

Canine Anatomy

Differences that Make
a Difference in
Movement Function



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da Vinci

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Objective

With knowledge of human anatomy and movement function already established, describe significant differences between canine and human anatomy that are relevant to canine movement function.

Describe the main reasons for the differences, with examples in canine anatomy.

** Note that there are many breed variations



No financial disclosures

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Differences in Canine and Human Anatomy that explain Movement Function in Dogs

Thoracic limb/forelimb function is primarily weight-bearing (WB)

Bones align toward the vertical.

Bones and joint structure allow paw contact on the ground.



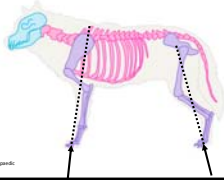
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Differences in Canine and Human Anatomy that explain Movement Function in Dogs

Dogs are quadruped with digitigrade posture.

Many canine muscles are constantly active. They may increase or decrease, but they are "on".

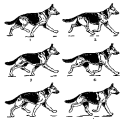
More muscles have multi-joint action, producing joint motion and/or stability at 2 or 3 joints.



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Differences in Canine and Human Anatomy that explain Movement Function in Dogs

By far, most movement in dogs is in the sagittal plane.



Most joint motions are flexion and extension.

Muscles are aligned to produce primarily flexion and extension motions.

Bones and joint structure and orientation promote sagittal plane movement.

Some ligaments are aligned to restrict motion in the sagittal plane.



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Differences in Canine and Human Anatomy that explain Movement Function in Dogs

Anatomical Position and Directional Motions

Bones and Joints

Joint Motions

Muscle Function

Significance to Surface Palpation




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Primary Movement Functions

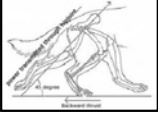
Thoracic Limb

- Stability with ground contact
- Stability for the head and neck muscles
- Gait/locomotion:
Landing on thoracic limbs
Advancing the thoracic limb
Pulling the pelvic limb forward



Pelvic Limb

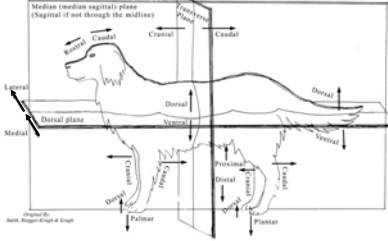
- Stability with ground contact
- Gait/locomotion:
Power generation
Advancing the pelvic limb



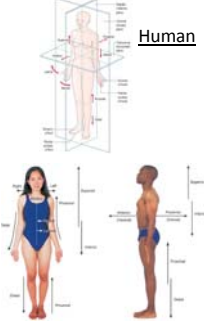
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Anatomical Position and Directional Terms

Dog



Human




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Bones & Joints – Scapula & Clavicle

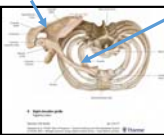
Dog


- Scapula near vertical
- No or small clavicle – thoracic limbs align vertically distal to the scapula
- Thoracic cage is compressed toward the sagittal plane




Human

- Advantageous to NWB and 3-D mobility
- Scapula - closer to frontal plane
- Distinct clavicle
- Thoracic cage opens toward the frontal plane

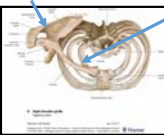




Dog and Horse Rib Cage – Front



Greater Scapular Muscular Dog




Human Thoracic Region

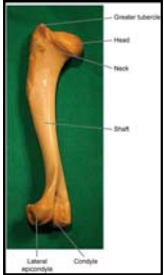
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Bones & Joints - Shoulder


Dog

- Vertically aligned scapula and humerus
- Flatter proximal surface, thicker shaft of the humerus





Human

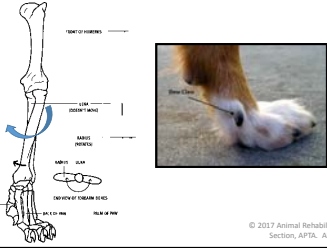


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Bones & Joints – Forepaw Contact

Dog

- Humeral retrotorsion (60°)
- Radioulnar joint pronated for stable posture
- Dewclaw does not prevent stable contact for digits 2 - 5




