

Cattle (***Bos taurus***) are large, [domesticated](#), [cloven-hooved](#) [herbivores](#). They are a prominent modern member of the subfamily [Bovinae](#) and the most widespread species of the genus [Bos](#). [Adult female](#) cattle are referred to as **cows** and adult [male](#) cattle are referred to as [bulls](#).

Cattle are commonly raised as [livestock](#) for meat ([beef](#) or [veal](#), see [beef cattle](#)), for [milk](#) (see [dairy cattle](#)), and for [hides](#), which are used to make [leather](#). They are used as [riding animals](#) and [draft animals](#) ([oxen](#) or [bullocks](#), which pull [carts](#), [plows](#) and other implements). Another product of cattle is [their dung](#), which can be used to create [manure](#) or [fuel](#). In some regions, such as parts of India, [cattle have significant religious significance](#). Cattle, mostly small breeds such as the [Miniature Zebu](#), are also kept as [pets](#).

Different types of cattle are common to different geographic areas. Taurine cattle are found primarily in Europe and temperate areas of Asia, the Americas, and Australia. [Zebus](#) (also called indicine cattle) are found primarily in India and tropical areas of Asia, America, and Australia. [Sanga cattle](#) are found primarily in [sub-Saharan Africa](#). These types (which are sometimes classified as separate species or subspecies) are further divided into [over 1,000 recognized breeds](#).

Around 10,500 years ago, taurine cattle were domesticated from as few as 80 wild [aurochs](#) progenitors in [central Anatolia](#), the [Levant](#) and [Western Iran](#).^[1] A separate domestication event occurred in the [Indian subcontinent](#), which gave rise to zebu. According to the [Food and Agriculture Organization](#) (FAO), there are approximately 1.5 billion cattle in the world as of 2018.^[2] Cattle are the main source of [greenhouse gas emissions](#) from livestock, and are responsible for around 10% of global greenhouse gas emissions.^{[3][4]} In 2009, cattle became one of the first livestock animals to have a fully mapped [genome](#).^[5]

Taxonomy

See also: [Bos](#) and [Bovinae](#)



[Zubroń](#), a [wisent](#) and cattle hybrid

Cattle were originally identified as three separate species: *Bos taurus*, the European or "taurine" cattle (including similar types from Africa and Asia); *Bos indicus*, the [Indicine](#) or "zebu"; and the extinct *Bos primigenius*, the [aurochs](#). The aurochs is ancestral to both zebu and taurine cattle.^[6] They were later reclassified as one species, *Bos taurus*, with the aurochs, zebu, and taurine cattle as subspecies.^[7] However, this taxonomy is contentious and some sources prefer the separate species classification, such as the [American Society of Mammalogists'](#) Mammal Diversity Database.^{[8][9]}

Complicating the matter is the ability of cattle to [interbreed](#) with other closely related species. Hybrid individuals and even breeds exist, not only between taurine cattle and zebu (such as the [sanga cattle](#) (*Bos taurus africanus* x *Bos indicus*), but also between one or both of these and some other

members of the [genus *Bos*](#) – [yaks](#) (the [dzo](#) or yattle^[10]), [banteng](#), and [gaur](#). Hybrids such as the [beefalo](#) breed can even occur between taurine cattle and either species of [bison](#), leading some authors to consider them part of the genus *Bos*, as well.^[11] The hybrid origin of some types may not be obvious – for example, [genetic testing](#) of the [Dwarf Lulu](#) breed, the only taurine-type cattle in Nepal, found them to be a mix of taurine cattle, zebu, and yak.^[12] However, cattle cannot be successfully hybridized with more distantly related bovines such as [water buffalo](#) or [African buffalo](#).

The aurochs originally ranged throughout Europe, North Africa, and much of Asia. In historical times, its range became restricted to Europe, and the last known individual died in [Mazovia](#), Poland, in about 1627.^[13] Breeders have attempted to recreate cattle of similar appearance to aurochs by crossing traditional types of domesticated cattle, creating the [Heck cattle](#) breed.

