

Modeling sex differences in metabolic regulation between placenta and fetal organs

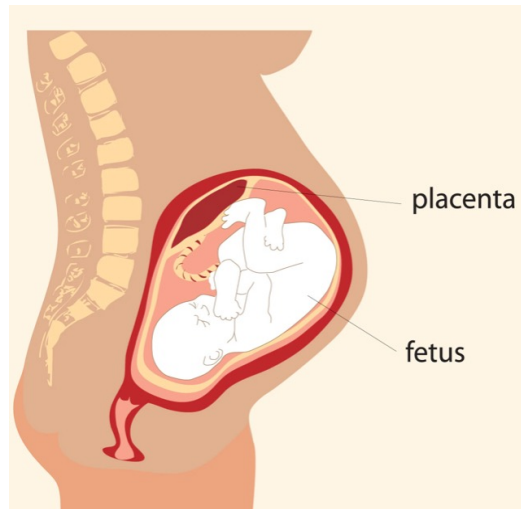
Susanta Behura
University of Missouri
E-mail: behuras@missouri.edu

Outlines

- Background
- Research Aim
- Methodology
- Results
- Conclusion

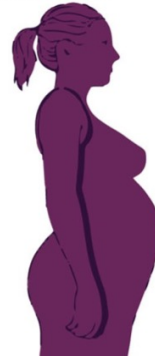
Placenta plays key roles in fetal development

Maternal-Fetal Metabolic Communication:
bidirectional communication of
nutritional status and metabolic demand

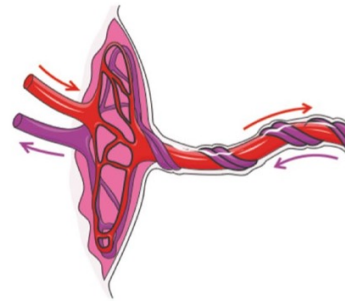


momjunction.com

Maternal



Placental



Fetal



Cellular and Molecular Life Sciences (2021) 78:1455–1486

**The placenta as a model for understanding the origin
and evolution of vertebrate organs**

[Oliver W Griffith](#)^{1,2}, [Günter P Wagner](#)^{1,2,3,4}

[Affiliations](#) + expand

PMID: 28812655 DOI: [10.1038/s41559-017-0072](https://doi.org/10.1038/s41559-017-0072)

Hypothesis and Research Aim

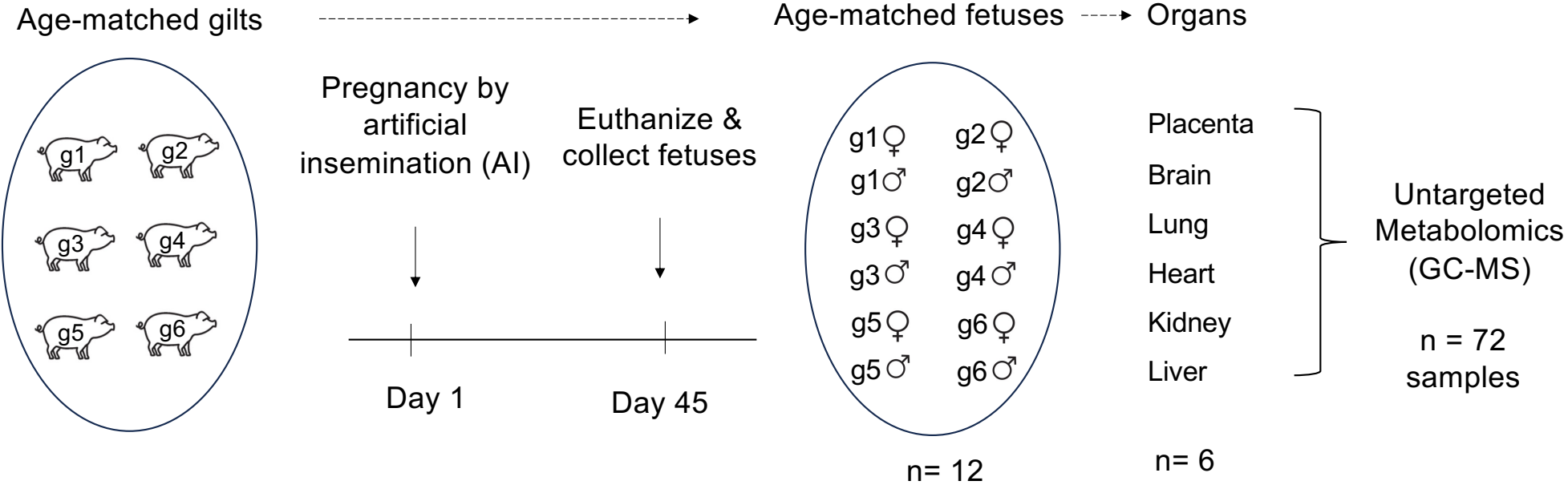
H: Fetus influences metabolism of the placenta

Aim 1: How metabolism of fetal organs related to that of placenta?

