The Australian Wine Research Institute

Why on earth would an engineer want to know about tannins?

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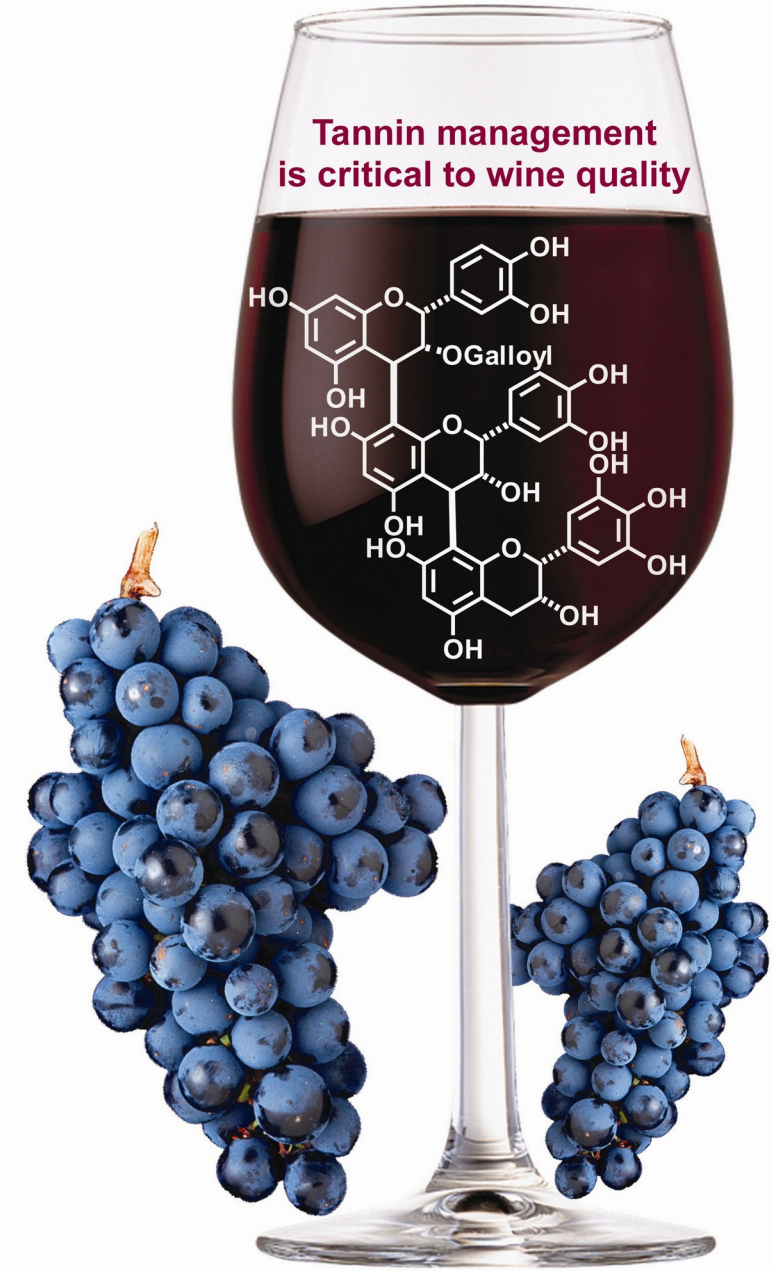
AWRI


Tannin management
is critical to wine quality
OH
HO
O
OH
OGalloyl
OH
OH
HO
O
OH
OH
OH
OH
HO
O
OH
OH
OH

Making

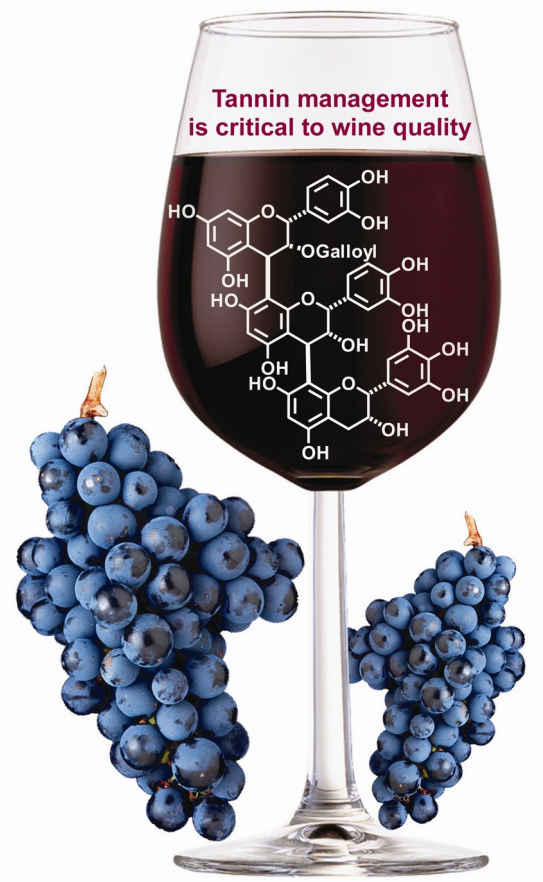
Decisions

is a risky business

Tannins – so what?

Seeds, skins and flesh of white and red grapes

- Browning
- Colour
- Astringency
- Mouth-feel
- Astringency
- Bitterness
- Protection against oxidation
- Quality indicators



Tannins

Tannins → COLOUR!

