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Linking Circadian Clocks to Mammalian Ovulation

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Toward a Better Understanding of...

Linking Circadian Clocks to Mammalian Ovulation

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Most biological processes are regulated by an internal circadian rhythm, critical for synchronizing cellular, organ, and bodily functions with the outside environment. One such process is the ovulation cycle in female mammals, regulated to occur when the oocyte is mature and at the optimal time of day, when sexual motivation and bodily activity peaks. The suprachiasmatic nucleus (SCN), located in the hypothalamus, is the main pacemaker in mammals, dictating the overall circadian rhythm of the body. VIP neurons, found mostly in the core region of the SCN, synchronize the overall rhythm of the SCN, taking in light cues from the outside environment. Given that ovulation is regulated by circadian rhythms, we think VIP neurons, named for their release of vasoactive intestinal peptide, may help regulate ovulation in mammals. VIP neurons connect synaptically with GnRH neurons, which regulate the release of luteinizing hormone (LH), and a surge of LH at the right time stage of the cycle triggers ovulation. We hypothesize that VIP neurons, through VIP release, send signals to GnRH neurons to contribute to the circadian timing of LH release and ovulation. To test this, we will observe how stimulation of VIP neurons affects ovulation of female mice. By optogenetically inducing VIP neuron stimulation out of phase with the normal circadian cycle in vivo, we will test whether VIP stimulation is by itself sufficient to trigger LH release and induce ovulation. Discovering the impact VIP neurons have on ovulation will not only provide important insight into how the circadian clock controls the timing of impact other circadian regulated circuits in the body. Understanding how circadian circuits work can help with diseases caused by a disruption in the normal circadian cycle, and in this case, how disruptions can affect reproduction and fertility.