AWRI

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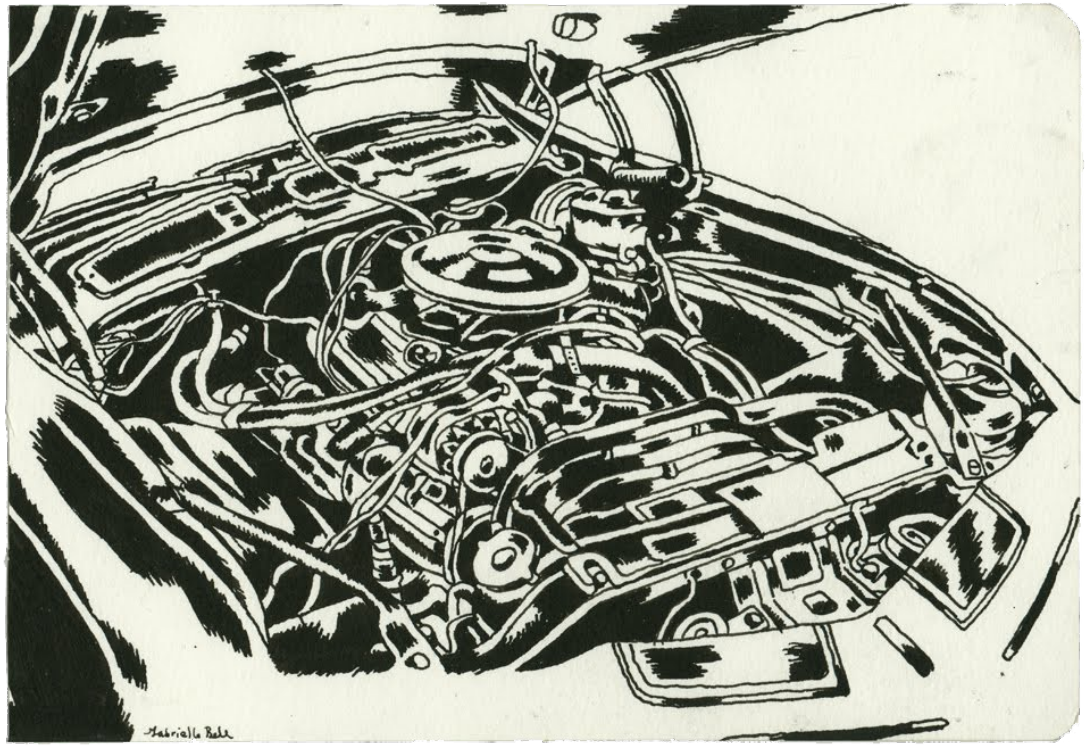
What's under the hood?



Genomic differences powering variation in primary fermentation

Simon Schmidt

Strain choice and the power of marketing

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Strain AwesomeX is generally recommended for red wine production, particularly varietal wines such as Shiraz/Syrah, Cabernet, Merlot and Pinot Noir.

In red grape juices, Strain AwesomeX produces blackberry, plum and raisin aromas.

Strain AwesomeY is recommended for its ability to develop the quintessence of the Chardonnay grape variety.

Strain AwesomeY produces wines with mouth feel whilst developing the most typical flavours of the variety: citrus flavours (lemon and grapefruit) as well as tropical fruit flavours.

Yeast genetic diversity

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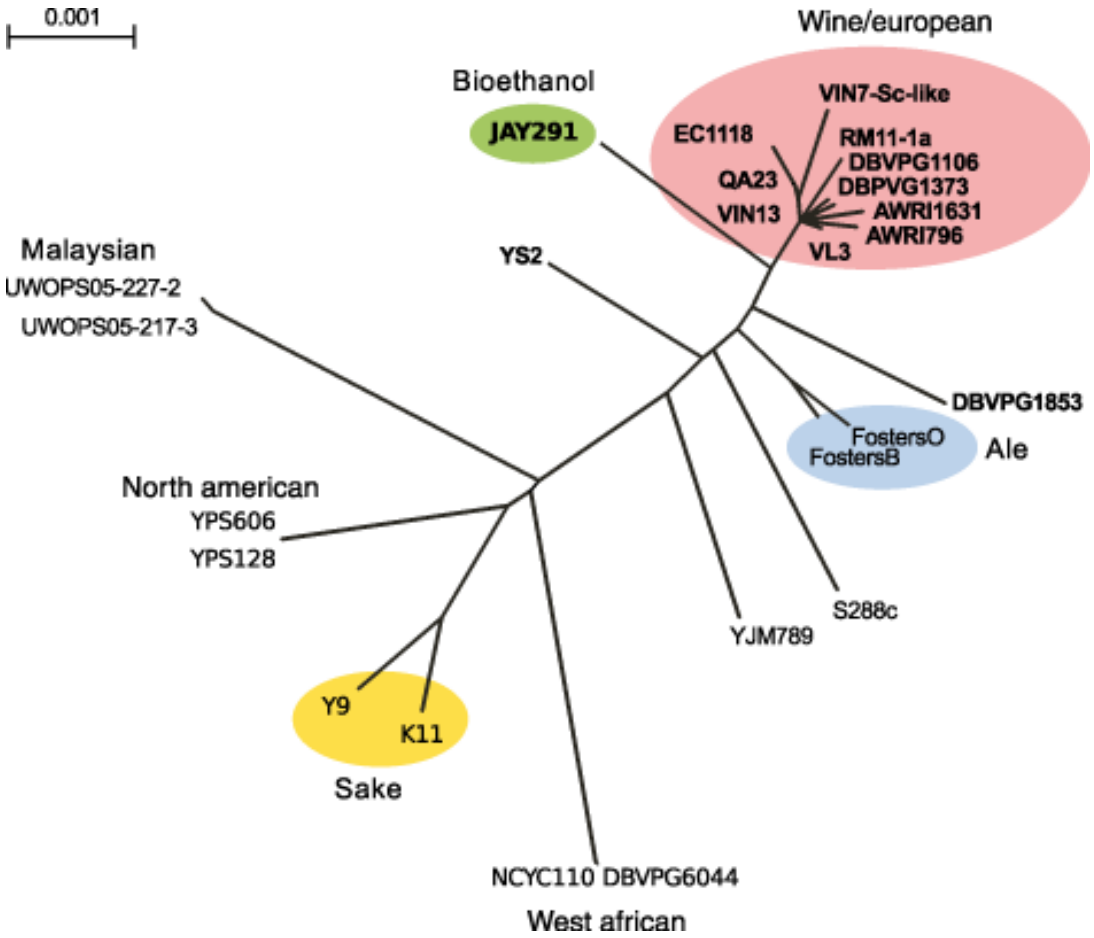

