

Some Basic Definitions for Gross Anatomy in Domestic Mammals



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Introduction

In the study and daily work of any field of science it is necessary to understand the specialised terminology that is used. This can be especially true for some scientific areas, such as Anatomy, where terms of direction, position, and movement used to describe both the position of organs in relation to one another, or to body's regions, and the actions of muscles, are of maximum interest. Imagine a radiographic diagnosis with no clear information of light direction, or a necropsy report with poor data on organs' relative position. For this reason, technicians should know what these terms mean.

In Veterinary Medicine, anatomical terminology varies significantly from that of human medicine because professionals are concerned with quadruped animals rather than bipeds, such as humans. In Veterinary Anatomy, a system of terms has been developed for animals that eliminates some of the confusing terminology common to human and animal medicine, although some confusing terms still remain. In animal topography, a good example has been the virtual elimination of the words anterior and posterior. Anterior, in human anatomy, means toward the front of the body (where the mammary glands are in males and females), and posterior means toward the back of the body (where you can feel your backbone). In quadruped animals, the area where the mammary glands are located is on the ventral part of the body, and the backbone is on the dorsal aspect of the body. In veterinary medicine, the term used to mean "toward the front or head end of the body" is "cranial". The word "anterior" is conditionally used, as in the anterior chamber of the eye and the anterior pituitary gland.

The main purpose of this booklet is to provide the student with some major clues about animal topography. These notes concern domestic mammals, because the majority of practices undertaken in the University of Lleida include them. Avian terms have been excluded, as they do not come within the scope of this text. Other aspects, e.g. dental topography, will be extensively treated, as the authors think that they are especially important both for clinical and for age-diagnostic purposes. Some terms in colloquial Catalan have been included (as footnotes), because we think that professionals should know them for their job with shepherds and breeders, who evidently do not need to have a command of the technical terminology.

Objectives

- Begin to learn the terminology of animal anatomy (domestic mammals) in order to understand the descriptions of body parts and their relative positions to one another
- Be able to locate these various anatomical areas on an animal
- Understand the terms used to describe body planes and sections in order to understand anatomical sections of organs.

Directional terms and virtual planes

Anatomical directional terms come in opposing pairs (like cranial/caudal, proximal/distal, or dorsal/ventral) while virtual planes describe body cuts made in order to view exposed structures. Directional terms are used to describe relative position consistently within a body, independent of how it is oriented in the East/West, North/South world. In the following list, opposite directional terms are signalled with a ↔ symbol. A separate part will be devoted to legs, and mouth and teeth.

- Caudal:** Pertaining to the tail end of the body or denoting a position more toward the tail or rear of the body than some other reference point (body part). For example, the tail is caudal to the head. Caudal or caudally means towards the rear end or tail of the animal, i.e. away from the head. For eyes, anterior and posterior must be used instead of cranial and caudal, respectively ↔ cranial.
- Cranial:** More toward the cranium or head end of the body than some other reference point (body part). For example, the head is cranial to the tail. Cranial or cranially means towards the front of the animal, i.e. towards the head. This term (and "caudal", also) applies to the neck and trunk and to the limbs proximal to the carpus and tarsus ↔ caudal.
- Deep:** Situated far beneath the surface; not superficial. For example, the bones are deep to the skin ↔ superficial.
- Distal:** Farthest from the centre of the body relative to another body part, or a location on a body part relative to another closer location. For example, the tibia is distal to the femur, and the lower part of the humerus is the distal part ↔ proximal.
- Dorsal:** Pertaining to the back area, towards or near the back or vertebral column of the animal and the corresponding surfaces of the head, neck and tail. For example, the backbone is dorsal to the belly. Dorsum is a noun that refers to the back area of the body ↔ ventral.
- Frontal:** A plane that divides the body into dorsal/ventral halves.
- Inferior:** Below, underneath, directed below, or pertaining to that which is below. For example, the mouth is inferior to the nasal cavity ↔ superior.
- Lateral:** Denoting a position farther away from the median plane of the body or of a structure, on the side or toward the side away from the median plane, or pertaining to the side of the body or of a structure. For example, the lateral surface of the leg is the outside surface ↔ medial.
- Medial:** towards or near the median plane, i.e. closer to the median plane of the body or of a structure, toward the middle or median plane, or pertaining to the middle

or a position closer to the median plane of the body or of a structure. For example, the medial surface of the leg is the inside surface ↔ lateral.

- j) **Median plane:** it divides the body longitudinally into symmetrical right and left halves (left and right halves, equally divided). Body median plane can be described as the “line down the middle of the animal” from nose to tail.
- k) **Nuchal:** Pertaining to the end of the head ↔ rostral.
- l) **Oblique:** At an angle or pertaining to an angle. For example, the vein crossed obliquely from the upper left side down to the lower right side; abdominal oblique muscles.
- m) **Paramedian plane:** Parallel to the median plane and also dividing the body into left and right parts, but not equally.
- n) **Peripheral:** Pertaining to or situated near the outer areas or surface of the body or a structure. For example, the subcutaneous fat is peripheral to the muscle.
- o) **Proximal:** Nearest to the centre of the body relative to another body part, or a location on a body part relative to another more distant location. For example, the femur is proximal to the tibia, and the upper part of the humerus is the proximal part ↔ distal.
- p) **Rostral:** Pertaining to the nose end of the head or toward the nose. For example, the nose is rostral to the eyes. This term is used to describe the position of structures on the head ↔ nuchal.
- q) **Sagittal plane:** The same as a paramedian plane. A midsagittal plane is the same as the median plane¹.
- r) **Segmental:** Transverse.
- s) **Superficial:** Near the surface of the body; not deep. For example, the skin is superficial to the underlying muscle ↔ deep.
- t) **Superior:** Above, directed above, or pertaining to that which is above. For example, the nasal cavity is superior to the mouth ↔ inferior.
- u) **Transverse:** plane perpendicular to the long axis of the body or limbs, regardless of the position of the body or limb. It divides the body cranially and caudally, not necessarily in equal divisions. It also divides the leg into upper and lower parts, not necessarily in equal divisions.
- v) **Ventral:** Pertaining to the belly or underside, towards

or near the belly or lowermost surface of the body and the corresponding surfaces of the head, neck and tail. For example, the kidneys are ventral to the backbone. *Ventrum* is a noun that refers to the belly area of the body ↔ dorsal (Figures 1 & 2).

