3

The implications of cattle domestication

This chapter presents an insight into domestication, such as the timelines and impact on natural cattle behaviour.

The main points of this chapter

- When domestication began, the human–animal relationship developed towards a symbiosis in which humans provided food and protection from predators in exchange for animal products (food and fur) and power.
- By keeping and selecting cattle for commercial production, we have reduced their longevity.
- Humans have modified the genotype of cattle for their own benefit more than any other species of domestic livestock and, in the process of this modification, we have often improved their welfare.
- Our modification of the cattle genotype has enabled us to keep them in a wide variety of conditions and environments. Even in environments where many people would consider that cattle are not well adapted, they still produce economic quantities of milk or grow at commercially acceptable rates.
- It is believed that selection of behavioural characteristics played a very important part in the early stages of cattle domestication.

- The greatest impact of housing on the behaviour and welfare of cattle is on their social structure, since it is necessary to bring them into much closer contact than would have been the case if they were living outdoors.
- Another major effect of housing is on their predisposition to specific diseases, such as lameness.
- Cattle have had to change their behaviour patterns to adapt to social and human influences.

3.1 How modern day cattle evolved

Throughout the history of the human species, animals have played an important part in human life, and vice versa. In the early hunter-gatherer/nomadic cultures, animals were viewed as prey, but also as dangerous predators. The same holds true for the animals' perspective as some species considered humans as predators, some as prey. When domestication began, the human–animal relationship developed towards a symbiosis in which humans provided food and protection from predators in exchange for animal products (food and fur) and power. Domestication can be defined as an evolutionary process by which a population of captive animals adapt to man and the environment he provides; this occurs over many generations through a combination of genetic changes and environmental experiences recurring each generation (Price 1998). Domestication is more than just taming, as it also includes goal-orientated breeding programs in captivity. In essence, it is a system in which the breeding, care and feeding of animals is completely under the control of humans. Like their human counterparts, domesticated animals now take on a wide variety of roles, with cattle the most diverse of all production animals, being suppliers of draught power, food and also animals connected with temples.

Fossilised cattle remains have been found in India dating back 2 million years, while in France, cattle drawings in caves have been found dating from 15 000 years ago. Based on archaeological remains, cattle were first domesticated in south-west Turkey ~8000 years ago with the more drought tolerant, humped (Zebu) cattle developed in Iran some 7000 years ago. However, more recent blood analyses have dated the origins of cattle to 500 000 years, long before modern humans were involved (Albright and Arave 1997). Cattle have been used in human cultures primarily as draught animals, as sources of ceremonial objects, meat, milk, leather, fertiliser, by-products and as trusting companions and possessions. Cattle were first selected for worship, because of their crescent-shaped horns that represented different phases of the moon. Their next key role was as draught animals to pull carts in temple ceremonies and in sacrificial rites, hence their selection for a quiet disposition and the appropriate horn shape. Much later, their role as suppliers of

food and other by-products became the main concerns. Almost all great civilisations were built by people with a bull-cow culture, compared to those with only sheep and goats. Not only were they a greater source of meat and milk than pigs, sheep and goats which had been domesticated earlier than cattle, they were also the first draught animals to work the land during agricultural (grain growing) evolution. Some cattle became specialised dairy or specialised beef breeds while others were dual-purpose breeds supplying both these products. Physical work has always been a product but now horses and tractors have taken over this role. In many developing countries, cattle are still a sign of wealth and prestige.

Only in India has a major cow culture survived where cattle are still revered. All but two Indian states currently have laws strictly forbidding mistreatment or slaughter of cattle. Special cow nursing homes have even been established to take care of barren cows and those no longer able to work. Even in Singapore, the senior author has visited a dairy farm that daily supplies the local Hindu temple with fresh milk from a herd of ~30 milking cows, but also has a second herd of over 60 aging, dry and non pregnant cows that are maintained until their natural deaths. In such cases, religion and culture are considered more important than farm profits.

