

BOUNDARY BAY



VETERINARY SPECIALTY HOSPITAL

24-Hour Specialty, Emergency & Critical Care
Langley, BC

“Wonky Back Ends”:

The clinician’s approach to hind limb weakness

The neurologic examination

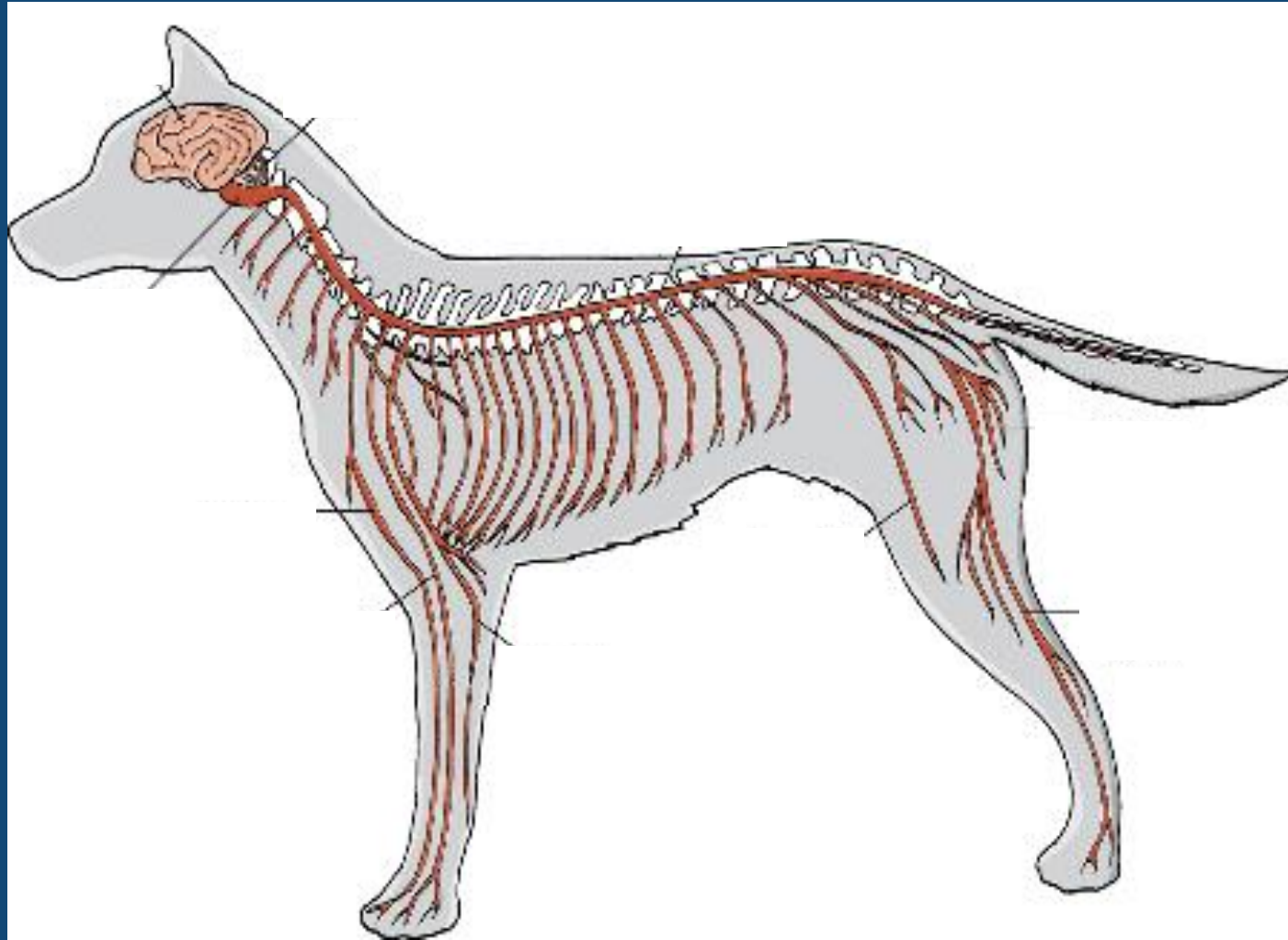
Elizabeth Meiman, DVM, DACVIM (Neurology)

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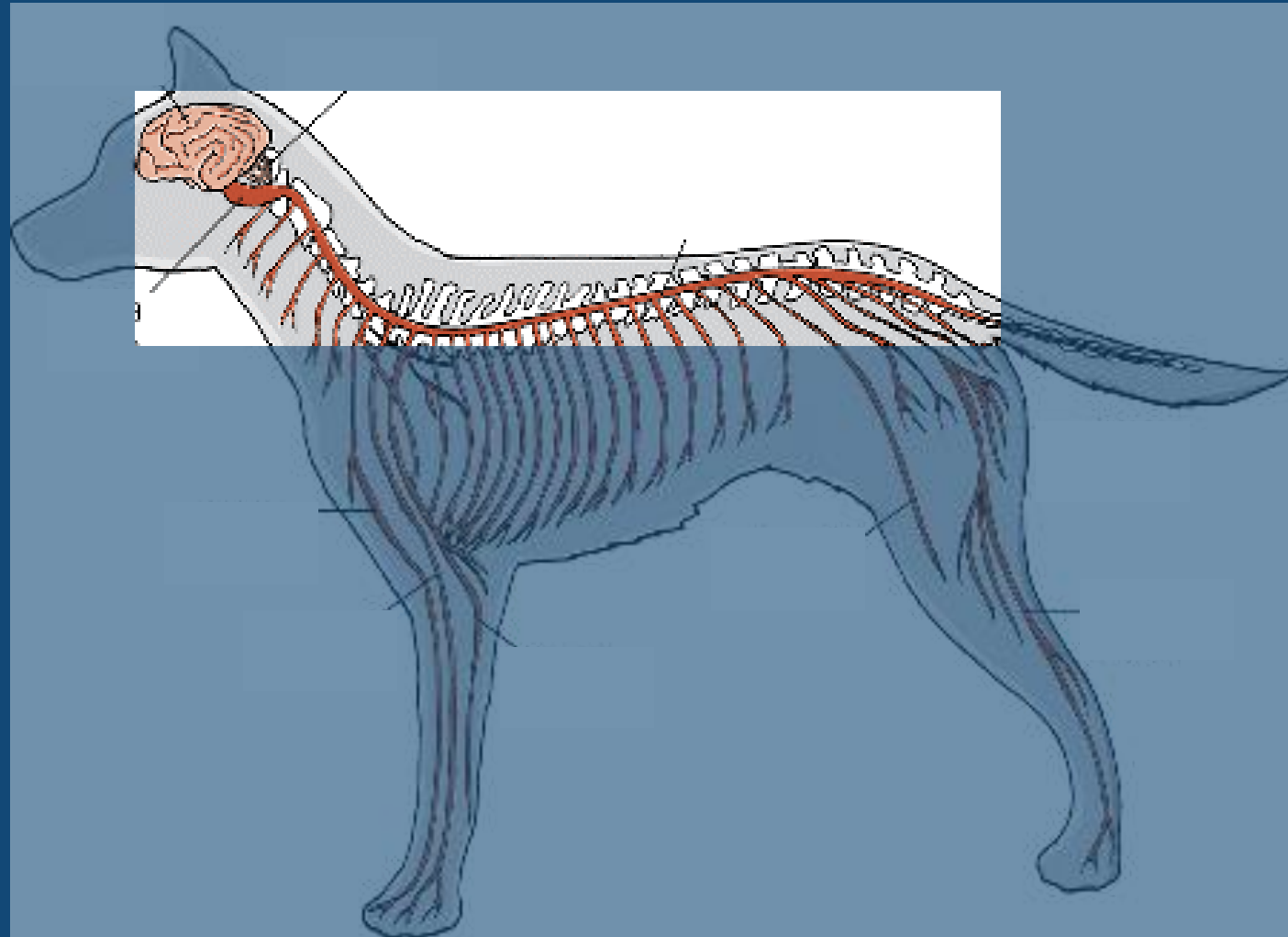


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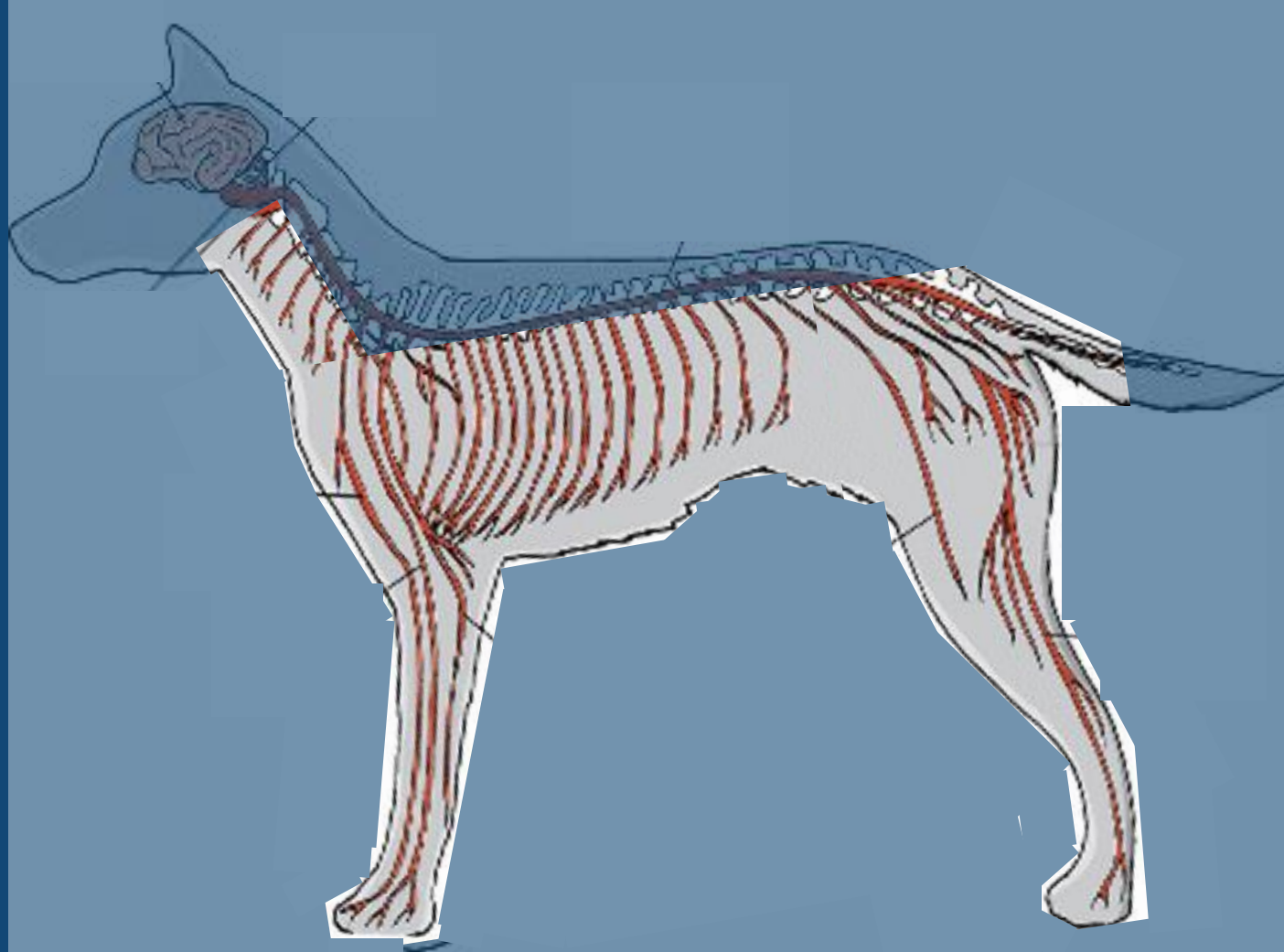




