



Poznań University of Life Sciences

FACULTY OF VETERINARY MEDICINE  
AND ANIMAL SCIENCES  
Department of Genetics  
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# Genetic architecture of methane emissions from dairy cows

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GRANT NO: OPUS 2013/09/B/NZ9/03179

**CH<sub>4</sub> = Greenhouse gas**

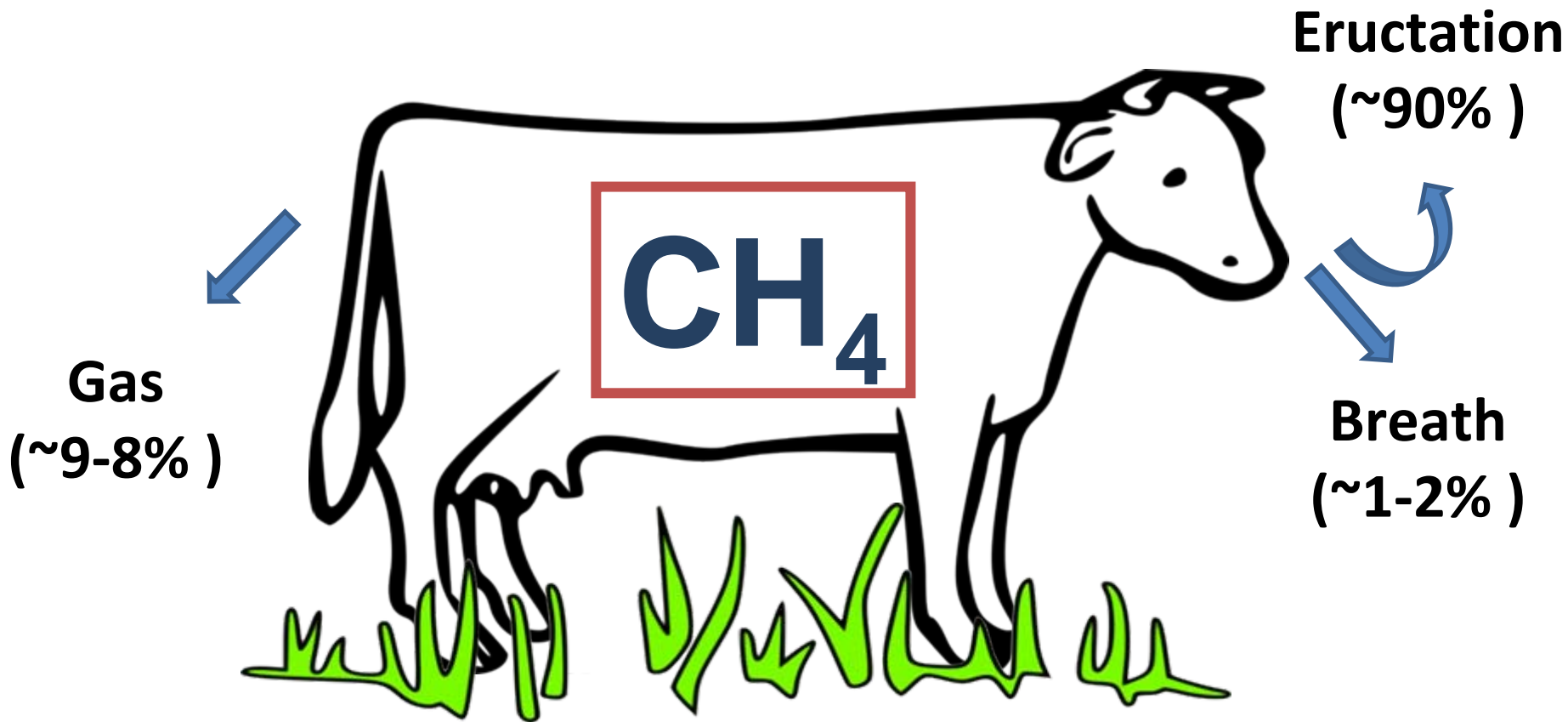
**CH<sub>4</sub> =  
2% – 12% energy losses**

**Does genetic variance  
in CH<sub>4</sub> exist?**

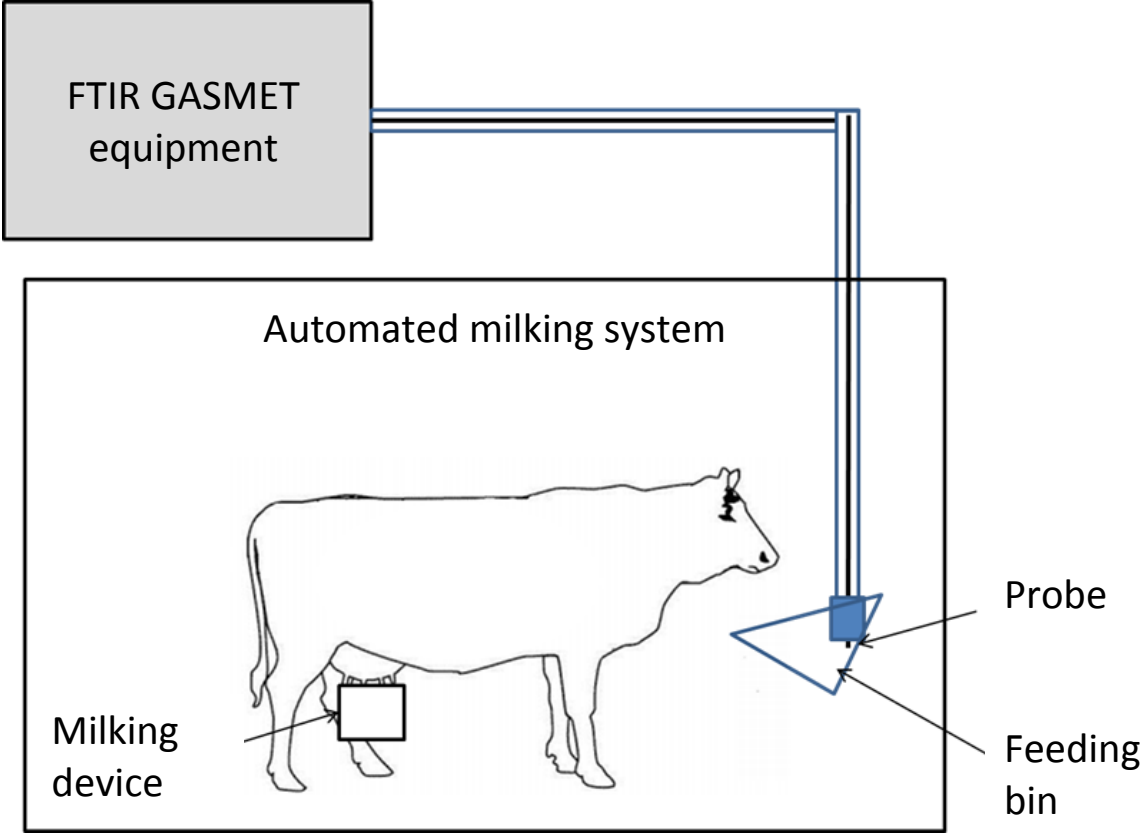
**27% of variation in  
daily CH<sub>4</sub> emission  
is heritable**

