

Richard Preiss

Desenvolvimento de novas leveduras Case Pomona





Precision in Yeast, Passion in Craft
knowledge, trust, and community make better beer.
Yeast, Nutrients and more, based in Guelph, Canada
Now also developing yeasts for Lallemand Brewing
(Pomona, and more to come?)

Why are we here?

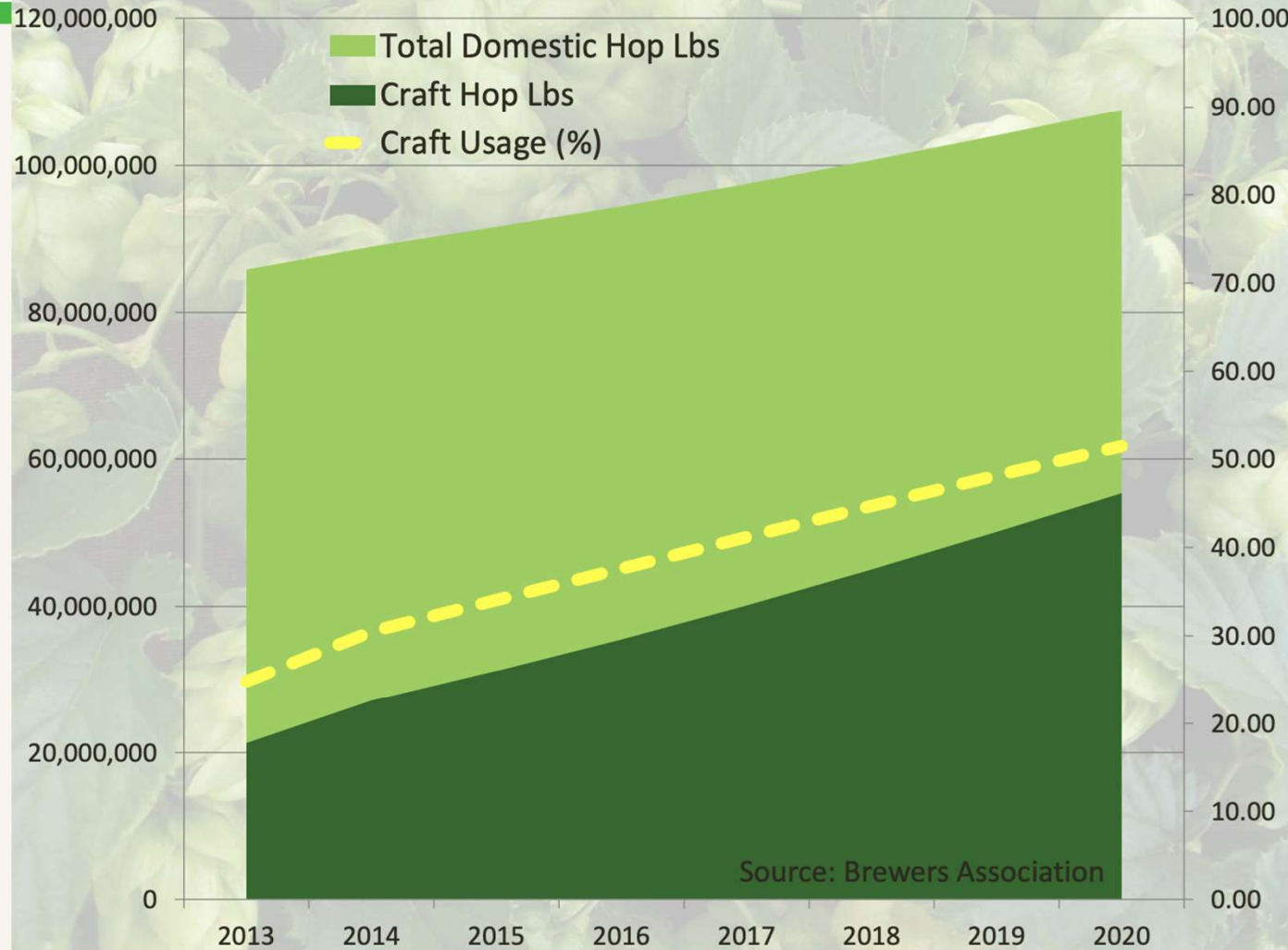




Hop-forward beers are *really* popular



Craft brewery hop usage is on the rise



Bart Watson,
Brewer's Association

Hops are expensive



Vinepair



**Flavoring by yeast
can help brewers get more
Value out of their \$\$\$ hops**

**Yeast is not as expensive,
And can be reused**



The most popular beer yeasts had not evolved or improved in decades!

Strain (common names)	Location	Date	Benefits
Cali Ale, Chico, etc	USA	1980s	Clean, fast, easy to use
Foggy London Ale, London III, 1318 etc	UK - London (National Collection of Yeast Cultures)	1970s	Haze positive, estery
34/70, etc	Germany	1970s	Clean-ish, fast, easy to use

Yeast Flavour Map - existing diversity



neutral/lager like

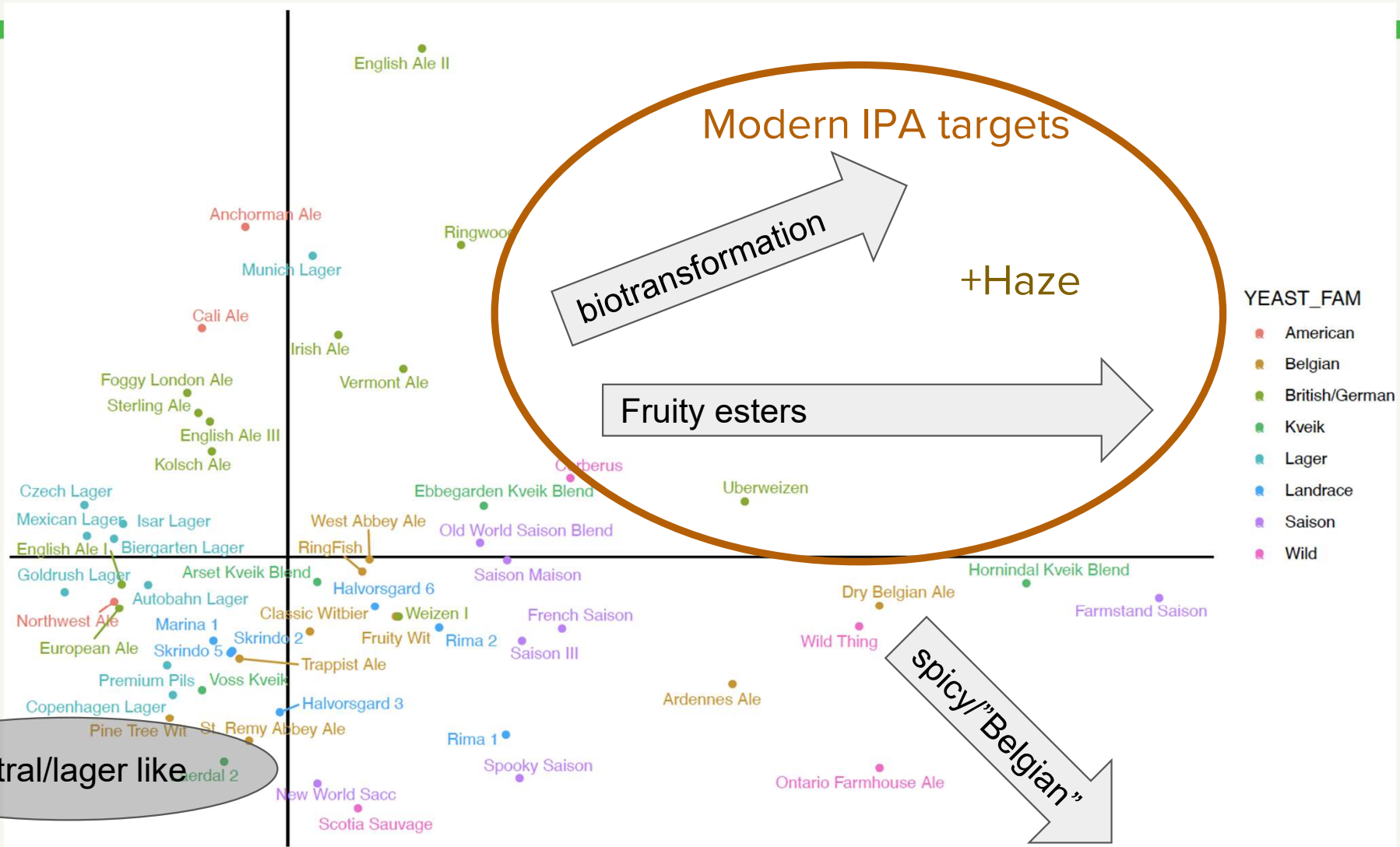
biotransformation

Fruity esters

spicy/"Belgian"

- YEAST_FAM
- American
 - Belgian
 - British/German
 - Kveik
 - Lager
 - Landrace
 - Saison
 - Wild

Yeast Flavour Map (and potential)