Human


- Less retrotorsion
- Mobile radioulnar joint
- Hands free

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Embryological Development

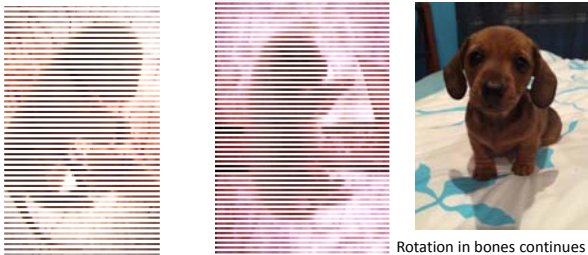
Rotation in bones occurs prior to joint development





<https://youtu.be/BsLfwgAFFIE>

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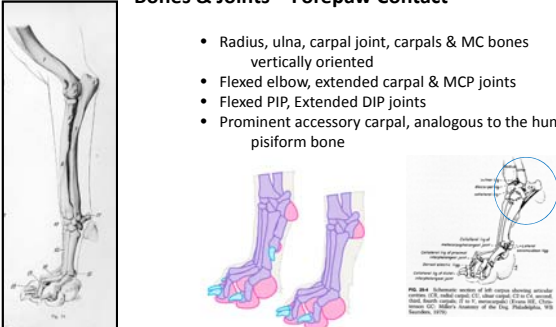
Rotation in joints occurs later, rotation in bones continues

Rotation in bones continues after birth due to stresses on the bones.

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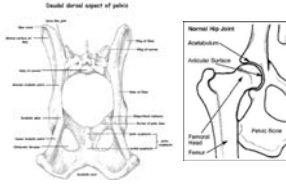
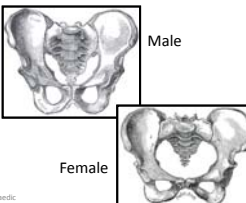
Bones & Joints – Forepaw Contact

- Radius, ulna, carpal joint, carpals & MC bones vertically oriented
- Flexed elbow, extended carpal & MCP joints
- Flexed PIP, Extended DIP joints
- Prominent accessory carpal, analogous to the human pisiform bone



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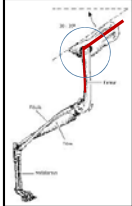



Bones & Joints – Pelvis

<p><u>Dog</u></p> <ul style="list-style-type: none"> • Narrower pelvis • Oriented toward the sagittal plane 	<p><u>Human</u></p> <ul style="list-style-type: none"> • Wider pelvis • Oriented toward the frontal plane 
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Bones & Joints – Pelvis and Coxofemoral (Hip) / Hip Joint

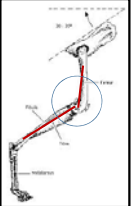
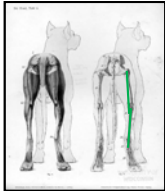

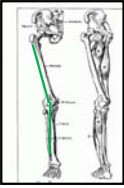
<p><u>Dog</u></p> <ul style="list-style-type: none"> • Coxofemoral/ hip joint flexed • Pelvis tilted cranially, more than human tilt • Neutral abduction/adduction 	<p><u>Human</u></p> <ul style="list-style-type: none"> • Hip joint neutral flexed/extended • Anteriorly titled pelvis • Hip joint adducted
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Bones & Joints – Stifle / Knee

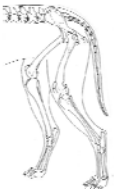
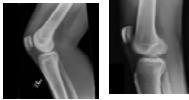

<p><u>Dog</u></p> <ul style="list-style-type: none"> • Stifle joint flexed • Stifle joint alignment near neutral ab/adducted 	<p><u>Human</u></p> <ul style="list-style-type: none"> • Knee joint neutral – flexed/extended • Knee joint slight valgus
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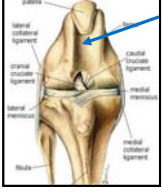
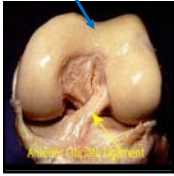
Bones & Joints – Stifle / Knee

<p><u>Dog</u></p> <ul style="list-style-type: none"> • WB – constant posture • Slope of the tibial plateau from cranial-proximal to caudal-distal • Cranial cruciate ligament risk with increased slope 	<p><u>Human</u></p> <ul style="list-style-type: none"> • WB – no constant posture • Slope of the tibial plateau changes directions • Anterior cruciate ligament risk with posterior slope
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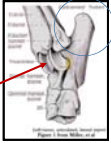


