

DETERMINING DIFFERENTIAL SPLICE JUNCTION USAGE IN THE SUCKLING LAMB ADIPOSE TISSUE TRANSCRIPTOME BY COMPARING PERIRENAL AND TAIL FAT

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INTRODUCTION

ANIMAL GENETICS

Immunogenetics, Molecular Genetics
and Functional Genomics

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Early adipose deposits in sheep: comparative analysis of the perirenal fat transcriptome of Assaf and Churra suckling lambs

A. Suárez-Vega*, J. J. Arranz*, V. Pérez†, L. F. de la Fuente*, J. Mateo‡ and B. Gutiérrez-Gil*

a. Carcass quality indicator of suckling lambs

b. Major fat reservoir in young lambs

Integrated analyses of the methylome and transcriptome to unravel sex differences in the perirenal fat from suckling lambs

Pablo A. S. Fonseca¹, María Alonso-García¹, Rocio Pelayo¹, Hector Marina¹, Cristina Esteban-Blanco¹, Javier Mateo², Beatriz Gutiérrez-Gil¹, Juan-José Arranz^{1*} and Aroa Suárez-Vega¹

Energy
reservoir

Metabolic
regulator

A lateral view of common sheep tail phenotypes

Suprarenal gland

pelvis

Ureter

Fat-long tail

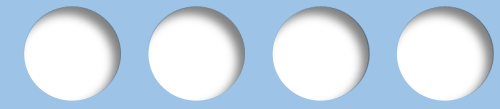
Fat-short tail

Fat-rumped tail

Thin-long tail

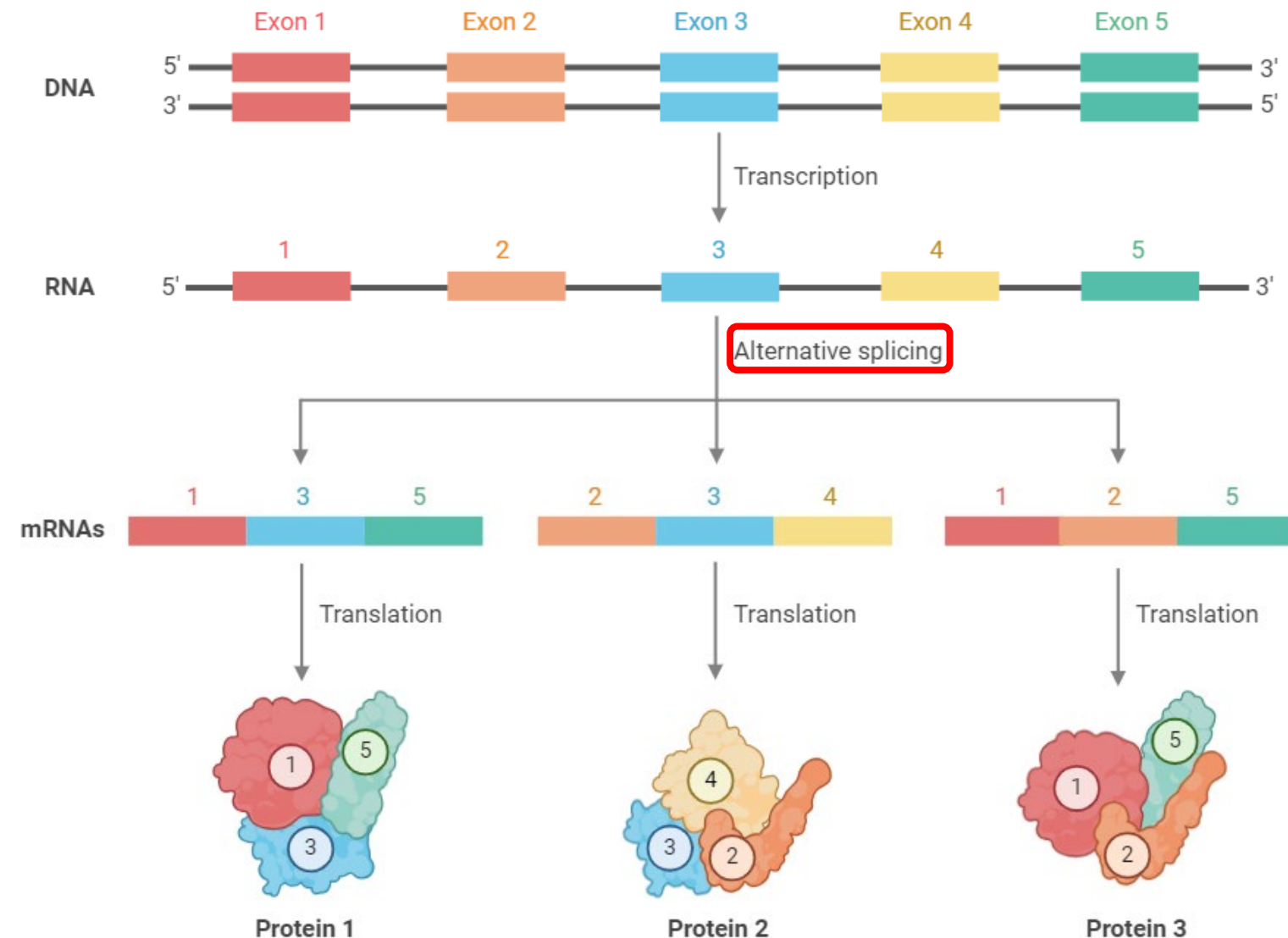
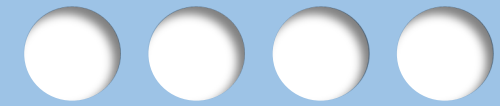
Thin-short tail

Kalds et al. (2021)



1. Quantitative measurements of **gene expression**
2. Detection of **lncRNAs**
3. Identification of **alternative splicing events**

INTRODUCTION



Alternative splicing (AS) is a fundamental biological process that regulates gene expression and increases protein diversity by producing tissue-specific protein isoforms.

