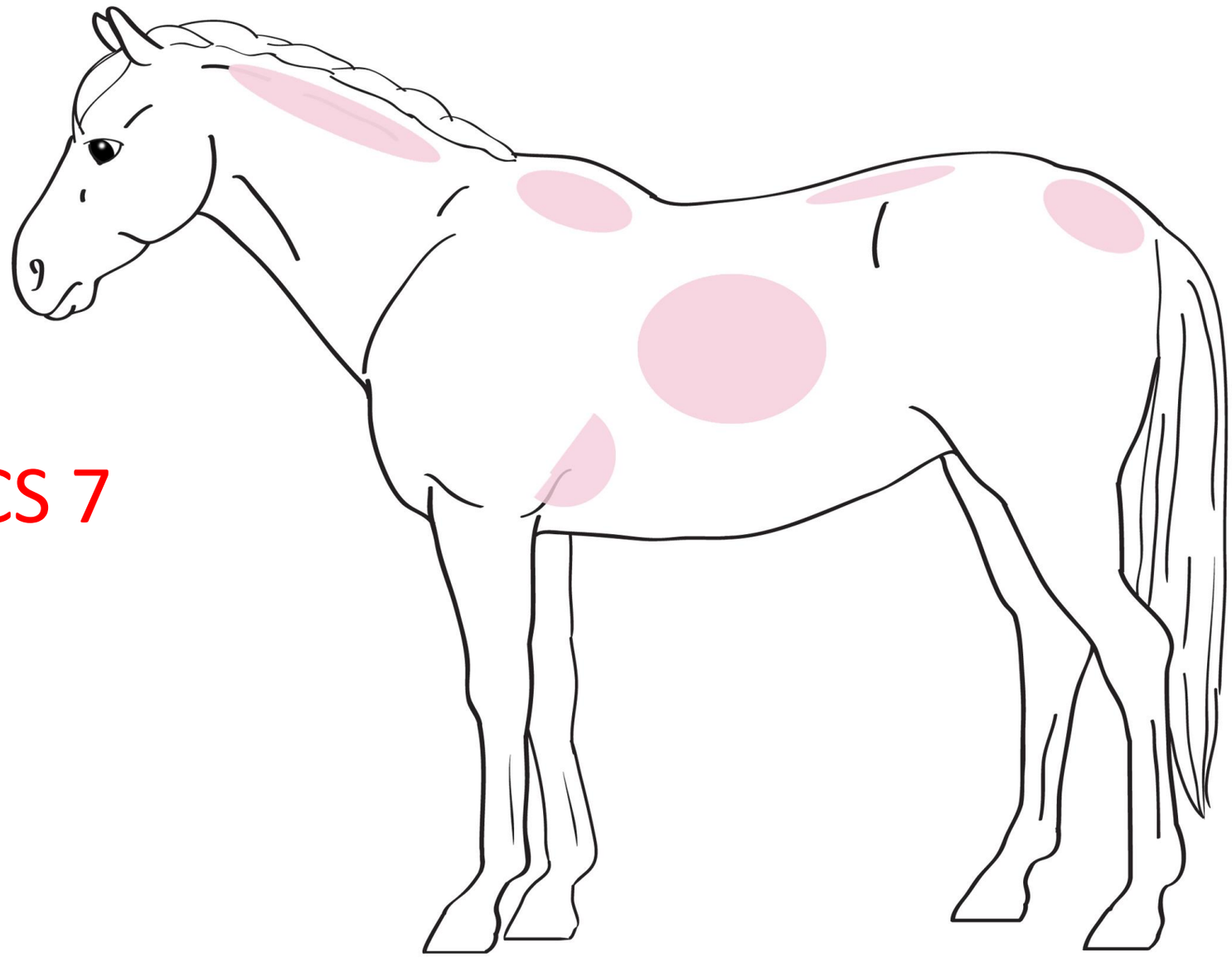
EquidDoc
VETERINARY SERVICES LLC

Assessing condition…

Ribs can be felt with deep finger pressure .

Back has a slight crease down its length.

Neck, shoulder and tail head show visible fat pads.



BCS 7

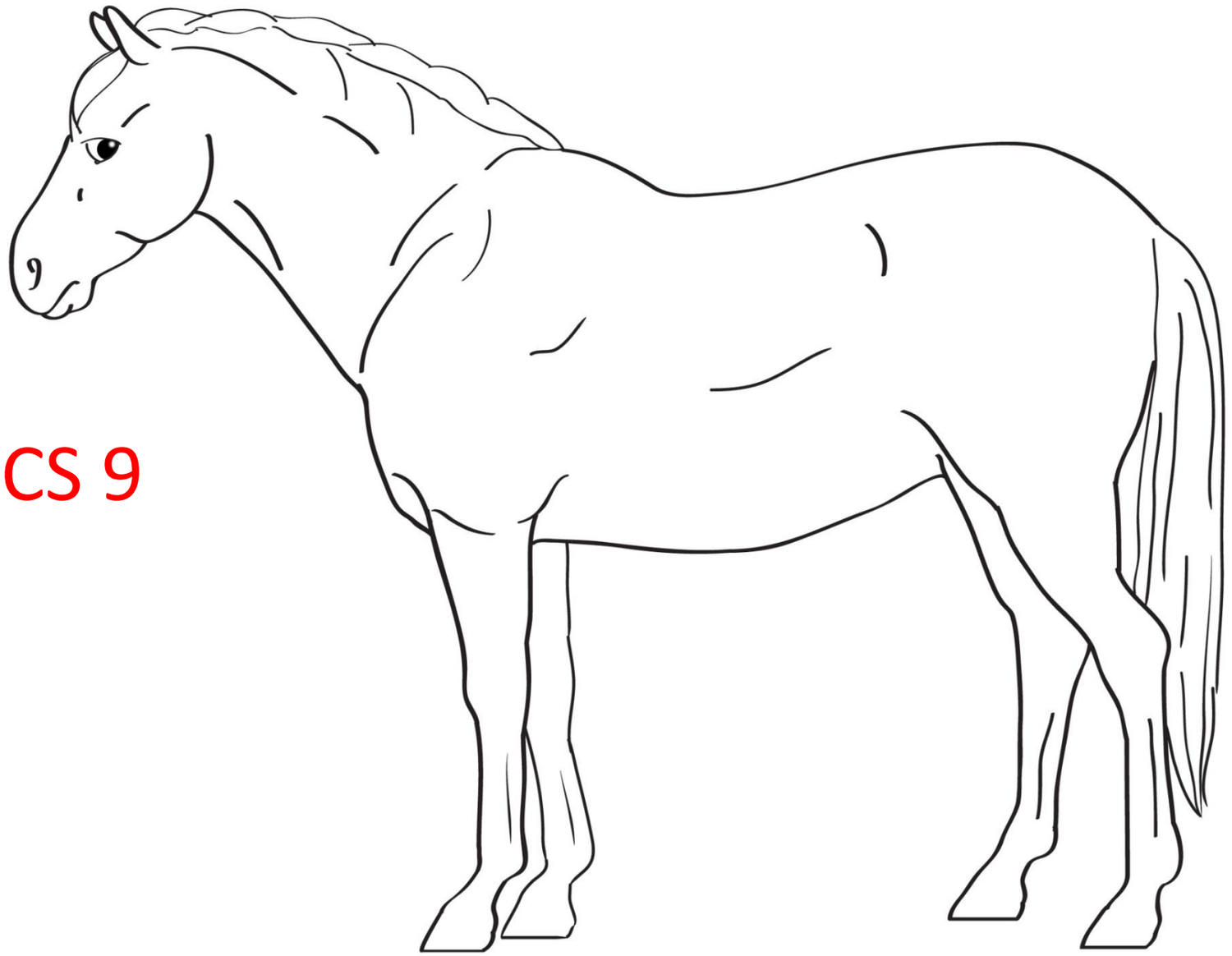
EquidDoc
VETERINARY SERVICES LLC

Assessing condition…

Ribs can be felt with deep finger pressure .

Back has a slight crease down its length.

Neck, shoulder and tail head show visible fat pads.



BCS 9

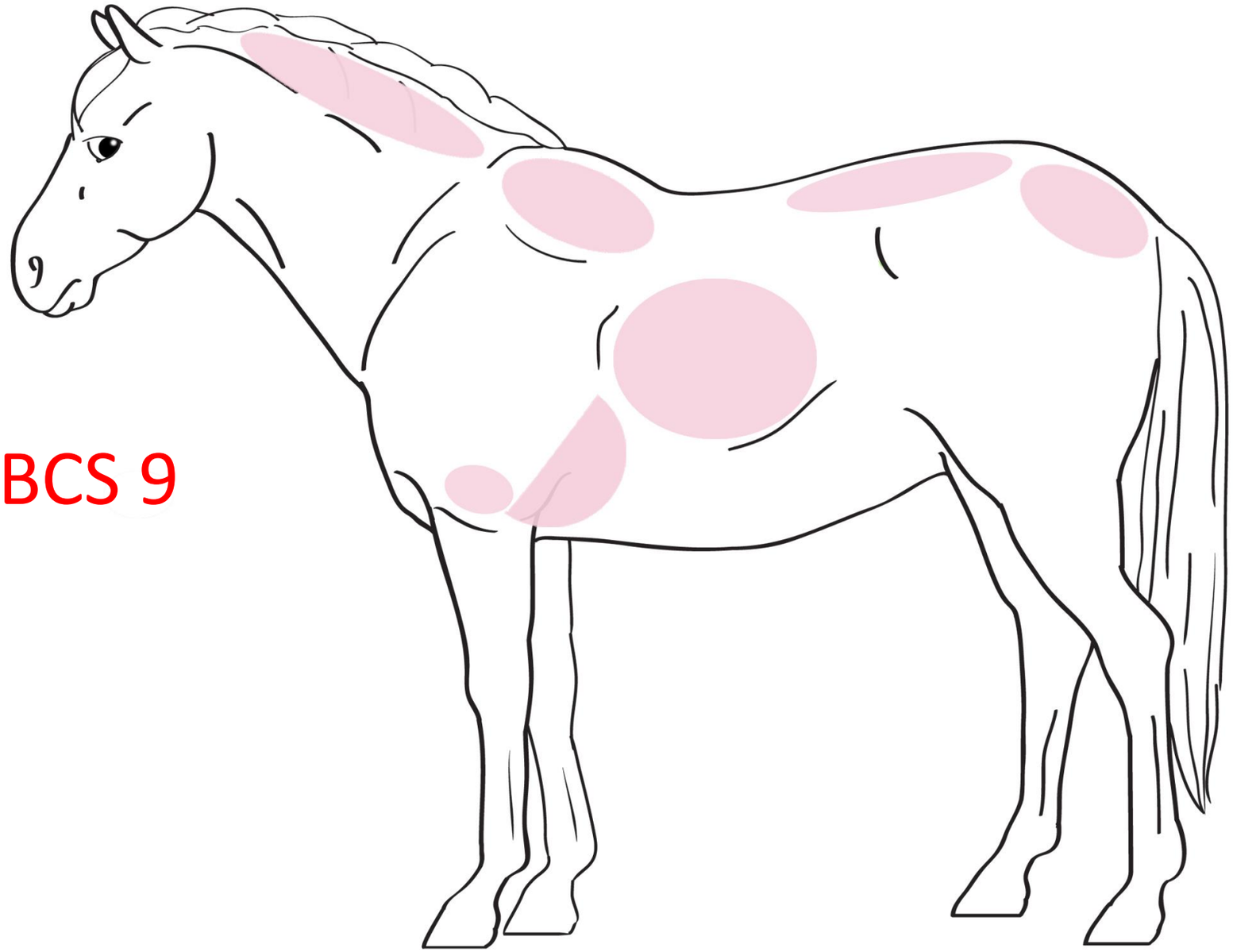
EquidDoc
VETERINARY SERVICES LLC

Assessing condition…

Ribs can be felt with deep finger pressure .

Back has a slight crease down its length.

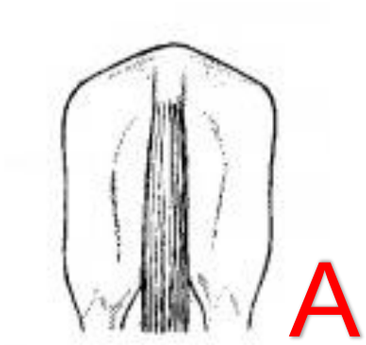
Neck, shoulder and tail head show visible fat pads.



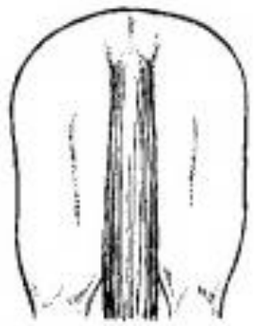
BCS 9

EquidDoc
VETERINARY SERVICES LLC

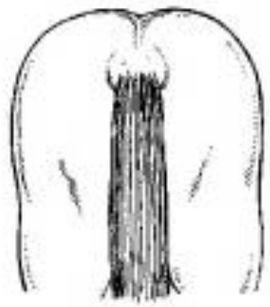
Which Butt is a 1? 3? 5? 7? 9?



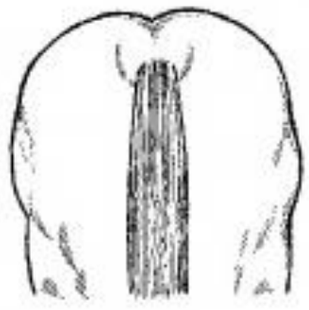
A



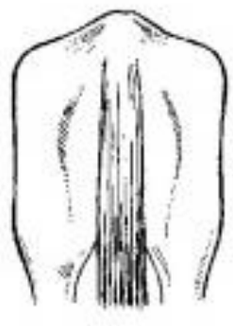
B



C



D

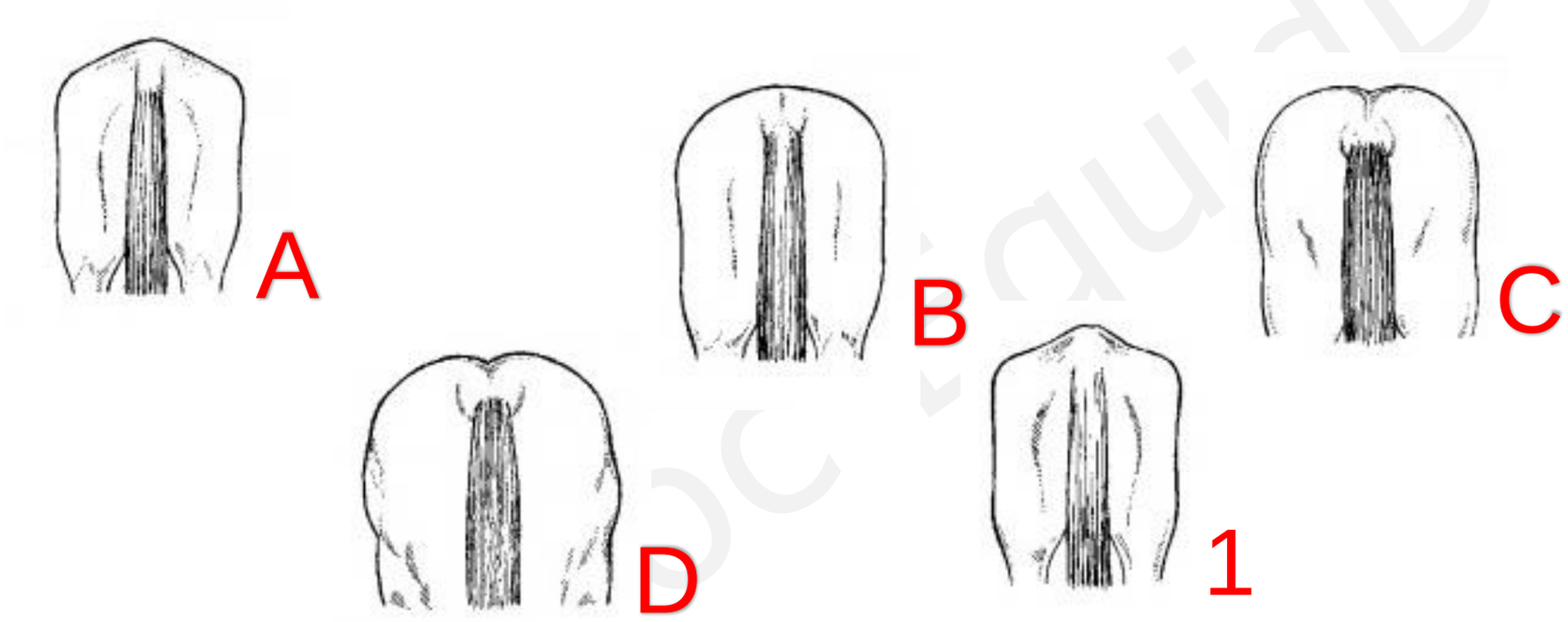


E

Score the Butt

EquidDoc
VETERINARY SERVICES LLC

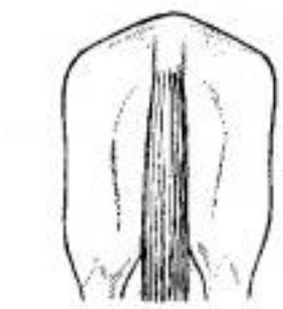
Which Butt is a 1? 3? 5? 7? 9?



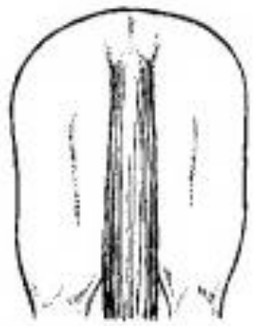
Score the Butt

EquidDoc VETERINARY SERVICES LLC

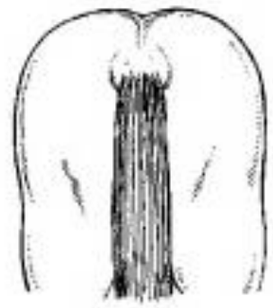
Which Butt is a 1? 3? 5? 7? 9?



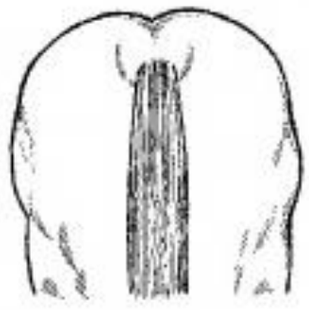
3



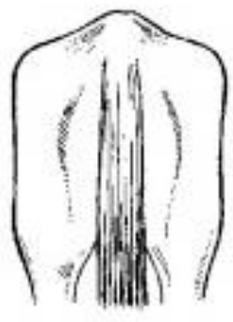
B



C



D

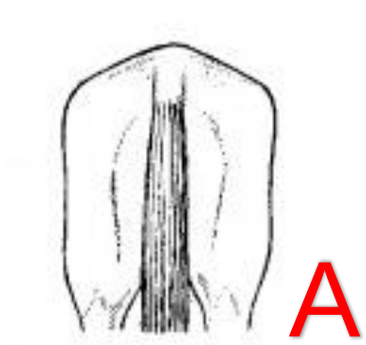


E

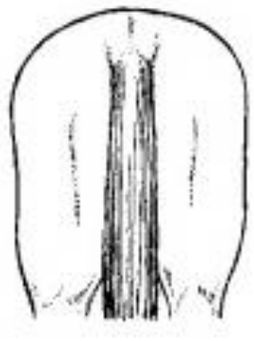
Score the Butt

EquidDoc VETERINARY SERVICES LLC

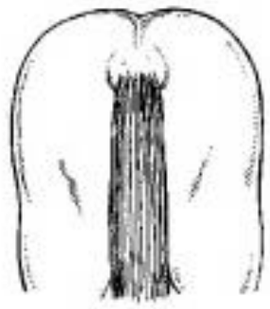
Which Butt is a 1? 3? 5? 7? 9?



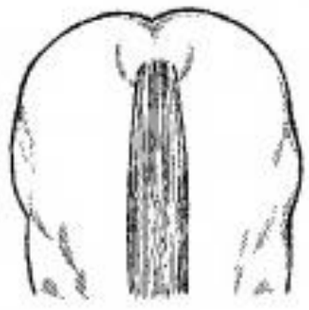
A



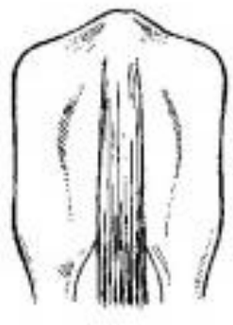
5



C



D

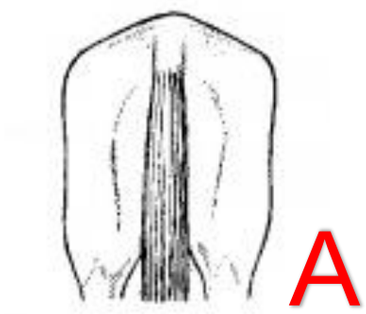


E

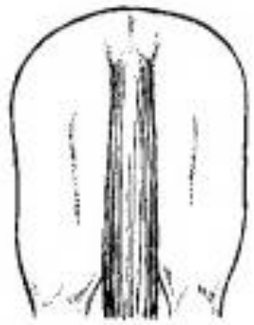
Score the Butt

EquidDoc
VETERINARY SERVICES LLC

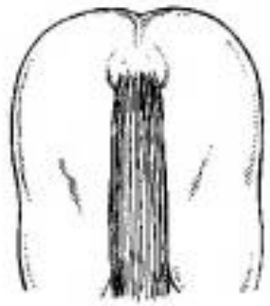
Which Butt is a 1? 3? 5? 7? 9?



