



The 75th EAAP Annual Meeting



Exploiting WGCNA to analyse the suckling lamb liver transcriptome profiles of males and females.

Vrcan, M., Alonso-García, M., Suárez-Vega, A., Marina, H., Pelayo, R.,
Fonseca, P.A.S, Arranz, J.J. y Gutiérrez-Gil, B.

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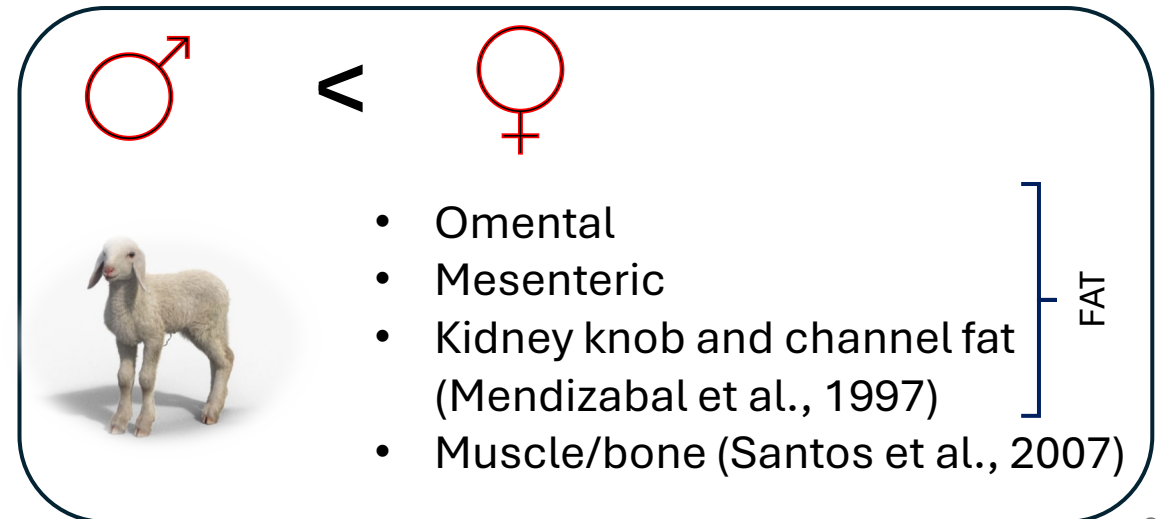
Suckling lamb carcass

- **Suckling lamb meat** is one of the most relevant products of the Mediterranean dairy sheep industry (Battacone et al., 2021).
- Suckling lamb **carcass composition** is a key determinant affecting both carcass quality and yield, and it is influenced by:

- slaughter body weight
- **fatness level**
- diet
- **sex**



(Sañudo et al., 1997; Velasco et al., 2000)

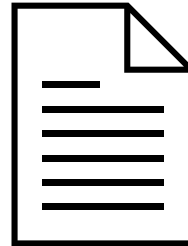


Previous studies

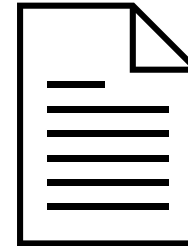
- Our group has previously compared lamb **perirenal fat transcriptome** between:



Assaf and Churra
(Suárez-Vega et al., 2018)

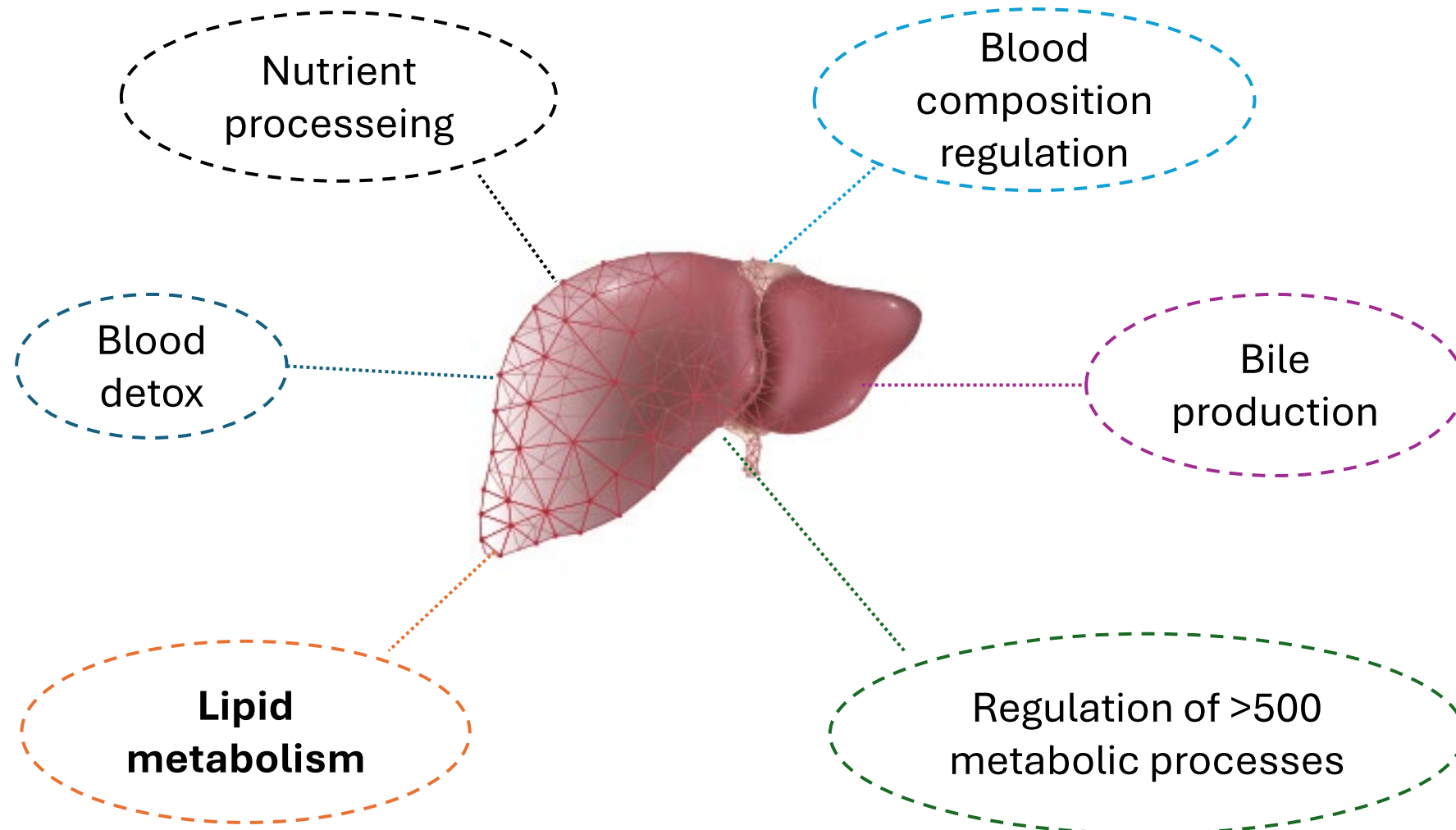


HighFat vs. LowFat
(Alonso-García et al., 2023)



