Cells to Systems

LECTURE 5

THE LANGUAGE OF ANATOMY

LECTURER

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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 to enable meaningful, unambiguous communication.
- Apply correct terminology for normal and novel structures in a meaningful way, an essential skill for a veterinarian.

KEY WORDS

- Position terms: left/right; medial/lateral; ventral/dorsal; cranial/caudal/rostral; palmar/plantar; superficial/deep; proximal/distal; axial/appendicular; axial/abaxial.
- Planes: median; sagittal; transverse; dorsal.
- Movement terms: flexion/extension/hyperextension, adduct/abduct, supinate/pronate.
- Prefixes: epi; peri; endo; dia; meta; infra; sub; supra, ante, anti, ab; ad; hypo; hyper.
- Tissues: bones, joints, cartilage, muscles, ligaments, tendons, nerves, veins, skin.

LECTURE OVERVIEW

LECTURE NOTES

Anatomy is the study of the structure - the form, relations, and arrangement of tissues and organs, and function resulting from these relations. Knowledge of anatomy is essential to veterinary medicine. It is required for examining animals to determine what is normal and what is abnormal. It is required to accurately and safely take samples of blood or tissues for diagnosis. It is needed for surgery and injections of medication, and much more.

The word ‘anatomy’ derives from an ancient Greek word meaning ‘to cut’. Now, as in ancient Greece, dissection is a crucial part of learning anatomy. To make anatomy easier to learn, it can be divided into gross anatomy (visible structures) and histology (microscopic structures). Anatomy can also be divided into body systems or only consider anatomy present in a particular body region.

Anatomy gives names to all structures of the body and the many parts within these structures, as well as their positions and relationships. These names can be used to describe what you see and to follow written descriptions. Prior to 1985, many languages had their own terminology for each structure. This made it very difficult for clinicians and researchers around the world to communicate, as some structures had more than 10 different names. To remove ambiguity and improve clarity, veterinary anatomical language was internationally standardised.

The definitive list of veterinary anatomical names is found in the *Nomina Anatomica Veterinaria* (NAV, current revision 6th edition 2017), as well as the guidelines which dictate the accepted names.
The names in the NAV must follow these guidelines:

1. Aside from a very limited number of exceptions, each anatomical concept should be designated by a single term.
2. Each term should be in Latin in the official list, but the anatomists of each country are free to translate the official Latin terms into the language of instruction.
3. Each term should be as short and simple as possible.
4. The terms should be easy to remember and should have, above all, instructive and descriptive value.
5. Structures that are closely related topographically should have similar names. For example, Arteria femoralis, Vena femoralis, Nervus femoralis.
6. Differentiating adjectives should generally be opposites, as major and minor, superficialis and profundus.
7. Terms derived from proper names (eponyms) should not be used.

To summarise these guidelines, the term used to describe an anatomical structure is in **Latin** (or the local language translation), is **short**, **simple**, **easy to remember**, **descriptive** and **instructive**, and is the **only term for this structure** (ideally). If **differentiating adjectives** are used for two or more structures, they should be **opposite**. Structures **closely related in their anatomical position** should have **similar names**.

While the names used in veterinary anatomical structures or concepts are derived from many languages, the majority are derived from ancient Greek or Latin. Becoming familiar with the translations for frequently used medical words (in particular commonly used prefixes, suffixes, or tissue names) will usually help bring meaning and comprehension to the sea of new words you will encounter in the coming years. You do not need to know which language the words come from, but the origin of some words has been included below for your interest (Gr = Greek, L = Latin).

Below is a list of some commonly used tissue names in veterinary anatomy, but many more will be encountered.