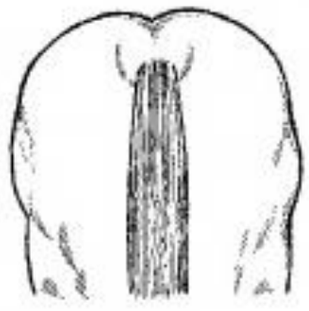
A



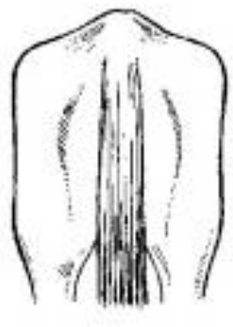
B



7



D

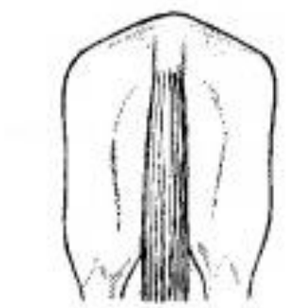


E

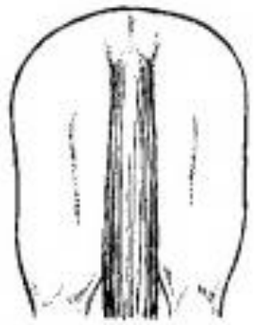
Score the Butt

EquidDoc
VETERINARY SERVICES LLC

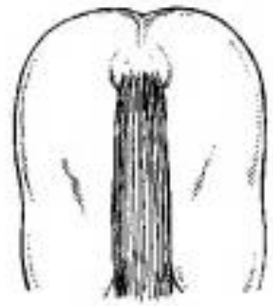
Which Butt is a 1? 3? 5? 7? 9?



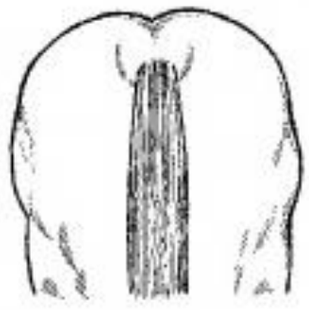
A



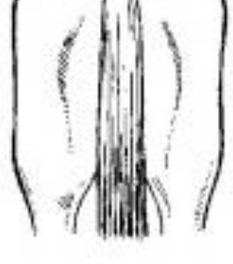
B



7



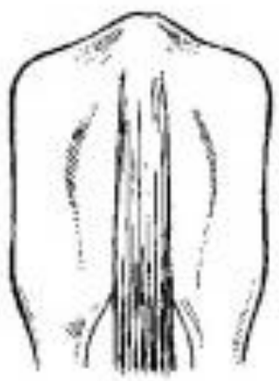
9



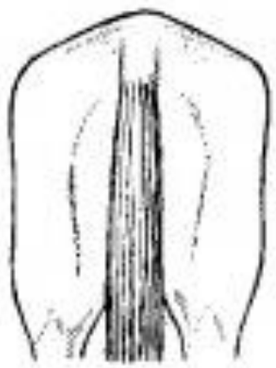
E

Score the Butt

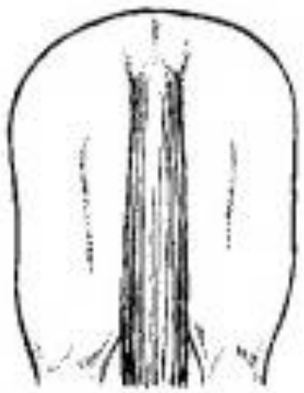
EquidDoc
VETERINARY SERVICES LLC



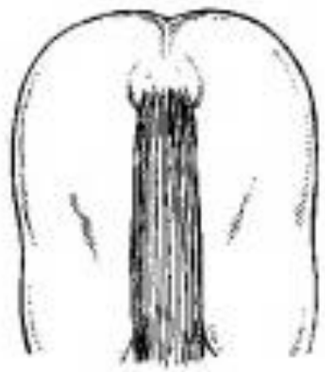
1



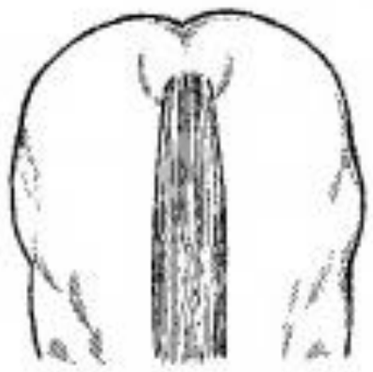
3



5



7



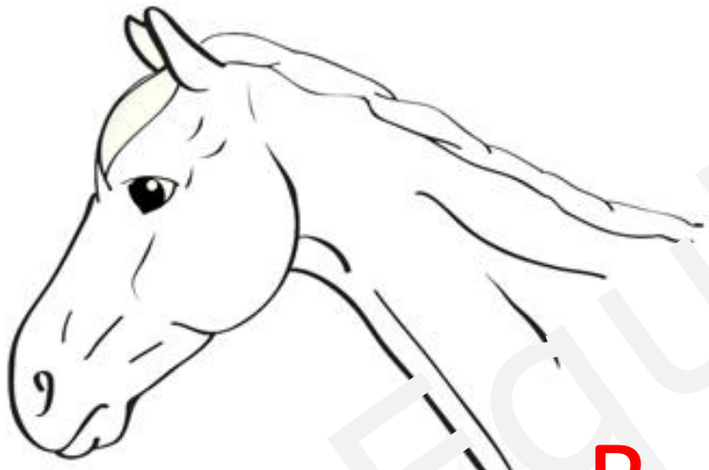
9

BCS for the Hind End

EquidDoc
VETERINARY SERVICES LLC

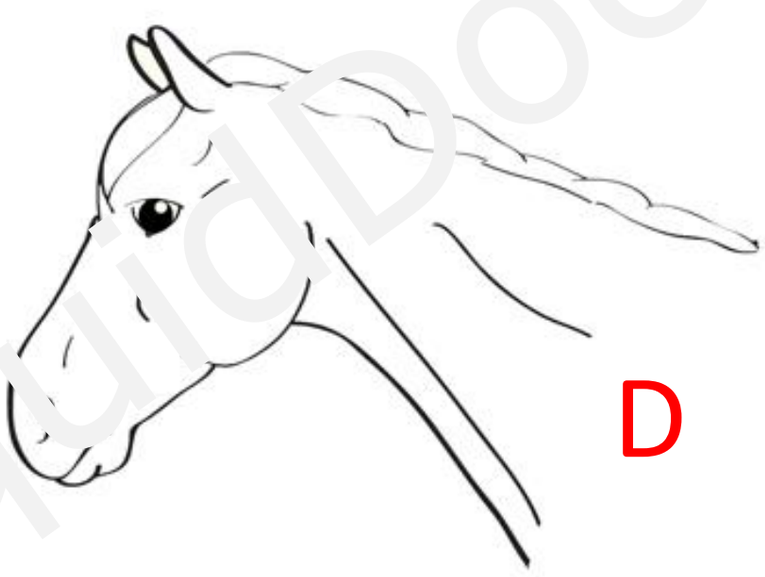
Which Crest is a 1? 3? 5? 7? 9?

A

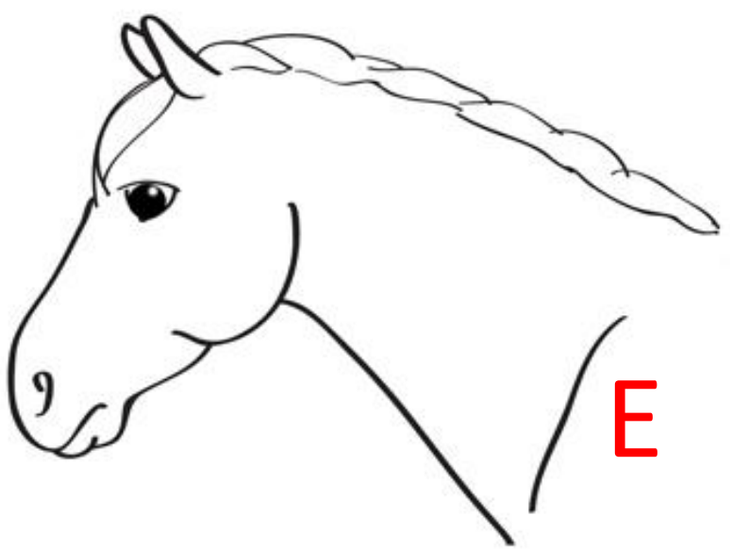


B

C



D



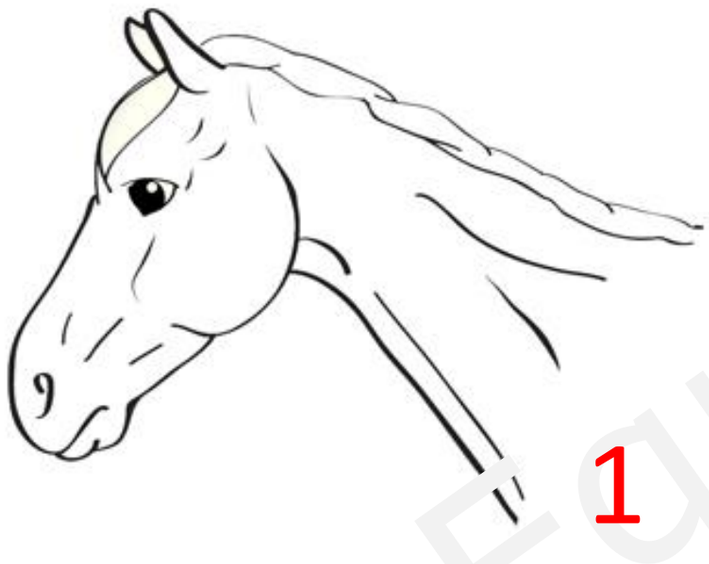
E

SCORING THE CREST

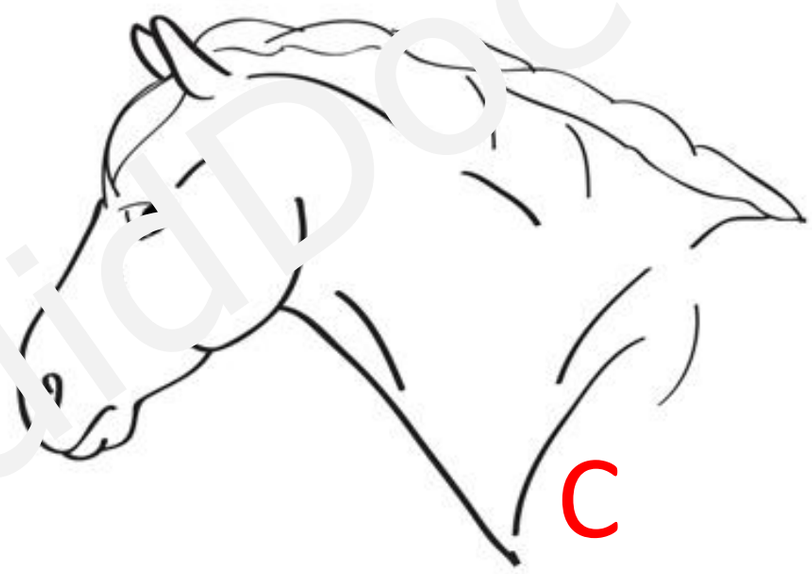
EquidDoc
VETERINARY SERVICES LLC

Which Crest is a 1? 3? 5? 7? 9?

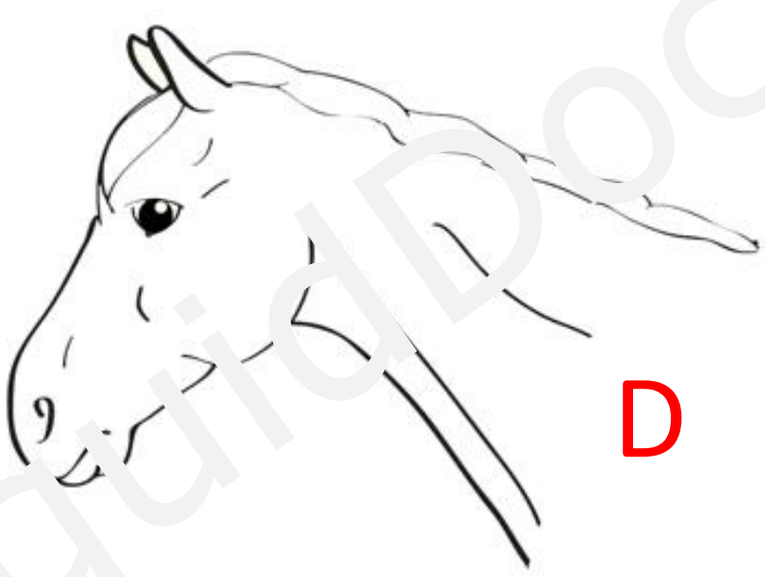
A



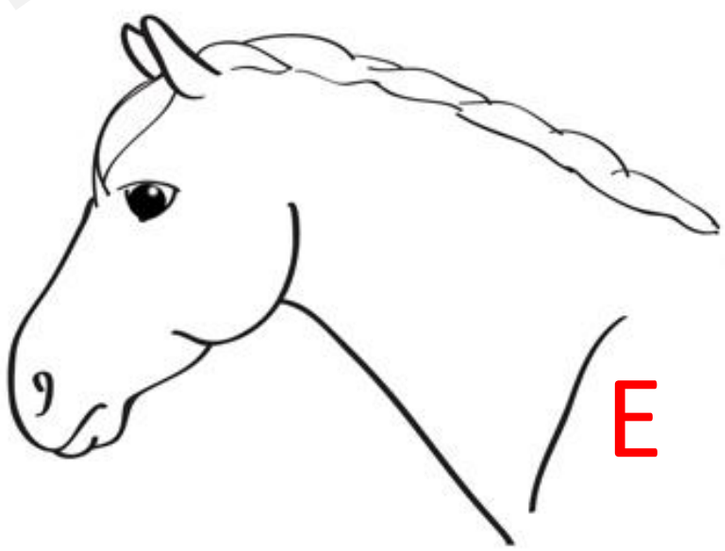
1



C



D



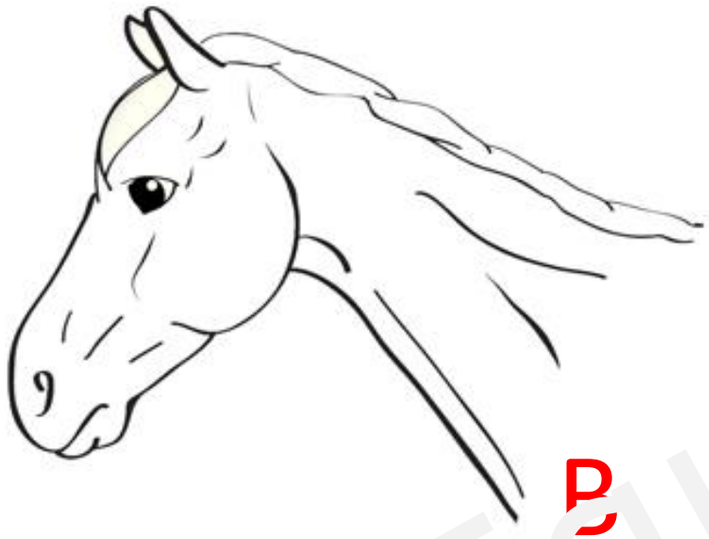
E

SCORING THE CREST

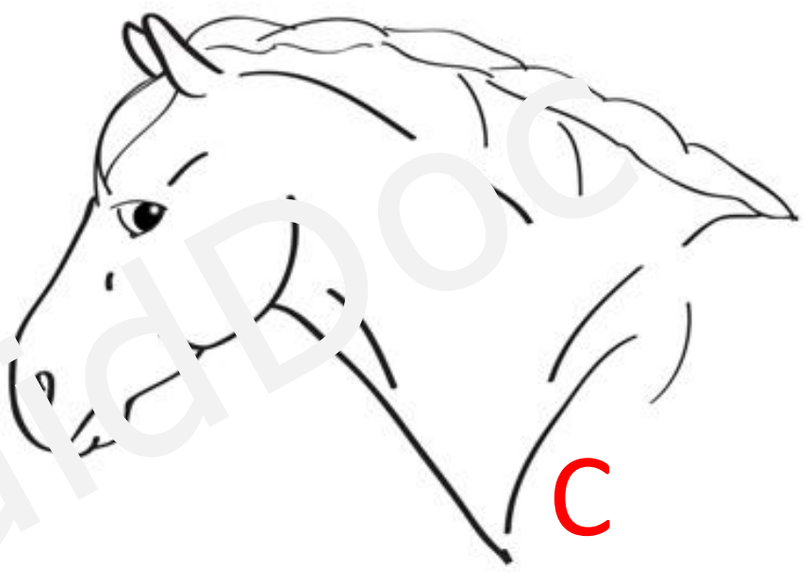
EquidDoc
VETERINARY SERVICES LLC

Which Crest is a 1? 3? 5? 7? 9?

A

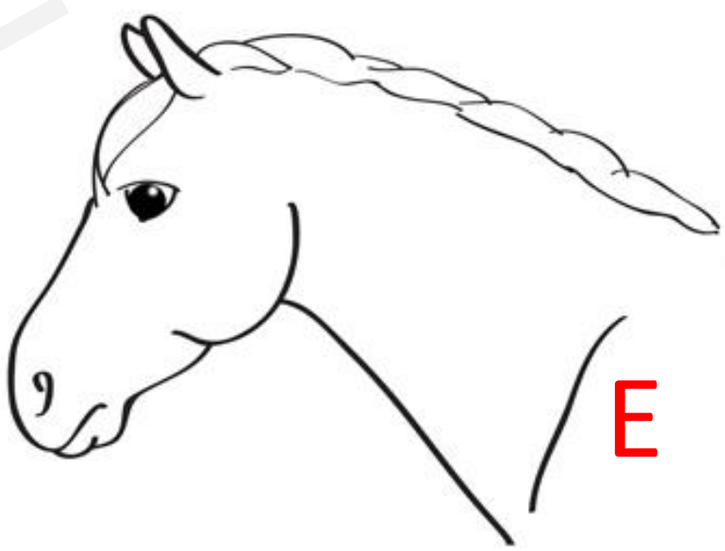


B



C

3



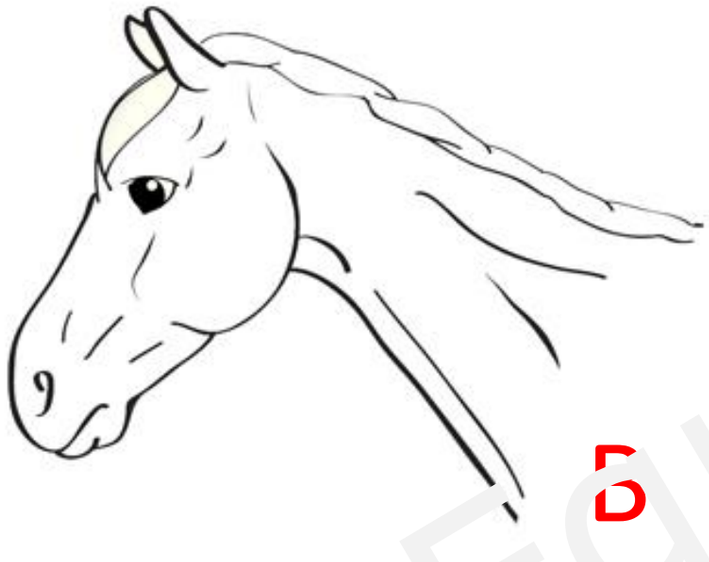
E

SCORING THE CREST

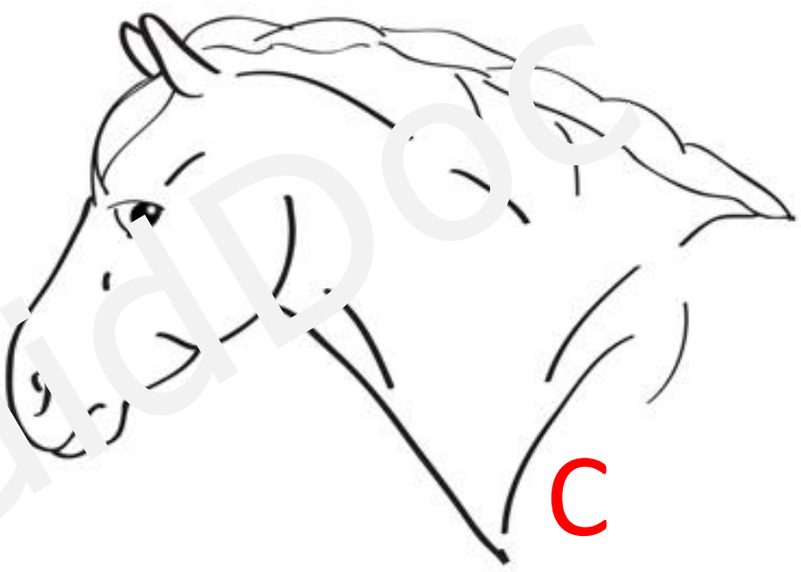
EquidDoc
VETERINARY SERVICES LLC

Which Crest is a 1? 3? 5? 7? 9?