Winemaking and Aging

Tannin and Anthocyanins

Anthocyanins

- Colour in grapes and young wine
- Lose colour
- Do not last long in wine

Pigmented polymers

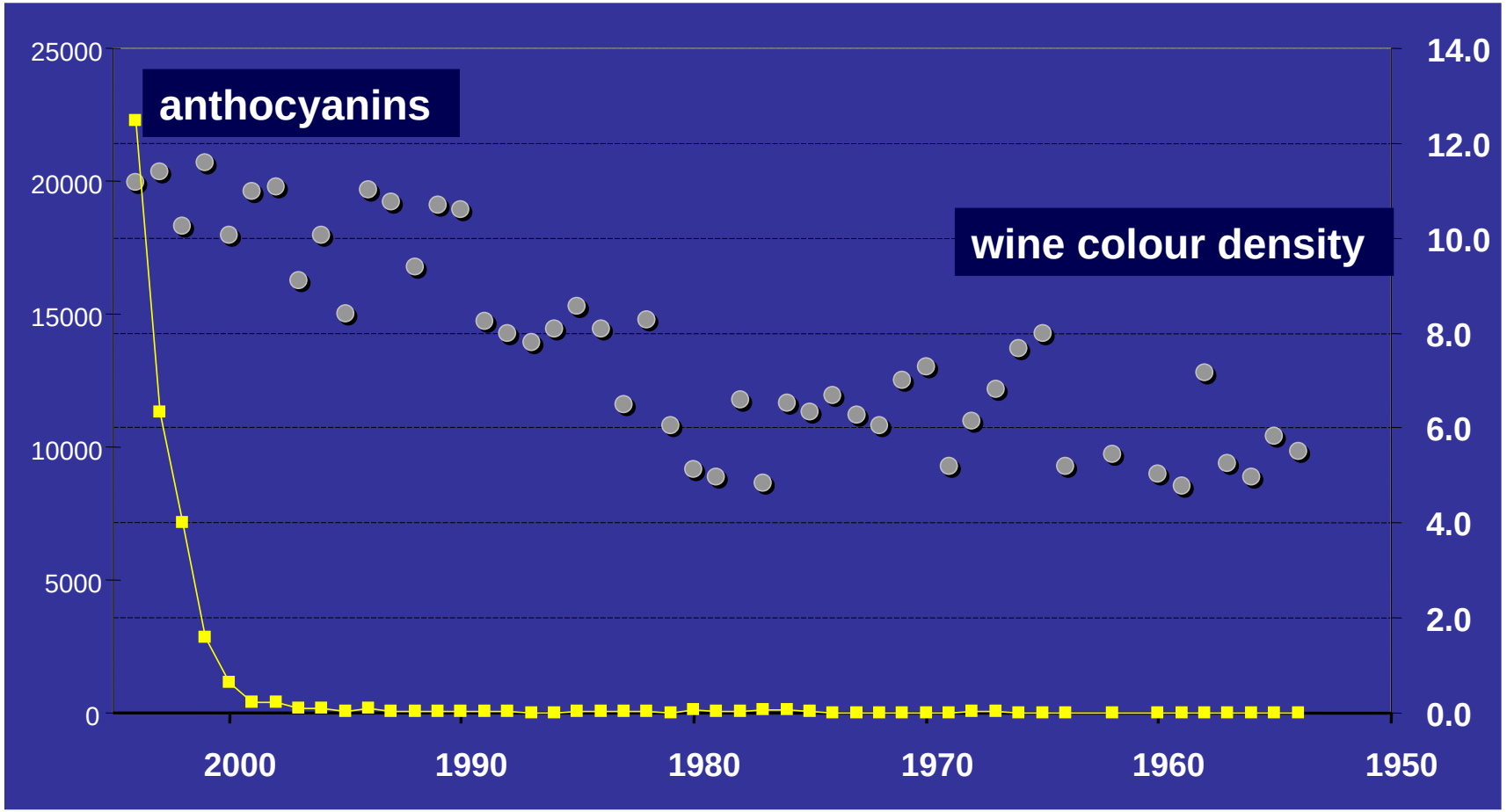
- Colour in wine
- Tannins with anthocyanins
- Important for long-term colour stability

