

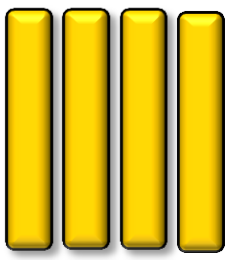
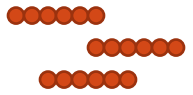
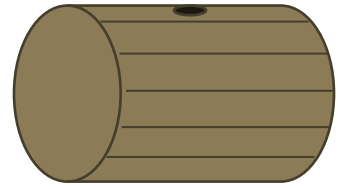
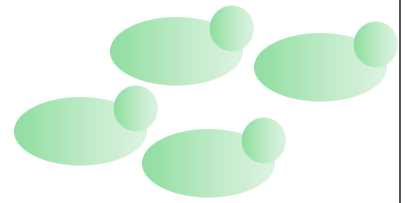
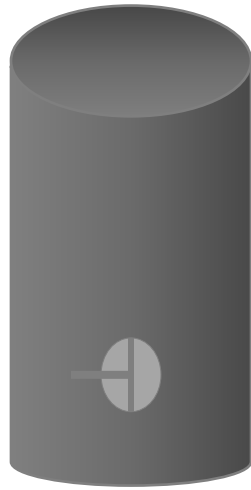
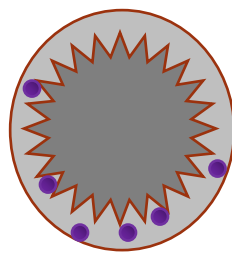
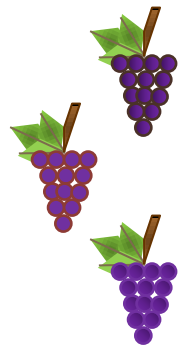
# Comparisons of yeast from wine, sake and brewing industries