Aim 2: Does fetal sex influence fetoplacental metabolism?

Methodology

Pig as large animal model

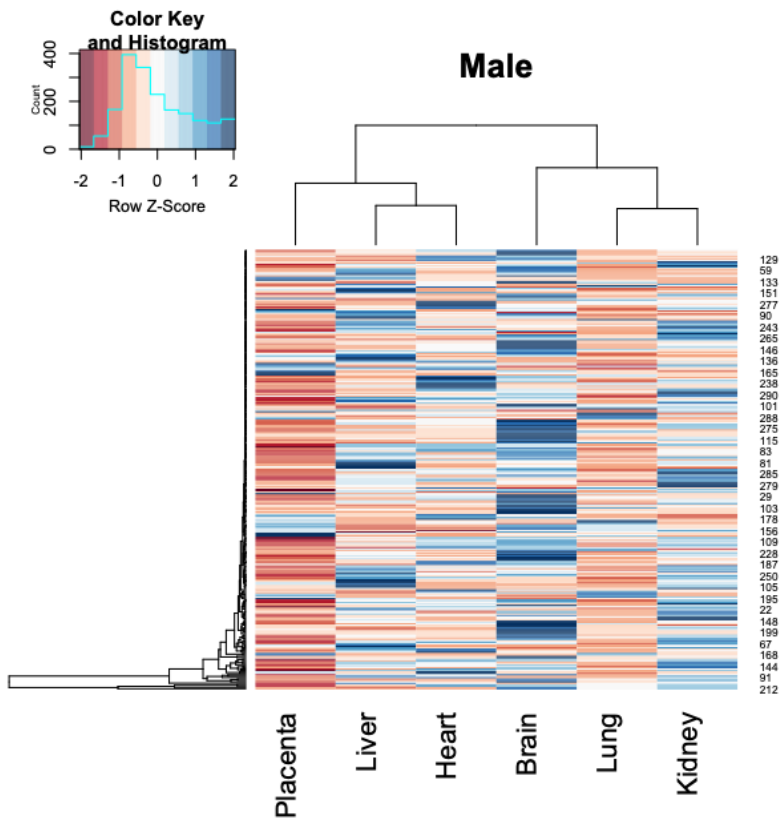
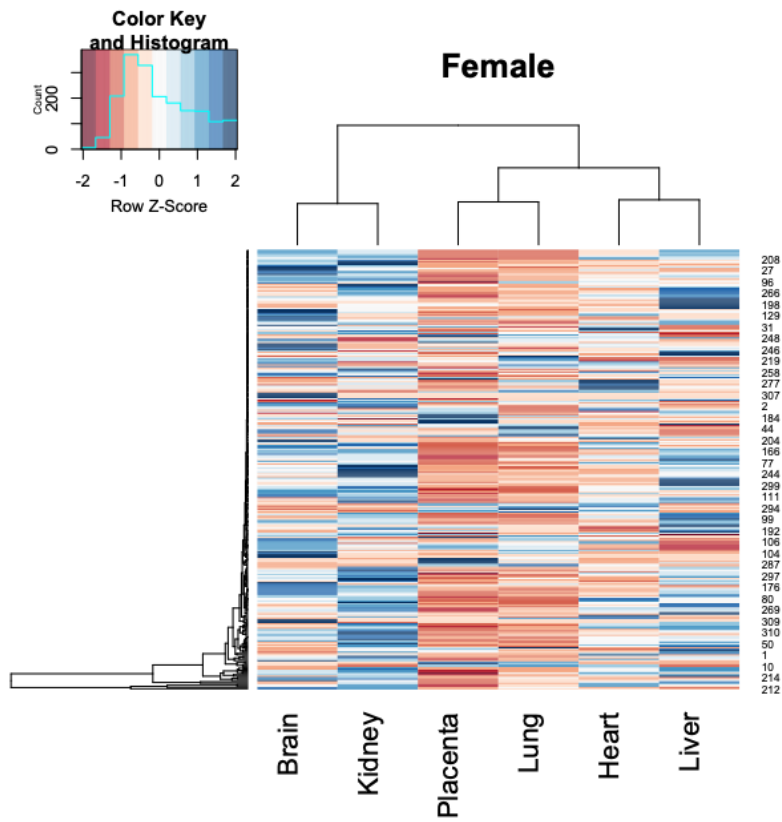