Males vs. females
(Fonseca et al., 2022)

Liver functions



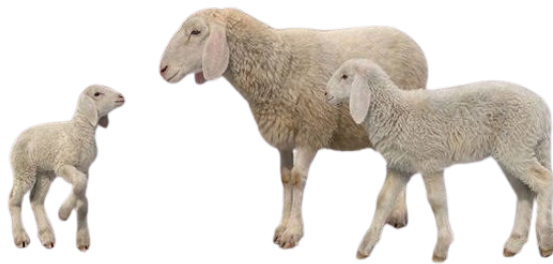
Objective



Exploit the potential of Weighted Gene Co-expression Network Analysis (WGCNA) to better understand the link between liver transcriptome profiles and quantitative traits related to carcass quality in male and female suckling lambs.

Experimental design

Primiparous sheeps



$n=6$

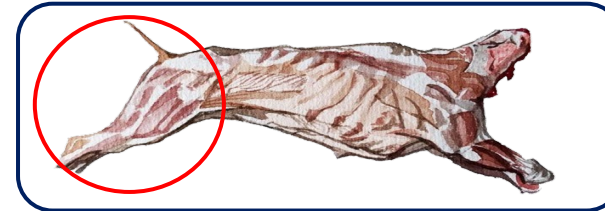
10.68 ± 0.29 kg



$n=6$

11.31 ± 0.70 kg

Carcass characterization



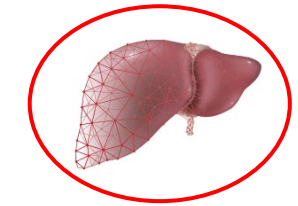
Leg dissection

- Muscle percent (**MP**)
- Bone percent (**BP**)
- Muscle/Bone (**MP/BP**)
- Pelvic fat percent (**PFP**)

