

PART FOUR:

ANATOMY

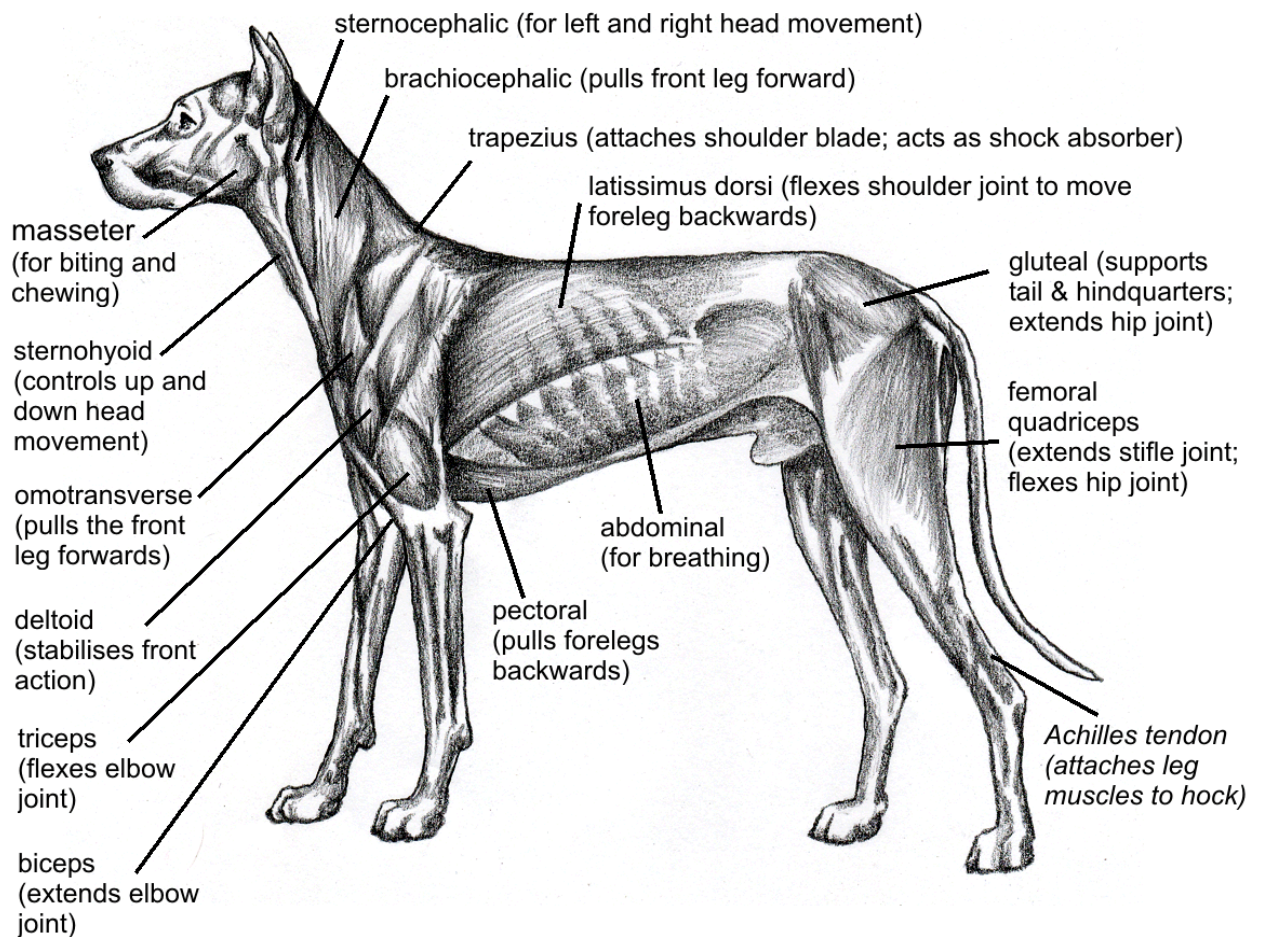
ANATOMY

The word “anatomy” is a scientific term that refers to the inner structure of the dog, comprising the muscles, skeleton and vital organs.

MUSCULAR ANATOMY

As judges, we tend to focus less on muscles than the bony landmarks and angles, yet, it is the dog’s musculature that holds everything together and facilitates its movement.

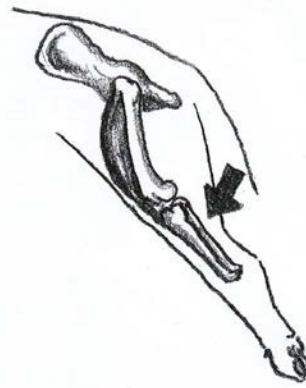
Note: You do NOT need to memorise the names of these muscles for the examination, but it is useful to know the names of the most important muscles (indicated on the sketch) and their functions.



