Master Student Internship Projects

Wu lab, GEDEV, Faculty of Medicine

Topic

RNA-mediated control of spermatogenesis, sperm function, and paternal contribution

Our lab

We are interested in several aspects of male reproduction, including spermatogenesis, sperm function, and intergenerational transmission of paternal information. Specifically, we are passionate about understanding how the interplay between germline small RNA, mRNA regulation (i.e., alternative 3′UTR and splicing, intron retention), and RNA-binding proteins leads to robust reproductive development. In the lab, several projects use genetically modified mice, imaging, biochemistry, sequencing, and bioinformatic analysis to answer interesting questions about the genetic and molecular mechanisms of reproduction. Our current focus is on piRNAs, a class of small RNA that interacts with PIWI proteins and is essential for animal fertility. We emphasize a collaborative and inclusive work environment and are part of the NCCR RNA & Disease, iGE3, and ANDRONET Cost Action (EU) networks.

Potential projects

- Biogenesis and function of mRNA-derived (genic) piRNA
- Spatial regulation of RNA-binding proteins in spermatogenesis and sperm
- Regulation of mRNA dynamics in spermatogenesis *via* 3′ UTRs
- Target regulation by sperm-derived paternal piRNA in mouse embryos

Project background & motivation

In sexual reproduction, both parents contribute their genomes to the zygote. In addition, maternal cytoplasmic factors, including small RNAs, are also critical for embryo development. In contrast, how embryos utilize paternal information provided by sperm is less understood. Our lab studies the mechanisms from multiple angles: we explore how sperm RNA is selected during spermatogenesis, how RNA-binding proteins may participate in sperm RNA selection, and how male mouse-specific germline small RNAs, piRNAs, contribute to paternal regulation of embryonic gene expression. We use a range of molecular biology, cellular biology, and genetic techniques to answer our questions, particularly those additionally supported by the expertise at the Faculty of Medicine, with mouse genetics, sequencing, and bioinformatic analyses being the technical pillars in the lab. By understanding how spermatogenesis is regulated and how

sperm contributes to embryo viability, our work could inform new recommendations to improve male fertility and medically assisted reproduction outcomes.

Recommended reading list

1. Relaxed targeting rules help PIWI proteins silence transposons, 2023 (PMID: 37344600)
2. piRNAs in sperm function and embryo viability, 2023 (PMID: 36538648)
3. The evolutionarily conserved piRNA-producing locus *pi6* is required for male mouse fertility, 2020 (PMID: 32601478)
4. (*Review*) PIWI-interacting RNAs: small RNAs with big functions, 2019 (PMID: 30446728)
5. (*Review*) Regulation by 3'-untranslated regions, 2017 (PMID 28853924)
6. A broadly conserved pathway generates 3'UTR-directed primary piRNAs, 2009 (PMID 20022248)

Complete lab publications at https://tinyurl.com/wulab-phw
Complete lab information at https://www.unige.ch/medecine/gede/en/research-groups/wu-lab