t.test

Males

Females

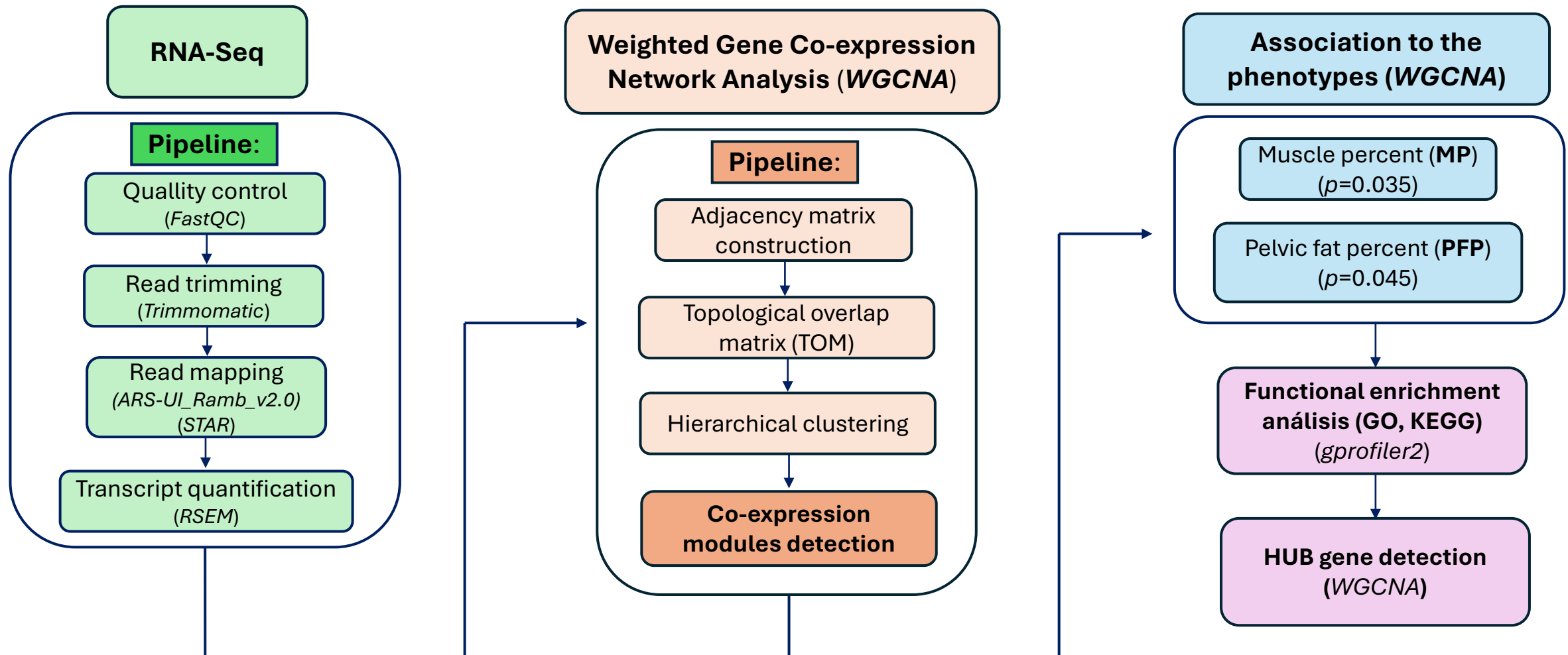


RNA



RNA

Bioinformatic workflow

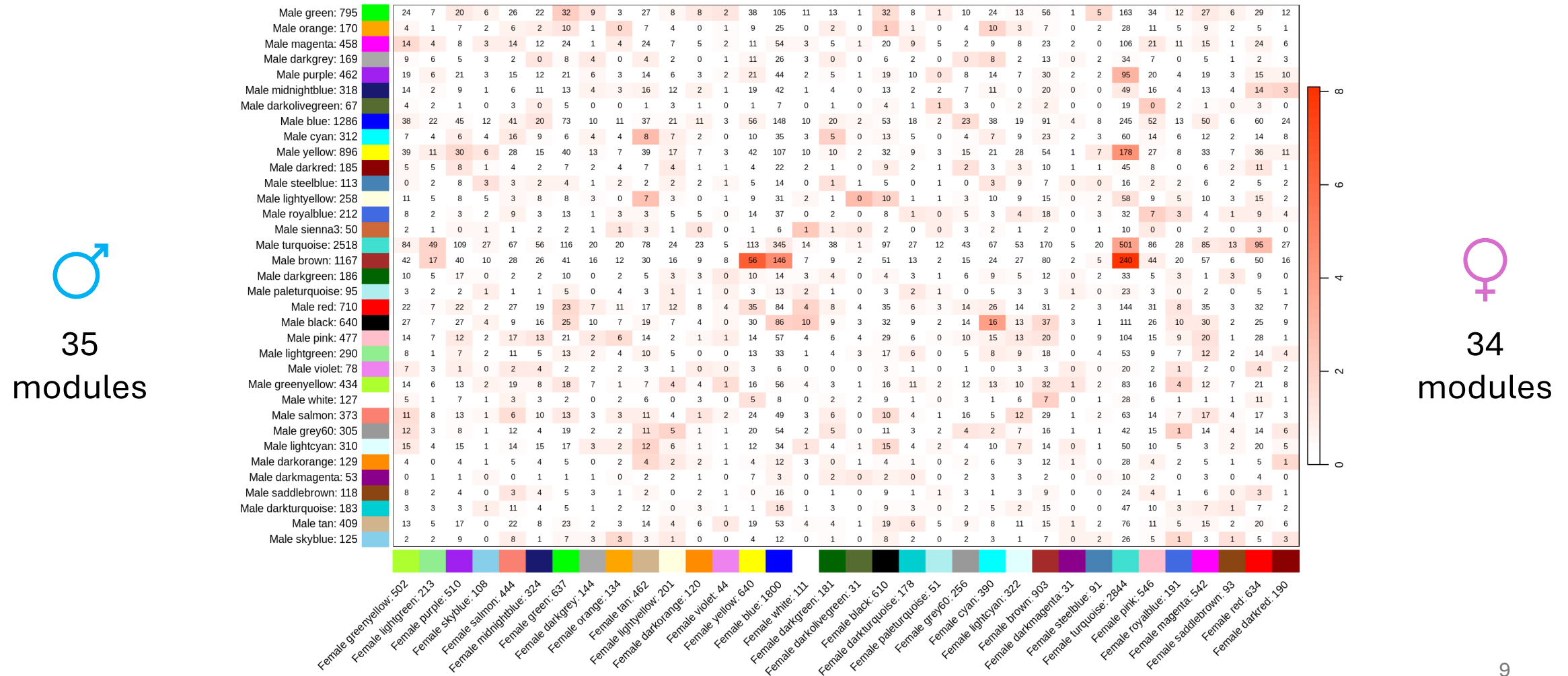


The analysis of the carcass phenotypes

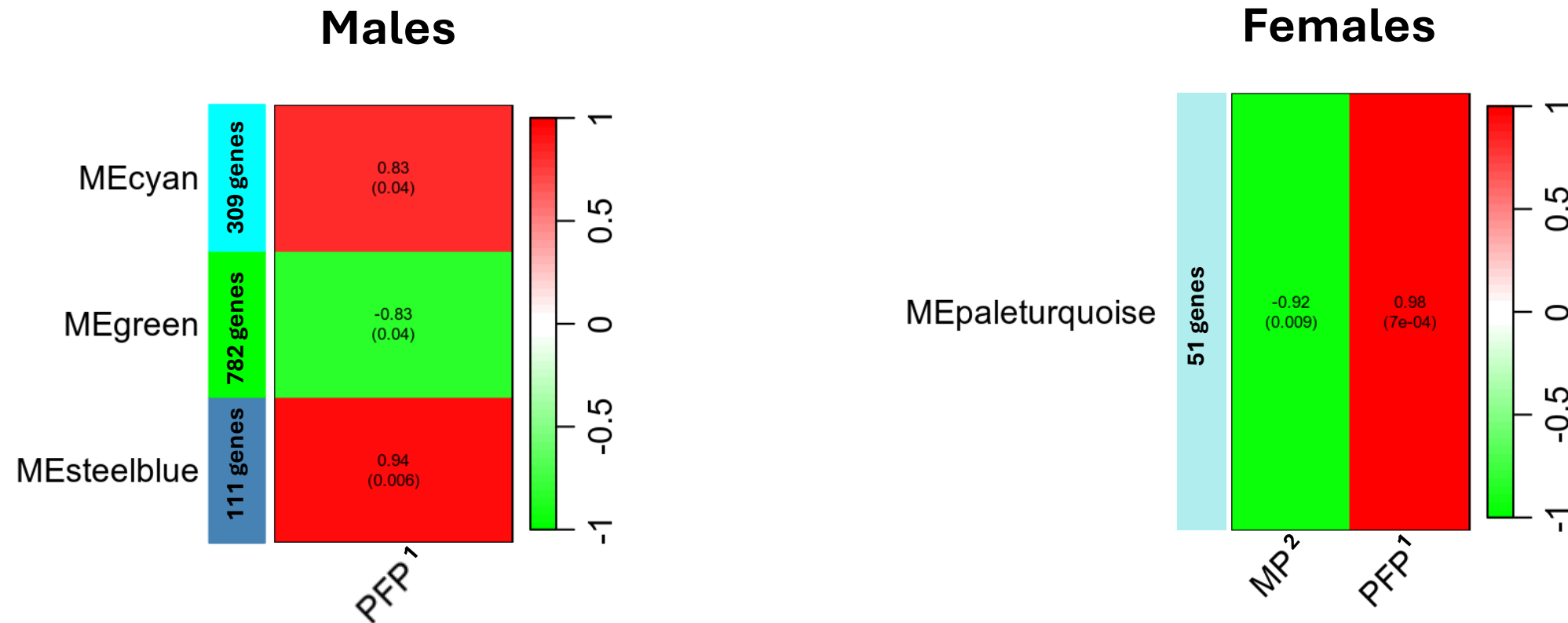
Leg tissue composition traits	Mean ($\pm$ SD)		<i>p</i> -value ¹
	Male	Female	
Muscle percent (MP)	55.306 ($\pm$ 0.861)	58.187 ($\pm$ 2.471)	0.035
Bone percent (BP)	31.302 ($\pm$ 2.73)	31.281 ($\pm$ 0.978)	0.986
Muscle / Bone (MP/BP)	1.778 ($\pm$ 0.153)	1.863 ($\pm$ 0.131)	0.323
Pelvic fat percent (PFP)	2.835 ($\pm$ 0.727)	1.999 ($\pm$ 0.487)	0.045