Results

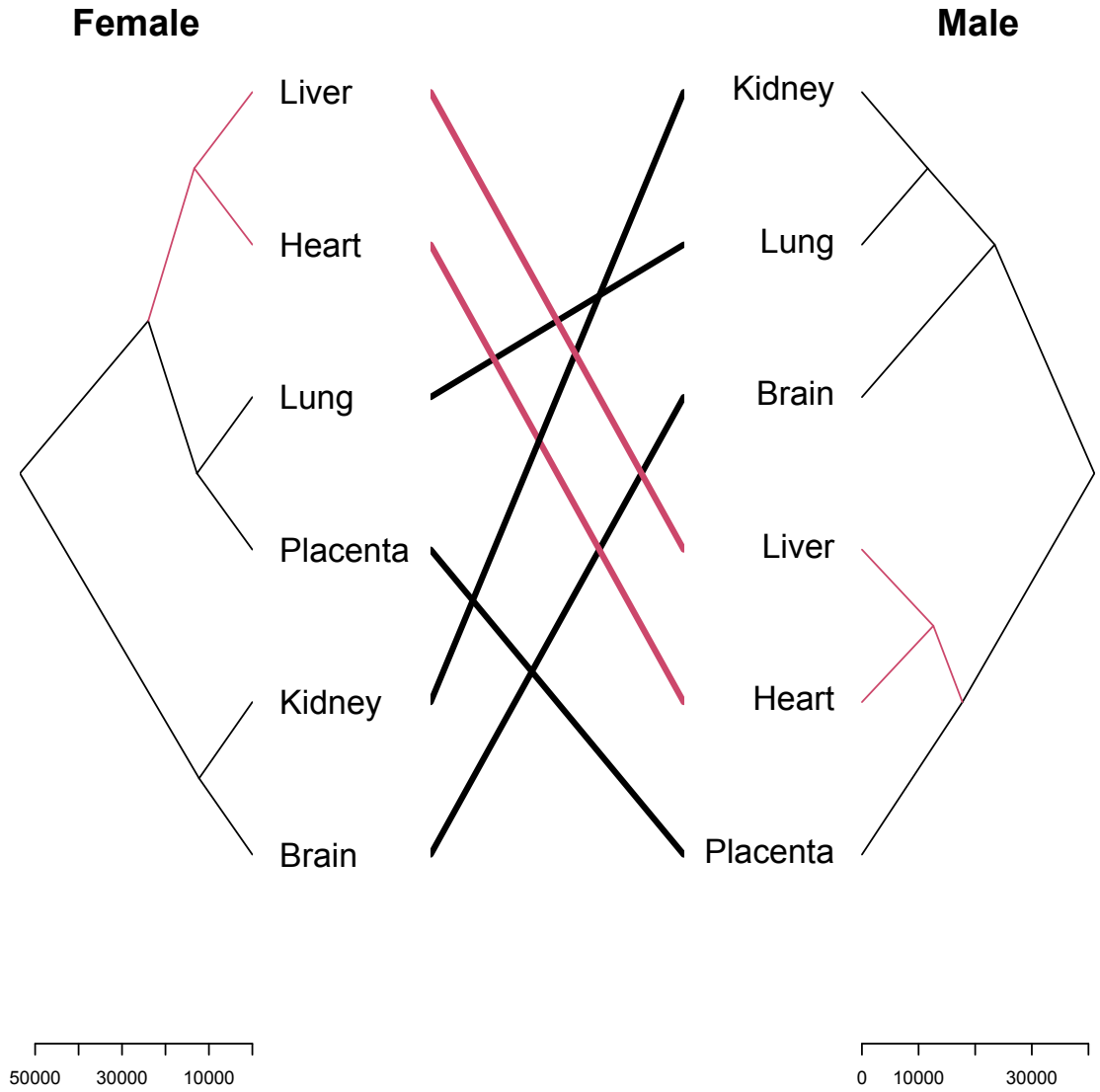
Total 311 detected

(166 known & 145 unknown)