Dr. Chandra Richter

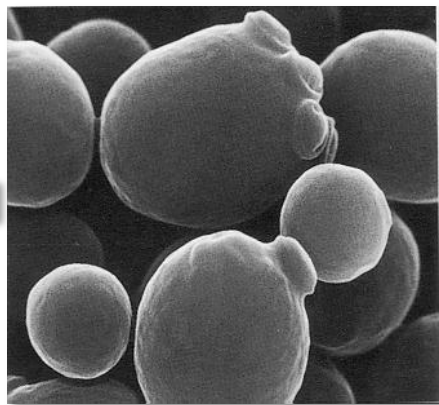
MBAA Northwest District Spring Meeting

June 1<sup>st</sup>, 2012

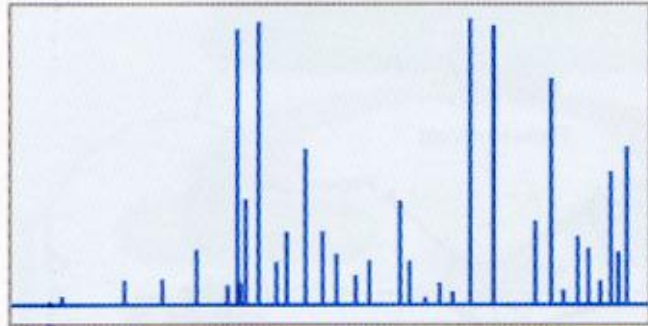
# Winemaking



# Winemaking



# Yeast make more than alcohol

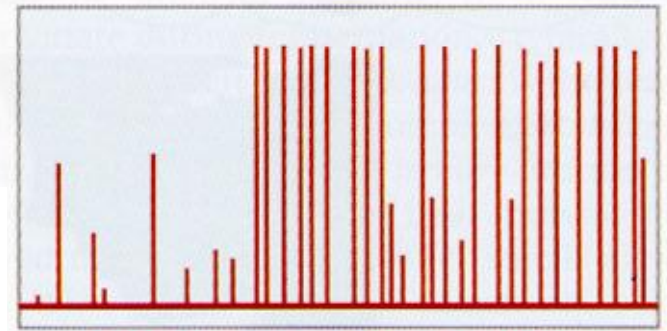


Volatile compounds in grape juice

*Saccharomyces cerevisiae*

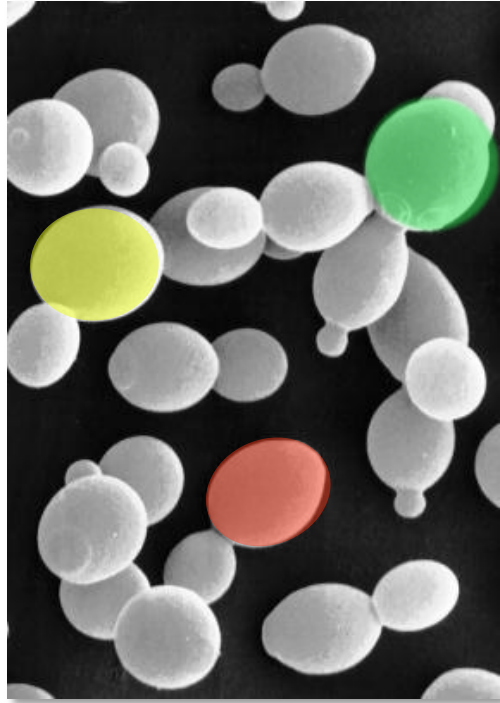


Fermentation



Volatile compounds in wine

# Do genomic differences result in product differences?



Adapted from Borneman et al 2008

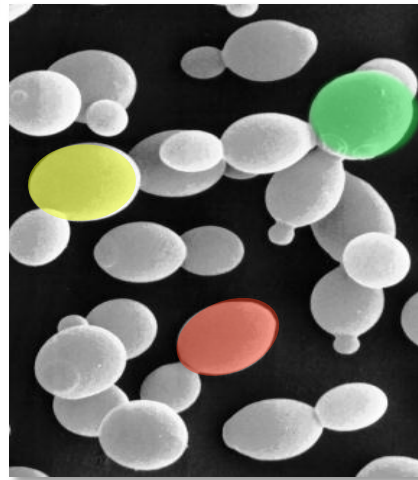
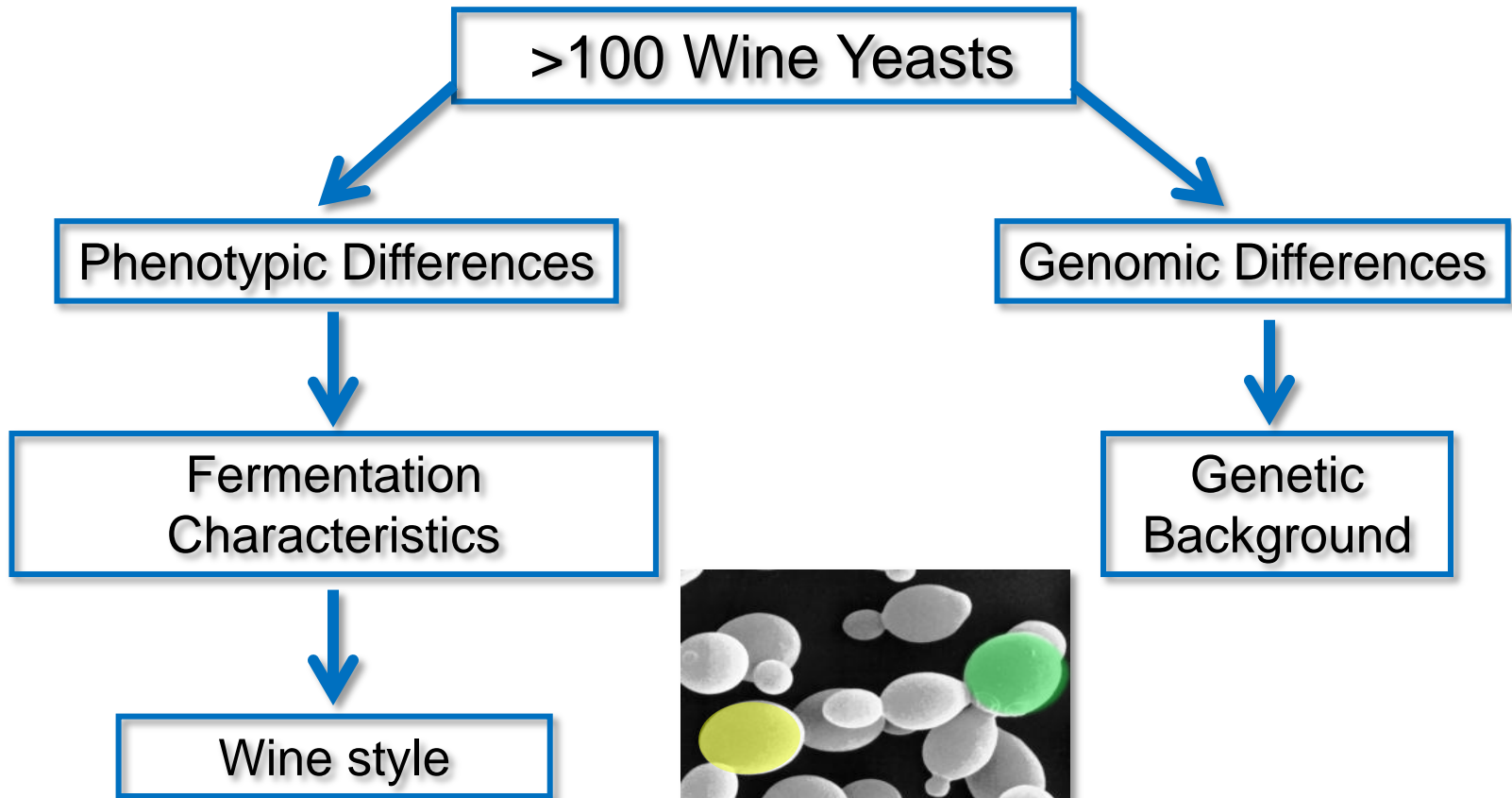


# Commercial Wine Yeasts

- Over 200
- Prices range \$2-90/lb
- Isolated from native ferments
- Sold as active dry yeast

