Spinal Trauma in Wildlife Rehabilitation

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Wildlife Center of Virginia

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- Wildlife Hospital in Waynesboro, Va
- ~4000 patients annually, all species
- Emphasis on teaching and research
- Come learn or work with me!

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Overview

- Anatomy
- Clinical signs and patient evaluation
- Treatment and diagnostics
- Prognosis
- Cases

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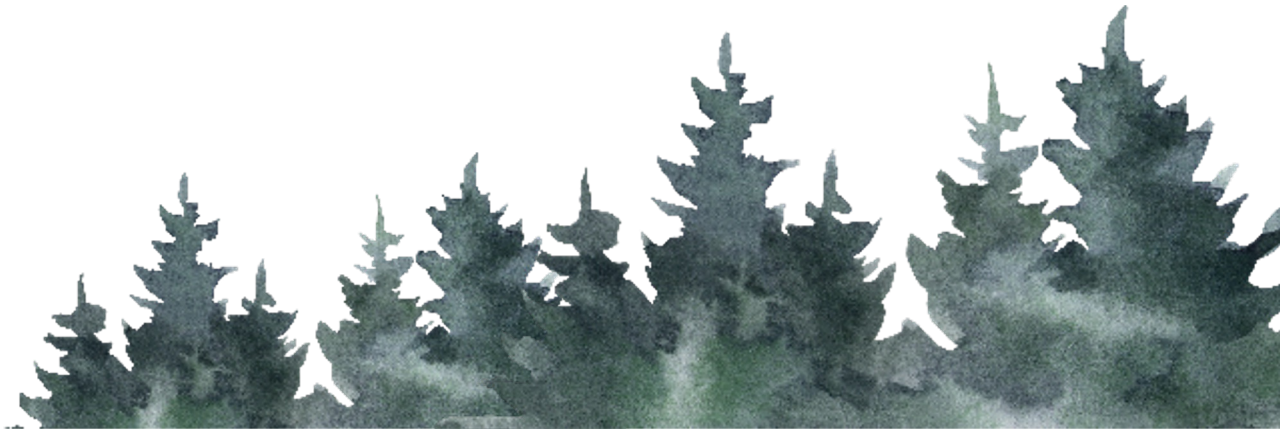

Why do we care?

- Patients in wildlife rehabilitation commonly present due to trauma
- Spinal trauma is a common presentation
- Accurate assessment essential for triage

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Anatomy

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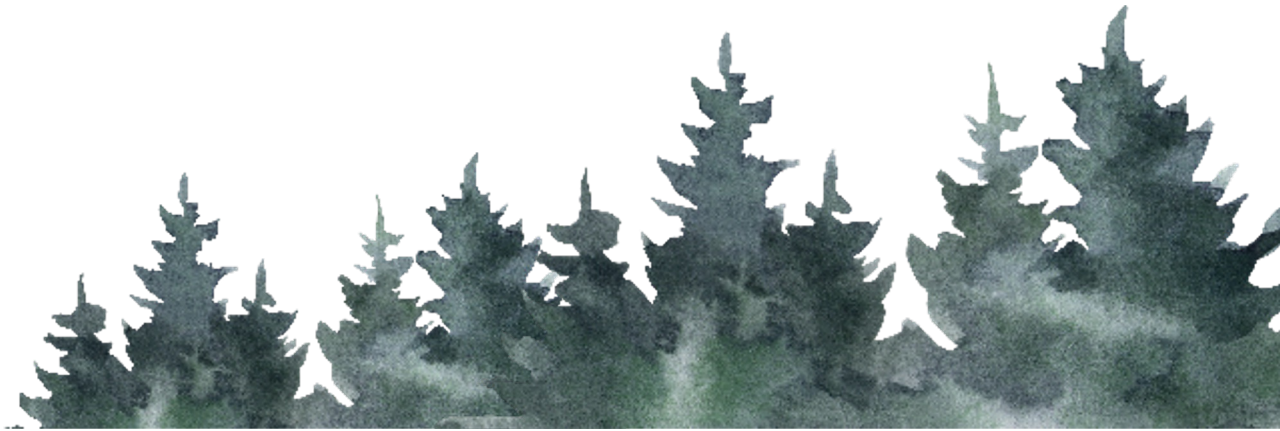
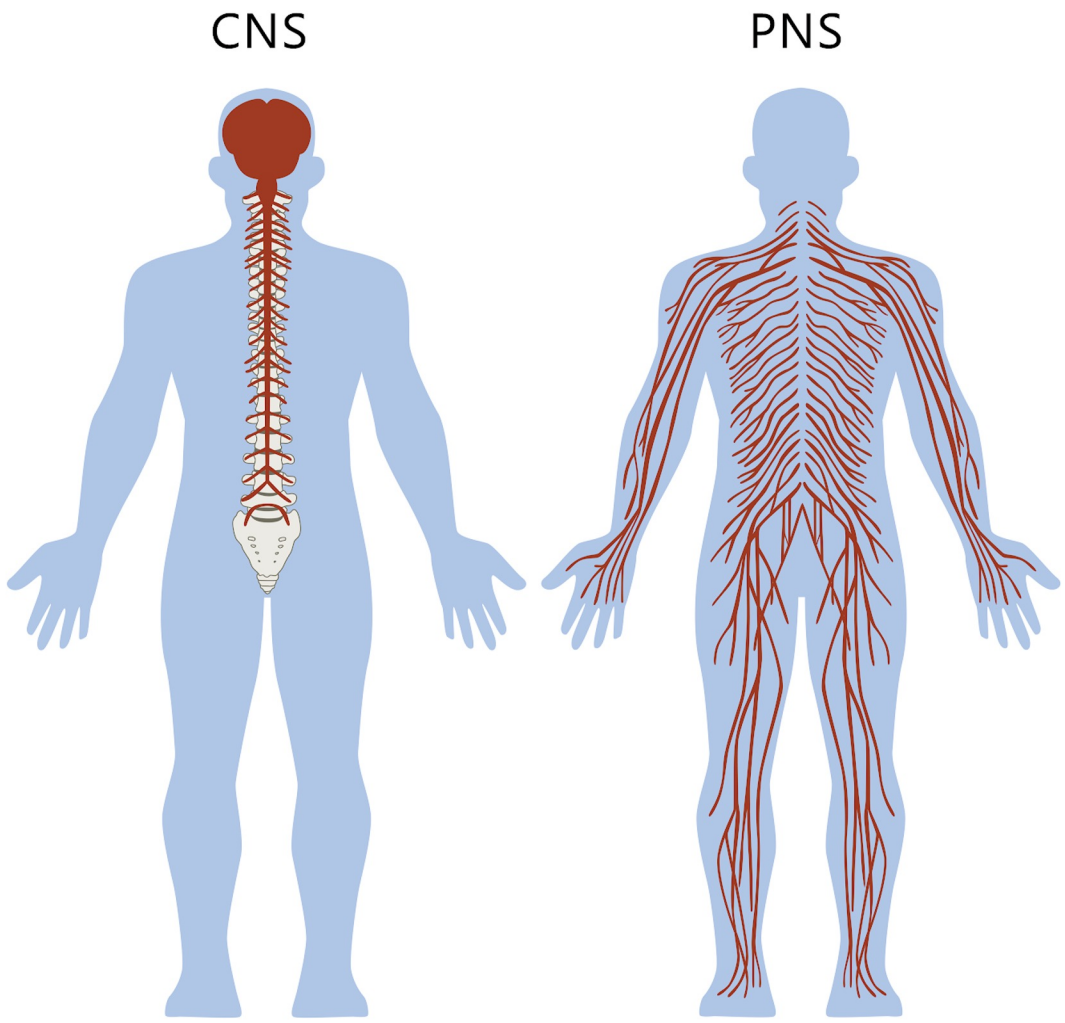