The only pure African taurine breeds (*Bos taurus africanus*) remaining are the [N'Dama](#), [Kuri](#) and some varieties of the West African Shorthorn.^[14]

Etymology

Cattle did not originate as the term for bovine animals. It was borrowed from [Anglo-Norman](#) *catel*, itself from medieval Latin *capitale* 'principal sum of money, capital', itself derived in turn from Latin *caput* 'head'. *Cattle* originally meant movable [personal property](#), especially livestock of any kind, as opposed to [real property](#) (the land, which also included wild or small free-roaming animals such as chickens—they were sold as part of the land).^{[15][16]} The word is a variant of [chatte!](#) (a unit of personal property) and closely related to [capital](#) in the economic sense.^{[17][18][16]} The term replaced earlier [Old English](#) *feoh* 'cattle, property', which survives today as *fee* (*cf.* German: *Vieh*, [Dutch](#): *vee*, [Gothic](#): *faihu*).

The word *cow* came via [Anglo-Saxon](#) *cū* (plural *cȳ*), from [Common Indo-European](#) *ǵʷōus* ([genitive](#) *ǵʷowés*) 'a bovine animal', *cf.* [Persian](#): *gāv*, [Sanskrit](#): *go-*, [Welsh](#): *buwch*.^[19] The plural *cȳ* became *ki* or *kie* in Middle English, and an additional plural ending was often added, giving *kine*, *kien*, but also *kies*, *kuin* and others. This is the origin of the now archaic English plural, *kine*. The [Scots language](#) singular is *coo* or [cou](#), and the plural is *kye*.

In older English sources such as the [King James Version](#) of the Bible, *cattle* refers to livestock, as opposed to *deer* which refers to wildlife. *Wild cattle* may refer to [feral](#) cattle or to undomesticated species of the genus [Bos](#). Today, when used without any other qualifier, the modern meaning of *cattle* is usually restricted to domesticated bovines.^[16]

Terminology



Look up [cattle](#), [cow](#), or [bull](#) in Wiktionary, the free dictionary.

In general, the same words are used in different parts of the world, but with minor differences in the definitions. The terminology described here contrasts the differences in definition between the United Kingdom and other British-influenced parts of the world such as Canada, Australia, New Zealand, Ireland and the United States.^[20]

- An "intact" (i.e., not [castrated](#)) adult male is called a [bull](#).
 - A father bull is called a *sire* with reference to his offspring.
- An adult female that has had a calf (or two, depending on regional usage) is a *cow*. Steers and heifers are also colloquially referred to as cows.

- A mother cow is called a *dam* with reference to her offspring. Often, mentions of *dams* imply cows kept in the herd for repeated breeding (as opposed to heifers or cows sold off sooner).
- A young female before she has had a calf of her own^[21] and who is under three years of age is called a *heifer* (*/ˈheɪfər/ HEF-ər*).^[22] A young female that has had only one calf is occasionally called a *first-calf heifer*. *Heiferettes* are either first-calf heifers or a subset thereof without potential to become lineage dams, depending on whose definition is operative.
- Young cattle (regardless of sex) are called *calves* until they are *weaned*, then *weaners* until they are a year old in some areas; in other areas, particularly with male beef cattle, they may be known as *feeder calves* or *feeders*. After that, they are referred to as *yearlings* or *stirks*^[23] if between one and two years of age.^[24]
- *Feeder cattle* or *store cattle* are young cattle soon to be either *backgrounded* or sent to fattening, most especially those intended to be sold to someone else for finishing. In some regions, a distinction between *stockers* and *feeders* (by those names) is the distinction of backgrounding versus immediate sale to a finisher.
- A castrated male is called a *steer* in the United States; older steers are often called *bullocks* in other parts of the world.^[25] but in North America this term refers to a young bull. *Piker bullocks* are micky bulls (uncastrated young male bulls) that were caught, castrated and then later lost.^[26] In Australia, the term *Japanese ox* is used for grain-fed steers in the weight range of 500 to 650 kg that are destined for the Japanese meat trade.^[27] In North America, draft cattle under four years old are called working steers. Improper or late castration on a bull results in it becoming a coarse steer known as a *stag* in Australia, Canada and New Zealand.^[28] In some countries, an incompletely castrated male is known also as a *rig*.
- A castrated male (occasionally a female or in some areas a bull) kept for draft or riding purposes is called an *ox* (plural *oxen*); *ox* may also be used to refer to some carcass products from any adult cattle, such as ox-hide, ox-blood, oxtail, or ox-liver.^[22]
- A *springer* is a cow or heifer close to calving.^[29]
- In all cattle species, a female twin of a bull usually becomes an infertile partial *intersex*, and is called a *freemartin*.
- A wild, young, unmarked bull is known as a *micky* in Australia.^[26]
- An *unbranded* bovine of either sex is called a *maverick* in the US and Canada.
- *Neat* (horned oxen, from which *neatsfoot oil* is derived), *beef* (young ox) and *beefing* (young animal fit for slaughtering) are obsolete terms, although *poll*, *pollard* and *polled cattle* are still terms in use for naturally hornless animals, or in some areas also for those that have been *disbudded* or *dehorned*.
- Cattle raised for human consumption are called *beef cattle*. Within the American beef cattle industry, the older term *beef* (plural *beeves*) is still used to refer to an animal of either sex. Some Australian, Canadian, New Zealand and British people use the term *beast*.^[30]
- Cattle bred specifically for milk production are called *milking* or *dairy cattle*;^[20] a cow kept to provide milk for one family may be called a *house cow* or *milker*. A *fresh cow* is a dairy term for a cow or first-calf heifer who has recently given birth, or "freshened."
- The adjective applying to cattle in general is usually *bovine*. The terms *bull*, *cow* and *calf* are also used by extension to denote the sex or age of other large animals, including whales, *hippopotamuses*, *camels*, *elk* and elephants.
- Various other terms for cattle or types thereof are *historical*; these include *nowt*, *nolt*, *mart*, and others.

