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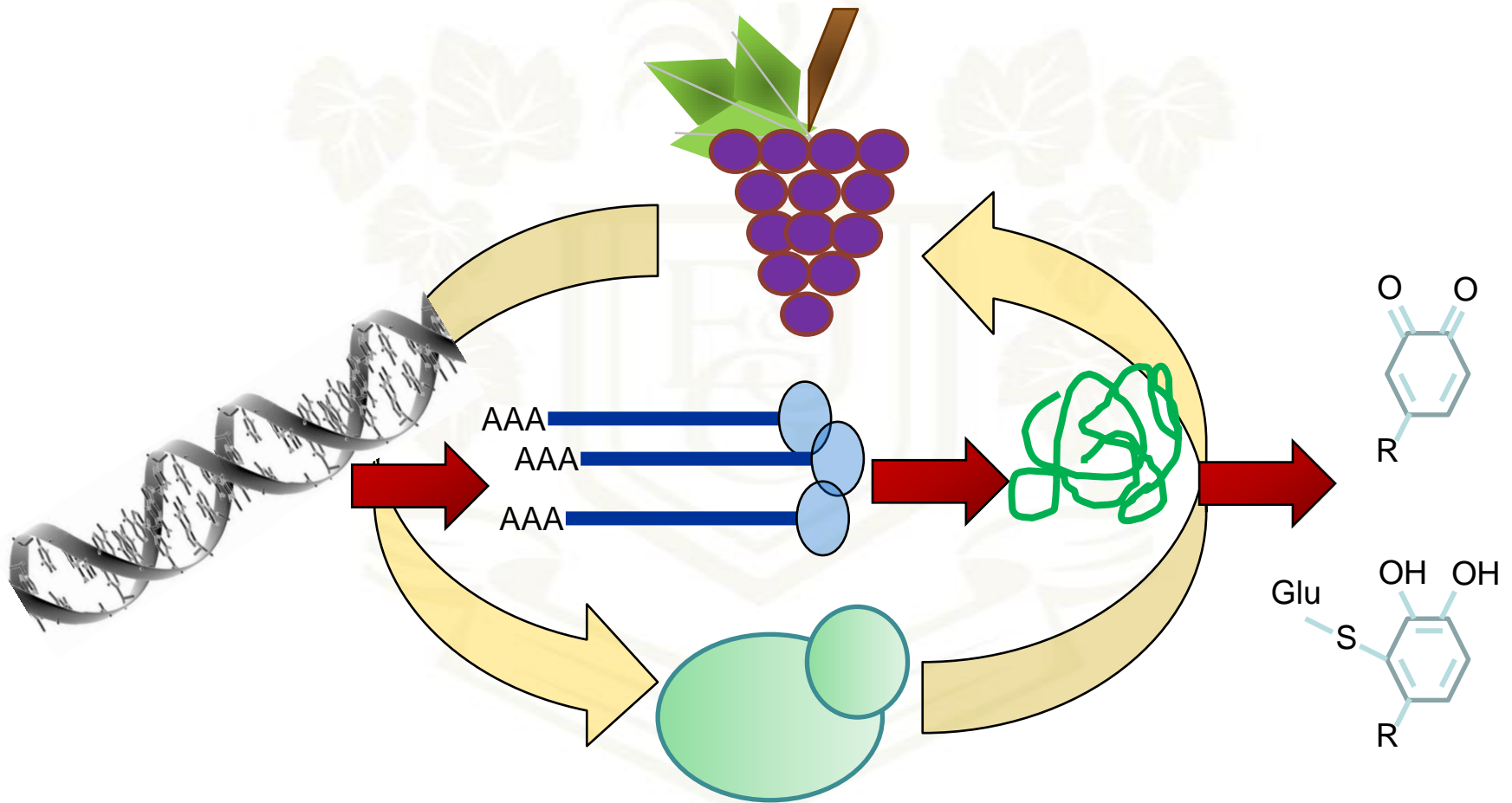
A Metabolomics Approach to Study Chardonnay Wine Fermentation

