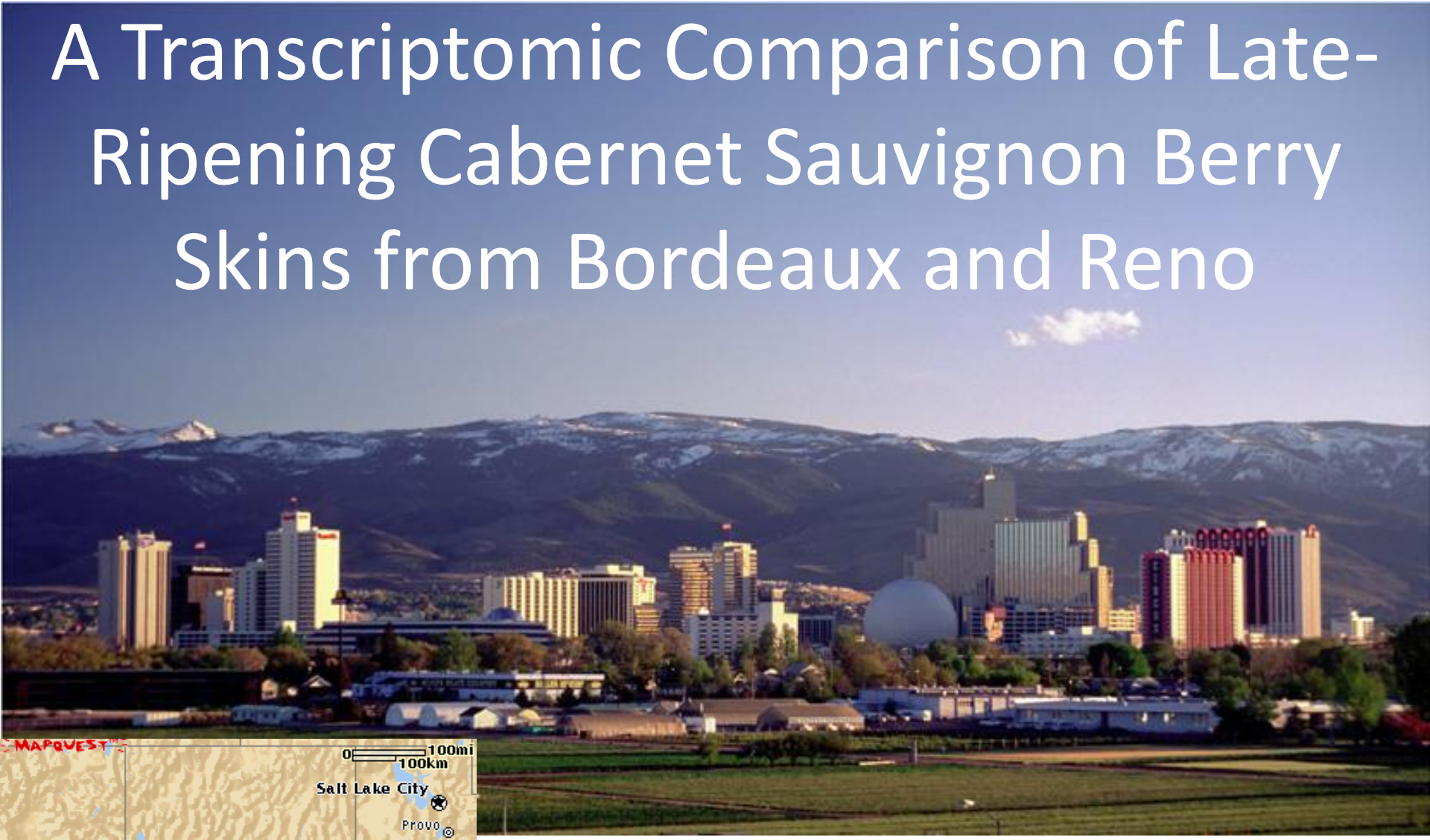
A Transcriptomic Comparison of Late-Ripening Cabernet Sauvignon Berry Skins from Bordeaux and Reno



Grant R. Cramer
Department of Biochemistry and Molecular Biology
University of Nevada, Reno