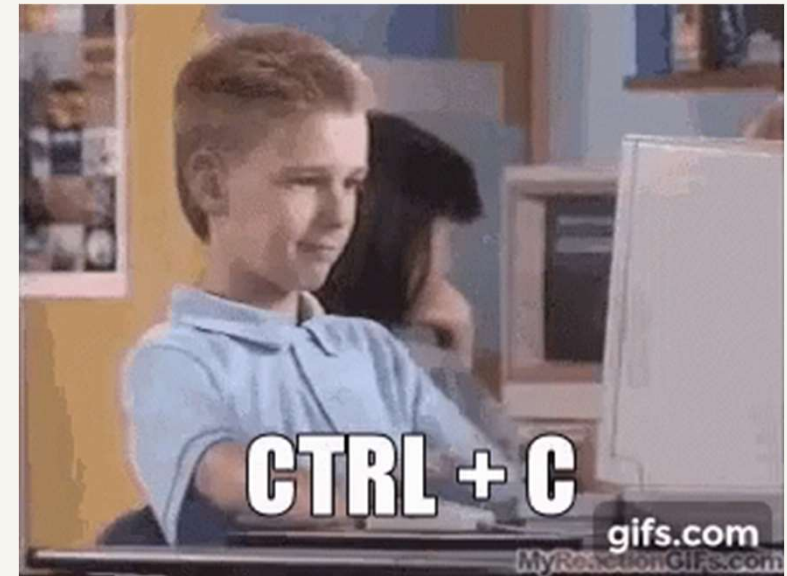
Yeast breeding



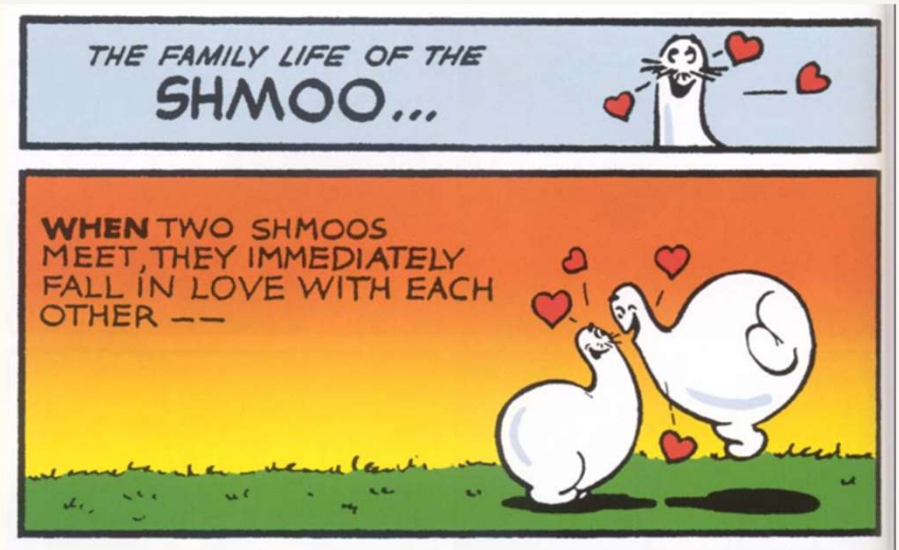
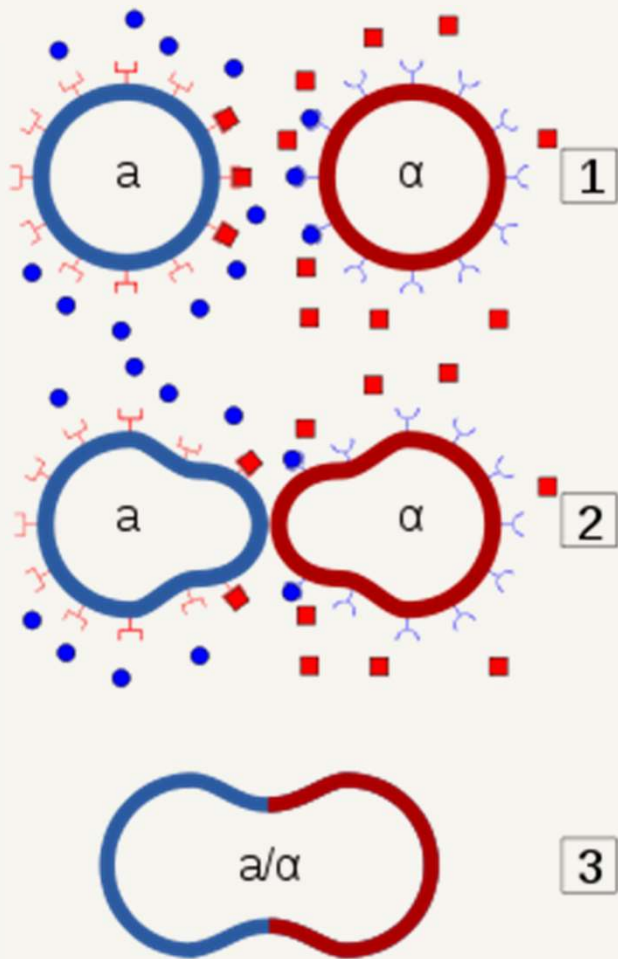
Lab evolution



Gene editing



Hybrid Yeasts (Yeast Breeding)



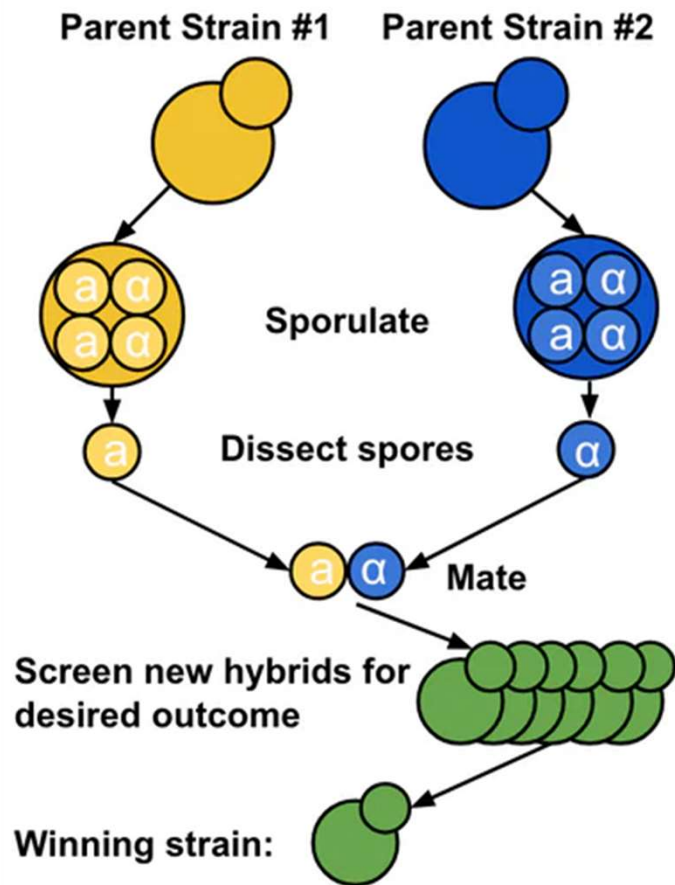
Hybrid Yeast versus Blends



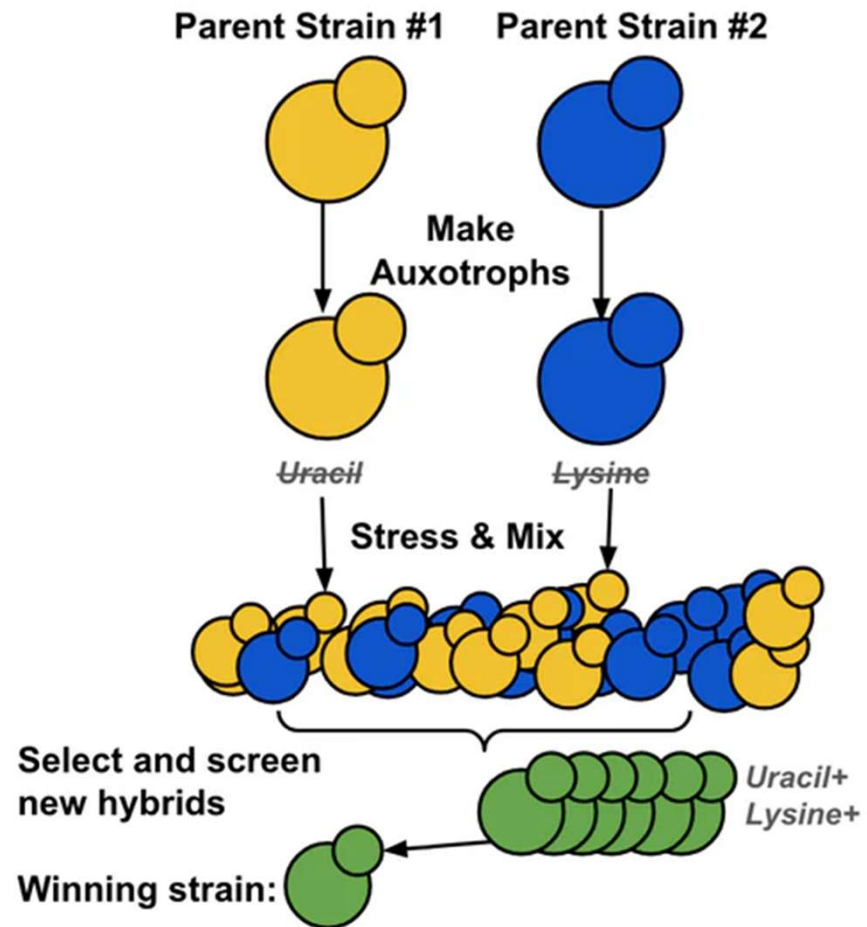
	Hybrids	Blends
Repitching	Stable	Unstable
Flavour consistency	Stable	May be unstable
Number of strains	1	More than 1
Ease of yeast product development	Moderate to Difficult	Easy