- Anecdotal understanding of wine yeast relationships
- Clouded history of strain "sharing"
- re-badging / re-selling
- Limited data about historical isolates

Borneman et al (2012) FEMS Yeast Research 12(1):88-96

Diversity of wine yeast characteristics

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- Responses to low pH and SO_2
  - Slow start to fermentation
- Oxygen limitation during fermentation
  - Sluggish and stuck ferments

Impact of pH and SO2 is yeast strain dependant

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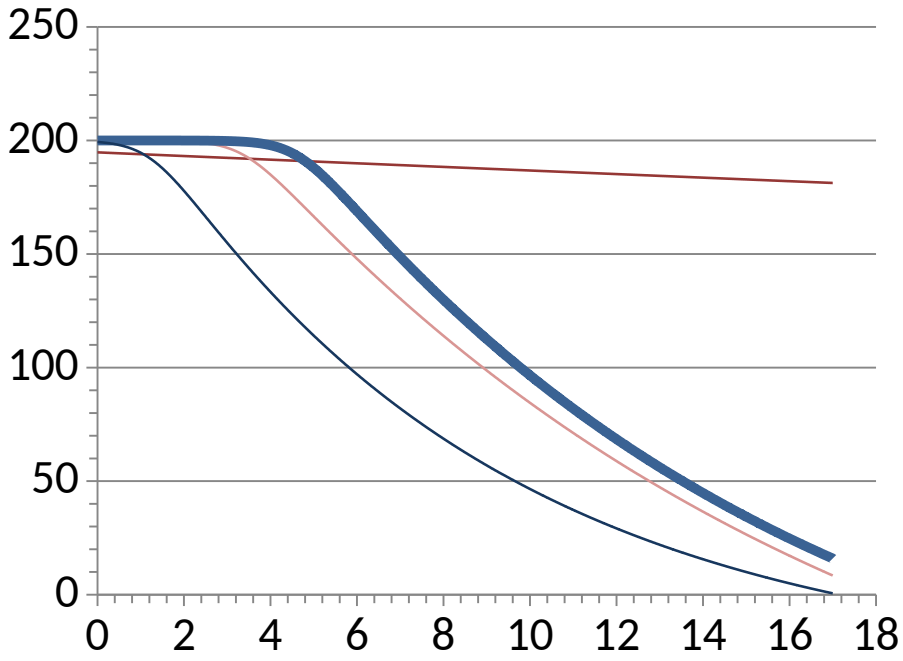