Anatomy of the nervous system



Central nervous system

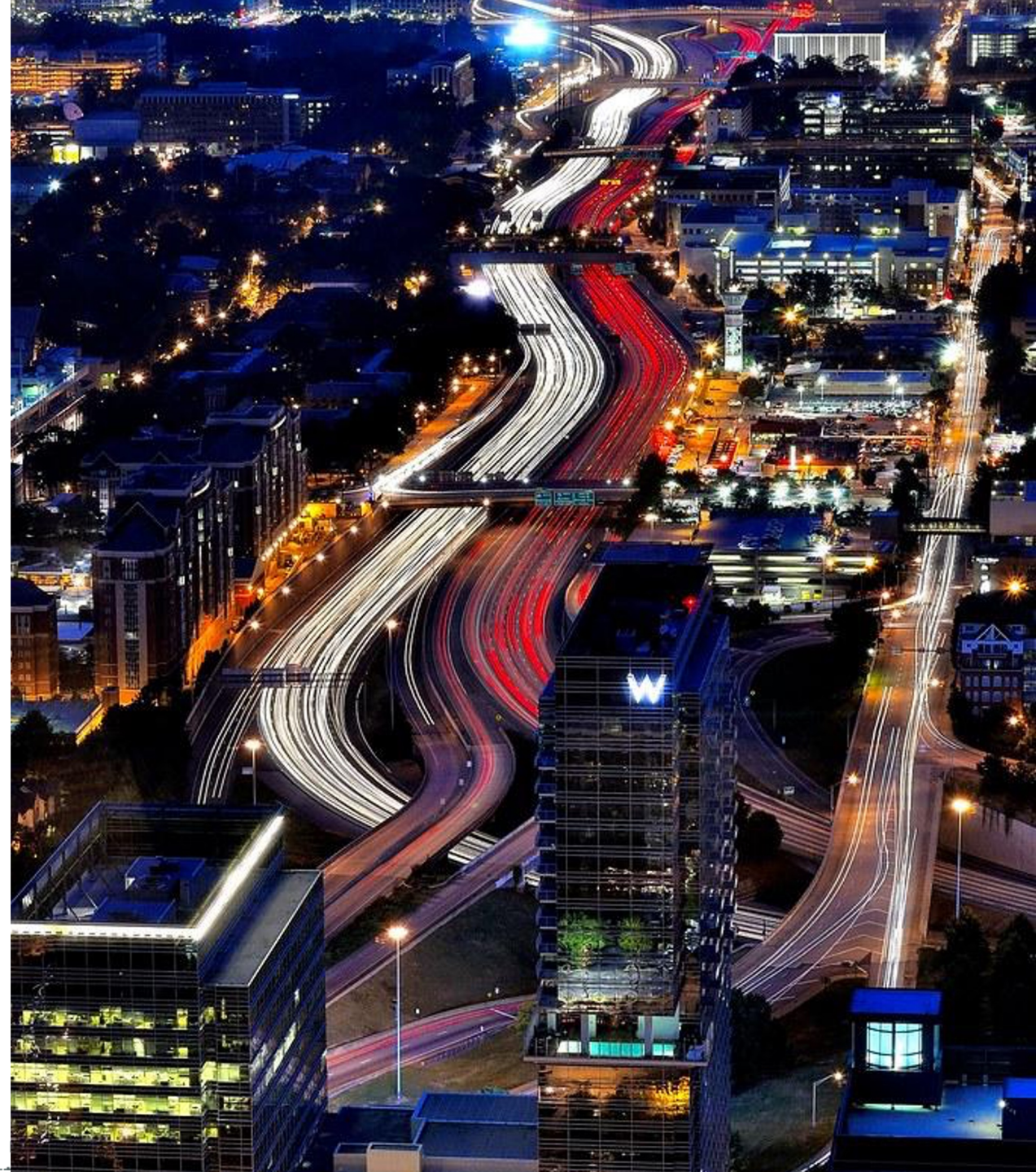
- Brain
- Spain cord

Peripheral nervous system

- All nervous tissue outside the brain and spinal cord
- Sends information from different areas of your body back to your brain
- carries out commands from your brain to various parts of your body

Spinal cord

- The spinal cord is part of the CNS but serves as a **communication pathway between** the brain and the peripheral nervous system



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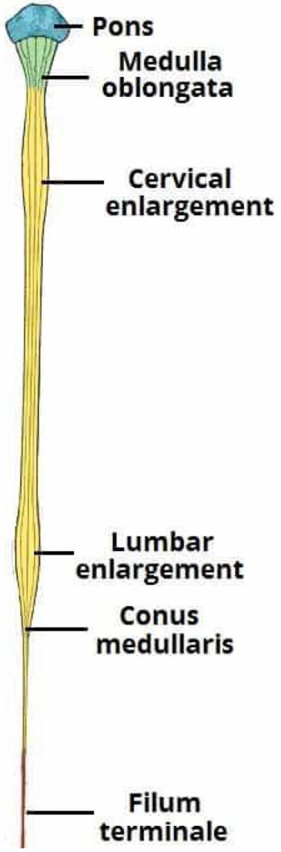
Anatomy of the spinal cord

- Long, tubular structure that runs within the vertebral column
- Extends from the base of the brain to the lumbar region of the spine
- cylindrical in shape
- protected by the vertebral column/spine



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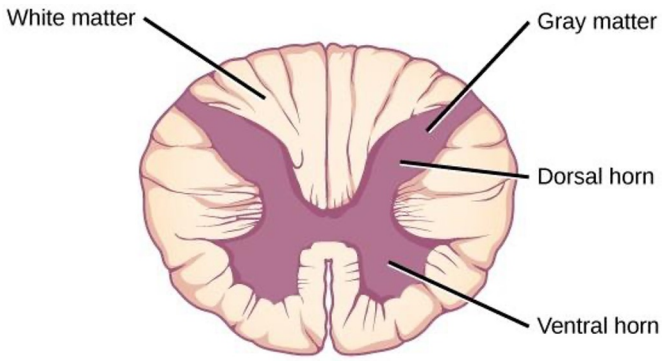
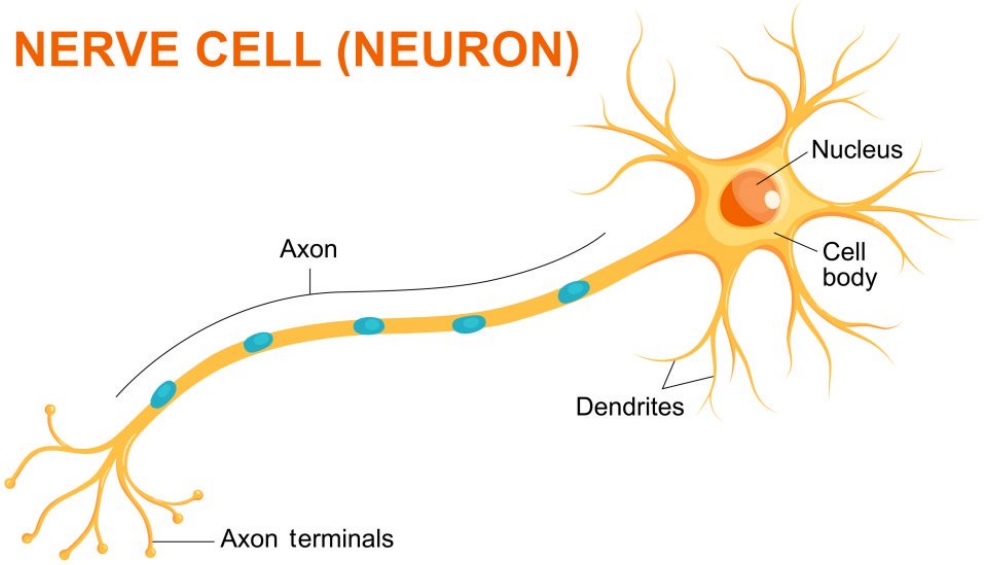
Spinal cord anatomy continued

- Spinal cord has an outer layer of white matter and an inner core of gray matter.
  - Gray matter contains neuronal cell bodies, dendrites, and synapses
  - white matter consists of myelinated nerve fibers (axons) that form tracts and facilitate communication between different parts of the nervous system.