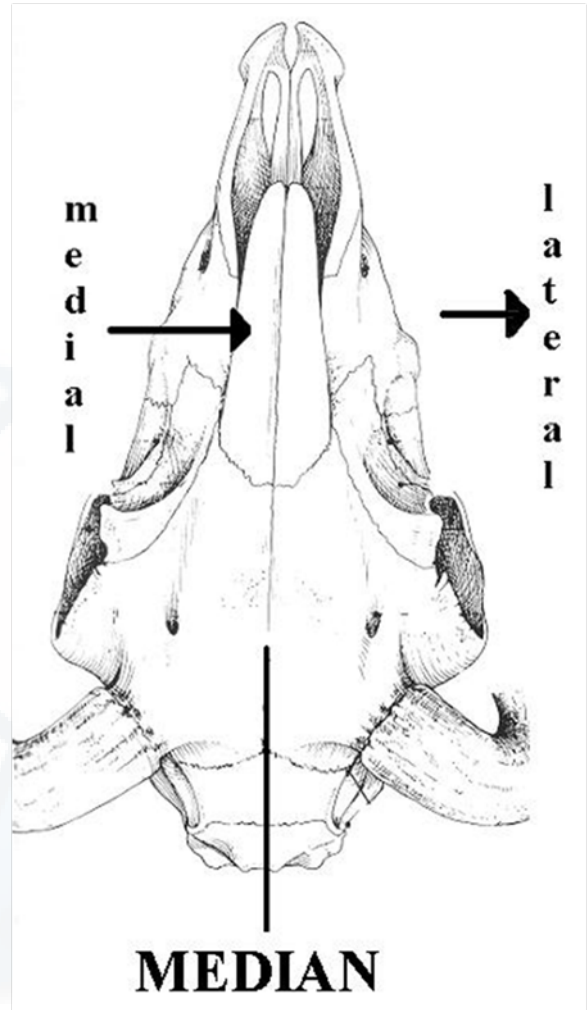


Figure 1: Directional terms and virtual planes.

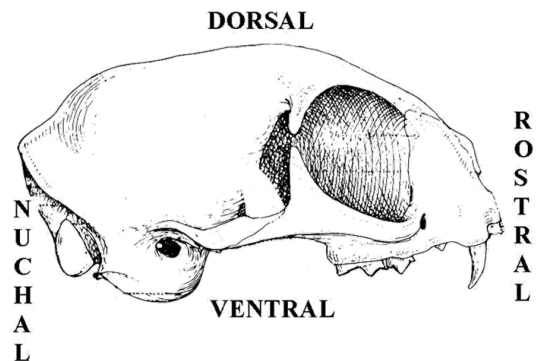


Figure 2: Anatomical directional terms of dorsal/ventral & Rostral/Nuchal.

¹Rigorously speaking, “sagittal” refers to the “antero-posterior” plane in humans, which is a confusing plane for quadrupeds. So, in my opinion, is better to reserve the term “sagittal” (and consequently “parasagittal”) to visceral planes, such as those referred to spleen, kidneys, and heart. A sagittal plane on this organs would produce a lateral and a medial halves, more or less equals, but not corresponding to the sides of the body.

Although most directional terms have the same meaning in human and veterinary anatomy, certain terms have special conflicting meanings in both, due, obviously, to differences between bipedal and quadrupedal stand. E.g. the quadruped head is oriented in the same direction as the rest of the body, while the human head is oriented with the face directed at a right angle to the rest of the body. So, for instance, *superior - inferior* for trunk in humans correspond to veterinary *cranial - caudal*, while *anterior - posterior* for trunk in humans correspond to veterinary *ventral - dorsal* (Figures 3 & 4).

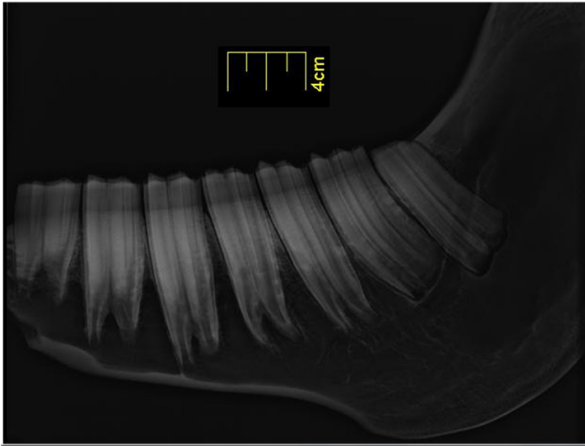


Figure 3: Lateral mandibular radiograph (horse) (procedence: Xavi Sánchez and Toni Argelich, from the Capellades Veterinarian Clinic).

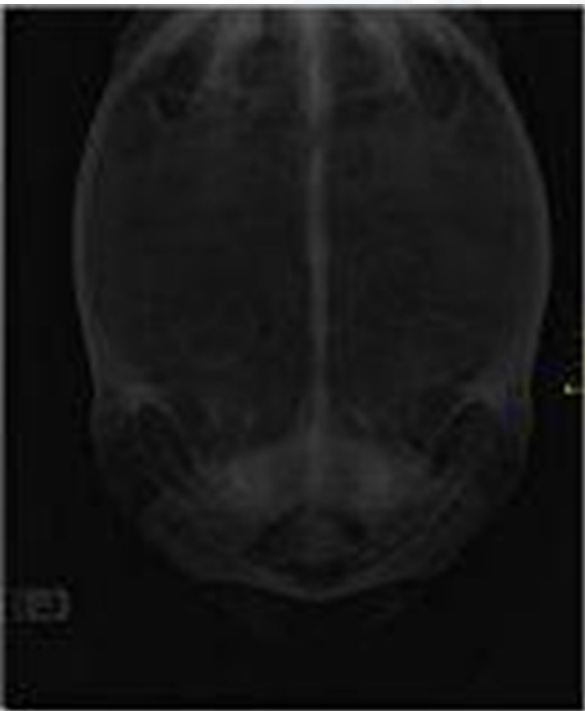


Figure 4: Ventrodorsal body radiograph (turtle) (procedence: Xavi Sánchez and Toni Argelich, from the Capellades Veterinarian Clinic).

Directional terms and virtual planes for legs

Apart from the previously seen terms, some specific words are used for legs:

- a. **Abaxial:** Lying outside the axis of the leg ↔ axial.
- b. **Appendicular:** Related to the limbs and their attachments to the axis of the body.
- c. **Axial:** Lying towards the axis of the leg ↔ abaxial.
- d. **Brachial:** Pertaining to the proximal area of the front legs of an animal, above the elbow joint.
- e. **Caudal:** For legs, pertaining to the back side of the leg above the carpus and tarsus.
- f. **Cranial:** For legs, meaning the front side of the leg above the carpus and tarsus.
- g. **Dorsal:** For legs it applies to the side of the leg opposite the palmar and plantar sides or, in other words, the front side of the leg from the carpus and tarsus distally (down).
- h. **Fibular:** lateral in position within the leg ↔ tibial.
- i. **Palmar:** The rear surface on the forefeet from the carpus to the phalanges. The opposite surface (i.e. the front surface) is the dorsal surface. This does not include the bottom surface of the front foot (solar) ↔ dorsal.
- j. **Patellar:** Pertaining to the patella or knee cap.
- k. **Plantar:** The rear surface of the hind leg from the hock to the phalanges. The opposite surface (i.e. the front surface) is the dorsal surface. This does not include the bottom surface of the hind foot (volar) ↔ dorsal.
- l. **Solar:** Denoting the part of the forelimb's foot in contact with ground (the bottom surface of the front foot) ↔ volar.
- m. **Tibial:** Denoting the medial aspect of the forelimb ↔ fibular.
- n. **Volar:** Denoting the part of the hindlimb's foot in contact with ground (the bottom surface of the hind foot) ↔ solar (Figure 5).

