

## FORM AND FUNCTION 2: THE MOUTH.

During the 1990s, Dr Helen Hewson-Fruend [www.acdb.au.com/biography.html] wrote a series of articles on form and function in the dog. I posted PART 1: THE BASIC DOG in an earlier blog. Here is Part 2.

### FORM AND FUNCTION: PART 2 THE MOUTH

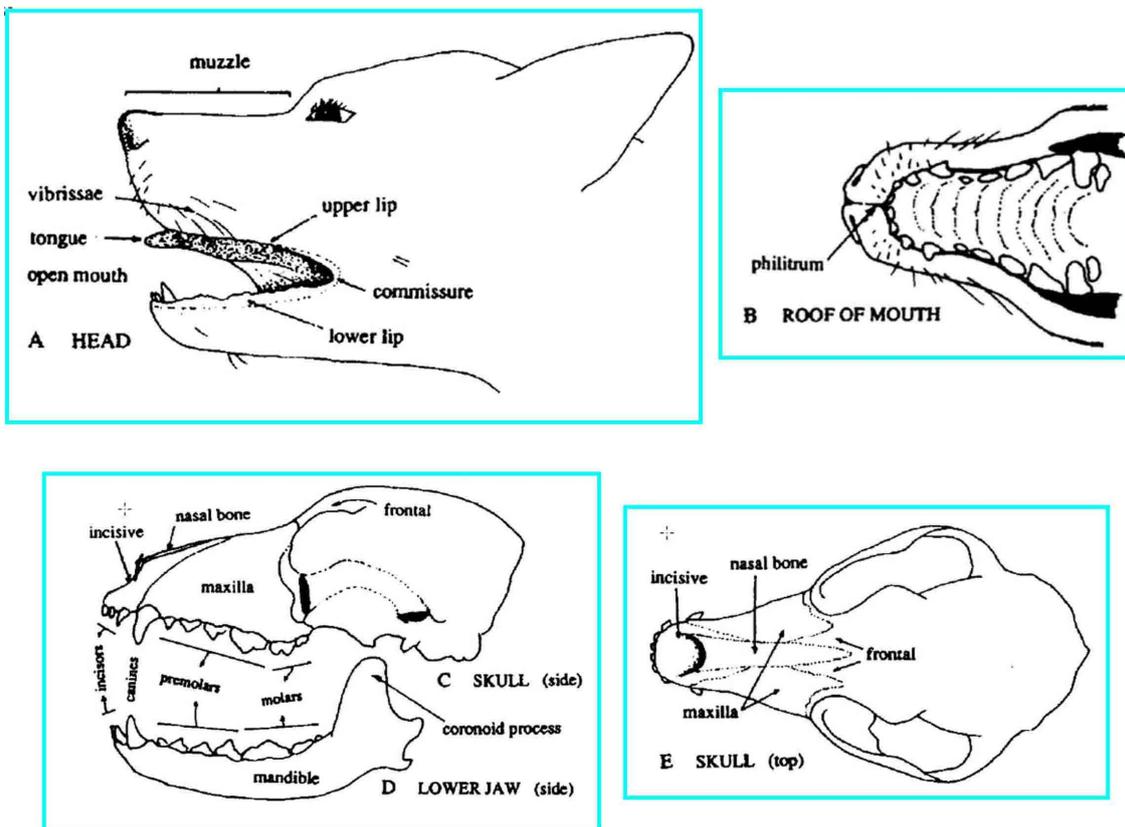
H.J..Hewson-Fruend

*“Ooh! Grandmama what big teeth you have!”*

*“All the better to eat you with, my Dear!”*

*Little Red Riding Hood*

The mouth is a structure of many functions: voicing, drinking, panting, killing, fighting, eating, tasting, digesting, grooming etc. In order to assess any structure it is necessary to understand its form and function and it is of greatest value to study the normal or basic form before examining variations and extremes.

