SHIVERS-STRINGHALT SYNDROME

PART 3: ANATOMY & STRUCTURES RESPONSIBLE

AUDREY DECLUE, DVM
DECLUE EQUINE, LLC

REVIEW

- **IN 1882 WILLIAM WILLIAMS STATED:**
- Professor Dick was of opinion that it was due to the presence of tumours in the lateral ventricles of the brain, and supported his views by a post mortem proof. But tumours in the ventricles may be present without chorea; and chorea is very often present without such tumours.
- Other writers have traced its origin to a hypertrophied condition of the nerves given off from the lumbar plexus, to the pressure of some exotoses on a nerve, and to paralysis of the muscles antagonistic to those affected with the spasm.

- **IN 1930 WILLIAM MITCHELL STATED:**
- From the frequency with which specimens were obtained in this region in September, I was led to believe that the Lumbar Vertebrae, with their more complicated articulations associated with the transverse processes of the 4th, 5th and 6th., would in all probability show similar changes.
- Remembering that the Lumbo-Sacral plexus of nerves was formed by the ventral roots of the 4th, 5th and 6th Lumbar and 1st and 2nd Sacral nerves, and that the ventral intervertebral foramina, by which the first three of these roots emerge, were in close proximity to joints medially. and laterally, it struck me that the nerves emerging from these foramina were peculiarly liable to suffer from the effects of osteo-arthritic change if these neighbouring joints should ever be affected.
- From this deduction I began to wonder if the conditions shivering and stringhalt might be explained in this way. It so happened that about this time a shiverer came to my notice which I managed to get the Zoo to buy for slaughter and I thus got an opportunity of testing the hypo- thesis I had formulated. (See Case 1 below.)

LET'S GET TO THE POINT!

FOR LITERALLY…

138 YEARS (W.WILLIAMS)
& 90 YEARS (W.MITCHELL)

THEY

HAD THE SOME OF THE ANSWERS

SO

MANY YEARS AGO!

UNFORTUNATELY…

SO MANY HORSES HAVE LOST THEIR LIVES AND CAREERS

SO…
WHAT IS CAUSING SHIVERS AND STRINGHALT?

IT IS AN

INJURY

TO SEVERAL:

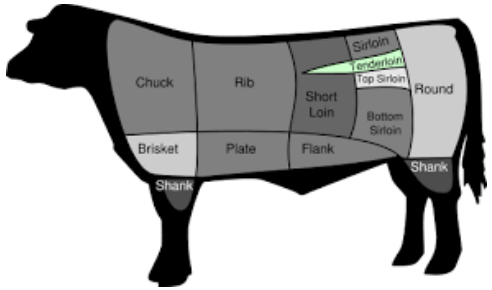
- MUSCULOSKELETAL STRUCTURES
- NERVE PLEXUS
  NERVE INJURY

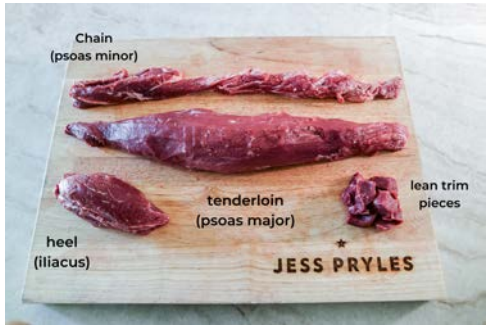
WHAT ARE THE RIGHT QUESTIONS??

WHAT	WHERE	WHEN	HOW	WHY
• Structures	• Located	• There is an Injury	• Does it occur?	• Is it occurring

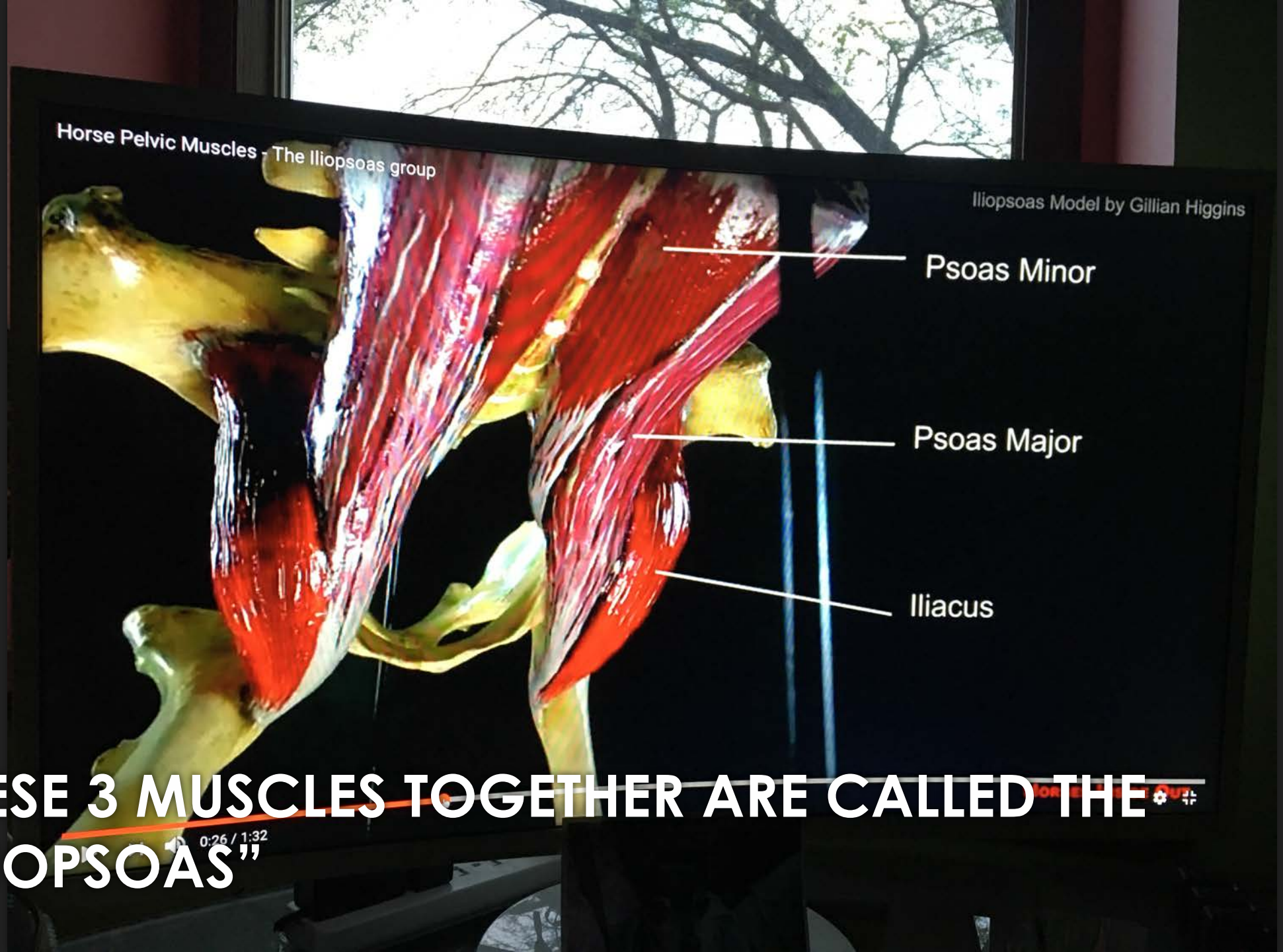
WHAT MUSCULOSKELETAL STRUCTURES ARE THE CAUSE?

THE
ILIOPSOAS MUSCLE:
a. PSOAS MINOR
b. PSOAS MAJOR
c. ILIACUS





THE ILIOPSOAS IS THE TENDERLOIN THAT YOU EAT!



THESE 3 MUSCLES TOGETHER ARE CALLED THE "ILIOPSOAS"

https://youtu.be/5d303jjt5d8

Horse Pelvic Muscles

WARNING!

NECROPSY PICTURES WILL BE SHOWN!