Muscles are attached to the skeleton by tendons and controlled by nerves. Muscles can only **contract** or **relax**. For this reason, two opposing sets of muscles are needed to perform normal functions – **flexors** and **extensors** – one to pull in one direction, the other to pull in the opposite direction.



flexor causes a bend



extensor causes an extension

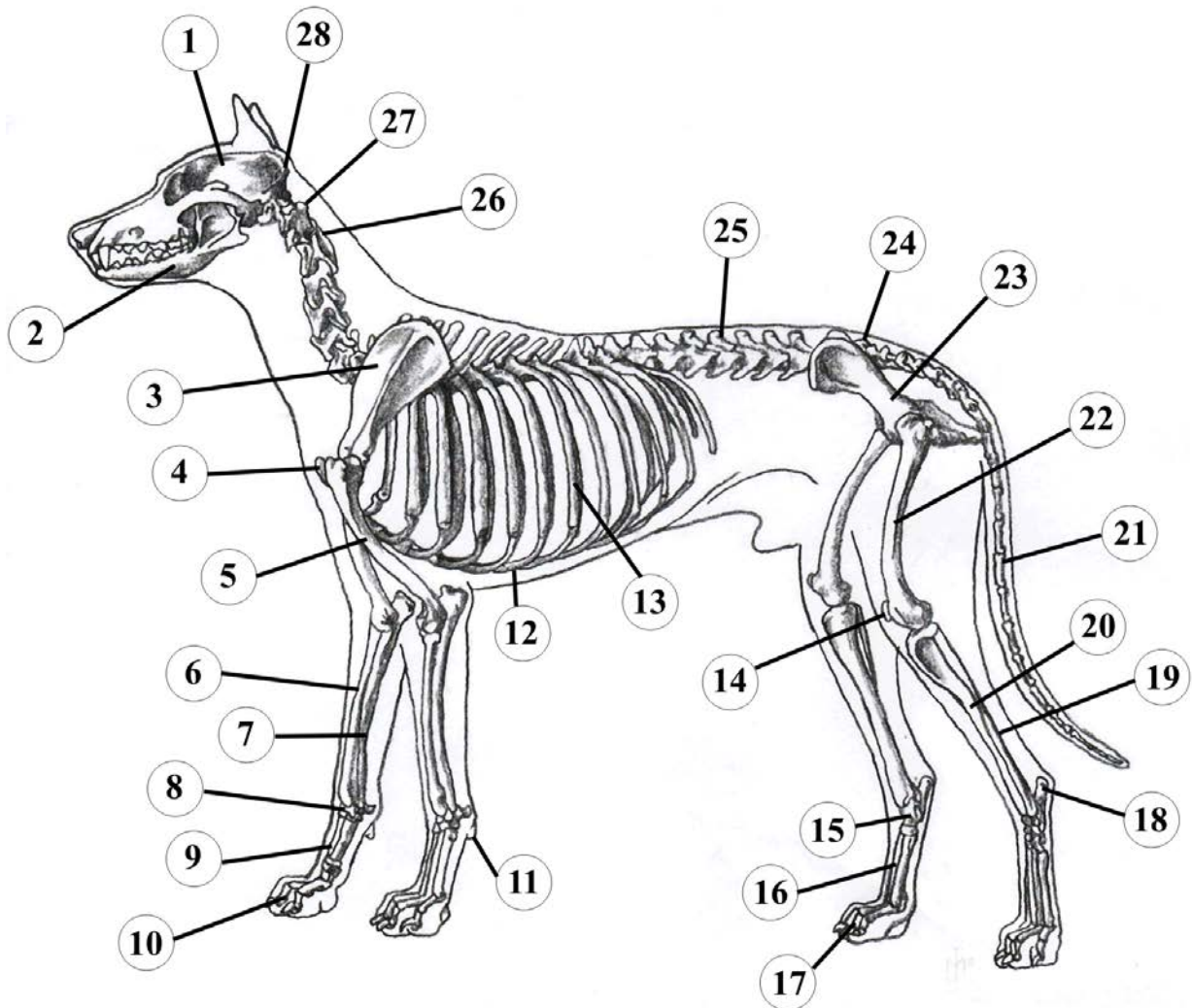
Tip:
Judging muscle
structure

As a general rule, if the skeletal angulation is incorrect, the muscles will have a reduced area in which to affix themselves, so there is likely to be less muscle development.