Central nervous system (CNS)



Peripheral nervous system (PNS)



Neurolocalization

- CNS

- Brain

- Forebrain
 - Brainstem
 - Cerebellum

- Spinal cord

- C1-C5
 - C6-T2
 - T3-L3
 - L4-S3
 - Caudal segments

- PNS

- Lower motor neuron

- Cell body within cervical & lumbar intumescences
 - Nerve root
 - Nerve

- Neuromuscular junction

- (Muscle)



Neurolocalization

- CNS

- Brain

- Forebrain

- Brainstem

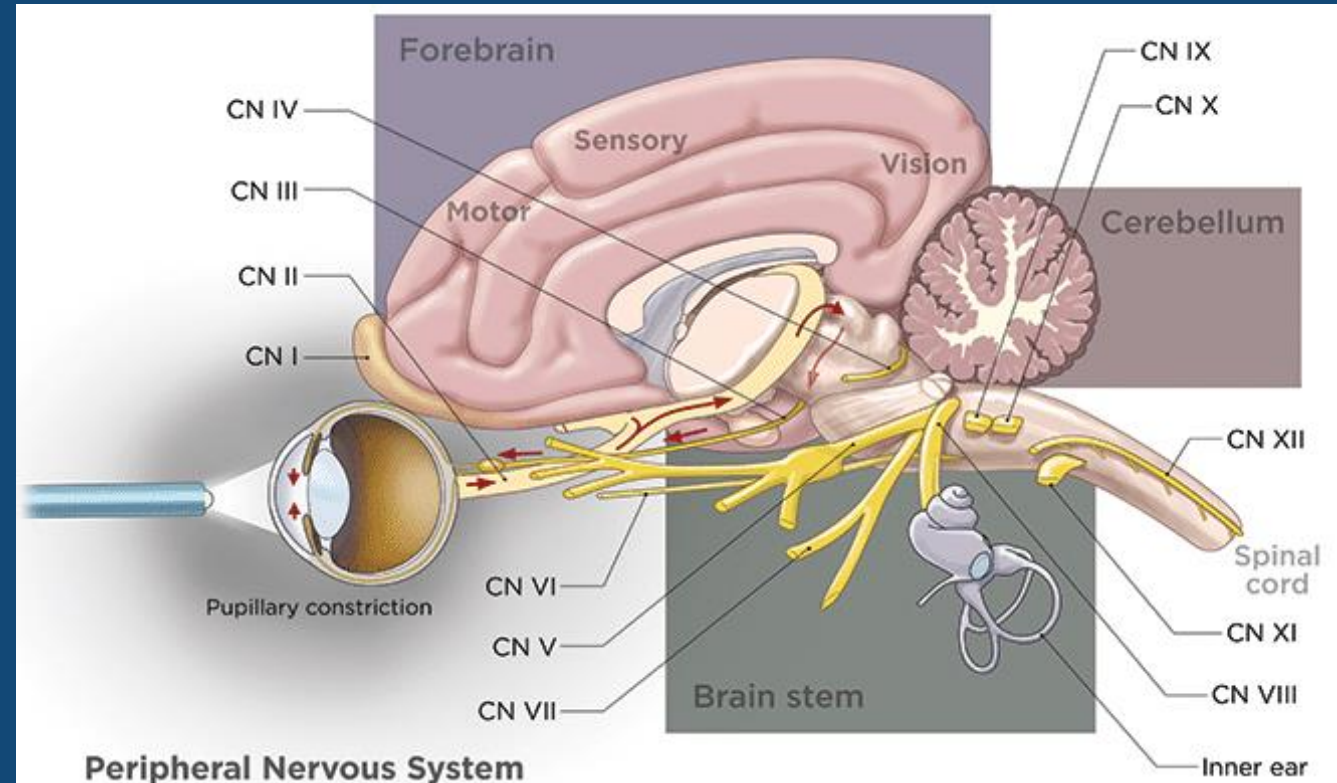
- Midbrain

- Pons

- Medulla

- Cerebellum

Caudal
fossa



Neurolocalization

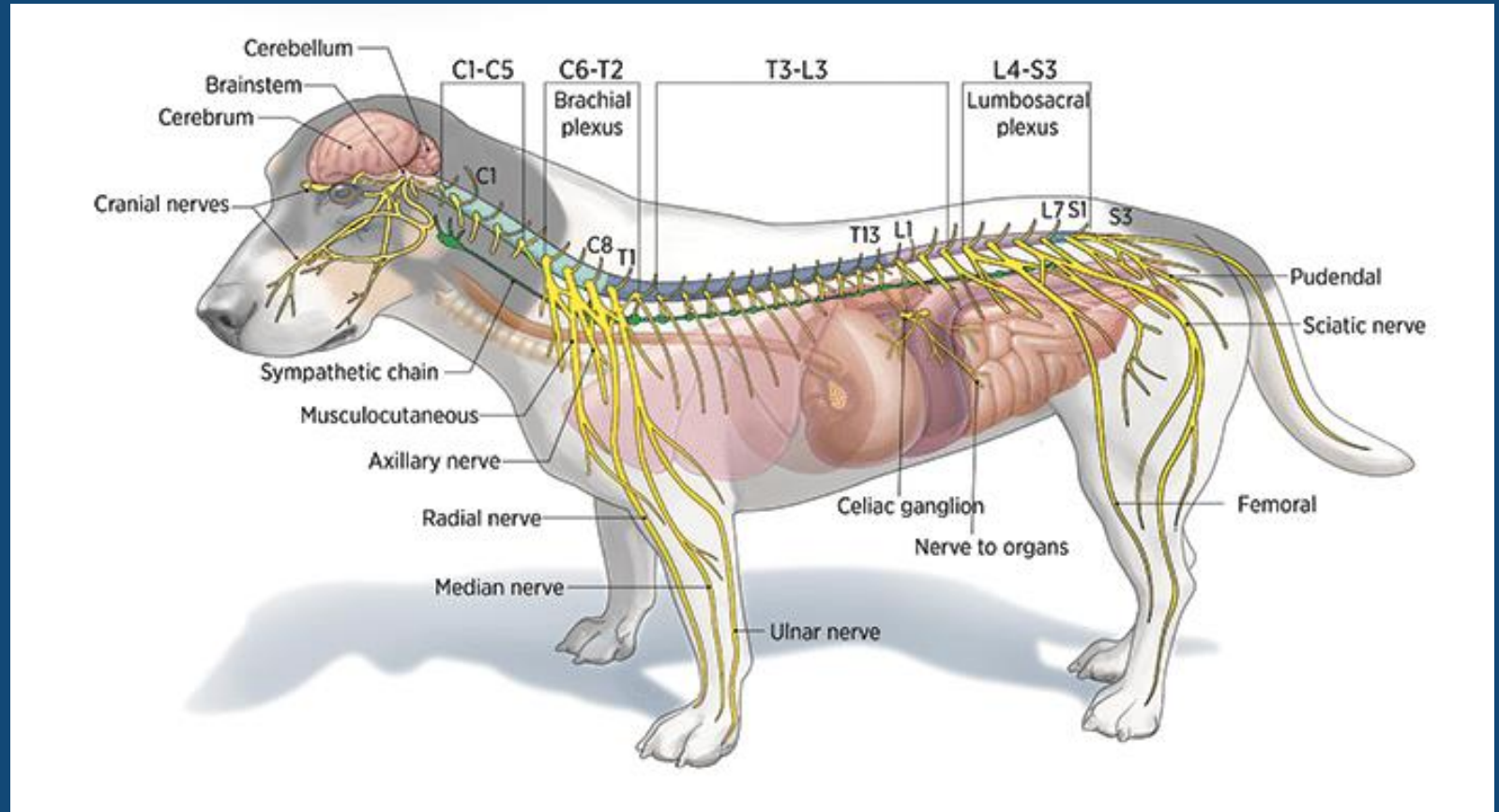
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Neurolocalization