NORMAL ILIOPSOAS

DENOIX

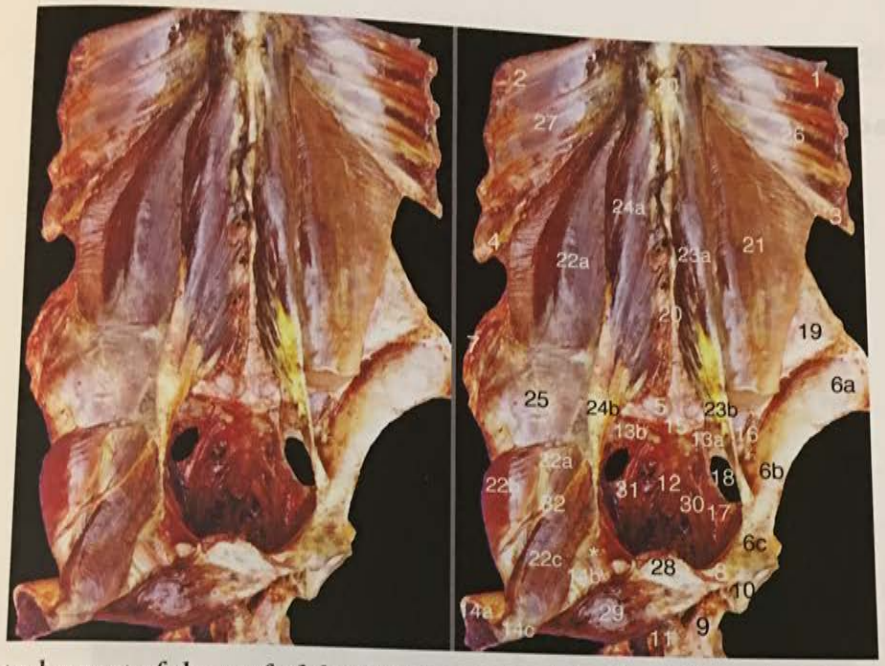
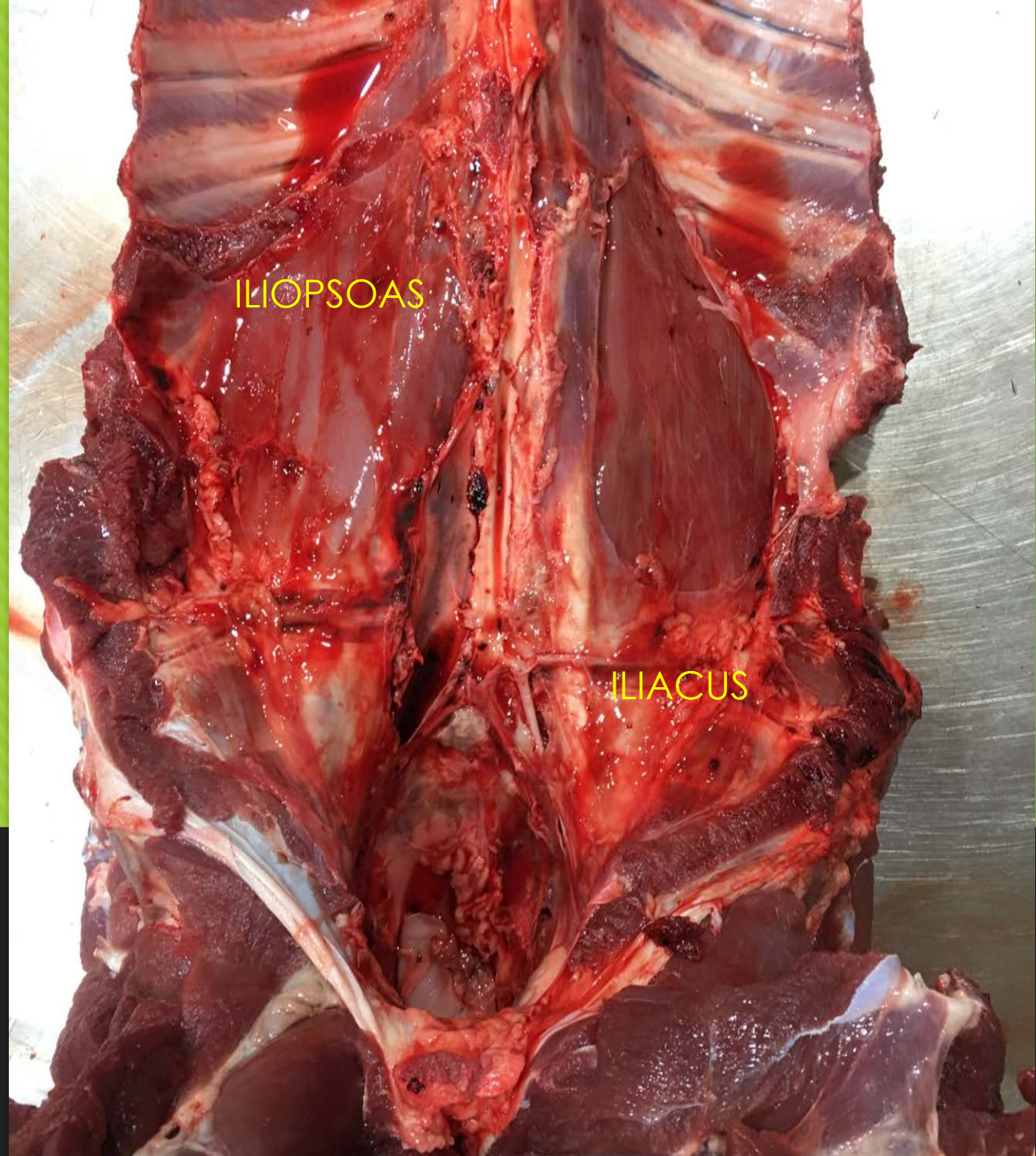


Fig. H.17 **Ventral aspect of the roof of the abdomen and pelvis. Cranial is to the left.**

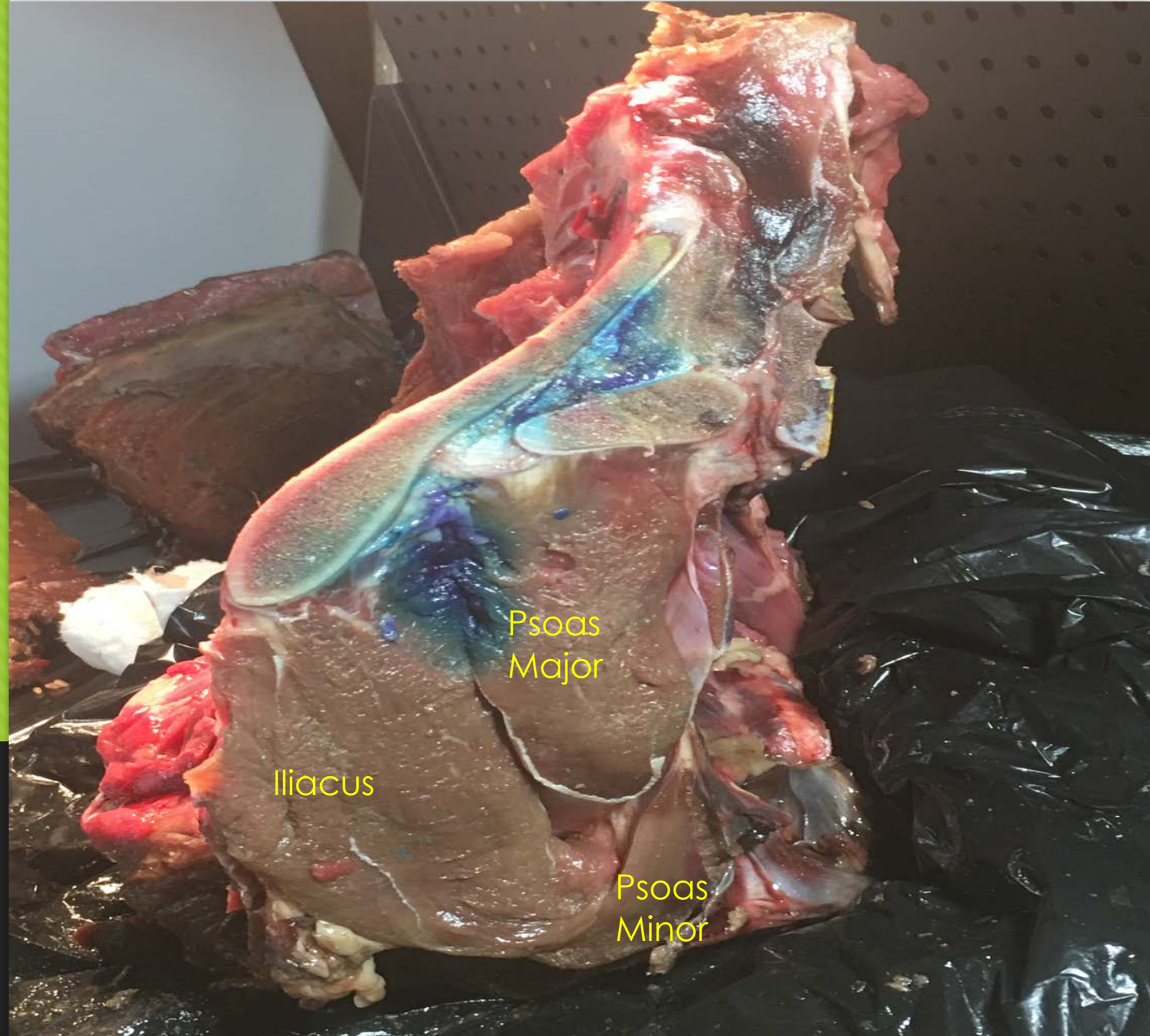
1- Left fifteenth rib; 2- Right fifteenth rib; 3- Left eighteenth rib; 4- Right eighteenth rib; 5- Sixth lumbar vertebra (body); 6- Left ilium, 6a- tuber coxae, 6b- neck, 6c- body; 7- Right tuber coxae; 8- Left pubis (body); 9- Left ischium; 10- Left acetabulum; 11- Pelvic symphysis; 12- Sacrum; 13- First sacral vertebra (sacral wings), 13a- left transverse process, 13b- right transverse process; 14- Right femur, 14a- body, 14b- head (in the right acetabulum*), 14c- lesser trochanter; 15- Lumbosacral disc (L6 disc); 16- Left sacroiliac joint; 17- Left sacrosciatic ligament; 18- Major ischiatic foramen; 19- Iliocostal ligament; 20- Ventral longitudinal ligament covering the lumbar vertebral bodies; 21- Left major psoas muscle (cut); 22- Right iliopsoas muscle, 22a- major psoas muscle, 22b- iliac muscle (lateral part), 22c- iliac muscle (medial part); 23- Left minor psoas muscle, 23a- muscle body, 23b- tendon inserted on the tuberculum of the minor psoas of the ilium neck; 24- Right minor psoas muscle, 24a- muscle body, 24b- tendon; 25- Iliac fascia; 26-Intercostal muscle; 27- Intercostal nerve; 28- Prepubic tendon (insertion of the rectus abdominis on the pubis); 29- Obturator externus muscle; 30- Left sciatic nerve; 31- Right sciatic nerve; 32- Right femoral nerve.

