Information on Regulation of Reproductive Cyclicity in Cattle

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Introduction

Reproductive cycles are regulated by hormones. The purpose of this paper is to give an overview of recent information on hormonal regulation of reproductive cycles in order to allow increased understanding of programs that are currently being developed or will be developed for improving reproductive efficiency in cattle.

Figure 1 shows a typical hormonal profile for 4 key reproductive hormones during the estrous cycle of the cow. Progesterone comes from the corpus luteum and increases after the time of ovulation and then decreases at the time of luteolysis. Prostaglandin (PG) $F_{2\alpha}$ comes from the nonpregnant uterus and is the hormone responsible for luteolysis. As shown below $PGF_{2\alpha}$ is secreted in distinct pulses near the time of luteolysis. Estradiol-17ß increases early in the cycle and after the time of luteolysis. This increase in estradiol causes estrus behaviour and the LH surge. The LH surge is responsible for ovulation of the preovulatory follicle. Ovulation occurs about 28 h after the initiation of the LH surge.

The remainder of this manuscript will provide more depth on this simplified view of the estrous cycle by summarizing some recent information on: regulation of follicular development, regulation of corpus luteum function, and how this information can be applied to understanding mechanisms involved postpartum anestrus and development of follicular cysts.

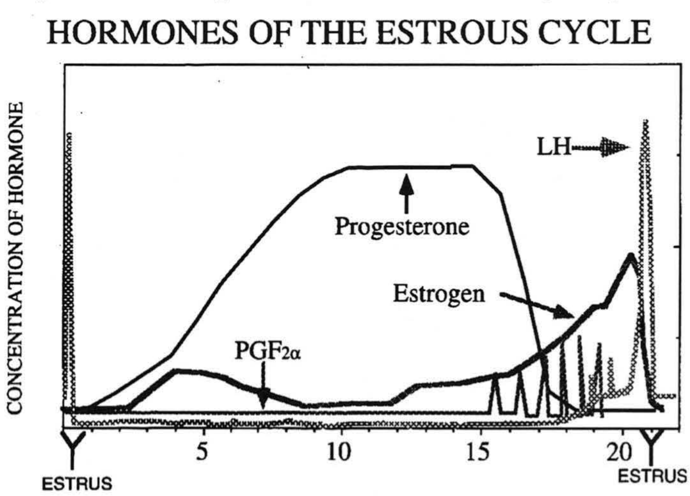


Figure 1. Diagrammatic representation of 4 key hormone concentrations during a normal estrous cycle in cattle.

Follicular Development

General Aspects

By mid-gestation, the ovary of the bovine fetus contains its full complement of oogonia. These oogonia are contained in primordial follicles (antrum-less follicles with a single layer of granulosa cells), and the initial stages of follicular growth begin prior to birth (Erickson, 1966; Marion *et al.*, 1968). At birth there are about 0.5 million follicles in the bovine ovary. Most of these follicles are at the primordial stage and can be viewed only with a microscope. Follicles gradually and continually leave this resting pool of primordial follicles and begin the slow growth to an antral follicle. Once the follicle starts to grow it will meet one of 2 fates—ovulation or atresia. Almost all follicles undergo atresia. This can be illustrated by calculating that an animal allowed to cycle normally for 15 years will ovulate less than 300 oocytes (ovulates every 21 days or 17.4 times per year times 15 years = 260 ovulations) out of the 0.5 million oocytes present at birth (Erickson, 1966). Most animals are pregnant during much of their life-span or would not be kept for 15 years; therefore, it is clear that less than 0.1% of follicles will go on to ovulate. It appears to take about 60 days for an activated primordial follicle to grow to ovulatory size (Lussier *et al.*, 1987). Information on the early stages of follicular growth are largely speculative, based on histologic data. Follicles greater than 3 mm in diameter can be evaluated on a daily basis by transrectal ultrasound a technique that has allowed researchers to acquire a great deal of information about these follicles in the last 10 years. Thus, this discussion will focus on follicular growth from 3 mm to preovulatory size. This growth only requires about 1 week and is highly dependent upon gonadotropic stimulation . Although some atresia (death) of follicles can occur throughout follicular growth, most occurs during this final week when a dominant follicle is selected from among a group of follicles in a follicular wave.