- PNS

- Lower motor neuron

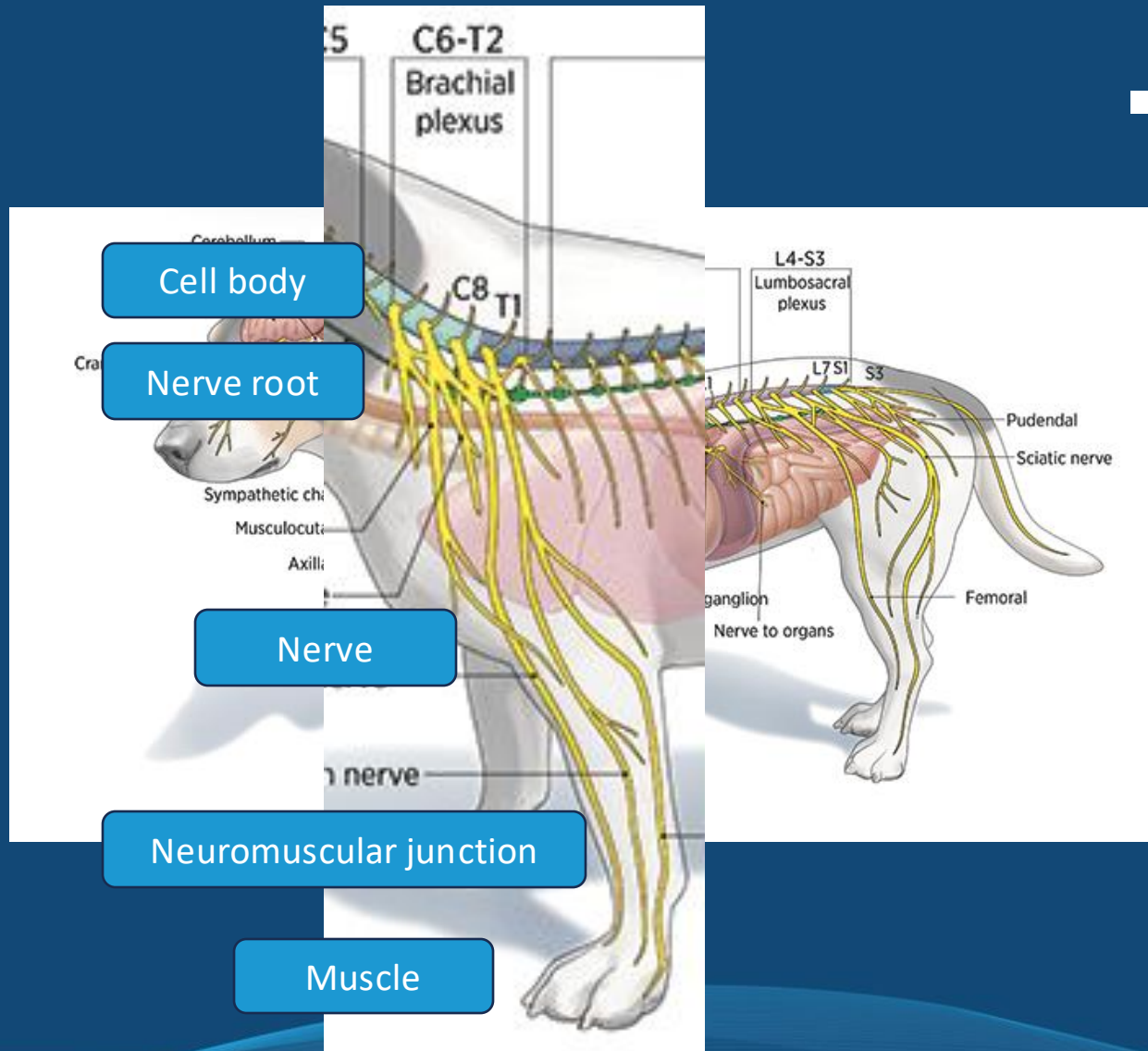
- Cell body within cervical & lumbar intumescences

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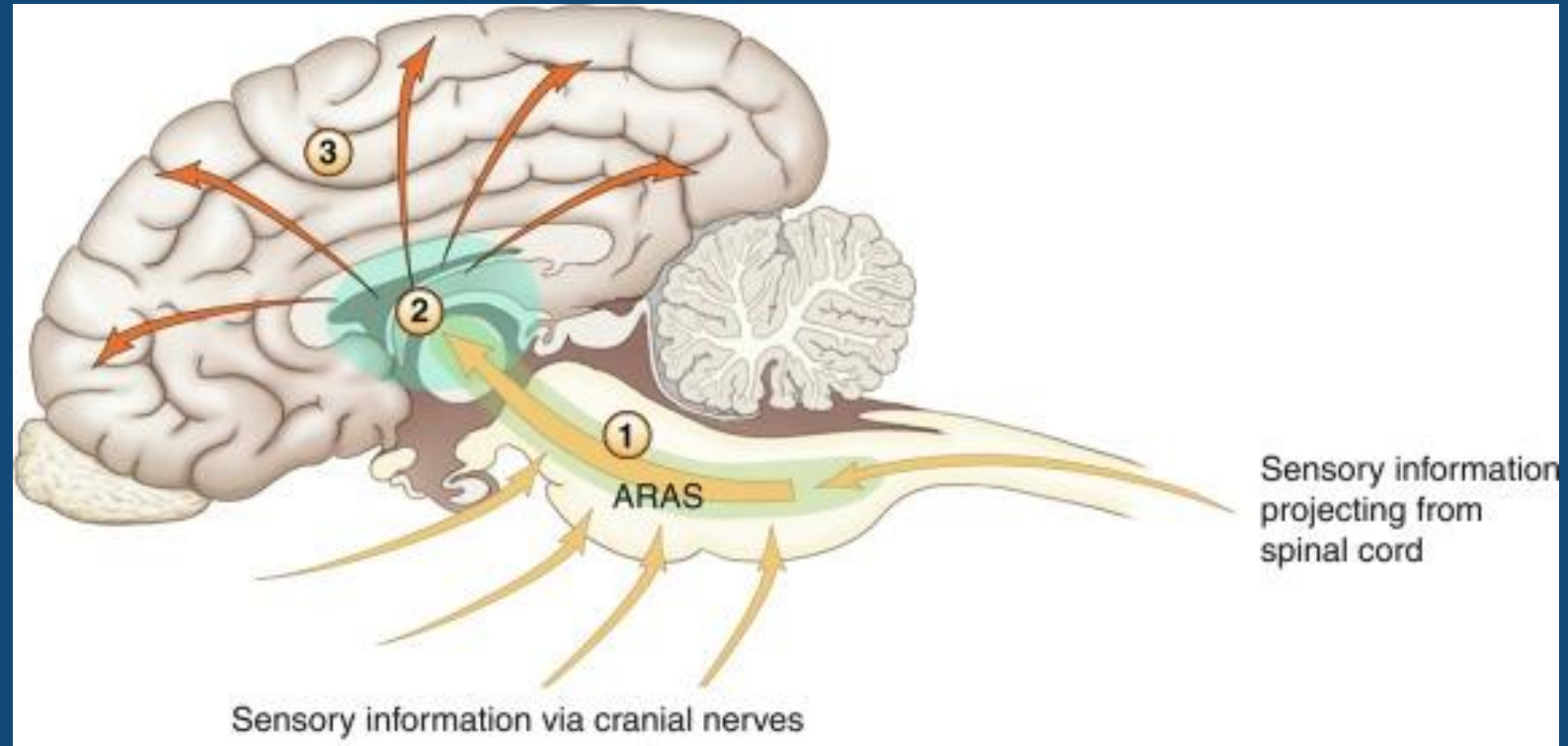
Neurologic examination components

- Mentation / sensorium
- Gait / posture
- Cranial nerves
- Proprioceptive testing
- Segmental spinal reflexes & muscle tone
- Nociception
- Spinal hyperesthesia



Mentation

- BAR
- QAR
- Dull/obtunded
- Stuporous
- Comatose



Gait / posture

- Gait
 - Ataxia, paresis, lameness
 - Circling, tendencies to turn one way
- Posture
 - Head / neck carriage
 - Head tilt or turn
 - Head pressing
 - Kyphosis, lordosis
 - Joint conformation & posture
 - Limb placement at stance
 - Nerve root signature
 - Tail position



Gait / posture



Gait / posture

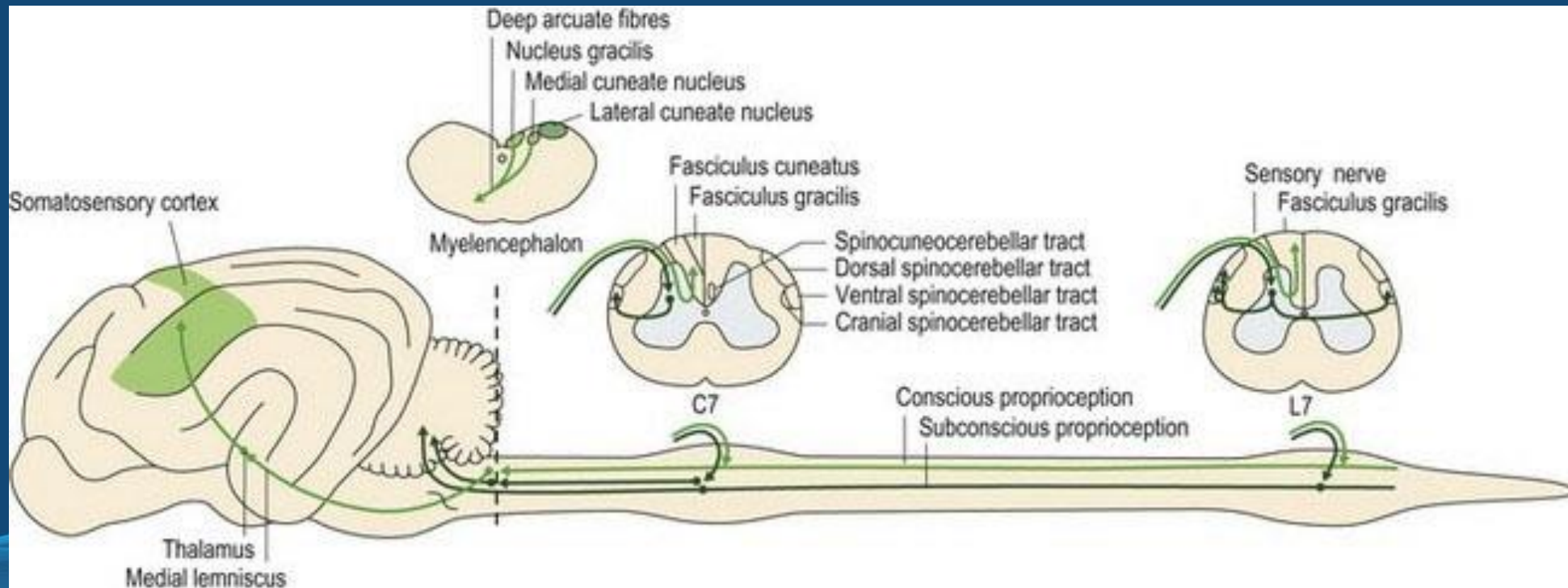
- **Ataxia = incoordination of gait**
 - 3 types:
 - General proprioceptive
 - Cerebellar
 - Vestibular