NORMAL ILIOPSOAS

8 MTH OLD HORSE



Normal Iliopsoas



ABNORMAL ILIOPSOAS

ATROPHY & FIBROSIS OF PSOAS MAJOR & PSOAS MINOR

FIBROSIS OF PSOAS LEFT MINOR

(RIGHT PSOAS MINOR REMOVED)

WHAT NERVES ARE INJURED & WHAT PLEXUS IS INVOLVED?

NERVE INURY TO THE LUMBOSACRAL PLEXUS WHICH IS THE NERVE ROOTS OF: L4-L5-L6-S1-S2

FEMORAL NERVE

OBTURATOR NERVE

SCIATIC NERVE

SPECIES COMPARISON

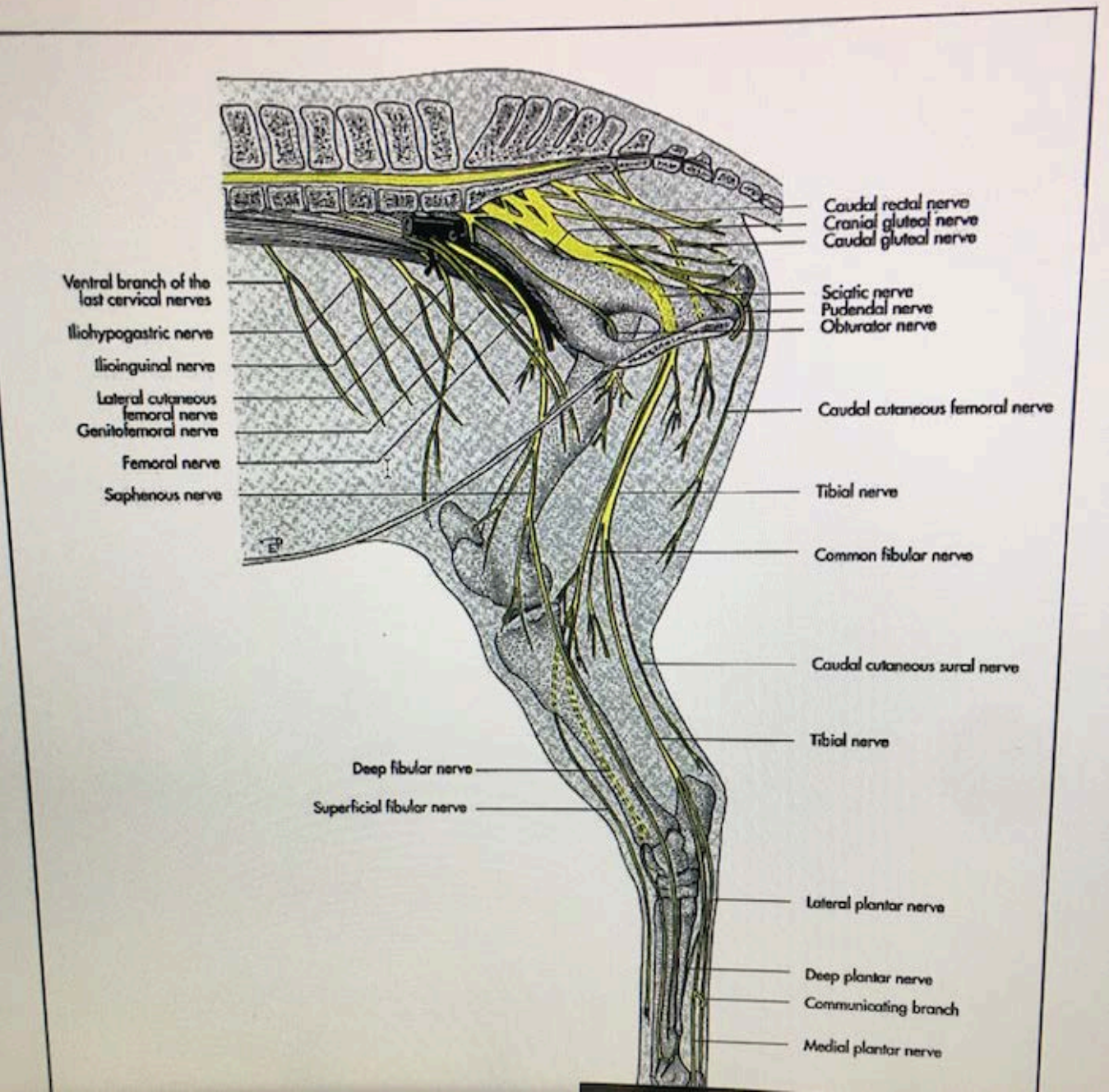
Table 1. Vertebral Formulas and Spinal Nerve Roots Supplying Major Peripheral Nerves in the Horse, Ox, and Dog[a]