For extremities, one must remember the following zonal terms: *cingulum* - the incomplete bony ring, formed by the scapulae or the pelvis, which supports the fore or hindlimbs, respectively, attaching its appendicular skeleton to the axial skeleton-, *stylopodium* -the proximal intermediate segment of the limb skeleton, the humerus and the femur-, *zygopodium* - the distal intermediate segment of the limb skeleton (radius and ulna, tibia and fibula)- and *autopodium* -the distal major subdivision of a limb, composed of *basipodium* (carpus and tarsus), *metapodium* (metacarpus and metatarsus) and *acropodus* (phalanges)-.

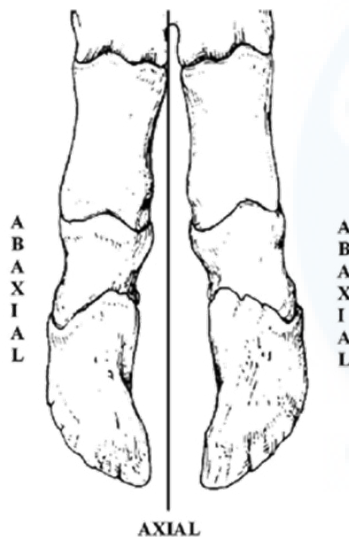
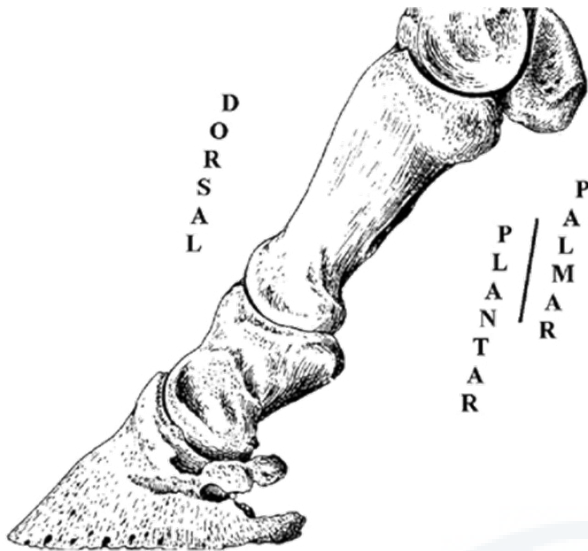


Figure 5: Directional terms and virtual planes for legs.

Denoting corporal areas

- i. **Abdominal:** Pertaining to the abdomen.
- ii. **Adjacent:** Next to, adjoining, or close to. For example, the tongue is adjacent to the teeth.
- iii. **Antebrachium:** The distal area of the front legs of an animal, below the elbow joint.
- iv. **Axial:** Related to the head, neck, and trunk or torso, the axis of the body.
- v. **Axillary:** Pertaining to the armpit area or on the medial aspect of where the front leg meets the torso.
- vi. **Cephalic:** Pertaining to the head.

- vii. **Cervical:** Pertaining to the neck area, the cervical vertebrae (the first 7 vertebrae in the dog and cat) or the region around these vertebrae, and to the cervix in the female's reproductive system.
- viii. **Coccygeal:** Pertaining to the tail or vertebrae of the tail, the coccygeal vertebrae.
- ix. **Cranium:** The head's bones, except jaw; skull.
- x. **Crural:** Pertaining to the rear legs of an animal (femur bone).
- xi. **Digital:** Pertaining to the area of the foot (phalanges).
- xii. **Frontal:** Pertaining to the forehead, or the area of the head above the eyes where the frontal bone and frontal sinuses are located.
- xiii. **Inguinal:** Pertaining to the groin or the medial aspect of the rear leg where it is attached to the body.
- xiv. **Lumbar:** Pertaining to the lumbar vertebrae (the part of the backbone between the thoracic vertebrae and the sacrum) or region around these vertebrae.
- xv. **Mammary:** Pertaining to the mammary glands.
- xvi. **Nasal:** Pertaining to the nose.
- xvii. **Oral:** Pertaining to the mouth.
- xviii. **Orbital:** Pertaining to the orbit.
- xix. **Pedal:** Pertaining to the foot.
- xx. **Pelvic:** Pertaining to the pelvis or hip bones (which are made up of four bones each: the ilium, ischium, pubic bone, and acetabular bone, which are joined in the middle by a symphysis of the right and left pubic bones).
- xxi. **Perineal:** Pertaining to the region between or surrounding the anus and the external genitalia (from tail to scrotal attachment or entire vulva).
- xxii. **Peritoneal:** Pertaining to the cavity inside the abdomen and the membrane (the peritoneum) that lines this cavity. The peritoneal cavity is the space inside the abdomen between the organs and the body wall.
- xxiii. **Pleural:** Pertaining to the cavity inside the chest and the membranes that line this cavity. The pleural cavity is the space inside the chest between the lungs and heart and the inside of the chest wall.
- xxiv. **Popliteal:** Pertaining to the caudal area or back of the true knee, the stifle joint, where the popliteal lymph node is located.
- xxv. **Pubic:** Pertaining to the bone located between the animal's rear legs, known as the pubic bone, which is part of the pelvis.
- xxvi. **Quadrants:** Arbitrary divisions of the abdominal cavity into four equal sections using the midabdominal transverse and median planes as the dividing lines.

- xxvii. Sacral:** Pertaining to the sacrum, the fused vertebrae by which the pelvis is attached to the backbone.
- xxviii. Scapular:** Pertaining to the scapula or the shoulder blade area.
- xxix. Skull:** bones of cranium (enclose cranial cavity) + bones of face (includes the mandible).
- xxx. Sternal:** Pertaining to the region of the sternum, or breastbone.
- xxxi. Thoracic:** Pertaining to the thorax or chest, the thoracic vertebrae (the part of the backbone between the cervical and lumbar vertebrae), or the region around these vertebrae.
- xxxii. Umbilical:** Pertaining to the umbilicus or navel (bellybutton).
- xxxiii. Vertebral:** Pertaining to the vertebrae or spinal column.

These anatomical, directional, and positional terms are the nomenclature used in veterinary radiography to describe views taken of the animal's body. If an animal is lying on its back in dorsal recumbency on an x-ray table, an x-ray beam would enter the ventrum of the animal and exit its dorsum prior to striking the cassette and film to produce a radiographic image. This view is called a ventral-dorsal view. The view is named according to how the x-ray beam penetrates the animal's body, in this case from ventral to dorsal. If we flip the animal over and put it in ventral recumbency, the view is dorsal-ventral. An x-ray entering the lateral side traversing to the medial side would be a lateral-medial, but for simplicity's sake it is just called a lateral or lateral view. An x-ray beam penetrating the front part of the leg and exiting the back part above the carpus or tarsus (hock) is called cranial-caudal. Below the carpus (and tarsus) and including the carpus (and tarsus), the view is called dorsal-palmar (or dorsopalmar) in the front leg, and dorsal-plantar (or dorsoplantar) in the rear leg. In large animals, oblique views of the lower leg are also obtained in addition to dorsopalmar and lateral. This is so a veterinarian can essentially view 360° around the leg radiographically. Therefore, a view taken at a 45° angle with the x-ray machine between the front and the lateral side of the front leg and the film on the inside back part of the front leg would be a dorsolateral palmaromedial oblique.