Colour of anthocyanins is sensitive to pH and SO_2

Malvidin-3-glucoside

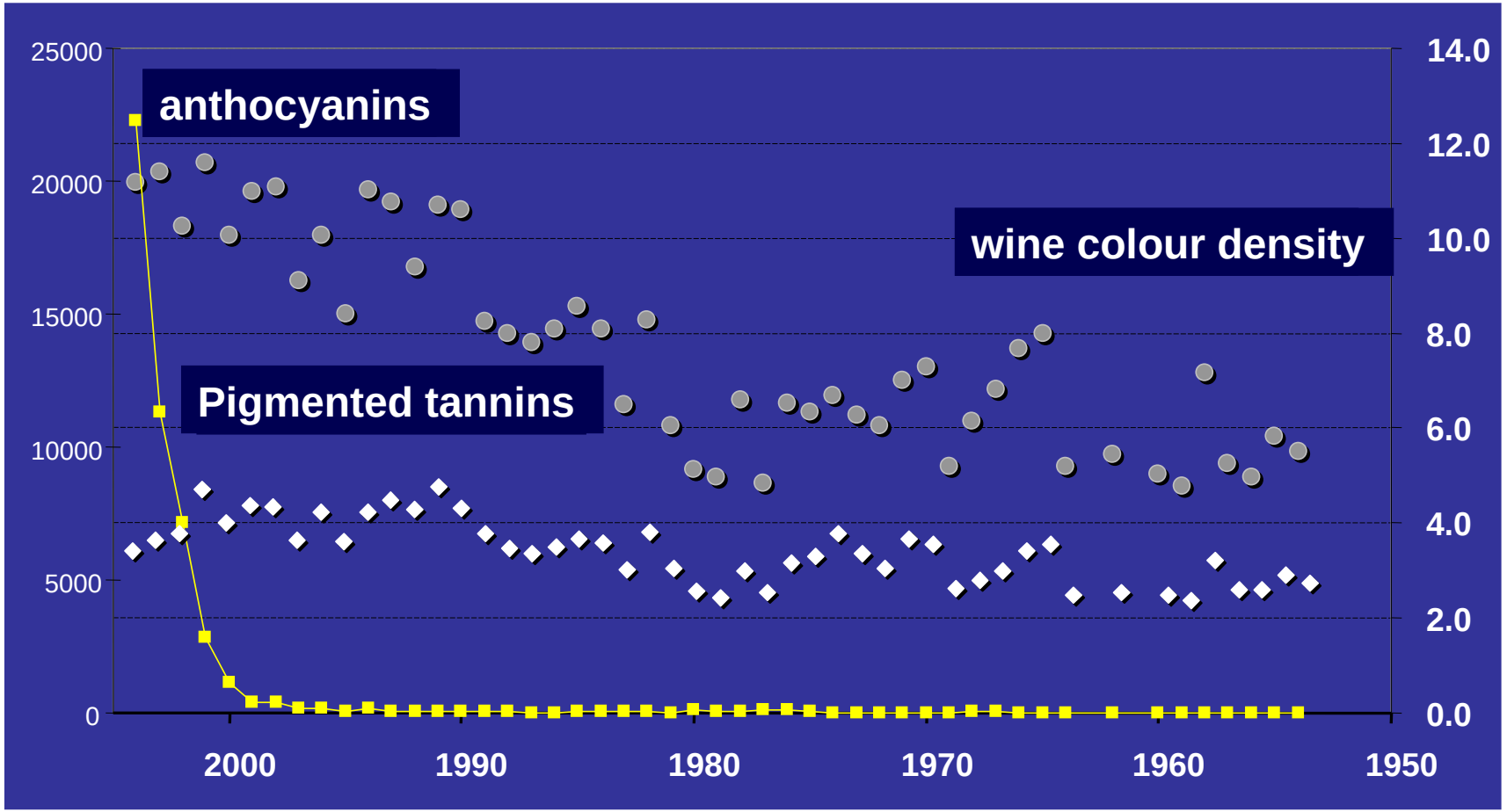
pH<1.5 **pH 3.7** **pH 3.7+SO_2**

Wine tannins, colour and age



Coonawarra Cabernet Sauvignon vintage 1954 – 2004, S. Hodder
analysed 12/2004 by M. Parker & B. Dambergs

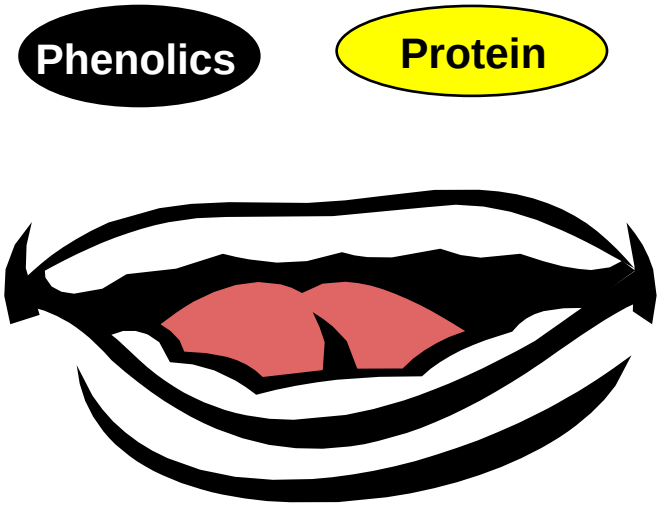
Wine tannins, colour and age



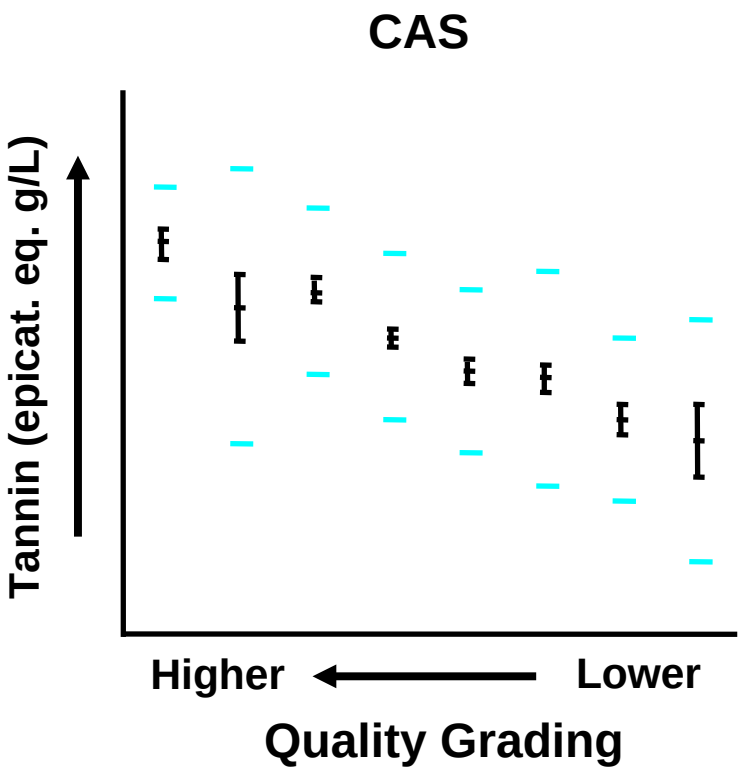
Coonawarra Cabernet Sauvignon vintage 1954 – 2004, S. Hodder
analysed 12/2004 by M. Parker & B. Dambergs

