Methods for detection of oestrus
During oestrus or ‘heat’, the female will accept a male, and during ‘standing heat’ will stand to be mounted. In pigs, this lordosis can be more easily detected by pushing forward on the rear of the sow. The efficiency of detection of oestrus in cattle can be less than 50%, so either methods to improve heat detection, or strategies to control the time of ovulation can be used to improve conception rates.

OESTROUS BEHAVIOUR.
Cows need adequate space to display mounting behaviour, with softer footing such as grass, dirt or straw. Mounting behaviour is decreased on concrete floors or floors that are too slippery or too coarse. Cows with sore feet or legs have less mounting activity. Cows that are themselves in heat or have recently been in heat are most likely to mount a cow in heat. As the number of cows in heat increases up to 3–4, the number of mounts per cow increases dramatically. The extent of mounting can be used as an indicator of oestrus. The tail-head area can be scarred and dirty from mounting by herd mates. A more accurate measure is to use brightly coloured enamel-based paint on the tail-head and to cover the paint strip with a contrasting colour of chalk. The extent of cover of tail paint and chalk is scored using a scale of 5, for no signs of oestrus and full presence of paint and chalk, to 0 for standing oestrus and absence of paint and chalk. Pressure-activated heat mount detectors that change colour from the weight of the mounting animal can also be fixed to the tail-head. There are more sophisticated pressure sensors available that either display the frequency of mounting behaviour directly or send signals to a remote device that records the mounting behaviour. Vasectomized teaser bulls, which can be fitted with a chin ball marking harness, are particularly useful in detecting heat when there are only a few cows in heat. Cows or heifers treated with testosterone or oestradiol can also be used as an alternative to vasectomized bulls. Standing heat can often be brief in duration and occurs mostly in the early morning and late evening, but various secondary signs can be used to detect oestrus. During oestrus, vaginal mucus is discharged that is clear and stringy, and the vulva is reddened, but this can be difficult to detect in cows. Blood stains on the tail or vulva are indicative of a recent heat. Cows in heat are restless, bellowing and trailing other cows. Pedometers fixed to the leg of the cow can be used to measure an increase in walking activity as a measure of oestrus. Feed intake and milk yield can also decrease during oestrus. Changes in perineal odours occur near oestrus and these can be detected using trained sniffer dogs or potentially using an ‘electronic nose’, which has electronic sensors that change electrical characteristics when exposed to volatile compounds. Follicular development can be estimated by palpating the ovaries via the rectum or using real-time ultrasound equipment with a transducer placed in the rectum. Pregnancy can be confirmed by this type of examination at about 40 days after breeding. For more information on the detection of oestrus in cattle.

MILK PROGESTERONE.
The level of progesterone in milk can be used to evaluate oestrus and pregnancy in dairy cattle. The level of progesterone rises slowly for the first 4–6 days after ovulation and reaches a maximum at days 10–17. It falls sharply at day 18–19 in non-pregnant cows due to luteolysis, but remains elevated in pregnant cows since the CL continues to function. The accuracy of pregnancy diagnosis using milk progesterone is only about 80%, due to factors such as errors in oestrus detection,
differences in cycle length, uterine disease, ovarian cysts and early embryonic mortality. It can more reliably be used to determine if a cow is not pregnant. This involves comparing progesterone levels in milk samples taken at the time of insemination to progesterone levels in milk at 21–24 days later. A high level of progesterone in milk can confirm the lack of oestrus and that a cow should not be inseminated. This can be particularly useful in high-producing cows or cows under heat stress, when there are poor outward signs of oestrus. A low progesterone level suggests that the cow might be near oestrus, but does not confirm that it is at the optimum stage for insemination. Low progesterone levels can also be due to inactive ovaries or the presence of follicular cysts. Luteal cysts can be distinguished from follicular cysts by a high level of progesterone. The presence of a functional CL can be confirmed by accompanying high progesterone levels in cows that will be used as embryo transfer recipients. Milk progesterone can be evaluated using commercially available kits for on-farm use and could potentially be measured with an on-line system during milking in the future.
Oestrous Behaviour and Its Detection

Introduction

The oestrous period in a cow is that time during which she will stand to be mounted by a bull or another cow. Changes in the levels of circulating hormones, particularly oestradiol from the developing follicle, induce the behavioural changes associated with oestrus (see Chapter 4). These changes may begin one or two days before standing oestrus. The cow will become more likely to mount other cows that are in oestrus, and other cows in the herd will begin to take an interest in her – sniffing her and resting their chins on her back, for example. Standing oestrus normally persists for several hours (see Table 4.2). There also seems to be a tendency for a higher proportion of oestrous activity to occur at night. The main period of oestrous activity precedes ovulation by approximately 12–15 hours. Although natural service normally occurs during standing oestrus, artificial insemination is most successful during the last half of and up to around six hours after standing oestrus (Asdell, 1964). The events around the time of oestrus are summarized in Fig. 8.1.