Pszczola et al. JAS, 2017

**Which genes control  
CH<sub>4</sub> emission?**



# Measuring scheme





# Collected CH<sub>4</sub> data

## Farm 1

## Farm 2



2014-NOV 2016-FEB  
2016-JUN 2016-SEP

2016-FEB 2016-MAR

**227**

**54**

**24,336**

**1,535**

**39,680**

**39,680**

# Daily CH<sub>4</sub> emission

$$CH_4 [l/d] = \frac{CH_4 [ppm]}{CO_2 [ppm]} * HPU [l/d]$$

**GWAS**

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# Method

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## Bayesian Variable Selection (BayZ)

Assumptions:

$$\beta \sim \begin{cases} N(0, \sigma_{g_0}^2) & \text{with probability : } \pi_0 \\ N(0, \sigma_{g_1}^2) & \text{with probability : } \pi_1 \end{cases} \quad \pi_1 = 0.001$$

500k MCMC iterations for posterior means

15k BURN-IN

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# Model

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## **Fixed**

Lactation (1 or 2+)

General lactation curve (3<sup>rd</sup> ord. Leg. pol.)

Year-week of the measurement (accounting for Farm)

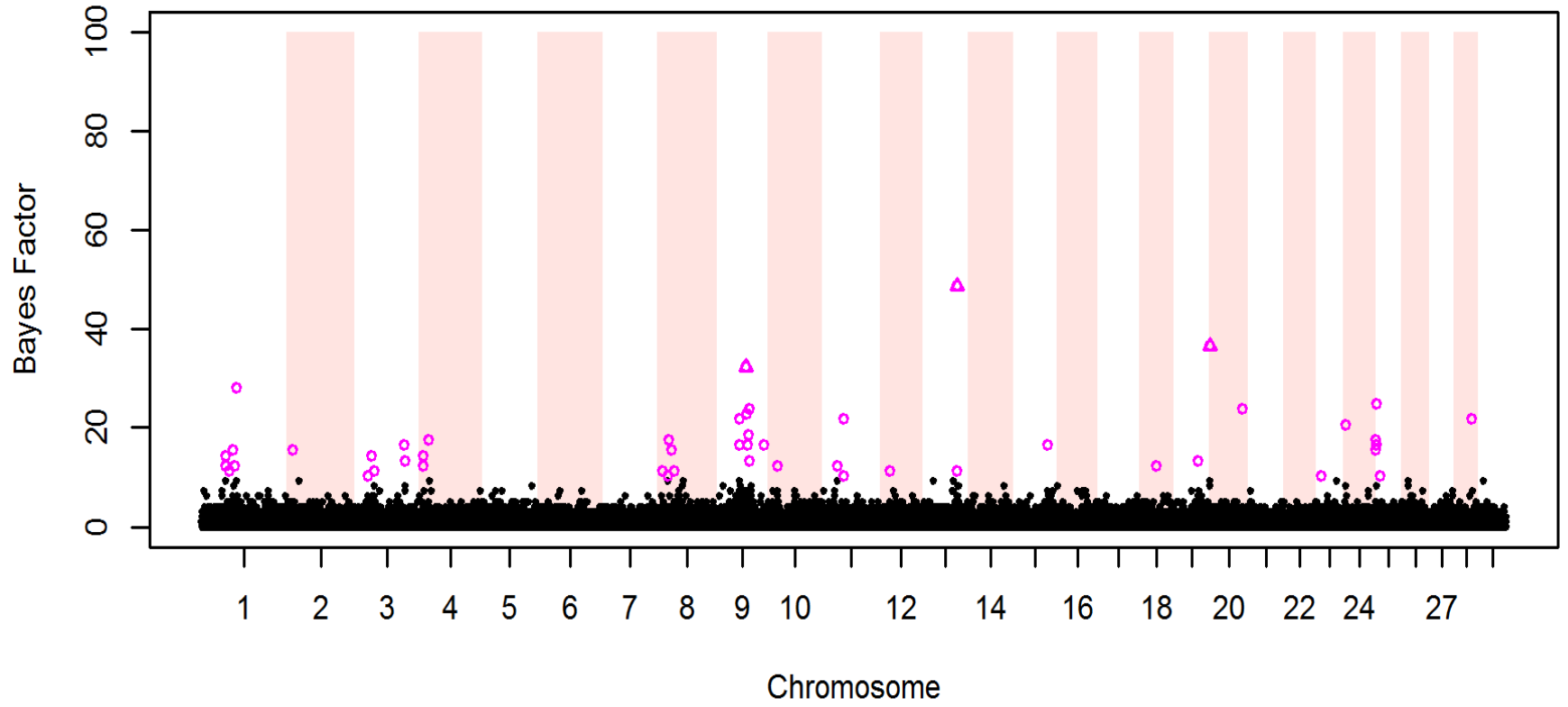
## **Random**

Animal (2<sup>nd</sup> ord. Leg. pol.)

