Melbourne
Veterinary School

Cells to Systems - Lecture 5, part 1
The Language of Anatomy

Dr Janine Hofmann
Lecturer of Veterinary Anatomy

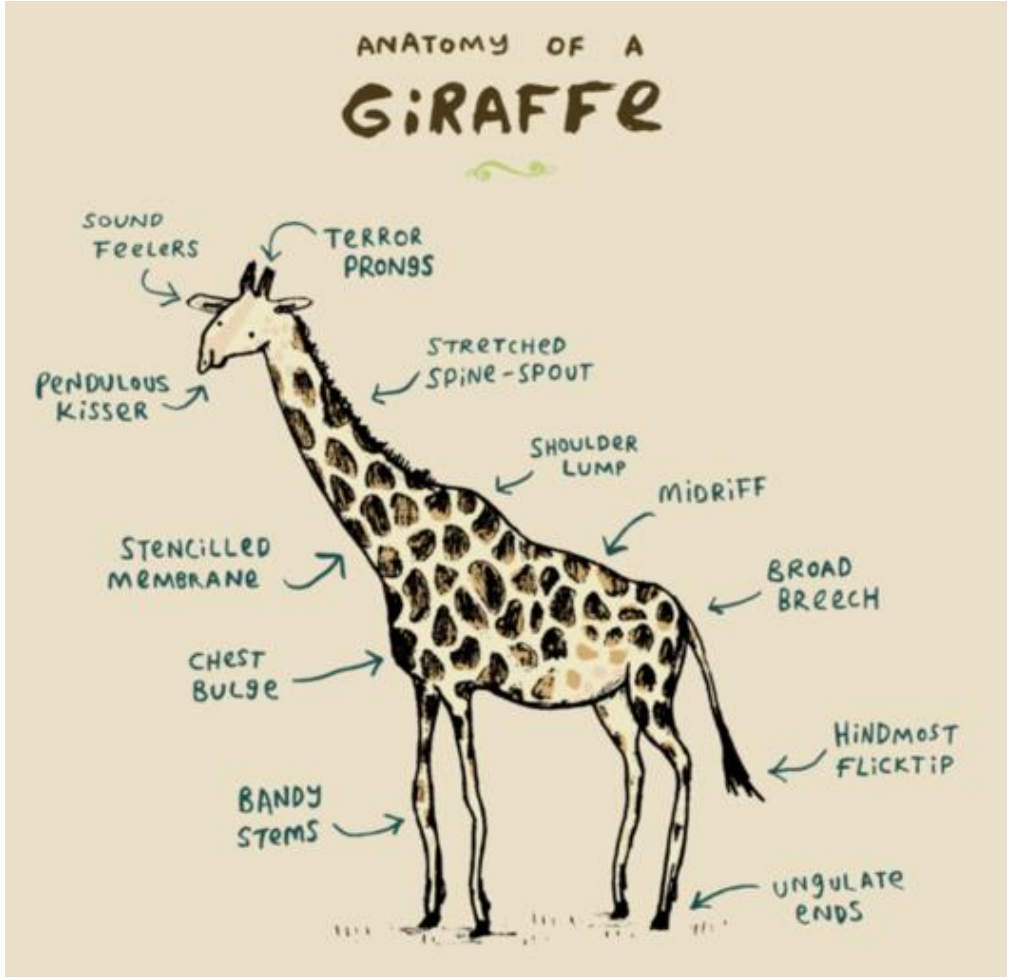
hofmann.j@unimelb.edu.au

VETS30015 / VETS90121

Intended Learning Outcomes

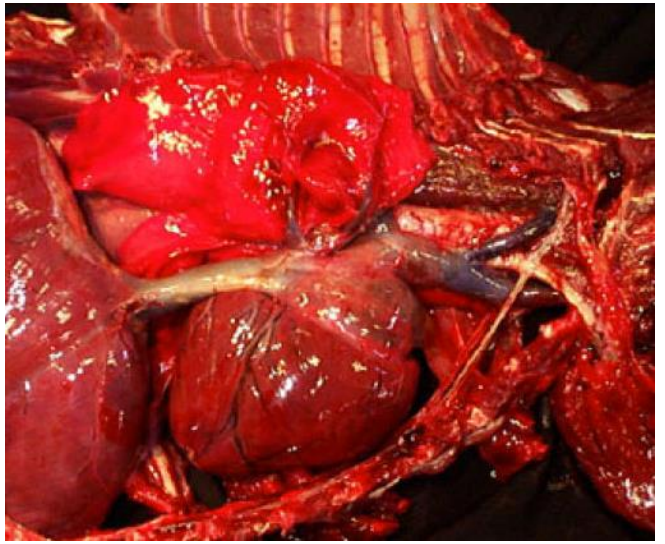
At the end of this lecture, you should be able to:

- Describe the position, relationships, form, and appearance of important animal structures and features
- Apply correct terminology for normal and novel structures in a meaningful way



What is anatomy?

- **Anatomy** is the study of the structure - the form, relations, and arrangement of tissues and organs, and function resulting from these relations.
- **'Anatomy'** comes from ancient Greek, meaning '**to cut**'
  - Dissection is still a crucial part of learning anatomy
- Many ways to categorize anatomy for ease of study
  e.g. gross (visible) vs histology (microscopic)
  e.g. systemic (by body system) vs regional (by body region)

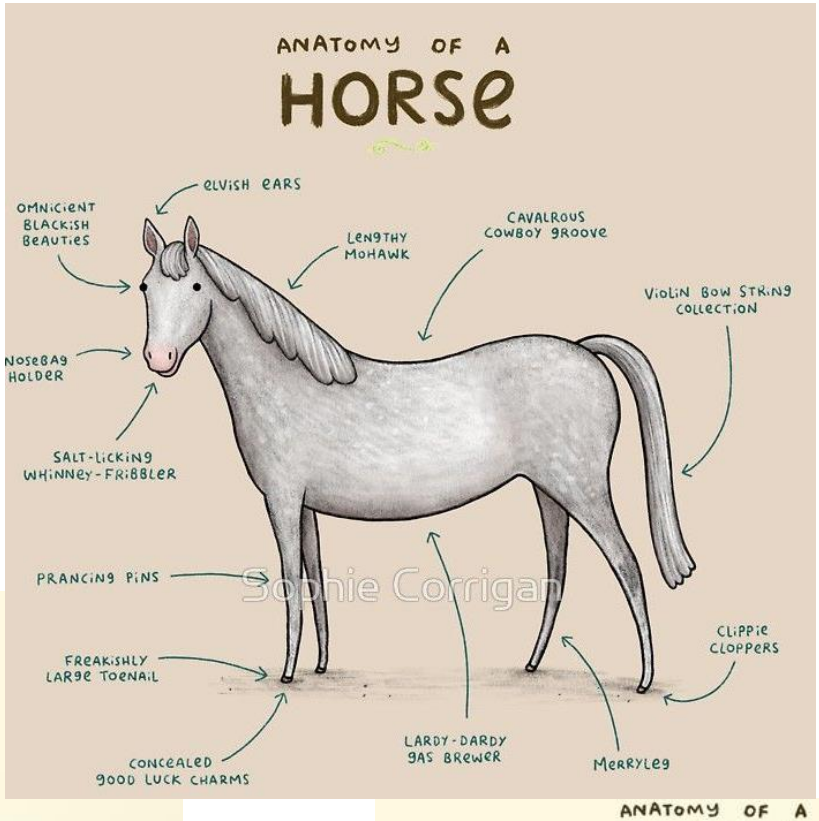


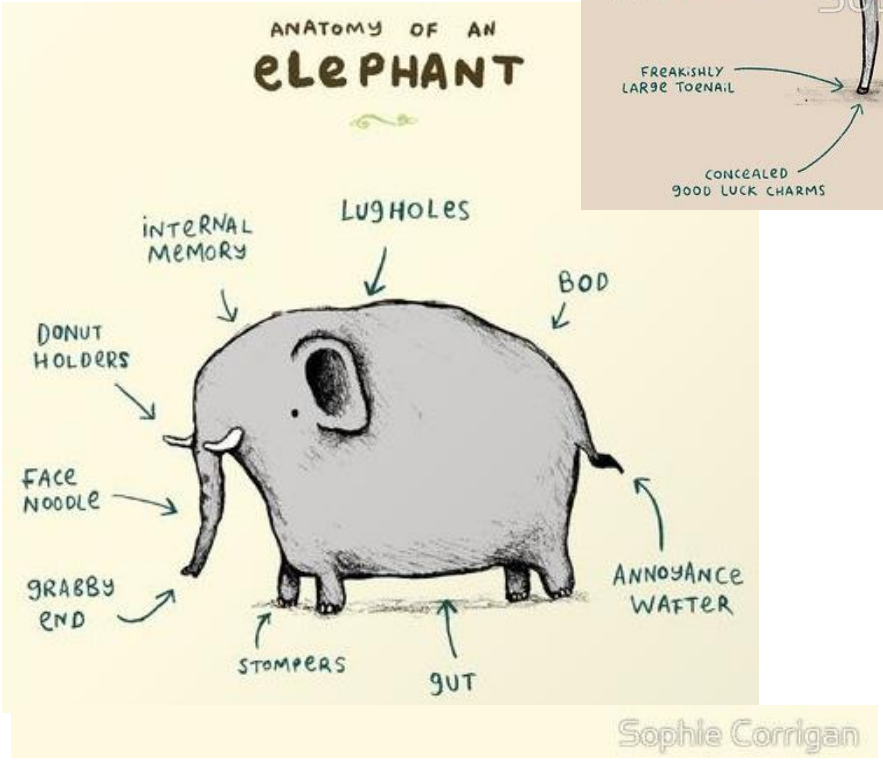
Why is anatomy important?

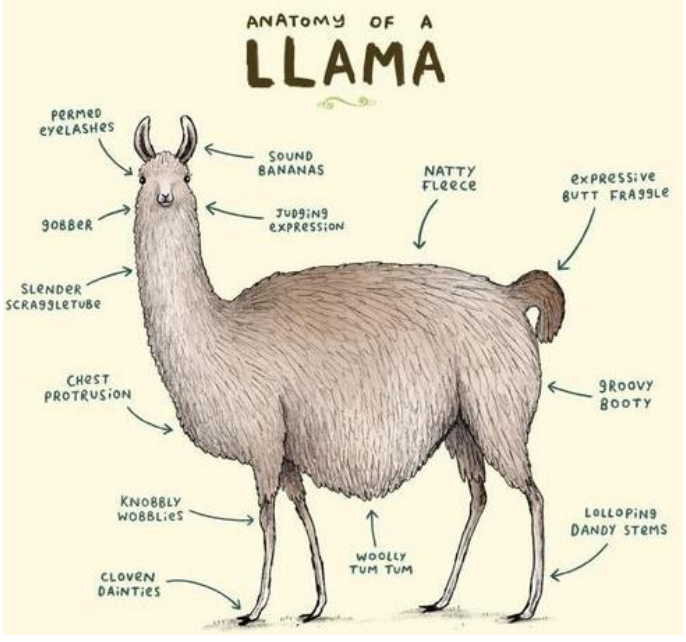
- You will use it every day in clinical practice
  - Animal examination and diagnosis – knowing what's normal to determine abnormal
    - Need anatomy to safely and accurately take diagnostic samples, take blood samples
    - Treatment – anatomy is crucial for safe and successful surgical procedures
    - Need anatomy to give injections of medication

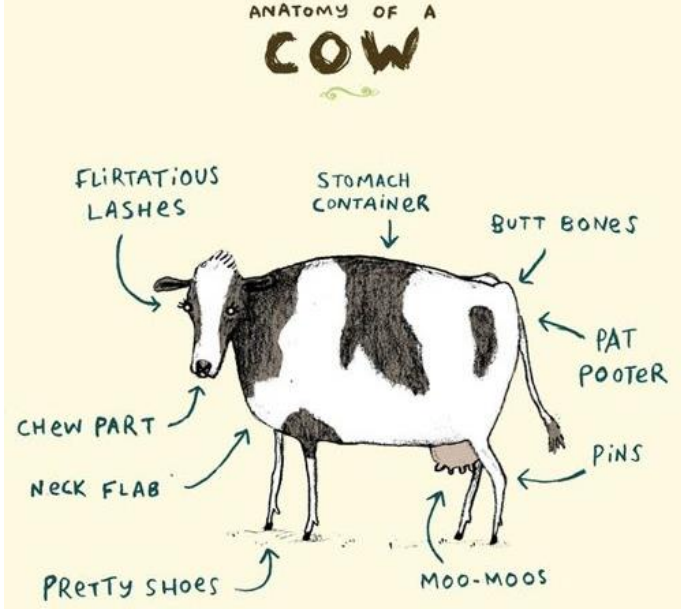
The language of anatomy

- Anatomy gives names to all structures of the body and the many parts within these structures, as well as their positions and relationships.
- Until 1895, many languages had their own terminology for the structures discovered
  - Very confusing!!