How Yeast Hybridization (Breeding) Works

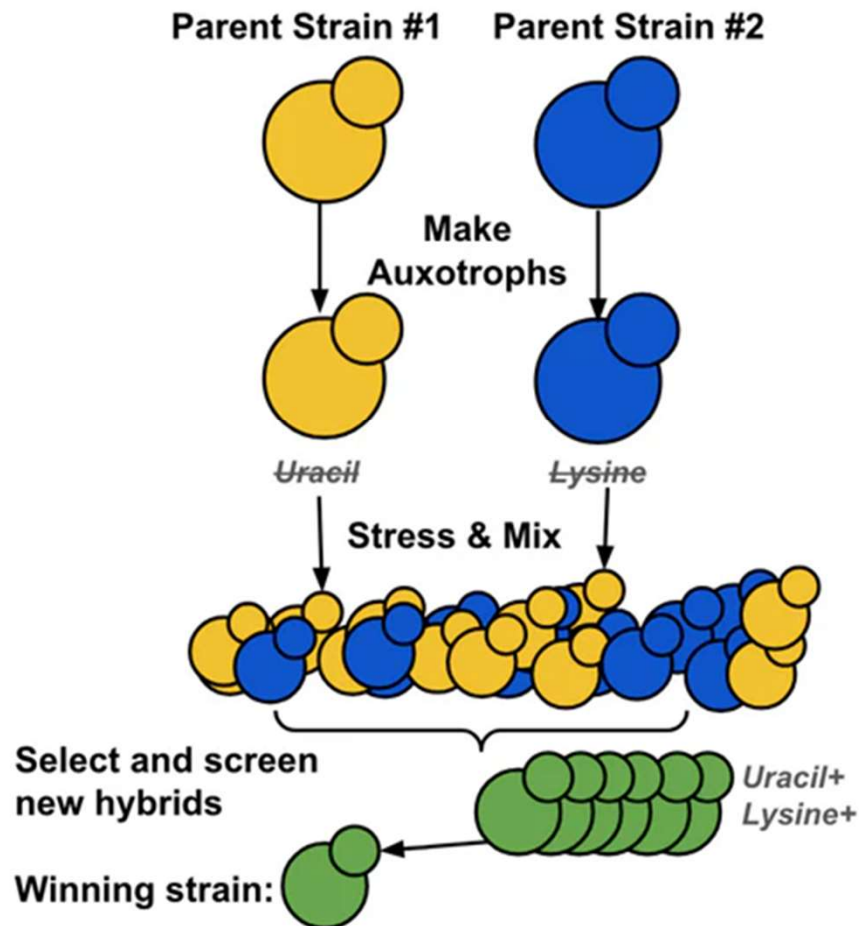
Spore-to-Spore Yeast Mating



Yeast Rare Mating



Yeast Rare Mating



Parent 1

UK genetic background

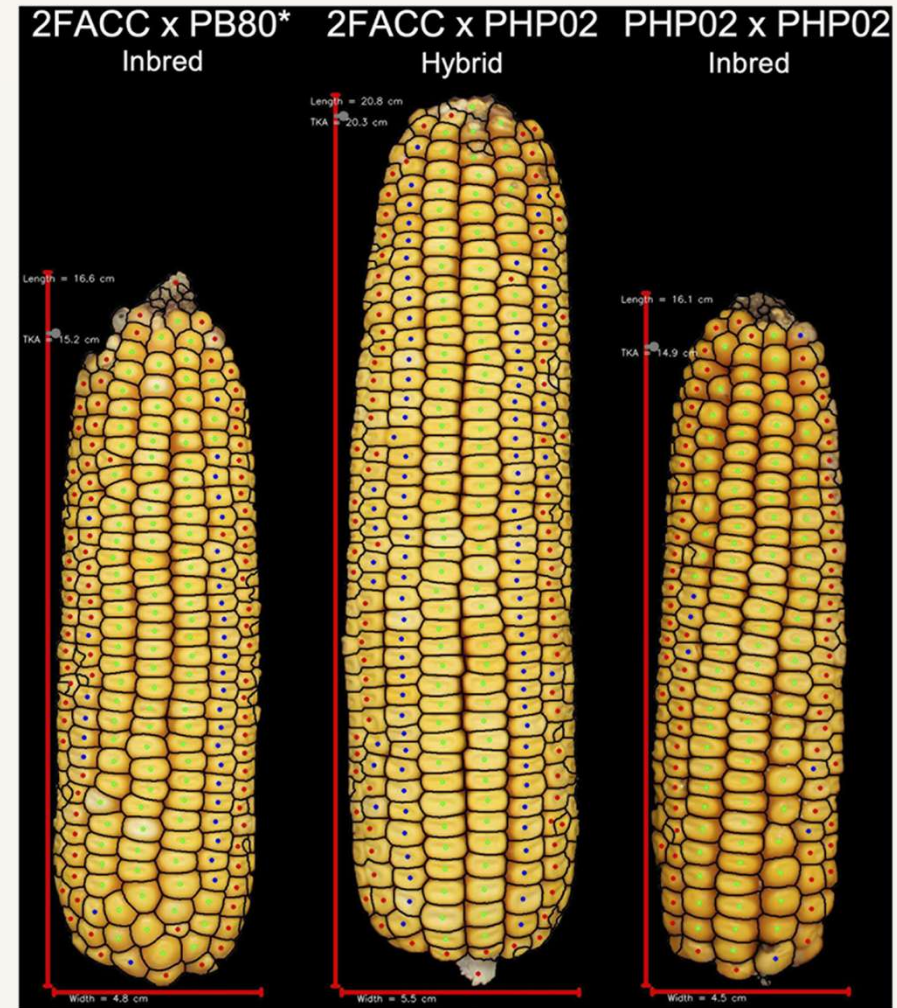
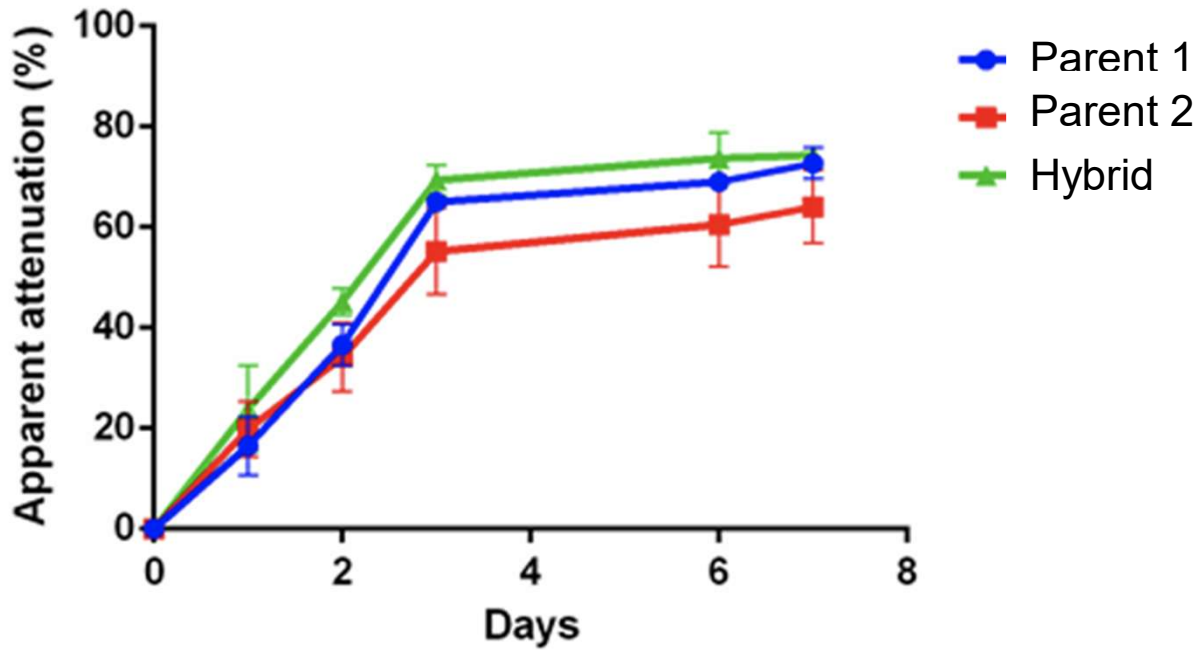
- Tetraploid
- Very efficient fermentation, low aroma formation

Parent 2

“Beer 2” genetic background

- STA1 positive (diastatic), POF-
- Diploid
- Excellent aroma formation (tropical fruity esters and biotransformation)

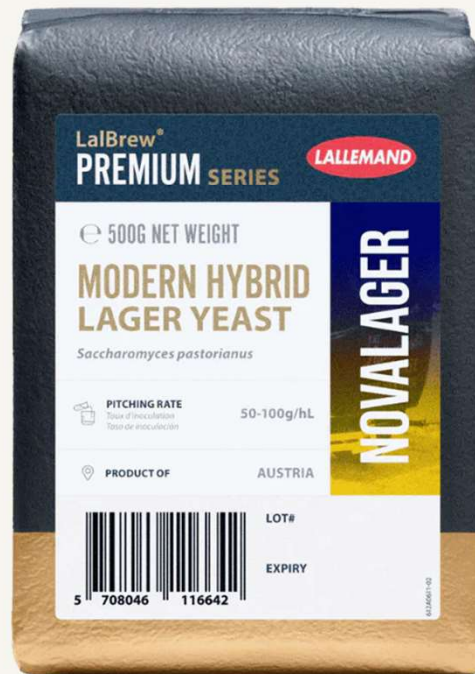
Hybrid Vigour: Hybrids often outperform parents



Hybrid Yeast Examples (Yeast Breeding)



