Understanding the molecular mechanisms of germline-dependent epigenetic inheritance: Computational analysis of multi-omics data

---

A Thesis
Presented to
The Division of
ETH Zürich

In Partial Fulfillment
of the Requirements for the Degree
Masters of Science

Deepak K. Tanwar

August 2021

Approved for the Division
(Health Sciences and Technology)

Isabelle M. Mansuy	Pierre-Luc Germain

Acknowledgements

I want to thank a few people.

Preface

This is an example of a thesis setup to use the reed thesis document class (for LaTeX) and the R bookdown package, in general.

Table of Contents

List of Tables

List of Figures

Abstract

The preface pretty much says it all.

Second paragraph of abstract starts here.

Dedication

You can have a dedication here if you wish.

Chapter 1

Introduction

1.1 Epigenetic

1.2 Epigenetic inheritance

1.3 Transgenerational epigenetic inheritance

1.4 Epigenetic modifications in germ cells

1.5 Models of epigenetic inheritance

1.6 MSUS mouse model

1.7 Artificial insemination

1.8 Sequencing techniques (RNA-Seq, small RNA-Seq, ATAC-Seq, WGBS, ChIP-Seq, RRBS)

1.9 short RNAs

1.10 Benchmarking

1.11 Aims

Chapter 2

Methods

2.1 Version controlled data analysis using git

2.2 Pipelines for data analysis

2.3 RNA-Seq

2.4 short RNA-Seq

2.5 RRBS

2.6 WGBS

2.7 ChIP-Seq

2.8 ATAC-Seq

2.9 Docker container for computational reproducibility of all the analysis

Chapter 3

MSUS datasets analysis

3.1 RNA-Seq

3.1.1 Datasets

3.1.2 Results

3.2 sRNA-Seq

3.2.1 Datasets

3.2.2 Results

3.3 ATAC-Seq

3.3.1 Datasets

3.3.2 Results

3.4 RRBS

3.4.1 Datasets

3.4.2 Results

3.5 WGBS

3.5.1 Datasets

3.5.2 Results

Chapter 4

Dynamic regulation of the transcriptome of the Spermatogonial cell during development

4.1 Manuscript

Chapter 5

shortRNA

Chapter 6

Benchmarking DMRs identification methods

Chapter 7

OmniSperm: An optimized pipeline for parallel multiomics analyses and offspring production using sperm from a single mouse for cross-generation research.

7.1 Manuscript

Conclusion

Appendix A

The First Appendix

This first appendix includes all of the R chunks of code that were hidden throughout the document (using the `include = FALSE` chunk tag) to help with readibility and/or setup.

In the main Rmd file

```
# This chunk ensures that the thesisdown package is
# installed and loaded. This thesisdown package includes
# the template files for the thesis.
if (!require(remotes)) {
  if (params$`Install needed packages for {thesisdown}`) {
    install.packages("remotes", repos = "https://cran.rstudio.com")
  } else {
    stop(
      paste('You need to run install.packages("remotes")",
            "first in the Console.')
    )
  }
}
if (!require(thesisdown)) {
  if (params$`Install needed packages for {thesisdown}`) {
    remotes::install_github("ismayc/thesisdown")
  } else {
    stop(
      paste(
        "You need to run",
        'remotes::install_github("ismayc/thesisdown")',
        "first in the Console."
      )
    )
  }
}
library(thesisdown)
```

```
# Set how wide the R output will go
options(width = 70)
```

In Chapter ??:

Appendix B

The Second Appendix, for Fun

References

Angel, E. (2000). *Interactive computer graphics : A top-down approach with opengl*. Boston, MA: Addison Wesley Longman.

Angel, E. (2001a). *Batch-file computer graphics : A bottom-up approach with quicktime*. Boston, MA: Wesley Addison Longman.

Angel, E. (2001b). *Test second book by angel*. Boston, MA: Wesley Addison Longman.