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Bones & Joints – Stifle / Knee

<p><u>Dog</u></p> <ul style="list-style-type: none"> • Deeper trochlear groove • Cruciates oriented more toward the sagittal plane 	<p><u>Human</u></p> <ul style="list-style-type: none"> • More shallow trochlear groove • Cruciates -oriented all 3 planes 
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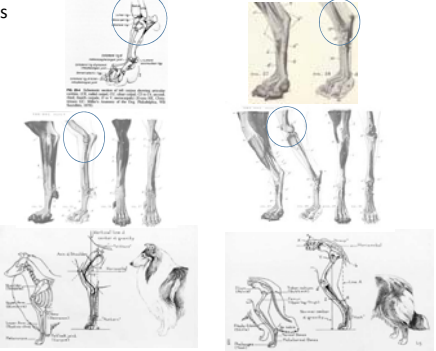
Bones & Joints – Tarsal/Ankle and Hindpaw/Foot

<p><u>Dog</u></p> <ul style="list-style-type: none"> • Vertically aligned MT bones • Extended tarsal and MTP joints • Flexed PIP, Extended DIP • Deeper trochlear groove for stability • Prominent calcaneus   <p style="text-align: center;">Ankle/ talocrural joint neutral</p>	<p><u>Human</u></p> <ul style="list-style-type: none"> • Intermittent stability and mobility 
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Bones & Joints – Dogs

Distinguishing thoracic from pelvic limbs



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Bones & Joints – Spine

Dog

- Vertebral segments
- Spinous processes – length and orientation

7 cervical, 13 thoracic, 7 lumbar, 3 sacral + coccygeal

Human

7C, 12T, 5L, 5S + coccygeal

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Bones & Joints – Spine

Dog

- Larger atlas and axis and all CSp vertebrae
- Flexed AO and AA
- Relatively straight C3-C7
- Extended (lordotic) at C-T junction and TSp
- Flexed/kyphotic LSp spine
- Slightly flexed or extended sacrum (depends on tail posture)

Human

- Increasingly larger from CSp –LSp
- CSp & LSp – lordotic
- TSp & SSp - kyphotic

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Bones & Joints – Spine

Dog

- Coccyx or tail
- Coccygeal bones - 20 (6-23)

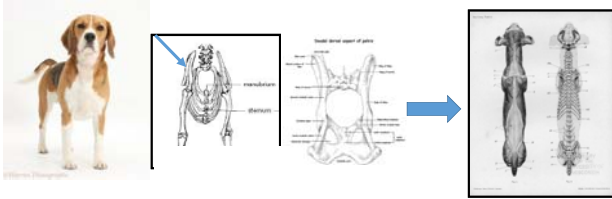
Human

- Coccyx or tailbone
- Coccygeal bones - 1-4

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Bones & Joints – Spine

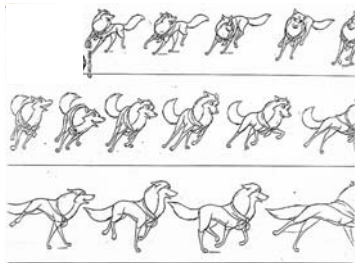
Sagittal plane aligned body



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What motion do you want to see?

Perspective /View ?



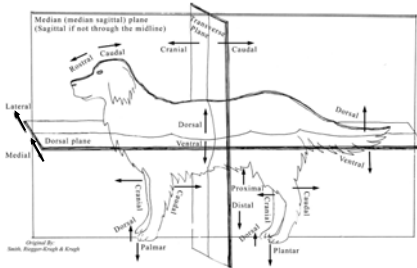
Less important:
names of the axis of motion,
 directional terms, and
 kinematics.
 You can look then up..

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Planes of Motion and Directional Terms



Photo provided by C Adrian



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Sagittal Plane

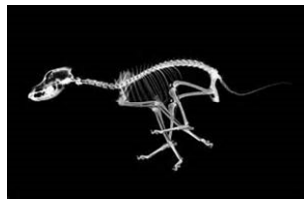
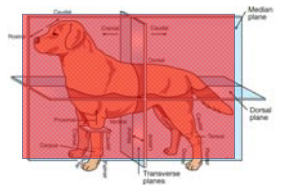