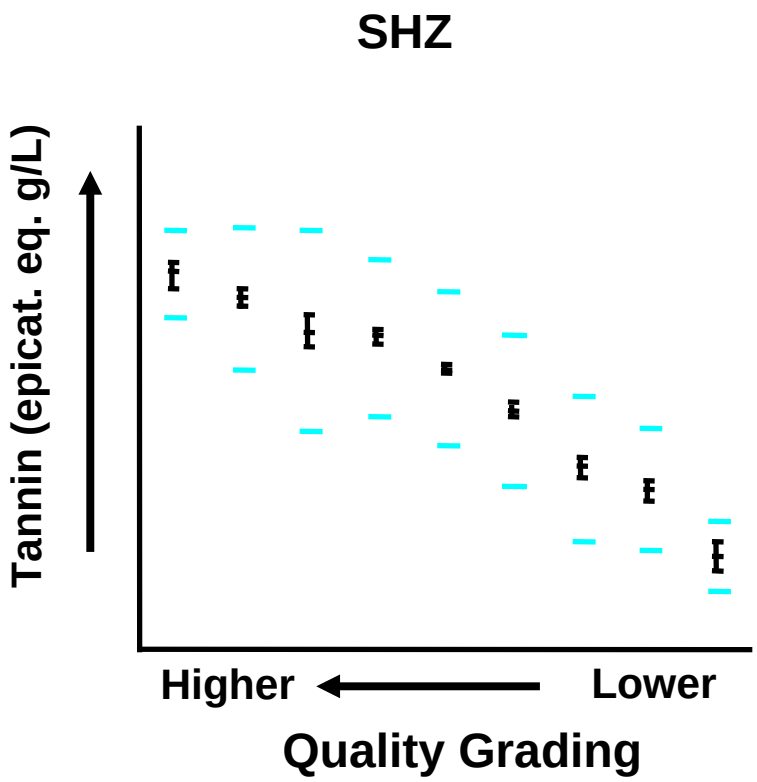
Tannins

Tannins → **TEXTURE!**



Quality vs. Wine Tannin



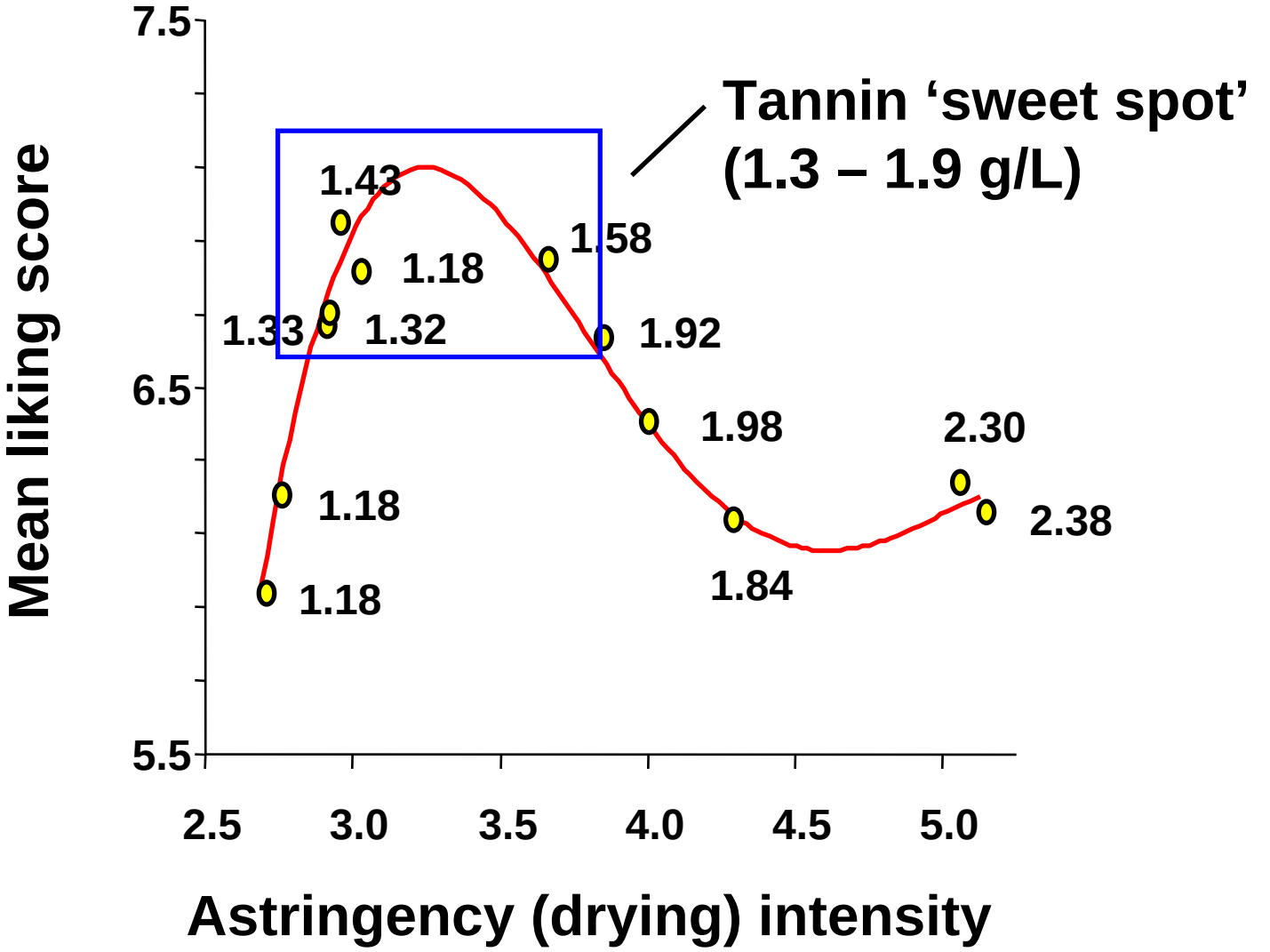


Analysis of Variance
F Ratio = 12.1
p Value = <.0001
N = 349

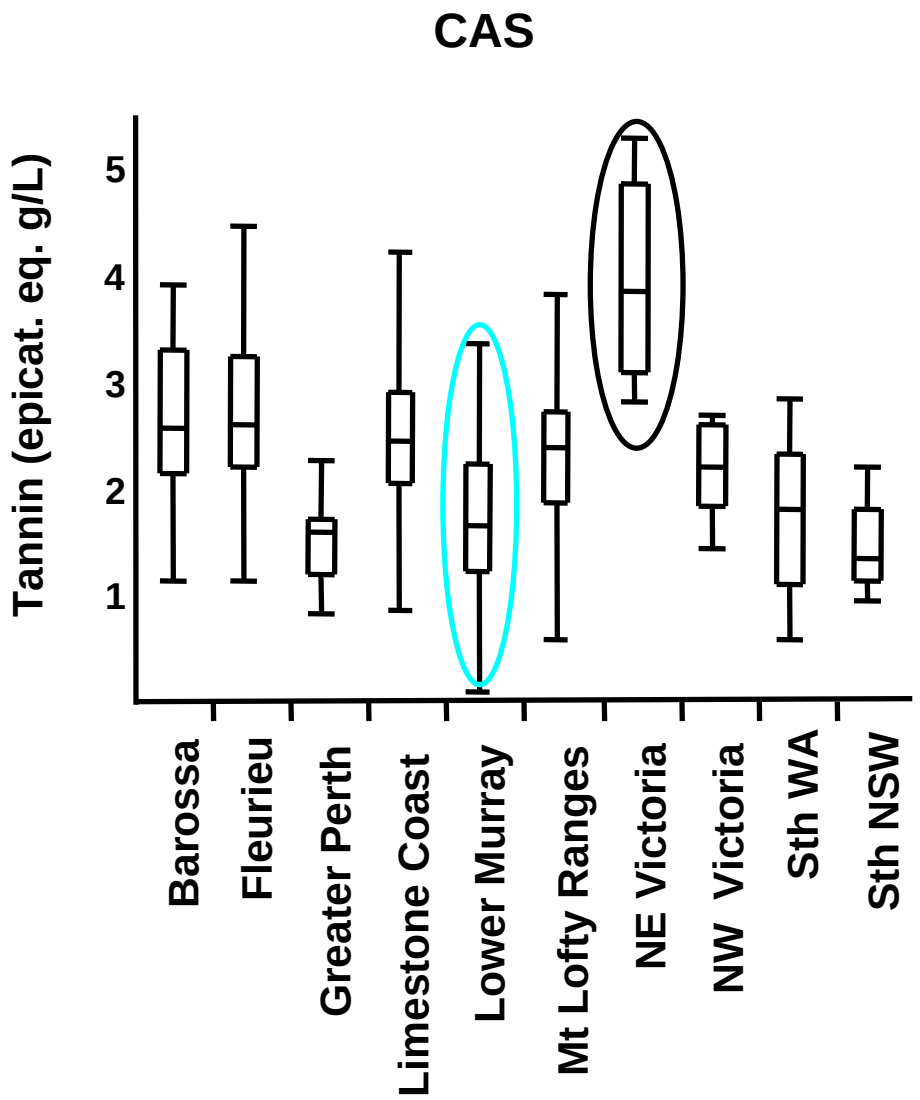
Analysis of Variance
F Ratio = 42.2
p Value = <.0001
N = 634

