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# Cells to Systems - Lecture 5, part 1

## The Language of Anatomy

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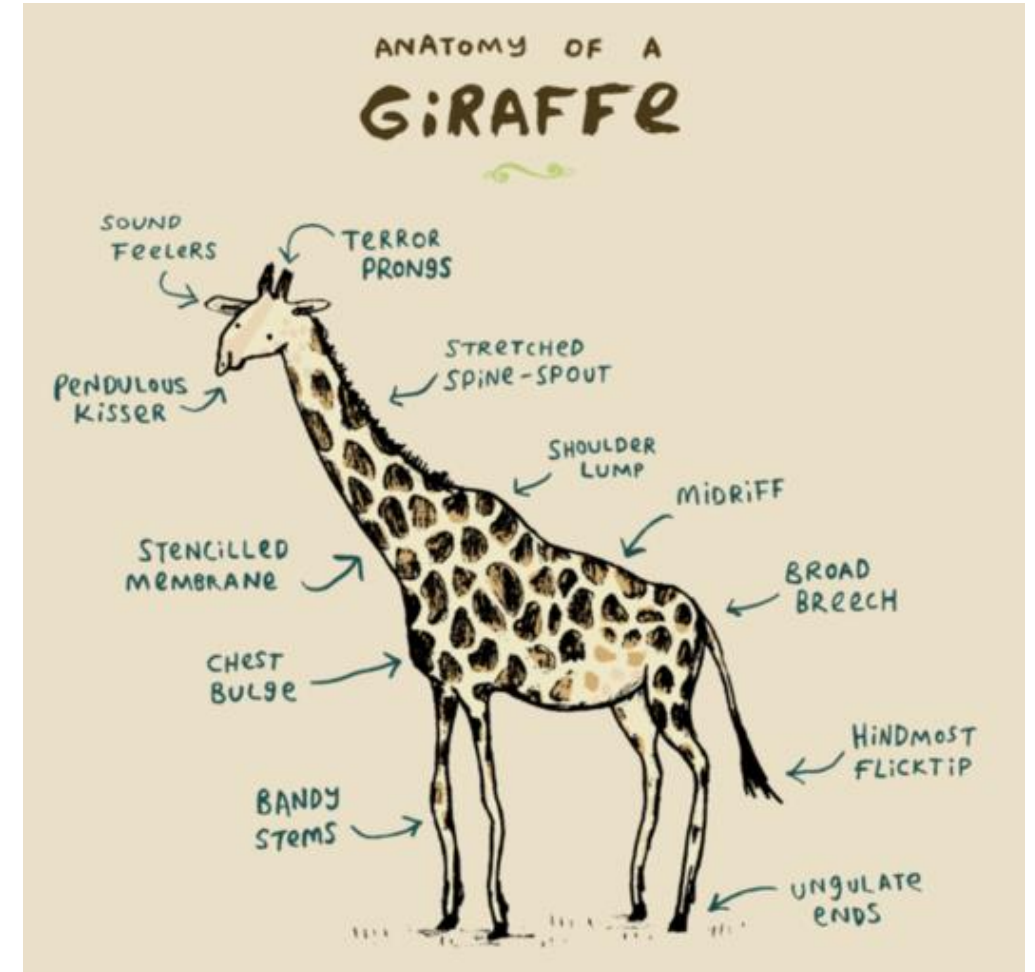


**VETS30015 / VETS90121**

# Intended Learning Outcomes

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

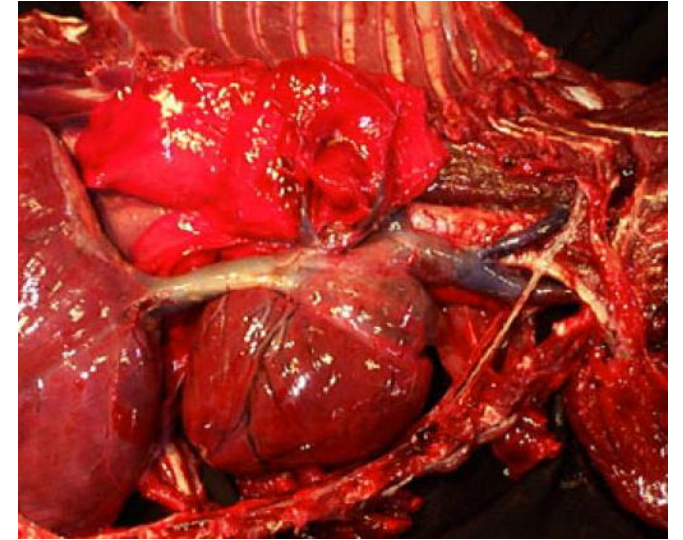
- Describe the position, relationships, form, and appearance of important animal structures and features
- Apply correct terminology for normal and novel structures in a meaningful way





# 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)

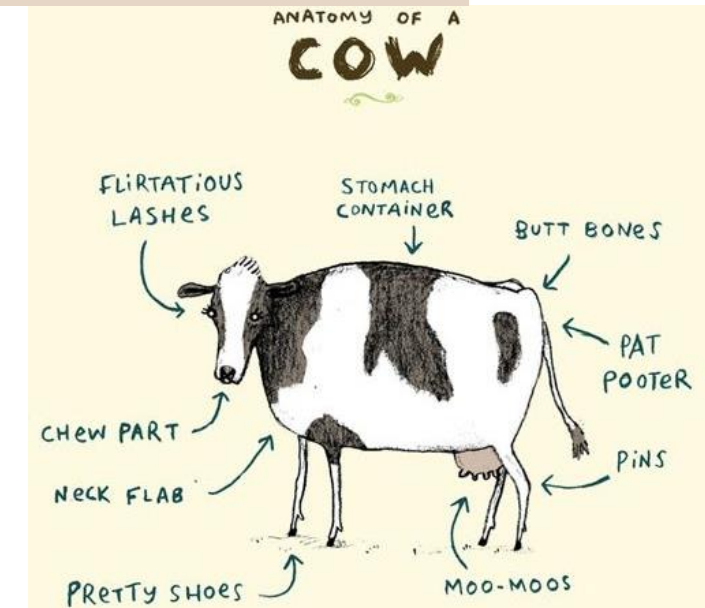
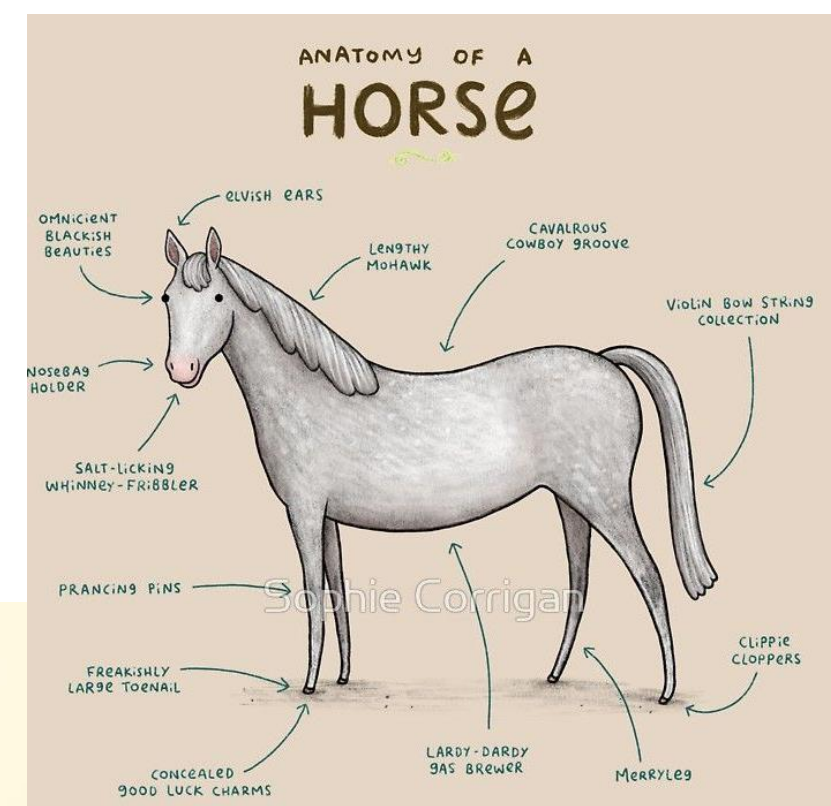
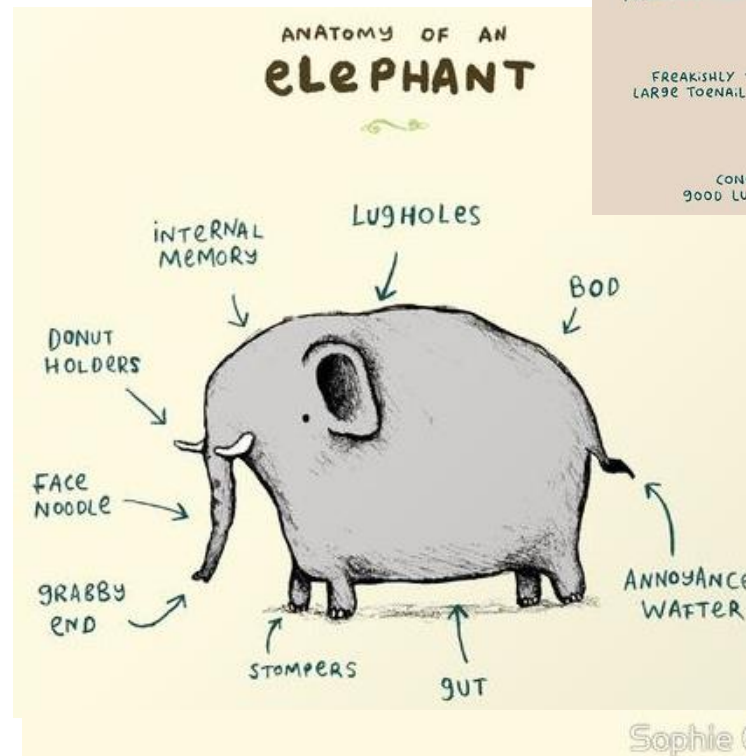
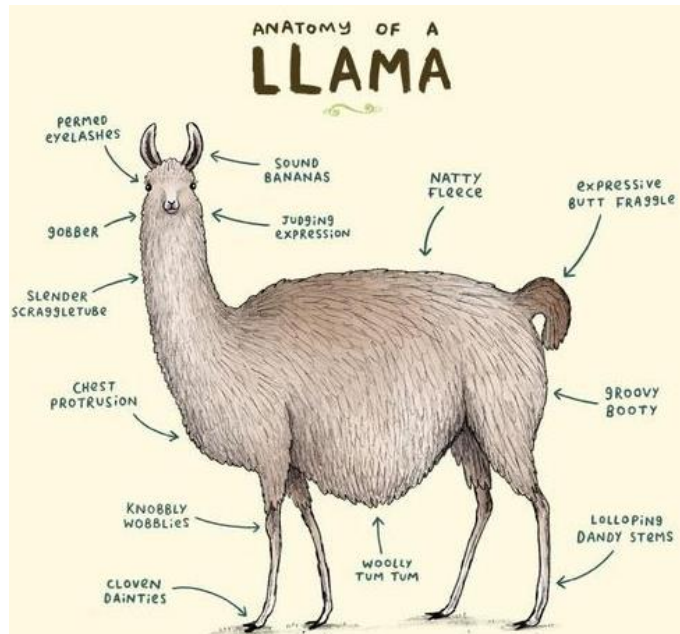