**Chandra Richter, PhD
E&J Gallo Winery**

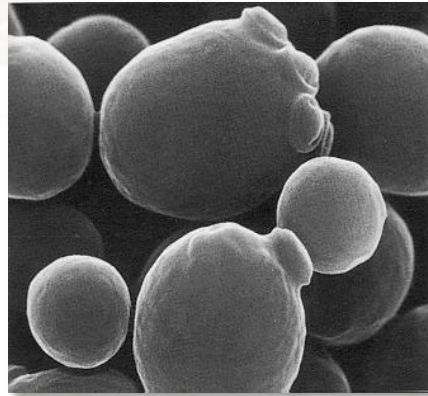
Metabolomics
March 24, 2014



Winemaking at the Molecular Level



Winemaking



Water

Sugar

Acids

Minor Components

Water

Ethanol

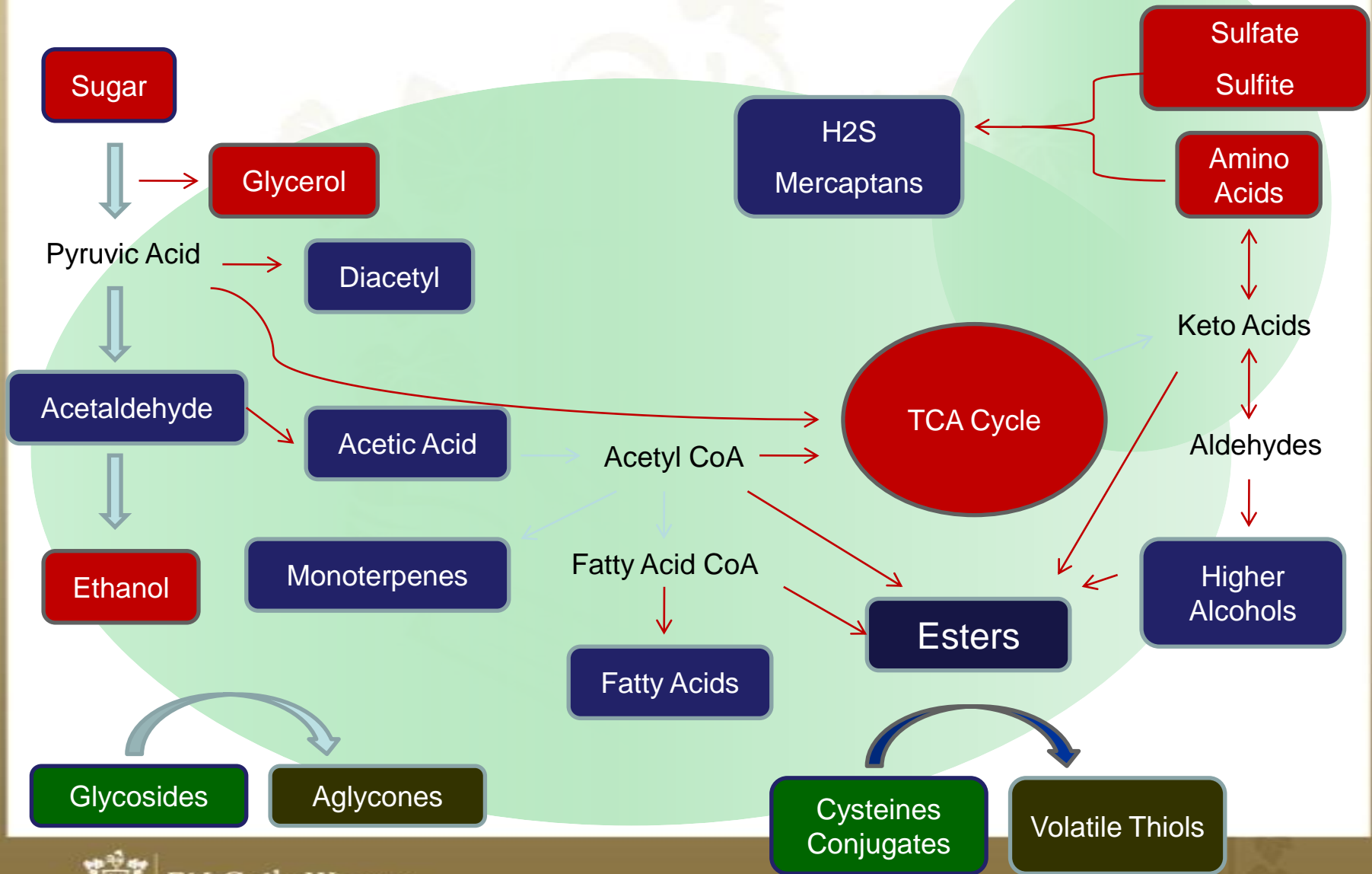
Glycerol

Acids

Minor Components



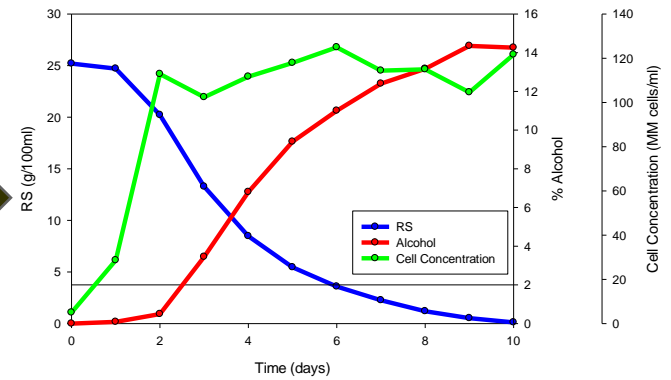
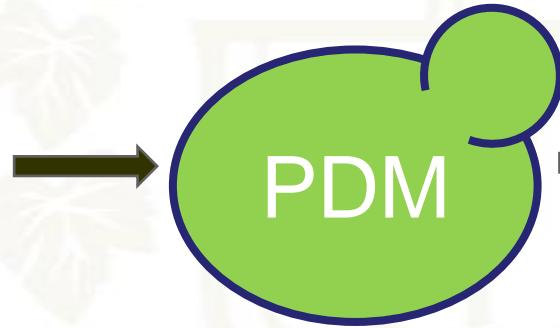
Yeast Metabolism



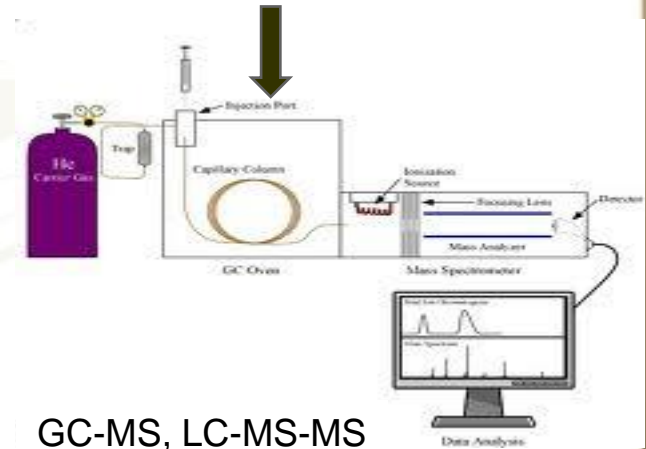
Identify metabolites present at three stages during fermentation



