

FROM:

<http://www.ultimateungulate.com/>

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Infraorder **un·gu·late** (un'gyoo-lit) [L., *unguis*, a hoof; *-atus* suffix meaning provided with] **n.** a mammal having hoofs

Ungulates, or hoofed mammals, comprise one of the most successful and diverse groups of large mammals alive today, having colonized nearly every habitat on all continents except Antarctica and Australia. All ungulates are mammals (belonging to the Class Mammalia) - a group of warm-blooded (endothermic) animals distinguished from other organisms by the presence of milk-producing skin glands. The mammary glands, for which the Class Mammalia is named, are specific to mammals - no other group of animals possess them. Over twenty other characters are used to diagnose mammals, including the presence of hair and three middle ear bones. All mammals, and thus all ungulates, belong to the Kingdom Animalia and to the Phylum Chordata (Subphylum Vertebrata).

The term "ungulate" - a Latin word meaning "provided with hoofs" - is a confusing term due to the modifications which have necessarily occurred with advances in science. A taxonomic infraorder - *Ungulata* - was originally used to ally the two orders of "true" hoofed mammals - *Perissodactyla* and *Artiodactyla*. These two orders both have large, hard hoofs - basically specialized claws or toe-nails - on the tips of their toes. Most of the weight is supported by the hoofs, with the result that the form of locomotion of ungulates is described as "unguligrade" (rather than "digitigrade", where the toes touch the ground, or "plantigrade", where the entire foot is on the ground, as in humans).

The odd- and even-toed ungulates are still referred to as the "true ungulates", but fossil and molecular evidence have resulted in the expansion of the term "ungulate". Currently included in the group are the elephants, sea cows, hyraxes, and aardvarks. Recent discoveries even appear to warrant the addition of the Cetaceans (whales and dolphins). All of these groups appear to have arisen from a common Condylarth ancestor nearly 90 million years ago.

The term "ungulate" is now used as a practical, descriptive name grouping together six taxonomic orders - *Tubulidentata*, *Hyracoidea*, *Proboscidea*, *Sirenia*, *Perissodactyla*, and *Artiodactyla*. The currently accepted relationship between these orders is shown in the phylogeny to the left. The "true ungulates" Artiodactyla and Perissodactyla are obviously not as closely related as once thought. The hyraxes, elephants, and sea cows are often grouped together as paenungulates ("almost ungulates"), as their feet and flippers all bear nails instead of true hoofs.

Order ar·ti·o·dac·ty·la (är'tee-oh dak ti'la): from Greek artios, complete, of numbers even; daktulos, a finger or toe

The even-toed ungulates are currently the most successful group of large herbivores, being native to every continent with the exception of Antarctica and Australia, and inhabiting virtually all latitudes and altitudes. In addition to their native ranges, many artiodactyl species have been introduced into non-native areas and have survived to produce feral (wild) populations. An incredible diversity is seen in the approximately 220 members of this order, which includes swine, hippopotami, camels, chevrotains, musk deer, giraffes, deer, pronghorns and bovids.

Sizes vary dramatically - from the tiny chevrotains which may weigh less than a kilogram when fully grown to the immense river hippopotamus, weighing up to 4,500 kg. Maximum height is

achieved by the giraffe - the tallest living land mammal - at up to 5.8 meters. Humans have relied heavily upon this order, which has provided us with many domesticated species including cattle, pigs, goats, and sheep. Many species have been introduced into areas outside of their natural range, including New Guinea, Australia, and the islands of Oceania. Only areas to which artiodactyls are native are shown on the map below; if introductions were included, almost the entire map would be shaded! In addition to the ten extant (modern) families, 18 extinct families are known. The evolution of the artiodactyls occurred primarily in the Old World (Europe and Asia), and while the order originated in the early Eocene (~ 55 million years ago), the main adaptive radiation of the ruminants did not occur until the Oligocene.

Diagnostic Characteristics

The primary distinguishing feature of this order is the paraxonic limb structure, in which the symmetry of the foot passes between the two middle digits (III and IV). The first digit (the "thumb" or pollex in the hand and the hallux on the hind limb) is absent in all modern artiodactyls, with the result that all species possess an even number of toes on each foot (with the exception of the Tayassuidae, in which the hind foot only has three digits). Two main types of foot structure are recognized; a cloven hoof with two weight-bearing toes, and a spreading foot with four digits. In all cases the third and fourth digits are well developed, while the second and fifth are reduced, vestigial, or absent.

The nasal bones of the artiodactyls are not expanded caudally, nor is there an alisphenoid canal.

Teeth are variable, but the upper incisors are always reduced or absent. Canines are usually small or not present at all, although in some species they are greatly enlarged into tusks. Two main types of molars are recognized - the brachyodont (low-crowned) teeth of the pigs, peccaries, and hippos, and the hypsodont (high-crowned) teeth of the camels and some ruminants. A postorbital bar is present in all species.

SUBORDER Suiformes

Suidae; swine

A group of relatively unspecialized Old World artiodactyls characterized by a squat body form and an elongated snout. The canines are modified into ever-growing tusks which protrude from the mouth and curve upwards. The dental formula is variable, even within some species, ranging from 34 to 44 teeth.

Tayassuidae; peccaries

Restricted to the New World, the peccaries are pig-like in form, but much smaller than members of the Suidae. The feet of the Tayassuidae are slender, with four toes on the forefeet but only two (Catagonus) or three (Tayassu, Pecari) toes on the hindfeet. The upper canines are equipped with a sharp cutting edge and point downwards. The dental formula for all species is $I \frac{2}{3}, C1/1, P \frac{3}{3}, M \frac{3}{3} \times 2 = 38$.