Singular terminology issue



A [Finncattle](#) at [Särkänniemi](#) in [Tampere](#), Finland

"Cattle" can only be used in the [plural](#) and not in the [singular](#): it is a [plurale tantum](#).^[31] Thus one may refer to "three cattle" or "some cattle", but not "one cattle". "One head of cattle" is a valid though periphrastic way to refer to one animal of indeterminate or unknown age and sex; otherwise no universally used single-word singular form of *cattle* exists in modern English, other than the sex- and age-specific terms such as *cow*, *bull*, *steer* and *heifer*. Historically, "ox" was not a sex-specific term for adult cattle, but generally this is now used only for [working cattle](#), especially adult castrated males. The term is also incorporated into the names of other species, such as the [musk ox](#) and "grunting ox" ([yak](#)), and is used in some areas to describe certain cattle products such as ox-hide and [oxtail](#).^[32]

Cow is in general use as a singular for the collective *cattle*. The word *cow* is easy to use when a singular is needed and the sex is unknown or irrelevant—when "there is a cow in the road", for example. Further, any herd of fully mature cattle in or near a [pasture](#) is statistically likely to consist mostly of cows, so the term is probably accurate even in the restrictive sense. Other than the few bulls needed for breeding, the vast majority of male cattle are castrated as calves and are used as [oxen](#) or slaughtered for meat before the age of three years. Thus, in a pastured herd, any calves or herd bulls usually are clearly distinguishable from the cows due to distinctively different sizes and clear anatomical differences. Merriam-Webster and Oxford Living Dictionaries recognize the sex-nonspecific use of *cow* as an alternate definition,^{[33][34]} whereas Collins and the OED do not.

[Colloquially](#), more general non[specific](#) terms may denote cattle when a singular form is needed. *Head of cattle* is usually used only after a numeral. Australian, New Zealand and British farmers use the term *beast* or *cattle beast*. *Bovine* is also used in Britain. The term *critter* is common in the western United States and Canada, particularly when referring to young cattle.^[35] In some areas of the American South (particularly the Appalachian region), where both dairy and beef cattle are present, an individual animal was once called a "beef critter", though that term is becoming [archaic](#).

Other terminology

Cattle raised for human consumption are called [beef cattle](#). Within the beef cattle industry in parts of the United States, the term *beef* (plural *beeves*) is still used in its archaic sense to refer to an animal of either sex. Cows of certain breeds that are kept for the milk they give are called [dairy cows](#) or *milking cows* (formerly *milch cows*). Most young male offspring of dairy cows are sold for [veal](#), and may be referred to as veal calves.