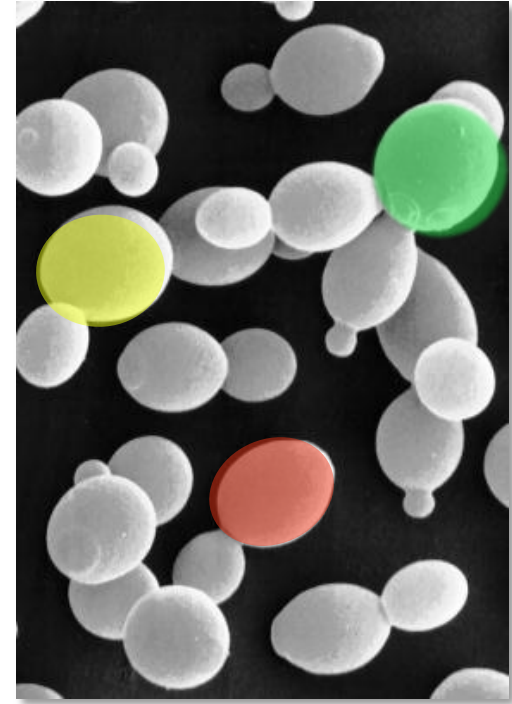


# Genomic and Phenotypic Differences



# Commercial Wine Yeast Strains

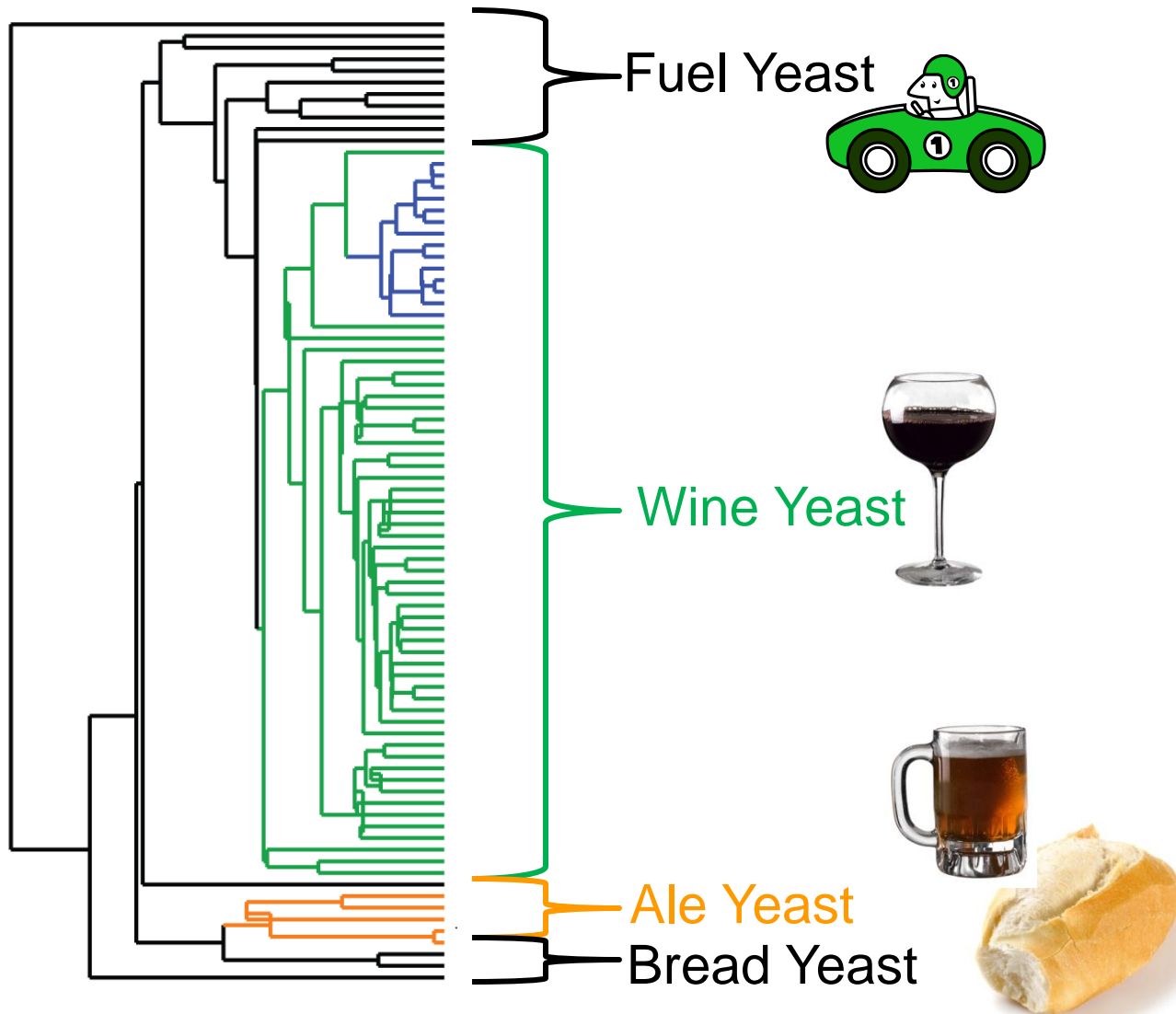
- Wine yeast selected for:
  - Temperature tolerance
  - pH tolerance
  - Low sulfur-compound production
  - Ability to ferment to dryness
  - Flavor and Aroma production



Not a lot of diversity among wine yeast.  
Could other industrial strains add diversity?