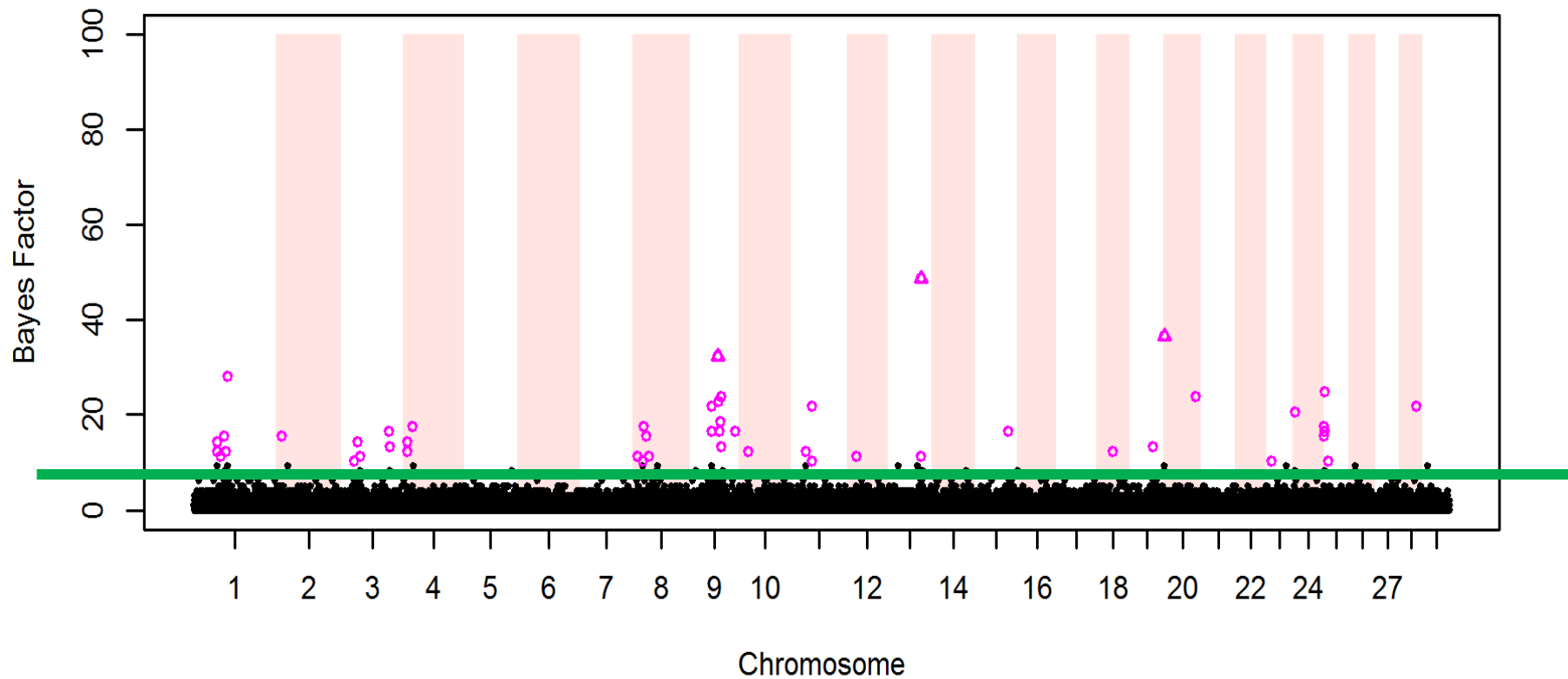
Permanent environment (2<sup>nd</sup> ord. Leg. pol.)