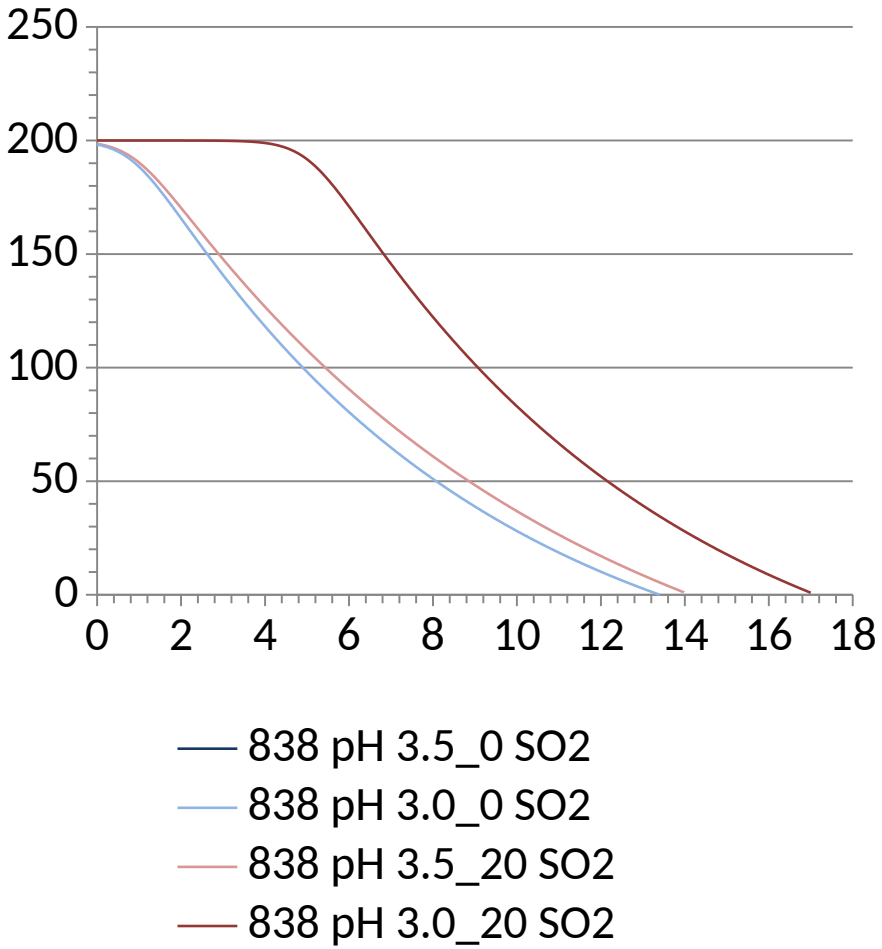

Long lag due to reduced viability following inoculation

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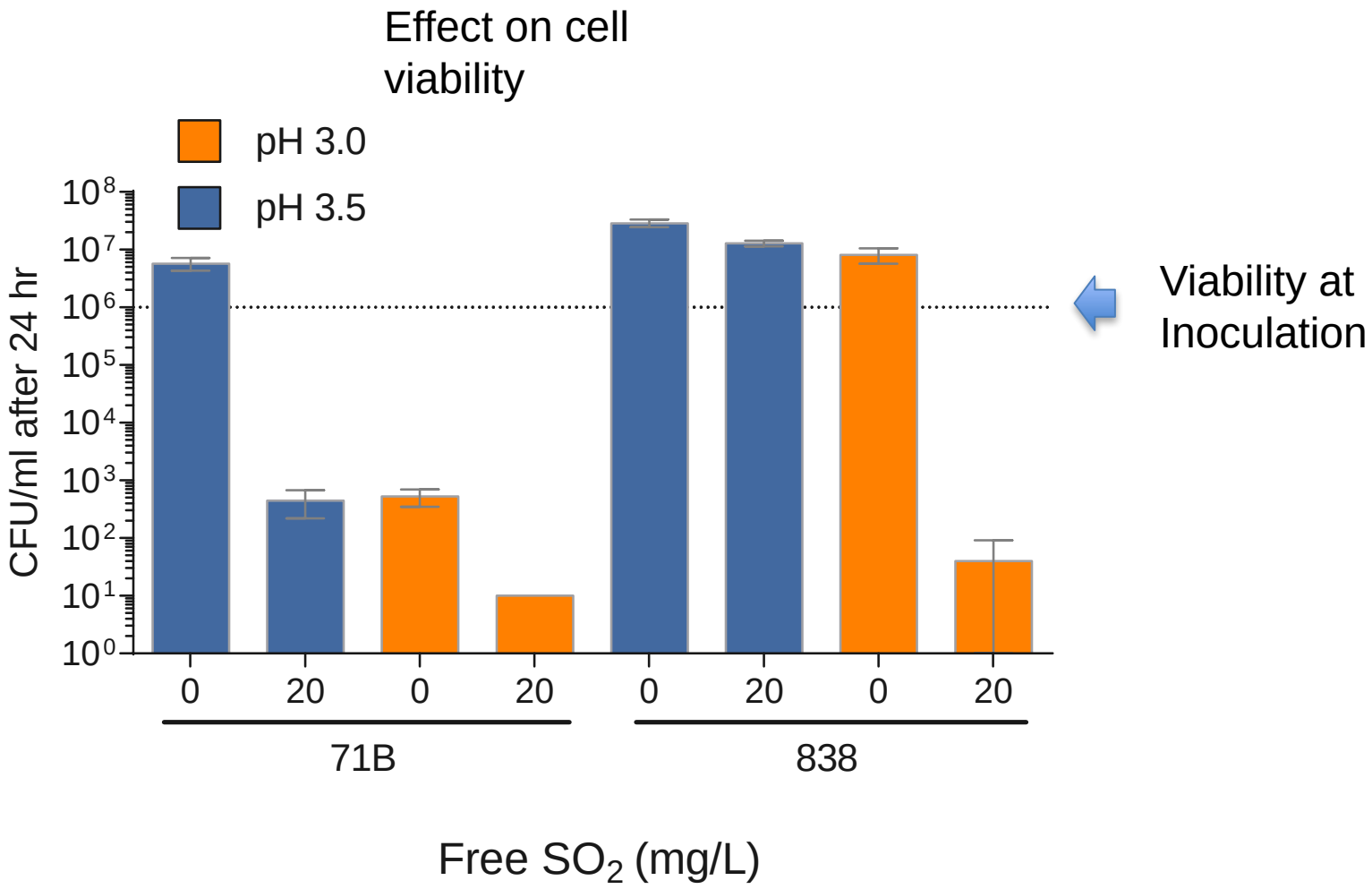

Moderate conditions can also affect sensitive strains

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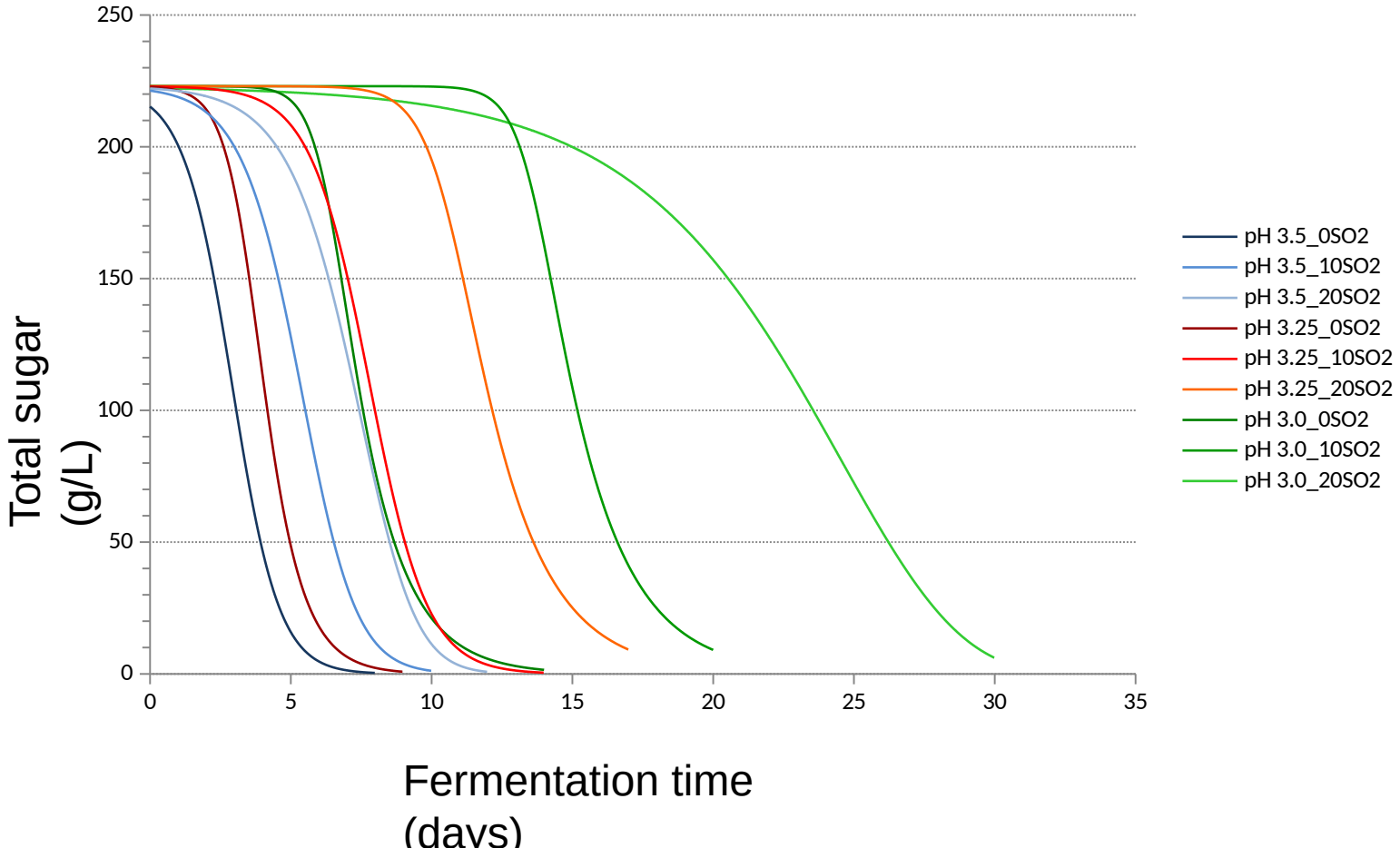
The effect of incremental changes in pH and SO2 on
fermentation of Chardonnay juice by 71B