# Industrial Yeast Strains



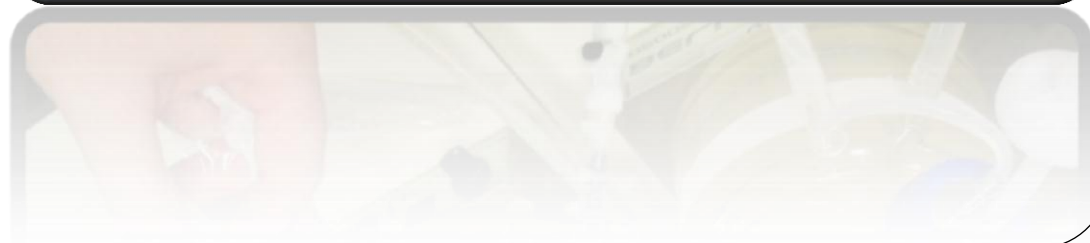
Dunn et al, 2012  
Genome Research

# Industrial Yeast

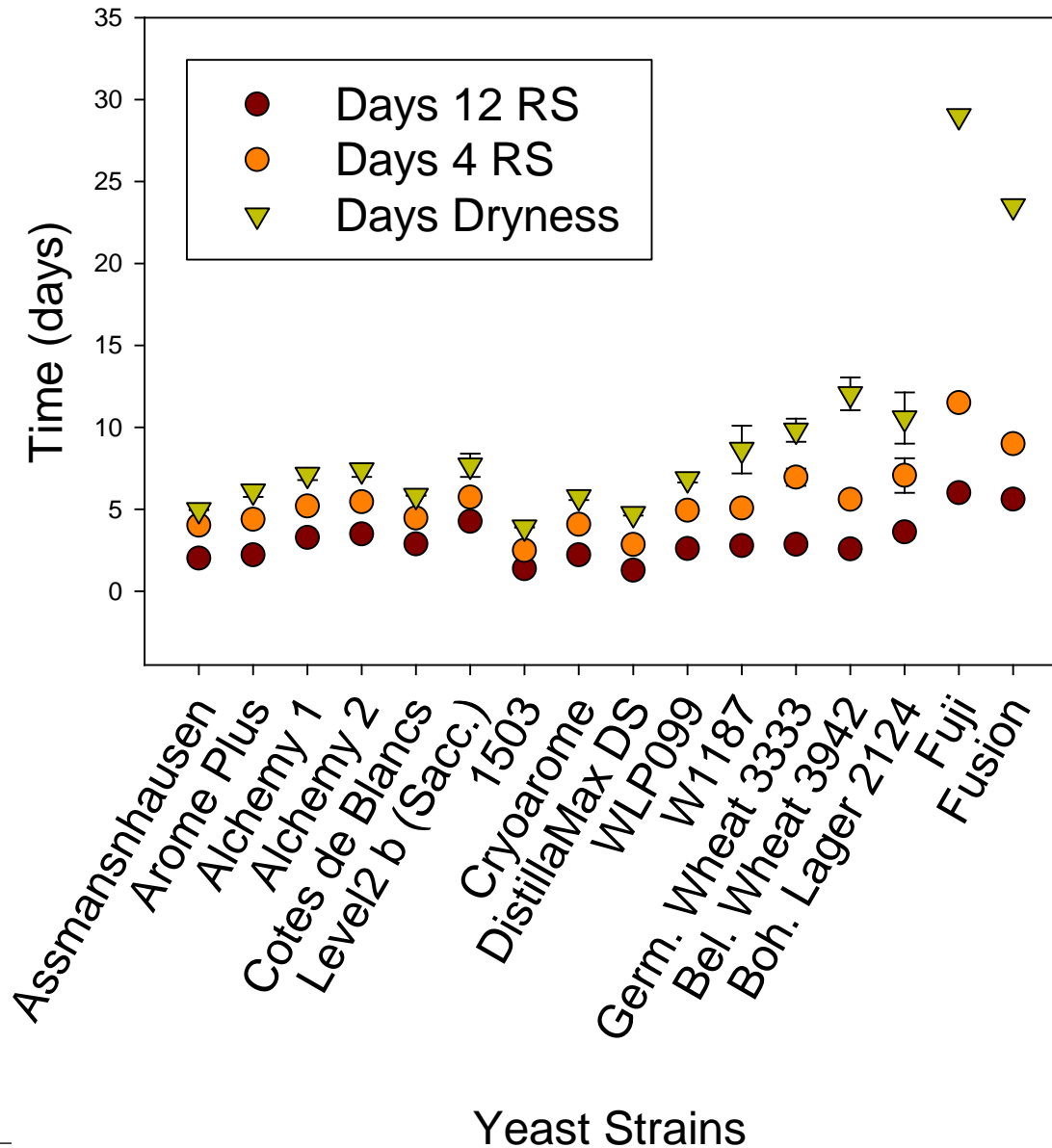
Yeast	Type	Producer
Assmanhausen	Wine	Enartis/Vinquiry
Arome Plus	Wine	AEB
Alchemy 1	Wine	AWRI/Anchor
Alchemy 2	Wine	AWRI/Anchor
Cotes de Blancs	Wine	Red Star
EZFerm44	Wine	Enartis/Vinquiry
Level 2b	Wine	Lallemond
1503	Wine	Maurivin
Cryoarome	Wine	AEB
DistillaMax	Distilling	Lallemond
WLP099	Beer	White Labs
W1187	Beer	Wyeast
Germ. Wheat 3333	Beer	Wyeast
Bel. Wheat 3942	Beer	Wyeast
Boh. Lager 2124	Beer	Wyeast
Fusion	Sake	Maurivin
Fuji	Sake	Maurivin