## Why is anatomy important?

- 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 6<sup>th</sup> edition (2017)
    - *Nomina Embryologica Veterinaria* and *Nomina 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)         | <u>epi</u> thelium, <u>epi</u> physis      | • Ad-    | (L – towards)      | <u>ad</u> duction                      |
| • Peri-  | (Gr – around)       | <u>peri</u> cardium, <u>peri</u> osteum    | • Ab-    | (L – away)         | <u>ab</u> axial, <u>ab</u> duction     |
| • Endo-  | (Gr – within)       | <u>endo</u> thelium, <u>endo</u> crine     | • Ante-  | (L – before)       | <u>ante</u> brachium                   |
| • Dia-   | (Gr – between)      | <u>dia</u> phragm, <u>dia</u> physis       | • Anti-  | (Gr – against)     | <u>anti</u> biotic, <u>anti</u> clinal |
| • Meta-  | (Gr – change/after) | <u>meta</u> bolism, <u>meta</u> physis     | • A-/An- | (Gr – not/without) | <u>an</u> oestrous                     |
| • Supra- | (L – above)         | <u>supra</u> condylar                      | • Retro- | (L – behind)       | <u>retro</u> bulbar                    |
| • Infra- | (L – beneath)       | <u>infr</u> aspinous, <u>infr</u> aorbital | • Di-    | (Gr –two)          | <u>di</u> gastricus                    |
| • Sub-   | (L – under)         | <u>sub</u> cutaneous                       | • Bi-    | (L – two)          | <u>bi</u> ceps brachii                 |
| • Hypo-  | (Gr – below)        | <u>hypo</u> glycaemia, <u>hypo</u> glossal | • Tri-   | (L & Gr – three)   | <u>tri</u> ceps brachii                |
| • Hyper- | (Gr – over)         | <u>hyper</u> extension                     |          |                    |                                        |

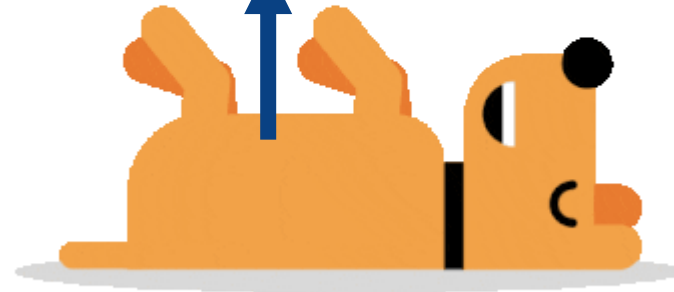
**L– Latin    Gr – Greek derivation**

# Directional terms

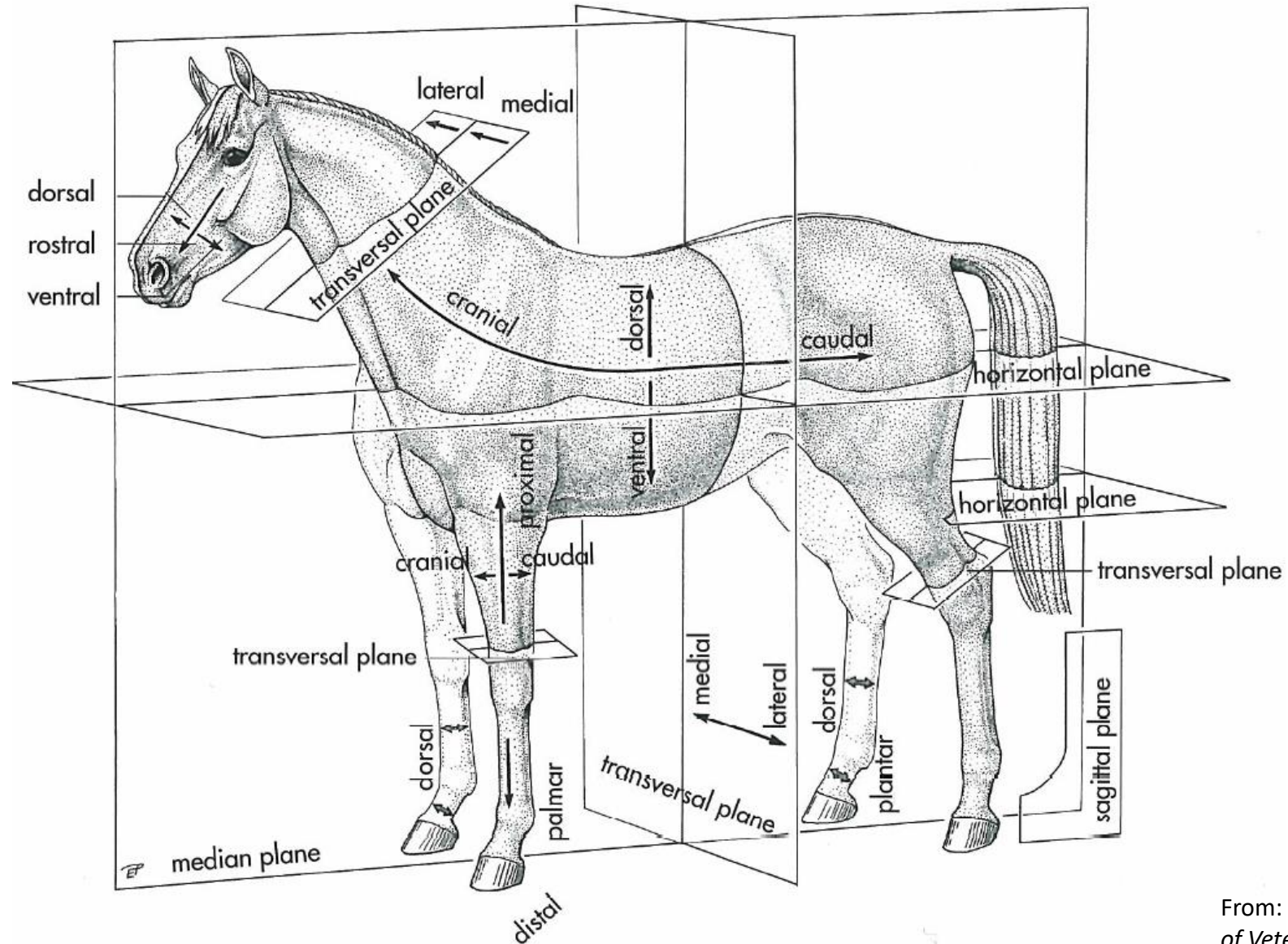
This is up



Or is this up?



- 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

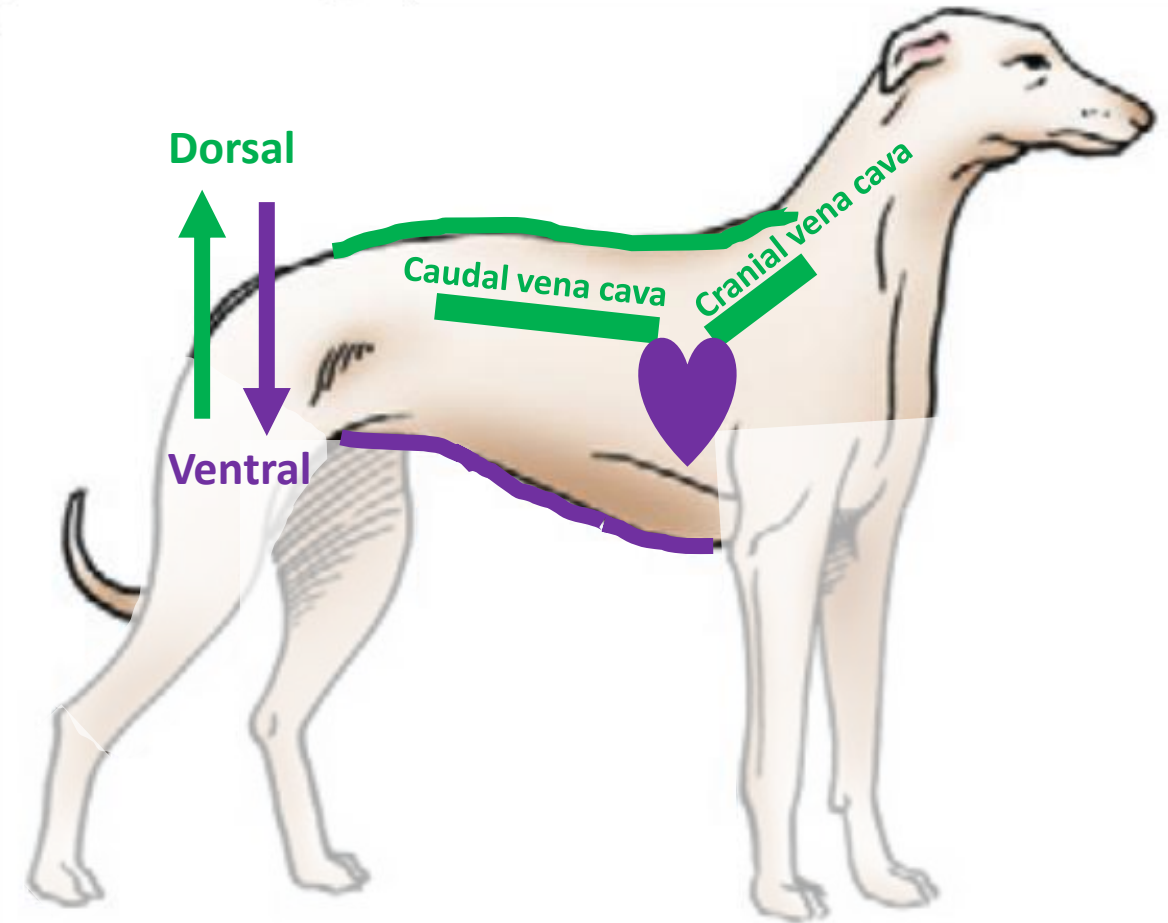
- applies to the entire body, except for the limbs.

