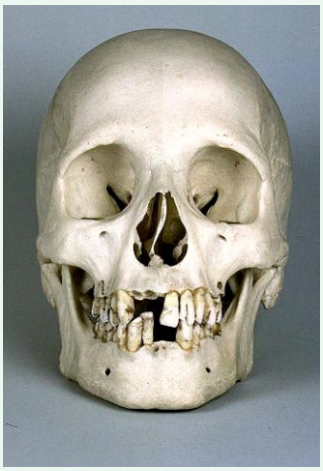
Hands On Learning
with Reading Museum Service

SKULLS AND TEETH Z18/A



The skull or cranium is a bony structure found in many animals which serves as the general framework for the head. Animals which have skulls are sometimes referred to as craniates. The skull has a number of functions including protecting the brain, maintaining a fixed distance between the eyes which is essential for stereoscopic vision, and a fixed position for the ears to help the brain to judge the direction and distance of sounds. The skull also serves as a mount for the teeth and jaws, to permit eating, and in some animals (deer and sheep, for example) the skull can have a defensive/aggressive function, having a frontal bone where horns are mounted.

Teeth are found in the jaws of many vertebrates (animals with backbones). The primary function of teeth is to tear and chew food, although in some animals they are also used for fighting and/or defence. The roots of the teeth are covered by gums.

The shape of the teeth is related to the animal's diet. Carnivores (meat eaters), for example, have all their teeth with very narrow points or edges and no grinding surfaces; omnivores, those feeding equally on plants and animals, have the front teeth (incisors) wedge shaped and the rear teeth (molars) with broad grooves and crowned surfaces. Ungulates (hoofed animals) have wide molars with multiridged patterns, and rodents have continuously growing incisors and highly variable molar patterns. Greatly modified teeth are conspicuous in the tusks of walruses, elephants, and narwhal.

In mammals, teeth vary in number from 0 in the anteaters, to 50 in the opossum and 100 small ones in the giant armadillo. Each mammal species has a specific total number of permanent teeth as well as a distinctive number of certain kinds of teeth such as incisors, canines, premolars, and molars.

While humans develop two sets of teeth throughout life, some animals develop only one set or many. Some sharks, for example, grow a new set of teeth every two weeks. Teeth are lacking in birds but modifications such as hooks, notches, and serrations of their beaks serve to function as an alternative.

Spotted Hyena Skull & Lower Jaw



The spotted hyena (or laughing hyena) *Crocuta crocuta*, is the largest and best-known member of the hyena family. Spotted hyenas live in the savannas and deserts of Africa in permanent social groups called clans.

When hunting in small groups, hyenas approach their prey from downwind in fan formation to cause an uneven dispersal of the target prey. When the prey are dispersed in this way, it is easier for the group to spot lame individuals and to separate the young from older animals. Their most commonly selected prey are wildebeest and zebra, both of which the hyenas hunt using different techniques. A wildebeest can be overcome by a single hyena, though it is more common for them to be felled by a group of three to four. Zebras, being more defensive than the easily spooked wildebeest often require a group of ten.

Hyenas kill small prey by crushing the skull with their jaws, whereas large game is disembowelled and devoured while the victim is still alive. Although unpleasant, this method allows the hyena to begin consuming food immediately and often results in a quicker death than suffocation (favoured by big cats).



Spotted hyenas (see photo, right) have such formidable jaws and teeth that they devour even the bones of their kill. In carnivores the molars have usually evolved into carnassial teeth - sharp teeth for cutting and shearing meat and skin, rather than flat teeth for grinding, as is the case with herbivores such as cows and horses. In this case the sharp carnassial teeth have been filed down to prevent them causing injury. The ridge running along the top of the skull is for attaching muscles to, which helps to give the jaws a strong grip.

Hippopotamus Tooth



The hippopotamus (*Hippopotamus amphibius*) is a large, plant-eating African mammal. As can be seen from the photographs shown below hippopotamuses have two contrasting kinds of teeth. At the front are several huge incisors. Despite the widespread depiction of hippos in children's literature as cute creatures they are, in fact, aggressive, unpredictable and easily enraged. These teeth are the means whereby they express their aggression, usually against fellow hippos. Much of the 'yawning' seen in a hippo pool is really one hippopotamus mildly threatening another or generally stating its negative intentions by displaying its tusks. Males in particular are extremely territorial, quarrelling constantly over water space and often fighting over females during breeding season.