The language of anatomy

- To remove ambiguity, anatomical language has been internationally standardised
  - Facilitates clear communication
    - Between colleagues verbally
    - From written text e.g. textbooks, clinical case notes.

  - *Nomina Anatomica Veterinaria* (NAV), current revision 6th edition (2017)
    - *Nomina Embryologica Veterinaria* and *Nomica Histologica Veterinaria* also available
  - Guidelines that decide the name for an anatomical structure or concept (with the occasional exception):
    - the **only term for this structure**
    - in **Latin** (or the local language translation)
    - **short**, **simple**, **easy to remember**, **descriptive** and **instructive**
    - if **differentiating adjectives** are used for two or more structures, they are **opposite** e.g. superficial and deep
    - structures **closely related in their anatomical position** have **similar names** e.g. femoral nerve, artery and vein

The language of anatomy

- The words of veterinary anatomy come from many languages
  - Most are from Ancient Greek (Gr) or Latin (L)

- Try to learn what common prefixes, suffixes, and root words mean
- Breaking down new words into their parts usually helps understand and remember them

- E.g. hypothermia ‘hypo-’ = below (Gr)
  ‘-thermia’ = heat (Gr)

Names associated with tissues

• Bones	osteo- (Gr - bone), os (L - bone)
• Joints	arthr- (Gr - joint), articular (L - joint)
• Cartilage	chondro- (Gr - cartilage)
• Muscles	myo- (L – muscle, ‘a little mouse)
• Ligaments	-ligamentum (L - to tie, to bind)
• Tendons	tend- (G – tendon, to stretch)
• Nerves	neuro- (G – nerves, cord)
• Veins	phleb- (G – vein)
• Skin	-derm (G – skin, hide), cutaneous (L – the skin), -thelium
• Blood	haem- (Gr/L - blood)

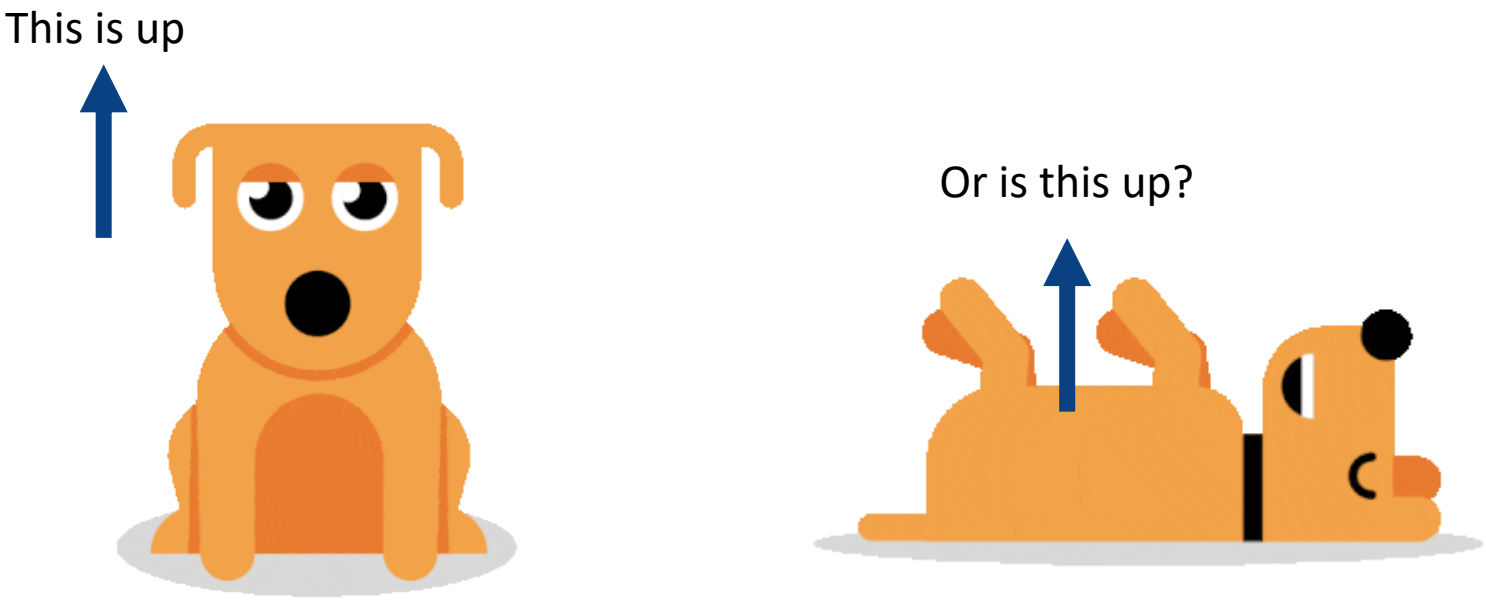
Common prefixes

Epi-	(Gr – upon)	epithelium, epiphysis
Peri-	(Gr – around)	pericardium, periosteum
Endo-	(Gr – within)	endothelium, endocrine
Dia-	(Gr – between)	diaphragm, diaphysis
Meta-	(Gr – change/after)	metabolism, metaphysis
Supra-	(L – above)	supracondylar
Infra-	(L – beneath)	infraspinous, infraorbital
Sub-	(L – under)	subcutaneous
Hypo-	(Gr – below)	hypoglycaemia, hypoglossal
Hyper-	(Gr – over)	hyperextension

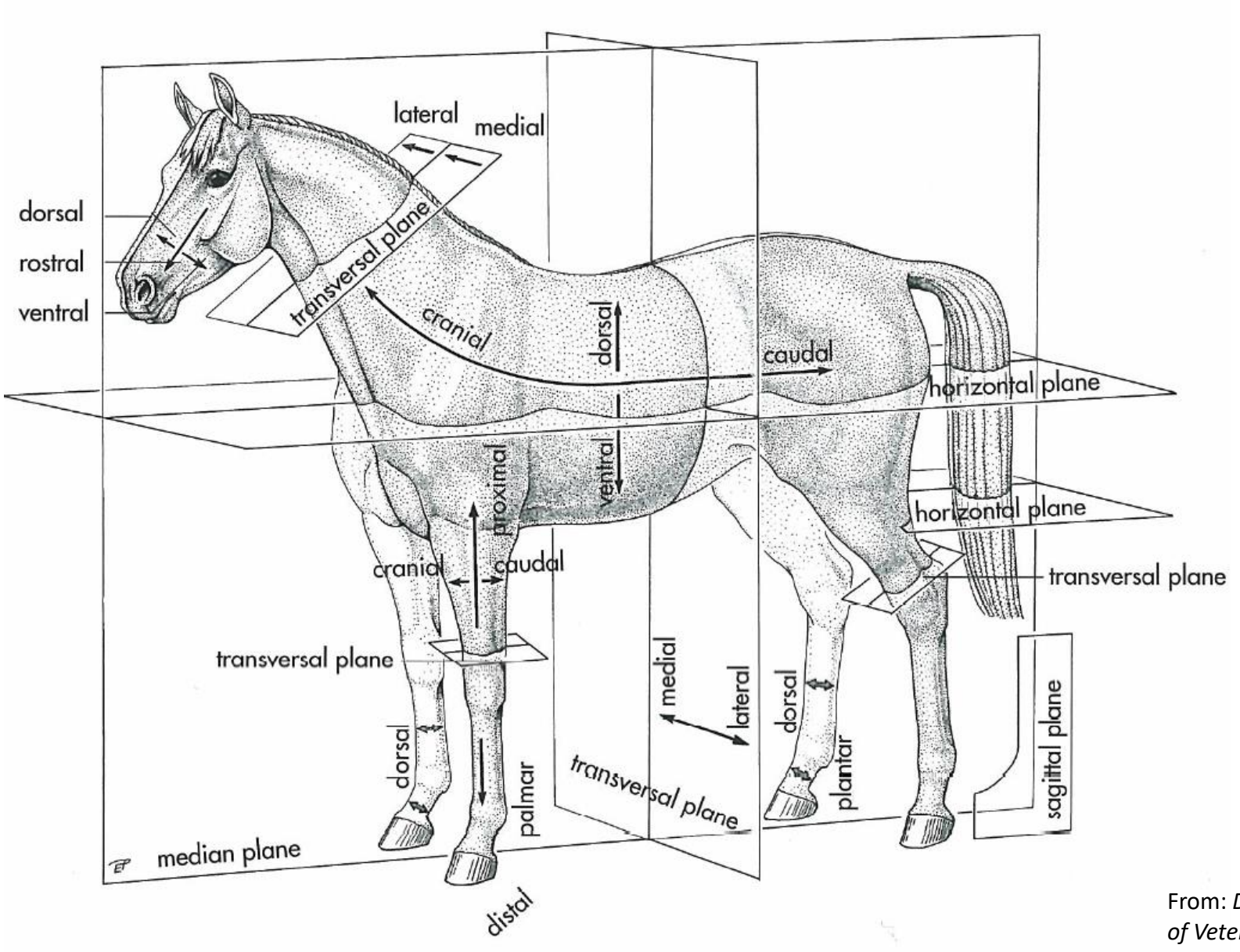
Ad-	(L – towards)	adduction
Ab-	(L – away)	abaxial, abduction
Ante-	(L – before)	antebrachium
Anti-	(Gr – against)	antibiotic, anticlinal
A-/An-	(Gr – not/without)	anoestrous
Retro-	(L – behind)	retrobulbar
Di-	(Gr –two)	digastricus
Bi-	(L – two)	biceps brachii
Tri-	(L & Gr – three)	triceps brachii

L– Latin Gr – Greek derivation

Directional terms



- Everyday terms can lead to confusion, depending on how the animal or observer is positioned.
- Standardized anatomical language uses directional terms **relative to the animal's body**.
- Still use **left** and **right**.
  - Remember, this is the ***animal's*** left or right.



From: *Dyce, Sack & Wensing's Textbook of Veterinary Anatomy* (4th ed).

Veterinary position terms are based on an upright, plantigrade stance.

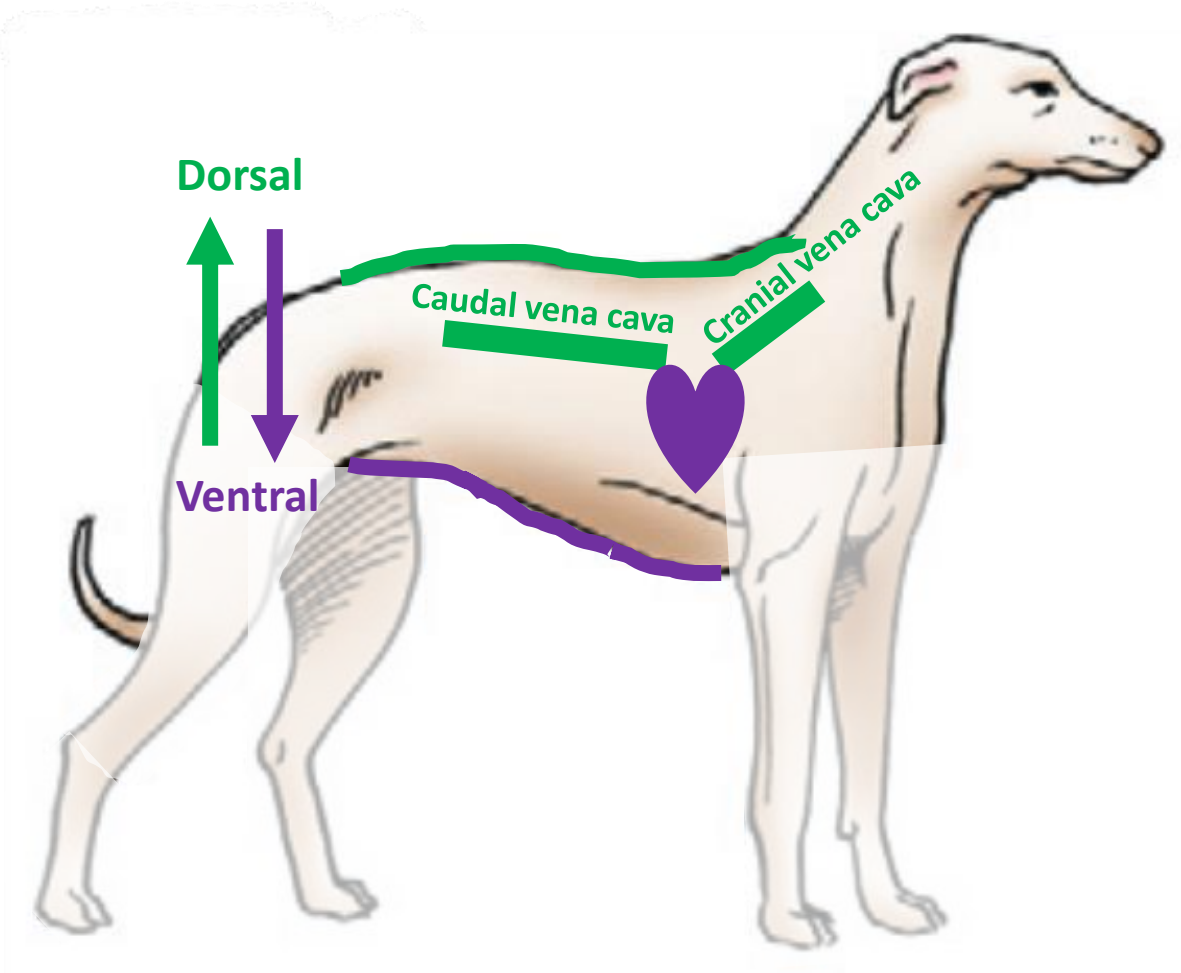
Directional terms

Dorsal (dorsalis in Latin, = back)
- closer to the back, also known as the dorsum

Ventral (ventralis in Latin, = belly)
- closer to the belly, also known as the ventrum

- applies to the entire body, expect for the limbs.