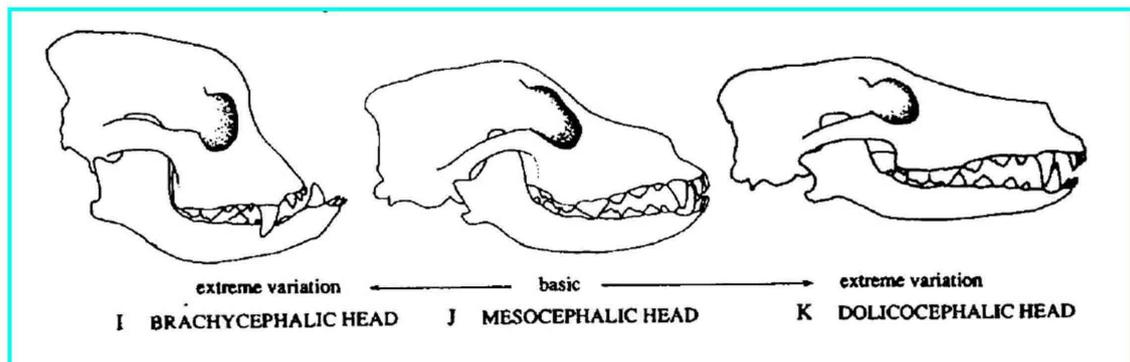
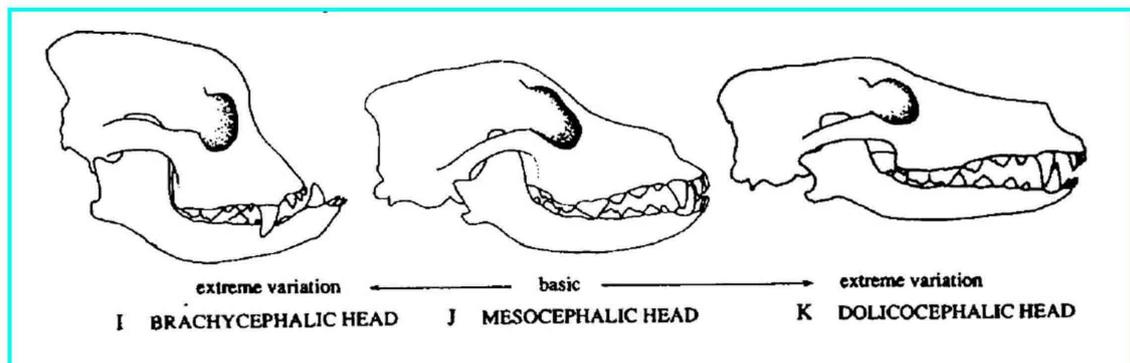
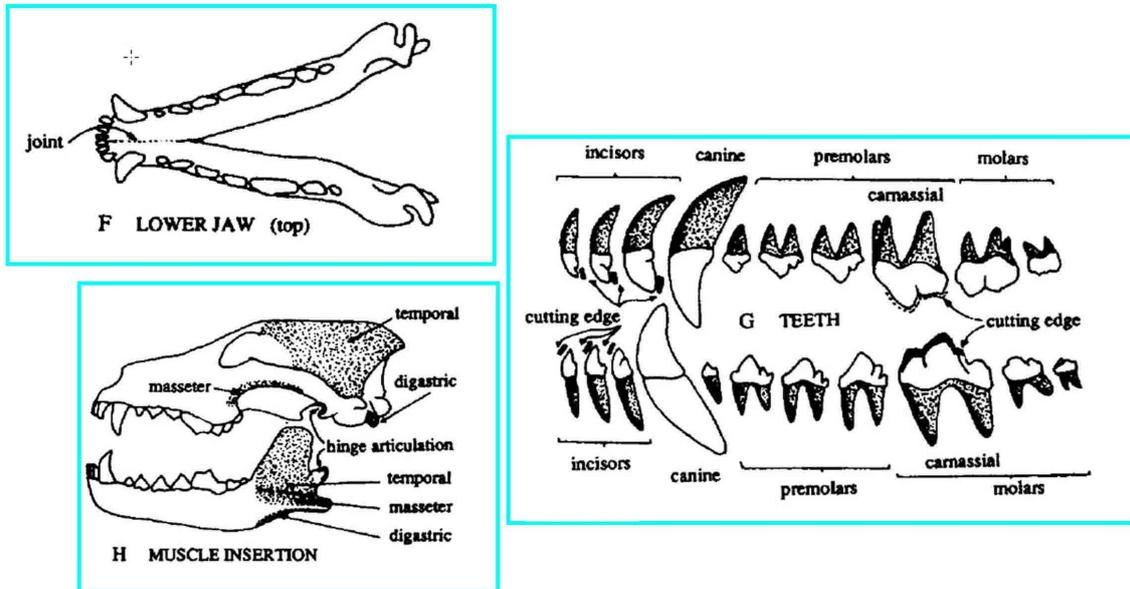


