

# The teeth and gut specialisation in a ruminant and a carnivore essay

[Food & Diet](#)



**ASSIGN  
BUSTER**

A ruminant is an herbivore with a multichambered stomach. The example of a ruminant that will be used is cattle.

The example of the carnivore that will be used is a dog. The carnivore is a meat eating organism. The dog is a carnivore, and wild members such as wolves are predators. Refer to fig. 2.

This diagram shows the structure of a dog's skull. The long, pointed teeth near the front of the mouth, the canines, are particularly noticeable. The top and bottom canines thrust past each other as the jaw is closed, allowing the dog to pierce the body of its prey with considerable force, and kill it. Behind the canines, you can see that the premolars and molars have sharp edges, and are sometimes known as carnassial teeth. They slice past each other as the jaw is closed.

The scissor-like action can crack and crush the bones, and cut meat into pieces which can then be swallowed. The small incisors at the front of the dogs mouth are little used un feeding, perhaps helping sometimes which scraping meat from the surface of bones. They are however useful in grooming fur. Dogs scarcely chew their food at all, keeping it in the mouth only long enough to chop into small pieces small enough to be swallowed.

As meat contains no starch, there is no need fro amylase to be secreted, and no chemical digestion takes place in the mouth. However, the stomach contains even more concentrated acid than in humans, allowing dogs to eat what we would consider very rotten and dangerous food without harm. As in humans, pepsin in the stomach breaks down proteins. Secretions from the

gall bladder and pancreas are also similar to those in the human gut. The meat in a dog's diet is, of course, made up of animal cells.

They do not have cell walls, and it is therefore easy for proteases and lipases to digest their plasma membranes and then the contents of the cytoplasm. Hence there is little need to chew food as the strong acid in the stomach plus the enzymes there quickly break the cells in the swallowed food. In this case the cattle will eat grass, once the food has been masticated (chewed), the food is then swallowed down the oesophagus down to the multichambered stomach. Refer to the fig.

1. In contrast to the carnivore, the food that a cow eats is made up of cells surrounded by cellulose cell walls. No mammal is able to produce an enzyme that digests cellulose. The cow has no long, pointed canines. Indeed, it has no canines at all, just a gap where you would expect them to be, known as a diastema. This gap enables the long, flexible tongue to move grass around in the mouth, bringing it into different positions on the teeth so that it can be thoroughly chewed from all angles.

The chewing is done by premolars and molars. Instead of the sharp edges of a dog's molars, those of a cow have broad surfaces with ridges and cusps. The ridges of the teeth on the upper jaw fit into the cusps of those on the lower jaw, and vice versa. Grass lying between these teeth is ground thoroughly, as the cow's jaw moves from side to side while it chews. The bone structure and musculature of the cow's lower jaw allows this side to side movement, whereas that of a dog results in a crisp up and down chopping movement.

The cow does have incisors on its lower jaw; they are shaped like chisels and point forward. There are no incisors on the upper jaw, only a horny pad. If you have a chance to watch a cow feeding, notice how it tears off mouthfuls of grass using its tongue, its incisors and the horny pad above that they can bite against. One further difference between the teeth of a cow and of a dog is that, while a cow's teeth continue to grow throughout life, a dog's teeth do not. The roots of a cow's teeth remain open, allowing blood to continue to enter the teeth and supply the living cells within with oxygen and nutrients, allowing growth.

In contrast, the roots of a dog's teeth become closed, preventing further growth once the teeth are fully formed. The need for continual growth of teeth in a herbivore arises because the teeth surfaces are continually ground down by chewing, whereas those of a carnivore tend to remain relatively undamaged. While the differences between the teeth of a cow and those of a human and dog are considerable, there are even greater differences in the structure of their stomachs. The multichambered stomach actually consists of four different chambers.

The first chamber is the rumen chamber. This chamber is the fermentation chamber. There is a symbiotic relationship between various bacteria, protozoans and fungi and the cow. The cow provides a sheltered, warm and optimum environment for these microorganisms to live and in return these microorganisms produce an enzyme called cellulase which breaks down the cellulose cell wall to the disaccharide cellubiose and in turn to the monosaccharide glucose via intermediates such as betaglucose, pyruvate

and fatty acid. It is important that this process occurs so that energy can be released in the form of ATP by aerobic respiration.

However, there are other enzymes which convert these sugars to fatty acids. This is because in cattle, fatty acids are the main respiratory substrate. Two bi-products of this conversion are carbon dioxide and methane which is released via the buccal cavity (mouth), while the fatty acids are absorbed through the walls of the rumen. It is extremely important that the mechanical digestion that takes place in the buccal cavity is done thoroughly so that there is a large surface area for digestive juices to work on. Now, the contents of the rumen then pass back up the oesophagus and the cow will then be 'chewing the cud'.

The cow will spend many hours 'chewing the cud'. This material is then sent back down the oesophagus and passed to the omasum and the abomasums (true stomach). Here the food is churned up and the proteins synthesised by the microorganisms are then hydrolysed by the proteases in the cow's stomach. Copious amounts of saliva are produced (100dm<sup>3</sup> per day) and this saliva contains a high proportion of urea.

This urea is made by the liver from the deamination of amino acids. The microorganisms reconvert the urea to amino acids and then protein. This in effect creates an internal nitrogen cycle as the bacterial proteins are broken up by the hydrolases and absorbed. Some of which are then used to make more urea in the liver.