Differential patterns of organ metabolism in female versus male fetuses

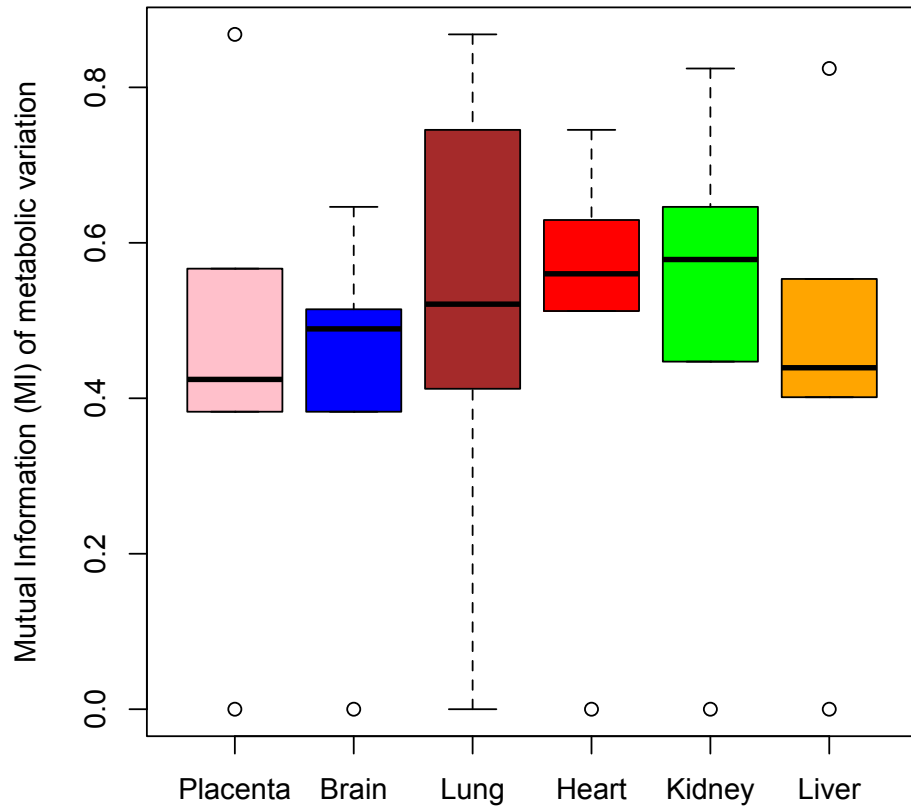


Lung and placenta show cluster in females but not in males

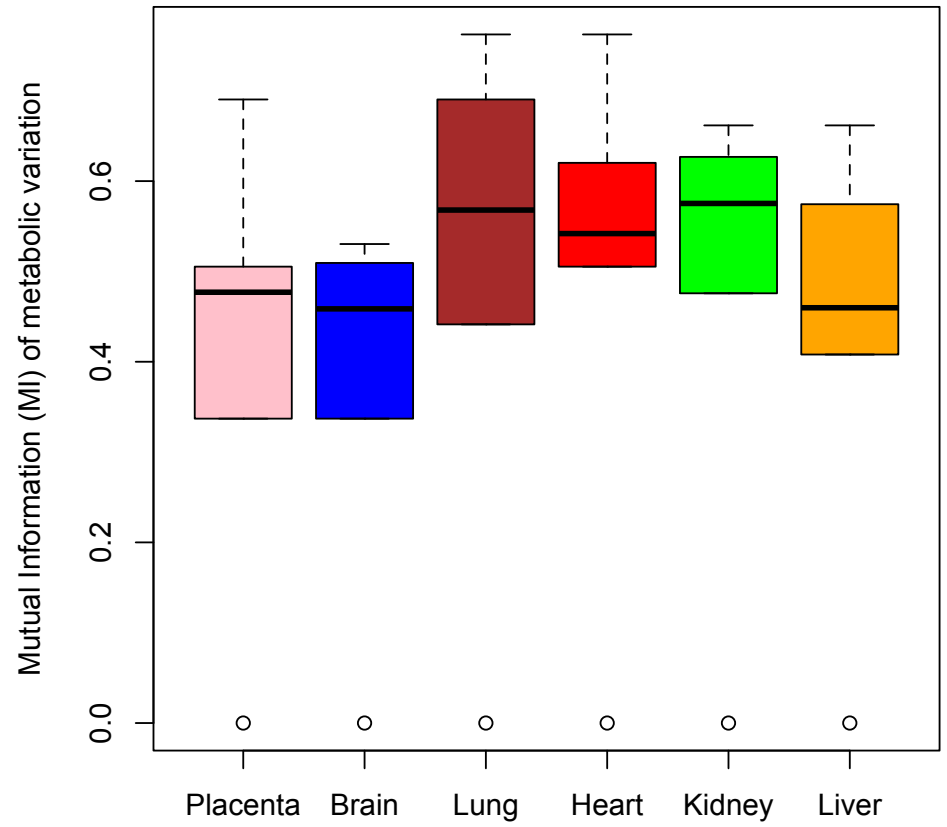