# Laboratory-Scale Winemaking

- Chardonnay  
(24RS/1.103 SG)
- 1.5 L fermentations
- 3 Replicates
- Temperature  
Controlled
- Constant agitation
- $5 \times 10^6$  cells/ml
- Sample daily
- Taste



# Fermentation Rate

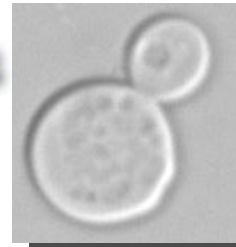
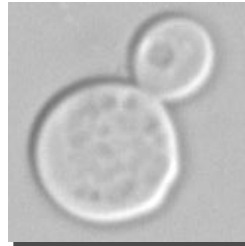


# Wine Chemistry

Yeast	Type	Days Dryness	Max Cell Density Wine	% YAN Consumed	Final VA (g/100mL)	Total SO2 (ppm)
Assmanhausen	Wine	5	102	91%	0.005	13
Arome Plus	Wine	6	172	96%	0.005	22
Alchemy 1	Wine	7	166	97%	0.004	28
Alchemy 2	Wine	7	139	97%	0.004	28
Cotes de Blancs	Wine	6	214	94%	0.056	21
EZFerm44	Wine	7	109	96%	0.007	19
Level 2b	Wine	6	153	96%	0.010	31
1503	Wine	5	129	93%	0.008	10
Cryoarome	Wine	4	162	96%	0.015	15
DistillaMax	Distilling	8	104	98%	0.010	8
WLP099	Beer	6	149	96%	0.019	52
W1187	Beer	9	162	92%	0.014	6
Germ. Wheat 3333	Beer	10	87	96%	0.015	23
Bel. Wheat 3942	Beer	12	91	93%	0.033	14
Boh. Lager 2124	Beer	11	96	96%	0.003	25
Fusion	Sake	24	56	80%	0.043	57
Fuji	Sake	29	80	68%	0.050	86

# Types of Aroma in Wine

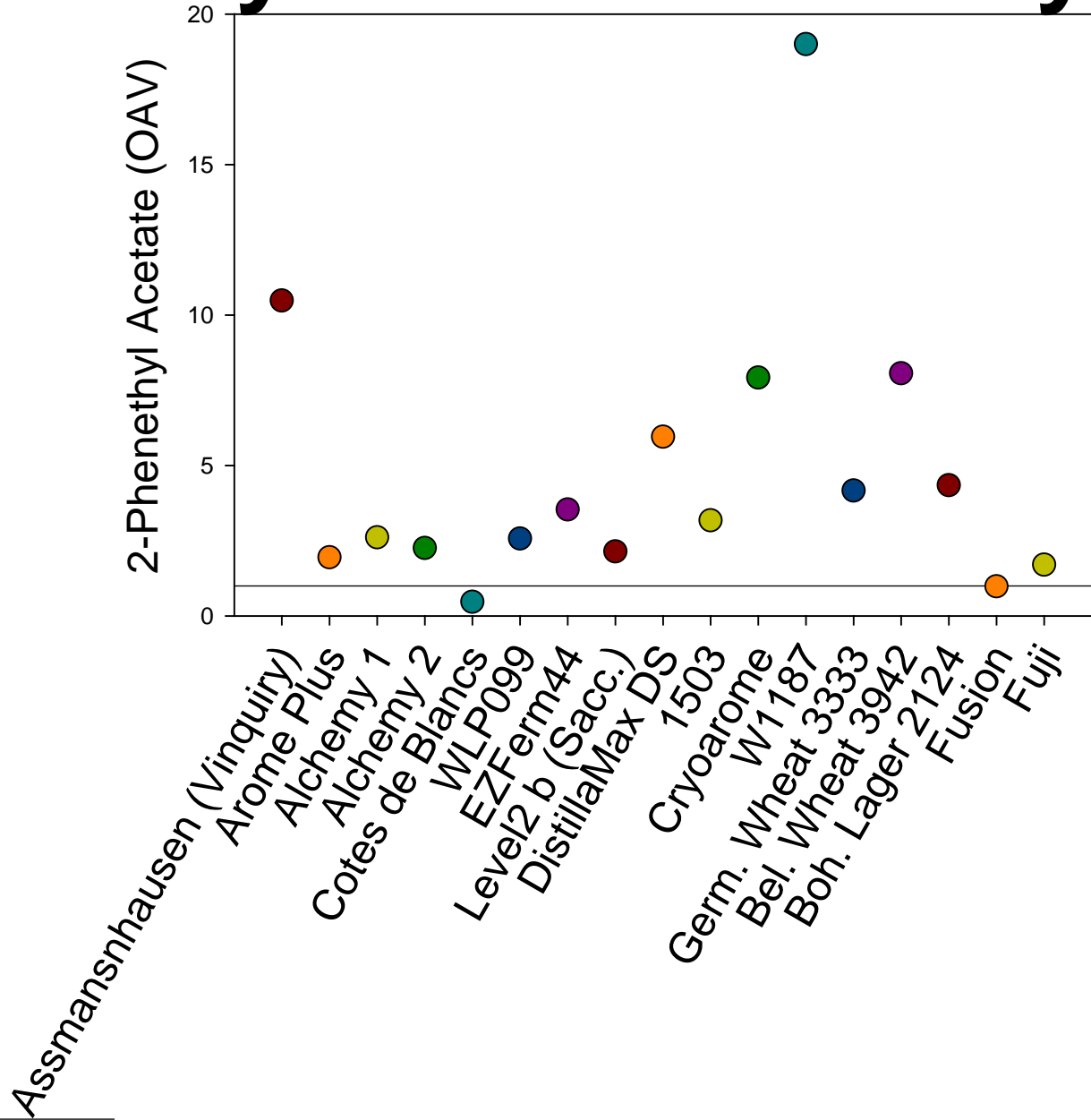
- 1) Derived by yeast
- 2) Modified by yeast
- 3) Grape compounds