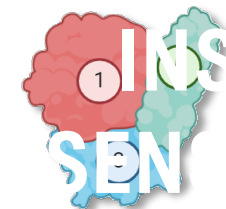
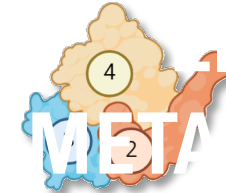
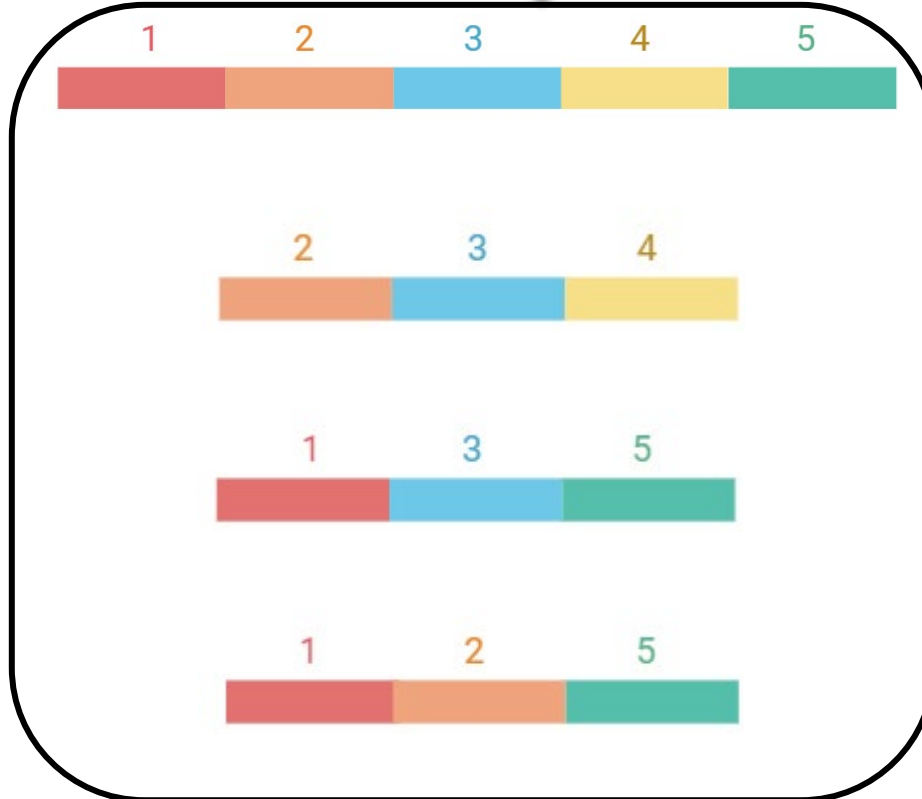
INTRODUCTION

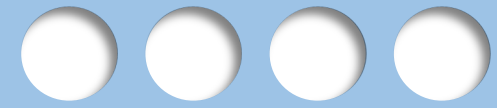
pre-mRNA



Alternative splicing

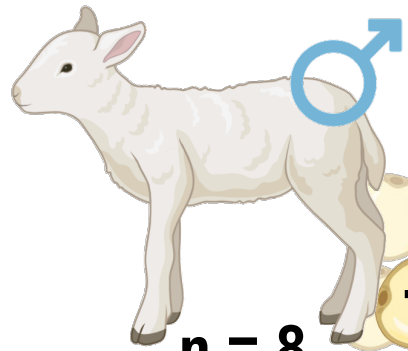
mRNAs





The aim of this study is to characterize the AS events and isoform expression in the fat transcriptome, and to elucidate the potential pathways and biological functions specifically associated to two key adipose tissues in Assaf suckling lambs, tail and perirenal fat

MATERIAL AND METHODS



Perirenal adipose tissue (PAT)
Tail adipose tissue (TAT)