Error

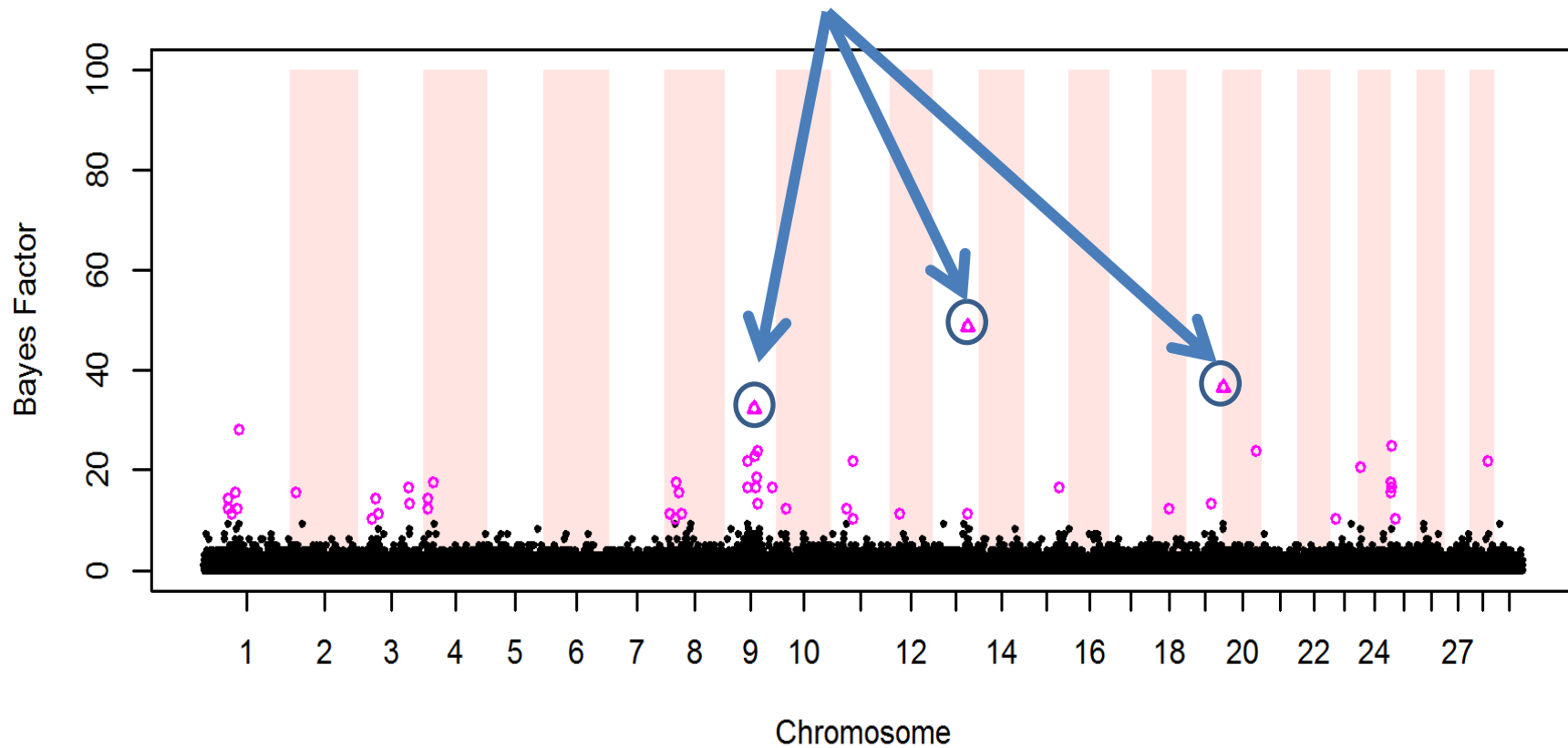
# Identified SNP



# 50 SNP with BF>10



# 3 SNP with BF>30





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# Variance explained

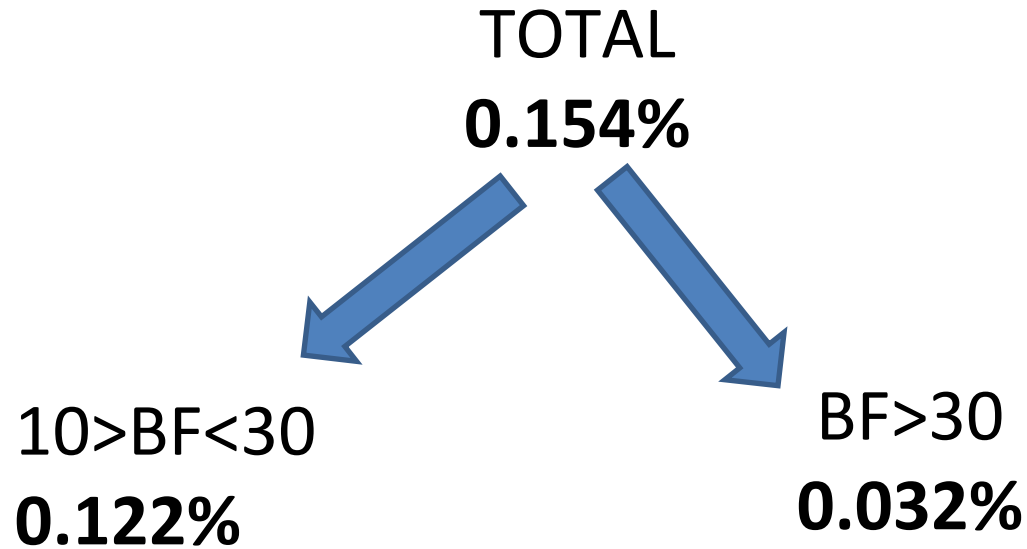
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TOTAL  
**0.154%**

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# Variance explained

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# Previously reported QTL

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# Previously reported QTL

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milk production  
& composition

body size

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# Previously reported QTL

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milk production  
& composition