Thus: correct angulation = appropriate muscling

SKELETAL ANATOMY

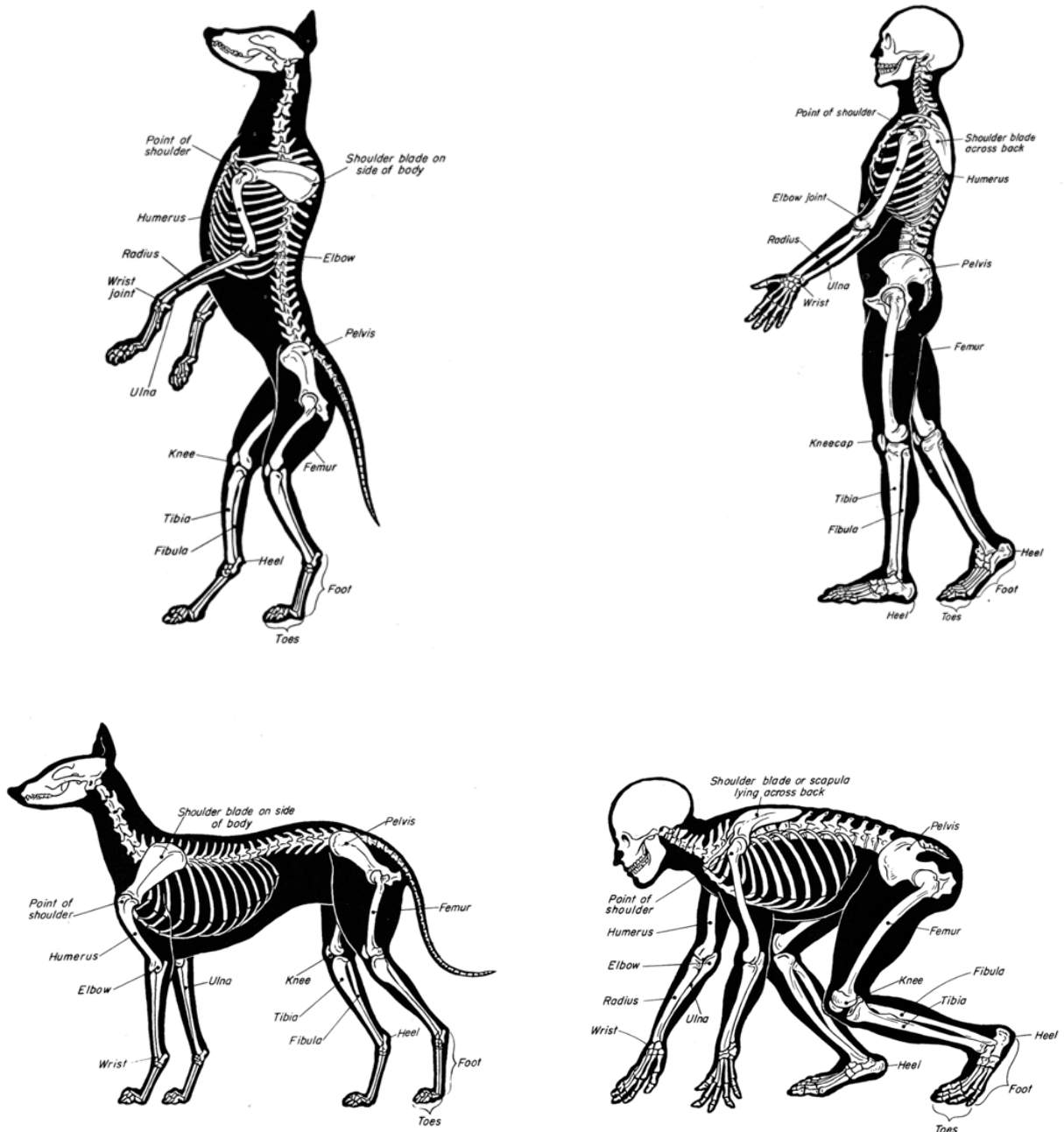
The skeleton is divided into two sections – the **axial skeleton**, which comprises flat and irregular-shaped bones that house and protect the body's vital organs, and the **appendicular skeleton**, which consists mainly of long and short cylindrical-shaped bones that support the body and used for locomotion. Bones act as levers to which the muscles are attached and they also store minerals and fat, and assist in the manufacture of blood cells.



- | | | | |
|--------------|----------------------|-----------------------|-------------|
| 1. skull | 8. carpus | 15. tarsus | 22. femur |
| 2. mandible | 9. metacarpals | 16. metatarsals | 23. pelvis |
| 3. scapula | 10. phalanges | 17. phalanges | 24. sacrum |
| 4. manubrium | 11. pisiform process | 18. calcaneal process | 25. spine |
| 5. humerus | 12. sternum | 19. fibula | 26. axis |
| 6. radius | 13. ribs | 20. tibia | 27. atlas |
| 7. ulna | 14. patella | 21. tail | 28. occiput |

Comparison of human and dog

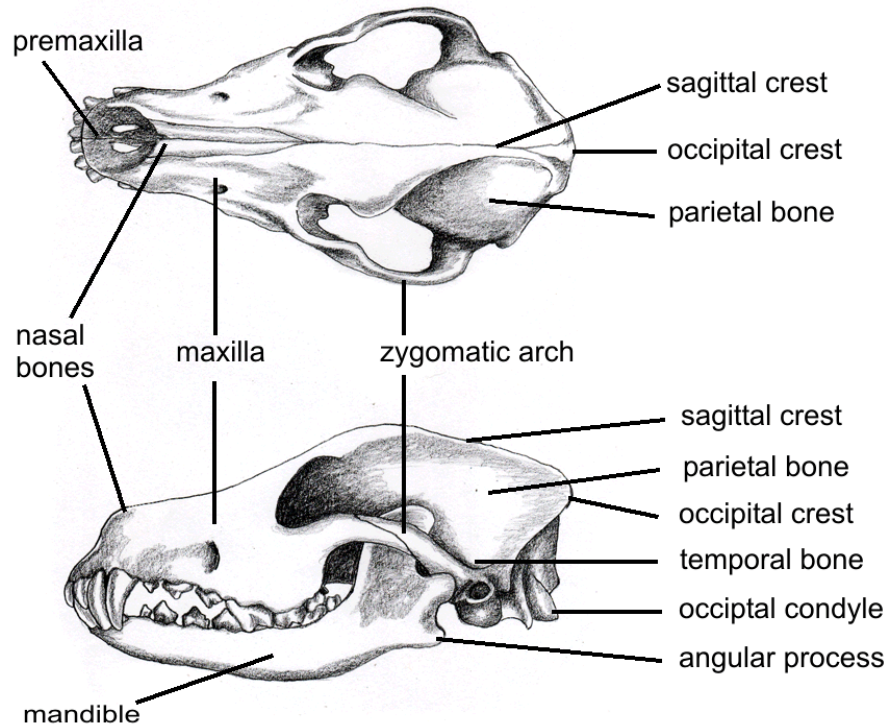
The anatomy of the dog is remarkably similar to that of a human in many respects, but there are also some very obvious differences, the main difference being in the shoulder assembly. In the human, the shoulder blade lies across the back and is attached to the body by the clavicle (collar bone). The dog still has a vestigial clavicle, but it doesn't attach the shoulder to the body – instead, the shoulder assembly is attached by muscles and tendons. Another major difference is that the human walks on the whole foot – from the heel to the toes, while a dog walks on its phalanges (fingers and toes), the heel acting as a hock joint and the wrist serving as a pastern joint.