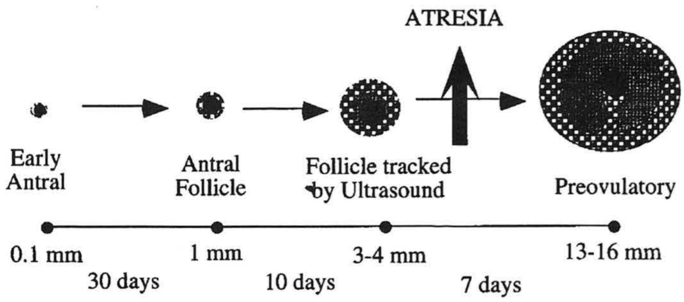


Figure 2. Schematic diagram of the final stages of follicular growth in cattle. Data from Lussier *et al.*, 1987. Most of the follicular atresia has been detected during the final stages of follicular growth as one follicle is selected from the group of follicles growing from the 3-4 mm pool. The final stages of growth from 3-4 mm until ovulation have been well characterized in the last few years by using transrectal ultrasound.

Follicular Waves

In cattle growth of follicles occurs in a distinct wavelike pattern. New follicular waves occur about every 10 days (6-15 day range). During an estrous cycle there will normally be 2 or 3 follicular waves. The figure below shows the pattern of follicular wave development in a heifer with 2 follicular waves during an estrous cycle (see Ginther *et al.*, 1989).

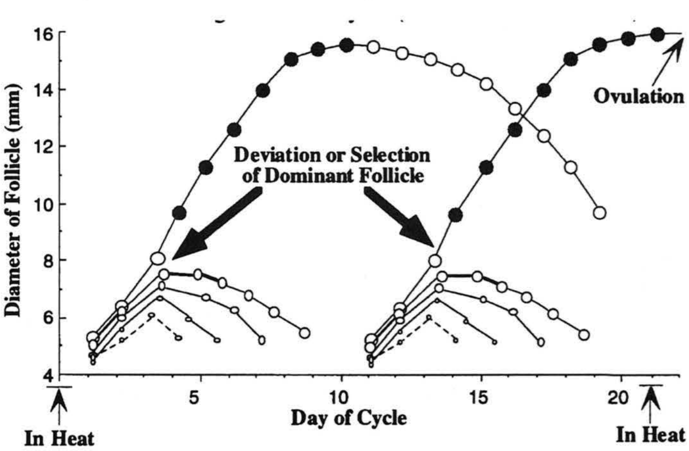


Figure 3. Diagram of the growth of follicles during a 21 day bovine estrous cycle. This heifer had two follicular waves during this estrous cycle. The points that are shaded indicate when a follicle is functionally dominant. The dominant follicle of the first follicular wave does not ovulate because of progesterone from the corpus luteum. A new follicular wave started about 11 days after estrus and this second dominant follicle ovulated. Also, cows can have three follicular waves during a normal estrous cycle.

As expected, the hormone most closely associated with these patterns of follicular growth is follicle-stimulating hormone (FSH); however, this was actually not demonstrated until 1992 (Adams *et al.*, 1992). As shown below, heifers that had 2 waves of follicular growth have an increase in FSH that precedes each of the two follicular waves (Figure 4.)

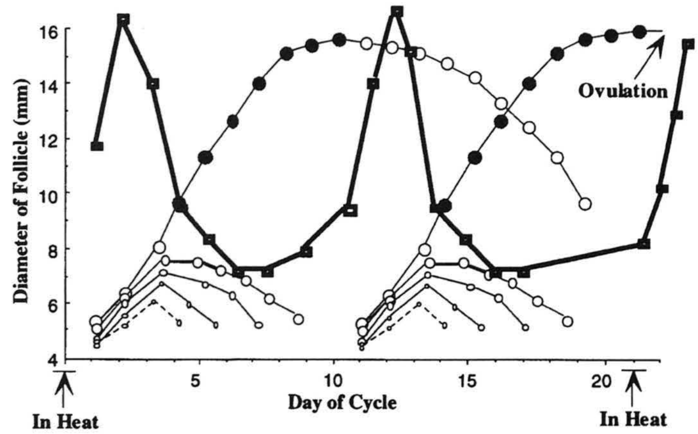


Figure 4. Average pattern of FSH secretion during follicular growth (modified from Adams *et al.*, 1992).

Regulation of follicular steroidogenesis by FSH and LH

The concentrations of FSH shown in Figure 4 are primarily regulated by 2 compounds of ovarian origin, inhibin and estradiol. In hibin appears to be secreted from most follicles greater than 3 mm in diameter, even many atretic follicles. This makes it unlikely that inhibin causes the rate-limiting control of FSH secretion. On the other hand, estradiol concentrations seem to precisely follow the growth of the dominant follicle. It is likely that both estradiol and inhibin together regulate FSH secretion; however, that inhibin is "always there" and that changes in estradiol concentration are the primary regulator of FSH secretion.

Production of estradiol in the bovine follicle requires the interaction of the two follicular cell types, theca and granulosa cells. Androgens are produced in the theca, diffuse to the granulosa cells and are converted to estrogens in the granulosa cells. A simplified view is given below. The three key enzymes for steroidogenesis are shown: Cholesterol side chain cleavage enzyme (P450scc); 17_{α}-hydroxylase/17,20-lyase (P450c17); and aromatase (P450arom). The cellular locations for these enzymes is also shown.