Sensitivity not limited to a single strain

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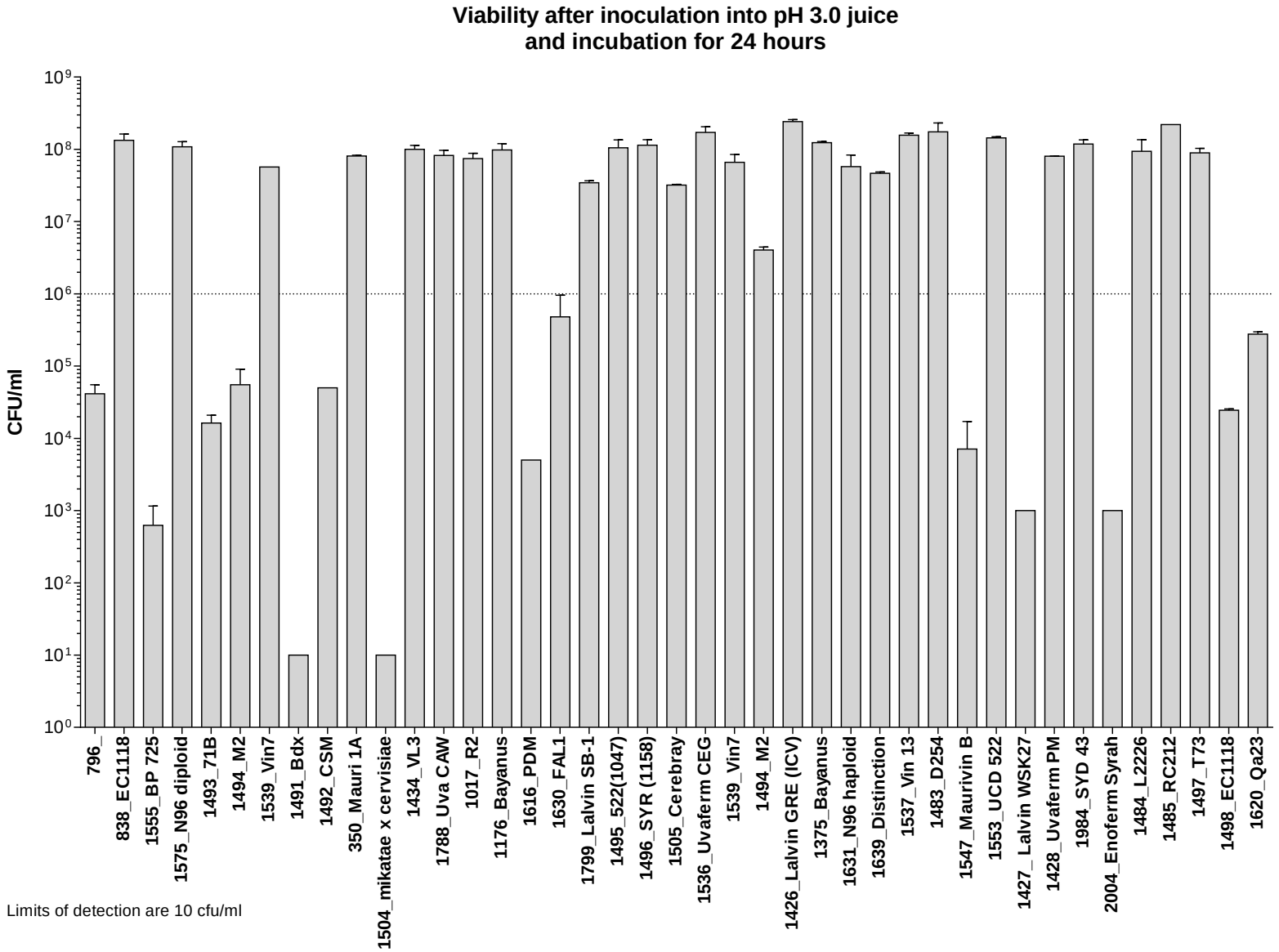

