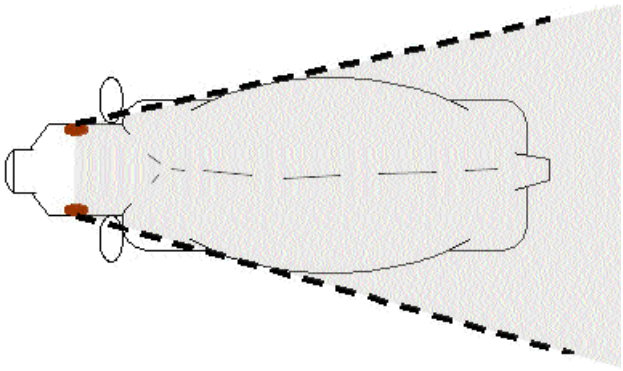
CATTLE

VISION AND OTHER SPECIAL SENSES

With their eyes positioned on the side of the head, cattle have panoramic vision of 330° and binocular vision of 25°–50°, which allows for good predator awareness (Phillips, 1993). Despite the wide set of their eyes, however, they do have a blind spot directly behind them (see below).



Cattle have slit-shaped pupils (Smith, 1998) and weak eye muscles, which inhibits their ability to focus quickly on objects (Coulter et al., 1993).

Cattle can distinguish long wavelength colours (yellow, orange and red) much better than the shorter wavelengths (blue, grey and green), which may have aided their response and survival when a herd member was attacked and blood was spilt (Phillips, 1993). Cattle can distinguish all colours from a grey background except blue (Dabrowska et al., 1981), and have a poor depth perception. Because of this poor depth perception and lack of definition, cattle will often baulk and refuse to cross a shadow or drain grate and are best moved through diffuse light.

While grazing, cattle constantly sniff the pasture, but it is not known if plants are rejected on the basis of odour. Cattle can distinguish smell, e.g. they will baulk at the smell of blood and offal.The sense of touch is important in determining which herbage is rejected or preferred. The secondary/special olfactory system can detect pheromones, volatile chemicals that are important in reproduction and feed selection (Currie, 1995).

The ears of cattle are very sensitive. Cattle can be calmed by playing soothing music, or stressed by loud noises such as yelling (NSW Feedlot manual 1997). Dairy breeds are more sensitive to sound and touch than beef breeds, high-pitched sounds, such as the whistle used to control most farm dogs, will increase the animals' heart rates (Lanier et al, 2000). Hearing in cattle is important in inter- and intra-species communication (Phillips, 1993).

Cattle flight zones can vary greatly. Feedlot cattle may move away from people, especially strangers, entering their flight zone of 1.5m, whereas less handled range cattle have a flight zone of 30m (NSW Feedlot manual, 1997).

Cutaneous sensitivity can be used to calm cattle by scratching under the neck and behind the ears, areas they find difficult to access (Moran, 1993).

Sensory input at the level of the penis is important for sexual behaviour during mounting (Hafez, 2000).

Older cattle grazing on rangelands will spend less time grazing than younger cattle due to their experience and learned paddock patterns (Krysl et al (1993).

SOCIAL ORGANISATION, DOMINANCE HIERARCHIES AND LEADERSHIP

Under farm conditions the dairy herd is organised into a social hierarchy. Schein and Fohrman (1955) found age and weight to be significantly correlated with rank, and height at the withers is also a contributing factor in steers (McPhee et al., 1964).

Other workers (Reinhardt, V. and Reinhardt, A., 1975) have shown an inverted U-shaped relationship between dominance and age. They found that cows rose in rank up to about 9 years old as their weight increased; thereafter, dominance declined as weight was gradually lost.

In free-range heterosexual herds of cattle there are several hierarchies among adult males, adult females and juveniles. As they age, young males fight adult females and eventually dominate them.

The hierarchy tends to be linear and large herds probably break down into a series of smaller hierarchies (Hafez and Bouisson, 1975). There is evidence that dominance hierarchies in young beef steers are formed soon after weaning and that they remain stable even when the groups are moved to other pens (Stricklin et al., 1980). Dominance and eating behaviour have been observed in beef cattle where only one animal at a time could eat, and it was found that high-ranking cattle had fewer meals but tended to spend more time per day eating. Also dominant cattle did not prevent subordinates from gaining access to the stall, and the lower-ranking cattle replaced higher-ranking cattle as frequently as they were replaced by higher ranking cattle. Dominance becomes important only when there is a very limited amount of food for which to compete (Stricklin & Gonyou, 1981).

Although early work has not shown a relationship between dominance and milk 26 production, recent field observations on ten commercial dairy farms showed that cows yielding a higher amount of milk came earlier for milking and those yielding a lower amount of milk came later (Rathore, 1982).