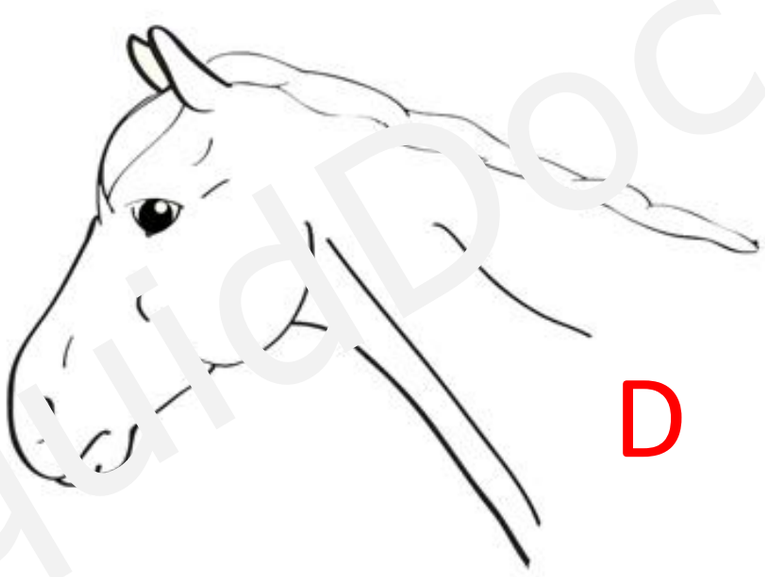
A



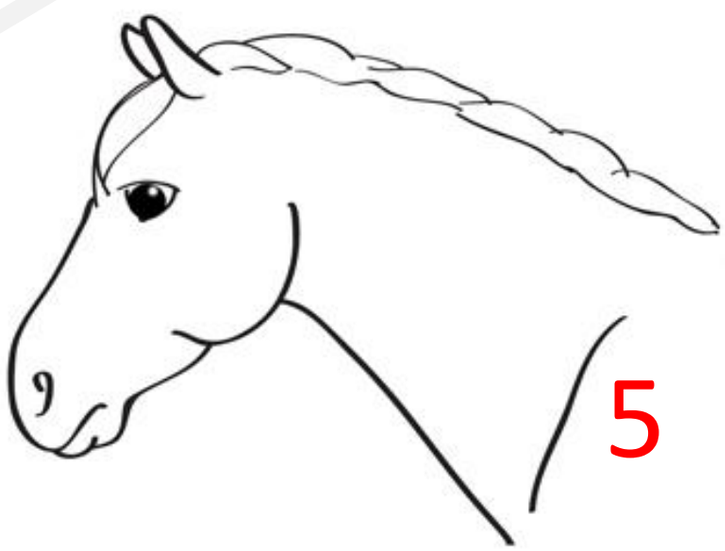
B



C



D



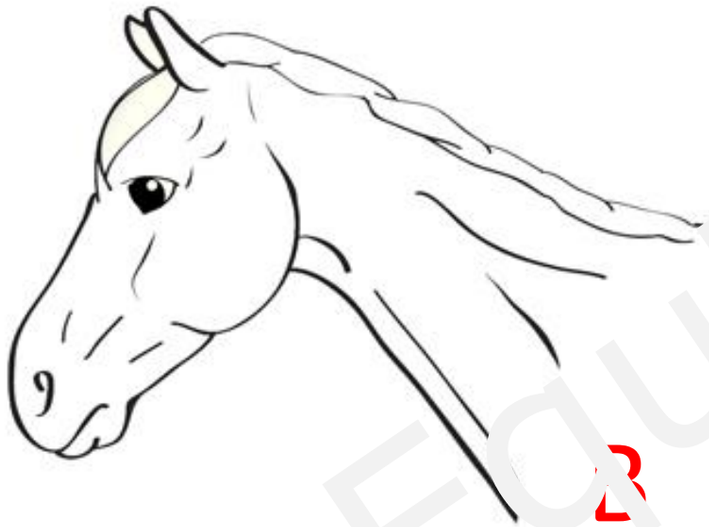
5

SCORING THE CREST

EquidDoc
VETERINARY SERVICES LLC

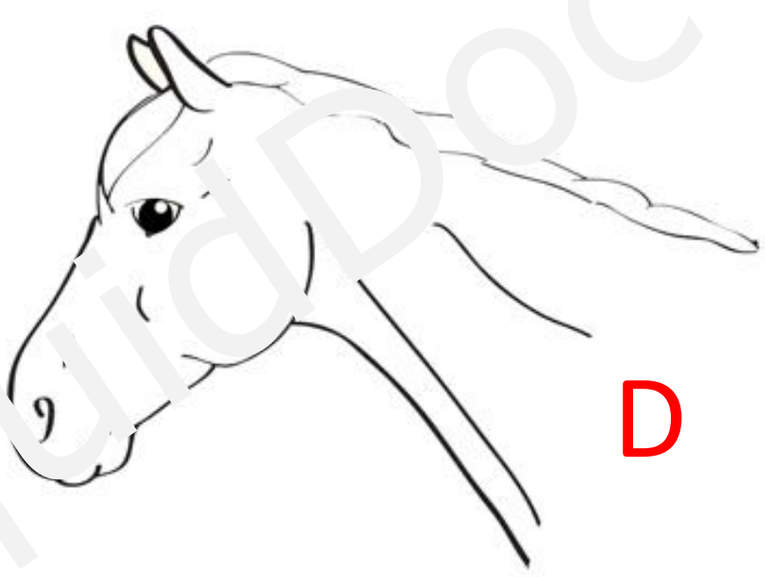
Which Crest is a 1? 3? 5? 7? 9?

7

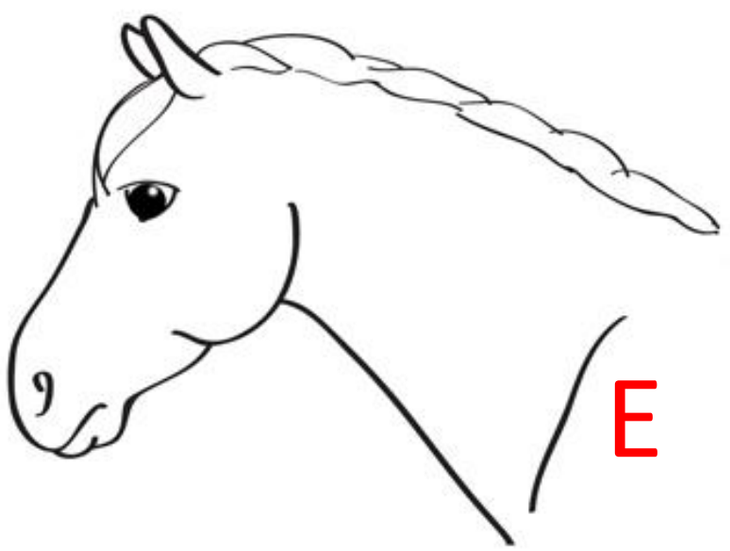


B

C



D



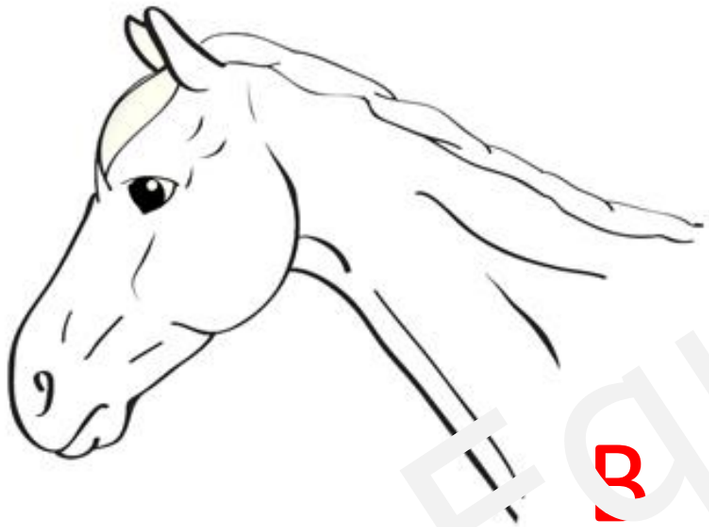
E

SCORING THE CREST

EquidDoc VETERINARY SERVICES LLC

Which Crest is a 1? 3? 5? 7? 9?

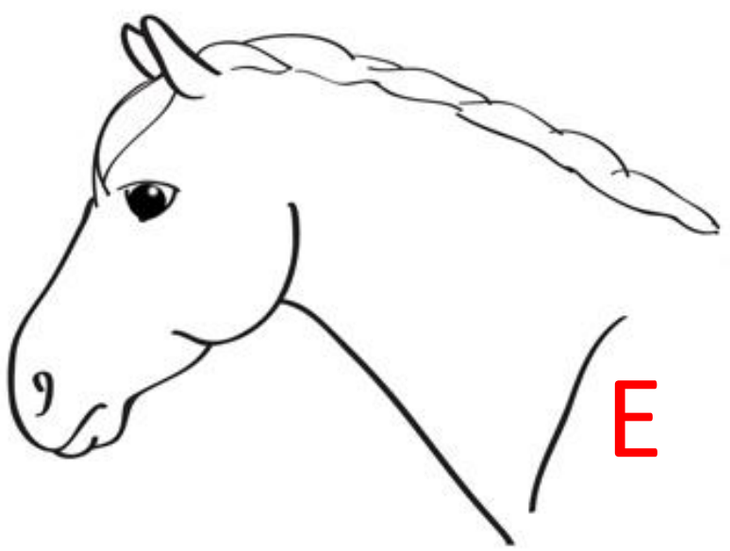
A



B

9

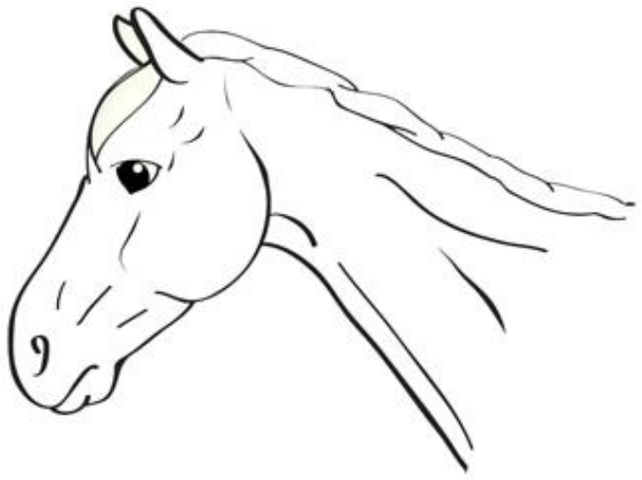
D



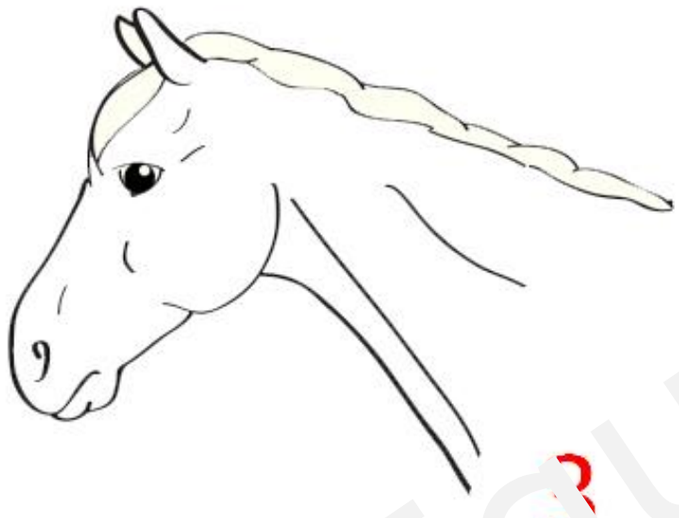
E

SCORING THE CREST

EquidDoc
VETERINARY SERVICES LLC



1



3

5

7

9

CREST SCORING

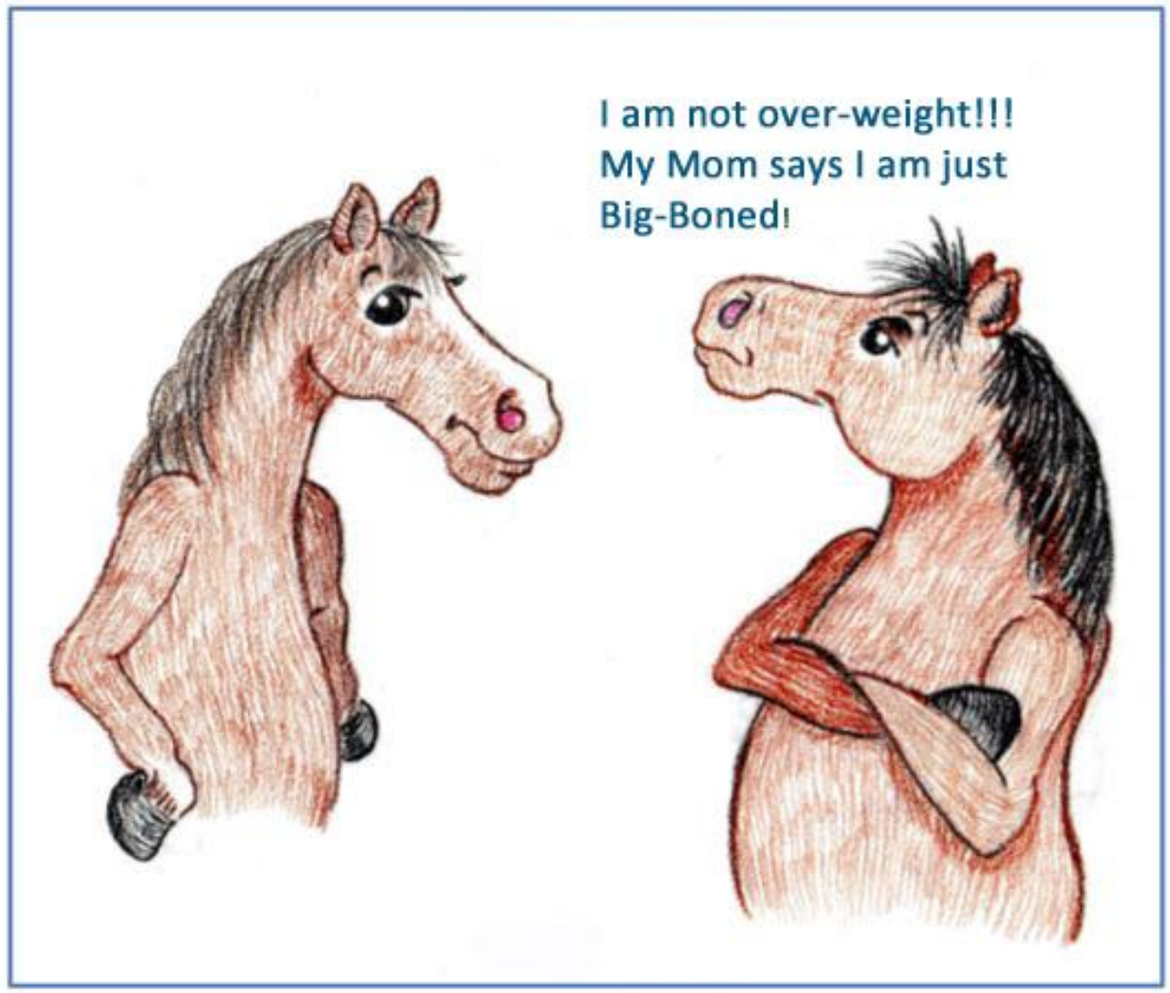
EquidDoc
VETERINARY SERVICES LLC

Health Concerns
When Exceeding Ideal Weight

- Laminitis
- Insulin resistance
- Joint and bone strain
- Reproductive issues
- Thermoregulation

EquidDoc
VETERINARY SERVICES LLC

Myths of the overweight horse:



- Some breed standards are supposed to have an Apple Butt
- Some breeds are just Big-Boned
- Some breeds are Easy Keepers
- Some horses get fat in summer and then skinny in winter

EquidDoc VETERINARY SERVICES LLC

Truths of the overweight horse:

- No breed standard promotes obesity

- Some breeds are predisposed to insulin resistance. These breeds may be sensitive to a high starch/high sugar diet.

- Horses need to EXERCISE year round to maintain a good weight

EquidDoc VETERINARY SERVICES LLC

Where did we go wrong?

- **Uncle Jimmy's Big Licky**
  Ingredients: Ground Corn, Sugar, Corn Syrup, Oats, Soybean Meal, Soybean Hulls, Wheat Middlings, Vegetable Oil Refinery Lipid, Corn Germ Meal, Molasses Products

  Like giving a kid a lunch bag of penny candy so they are BUSY for a while

- Hay WAS less expensive to feed in the past

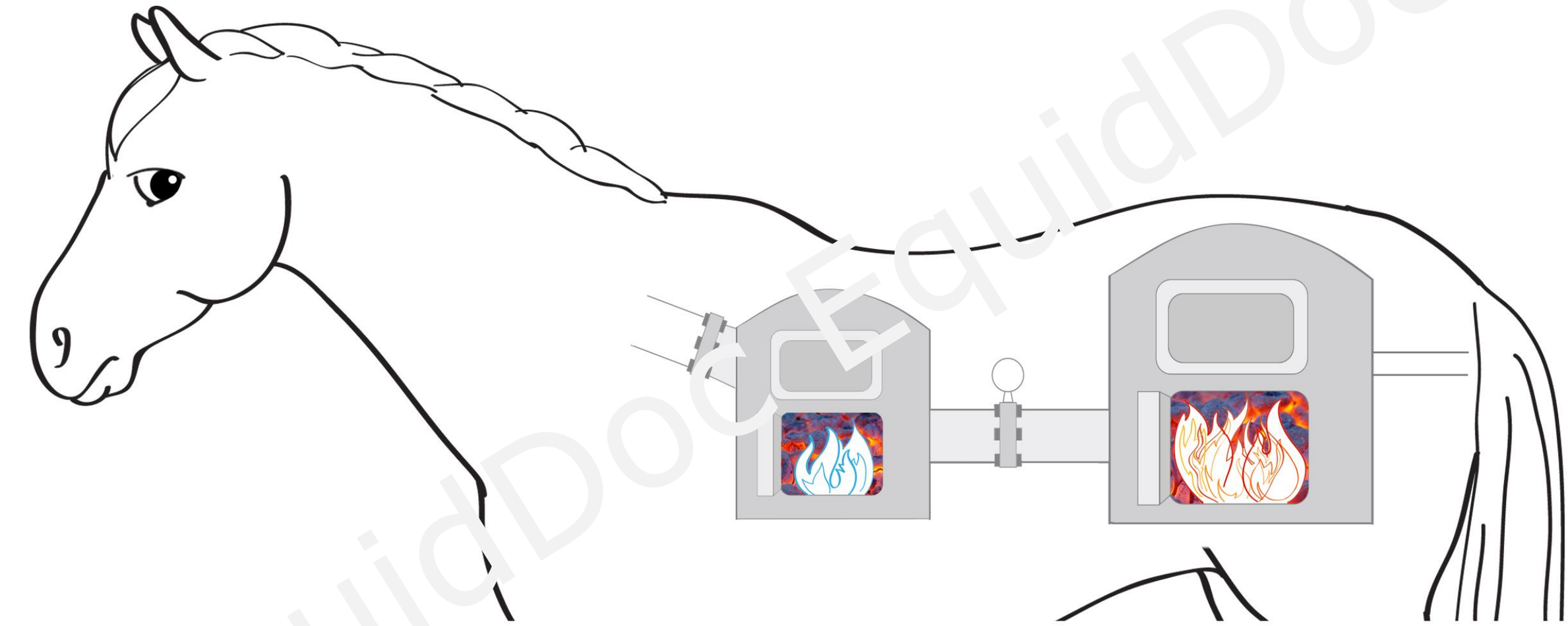
EquidDoc VETERINARY SERVICES LLC

What Are We Feeding?