(Illustrations by the late Charles R. Knight: "Animal Drawing – Anatomy and Action for Artists (Dove)

The skull

The skull includes the **brain case (back skull)** and the **facial area**. While, in usual terminology, judges normally use the term “skull” to refer to the brain case, but in fact, the skull includes the brain case as well as the facial area and the lower jaw (**mandible**).



The sizes and shapes of skulls are as varied as the number of different breeds, but generally, skulls can be grouped into 3 basic shapes:

dolichocephalic
(eg. Rough Collie)



brachycephalic
(eg. Boston Terrier)

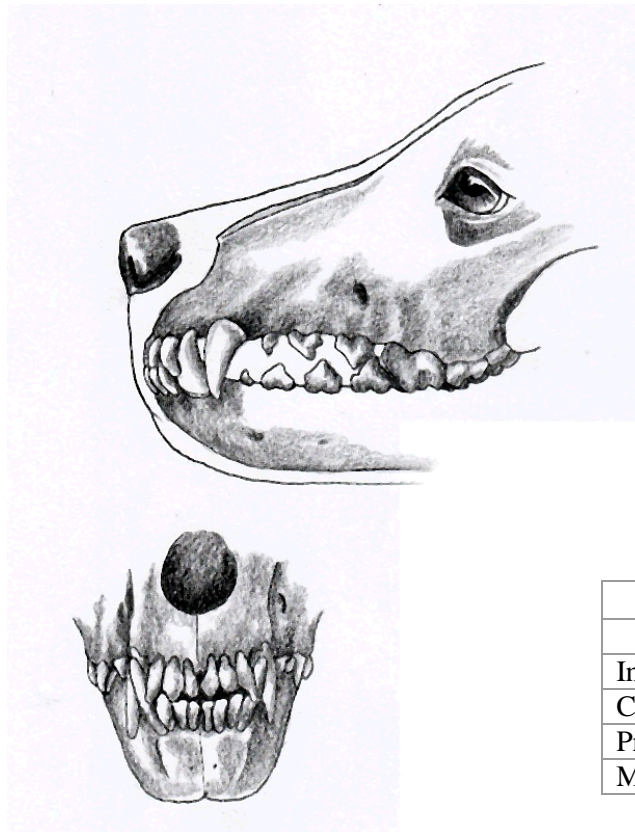


mesocephalic
(eg. Australian Shepherd)



Dentition

Adult dogs have 42 permanent teeth – 20 in the upper jaw and 22 in the lower jaw. Puppies have 28 deciduous (temporary) teeth – 14 in the upper jaw and 14 in the lower jaw – that begin to erupt at around 3 – 4 weeks of age. Puppies do not have any of the molars or premolar 1. The permanent teeth start replacing the deciduous teeth from about 3 – 4 months old.

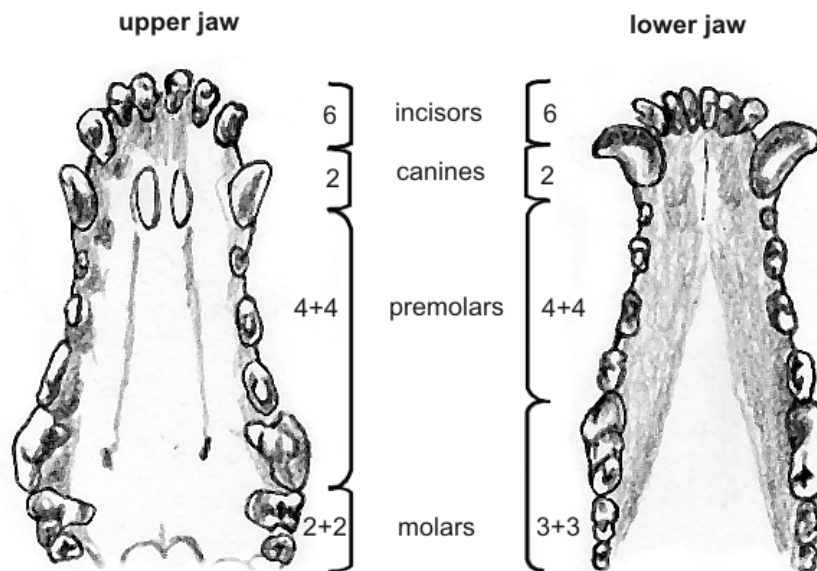


Tooth Emergence Schedule		
	Deciduous	Permanent
Incisors	4-6 weeks	3-5 months
Canine	5-6 weeks	4-6 months
Premolars	6 weeks	4-5 months
Molars		5-7 months

There are 4 types of teeth with different functions:

- **incisors** - used for cutting and nibbling food, scooping, picking up objects and grooming. These are the front teeth situated between the canines. In adults and puppies there are 6 upper and 6 lower in rows in each jaw. The centre two incisors are usually somewhat small while the others, away from the center, increase proportionately in size and depth.
- **canines** - used for holding and tearing prey or food, slashing and tearing when fighting and as a cradle for the tongue. The lower canines lock in position in front of the upper canines and are placed on either side of the incisors. In adults and puppies there are two upper and two lower canines, one upper and lower on each side of the jaw.
- **premolars** - used for cutting, holding, shearing, carrying and breaking food into small pieces. These teeth are situated behind the canines. Puppies do not have P1 teeth (only P2, P3, P4), while adults have 8 premolars in the upper jaw and 8 in the lower, 4 on each side.
- **molars** - used for grinding food into small pieces. The molars are situated behind the premolars and are the last teeth in the back of the jaw. Puppies do not have molars, while adults have 4 molars on the top, two on each side of the upper jaw and 6 molars on the bottom, 3 on each side of the lower jaw.