Gait / posture:

General proprioceptive ataxia

- Lack of kinesthesia (awareness of position and movement of the parts of the body in space)



Gait / posture:

General proprioceptive ataxia

- Lack of kinesthesia (awareness of position and movement of the parts of the body in space)
 - Lengthened strides
 - Knuckling, dragging of the toes
 - Excessive adduction or abduction



Gait / posture: General proprioceptive ataxia



Gait / posture: General proprioceptive ataxia



Gait / posture: General proprioceptive ataxia



Gait / posture:

Proprioceptive postural deficits

- Lack of kinesthesia (awareness of position and movement of the parts of the body in space)
 - Irregular paw placement
 - Limb held out to the side of the body
 - Limb sliding out when sitting or standing



Gait / posture:

Proprioceptive postural deficits



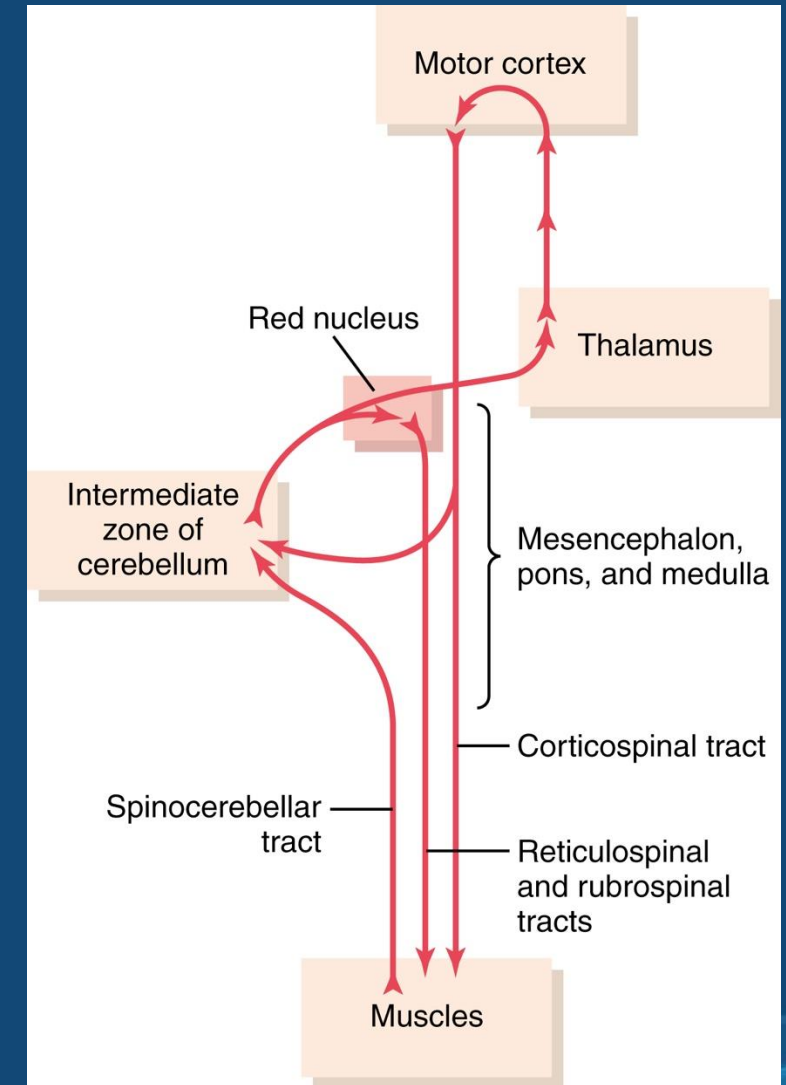
Proprio

deficits



Gait / posture: Cerebellar ataxia

- Inability to regulate rate, range, and force of a movement (dysmetria)



Gait / posture: Cerebellar ataxia

- Inability to regulate rate, range, and force of a movement (dysmetria)
 - Sudden bursts of movement
 - Over-flexion of the limbs during protraction
 - Slapping of feet onto the ground
 - Truncal sway



Gait / posture: Cerebellar ataxia



Gait / posture: Cerebellar ataxia (mimic!)

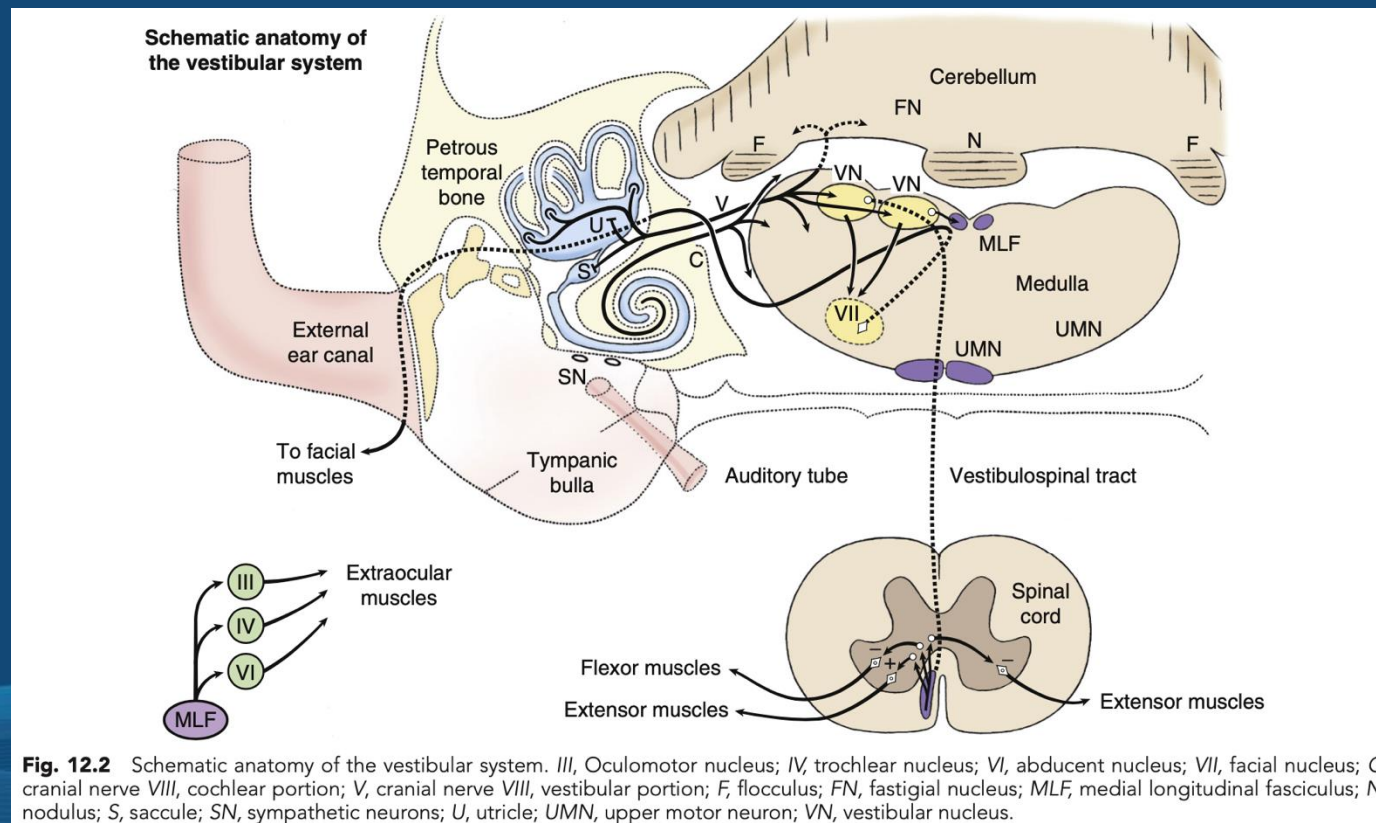


Gait / posture: Cerebellar ataxia



Gait / posture: Vestibular ataxia

- Loss of balance due to lack of orientation of the head with the eyes, neck, trunk, limbs



Gait / posture: Vestibular ataxia

- Loss of balance due to lack of orientation of the head with the eyes, neck, trunk, limbs
 - Head tilt
 - Leaning / rolling / falling to the side
 - Circling motions due to falling to the side
 - Flailing of limbs