RNA-Seq

TCAAATATCATGCGCAT
AGTCAATATCATGCG
TCAAATATCATGCGCAT

MATERIAL AND METHODS



Mapping

STAR

**Expression
Quantification**

RSEM

**Differential
Expression
Analysis**

DESeq2

**Functional
Enrichment
Analysis**

clusterProfiler

**Differential
Isoform
Expression
Analysis**

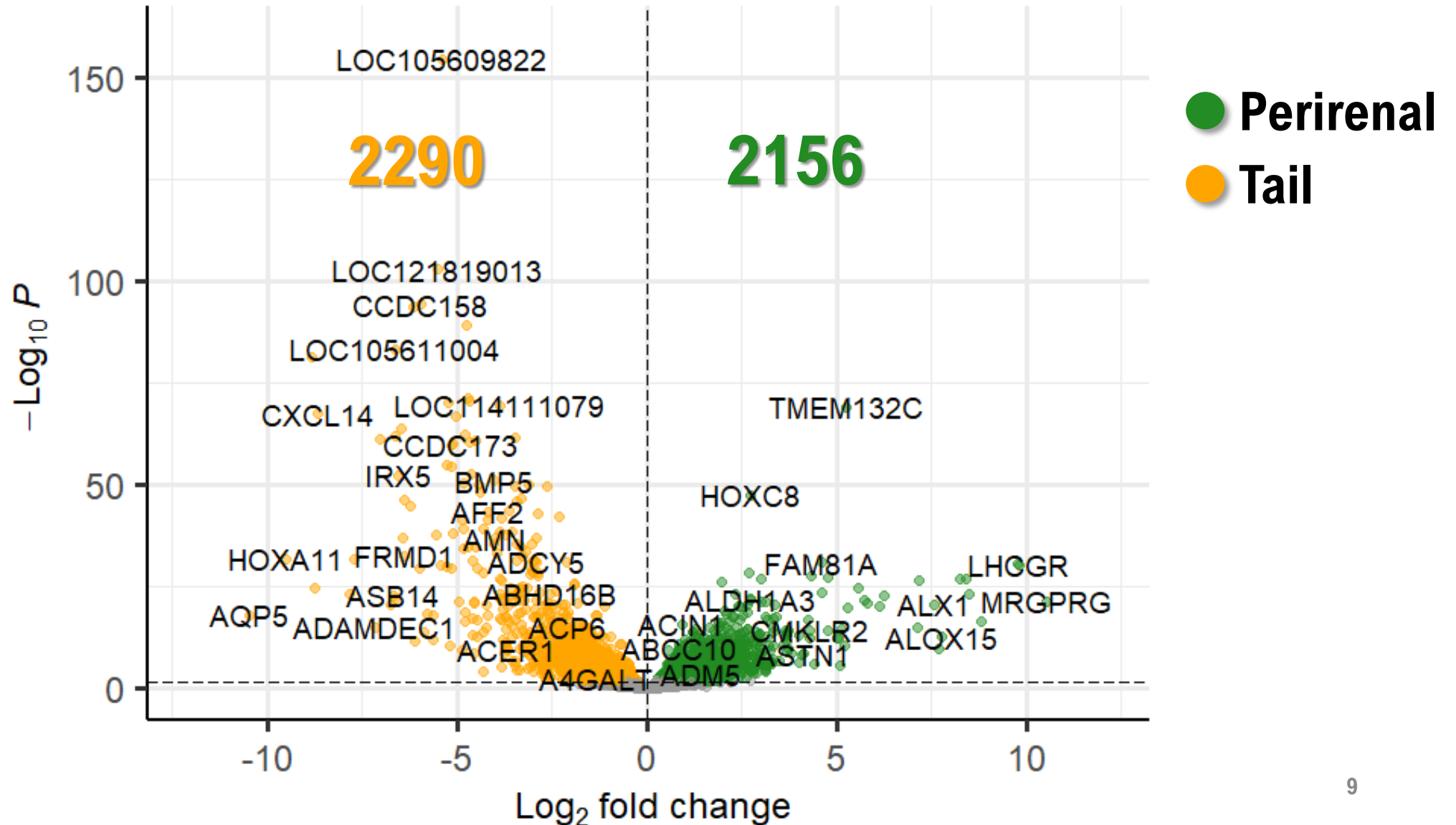
IsoformSwitchAnalyzer

**Differential Exon
Usage**

DEXSeq

RESULTS

Differential Expression Analysis



RESULTS

**386 DEIs in
annotated genes**

■ Intron Retention

■ Exon Skipping

■ Multiple Exon Skipping

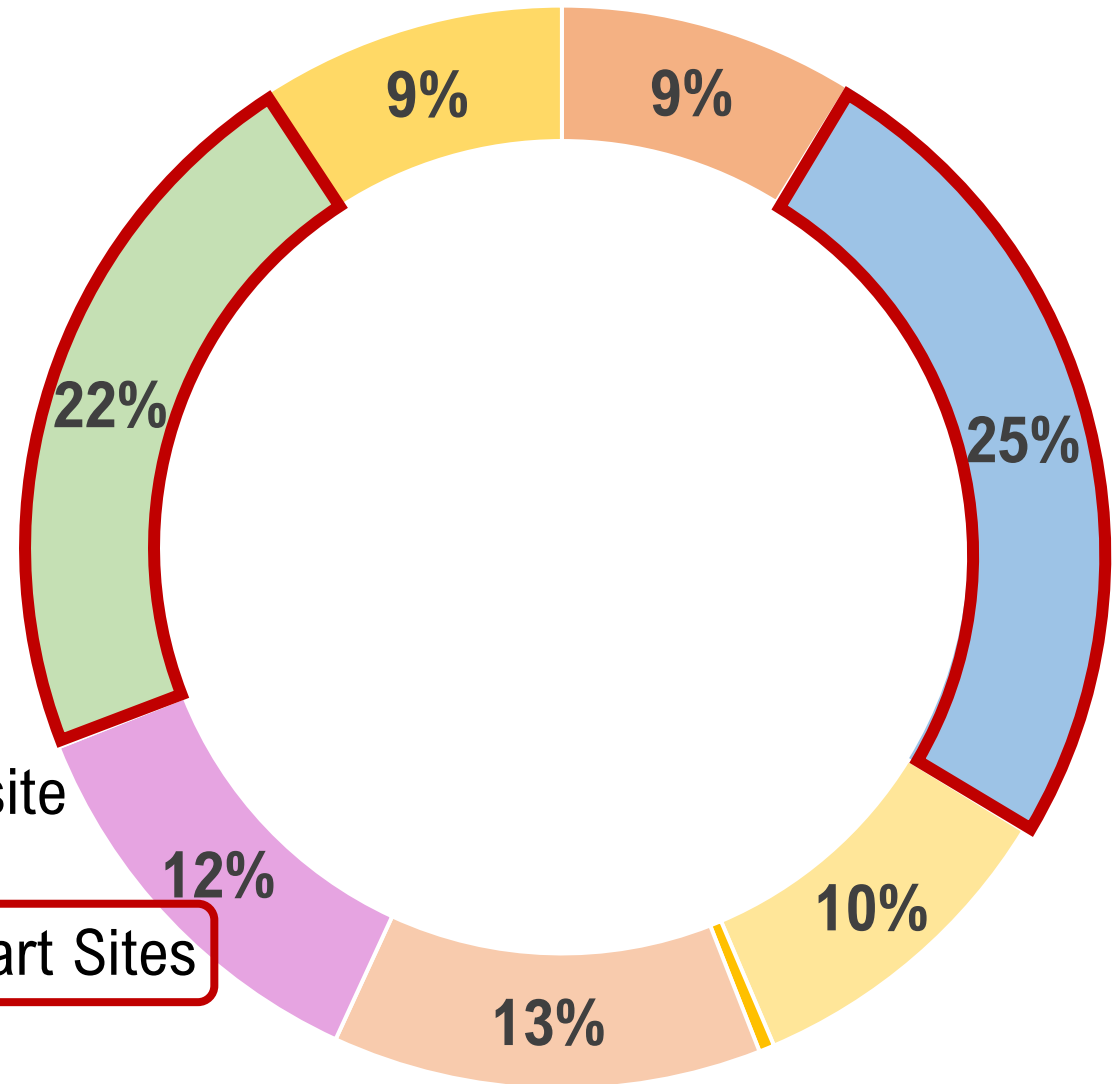
■ Mutually exclusive exon

■ Alternative 5'end donor site

■ Alternative 3'end acceptor site

■ Alternative Transcription Start Sites

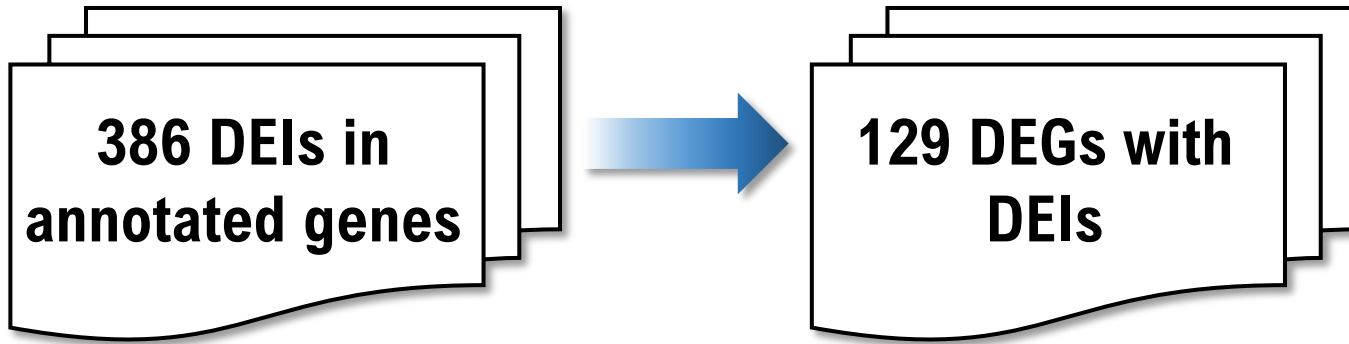
■ Alternative Transcription Termination
Sites