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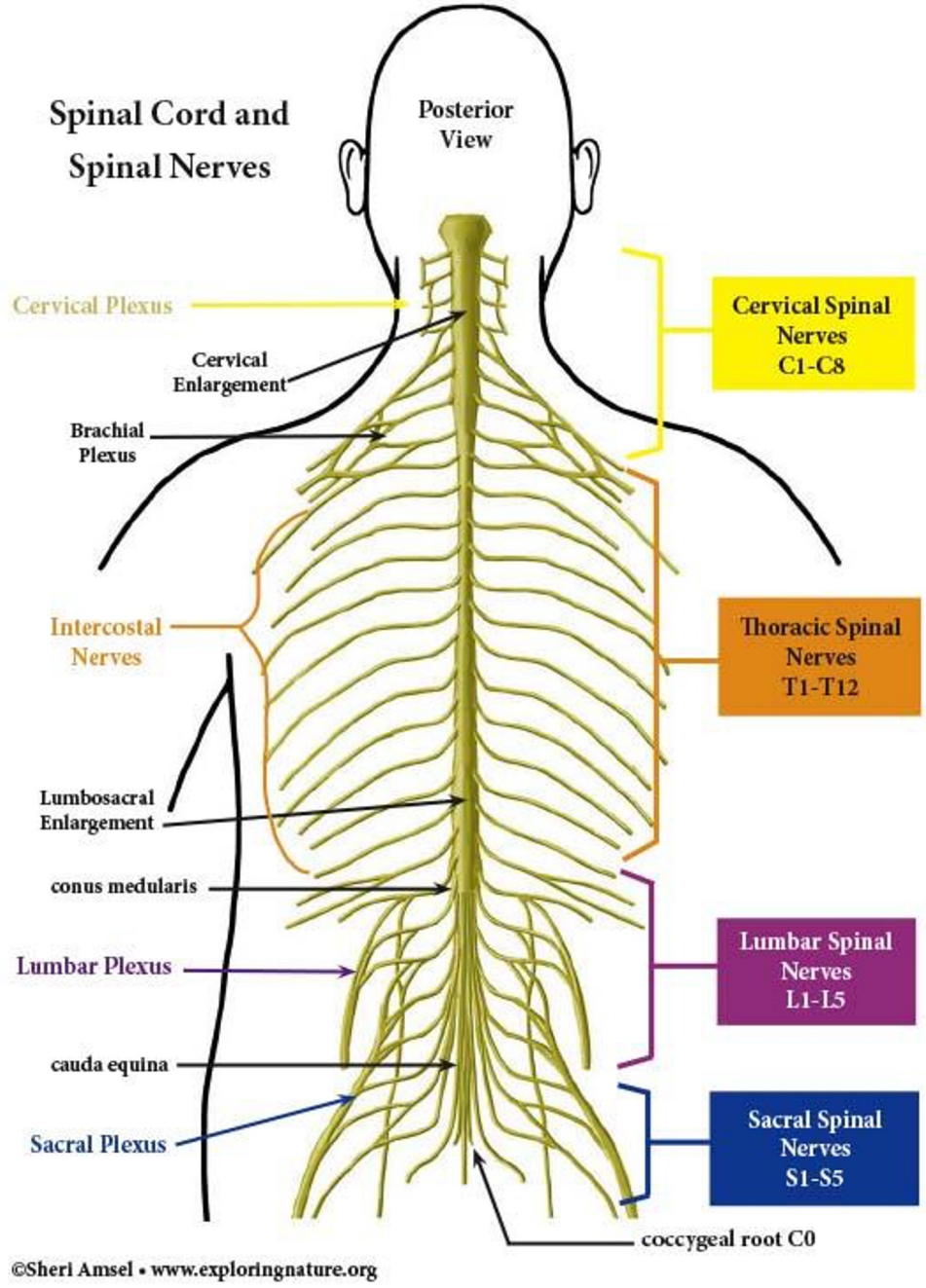
Spinal Nerves

- The spinal cord gives rise to pairs of spinal nerves at each vertebral level.
  - These nerves exit the vertebral column through openings called intervertebral foramina.

- Spinal nerves transmit sensory information to the spinal cord and convey motor commands from the spinal cord to muscles and glands



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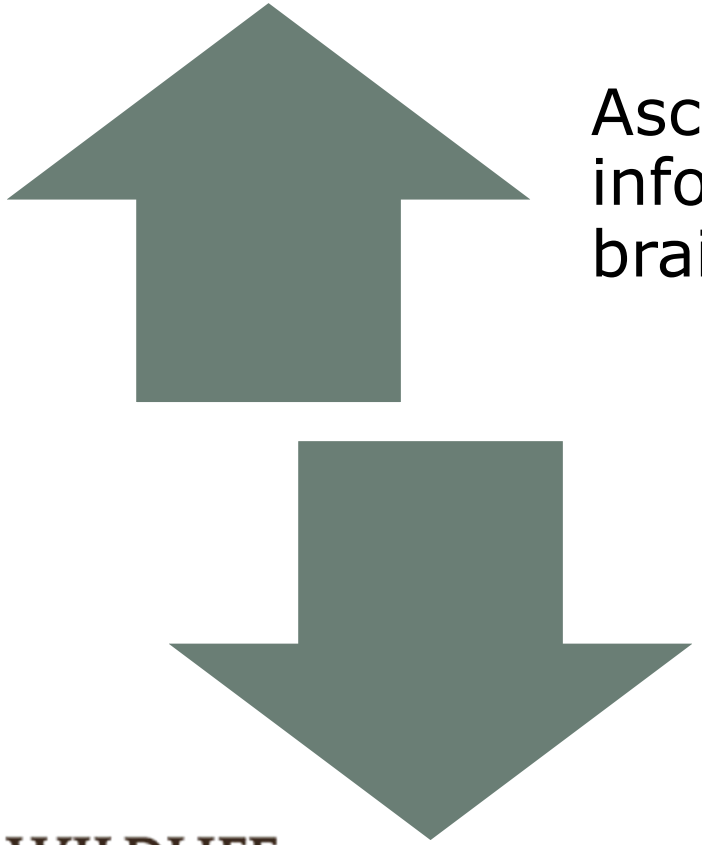
Ascending and Descending Tracts



Ascending tracts carry sensory information from the body to the brain

descending tracts transmit motor commands from the brain to the body

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Clinical signs and patient evaluation

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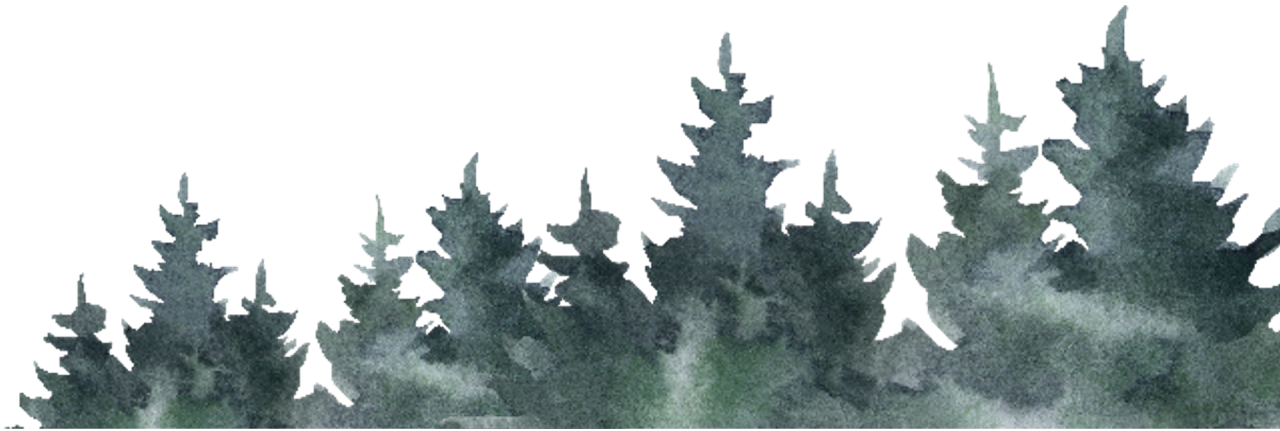
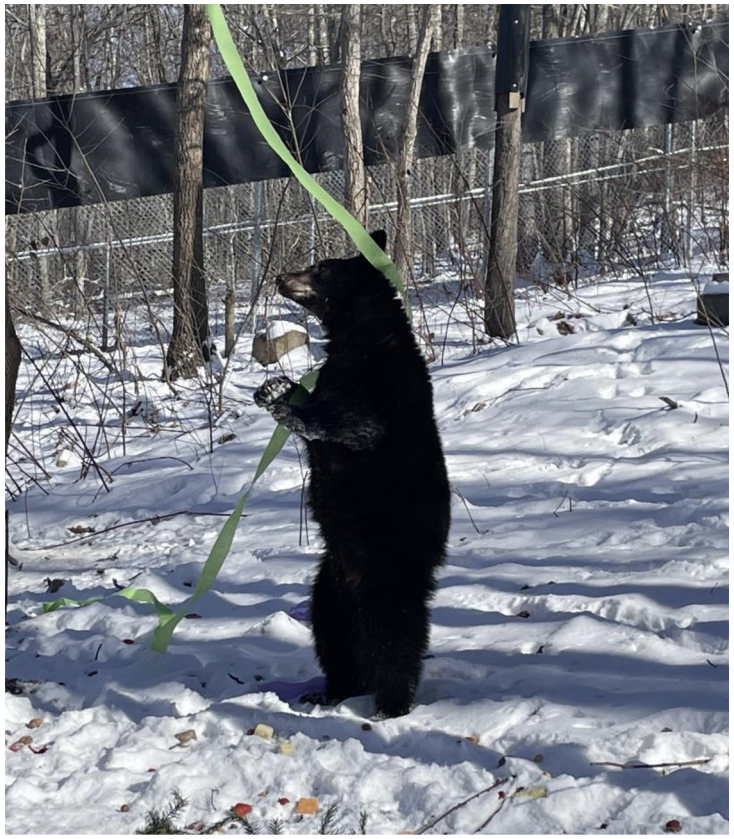


Where to start?