Non diastaticus
saison



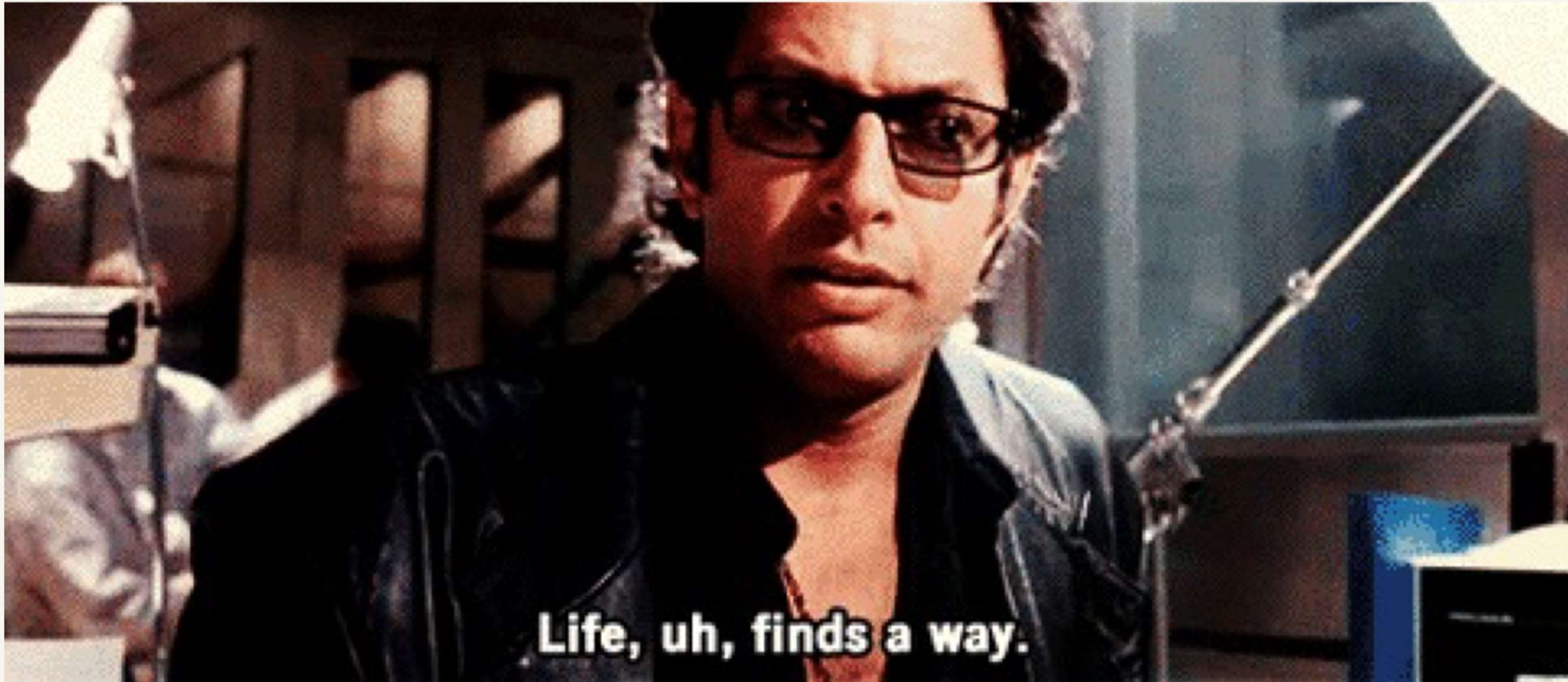
Zero sulfur,
efficient lager



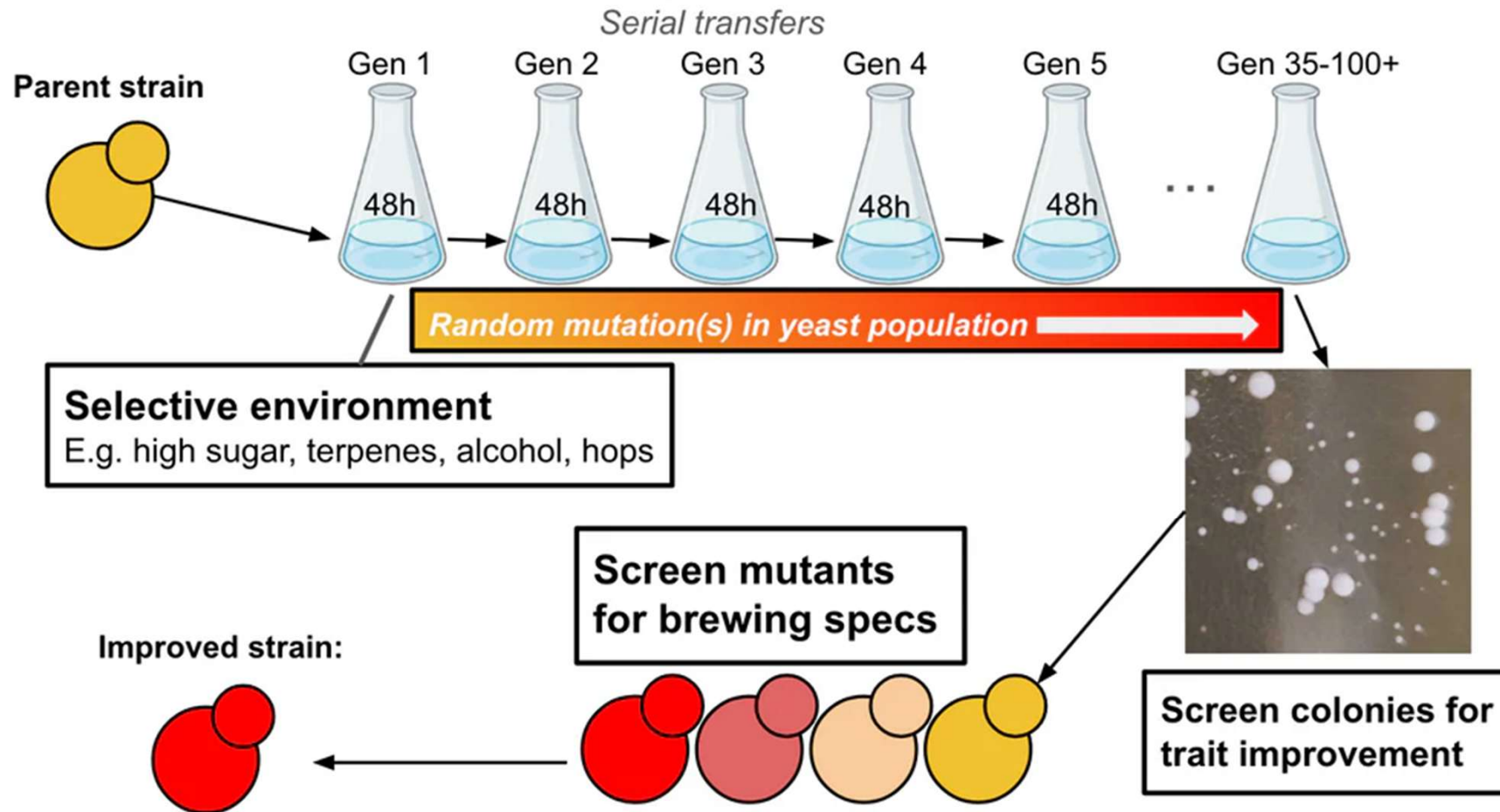
Maltose negative
yeast for non
alcoholic beers