- Concentrates– Corn, Barley, Oats
- High sugar treats – Mints, Sugar Cubes, Carrots, apples, Commercial Horse Treats
- Why is that a problem?

EquidDoc VETERINARY SERVICES LLC

The Horse's Furnace

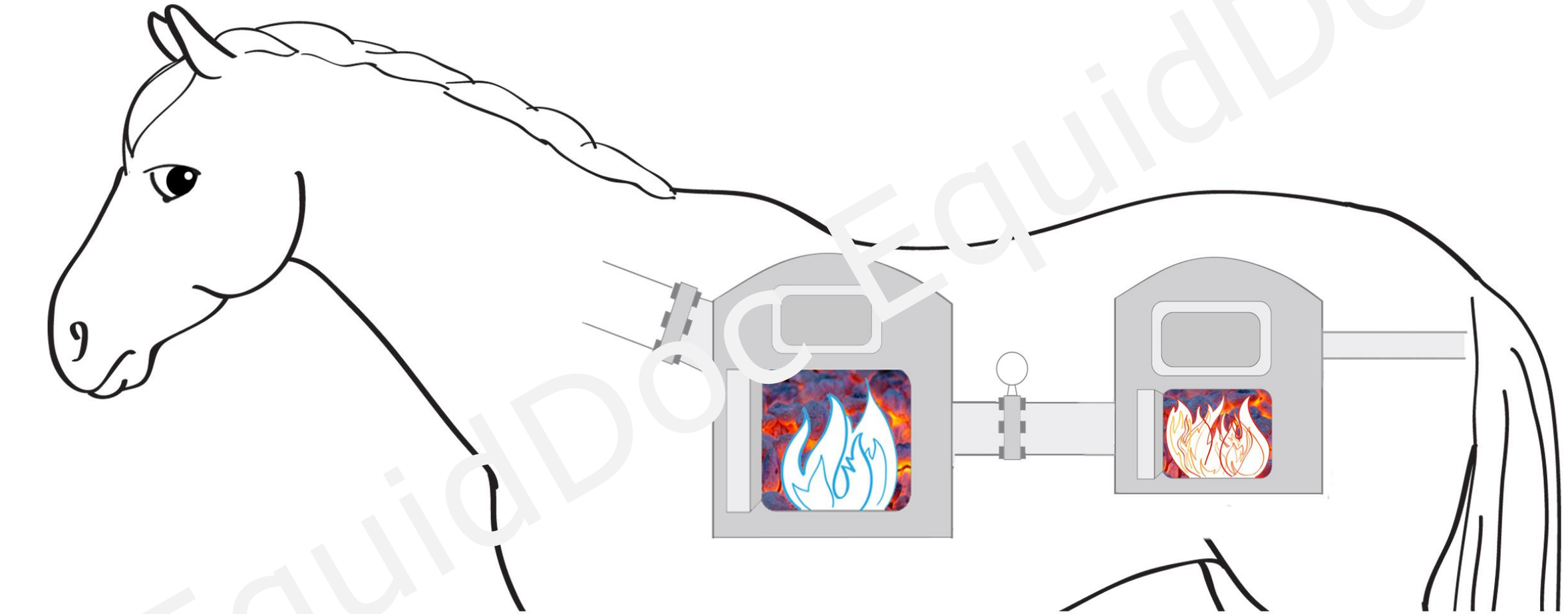


Front Furnace (stomach/small intestines) – Burns Hot

Rear Furnace (large intestine/cecum) - Burns Long & Slow

EquidDoc VETERINARY SERVICES LLC

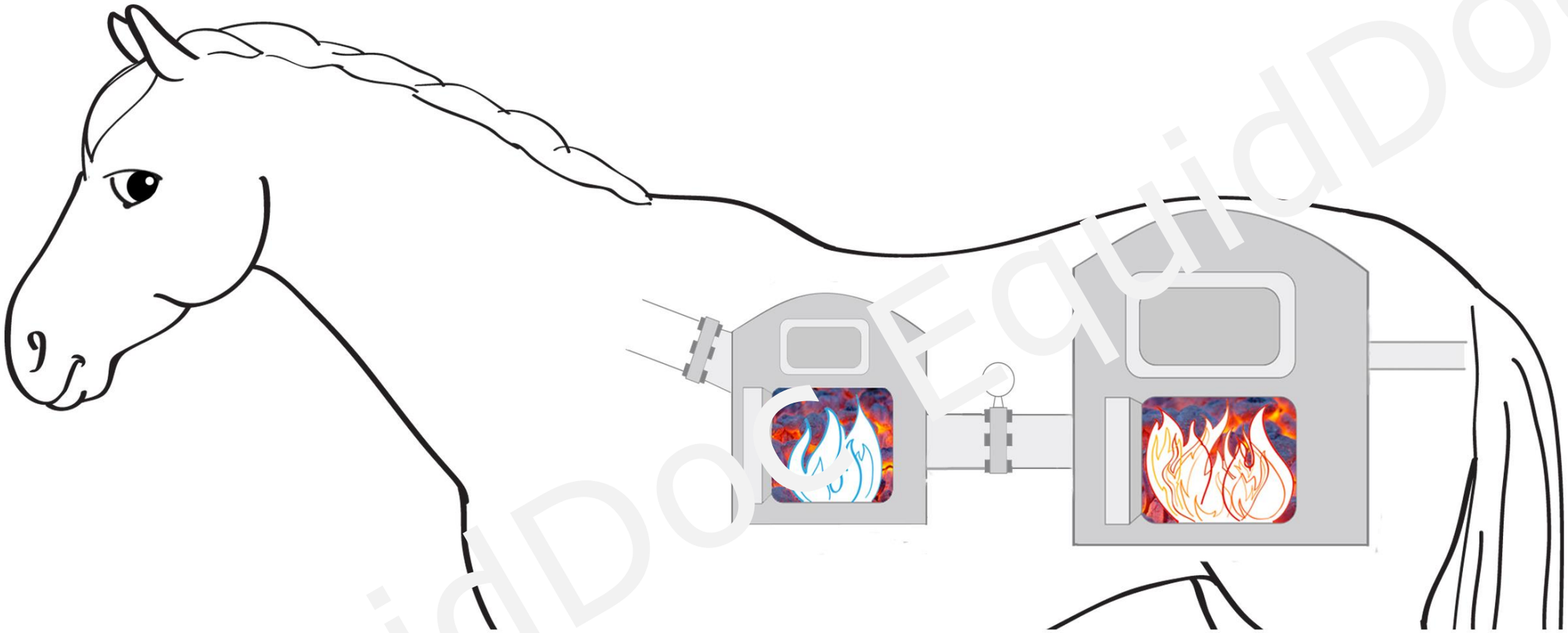
Over-feeding Non-Structural Carbohydrates



- Rapidly increases blood glucose levels
- Insulin levels increase
- Can lead to Equine Metabolic Disease

EquidDoc
VETERINARY SERVICES LLC

Feeding Structural Carbohydrates



- Stable blood glucose levels
- Continuous forage feeding
  * Promotes normal gut activity
  * Chewing buffers stomach
  * Reduces Stress

EquidDoc VETERINARY SERVICES LLC

% Non-Structural Carbohydrates

ALFALFA HAY	**11.4%**
GRASS HAY	13.3%
BEET PULP	**12.2%**
OATS	50.7%
BARLEY	**63.1%**
CORN	77.0%
MOLASSES	**58.4%**

Optimally < 15%

EquidDoc VETERINARY SERVICES LLC

Hay Stretcher - Hay Pellets – Forage cubes what is the difference?

- Hay Stretcher Pellets

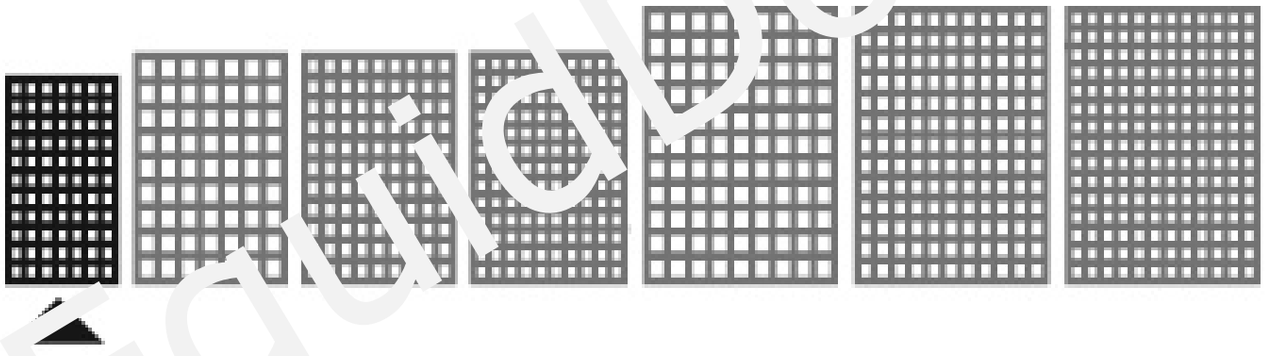
- Hay Pellets

- Haylage/Forage Cubes

EquidDoc VETERINARY SERVICES LLC

How should we feed?

- Feed concentrates 3-4 meals/day
- Feed concentrates AFTER a hay meal
- Feed Hay In multiple locations
- Use Slow Feeders (Nibble Net/



Horses that score 7 or above on Body Condition SHOULD NOT be turned out on grass PERIOD

EquidDoc VETERINARY SERVICES LLC

What about Horsey Treats

- Apple peels

- Homemade horse treats made with ground Flaxseed meal
- Peanuts in the shell

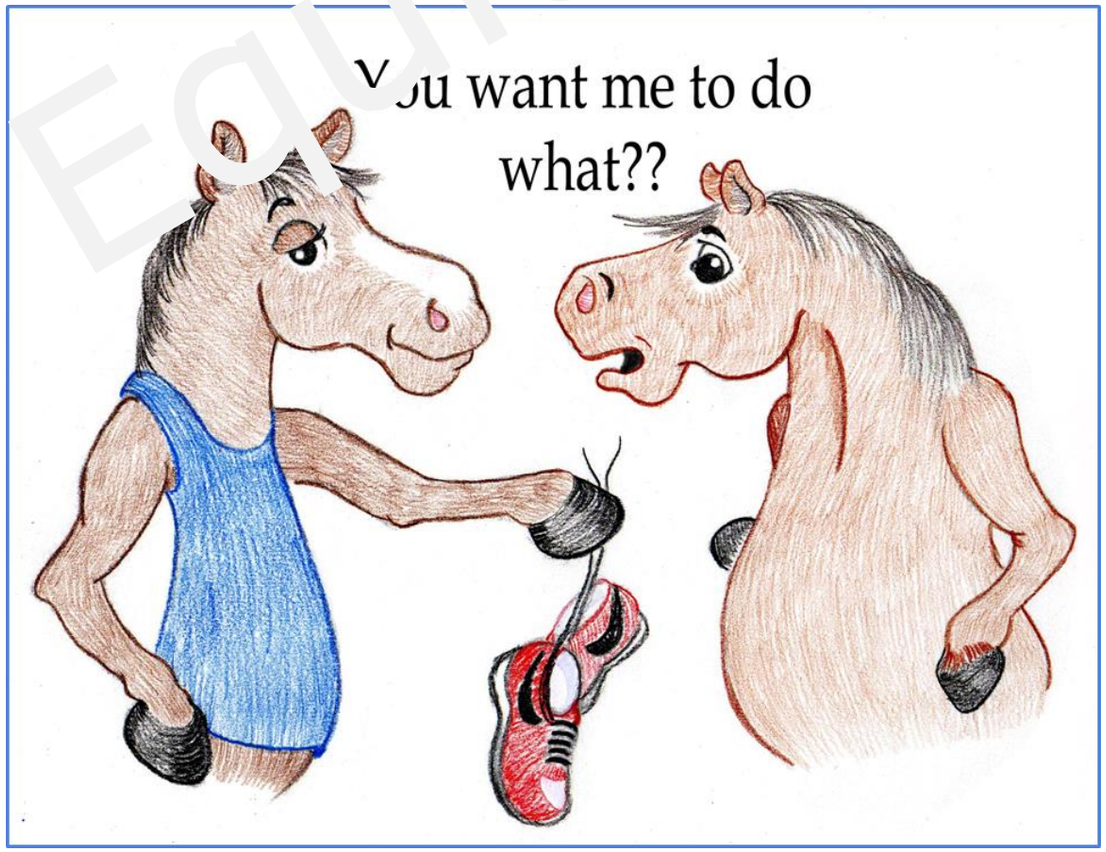
REMEMBER FOOD IS NOT LOVE!

EquidDoc VETERINARY SERVICES LLC

Food Is Not Love – But Time Together is!

- Horses in all day turnout spend 90% of their time STANDING
- Stabled horses should be hand-walked 30-45 minutes

EXERCISE	BPM	KCAL/MIN
Walk	60 bpm	24 kcal/min
Slow Trot/Jog	90 bpm	56 kcal/min
Fast Trot/Jog	120 bpm	99 kcal/min
Canter/Lope	150 bpm	159 kcal/min
Gallop	180 bpm	230 kcal/min



EquidDoc VETERINARY SERVICES LLC

Bring a Curry Instead of a Cookie!

- Assess Body Condition Score twice a month

- Post it on your barn calendar to track the score

- Use a weight tape to track your
- bi-monthly weight assessment

EquidDoc
VETERINARY SERVICES LLC

Low Carb Horse Treats

- **LOW STARCH APPLE CINNAMON HORSE TREATS**
- Ingredients:
- 1 lb. bag of Bob's Red Mill organic ground flaxseed (from Wal-Mart or grocery store)
- ½ cup Unsweetened applesauce
- 2 tbs. Cinnamon
- 2 cups hot water
- Cookie sheet, and parchment or wax paper
- Directions:
- Preheat oven to 350 degrees. Put ground flaxseed into mixing bowl add the Cinnamon and mix. Add applesauce, then HOT water. Initially mix with rubber spatula, then use your hands until the dough is smooth.
- Cover cookie sheet with parchment or wax paper. (Do NOT use cooking spray.) Place dough on paper covered cookie sheet to evenly cover it. The thinner you spread the dough, the crunchier your horse cookies will be. Cut the dough into squares BEFORE baking; this allows them to come apart easily after baking. They are difficult to cut apart once baked.
- Place in preheated oven and bake at 350 degrees for 70 - 75 minutes. Turn off the oven and let them sit in the warm oven for another 30 minutes to increase crunch.

EquidDoc VETERINARY SERVICES LLC

Equine Metabolic Syndrome

- What is Equine Metabolic Syndrome (EMS)?
- How do we diagnose it?
- What is the goal of treatment?
- What is insulin resistance?
- What is the link between insulin and laminitis?

EquidDoc
VETERINARY SERVICES LLC

Identifying EMS & PPID

- A large part of diagnosis can be correctly made through physical characteristics.

- Test to detect early disease
- Test to monitor treatment
  - Pre-treatment vs Post-treatment
    - Are the treatments working?
    - Do we need to get more aggressive with treatment?

EquidDoc VETERINARY SERVICES LLC

Equine Metabolic Syndrome (EMS)

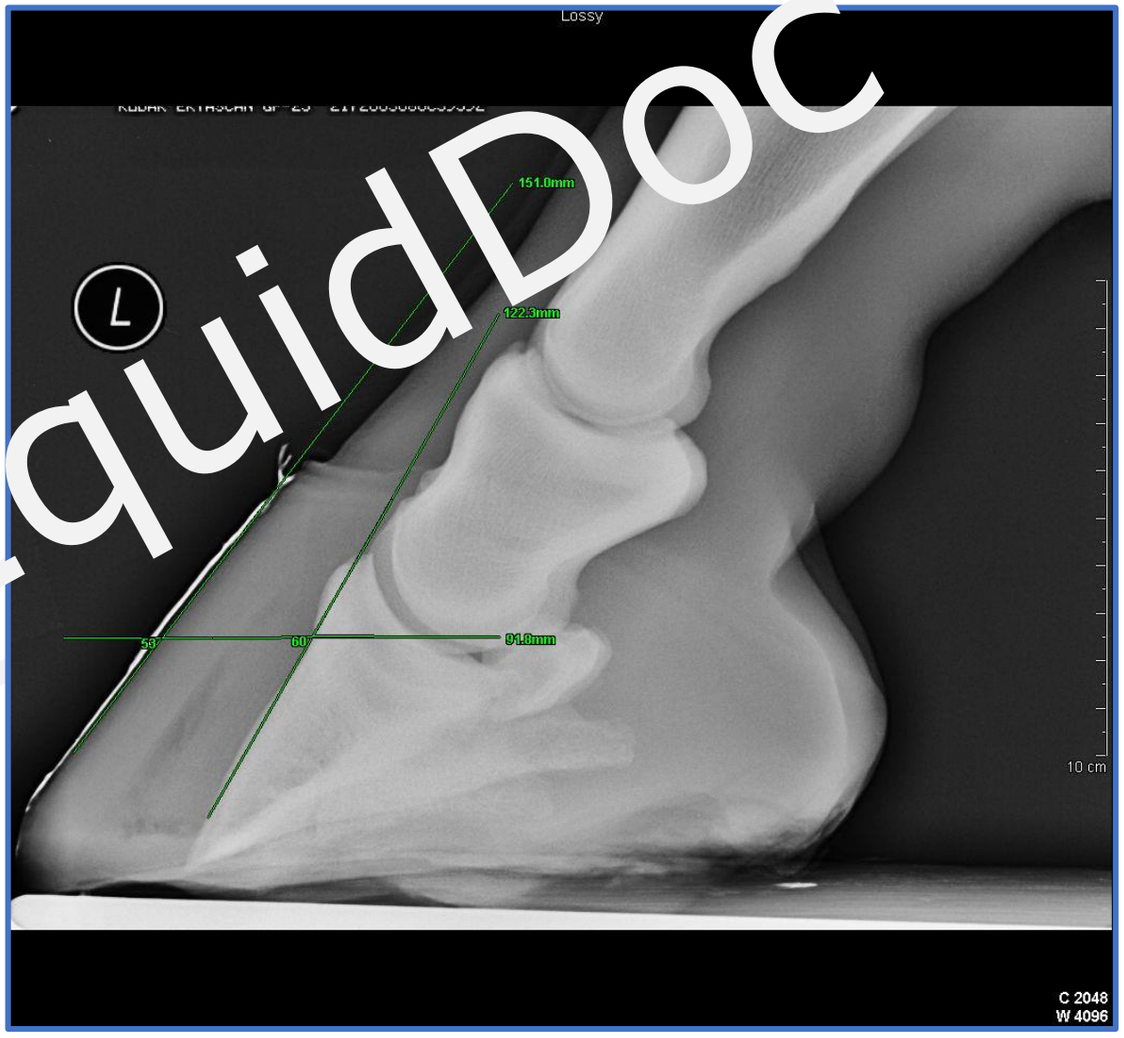
- Defined as having three characteristics

1. Regional adiposity
   - OR generalized obesity
2. Insulin Resistance (IR)
3. Laminitis
   - A predisposition to laminitis
   - A current or a previous bout of bilateral lameness

EquidDoc
VETERINARY SERVICES LLC

Diagnosis & Treatment

- GOAL: to diagnose early and establish a treatment protocol to PREVENT laminitis.



EquidDoc
VETERINARY SERVICES LLC

Identify Horses at risk for EMS

- Breed and physical characteristics

- At Risk Breeds
  - Pony Breeds
  - Morgans
  - Paso Finos
  - Miniature horses
  - Saddlebreds
  - Warmbloods
  - Most breeds possible, but unlikely in Thoroughbreds & Standardbreds

- Physical characteristics
  - Cresty neck
  - Fat deposits under the skin
  - Easy keeper (can't lose weight)

EquidDoc VETERINARY SERVICES LLC

Diagnosis – Insulin Resistance

- Baseline/ Resting Insulin
  - No need to fast
  - No grain, just hay
  - Insulin > 50 U/L = Insulin dysregulation
    - High specificity, low sensitivity
    - But what if you get a midrange value (20-50) and still suspect insulin dysregulation?