	P450scc		P450c17		Aromatase	
Cholesterol	⇒	pregnenolone	⇒	androgens	⇒	estrogens
	Theca or Granulosa		*Theca*		*Granulosa*	

A recent study (Xu, *et al.*, 1995a) has evaluated the expression of mRNA for these enzymes in growing follicles from ovaries at known times of the first follicular wave. There was also a second study that this group did in which they analyzed LH and FSH receptors in these same follicles (Xu *et al.*, 1995b). I have combined these data in one Table below.

Table 1. Expression of mRNAs for P450c17, Aromatase, LH receptor and FSH receptor in theca and granulosa cells of bovine follicles collected on different days of the first follicular wave. There was no FSH receptor or aromatase in theca and no P450c17 in granulosa (not shown).

Day of Wave	No. Heifers (No. follicle)	Size of Follicle	Theca P450c17	Theca LH rec	Granulosa Aromatase	Granulosa FSH rec	Granulosa LH rec
0	3 (8)	5.3±0.4	8±3^{b}	15±7^{a}	4±1^{c}	15±5	0^{a}
2	4 (12)	6.7±0.5	20±5^{b}	13±6^{a}	24±5^{b}	25±4	0^{a}
4	4 (4)	10.8±0.8	59±12^{a}	59±10^{b}	54±13^{a}	31±11	26±10^{b}
6	5 (5)	12.9±0.6	7±2^{b}	21±10^{a}	51±9^{a}	14±4	24±8^{b}
8	4 (4)	11.1±1.0	13±6^{b}	28±10^{a}	8±5^{b,c}	13±6	9±7^{a}
10	3 (3)	11.7±0.3	0.2±0.1^{b}	10±7^{a}	0	6±3	0^{a}

Another study has also been done that (Jolly *et al.*, 1994) cAMP response of different size follicles after stimulation with FSH or LH. FSH stimulates cAMP from granulosa cells of follicles of all sizes including small follicles and FSH receptor is found in follicles with as few as 2 layers of granulosa cells (Tisdall *et al.*, 1995). In contrast, LH stimulates cAMP in granulosa cells primarily from healthy follicles greater than 9 mm in size. This is consistent with follicles above 9 mm acquiring LH receptors and responsiveness.

As we examine these data, particularly Table 1, we can ask the question what parameters change as the dominant follicle grows from the wave of growing follicles? All follicles seem to have LH receptor in the thecal cells and FSH receptor in the granulosa cells. In fact, another study has shown FSH receptors on follicles with as few as 2 granulosa cell layers (Tisdall *et al.*, 1994). The aromatase mRNA increases at day 2 suggesting that the early decrease in FSH secretion is probably due to a small increase in estradiol secretion from the follicle due to increasing aromatase activity. The most striking change occurred by day 4 when the cells abruptly acquire LH receptors. In the other data set follicles greater than 9 mm had LH responsiveness. A cellular model below schematizes what we think is happening at the time of selection of the dominant follicle (Figure 5). Prior to selection the granulosa cells are producing estradiol under the influence of FSH. This cell also shows that FSH acts by stimulating production of cAMP inside the granulosa cell. The cAMP can induce aromatase expression and production of estradiol and this would tend to decrease FSH secretion. LH is present but does not act on the granulosa ells because they do not have LH receptors. At the time of definitive follicle selection, the dominant follicle acquires LH receptors. These LH receptors allow increased production of cAMP even in the presence of decreasing FSH. Circulating FSH is further decreased by high estradiol production by the dominant follicle and follicles that continue to be dependent upon FSH stimulation are selected against and subsequently lost.

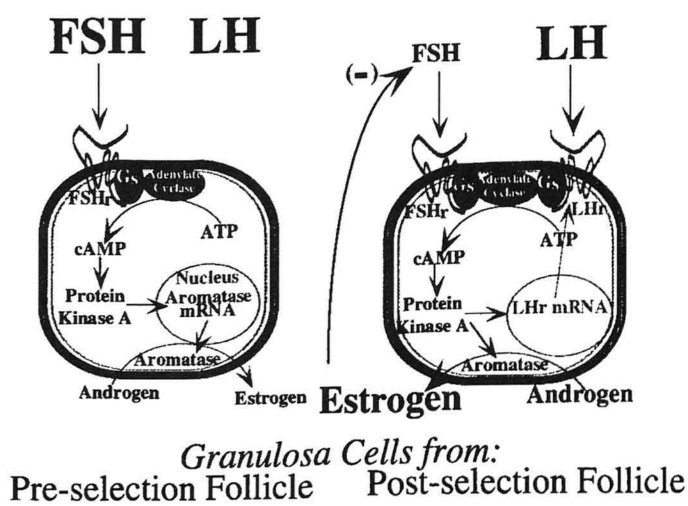


Figure 5. A cellular diagram depicting the intracellular events in granulosa cells during the time of selection and the dominant follicle. The cell on the left represents granulosa cells in a developing follicle prior to selection. The cell on the right is after selection. Note that LH receptors are now expressed on the granulosa cells and this allows high intracellular cAMP even in the presence of decreasing FSH.