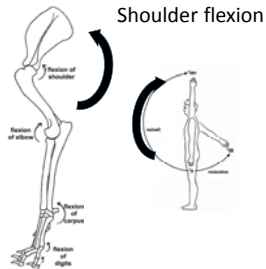
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Naming conventions for flexion and extension joint motions

Flexion – named by the acute angle or angle that becomes more acute with motion

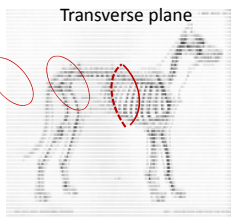
Named by movement during gait
Carpal flexion
Digit flexion follows carpal flexion



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Naming convention for the Transverse Plane

Horizontal or Transverse plane



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Transverse Plane

Photo provided by C Adrian

Spine rotation
Abduction/adduction

Cranial/caudal view

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Dorsal Plane

Photo provided by C Adrian

Limb rotation

Dorsal/ventral view

Spine side bend

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Muscles

30% and 30% BW (60-65% total)

20% and 20% BW (35-40% total)

● Center of Mass

Thoracic limb anti-gravity muscles
Digit and MCP flexors
Carpal joint flexors
Elbow extensors
Shoulder extensors

Pelvic limb anti-gravity muscles
Digit and MTP flexors
Tarsal extensors
Stifle extensors
Hip extensors

Dutch Shepherd Dog Skeleton
Wing Ni Chang

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Muscles of the Thoracic limb

No clavicle for muscle attachments

Allows thoracic limb muscles to synchronize head and thoracic limb movement

Gait: Braking, advancing the thoracic limb Pulling the spine and pelvic limb forward

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Thoracic Limb Muscles

Many muscles of the thoracic limb support the head

Differ in names and number

Rhomboides Muscle

- M. brachiocephalicus
- A. claviculohumeralis
- M. omotransversarius
- M. trapezius
- M. cleidocranialis
- M. cleidobrachialis
- M. cleidocranialis
- M. cleidocranialis
- M. cleidocranialis

A is the **brachiocephalicus**. The asterisk * is approximately at the level of the clavicular intersection, dividing the **cleidocervicalis (A1)** and **cleidobrachialis (A3)**. B is the **omotransversarius**. C1 and C2 are the cervical and thoracic portions, respectively, of the **trapezius muscle**.

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Dogs have large shoulder adductor muscle mass

Thoracic cage huggers

Superficial pectorals Deep pectoral Major part

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Canine shoulder flexor muscles

Canine shoulder flexors are human shoulder extensors, e.g. latissimus dorsi and teres major

Significance relative to humans:
 Know the convention of naming shoulder flexion and extension
 Surface palpation

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Canine triceps brachii muscle – Elbow extensor, shoulder flexor - 4 heads

Long head 2 joint
 Lateral head
 Medial head
 Accessory head

3 heads of the human triceps brachii
 Long head
 Lateral head
 Medial head
 Elbow extensor & shoulder extensor

Significance relative to humans:
 Example of a muscle that follows human naming convention but does not describe canine structure
 Four heads for more muscle mass
 Long head is a shoulder flexor

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Canine triceps brachii

Long head (A)
 Lateral head (B)
Tensor fasciae antebrachii
Additional elbow extensor


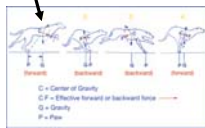
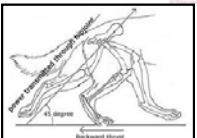
Significance relative to humans:
 An additional muscle reflects the need for elbow extensor strength

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Muscles of the Pelvic Limb

Gait: Power generation – digit flexors, tarsal extensors, stifle extensors, coxofemoral extensors

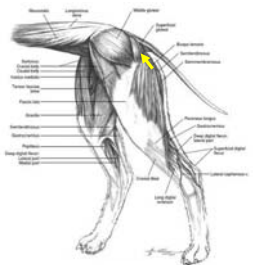

Advancing the pelvic limb - digit extensors, tarsal flexors, stifle flexors, coxofemoral flexors

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Canine Superficial gluteal

Analogous to the human gluteus maximus

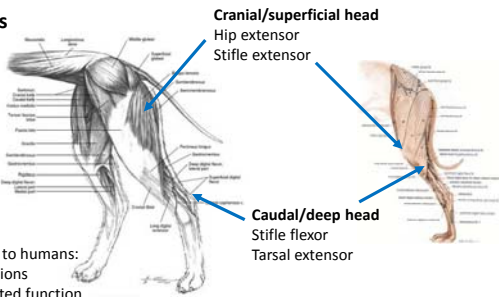
Significance relative to humans:
Relative need for hip extensors
Palpation