The term *dogies* is used to describe orphaned calves in the context of [ranch](#) work in the [American West](#), as in "Keep them dogies moving".^[36] In some places, a cow kept to provide milk for one family is called a "house cow". Other obsolete terms for cattle include "neat" (this use survives in "[neatsfoot oil](#)", extracted from the feet and legs of cattle), and "beefing" (young animal fit for [slaughter](#)).



[A cow's "moo"](#)

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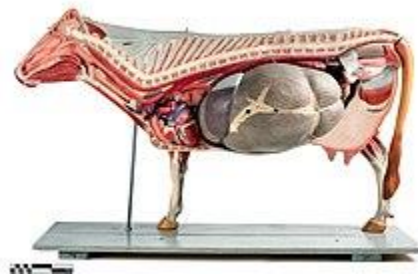
An [onomatopoeic](#) term for one of the most common [sounds](#) made by cattle is *moo* (also called *lowing*). There are a number of other sounds made by cattle, including calves *bawling*, and bulls *bellowing*. Bawling is most common for cows after weaning of a calf. The [bullroarer](#) makes a sound similar to a bull's territorial call.^[37]

Characteristics

Anatomy



Displayed skeleton of a domestic cow



Anatomical model of a cow

Cattle are large [quadrupedal ungulate mammals](#) with [cloven hooves](#). Most breeds have [horns](#), which can be as large as the [Texas Longhorn](#) or small like a [scur](#). Careful genetic selection has allowed [polled](#) (hornless) cattle to become widespread.

Digestive system

Further information: [Digestive system of ruminants](#)

Cattle are [ruminants](#), meaning their [digestive system](#) is highly specialized to allow the consumption of difficult to digest plants as food. Cattle have one [stomach](#) with four compartments, the [rumen](#), [reticulum](#), [omasum](#), and [abomasum](#), with the rumen being the largest compartment. The reticulum, the smallest compartment, is known as the "honeycomb". The omasum's main function is to absorb water and nutrients from the digestible feed. The omasum is known as the "many plies". The abomasum is like the human stomach; this is why it is known as the "true stomach".

Cattle are known for [regurgitating](#) and re-chewing their food, known as [cud](#) chewing, like most ruminants. While the animal is feeding, the food is swallowed without being chewed and goes into the rumen for storage until the animal can find a quiet place to continue the digestion process. The food is regurgitated, a mouthful at a time, back up to the mouth, where the food, now called the [cud](#),

is chewed by the molars, grinding down the coarse vegetation to small particles. The cud is then swallowed again and further digested by specialized [microorganisms](#) in the rumen. These microbes are primarily responsible for decomposing [cellulose](#) and other [carbohydrates](#) into [volatile fatty acids](#) cattle use as their primary [metabolic](#) fuel. The microbes inside the rumen also synthesize [amino acids](#) from non-protein [nitrogenous](#) sources, such as [urea](#) and [ammonia](#). As these microbes reproduce in the rumen, older generations die and their cells continue on through the digestive tract. These cells are then partially digested in the small intestines, allowing cattle to gain a high-quality protein source. These features allow cattle to thrive on [grasses](#) and other tough vegetation.

Reproduction

Further information: [Bull § Reproductive anatomy](#)



Reproductive system of a bovine female



Ox testes

On farms it is very common to use [artificial insemination](#) (AI), a [medically assisted reproduction technique](#) consisting of the artificial deposition of [semen](#) in the [female's genital tract](#).^[38] It is used in cases where the [spermatozoa](#) can not reach the [fallopian tubes](#) or by choice of the owner of the animal. It consists of transferring, to the [uterine cavity](#), spermatozoa previously collected and processed, with the selection of morphologically more normal and mobile spermatozoa. Synchronization of cattle [ovulation](#) to benefit [dairy farming](#) may be accomplished via [induced ovulation](#) techniques.