body size

health status

feed efficiency

# 5 candidate genes found

# 5 candidate genes found

***CYP51A1***

BTA 4

***PPP1R16B***

BTA 13

***NTHL1, TSC2, PKD1***

BTA 25

metabolism

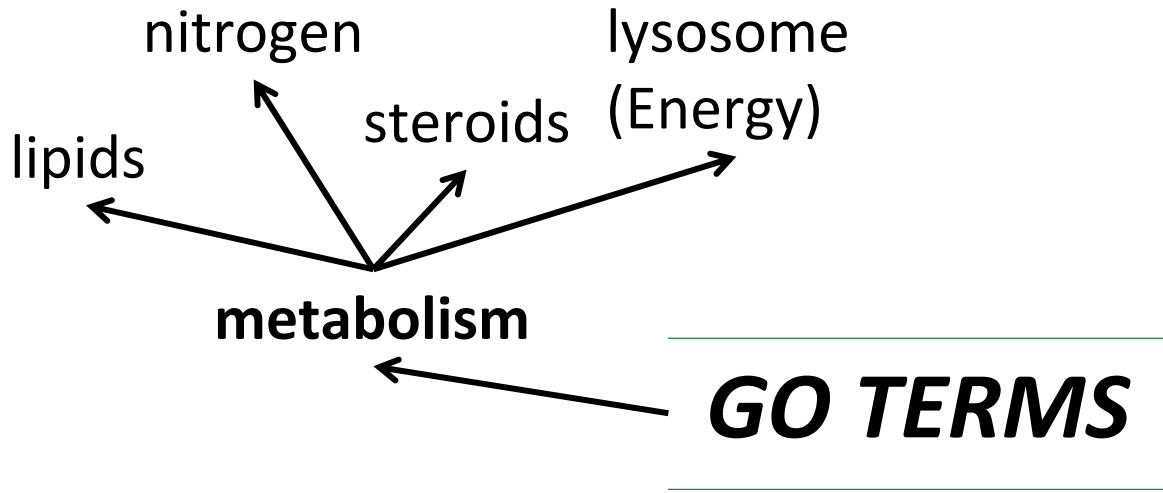


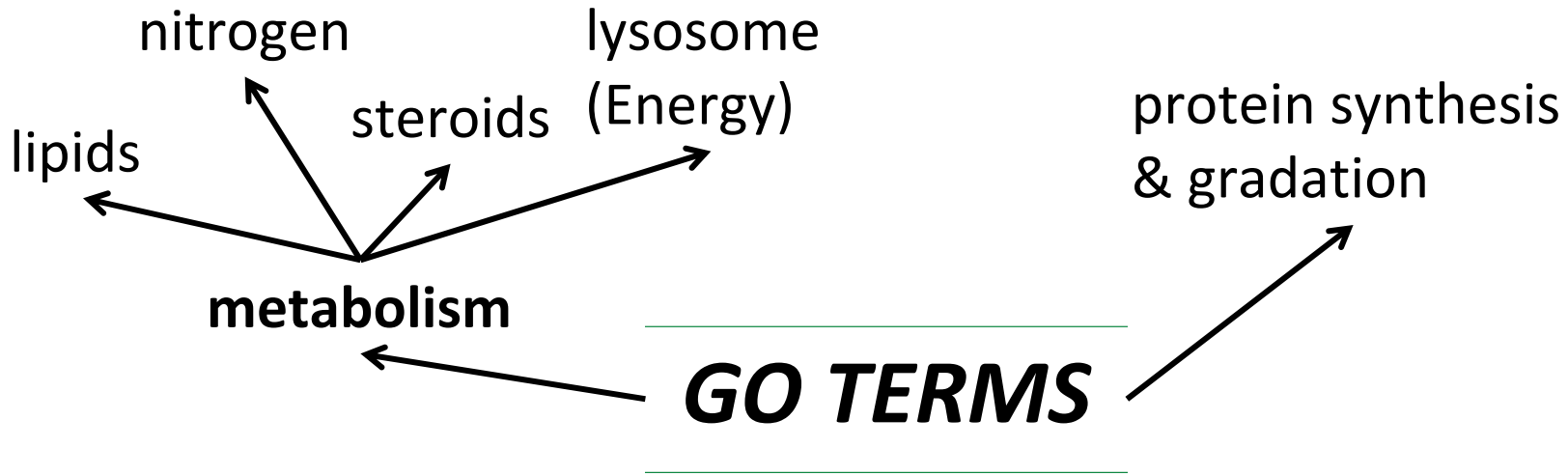
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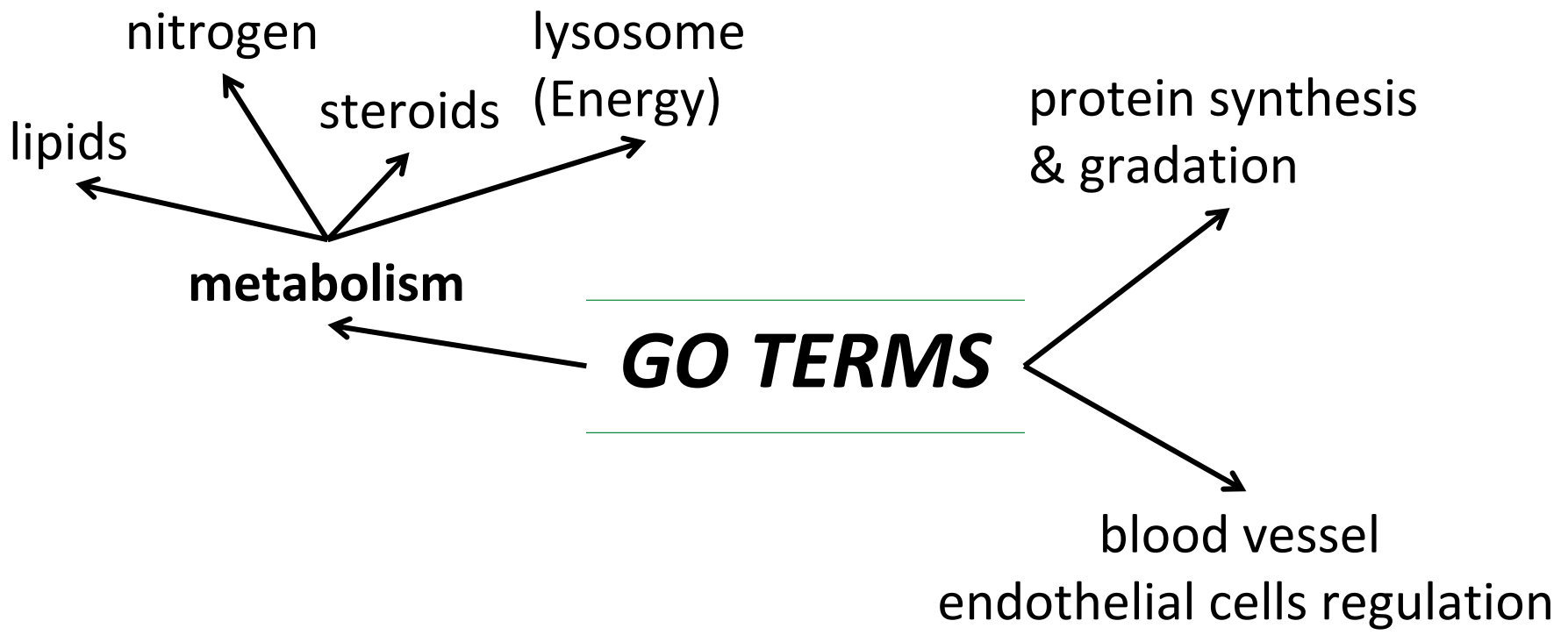
***GO TERMS***