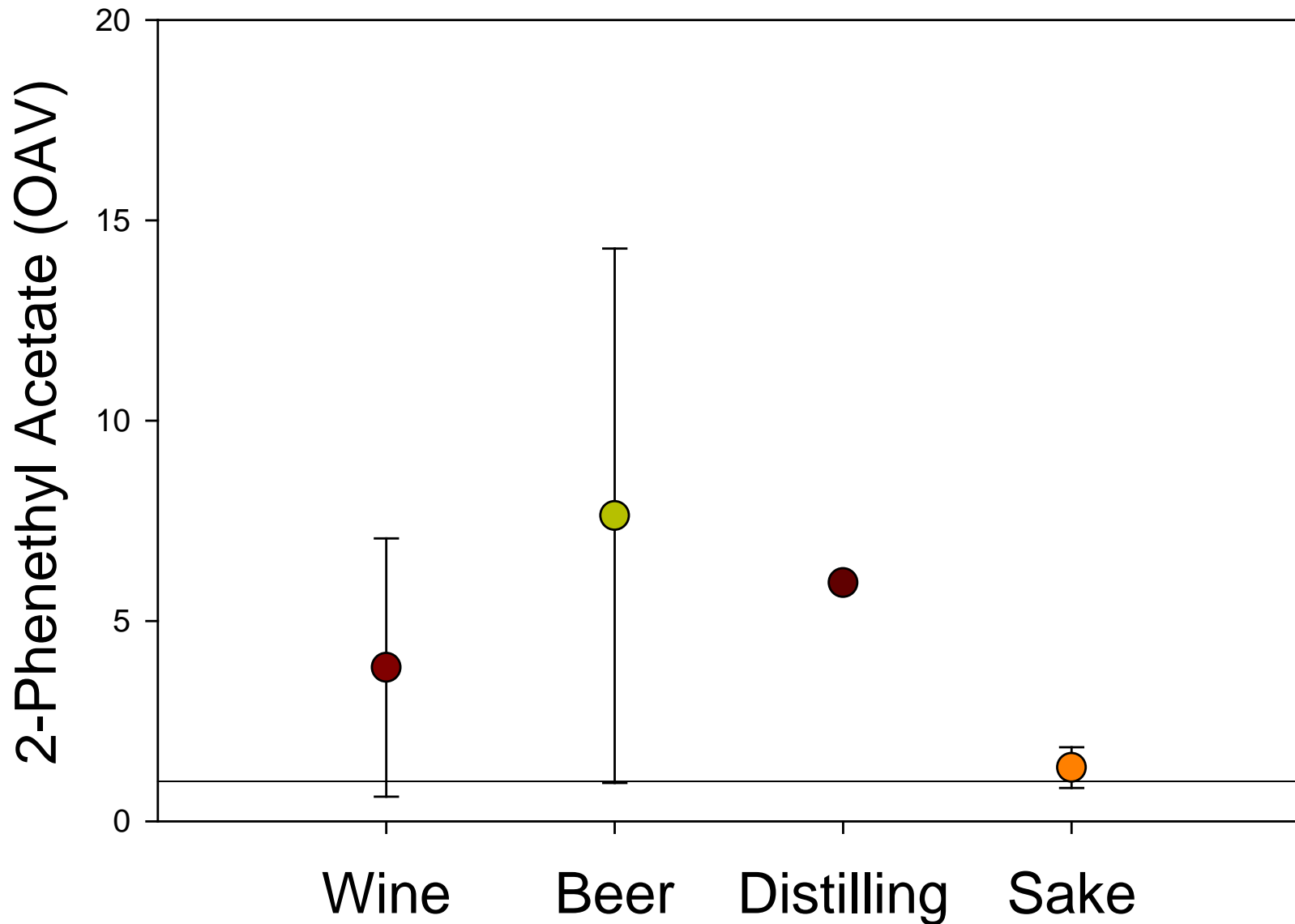




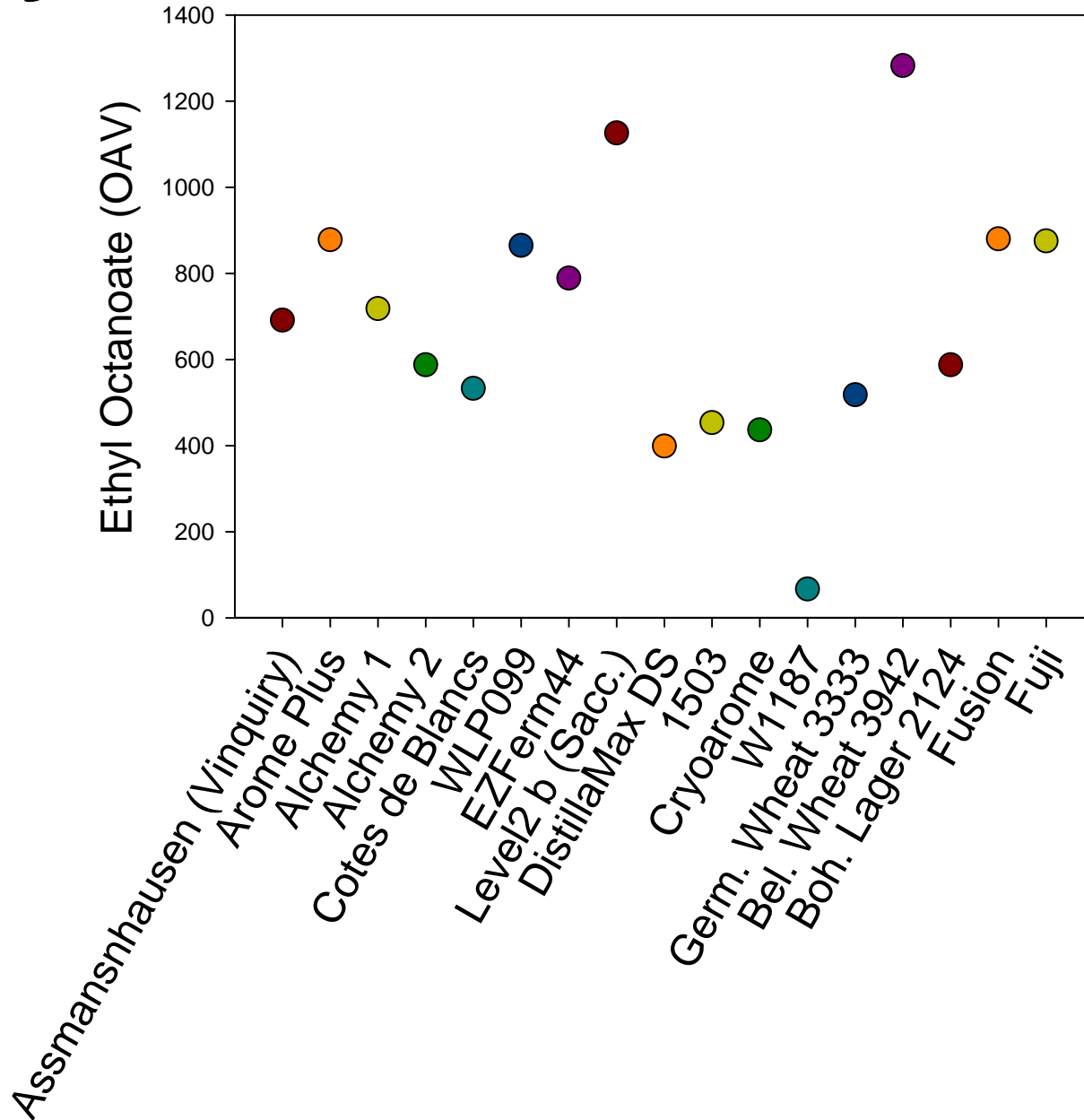
# 2-Phenethyl Acetate: Honey, Rose



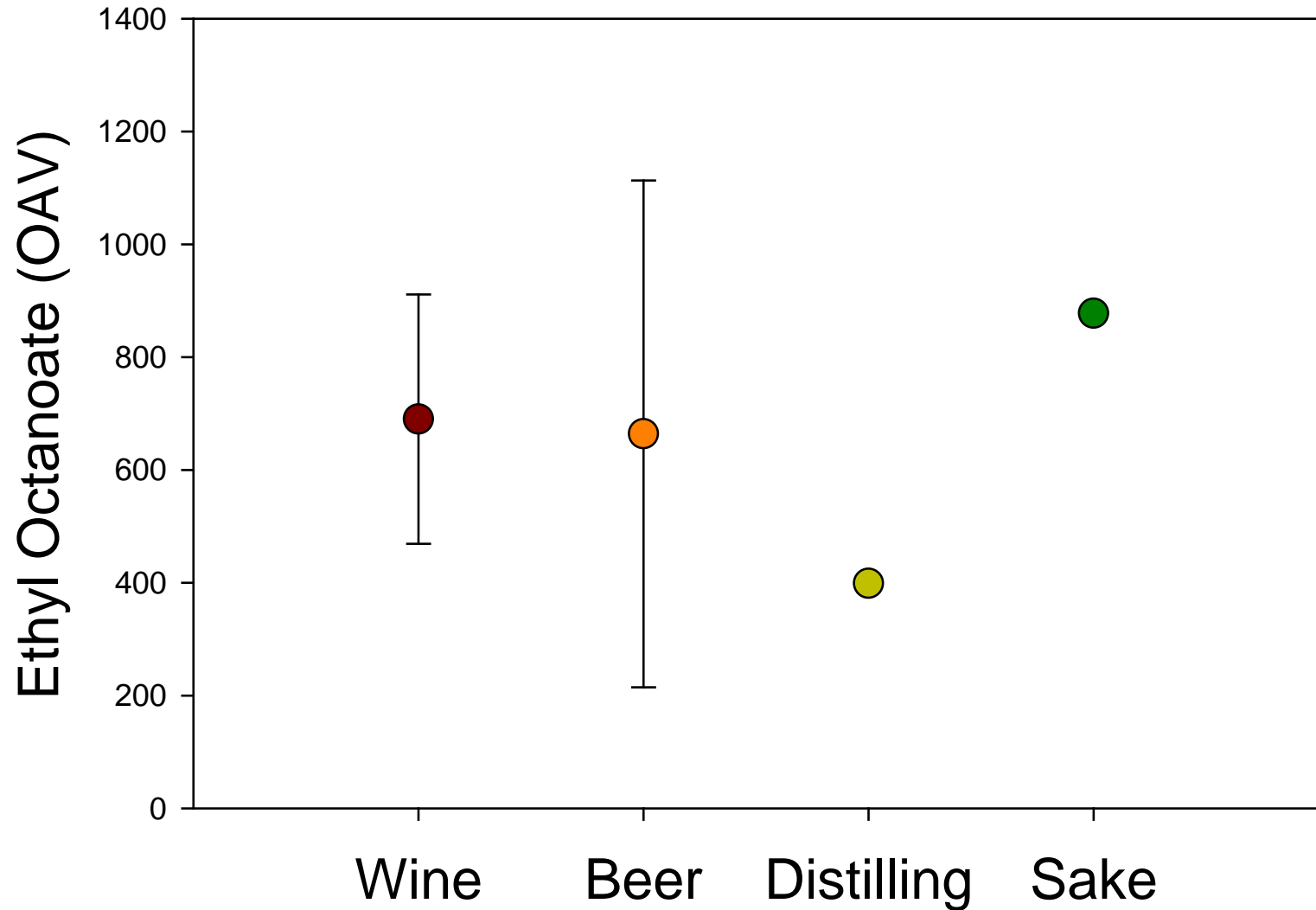
# 2-Phenethyl Acetate: Honey, Rose



# Ethyl Octanoate: Fruit, Grape



# Ethyl Octanoate: Fruit, Grape



# Greater Diversity in