- Distance exam
  - Lots of information about neurologic status can be gained here
- Full physical exam
- Neuro exam



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Spinal Trauma Clinical Signs

- Loss of movement in the pelvic limbs
- Loss of bowel/bladder control or palpably large bladder
- Loss of deep pain
- Loss of muscle tone
- Loss of cloacal/anal tone
- Rigid limbs
- Tail limp or deviated from normal position
- Ataxia

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Natural history vs pathology

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Neurological exam

- Assess the animal's awareness/mentation
  - consciousness
  - response to stimuli (species appropriate)
  - depression
- Look for central nervous system signs
  - Seizures
  - head tilt
  - nystagmus
- Evaluate ambulation and ability to move all limbs
  - ataxia
  - paresis
  - paralysis

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Important definitions

Paresis:

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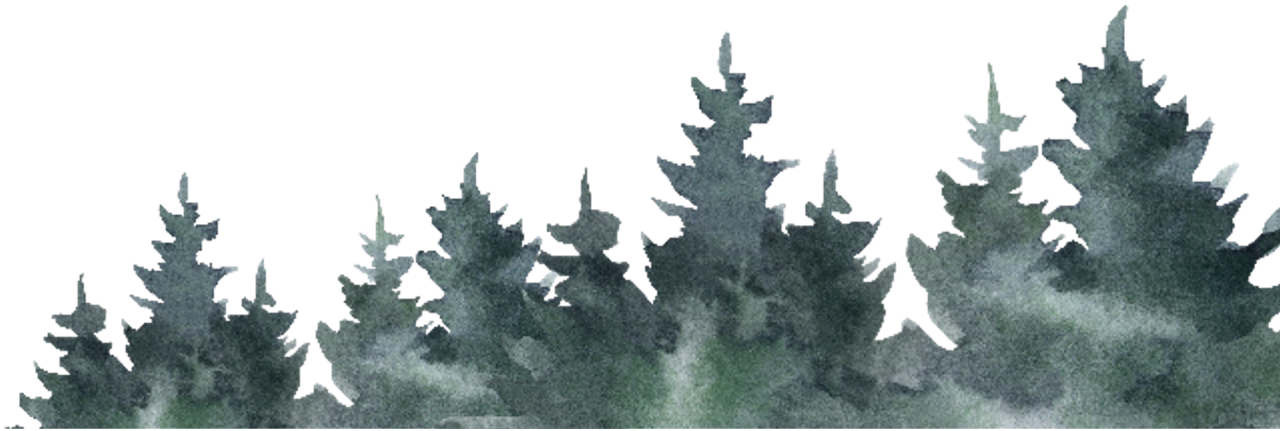

More important definitions

Proprioception	Motor	Deep pain
• the body's ability to sense its own position and movement, providing essential feedback for motor control and coordination	• ability of the body to perform purposeful and voluntary movements through the coordinated action of muscles and nerves	• deep pain involves the perception of pain arising from deep tissues within the body

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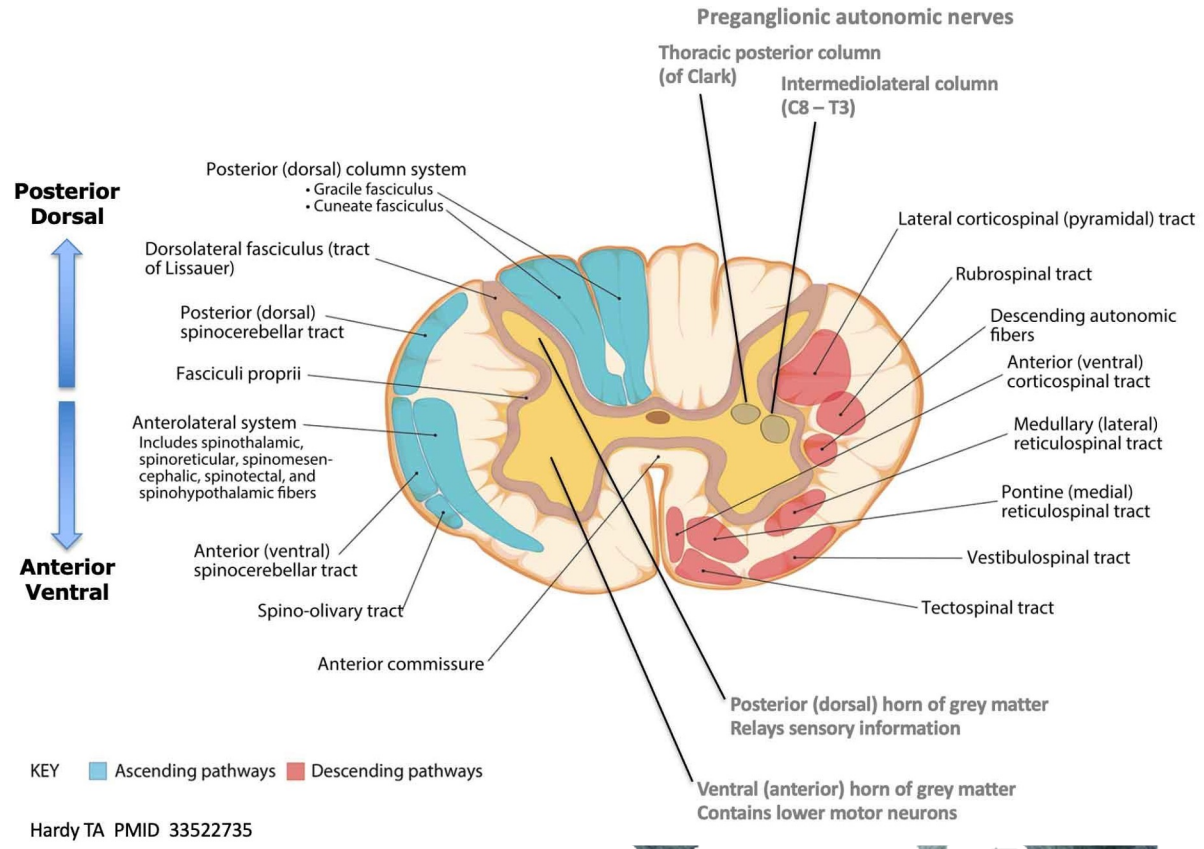
Simplified spinal cord anatomy

- *Proprioceptive tracts* run in the outermost later
  - Medial lemniscus
- *Motor tracts* run in the middle
  - Pyramidal tract
- *Deep pain tracts* run in the core
  - Spinothalmic tract



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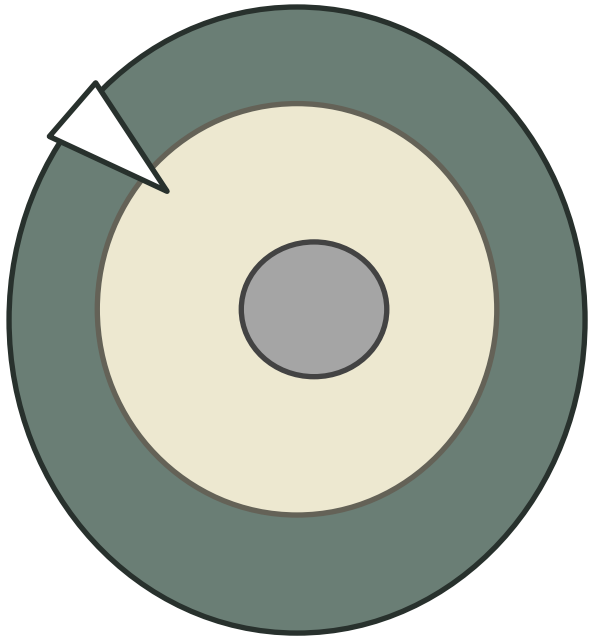
Spinal injuries - superficial

- Clinical signs:
  - ataxia
  - Patient can move legs but is not coordinated due to lack of proprioception
- No need to test deep pain, but if tested withdrawal is maintained