Anatomical Terms for the Mouth and Teeth

- A. Buccal:** Surface of the tooth that is next to the cheek. As a directional term, *buccal* means toward the cheek.
- B. Contact:** Surface of the tooth that is adjacent to the next tooth.
- C. Labial:** Surface of the incisor teeth that is next to the lips.
- D. Palatal:** Surface of the upper teeth that is next to the hard palate.

- E. Distal (teeth position):** Surfaces of the incisor teeth that are away from the middle or median plane of the mouth (the lateral surfaces), and the caudal surfaces of the canine, premolar, and molar teeth.
- F. Lingual:** Surface of the lower teeth that is next to the tongue. As an adjective, *lingual* means pertaining to the tongue.
- G. Mesial:** Surfaces of the incisor teeth that are toward the middle or median plane of the mouth (the medial surfaces), and the rostral surface of the canine, premolar, and molar teeth.
- H. Occlusal:** Surface of the tooth that makes contact with the opposing tooth. It is the chewing or biting surface. As a directional term, *occlusal* means toward the chewing or biting surface.

Adult mammals have four types of teeth²: incisors, canines, premolars, and molars³ (in rostro-nuchal order). According to eruption, dentition is classified as diphyodont, i.e. they have two sets of teeth, and monophodont. In the former, one must differentiate the temporary (deciduous, primary or "milk"⁴), and permanent (secondary or adult) teeth. The canine, first premolar and three molars have no deciduous precursors

Movements and position of the body

- i. Abduction:** Movement of a limb part away from the median plane (of the middle of the body, in the case of limbs; of the hand or foot, in the case of digits).
- ii. Adduction:** Movement of a body part toward the median plane (of the middle of the body, in the case of limbs; of the hand or foot, in the case of digits).
- iii. Circumduction:** Movement of a part, an extremity, in a circular direction.
- iv. Eversion:** Turning outward or inside out.
- v. Extension:** Straightening or the act of straightening, as with a joint.
- vi. Flexion:** The act of bringing the distal portion of a joint in continuity (although only parallel) with the long axis of the proximal portion.
- vii. Flexion:** The act of flexing or bending, bending of a joint to approximate the parts it connects; bending of the spine so that the concavity of the curve looks forward.
- viii. Pronation:** In ventral recumbency (with the ventral plane in a downfacing position).

²In Catalan these are feminine words: "les dents incisives", "les dents canines", etc.

³Queixals".

⁴"Dents de llet" or "primeres dents".

- ix. **Recumbent:** Lying down. A modifying term is used to describe the surface on which an animal is lying. For example, dorsal recumbency means the animal is lying on its back, face up. Ventral recumbency refers to an animal lying on its ventral surface, or its belly. If the animal is lying on its side, it is in lateral recumbency. On the right side, it is called *right lateral recumbency* and on the left side, *left lateral recumbency*.
- x. **Rotation:** Turning or movement of a body around its axis.
- xi. **Supination:** In dorsal recumbency (with the ventral plane in an upward position) (Figure 6).

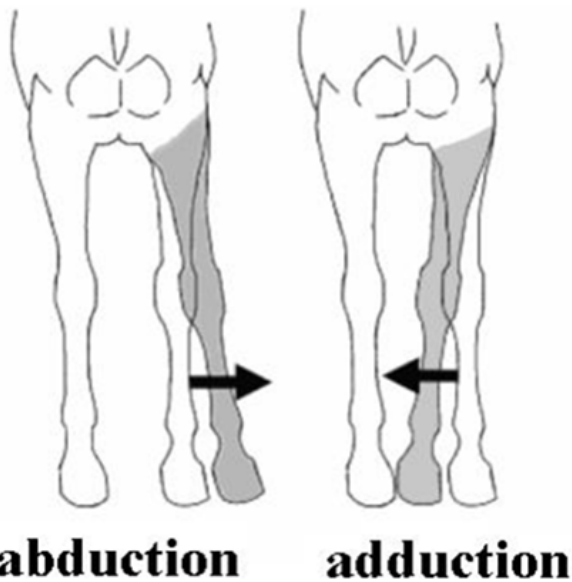


Figure 6: Movements and position of the body.

Colloquial Anatomical Terms for large ungulates

One must know some colloquial anatomical terms that sometimes are needed to be understood by non-professional people (owners, breeders...).

- 1) **Brisket:** Mass of connective tissue, muscle, and fat covering the cranioventral part of the ruminant chest between the forelegs.
- 2) **Cannon bone:** Third and fourth metacarpal (metatarsal) of the ruminant (not commonly used); also called the shin bone.
- 3) **Coffin bone:** Distal interphalangeal joint (joint between the short pastern and coffin bones [phalanges II and III, respectively]) in ungulates.
- 4) **Crest:** Dorsal margin of the neck.
- 5) **Dewclaw:** Accessory claw of the ruminant foot that projects caudally from the fetlock.

- 6) **Dewlap:** Loose skin under the throat and neck, which may become pendulous in some breeds.
- 7) **Dock:** Solid part of the tail.
- 8) **Elbow:** Forelimb joint formed by distal humerus, proximal radius, and proximal ulna.
- 9) **Eye socket:** The orbit.
- 10) **Fetlock joint:** Metacarpophalangeal and metatarsophalangeal joint (joint between the cannon bone and the long pastern bone [phalanx I]) in ungulates.
- 11) **Flank:** Side of the body between the ribs and ilium.
- 12) **Forearm:** Part of the foreleg supported by the radius and ulna, between the elbow and knee.
- 13) **Forehead:** Region of the head between the eyes and ears.
- 14) **Heart girth:** Circumference of the chest just caudal to the shoulders and cranial to the back.
- 15) **Heel:** Caudal region of the hoof that has an area of soft tissue called the bulb.
- 16) **Hock:** Tarsal joint.
- 17) **Hoof:** Hard covering of the digit in ungulates.
- 18) **Hard:** Horny outer layer of the covering of the digit in ungulates.
- 19) **Hooks:** Protrusion of the wing of the ilium on the dorsolateral area of ruminants.
- 20) **Knee:** Carpus in ungulates.
- 21) **Loin:** Lumbar region of the back, between the thorax and pelvis.
- 22) **Muzzle:** Two nostrils (including the skin and fascia) and the muscles of the upper and lower lip.
- 23) **Paralumbar fossa:** Hollow area of the flank whose boundaries are the transverse processes of the lumbar vertebrae (dorsally), the last rib (cranially), and the thigh muscles (caudally).
- 24) **Pastern joint:** Proximal interphalangeal joint (joint between the long and short pastern bones [phalanges I and II, respectively]) in ungulates.
- 25) **Pins:** Protrusion of the ischium bones just lateral to the base of the tail in ruminants.
- 26) **Poll:** Top of the head; occiput; nuchal crest.
- 27) **Quarter:** One of the four glands in the cow's udder.
- 28) **Shoulder:** Region around the large joint between the humerus and scapula.
- 29) **Sole:** Bottom of hoof.