Ways to use **dorsal** and **ventral**:
e.g. the **dorsal midline** is the line that runs along the centre of the back, also known as the **dorsum**, shown in green.
e.g. the **ventral midline** is the line that runs along the centre of the back, also known as the **ventrum** , shown in purple.
e.g. the heart is located **ventral** to the two large veins of the body, the cranial and caudal vena cava (who's names are explained more on future slides).



Directional terms

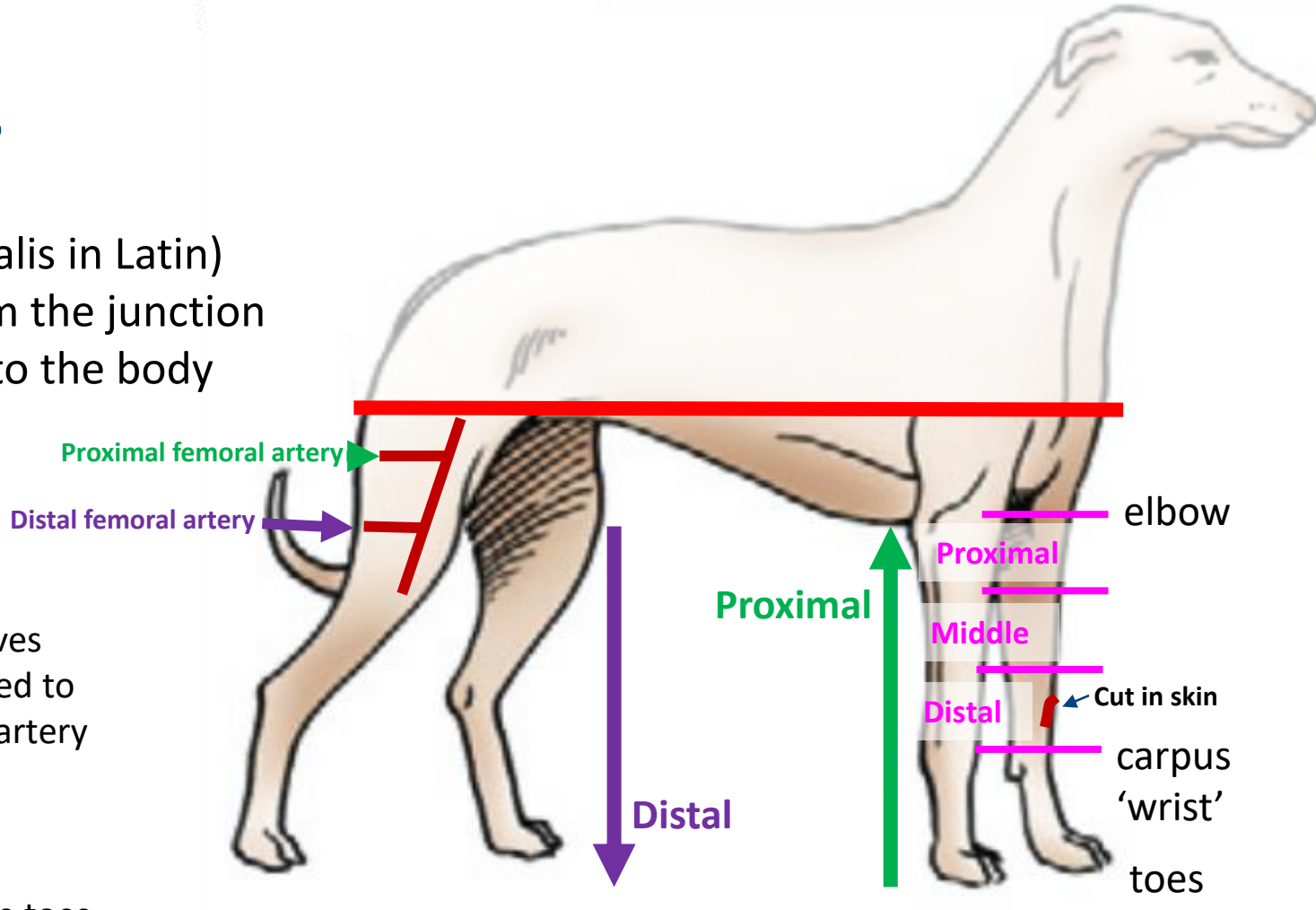
Proximal (proximalis in Latin)
- closer to the junction of the limb to the body

Distal (distalis in Latin)
- away from the junction the limb to the body

- applies to the limbs and tail.

Ways to use **proximal** and **distal**:
e.g. the **proximal femoral artery** is a blood vessel that leaves the major artery in the hindleg closer to the body compared to the **distal femoral artery**, which leaves the major hindleg artery further away from the body.

e.g. the toes are **distal** to the elbow in the forelimb
e.g. as you move **proximally** through the forelimb from the toes, you first encounter the carpus ('wrist'), then the elbow.
e.g. the dog has a cut in the skin on the distal third of their antebrachium ('forearm').



Directional terms

Cranial (cranialis in Latin) (cranium = head, Gr)
- closer to the head

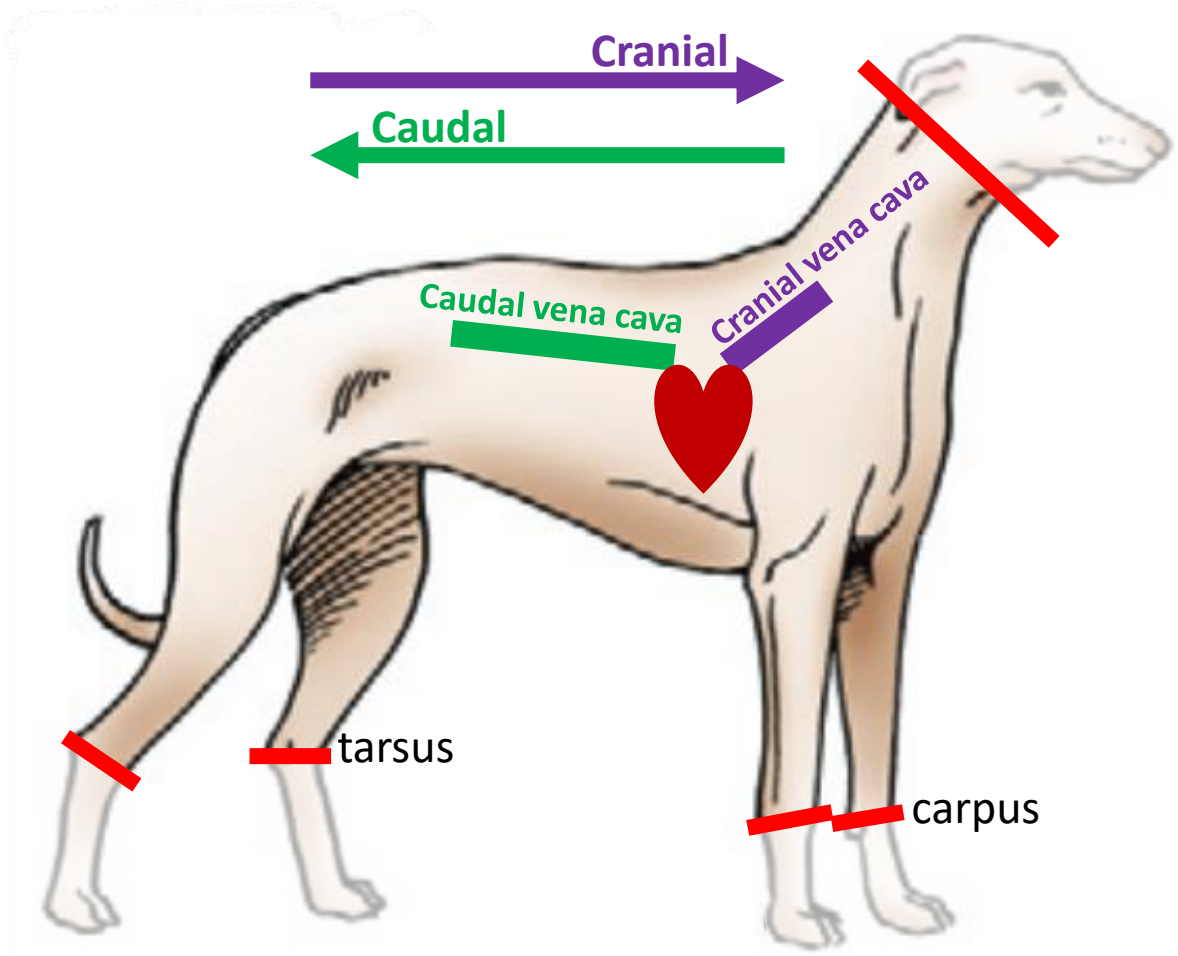
Caudal (caudalis in Latin) (cauda = tail, L)
- closer to the tail

- applies to the neck and trunk & to the limbs proximal to the carpus ('wrist') and tarsus ('ankle').

Ways to use **cranial** and **caudal**:
e.g. the **cranial vena cava** is **cranial** to the heart.

e.g. the **caudal vena cava** is **caudal** to the heart.

e.g. as you move **cranially** through the body from the tail, you will first encounter the caudal vena cava, then the heart, then the cranial vena cava.

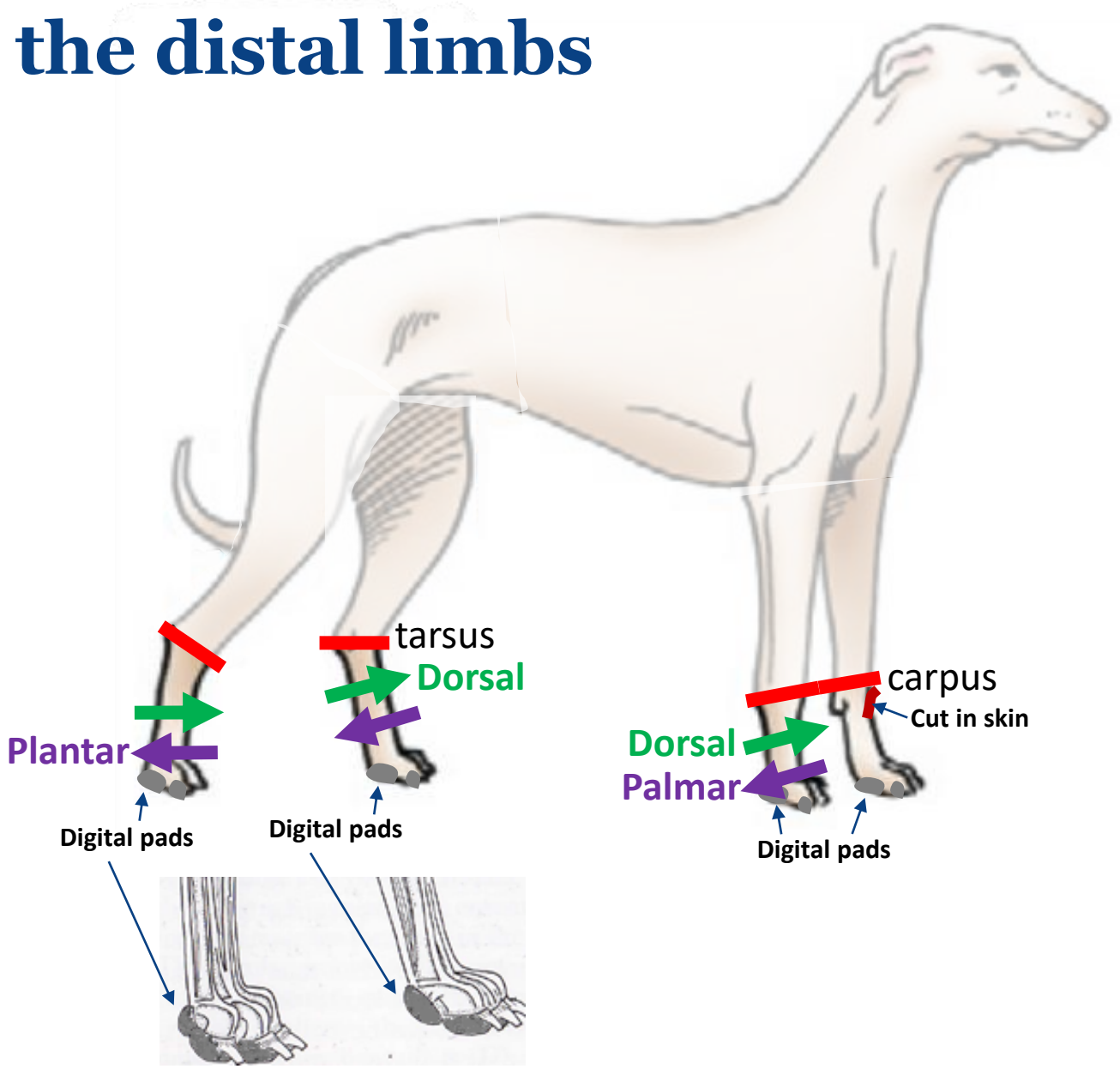


Directional terms for the distal limbs

Dorsal (dorsalis in Latin)
Palmar (palmaris in Latin) – forelegs only, 'palm'
Plantar (plantaris in Latin) – hindlegs only