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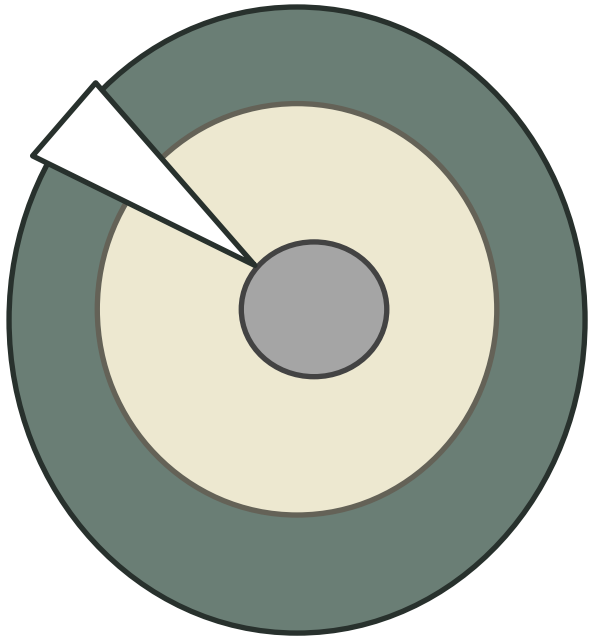
Spinal injuries - moderate

- Clinical signs:
  - unable to move legs voluntarily
  - Deep pain is maintained

- Withdrawal reflex maintained and should be tested to differentiate between the next stage



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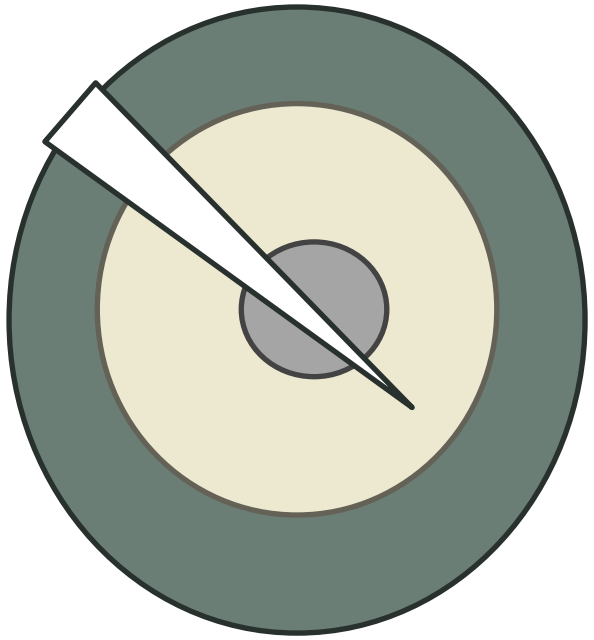
Spinal injuries - severe

- Clinical signs:
  - Unable to move legs voluntarily
  - No deep pain
  - ‘Paralysis’
- Withdrawal reflex maintained so must carefully evaluate for deep pain



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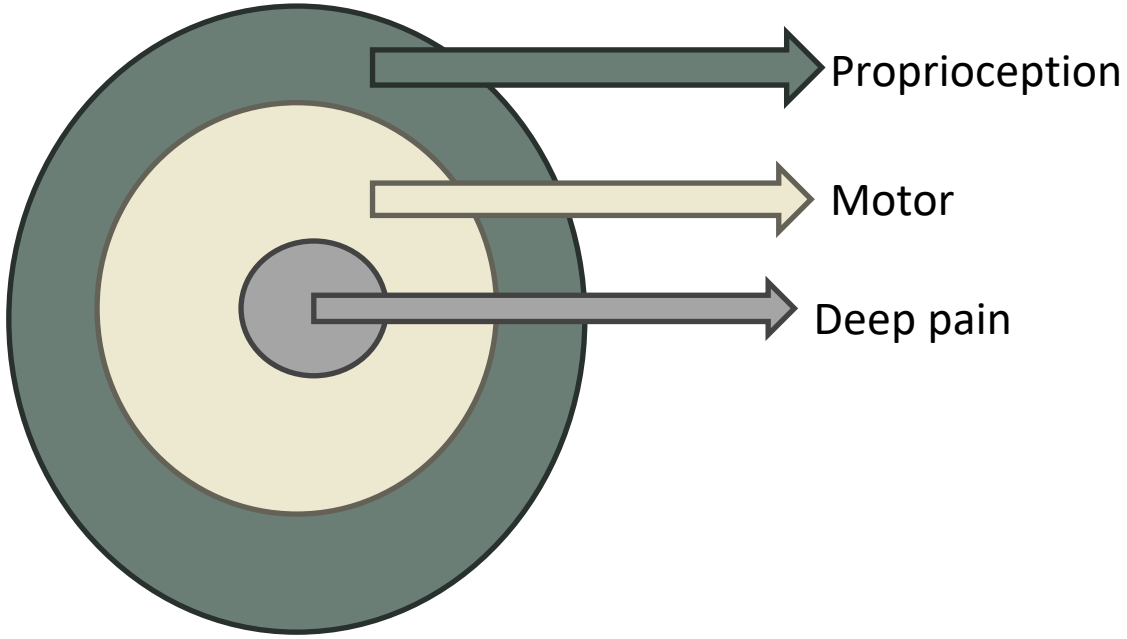
Spinal trauma and deep pain evaluation

- In patients with suspect spinal trauma and decreased use of the pelvic limbs it is critical to understand the difference between reflex and deep pain
- If a patient has voluntary motor function of the pelvic limbs, you do not need to test for deep pain
- If there is no motor function, you should test for deep pain



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Deep pain

the perception of pain that originates from structures located deep within the body, such as muscles, bones, and organs.	Processing: It involves the transmission of signals from specialized receptors (nociceptors) located in deep tissues to the spinal cord and then to the brain. **Requires conscious perception by the brain**

Reflex

an involuntary, rapid response to a stimulus an automatic and nearly instantaneous reaction that doesn't involve conscious thought	Processing: Reflexes are controlled by the spinal cord without the need for involvement of the brain. **Occurs through a reflex arc, which consists of sensory neurons, interneurons in the spinal cord, and motor neurons.**

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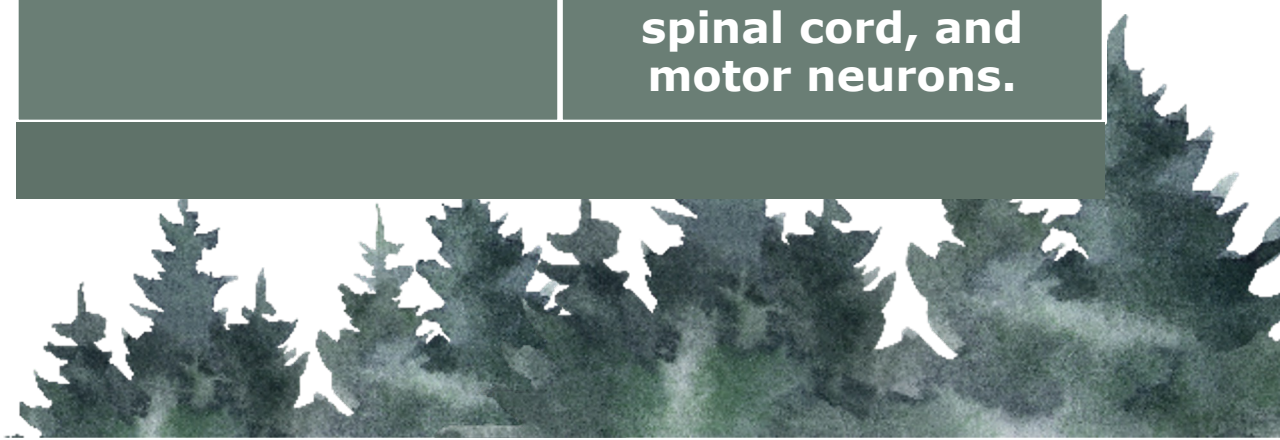
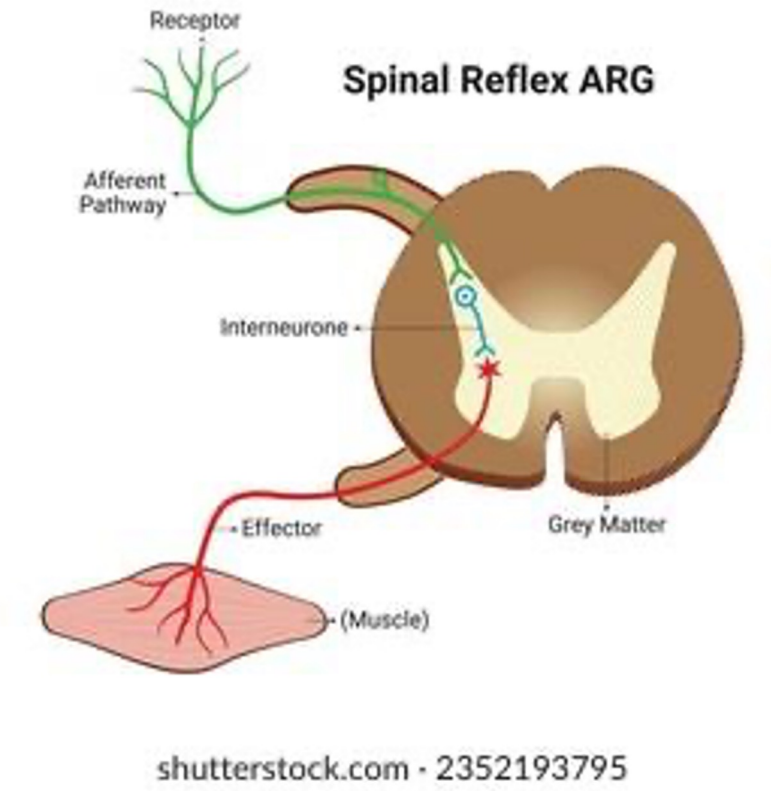


