

BACK TO THE BASICS: Explaining the Estrous Cycle

A working knowledge of the dairy cow's estrous cycle and its associated hormones can help you improve conception rates and boost reproductive efficiency. The following article outlines the most common reproductive hormones, the role each plays within the estrous cycle and how they relate to the reproductive success of your herd.

REPRODUCTIVE HORMONES

Dairy cattle reproduction is controlled by multiple hormones which are produced by numerous endocrine glands. These hormones are secreted by the glandular cells and pass into the blood where they are transported throughout the body to complete their respective functions.¹

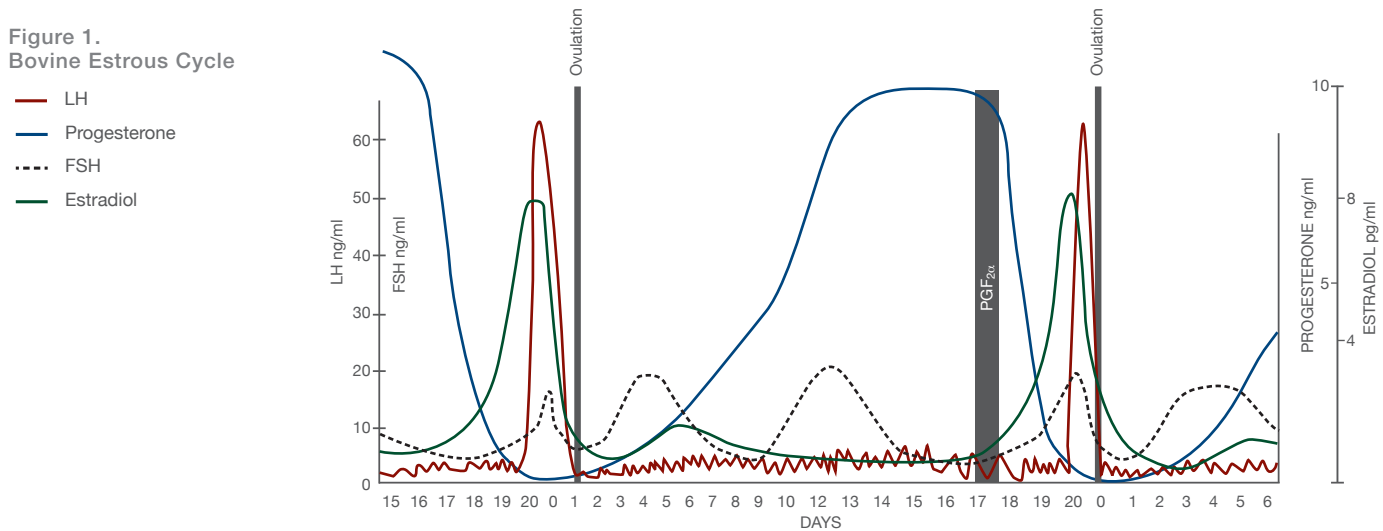
- **Estradiol** is produced by the Graafian follicle and is responsible for multiple functions including uterine development, onset of behavioral estrus and the increase of vaginal mucous secretion. Additionally, estradiol cues the release of the gonadotropin releasing hormone from the hypothalamus.
- **Gonadotropin Releasing Hormone (GnRH)** causes ovulation of the dominant follicle by causing the release of the luteinizing hormone from the pituitary gland.
- **Luteinizing Hormone (LH)** is secreted from the pituitary gland and travels through the blood to the ovary after being signaled for release by the GnRH. LH is responsible for causing the follicle to rupture (ovulate) by acting on the ovary which will release the egg. Following ovulation the LH also stimulates the development of the corpus luteum (CL).
- **Follicle Stimulating Hormone (FSH)** is also secreted by the pituitary gland and travels through the blood to the ovary after being signaled for its release by the GnRH. FSH stimulates the growth, development and function of the follicle.
- **Progesterone** is secreted by the CL and is essential for pregnancy. This hormone also prevents the dairy cow from coming into heat and ovulating when pregnant.
- **Prostaglandin (PGF_{2α})** is secreted by the uterus and causes regression of the CL and a decrease in progesterone levels. If the cow is pregnant, the embryo will block the release of PGF_{2α} and allow the CL to continue to secrete progesterone.

THE ESTROUS CYCLE

The 21-day estrous cycle relies on each of the reproductive hormones for successful completion. The hormones work in the following order on the day highlighted.

Figure one below illustrates the hormone levels throughout the estrous cycle.

Figure 1.
Bovine Estrous Cycle



Day 0: Defined as the day of estrus. During this period, a cow will stand to be mounted. Heat usually lasts for an average of 8 – 12 hours but can sometimes last as few as four hours.² During this time the follicle structure on the ovary is present. Estradiol from the follicle triggers GnRH release.

When GnRH is released, it will also cause the release of LH, which in turn induces ovulation and releases the egg. The LH surge occurs at the onset of estrus (Day 0); ovulation occurs approximately 32 hours following the LH pulse. If sperm are present when the egg is released, fertilization will occur—a fertilized embryo will stay in the oviduct three to four days before moving to the uterus.

Day 1 – 5: The follicle “luteinizes” to form the CL which secretes progesterone.

Day 9 – 10: The CL reaches maximum size and progesterone output.

Day 16 – 18: If a cow does not become pregnant $\text{PGF}_{2\alpha}$ will be released by the uterus. As progesterone levels decrease and an increase in GnRH pulsatility takes place, release of LH increases, and a preovulatory estrogenic follicle develops.¹

If pregnancy has occurred, the developing embryo blocks the release of $\text{PGF}_{2\alpha}$ and progesterone continues to be secreted. As mentioned previously, progesterone is necessary for pregnancy; it prepares the uterus for pregnancy, while preventing the cow from ovulating and entering heat again.



The estrous cycle is continually repeated until a successful pregnancy has occurred.

The estrous cycle and associated hormones are the cornerstone of dairy cattle reproduction. Developing a better understanding and utilizing this knowledge on your dairy operation will allow you to optimize reproductive efficiency with your herd.

References

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- 2 Burns, P.D. The Dairy Cow Heat Cycle. Colorado State University. Available at: <http://www.cvmb.colostate.edu/ilm/proinfo/cdn/2002/heat%20cyclesep02.pdf>. Accessed August 15, 2011.

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