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 belly, 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

- applies to the limbs and tail.

## **Distal** (distalis in Latin)

- away from the junction of the limb to the body

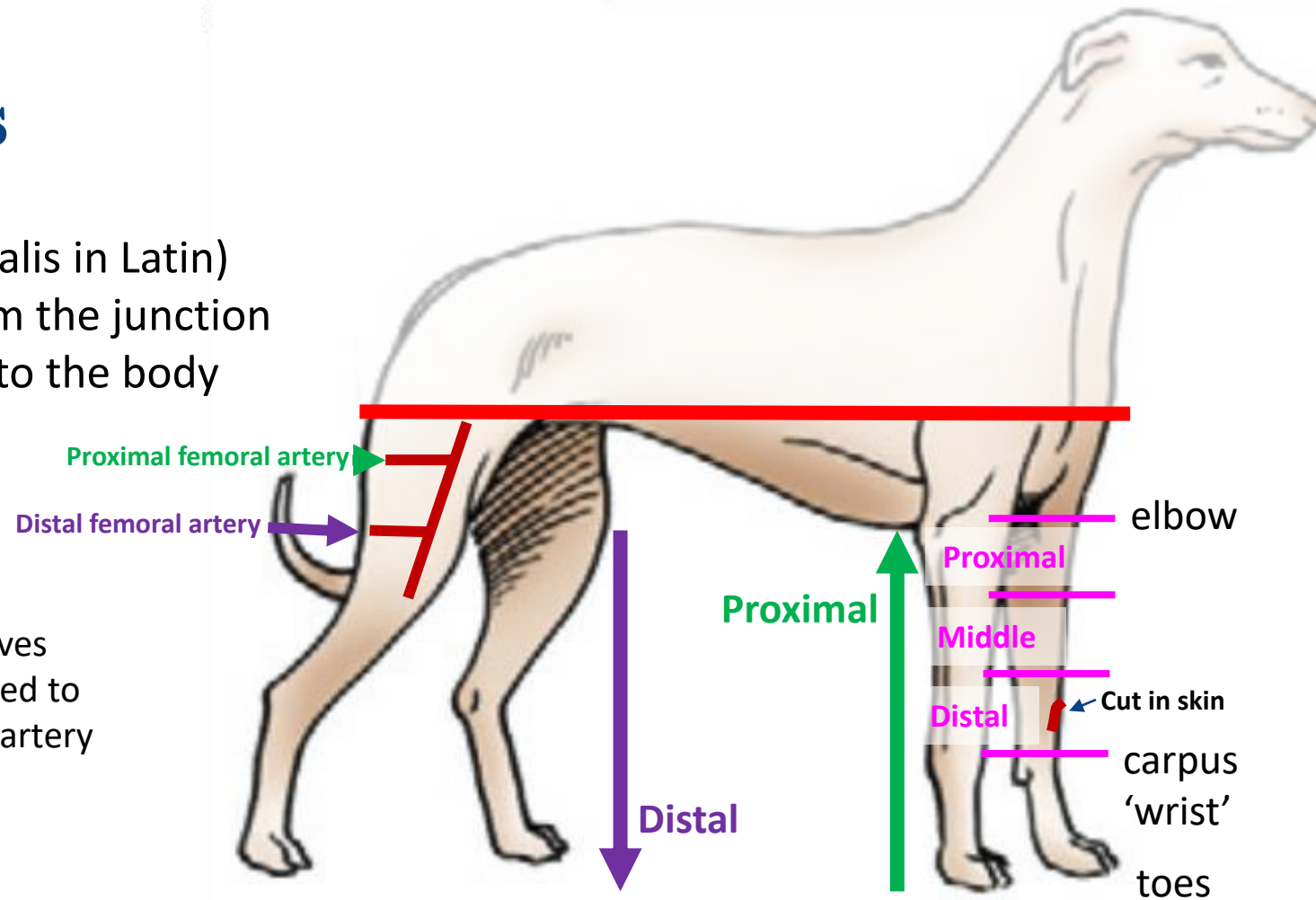
### Ways to use **proximal** and **distal**:

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) **Caudal** (caudalis in Latin)  
(cranium = head, Gr) (cauda = tail, L)  
- closer to the head - closer to the tail

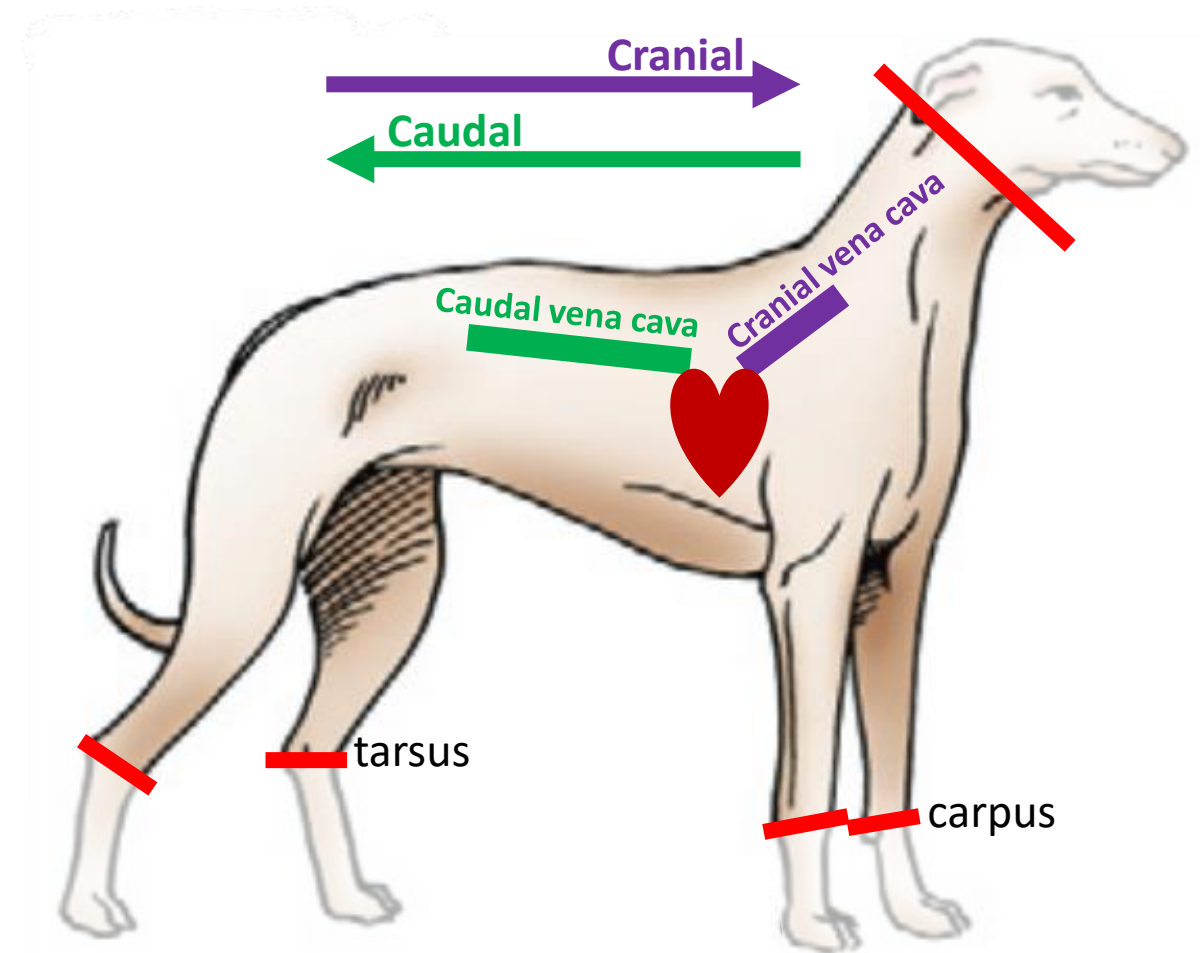
- applies to the neck and trunk & to the limbs  
proximal to the carpus ('wrist') and tarsus ('ankle').