- 30) **Stifle joint:** Femorotibial and femoropatellar joint in quadrupeds (“the true knee”).
- 31) **Switch:** Tuft of hair at the end of the tail.
- 32) **Tail:** Caudal part of the vertebral column extending beyond the trunk.
- 33) **Tail head:** Base of the tail where it connects to the body.
- 34) **Teat:** Nipple of mammary gland.
- 35) **Toe:** Cranial end of the hoof.
- 36) **Udder:** Mammary gland.

Teeth: the Triadan system

The Triadan method for identifying individual teeth is increasingly used in veterinary dentistry and has many advantages. The quadrants are numbered from 1 to 4 in a clockwise direction, beginning at the right maxillary quadrant. However, for deciduous teeth, these same quadrants can be numbered differently. For example, the first maxillary equine deciduous cheek tooth (Triadan 508) is replaced at about 2.5 yr of age by its permanent successors, Triadan 108.

The occlusal surface of the rows of cheek teeth in horses is not level as occur in some other species; instead, the surface of the last three cheek teeth curves upward in the caudal direction (“curve of Spee”). This curvature is most marked in Arab-type breeds, which often have a similar curvature on their dished nasal and frontal bones. A marked curve of Spee can also be present in some other smaller breeds. It is important that, during oral examination, this normal feature is not mistaken for an overgrowth of Triadan 311 and Triadan 411, which if mistakenly “reduced” will expose their pulp cavity.

In male horses, the canine tooth (*dens lupinus*) is termed “tush”⁵, which is normally more developed in maxillary piece. In ruminants it is commonly accounted as a fourth incisor (Figure 7).

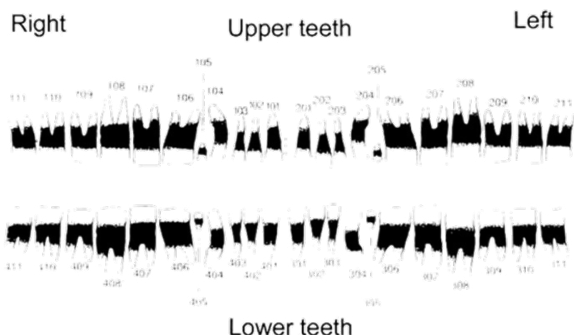


Figure 7: The Triadan system of equine dental nomenclature.

⁵“Ullals”, with no differentiation between maxillary and mandibular teeth, or species, except for boars, for which the term “dent queixalera” can be used.

The Triadan system of equine dental nomenclature

Dental nomenclature

The occlusal or masticatory surface is the area of tooth in contact with the opposing teeth. The term crown refers to the enamel-containing part of the tooth and, in brachyodont teeth, refers to the enamel covered, erupted aspect of the tooth. However, in young horses, most of the dental crown is unerupted or reserve crown. The short portion of the crown visible in the equine oral cavity is termed the clinical or erupted crown. Coronal is used as a term relating to the direction toward the occlusal surface. Apex (apical region) refers to the area of tooth furthest away from the occlusal surface, i.e. the area where the roots develop, and the term apical also refers to the direction opposite to coronal. Lingual refers to the medial aspect (area closest to the tongue) of the lower teeth, while palatal refers to the same (medial) aspect of the upper teeth. Buccal refers to the lateral aspect (aspect closest to cheeks) of both upper and lower (cheek) teeth, while labial refers to the rostral and rostro-lateral aspect of teeth close to the lips (incisors only in horses). The term interdental (interproximal or proximal) refers to the aspects of teeth that face the adjoining teeth in the same row. The term mesial (in a direction toward 01s) and distal (in a direction toward 11s) is used to refer to the position of teeth in species that have a true dental arch. However, it is an inappropriate term for use on the cheek teeth of horses that have a large interdental space (i.e. between the incisors and cheek teeth, “bars of the mouth”) and whose cheek teeth are in straight rows rather than an arch. Therefore, the terms rostral and caudal are more appropriate to refer to the position of the cheek teeth in the cheek teeth rows. However, the terms mesial and distal must be used with equine incisors, which do form a true arch.

By definition, the term tooth root specifically refers to the apical area that contains no enamel. At eruption, hypsodont teeth have no true roots - these begin to develop about a year or so later.

The term apical is a much more appropriate term for this area of hypsodont teeth that, for example, commonly develop apical infections of the mandibular second and third cheek teeth even before the development of any roots. This is why the term “tooth root abscess” must be considered inappropriate in such cases.

Basic word structure

Most anatomical terms can be deciphered by breaking them down to their roots. Root word - the foundation of the word - may change to a combining form to link words. The most common word prefixes and suffixes seen in veterinary practice are listed in the tables below.

Common prefixes

A prefix is found at the beginning of a word. It has a general meaning in itself. E.g. *endo* means “within”, but when

combined with another word it gives a specific meaning: *endometrium* meaning literally “in the inner lining uterus”. (Table 1)

Other interesting terms are *circa*, about (like in *circadian*, a daily rhythm or daily occurrence) and *circum*, around (like in *circumference*). Some words simply have a meaning that can be used within a word, e.g. *genesis* means “creation or origination”. Thus *carcinogenic* means that something “creates” a neoplasm; similarly, *pathogenic* means “causing disease”.

Common suffixes

A suffix is found at the end of a word, e.g. *-aemia* in *ischaemia*. Suffixes have a general meaning, e.g. *aemia*

means related to blood, but when added to a word it becomes specific: *ischaemia* meaning reduced or deficient blood supply (Table 2).

Common roots of words

The root of a word is the essence of its meaning. The root often refers to the organ, structure or disease in question: the root *hepato* relates to liver, and *pneumo* relates to the lungs. They are often derived from the Latin or Greek vocabulary (Table 3).

Combining forms (Table 4)

Terminology frequently used to designate body parts of organs: inverse list (Table 5)

Table 1: Common prefixes.