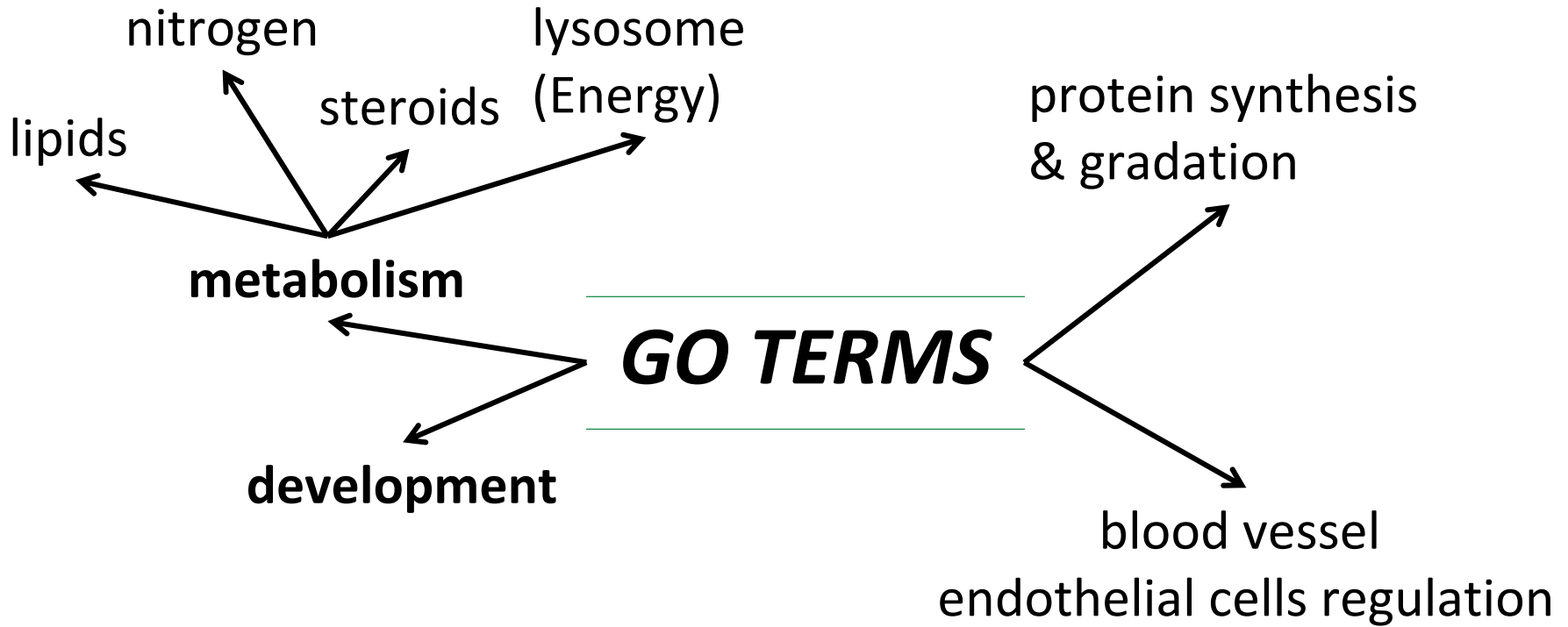
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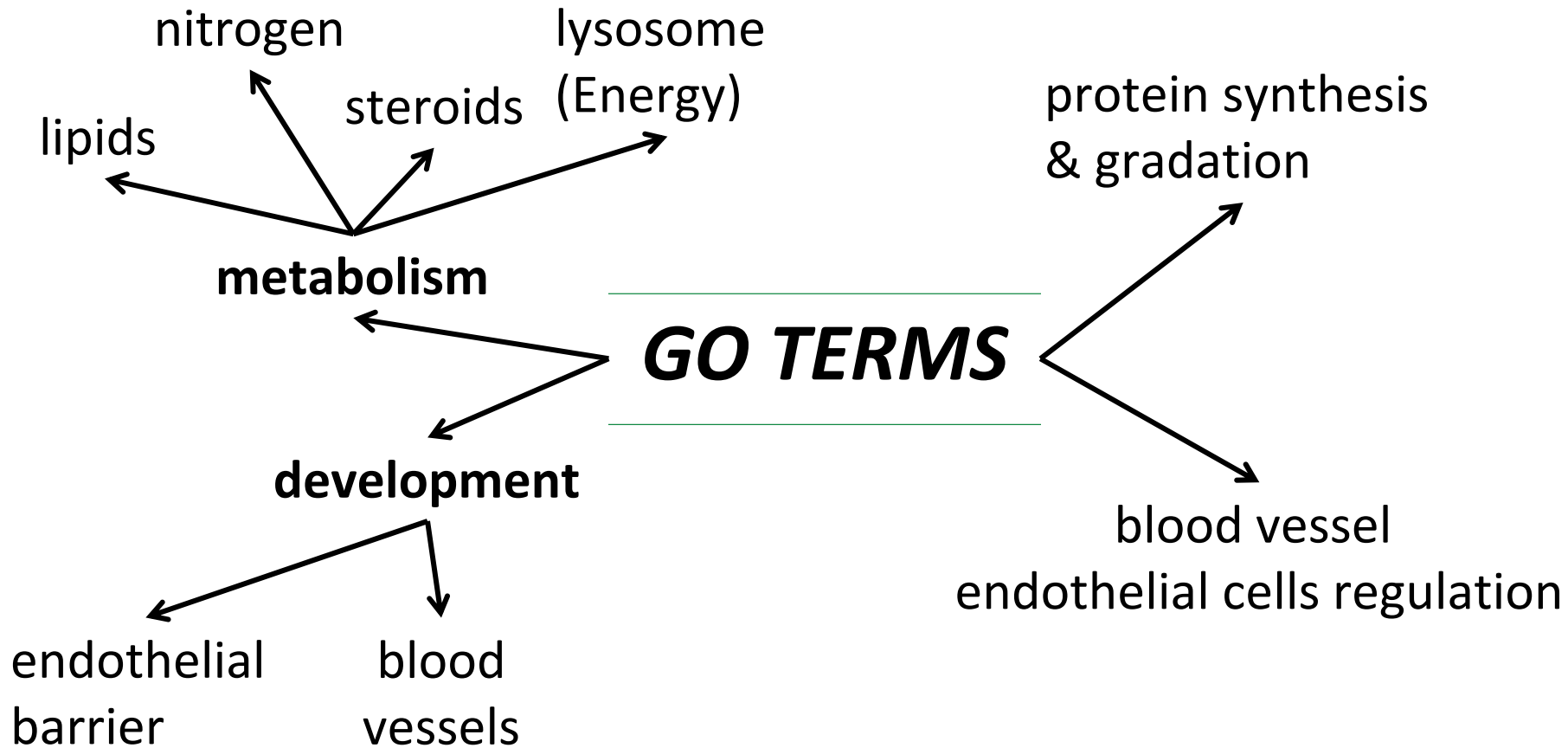