¹ t-student *p*-value

Male and female co-expressed modules

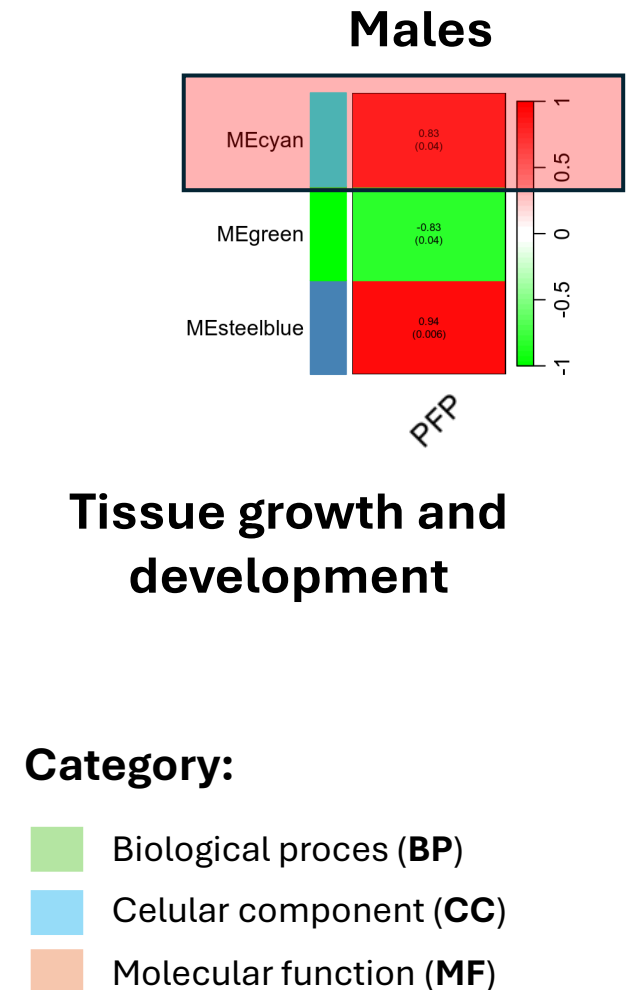
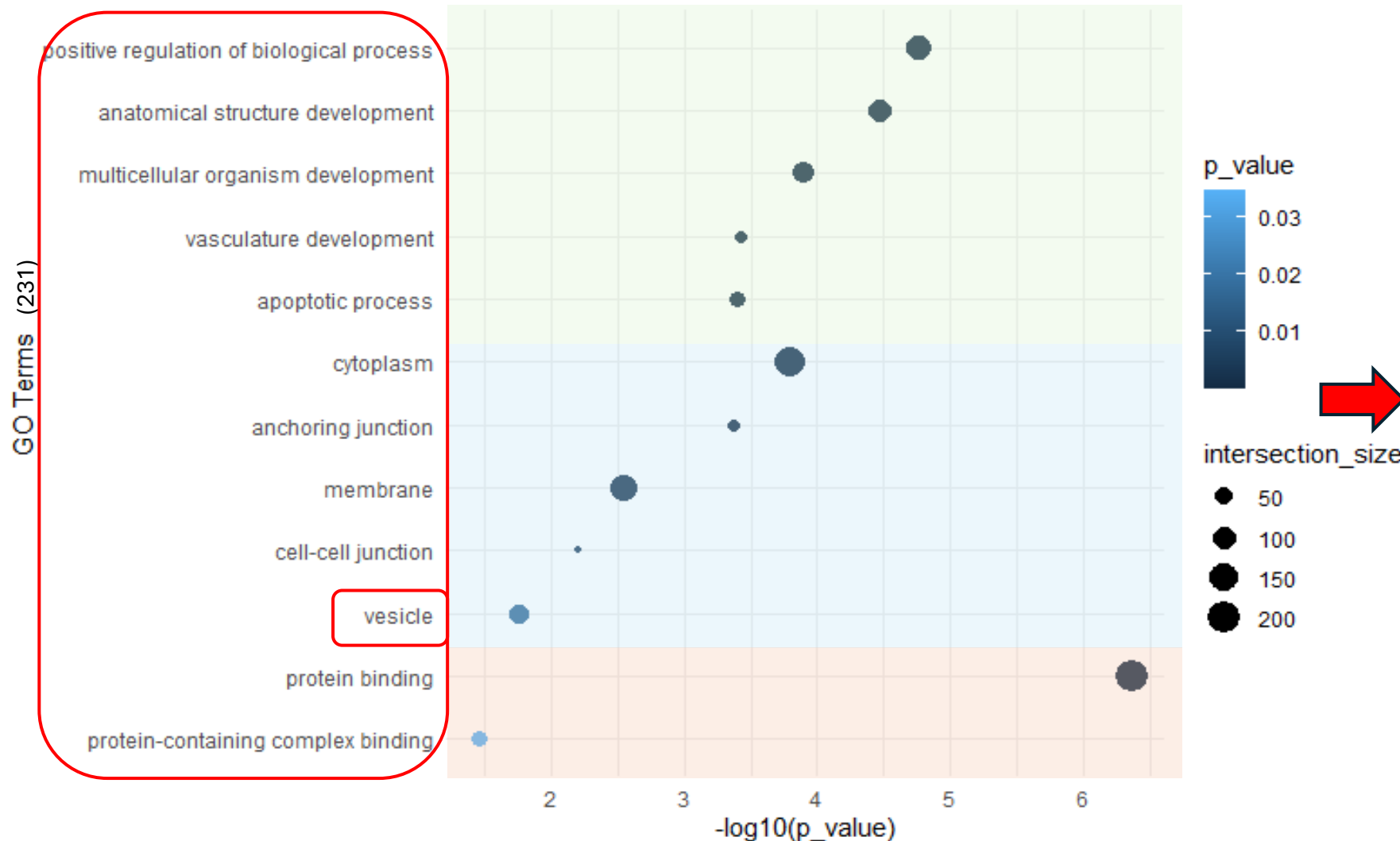