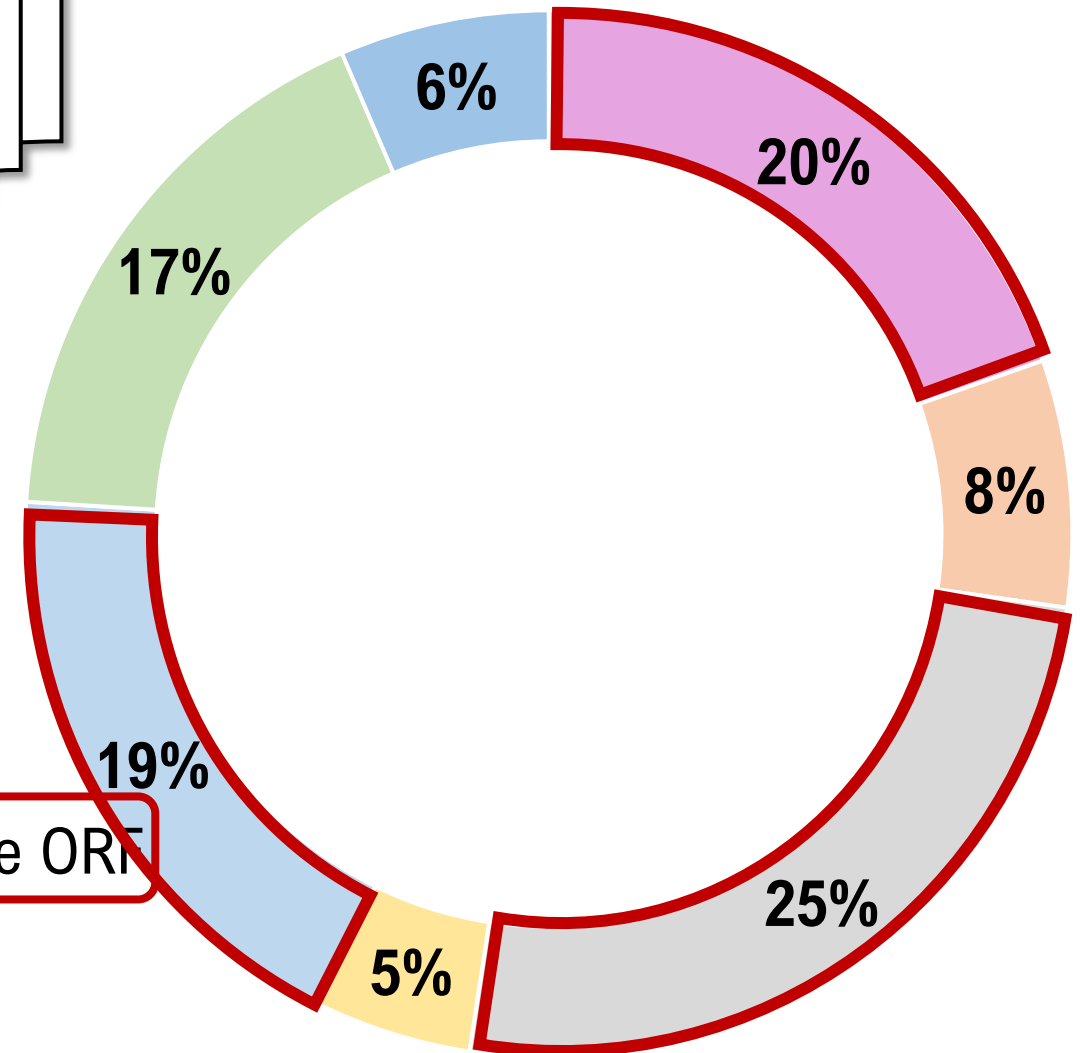
Deciphering the role of alternative splicing as a potential regulator in fat-tail development of sheep: a comprehensive RNA-seq based study

Bakhtiarizadeh (2024)

RESULTS



- Differences in Exon Number
- Intron Retention
- Differences in Intron Structure
- Different use of Last Exon
- Differences in genomic position of the ORF
- Different Transcription Start Site
- Different Transcription Termination Site