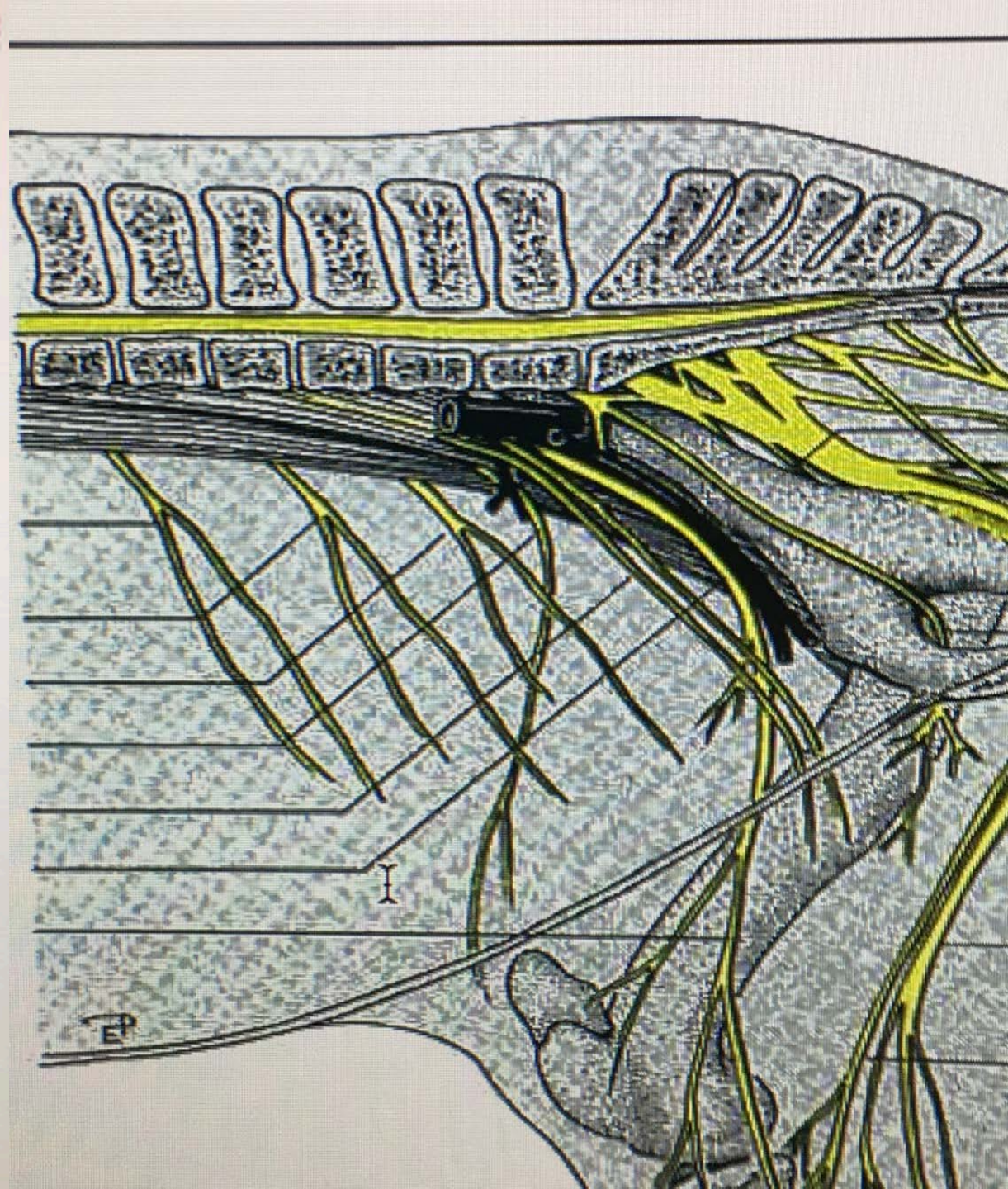
	Horse	Ox	Dog
Vertebral Formula	$C_7T_{18}L_{5-6}S_5Cd_{15-21}$	$C_7T_{13}L_6S_5Cd_{18-21}$	$C_7T_{13}L_7S_3Cd_{5-20}$
Brachial Plexus Nerves[28,34,b]			
Suprascapular	C6, C7 (10/10)	C6, C7 (10/10)	C6, C7 (6/6)
Subscapular	C6 (3/10) C7 (10/10)	C6, C7 (10/10)	C6, C7 (6/6)
Musculocutaneous	C7, C8 (10/10)	C6 (9/10) C7 (10/10) C8 (9/10)	C6–8 (6/6) T1 (2/6)
Axillary	C6 (1/10) C7 (10/10) C8 (10/10)	C7, C8 (10/10)	C6 (5/6) C7 (6/6) C8 (2/6)
Radial	C7 (1/10) C8 (10/10) T1 (10/10)	C7–T1 (10/10)	C6 (5/6) C7–T1 (6/6) T2 (3/6)
Median	C7 (1/10) C8–T2 (10/10)	C8–T1 (10/10)	C7 (5/6) C8, T1 (6/6) T2 (4/6)
Ulnar	T1 (10/10) T2 (9/10)	C8–T2 (10/10)	C7 (1/6) C8, T1 (6/6) T2 (4/6)
Lumbosacral Plexus Nerves[1,50,c]			
Obturator	[L3], L4, L5, [L6]	L4, L5, L6	[L4], L5, L6
Femoral	[L3], L4, L5, [L6]	[L4], L5, [L6]	L4 (5/11) L5 (11/11) L6 (9/11)
Sciatic	[L5], L6, S1, [S2]	L6, S1, [S2]	[L5], L6–S1, [S2]
Common peroneal	—	—	[L5], L6, L7
Tibial	—	—	L6–S1, [S2]

[a]Numbers in parentheses designate the number of animals containing particular fiber distributions out of the total number studied. In some cases, conflicting data or no numerical data are available on nerve root distribution. In these instances, brackets are used to denote less frequently seen contributing nerves according to the cited references.

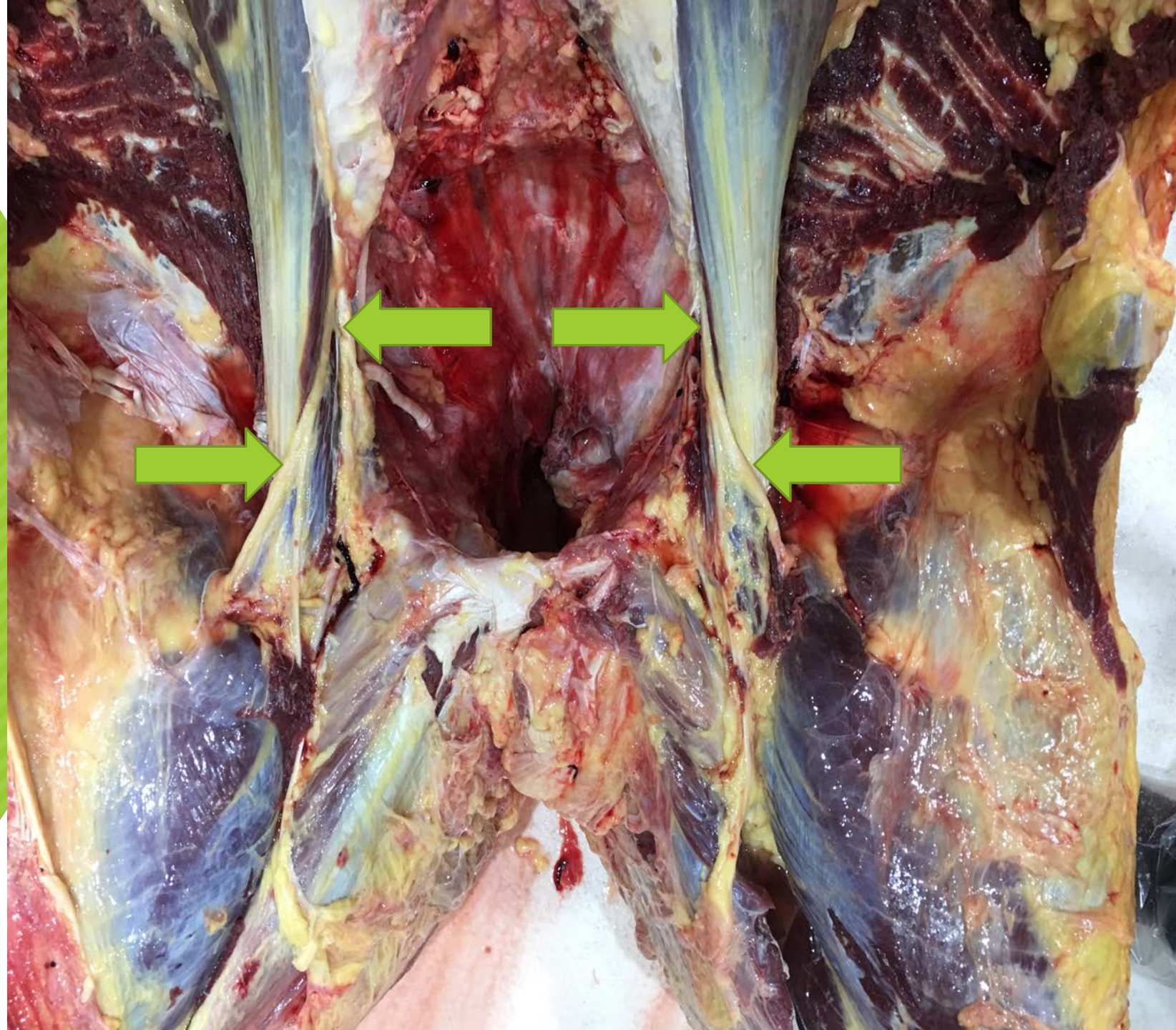
[b]Sharp JW, Bailey CS, Johnson RD, Kitchell RL: Spinal nerve root origin of the median, ulnar and musculocutaneous nerves and their muscle nerve branches to the canine forelimb. *Anat Histol Embryol* 19:359–368, 1991.

[c]Langley JN, Anderson HK: The innervation of the pelvic and adjoining viscera. III. External generative organs. *J Physiol (Lond)* 19:85–121, 1895.


Caudal rectal nerve
Cranial gluteal nerve
Caudal gluteal nerve
Ventral branch of the last cervical nerves
Sciatic nerve
Pudendal nerve
Obturator nerve
Iliohypogastric nerve
Ilioinguinal nerve
Lateral cutaneous femoral nerve
Genitofemoral nerve
Caudal cutaneous femoral nerve
Femoral nerve
Saphenous nerve
Tibial nerve
Common fibular nerve
Caudal cutaneous sural nerve
Tibial nerve
Deep fibular nerve
Superficial fibular nerve
Lateral plantar nerve
Deep plantar nerve
Communicating branch
Medial plantar nerve



FEMORAL NERVES RUN **BETWEEN** THE PSOAS MINOR AND MAJOR MUSCLES!