Chardonnay Juice



Look for metabolic patterns



GC-MS, LC-MS-MS



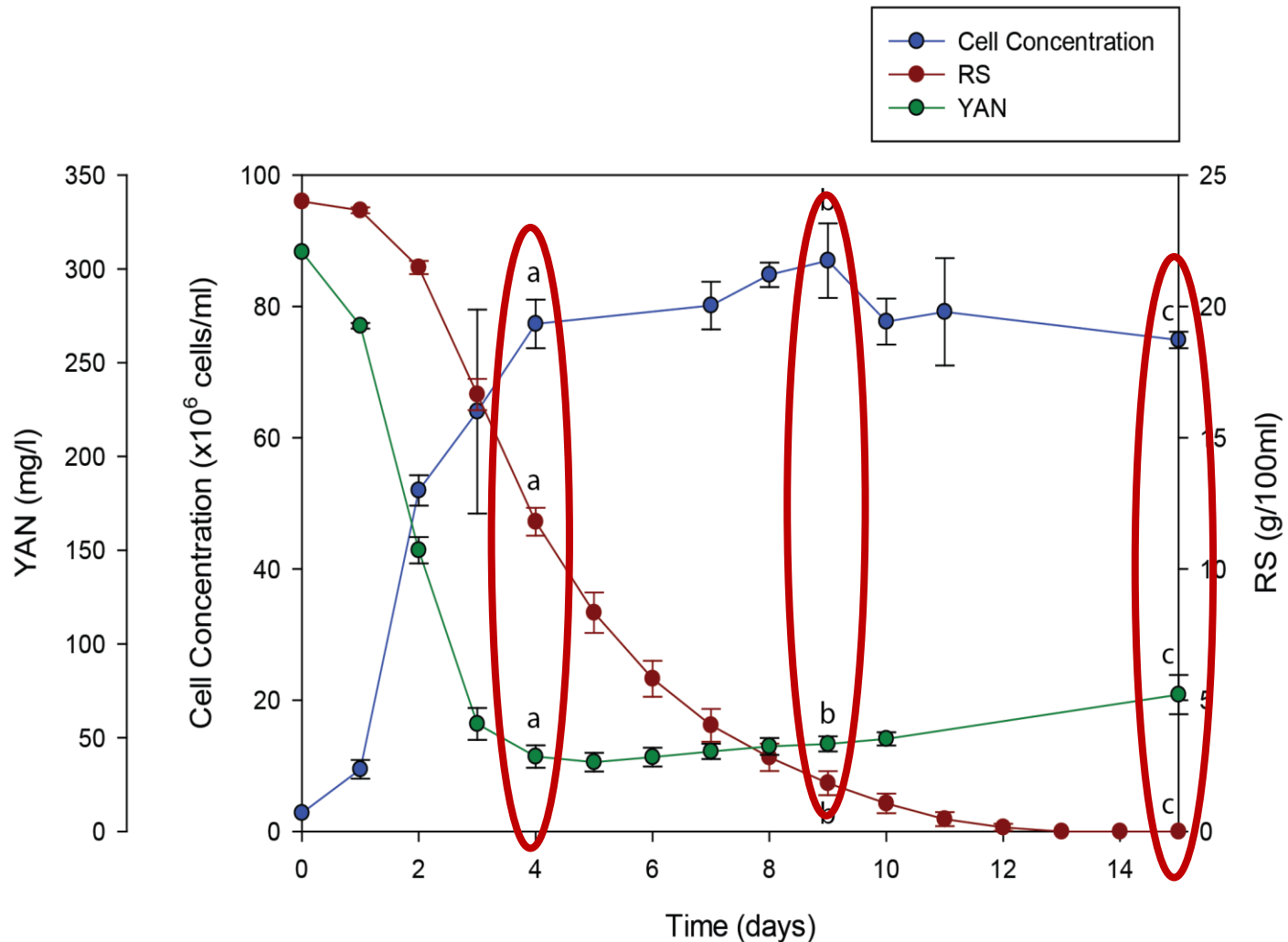
Winemaking Process



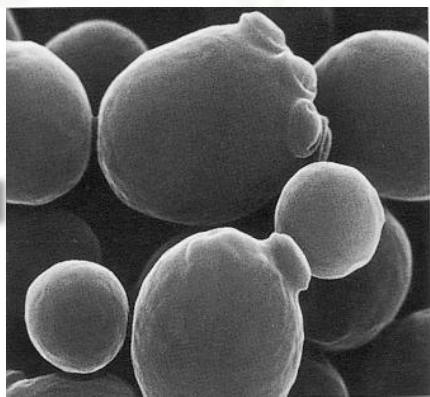
- Chardonnay juice
- 10 gallon
- 65F
- Agitation
- PDM yeast
- Triplicate
- Sampled Daily



Fermentation Timecourse



Endo- and Exo-Metabolome



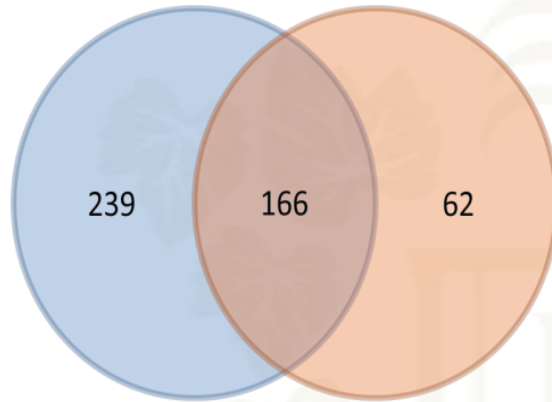
Endo-Metabolome

Exo-
Metabolome



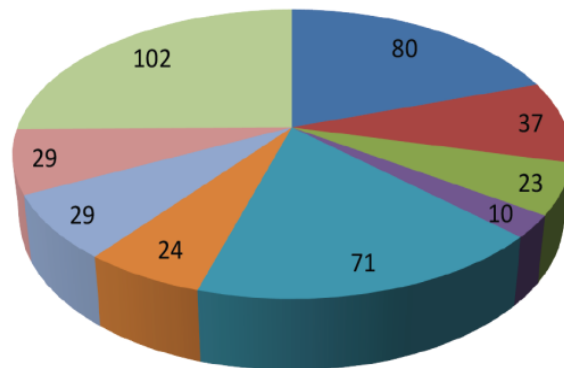
Summary of Metabolites

A.