Artificial insemination is probably used in only 3–5% of beef cows in the UK (data calculated from MMB, 1982 and MLC, 1983). The main reason for this lack of usage is the practical difficulty of detecting oestrus in extensively managed suckler herds. Consequently most beef breeders use a bull both to detect oestrus and to breed with the cows. Most of the information in this chapter therefore relates to dairy herds.

Unless a bull is to be left running with the herd it is essential that stockpersons know when oestrus is occurring so that the cow can be taken to the bull, or artificial insemination carried out, at the optimum time for fertilization to occur. This means that efficient and accurate detection of oestrus, or at least of changes associated with ovulation, is of vital importance. As was discussed in Chapter 1, a cow’s calving interval is influenced mainly by the calving to conception interval, which is influenced in turn by a number of factors including the occurrence and detection of oestrus at the correct time. Milk progesterone profile studies have consistently shown that the majority of the cows experience normal ovarian cycles by the time that insemination is desired, but that only about 50% of ovulations are accompanied by a reported observed oestrus. In a study at Nottingham University, oestrus was observed by herdspeople in only 60% of approximately 2500 cows in commercial herds by the time they had reached 60 days postpartum. Fifteen per cent of the cows were not observed in oestrus during the critical period after 50 days postpartum even though they were cycling normally. This indicates that oestrus detection problems are a major cause of extended calving intervals.

The worsening problem is due in part to increasing pressures on stockpersons who are able to spend less time on detecting and recording oestrus. However, there also seems to have been a decline in the intensity of oestrous behaviour in recent years. In Chapter 12, we will discuss the nutritional and other stress factors that affect the reproductive system and contribute to problems of ovarian cyclicity, fertilization and conceptus survival. A specific effect of energy deficiency and stress is a suppression of oestradiol production by the dominant follicle. This could in turn affect the intensity of oestrous behaviour and help to explain the apparent drop in oestrus intensity in modern dairy herds. Lyimo et al. (2000) found a high correlation between blood oestradiol levels and the intensity of oestrous behaviour. Records from more than 244 000 cows in more than 2100 herds were collected as part of the ADAS ‘Datamate’ computer-based reproductive management program for about ten years from 1986. They showed that 57% of Friesian cows were inseminated within 20 days of their start of service date, compared to 50% of Holsteins.
If a given opportunity to inseminate a cow is missed because of a failure to detect oestrus, that cow’s calving interval will be extended by at least another cycle length (i.e., about 21 days), unless ovulation is artificially induced (see Chapter 7). The financial losses associated with these extended calving intervals have also been discussed in Chapter 1. It is thus easy to see that the economic consequences of missing oestrus can be extremely important. On the other hand, there can be serious consequences if oestrus is recorded at a time other than around ovulation. At best the falsely recorded oestrus could mislead the herdsman as to when the next true oestrus is due. If the cow is inseminated the cost will be wasted. Furthermore, when the uterus is under the influence of progesterone as it is during the luteal phase of pregnancy, it has a very low resistance to pathogens, so that infection could result from the mistimed insemination. At worst, if the cow is already pregnant, insemination into the uterus could cause her to abort. Such abortions have been detected in studies using milk progesterone profiles. Studies at the Scottish Agricultural College (SAC) have revealed a number of such cases, in spite of previous publicity about the dangers of inseminating cows that could possibly already be pregnant. Fig. 8.2 summarizes the incidence of mistimed inseminations in these studies.

The trend towards larger dairy herds and an increased reliance on employed labour has added to the problems of oestrus detection to the extent that many farmers are reverting to the use of a bull for natural service with at least some of their cows. An understanding of the characteristics of oestrus, procedures for its detection and a knowledge of possible aids to oestrus detection are therefore of paramount importance in achieving efficient reproductive performance.