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’

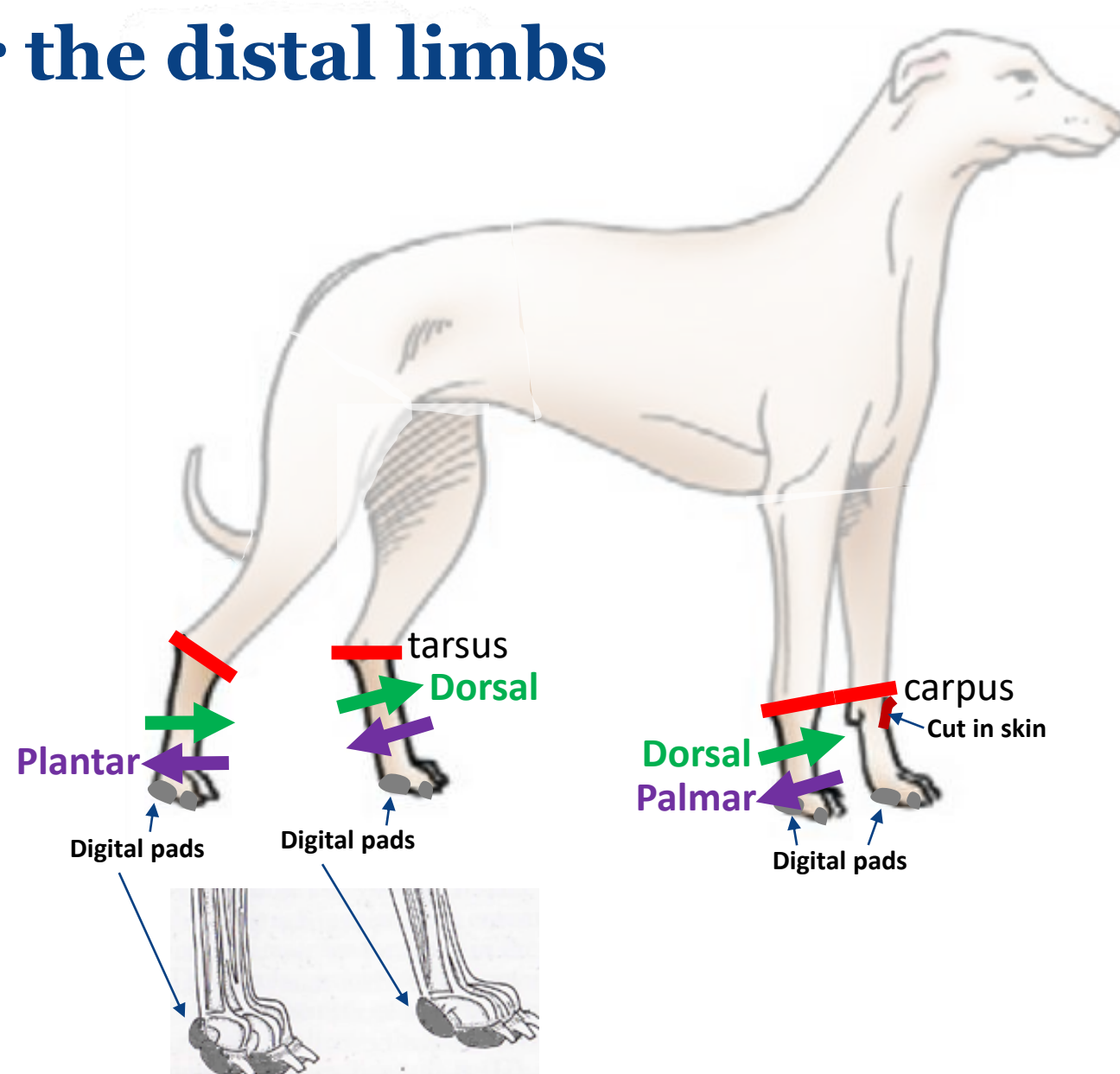
**Plantar** (plantaris in Latin) – hindlegs only

- **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

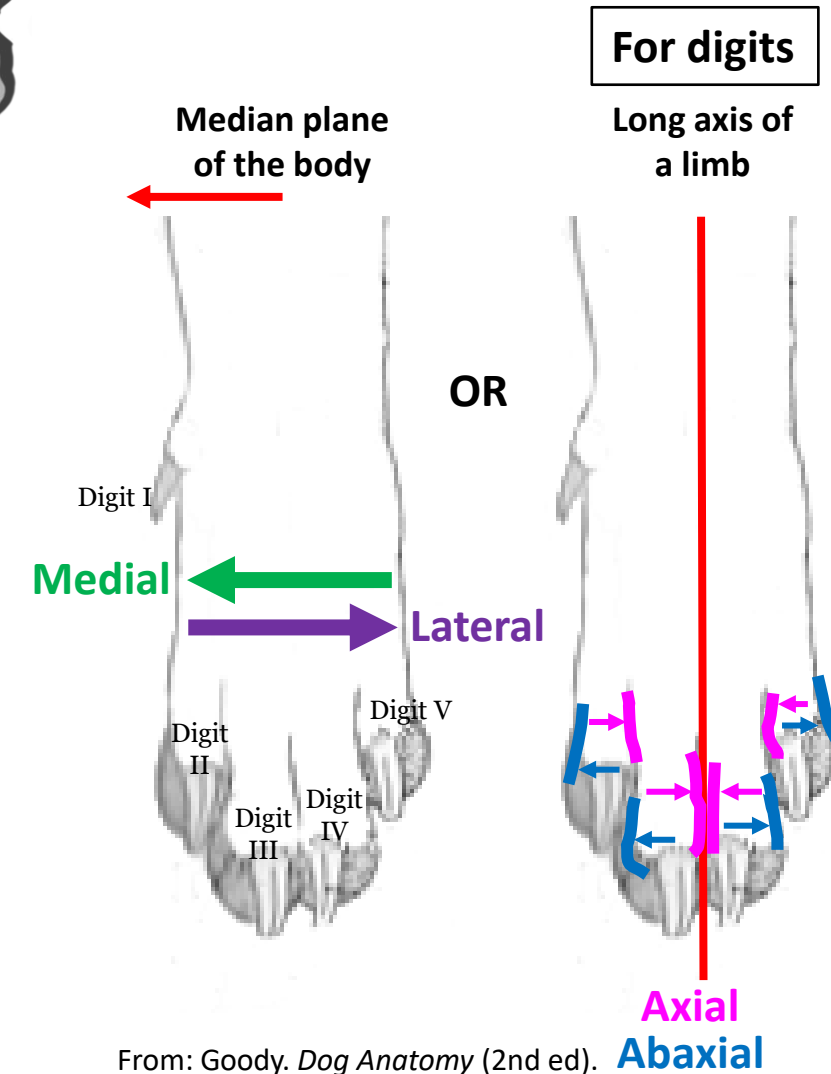
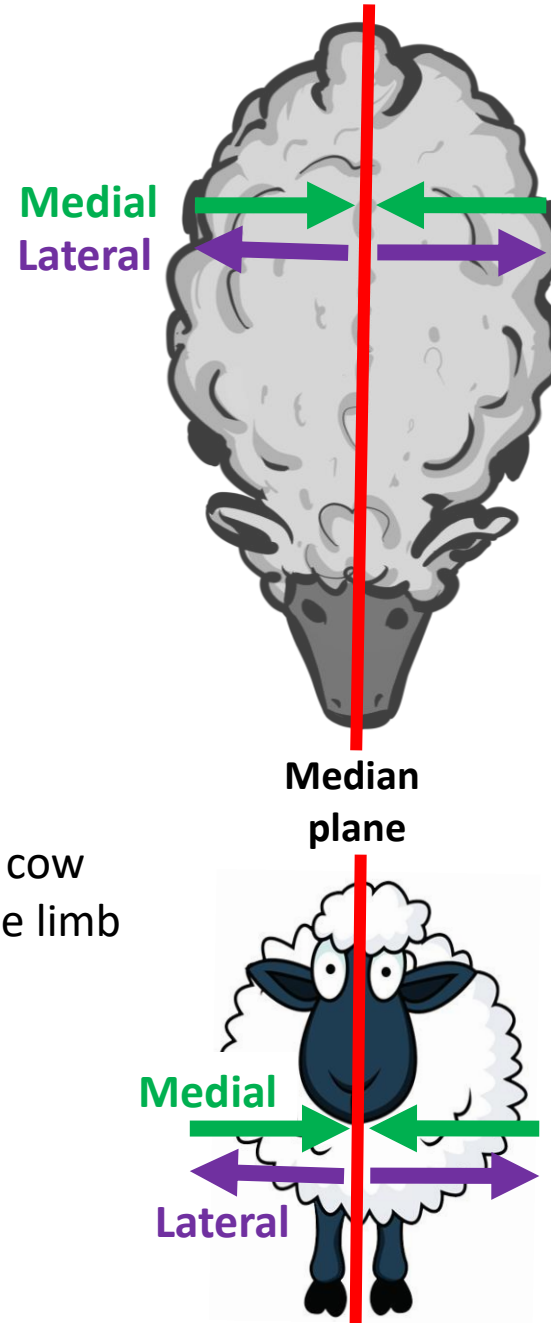
e.g. the first digit (dewclaw) is on the medial side of the limb