Follicular waves under different physiological conditions

Follicular waves do not occur only in cycling cattle (Table 2.) Follicular waves are present in prepubertal calves by 2 months of age (Evans *et al.*, 1994) and are also present in dairy or beef cattle prior to onset of cyclicity (Savio *et al.*, 1990). Follicular waves also occur during most of pregnancy (Ginther *et al.*, 1996). The presence of these waves during pregnancy has allowed oocytes to be collected from pregnant cows using ultrasound--guided follicular aspiration (Meintjes *et al.*, 1995). A modified technique has also been reported to collect oocytes from prepubertal calves (Brogliatti and Adams, 1996). The regulation of follicular waves in some of these states of non-cyclicity will be discussed in the next section of this manuscript.

Table 2. Physiologic states in which follicular waves have been found.

Physiologic State	Follicular Waves	Length of Follicular Wave
Estrous Cycle	Yes	9-14 days
Anestrus	Yes	7-12 days
Prepubertal	Yes	7 days
Pregnancy	Yes	6-12 days (vary by stage)

Physiological Regulation of Non-cyclicity

An understanding of the physiological mechanisms that lead to anestrus and ovarian cysts is dependent upon a thorough understanding of the hypothalamic, pituitary, and ovarian mechanisms that regulate the normal estrous cycle. From the information discussed above, follicular growth can be divided into 4 general stages: gonadotropin independent (prior to 3 mm size), FSH-dependent (3-10 mm), LH pulse-dependent (10 mm to preovulatory, and LH surge-dependent (ovulation). Follicles can be lost at any time during these 4 stages of growth. Probably the majority of follicle losses occur during the FSH-dependent stage as one follicle is selected from a group of follicles. The dominant follicle that emerges from this group of follicles is dependent upon LH and will proceed to continued growth (sufficient LH pulses), atresia (insufficient LH pulses), or ovulation (LH surge). In order to understand the mechanisms leading to various reproductive conditions, I will begin by discussing a well researched anestrous condition, seasonal anestrus in the ewe.

Seasonal Anestrus

In most wild species there is a period of seasonal anestrus that allows productive function and particularly birth of young to coincide with a time that should allow maximal likelihood of survival of young. Seasonal anestrus has been researched extensively in sheep. There are 3 key points that need to be clear in order to understand seasonal reproduction.

1. In the breeding season estradiol primarily regulates LH secretion by a direct action on the pituitary; whereas, progesterone inhibits LH secretion by directly inhibiting GnRH secretion by the hypothalamus.

2. In the anestrus season low levels of estradiol will inhibit pulsatile secretion of GnRH by the hypothalamus. Thus, a low level of estradiol (2 pg/ml) will not inhibit LH pulses in the breeding season but is inhibitory to LH secretion during the anestrus season (Goodman, 1994).

3. Inhibition of LH secretion will not allow final stages of follicle development and estradiol secretion.

Thus, follicle development continues during seasonal anestrus but there is not sufficient LH to dive a follicle through the final stages of development.

Postpartum Anestrus

Physiology of Post-Partum Anestrus: In dairy cattle there is always a period of negative energy balance during the first few weeks postpartum. Dry matter intake increases and cows progress to a positive energy balance by about 8 weeks after calving (range 4-14 weeks). An equation has been given by Canfield and Butler, 1991 that explains the days to first ovulation as a function of days to lowest energy balance:

$$\text{Days to First Ovulation} = 10.4 + (1.2 \text{ X days to energy nadir}) \quad (r^2 = 0.77)$$

So if energy balance nadir is at 20 days, what is the expected days to first ovulation? The average days to first ovulation in U.S. Holsteins from ten different studies is 33.3 days (mean, SEM 2.09; reviewed by Ferguson, 1996). In beef cattle, even though milk production is much lower there is also a time of negative energy balance that will increase the number of days to first ovulation.