### FORM

The mouth comprises the oral cavity (from the Latin *os oris*) and its opening, fig. A. Anatomically it is set between the jaws which are made up of three pairs of bones. The **incisives** and **maxillae** form the upper jaw and the **mandibles** form the lower jaw. The incisives and maxillae together with the **nasals** and **palatines** are fused to form the muzzle which in turn is fused to the bones of the cheeks and the cranium (brain case) figs C, D and E. The two mandibles join each other in a fibrous joint at the front, fig. F. At the back of the mouth each mandible joins the cranium in a hinge joint, fig. H. The lower jaw articulates with the temporal bones. The muscles associated with opening and closing the jaw join it to the cranium.

The teeth are anchored in **sockets** in the jaw bones: the incisors (I) in the incisives above and the mandibles below; the **canines** (C), **premolars** (PM) and **molars** (M) in the maxillae above and the mandibles below. Each

tooth has one or more **root(s)** and one or more **cusp(s)**. The **deciduous teeth** (milk teeth) number 28: 6 incisors, 4 canines and 12 premolars. (The deciduous premolars represent the 2nd, 3rd and 4th premolars). The **permanent teeth** (adult teeth) number 42: 6 incisors, 4 canines, 16 premolars and 10 molars, figs C, D and G. The dental formula is:  $I^{3/3} C^{1/1} PM^{4/4} M^{2/3} = 21 \times 2$ ; that is, 42 teeth in all.



The tongue forms the floor of the mouth and the tissue covering the palatine, maxillae and incisive bones forms the **palate** (roof) of the mouth (fig. B). The upper surface and margin of the tongue is covered with various **papillae**; five types are recognised. The lips comprise tissue (skin, muscle and mucosa) which close the oral cavity. They meet at the **commissures** (corners). The upper lips meet in front at a narrow cleft called the **philtrum**. Together with the muzzle they bear the **vibrissae** (whiskers), figs A and B]. **Salivary glands** pour secretions into the mouth. There are four major glands: **parotid, mandibular, sublingual** and **zygomatic**.

## FUNCTION

**Voicing.** Sound is created in the **larynx** (not part of the mouth) and is emitted through the mouth. It may be modified by changing the volume of the mouth and the degree of opening.

**Drinking.** The tongue, being very muscular, is shaped into a ladle and the dog drinks by ladling water (lapping) into the mouth to swallow.

**Panting.** Dogs breathe predominantly through the nose, but do pant through the mouth. While panting the tongue is frequently extended and protruded externally to one side or the other (lolling). This aids in reducing body temperature. The exposed mucosae of the lips and the surface of the tongue form an evaporating surface as air is panted across. This results in cooling.

**Killing.** The major weapon available to the dog is the mouth. Having chosen a prey animal, it is caught following a short sharp dash. It is grabbed and pulled down, or shaken, depending on the size of the prey. Dogs usually break the neck of small animals; a pack of dogs (wolves) is required to kill a large animal. The jaws are enormously strong. The **coronoid process** of the mandible has a large surface area. The **temporal** and **masseter** muscles are attached to it, fig. H. They are large and strong and close the mouth (by flexion). The **digastric**, a much smaller muscle, is responsible for opening the mouth (by extension). The opposing action operates as a set of levers with the articulation between the mandible and the temporal bone being the fulcrum. The canine teeth are extremely effective in wounding and are the predominant offensive teeth in the process of killing. The incisors, however, certainly play a role in procuring prey.

**Fighting.** Fighting is an activity closely associated with killing. It may be initiated as a means of attack or as a means of defence. However it is always associated with defence of territory or kind, or establishment of dominance. The teeth are the ultimate weapons available to establish supremacy or dominance. The prime wound-inflicting teeth are the canines.

**Eating.** The incisors are cutting teeth. They scissor over each other (scissor-bite) with the upper incisors (in front) cutting over the lower (behind). This action is used for biting, ripping, or tearing chunks off to chew. The forward premolars are used for crushing, chewing and gnawing. The 4th upper premolar, together with the 1st lower molar are the **carnassial** teeth, fig. G. They are large and positioned to act -powerfully in a shearing action especially useful in slicing tendon and skin. In principle carnivores (meat eaters) bite with a chopping motion; upper and lower tooth rows come together without sliding past each other. However, only one set of carnassials can operate at one time. There is some sideways play in the mandible at the hinge joint. Moreover, the front joint between the two mandibles is not fixed and allows some alteration of their relative positions as one or other set of carnassials comes into play. During the chewing process, food is moved around the mouth using the muscular action of the tongue.