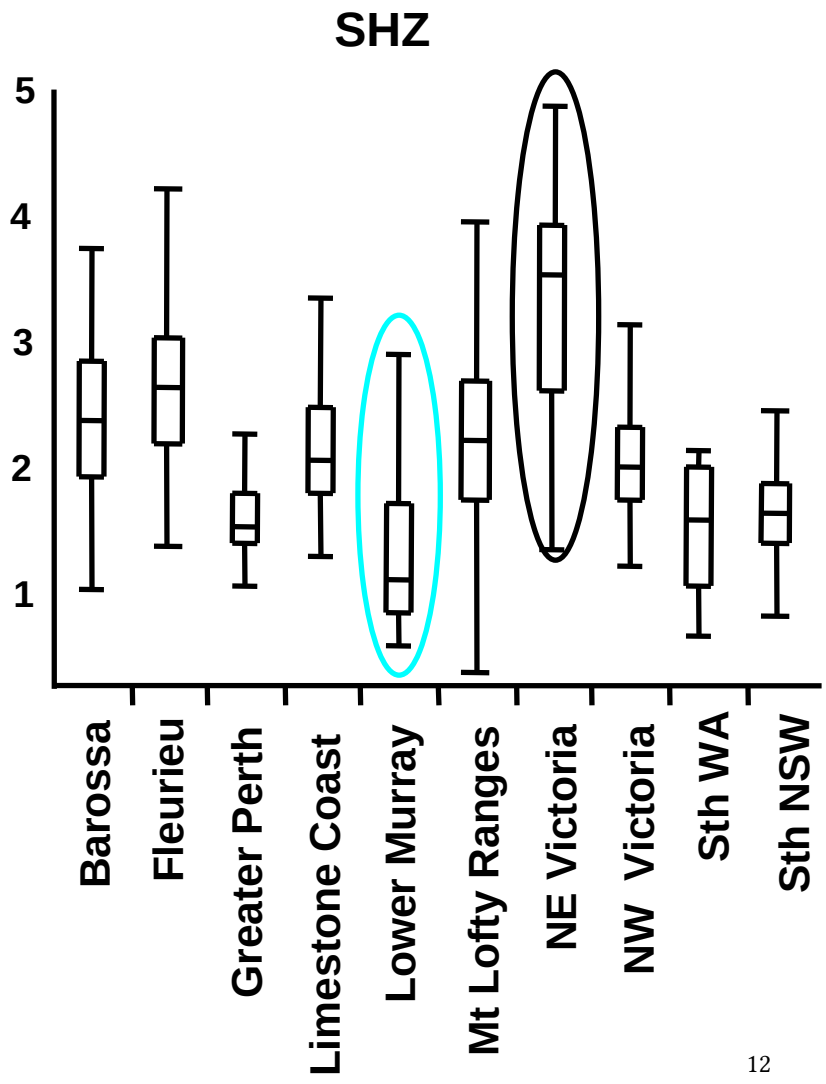
One-Way ANOVA - plot shows mean and mean error bars and Std dev – (2004 –2007)

Consumer Preference



Regional differences in Wine Tannin concentration





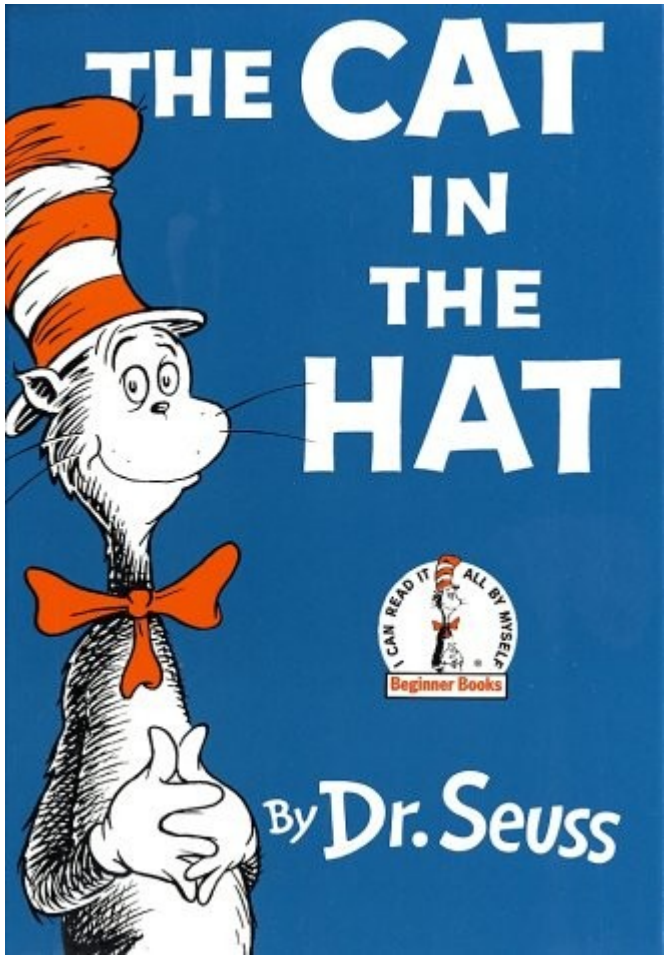
Tannin Measurement

- Methyl Cellulose Precipitable (MCP) Tannin assay
- Precipitation assay using a hydrophobic, commercially available polymer, Methyl Cellulose
- Based on the ability for the polymer to selectively complex and precipitate tannins from the sample