Heifers that are ovariectomized have high numbers of LH pulses. If ovariectomized and non-ovariectomized heifers are fed 2 different levels of feed (energy) a very interesting effect is observed. Low amount of feed will dramatically inhibit LH pulses in the heifers that were not ovariectomized. In contrast the ovariectomized heifers show high numbers of LH pulses with high or low amounts of feed. Thus, it appears that again estradiol is inhibitory to LH pulses when levels of feed are minimal. Figure 6 below is an attempt to describe a physiological scenario for lack of cyclicity due to low nutrition. Low nutrition leads to inhibitory effects of estradiol on GnRH secretion from the hypothalamus. This leads to low LH pulses and lack of final follicular growth. If the follicle could grow larger it could cause a GnRH and LH surge and eventually ovulation.

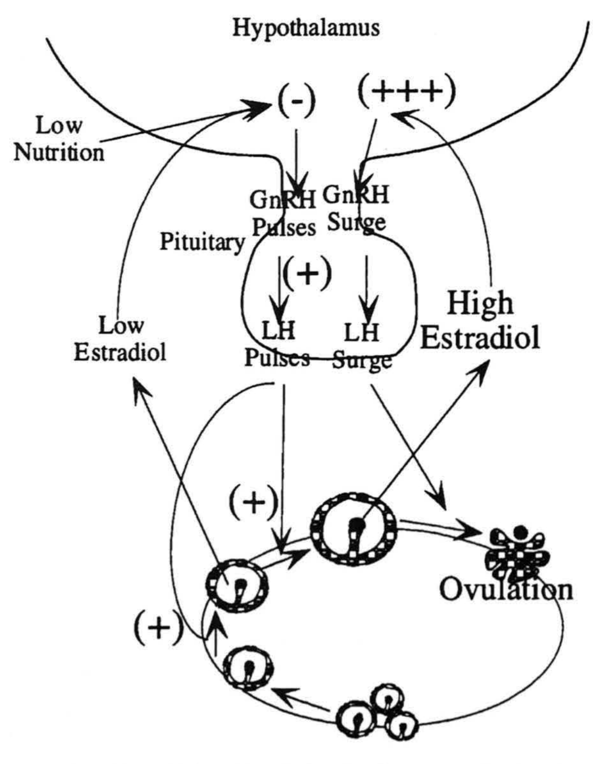


Figure 6. Possible physiological scenario for lack of cyclicity with low nutrition.

The effects of low nutrition are increased by suckling. Three examples are shown in Table 3 of the numerous scientific studies that have shown the effects of suckling on reproduction. Note that days to estrus or luteal activity are increased. Conception rate may also be increased by suckling.

Table 3. Effects of suckling on reproduction in beef cattle.

	Non-suckled	**Suckled**	
Short *et al.*, 1972			
Days to Estrus	25 days[a]	65 days[b]	
Conception rate	50%	61%	
Carter *et al.*, 1980			
Days to Estrus	14 days[a]	62 days[b]	
Days to Luteal Function	10 days[a]	35 days[b]	
Conception rate	52%[a]	95%[b]	
Carruthers & Hafs, 1980	**Milked 2X**	**Milked 4X**	**Suckled**
Days to Estrus	39 days[a]	45 days[a,b]	50 days[b]
Days to Luteal Function	19 days[a]	23 days[a]	39 days[b]

(Numbers with different letters within a row are different ($P<0.05$)).

Thus, low nutrition and/or suckling can prevent final growth of follicles due to a negative feedback effect of estradiol on the hypothalamus to reduce pulses of GnRH. The resulting decrease in LH pulses causes follicles to not grow sufficiently to reach to preovulatory size so that sufficient estradiol can be produced to elicit an LH surge and ovulation.

Early post-partum dairy and beef cattle have been examined by ultrasound to determine the patterns of follicle development. Within the first few days after parturition there is growth of a follicular wave. The first dominant follicle ovulates in about 75% of well-fed dairy cows but in only about 10% of suckled beef cattle (Savio *et al.*, 1990; Murphy *et al.*, 1990). In pasture-fed dairy cattle the days to first ovulation are greater with an everage of 4.2 of waves of follicle growth before the first ovulation (McDougall *et al.*, 1995). In cows that do not ovulate the follicle of the first follicular wave there appears to be insufficient growth of the follicle. As follicles are closer to the ovulatory wave the dominant follicles appear to reach a larger size. In US Holsteins that are on a high plane of nutrition most follicles reach a large size but some still do not ovulate due toounknown mechanisms.

Treatments for Postpartum Anestrus

Treatments to reduce anestrus and improve reproduction must focus on increasing LH pulse frequency and allowing follicles to reach the final stages of maturation. The most obvious method that should be used is to reduce the negative energy balance during the postpartum period. In addition, disease conditions should be minimized. Cows that lose 1 or more body condition scores will be more likely to be anestrus. Optimal nutrition during the transition period as well as during early lactation are critical to reducing anestrus.