Hippopotamidae; hippopotamuses

This family is restricted to Africa, with only two species. The thick skin is very scarcely haired. The skull is distinct in form, with elevated eyes (orbits), ears, and nostrils. The limbs are robust and have four well-developed digits. The distal phalanx (the tip) of each toe touches the ground, rendering the foot posture semi-digitigrade. Both the incisors and canines are tusk-like. The dental formula is $I \frac{2-3}{1-3}, C \frac{1}{1}, P \frac{4}{4}, M \frac{3}{3} \times 2 = 38-44$.

SUBORDER Tylopoda

Camelidae; camels, llamas

The neck is long and thin and the palette is cleft. Unique among mammals, the red blood cells are oval in shape. The feet have only two digits (III and IV), which sit almost flat on the ground as part of a wide pad; the foot posture is thus digitigrade. The hooves are reduced, growing only on the upper surface of the distal phalanges. The foot bones (metapodials) are fused to form a "cannon bone". Camelids ruminates (regurgitate and rechewing their food), and have a three-chambered stomach. The dental formula is $I \frac{1}{3}, C \frac{1}{1}, P \frac{2-3}{1-2}, M \frac{3}{3} \times 2 = 30-34$.

SUBORDER Ruminantia

The ruminants (suborder Ruminantia) are considered to be the most advanced artiodactyls. The stomach has four (sometimes three) chambers which allow for the proliferation of microorganisms which are able to digest tough vegetation which would otherwise be unavailable to the animal. The dental formula is generally $I \frac{0}{3}, C \frac{0}{1}, P \frac{3}{3}, M \frac{3}{3} \times 2 = 32$, although in members of the Tragulidae, Moschidae and some Cervidae the upper canine may be present (total teeth 34). The bones in the feet (metapodials) are fused to form a cannon bone, although in Hyemoschus (Tragulidae) this does not occur until after maturity. Only the third and fourth digits are well developed; the second and fifth are vestigial or absent.

Tragulidae; chevrotains (mouse deer)

There are no horns or antlers. There are four digits on each foot, but the second and fifth digit are short and slender. The stomach is three-chambered and ruminating. The upper canines form tusks in the male which protrude downwards from the mouth, while the lower canines resemble incisors.

Moschidae; musk deer

As with the Tragulidae, no horns or antlers are present, and the upper canines are present and form downward-pointing tusks in the male. The hind legs are longer than the forelimbs. Males of all species possess a gland in their abdomen which secretes a pungent, waxy substance called musk.

Giraffidae; giraffe, okapi

Native to Africa, this family is adapted for browsing. The legs are long to very long, and have only two digits. Present on the heads of males (Okapia) or both sexes (Giraffa) are two skin-covered bony knobs known as ossicones, which grow from the frontal (Okapia) or parietal (Giraffa) bones. These ossicones are short and unbranched, and are never shed.

Cervidae; deer

Deer are found world-wide with the exception of most of Africa and Australia (where they have been introduced). Branching antlers are present in the males of all but one species (Hydropotes inermis), and are never borne by females with the exception of Rangifer tarandus. These antlers are formed of bone, and are usually shed and regrown annually. Males of a few species possess enlarged, tusk-like upper canines (Hydropotes, Muntiacus, Elaphodus). In other species the upper canines are either vestigial or absent. There are usually two lacrimal canals. There is no gall bladder.

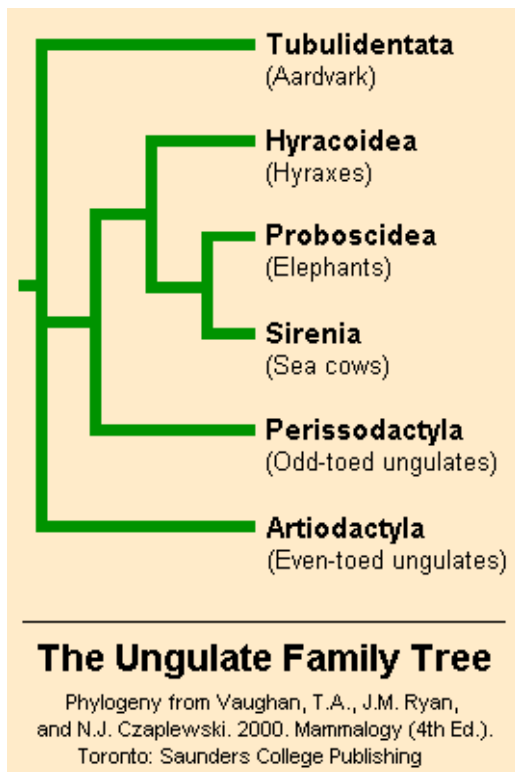
Antilocapridae; pronghorn

The single living species is found only in western North America. The feet have two digits. The

'horns' are unique, consisting of a bony core covered with a keratinized sheath which is shed annually.

Bovidae; antelope, cattle, sheep, goats

All males - and females of some genera - possess unbranched horns attached to the frontal bones of the skull. The horns are composed of a bone core and are covered with a keratin sheath which is never shed. Tetracerus is unique in that males regularly bear four horns (two pairs); all other genera (with the exception of some domestic sheep) have only one pair. The upper canines are always absent. A single lacrimal canal is usually present.



eutherian=has a placenta

monocotyledons: grasses

dicotyledons: forbs, browse: broadleaved plants