Limits of detection are 10 cfu/ml

Stimulation of sluggish ferments

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Controlled use of oxygen

- Oxygen content of juice at inoculation can vary
  - Degree of protection during preparation
  - Time between preparation and inoculation
- Oxygen exposure during ferment
  - Fermentation type
  - Winery practices
  - Winery hardware

Impact of winery operations on dissolved oxygen in juice and fermenter

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"Device"	DO before	DO steady state	
Pump ove			enter
Pump ove			or
Plunging			enter
"Airdraw t			
In-line spa			
Open tap			ninoc.
crack the			
Venturi	0.9%	42%	110+ SWAP fermenter

Effect of plunging and pump-over on ferment dissolved oxygen

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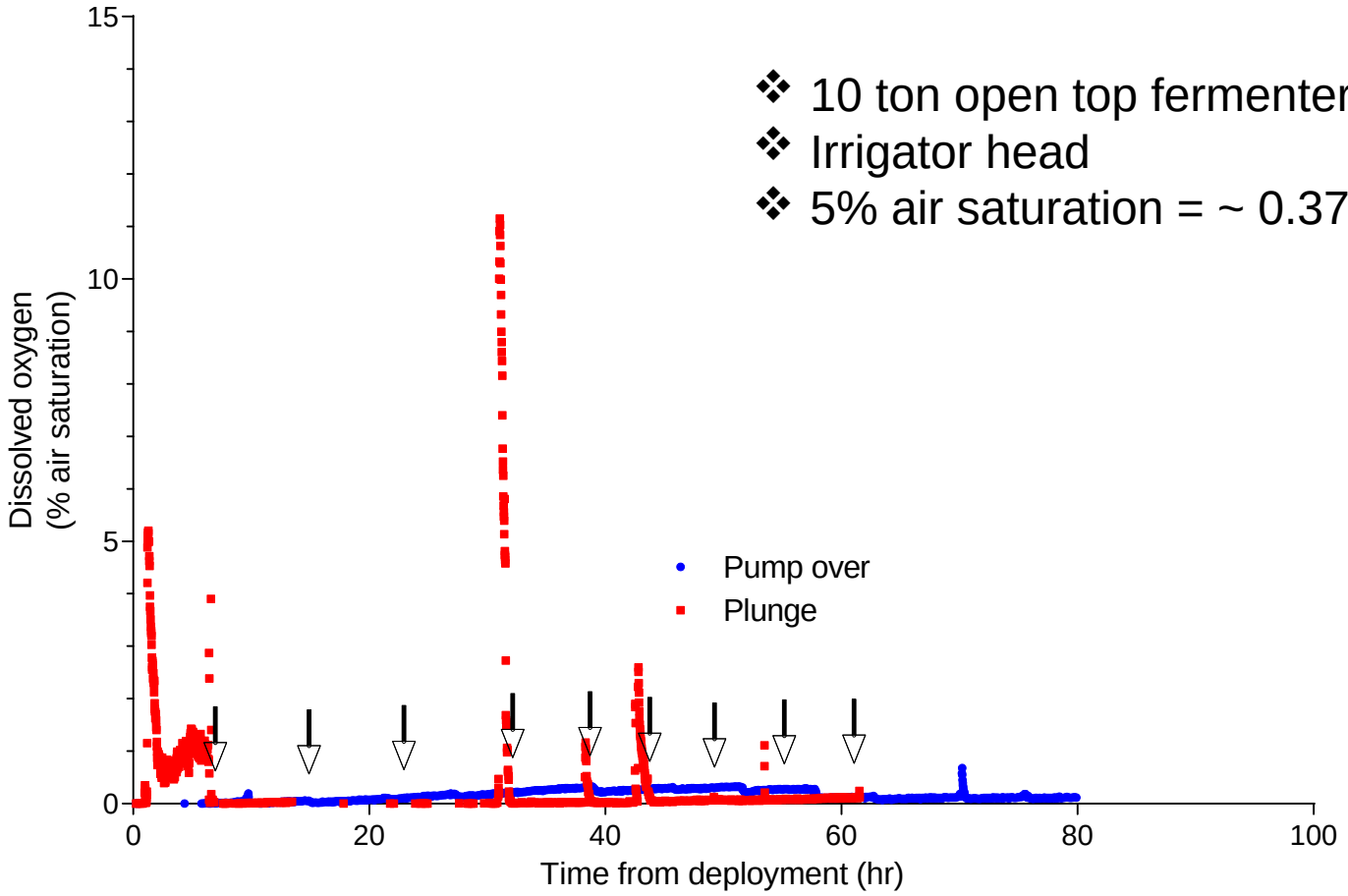

- 10 ton open top fermenter
- Irrigator head
- 5% air saturation = ~ 0.375 mg/L O_2