Gait / posture: Vestibular ataxia



Gait / posture: Vestibular ataxia

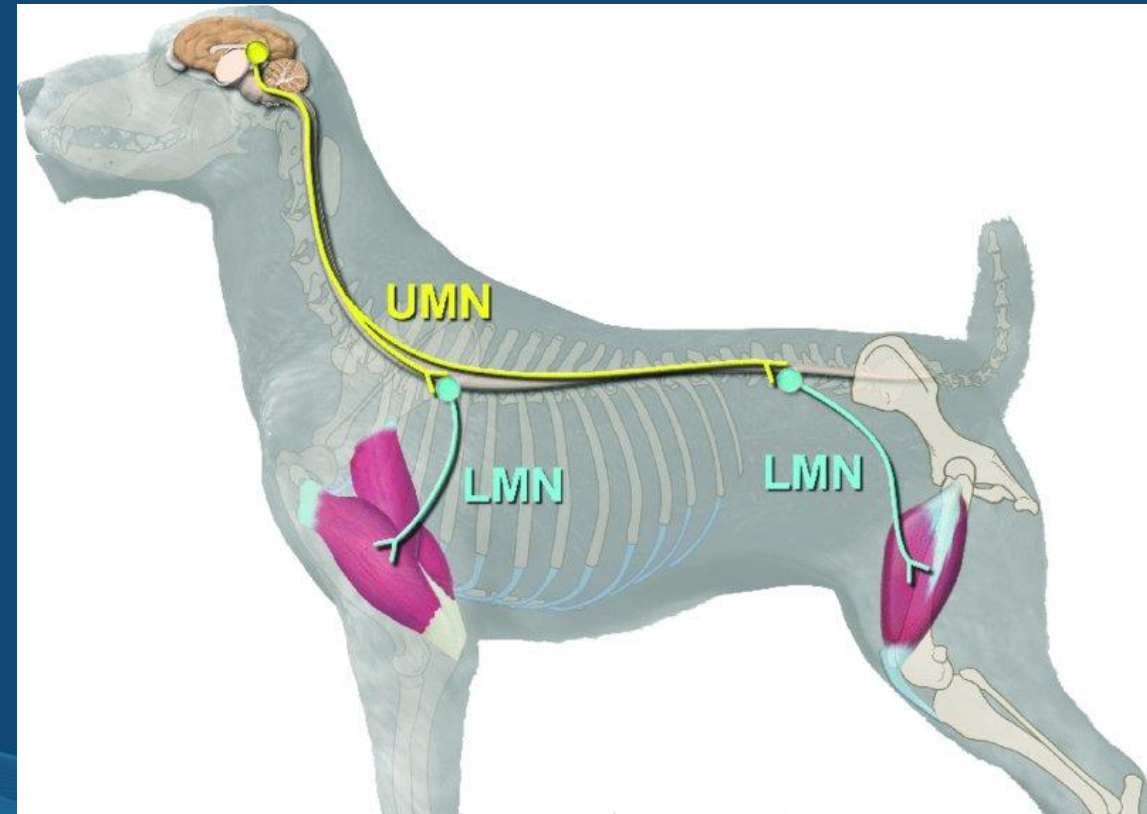


Gait / posture: Which ataxia(s)?



Gait / posture

- Paresis = deficiency in ability to generate gait or in the ability to support weight
- 2 types:
 - Upper motor neuron
 - Lower motor neuron



Gait / posture:

Upper motor neuron (UMN) quality paresis

- Deficiency in ability to generate gait
 - Delay in protraction (forward motion) of the limb, or absence of protraction
 - Longer strides
 - Spasticity (spastic muscle tone)



Gait / posture: Upper motor neuron (UMN) quality paresis



Gait / posture:

Lower motor neuron (LMN) quality paresis

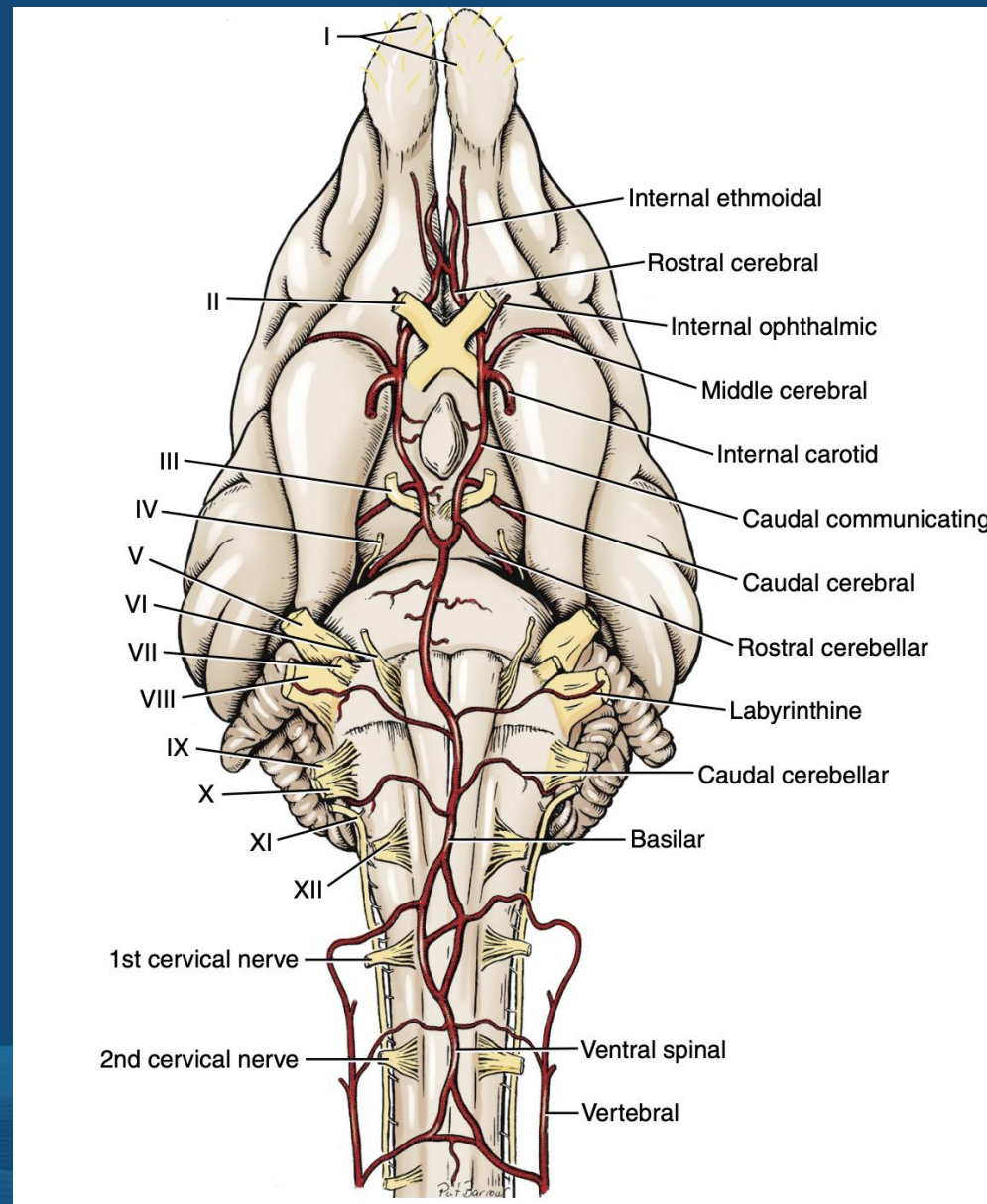
- Deficiency in ability to support weight
 - Short strides, appears similar to lameness
 - Bunny-hopping
 - Buckling / collapse of the limb during weight-bearing

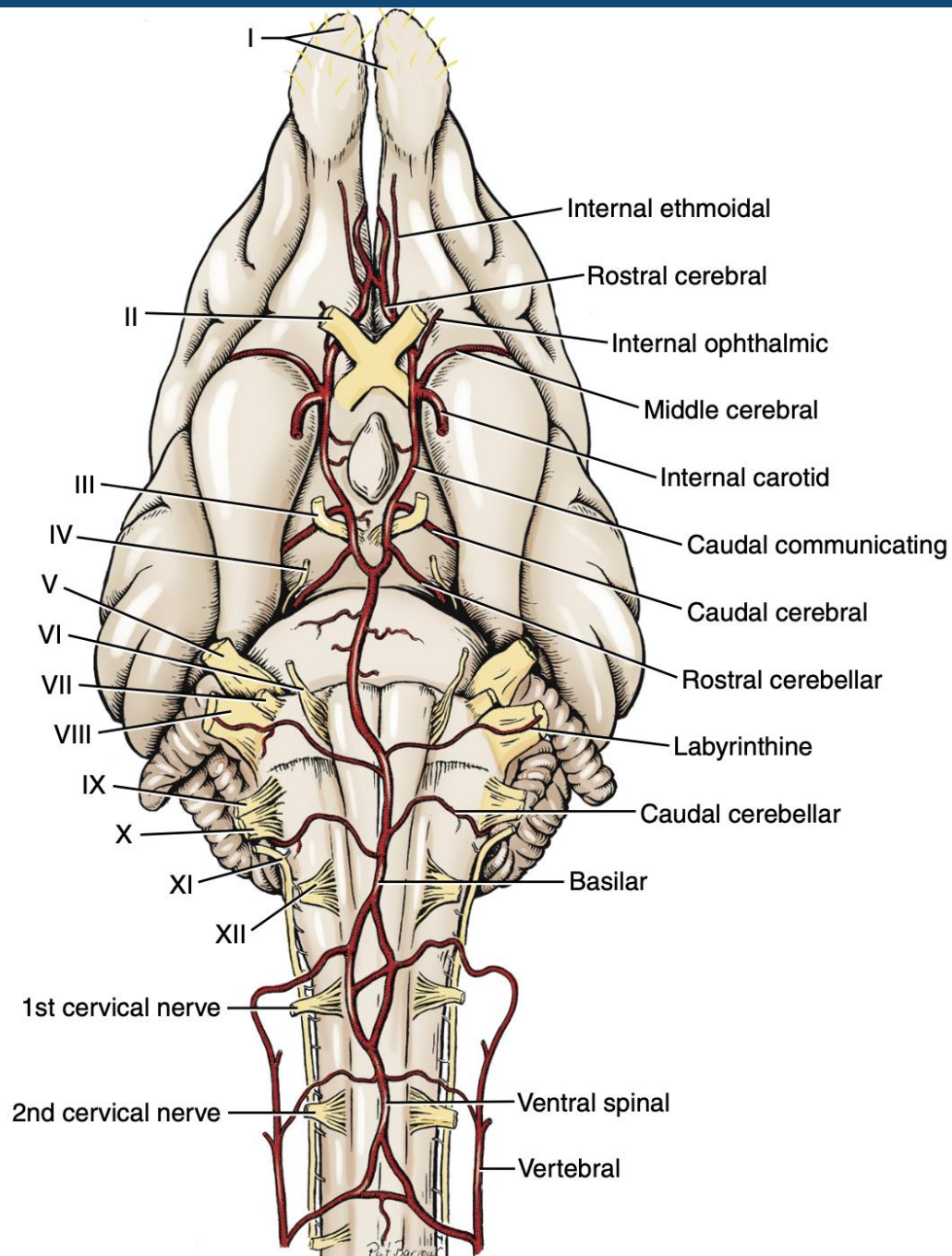


Gait / posture: Lower motor neuron (LMN) quality paresis



Cranial nerves





BOX 21.1 ORDER OF THE CRANIAL NERVE EXAMINATION

MENACE RESPONSE

Cranial nerve II—central visual pathway to the occipital lobe; cerebellum—cranial nerve VII—for closure of the palpebral fissure