Lung metabolism is more variable in female than male fetuses

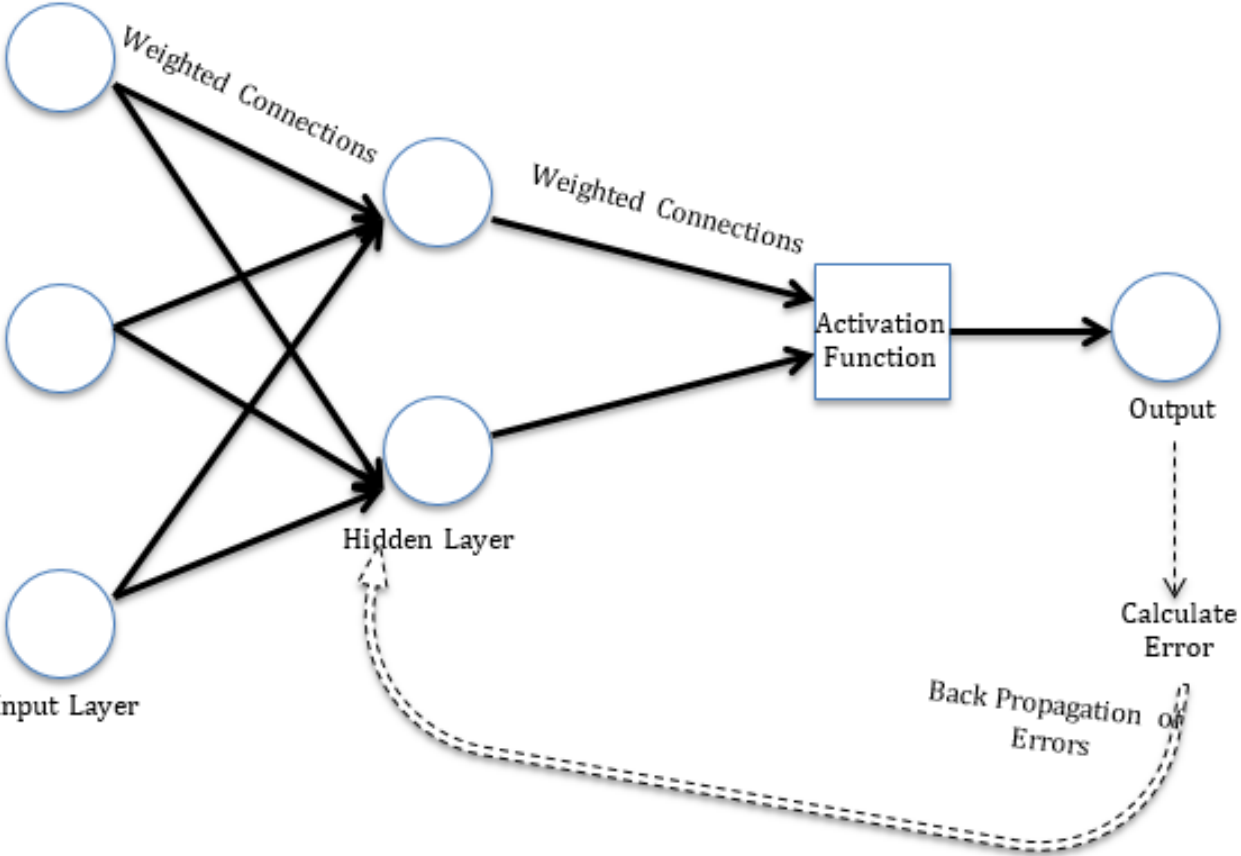
Female



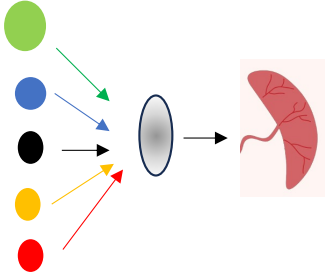
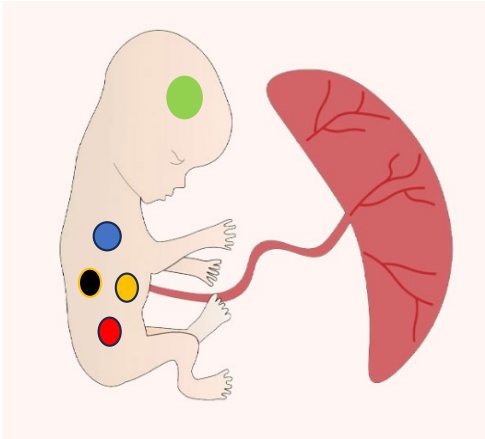
Male