3.2 Impacts of domestication

During the domestication process, humans have provided the basic requirements such as food, water, a suitable environment, veterinary care and companionship, but have taken away the freedoms that cattle would have in the wild, such as choice of mate, companion, and feed and – of most importance – their freedom of movement. Furthermore, by keeping and selecting for commercial production, we have reduced their longevity, which would otherwise be as high as 20 to 25 years, for various reasons such as:

- Draught animals are culled when they become 'too old' because of the high demands of their work.
- Meat animals become less efficient in converting stock feed to saleable products and older cattle have lower growth rates and produce increasingly more fat in their carcasses.
- Milk animals are culled because of metabolic strain after only three or four lactations, or 6 or 7 years old, due to the impact of the stress of many lactations and the poor conditions that they are often kept in.

Humans have modified the genotype of cattle for their own benefit more than any other species of domestic livestock. In the process of this modification, many aspects of their welfare have improved. The ease with which cattle can coexist with humans is in marked contrast to other species that have not been as extensively

domesticated. Training an animal to voluntarily walk to the milking parlour twice daily then stand still for up to 10 min is a perfect example of this level of domestication. Other species farmed for their saleable products such as deer, ostriches, mink and even sheep are more difficult to handle as many individuals often show high levels of aggression towards each other and their keepers. There have been attempts, largely unsuccessful, to domesticate gazelles, antelopes and even hyenas.

Through centuries of intensive selective breeding for milk production by humans, dairy cows have evolved to become one of the most efficient biological machines in the world. For example, within the Friesian breed, dairy cows in early lactation can produce up to seven times more animal protein each day than rapidly growing bulls. Dairy cows, averaging 25 L of milk per day, each produce 700 g/day of milk protein in contrast to the 100 g/day of carcass protein retained in rapidly growing Friesian bulls (Moran and Wood 1986).

As well as changing the basic anatomy of cattle through selection for meat or milk production, their dehorning is another evolutionary step in their domestication. The breeding of poll (hornless) beef and dairy cattle is now routine, as is the removal of vestigial horn 'buds' in calves. Without horns, cattle have become more compatible at the feed trough, in yards and at pasture, with less injury to each other and to humans. Hornless heifers spend more time eating and ruminating than do horned heifers (Albright and Arave 1997). When kept singly, hornless heifers gain more weight than horned heifers or than when kept in groups.

Our modification of the cattle genotype has enabled us to keep them in a wide variety of conditions and environments. Even in environments where many people would consider that cattle are not well adapted, they still produce economic quantities of milk or grow at commercially acceptable rates. It is argued, however, that this does not mean that such systems are justified just because the stock do not overtly manifest their difficulties in coping with the system. Cattle 'suffer in silence' partly due to the impact of domestication and partly due to the evolutionary forces pre-domestication. They are prey animals that graze in open grasslands and do not wish to attract attention to themselves by active vocalisation or other displays if they are having trouble coping with the environment.

The International Dairy Federation (IDF) (2008) have identified four stages of domestication of dairy cattle for human benefit and how these have impacted on their welfare:

1. In their wild state the animals expressed natural productivity but their welfare was not maximised because of predation, disease, lack of feed and other adverse natural events.
2. As they became domesticated and more of their needs were fulfilled through commercial farming, their production increased and their welfare improved

since all their basic needs were met along with protection from disease and shelter; this would then have been their point of maximal welfare.
3. Beyond this point, further efforts have been made to increase production and this starts to impinge on their welfare.
4. Ultimately there arrives a point at which the increased drive for production will reach or even exceed their biological limits and their welfare becomes poor.

Therefore, an excessive drive for very high production can result in a sharp decline in animal welfare below those of their wild counterparts unless adequate resources are provided to meet the demands of this increased production. IDF argue that Stage 4 may have already been reached in some systems of dairy farming. Poorly managed tropical small holder dairy (SHD) farming with genetically selected high producing dairy cows could be one such example.

3.3 Impacts on behaviour

The behaviour of domestic cattle has been extensively studied and it is believed that selection of behavioural characteristics played a very important part in the early stages of domestication. However, there are many problem behaviours that can contribute to reduced productive efficiencies and these will be discussed in more detail in the following chapters. Many have been derived from the artificial environment that cattle are often kept in, since these abnormalities are absent in extensively kept cattle. They often evolve when animals are unable to behave naturally. They are particularly common in hot, humid regions where heat stress reduces their resistance to such environmental constraints. Opportunities to modify the environment are always limited, unless productivity is greatly reduced.