Male and female co-expressed modules associated to the traits

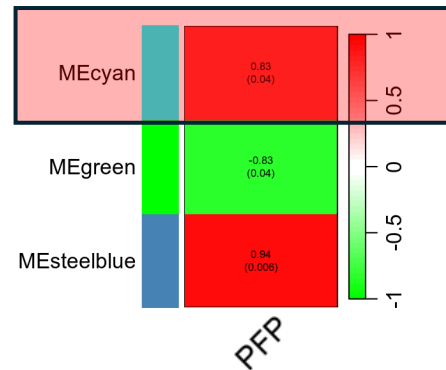
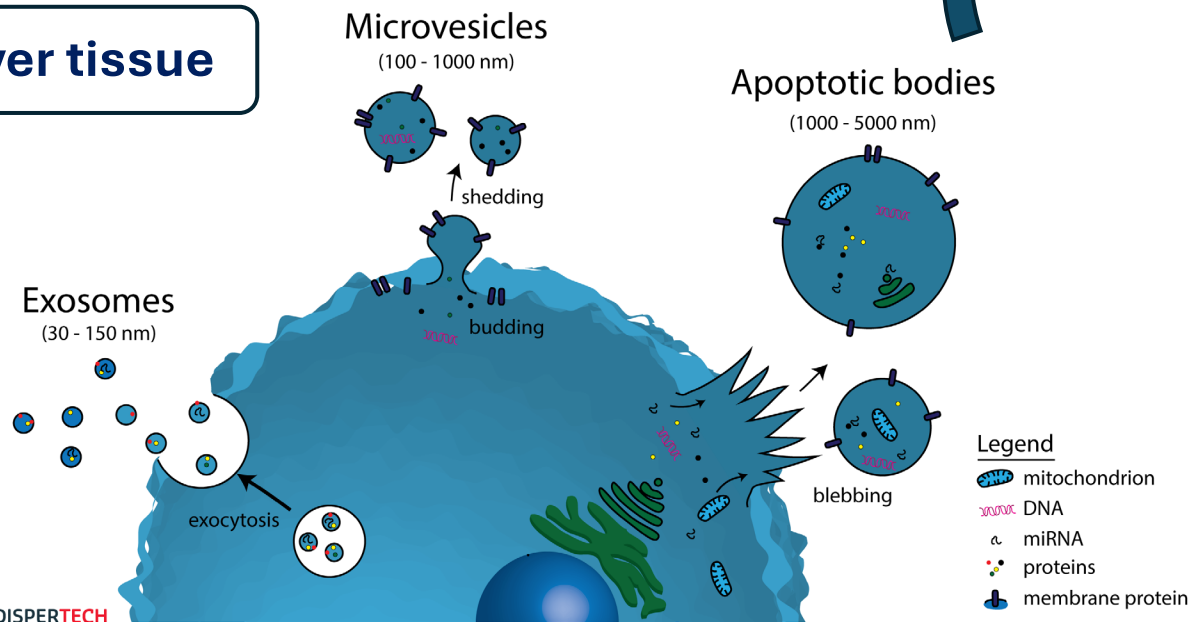
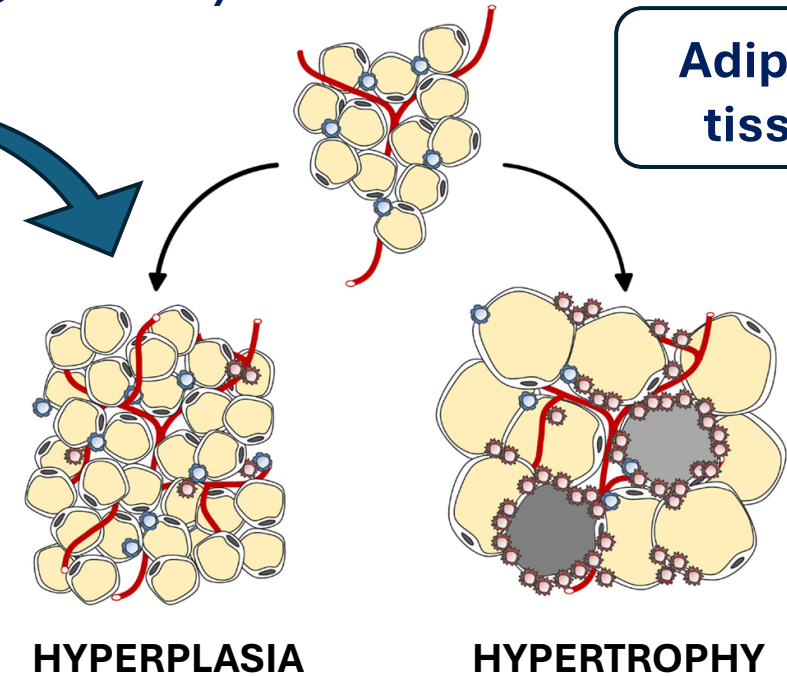


¹ PFP-pelvic fat percent, ² MP-muscle percent

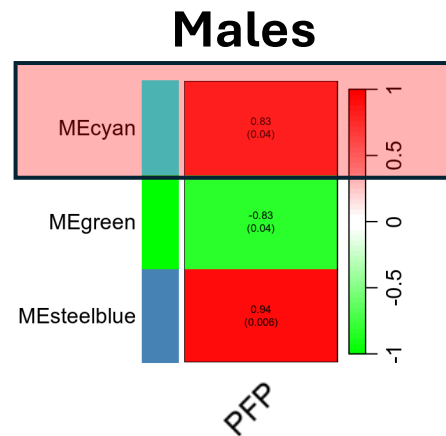
Functional enrichment analysis of the *cyan* module



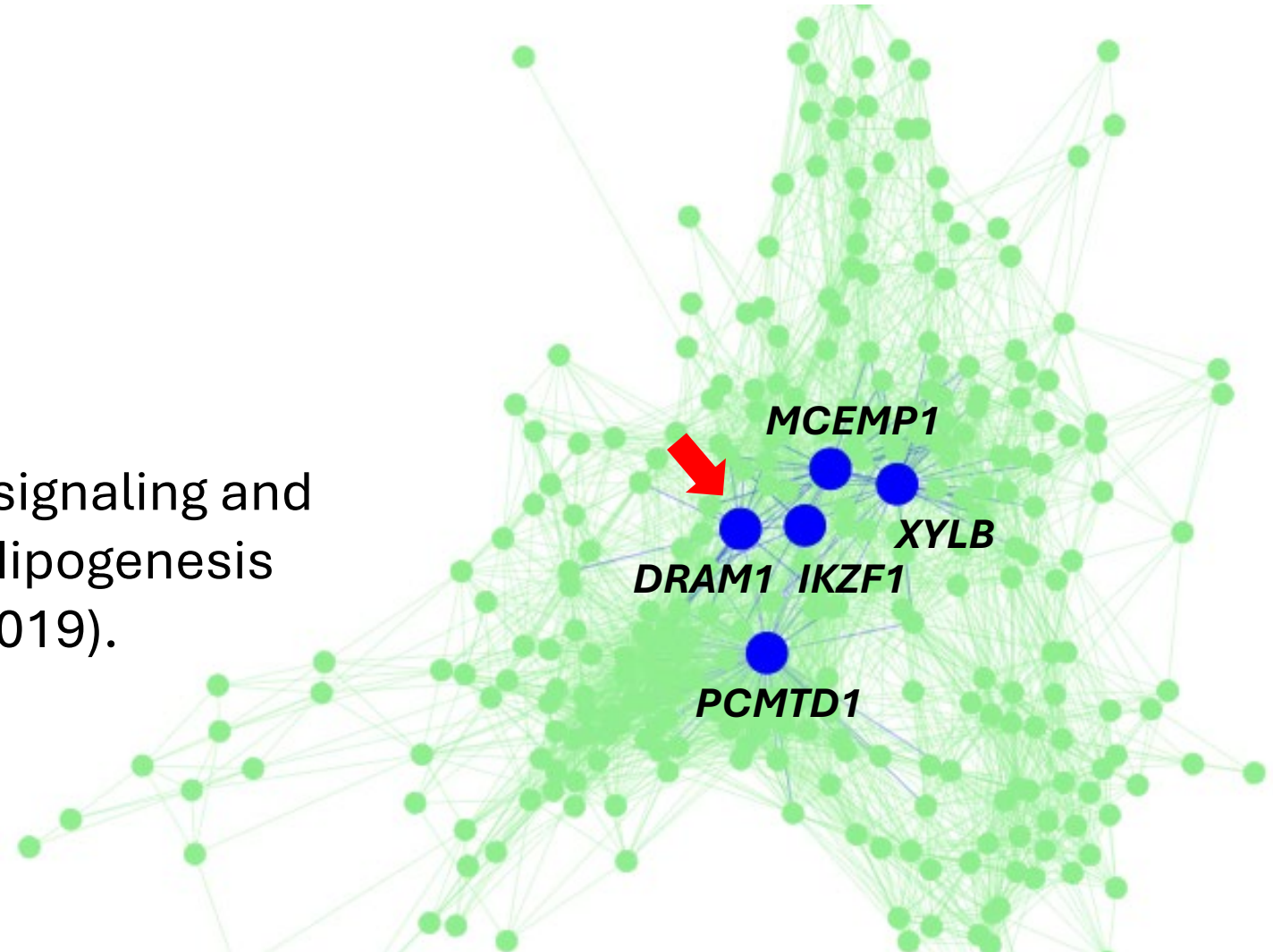
Adipose tissue remodeling via extracellular vesicles (Zhao et al., 2020)