- 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), -theium
- Blood — haem- (Gr/L - blood)

Some commonly used prefixes in veterinary anatomy, their origins and meanings, and examples of their use:

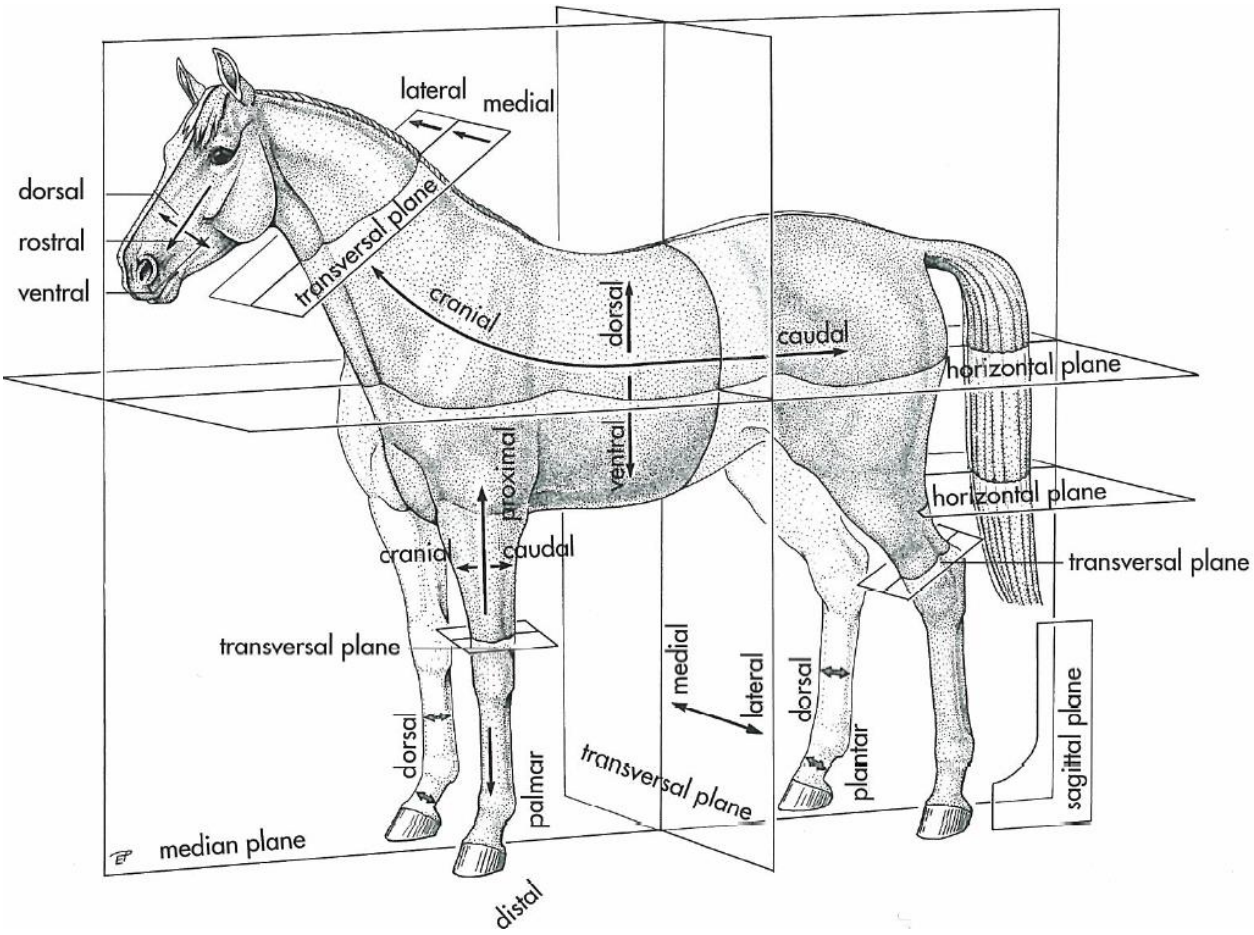
- Epi- (Gr – upon) epithelium, epiphysis
- Peri- (Gr – around) pericardium, periosteum
- Endo- (Gr – within) endothelium, endocrine
- Dia- (Gr – between) diaphragm, diaphysis
- Meta- (Gr – change/after) metabolism, metaphysis
- Supra- (L – above) supracondylar
- Infra- (L – beneath) infraspinous, infraorbital
- 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