Functional Enrichment Analysis

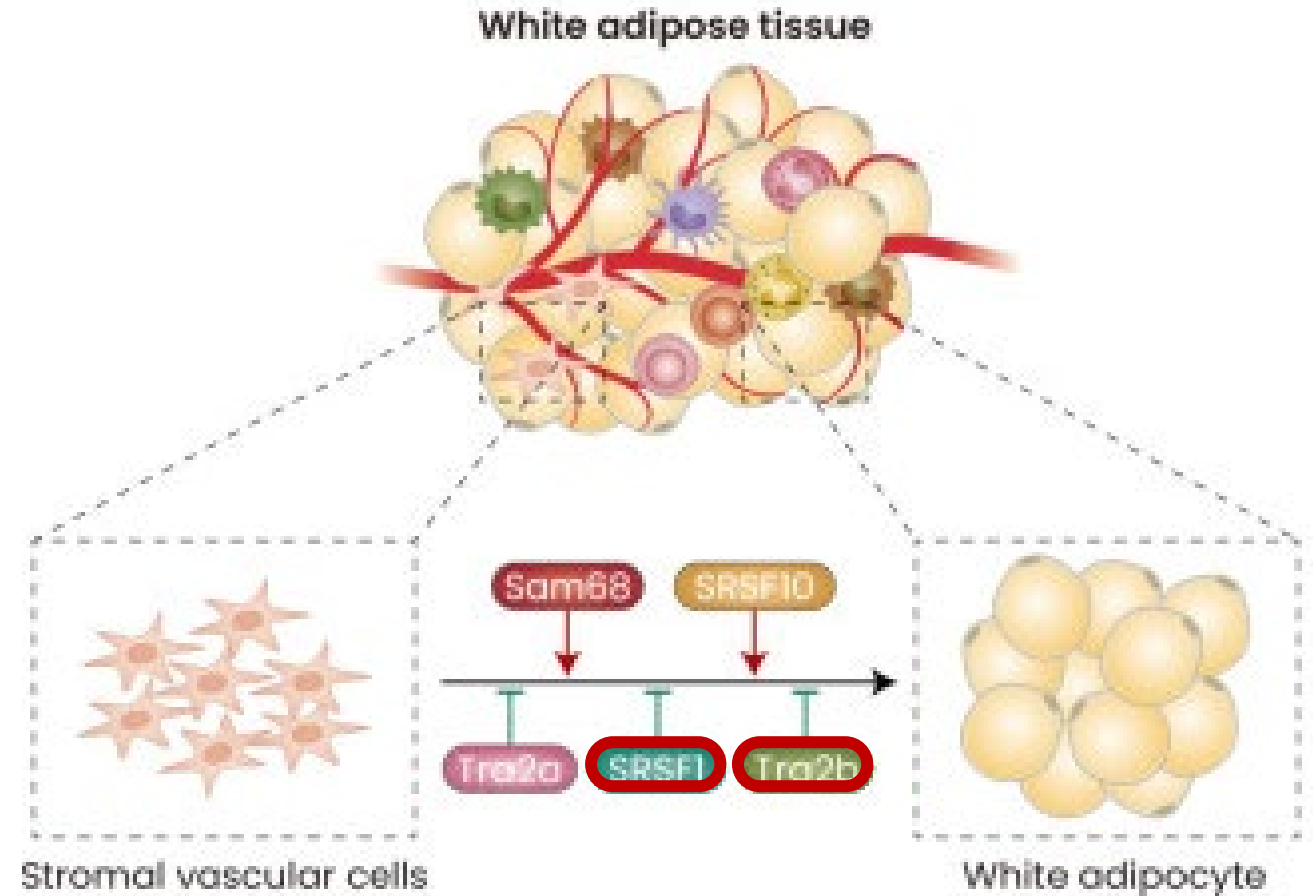
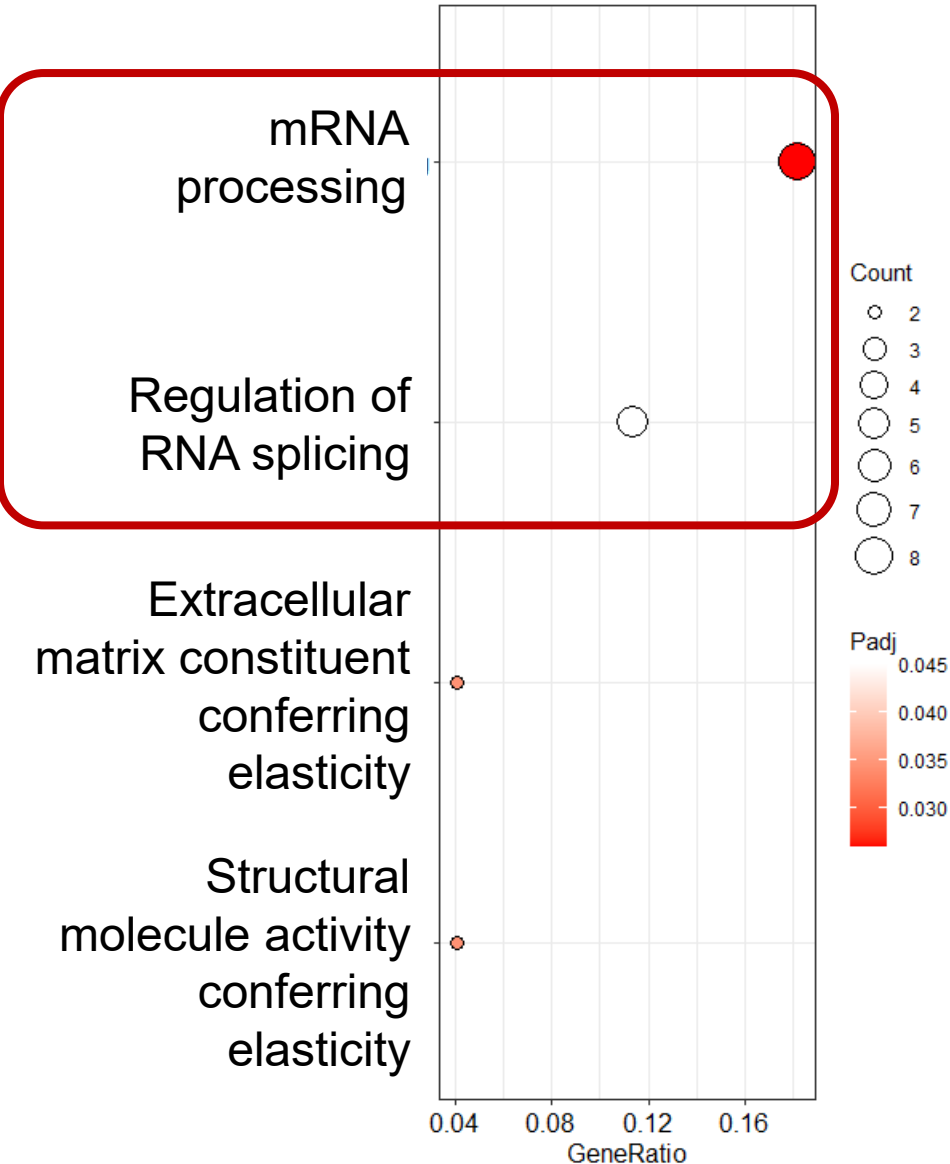