SOP is available at www.crcv.com.au/resources/ or soon on the AWRI website

Mercurio et al, (2007) Journal of Agricultural and Food Chemistry, 55(12); 4651-4657

Hat change – Industry Applications



REALITY
CHECK
AHEAD

Adams-Harbertson Assay

Wine

Dilute into buffer pH 4.9

Dilute into buffer pH 4.9
Containing BSA protein

Centrifuge 13,000g

Supernatant
Add SO_2

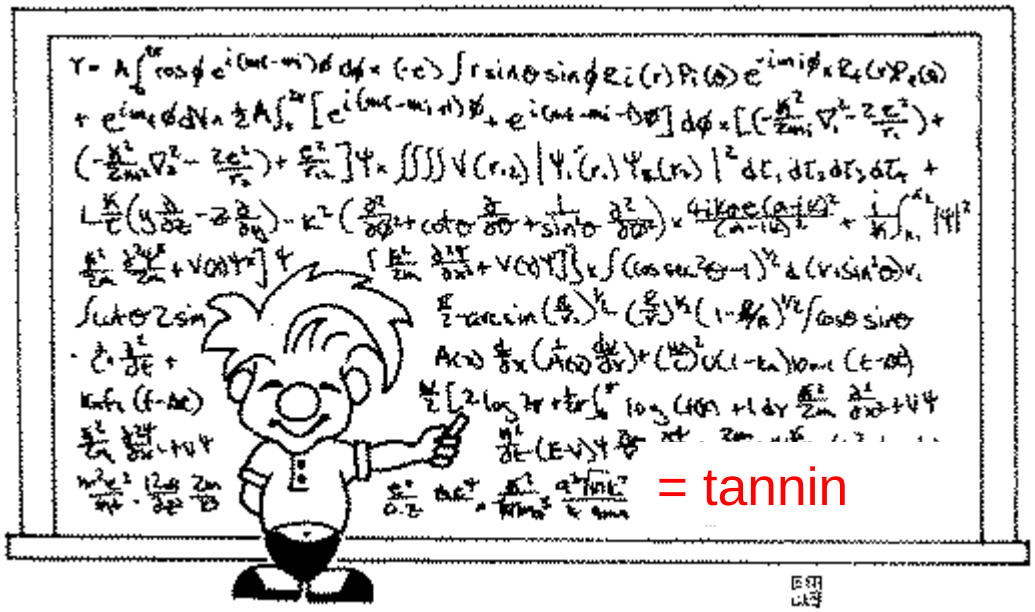
Read at 520 nm
(SPP)

Read
(total

Adjust to pH 1.8

Read at 520 nm
(Anthocyanins)

STILL TOO COMPLICATED!



(Anthocyanins)