Rigorous exclusion of oxygen can cause stuck fermentations

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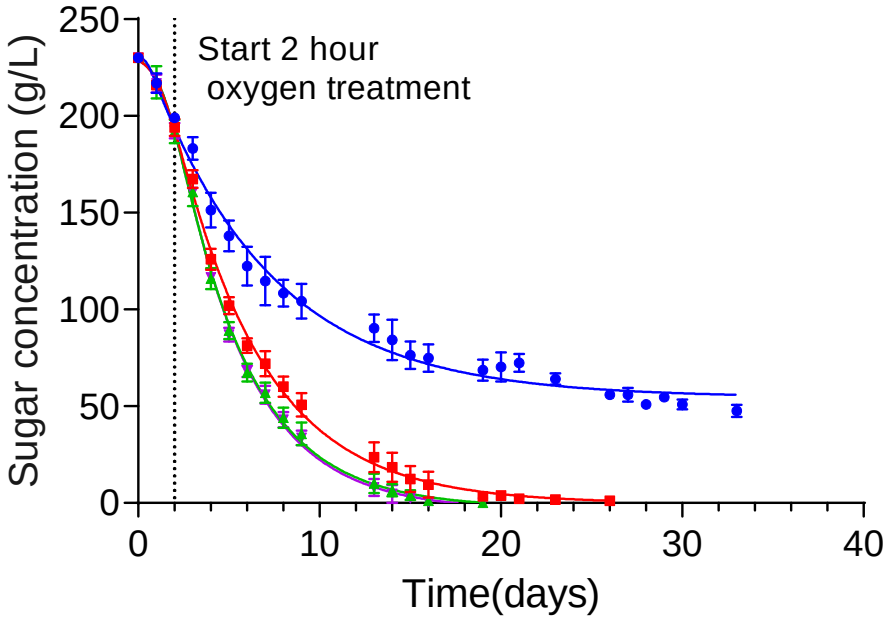
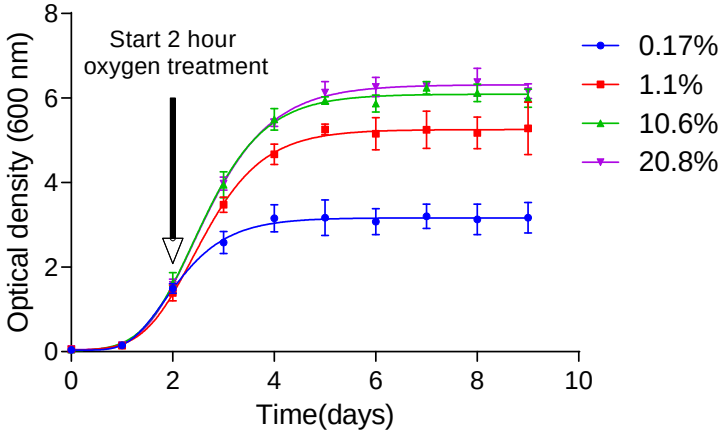
Sugar consumption

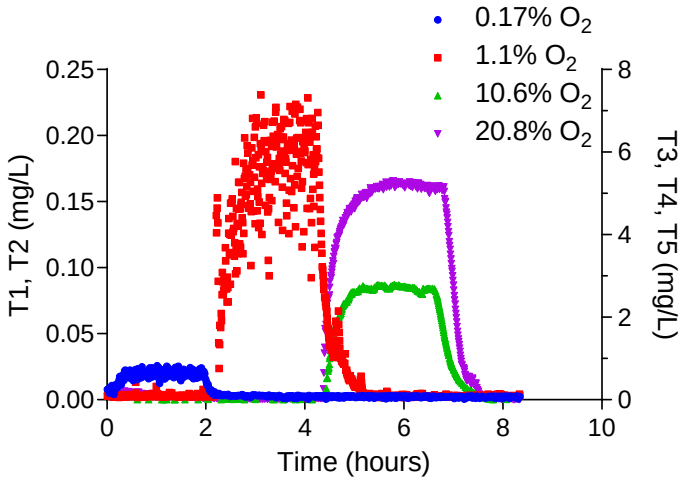


[O2 input]	dO_2 achieved	O_2 consumed
0.17%	0.02 mg/L	0.14 mg/L
1.1%	0.19 mg/L	9.0 mg/L
10.6%	2.7 mg/L	65 mg/L
20.8%	5.2 mg/L	116 mg/L

Biomass formation



Dissolved oxygen



Oxygen addition during fermentation can alter profile of fermentation volatiles

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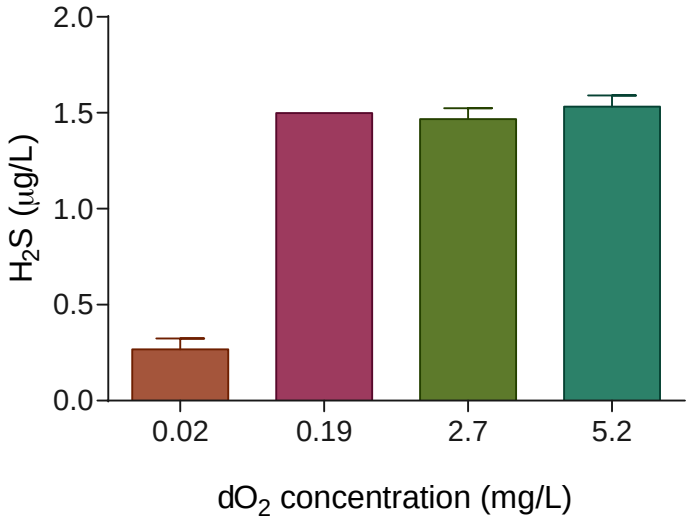