Prefix	Meaning	Examples
A-, ab-, as-	Without; not; off, away	Agalactia (“condition of no milk”)
Ad-	Toward, near	Adduct (“to draw toward the median”)
Amb-, ambi-	Both	Ambidextrous (“both right”)
Amphi-	On both sides	Amphiarthrosis (“joined on both sides”)
An-	No, not	Anaemia (“without blood”)
Ana-	Up, apart	Anatomy (“process of cutting apart”)
Ant-, Anti-	Working against; counteracting	Antibiotic (“against life”)
Ante (also Pre-)	Before	Antebrachium (the area of the front legs that is found between the elbow and the carpal joints)
Auto-	Self	Autonomic (“pertaining to ones nerves”)
Bili-	Pertaining to bile	Biliary (“pertaining to the bile”)
Brady-	Slow	Bradycardic (“slow heart”)
Cardi-, cardio-	Relating to the heart	Cardiac (pertaining to the heart)
Cervico-	Relating to the neck	Cervical (pertaining to the cervical region)
Co-	Work together	Coagulant (work together to form clot)
Con-	Together with	Concussion (together with blow)
Contra-	Against, proposed	Contralateral (against the side)
Cyto-	A cell	Cytology (the study of cells)
Di-	Twice	Diarticular (two joints)
Dia-	Through, complete	Diagnose (Knowledge of a condition)
Dialy-	To separate	Dialysis (to separate, break apart)
Dys-	Difficult; impaired	Dyscrasia
En-	Inward	Encephalic (in the head)
Endo-	Within, inner	Endocrine (secrete within)

Epi-	Upon; outside of	Epidermis (pertaining to the skin above)
Erythro-	Red	Erythrocyte (red blood cell)
Ex-	Out	Excise (to cut out)
Exo-	Outside of, outward	Exogenous (pertaining to outward production)
Extra-	Outside of; in addition to	Extra-label (outside of the label: use of a drug in a way or for a purpose not specified on the label)
Fibro-	Relating to fibres	Fibrosarcoma (fibre cancer)
Gaster-, gastr-, gastro-	Pertaining to the stomach	Gastrotomy (cut in the stomach)
Hemi-	Half	Hemilaminectomy (removal of half the lamina)
Hemo- (US), Haemo- (Brit)	Relating to the blood	Haemogram (blood report/graph)
Hyper-	Excessive; increased	Hyperthyroidism (an overactive thyroid gland)
Hypo-	Decreased; deficient; beneath	Hypothyroidism (an underactive thyroid gland)
Homeo-	Denoting likeness or resemblance	Homeopathy (the study of like diseases)
Homo-	Same, similar	Homogeneous (generated the same)
Hyal-	Clear, transparent	Hyaline (clear, transparent)
Hyper-	Excessive, above	Hypertrophic (pertaining to excessive food)
Hypo-	Below, deficient	Hypothyroid (deficient thyroid)
Idio-	Relationship to one's self or something separate and distinct	Idiopathic (pertaining to a disease)
In-	Not, in, inside with	Ingesta (material within)
Infra-	Below	Infraorbital (pertaining to below the eye)
Intra-	Within	Intrauterine (within the uterus)
Iso-	Equal, alike	Isometric (equal measure)
Karyo-	Relating to a cell's nucleus	Karyocyte (nucleated cell)
Medi-	Middle	Mediastinum (middle of the sternum)
Omni-	All	Omnivore (one that eats all)
Para-	Besides	Parathyroid gland (the name for glands that are located on the top of the thyroid gland)
Peri-	Around; in the region of	Perivascular (pertaining to around a vessel)
Post-	After; behind	Postsurgical (after surgery)
Poly-	Many; much	Polygastric (having more than one compartment to the stomach)
Pre-, Pro-	Before, in front of, favouring	Prognathism (condition before the jaw)
Pseudo-	FALSE	Pseudopregnancy (false pregnancy)
Pyo-	Pus	Pyorrhoea

Re-	Back	Recheck (check back)
Retro-	Behind	Retrograde (going backward)
Semi-	Half	Semicircular (half circle)
Steato-	Fatty	Steatitis (fat inflammation)
Sub-	Under, near	Submandibular (under the mandible)
Supra-	Cranial above, on top of relative position	Supra-cardinal vein
Syn-	Joined together	Synarthrosis (joint joined together)
Tachy-	Rapid	Tachycardia (an abnormally fast heartbeat)
Trans-	Across, over, through	Transplacentally (across or through a placenta)
Un-	Not, reversal	Unconscious (not conscious)

Table 2: Common suffixes.

Suffix	Meaning	Examples
-able, -ible, -ble	The power to be	Palpable (the power to feel)
-ac	Pertaining to	Cardiac (pertaining to the heart)
-aemia (Brit)	Relates to the blood	Ischaemia (deficiency of blood in a localised area of tissue)
-al	Pertaining to	Neural (pertaining to a nerve or nerves)
-algia	Pain	Arthralgia (pain of the joint)
-ase	Forms the name of an enzyme	Asparaginase (enzyme)
-blast	Designates a cell or structure	Myeloblast (bone marrow cell)
-cele	Denoting a swelling	Sialocele (swelling of the salivary gland)
-centesis	Puncture or aspiration	Cystocentesis (puncture of a cyst)
-cyte	Cell	Erythrocyte (red blood cell)
-ectomy	Surgical removal	Lumpectomy (excision of a lump)
-emia (US)	Blood condition	Lipemia (fat in the blood)
-esthesia (US), -aesthesia(Brit)	Denoting sensation	Anaesthesia (without sensation)
-gene, -genesis, -genetic, -genic	Giving rise to; causing, producing	Angiogenesis (blood vessel origin)
-gram	A tracing, a mark	Echocardiogram (echo tracing of the heart)
-graph	A writing, a record	Electrocardiograph (record of electrocardiogram)
-ia/iasis	Denoting a condition or pathologic state	Leucopenia (decreased white blood cells), atelectasis (condition collapsed lung)
-ic	Pertaining to	Gastric (pertaining to the stomach)
-ist	One who specialises in	Nephrologist (person specialising in kidneys)

-itis	Inflammation	Pancreatitis (inflammation of the pancreas)
-logy	Process of study	Zoology (the study of animals)
-lysis	Separation	Autolysis (the breakdown of animal tissue by the action of enzymes contained in the tissue affected; self-digestion)
-oid	Denoting form or resemblance	Opioid (like an opiate)
-oma	Neoplasm, mass	Haematoma (mass of blood)
-opsy	View of, vision	Necropsy (viewing of a deceased body)
-osis	Abnormal condition	Proptosis (abnormal forward placement of the eye)
ostomosis, ostomy, -stomy	Surgical opening	Gastrostomy (opening the stomach)
-plasty	Surgical repair	Rhinoplasty (shaping the nose)
-rhagia, -rhagic	Denoting discharge, usually bleeding	Haemorrhagic (bloody discharge)
-rhaply	Meaning suturing or stitching	Gastrorhaphy (surgical repair of the stomach by suture)
-rhea	Meaning a flow or discharge	Diarrhoea (rapid flow of faecal matter)
-scope	Instrument to visually examine	Endoscope (instrument used to view something within)
-scopy	Visual examination	Gastroscopy (visual examination of the gastrointestinal tract)
-sis	State of condition	Prognosis (forethought of knowledge)
-tome, -tomy	Instrument to cut, process of cutting	Osteotome (instrument that cuts bone)

Table 3: Common roots of words.