Read at
520 nm

Dilute
into
1M HCl

Dilute into Model wine
containing SO2

Dilute into
Model wine

Dilute into
Model wine
containing
acetaldehyde

Centrifuge

Add salt

Centrifuge

Add Methyl cellulose and salt

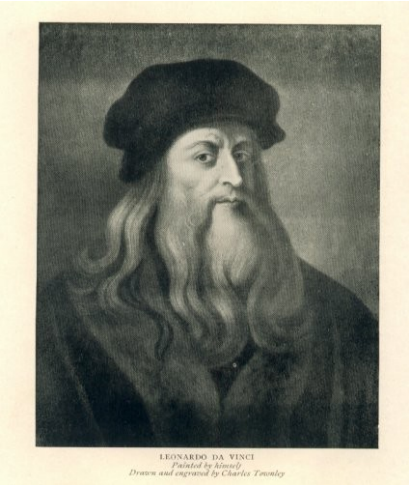
Wine

Wine

Somers colour measures

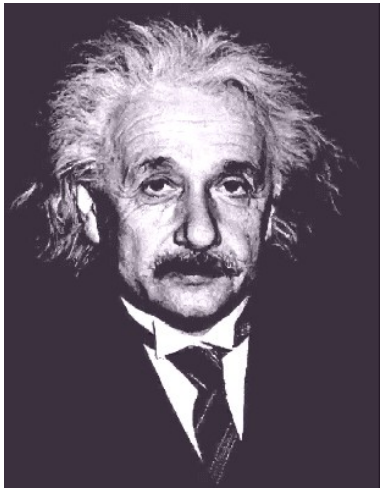
MCP Tannin assay

Two science demigods talking on the subject of simplicity



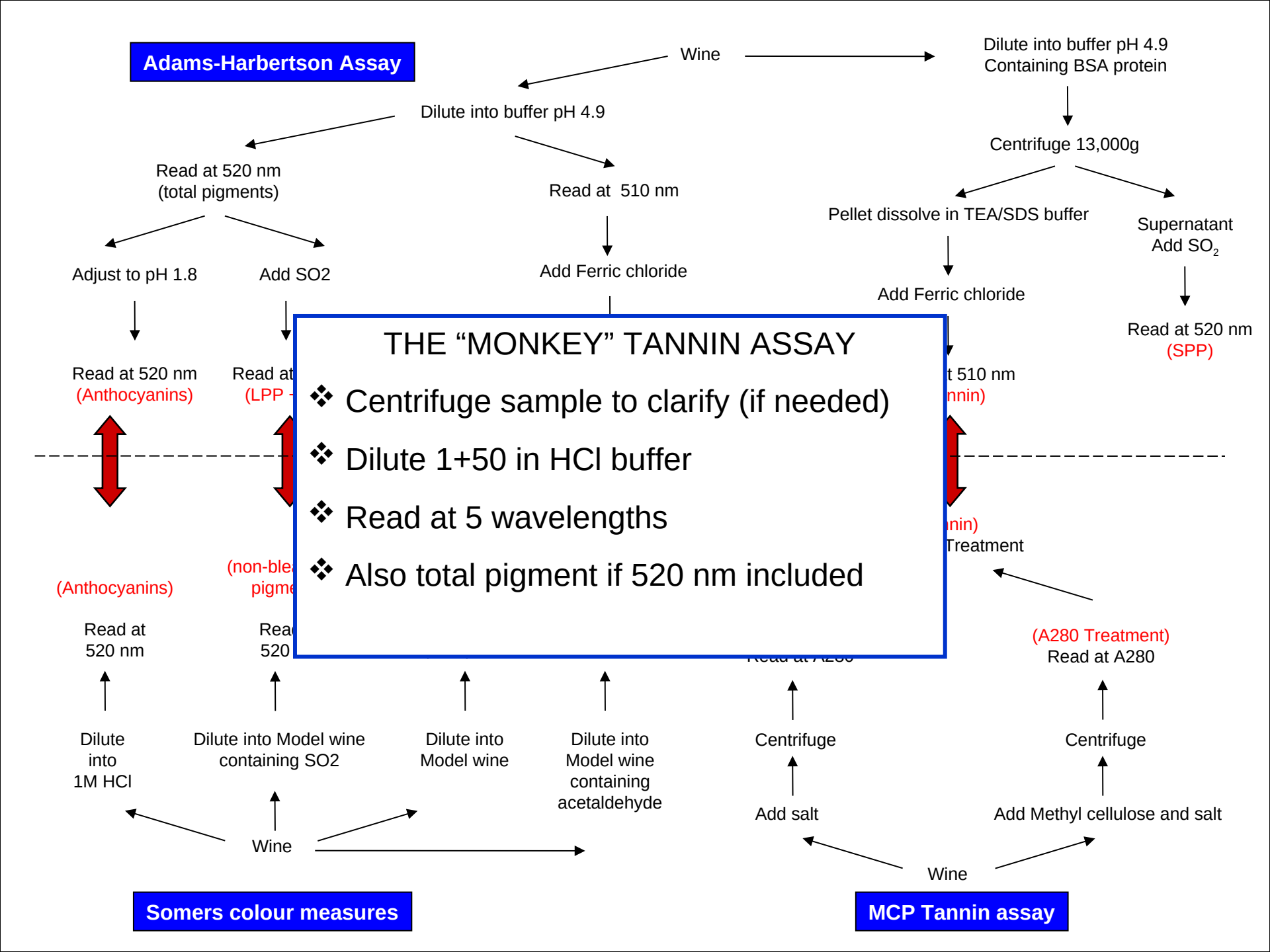
“Simplicity is the ultimate sophistication.”

Leonardo da Vinci



“Most of the fundamental ideas of science are essentially simple……..”