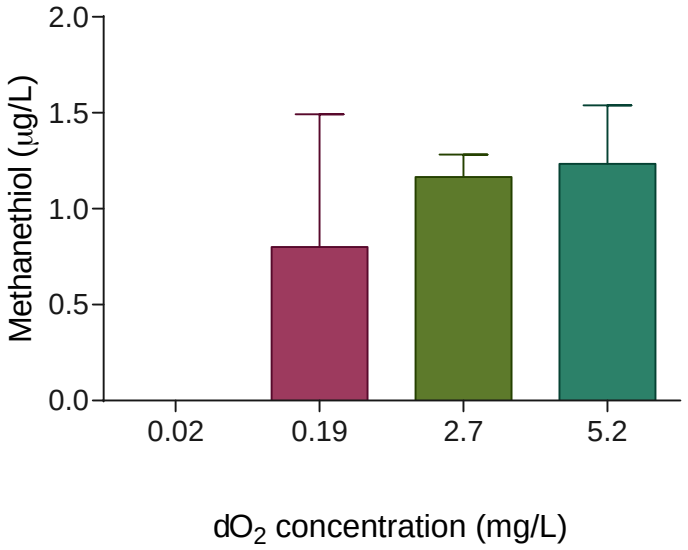

Diverse response by yeast to defined oxygen input

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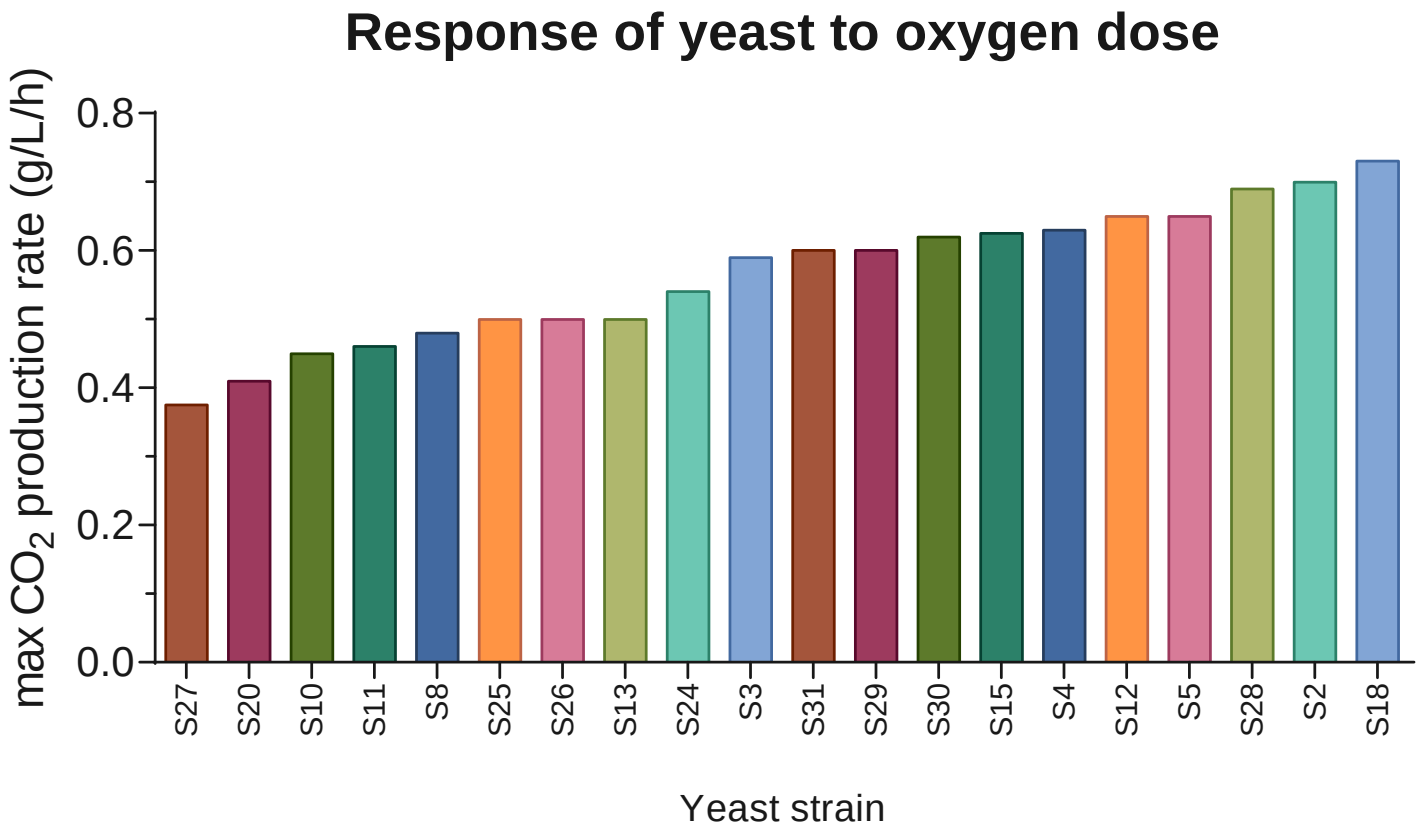

Reproduced from Julien et al (2000) 51:215-222

So…What's under the Hood of a yeast?

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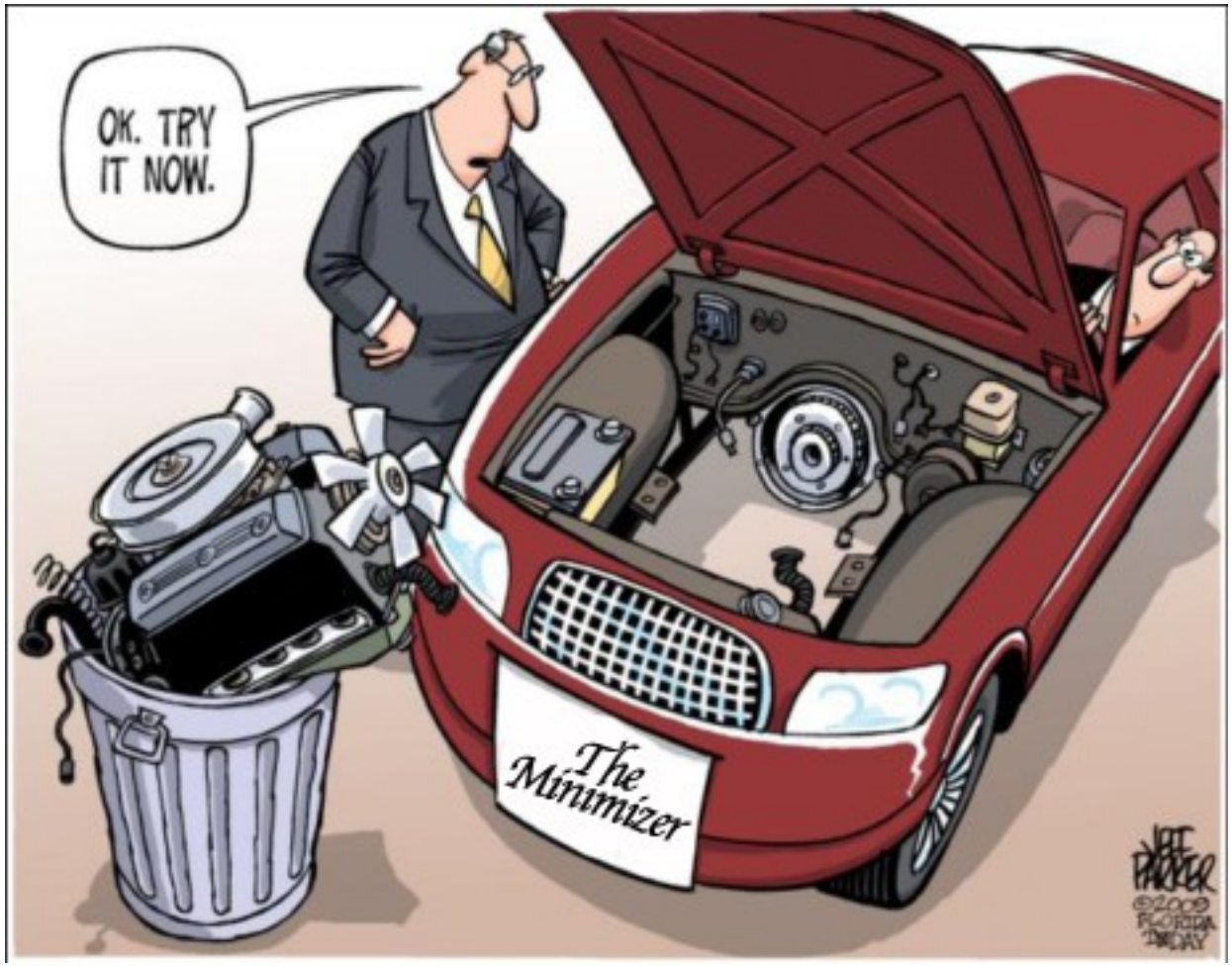
And how do we start to understand it?