- 4 enriched terms from **Gene Ontology: Biological Process** category



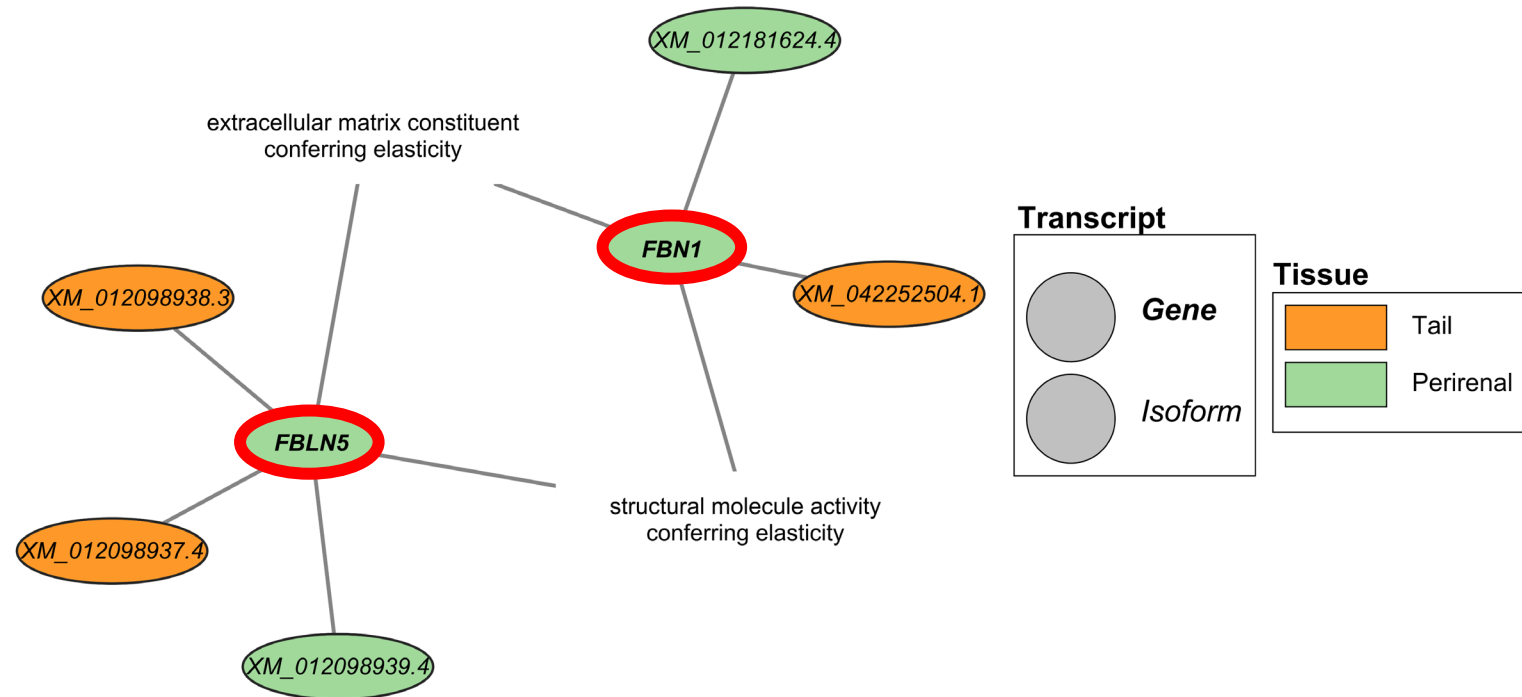
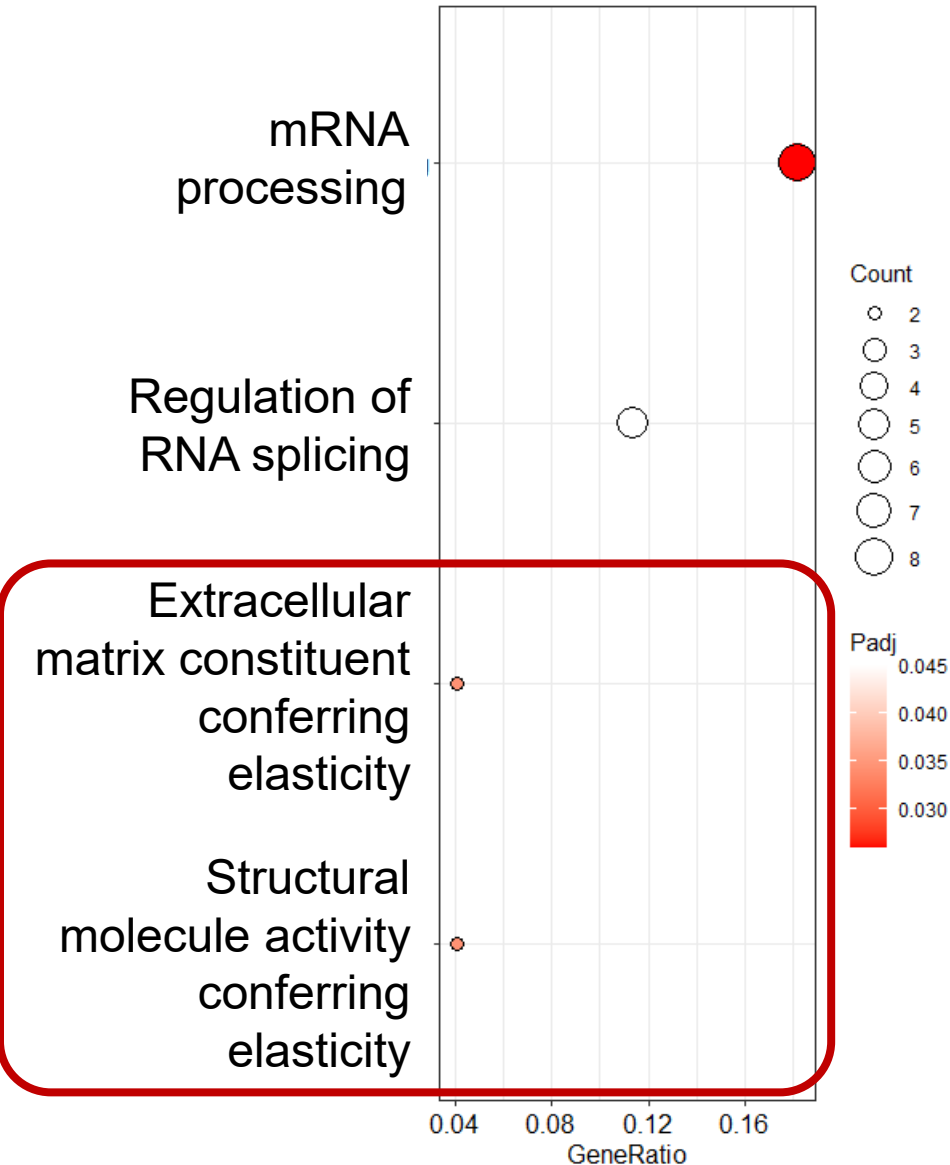
- 2 enriched terms from **Gene Ontology: Biological Process** category
- 2 enriched terms from **Gene Ontology: Cellular Component** category

Perirenal Fat Tissue



Review by T. Naing & Sun (2023)