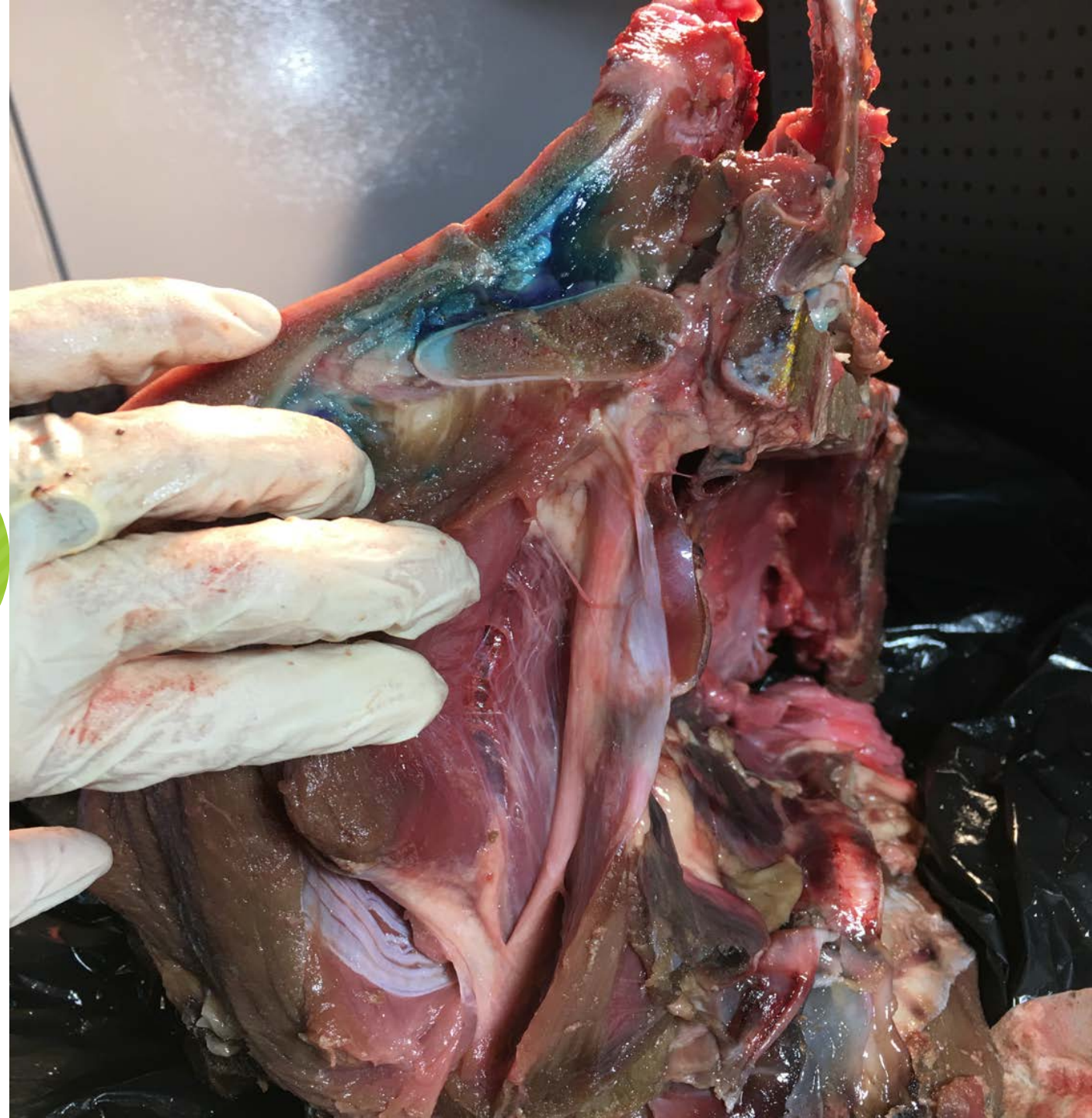
Methyl Blue Study & Necropsy

Methyl Blue Study & Necropsy

Methyl Blue Study & Necropsy

Methyl Blue Study & Necropsy

Methyl Blue Study & Necropsy

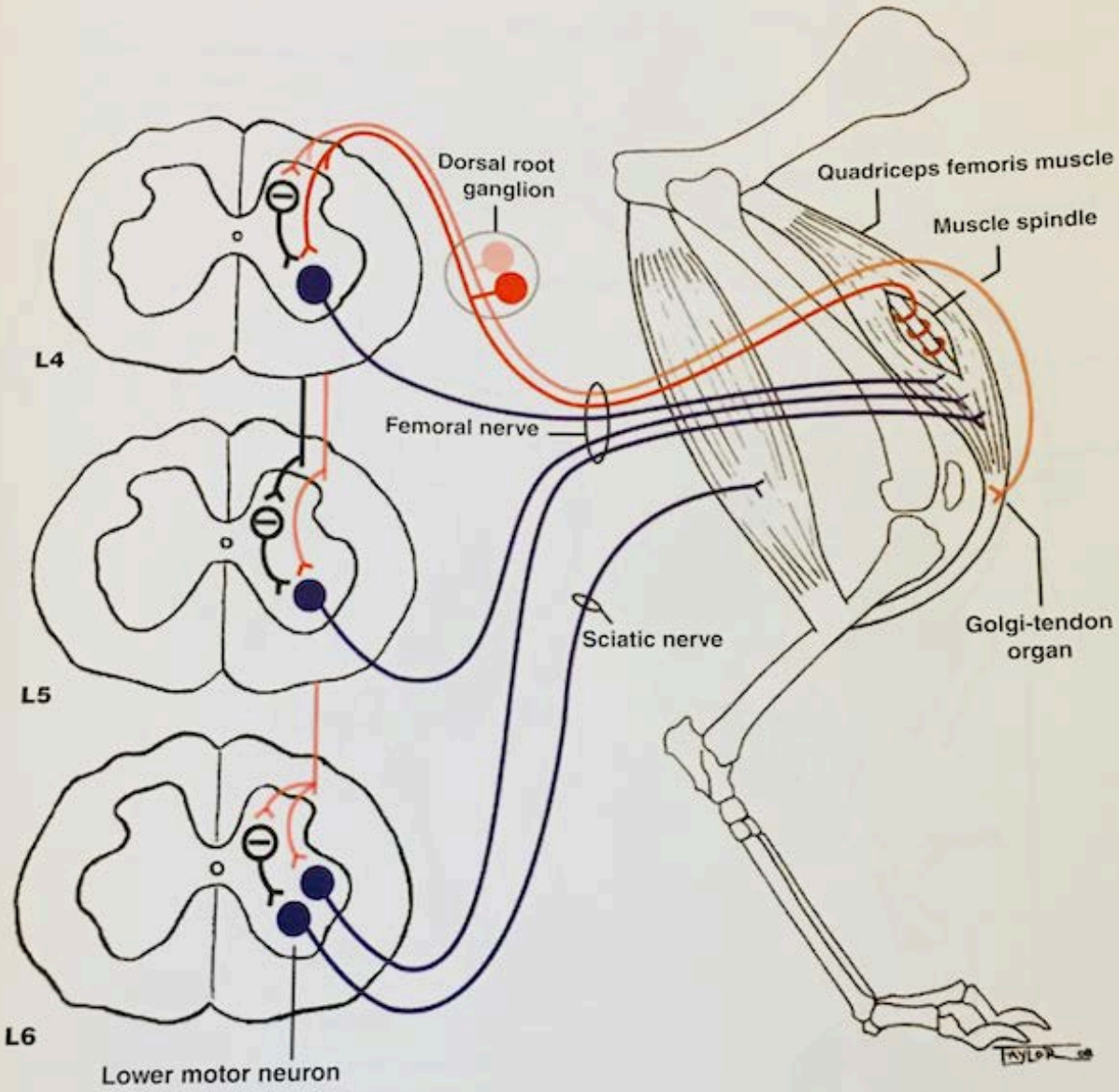


Methyl Blue Study & Necropsy

VERY SIMPLE TO FIGURE OUT…

IF YOU CAN UNDERSTAND…

BASIC WIRING DIAGRAMS!