Males**Liver tissue****Adipose tissue**

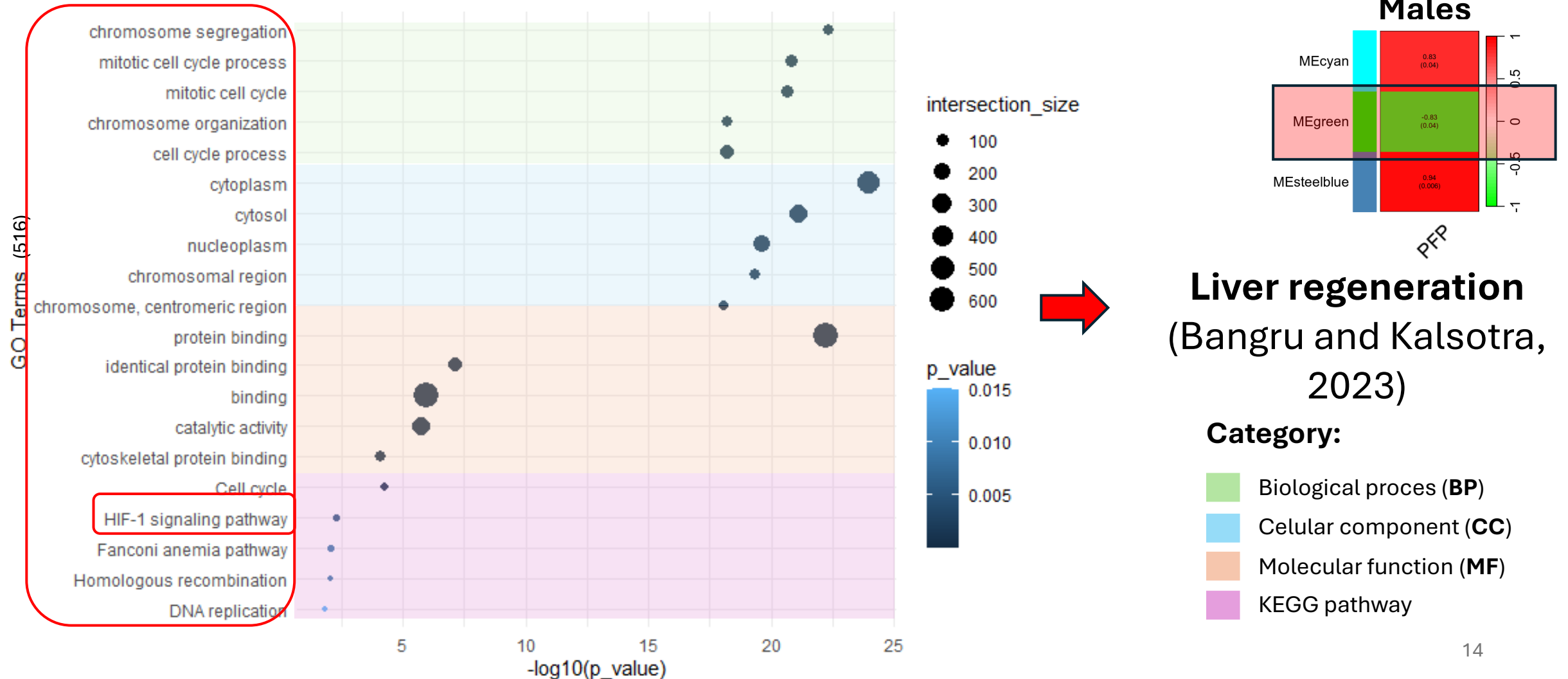
HUB genes identified in the male *cyan* module



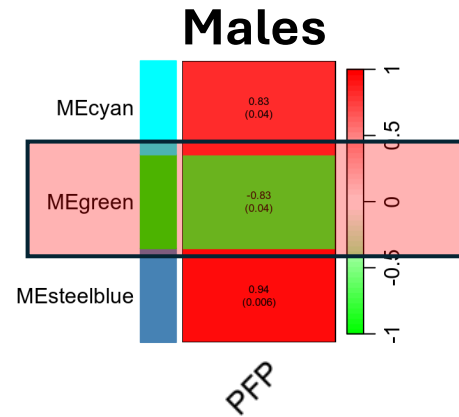
DRAM1 modulates insulin signaling and mTORC1 activity during adipogenesis (Beaumat et al., 2019).