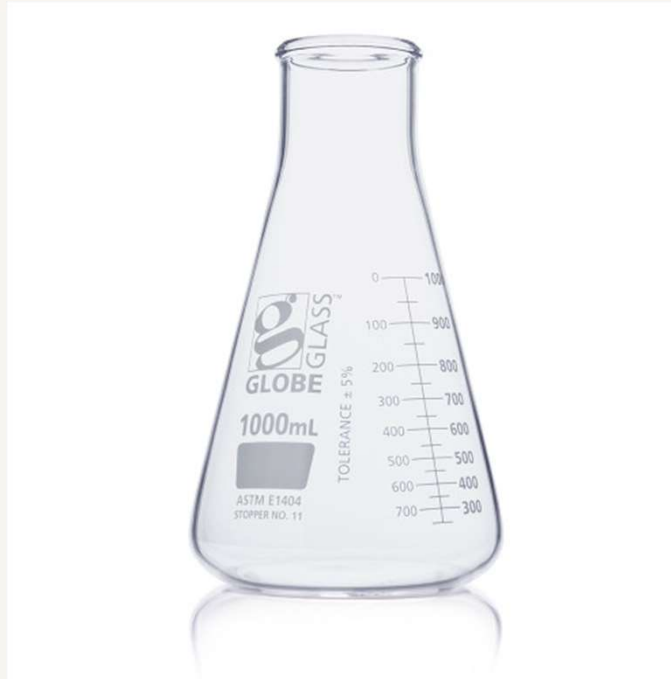
Aroma &
efficiency for IPA



Adaptive Laboratory Evolution of Beer Yeast

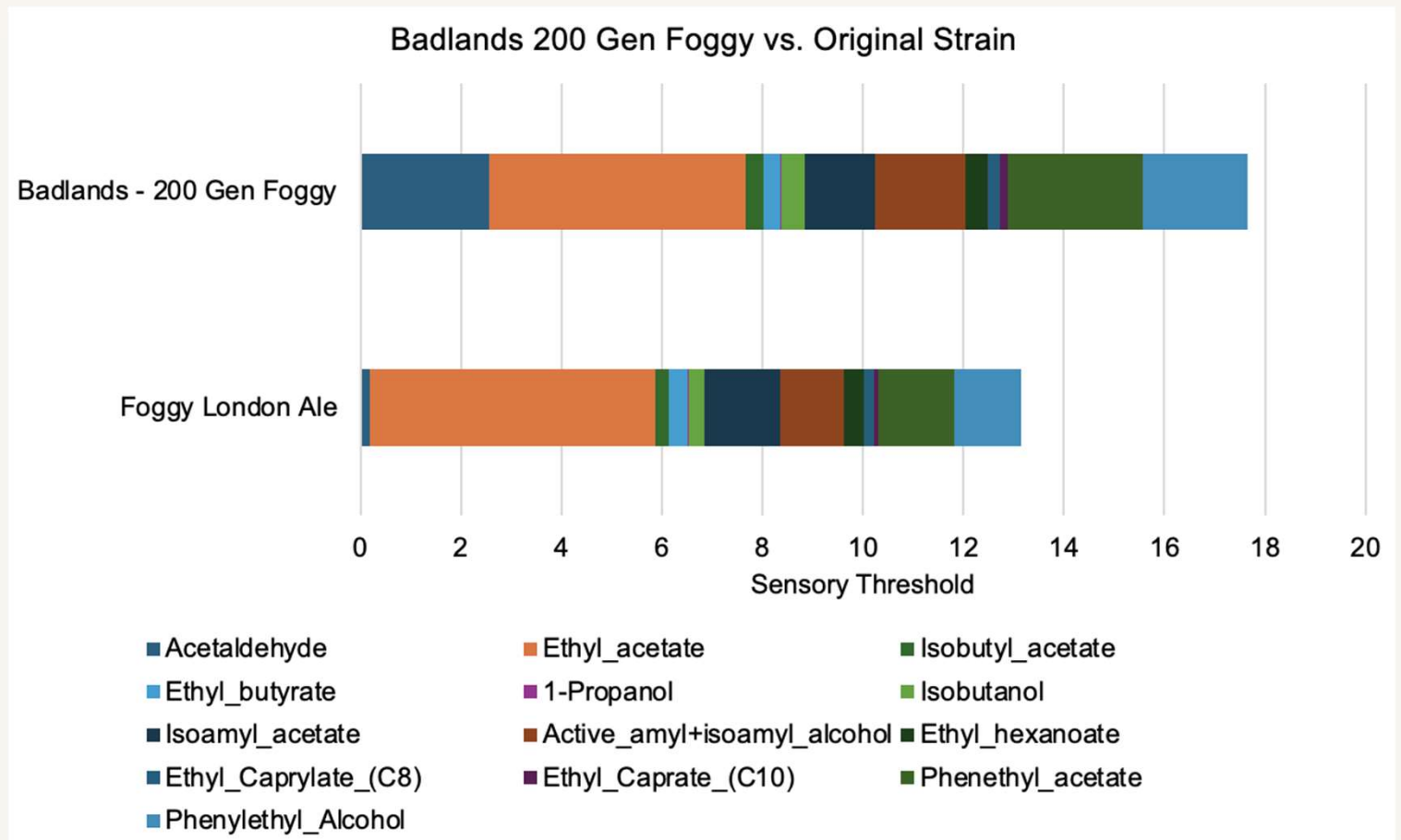


Stuff needed for lab evolution



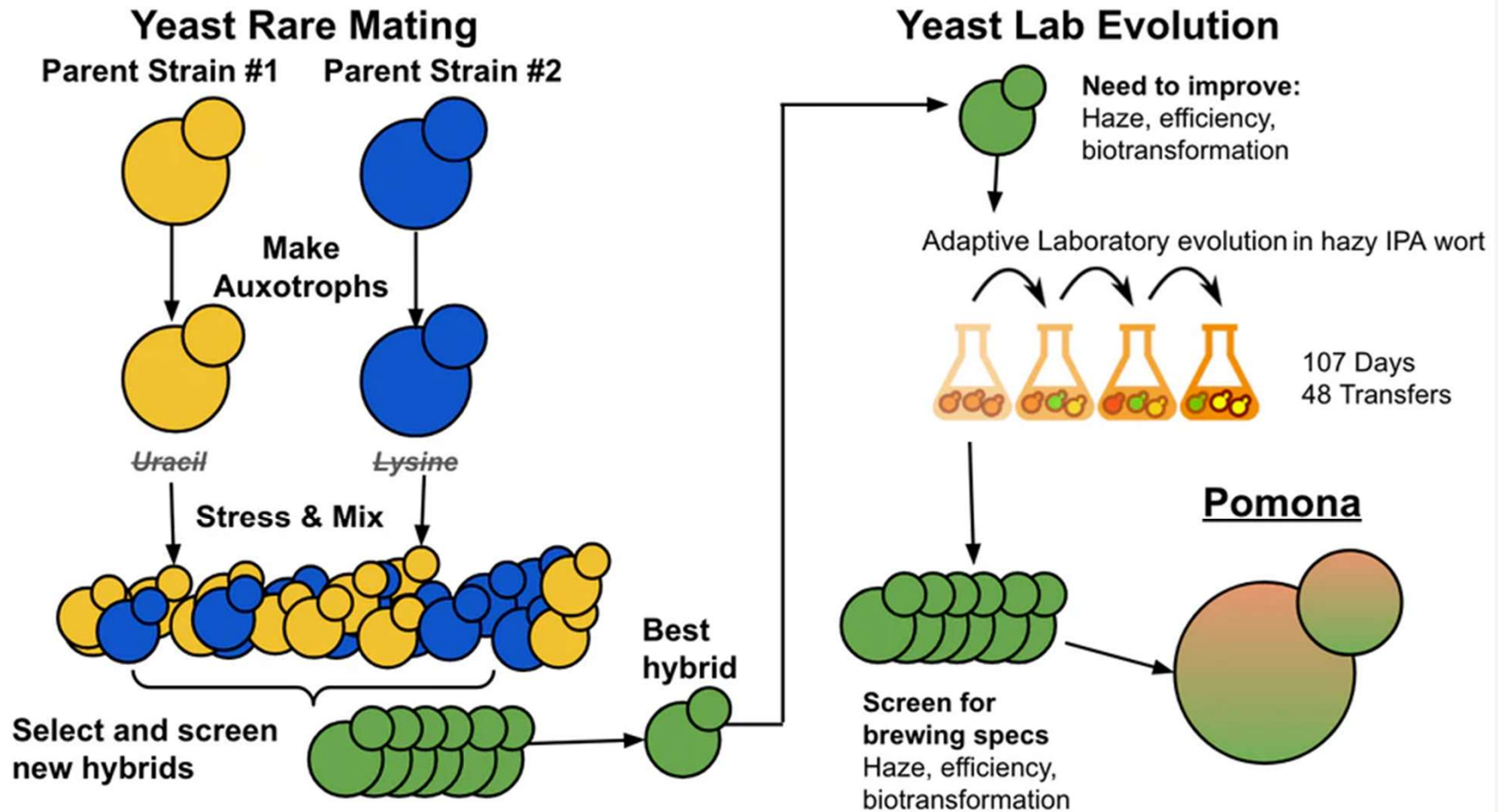
Or repitch >100 times

Example: Badlands Brewery



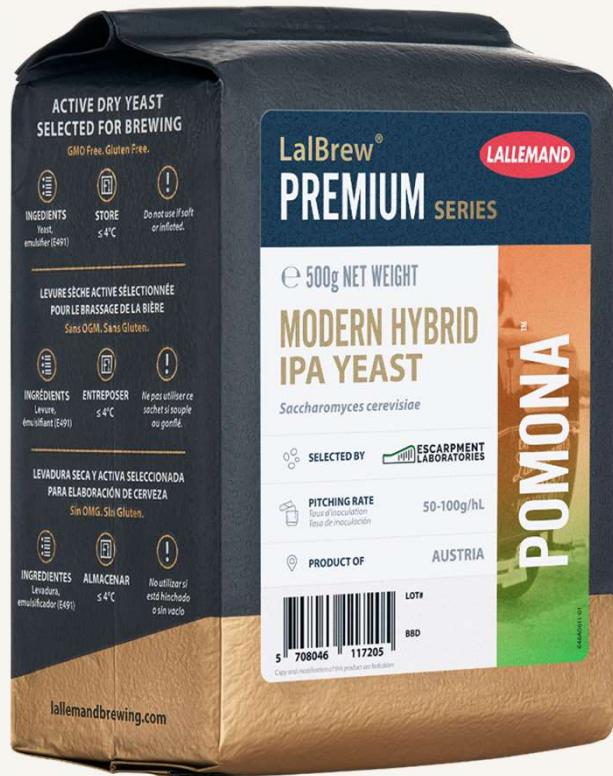
Combining Breeding and Lab Evolution: LaIBrew Pomona

Development of Pomona Yeast





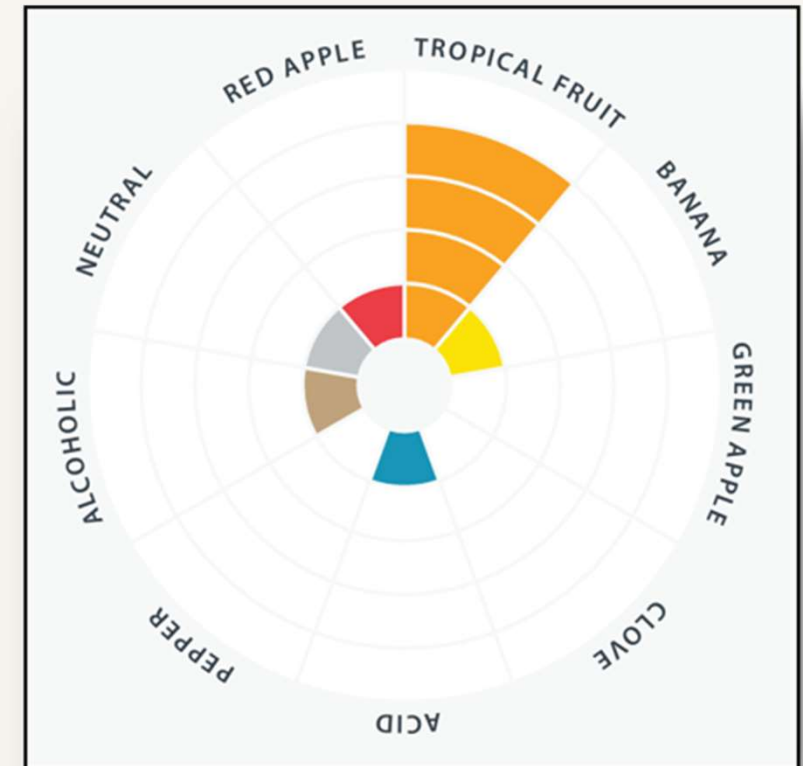
Combining Breeding and Lab Evolution: LaIBrew Pomona



STA:	Negative
POF :	Negative
Fermentation time:	4-5 days
Flocculation:	Medium
Optimal temperature:	18-22°C
Attenuation range:	75-84%
Alcohol tolerance:	10% abv

Dominant Aromas: Peach, citrus, and tropical fruits.

