Neural Regulation of Fertility or “What’s going on in the Herbison lab?”

Did you know that the brain controls fertility in all mammals including humans?

The primary goal of the laboratory is to understand precisely how the brain controls reproductive hormone secretion so that new treatments can be brought forward for the beneficial regulation of fertility in the clinic.

In Western societies, 15-25% of couples suffer from infertility – in about a third of cases this results from a problem in communication between the brain and ovary. This includes conditions like –

- Polycystic Ovary Syndrome (PCOS): a condition affecting 6-10% of reproductive-age women in which the pulses coming from the brain cannot act directly on the ovary to facilitate ovulation.
- Hypothalamic amenorrhea: a situation where excessive stress results in abnormal hormone pulse leading to a loss of periods and fertility.

Control of fertility by kisspeptin and GnRH neurons

1. How do the preoptic area kisspeptin neurons control the GnRH surge that initiates ovulation?

2. How do the arcuate nucleus kisspeptin neurons control the pulses of GnRH and LH?

3. What goes wrong with the brain control of fertility at times of metabolic stress and in PCOS?

Techniques we use to explore how the brain controls fertility

- Techniques to explore how the brain controls fertility
  - CRISPR knockout studies
  - Gene expression analysis
  - In vivo electrophysiology and calcium imaging
  - In vivo targeted gene deletion with CRISPR
  - Tissue clearing and expansion microscopy
  - In vivo rodent brain imaging
  - In vivo hormone profiling

Our Questions

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We are using animal models of obesity and PCOS to try and understand:

1. How these conditions impact the GnRH pulses and surge generation.
2. What pathways are activated within the arcuate nucleus kisspeptin neurons to regulate the frequency of episodic LH surges.
3. How gonadal steroids modulate the activity of the kisspeptin neurons from the POA.

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Neuroendocrinology of fertility control and ovulation in humans and other mammals.