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). **Axial**  
**Abaxial**



# 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

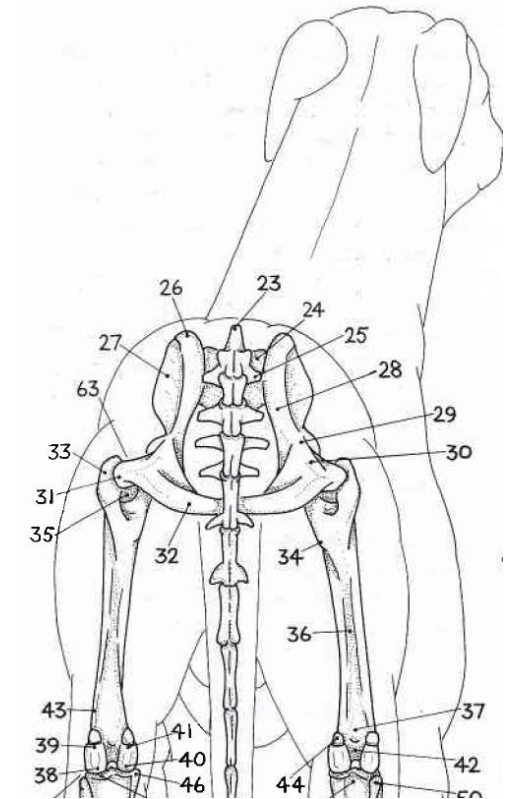
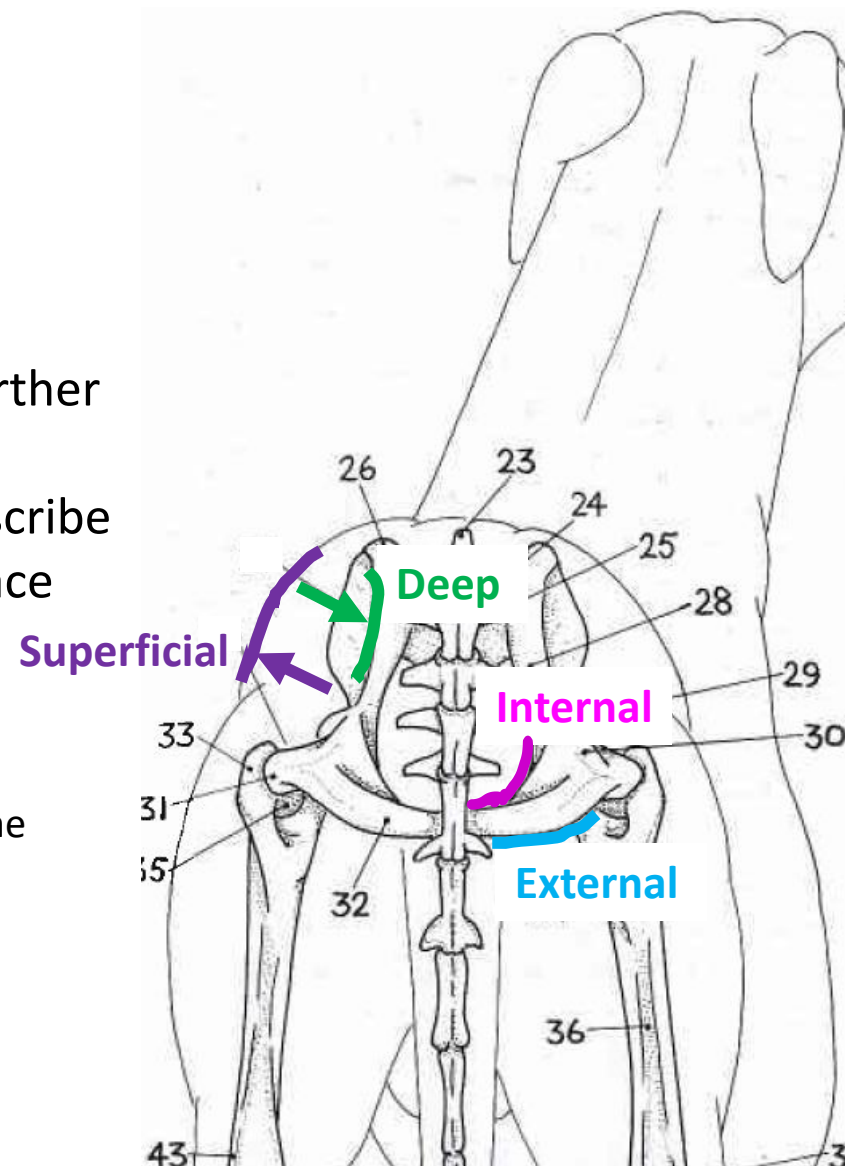
**Internal/inner** and **external** are also used to describe a structure based on proximity to the body surface

- 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.



# 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.

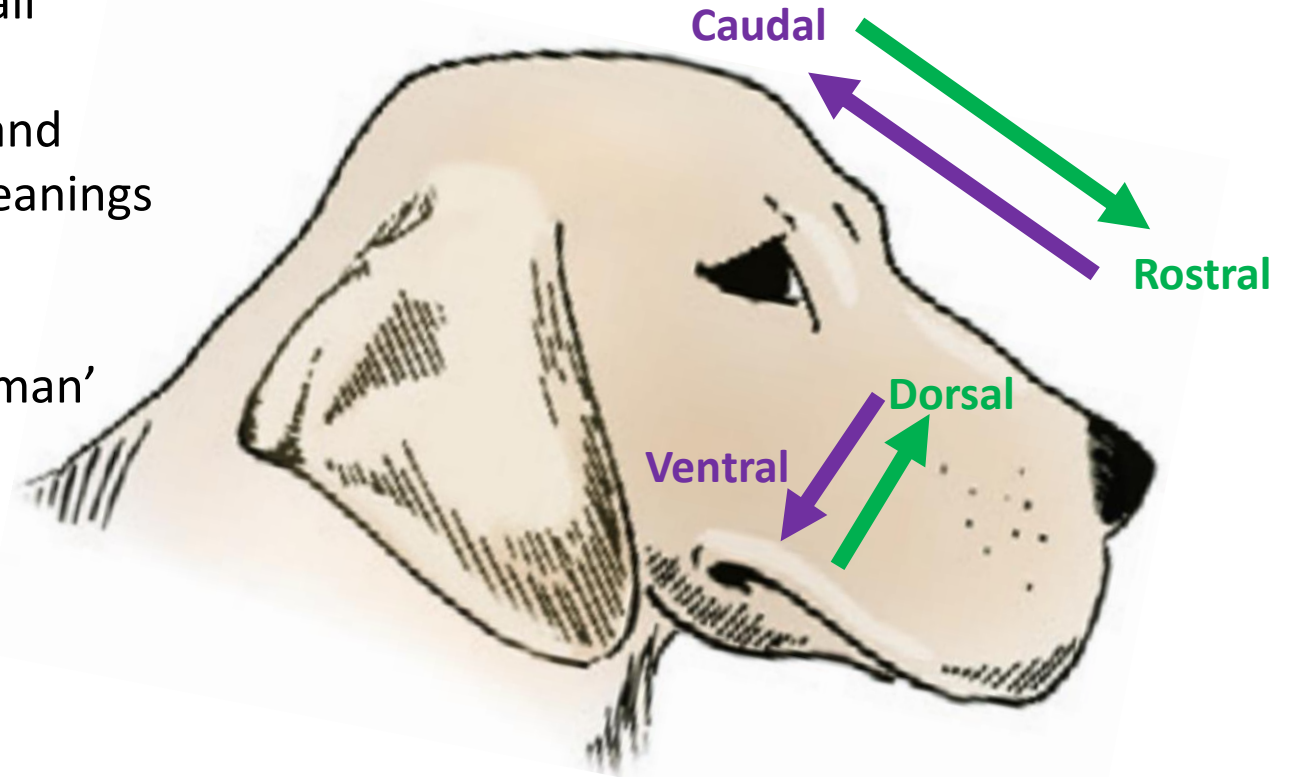
Some eye and ear structures are the only place 'human' terms (anterior, posterior, superior, and inferior) apply in veterinary anatomy

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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# Cells to Systems - Lecture 5, part 2

## The Language of Anatomy

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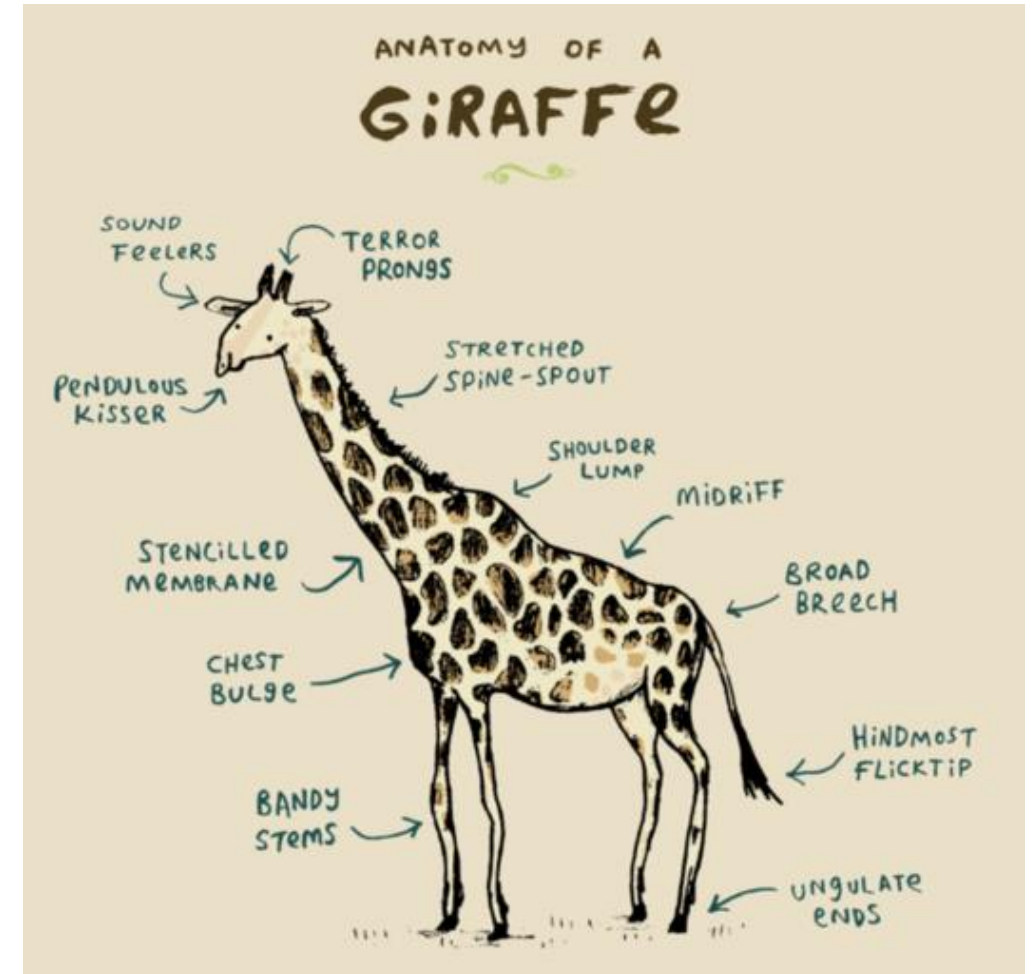


