#20: What Can the Domestic Hen Teach Us About Ovarian Function?

Kahina Ghanem, Alan Johnson

The domestic hen is an ideal model organism to study vertebrate ovarian function, due in large part to a single ovary that contains an orderly arrangement of follicles at different stages of development. Accordingly, the single largest follicle is ovulated on an approximate daily basis. The rate-limiting step in maintaining this process is the highly regulated selection of a prehierarchal follicle from a pool of undifferentiated, 6-8 mm follicles, referred to as prehierarchal follicles. The single, selected prehierarchal follicle rapidly undergoes changes that enable it to grow and accumulate yolk at a rate of ~2g/day. At a cellular level the granulosa cell (GC) monolayer surrounding the oocyte becomes responsive to follicle stimulating hormone (FSH) and initiates progesterone production. Although, some of the cellular changes that promote this transformation have been characterized, the most proximal event that leads to the selection of one follicle over the others remains to be identified. In this study we hypothesized that the selection of a single follicle occurs as a result of a comparatively higher sensitivity of the GC layer to FSH. Groups of age matched laying hens, 60-70 weeks of age (N=5 per treatment), were injected with phosphate buffered saline or 30 IU, 75 IU, 100 IU, 300 IU of pregnant mare serum gonadotropin (PMSG), or 25 IU FSH. Ovaries were collected 29 h post-injection. Follicles 1mm in diameter were dissected out and weighed. The selection status of a follicle was established based on a weight of 0.24 g. The granulosa layer was collected from the most recently selected (9-12mm) follicles, the largest 6-8 mm prehierarchal follicle, and three smaller 6-8 mm follicles then incubated with 10 ng FSH in 1 ml complete DMEM medium for 3 h. The expression of mRNA encoding steroidogenic acute regulatory protein (STAR) and P450 side-chain cleavage enzyme (CYP11A1) was measured using quantitative real time PCR. Here we report that each dose of PMSG induced the selection of multiple follicles (2 to 13) in a dose-dependent manner, and this was confirmed by elevated STAR and CYP11A expression. PMSG was confirmed to act through FSH bioactivity as FSH injections also resulted in multiple (14 to 18) selected follicles. From these results we conclude that increasing the concentration of FSH bioactivity activates FSH receptor signaling and promotes the selection of multiple follicles in a dose-dependent manner.