Neural network modeling of fetoplacental metabolism

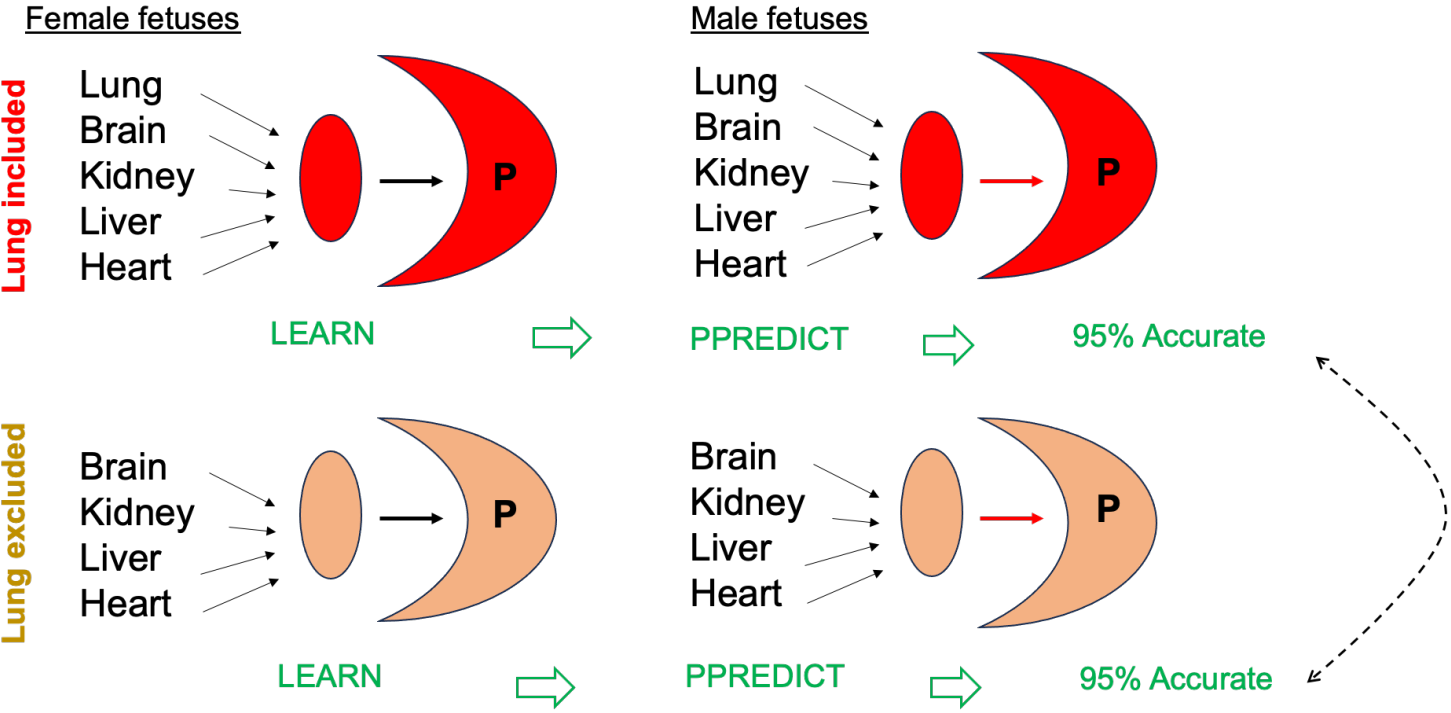


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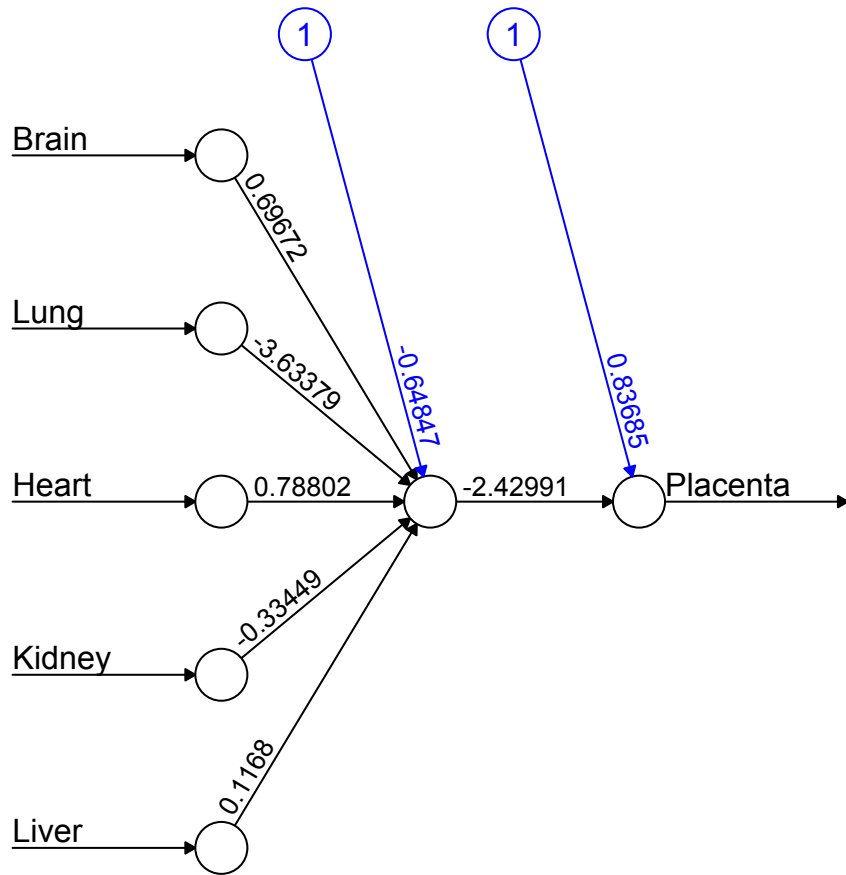