Reflex vs Deep Pain

- Deep pain requires that a stimuli is noted peripherally, and that neurologic signal is transmitted through an intact spinal cord, to the brain
- A reflex is an automatic reaction that occurs without neurologic transmission to the brain
- <u>Spinal cord can be completed severed, and a reflex would remain intact</u>



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Withdrawal reflex

Commonly mistaken for ‘motor’ in wildlife patients

Rapid, involuntary response to painful or harmful stimuli mediated by a spinal reflex arc thus does not indicate intact spinal cord

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Cross extensor reflex

- Neurologic response that may occur with the withdrawal reflex in response to painful or harmful stimulus
- Do not mistake for motor!

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Spinal reflexes in turtles

- Can display coordinated walking or swimming motions even when the brain is not actively controlling these movements due to spinal reflexes
- spinal cord contains neural circuits that can generate rhythmic motor patterns without direct input from the brain
- often observed in turtles with incomplete spinal injuries or those with partial loss of motor function.

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Testing for deep pain

- Pinch toes with hemostat **hard**
- Don’t look at the patient's limbs, but rather their face
- Monitor for a conscious reaction to the stimuli
  - Wincing, biting, looking at the site etc.
- Simply pulling the leg away can be reflexive and its not indicative of preserved deep pain

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Differentials that can present like spinal trauma

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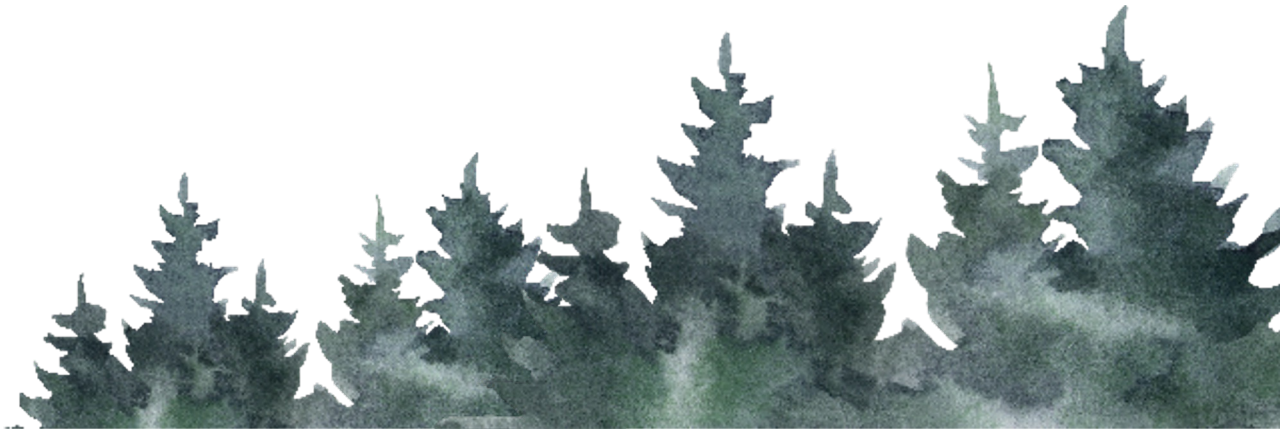

Treatment and diagnostics

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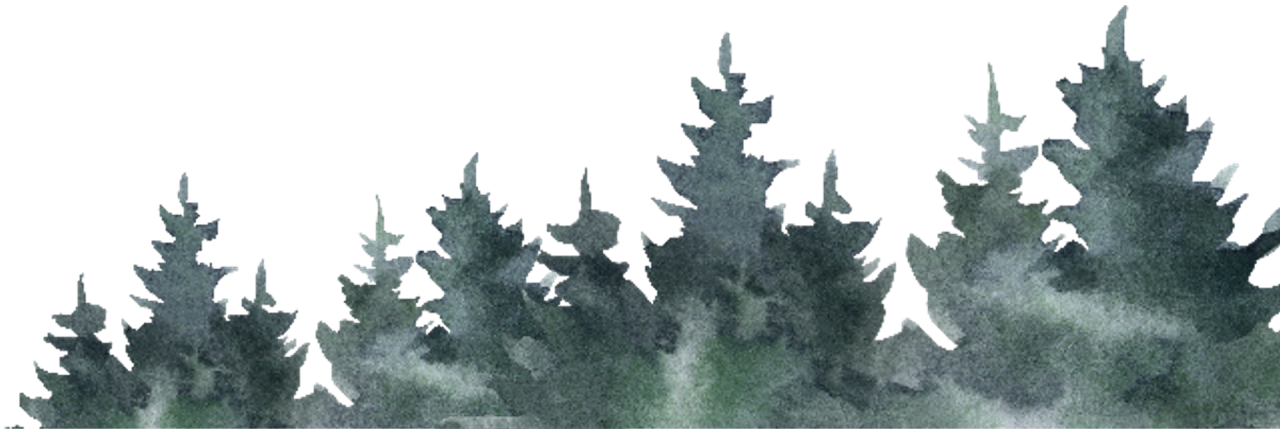

Diagnostics

- Most important diagnostics test for spinal trauma is your physical exam!
- Radiographs
- Hematology
  - Lead?
- Advanced imaging
  - CT/MRI

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Radiographs

- Radiographs have poor sensitivity for spinal trauma
- Complex 3-dimensional area is difficult to evaluate in 2 dimensions
- Soft tissue, swelling and inflammation are not well represented
- Minor fractures often missed
- If spinal fracture is visible radiographically prognosis is poor

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Treatments

- Analgesia
- Anti-inflammatories
- Fluid therapy
- Physical therapy
- Laser
- NOT steroids
- Supportive/nursing care is key

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Supportive care

- Assisted feeding
- Enclosure set up
  - Padding, slings, donuts
- Vent cleaning
- Careful monitoring for related issues
  - Hock sores
  - Keel sores