Insulin will be elevated with:

1. Large grain meals
2. Pregnancy
3. PPID
4. Illness/Stress/Pain
5. EMS

EquidDoc VETERINARY SERVICES LLC

Diagnosis – Insulin Resistance

- Dynamic testing is more sensitive than baseline
- Oral Sugar (Glucose) Test – (OST)
  - Fasting (6-8 hours)
    - 1 flake hay 10pm
  - Karo syrup (light color, not lite)
    - 75 cc per average sized horse
    - 1 hour prior to blood draw
  - If Insulin > 45 U/L = Insulin dysregulation

Insulin will be elevated with:

1. Large grain meals
2. Pregnancy
3. PPID
4. Illness/Stress/Pain
5. EMS

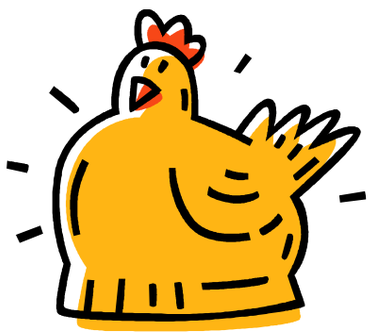
EquidDoc VETERINARY SERVICES LLC

Additional Diagnostic Tests

- Leptin
  - A hormone produced by metabolically active fat
  - Can help quantify the amount of internal adipose tissue
  - Available with insulin testing on a metabolic panel
- ACTH baseline / TRH stimulation testing
  - PPID status essential to know in EMS management

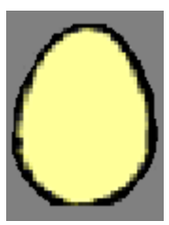
EquidDoc VETERINARY SERVICES LLC

Insulin Resistance



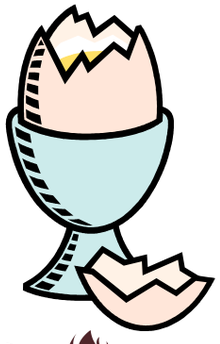
Diet → **FAT** → **Insulin Resistance** → **Laminitis**

Insulin Resistance → **FAT** / regional adiposity → **Laminitis**



Not all fat horses are insulin resistant and

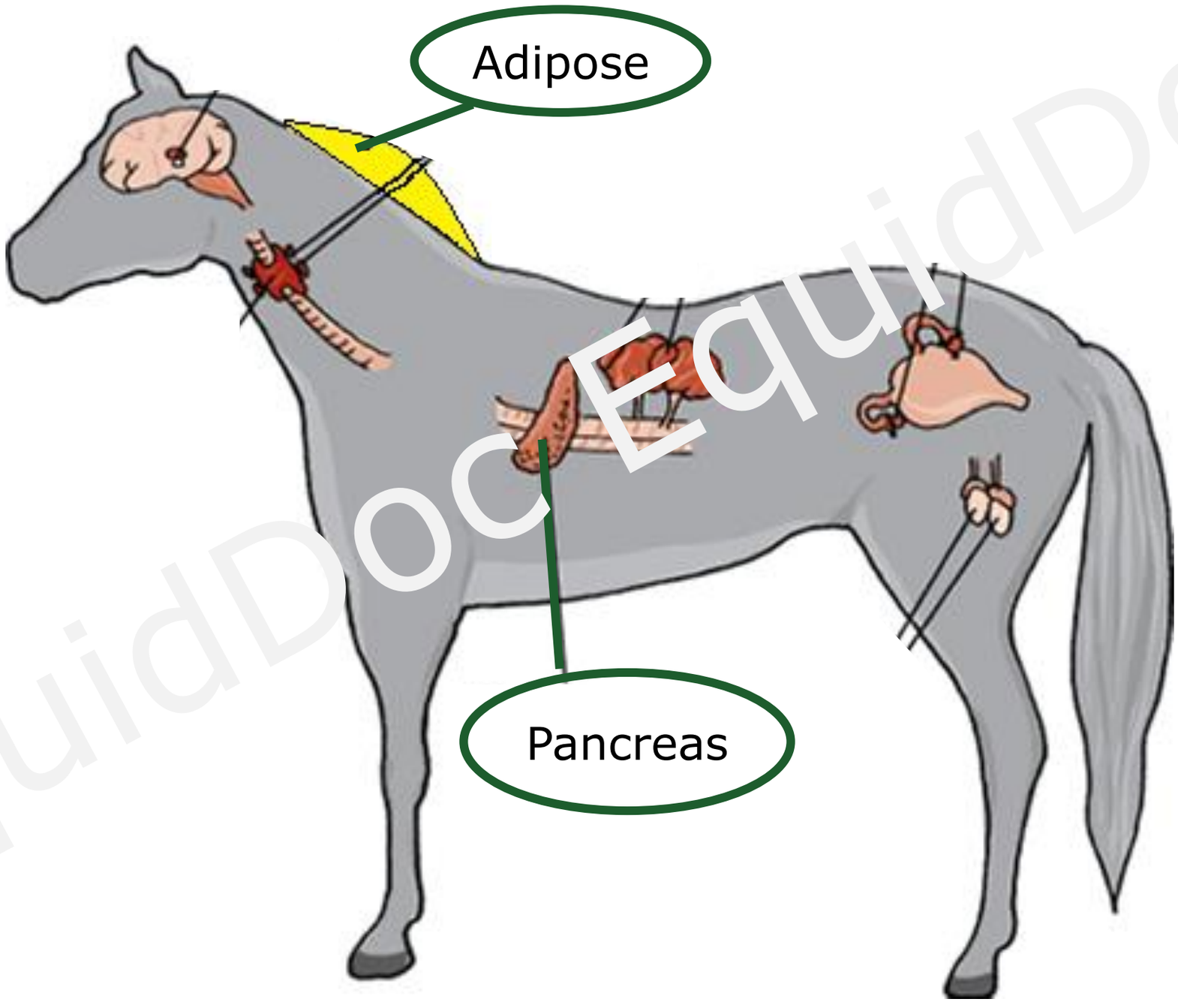
not all insulin resistant horses are fat.



Goal: Diagnose early
establish a Treatment protocol
PREVENT laminitis.

EquidDoc
VETERINARY SERVICES LLC

Endocrine system 101

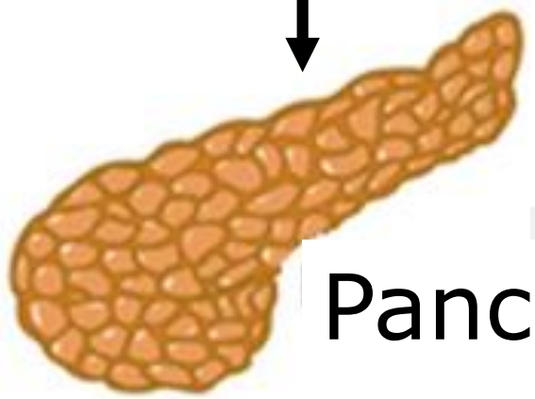


EquidDoc
VETERINARY SERVICES LLC

http://www.merckmanuals.com/pethealth/horse_disorders_and_diseases/

Endocrinology 101 – Insulin

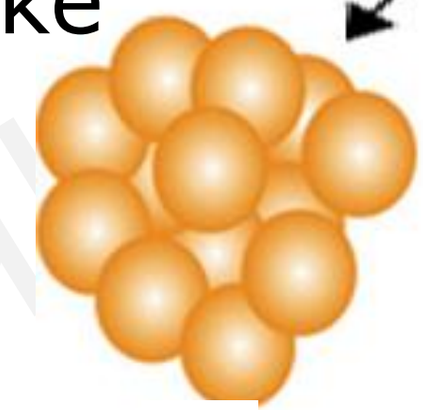
Blood Sugar ↑



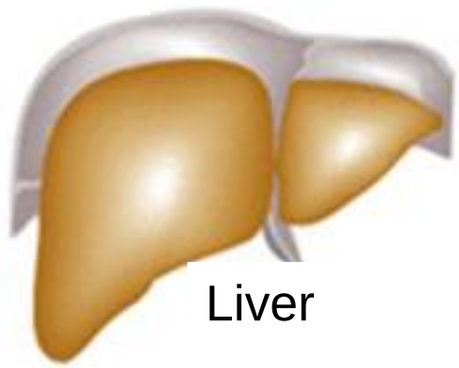
Pancreas

Insulin

Glucose Uptake

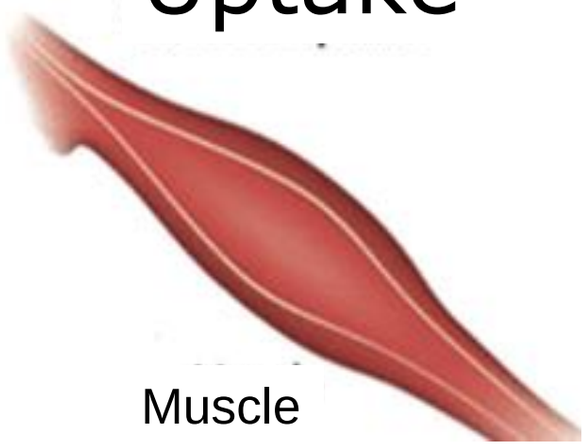


Fat



Liver

Glucose Uptake

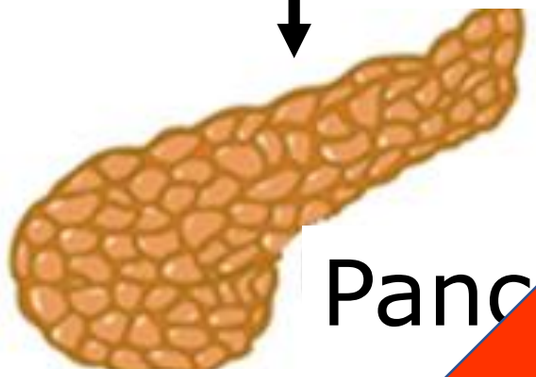


Muscle

Blood Sugar ↓

Endocrinology 101 – Insulin

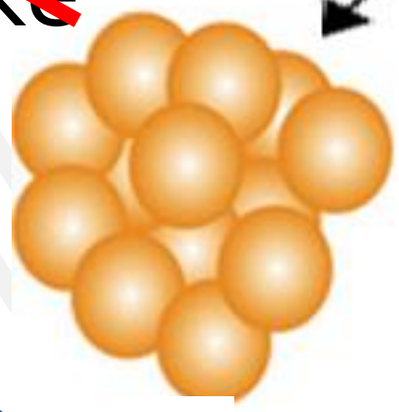
Blood Sugar ↑



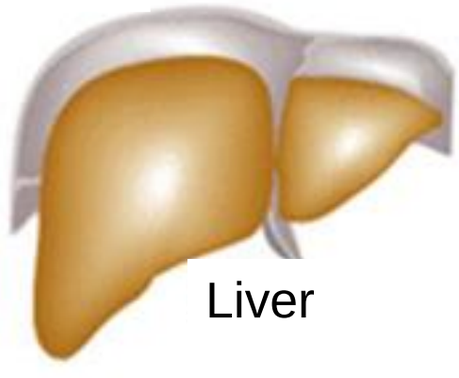
Pancreas

Insulin

Glucose Uptake

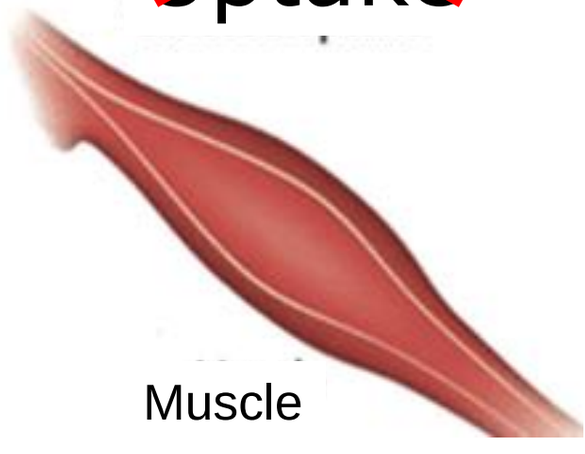


Fat



Liver

Glucose Uptake



Muscle

Blood Sugar ↑

Laminitis and Insulin

- Inflammation/ breakdown of the laminae that connect the coffin bone to the hoof wall
- As the laminae weaken, the opposing forces on the coffin bone cause rotation and sinking

Insulin ↑

↓

Growth Factors ↑ and Blood Flow ↓

↓

Cells Energy Crisis

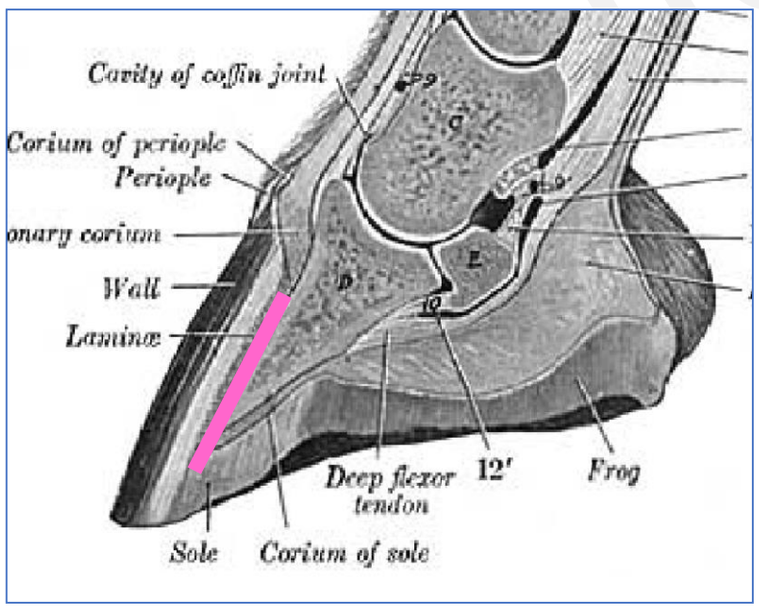
↓

Cell Death and Inflammation

↓

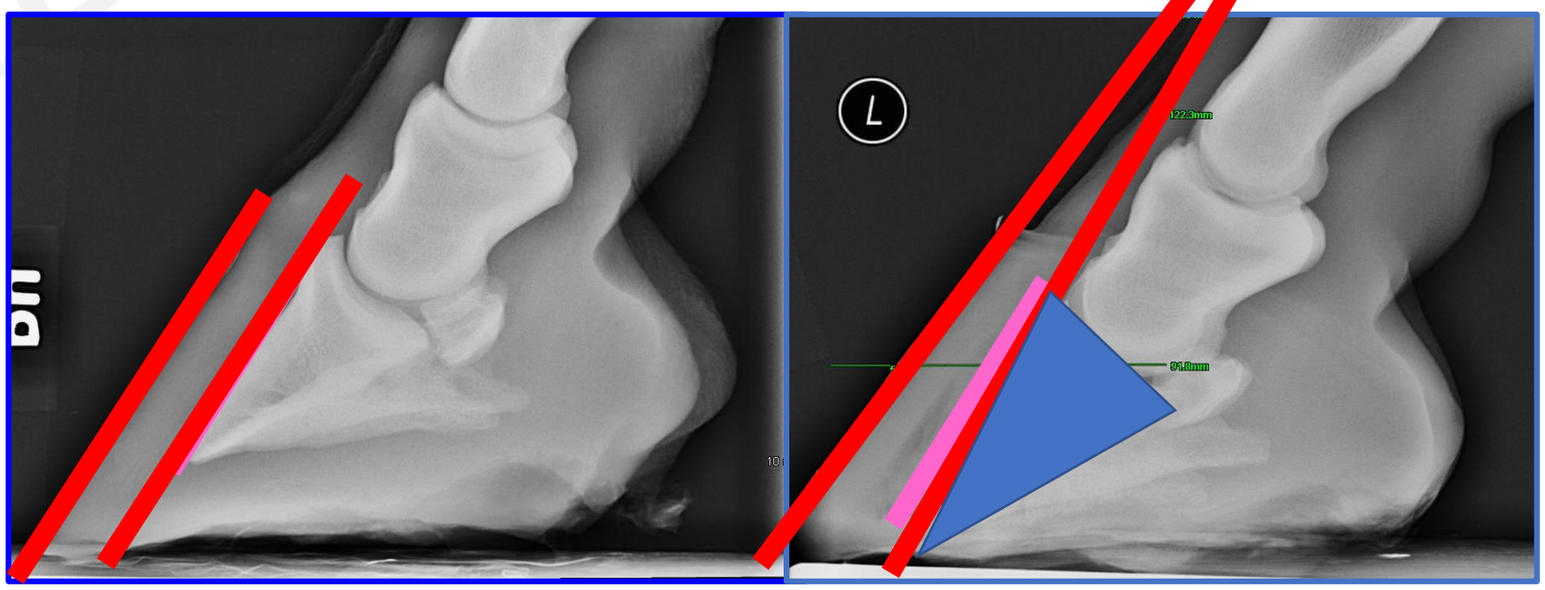
Enzymes ↑

that break down laminae



Normal

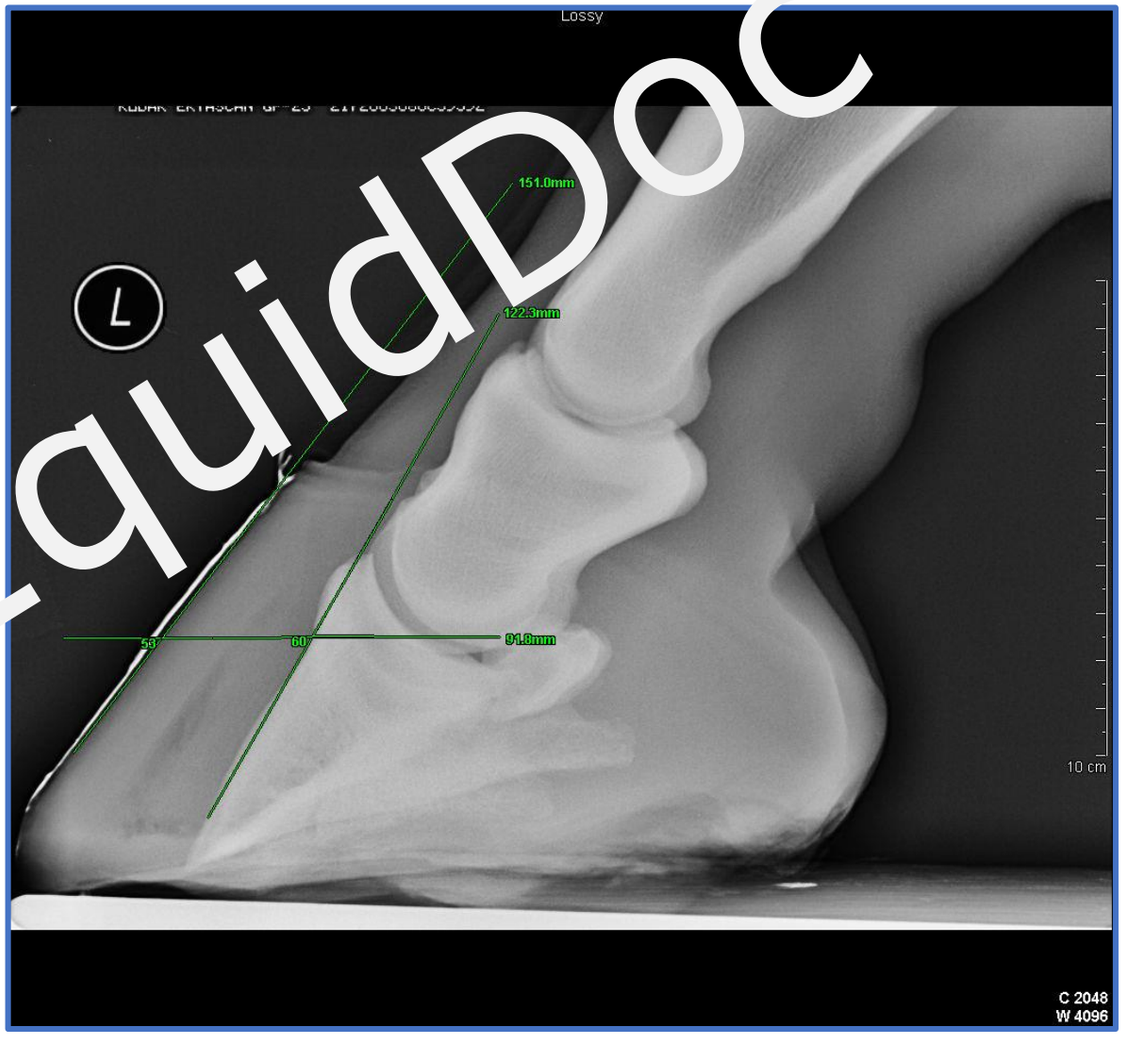
Laminitis



*De Laat et al Equine Laminitis: induced by 48 h hyperinsulinemia in Standardbred horses. Equine Vet J 2010, 42:129-135

Diagnosis & Treatment

- GOAL: to diagnose early and establish a treatment protocol to PREVENT laminitis.