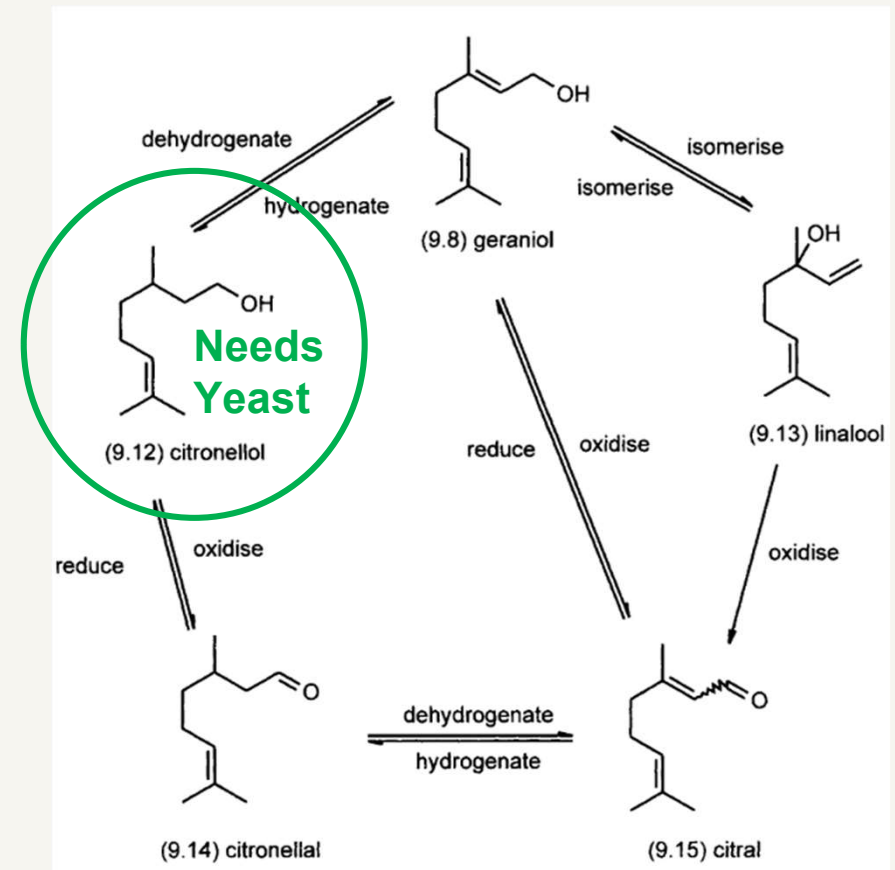
+ Haze-positive



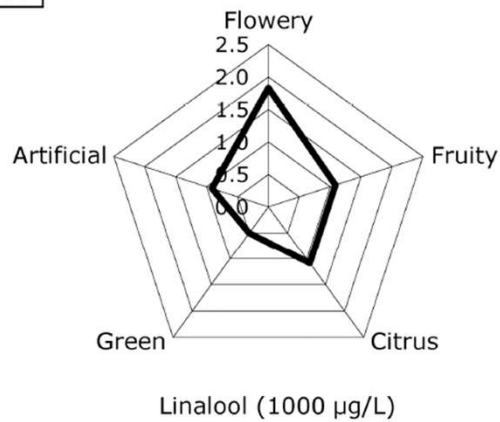
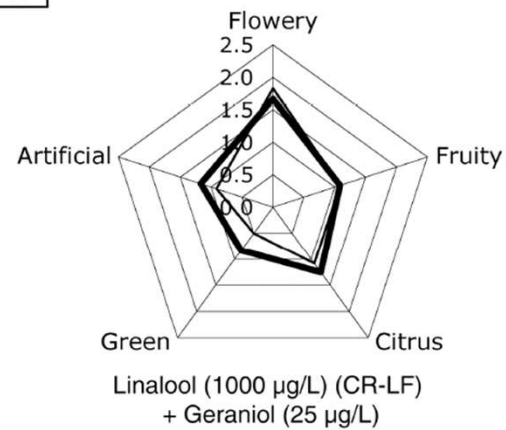
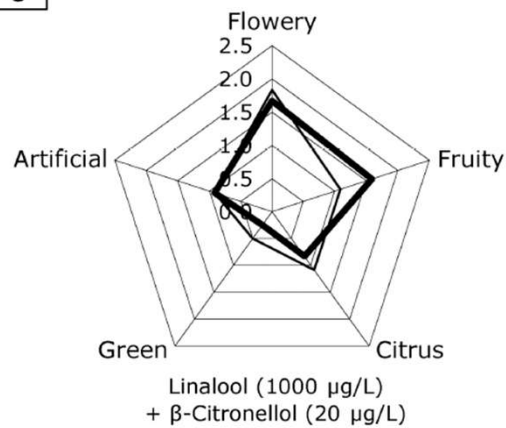
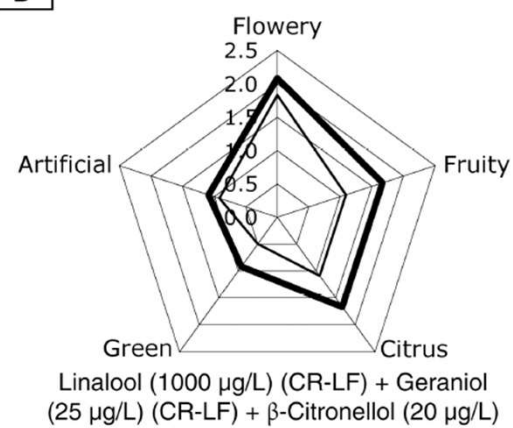
Potential for improving hop terpene biotransformation:

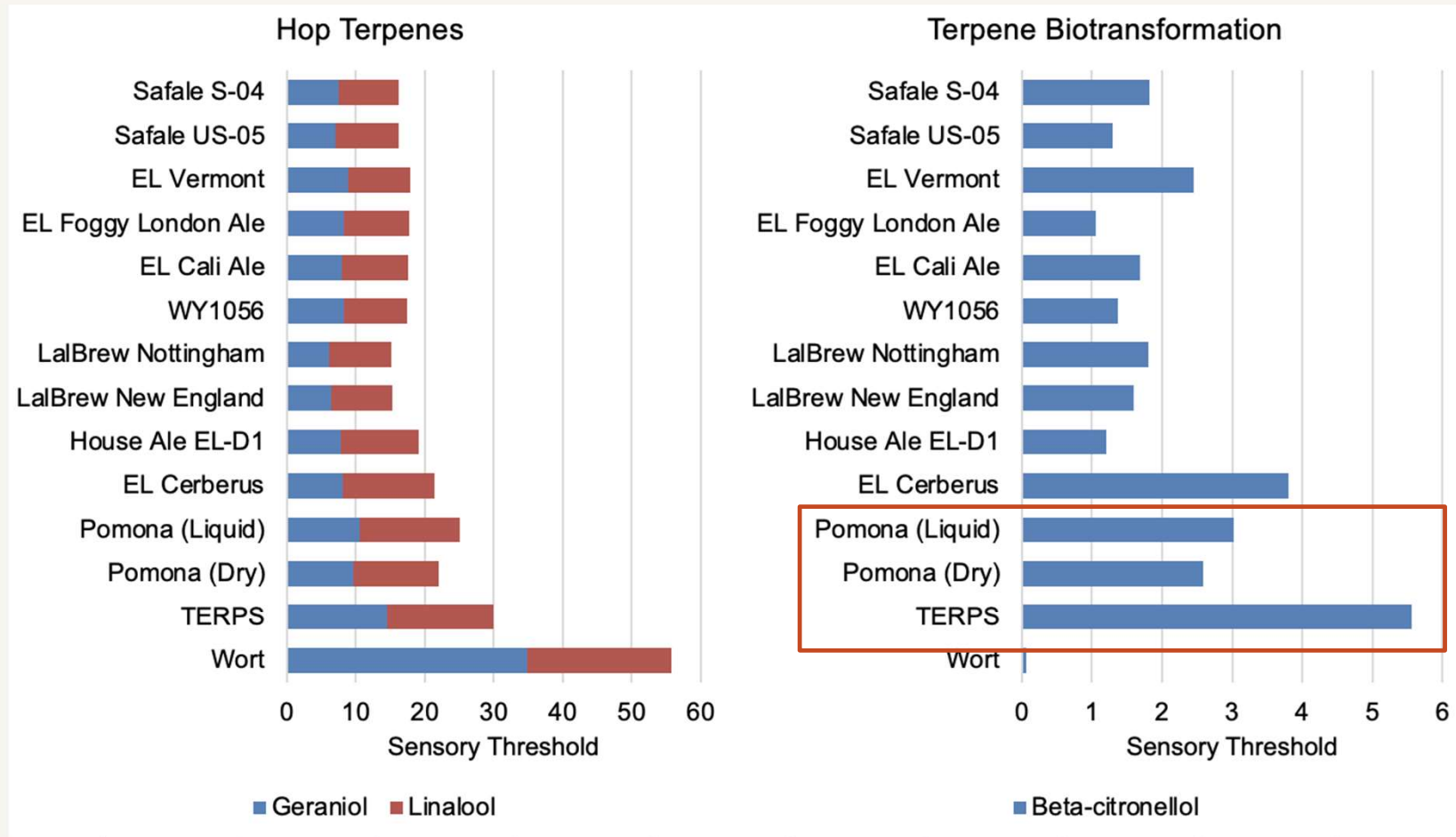
- Turn floral hops into citrusy flavours
- Extend shelf life of beer
- Get different or new flavour profile from your hops