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# Intended Learning Outcomes

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



# 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

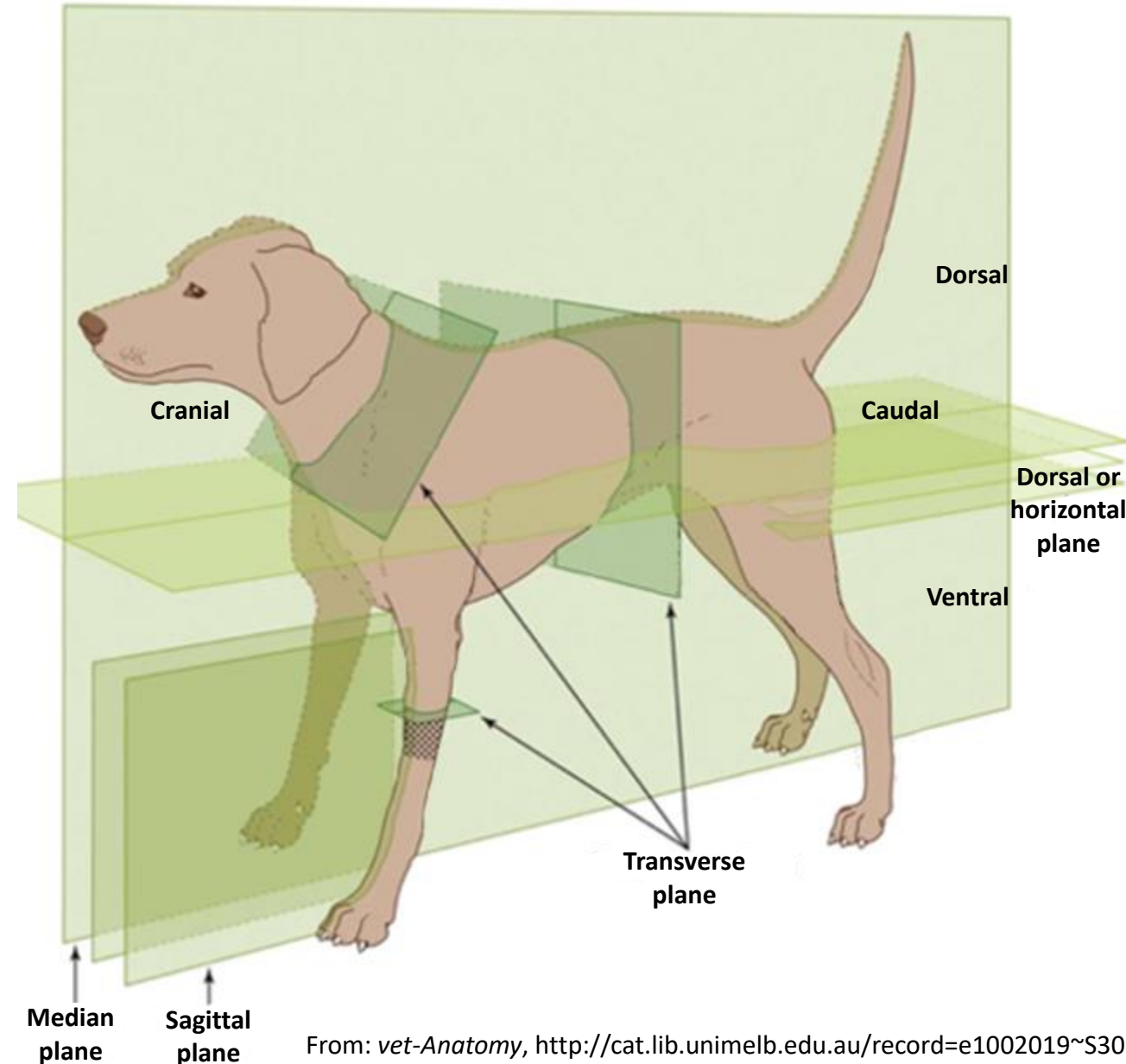
- Parallel to median plane

## 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





# 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

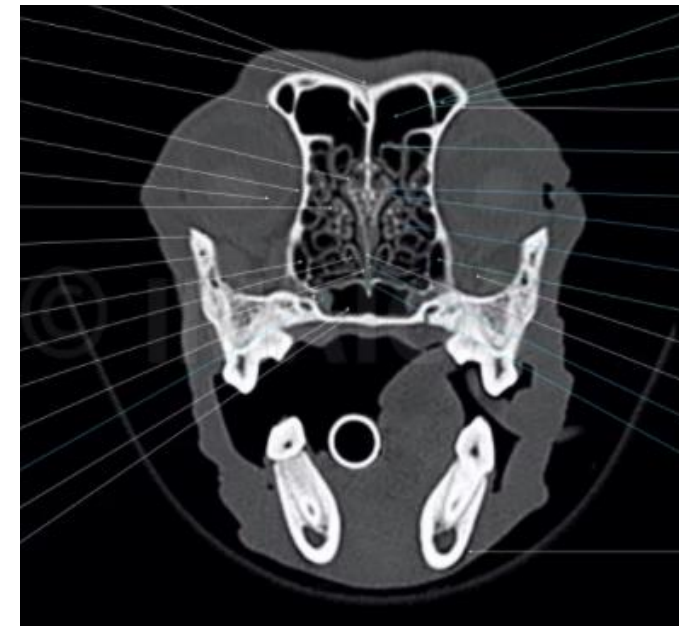
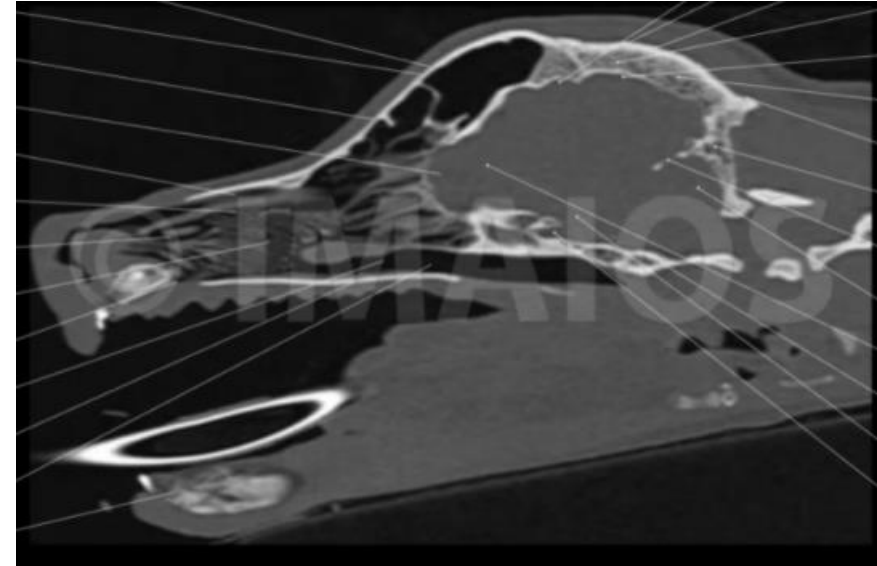
- Parallel to median plane

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- 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 plane

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



# 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

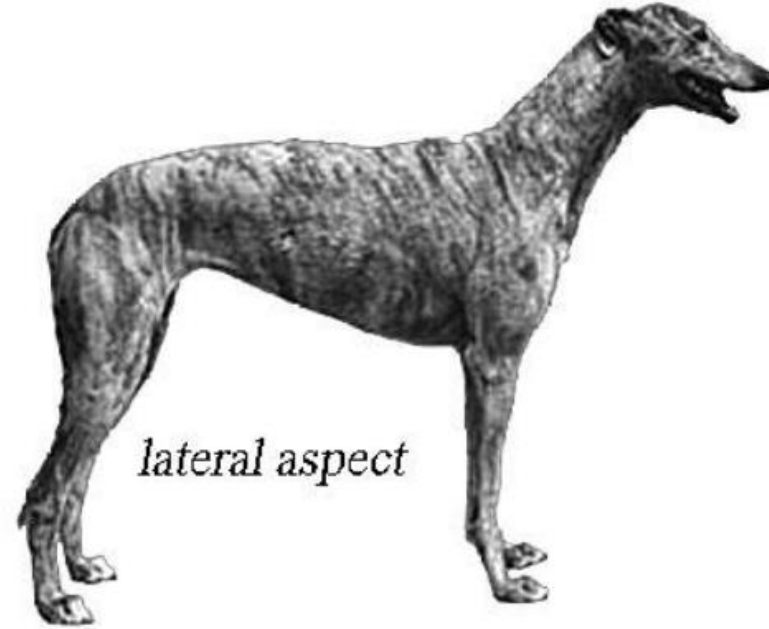


*dorsal aspect*

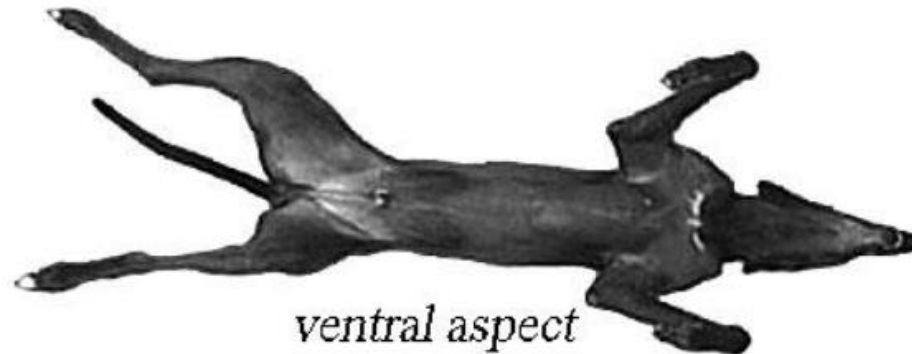
*caudal aspect*



*lateral aspect*



*cranial aspect*



*ventral aspect*

# Aspects

- Aspects or views are used to communicate from what direction you are observing the animal
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e.g. when a dog rolls over onto their back, you are looking at their ventral aspect.