Suffix	Meaning
Arthr(o)	Joint; articulation
Broncho	Relating to bronchi
Cardi(o)	Heart
Chondro	Cartilage
Cyst(o)	Bladder
Dermat(o)	Skin
Gloss(o) (also lingual)	Tongue
Haemat(o)/Haem(o) (Brit), Hemat(o)/Hem(o) (US)	Blood
Hepat(o)	Liver
Hist(io/o)	Tissue
Laryngo	Pertaining to the larynx
Mamm(o) (also masto)	Mammary gland
Metra (also metro)	Uterus

Myelo	Pertaining to the spinal cord or bone marrow
Myo-	Muscle
Neur(o)	Nerve
Opthalm(o)	Eye
Odonto	Teeth
Orchi	Testis (testicle)
Oste(o)	Bone
Ovari(o)	Ovary
Pneum(o)	Lung; air or gas
Ren-	Kidney
Rhin(o)	Nose
Splanchno ⁶	Viscera
Tric(o)	Hair
Vas(o)	Vessel; duct

⁶Not *splachno*. Not related to spleen, “melsa”

Table 4: Combining forms.

Root	Meaning	Example	Definition of example
Aer-, aero-	Denoting gas	Aerophagic	Condition of gulping air, filling the stomach with air
Alge-, algesi-,	Relating to pain	Analgesia	Without pain
Anomalo-	Denoting irregularity	Anomaly	An irregular finding
Arthro-	Relating to joints	Arthrodesis	Fusion of a joint
Brevi-	Short	Abbreviate	Very short, shortened
Celio-	Denoting the abdomen	Celiotomy	Incision in the abdomen
Chol-, chole-,	Relating to bile	Cholestasis	Stoppage of the bile flow
Chrom-, chromo-	Relating to colour	Chromatophilic	Likes colour (takes up stain well, i.e. cells)
Cranio-	Relating to the cranium, of the	Craniotomy	A cut in the cranium
Cryano-, cryo-	Denoting cold	Cryosurgery	Surgery performed by freezing (with liquid
Crypt-	To hide, a pit	Tonsillar crypt	Pocket of skin where the
Cyano-	Dark blue	Cyanobacteria	Photosynthesizing bacteria esp. in water
Cyclo-	Pertaining to a cycle	Acyclic	Without a cycle
Cysto-	Relating to a sac or cyst	Cystotomy	Incision in a cyst (usually denoting the urinary bladder)
Cyto-	Denoting a cell	Cytology	The study of cells
Dacryo-	Pertaining to the lacrimal glands	Dacryosyrinx	Lacrimal duct

Dactylo-	Relating to digits	Polydactyly	Many digits (i.e. 6-toed cats)
Dent-, dento-,	Relating to teeth	Dental	Pertaining to the teeth
Derma-,	Relating to the skin	Dermatophytosis	Condition of skin fungus
Desmo-	Relating to a bond or ligament	Desmitis	Inflammation of a ligament
Dextro-	Right	Dextroversion	Version of the right, (i.e. movement of eyes to the
Diplo-	Double, twofold	Diploid	Resembling a double or two of the same
Dorsi-, dorso-	Referring to the back	Dorsal	Pertaining to the vertebral column
Duodeno-	Relating to the duodenum	Duodenoscopy	Observing the duodenum
Electro-	Relating to electricity	Electrocautery	Burning by electricity (or coagulating)
Encephalo-	Denoting the brain	Encephalitis	Inflammation of the brain
Entero-	Relating to the intestines	Enterotomy	Incision in the intestines
Eso- (US), Oeso- (Brit)	Inward	Oesophagus	Structure that brings the food inward
Facio-	Relating to the face	Facial	Pertaining to the face
Gero-, geronto-	Denoting old age	Geriatric	Pertaining to the aged
Gingiva-	Relating to the gingiva or gum	Gingivitis	Inflammation of the gingiva
Gloss-, glosso-	Relating to the tongue	Hypoglossal	Under the tongue
Gluco-	Denoting sweetness	Glucosuria	Glucose in the urine
Glyco-	Relating to sugar	Glycosuria	Glucose in the urine
Gnath-,	Denoting the jaw	Prognathic	Having a protruding jaw
Hist-, histio-, histo-	Relating to a tissue	Histopathology	Microscopic examination of tissue for disease (what you do to a biopsy)
Hydr-, hydro-	Denoting water	Hydrocephalic	"Water" on the brain (excessive fluid retention in the cranium)
Ileo-	Pertaining to the ileum	Ileocecal	The area where the ileum joins the cecum
Ipsi-	Meaning self	Ipsilateral	On the same side
Irido-	Relating to a coloured circle	Iridiodialysis	Separation or loosening of the iris from its attachments
Iso-	Equal	Isometric	Measures the same
Jejuno-	Pertaining to the jejunum	Jejunostomy	Surgically created an opening in the jejunum
Kerato-	Relating to the	Keratoconjunctivitis sicca	Inflammation and drying of the cornea and conjunctiva
Labio-	Pertaining to the lips	Labial	Pertaining or toward the lips
Lacto-	Relating to milk	Agalactia	Not producing milk
Laparo-	Pertaining to the loin or flank	Laparoscopy	Visualisation of the abdominal cavity

Latero-	Pertaining to the side	Lateral	Pertaining to the side
Leido-, leio-	Smooth	Leiomyosarcoma	Sarcoma of the smooth
Leuk-, leuko- (US), Leuc-, leuco- (Brit)	Denoting deficiency of colour	Leucocyte	“White” blood cell
Lip-, lipo-	Pertaining to fat	Lipoma	Fatty tumour
Litho-	Denoting a calculus	Urolith	Urinary stone
Macr-, macro-	Large, long	Macrocytic	Large cells
Masti-, mastro-	Relating to the breast	Mastitis	Inflammation of the breast tissue
Meg-, mega-	Great, large	Splenomegaly	Enlarged spleen
Meningo-	Denoting membranes, covering the brain	Meningioma	Tumour of the spinal membranes
Micr-, micro-	Small in size or extent	Microscopic	Unable to be seen by the naked eye
Mono-	One	Monochrome	One colour
Morpho-	Relating to form	Morphologic	Pertaining to the shape of something
Multi-	Many	Multipara	Many viable births (i.e. as in cats)
My-, myo-	Relating to muscle	Myotomy	Incision of a muscle
Myc-, mycet-	Denoting a fungus	Mycotic	Pertaining to fungus-like appearance
Myringo-	Denoting tympani or the eardrum	Myringectomy	Excision of the eardrum
Myx-, myxo-	Pertaining to mucus	Myxovirus	Synonym for influenza virus (mucus virus)
Naso-	Relating to the nose	Nasopharyngeal	Pertaining to the area where the nose and pharynx meet
Necro-	Denoting death	Necrotic	Pertaining to dead tissue
Neo-	New	Neoplasm	New growth
Nephr-, nephro-	Denoting the kidney	Nephrotoxin	Toxic to the kidney
Normo-	Normal or usual	Normovolaemia	Normal blood volume
Oculo-	Denoting the eye	Oculomotor	Nerve that controls eye
Onco-	Denoting a swelling or mass	Oncology	The study of masses
Onycho-	Relating to the nails	Onychectomy	Declaw (removal of toenail)
Oo-	Denoting an egg	Oocyst	Egg cell
Opisth-, opistho-	Backward	Opisthotonos	A form of spasm in which the head and tail are bent dorsally and the abdomen bent
Ophthal-, ophthalmo-	Pertaining to the eye	Ophthalmoscope	Instrument to examine the eye
Optico-	Relating to vision	Optical	Pertaining to the ability to see
Orchi-, orcho-	Relating to the testes	Orchiectomy	Removal of the testes
Oro-	Relating to the mouth	Oronasal	Where the mouth meets the nasal passages
Ortho-	Straight, right	Orthopaedic	Practice of correct function of the skeletal system