Bulls become fertile at about seven months of age. Their fertility is closely related to the size of their [testicles](#), and one simple test of fertility is to measure the circumference of the scrotum: a young bull is likely to be fertile once this reaches 28 centimetres (11 in); that of a fully adult bull may be over 40 centimetres (16 in).^{[39][40]}

A bull has a fibro-elastic penis. Given the small amount of erectile tissue, there is little enlargement after erection. The penis is quite rigid when non-erect, and becomes even more rigid during erection. Protrusion is not affected much by erection, but more by relaxation of the [retractor penis muscle](#) and straightening of the [sigmoid flexure](#).^{[41][42][43]}

The [gestation period](#) for a cow is about nine months long. The [secondary sex ratio](#) – the ratio of male to female offspring at birth – is approximately 52:48, although it may be influenced by environmental and other factors.^[44] A cow's [udder](#) contains two pairs of [mammary glands](#), (commonly referred to as *teats*) creating four "quarters".^[45] The front ones are referred to as *fore quarters* and the rear ones *rear quarters*.^[46]

Weight and lifespan



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The weight of adult cattle varies, depending on the breed. Smaller kinds, such as Dexter and Jersey adults, range between 300 and 500 kg (600 and 1,000 lb).^[citation needed] Large Continental breeds, such as Charolais, Marchigiana, Belgian Blue and Chianina adults range from 640 to 1,100 kg (1,400 to 2,500 lb).^[citation needed] British breeds, such as Hereford, Angus, and Shorthorn, mature at 500 to 900 kg (1,000 to 2,000 lb), occasionally higher, particularly with Angus and Hereford.^[citation needed] Bulls are larger than cows of the same breed by up to a few hundred kilograms. British Hereford cows weigh 600–800 kg (1,300–1,800 lb); the bulls weigh 1,000–1,200 kg (2,200–2,600 lb).^[47] Chianina bulls can weigh up to 1,500 kg (3,300 lb); British bulls, such as Angus and Hereford, can weigh as little as 900 kg (2,000 lb) and as much as 1,400 kg (3,000 lb).^[citation needed]

The world record for the heaviest bull was 1,740 kg (3,840 lb), a [Chianina](#) named Donetto, when he was exhibited at the [Arezzo](#) show in 1955.^[48] The heaviest steer was eight-year-old 'Old Ben', a [Shorthorn/Hereford](#) cross weighing in at 2,140 kg (4,720 lb) in 1910.^[49]

In the United States, the average weight of beef cattle has steadily increased, especially since the 1970s, requiring the building of new slaughterhouses able to handle larger carcasses. New packing plants in the 1980s stimulated a large increase in cattle weights.^[50] Before 1790 beef cattle averaged only 160 kg (350 lb) net; and thereafter weights climbed steadily.^{[51][52]}

A newborn calf's size can vary among breeds, but a typical calf weighs 25 to 45 kg (55 to 99 lb). Adult size and weight vary significantly among breeds and sex. Steers are generally slaughtered before reaching 750 kg (1,650 lb). Breeding stock may be allowed a longer lifespan, occasionally living as long as 25 years. The oldest recorded cow, [Big Bertha](#), died at the age of 48 in 1993.

Cognition

In laboratory studies, young cattle are able to memorize the locations of several food sources and retain this memory for at least 8 hours, although this declined after 12 hours.^[53] Fifteen-month-old heifers learn more quickly than adult cows which have had either one or two calvings, but their longer-term memory is less stable.^[54] Mature cattle perform well in spatial learning tasks and have a good long-term memory in these tests. Cattle tested in a [radial arm maze](#) are able to remember the locations of high-quality food for at least 30 days. Although they initially learn to avoid low-quality food, this memory diminishes over the same duration.^[55] Under less artificial testing conditions, young cattle showed they were able to remember the location of feed for at least 48 days.^[56] Cattle can make an association between a visual stimulus and food within 1 day—memory of this association can be retained for 1 year, despite a slight decay.^[57]

Calves are capable of discrimination learning^[58] and adult cattle compare favourably with small mammals in their learning ability in the [closed-field test](#).^[59]

They are also able to discriminate between familiar individuals, and among humans. Cattle can tell the difference between familiar and unfamiliar animals of the same species (conspecifics). Studies show they behave less aggressively toward familiar individuals when they are forming a new group.^[60] Calves can also discriminate between humans based on previous experience, as shown by approaching those who handled them positively and avoiding those who handled them aversively.^[61] Although cattle can discriminate between humans by their faces alone, they also use other cues such as the color of clothes when these are available.^[62]