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Canine Biceps femoris

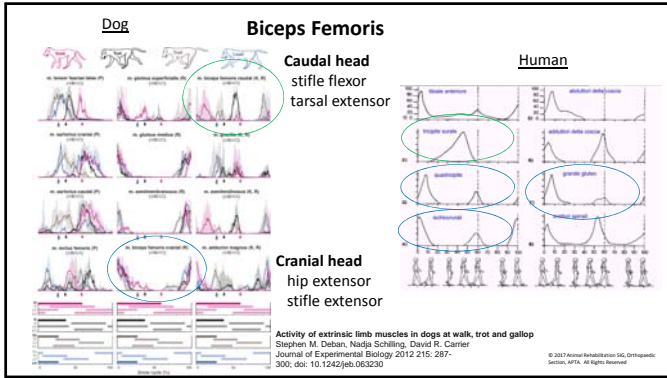
Cranial/superficial head
Hip extensor
Stifle extensor

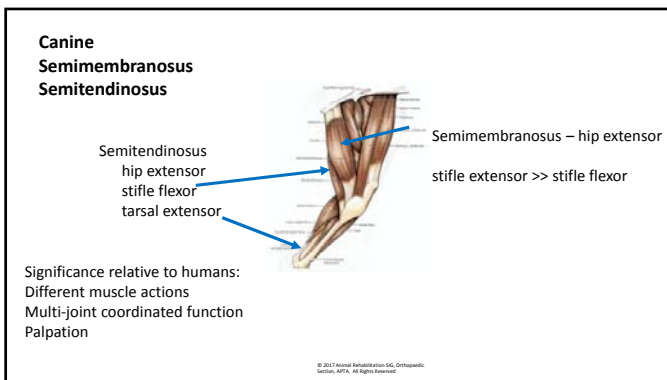
Caudal/deep head
Stifle flexor
Tarsal extensor

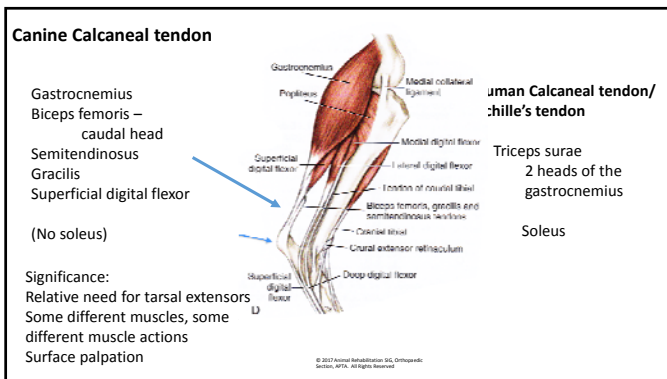



Significance relative to humans:
Different muscle actions
Multi-joint coordinated function
Palpation

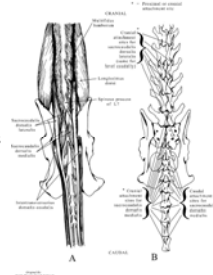
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Spine Muscle Function Dog	Spine Muscle Function Human
<ul style="list-style-type: none"> ▪ Greater support of the head needed ☐ Gravity eliminated posture ❖ WB function— highly coordinated, consistent spine & limb motion ✓ Usually at least 2 limbs produce motion ➢ Change of orientation of the spinous processes 	<ul style="list-style-type: none"> ▪ Support but more mobility of the head ☐ Support of body against pull of gravity ❖ NWB UL – spine and limb motion often function separately WB LL – widely variable spine & limb motion and stability ✓ Motion can be from 1 limb or both ➢ Spinous process direction is consistent
 <p>25 to 35 degree angle Normal Pelvic Angle Fig. 1</p>	
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Canine tail muscles	Human
<p>Sacrocaudalis dorsalis lateralis Sacrocaudalis dorsalis medialis Sacrocaudalis dorsalis ventralis lateralis Sacrocaudalis dorsalis ventralis medialis</p> <p>Intertransversarius dorsalis caudalis Intertransversarius ventralis caudalis</p>	<p>None</p>
	
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<p>Thanks for Listening until the Tail End</p>	
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