PUPIL SIZE AND SYMMETRY, AND PUPILLARY LIGHT REFLEX

Cranial nerve II—rostral brainstem; cranial nerve III (GVE)—ciliary ganglion; ciliary nerves for pupil constriction—direct and indirect

EYE POSITION

Strabismus: cranial nerve III (GSE)—ventrolateral; cranial nerve IV—extorsion; cranial nerve VI—medial; cranial nerve VIII (vestibular)—ventrolateral, inconstant

EYE MOVEMENTS

Normal physiologic (vestibulo-ocular) nystagmus: cranial nerve VIII (vestibular)—brainstem—MLF; cranial nerve VI for abduction and cranial nerve III (GSE) for adduction

Abnormal nystagmus: cranial nerve VIII (vestibular) and central vestibular components

PALPEBRAL FISSURE SIZE

Cranial nerve III (GSE), cranial nerve VII (horse and farm animals), sympathetic nerves, cranial nerve V—atrophy of masticatory muscles

THIRD EYELID PROTRUSION

Sympathetic nerves: cranial nerve V—atrophy of muscles of mastication, tetanus; facial paralysis when menaced

CRANIAL NERVE VII

Facial muscles: position, tone and movement of eyelids, ears, lips and nose; menace response (cranial nerves II–VII); palpebral reflex (cranial nerves V–VII)

CRANIAL NERVE V

Muscles of mastication: jaw function, atrophy

Sensory: palpebral reflex (cranial nerves V–VII); nasal septum for nociception; autonomous zones of three branches

CRANIAL NERVES V, IX, X, AND XII

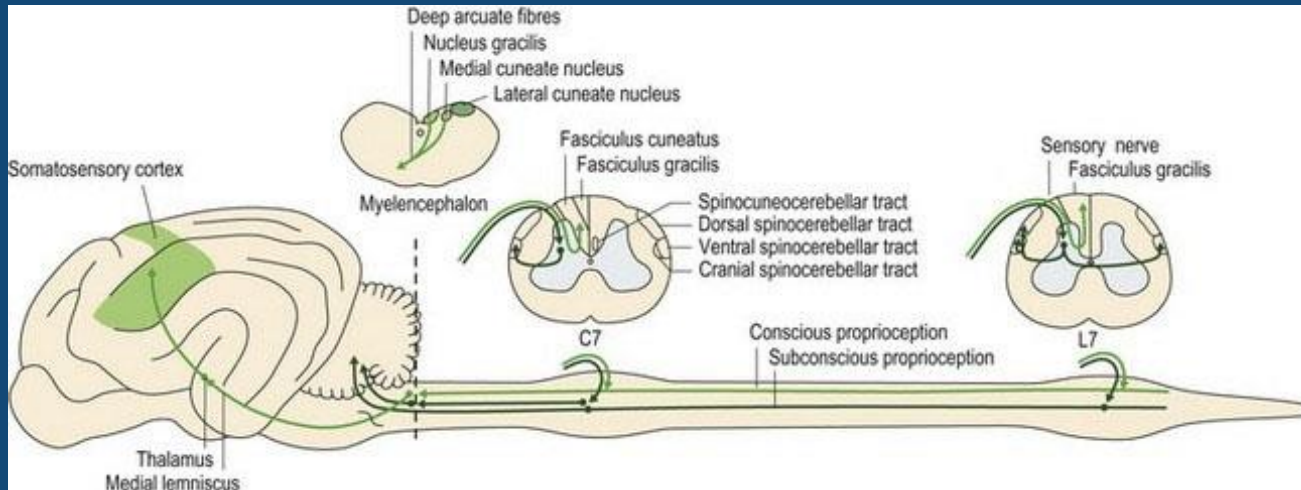
Gag reflex: jaw tone (cranial nerve V), tongue size and movement (cranial nerve XII), gagging, and swallowing (cranial nerves IX, X)

GSE, General somatic efferent; GVE, general visceral efferent; MLF, medial longitudinal fasciculus.