These problem behaviours discussed in Chapter 4 include:

- excessive licking and sucking behaviour in calves
- mounting behaviour in steers
- tongue rolling, prepuce sucking and stereotypes in steers
- excessive licking and grooming in cows
- physical evidence of metabolic problems in digesting high carbohydrate feedstuffs.

3.3.1 Housing

Intensive housing has one of the greatest impacts on the behaviour and welfare of cattle (Figure 3.1). This situation alters their social structure, as they are kept in much closer contact than when they are housed extensively. Another major effect of housing is on their predisposition to specific diseases (Figure 3.2), such as

lameness. However, cattle can adapt to a variety of housing systems, in that they can tolerate being housed individually or in small or large groups (Figure 3.3). Space availability can be reduced to little more than that required for the animal to stand up or lie down. A major part of domestication is to facilitate adaptation to housing. Such changes in the environment can result in abnormal stereotypic behaviour (repeated sequences of a behaviour that has no apparent purpose or benefit) that develop rapidly in intensively housed cattle with inadequate space and diet. Other non-stereotyped behaviours, such as intersuckling and excessive licking and grooming, are also indicative of deficiencies in the environment. Sometimes the housing causes a restriction on movement that is not conducive to good welfare for the animal but is for the benefit of the herdsperson. For example, stalled cattle may have a 'cow trainer' (electrified wires) placed above them to ensure that they move backwards when they arch their back to urinate or defecate, so the excreta is conveniently placed in the alleyway rather than on the bedding.

Temperature stressors can occur either inside or outside the housing. Inadequate ventilation and radiant heat load from a low roof are the most likely

Figure 3.1: Rarely do milking cows have an opportunity to graze on tropical small holder farms.

Figure 3.2: A dairy heifer suffering from severe skin infestation of papilloma virus. This is primarily the result of high density housing.

causes of heat stress. Outdoors, lack of shade is often a problem. Heat stress can be exacerbated because of the considerable heat of digestion occurring in the rumen. Cattle are also stressed by driving rain and will seek shelter, particularly avoiding facing the rain.

Stray electricity affects cattle more than humans. This stray voltage can originate from faulty equipment grounding, which often occurs in the corrosive environment of the cattle shed, or from a large voltage drop on the farm, which results in the supply being out of phase with the central power source.

3.3.2 Lameness

Much of the lameness in housed cattle is associated with cows walking or turning on hard or uneven concrete covered in slurry. The shock of regularly stepping on concrete, coupled with the softening of the hoof when the cow stands in slurry, can traumatise the hoof and lead to primary foot lesions.

Bad cubicle design may predispose cattle to lameness. Cows spend less time lying in small cubicles, cubicles with hard surfaces or cubicles with divisions that impede movement. Hock damage may occur as the animal lies down, especially on

Figure 3.3: Milking cows can become very placid when well looked after.

abrasive surfaces. Stock lying on soft surfaces or in wide cubicles are less likely to experience this problem. However, if cubicles are too wide, cows may attempt to turn around and get stuck, particularly if they are inexperienced at lying in cubicles.

3.3.3 Social influences

The impact of social circumstances is much harder to define than that of other aspects of cow management. In the presence of a dominant cow, subordinate cows take evasive action. In a confined space, such as a shed, many escape attempts take place every day. Overt aggression is rare and an unsuccessful escape attempt is most likely to be met by a ritualised threat display. Social interaction between animals that is associated with aggression, including threatening and submissive behaviour, is referred to as agonistic behaviour. Unless food resources are limiting, there is little evidence that milk yield of subordinate cows is any less than of dominant cows. However, the movement of cows between different groups can reduce milk yield, and high stocking densities in dairy cow buildings can increase blood indicators of stress.

At pasture, dairy cows show evidence of increased vigilance when they are in groups of fewer than eight cows. Large groups in small paddocks or strip grazed cows will show more aggression than if they were grazed in a larger field. Competition for resources, such as food, may induce fighting between cows, but even then, damage to an individual is rare unless the cows are horned. Competition may be prevented by feeding concentrate at barriers in sheds with self-locking yokes.