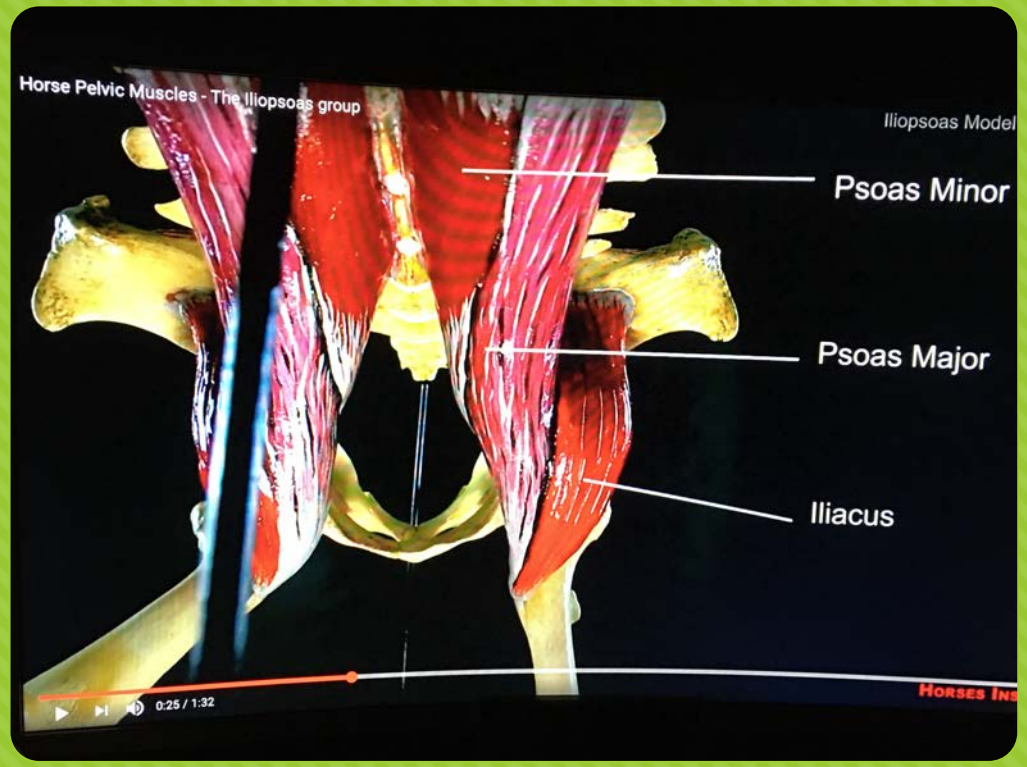
quadriceps reflex requires intersegmental coordination. Afferent inputs to one segment of the spinal cord influence efferen
this simplified illustration, sensory fibers of the femoral nerve are shown to enter cord segment L4. However, they also ent
llateral branches of sensory fibers also distribute to other segments that innervate the muscles for the quadriceps reflex. T
otor neurons of the femoral nerve innervating the quadriceps femoris muscle. Descending collateral branches also inhibi

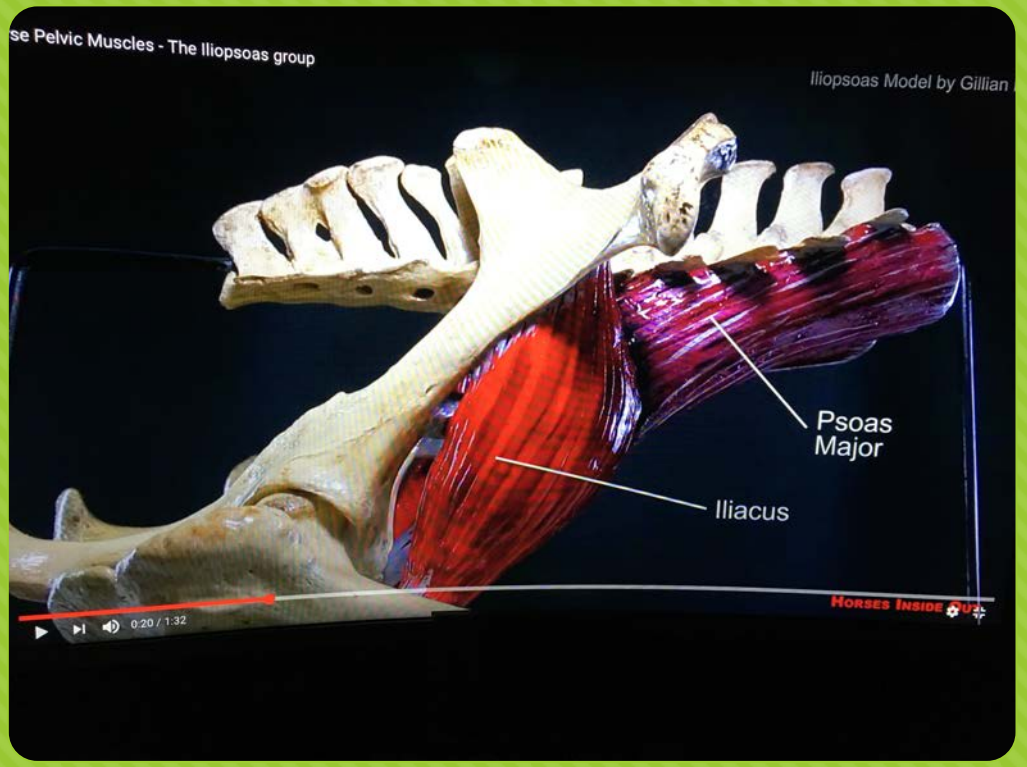
WHAT ARE THE RIGHT QUESTIONS??

WHAT | **WHERE** | WHEN | HOW | WHY

-
- Located

WHERE ARE THESE STRUCTURES?





UNDER THE SPINE!

H.4.2 Transverse sections

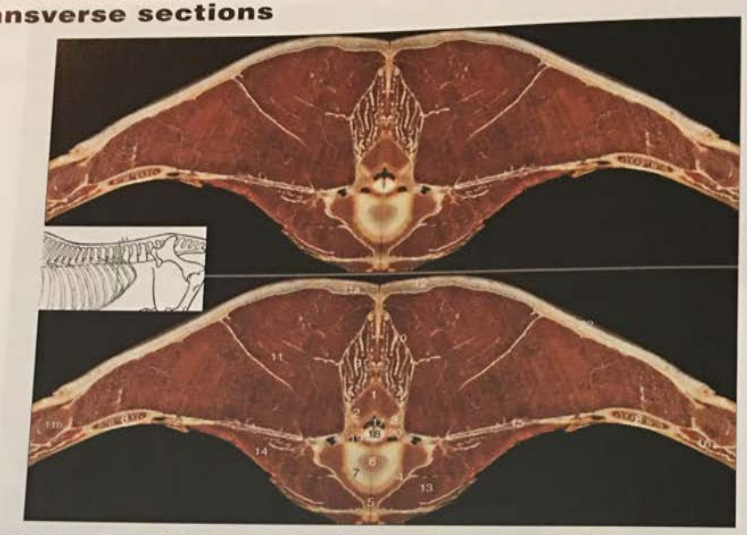


Fig. H.20 **Transverse section of the thoracolumbar area between the last thoracic vertebra and the first lumbar vertebra.**

1- Vertebral arch of the eighteenth thoracic vertebra (T18); 2- Caudal articular process of T18; 3- Articular process joint between T18 and the first lumbar vertebra (L1); 4- Vertebral fossa of T18; 5- Ventral crest of T18; 6- Vertebral head of L1; 7- Intervertebral disc between T18 and L1; 8- Eighteenth (last) rib; 9- Multifidus muscle; 10- Multifidus fascia; 11- Erector spinae muscle, 11a- aponeurosis, 11b- iliocostalis lumborum muscle; 12- Thoracolumbar fascia; 13- Psoas minor muscle; 14- Psoas major muscle; 15- Costotransverse muscle; 16- Intercostal muscles; 17- Vertebral canal; 18- Spinal cord; 19- Internal vertebral plexus; 20- Intervertebral foramen; 21- Dorsal costoabdominal artery, vein and nerve; 22- Skin.