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Prognosis

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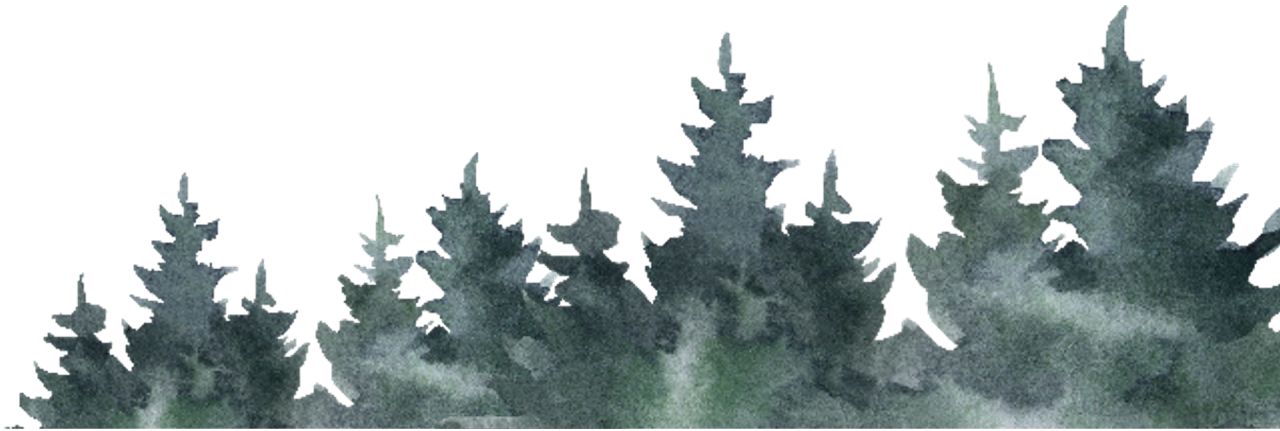
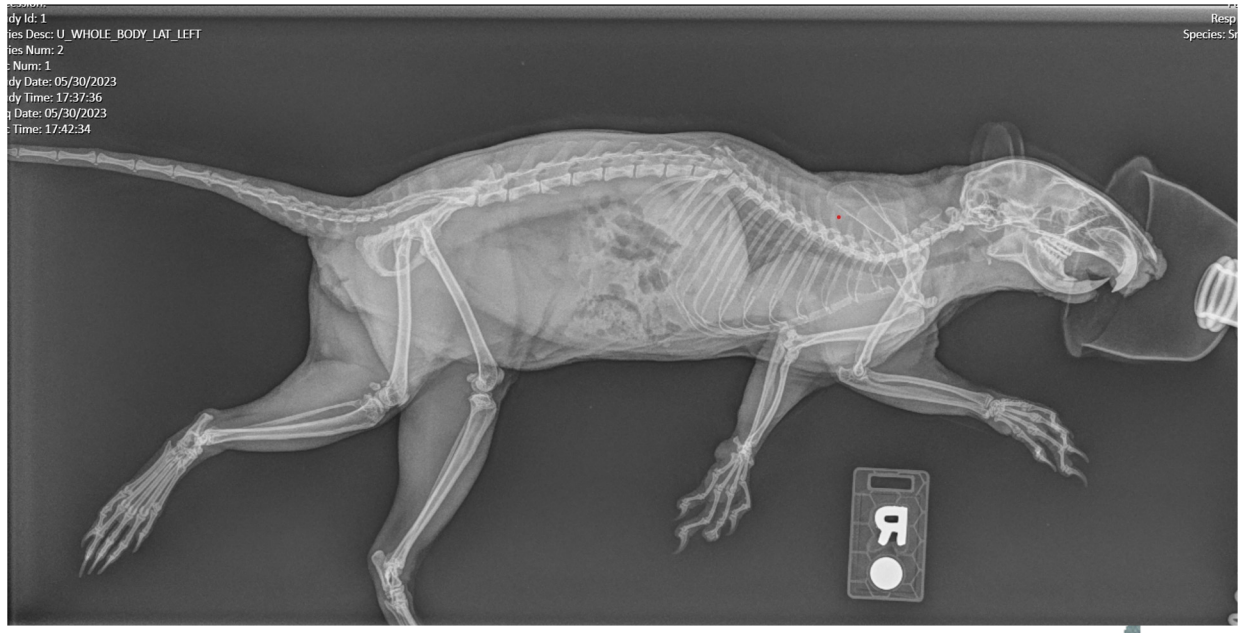


Prognosis of Spinal Trauma

- Similar to head trauma
- In general, if increasing abnormalities and declining signs or lack of improvement for >3 days are noted, euthanasia should be considered



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Prognostic Indicators of Spinal Trauma

- Fair
  - Ambulatory with intact superficial pain
- Guarded
  - Deep pain present
  - Weakly ambulatory
- Poor, euthanasia recommended
  - Loss of deep pain
  - Loss of sensory and motor function
  - Evident spinal fracture/luxation

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Case 1

Presenting complaint

- Juvenile COHA found laying under a window
- Finder suspects it hit the window
- Finder reports it was laying in the ground flapping trying to get away, but could not stand

Distance exam

On distance exam you note the patient is bright, alert and responsive

Hands on physical exam

Patient is unable to stand but is kicking/tying to talon you with legs

Slight increase in respiratory rate and effort

Otherwise PE WNL

Do we need to test this patient for deep pain?

a) Yes - the movement in the legs could be a reflex
b) No - motor is intact thus deep pain is intact
c) Yes - best to double check and no harm in checking
d) No - patient is not a candidate for rehab, euthanize

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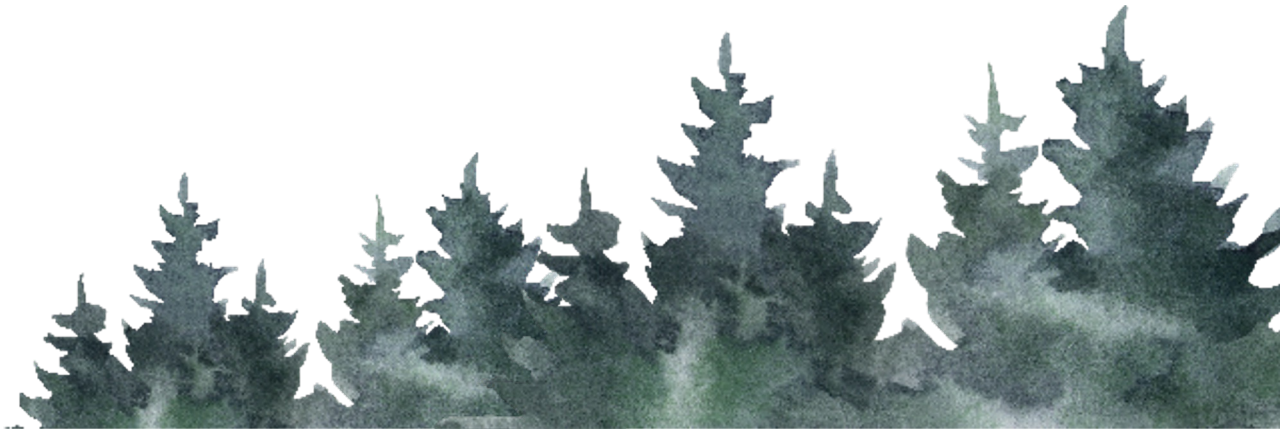

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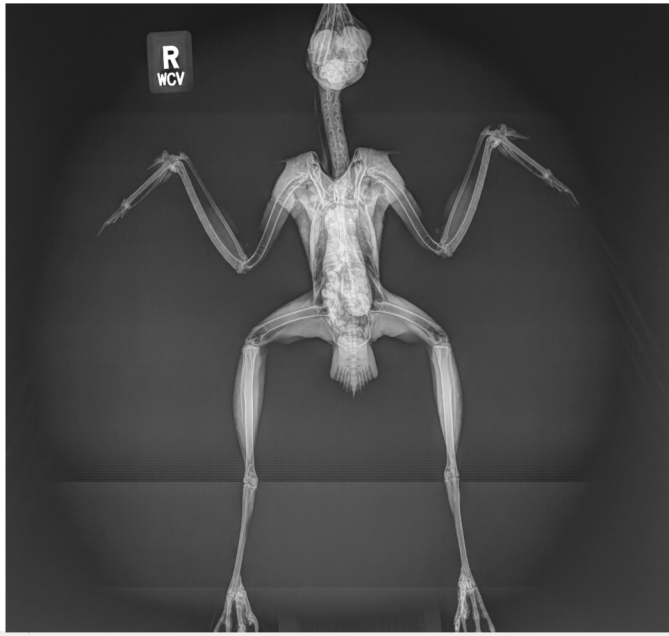

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Otherwise PE WNL

Diagnostics

Radiographs are WNL

Lead is low

PCV/TP are WNL

Treatment plan

Cooper's Hawk **24-0000904** **24-00129** **01/19/2024** **Waiting Room** **Init/Cur Wt: 300 g / 300 g**

Init/Cur Body Con: /

Circumstances of Rescue: Collision
Stationary object
Walls/windows

Problems:

RX: Meloxicam (1.500 mg/ml) 0.30 mls PO 2 times per day D1/5

RX: LRS + Vitamin B (1 mg/ml) 18.00 mls SC one time per day D1/3

RX: gabapentin (50 mg/ml) 0.06 mls PO 2 times per day D1/5

TX: Monitor neurologic status one time per day D1/3

Comments: monitor for use of pelvic limbs - motor +?

