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The Chappell lab predominantly investigates the role of endogenous intracellular circadian clocks in the neuroendocrine regulation of reproduction in mammals. Using a combination of molecular biological and physiological techniques, we are exploring how oscillatory gene expression patterns in hypothalamic gonadotropin-releasing hormone (GnRH) neurons modulate secretion of this neuropeptide, which is crucial for gamete production, steroid hormone production, and ovulation in females. We utilize several models of molecular circadian clock disruption, and are determining the necessity of cell-specific clocks using multiple transgenic mouse lines. Additionally, we have created several sub-cloned immortalized cultured GnRH-secreting neuronal cell lines, in which we can monitor clock oscillations concomitantly with peptide secretion, and in which we can reversibly disrupt clock function. Specific projects available include examining the effects of estrogen feedback on GnRH neuronal gene expression patterns, activity, and secretion, using both *in vitro* cell culture and *in vivo* mouse models, and investigating the role of clock gene expression patterns in the initiation and progression of hormone-responsive reproductive cancers, such as prostate and breast cancer. Students will use methodologies ranging from real-time quantitative RT-PCR, transient transfection of cultured cells, evaluation of reproductive capacity in mice, and monitoring gene expression and protein abundance changes in cells using fluorescence microscopy and luminometry. Summer students will have the opportunity to perform studies which provide insight into broad mechanisms of endocrine neurosecretion, and advance circadian biology by exploring how transcriptional oscillations can control synchronous multi-cellular events to regulate numerous biological processes and even orchestrate complex behaviors. Potential applications of this research include new directions in treating a range of reproductive physiological disorders that result from malfunction of hypothalamic neurosecretion, including polycystic ovarian syndrome (PCOS) and primary ideopathic hypogonadism, both of which are associated with atypical hormone release patterns.

Additionally, we have also begun funded projects investigating the role of cell-specific oscillators in the etiology and progression of prostate cancer cells in humans, and students could be involved in performing several of the above methodologies to monitor gene expression patterns in cancer cell lines, as well as performing a host of assays evaluating cell proliferation, differentiation, and programmed cell death. A third project in my laboratory is an international collaboration to explore reproduction in scleractinian coral, using available cnidarian genome databases to investigate how coral, anemone, and hydra use hormonal signals to time gamete maturation and release. Students involved in this project would learn protocols in genomic data mining, hormone binding assays, and immunohistochemistry.