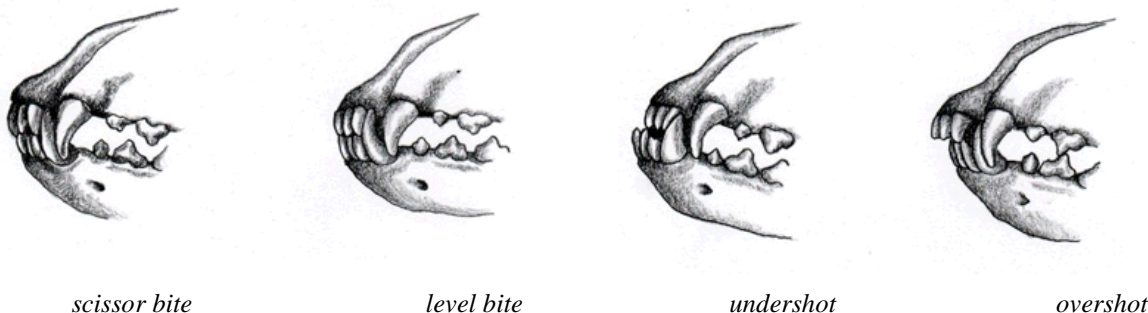
All these specialised teeth are not independent entities. Their position in the jaw is determined by their function and they require a properly-formed skull and lower jaw to function efficiently.



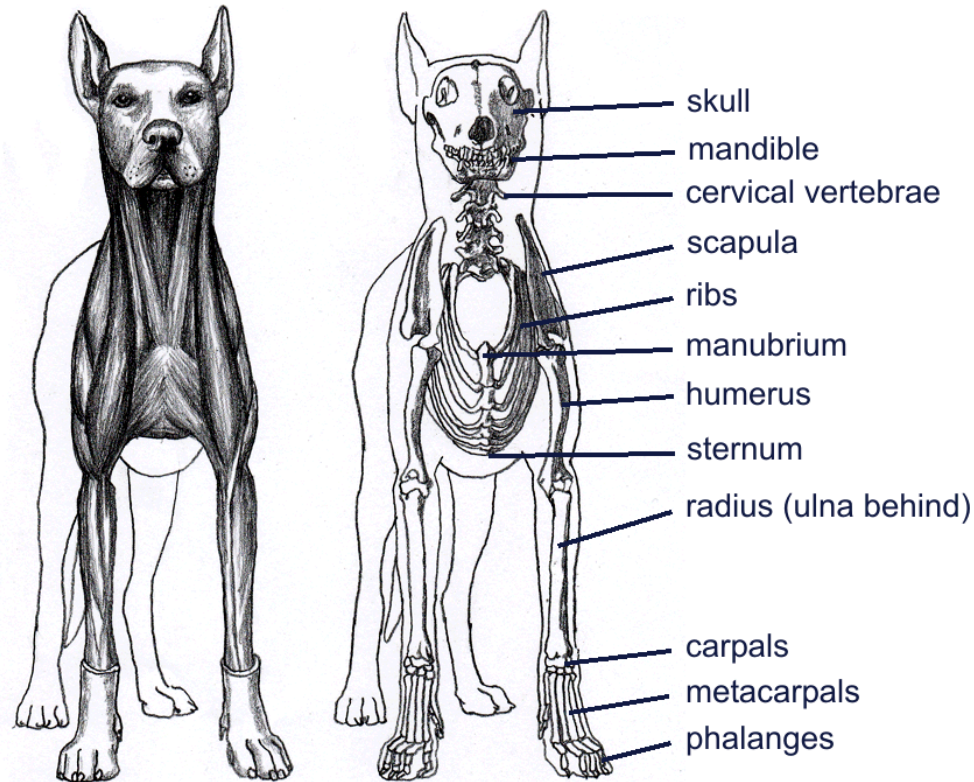
Most breeds call for a **scissor bite** – where the upper teeth closely overlap the lower teeth and are set square to the jaw. A **reverse scissor bite** (not to be confused with an undershot mouth) occurs when the lower teeth closely overlap the upper teeth and, in all respects, resemble a scissor bite in the opposite direction (typical of a Mastiff). A **level bite (pincer bite)** occurs when the incisors meet edge to edge, desired in, for example, the Bullmastiff.

Typical dentition faults usually include **missing teeth** and **malocclusions**. Missing teeth can obviously not do the work they were intended to do, and this is a very important fault in some breeds, especially the working breeds. In other breeds, however, the degree of fault varies, so judges can show reasonable tolerance. A missing P1 (the first premolar) – one of the smallest teeth – is less of a problem, for example, than a missing carnassial (the fourth premolar in the upper jaw).