Perirenal Fat Tissue

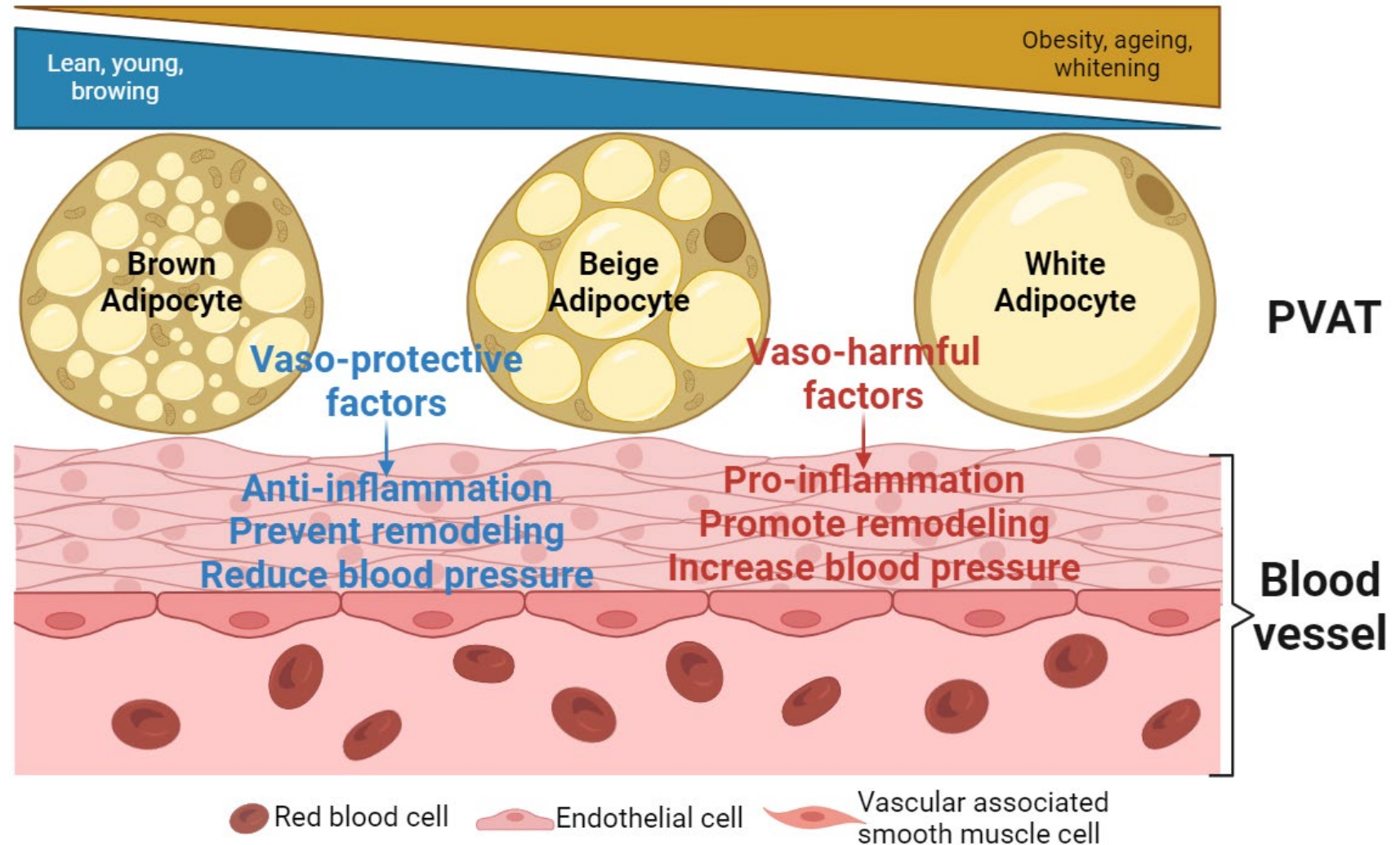
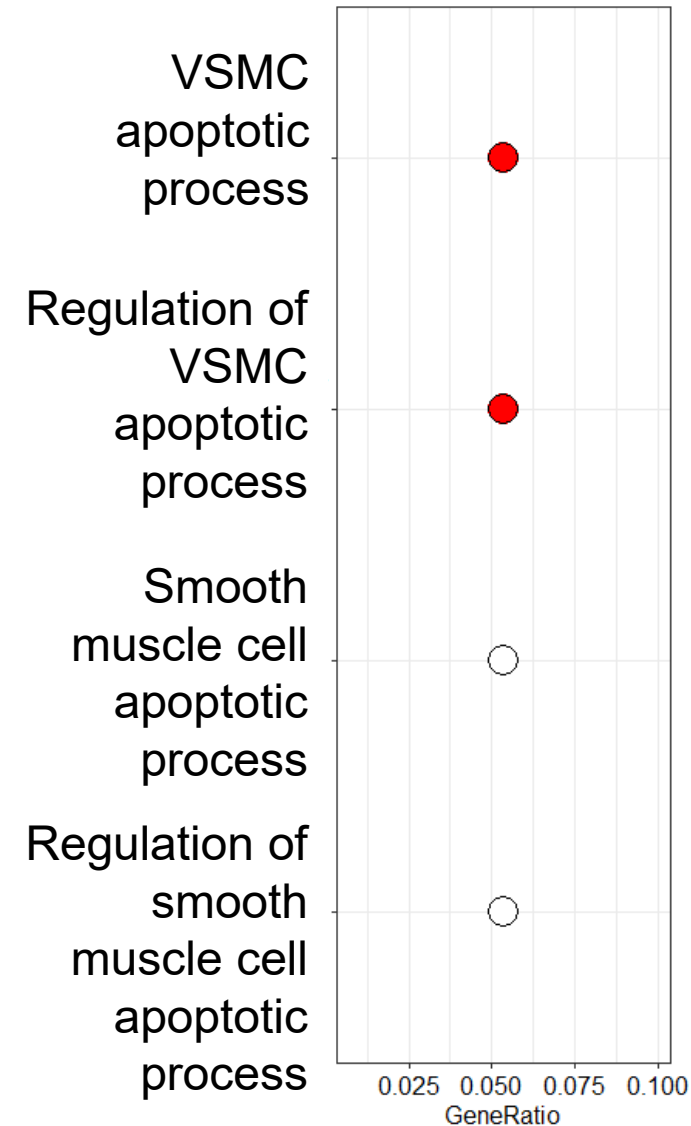


Defining the Regulated Secreted Proteome of Rodent Adipocytes upon the Induction of Insulin Resistance

Jae-Min Lim,^{†,‡} Dan Sherling,[†] Chin Fen Teo,^{†,§} Dorothy B. Hausman,^{||} Dawei Lin,[⊥] and Lance Wells^{*,†,‡,§}