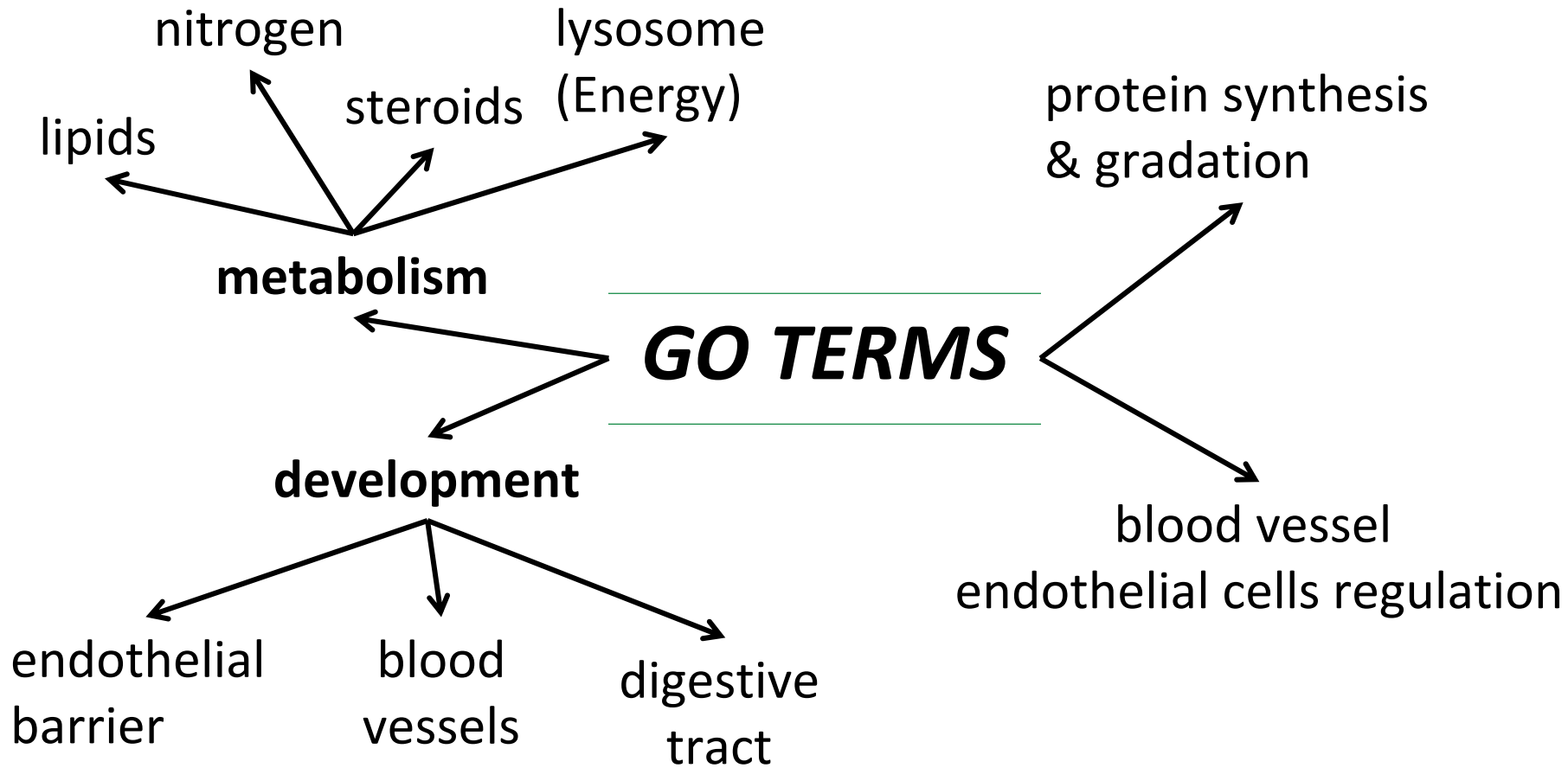


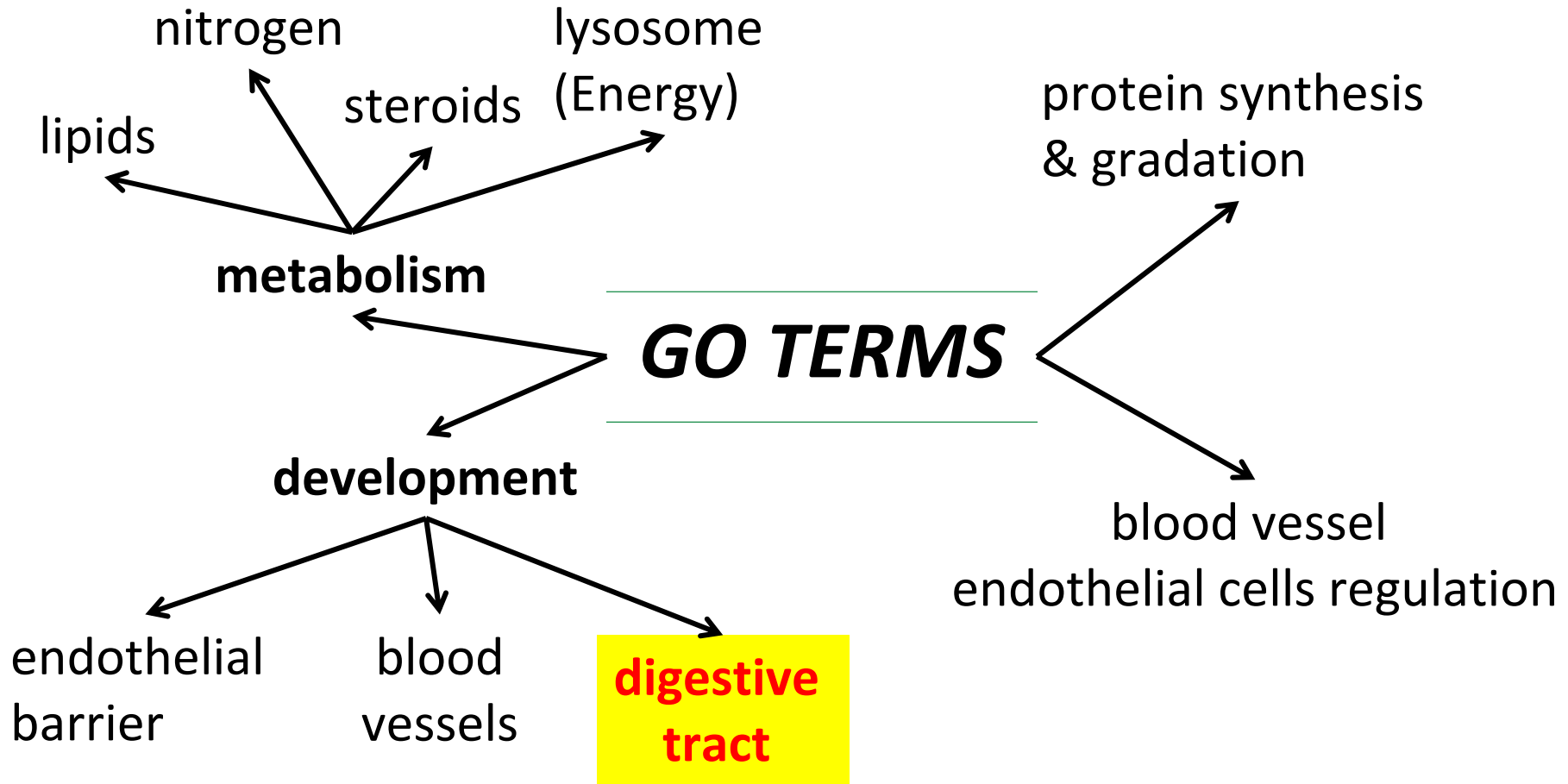












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# Conclusions

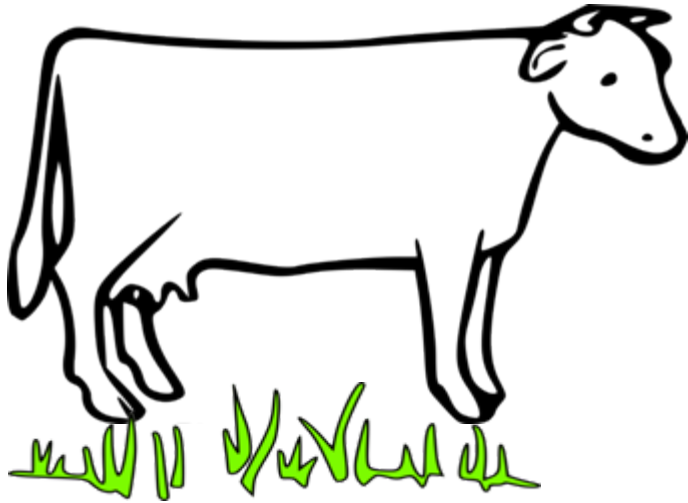
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small proportion of the genetic variance explained

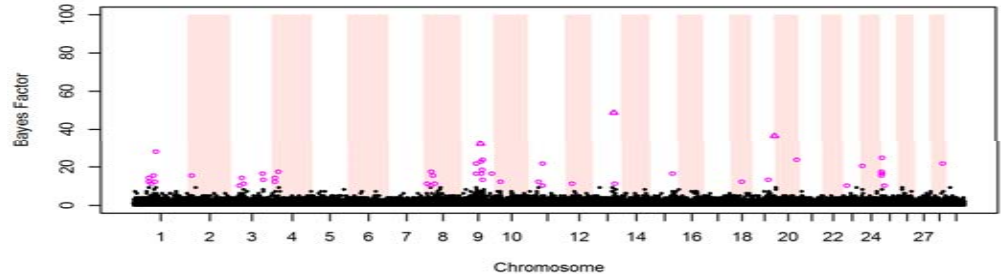
QTL in genomic regions for traits related to CH<sub>4</sub>

Candidate genes possibly relevant to CH<sub>4</sub> emission





# CH<sub>4</sub> emission has complex genetic architecture



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