Malocclusions most generally manifest in **undershot** and **overshot** bites, **crooked teeth**, or **wry mouth**. An undershot bite occurs when the lower jaw extends beyond the upper. This may happen because the lower jaw has grown too long or the upper jaw is too short. In an overshot bite, the upper jaw is longer than the lower. In both instances, the teeth will not mesh properly. Sometimes a slightly overshot or slightly undershot bite can be forgiven, but if the distance between the teeth is considerable – a limit of which is often mentioned in some breed standards – the occlusion is seriously affected and the fault must be considered serious. Crooked teeth may be due to crowding in a too-small or too-narrow jaw or the result of damage to the mouth. In a wry mouth, one side of the lower jaw has grown longer than the other, causing the jaw to skew to one side so that the incisors and canines cannot align properly. Given the many possibilities of malocclusions, consideration must be given to the cause of such problems, which generally begin with poor jaw development, strength, width, length and depth – the root of the problem often being more serious than the actual manifestation of poor occlusion.



The forequarters



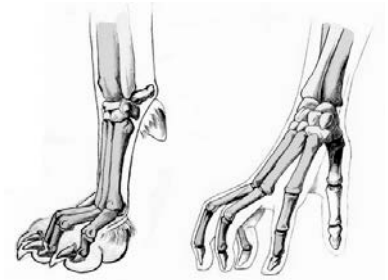
Approximately 60% of the weight of most dogs is supported by the forequarters, which acts as a shock absorber as it absorbs the impact from the ground and co-ordinates with the drive from the hindquarters. Equal to the importance of a well-built, well-proportioned front assembly on a dog, is the necessity to observe and evaluate the effectiveness of all the elements that make the front assembly work for a dog – the columns of support, the layback of shoulder, the depth of chest, the amount of bone, the slope of pasterns, the structure of the feet.

Attached purely by muscles and tendons to the first five ribs and adjacent thoracic vertebrae, the **scapula** is a large, flat, triangular bone with a ridge down the centre called a **spine**, its purpose to allow firm attachment of muscles. At the highest part of the scapula, the two blades almost meet at the withers with a small space between them to allow sufficient flexibility for the dog to lower his head to the ground. There is no bony connection between the ribcage and the scapula, although a vestigial clavicle remains as a floating, unused bone in the shoulder assembly. At the lower end of the scapula is a hollowed section that allows the **humerus** to snugly fit in a **ball-and-socket joint**.

The **humerus** is the largest bone in the forequarters. The shaft of the humerus runs down and back towards the elbow joint, where another hollowed section facilitates the elbow joint, which is also a ball-and-socket joint. It is at this joint where **elbow dysplasia** can occur, which can only be diagnosed by thorough veterinary examination and is not to be confused with looseness in elbow.

From the elbow to the pasterns, the **forearm (lower arm)** comprises two fused parallel bones, the **radius** and the **ulna**. Being the larger of the two bones, the radius is positioned in the front and carries most of the weight. The ulna, considerably smaller and slimmer is joined to the radius behind it so that the two bones can work as one. A protuberance on the top of the ulna, called the **olecranon**, extends beyond the elbow joint to form the **point of elbow**.

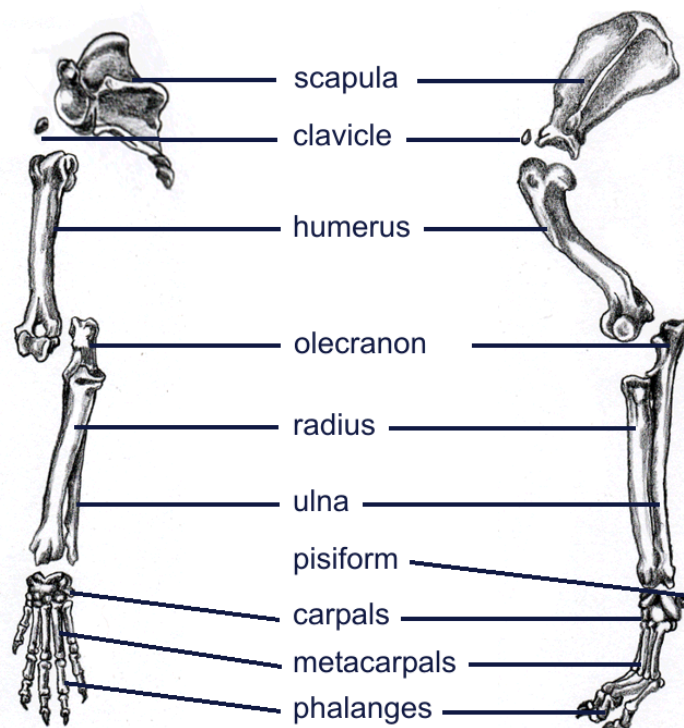
The forearm ends at the **carpus**, which is the equivalent of a human's wrist. This joint comprises 7 **carpal bones** arranged in two rows plus a number of **accessory bones**, including the **pisiform bone**, which is a small knobby, pea-shaped bone at the back of the wrist at the base of the stopper pad. From this joint, the **metacarpus (pastern)** comprises five long, slender **metacarpal bones**. These are equivalent to the bones of the hand in a human.