In audio play-back studies, calves prefer their own mother's vocalizations compared to the vocalizations of an unfamiliar mother.^[63]

In laboratory studies using images, cattle can discriminate between images of the heads of cattle and other animal species.^[64] They are also able to distinguish between familiar and unfamiliar conspecifics. Furthermore, they are able to [categorize](#) images as familiar and unfamiliar individuals.^[60]

When mixed with other individuals, [cloned](#) calves from the same donor form subgroups, indicating that kin discrimination occurs and may be a basis of grouping behaviour. It has also been shown using images of cattle that both artificially inseminated and cloned calves have similar cognitive capacities of kin and non-kin discrimination.^[65]

Cattle can recognize familiar individuals. Visual individual recognition is a more complex mental process than visual discrimination. It requires the recollection of the learned idiosyncratic identity of an individual that has been previously encountered and the formation of a mental representation.^[66] By using two-dimensional images of the heads of one cow (face, profiles, ¾ views), all the tested heifers showed individual recognition of familiar and unfamiliar individuals from their own breed. Furthermore, almost all the heifers recognized unknown individuals from different breeds, although this was achieved with greater difficulty. Individual recognition was most difficult when the visual features of the breed being tested were quite different from the breed in the image, for example, the breed being tested had no spots whereas the image was of a spotted breed.^[67]

Cattle use [visual/brain lateralisation](#) in their visual scanning of novel and familiar stimuli.^[68] Domestic cattle prefer to view novel stimuli with the left eye, i.e. using the right brain hemisphere (similar to horses, Australian magpies, chicks, toads and fish) but use the right eye, i.e. using the left hemisphere, for viewing familiar stimuli.^[69]

Senses

Cattle use all of the five widely recognized sensory modalities. These can assist in some complex behavioural patterns, for example, in grazing behaviour. Cattle eat mixed diets, but when given the opportunity, show a partial preference of approximately 70% clover and 30% grass. This preference has a diurnal pattern, with a stronger preference for clover in the morning, and the proportion of grass increasing towards the evening.^[70]

Vision



Cattle receive about half of their information visually.

Vision is the dominant sense in cattle and they obtain almost 50% of their information visually. ^[71]

Cattle are a prey animal and to assist predator detection, their eyes are located on the sides of their head rather than the front. This gives them a wide field of view of 330° but limits [binocular vision](#) (and therefore [stereopsis](#)) to 30° to 50° compared to 140° in humans. ^{[60][72]} This means they have a blind spot directly behind them. Cattle have good visual acuity, ^[60] but compared to humans, their visual accommodation is poor. ^{[clarification needed][71]}

Cattle have two kinds of [color receptors](#) in the [cone cells](#) of their [retinas](#). This means that cattle are [dichromatic](#), as are most other non-primate land mammals. ^{[73][74]} There are two to three rods per cone in the [fovea centralis](#) but five to six near the optic papilla. ^[72] Cattle can distinguish long wavelength colors (yellow, orange and red) much better than the shorter wavelengths (blue, grey and green). Calves are able to discriminate between long (red) and short (blue) or medium (green) wavelengths, but have limited ability to discriminate between the short and medium. They also approach handlers more quickly under red light. ^[75] Whilst having good color sensitivity, it is not as good as humans or [sheep](#). ^[60]

A common misconception about cattle (particularly bulls) is that they are enraged by the color red (something provocative is often said to be "like a red flag to a bull"). This is a myth. In [bullfighting](#), it is the movement of the red flag or cape that irritates the bull and incites it to charge. ^[76]

Taste

Cattle have a well-developed sense of taste and can distinguish the four primary tastes (sweet, salty, bitter and sour). They possess around 20,000 taste buds. The strength of taste perception depends on the individual's current food requirements. They avoid bitter-tasting foods (potentially toxic) and have a marked preference for sweet (high calorific value) and salty foods ([electrolyte](#) balance). Their sensitivity to sour-tasting foods helps them to maintain optimal ruminal [pH](#). ^[71]

Plants have low levels of sodium and cattle have developed the capacity of seeking salt by taste and smell. If cattle become depleted of sodium salts, they show increased locomotion directed to searching for these. To assist in their search, the olfactory and gustatory receptors able to detect minute amounts of sodium salts increase their sensitivity as biochemical disruption develops with sodium salt depletion. ^{[77][78]}