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  - Thus the aspect is a combination of two adjacent aspects  
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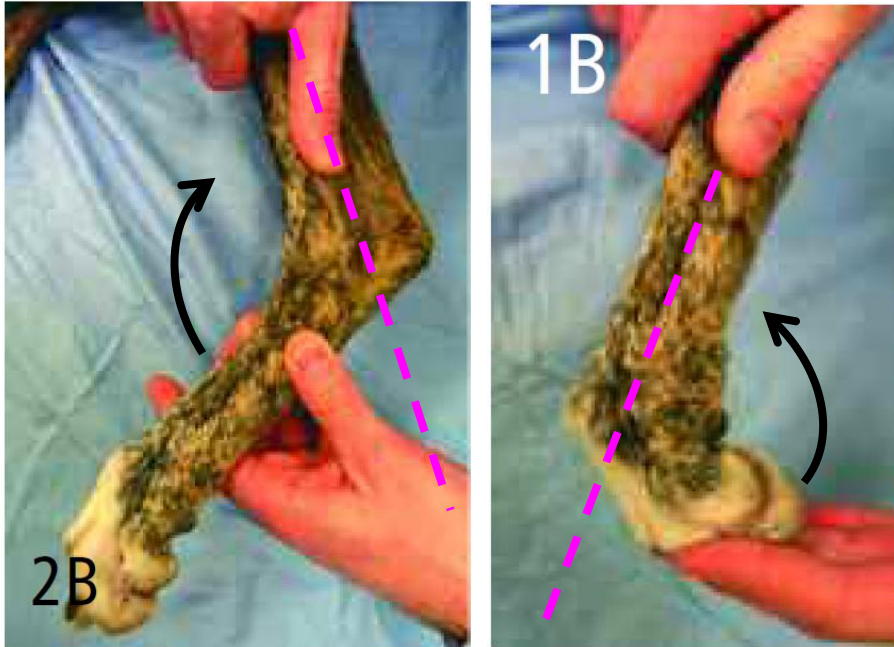
Dorsomedial aspect

Medial aspect

Mediopalmar aspect

# Describing movement

## Flexion



## Extension



## Hyperextension

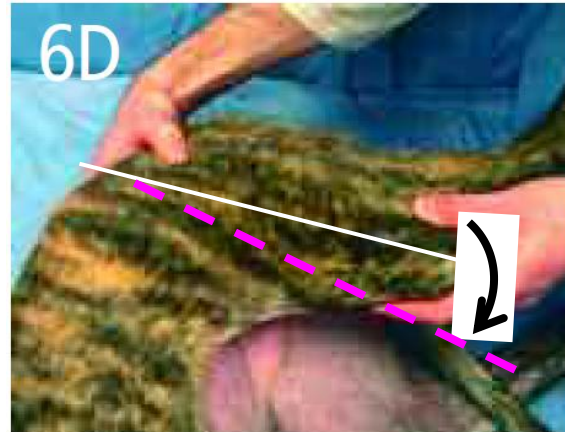


- **Flexion** - the angle between the bones at a joint becomes smaller
- **Extension** - the angle between the bones at a joint approaches 180° (straight line)
- **Hyperextension** - a joint travels beyond 180° in a continuation of the extension movement



# Describing movement

## Adduction



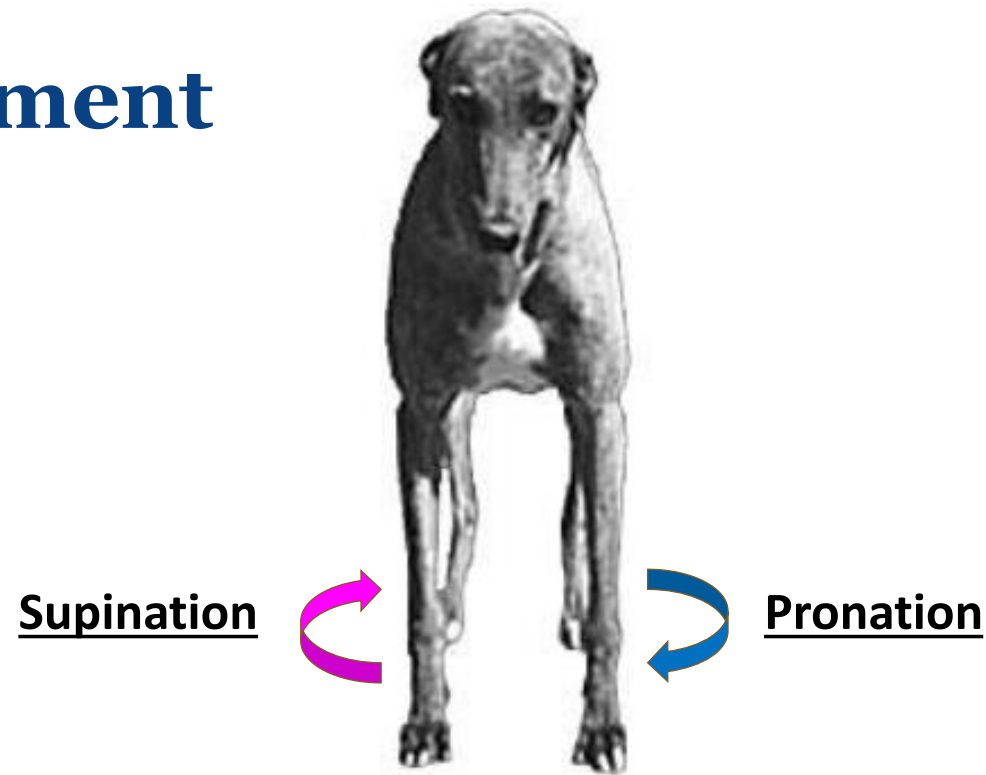
## Abduction



- **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)



# 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.

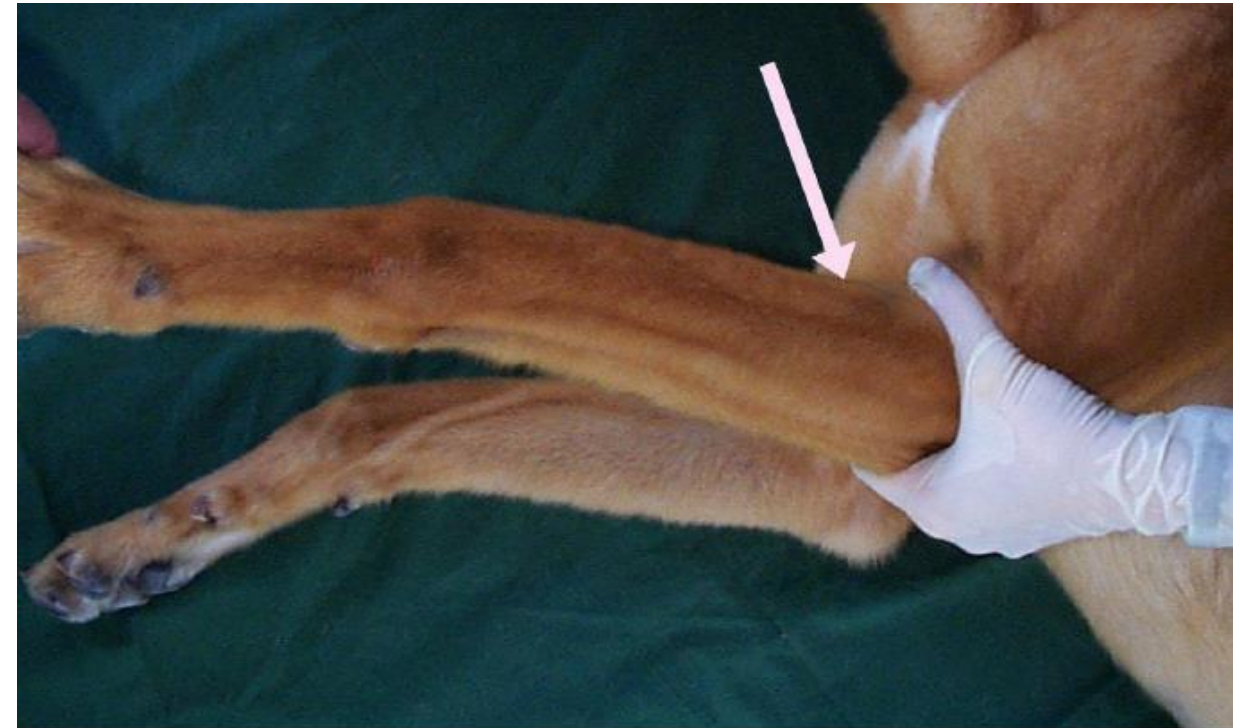
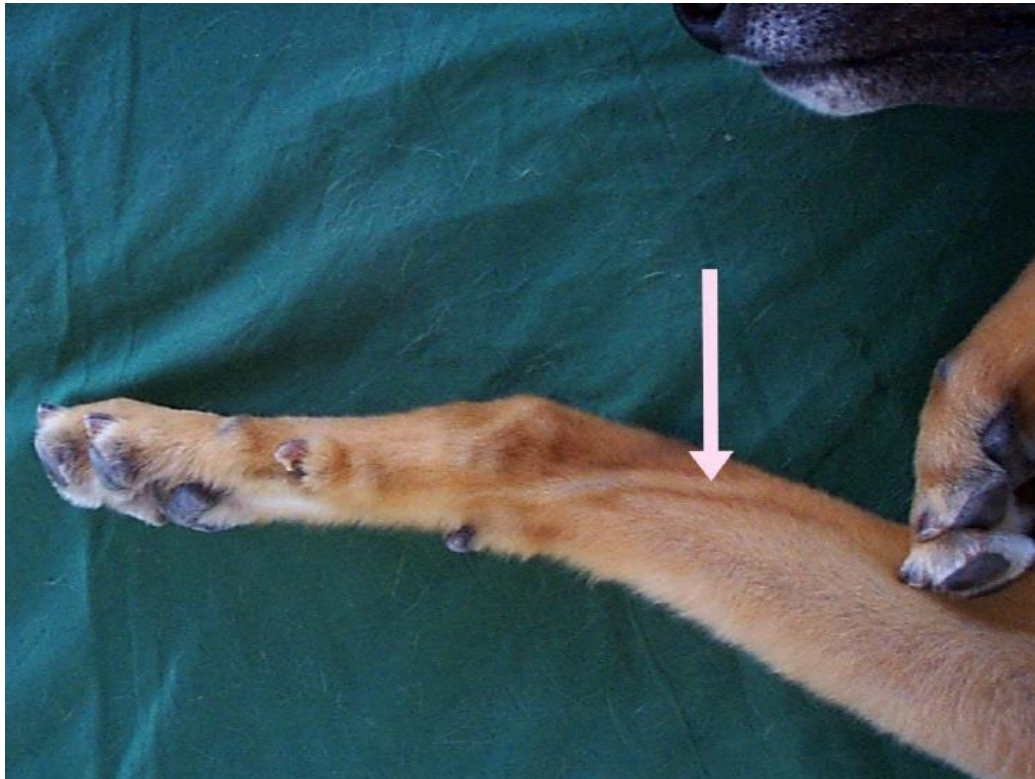
It then runs medially to the cranial surface of the antebrachium where it joins the accessory cephalic vein and continues proximally on the cranial surface of the extensor carpi radialis muscle to the flexor angle of the elbow joint.