- **dorsal** and **palmar** is used for the carpus and everything distal to it in the forelimb
- **dorsal** and **plantar** is used for the tarsus and everything distal to it in the hindlimb

Ways to use **dorsal**, **palmar**, and **plantar**:
e.g. the digital pads are found on the **palmar** and **plantar** surfaces of the forelimbs and hindlimbs respectively.
e.g. the dog has a cut in the skin on the **dorsal** surface of the carpus.



Directional terms

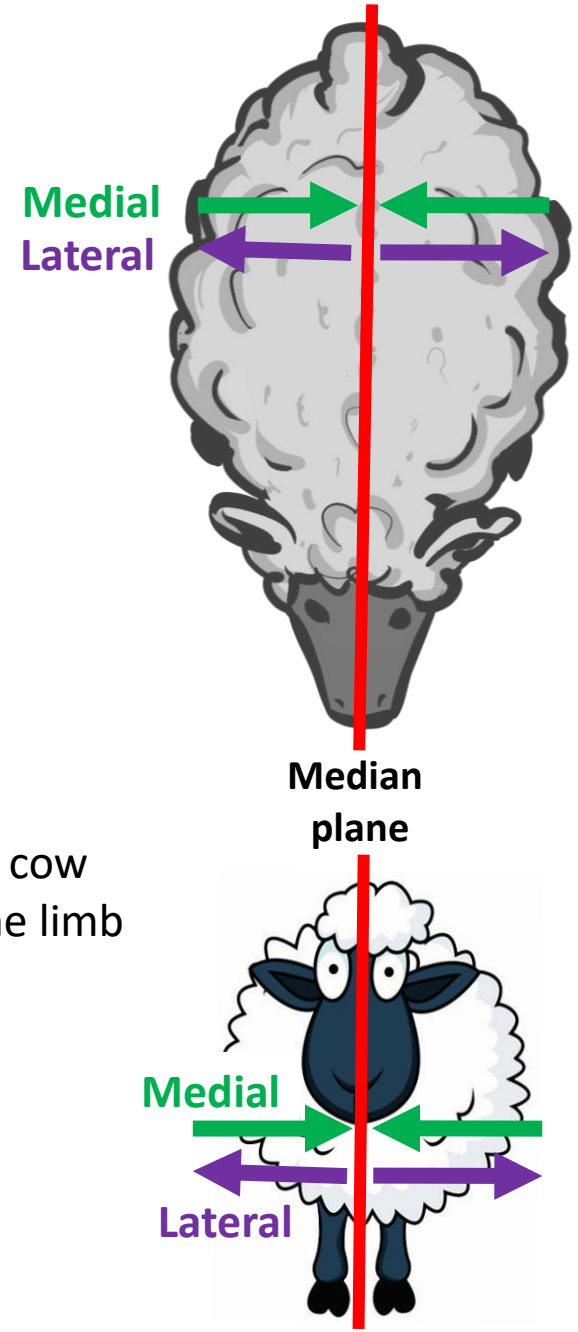
Medial (medialis in Latin)
- closer to the median plane (the 'centre' or 'middle' of the body)

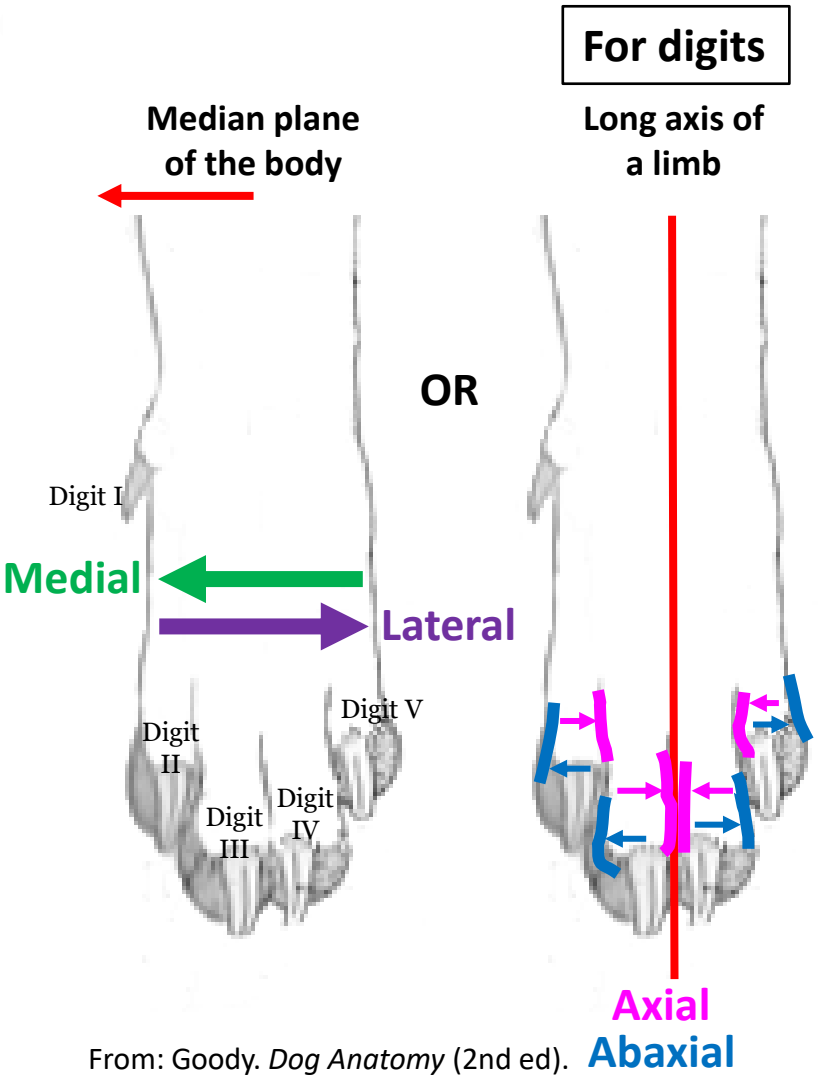
Lateral (lateralis in Latin)
- closer to the side or flank of the body

- applies to the whole body

Ways to use **medial** and **lateral**:
e.g. the hindlimbs are located lateral to the udder of a cow
e.g. the first digit (dewclaw) is on the medial side of the limb
e.g. the fifth digit is on the lateral side of the limb

Special terms for sides of digits (other than the horse)
Axial - near the 'centre' or **axis** of a limb
Abaxial - away from the **axis** of a limb





From: Goody. *Dog Anatomy* (2nd ed).

Directional terms

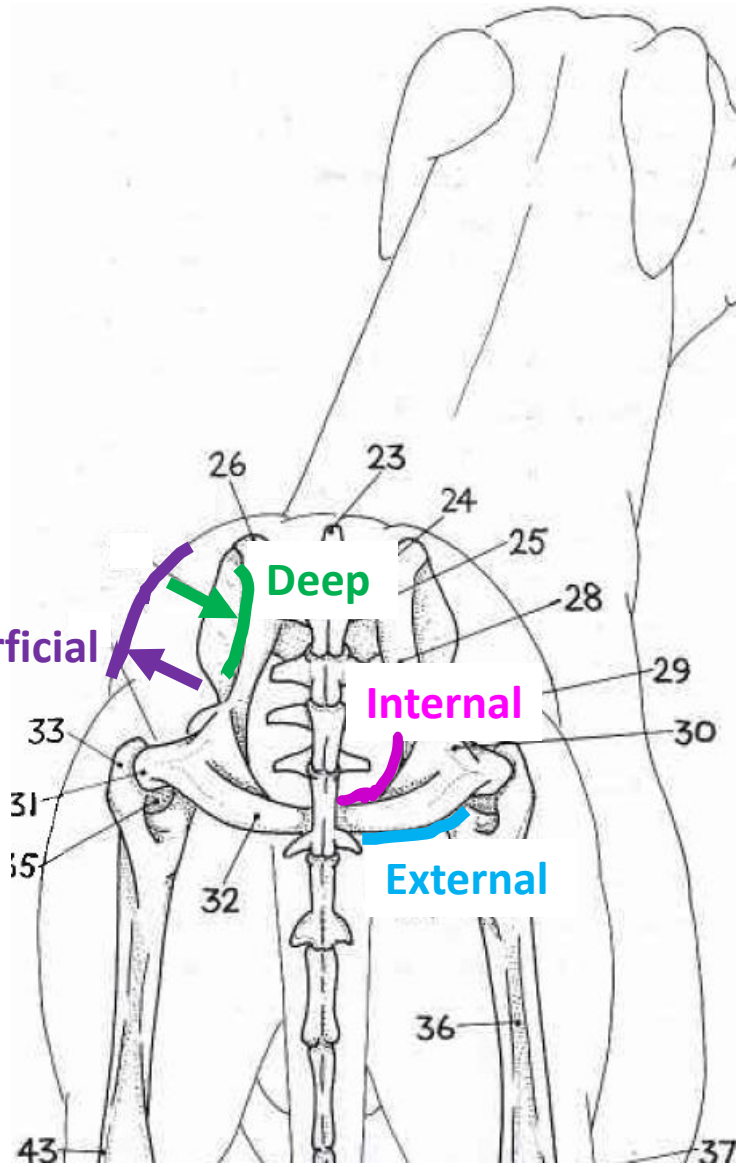
Superficial (superficialis in Latin)
- closer to the surface of the skin

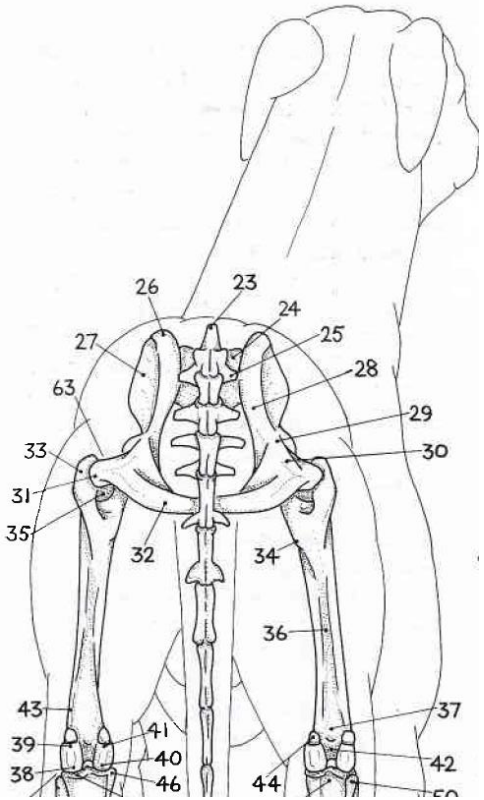
Deep (profundus in Latin)
- closer to the 'centre' of the body or limb, or further away from the skin surface

Internal/inner and **external** are also used to describe a structure based on proximity to the body surface

- applies to the entire body.

e.g. the **deep** gluteal muscle is located next to the pelvis bone under several layers of tissue, while the **superficial** gluteal muscle is closer to the skin.
e.g. the **external** ear is seen on the skin surface, while the **inner** ear is located within the skull.
e.g. the **internal** obturator muscle is located on the inside of the pelvis, and the **external** obturator muscle is on the outside of the pelvis.