Challenge: poorly understood

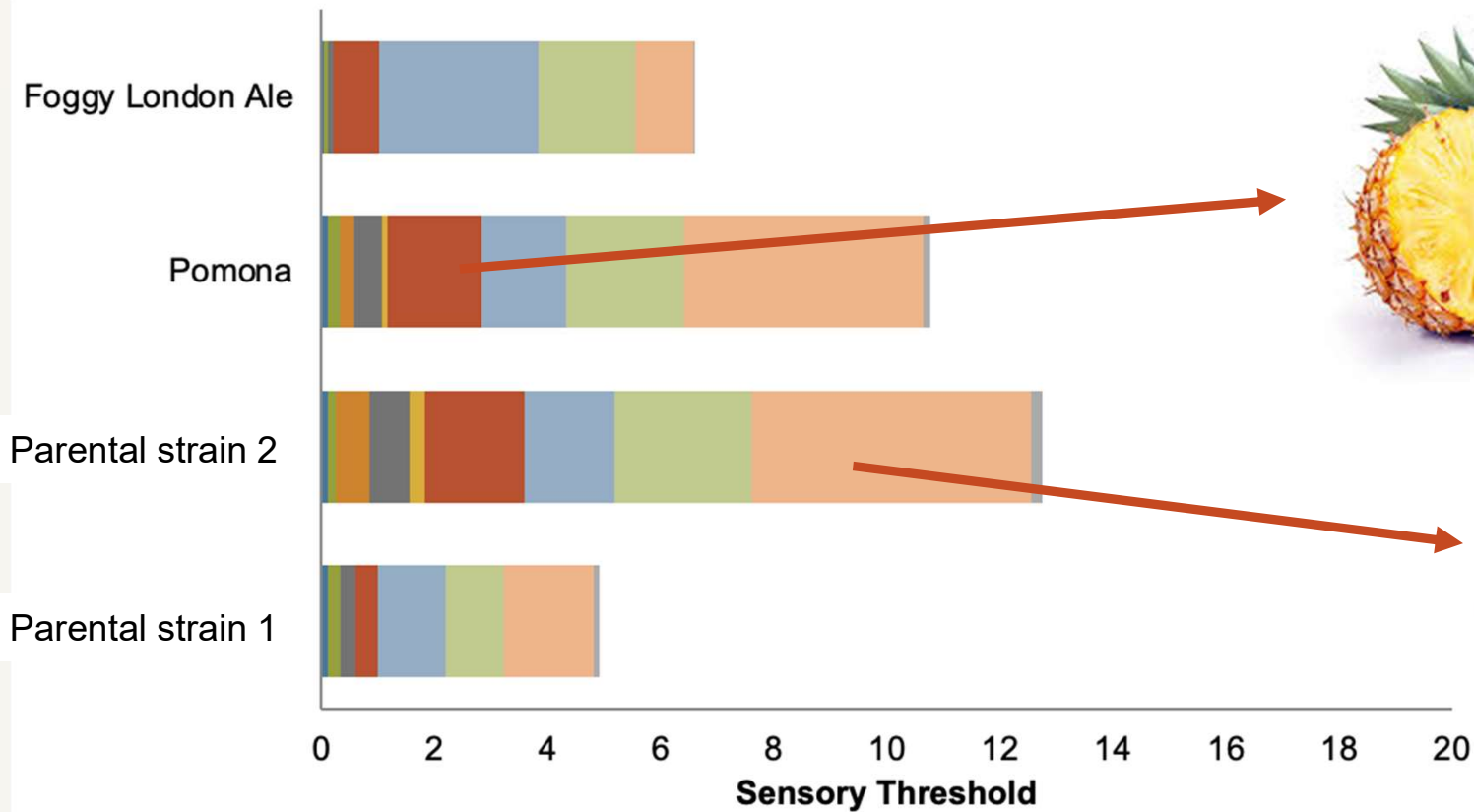


Terpene flavor is synergistic

A

B

C

D




Aroma compound comparison

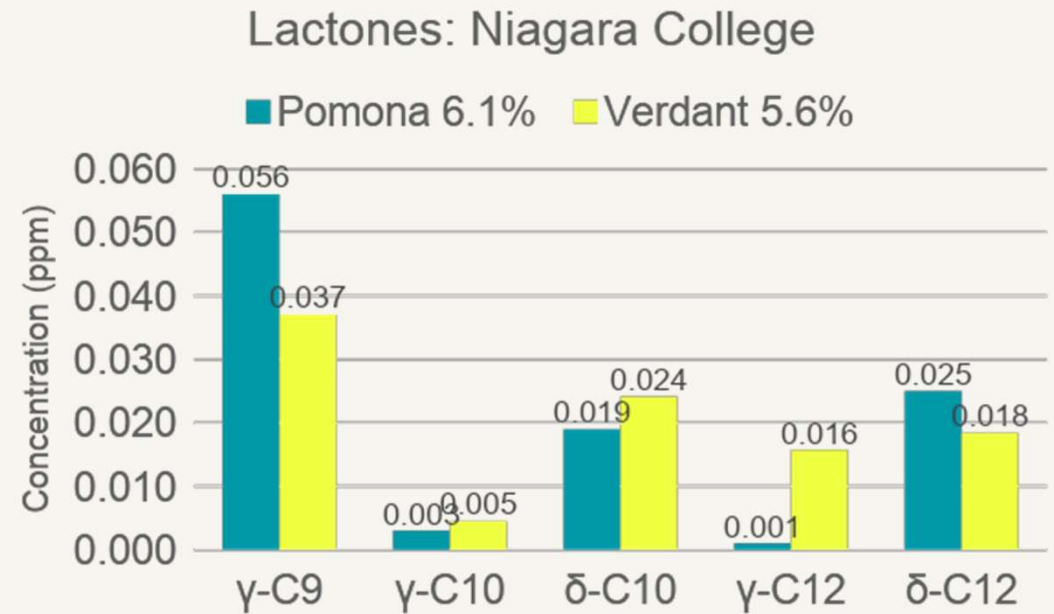


- Isoamyl Alcohol ■ Phenethyl Alcohol ■ Isoamyl Acetate ■ Phenethyl Acetate
- Ethyl Acetate ■ Ethyl Hexanoate ■ Ethyl Octanoate ■ Ethyl Decanoate
- Beta Citronellol ■ 4-vinylguaiacol



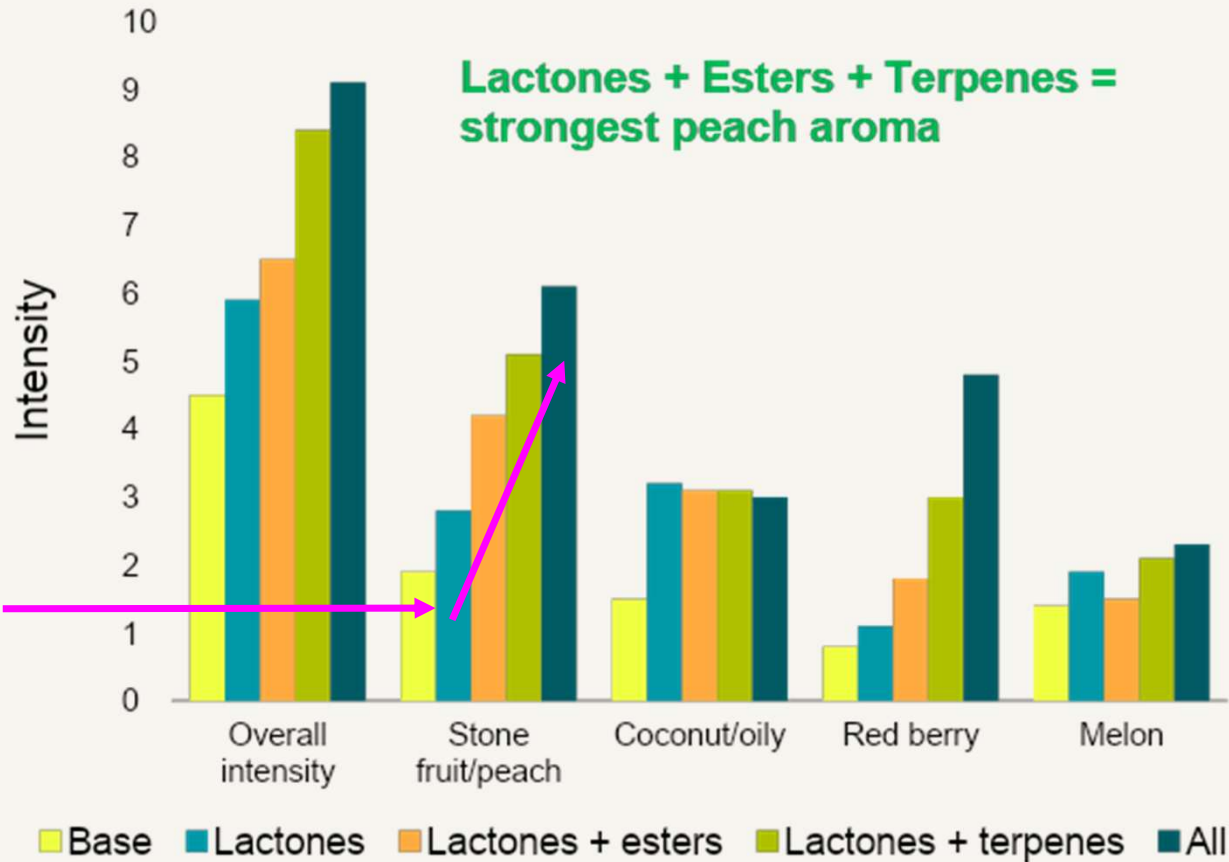
Precursors: grain (oats), hops (e.g. Sabro, HBC1019)

Compound	Sensory Descriptor	Threshold (ppm)
gamma-Nonalactone (γ -C9)	Coconut	0.0200
gamma-Decalactone (γ -C10)	Peaches, coconut	0.0013
d-Decalactone (δ -C10)	Coconut, oily	0.0027
gamma-Dodecalactone (γ -C12)	Fruity, perfume, earthy	0.0040
d-Dodecalactone (δ -C12)	Fruity, tropical	0.0020

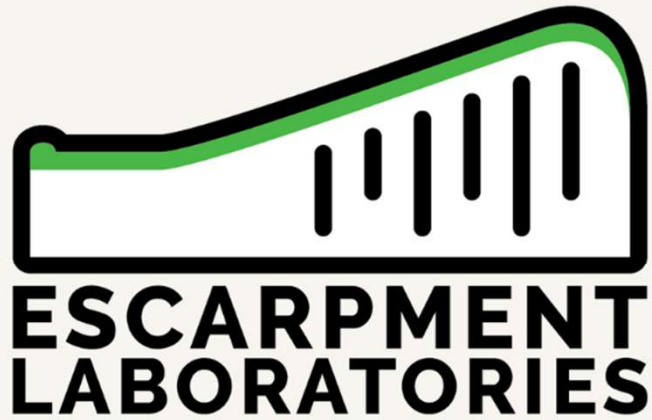


Pomona™ above threshold for coconut, fruity, tropical sensory characteristics

Peach/Stone Fruit aroma = synergy of lactones, terpenes, esters



Hotchko & Shellhammer (2017), "Influence of Ethyl Esters, Oxygenated Terpenes, and Aliphatic γ - and δ -Lactones (C9–12) on Beer Fruit Aroma"



Practical Tips and Recipe Design for IPA

Terpenes

Hops:

- Bravo
- Centennial
- Cascade
- Chinook
- Mosaic
- Strata

Yeast: Pomona, New England

Underrated hops made better through yeast!