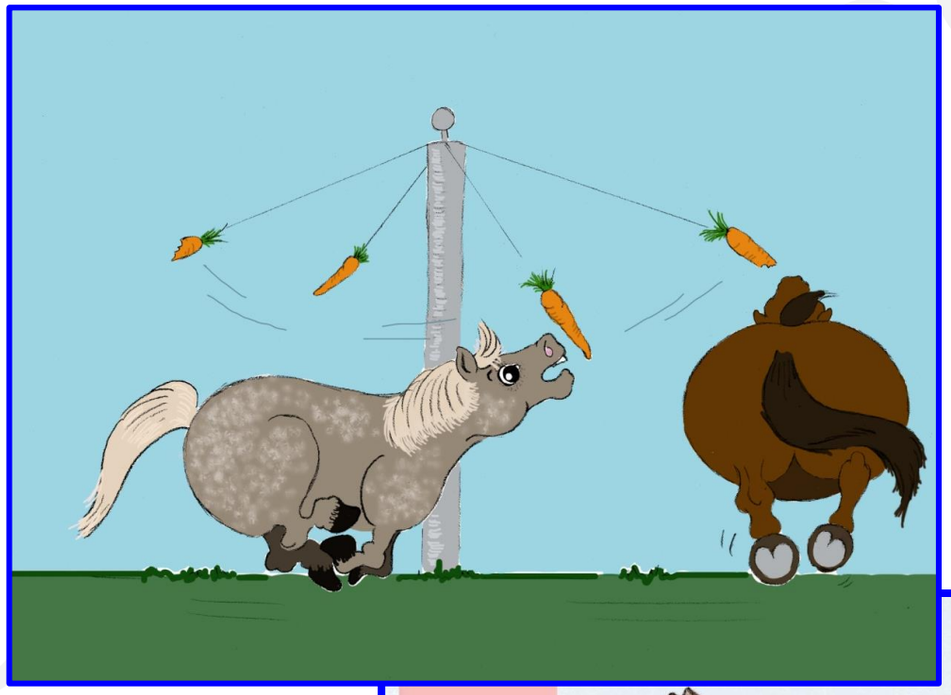


EquidDoc
VETERINARY SERVICES LLC

Weight management

- Weight Loss
  - ↑ physical activity
  - ↓ caloric intake

- Regular exercise
  - Improves insulin sensitivity even before weight loss or a change in fat distribution



EquidDoc VETERINARY SERVICES LLC

Weight Management – Step 1
Exercise Regimen

- Start with 10 minute handwalk 3-5 times per week
  - Ponies hand-walked 10 minutes per day lost weight!
  - Won’t self-exercise!
- 2-3 exercise sessions per week
  - Handwalking, Lunging, or Riding
  - 20-30 minutes per session

Weight Management – Step 2
Calorie reduction

- Eliminate pasture access
  - Confine to drylot or use grazing muzzle

- Eliminate grain from diet
  - Replace with ration balancer
- Restrict/limit hay intake
  - 1.2- 1.5% body weight

EquidDoc VETERINARY SERVICES LLC

Hay and pasture analysis:

- Appearances aren't everything
  - Cannot assess calorie and sugar content visually
  - Requires a forage analysis

- We can refer you to a Nutrena or Poulin nutrition specialist to assist you with a forage analysis

EquidDoc
VETERINARY SERVICES LLC

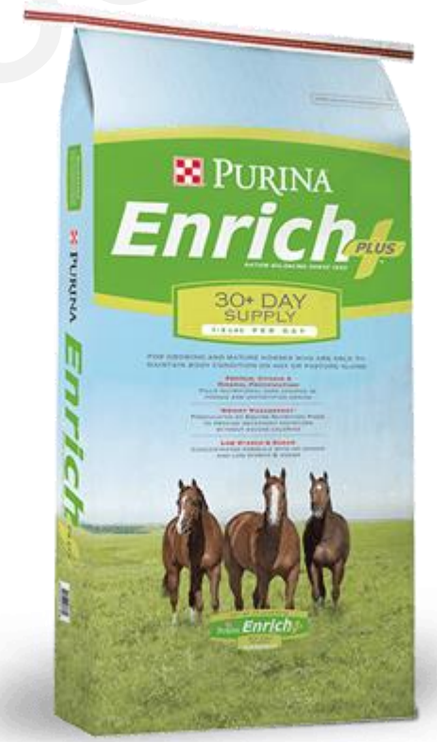
Soaking hay…

- Leach out water soluble carbohydrates in order to reduce overall carbohydrate levels in hay.
- Use large clean bucket and completely submerge flake hay
- Soak hay for 60 minutes in cold water
- Recommended to reduce sugar content in high risk laminitis

Longland et al Effect of soaking on the water-soluble coarbohydrate and crude protein content of hay. Vet Rec 2011 168:618-622

Mineral and vitamin supplements

- Mineral-vitamins lost in soaking hay
- Available in a pelleted formulation so horses believe that they are still getting grain!
  - Still have calories and carbohydrates

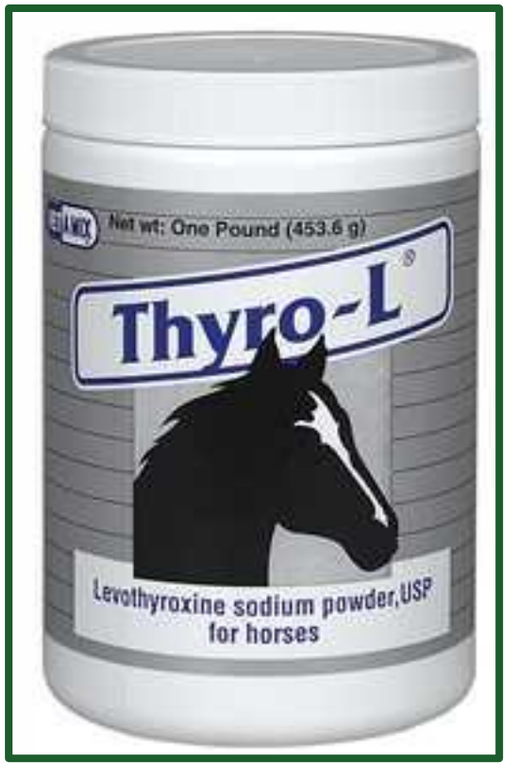


EquidDoc
VETERINARY SERVICES LLC

IR medication

- Metformin
  - Human diabetes medication
  - For short term use
    - Active laminitis
    - Reduce high insulin levels

- Levothyroxine (Thyro-L)
  - Increases metabolic rate for weight loss
  - For use in horses:
    - That cannot exercise due to laminitis
    - That have failed to lose weight despite diet and exercise



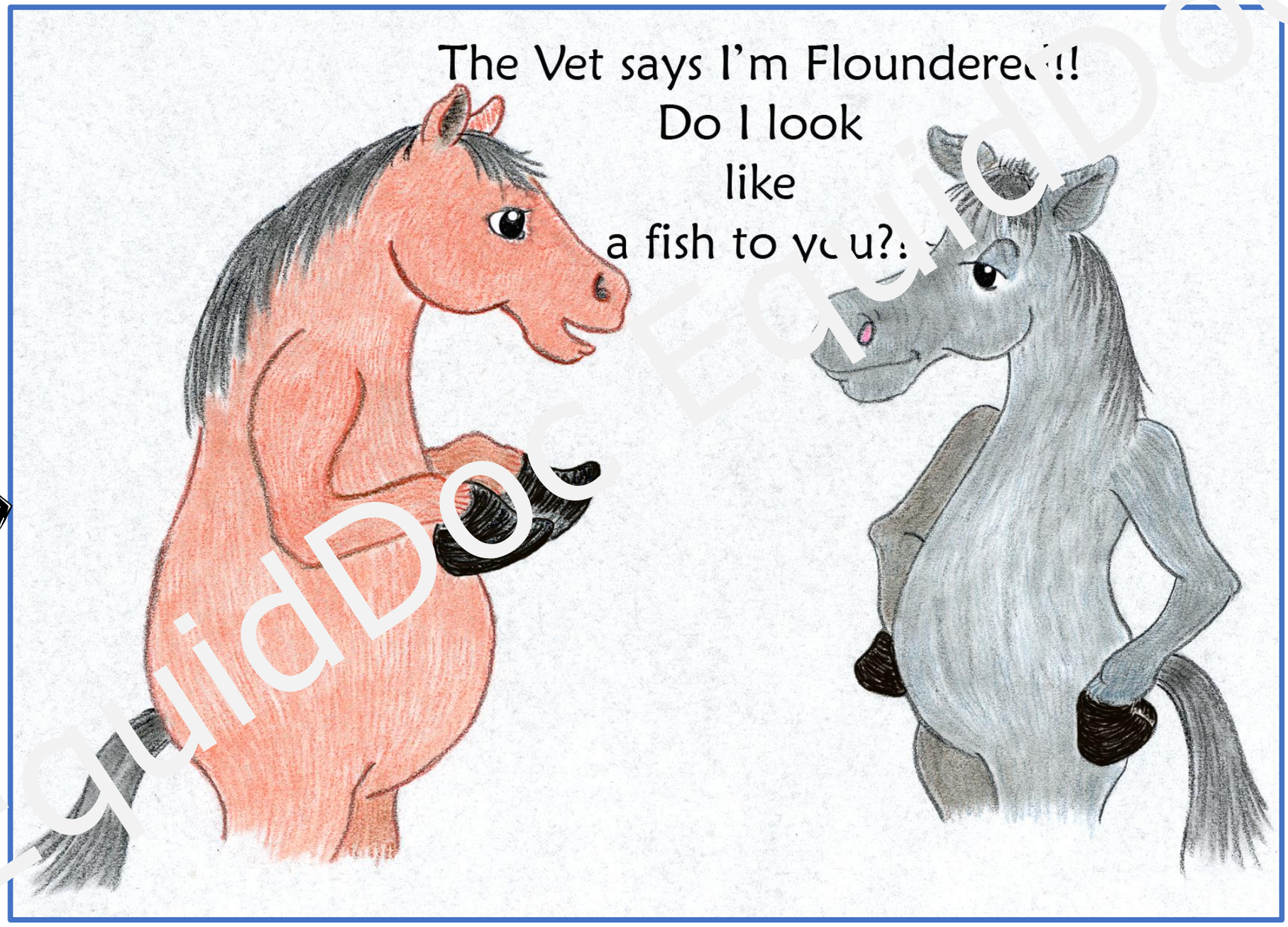
EquidDoc VETERINARY SERVICES LLC

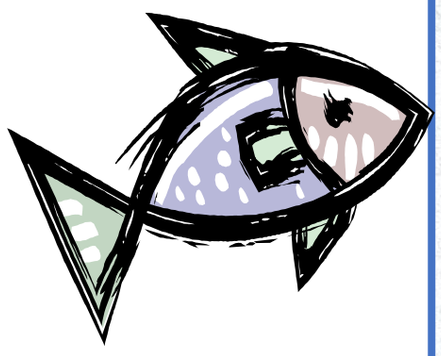
Insulin Resistance may be a precursor…

- New research indicates many horses with Cushing's disease (PPID) also have EMS
- Could EMS be a precursor to PPID or do they occur together?

EquidDoc VETERINARY SERVICES LLC

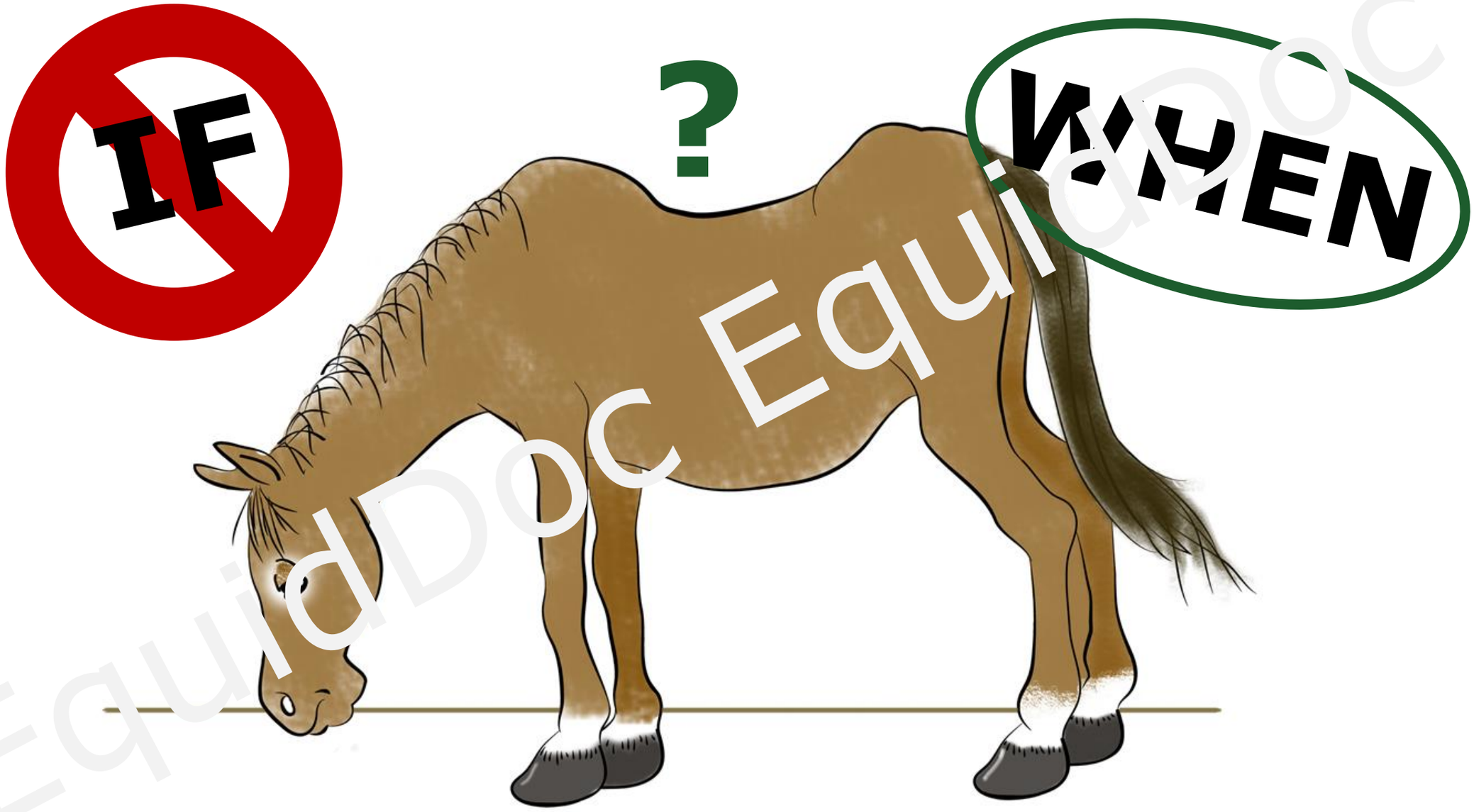
QUESTIONS?





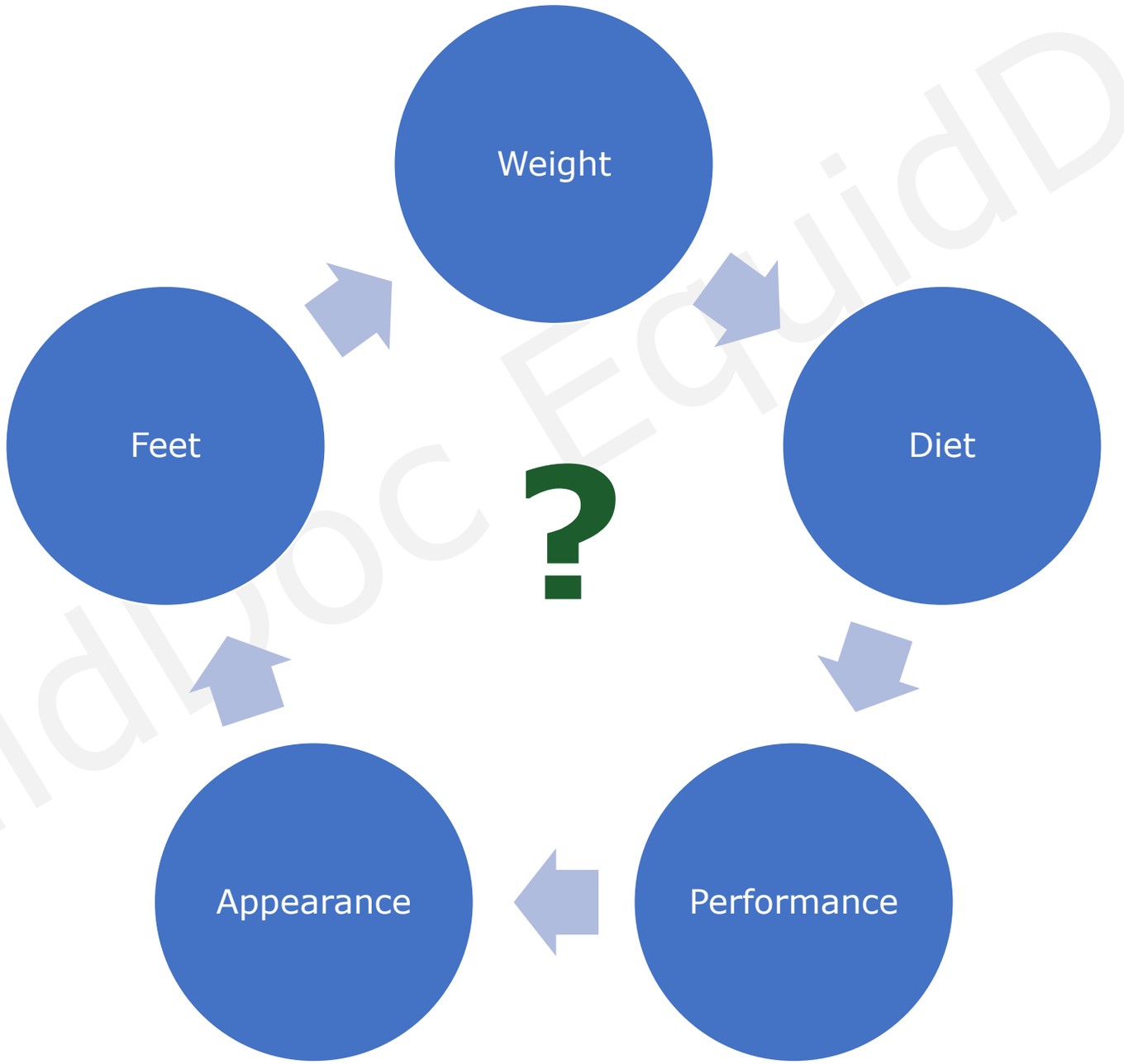
EquidDoc
VETERINARY SERVICES LLC

Equine Cushing's-like Disease aka Pars Pituitary Intermedia Dysfunction aka PPID



EquidDoc VETERINARY SERVICES LLC

Equine Cushing's-like Disease aka Pars Pituitary Intermedia Dysfunction aka PPID



EquidDoc VETERINARY SERVICES LLC

Equine Cushing's-like Disease aka Pars Pituitary Intermedia Dysfunction aka PPID

He is always slow to shed out...

He lost muscle because I gave him the winter off…

?