# 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?

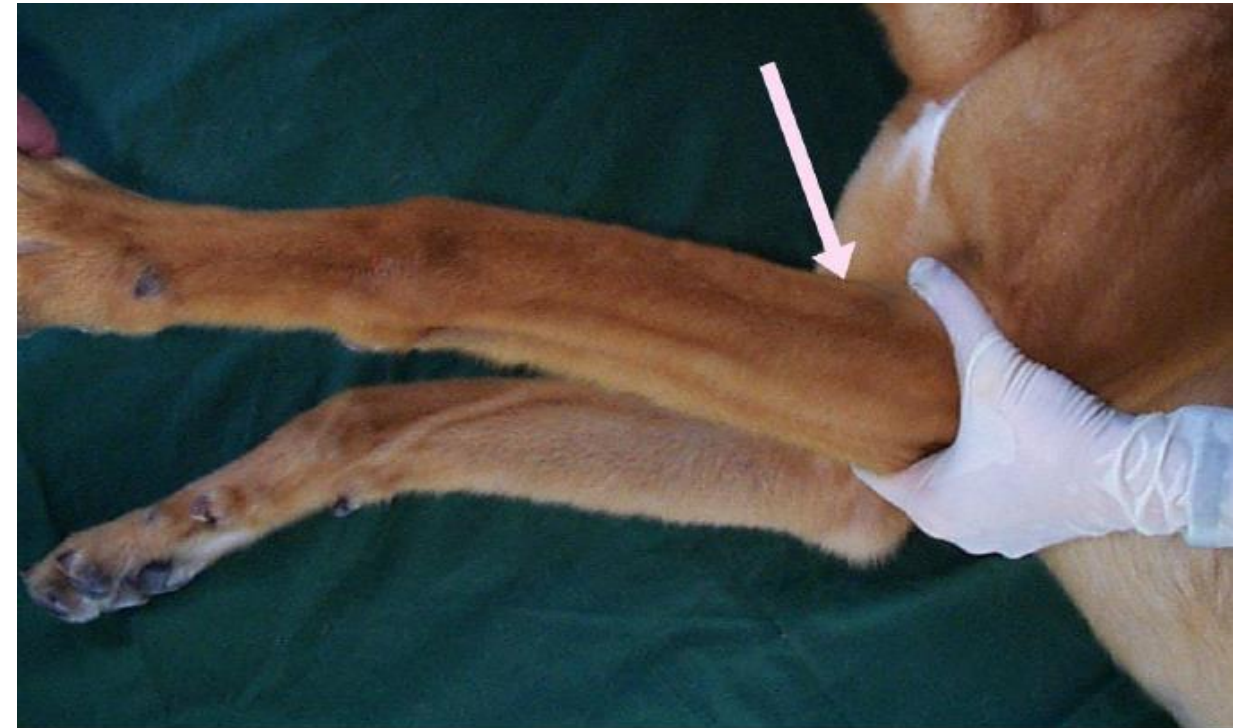
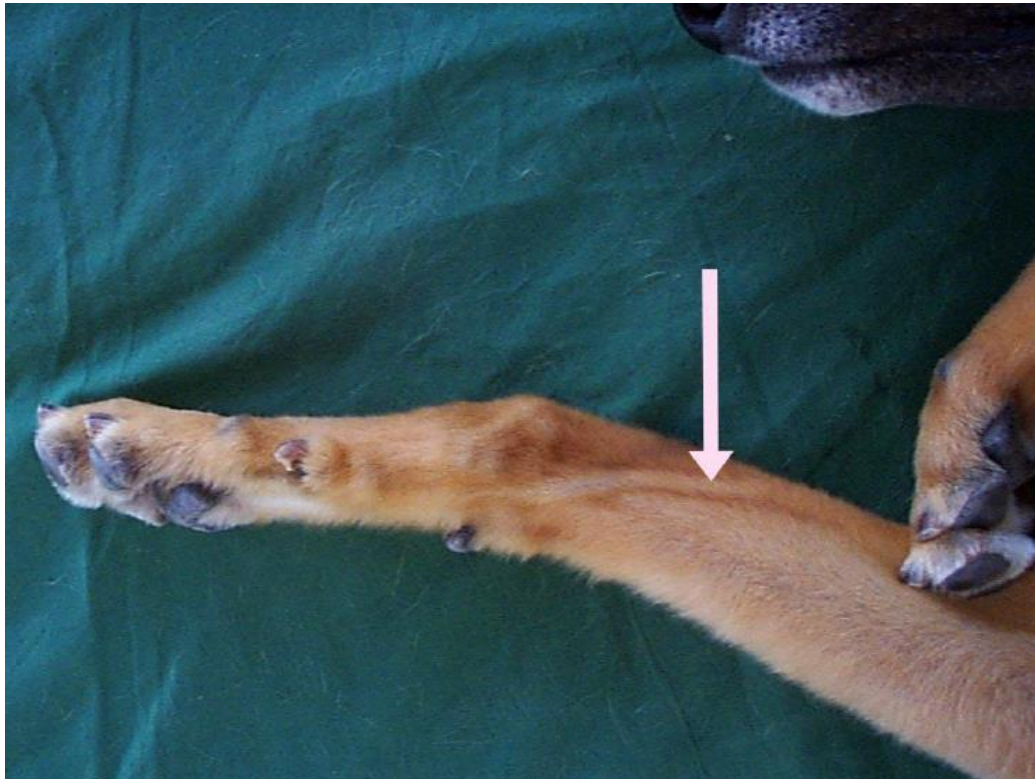


Region?  
Aspect?



# 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.



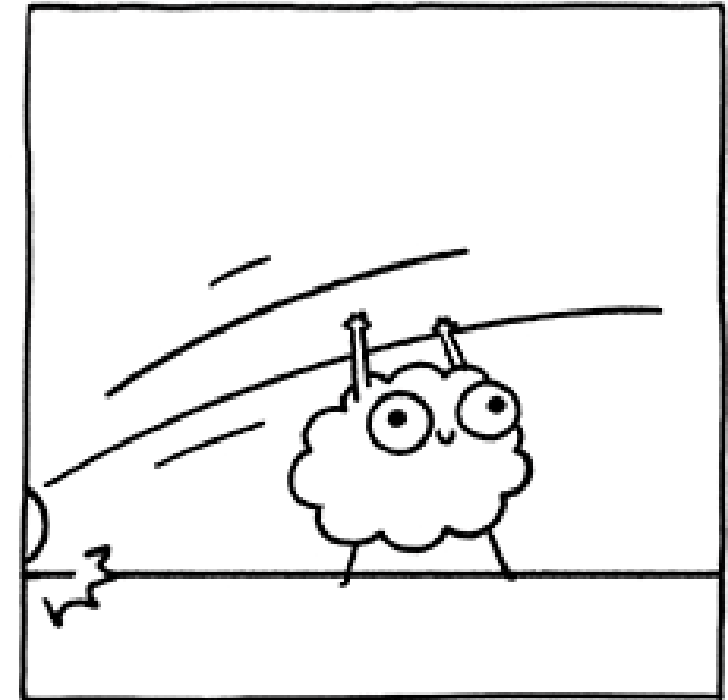
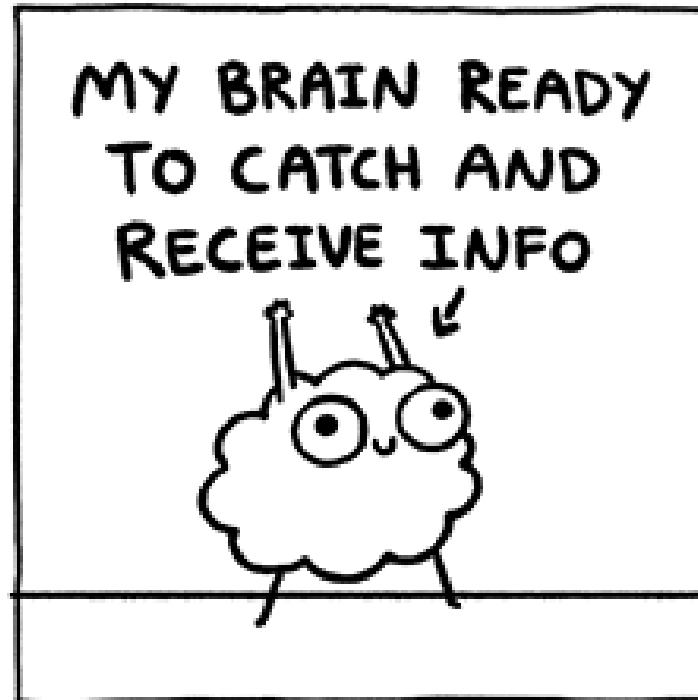


# Reference texts

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