Functional enrichment analysis of the *green* module



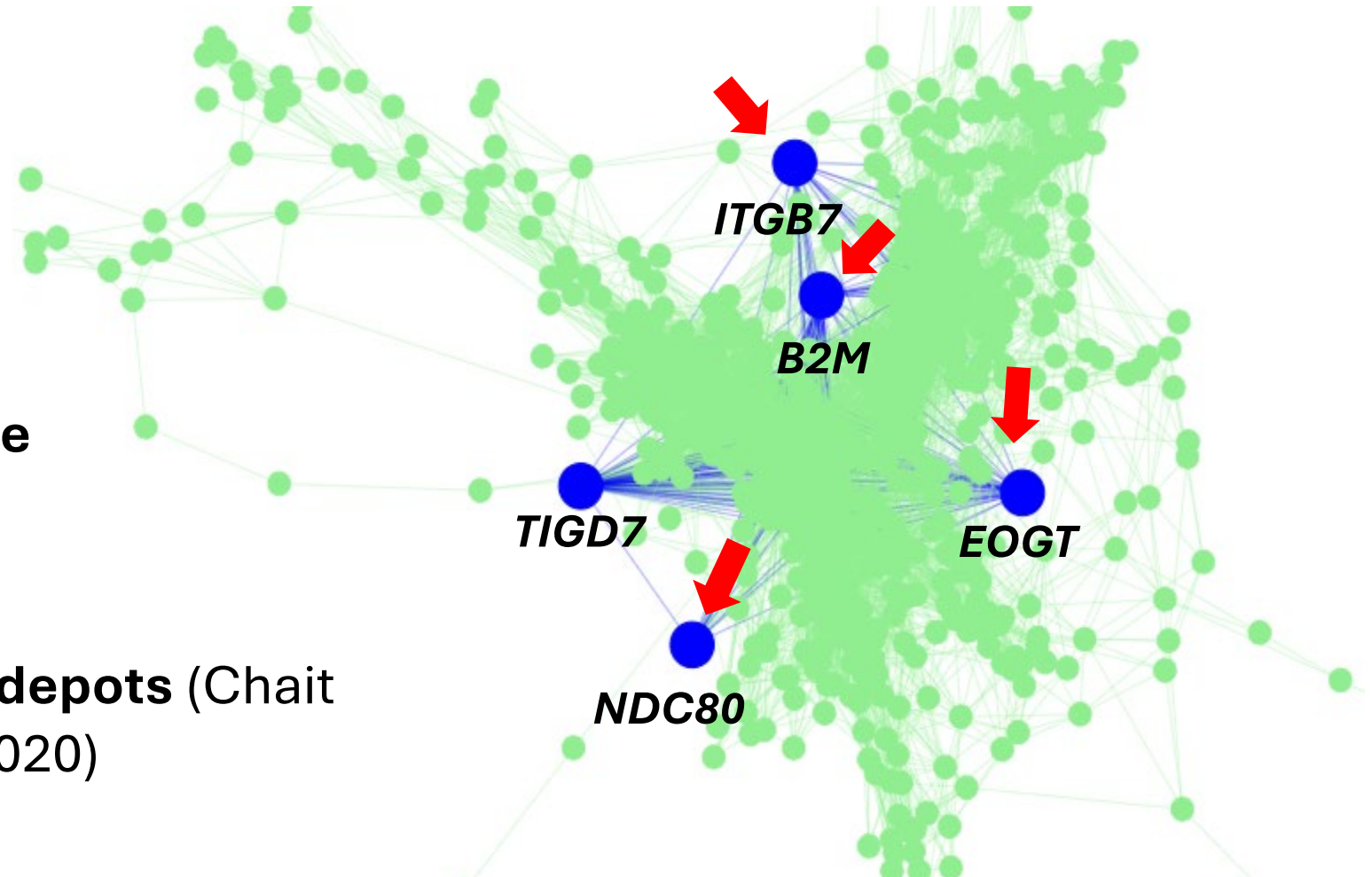
HUB genes identified in within *green* male module



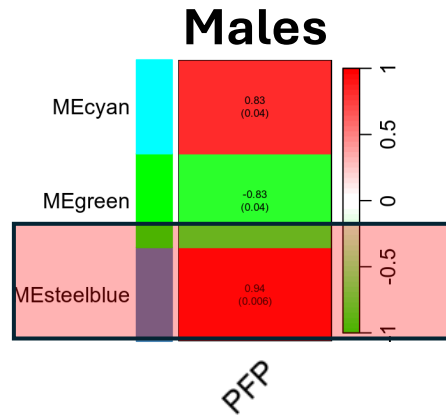
Immune response



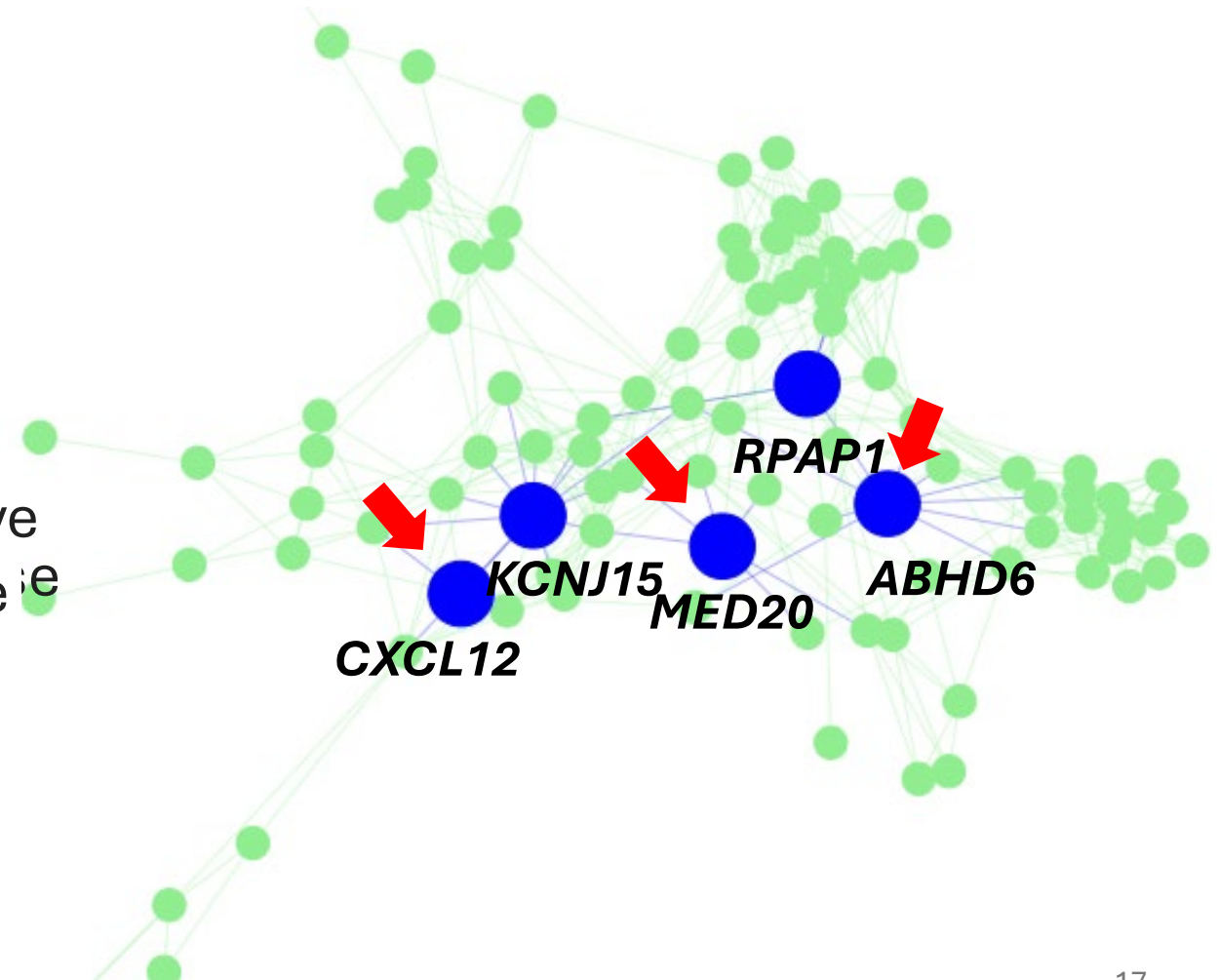
Expansion of adipose tissue depots (Chait and J. den Hartigh, 2020)