RESULTS

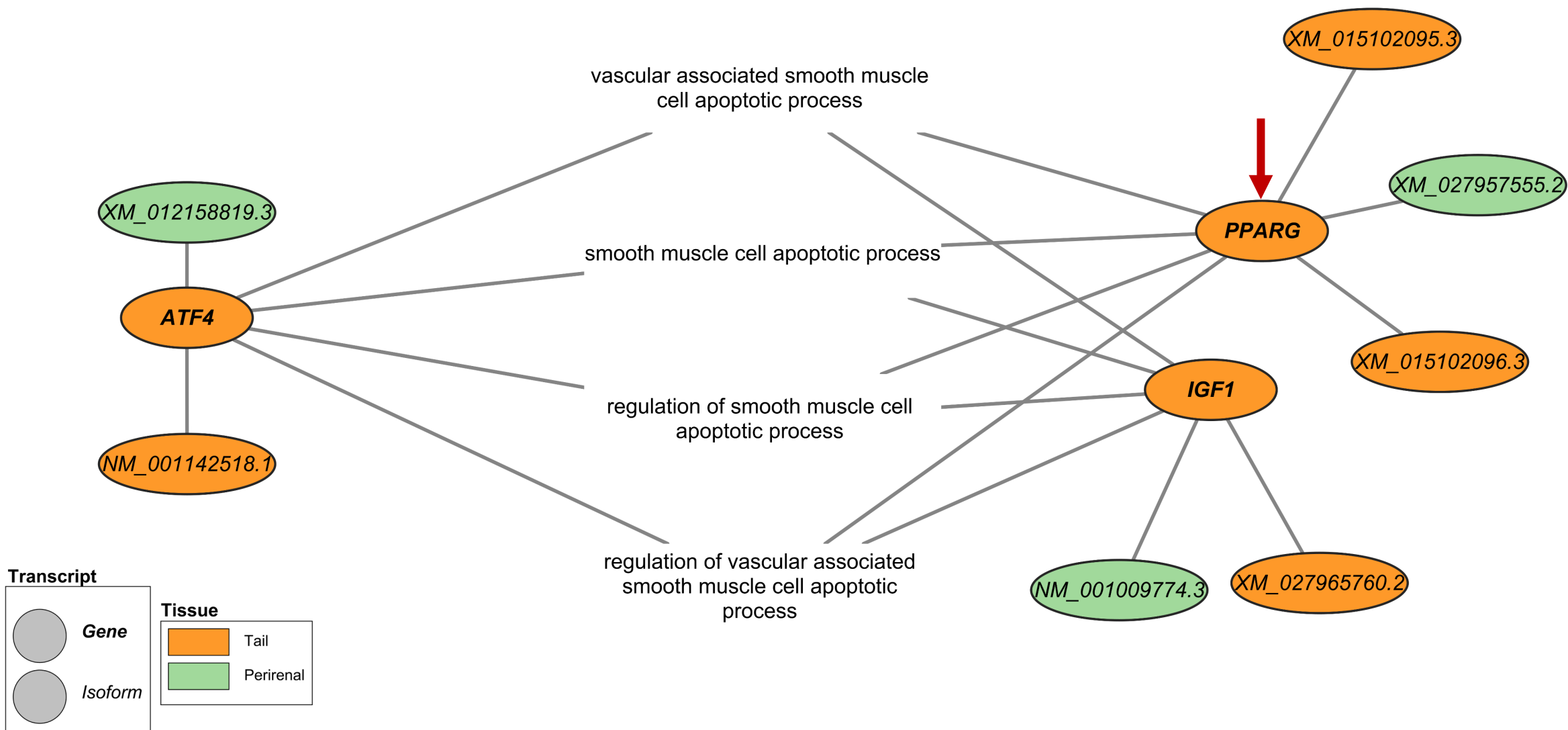
Tail Fat Tissue



Modified from Chang, García-Barrio & Chen (2020)

RESULTS

Tail Fat Tissue



PPARG

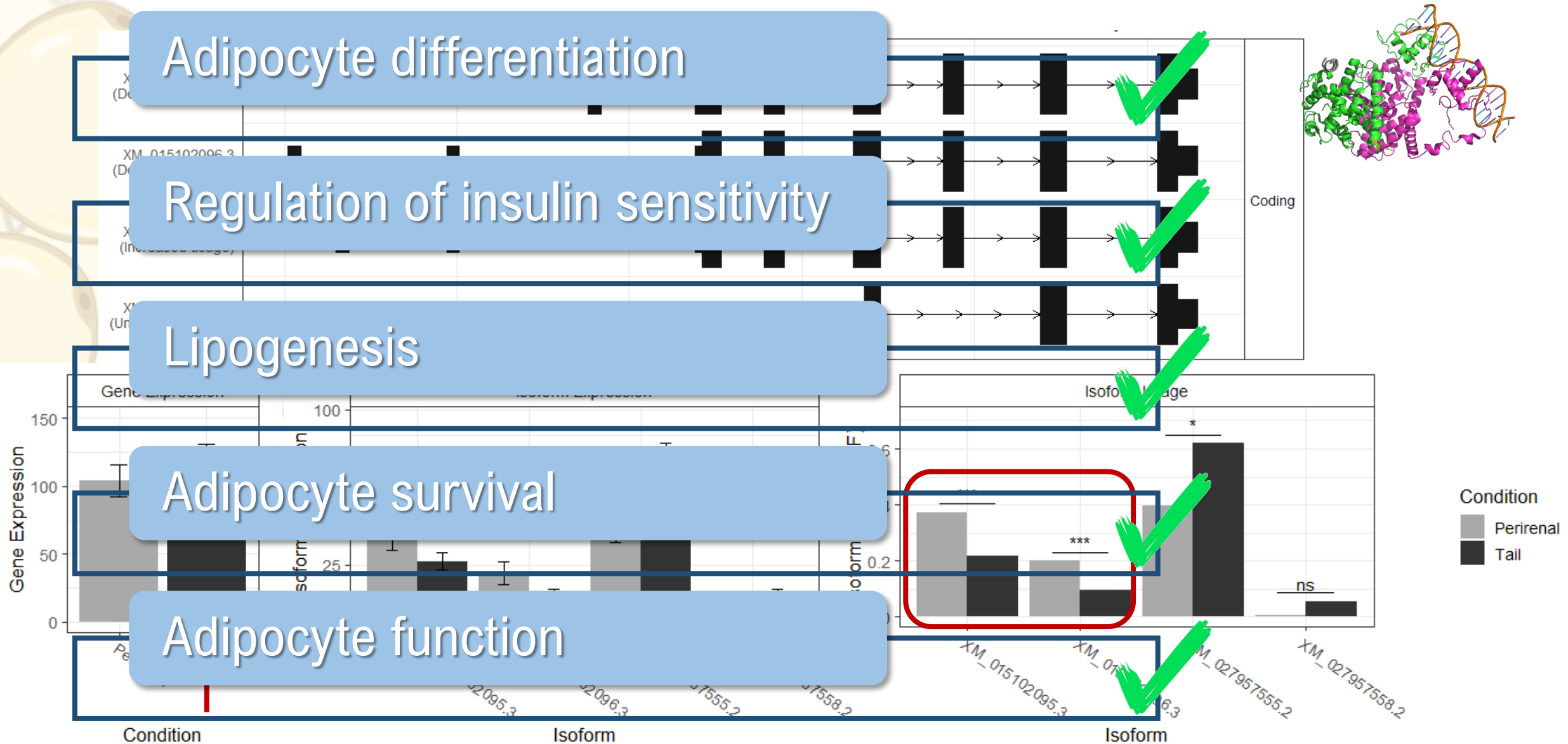
Adipocyte differentiation

Regulation of insulin sensitivity

Lipogenesis

Adipocyte survival

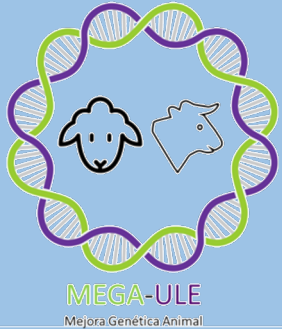
Adipocyte function



CONCLUSIONS

- 🐑 We detected significant differences in AS events and isoform expression between the perirenal and tail fat depots in suckling lambs.
- 🐑 These findings underscore the complexity of adipose tissue regulation and highlight the importance of specific genes and biological processes.
- 🐑 Future analyses should focus on the detection of isoforms that are actively involved in the differential fat deposition between the two tissues.





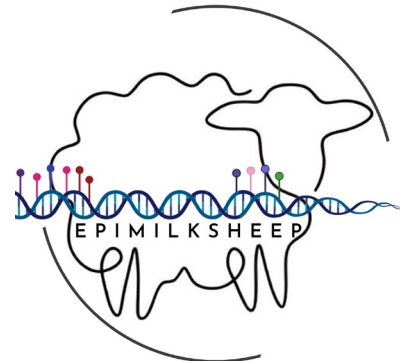
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