The point of learning anatomical names and terms is to use them to communicate, so they are only useful if you can be correct in your use of these words. Like any language, this will require practice. Use anatomical terms when asking questions and practice describing the positions of structures to your fellow students. Translating anatomical descriptions into lay terminology will assist you in developing ways of communicating to clients as well as improving your understanding of the terminology.

DIRECTIONAL TERMS:

Being able to describe a structure, its relationship to structures nearby, and its function are much more important than being able to name the structure. Identification of a structure is possible using just position terms and a general descriptive term such as bone, muscle, tendon, ligament, nerve, vessel (or more specifically artery or vein), lymph node, and organ, as long as you can relate that structure to something that is more accurately identifiable. To describe the position and the tissue, you will need a bank of descriptive words.

Terms to describe direction in veterinary science are based on an upright, plantigrade (feet flat on the ground) stance.



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

The correct terms for describing anatomy of an animal are:

- Left and right (from the animal's perspective)
- Dorsal – towards the animal's back or 'dorsum'
- Ventral – towards the animal's belly or 'ventrum'
- Proximal (limbs and tail) – towards the junction to the body
- Distal (limbs and tail) – away from the junction to the body
- Cranial – towards the head (cranium, Gr = head)
- Caudal – towards the tail (cauda, L = tail)
- Medial – towards the 'centre' or 'middle' of the body, towards the median plane (see below)
- Lateral – towards the flank or side of the body, away from the median plane
- Superficial – towards the surface of the body
- Deep – away from the surface of the body
- External – towards or in the surface of the body
- Internal/inner – away from the surface of the body

For the carpus, tarsus, and all structures distal to these joints:

- Dorsal – the side of the distal limbs away from the ground, towards the dorsum
- Palmar – the 'palm', the side of the distal **forelimb** in contact with the ground
- Plantar - the side of the distal **hindlimb** in contact with the ground

For the digits:

- Axial – towards the central axis of the limb
- Abaxial (ab – L – away) – away the central axis of the limb

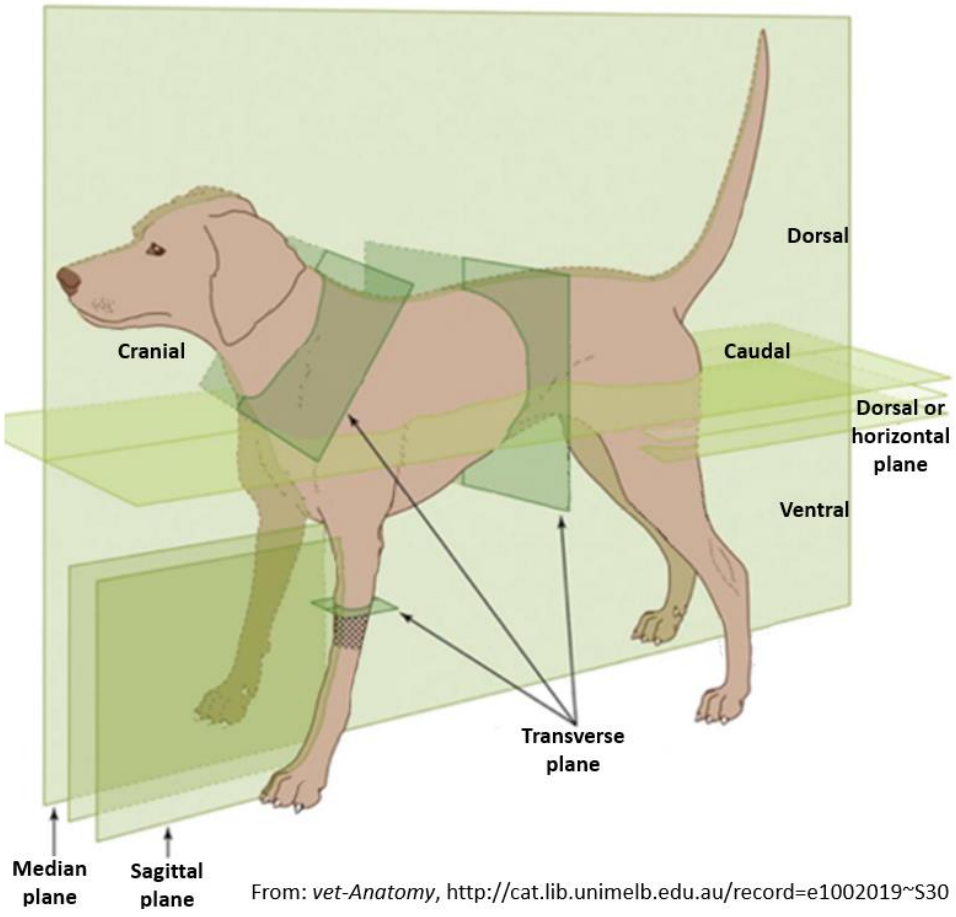
For the head:

- Rostral – towards the nose or 'rostrum'
- All other directional terms are the same i.e. dorsal and ventral, medial and lateral, superficial and deep, internal and external.
- Some features of the eyes and ears are the only structures where the human terms 'anterior', 'posterior', 'superior', and 'inferior' are applicable in veterinary anatomy.

BODY PLANES:

The planes of the body are 2-dimensional slices through the 3-dimensional body, which allows the body to be divided into different sections or allows us to view the arrangement of tissues in a certain slice. Understanding body planes is central to interpreting ultrasound, CT scans and MRI diagnostic images.

- Median plane – through the 'centre' or 'middle' of the body, creating equal left and right halves of the body.
- Sagittal plane – parallel to the median plane, dividing the body into unequal left and right parts.
- Transverse plane – through the body or limb at right angles to the long axis, creating cranial and caudal parts (on the body) or proximal and distal parts (on the limbs).
- Dorsal plane – through the body at right angles to both median and transverse planes, dividing the body into dorsal and ventral parts.

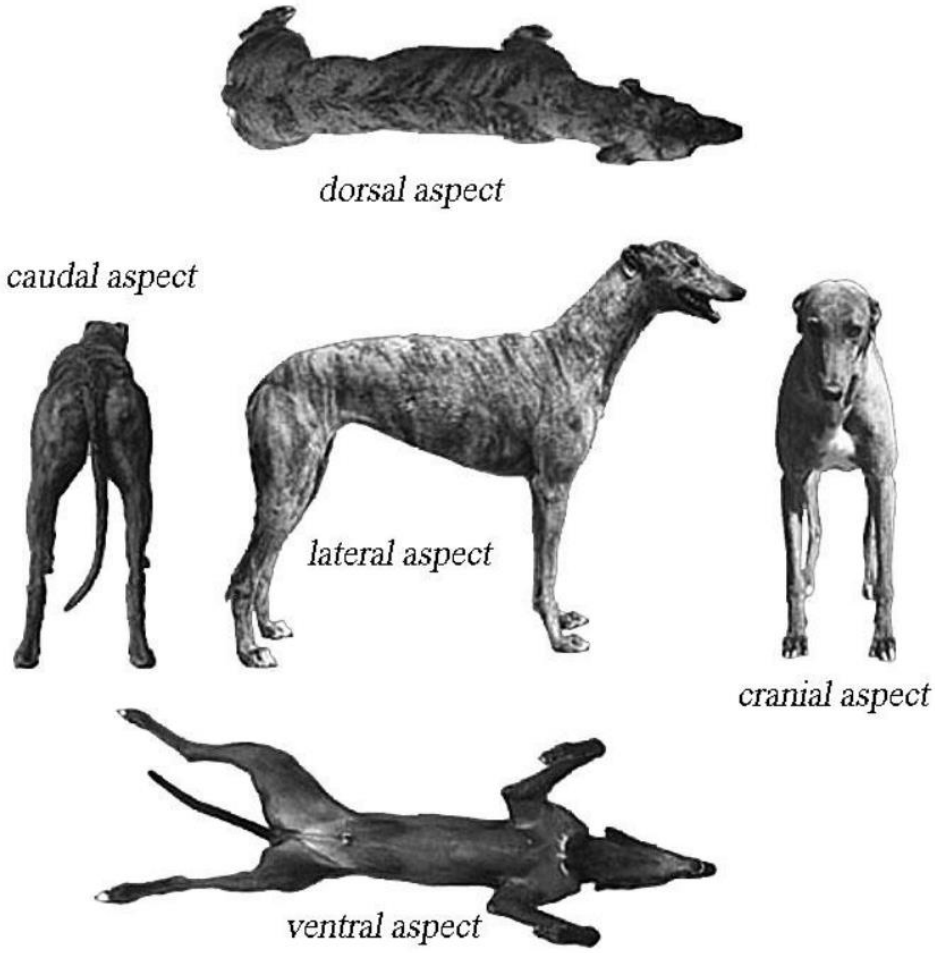