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Directional terms for the head

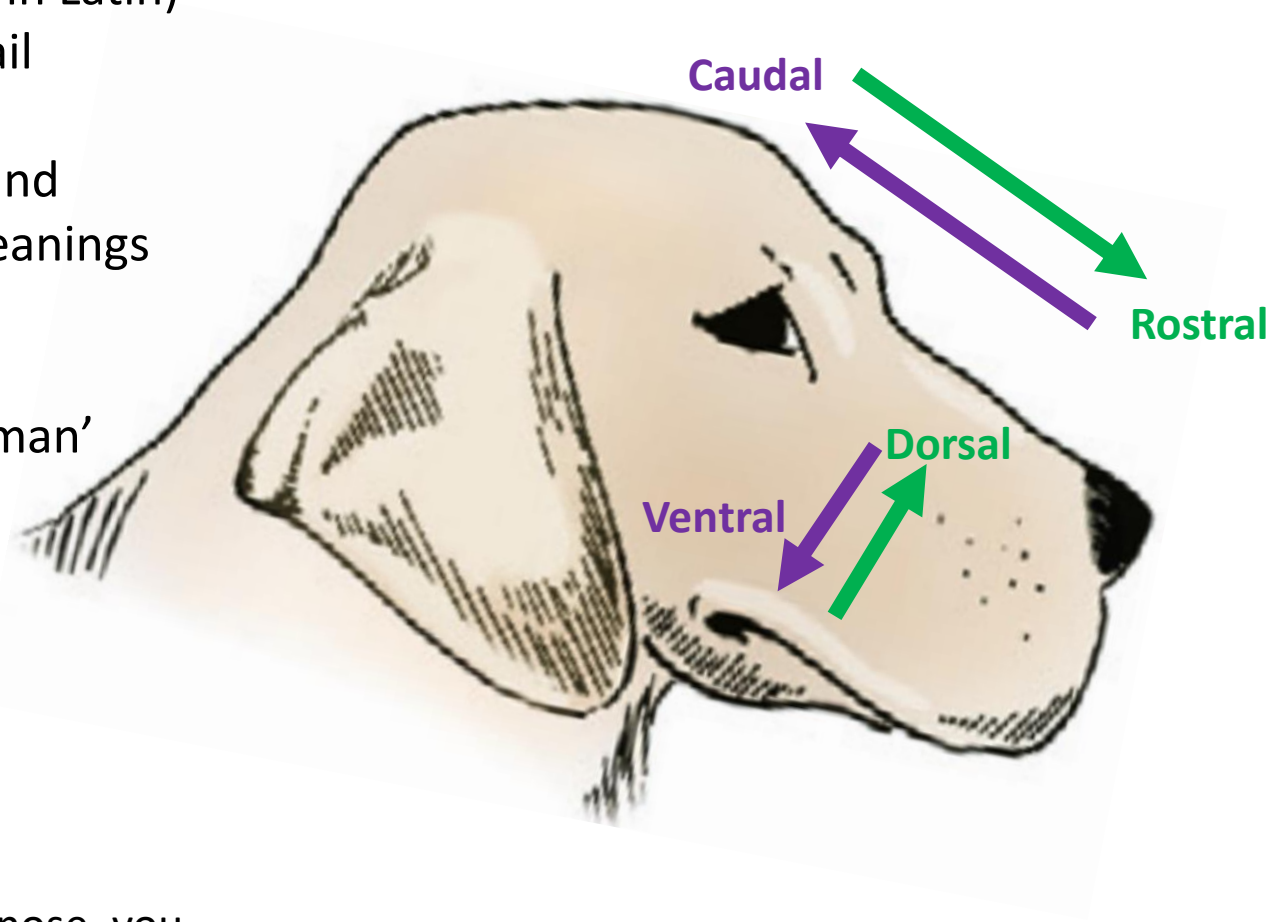
Rostral (rostralis in Latin)
- closer to the nose (‘rostrum’)

Caudal (caudalis in Latin)
- closer to the tail

Dorsal and **ventral**, **medial** and **lateral**, **superficial** and **deep**, **internal** and **external** used on head, same meanings as rest of body.

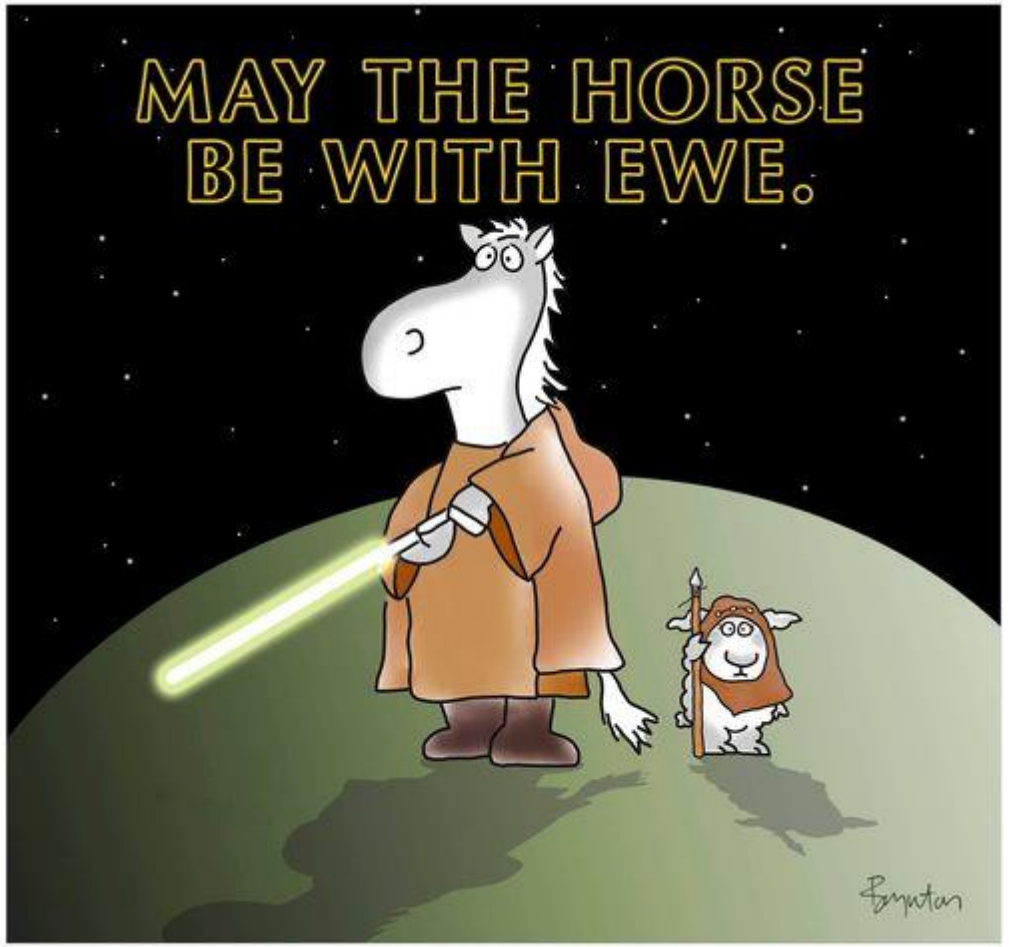
Some eye and ear structures are the only place ‘human’ terms (anterior, posterior, superior, and inferior) apply in veterinary anatomy

Ways to use **rostral** and **caudal** in the head:
e.g. the whiskers are found more **rostrally** on the head compared to the eye.
e.g. the nose is the most **rostral** body part of the dog.
e.g. as you move **caudally** on the head of a dog from the nose, you will encounter the eye, then the ear.



Take home messages

- The language of anatomy allows precision and clarity in communications about a structure or concept
  - Using the language correctly allows your meaning to be properly understood.
  - Using the language incorrectly may mean your meaning is lost or misinterpreted.
- Frequently used directional terms:
  - Prefixes: epi, peri, endo, dia, meta, supra, infra, sub, hypo, ante, anti, a/an, retro, di/bi, tri.
  - Tissues: osteo-, os; arthr-, articular; chondro-; myo-, -mysium; -ligamentum; tend-, teno-; neuro-, -neurium; phleb-; -derm(L), cutaneous(G), -thelium.
  - Dorsal/ventral/palmar/plantar
  - Cranial/caudal/rostral
  - Medial/lateral; axial/abaxial



Reference texts

- Nomina Anatomica Veterinaria – available online at http://www.wava-amav.org/wava-documents.html
- Studdart, Gay & Hinchcliff. *Saunders Comprehensive Veterinary Dictionary*. Elsevier, Missouri.
  - available as a downloadable e-book through the library.
- Hermanson, de Lahunta & Evans. *Miller and Evans' Anatomy of the Dog* (any edition). Elsevier.
  - available as a downloadable e-book through the library.
- Goody. Dog Anatomy, *A pictorial approach to canine structure* (2nd edition).
- Singh. *Dyce, Sack & Wensing's Textbook of Veterinary Anatomy* (any edition).
- König & Liebich. *Veterinary Anatomy of Domestic Mammals* (any edition).

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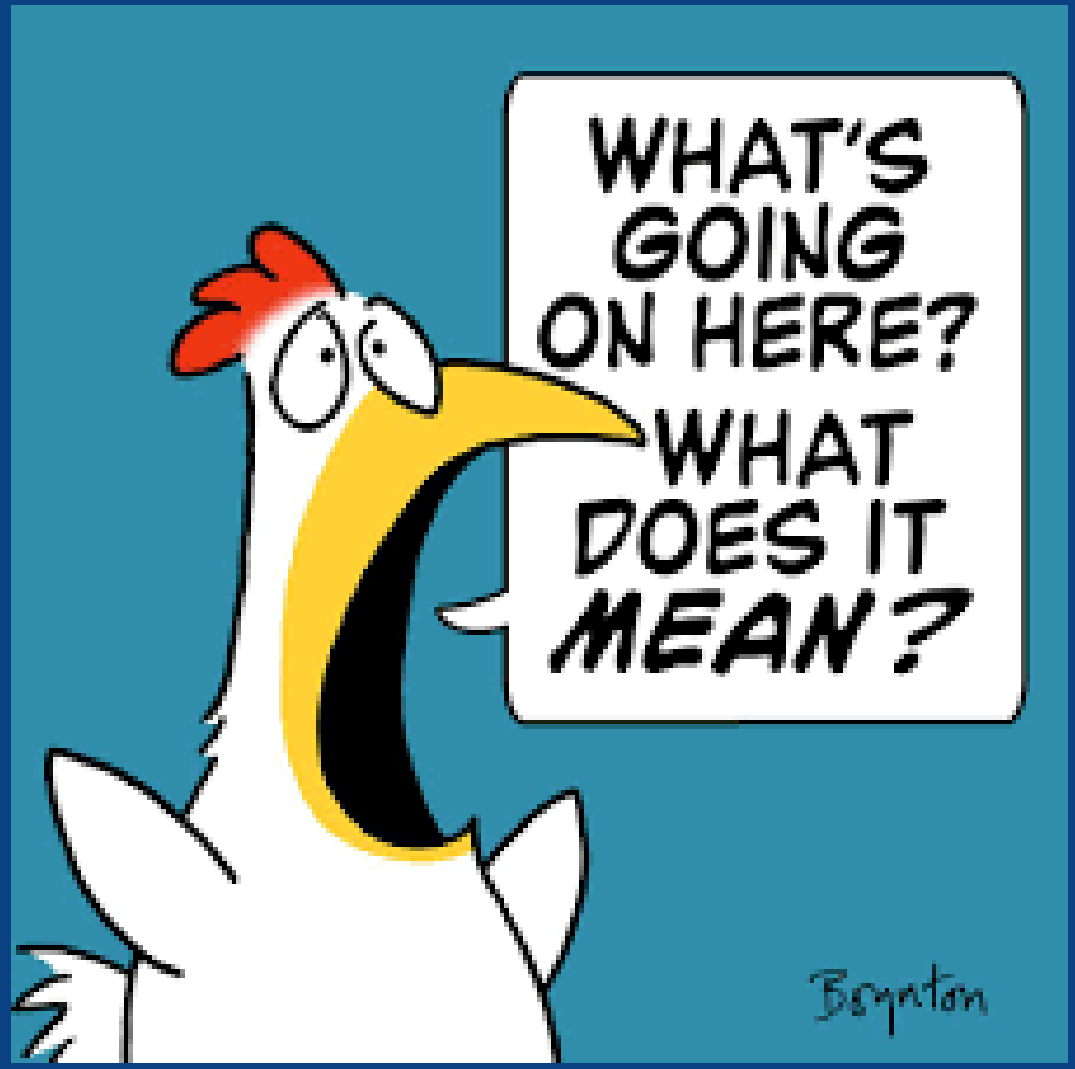