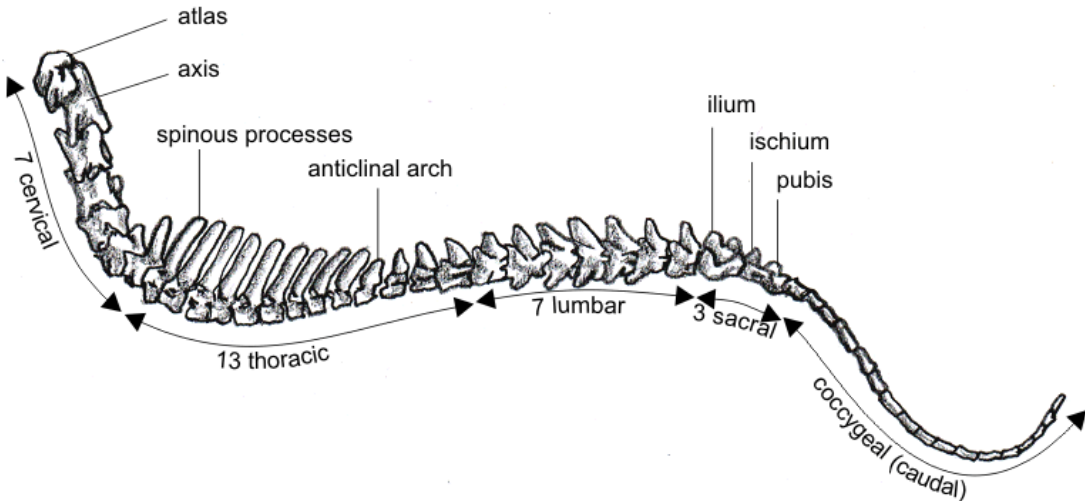
When judging a dog in profile, ensure that the dog is standing with its forearms perpendicular to the ground. A **propped (posting) stance** alters the balance and appearance of the exhibit.

Depending on the specific breed standard, there are several types of shoulders, some of which are desired, others are described as faults:

- **flat shoulders (smooth shoulders):** shoulders are sufficiently muscled, yet not excessively so. The appearance is smooth and clean.
- **loaded (bossy) shoulders:** coarse shoulders that show excessive muscle development so that the dog tends to look lumpy and over-developed. Not to be confused with well-developed shoulder development, which is a requirement of draught and harness dogs.
- **loose shoulders:** when the muscle attachments are insufficiently firm, allowing excessive movement of the shoulders from the ribcage; it usually results in weaving in front movement and usually presents as loose in elbow.
- **low in shoulder (flat withers):** when the withers are set lower than the spine – usually a fault, but a requirement of the Dandie Dinmont Terrier.
- **steep shoulders (straight in shoulder):** steep angulation between shoulder blade and upper arm resulting in a shortened neck and restricted movement. Not to be confused with slightly open shoulders, often typical in Sighthound breeds.
- **tied-in shoulders:** when the muscle attachments are too firm or inelastic; it usually results in restricted length of stride.



The spinal column



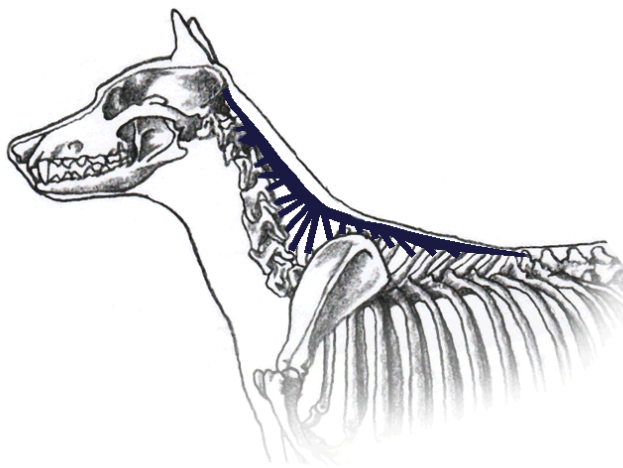
The **spine (vertebral column)** contains and protects the spinal column. Except for the **caudal (coccygeal)** vertebrae, which vary in number in some breeds, the number of **cervical** (neck), **thoracic** (chest), **lumbar** (loin), and the **sacral** vertebrae contain the same number of segments in all breeds.

In the neck area, the first two vertebrae behind the skull, the **atlas** and the **axis**, are shaped differently from the other cervical vertebrae because they allow freedom of head movement in many directions.

The **thoracic vertebrae** form the anchorage points for the ribs and the shoulder blade via muscles and tendons. Between the 10th and 11th thoracic vertebrae, the **spinous processes** (spines of the vertebrae) change direction – this for flexibility. This area is called the **anticlinal arch** and is very obvious in some breeds, particularly galloping breeds.

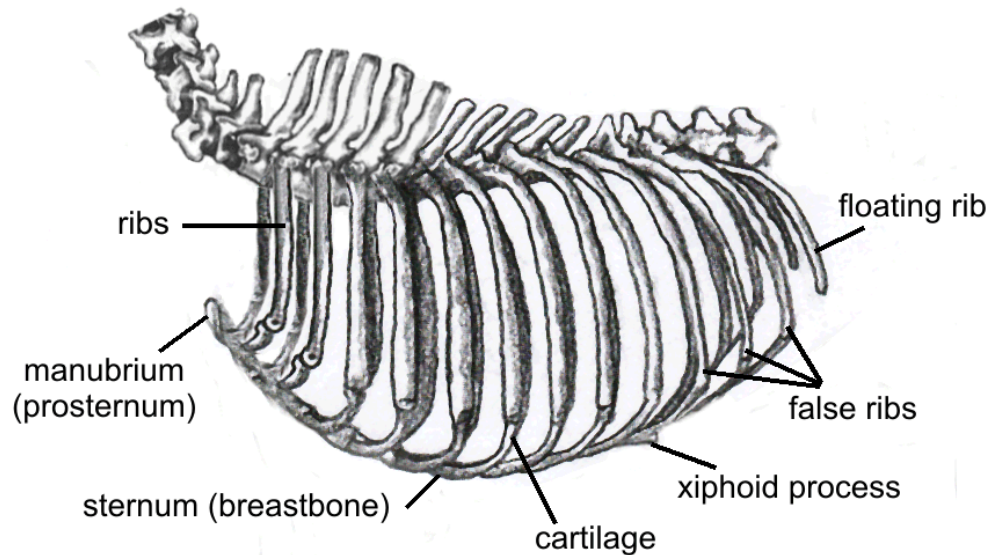
The **lumbar vertebrae** provide support for the loin and abdominal muscles – this in the area also called the coupling. Excessive length in this area often causes weakness in the spine.