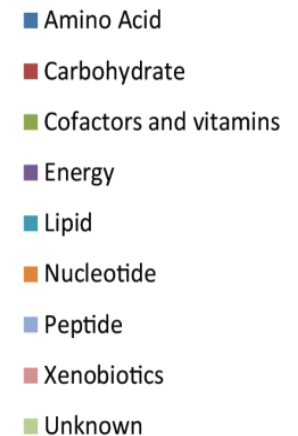
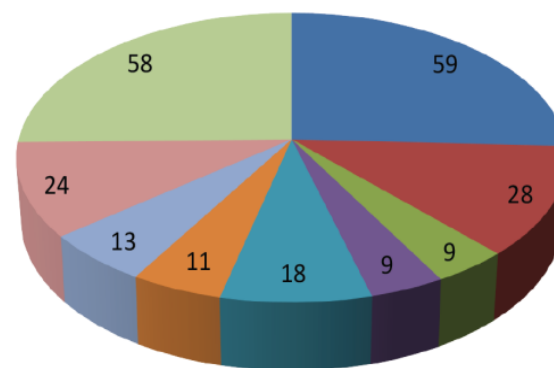


B.

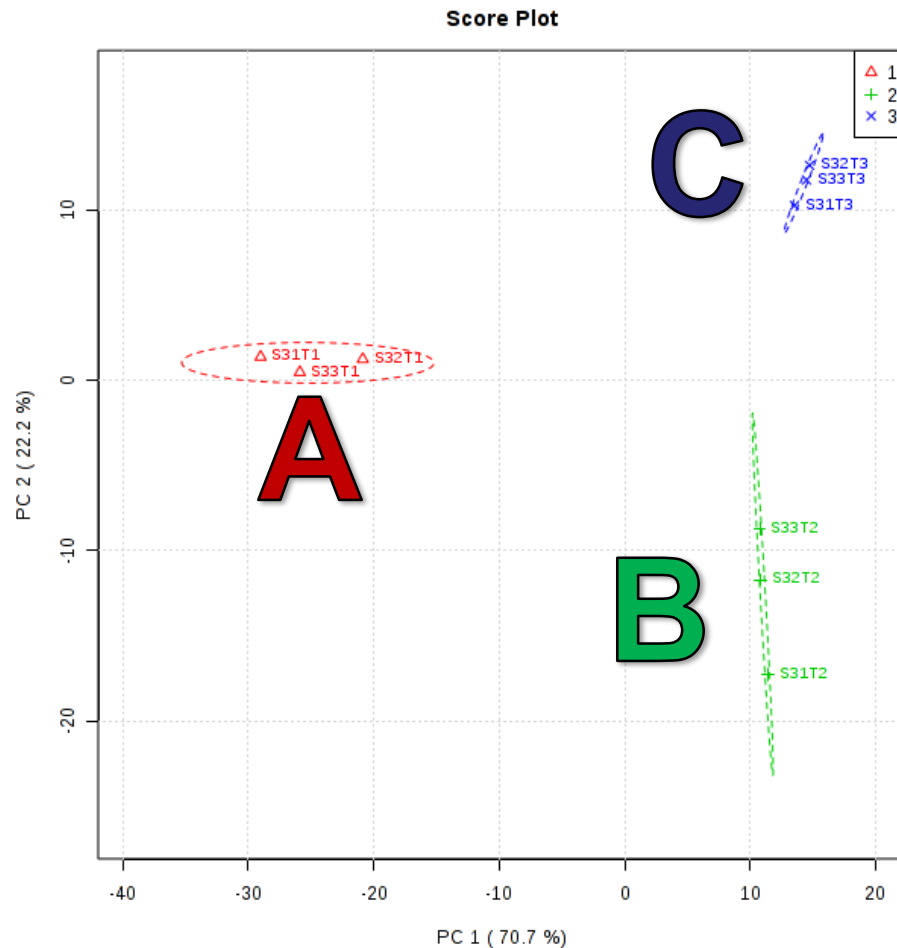
Endometabolome



Exometabolome

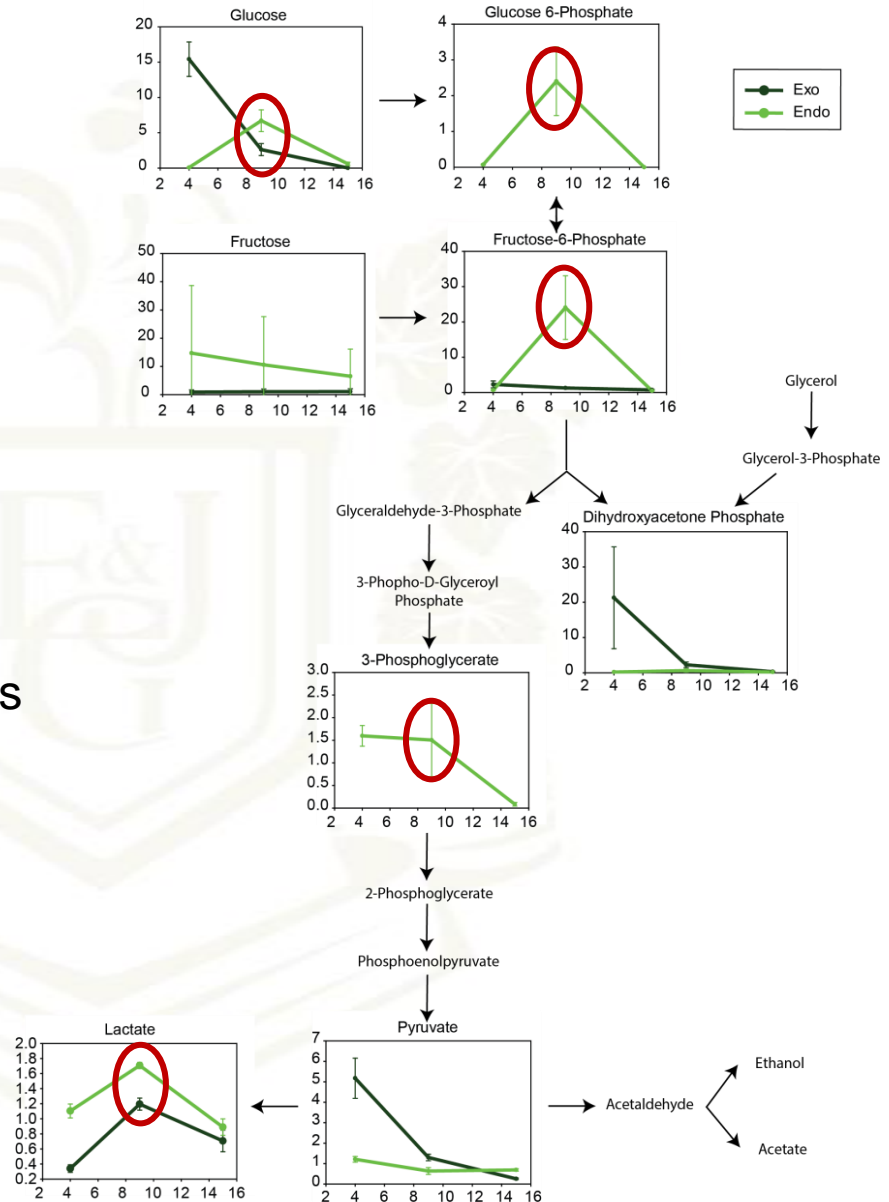


PCA Separates Time