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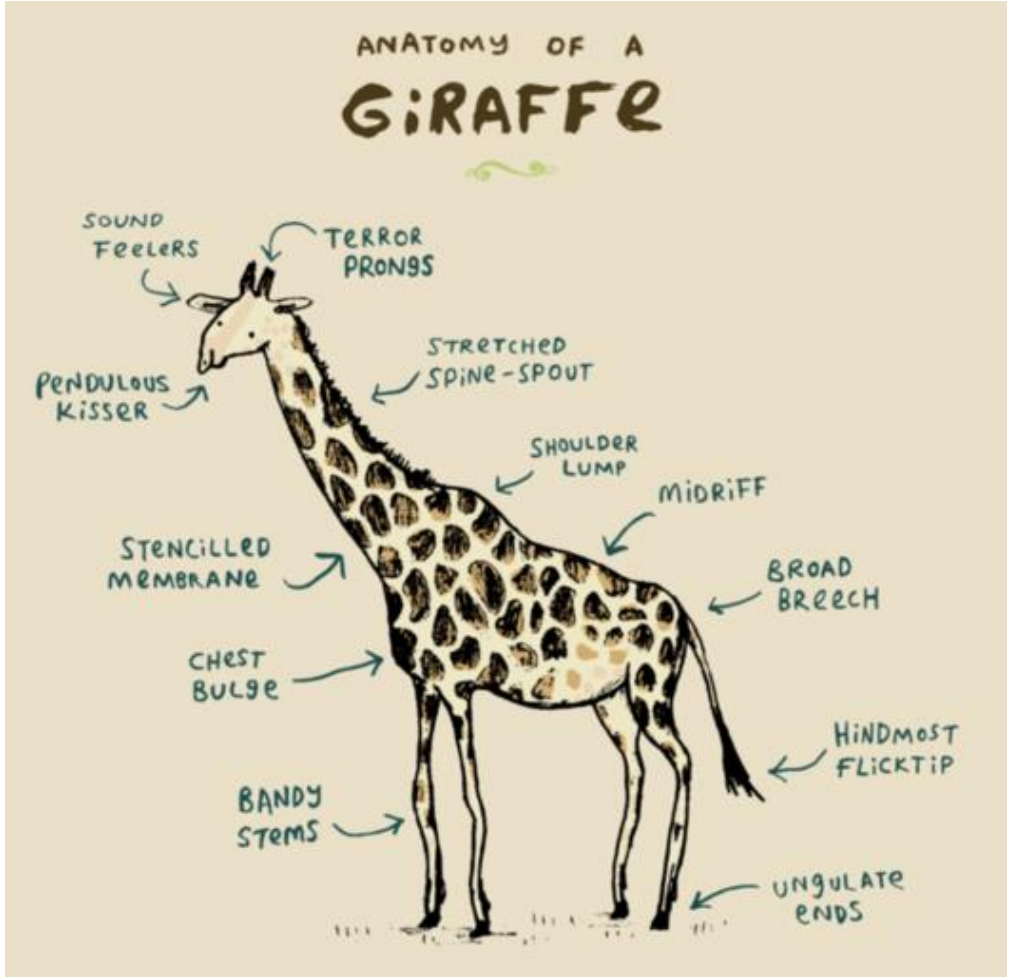


Planes of the body

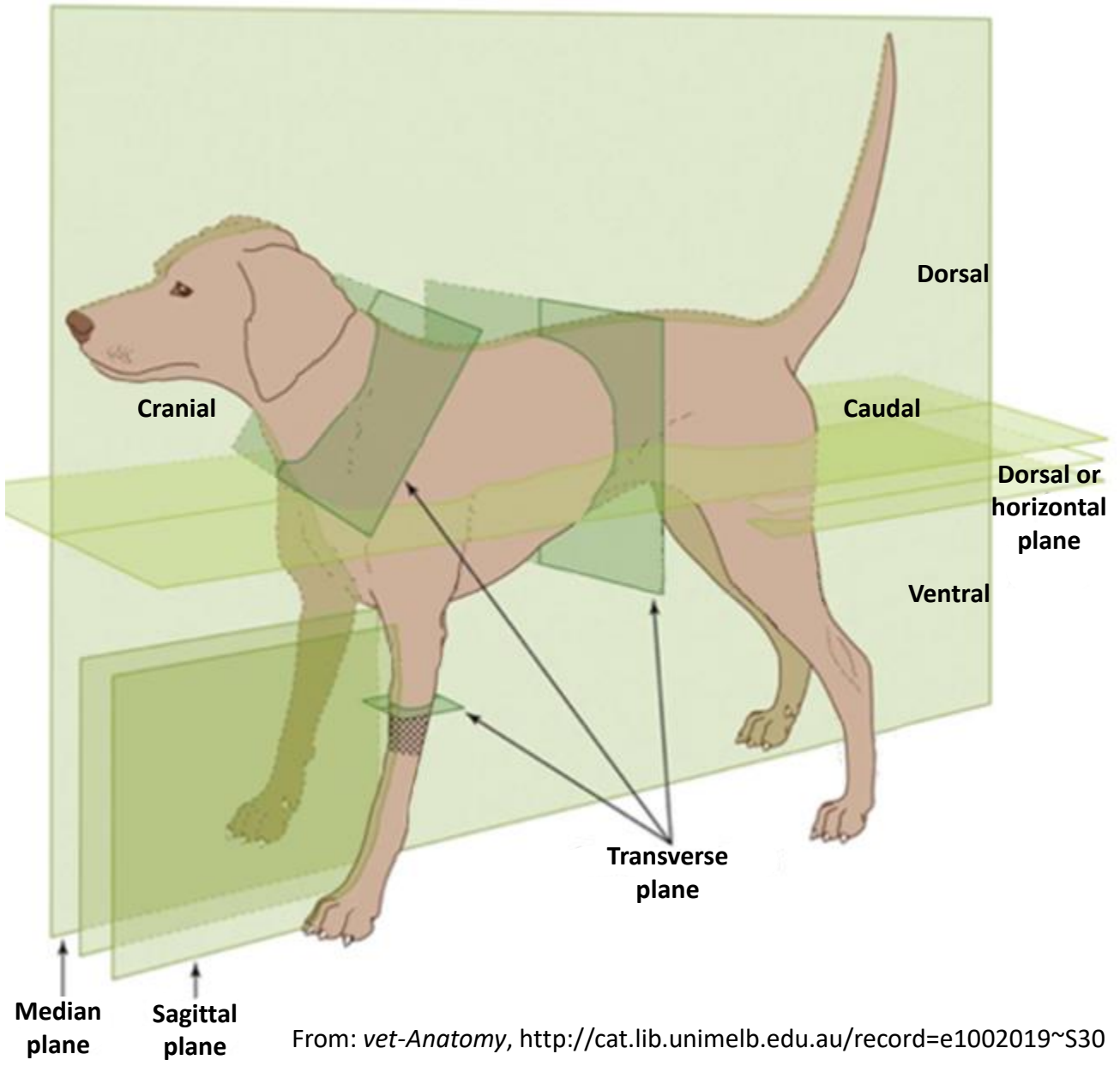
- Planes are 2D slices through a 3D structure used to divide the body into different sections

Median plane
- Cuts through the 'middle' or 'centre' of the body
- Divides the body into **left** and **right**

Sagittal plane
- Parallel to median plane

Transverse plane
- At right angles to the long axis of the body part being sectioned
  - Different directions on body compared to limbs
- Divides the body into **cranial** and **caudal** parts
- Divides a limb into **proximal** and **distal** parts

Dorsal or horizontal plane
- At right angles to both the median and transverse planes
  - Parallel to the ground
- Divides the body into **dorsal** and **ventral** parts



From: *vet-Anatomy*, http://cat.lib.unimelb.edu.au/record=e1002019~S30

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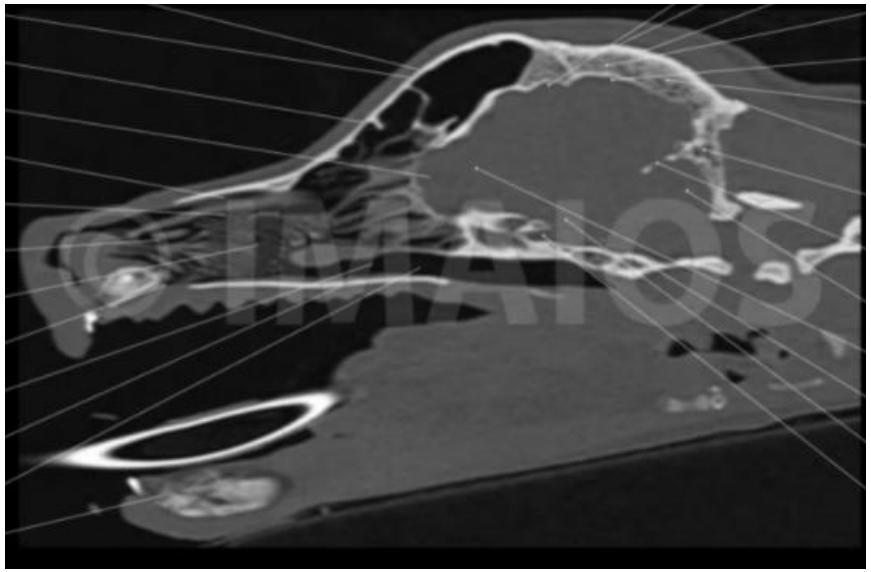

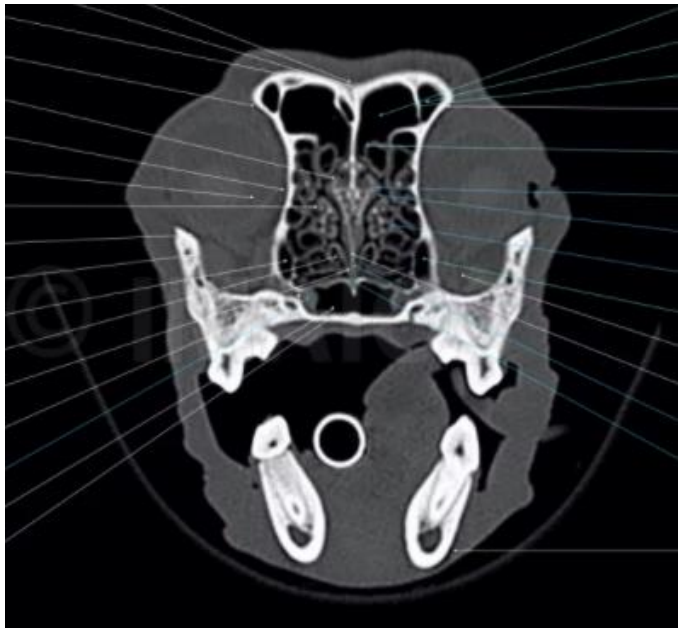

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Aspects

- Aspects or views are used to communicate from what direction you are observing the animal
- The name of the aspect you are viewing is the part of the animal closest to you (or the camera)

e.g. when a dog rolls over onto their back, you are looking at their ventral aspect.

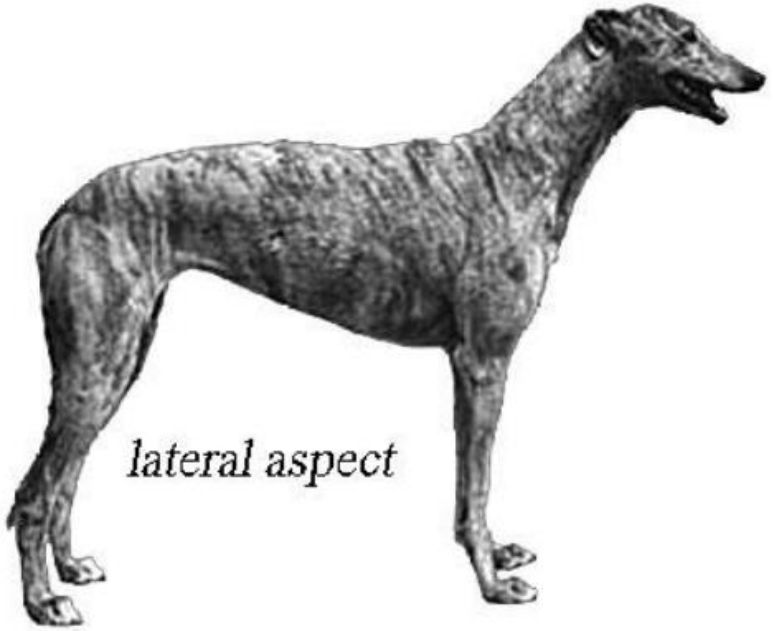
- The view might be angled
  - Thus the aspect is a combination of two adjacent aspects

  e.g. craniolateral, caudolateral, etc.

