Major campaign

Doctoral and postdoctoral recruitment in mother-child health

06 – Epigenetic regulation of *in vitro* oogenesis from human pluripotent stem cells

Type de projet : ☐ Doctoral ☒ Postdoctoral

Research Team

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Research Axis: Fetomaternal and Neonatal Pathologies

Research Interests

Our lab is interested in the mechanisms and biological roles of epigenetic reprogramming for pluripotency and germ cell/oocyte development. We specifically study the processes of X-chromosome in- and reactivation, classical models of epigenetics, by developing tailored mouse and human iPSC-reprogramming and organoid systems of germ cell and oocyte development. We thereby made fundamental discoveries on the interplay between 3D-genome structure, epigenetics and transcription and the importance of X-chromosome remodeling for meiosis and oogenesis. Furthermore, together with the clinic, we studied the impact of aging on the human oocyte transcriptome by single-cell RNA-Seq and derived patient-specific iPSC-lines and tested their capacity for germ cell differentiation *in vitro*.

Our future goal is to further advance our knowledge on epigenetic reprogramming during germ cell development and thereby contribute to the development of next generation organoid models of mouse and human oogenesis, which faithfully recapitulate *in vivo* oocyte development. These *in vitro* models will open the reproduction field to in-depth epigenomic and mechanistic studies, and facilitate patient-specific disease modeling, offering insights into human fertility disorders. Furthermore, such *in vitro* systems could provide versatile platforms for testing fertility or contraceptive drugs and for assessing the impact of environmental toxins, chemicals, or drugs on the reproductive system.

Description of the research project

In our previous work, we have shown that faithful epigenetic remodeling of the X-chromosome is critical for differentiation of mouse pluripotent stem cells into oocytes *in vitro*. Human *in*

vitro systems however did not reach beyond early germ cell stages so far. A major bottleneck has been faithful epigenetic reprogramming to erase and establish epigenetic marks, which is critical for germ cell maturation, and offspring health *in vivo*.

In this project, the Postdoc candidate will use human pluripotent stem cells (hPSCs) of different epigenetic states to assess the impact of the epigenome on human germ cell differentiation with the goal to reach more mature oocytes. The project will make use of advanced cell culture models such as ovarian organoids, CRISPR engineering and single-cell expression profiling / multi-omics techniques.

Study programs targeted

The candidate should have a Ph.D. in a field related to either reproduction, stem cells, development, molecular biology, epigenetics, or genomics.

Required expertise and skills

Human pluripotent stem cell culture / tissue engineering, Reproductive Biology, Epigenomics.

The ideal candidate would have experience in some of the following techniques: mammalian cell culture, tissue engineering, flow-cytometry, genomics, microscopy, CRISPR, molecular biology, bioinformatics.

Personal skills: Curiosity-driven, self-motivated, ambitious, high degree of independence, team-player, excellent communication skills in English.

Funding

Funding will be adjusted depending on experience and expertise level of the candidate (minimum 45.000 CAD per year) and will be granted until they receive their own financial support through granting agencies or foundations.

Keywords

Epigenomics, germ cells, organoids, *in vitro* oogenesis, pluripotent stem cells, reprogramming, X-chromosome inactivation

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