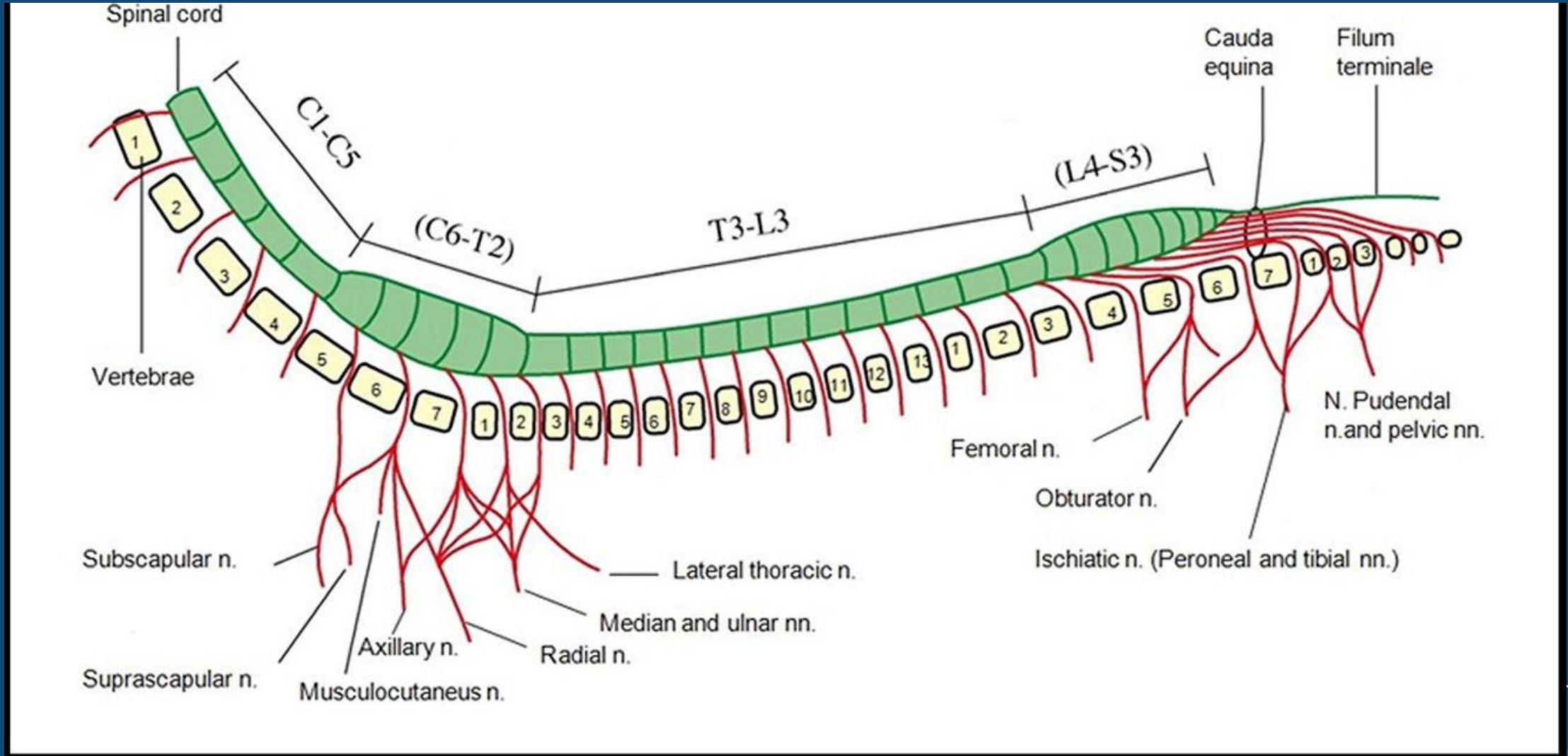


Proprioceptive testing

- Postural reactions:
 - Hopping
 - Paw placement



Spinal reflexes & muscle tone



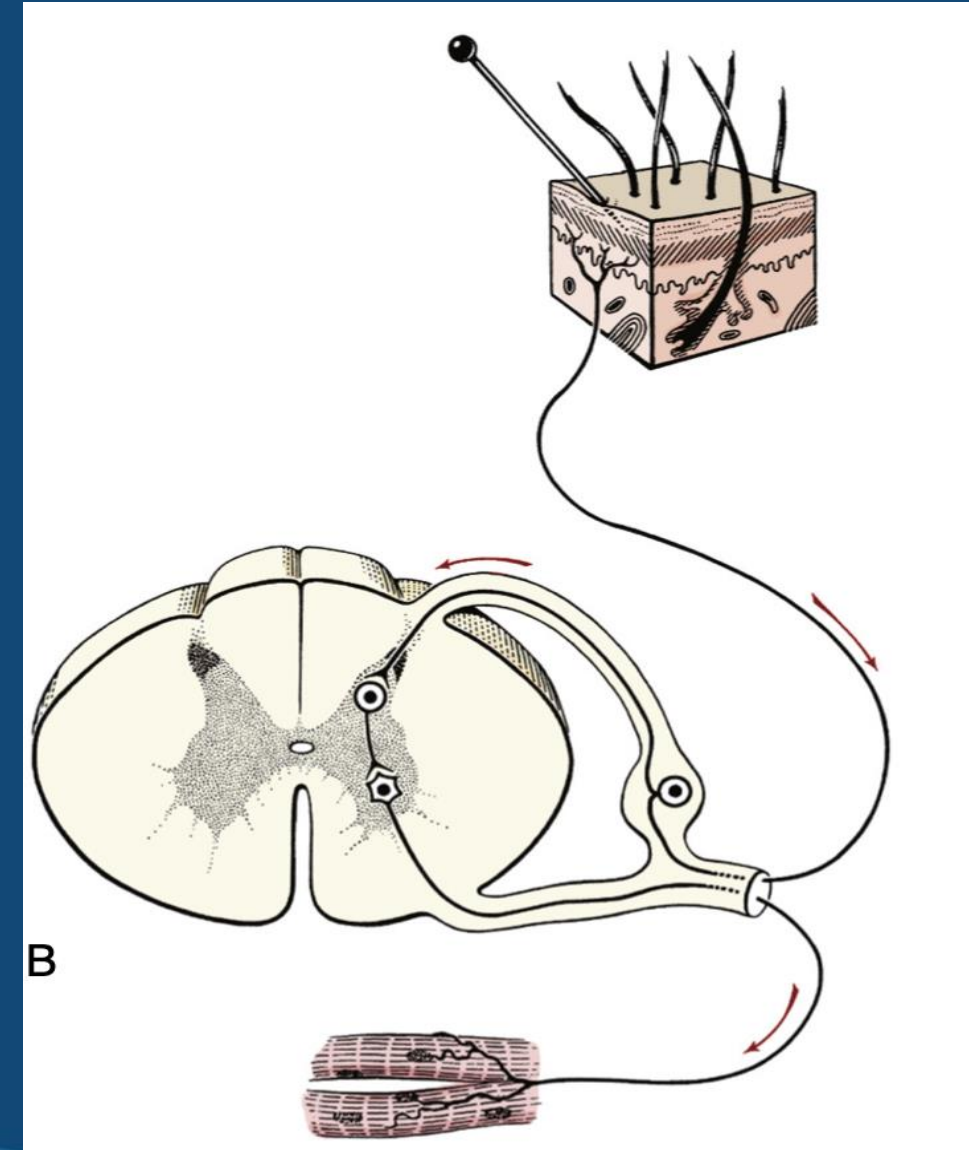
Spinal reflexes & muscle tone



Spinal reflexes & muscle tone

Thoracic limbs

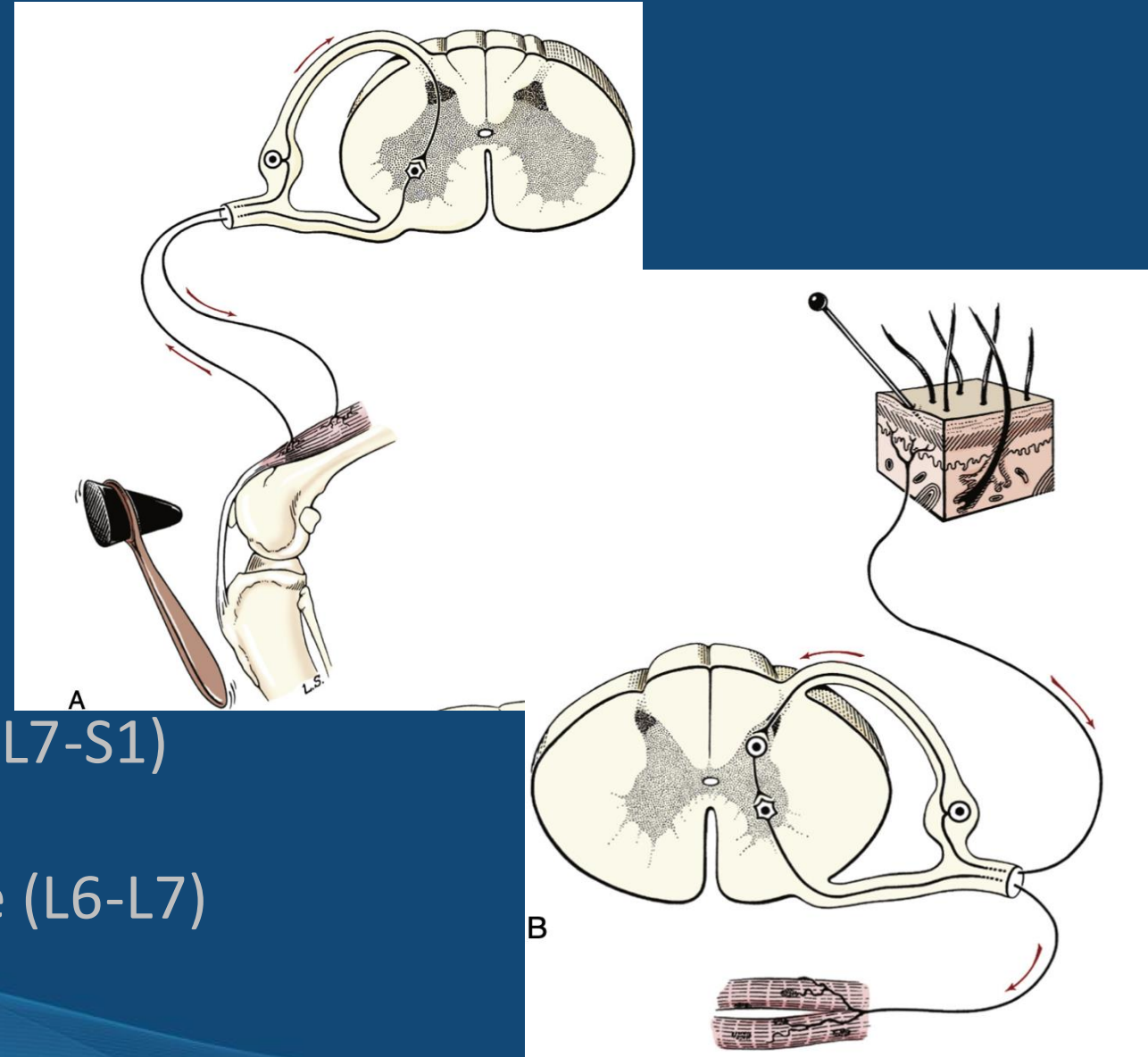
- Withdrawal reflex (C6-T2)
- Biceps reflex
 - Musculocutaneous nerve (C6-C8)
- Triceps reflex
 - Radial nerve (C7-T1)
- Extensor carpi radialis reflex
 - Deep branch of radial nerve (C7-T1)



Spinal reflexes & muscle tone

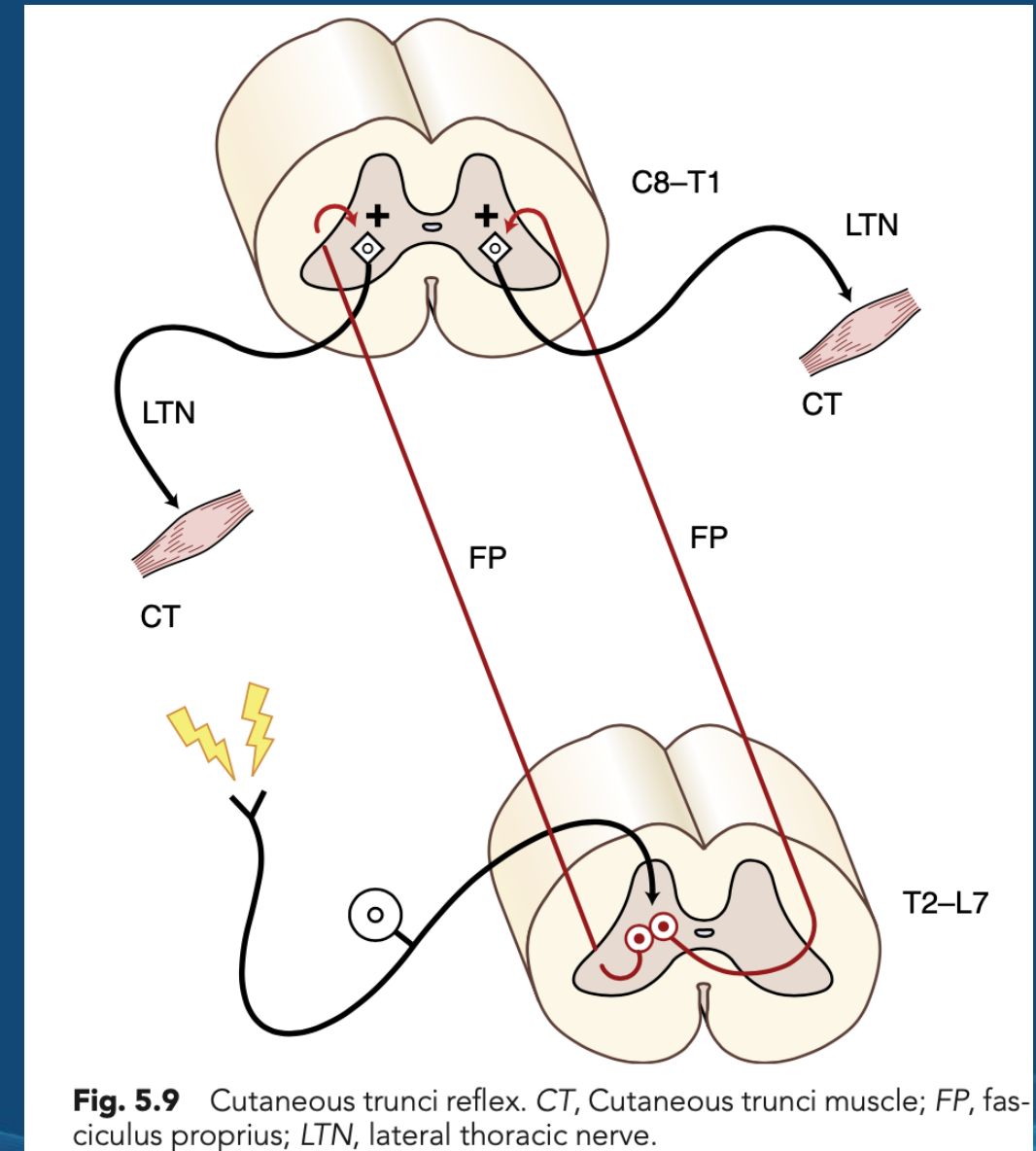
Pelvic limbs

- Withdrawal reflex
 - Sciatic nerve (L6-S1)
- Patellar reflex
 - Femoral nerve (L4-L6)
- Gastrocnemius reflex
 - Tibial branch of sciatic nerve (L7-S1)
- Cranial crural muscle reflex
 - Fibular branch of sciatic nerve (L6-L7)