Hearing

Cattle hearing ranges from 23 [Hz](#) to 35 kHz. Their frequency of best sensitivity is 8 kHz and they have a lowest threshold of -21 [db](#) (re $20 \mu\text{N/m}^{-2}$), which means their hearing is more acute than horses (lowest threshold of 7 db).^[79] Sound localization acuity thresholds are an average of 30° . This means that cattle are less able to localise sounds compared to goats (18°), dogs (8°) and humans (0.8°).^[80] Because cattle have a broad foveal fields of view covering almost the entire horizon, they may not need very accurate locus information from their auditory systems to direct their gaze to a sound source.

Vocalizations are an important mode of communication amongst cattle and can provide information on the age, sex, dominance status and reproductive status of the caller. Calves can recognize their mothers using vocalizations; vocal behaviour may play a role by indicating estrus and competitive display by bulls.^[81]

Olfaction and gustation



Several senses are used in social relationships among cattle.

Cattle have a range of odiferous glands over their body including interdigital, infraorbital, inguinal and [sebaceous](#) glands, indicating that olfaction probably plays a large role in their social life. Both the primary olfactory system using the [olfactory bulbs](#), and the secondary olfactory system using the [vomeronasal organ](#) are used.^[82] This latter olfactory system is used in the [flehmen](#) response. There is evidence that when cattle are stressed, this can be recognised by other cattle and this is communicated by alarm substances in the urine.^[83] The odour of dog faeces induces behavioural changes prior to cattle feeding, whereas the odours of urine from either stressed or non-stressed conspecifics and blood have no effect.^[84]

In the laboratory, cattle can be trained to recognise conspecific individuals using olfaction only.^[82]

In general, cattle use their sense of smell to "expand" on information detected by other sensory modalities. However, in the case of social and reproductive behaviours, olfaction is a key source of information.^[71]

Touch

Cattle have tactile sensations detected mainly by [mechanoreceptors](#), [thermoreceptors](#) and [nociceptors](#) in the skin and muscles. These are used most frequently when cattle explore their environment.^[71]

Magnetoreception

There is conflicting evidence for [magnetoreception](#) in cattle. One study reported that resting and grazing cattle tend to align their body axes in the geomagnetic north–south direction.^[85] In a follow-up study, cattle exposed to various magnetic fields directly beneath or in the vicinity of power lines trending in various magnetic directions exhibited distinct patterns of alignment.^[86] However, in 2011, a group of [Czech](#) researchers reported their failed attempt to replicate the finding using [Google Earth](#) images.^[87]

Behavior

Under natural conditions, calves stay with their mother until weaning at 8 to 11 months. Heifer and bull calves are equally attached to their mothers in the first few months of life.^[88] Cattle are considered to be "hider" type animals, utilizing secluded areas more in the hours before calving and continued to use it more for the hour after calving. Cows that gave birth for the first time show a higher incidence of abnormal maternal behavior.^[89]

Video of a calf suckling



A cow giving birth

In one study, beef-calves reared on the range were observed to suckle an average of 5.0 times every 24 hours with an average total time of 46 min spent suckling. There was a diurnal rhythm in suckling activity with peaks between 05:00–07:00, 10:00–13:00 and 17:00–21:00.^[90]

Reproductive behavior

Semi-wild [Highland cattle](#) heifers first give birth at 2 or 3 years of age, and the timing of birth is synchronized with increases in natural food quality. Average calving interval is 391 days, and calving mortality within the first year of life is 5%.^[91]

Dominance and leadership

One study showed that over a 4-year period, dominance relationships within a herd of semi-wild highland cattle were very firm. There were few overt aggressive conflicts and the majority of disputes were settled by [agonistic](#) (non-aggressive, competitive) behaviors that involved no physical contact between opponents (e.g. threatening and spontaneous withdrawing). Such agonistic behavior reduces the risk of injury. Dominance status depended on age and sex, with older animals generally being dominant to young ones and males dominant to females. Young bulls gained superior dominance status over adult cows when they reached about 2 years of age.^[91]

As with many animal dominance hierarchies, dominance-associated aggressiveness does not correlate with rank position, but is closely related to rank distance between individuals.^[91]

