Normal reproduction in the cow depends on interaction among several hormones, especially estrogen and progesterone, which are both produced by the ovary. Estrogen is created by maturing follicles and regulates the development and function of much of the reproductive tract. Estrogen is the hormone that triggers onset of heat (estrus).

Progesterone is the predominant hormone between heat cycles and during pregnancy. It is responsible for and necessary for continuation of pregnancy once an embryo establishes itself in the uterus. Progesterone suppresses further development of follicles in the ovary and, thus, thwarts production of estrogen.

A rise in estrogen is what brings the cow into heat; then progesterone levels rise while she’s still in heat, since progesterone is crucial for preparing the uterus to receive a fertilized egg and providing an environment where it can grow. The embryo cannot attach and survive unless the uterine tissues have been prepared by these hormones. Once pregnancy is established, however, high levels of progesterone are necessary to make sure there are no contractions or changes in the uterus that might terminate the pregnancy. Progesterone keeps the cow from coming back into heat.

Both hormones work as a team for reproduction. Estrogen makes things happen (preparing the vagina, cervix and uterus for breeding and bringing the cow into heat), and progesterone calms things down (creating an interlude between heat periods and ensuring a safe, stable pregnancy).

Other necessary hormones, follicle stimulating hormone (FSH) and luteinizing hormone (LH), are produced by the pituitary gland and influence the two ovarian hormones. FSH triggers growth, development and function of the follicle (which then creates estrogen), and LH causes the follicle to rupture (ovulate) and the corpus luteum (CL) to emerge in its place. The CL produces progesterone.

Several other hormones play a role in reproduction. Prostaglandin is secreted by the uterus and causes the CL on the ovary to regress so follicles can develop and create estrogen to trigger a new heat cycle. If an embryo has attached to the uterine lining, however, it sends a signal to the uterus to prevent prostaglandin release, and therefore, the CL remains in place on the ovary. The CL thus continues to produce progesterone and keep the cow from coming back into heat, protecting the pregnancy. Contractions and secretions of the uterus during heat (which aid passage of sperm) would be dangerous to the developing embryo.

**Estrous cycle**

The estrous cycle in cattle consists of a series of events that keep recurring in definite order. A complete cycle averages 20 days in heifers and 21 days in cows (ranging from 17 to 24 days from the start of one heat period to the start of the next, if the animal does not become pregnant). During the last part of the cycle, the reproductive tract prepares for the next estrus and ovulation.
Most cows follow a specific timetable, though these time frames are averages; some individuals have a slightly shorter or longer sequence of events. At the beginning, which can be called day 0, the cow is in a standing heat, brought on by increased levels of estrogen produced by a maturing follicle. At the end of standing heat, which lasts from eight hours to two days but is usually about 12 to 24 hours, the mature follicle ruptures and ovulates in response to a surge of LH from the pituitary gland. Ovulation usually takes place 12 hours after the cow goes out of heat.

On days 1 and 2, the cells that lined the follicle change and create the CL in the area where ovulation occurred. During days 2 to 5, the CL grows rapidly and produces high levels of progesterone, causing any other follicles that were maturing to regress. During the early part of this phase, part of the lining over the caruncles (small bumps on the uterine wall where the placenta attaches during pregnancy) becomes engorged with blood, and some bleeding from the smaller capillaries may occur. This post-estrus bleeding (caused by withdrawal of estrogen) may create a little bloody discharge by day 2 or 3 after the cow/heifer goes out of heat. If you didn’t notice she was in heat, this discharge will be a clue that she was in heat a few days earlier.

On days 5 and 6, the CL continues to develop and usually reaches maximum growth and production of progesterone by day 15 or 16. This period is the longest phase of the estrous cycle and is called diestrus (which means between estrus). Progesterone secreted by the CL blocks any LH release from the pituitary gland, so the ovaries are relatively inactive: no follicles can mature or ovulate. The cervix is tightly closed and there are no secretions from the reproductive tract.

On days 16 to 18, the follicles on the ovaries begin growing again, and the resultant estrogen secretion stimulates the uterus to secrete prostaglandin, causing rapid regression of the CL. By day 18 or 19, the CL is becoming nonfunctional, so there’s very little progesterone release — no more blocking action by progesterone on the other hormones. Several follicles on the ovary start growing, and one becomes dominant with a fast surge of growth-secreting estrogen.

By day 19 or 20, the cow comes into heat again due to the increase in estrogen and the corresponding decrease in progesterone. The cycle then returns to day 0 to start over again, and the mature follicle ruptures at the end of heat and releases its egg.

**Signs of heat**

There are several behavioral signs of estrus, which are often more pronounced in heifers than in cows. As the animal comes into heat, she is restless and may bawl and wander in search of a bull (traveling three or four times as much as she would normally do), sniffing other cattle. She interacts more with herdmates — licking them or fighting with them. As she progresses into heat, she starts riding other cattle and standing for them to mount her.