Osteo-	Relating to the bones	Osteoporosis	Pathological loss of bone
Ot-, oto-	Denoting an ear	Otoscopy	Visual exam of the ear
Patho-	Denoting disease	Pathology	The study of disease
Pedia-, pedo- (US), paedia-,	Denoting a child or	Paediatrics	Pertaining to the study of the young/child
Perineo-	Combining form for the region between the anus and scrotum or vulva	Perineum	The region between the anus and scrotum or vulva
Phago-	Denoting a relationship to eating	Phagocytosis	The "eating" of cells or absorption of cells
Pharyngo-	Pertaining to the pharynx	Pharyngotomy	Incision in the pharynx
Phleb-, phlebo-	Denoting the veins	Phlebitis	Inflammation of the veins
Phot-, photo-	Relating to light	Photoperiod	Period of light
Pilo-	Relating to hair	Piloerection	Hair standing on end
Plasmo-	Relating to plasma or the substance of a cell	Plasmacyte	Plasma cell
Pneuma-, pneumono-,	Denoting air or gas	Pneumonitis	Inflammation of lung tissue = pneumonia
Pod-, pod-	Meaning foot	Arthropod	Jointed foot (type of insect)
Poly-	Many	Polydactyly	Many digits
Ptyalo-	Denoting saliva	Ptylectasis	Dilation of a salivary duct
Pulmo-	Denoting the lung	Pulmonary	Pertaining to the lungs/respiratory system
Pupillo-	Denoting the pupil	Papillary	Pertaining to or emanating from the pupil
Pyel-, pyelo-	Denoting the pelvis	Pyelonephritis	Inflammation of the renal
Pyloro-	Relating to the pylorus	Pylorus	The distal aperture of the stomach or abomasum
Py-, pyo-	Denoting pus	Pyonephritis	Infection in the kidneys
Recto-	Denoting the rectum	Rectocele	Hernial protrusion of part of the rectum and colon
Rhin-, rhino-	Denoting the nose	Rhinocopy	Visual exam of the nose
Sclero-	Denoting hardness	Scleroderma	Hardened skin
Sero-	Pertaining to serum	Seroma	Swelling of serum
Sinistro-	Left	Sinistrocerebral	Situated in the left hemisphere of the brain
Somato-	Denoting the body	Somatic	Pertaining to the body
Spasmo-	Denoting a spasm	Spasmodic	Pertaining to a spasm
Spermato-,	Denoting sperm	Spermatocide	Agent that destroys
Sphero-	Denoting a sphere, round	Spherocyte	Red blood cell with decreased volume that is round and dense (not
Sphygma-	Denoting a pulse	Sphygmomanometer	Instrument for measuring arterial blood pressure
Spleen-, spleno-	Denoting the spleen	Splenomegaly	Enlargement of the spleen

Steno-	Narrow, short	Stenosis	Narrowing of an area
Steth-, stetho-	Relating to the chest	Stethoscope	Instrument used to obtain an aural examination of the
Stomato-	Denoting the mouth	Stomatocyte	Red blood cell with the appearance of a mouth
Sym-, syn-	With, along, together	Symmetrical	Equally on both sides
Tacho-, tarchy-	Swift	Tachycardic	Pertaining to a swift/fast
Tarso-	Relating to the flat of the foot	Tarsal	Pertaining to the hind foot
Terato-	Denoting a marvel, prodigy, or monster	Teratogenic	Production of a deformity in a developing embryo
Thoraco-	Relating to the chest	Thoracocentesis	Puncturing the chest with a needle
Thrombo-	Denoting a clot	Thrombocyte	A cell specialised for forming clots

Table 5: Terminology frequently used to designate body parts of organs: inverse list.

Body part/organ	Medical terminology
Air	Pneumo-
Anus	Anal, ano-
Arm	Brachial, brachio- [?]
Blood	Hem-, hemo-, hemat- (US), Haem-, haemo-, haemat- (Brit)
Chest	Thoracic, thorax, thoraco
Ear	Auricle, oto-
Eye	Ocular, oculo-, ophthalmo-
Foot	Pedal, ped-, -pod
Gallbladder	Chole-, chol-
Head	Cephalic, cephalo-
Heart	Cardium, cardiac, cardio-
Kidney	Renal, nephric, nephro-
Lip	Cheil-, labi-
Liver	Hepatic, hepato-
Lungs	Pulmonary, pulmonic
Mouth	Oral, os, -stoma, stomat-
Muscle	Myo-
Neck	Cervix, cervical, cervico-
Penis	Penile
Rectum	Rectal

Skin	Derma-, integumentum
Stomach	Gastric, gastro-
Testicle	Orchio-, orchi-, orchid- ⁸
Urinary bladder	Cysti-, cysto-
Uterus	Hystero-, metra-
Vagina	Vulvo-, vaginal

⁷Word-forming element meaning “arm,” from Greek *brakhion* “arm,” perhaps originally “upper arm,” literally “shorter,” and from *brakhys* “short”, in contrast to the longer forearm. Do not confuse with branchio-, from Greek *branchia*, “gills”!

⁸A curiosity about this word: the name orchidea (genus *Orchis*) comes from the Ancient Greek ὄρχις (*órkhis*), literally meaning “testicle”, because of the shape of the twin tubers in some species of this plant, that resembles this part of the male reproductive tract

Review Questions

- For its use in radiography, if dorso-palmar is used for the front leg, what stands for the hind leg?
- Describe in anatomical terms where a saddle and cinch is placed on a horse.
- If a veterinarian tells his technician to lay a dog on its right side, how would this be phrased using correct anatomical terms?
- Describe in anatomical terms the location of an injection into the muscles 1.5 cm to the right of lumbar vertebra L3.
- Fill in the blanks: The stifle joint is _____ to the hip joint but _____ to the hock joint.
- Fill in the blanks: The inside of the upper teeth is called the _____ side, whereas the inside of the bottom teeth is called the _____ side.
- Would an adductor muscle be on the medial or lateral side of the leg?
- What plane divides the body into its dorsal and ventral halves?
- Name and describe in anatomical terms the direction of the x-ray beam as it penetrates through the animal's hind leg from front to rear.
- Correct this sentence: the tail bones (caudal vertebrae) belong to the appendicular skeleton, as well as *os cardis* and *os penis*.
- Be able to assign a Triadan number to any equine tooth. What two teeth numbers are most often not present in either gender? Which numbers are not present as deciduous teeth? Which numbers are not present in most mares? Which two numbers are most likely to cause problems with bits?
- What are the 2 major factors used in dental age estimation?

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