Dominance is maintained in several ways. Cattle often engage in mock fights where they test each other's strength in a non-aggressive way. Licking is primarily performed by subordinates and received by dominant animals. Mounting is a playful behavior shown by calves of both sexes and by bulls and sometimes by cows in estrus,^[92] however, this is not a dominance related behavior as has been found in other species.^[91]

The horns of cattle are "[honest signals](#)" used in mate selection. Furthermore, horned cattle attempt to keep greater distances between themselves and have fewer physical interactions than hornless cattle. This leads to more stable social relationships.^[93]

In calves, the frequency of agonistic behavior decreases as space allowance increases, but this does not occur for changes in group size. However, in adult cattle, the number of agonistic encounters increases as the group size increases.^[94]

Grazing behavior

When grazing, cattle vary several aspects of their bite, i.e. tongue and jaw movements, depending on characteristics of the plant they are eating. Bite area decreases with the density of the plants but increases with their height. Bite area is determined by the sweep of the tongue; in one study observing 750-kilogram (1,650 lb) steers, bite area reached a maximum of approximately 170 cm² (30 sq in). Bite depth increases with the height of the plants. By adjusting their behavior, cattle obtain heavier bites in swards that are tall and sparse compared with short, dense swards of equal mass/area.^[95] Cattle adjust other aspects of their grazing behavior in relation to the available food; foraging velocity decreases and intake rate increases in areas of abundant palatable forage.^[96]

Cattle avoid grazing areas contaminated by the faeces of other cattle more strongly than they avoid areas contaminated by sheep,^[97] but they do not avoid pasture contaminated by rabbit faeces.^[98]

Temperament and emotions



Ear postures of cows are studied as indicators of their emotional state and overall [animal welfare](#).^[99]

In cattle, temperament can affect production traits such as carcass and meat quality or milk yield as well as affecting the animal's overall health and reproduction. Cattle temperament is defined as "the consistent behavioral and physiological difference observed between individuals in response to a stressor or environmental challenge and is used to describe the relatively stable difference in the behavioral predisposition of an animal, which can be related to psychobiological mechanisms".^[100] Generally, cattle temperament is assumed to be multidimensional. Five underlying categories of temperament traits have been proposed:^[101]

- shyness–boldness
- exploration–avoidance
- activity
- [aggressiveness](#)
- sociability

In a study on Holstein–Friesian heifers learning to press a panel to open a gate for access to a food reward, the researchers also recorded the heart rate and behavior of the heifers when moving along the race towards the food. When the heifers made clear improvements in learning, they had higher

heart rates and tended to move more vigorously along the race. The researchers concluded this was an indication that cattle may react emotionally to their own learning improvement.^[102]

Negative emotional states are associated with a bias toward negative responses towards ambiguous cues in judgement tasks. After separation from their mothers, Holstein calves showed such a cognitive bias indicative of low mood.^[103] A similar study showed that after hot-iron disbudding ([dehorning](#)), calves had a similar negative bias indicating that post-operative pain following this routine procedure results in a negative change in emotional state.^[104]

In studies of visual discrimination, the position of the ears has been used as an indicator of emotional state.^[60] When cattle are stressed other cattle can tell by the chemicals released in their urine.^[83]

Cattle are very [gregarious](#) and even short-term isolation is considered to cause severe psychological [stress](#). When [Aubrac](#) and Friesian heifers are isolated, they increase their vocalizations and experience increased [heart rate](#) and plasma [cortisol](#) concentrations. These physiological changes are greater in Aubracs. When visual contact is re-instated, vocalizations rapidly decline, regardless of the familiarity of the returning cattle, however, heart rate decreases are greater if the returning cattle are familiar to the previously isolated individual.^[105] Mirrors have been used to reduce stress in isolated cattle.^[106]

Sleep

Further information: [Sleep in non-human animals](#) and [Cow tipping](#)

The average sleep time of a domestic cow is about 4 hours a day.^[107] Cattle do have a [stay apparatus](#),^[108] but do not sleep standing up;^[109] they lie down to sleep deeply.^[110] In spite of the [urban legend](#), cows cannot be tipped over by people pushing on them.^[111]