**Tasting.** The papillae of the tongue include some **taste buds**.

**Digestion.** As food is chewed and moved around the mouth it is mixed with saliva which contains enzymes and begins the digestive process.

**Grooming etc.** Dogs use the incisor teeth in grooming to remove burrs etc from their coat. They also use the incisors for fleaing themselves. However, they use the tongue much more for regular grooming. Some of the papillae project and are rough and function like a minute brush. The tongue is also used to lick and cleanse wounds. The bitch uses her tongue to dry, clean and stimulate her pups.

## VARIATIONS: EXTREMES AND CONSEQUENCES

Thus far we have looked at the basic dog, fig. J, with its mesocephalic head structure. There are, however, some major anatomical variations which need to be addressed.

### Disposition of teeth and bite

The most obvious variation is that seen in the **brachycephalic** head. The gene(s) causing this modification result in a massive foreshortening of the muzzle. The nasal, incisive, maxilla and palatine bones are very

foreshortened. The mandible is modified to a lesser extent and only partially accommodates the distortion, fig. I. This results in crowded, displaced teeth and a grossly **undershot bite**; the lower incisors are in front of the upper incisors. In the worst exemplars teeth are rotated about their axes in order to fit. Consequently, none of the teeth of the upper and lower jaws meet effectively. This includes the large carnassial shearing teeth.

The **dolicocephalic** head, at the other extreme, has the muzzle lengthened to be as long or longer than the cranium, fig. K. The effect on the mouth is usually a spacing of the teeth without appreciable loss of function. However, it is not uncommon to find that the mandible is not proportionately lengthened in relation to the upper jaw. The effect is an **overshot bite**; the lower incisors are behind, and do not touch, the upper incisors. Sometimes dogs, with a **mesocephalic** head have a **reverse scissor-bite** where the lower incisors are in front of the upper incisors or an **undershot bite** or an **overshot bite** where the incisors do not touch at all. This is due to unproportional development of the upper and lower jaws in relation to each other. When this happens it is usual for the canines to be displaced -touching in an undershot bite and with a gap in an overshot bite. In the former case it is usual for the upper and lower canines to wear. With age the canines are weakened and very vulnerable to being broken. Depending on the severity of the unproportional development it is possible that the carnassial teeth are also displaced sufficiently to lose their shearing ability.

In some mouths, which would be regarded as possessing a normal scissor bite, abutment of the canines can be observed. The contour of the jaws and the angle of set of the teeth appear to be contributing factors. As above, the canines are worn and weakened and very vulnerable to being broken. Another abnormality is a differential development of the bones on either side of the mouth. This results in a **wry mouth** where the disposition of the teeth is asymmetrical.

### Number of teeth

The front premolars decrease in size towards the canines and do not touch. It is not uncommon to find one or more of the front premolars missing, indicating redundancy. Missing teeth have also been observed in wolves and Neolithic dogs but the phenomenon is more common in the modern domestic dog. **Domestication resulted in a general decrease in size of teeth as the available food changed. In particular the front premolars were of decreasing significance to the domestic dog, the chewing function of the premolars having become less important.** The 1<sup>st</sup> premolar is most affected, becoming rudimentary or lost altogether. Hence the phenomenon is an evolutionary process closely linked to domestication. It is an indicator of advance.

### ASSESSING THE MOUTH

Since the functions of the mouth are so important and varied, it is no wonder that some emphasis is placed on the mouth in judging. But **is the wrong emphasis placed on the one structure which is easy to see, easy to define, and, in the case of the teeth, easy to count?** Considerable emphasis is placed on the relative position of the incisors, on the number of teeth and on a high level of functionality of the incisors. Yet we find that **a) the canine and carnassial teeth are unarguably of greater functional significance than the incisors, and b) the loss of front premolars is evidence of evolutionary progression.**

Moreover, **a high level of functionality is required in some breeds while being ignored in others. Is it acceptable to adopt double standards?**

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