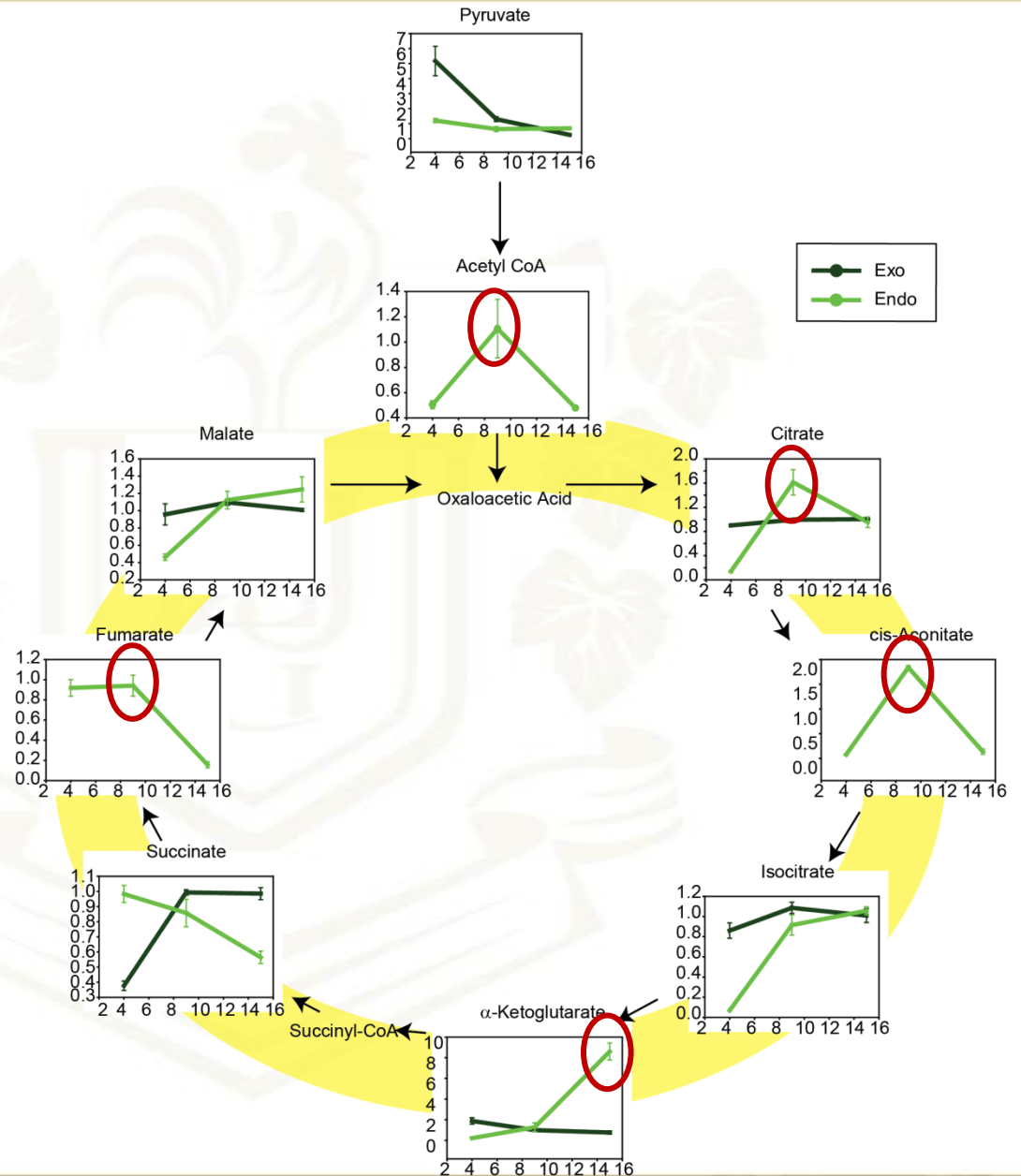
Glycolysis

- Early stages of fermentation: sugars are high in the juice and low in the cell.
 - Cells are rapidly producing biomass.
- Later stages in fermentation: cells reduce uptake of sugar and glycolysis slows.