Talk Outline

- Experimental conditions
- Transcriptomic analysis and results
- Conclusions

Reno and Bordeaux Experimental Conditions

Grapes harvested at 4 different °Brix levels at physiological maturity

Environmental Variable	BOD (2013)	RNO (2012)
Elevation (m)	25	1,373
Average Daily Solar Radiation (kW-hr m^{-2})	1.17	5.86
Day length Starting Harvest Date	12:25:36	12:38:34
Day length Ending Harvest Date	11:20:57	11:57:37
Maximum Temperature Starting Harvest Date	19	30.5
Minimum Temperature Starting Harvest Date	13	13.9
Maximum Temperature Ending Harvest Date	18	27.8
Minimum Temperature Ending Harvest Date (°C)	11	6.7
Ave September Maximum Temperature (°C)	23.9	30.2
Ave September Minimum Temperature (°C)	13.9	10.2
Latitude	44°47’23.83’’ N	39°52’96’’ N
Longitude	0°34’39.3’’ W	119°81’38’’ W
September Precipitation (mm)	65.5	2.03
Average Monthly Relative Humidity (%)	74	34
Soil Type	Gravelly soil	Sandy Loam
Soil pH	6.2	6.7
Root stock	SO4	Own-rooted

RNA-seq analysis of berry skins using Illumina technology

Experimental Design

- Three experimental replicates collected for berry skins at 4° Brix levels at or near physiological maturity for grapes of the respective location
- BOD = 19.5, 20.5, 21.5, and 22.5 °Brix
- RNO = 20, 22, 24 and 26 °Brix