One method to increase LH pulses is to provide progestin. As shown in Table 4 there is an increase in number of pulses with removal of suckling. In addition, insertion of a progesterone implant further increased LH pulses. Thus, low levels of progesterone may actually increase LH pulses with resulting increases in follicle development.

Table 4. Effect of progesterone implants on LH secretion (data from Williams *et al.*, 1983).

Characteristic	**Suckled No Prog**	**Suckled +Prog**	**Nonsuck No Prog**	**Nonsuck +Prog**
Mean LH (ng/ml)	1.0±.02[a]	1.2±.03[a]	1.5±.04[b]	2.0±.05[c]
LH Pulses/6 h	1.2±.3[a]	1.8±.5[a]	3.0±.6[b]	4.7±.7[c]
LH Pulse amplitude	1.3±.2	1.4±.1	1.3±.3	1.8±.2

Recent data have shown that anestrous beef cattle can be synchronized by using a modified Ovsynch protocol that includes a progestin treatment between the first GnRH and the $PGF_{2\alpha}$ treatment. In one experiment done by Stevenson *et al.*, 1997 the cows were evaluated for cycling status and treated with either a double injection with $PGF_{2\alpha}$ 14 days apart or with a modified Ovsynch protocol that contained a norgestomet implant between the GnRH and $PGF_{2\alpha}$ treatment. The results are shown in Table 5. The 2 treatments had similar pregnancy rates in those cows that were cycling prior to starting treatments. In contrast the norgestomet/GnRH treatment was superior in non-cycling cows as compared to the program with PGF and estrus detection. There was no comparison between Ovsynch with or without the norgestomet. In Table 6 is shown the effect of feeding an orally active progestin, melengestrol acetate (MGA), for 7 days with or without other hormone treatments. All cows received PGF on the 7th day of MGA feeding when MGA feeding was stopped. Some cows received estradiol benzoate (EB) on day 8 while cows in the other 2 groups received GnRH at 54 h and all cows were inseminated at 54 h.

Table 5. Conception rates in cycling and non-cycling cattle after induced ovulation.

	PGF/PGF		GnRH/Norg/ PGF/GnRH	
Cycling Status	No.	% Pregnant	No.	% Pregnant
Non-cycling	49	27%[a]	53	62%[b]
Cycling	130	56%	120	59%

Table 6. Results on alternative strategies for timed insemination of cows.

	MGA/PGF/GnRH	E2+P4/MGA/EB	GnRH/MGA/PGF/GnRH
Pregnancy rate	32%	55%	60%

Thus, good pregnancy rates can be achieved in cows by combining a progestin with a follicular synchronization and ovulation synchronization scheme. Anestrous lactating cows can be effectively treated with a regular Ovsynch protocol (GnRH-7 d-PGF-2d-GnRH-16h-AI). This is because many anestrous dairy cows have follicles of sufficient size and ovulatory capacity but for some reason do not have an LH surge. In a study done on anestrous dairy cows (Dougall *et al.*, 1995) showed that 9 of 10 GnRH treated cows ovulated after the short cycle that followed this first postpartum ovulation. Thus, anestrous cows should not be treated only with a single GnRH injection but probably the full Ovsynch protocol is appropriate.

Problem Set on Number of Follicular Waves during an Estrous Cycle

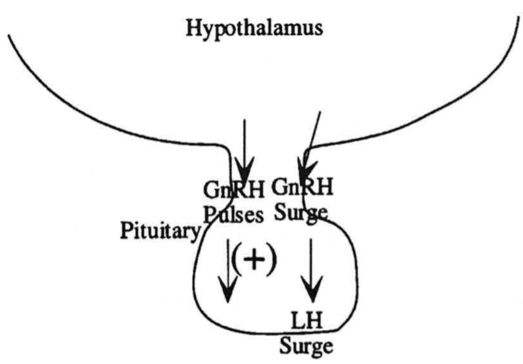
Cows generally have either 2 or 3 follicular waves during an estrous cycle. Think of 2 possible physiological scenarios that could produce 3 follicular waves during a cycle as compared to 2 follicular waves.

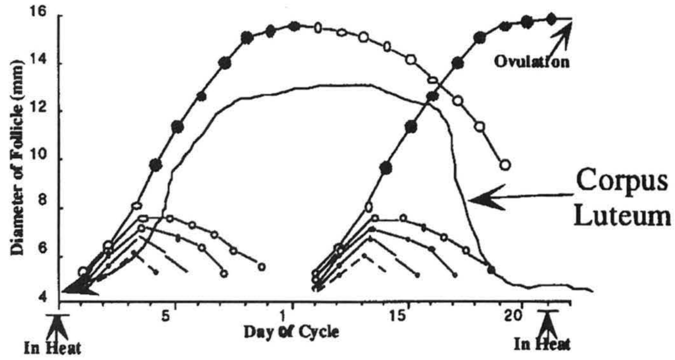
The number of follicular waves during an estrous cycle can be altered by nutrition. As shown in Table 7 there is an increased percentage of heifers with 3 follicular waves when lower amounts of energy are fed.