TX: Hand Feed one time per day D1/3

Comments: hand feed or gavage if not self feeding

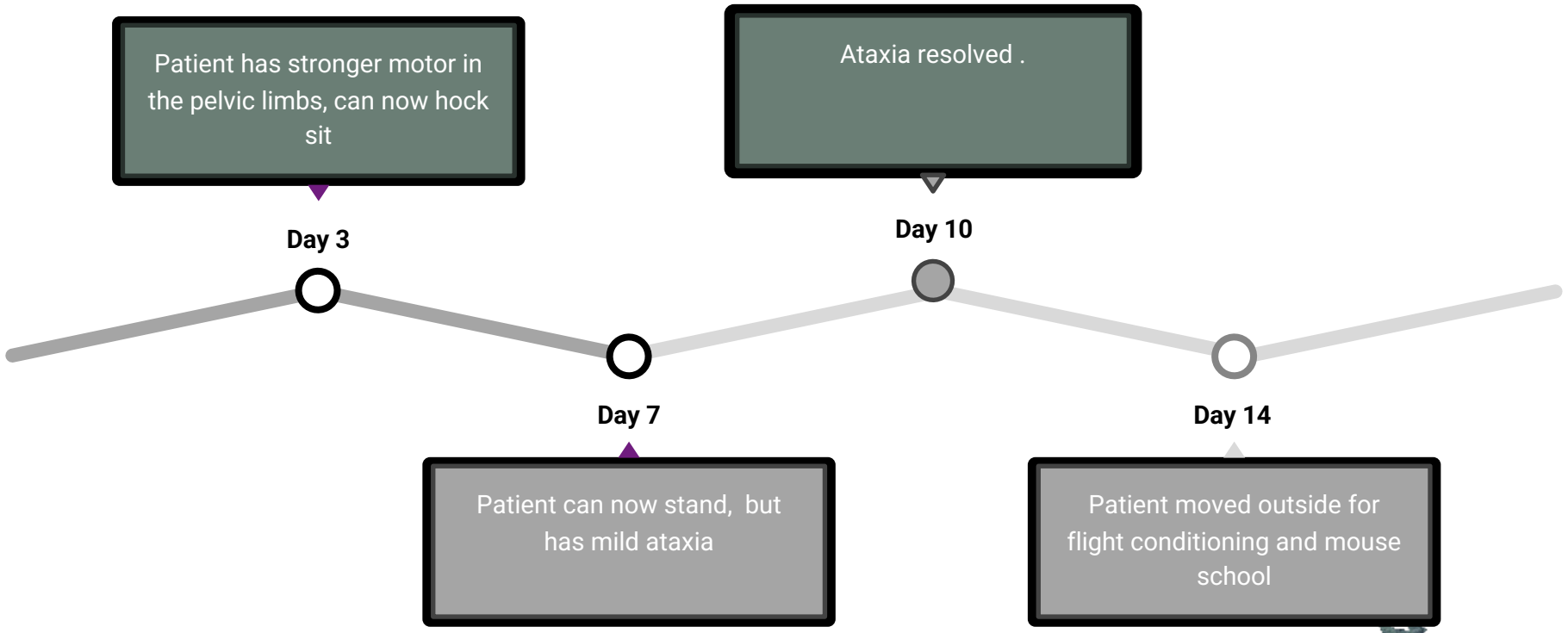
TX: Other one time per day D1/3

Comments: monitor for keel or hock sores

TX: Tailguard- monitor one time per day D1/10

Notes:

Outcome



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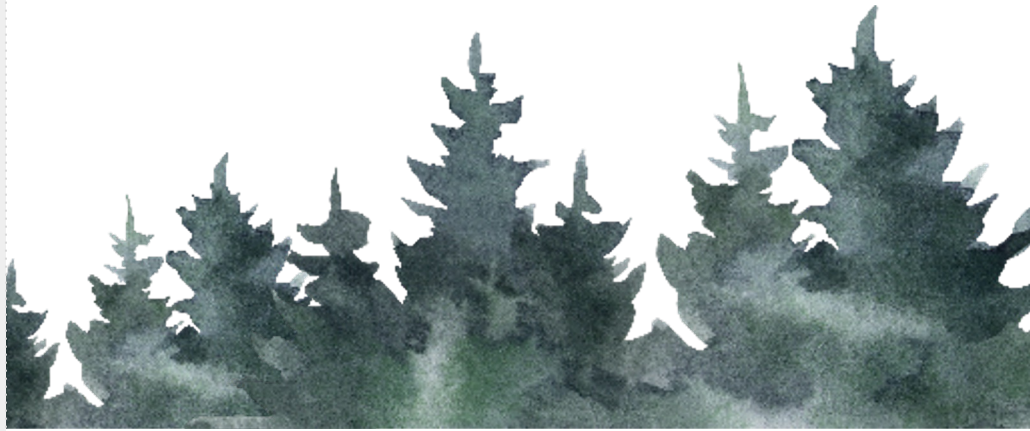
Case 2

Presenting complaint	Distance exam	Physical exam
Adult eastern grey squirrel	Aggressive, appropriate mentation	BARF
Laying on side of road	Laying in intake box, standing on thoracic limbs, pelvic limbs splayed out behind	Orthopedic exam WNL, no fractures appreciated
Using front legs but not back legs	Respiratory rate appears WNL	Not moving pelvic limbs
Attempted to bite finder		



Do we need to test for deep pain?

a) No - patient has no motor, euthanasia is the next step
b) Yes - patient has no motor, deep pain test is critical for prognosis
c) No - patient has motor function in the forelimbs
d) Yes - patient has intact reflexes, need to differentiate between reflex and deep pain

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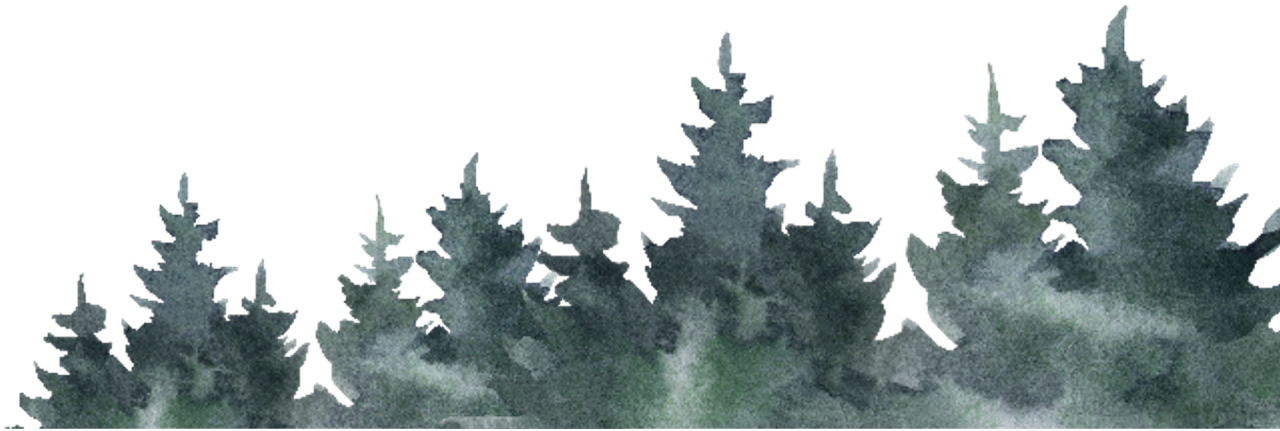

Case 2

Presenting complaint	Distance exam	Physical exam	Deep pain test	Diagnostics
Adult eastern grey squirrel	Aggressive, appropriate mentation	BARF	You pinch the toes of the pelvic limbs hard with hemostats and the patient pulls the leg away but does not growl	Radiographs confirm a spinal fracture
Laying on side of road	Laying in intake box, standing on thoracic limbs, pelvic limbs splayed out behind	Orthopedic exam WNL, no fractures appreciated	You touch the forelimb and the patient growls and tries to bit	
Using front legs but not back legs	Respiratory rate appears WNL	Not moving pelvic limbs		
Attempted to bite finder				

Treatment plan?

- humane euthanasia
- Prognosis for return to function is grave

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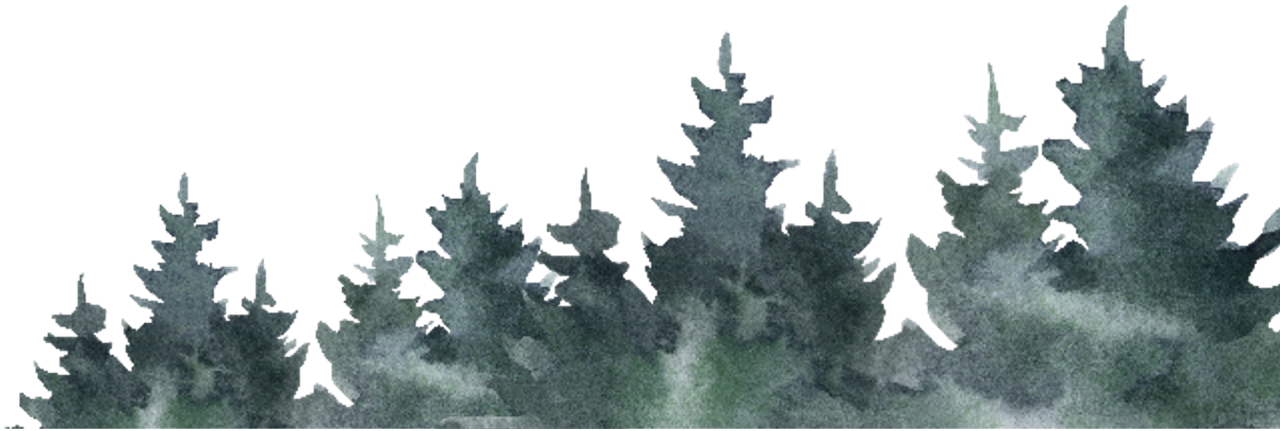

Questions?

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