Characteristics of oestrus

The main criterion
For the stockperson, the only reliable indication of oestrus is that the cow will stand to be mounted by a bull or another cow (Fig. 8.3a) and can often be seen ‘soliciting’ or apparently encouraging other cows to mount her (Fig. 8.3b). A cow in oestrus is often described as being ‘in heat’ or ‘bulling’. From the point of view of oestrus detection, it is fortunate that other cows, especially if they are also within a few days of oestrus, will mount a cow in oestrus. In the wild this characteristic possibly served to draw the bull’s attention to the oestrous cow, and likewise this may also draw the stockperson’s attention to the appropriate cow. In fact, the most frequently observed sign of oestrus is that the cow tries to mount other cows. This probably accounts for the common mistake of thinking that the cow being mounted is the one in oestrus. If an oestrous cow tries to mount a non-oestrous cow she is usually unsuccessful unless the other cow is trapped, or is mounted from the front or the side so that she cannot escape. In Fig. 8.3c, for example, it is possible that the mounting cow is the one in oestrus since the other cow is trying to walk away. Oestrous cows sometimes manage to mount others that are trapped by fences or other cows, or that find it difficult to escape because of illness, injury or even fear of cows higher in the pecking order. This can be misleading. Normally, the oestrous cow will only be mounted from the rear by other cows, but she will attempt to mount her herd mates from the front, the rear or the side.

Supplementary signs of oestrus
There are a number of supplementary behavioural signs of oestrus which in
themselves may not mean that a cow is due for insemination, but they could be useful in drawing attention to particular animals. The main signs are summarized below:

*Signs that the cow has been mounted*
- Dirty rump and flanks.
- Ruffled hair on the tail-head (Fig. 8.3h). Sometimes patches of hair are completely removed and the skin may be raw or bleeding.
- Streaks of saliva or signs of licking on her flanks from interested herd mates.

*Other behavioural changes*
- Aggressiveness (Fig. 8.3d).
- Bellowing.
- Restlessness.
- ‘Flehmens lip curl’. This may be displayed by the cow in oestrus, or, more frequently, a cow that is interested in her (Fig. 8.3g).
- Other departures from routine, such as a cow coming into the milking parlour last when she would normally be one of the first, or vice versa. At pasture, she and one or more others particularly interested in her could be the only ones not grazing.

*Physiological changes*
- Increased mucus secretion in the cervix and vagina. This leads to another common and quite reliable sign of oestrus: the clear string of mucus that is extruded from the vagina and often adheres to the tail. The cow is often said to have a ‘bulling string’ or to be ‘sliming’. In some cases, such as when cows are continually tied up, this may be the main or only criterion for having them inseminated. However, the timing of expulsion of mucus is variable and insemination could be mistimed by up to two days. If the mucus is cloudy or discoloured, the vagina could well be infected and the cow is not necessarily in oestrus.
- At times, especially in cold weather, vapour can be seen rising from the backs of cows in oestrus. This results from a rise in body temperature associated either with increased activity or with the physiological changes of oestrus.
- In dairy cows there is commonly a drop in milk yield on the day of oestrus, which may be due either to reduced production or to an interference with the let-down process. The basic cause could be psychological stress or physiological change. As there are many other causes of reduced milk yield, it is not in itself a very good indication of oestrus.
- If the lips of the vulva are parted they are usually more swollen and a deeper red in colour in an oestrous as compared with a non-oestrous cow.
- Around two days after the end of oestrus, blood or bloody mucus is often seen extruding from the vagina or adhering to the skin around the vulva or on the tail. This results from the increased secretion of blood products (including the white cells that help to combat infection) into the uterine lumen under the influence of oestradiol at oestrus. Stockpeople sometimes assume that a cow is not pregnant if she ‘bleeds’, but in fact the occurrence of this metoestrous bleeding is independent of insemination and conception.

When checking for oestrus it is sometimes helpful to get the cows moving and thus initiate activity, but it is normally best to observe them quietly for a while without distracting them. Thus, for example, a stockperson should not send his/her dog to round up the cows until they have been observed for oestrus, and during winter lights should be left on all evening so
that cows are not disturbed by lights being switched on during a late evening check.
To summarize:
• Observe for oestrus frequently and for sufficient time. A cow in heat may only be mounted every 15 or 20 minutes. Five minutes will not do!
• Late evening (from about 8–10 pm) checks are very important.
• The cows and their environment should be in the right condition.
• Good records are vital to keep track of regular oestrus cycles and to highlight irregular ones.
Records from ‘Datamate’ confirm the importance of good oestrus detection procedures, as the results in Table 8.1 show.