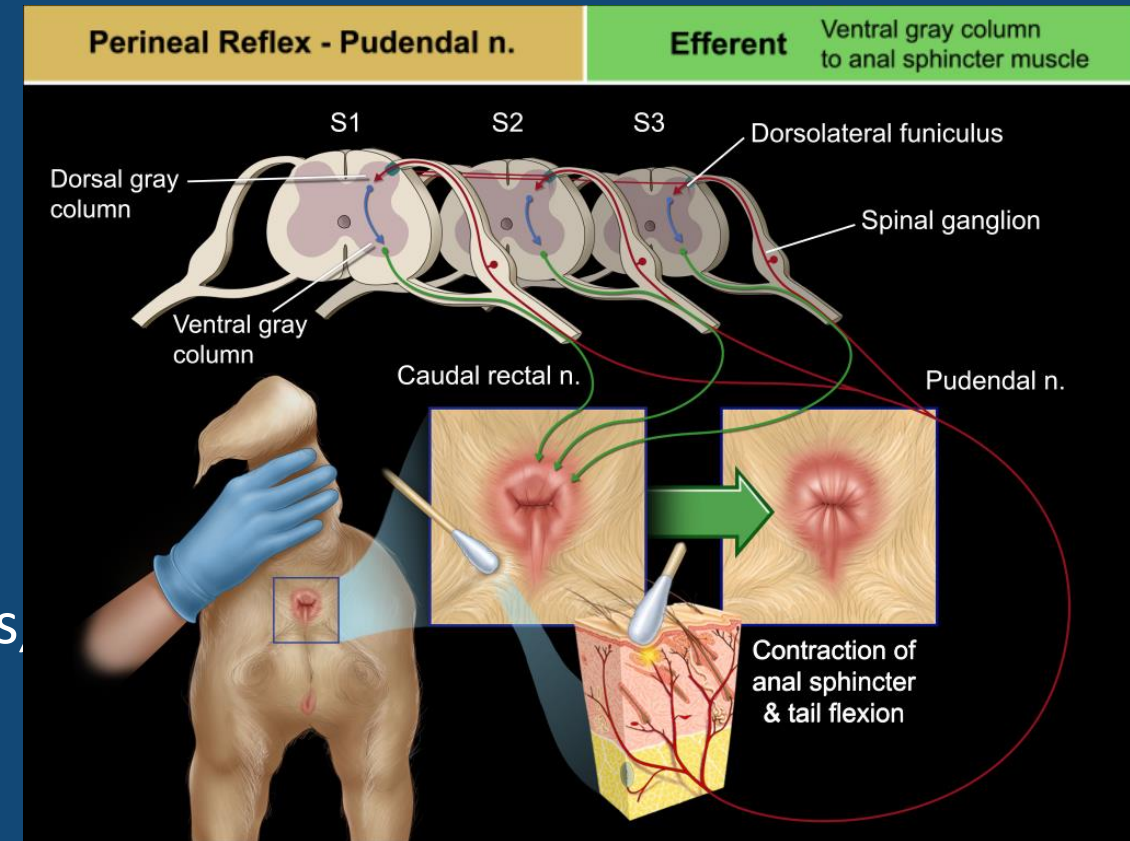
Cutaneous trunci reflex

- Afferent component:
 - Cutaneous nerves → dorsal branches of lumbar & thoracic spinal nerves
- Efferent component:
 - Lateral thoracic nerve (C8-T1)



Perineal reflex & anal sphincter tone

- Afferent component:
 - Pudendal nerve (S1-S3)
- Efferent component:
 - Pudendal nerve, caudal rectal nerve (S1-S3)
 - External sphincter muscle of anus
 - Skeletal (striated) muscle of the penis, vulva, vestibule
 - Urethralis muscle
 - Skin of anus, perineum, caudal thigh



Nociception

- The patient's perception of a noxious stimulus
 - “Deep pain”
- Nociceptors – high-threshold sensory receptors that respond to mechanical, electrical, or chemical stimuli (i.e. noxious stimuli)
- When to test?
 - Paraplegic patients

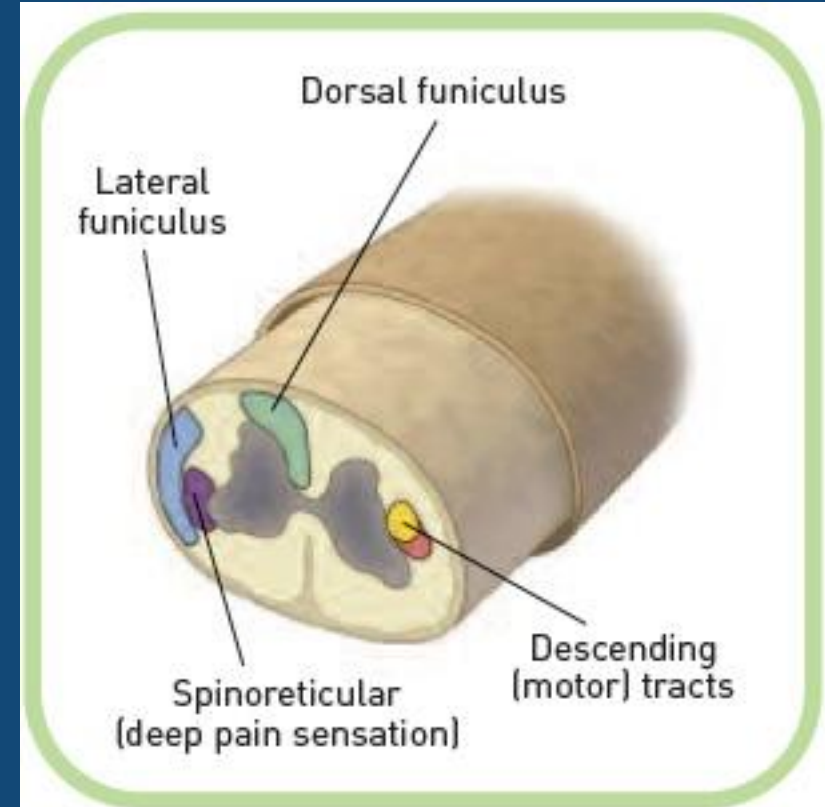
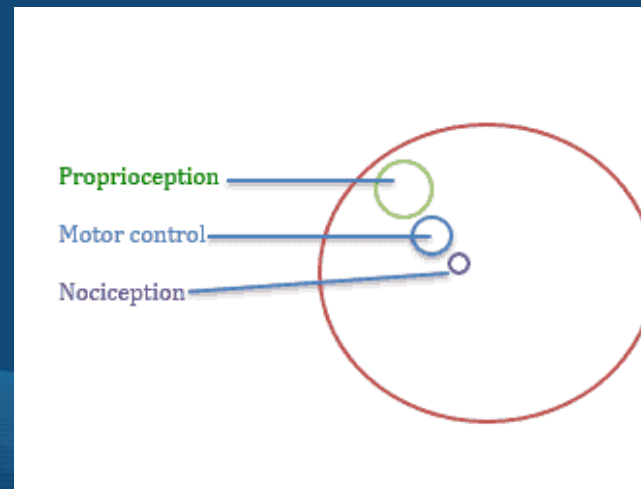


Fig 4. The approximate location of the various spinal pathways within the cord



Spinal hyperesthesia

- Palpate the vertebral column for any evidence of back or neck pain
- Evaluate for any muscle spasms (neck pain)
- Perform gentle cervical range of motion if indicated



Exam findings



Neurolocalization



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 - Nerve

- Neuromuscular junction

- (Muscle)



Neurolocalization

- Non-ambulatory tetraparetic patient – is it:
- **C1-C5 myelopathy?**
 - UMN/GP tetraparesis/ataxia x 4
 - Proprioceptive deficits x 4
 - Spastic tone
 - Intact spinal reflexes
- **C6-T2 myelopathy?**
 - “Two-engine gait” – LMN paresis in thoracic limbs, UMN/GP paraparesis/ataxia in pelvic limbs
 - Proprioceptive deficits in pelvic limbs
 - Spinal reflexes decreased in thoracic limbs, intact in pelvic limbs
- **Diffuse neuromuscular?**
 - Cranial nerve deficits
 - Dysphagia, regurgitation
 - Dysphonia
 - Dyspnea – stridor
 - Hypersalivation
 - Facial weakness – palpebral reflex deficits
 - Prehension deficits
 - Lack of proprioceptive deficits
 - Decreased muscle tone
 - Decreased to absent spinal reflexes



Neurolocalization

- Non-ambulatory paraparetic patient – is it:
 - **T3-L3 myelopathy?**
 - UMN/GP tetraparesis/ataxia x 2
 - Proprioceptive deficits x 2
 - Spastic tone in pelvic limbs
 - Intact spinal reflexes
 - **L4-S3 myelopathy?**
 - LMN paraparesis +/- ataxia in pelvic limbs
 - Proprioceptive deficits in pelvic limbs
 - Decreased muscle tone in pelvic limbs
 - Spinal reflexes decreased in pelvic limbs
- **Diffuse neuromuscular?**
 - Cranial nerve deficits
 - Dysphagia, regurgitation
 - Dysphonia
 - Dyspnea – stridor
 - Hypersalivation
 - Facial weakness – palpebral reflex deficits
 - Prehension deficits
 - Lack of proprioceptive deficits
 - Decreased muscle tone
 - Decreased to absent spinal reflexes
- **Orthopedic?...**



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