Using whole genome sequencing to explore wine yeast diversity

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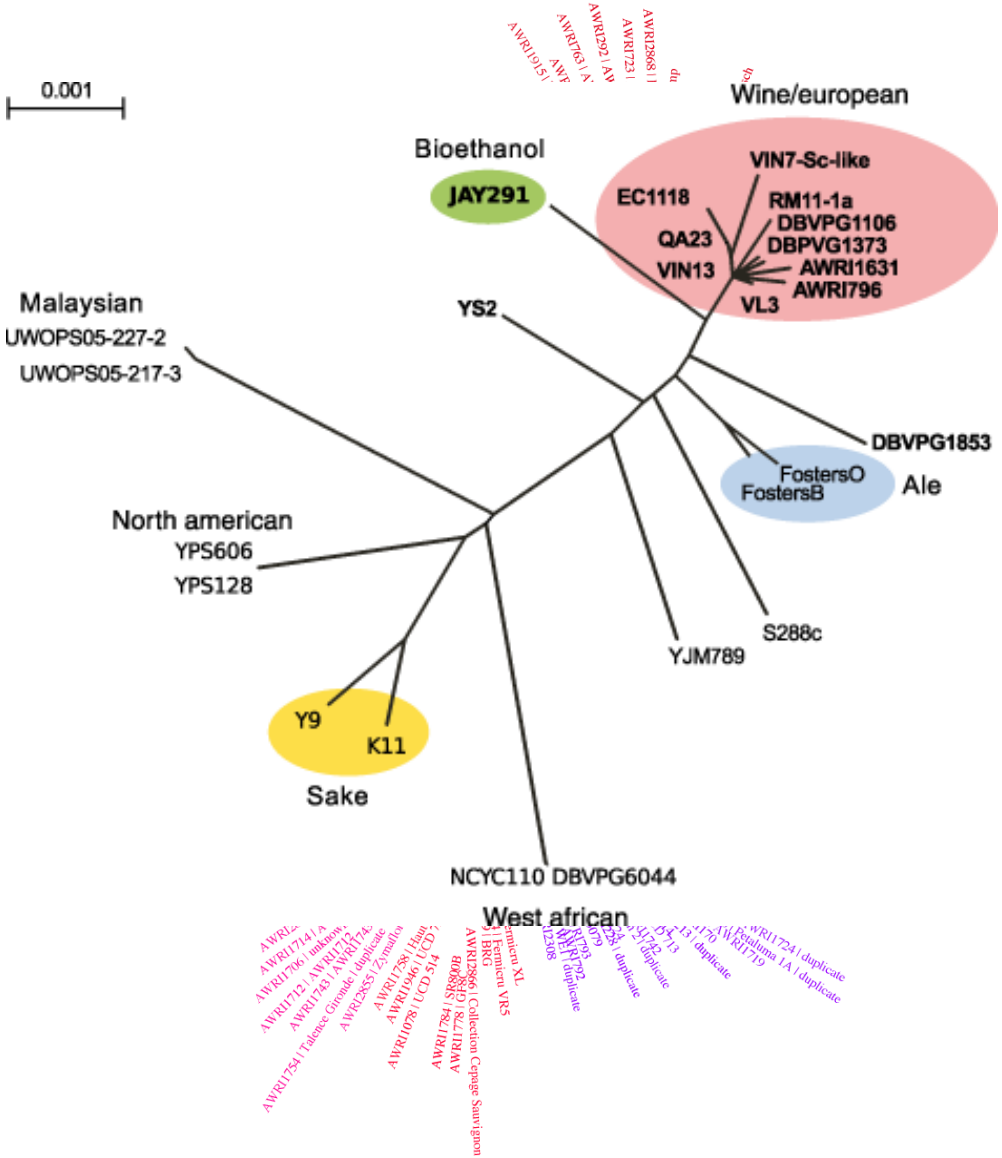

- 180 Unique wine strains sequenced
- Strains from major yeast suppliers
  - 50% of strains sequenced commercial
- 6 Major clades within the collection of sequenced wine yeast

Where to from here?

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- Informed choice and application
  - Improved understanding of strain characteristics
  - Improved ferment management
- Engineered solutions
  - Use of genetic markers for strain selection and development
  - Development of yeast with combinations of desirable properties
- The challenge
  - To do this without the use of GM technology

Image by Col Ford and Natasha de Vere

Acknowledgements

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