From: *vet-Anatomy*, http://cat.lib.unimelb.edu.au/record=e1002019~S30

A S P E C T S :

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 in an image). The aspect is named using the directional terms outlined above e.g. *cranial aspect* if you are viewing the front of the animal and it's cranium is closest to you.

The view might be angled and thus the description of the aspect will be a combination of two adjacent directions. For example, the horse in the directions diagram above is viewed from the craniolateral aspect.

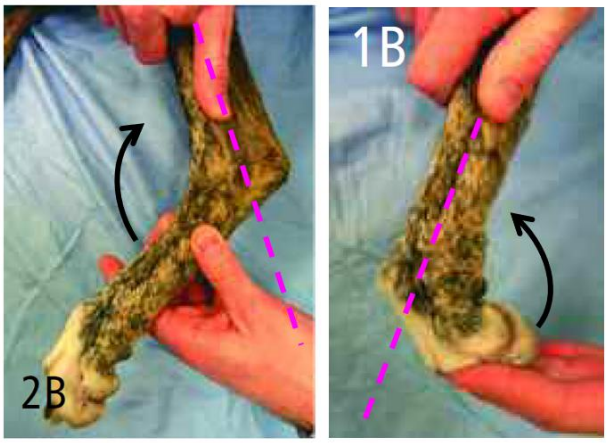


JOINT MOVEMENT:

We also need words to describe how a joint is moving. For this, we use the long axis of the limb as reference and determine if the angle between the two bones of a joint is getting smaller or increasing compared to this straight line.

- Flexion (L – to bend) - the angle between the bones at a joint becomes smaller.
- Extension (L – stretch out) - the angle between the bones at a joint approaches 180° (approaches the straight line of the limb axis)
- Hyperextension - a joint travels beyond 180° straight line of the limb axis in a continuation of the extension movement.
    - ‘hyper’ (Gr – over) + ‘extension’ (L - stretch out)

