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# Mechanisms involved in selection of a single dominant follicle and regression of the corpus luteum: Does a common differentiating cell type, the granulosa/large luteal cell, underlie these two disparate physiological events?

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**ABSTRACT**

***Background*:** Selection of a single dominant follicle in cattle involves a sequence of endocrine, intercellular, and intracellular changes that produces a single follicle that continues to grow, whereas the non-selected follicles cease growth and eventually undergo atresia. Technical breakthroughs have helped to unravel the pattern of changes during selection but have not yet definitely established the role of each specific change in the follicle selection process. Following ovulation and luteinization, the granulosa cells become the large luteal cells. More than 80% of P4 production by the ruminant CL is due to the functional properties of the large luteal cell. Factors related to CL development and regression are described below.
***Review*:** In Holstein heifers morphologically distinguishable selection of a single dominant follicle occurs when the follicle reaches ~8.5 mm in diameter. The circulating FSH concentrations, on average, reach a nadir near this time, although individual cows show surprising variation in the magnitude and pattern of the changes in FSH that accompany follicle selection. Blockade of LH pulses by treatment with the GnRH receptor antagonist, Acyline, does not inhibit follicle growth before 8 mm but follicles do not proceed past the point of follicle selection in Acyline-treated animals. This effect is consistent with the dramatic increase in expression of LH receptors in granulosa cells near the time of follicle selection and suggests that a shift from FSH-dependence to LH-dependence occurs in the dominant follicle. Surprisingly, Acyline-treated animals do not have the characteristic increase in LH receptor expression in granulosa cells indicating a potential role for LH pulse in induction of LH receptors in the granulosa cells of the dominant follicle. A myriad of other gene expression changes have been reported in granulosa cells near the time of follicle selection including changes that would: increase estradiol production, inhibit apoptosis, change intrafollicular paracrine regulators, change the extracellular matrix, and alter metabolism and cell proliferation. The granulosa cell is only 10 μm in diameter in the preovulatory follicle, however the LH surge and subsequent luteinization produce a cell of about 38 μm in diameter, a growth of over 50-fold (500 $\mu m^3$ to 30,000 $\mu m^3$) in cell volume. Although, the large luteal cells represent less than 4% of the luteal cells, their large volume represents about 40% of the total volume of the CL. This cell type is differentiated to be an amazing P4 production factory that appears to be constitutively "on" but can be turned off by the actions of prostaglandin F2α (PGF) during luteolysis. The corpus luteum acquires the ability to undergo luteolysis following PGF treatment at about 7 days after the LH surge. This has been termed "luteolytic capacity". We have been able to demonstrate acquisition of many of the same molecular features of luteolytic capacity during luteinization of granulosa cells in vitro.
***Conclusions*:** 1) Selection of a single dominant follicle seems to involve and may depend upon molecular changes in the granulosa cell; 2) It seems likely that changes in the large luteal cells are the physiologic key to acquisition of luteolytic capacity.

**Keywords:** follicle, corpus luteum, cattle.

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