She’ll usually stand and let another cow or heifer mount her before she’ll stand for a bull and will also try to mount the bull before she’ll stand still for him to breed her. He’ll often rest his chin on her rump or loin to test whether or not she will stand before he tries to mount her. If there are several females in heat at the same time, they will be grouped together, riding each other and the bull, if there’s a bull present. Cows coming into or going out of heat will be part of the active group engaging in mounting or fighting activity.

Duration of standing heat will vary among individuals, ranging from six to 24 hours (12 to 16 hours is average). This can differ **continued on page 58 ...**
Reproduction

from one heat cycle to another; cows are not always consistent in their length of standing heat. As a cow goes out of heat, she may continue for a few hours to stand for other cows to mount her but will no longer accept the bull.

Physical signs of heat include secretion of fluid and mucus from glands in the uterus, cervix and vagina; the cervix is relaxed and open for sperm from the bull to enter the uterus, and the fluids enable the sperm to swim through the uterus and into the oviducts.

There may be a discharge from the vulva — a transparent mucus with the consistency of egg white. It is so viscous and elastic that it holds together in a long string from the vulva to the ground. This mucus may be smeared over the cow’s or heifer’s buttocks and flanks due to her tail swishing. Her tail may be slightly raised, and her vulva may be enlarged (swollen) and reddish.

If she’s with other cattle, there is usually a ruffling of hair over her tailhead and hipbones from mounting activity. Even if you didn’t see her in heat, there is generally some evidence for a few days. She may have mud on her hips and flanks from the feet of animals that mounted her. If she’s shedding winter hair, it will be rubbed off over her tailhead and hipbones from being mounted. In some cases there may be abrasions and raw areas, if she was mounted a lot, especially if there was more than one bull with the group and they competed with each other, chasing her around and breeding her repeatedly.

If she was actually bred, she will hold her tail out for several hours or several days due to irritation of the vagina. She may stand with her back arched, straining. There may be a discharge of seminal fluid from her vulva. Sometimes a bull will mount and enter a cow but not ejaculate (especially if he’s tired), and this activity won’t create much irritation, so she won’t show evidence of being bred. If she was bred (with the bull giving a leap and a thrust as he ejaculates), she will hold her tail out afterward and show signs of vaginal irritation. Even after she no longer holds her tail out, it may still “kink” out a little for a day or so when she’s traveling, especially when trotting.

If she was bred, there may be a white/yellow discharge from her vulva a day or two later. Though it may look like pus, it’s usually not (unless the cow has a uterine infection). After breeding, the uterus cleans out the extra debris (seminal fluid, dead sperm, etc.), flushing it out while the cervix is still partially open and the newly created conceptus is still safe in the oviduct. The discharge from the vulva at this time is normal.

It takes three to four days for the fertilized egg to move down through the oviduct and into the uterus, and this process gives Mother Nature a chance to “clean house” after the breeding and prepare the uterus to receive the embryo. Unless a cow already has a uterine infection (such as following a difficult calving), this flushing gets rid of any contamination and the pregnancy can safely begin.

The vaginal discharge after breeding is thus white or yellowish rather than clear. If it’s clear, the cow may not have been bred. A sign that the cow or heifer was in heat will be a bright red (bloody) tinge to the otherwise clear mucus, about 48 hours after she goes out of heat. This bloody discharge is seen more often in heifers than in cows and will be evident even if she was not bred (as in a group of heifers before the bull is put with them). If you are watching females for signs of heat (as for an artificial insemination [AI] program) and you notice this bloody discharge, it is too late for that animal to be bred, but you can estimate that she’ll be back in heat again in about 17 to 19 days.

Short cycles

Even though a cow usually returns to heat 18 to 24 days after her last heat period (if not bred and settled), short cycles often occur in which she returns to heat seven to 12 days after her last heat. These short cycles may be caused by a non-functional CL (or the CL did not form after ovulation or dies prematurely). Progesterone levels remain too low to keep her from coming back into heat again. These short cycles are common, especially when cows start cycling again after calving. The first heat, which usually occurs a few weeks to two months after calving, may be followed by another heat just seven to 12 days later.

Immediately after the cow calves, follicles in the ovaries begin to grow again but may take longer to ovulate because the cow is nursing a calf. It takes awhile for the cycle to normalize after calving, though if a cow loses her calf and dries up her milk, she will return to heat sooner. Even if a cow comes into heat soon after calving, however, you don’t want her bred that early. The uterus is not ready for another pregnancy yet. Complete involution (shrinking back to normal size) of the uterus takes awhile, and it’s best if the cow is at least 45 days past calving before she is bred again.

Editor’s note: For more information about reproduction, see Heather Smith Thomas’ new book “Essential Guide to Calving” available at Amazon.com or anywhere books are sold.