Flexion



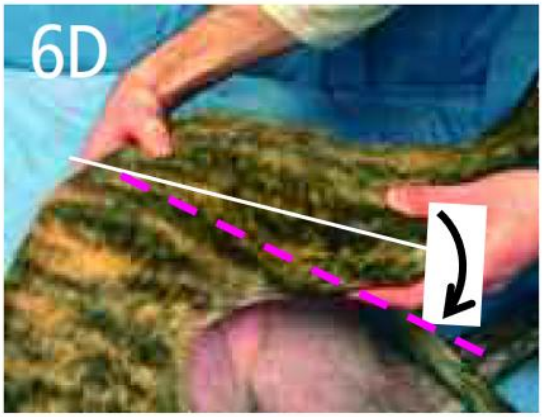
Extension

Hyperextension

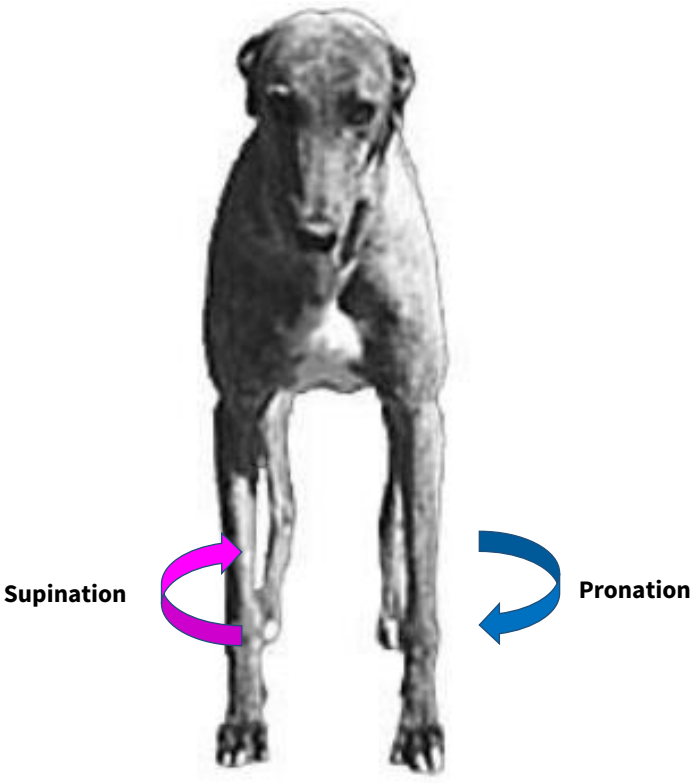
- Adduction – joint movement such that a limb moves towards the midline of the body
    - ‘ad’ (L – toward) + ‘duction’ (L – bringing)
- Abduction – joint movement such that a limb moves away from the midline of the body
    - ‘ab’ (L – away) + ‘duction’ (L – bringing)

Abduction

Adduction



- Pronation – rotation of the manus (‘hand’) or pes (‘foot’) so the palmar/plantar surface turns toward the ground
    - ‘pronate’ (L – lying face down)
- Supination – rotation of the manus (‘hand’) or pes (‘foot’) so the dorsal surface turns toward the ground
    - ‘supinate’ (L - lay on the back)



BUILDING A PICTURE OF THE BODY IN YOUR MIND:

If you identify the relative position and type of structure yourself whenever you encounter a new name, then you will be creating meaning for yourself in association with that word. In time, and with a great deal of practice, you will be able to build a complete picture of the body in this way.

It is much more important to be able to build this mental “picture”, than to remember the precise name of a specific structure. From such a mental picture, you may deduce a lot about the function of specific structures and hence develop ideas of how to approach problems that you may encounter in clinical practice. You will also be able to find the correct name from a textbook if you can follow a description in detail.

FURTHER READING

Nomina Anatomica Veterinaria – available online here.

Studdart. Gay & Hinchcliff, *Saunders Comprehensive Veterinary Dictionary*. Available as a downloadable e-book through the University library here.

Singh. *Dyce, Sack & Wensing’s Textbook of Veterinary Anatomy* (any edition). Link to its’ University library page here.

König & Liebich. *Veterinary Anatomy of Domestic Mammals* (any edition). Link to its’ University library page here.

Hermanson, de Lahunta & Evans. *Miller and Evans’ Anatomy of the Dog* (any edition). Available as an e-book through the University library here.