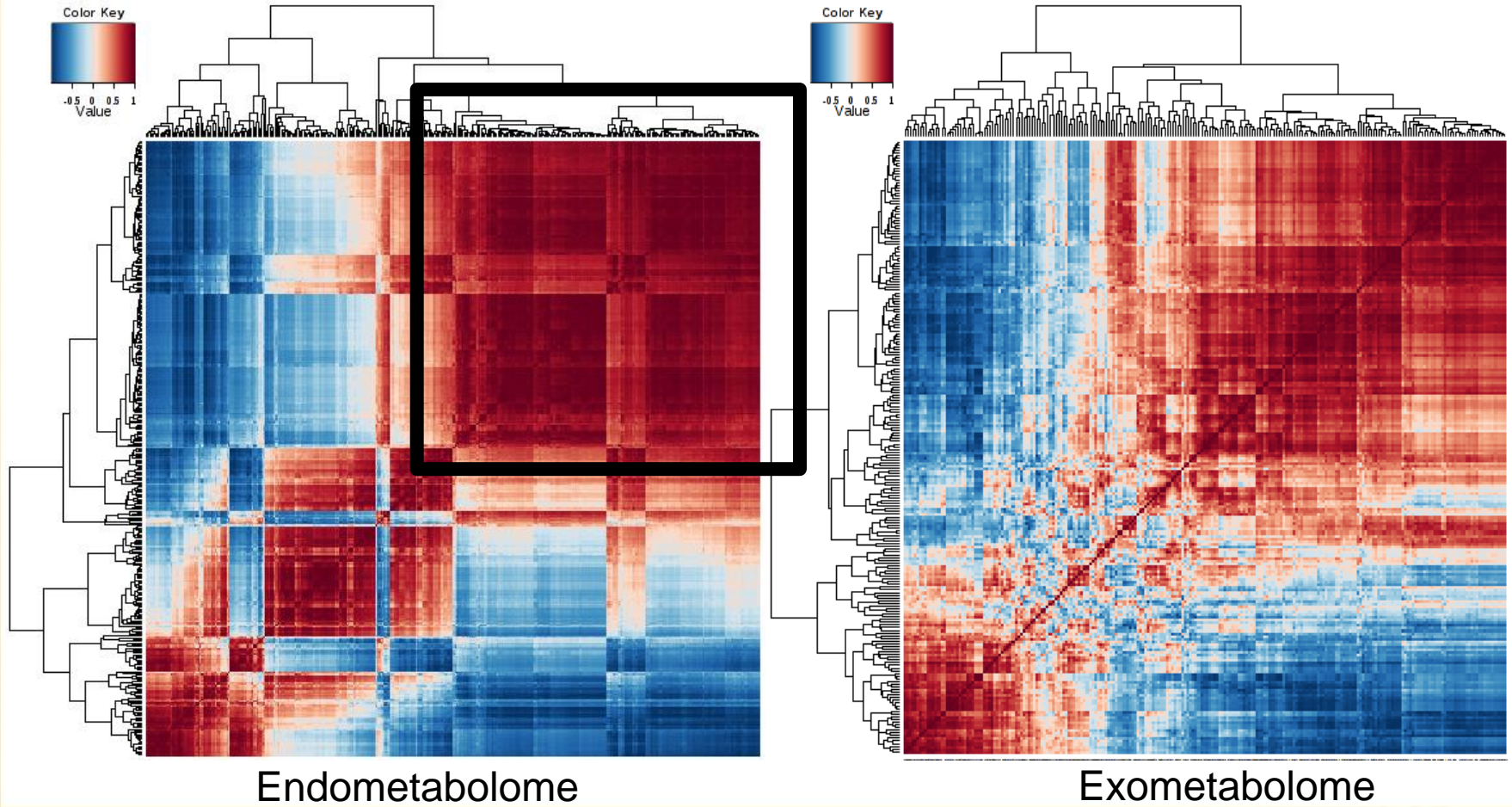


TCA

- Similar pattern seen in the TCA cycle intermediates.
- α -ketogluterate shows a unique profile
 - Deamination of glutamine