Table 7. Effect of dietary intake on proportion of heifers with 2 or 3 dominant follicles during the estrous cycle.

	Low Feed	Medium Feed	High Feed
No. of Heifers	7	7	5
% with 2 waves	29%	57%	80%
% with 3 waves	71%	43%	20%
Max Diameter of DF (mm)	11.3±.3[a]	13.2±.3[b]	13.7±.4[b]
Persistence of DF (days)	9.8±.7[a]	11.9±.7[b]	12.7±.8[b]
Duration of cycle (days)	20.7±.6	21.4±.6	21.6±.7

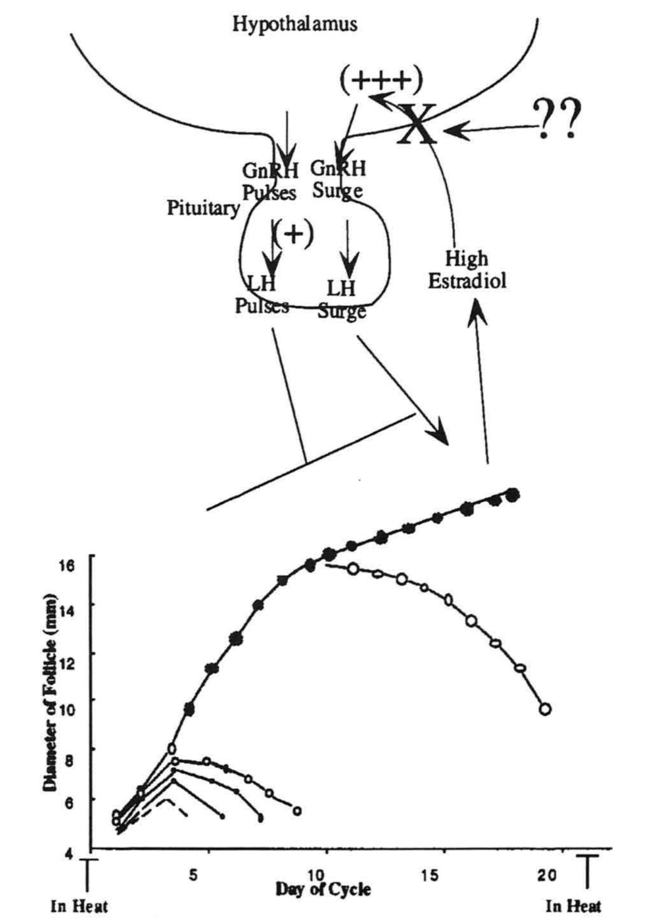
How could low feed lead to more heifers with 3 follicular waves? Draw a scenario in the figure that follows.





Ovarian Cysts

Endocrinology of Ovarian Cyst Development: Below is a physiological scenario that could produce an ovarian follicular cyst.



One important question is the physiological situation that leads to a lack of ovulation of the ovarian cyst. Experimentally, large persistent follicles can be produced by provision of continuous low amounts of progesterone. The concentration of progesterone must be too low to inhibit pulsatile LH secretion but sufficiently high to block the LH surge and ovulation. It is possible that something other than progesterone is the inhibitor of the LH surge in cystic cows. Intrauterine infusion of endotoxin increased serum cortisol and blocked the LH surge suggesting that intrauterine infection may cause cysts under certain conditions (Peter *et al.*, 1989).

In most situations of follicular cysts there are multiple cystic structures. It is not clear why this may happen. One possible scenario is that estradiol has an effect to prevent FSH secretion when it acutely high. After about 3-5 days the cow seems to adapt to the high estradiol concentration and FSH concentrations increase. This may occur in the cystic condition with a single follicular cyst being present and a new follicular wave starting and a dominant follicle (or multiple dominant follicles) developing from the new follicular wave. It is known that cows will adapt to high estradiol and that FSH concentrations will rise and a new follicular wave begin even in the presence of continued high estradiol (our data in Syncro-Mate-B-treated heifers).

Classification of Cysts: Cysts are generally classified into 2 general categories, follicular or luteal. Follicular cysts are thin-walled large ovarian structures and low amounts of progesterone are found in the milk or blood. Many times these cows will show frequent heats (nymphomania). There may also be a fairly constant discharge from the vulva. Most times there are multiple follicular cysts on the ovaries of cows and these structures may be very large. Luteal cysts are thick-walled structures that are generally only found as single structures. There are medium to high concentrations of progesterone in the milk or serum. Cows do not show heat. We have speculated from our field operations that there should a third classification of ovarian cysts that we have termed benign follicular cysts. These structures are thin-walled, large but seem to have little or no hormonal or functional activity. When we have removed these structures from the ovaries they have few if any cells in the follicles. The characteristics of these 3 types of cysts are summarized in Table 8.