Separation of cow and calf will stress some cows, particularly if the separation occurs after a substantial period together. Initially after separation the cow makes attempts to reunite with the calf, through increased locomotion and vocalisation and even breaking of separation fences. Feeding and sleep patterns may be altered, rumination reduced and a stress response becomes apparent such as increased heart rate and blood indicators. Some studies show that these stress responses decrease in cows that have had several calves. There is even some evidence that cows reared in isolation are not as good mothers as cows reared with other calves. They are slow to start licking their calves and are less aggressive, demonstrating reduced motivation for social contact.

Keeping cattle in intensive environments inevitably leads to a modification of their behaviour compared with wild cattle. Behavioural needs are best determined by investigating which innate behaviours need to be performed and then, which behaviours are required to meet their physiological needs. The physiological needs include:

- absorption of adequate nutrient supplies from the gut
- perpetuation of the genotype by reproduction
- adequacy of the environment in terms of thermal and other sensory requirements.

Taking these into account, the major behavioural needs are:

- reaction to danger (flight and escape)
- ingestion
- body care (including elimination)
- motion
- exploration/territorialism
- rest
- association (including social and reproductive behaviour).

3.3.4 Interactions with humans

The permanent contact between cattle and humans makes them easier to handle, since they learn to follow the humans as their leader. Acting responsibly as the 'boss' animal brings stability to the herd, and there is evidence that cattle respond best to a person who is confident and consistent in handling them. The cattle also

respond to regular communication with their keepers, particularly during periods of stress such as calving. This communication may be in the form of touching the animals, petting, stroking or scratching, particularly around the head and neck. This mimics grooming. Communication can also be verbal and visual, such as talking to and looking at cattle in their charge. Firm handling to assume dominant status combined with the caring role of the matriarchal substitute is necessary if cattle are to be contented. Modern production systems are designed for minimal labour input hence the importance of the stockperson's role in the herd is often not recognised. Investment in physical means to overcome abnormal behaviour can be reduced with greater attention to their psychological needs for adequate social bonding.

Cattle can recognise and respond to differences in human temperament that will affect their response to handling. The major types of interactions are:

- hand and arm (tactile) interaction
- vocal interaction
- holistic empathetic interactions, such as smell and other senses.

These can be pleasant (patting the back, stroking) or aversive (hitting) and performed with varying degrees of confidence. Phillips (2002) argues that some respect or fear of the stockperson may be necessary to enable cattle to be moved with ease and discourage them from attempting to force interactions with humans. It is important for a stockperson to be able to assess an animal's temperament, so that they can predict its behavioural reactions to handling and milking and modify their own behaviour accordingly.

There have been equivocal findings about the impact of handling on milk yields in dairy cows in that some researchers have found a negative relationship between aggressive handling and milk yield while others have reported no effect. Likewise, studies relating cow temperament to milk yield have been inconclusive. Farm studies have noted a change in milking personnel can lead to a change in herd milk yield, but this could be due to other changes in milking management rather than the milkers themselves. With increasing herd sizes and automation on dairy farms, such as machine feeding of total mixed rations, there may be less positive interactions between stock and humans.

Normally most contact with older cattle has neutral or negative associations, such as delivering injections, inserting intra-vaginal devices and weighing stock. These all disrupt the normal social structure within herds, bringing stock into abnormally close contact with each other and with humans and increase the risk of physical damage when stock are forced to enter races, crushes and gates in yards. Young cattle may have positive associations with humans, say, with bucket feeding, but not older stock that are often fed out of machines. Newly calved heifers have to join the rest of the milking herd so must learn to cope with being mixed with older

stock and having to develop a new dominance order as well as adjusting to the new traumas associated with the twice daily routine of machine milking. The process of milking, which can relieve pressure inside the udders of high yielding cows, was thought to be the major motivation for cows to enter automatic, robotically operated milk harvesting systems, but this has not always been found to be the case. The 'promise' of extra feed is another incentive for cows to enter the milking parlour.

The herd person plays a major role in shaping the temperament of cattle in their care. Extra handling of young calves reduces their flight distance (see Chapter 4). However, such positive interactions reduce with age although regular positive contact at any age reduces the strength of the adverse reactions to later handling.

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