Brewing Yeasts

## Wine Yeast

- Temperature tolerance
- pH tolerance
- Low Sulfides
- Ferment to dryness
- Flavor and Aroma



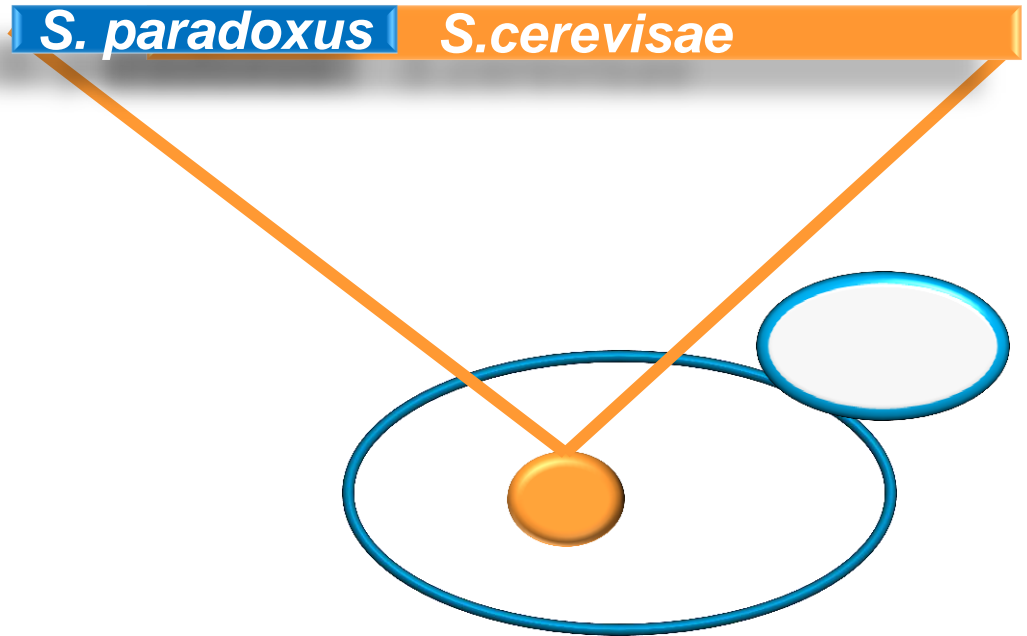
## Brewing Yeast

- Temperature controlled
- Higher pH
- Off notes
- Ferment to target
- Diverse Flavor and Aroma





# Sake Yeast and Foam Production



- *S. paradoxus* gene insertion
- Sake yeast genes
  - Foam production (*AWA1*)

# Conclusions

- Very little diversity in wine yeast strains
- More diversity in brewing yeast
- Alternative yeast strains do offer unique profiles
- Phenotypic evolution by industry