Correlation Profiles



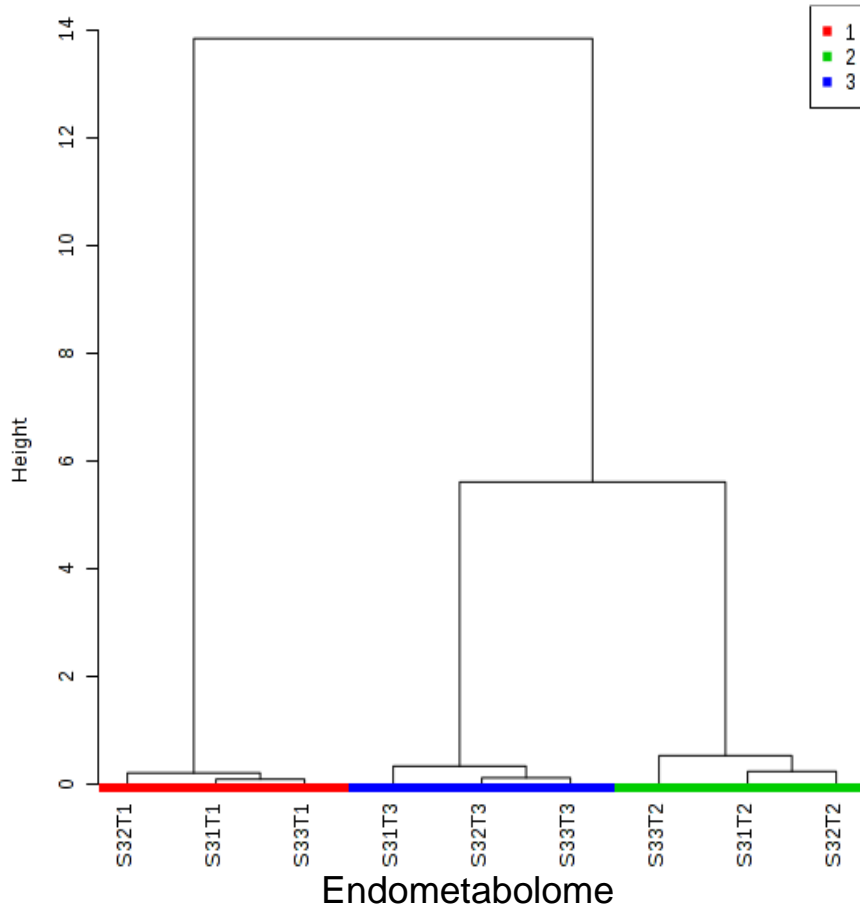
Endometabolome

Exometabolome

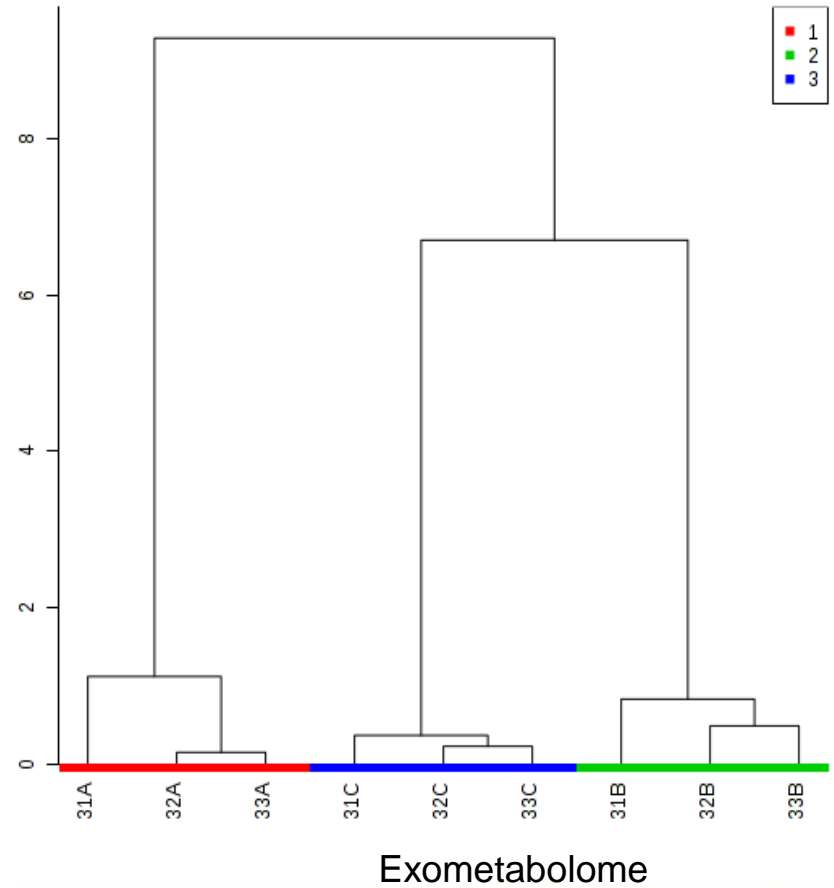


Hierarchichal Relationship

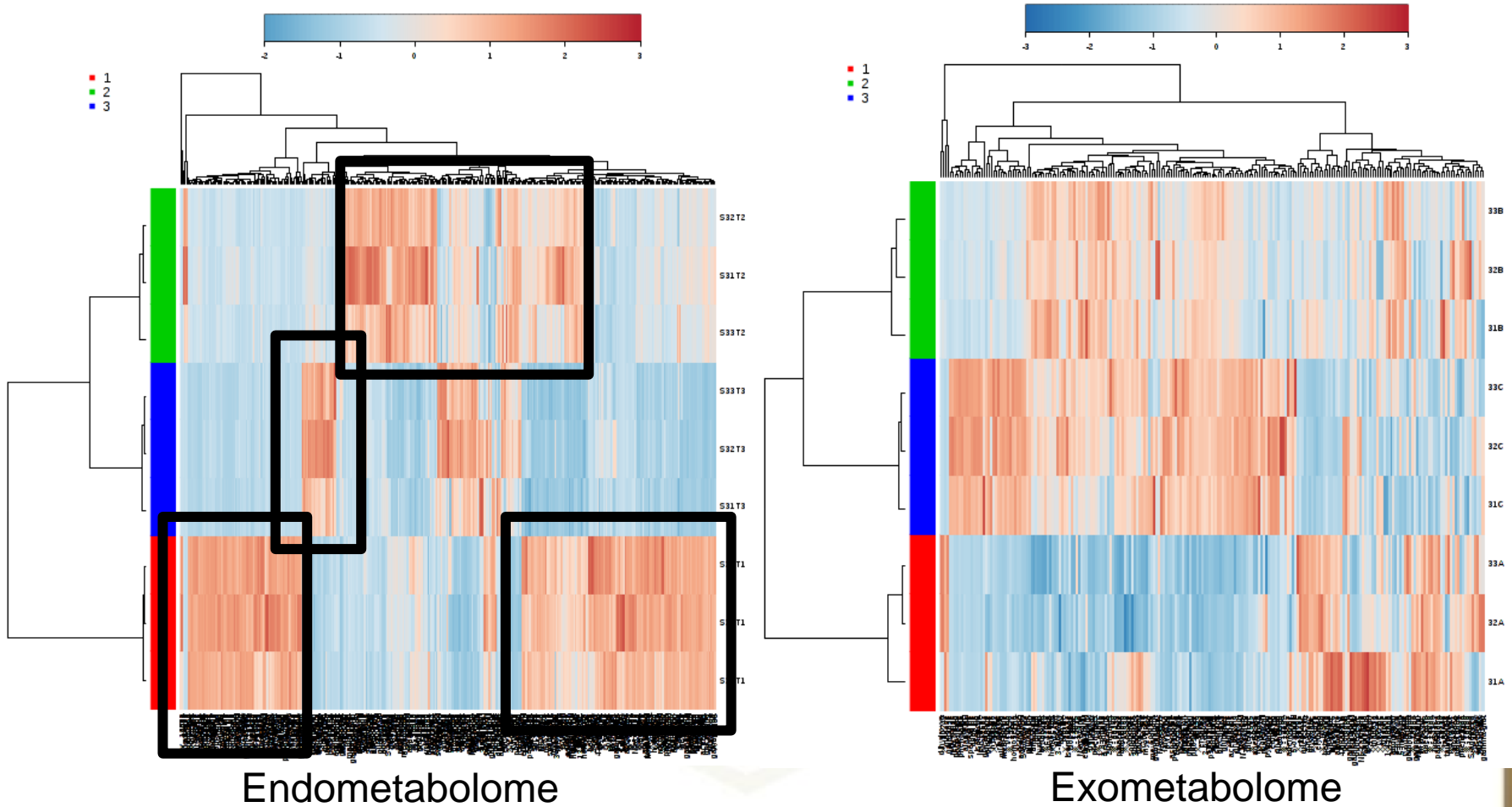
Cluster with ward method



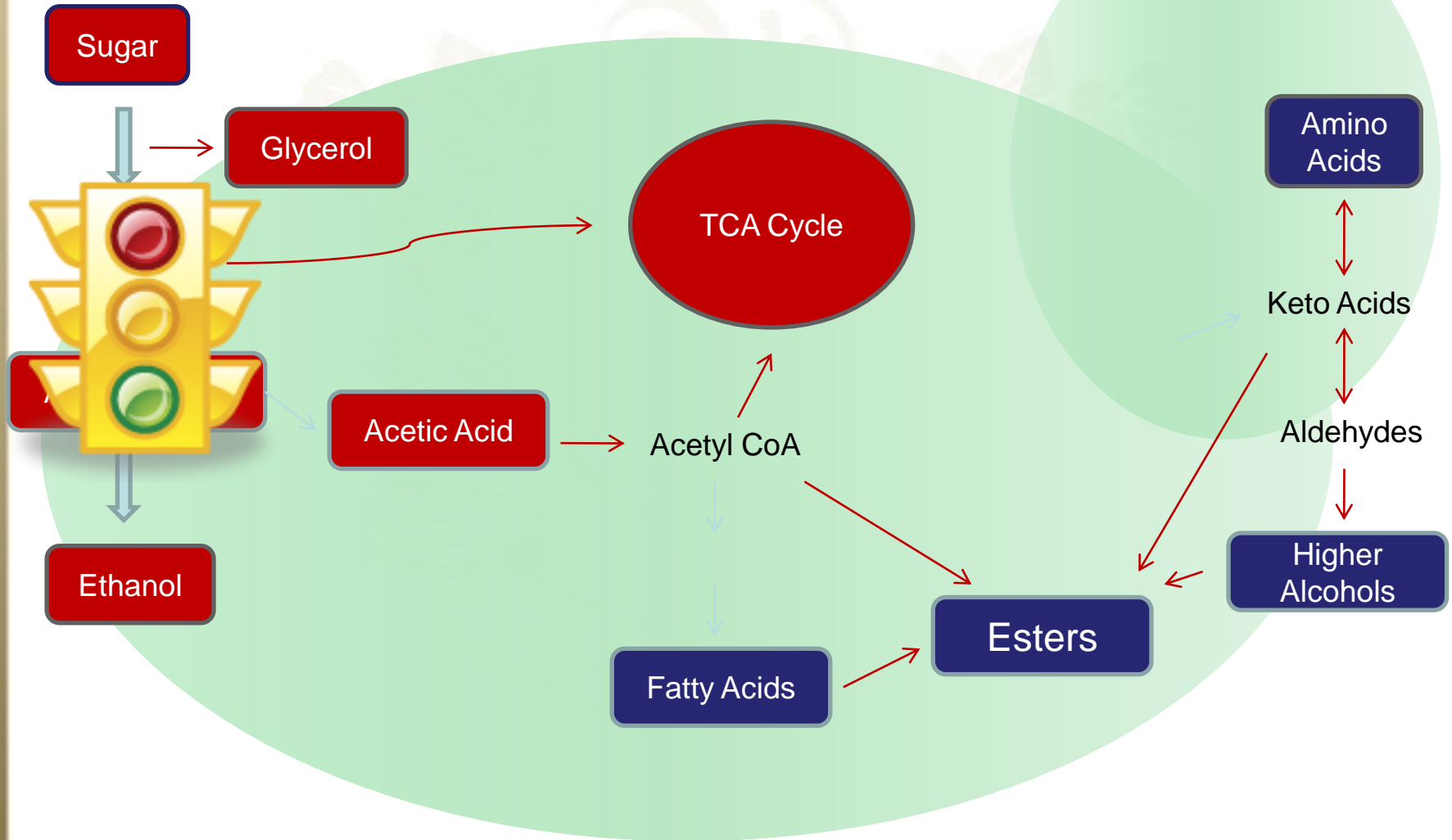
Cluster with ward method



Metabolic Flux



Regulation of Metabolism



Conclusions

- Identified the endo- and exo-metabolome over the course of a wine fermentation
- Metabolic pathways are differentially regulated through fermentation
 - Glycolysis, TCA active during early stages
 - Amino acid catabolism increases activity at later stages
- Provides understanding of key primary and secondary metabolites



Acknowledgements

- Dave Santino
- Steven Kukesh
- Nick Dokoozlian
- Metabolon
 - Adam Kennedy
 - Lining Guo



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