The tooth in this box, however, is from the main section of the jaw and is one of the molars which would have been used for grinding the vegetation on which these aggressive vegetarians depend. Most such molars are flat topped, reflecting their regular grinding action. This example, which is relatively sharp, may be from the very back of the jaw, where there is less grinding activity.





Pigs Teeth



As with the hippopotamus, the pig's mouth contains dramatically different kinds of teeth. The small molars are for processing food, but the circular tusks are for aggression and display. Both males and females can develop tusks, although they are much less developed in females. The upper canines curl up and out along the sides of the mouth. The shorter lower canines also turn out and curve back toward the eyes. These tusks are often broken or worn from use. The fact that these have curled into circles suggests their owners led a relatively quiet life!

Walrus Tusk

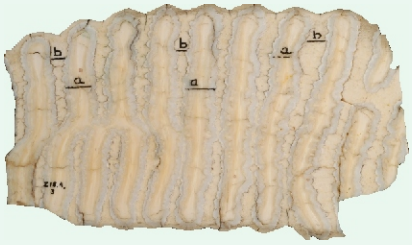


Walruses are members of the group which has been given the name *Odobenidae*. The compound *Odobenus* comes from *odous* (Greek for tooth) and *baino* (Greek for 'walk') and derives from the idea that walruses use their tusks to pull themselves out of the water. In fact, their tusks are used more as a symbol of age, sex, and social status.

Walrus tusks are found on both the male and the female. They grow continually throughout their life. Pups have no tusks when they are born. The tusks of the males are much longer and wider in proportion to their body than those of the female. The males use their tusks as a symbol of their masculinity turning their heads and thrusting their tusks up in a show to prove their dominance. Tusks are also used as weapons in fighting. Occasionally they use them to form and maintain holes in the ice, or to anchor themselves to the ice.

Walruses live in the seas around the Arctic. This specimen was originally labelled 'Vancouver Island' which is rather puzzling, as they do not live that far south. Perhaps it was bought there. It is rather discoloured and small. It may have belonged to a juvenile.

Elephant Tooth Section



This is a section of an elephant's tooth. Some idea of the size and shape of complete teeth can be seen in the photographs below, right.

Unlike most mammals, which grow baby teeth and then replace them with a permanent set of adult teeth, elephants grow several sets of teeth throughout their entire life. After one year the tusks (which are used to dig for water and roots, debark and move trees and occasionally as weapons) are permanent, but the other teeth are replaced five times in an elephant's life.



The teeth do not emerge from the jaws vertically like human teeth, instead they have a horizontal progression, like a conveyor belt. New teeth grow in at the back of the mouth, pushing older teeth toward the front, where they wear down with use and the remains fall out. This example, from an Indian elephant, shows both the exposed teeth from one side of the jaw and teeth which were developing inside the gums at the back of the mouth.



Elephants spend 20 hours a day snacking and eating. They will eat some 200-300 kg of leaves a day and drink up to 100 litres of water. The movement of the elephant's jaw during chewing is forwards and backwards, unlike cows who use sideways movements to chew the cud. The ridges on the teeth act as two rasps grating upon one another.

When an elephant becomes very old, the last set of teeth is worn to stumps, and it must rely on softer foods to chew. Very elderly elephants often spend their last years exclusively in marshy areas where they can feed on soft wet grasses. Eventually, when the last teeth fall out, the elephant will be unable to eat and will die of starvation. Were it not for tooth wear, their metabolism would allow them to live much longer. As more habitat is destroyed, the elephants' living space becomes smaller and smaller; the elderly will no longer have the opportunity to roam in search of more appropriate food and will, consequently, die of starvation at an earlier age.

Heron Skull



The grey heron (*Ardea cinerea)* eats mainly fish, amphibians, small mammals and, occasionally, birds. It can stand motionless for hours with its neck stretched out, looking for food, or hunched down with its neck bent over its chest.

In birds, the beak is the important food-gathering and processing part. This means that the size and shape of a bird's beak is an excellent guide to its diet and general ecology. We can infer quite a lot about a bird's natural history by examining and comparing beaks of different species. The most distinctive feature of this heron skull is the large, dagger-like beak, which is ideal for grabbing its prey. By way of comparison, the photograph below shows the skull of a shoveler duck, which has a broad, spade-shaped beak lined with hair-like lamellae, which it uses to sift through the water to filter out insects and plant matter. It would be impossible for the shoveler to hunt for quickly moving fish, just as the heron would be unable to extract nutritious material from a mouthful of water.