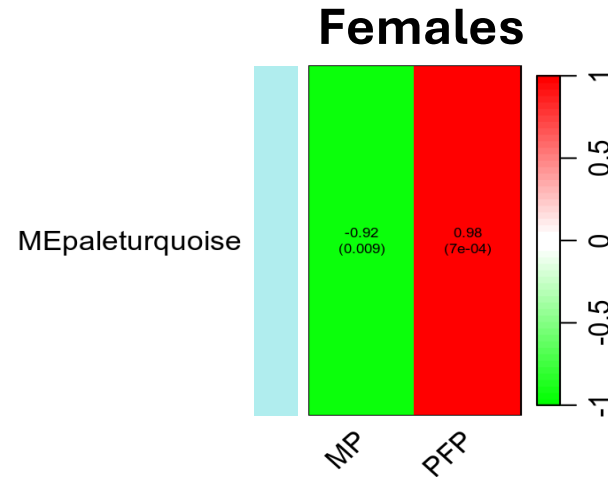
HUB genes identified within the *steelblue* male module



CXCL12 and **CXCR4** both up-regulated
ABHD6 is a negative modulator of adaptive
 thermogenesis in visceral adipose tissue
 (Thomas et al., 2013).
 under high-fat diet (Kurita et al., 2019)
 - Regulated by hypoxia inducible factor

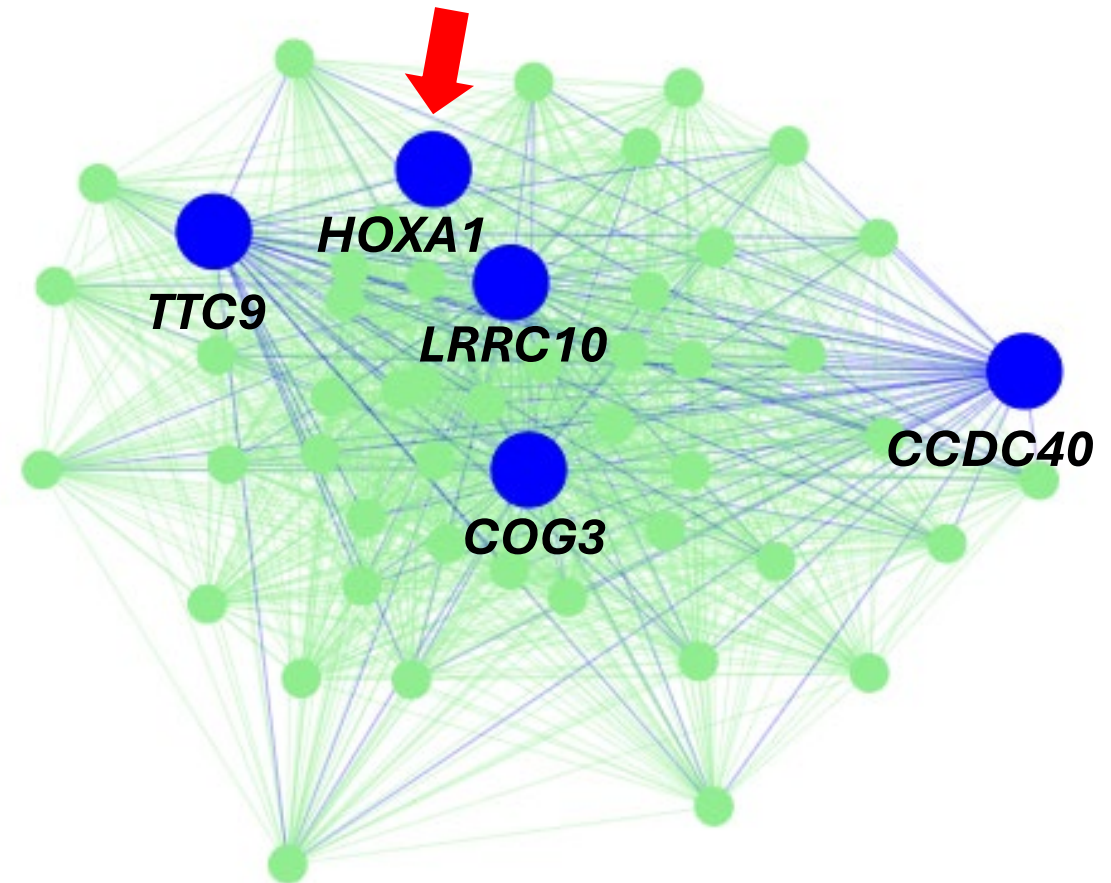


HUB genes identified within the *paleturquoise* female module



Expression of ***Hox*** genes is linked with **fat accumulation** in differentiated brown adipocytes (Singh et al., 2016).

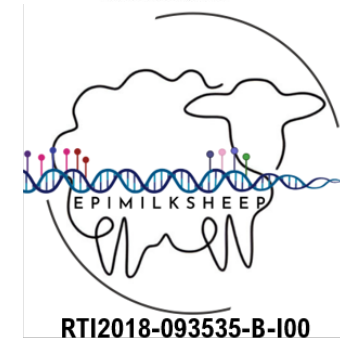
Hox genes have an essential role in **skeletal and connective tissue patterning** (Pineault and Wellik, 2014)



- ✓ The results presented here highlight sex-dependent differences in the liver transcriptome associated with the molecular mechanisms underlying carcass trait:
 - ➔ For **males**, these results underscore the **importance of the vesicles and hypoxia pathways** in fat deposition.
 - ➔ For **females**, HUB genes, particularly, **HOX1** showed a clear **association to the muscle percent and pelvic fat percent**, traits that differentiate male and female carcasses.
- ✓ These findings emphasize the need for further analyses into the biological processes and pathways affecting muscle and adipose tissue growth and development.



Thank you!



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