She used to be fat, but this winter helped her lose the weight…

- **30% of horses > 15 years of age**
- **equally geldings & mares**

EquidDoc VETERINARY SERVICES LLC

Pituitary Pars Intermedia Dysfunction (PPID)

Early Signs

1. Increased lethargy
2. Regional shaggy haircoat
3. Delayed shedding
4. Loss of topline
5. Regional adiposity
6. Loss of Topline
7. Abnormal sweating

---

1. Recurrent Corneal Ulcers
2. Recurrent Hoof Abscesses
3. Desmitis/Tendonitis
4. Recurrent Laminitis

EquidDoc VETERINARY SERVICES LLC

Pituitary Pars Intermedia Dysfunction (PPID)

Advanced Signs

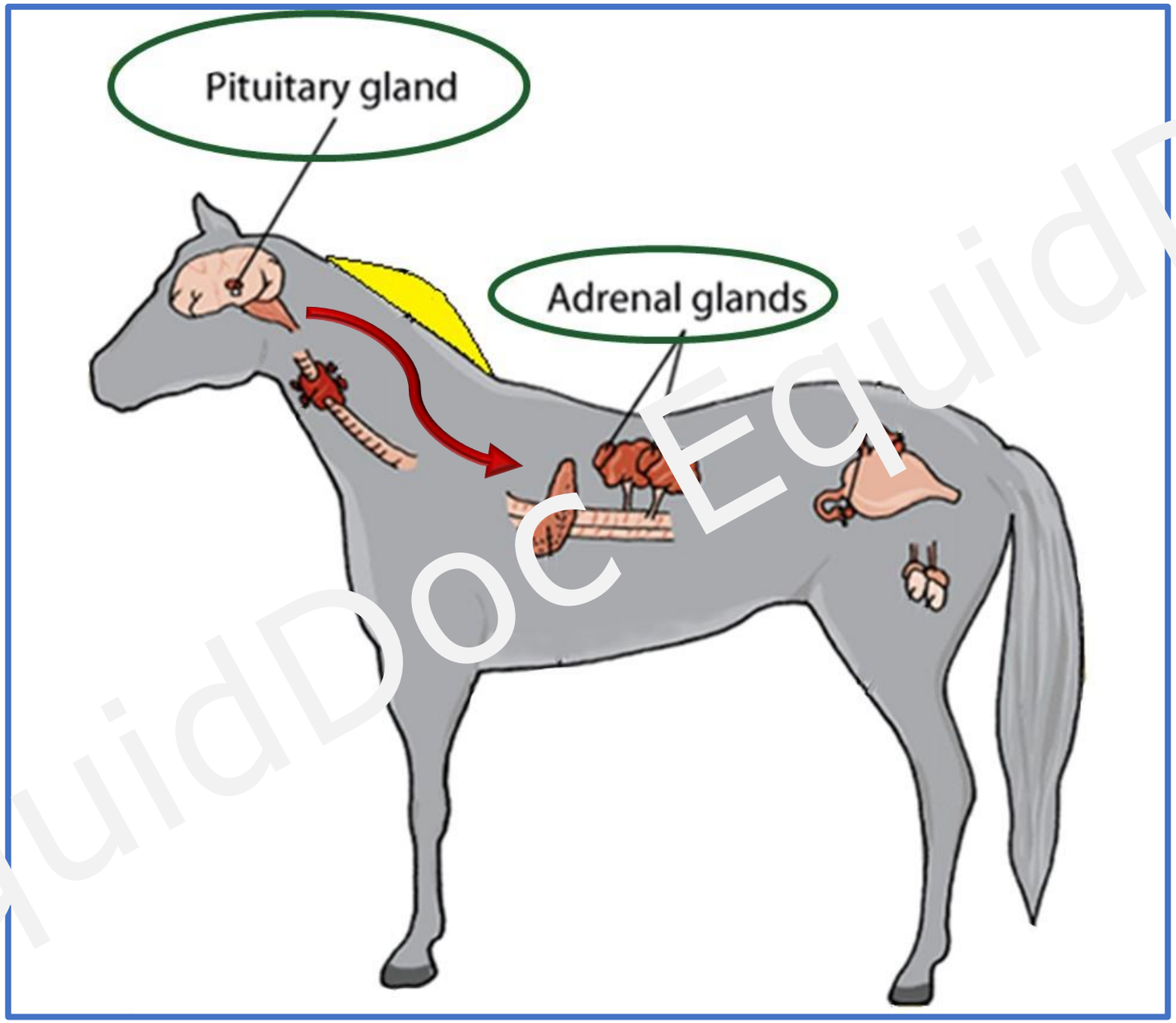
1. Dull
2. Exercise intolerant
3. Poor shedding
4. Pot-bellied abdomen
5. Muscle atrophy
6. Regional Adiposity
7. Poor Performance
8. Loss of Topline
9. Increased Thirst/Urination

---

1. Blindness
2. Delayed healing of wounds
3. Laminitis/Hoof Abscesses
4. Suspensory Ligament/Tendon laxity

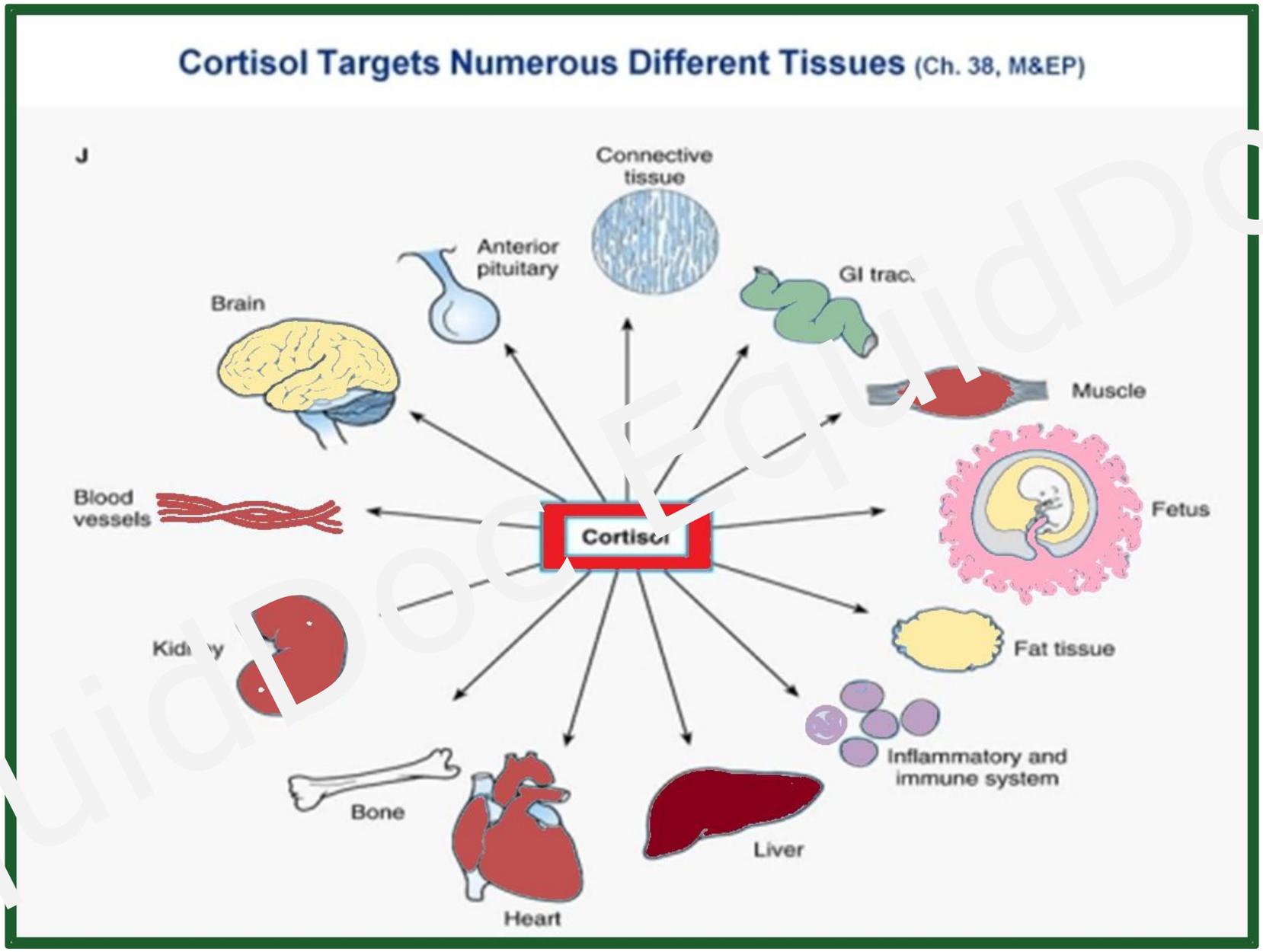
EquidDoc
VETERINARY SERVICES LLC

PPID: an endocrine disorder



EquidDoc
VETERINARY SERVICES LLC

Cortisol – the stress hormone



- ***Moderate*** amounts of cortisol are necessary

- ***Too much*** cortisol is damaging
  - Abnormal fat production
  - Weakened immune system
  - Increased urine output
  - Poor digestion, prone to EGUS
  - Poor performance

EquidDoc VETERINARY SERVICES LLC

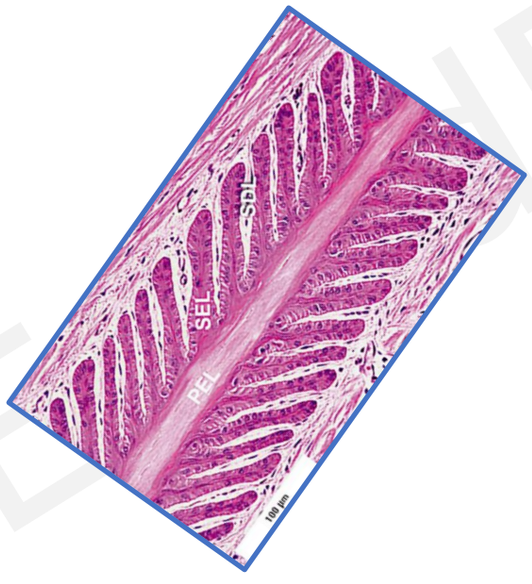
Diagnosis for PPID

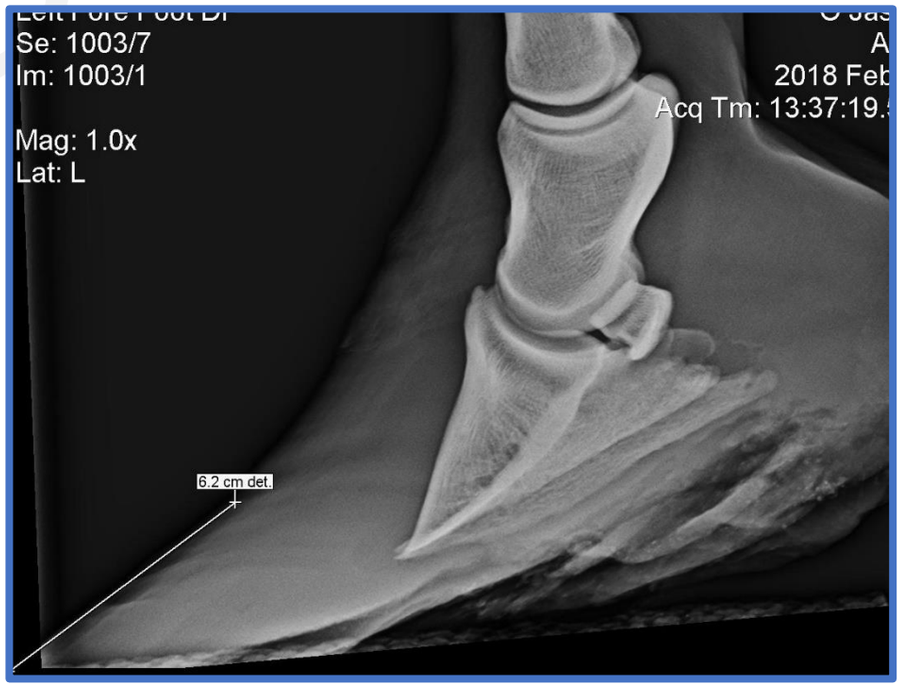
GOALS:

1. Test to detect early disease

2. Test to monitor treatment

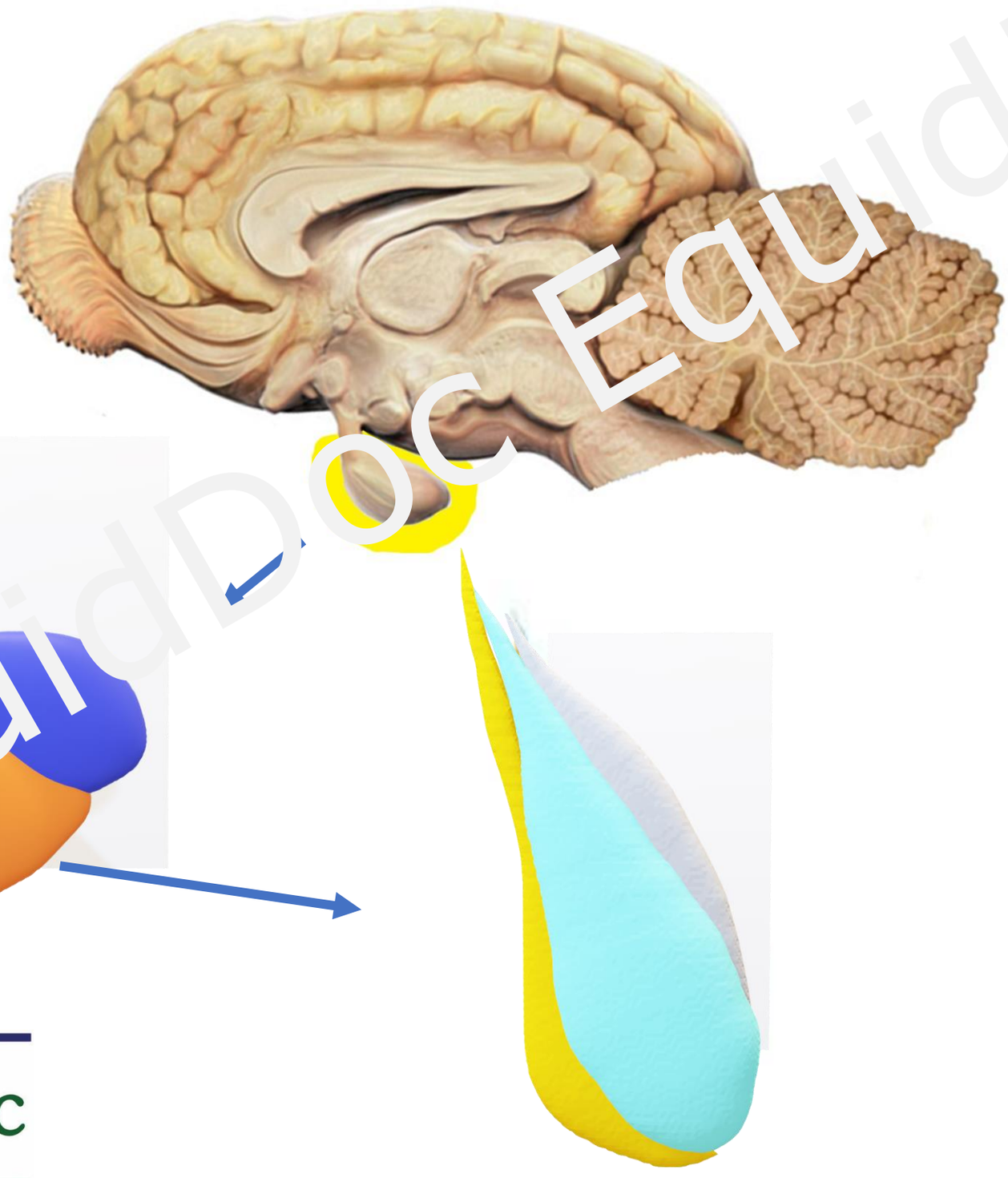
www.northernfloridaequine.com



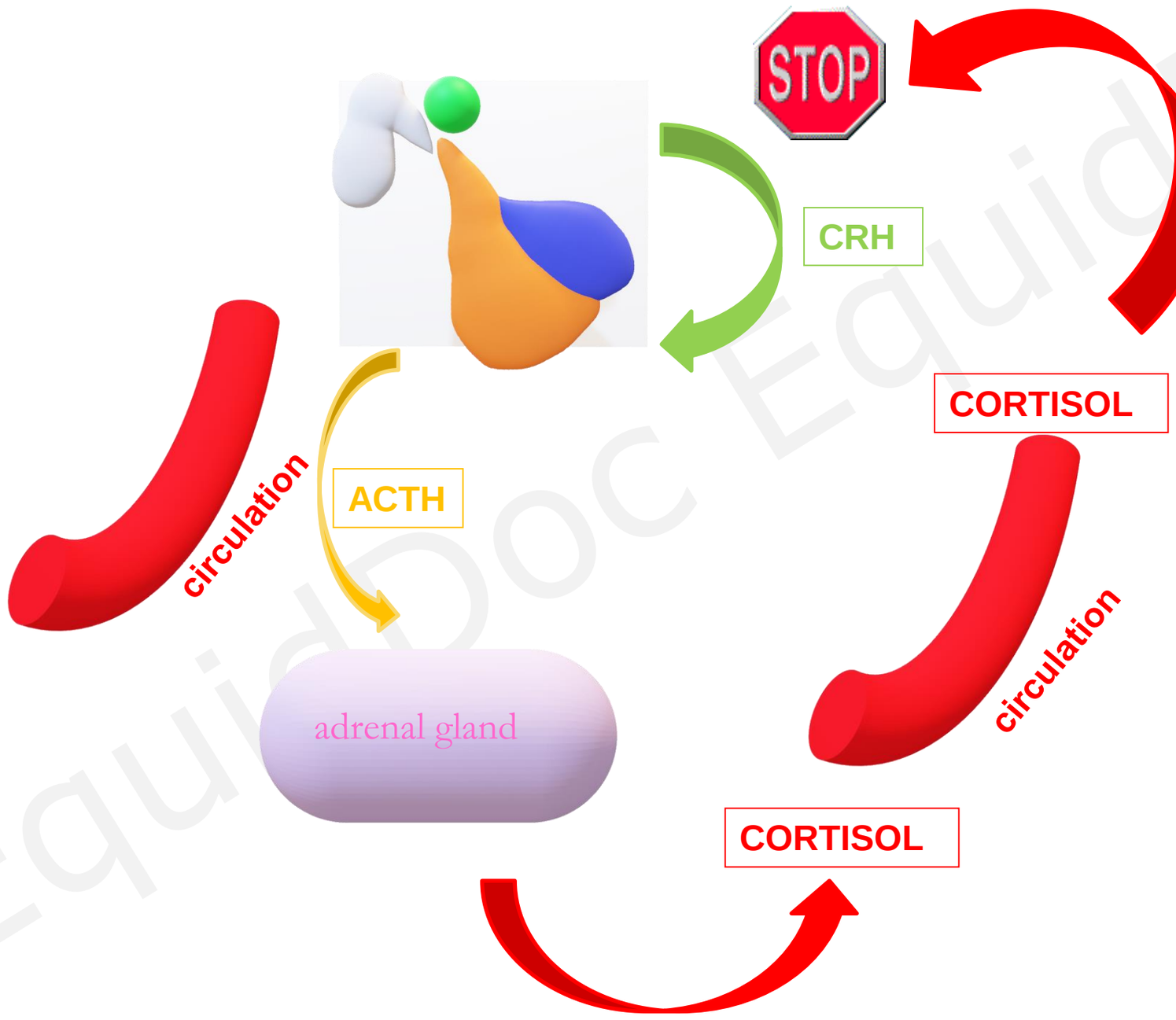


EquidDoc
VETERINARY SERVICES LLC

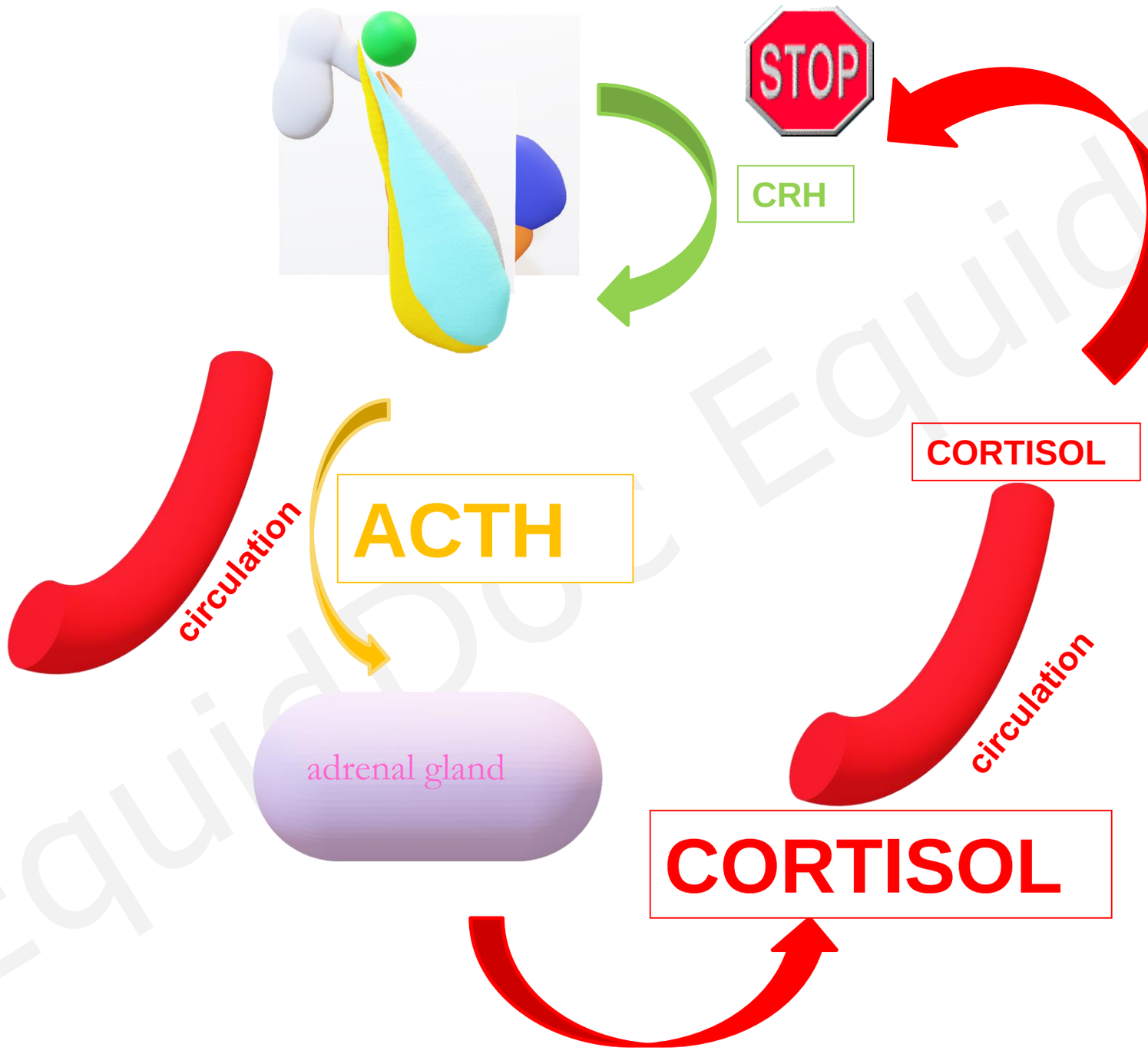
Pituitary Gland



Normal pituitary function



Abnormal pituitary function

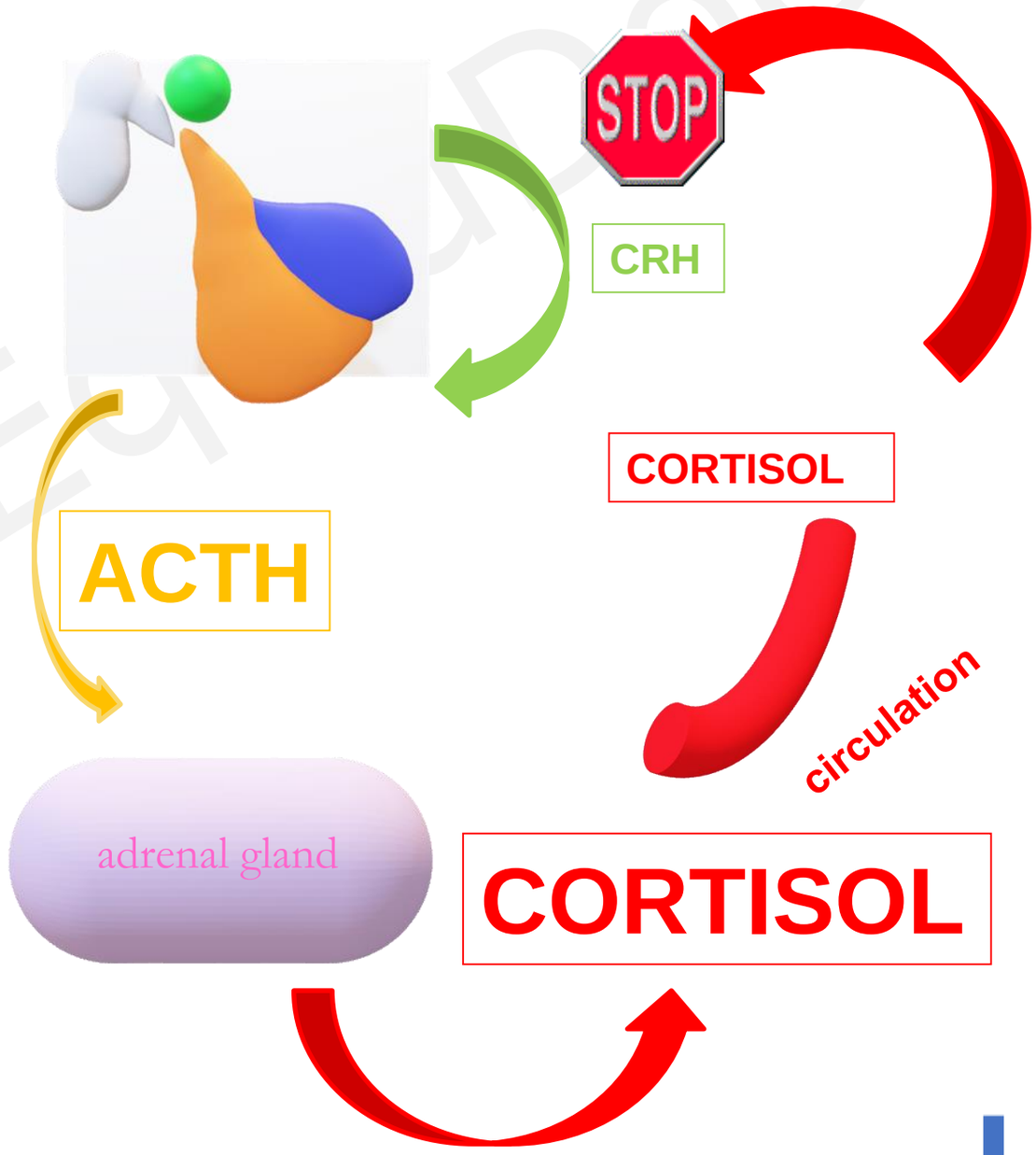


EquidDoc VETERINARY SERVICES LLC

Diagnosis – PPID

- Resting ACTH concentration
  - No grain within 12 hours
  - ACTH ↑ with pain and stress, no testing during laminitis flare-up
  - Blood handling
  - **PPID if ACTH > 35 pg/ml**
- Seasonal elevation
  - mid-July-mid-Nov
  - ACTH ↑ in late summer and autumn in healthy horses

July-Nov	ACTH Result
Negative	<50 pg/ml
Equivocal	50-100 pg/ml
PPID	>100 pg/ml



Diagnosis – PPID

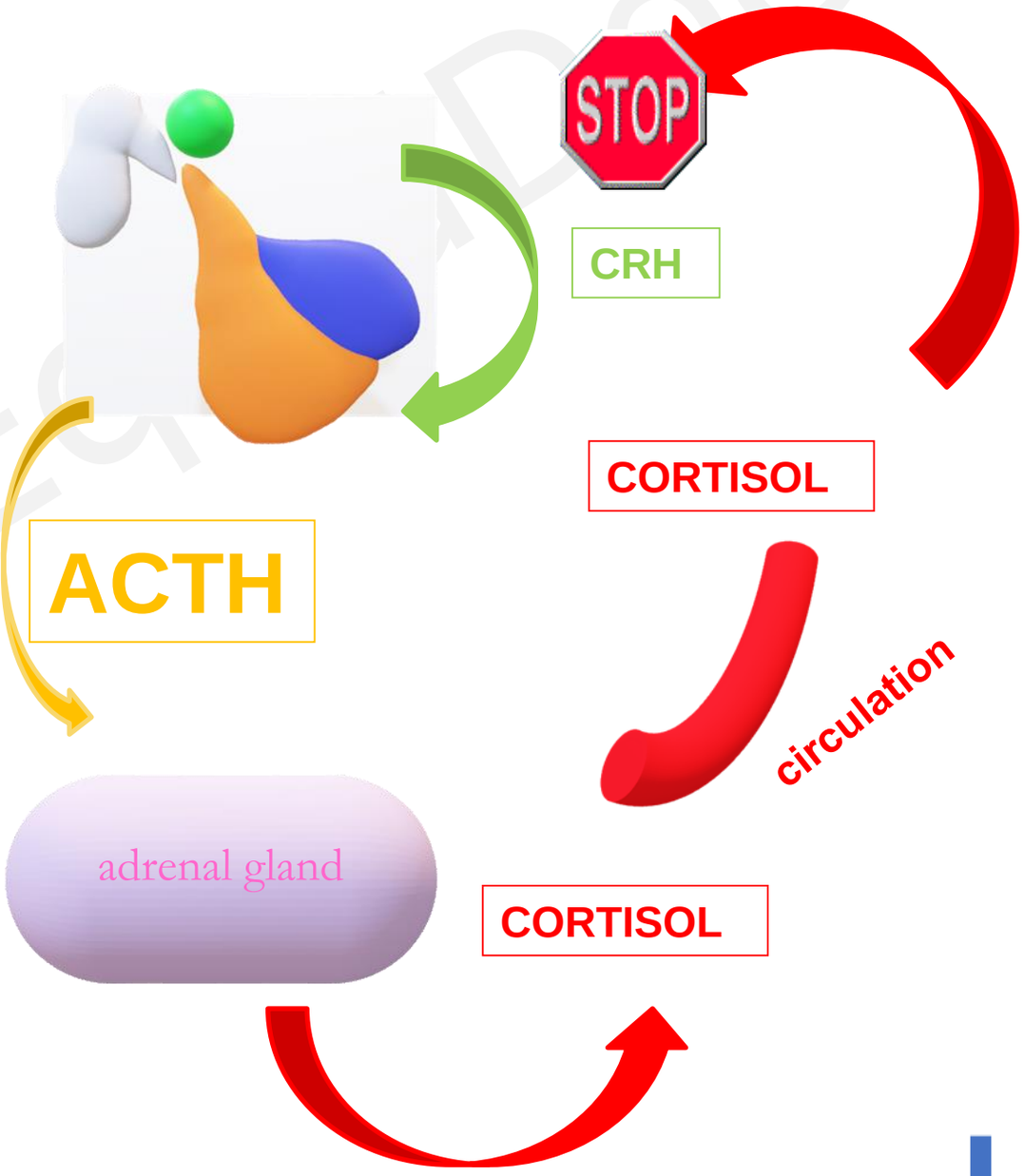
- TRH stimulation
  - Normal resting ACTH
  - Safe
  - Not during mid-July thru mid-Nov

1. Baseline ACTH

2. Give synthetic Thyrotropin Releasing Hormone (TRH)

3. 10 minutes, post-TRH ACTH

Nov-July	ACTH Result
Negative	<110 pg/ml
Equivocal	110-200 pg/ml
PPID	>200 pg/ml



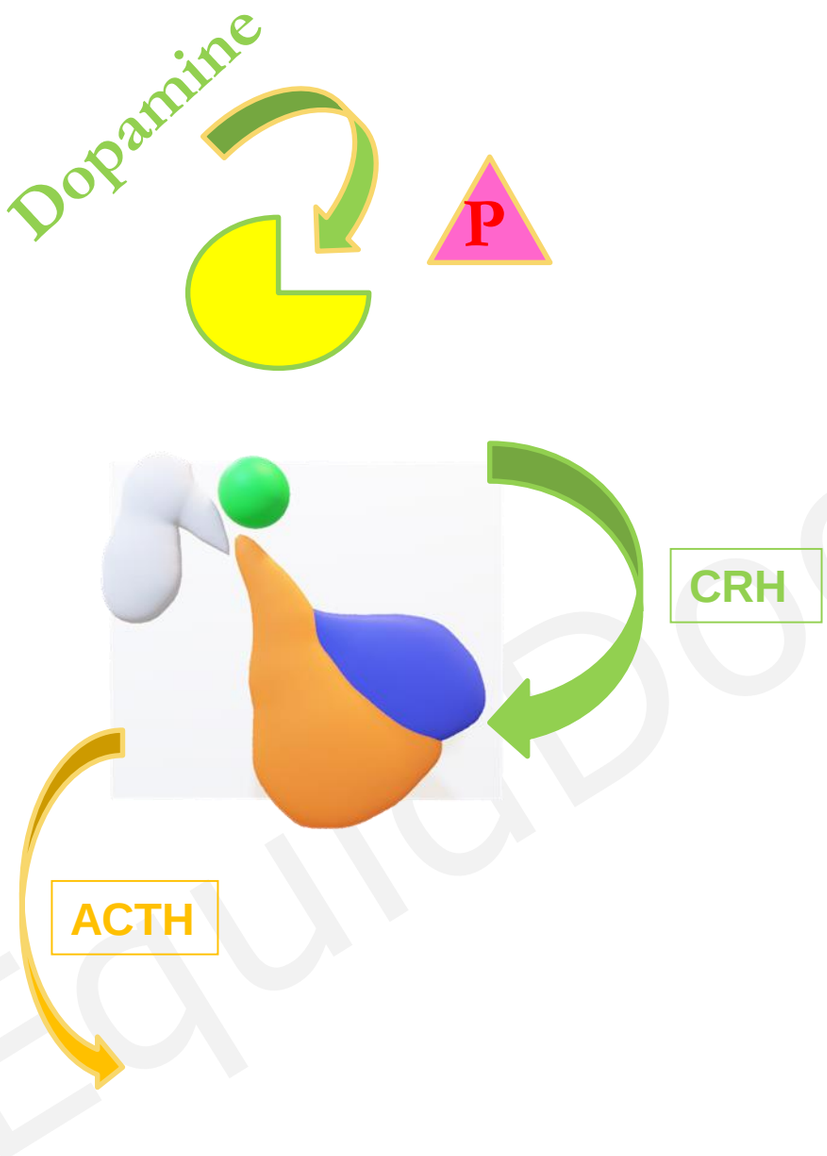
Diagnosis – PPID

- TIMING NO LONGER A PROBLEM
  - Response to treatment

- NO LONGER RECOMMENDED
  - Dexamethasone suppression test
  - TRH stimulation measuring cortisol
  - ACTH stimulation test
  - Resting cortisol concentration
  - Diurnal cortisol rhythm

EquidDoc VETERINARY SERVICES LLC

PPID Medication

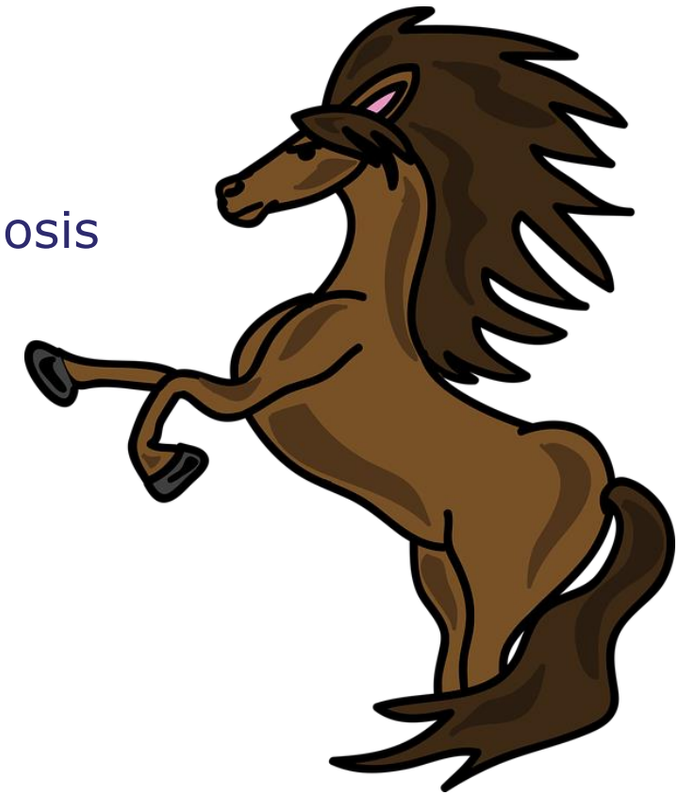


- Pergolide mesylate
  - Prascend
- Dosing – daily, for life
  - Proper technique
  - Open & prepare immediately before dosing
  - Tablets allow dosing changes

EquidDoc VETERINARY SERVICES LLC

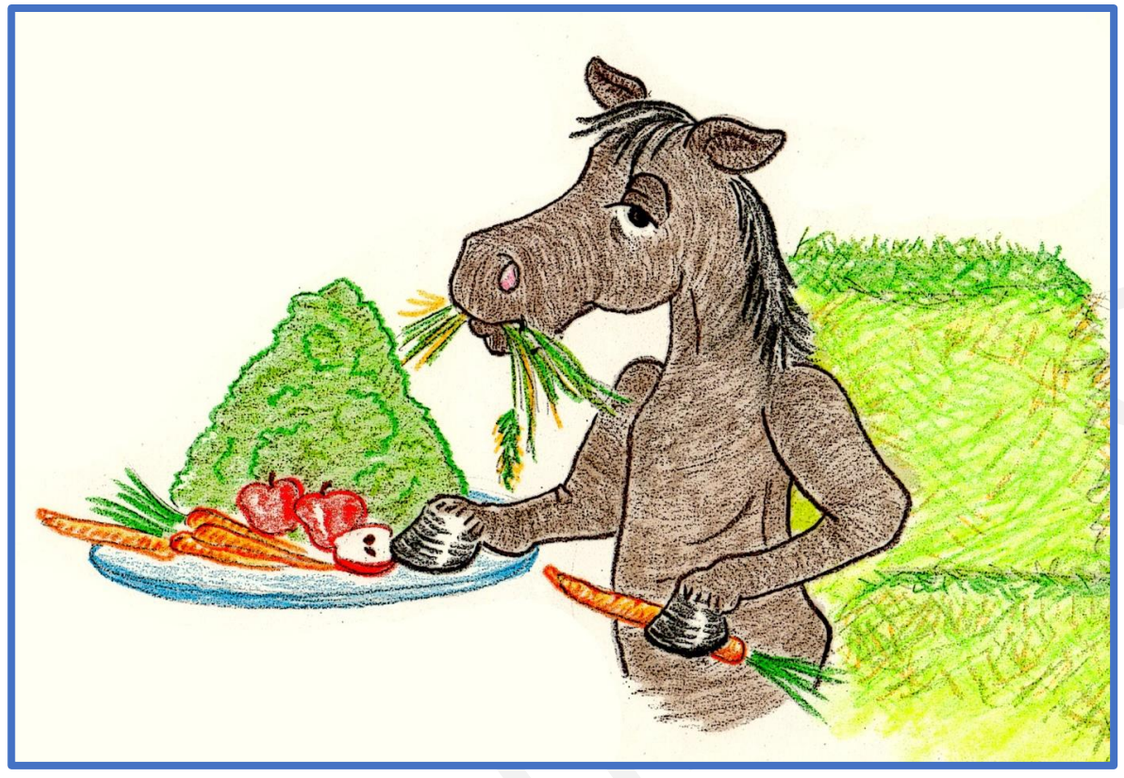
Treatment Follow-up

- Side effects – minimal!
- Permitted for showing with medication report form
- Re-testing ACTH
  - 3-6 months
  - Annual
  - Same test form as diagnosis
- Clinical signs improve
  - 3-6 months



EquidDoc VETERINARY SERVICES LLC

PPID: Whole horse treatment



- Medicate with pergolide
- Resolve dental issues
  - Annual oral exam +/- float
- Maintain hoof health
  - Survey x-rays
- Exercise!
  - Modulate insulin levels
  - Maintaining muscle mass
  - Joint health
- Dietary changes…

EquidDoc VETERINARY SERVICES LLC

PPID – Feeding

- ↑ calorie but ↓ carbohydrate feeds…

Laminitis Treatment

METABOLIC LAMINITIS

- Anti-inflammatory
  - **NSAID – Bute**
  - Cryotherapy in initial onset
  - DMSO
- **Control insulin levels**
  - Medication
  - Eliminate sugar
- **Control ACTH levels**
  - Pergolide
  - Increase dose

OTHER CAUSES

- Anti-inflammatory
  - NSAID – Bute
  - **Cryotherapy in initial onset**
  - DMSO - uncertain
- Control insighting factors
  - Treat infection
  - Stop colitis

EquidDoc VETERINARY SERVICES LLC

To summarize:

EMS

- Age <15 yo
- Pony, Morgans, Arabians, Warmbloods, Saddlebreds, Paso Finos, other
- Normal hair coat
- Obesity or regional adiposity

PPID

- Age > 15 yo
- Any breed
- Long, thick, sometimes curly, delayed shedding, excessive sweating
- Weight loss, swayback, pendulous abdomen, regional adiposity still possible

If your horse has laminitis they must be tested for these two diseases!

EquidDoc VETERINARY SERVICES LLC

To Summarize:

EMS	PPID
1. Diagnose w/oral sugar test	1. Diagnose with ACTH test, TRH Stim
2. Weight loss with thyroxine as directed by your veterinarian	2. Treat with pergolide as directed by your veterinarian
3. Exercise once laminitis is under control	3. Exercise once laminitis is under control
4. Feed low calorie, low WSC & Starch feed	4. Feed low WSC & starch feed, if thin feed fat based calories
5. Soak hay	5. Soak hay if also IR

EquidDoc VETERINARY SERVICES LLC

Questions?

EquidDoc VETERINARY SERVICES LLC