Aggressive interactions in cows appear to be ritualised and occur in sequence: approach, threat, physical contact or fighting. Once the dominance relationship of any pair of animals is learned (Beilharz and Zeeb, 1982), it eliminates the need for further combat. The subordinate animal retreats from the dominant at the slightest threat and physical contact is of minor importance as long as the animals can see each other's posture.

Leadership. Until recently there appeared to be no evidence for a relationship between leadership and dominance. It had been suggested, but not substantiated, that the most dominant animals were in the middle of

the herd (Kilgour and Scott, 1959). A recent study looked at patterns of leadership during grazing movements (Sato, 1982), which were divided into following, independence and leading. It was found that high-ranking animals tend to lead, medium ranks tend to follow and low-ranking animals tend to be independent. An interesting suggestion was that it was the active movement of high-ranking animals and the independent movement of low-ranking animals that governed the voluntary formation in grazing patterns.

Grazing. Grazing occupies a large amount of time in both dairy cows (about 8 hours/day) and in beef cattle (about 9 hours/day). Grazing behaviour is affected by many factors, including environmental conditions and plant species. These will be discussed in detail in the chapter on grazing animal management and behaviour. Cattle usually stand to graze and the pattern of grazing behaviour of each herd member is relatively similar. The animal moves slowly across the pasture with the muzzle close to the ground, biting and tearing off grass, which is swallowed without much chewing. They ruminate when resting and time devoted to ruminating is approximately three-quarters of that spent in grazing. This will be altered by the type of pasture. A useful ratio is the R:G ratio, i.e.

$$\frac{\text{ruminating hours}}{\text{grazing hours}} \quad \text{per day} \qquad \text{i.e.} \quad \frac{6}{9} \qquad = 0.6$$

if grazing is not restricted by management and is influenced by abundance of pasture and environmental factors (Tribe, 1955). If pasture is good, ruminating time is short, and the R:G ratio is low (0.4); if the herbage is poor and fibrous, ruminating time is longer and R:G value is high (1.3).

Group cohesion. In open treeless areas, free-ranging cattle group into large mobs and the distances between individuals are smaller than in areas with sparse to moderate tree and shrub cover. This means that the mob is more tightly clumped in open areas (Dudzinski et al., 1982) and this affects the grazing pattern.

Resting behaviour. The amount of time cattle spend resting depends on environmental conditions, time spent ruminating and grazing, and on breed. Studies on Zebu cattle showed individual preferences for particular resting areas, which could be traced throughout 12 months. The consistency with which an animal lies on its resting place is independent of its dominance hierarchy, which indicates that no competitive situation arises with other herd members for particular resting sites. The animals will avoid sources of noise and disturbance and choose non-habitual resting sites if the preferred ones are close to the noise or disturbance (Reinhardt et al., 1978). Zebus and Zebu crossbreds will remain out in the bright sunlight resting or grazing, while British breeds seek the shade (Kelly, 1959). In a dairy herd of Friesian cows it was found that there was a consistent order for lying down and standing up (Benham, 1982)

Cattle have long memories (NSW Feedlot manual, 1997). They can individually identify 50–70 other herd members (Fraser & Broom, 1997).

Cattle will follow the lead animal (not necessarily the most dominant animal) quietly (NSW Feedlot manual 1997, Fig 9.1). This animal may lead, but often does not have control over herd direction but rather if a change of flight direction is caused, will run forward to the front position.

Bos indicus cattle are generally more excitable than the European ***Bos taurus*** breeds (NSW Feedlot manual 1997, Fig 9.1).

Subordinate status can lead to attenuation of sexual displays (Hafez, 2000).

High hair whorls on the face are found in reactive cattle (Grandin, 1995).

Cattle will graze pasture that is 5 cm above the ground, distinguishing plants while grazing (Hosokawa, 1990).

The herd's day involves maintenance behaviour: standing, walking, lying, feeding, drinking, self-grooming, allogrooming, agonistic behaviour and ruminating (Mitlohner et al., 2001).

Grazing is affected by temperature. In very high temperatures cattle will graze predominantly at night (Krysl et al., 1993).

Cattle accustomed to a rotational system of paddock allocation will graze faster than cattle that are left in paddocks for longer periods, they will also tolerate lower feed supply, knowing that feed will be available in the next paddock in the rotation (Krysl et al., 1993).

Cattle in rangelands graze with younger animals in the centre of the herd, surrounded by the more aggressive members. Aging and weak cattle will often graze away from the herd, sometimes due to an inability to keep up; this exposes them to potential predator attack (Manning et al., 1998).

Dairy cattle that are placed in new herds and exposed to dominance struggles involving aggression will often show a reduction in milk production for several days (Fraser et al., 1997).

Fear may contribute significantly to the establishment of dominance (Albright et al., 1997).