Fetoplacental metabolic network

Modeling sex differences of fetoplacental metabolism

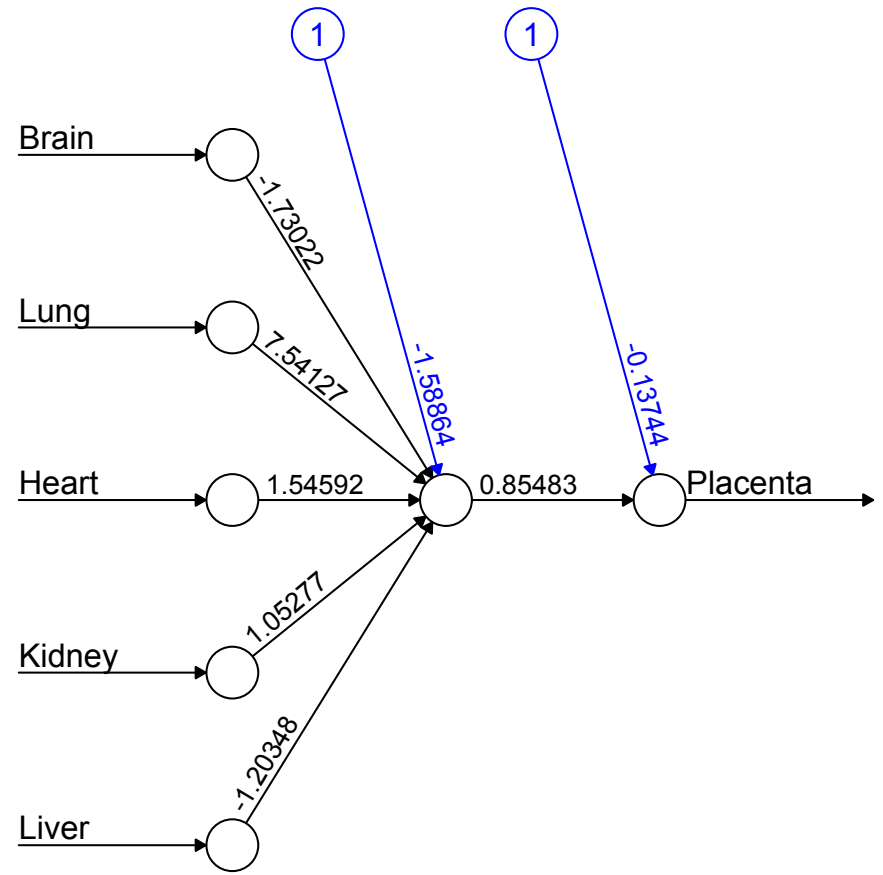


Female (Including lung)