Badger Skull



The most distinctive feature of this skull is the ridge of bone running along the top of the brain case. This is known as a sagittal crest. The presence of this ridge of bone indicates that the animal has exceptionally strong jaw muscles. The sagittal crest serves primarily for attachment of the main chewing muscles. Development of the sagittal crest is thought to be connected to the development of this muscle. A sagittal crest tends to be present on the skulls of adult animals that rely on powerful biting and clenching of their teeth, usually as a part of their hunting strategy. Badgers, however, are not great hunters and the presence of this ridge is puzzling. They eat insects, small mammals and reptiles, fruits and other plant matter and carrion. Studies have shown that, in Britain, earthworms are the most important component of their diet. Whatever the origin of this feature, the bite of a badger is popularly reputed to be fearsome - they are supposed to be able to make a mark on a steel spade! The reputation of its bite may also, sadly, have contributed to its use in illegal badger-baiting contests. Another factor which has contributed to the stories of their tenacious grip is that the jaw-joint of the badger is constructed so that it cannot be dislocated without breaking the part of the socket into which it fits.

Armadillo Exoskeleton



Armadillos are small mammals, whose most distinctive feature is its exoskeleton - an exterior protective structure which in many ways resembles a suit of armour. Many different species have evolved this feature - tortoises are another mammalian example - while some, which once had a hard outer coat (octopuses, for example), have evolved in the opposite direction. Such a hard outer layer has a defensive advantage, but it can also be inflexible and restrict growth, as in the case of insects.

There are around 20 living species of armadillo, some of which are distinguished by the number of bands on their armour. Body armour in mammals is generally made of compressed hair, as in the plates of pangolins and the horns of the rhinoceros, but the armour of the armadillo is made up of small plates of bone (called scutes), each covered by a layer of horny skin and separated from its neighbouring scutes by soft skin from which sparse hairs grow. The armour hangs down over the body protecting the soft underparts and limbs. It is divided into two shields, one covering the fore limbs and one the hind limbs, the two being linked across the middle of the back by a series of transverse bands of plates that allow the armour to be flexed slightly. Only one species, the three-banded armadillo, can roll itself into a ball, but none of the others can do so. Most rely on speed or their digging ability to escape danger.



This example has been rather grotesquely displayed, with the tail pulled around and stuck into the mouth. In fact, it was probably bought this way and was intended to be used as a basket. Charles Apelt, an American-German businessman, first popularised the armadillo basket as a Texas souvenir by displaying one at the 1902 World Fair. His family company, the Apelt Armadillo Company (including the Apelt Armadillo Farm, the only known commercial attempt at raising armadillos) was in business in Texas until the 1970s. Its main product was the armadillo basket - a dried armadillo shell with the tail curled up over towards the head to form a handle - but they also produced lamps, wall hangings, and other curios fashioned from the armadillo's shell. Consequently, this specimen is probably a nine-banded armadillo, *Dasypus novemcinctus*, which is the only armadillo species found in the USA (see photo, right). German settlers in Texas would often refer to the armadillo as *Panzerschwein* (armoured pig)!

Goat Skull



While some animals such as the walrus and hippopotamus have developed their canine teeth as a means of display and aggression, others such as the deer and the cow, have evolved projections on the top of the skull for the same purpose. True horns, which are a pointed projection covered in keratin (the material which also forms hair and finger nails), are found only among the families *Antilocapridae* and *Bovidae* (cows, buffalo, yaks, antelope and goats). Other animals have developed projections, although they are not strictly horns. Deer antlers, for example, consist of bony outgrowths from the head but do not have the covering of keratin that is found in true horns.

Squirrel Skull



While the dominant teeth in the goat skull are the molars, which are used for grinding up grasses, the dominant teeth in this skull are the large incisors, which efficiently break seeds and nuts. Such large and sharp incisors are also found in the skulls of mice and other rodents. The red squirrel's incisors grow at a rate of 15 cm a year, but they stay shorter than this because of their continuous use and wear, particularly in opening pinecones. They use their incisors to strip the woody scales from pinecones to get the seeds they protect. The thin, yellow-brown area of the incisor is a hard enamel. The colour is due to the iron content in the enamel. The incisors are separated from the tiny grinding pre-molars and molars by a large space called a diastema. This is the case with all rodents and lagomorphs (rabbits and hares). There are no carnassial teeth in a rodent's jaw, just incisors and molars.