The **sacrum** comprises 3 fused bones, the **ilium**, the **ischium**, and the **pubis**, that do not permit movement – this area provides a firm attachment for the pelvis.



There is a very strong set of **ligaments** that connects the axis of the neck to the spinous processes of the vertebrae. (*Note: tendons connect muscle to bone, while ligaments connect bone to bone*) The neck ligaments provide the power to raise and lower the head, particularly during gaiting. The bigger the neck vertebrae and the longer the spinous processes, the better the neck ligament attachment. In many breeds, particularly galloping breeds, high withers indicates long spinous processes, which is a strong advantage. The strength of this neck ligament is manifested in an **arched neck** instead of a **ewe neck**, which is faulty.

The ribcage



The ribcage contains a series of flat, narrow, elongated bones called **ribs**. The ribcage contains and protects the vital organs and also serves as a mechanism to aid breathing. For this reason, the capacity of the chest is important and often specified in most breed standards.

Measurement of the chest is considered in **length, breadth** and **depth**, defined primarily by the dog's function. So, for example, a Sighthound will need a deep chest with plenty of heart and lung room, not too broad to allow flexibility in action.

There are 13 pairs of ribs, each with a boney section and a lower cartilage section. Ribs 1 – 9 are the only **true ribs**. They are attached to the vertebrae and the **breastbone (sternum)** and are, thus, less flexible than the other ribs. The first 4 or 5 ribs are flatter to accommodate the action of the scapula. Ribs 10 – 12 are called **false ribs** because they attach to each other by cartilage. The last rib, called a **floating rib**, is unattached to the breastbone or the remaining ribs.

In most breeds, the ribcage should be well sprung, which means that it should have sufficient curve – **oval or egg-shaped**. It is in the middle section of the ribcage where variation occurs between breeds, some requiring flatter sides, such as the Bearded Collie, while in some, excessively flat is a fault called **slab-sided**. Some breeds require well-rounded, **barrel ribs**, such as the Labrador Retriever, but in many this can also be a fault.

In most breeds, the ribs should be angled backwards because as the dog breathes, the ribs rotate forwards to increase lung capacity. A **good length of rib** – where the ribcage well laid back and occupies most of the body length – is said to be "**well ribbed up**". While you may not be able to see or feel the front ribs, the layback of the last few ribs should give sufficient reflection of the rest of the ribcage.

Spring of rib also affects how the shoulder blade is attached and functions. On a barrel-shaped ribcage (like a Bulldog's, the shoulder blade tends to move more up and down (hence the characteristic roll), while an oval-shaped ribcage offers a flatter surface for the shoulder blade to move and allows the legs to converge or single-track under the body.

The hindquarters

At the base of the spine, at the conformational area we call the croup, the **pelvis** comprises two fused halves of flat bone that attach to the spine at the sacrum. The pelvis is angled to the degree that defines the slope of croup (pelvic slope). A hollowed area on each **pelvic wing**, called the **acetabulum**, houses the head of the **femur** to form another ball-and-socket joint – the hip joint. It is at this joint where **hip dysplasia** can occur, but no judge is to be expected to know how to identify this condition – this diagnosis is purely reliant on thorough veterinary examination.

The femur is the longest single bone in the dog's skeleton. This bone runs down and forwards towards the **stifle joint**. At the lower end of the femur is a shallow groove, called the **trochlea**, in which the **patella** (kneecap) is positioned firmly between strong ligaments. The stifle joint comprises the trochlea, the patella and the upper portions of the **tibia** and **fibula** (the bones of the lower thigh).

Similar to the radius and ulna, the tibia and fibula are fused at both ends, allowing them to form a single leverage unit. The tibia is the larger of the two bones and positioned in front of the smaller fibula. They slope downwards, completing the stifle angle and connect to the bones of the hock (heel).

The **tarsus** comprises 7 **tarsal bones**, the largest of these is the **fibular tarsal** that extends upwards to form the hock (heel). The **achilles tendon** – the main tendon that attaches the leg muscles – is rooted to this bone at the uppermost part, the **calcaneal process**.

Connected to the tarsal bones are the elongated **metatarsals**, equivalent to the bones of the foot in the human. Together, these bones form the **metatarsus** (rear pastern). In most breeds, the first metatarsal is absent, but when it is present, it forms a hind **dewclaw**, which may need to be removed or may be a requirement, as in the Pyrenean Mountain Dog, which actually must have a **double dewclaw**. The hind feet comprises **phalanges** similar to the front feet, but are usually smaller, longer and narrower.