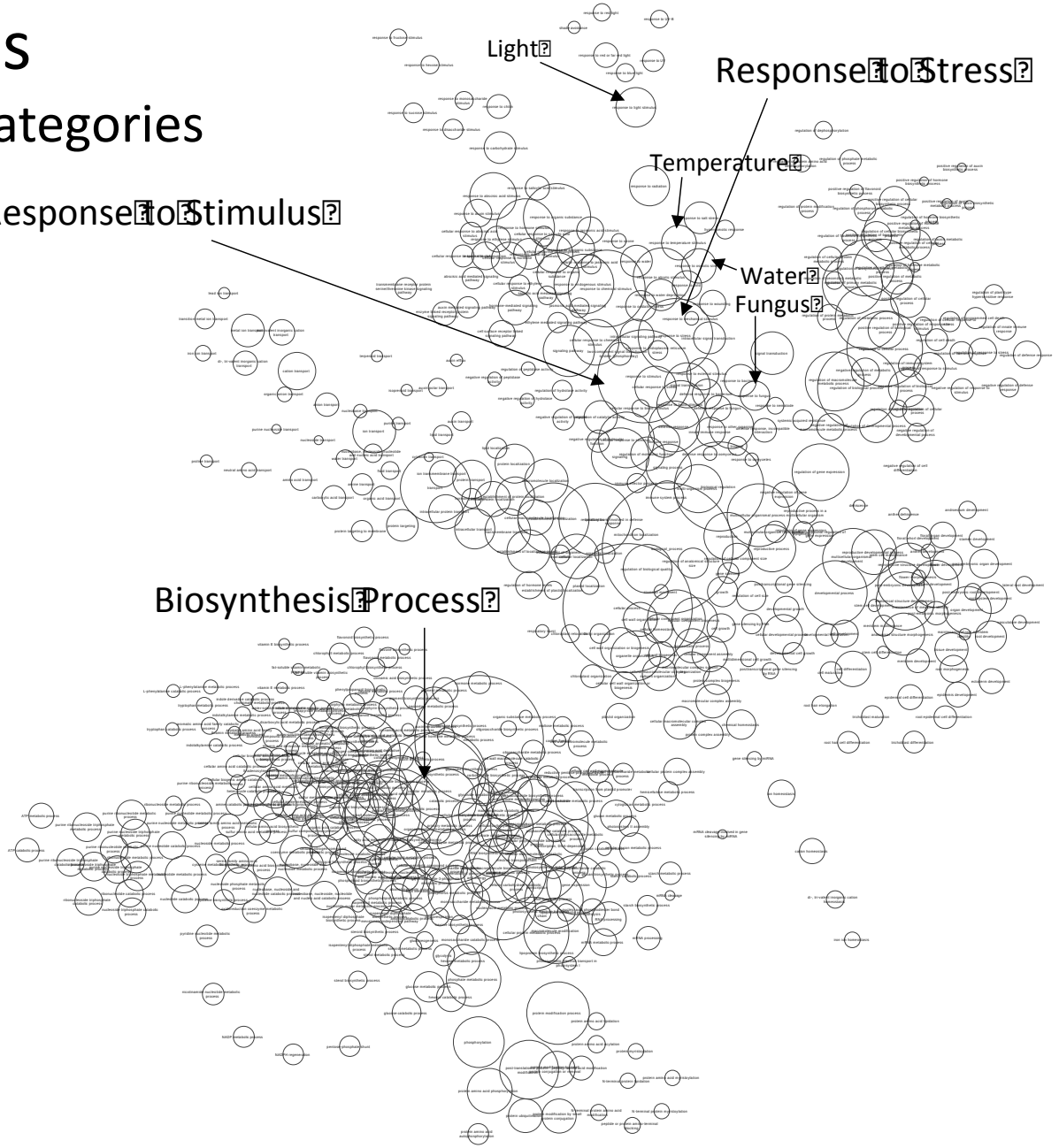
Transcriptomic Method

- 50 bp Illumina reads
- Read alignment using the V2 assembly of the PN40024 *Vitis vinifera* reference genome
- Transcripts per million (TPM) calculated using Salmon
- Differentially expressed genes (DEGs) determined using DESeq2
- Gene Set Enrichment Analysis (GSEA) performed with BinGO