e.g. if you were viewing a digit on an angle

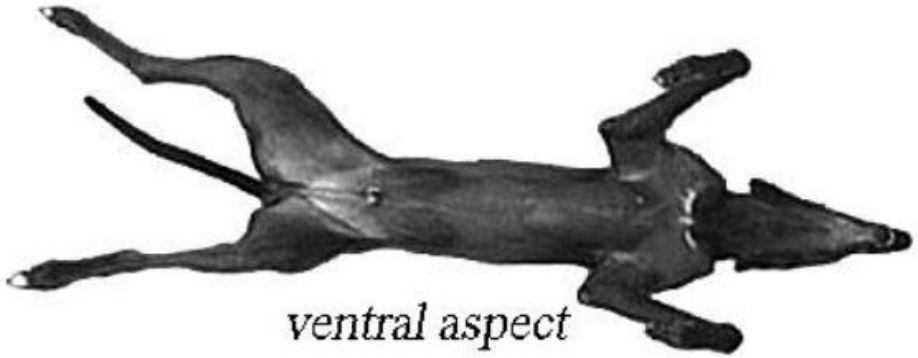
dorsal aspect

caudal aspect



lateral aspect

cranial aspect



ventral aspect

Images by Dr Helen Davies

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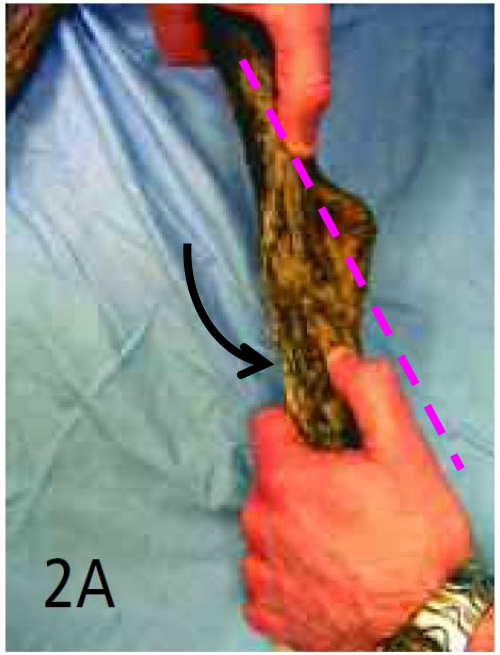
Dorsomedial aspect Medial aspect Mediopalmar aspect

Images by Dr Helen Davies

Describing movement

Flexion

Extension



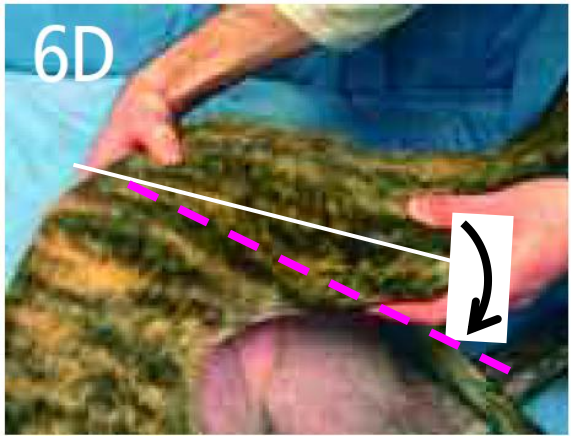
Hyperextension

- **Flexion** - the angle between the bones at a joint becomes smaller
- **Extension** - the angle between the bones at a joint approaches 180^{o} (straight line)
- **Hyperextension** - a joint travels beyond 180^{o} in a continuation of the extension movement

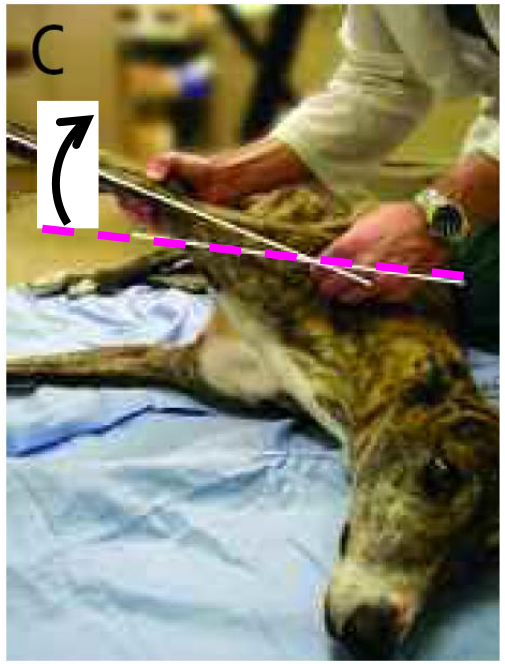
From: DB Fox. Orthopedic Examination of the Rear Limb in the Dog, NAVC Clinician's Brief July 2008 p63-66
& DB Fox. Orthopedic Examination of the Forelimb in the Dog, NAVC Clinician's Brief July 2008 p19-22

Describing movement

Adduction



Abduction



- **Adduction** – joint movement such that a limb moves *towards* the midline of the body; (Latin - 'ad' = toward + 'duction' = bringing)

  hint: think the limb is being "added" to the body mass

- **Abduction** – joint movement such that a limb moves *away* from the midline of the body; (Latin - 'ab' = away + 'duction' = bringing)

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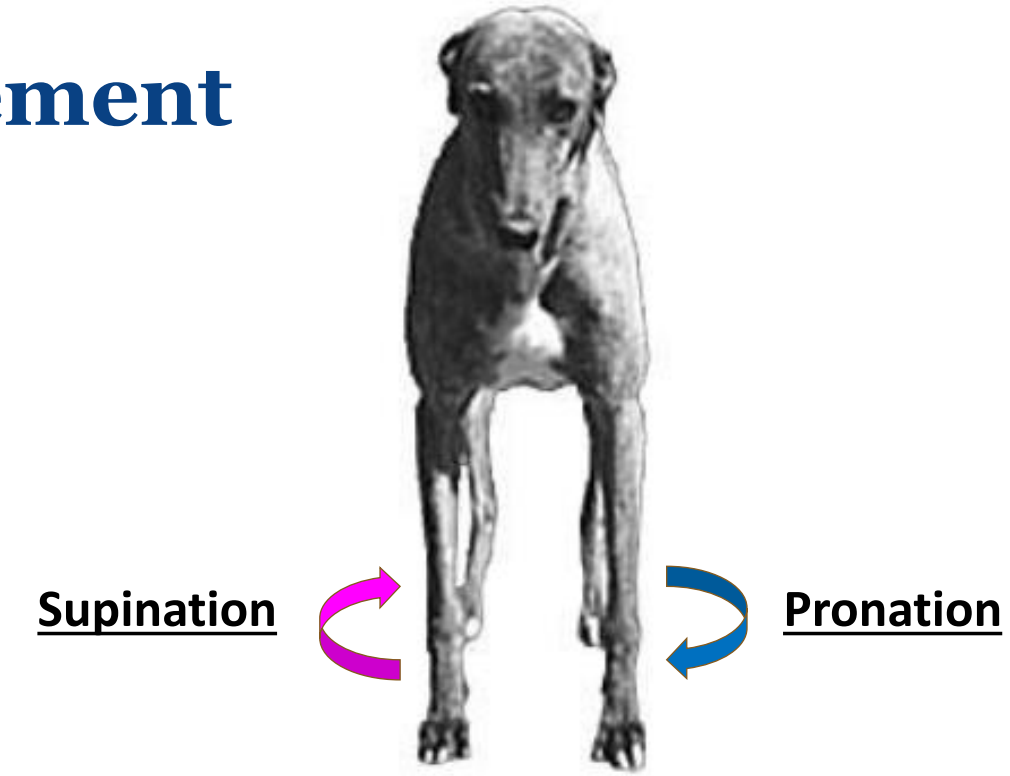
& DB Fox. Orthopedic Examination of the Forelimb in the Dog, NAVC Clinician's Brief July 2008 p19-22

Describing movement



- **Pronation** – rotation of the manus (‘hand’) or pes (‘foot’) so the palmar/plantar surface turns toward the ground; (Latin - ‘pronate’ = lying face down)

  hint: think the palm is turning towards the ground

- **Supination** – rotation of the manus (‘hand’) or pes (‘foot’) so the dorsal surface turns toward the ground; (Latin - ‘supinate’ = lay on the back)

  hint: think the palm is turning towards upwards and can now hold some ‘soup’!

Example

The cephalic vein crosses the palmar side of the distal third of the third and fourth metacarpal bones.

It then courses proximally on the palmar side of the interosseous muscles and passes superficial to the flexor retinaculum parallel to the carpal canal.

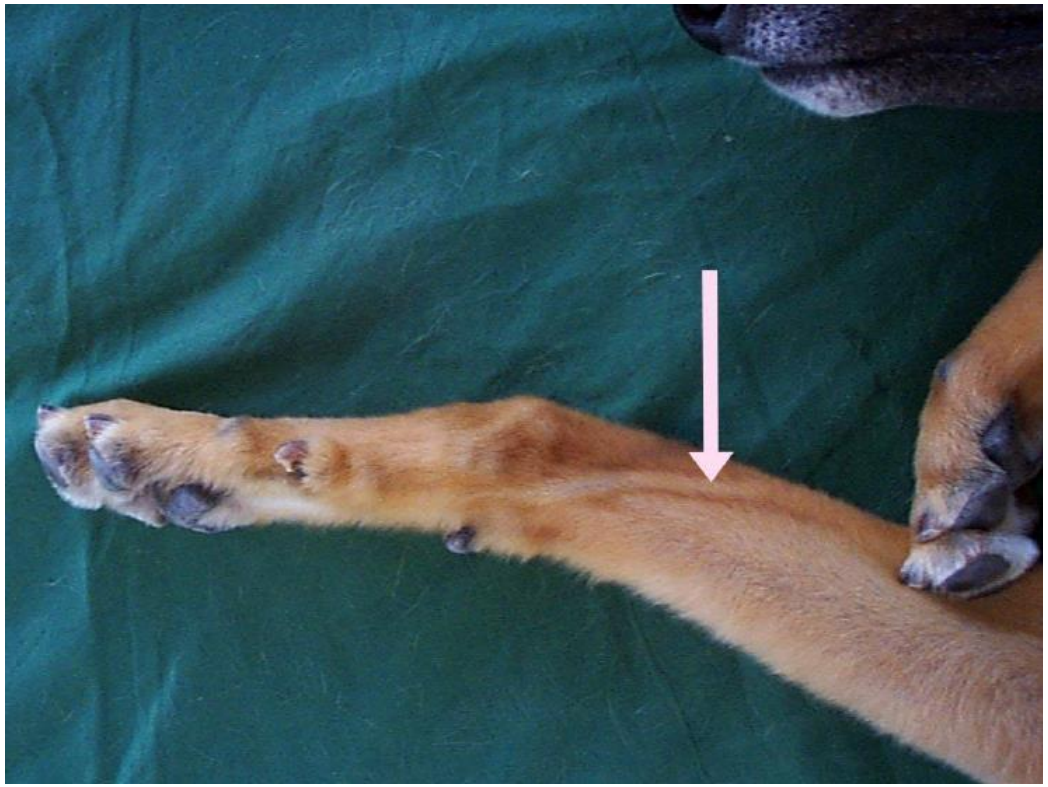
It then runs medially to the cranial surface of the antebrachium where it joins the accessory cephalic vein and continues proximally on the cranial surface of the extensor carpi radialis muscle to the flexor angle of the elbow joint.