In an exchange between two animals where one is clearly larger, healthier, stronger and older than the other, it may take no more than a movement gesture or threat to make the smaller animal submit or yield space (Albright et al., 1997).

An aggressive bull will turn his body perpendicular to a challenger to display his full height and length (Houpt, 1998). Aggression is expressed by bunting or striking a challenger with the head (Houpt, 1998).

Dairy bulls are generally more aggressive than those of beef breeds, as well as being larger (Houpt, 1998). The unpredictable nature of a bull's aggressiveness leads farmers to use artificial insemination techniques so they no longer have to house bulls on the farm.

There is a tendency in the milking hierarchy for more dominant cows to enter the dairy first, and these individuals are also more likely to produce higher yields (Phillips, 1993).

Grazing time will be increased with the introduction of cattle (both dairy and beef) into new pasture, as more time is spent exploring the paddock, which could be associated with search grazing (Krysl et al., 1993).

The grazing time of calves in the presence of experienced grazing cattle was significantly longer than that

of calves grazing by themselves (Fukasawa et al., 1999).

A study of 7 breeds of cattle indicated that in windy wet weather grazing occupied 48% of their time and in windless cloudy conditions, grazing occupied 67% of their time (Rogalski, 1975).

Cattle lie down to sleep, ruminate or drowse for nearly half of their day (Houpt, 1998).

When cattle lie down they hold their heads up or drawn back to the flank area (Albright et al., 1997).

Lying-down times of a lactating dairy cow depend on the type of housing, the comfort of the stall or lying out area, the type of diet, whether or not pregnant and climatic factors (Albright et al., 1997).

SEXUAL BEHAVIOUR

As the cow reaches oestrus the bull becomes very excited and follows her closely, licking and smelling her external genitalia and often exhibiting flehmen. Recent work has shown that the bull uses the tongue to transfer fluid (probably urine) to a short incisive spur located on the dental pad. It is then transferred to the vomeronasal organ (Jacobs et al., 1980) which is considered to be the site of pheromone identification. Pre-copulatory patterns include pawing the ground and snorting, chin-resting on the cow's rump just before mounting and then copulation. Copulation is short (seconds) compared with horses and pigs (minutes).

Social ranking of bulls can influence their sexual activity, the most dominant animals mating the most. Chenoweth (1981) has written a useful review of libido and mating behaviour in bulls and other species.

The female becomes hyperactive when oestrus begins and the number of indiscriminate agonistic interactions and mounting attempts increase (Schein and Fohrman, 1955). A subjective measure of the intensity of oestrus from how 'excitable' a cow seems to be, can be designated as strong, medium or weak. Relative differences between breeds, ages and individuals can be fairly accurately rated (Hafez and Bouisson, 1975).

Castrated males (steers, bullocks) may display similar sexual behaviour as intact/complete males (e.g. mounting); the lack of androgens inhibits actual mating/copulation. After male cattle are castrated, erections are the last aspect of male sexual behaviour to be lost (Hafez, 2000).

Female sexual behaviour depends on 'the circulating endocrine balance', controlled by ovarian secretions, primarily oestrogen (Hafez, 2000).

As cows become sexually receptive they may mount or be mounted by other cows, sniff males or become involved in mock fighting. Cows are receptive for approximately a day (Hafez, 2000).

The level of sexual behaviour displayed is determined by genetics, environmental factors, physiological factors, health and previous experience, e.g., bulls of dairy breeds are generally more sexually active than those of the beef breeds. New herd members attract greater sexual attention. Therefore, their introduction to a breeding group can be a useful means of stimulating sluggish bulls (Hafez, 2000).

Testosterone and oestrogen enhance the libido of males and females respectively (Currie, 1995).

Oestrous duration of cows is longer when there are many other cows in oestrus at the same time (King, 1990).

The bull detects the pro-oestrous cow about 2 days before oestrus and remains in her general vicinity (Albright et al.,.1997).

During the oestrus period the cow increases her frequency of urination so the bull can sample both the odours and the taste of her urine (Phillips, 1993).

The period of sexual receptivity (mounting behaviour) ranges from 1 to 18 hours, with the average being about 4.4 hours (King, 1990).

Bulls that are used for AI or hand-breeding may have poor semen quality or poor reproductive behaviour, due to the lack of stimulatory effects that result from the prolonged courtship (Houpt, 1998).

Bulls commonly masturbate, especially at times of inactivity (Houpt, 1998).

Mounting causes an immobilisation reflex (rigid stance) in the oestrous females that are being mounted (Albright et al., 1997).

MATERNAL-OFFSPRING BEHAVIOUR

Suckling behaviour begins 2-5 hours after birth and the mother must be standing. The calf vigorously butts the mother's udder with its head while suckling. It has been noted that heifers which had a difficult birth took longer to stand than cows who had already had several calves. Experienced cows usually stand within one minute of the birth of the calf (Edwards and Broom, 1982). The mother licks the young to stimulate breathing, circulation, urination and defecation. The cow is a 'hider' species so the young are hidden near the birth site straight after birth and the afterbirth is eaten, because it could attract predators.