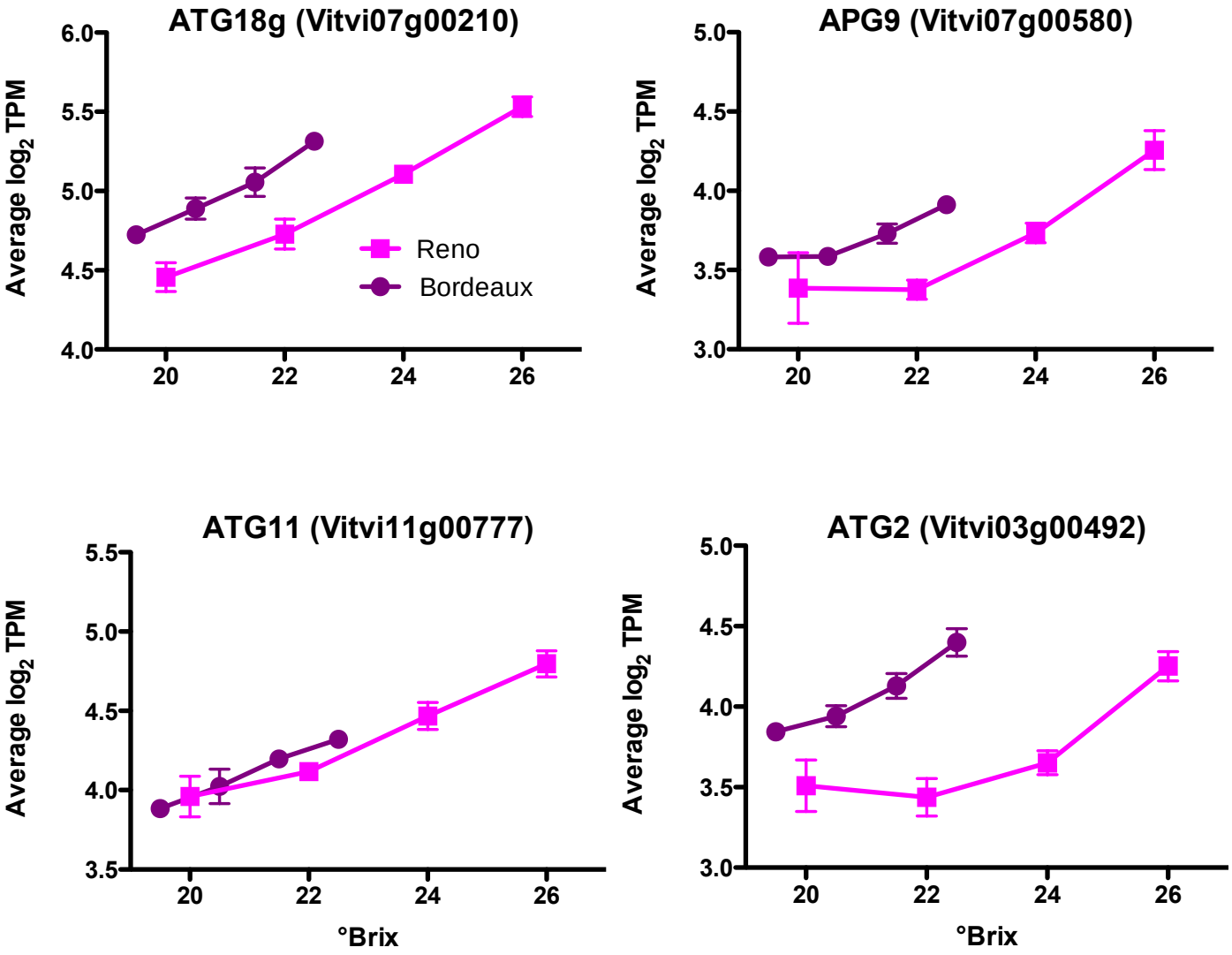
Gene Ontology Enrichment

4455 DEGs

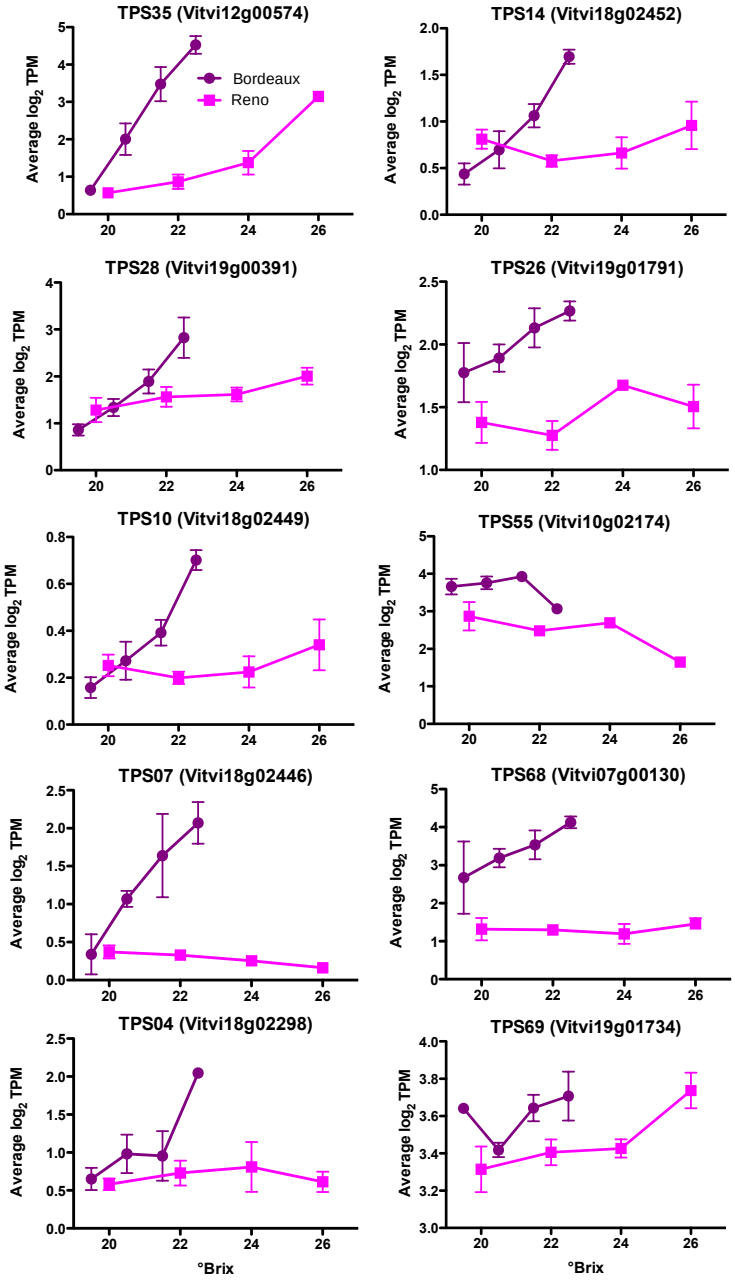
100s of GO categories



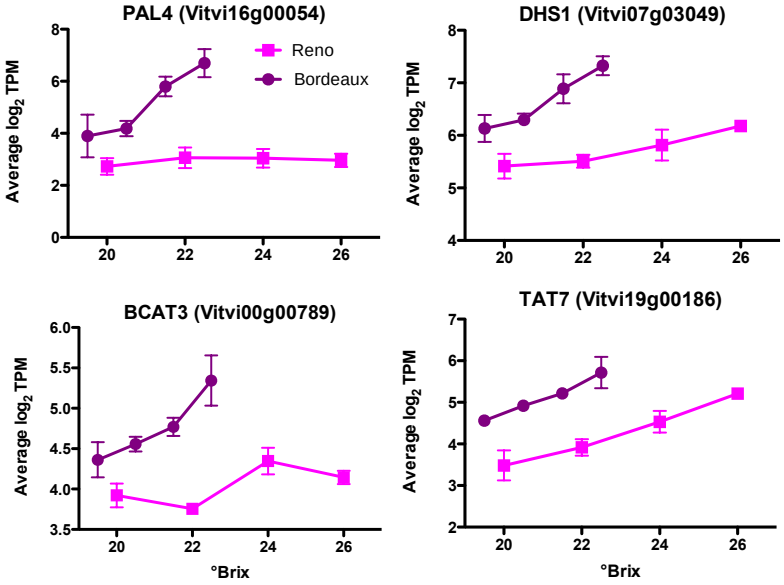
Autophagy genes indicate BOD grapes ripen at lower sugar levels than RNO grapes



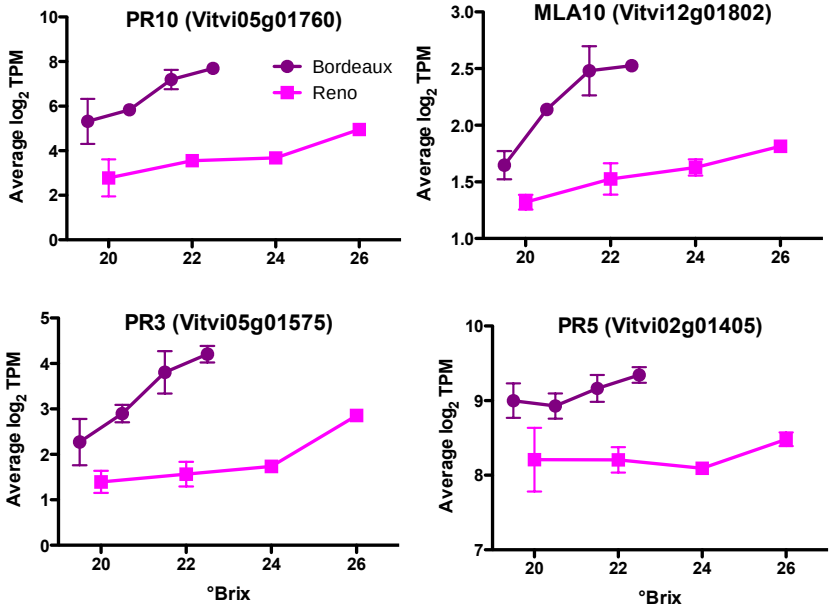
Terpene Synthases



Phenylpropanoid Metabolism

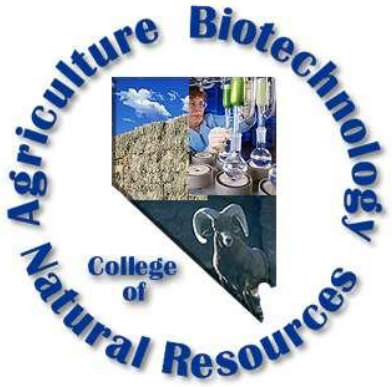


Powdery Mildew Responsive



Conclusions

1) BOD berries reached maturity at lower sugar levels than RNO berries
2) Transcriptomic responses were dynamic and very sensitive to the environment
3) Temperature, light, water status and fungal infection were identified as some of the most influential factors affecting DEGs
4) Many flavor- and aroma-associated pathways were differentially affected



Acknowledgements

University of Nevada, Reno

Noé Cochetel

Ryan Ghan

University of Bordeaux

Serge Delrot

Agnès Destrac-Irvine

Aude Habran