Thiols

Hops with high free thiols:

- Citra
- Nelson Sauvin
- Mosaic

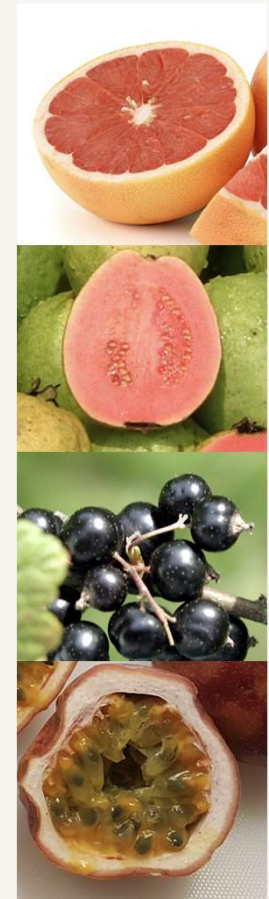
Hops with bound thiols:

- Cascade
- Calypso
- Saaz and variants (e.g. Motueka)

Other sources of bound thiols:

- Malts
- Adjuncts (e.g. Phantasm grape powder)

Yeast: Diamond, Pomona, Verdant, Nottingham



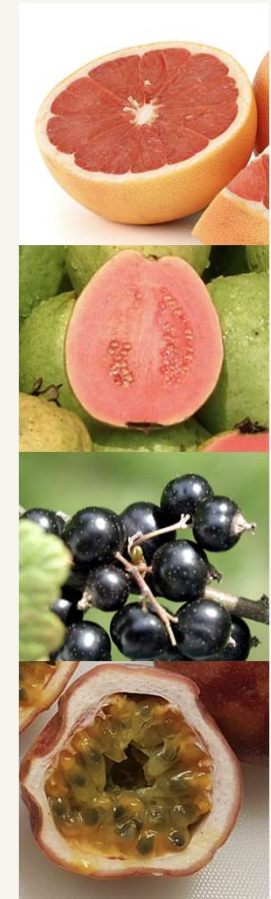
Terpenes

- Late kettle/whirlpool
 - “Cool Pool” cooler whirlpool, 70-80C, can maximize terpene extraction
- Dry hopping early



Thiols

- Bound thiols:
 - Mash hopping 3-5g/L
 - Late kettle and whirlpool hopping
- Unbound thiols:
 - Dry hopping (mid or end of ferment)



Adding Haze

- Reduce yeast stress
- Late dry hopping
- Heavy dry hop rate
- Haze positive yeast
 - Foggy London Ale, Verdant, Pomona



Removing Haze

- Early dry hopping
- Lower dry hop rate (higher whirlpool rate)
- Haze neutral yeast
 - Cali Ale/BRY097, Vermont Ale/New England, Lager yeast



Cool Pooling

- Whirlpool 70-80 C
- Helps maximize terpene and flavour extraction from hops
- Popularized for West Coast IPA, can help with others

Cone Shaving

- Dropping trub and early flocculating yeast from bottom of fermentor at 24h, 48h
- Gives yeast time to grow and get through lag phase
- Removing trub afterward reduces mercaptan (bad sulfur) according to Russian River Brewing
- Popularized for West Coast IPA, can help with others



Hot Side

- Strata + Simcoe whirlpool

Geraniol + 4MMP

Fermentation

- Pomona yeast
- Fermentation at 20°C

Esters + terpene transformation

Dry hop

- Citra + Simcoe
- End of ferment (within 1°P of FG)
- 3 days contact time

Unbound thiols



Hot Side

- Cascade
- Calypso
- Mash Hop and/or Whirlpool
- Phantasm powder

Bound thiols

Fermentation

- Blend Diamond and Nottingham, ferment cool (16C)

Bound thiol release

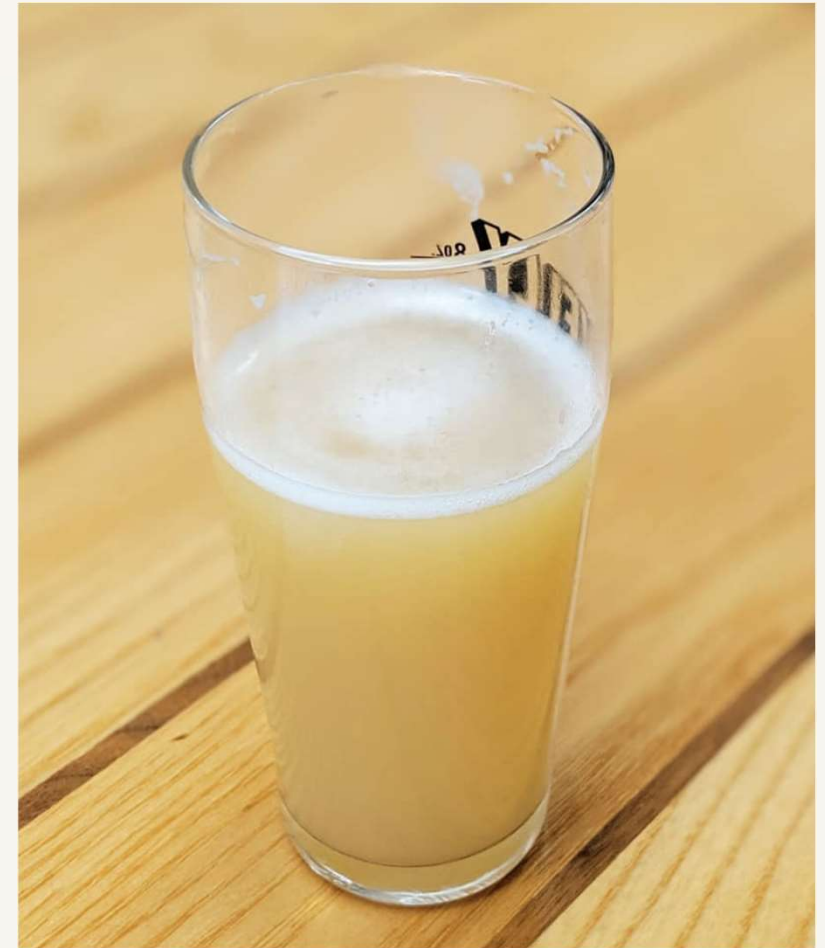
Dry hop

- Any super aromatic hop
- End or post ferment
- 3 days contact time

Unbound thiols

Conclusions

- We can use what we know to **enhance hop flavours** in beer
- The right mix of **hops, yeast, and timing** is important
- **Biotransformation is complicated**, but we can break it down and harness the science to make better beer!



Knowledge Base

>80 entries

Including strain specific yeast data

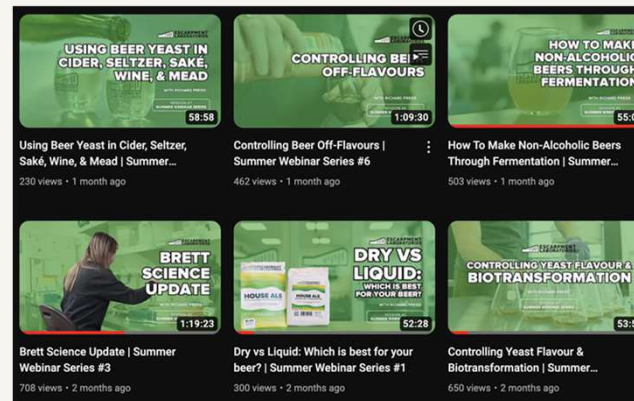
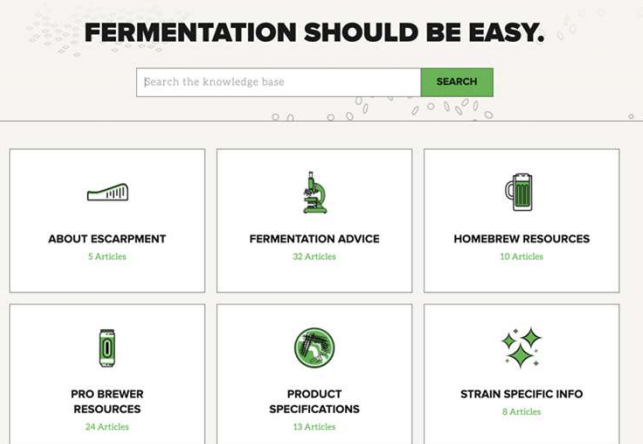
YouTube

>50 hours of content

Including “yeast basics” and flavour series

Blog

Technical blogs, recipes, and more

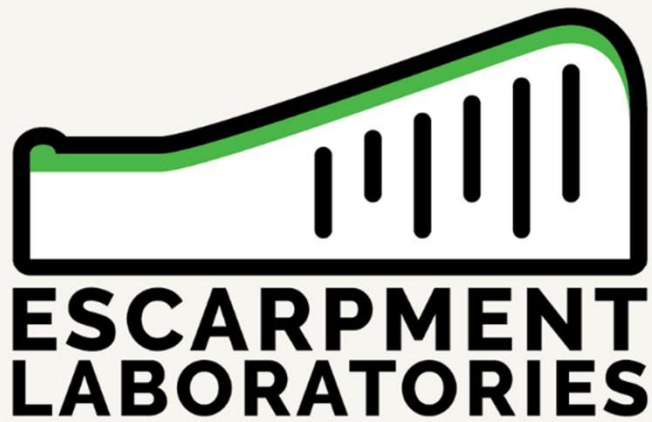


OCTOBER 18, 2023 • KNOWLEDGE

NICOLE IRVINE

THE ULTIMATE COST SAVING GUIDE TO BREWING WITH YEAST

See also: Lallemand Brewing resources including Biotransformation guide



Obrigado