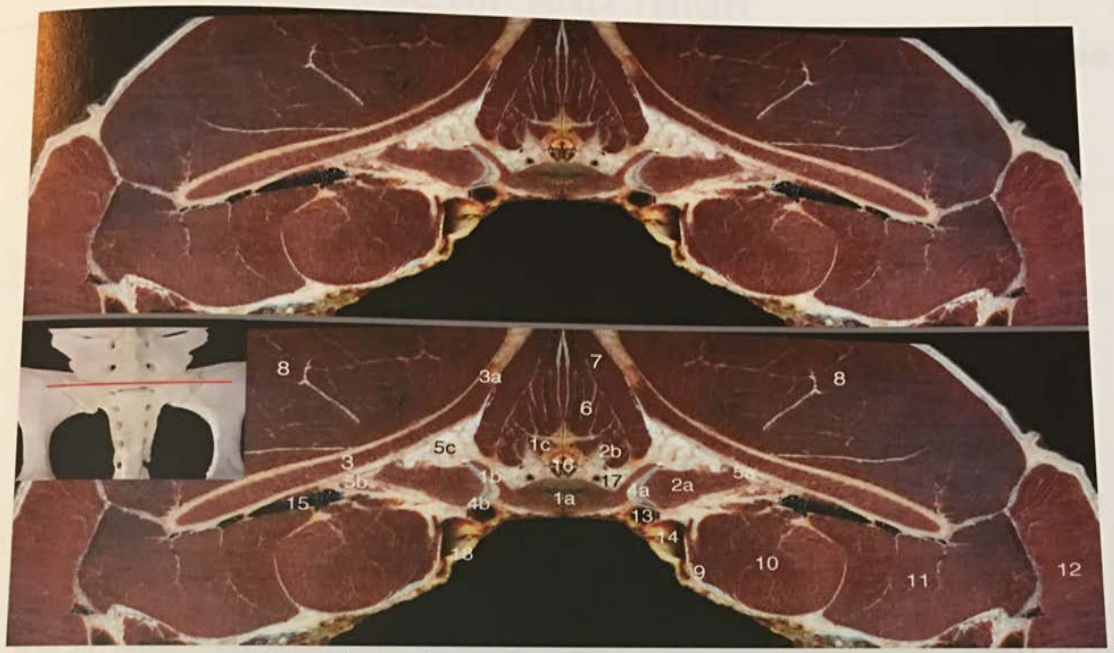


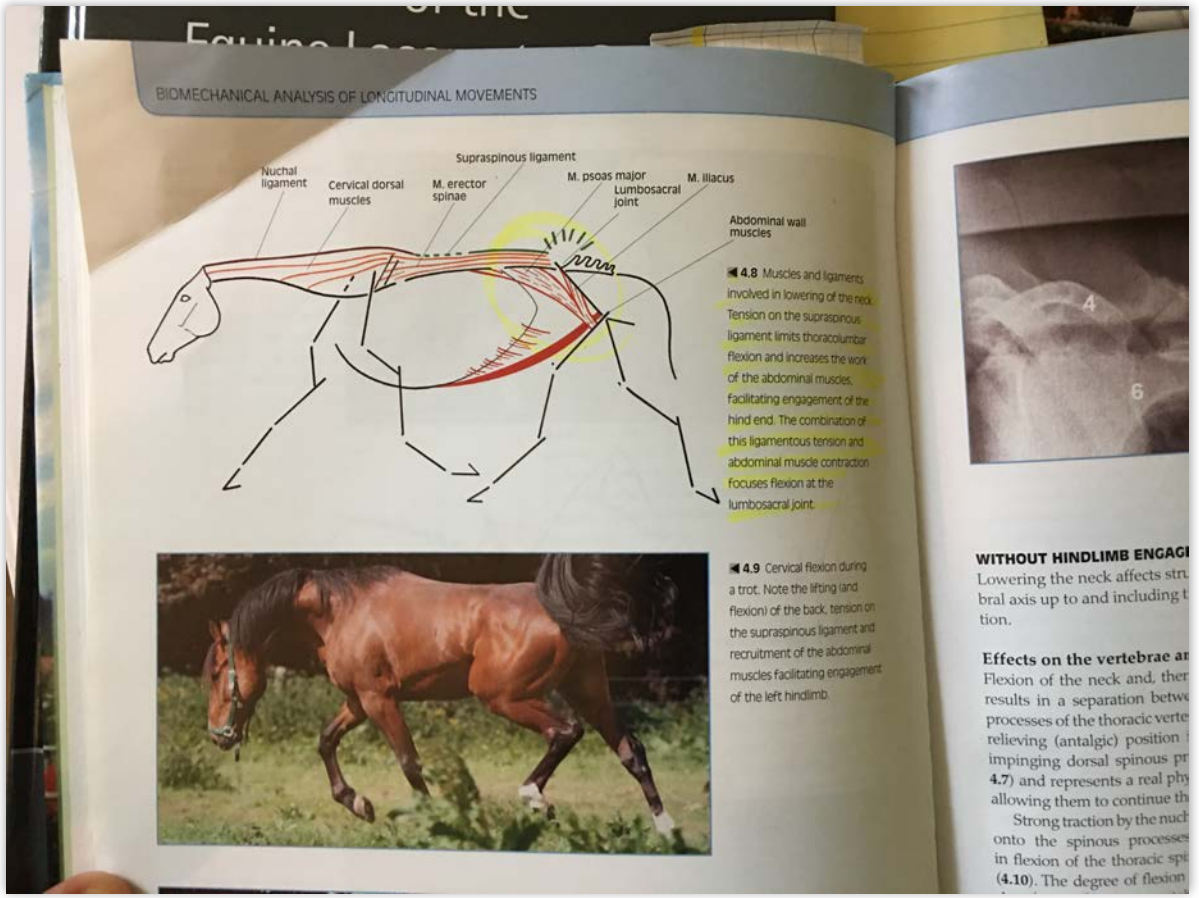
Fig. I.17 **Transverse section of the lumbosacroiliac junction passing through the body of the sixth lumbar vertebra (L6).**

1- Sixth lumbar vertebra (L6), 1a- body, 1b- transverse process, 1c- caudal articular process; 2- First sacral vertebra (S1), 2a- transverse process, 2b- cranial articular process; 3- Iliac wing, 3a- base of the sacral tuber; 4- Lumbosacral intertransverse joint, 4a- joint space, 4b- ventral lumbosacral intertransverse ligament; 5- Sacroiliac joint, 5a- joint space, 5b- ventral sacroiliac ligament, 5c- interosseous sacroiliac ligament; 6- Multifidus muscle; 7- Dorsolateral sacrocaudal muscle; 8- Gluteus medius muscle; 9- Psoas minor muscle and tendon; 10- Psoas major muscle; 11- Lateral part of the iliac muscle; 12- Tensor fascia latae muscle; 13- Internal iliac artery; 14- Common iliac vein; 15- Iliolumbar artery and vein; 16- Sacral canal with end of the spinal cord, dural cone and origin of the cauda equina; 17- Dorsal ramus of the sixth lumbar nerve; 18- Ventral ramus of the fifth lumbar nerve.