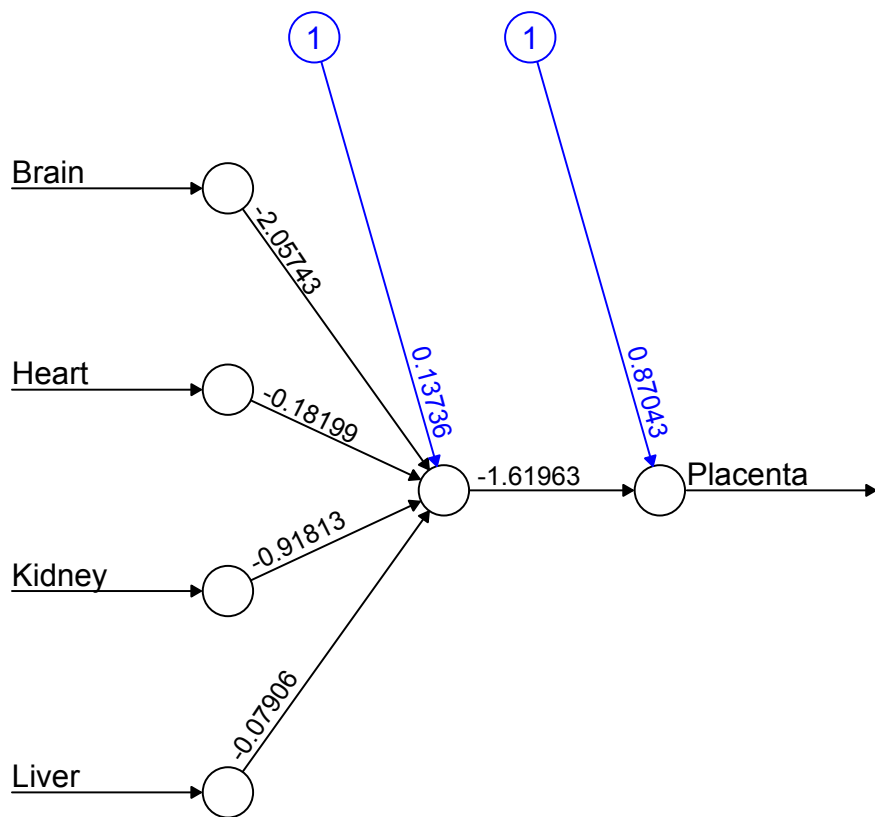
Error: 0.090026 Steps: 1094

Male (Including lung)



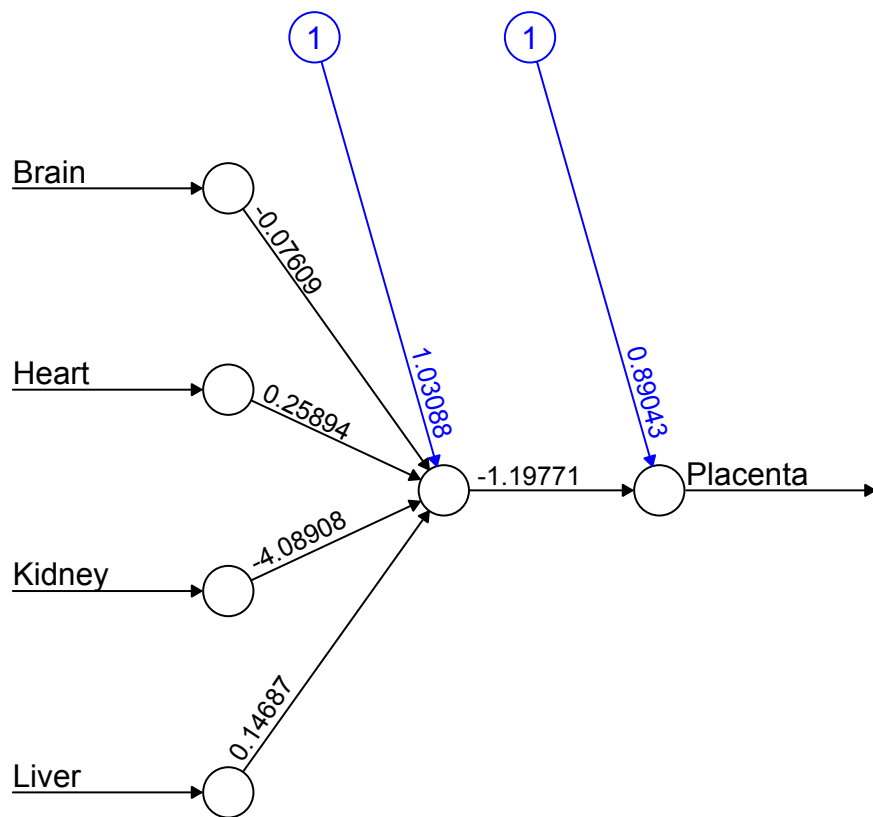
Error: 0.205549 Steps: 101

Female (excluding lung)



Error: 0.228271 Steps: 346

Male (excluding lung)



Error: 0.233488 Steps: 960

Significant predictors of sex-bias fetoplacental metabolism

Female bias

Adenine
Inosine
Cytosine
Guanine
Citric Acid
Glyceric Acid
L-Aspartic acid
Pyroglutamic Acid
Homoserine
L-Proline
Methionine
Creatine
Timonacic

Male bias

Sucrose

Conclusion

- Placental metabolism is likely modulated by metabolic need of fetal organs in a sex dependent manner
- Lung may be involved in sex bias fetal metabolism

[Breathe \(Sheff\)](#). 2018 Jun; 14(2): 131–140.

doi: [10.1183/20734735.000318](https://doi.org/10.1183/20734735.000318)

Sex differences in respiratory function

[Antonella LoMauro](#) and [Andrea Aliverti](#)



Future direction: How fetoplacental metabolism is regulated (RNA-seq, single-cell analysis)

Acknowledgement

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THANK YOU