

# The science behind dairy and beef cattle reproduction, lactation and recovery

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Although it may be common knowledge to some, to many others it may seem like rocket science. Many of us enjoy a nice, juicy steak when we have a nice dinner out or eat beef on our tacos on a regular basis. If you don't enjoy meat, what about dairy? Almost everyone enjoys a refreshing, cold glass of milk with warm cookies or what about milk with your cereal? Still no? I guarantee, unless for medical reasons, that you love a sweet and savory bowl of ice cream after a long day at work or on a hot summer night. Where and how are these products produced? Did a human one day just decide to drink from a cow's udder or slice them up? We may never know, but what we can determine is that in today's age, cattle are genetically redesigned and purposefully bred for consumerism. Bred for profit and livelihoods. As the lowly and demanding consumer, we constantly ensure that multitudes of families are provided for, the cattlemen, the butcher, the seller, all of these people have brainwashed the consumer into thinking we need more and better products instead of relying on what we are given instead of constantly improving things (this doesn't sound like a maniacal leader with a funny mustache and wanting to build a supreme race or anything...no not at all).

When asking farmers which cow they believe is overall better, you will have to confer with each specific farmer and they will all say that either dairy (any specific breed) is superior to beef or vice versa (it just depends on what they grow). What will not differ is their reproduction, lactation and cyclicity except for classical weight and breed differences (mild changes). Most cattle have a gestation of around 275 days and usually are re-inseminated to ensure pregnancy around 85 days post-partum (Crowe and Mullen, 2013). This delay ensures that in dairy cattle the heifers are constantly lactating to provide

nutrition not only to calves but also to where she can be milked a few times daily in order to provide and service the dairy industry! Before we begin talking about the cute and sweet calves, we must first discuss how they get to that point. Let's take it all the way back to the brain and hormone secretion. Gonadal activity is controlled by the hypothalamus and anterior pituitary gland which secretes GnRH. This acts as a stimulant on the anterior pituitary gland to secrete LH and FSH which has great impacts on the ovaries. To begin, FSH helps with the growth and maturity of the growing follicle while LH is introduced at the later stage to continue growth into final maturation of the dominant follicle. If the follicle continues to grow, then a hormone called Inhibin is released. This hormone does exactly what it sounds like, inhibit, but it only inhibits FSH secretion not LH secretion. This causes the estrogens to favor when LH has its spikes and during the peak of LH secretion. The spike of LH is commonly known when the follicle ruptures it signifies the beginning of ovulation (Crowe and Mullen, 2013). Estrogens can also help with changing of the uterine lining to help with transportation of spermatozoa from insemination. The corpus luteum is formed when the ovarian follicle ruptures and leaves the ovaries which thus leaves capillaries that eventually are filled with blood. This corpus luteum produces progesterone which leads to negative feedback of the hypothalamus and causes a decrease in GnRH, LH and FSH secretion which overall leads to no secondary ovulation. Progesterone also helps with the mucous membrane of the uterus to help prepare for an embryo which also helps to maintain and with nourishment after fertilization during the gestational period. If the uterus does not detect an embryo then PGF2 $\alpha$  is

released from the uterus to destroy the structure of the corpus luteum, which is known as the luteolytic cycle (Crowe and Mullen, 2013). This decreases the amount of progesterone produced which overall decreases the negative feedback that eventually becomes withdrawn from the hypothalamus allowing for another cycle to begin again.

These are not the only things that contribute to reproduction, but they are a big part of it. With higher conception and higher submission rate you will have likely good bovine reproduction rights, but to ensure the best reproduction you need a good and consistent ovarian cycle (Crowe and Mullen, 2013). As we recently talked about LH pulsation, reproduction is dependent upon this pulse. With increased progesterone you get one pulse of LH for every four hours which is a consistent with patterns in the luteal phase of ovulation but when stimulations are finally maintained and the final maturation has come to the dominant follicle with increased estradiol concentration there should be one pulse of LH per hour, which leads to a positive feedback on the hypothalamus which will lead to it a standing heat or estrus (Crowe and Mullen, 2013). This is just one of the follicular waves that occurs in ovulation, around three waves occur every 21 days in bovine reproduction (McNamara et al, 2013). Although there may be three waves, usually the first ovulation is a silent ovulation in both beef and dairy cows known as atresia, but following this short cycle, there are much high chances of fertilization (Crowe and Mullen, 2013). In order to have good ovarian cyclicity there also needs to be good body composition and conditions (McNamara et al, 2013). With this occurring, it allows for the best ovulation

regulation, nursing, lactation, and reproduction (Crowe and Mullen, 2013). If the conditions are poor, then this causes stress on the cattle and a delay in ovulation which thus decreases the chance of fertilization.

After a cow has calved and she is needing to begin ovulating again, there is need for a strong balance between cyclicity of LH pulsation, lactation and meal supplements. After birth, there is usually a prolonged luteal phase known as anestrus (Crowe and Mullen, 2013). But this does not come without side effects, this can cause vaginal discharge, change in lactation production and function or follicular cyst (McNamara et al, 2013). Most of the anestrus and irregular ovulation is due to irregularity of LH pulsation (Crowe and Mullen, 2013). To ensure that a cow is properly ovulating postpartum, analogs of GnRH can be given at one to four-hour intervals or in the known stages of follicular growth to promote effective ovulation for fertilization (Crowe and Mullen, 2013). After giving birth, the follicular growth resumes in a matter of 7-10 days but if there is delay it is likely due to LH insufficiency (Crowe and Mullen, 2013). As cows are lactating, their cycles of estrus are significantly reduced, they decreased from 18-24 hours to 6-10 hours, suggesting that cattle that are lactating eat more and have a faster metabolic rate (McNamara et al, 2013).

Overall, cows need a great diet to support fertilization, pregnancy, birth and lactation. All of these processes are necessary in the dairy and beef industry, but they would be nowhere without simple hormones that circulate throughout their bodies. The secretion of GnRH to stimulate the release of LH and FSH supports the theory that all things work on a cyclic pattern and on a

biological clock. If one tiny piece falls out of rhythm, then everything falls out of synchronization.

#### Literature Cited

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