Jean-Marie Denoix
Clinical Anatomy-Equine
Locomotor Systems

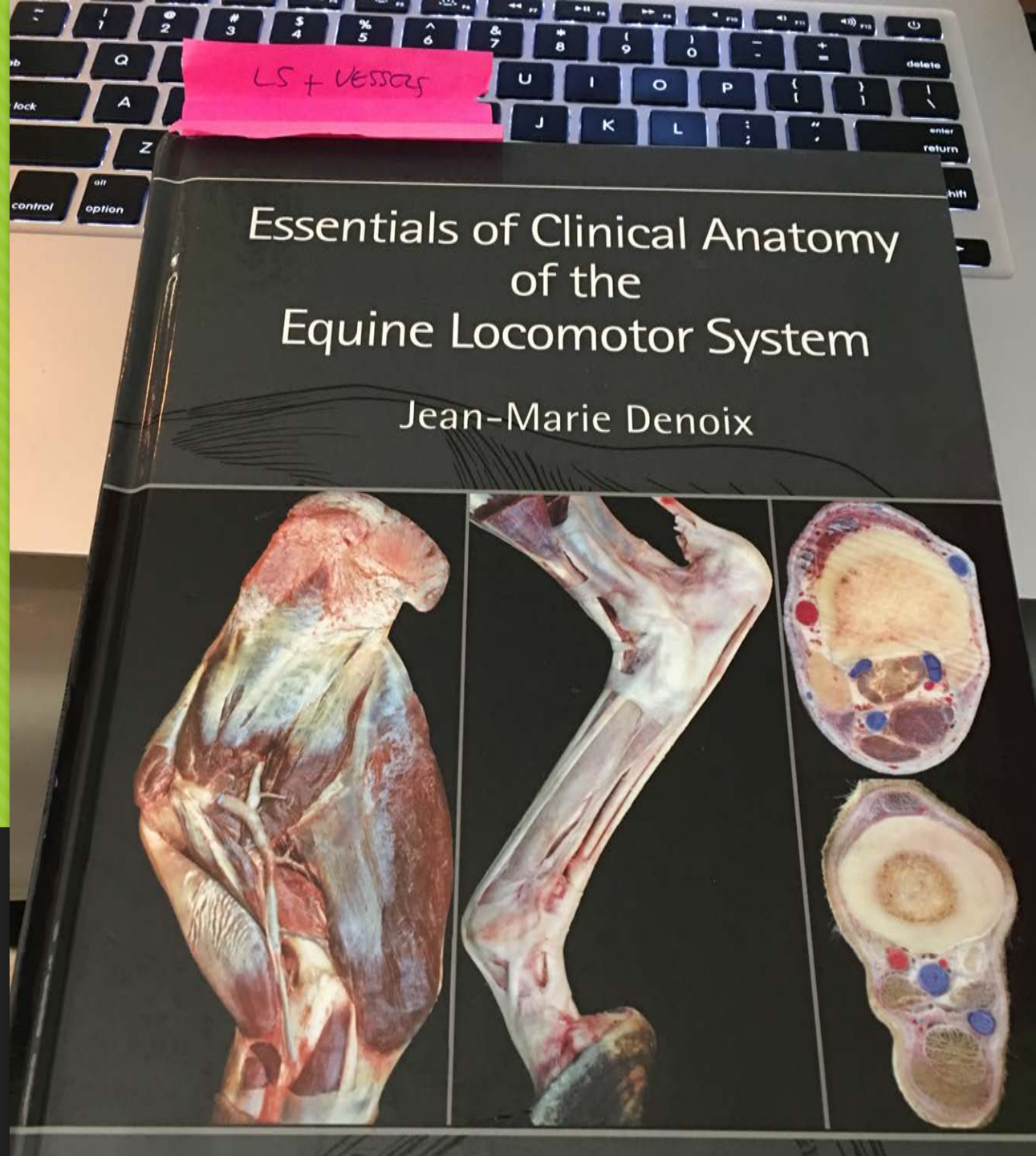
Jean-Marie Denoix pg. 56

Biomechanics & Physical Training of the Horse



Sincere thanks and gratefulness to:

Jean-Marie Denoix



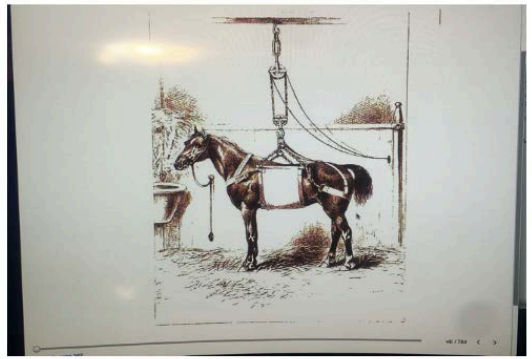
THE PRINCIPLES AND PRACTICE OF VETERINARY SURGERY.

BY WILLIAM WILLIAMS, F.R.C.V.S., F.R.S.E., Etc.

EX-PRESIDENT OP THE ROYAL COLLEGE OF VETERINARY SURGEONS; PRINCIPAL, AND PROFESSOR OF VETERINARY MEDICINE AND SURGERY AT THE NEW VETERINARY COLLEGE, EDINBURGH; PROFESSOR OF VETERINARY SURGERY AND EXAMINER IN AGRICULTURE FOR THE HIGHLAND AND AGRICULTURAL SOCIETY OK SCOTLAND; FOREIGN CORRESPONDENT OF THE SOCIETE CENTRALS DE MEDICINE VETERINAIRE; AND AUTHOR OF "THE PRINCIPLES AND PRACTICE OF VETERINARY MEDICINE."

FOURTH EDITION
BODLEIAN LIBRARY OXFORD; 23 JAN 83

JOHN MENZIES & CO., EDIBURGH AND GLASGOW.
J. & A. CHURCHILL, LONDON.
1882



The Veterinary Record.

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888.

No. 25. JUNE 21, 1930. VOL. 10.

Some Further Observations on Pathological Changes Found in Horses Affected with "Shivering," and their Significance.*

By W. M. Mitchell, *M.C., T.D.*, M.B., B.Sc. (Edin.), M.R.C.V.S., Professor of Surgery and Obstetrics, Royal (Dick) Veterinary College, Edinburgh.

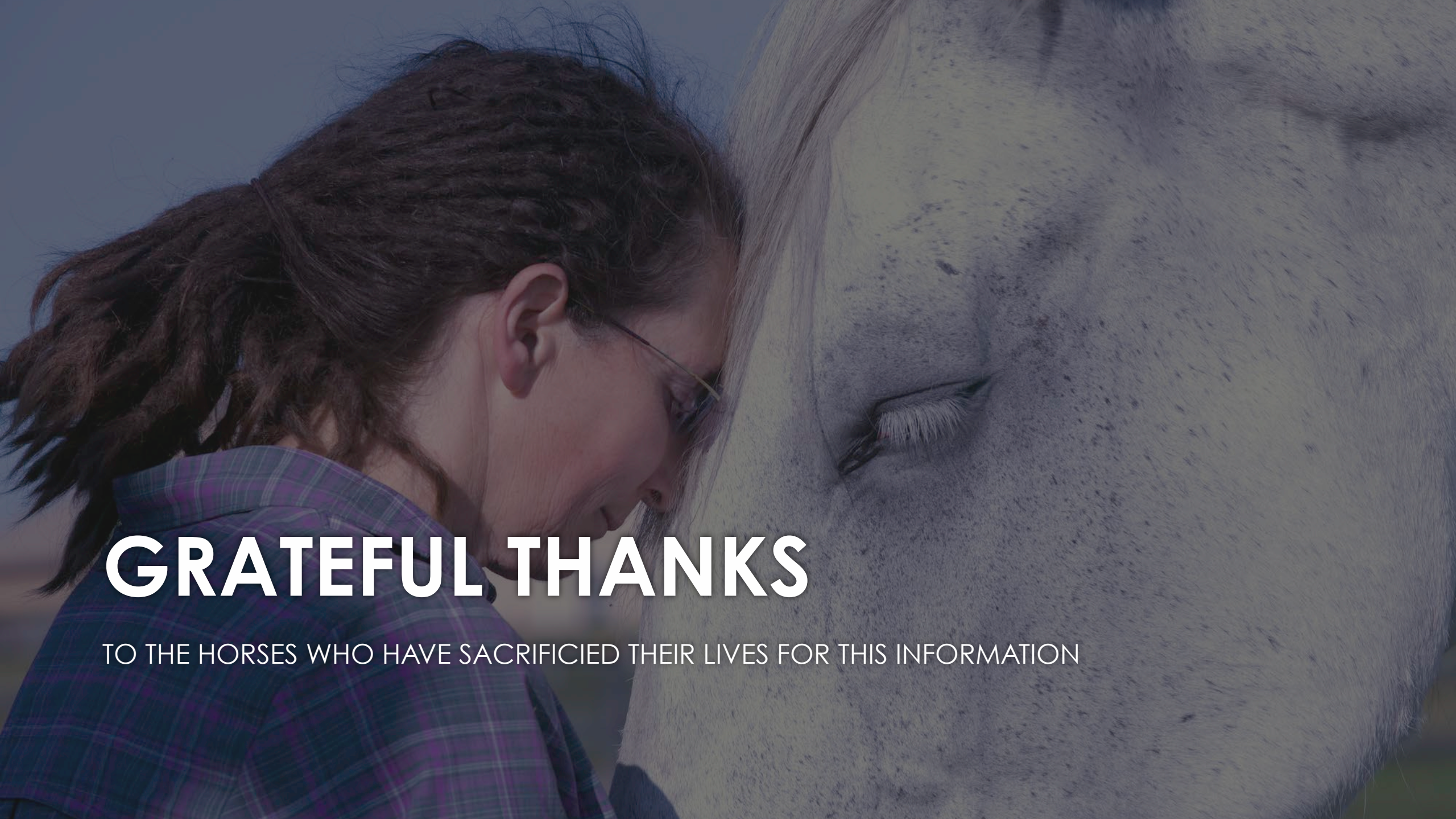
4½-year-old showing complete ossification of all cartilages. (Specimens exhibited.)

I think I can assert that a horse which is a shiverer will always show some evidence of osteo-arthritis, often clinically, but certainly on *post-mortem* examination.

Periosteal Separation.—In the case of the 5-year-old, while examining the right hip joint, I found there was a partial disintegration of the accessory ligament and,

THANKS TO:

WILLIAM WILLIAMS & WILLIAM MITCHELL



GRATEFUL THANKS

TO THE HORSES WHO HAVE SACRIFICIED THEIR LIVES FOR THIS INFORMATION

WHAT IS NEXT?

WHAT IS THE DIFFERENCE AND STRUCTURES INVOLVED IN THE CLINICAL SIGNS OF:

SHIVERS VERSUS STRINGHALT?
FRONT LIMB VERSUS HIND LIMB SHIVERS & STRINGHALT

WHAT CAN YOU DO?

- SUBSCRIBE TO THIS CHANNEL
- STAY TUNED TO THIS CHANNEL
- SHARE THIS CHANNEL
- LISTEN TO: THE HORSE FIRST PODCAST
- DONATE TO THE KINEMATIC RESEARCH AT DECLUE EQUINE.COM