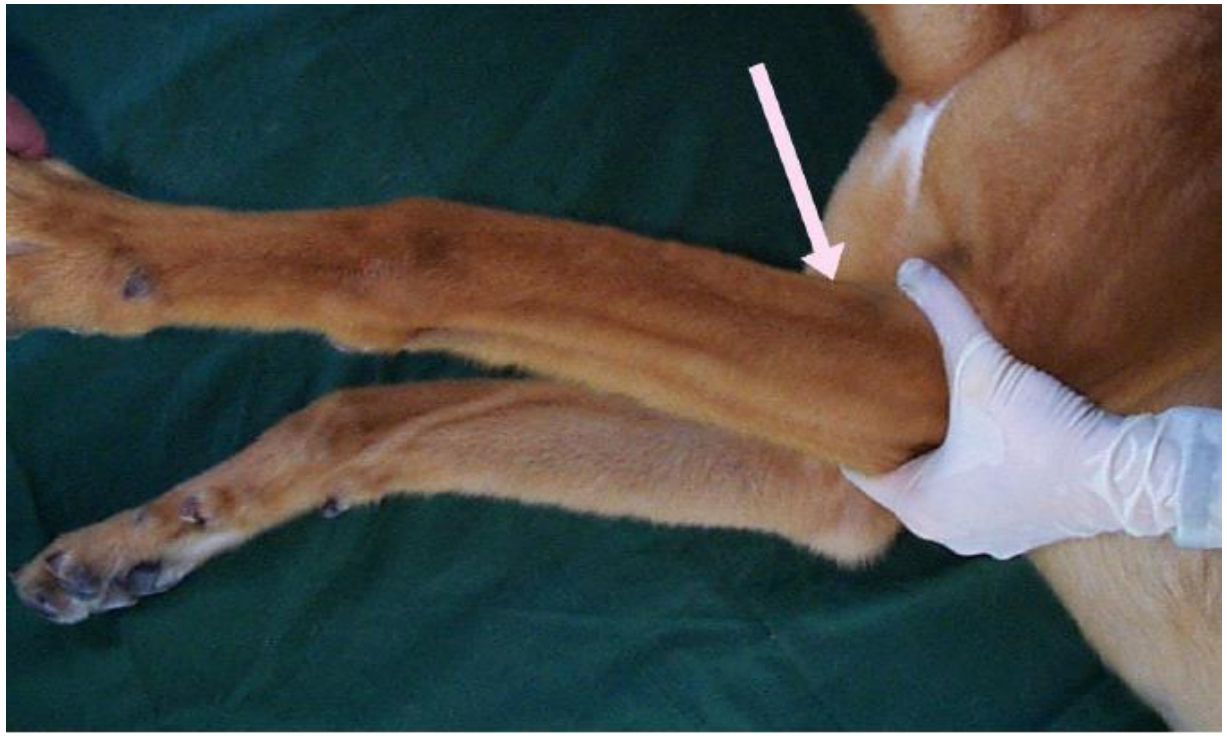
Example

- The cephalic (L – pertaining to the head) vein crosses the palmar side of the distal third of the third and fourth metacarpal (meta = after + carpal – pertaining to the carpus (Gr wrist)) bones.
- It then courses proximally on the palmar side of the interosseous (inter = between + osseous – pertaining to bones) muscles and passes superficial to the flexor (L – flex = bent) retinaculum (L – a rope cable) parallel to the carpal canal.
- It then runs medially to the cranial surface of the antebrachium (ante = before + brachium L/Gr – arm) where it joins the accessory cephalic vein and continues proximally on the cranial surface of the extensor (L – extend = stretch out) carpi radialis (L – pertaining to the radius) muscle to the flexor angle of the elbow joint.

Example – the cephalic vein in the dog

Region?
Aspect?

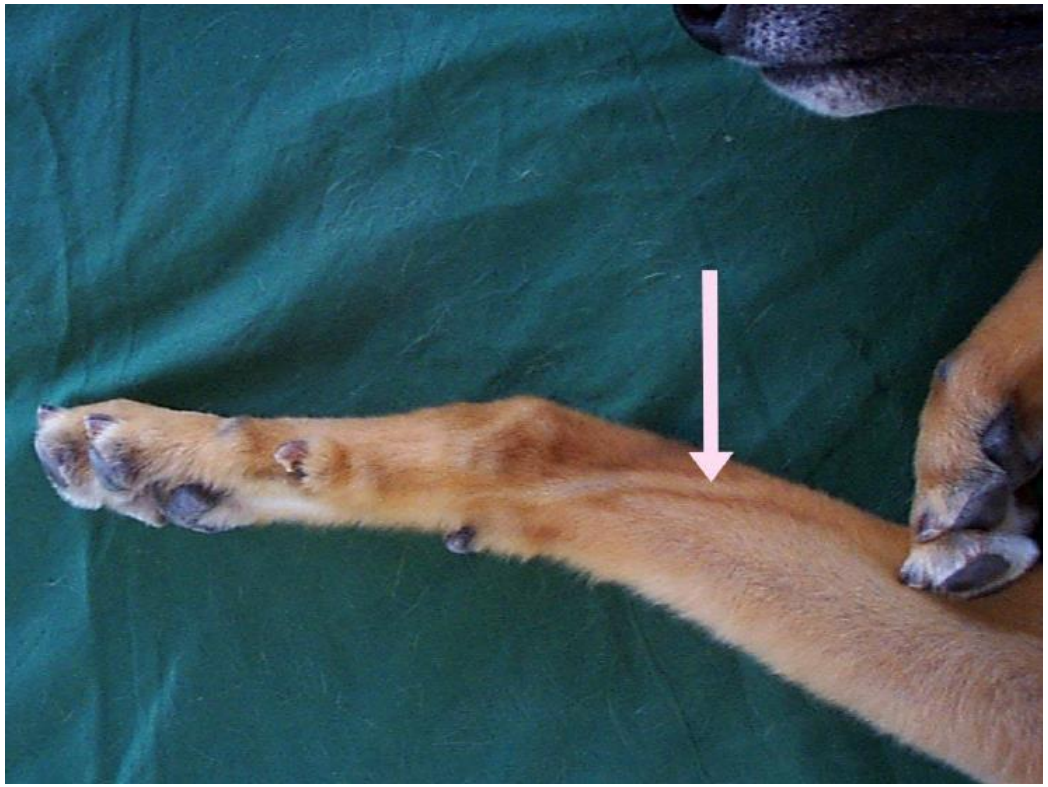


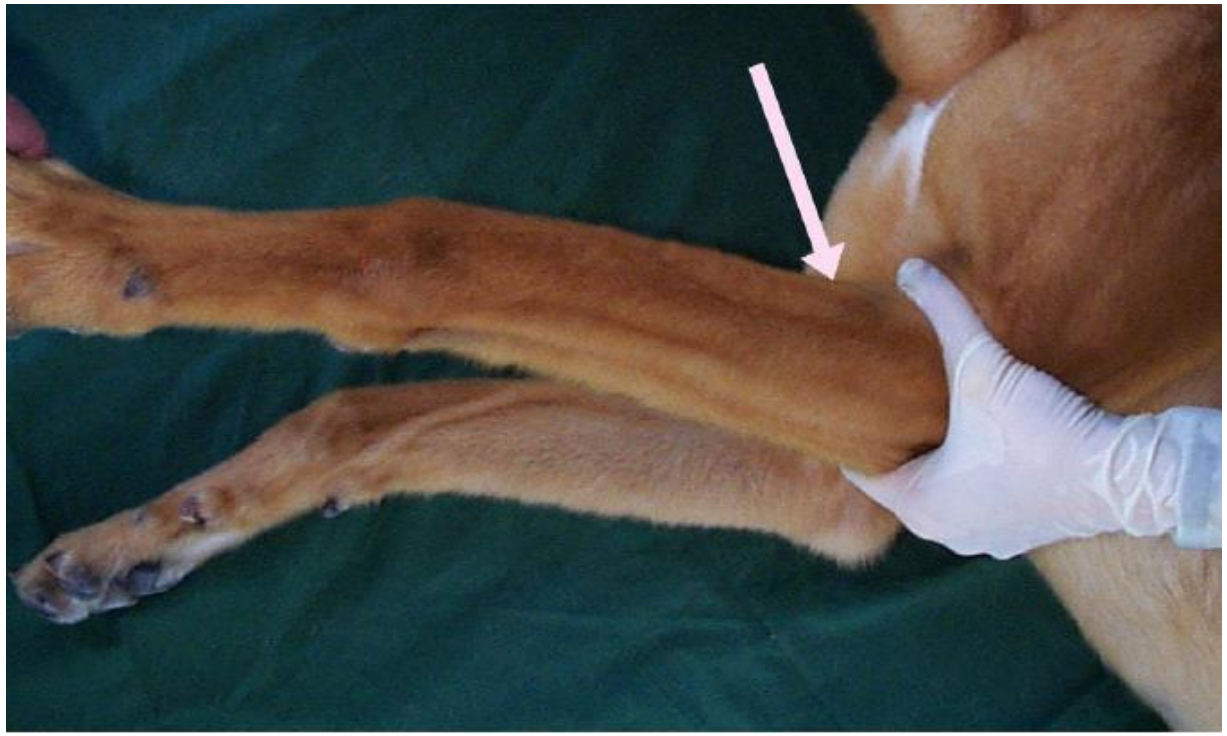


Region?
Aspect?

Example – the cephalic vein in the dog

Region? Right forelimb
Aspect? Medial aspect





Region? Left forelimb
Aspect? Lateral (craniolateral) aspect

Take home messages

- The language of anatomy imparts precision and clarity to communications about a structure or concept
  - Using the language correctly allows your meaning to be accurately understood.
  - Using the language incorrectly may mean your meaning is lost or misinterpreted.
- Frequently used anatomical terms:
  - Median/sagittal/transverse/dorsal planes
  - Movement: flexion/extension/hyperextension; adduct/abduct; pronate/supinate.

Reference texts

- Nomina Anatomica Veterinaria – available online at http://www.wava-amav.org/wava-documents.html
- Studdart, Gay & Hinchcliff. *Saunders Comprehensive Veterinary Dictionary*. Elsevier, Missouri.
  - available as a downloadable e-book through the library.
- Singh. *Dyce, Sack & Wensing's Textbook of Veterinary Anatomy* (any edition).
- König & Liebich. *Veterinary Anatomy of Domestic Mammals* (any edition).
- Hermanson, de Lahunta & Evans. *Miller and Evans' Anatomy of the Dog* (any edition). Elsevier.
  - available as a downloadable e-book through the library.

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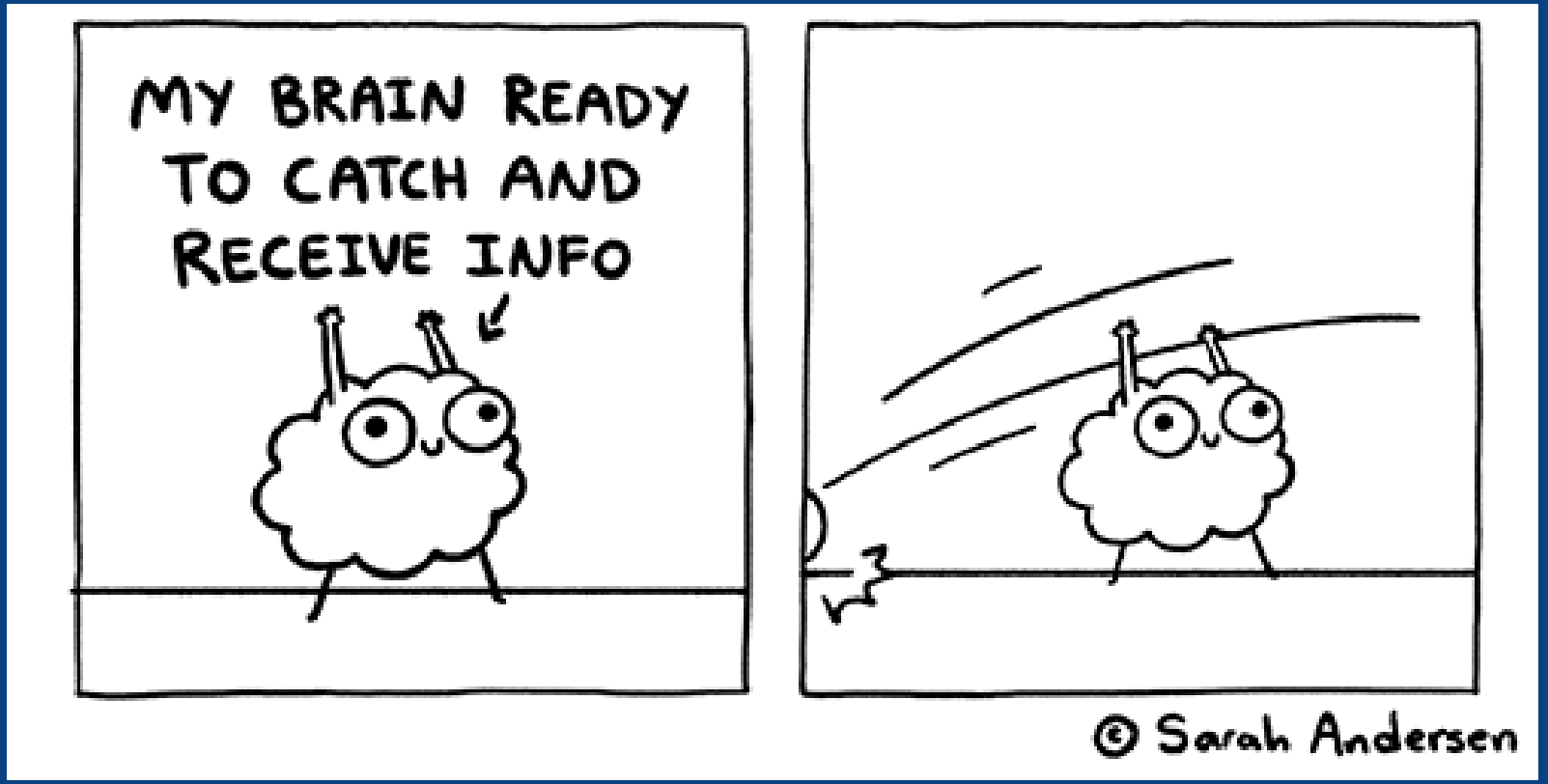

Dr Janine Hofmann

hofmann.j@unimelb.edu.au