Table 8. Classification of functional activity of ovarian cysts.

Classification	Major Hormone Secreted	Response to GnRH	Response to $PGF_{2\alpha}$
Follicular	Estradiol	Luteinization	None
Luteal	Progesterone	None	Regression
Benign Follicular	None	None	None

A clear epidemiological evaluation of these 3 types of cysts has not been undertaken. It is clear that they are difficult to differentiate by rectal palpation. A study was designed to evaluate the accuracy of diagnosis of cysts by rectal palpation as compared to ultrasound. Cows were evaluated by 2 clinicians and serum progesterone concentrations were evaluated on all cows. A follicular cyst was designated if < 0.5 ng/ml; whereas, a luteal cyst was > 0.5 ng/ml progesterone. Palpation was correct 51.1% (24 of 47) of the time; whereas, ultrasound was correct 85.1% (40/47).

Treatment of Cystic Cows: Look at the physiological scenario for development of cysts and speculate about 2 possible methods to treat a cystic cow and the physiological mechanism by which these treatments would work.

Any treatment of cows should be done with the clear understanding that cysts have probably not been accurately classified into follicular, luteal, or benign categories. A treatment with GnRH may help a follicular cyst but could do nothing for the cow with a luteal or benign cyst. The best way is probably to select a treatment that will be effective for cows with any of the 3 types of cysts. Use of Ovsynch is such a treatment. Table 9 shows the response of different cysts to the 3 hormonal injections that are part of the Ovsynch protocol.

Table 9. Ovarian response to Ovsynch treatments in cows with different types of cysts.

Classification	Response to 1st GnRH	Response to $PGF_{2\alpha}$	Response to 2nd GnRH
Follicular	Luteinization	Regression	Ovulation of DF
Luteal	Ovulation if DF	Regression	Ovulation of DF
Benign Follicular	Ovulation if DF	Regression if CL	Ovulation of DF

Treatment of cystic cows with Ovsynch has not been well characterized by scientific studies. However, there have been numerous reports from veterinarians of the success of using Ovsynch with cystic cows. I am attaching an E-mail message that was recently provided to the AABP-L regarding use of Ovsynch in cystic cows by Roger Martineau.

Subject: Re: cystic ovaries
>Author: rmartin@abacom.com (Roger Martineau) at Internet-Mail
>Date: 3/2/98 8:41 PM
>
">Dear Dr Britt,
> I have been using extensively Ovsynch since 3 years in 38 herds on monthly visits and I had very good success managing cystic ovaries with it. In fact, I have so far a 44% pregnancy rate on 104 cystic cows as compared to 40% on 2,200 cows normal cows. The cystic cows were not P4 evaluated. It is now the treatment of choice we used on cystic cows in our practice. I doubt it could be used as a diagnostic tool in cystic cows because I am very confident it works. I have not tested my misdiagnosis rate, but I have the feeling that it is relatively low...I

would like to confirm all the cystic cows as truly cystic by ultrasonography or milk progesterone, but it is not economically feasible in my practice. Is it really needed? I feel strongly that the treatment should be the same: Ovsynch."

Other treatments may be appropriate but have not been well tested. Treatment with GnRH or $PGF_{2\alpha}$ alone may not be accurate for the type of cystic structure. Treatment with a progesterone releasing device (CIDR) would probably be appropriate if a treatment with estradiol were given at the first to initiate a new follicular wave and to regress the corpus luteum.

Problem on Treatment of Cystic Ovaries: Hamilton *et al.*, 1995 showed that mean concentrations of LH were greater in cows with cysts (1.07 ± 0.01 ng/ml) than in control cows (0.47 ± 0.01 ng/ml) or in cystic cows that spontaneously recovered from cysts (0.68 ± 0.1 ng/ml) at a similar stage of follicle development. A researcher that works with cystic ovarian disease asked me, "If LH concentrations are elevated in cystic cows, why should we treat cows with GnRH which primarily releases LH?" Why do you think we treat cystic cows with GnRH or LH one of the causative factors in development of cysts appears to be elevated LH?

Conclusions

This manuscript has attempted to demonstrate how our current understanding of follicular waves in increasing our understanding of various physiological conditions. In the manuscript in last year's AABP meeting I attempted to provide specific information on how knowledge of follicular waves has allowed us to develop timed AI programs. Clearly, this understanding is allowing us to provide treatment for cows with a greater physiological rationale. It is likely that this information will provide a great deal more practical information in the coming years.

References

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