Teat sucking by the calf is most intense soon after it stands up and it is common for suckling to occur first from a front teat (Edwards and Broom, 1982). The distance maintained between the cow and calf increases steadily with time after calving but they keep in contact by vocalising. Within the first week of life the calf begins to follow the cow, but for periods of the day, groups of calves will be found lying together for much of the day while the cows are grazing. It is in the period before calves are themselves grazing that 'nurseries' may form (Squires, 1981). There may be 'guard' cows left in charge and observations are reported from cows under extensive rangeland conditions. Fostering of calves is possible if a group of calves is placed with several nurse cows, but there is a large variation in the number of sucklings permitted by the cows (Kilgour, 1972).

A cow becomes restless 1–2 days before calving. If possible, she will leave the herd shortly before birth, finding a quiet place to calve. This is often not possible in most domestic contexts, so herd interference can occur at the birth, and bonding may be disrupted (Hafez, 2000).

If calves are removed from their mothers immediately after weaning, they can be pre-conditioned. This involves handling quietly, early castration and dehorning to accustom them to human handling, making them qui-

eter to handle as they age. They will suffer less stress than cattle that have had less frequent human contact (Grandin, 1999). This is in comparison with calves that are left with their mothers and learn behaviours to avoid humans (NSW Feedlot manual, 1997).

Vision, olfactory and vocal senses are involved in cow and calf identification. Cows will groom their calves, 'labelling' them as their own (Hafez, 2000). Calves usually stand 45 minutes after birth, and are suckling 2–5 hours later; the mother aids suckling by positioning her body for easier access (Hafez, 2000). Between birth and 7 months, the mean duration of suckling time for calves was seen to be 34 minutes, with the suckling frequency being 4.5 times per day (Hattori et al., 1995). Weaning studies in ***Bos indicus*** have shown that heifer calves are weaned at 8 months of age, whereas bull calves are weaned at 11 months (Houpt, 1998).

Twins may receive less grooming than single calves (Hafez, 2000). Cows will lick the urogenital/rectal areas to stimulate urination and defecation (Hafez, 2000). Hormones regulate maternal behaviour (Currie, 1995).

At calving, cows should be allowed to seek isolation in a sheltered place, which will allow a dry and soft surface to lie on. Dairy calves should be licked by their mothers, but the duration must be controlled so that calves are able to suck (Lidfors, 1994).

The heritability of maternal behaviour is low in cattle (Houpt, 1998), so it is difficult for farmers to select for good mothering ability in bloodlines.

Contact between the cow and her calf for a period as brief as 5 minutes postpartum results in a strong specific maternal bond (Houpt, 1998).

ABNORMAL BEHAVIOURS

1. ***Mismothering***. This may be due to the mother having suffered a long and difficult birth and not being able to stand up for suckling. The calf may also be too weak to suckle. Cases of mismothering are common with cows calving in synchrony in intensively managed maternity groups (Albright et al., 1997).
2. ***Nymphomania***. Such cows behave like bulls, pawing and mounting but refuse to stand for mounting by other cows. It could be an inherited trait. Nymphomania is more common in high-producing dairy cows than in cows of beef breeds (Houpt, 1998). Nymphomania is usually associated with follicular cysts (Houpt, 1998).
3. ***Buller-Steer Syndrome.*** This a common health and economic problem in feedlot operations (Ulbrich, 1981). The typical buller-steer sexually attracts his penmates who take turns following and mounting the abnormal animal. It does not seem to be associated with rank, and may be due to boredom. When detected, bullers are segregated and treated for injury or illness. Approximately 2% of steers in a feedlot situation are buller steers (Houpt, 1998).
4. ***Illness/disease.*** Cattle that are not healthy will show abnormal behaviour. Healthy cattle will appear alert, stretch on rising and be vocal – they often vocalise in response to pain or stress (Grandin 2001). Unwell cattle often show little interest in their environment, have dull eyes, sluggish movement, poor grooming and poor appetite (NSW Feedlot manual, 1997). Other indicators of sickness include over-stretching of the neck, hunching the back, kicking the belly area (indicating abdominal pain), grinding teeth, star-gazing, etc. (Moran, 1993).

Atypical sexual behaviour, such as nymphomania, homosexuality, hypersexuality, masturbatory behaviour, may be caused by genetic flaws, endocrine imbalances, management problems, and in many cases may be reversed (Hafez, 2000).

Masturbation in males is common, especially in bulls on a high protein diet (Hafez, 2000).

Humans may modify behaviour by processes such as castration, spaying and endocrine implants to increase production and ease of handling (Currie, 1995).

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