Albert Einstein

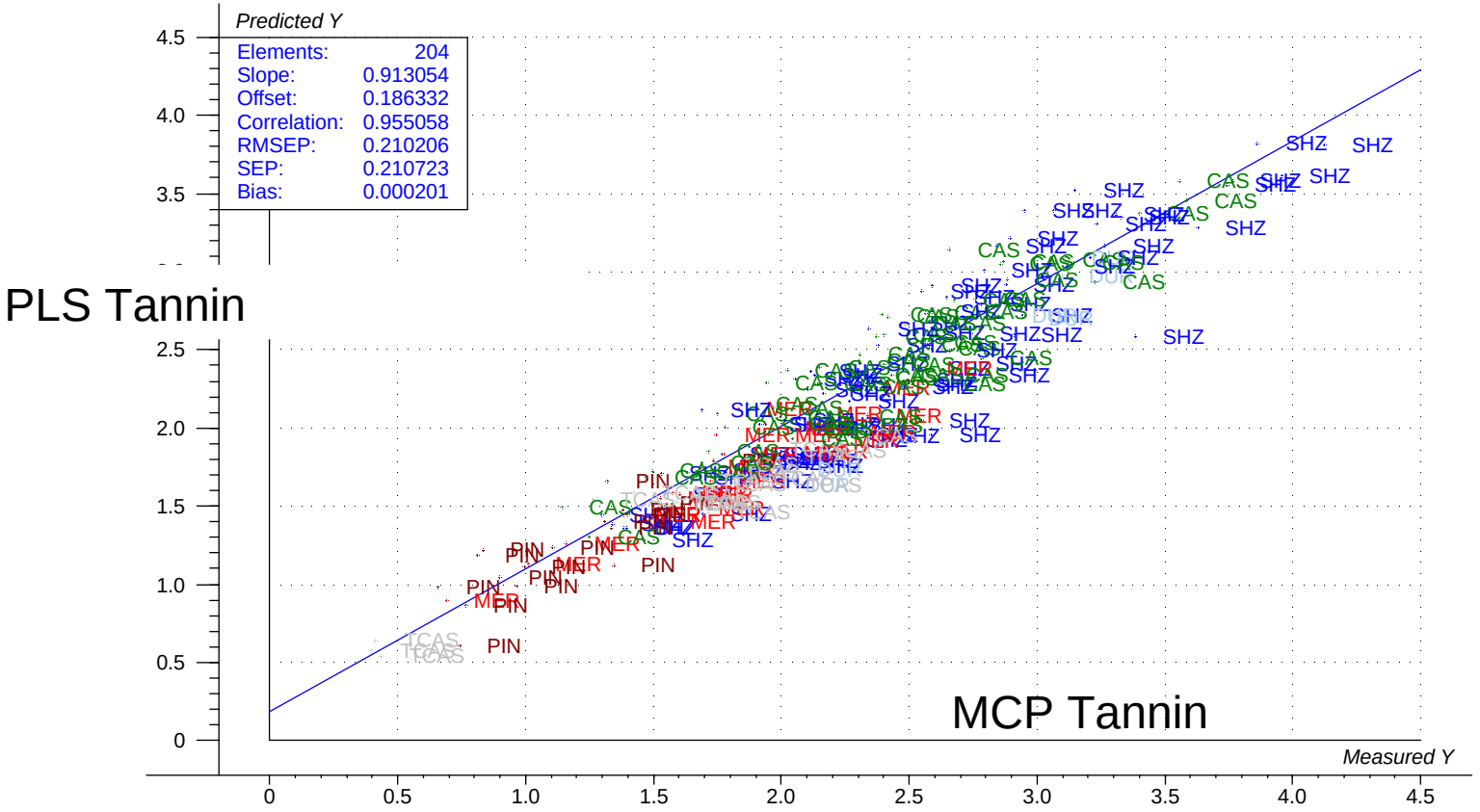

Adams-Harbertson Assay
Wine
Dilute into buffer pH 4.9
Containing BSA protein
Dilute into buffer pH 4.9
Centrifuge 13,000g
Read at 520 nm
(total pigments)
Read at 510 nm
Pellet dissolve in TEA/SDS buffer
Supernatant
Add SO2
Adjust to pH 1.8
Add SO2
Add Ferric chloride
Add Ferric chloride
Read at 520 nm
(SPP)
Read at 520 nm
(Anthocyanins)
Read at
(LPP
t 510 nm
nnin)
THE "MONKEY" TANNIN ASSAY
Centrifuge sample to clarify (if needed)
Dilute 1+50 in HCl buffer
Read at 5 wavelengths
Also total pigment if 520 nm included
nin)
Treatment
(Anthocyanins)
(non-ble
pigme
Read at
520 nm
Rea
520
(A280 Treatment)
Read at A280
Dilute
into
1M HCl
Dilute into Model wine
containing SO2
Dilute into
Model wine
Dilute into
Model wine
containing
acetaldehyde
Centrifuge
Centrifuge
Add salt
Add Methyl cellulose and salt
Wine
Wine
Somers colour measures
MCP Tannin assay

Roadblock to uptake of spectroscopy/chemometric methods

SOLUTION?

Use existing equipment e.g. standard UV-Vis spectrophotometer

Partial Least Squares (PLS) regression to predict MCP tannin with 110 wavelengths

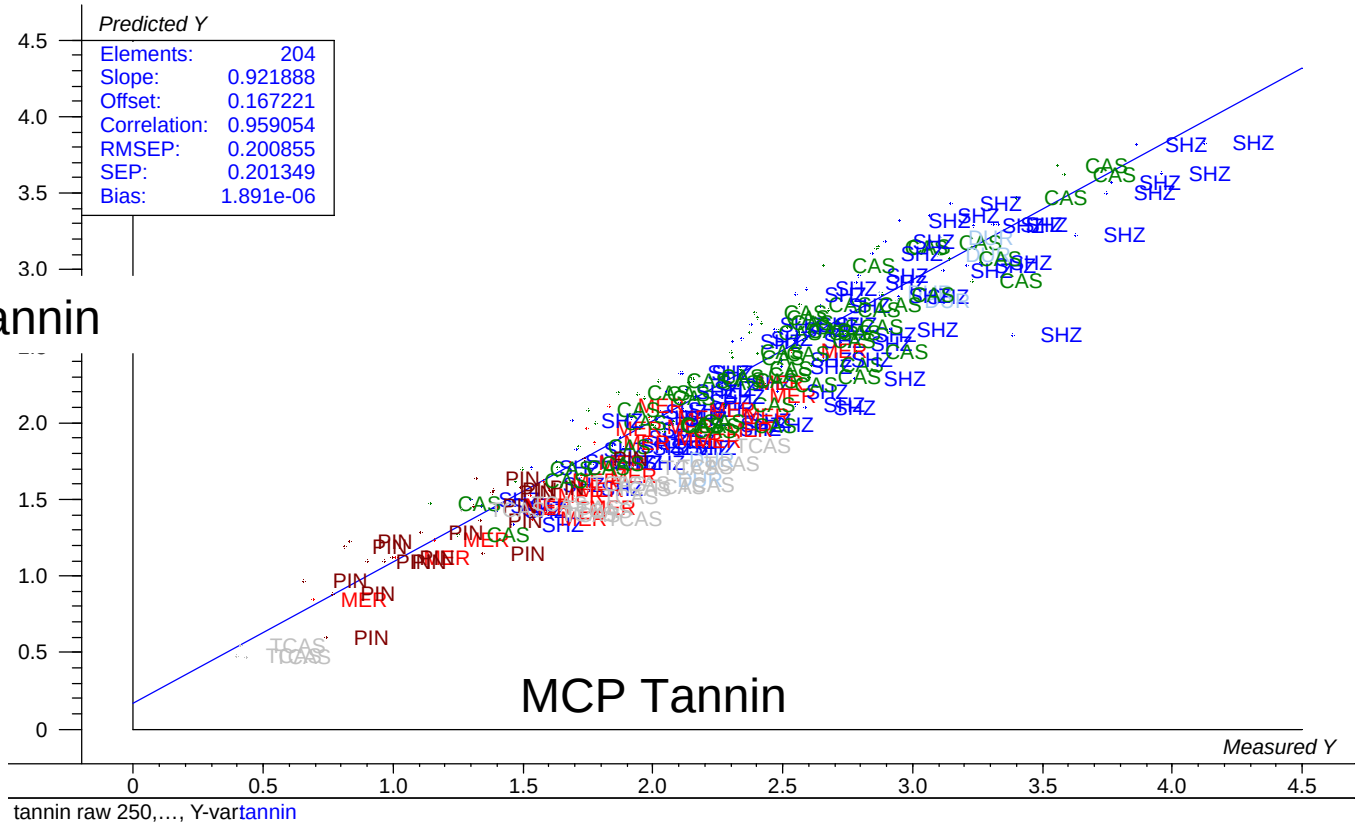


2 Factors

R^2 (val) = 0.91 SECV = 0.21 g/L Epicat equiv

CV = 10.0% RPD = 3.4 raw spectra 240-350 nm

Multiple Linear Regression (MLR) using only 5 UV wavelengths



R^2 (val) = 0.92 SECV = 0.20 g/L Epicatechin equiv

CV = 9.3% RPD = 3.6

NOTE: using only A_{280}
R^2= 0.76, SECV = 0.34 g/L

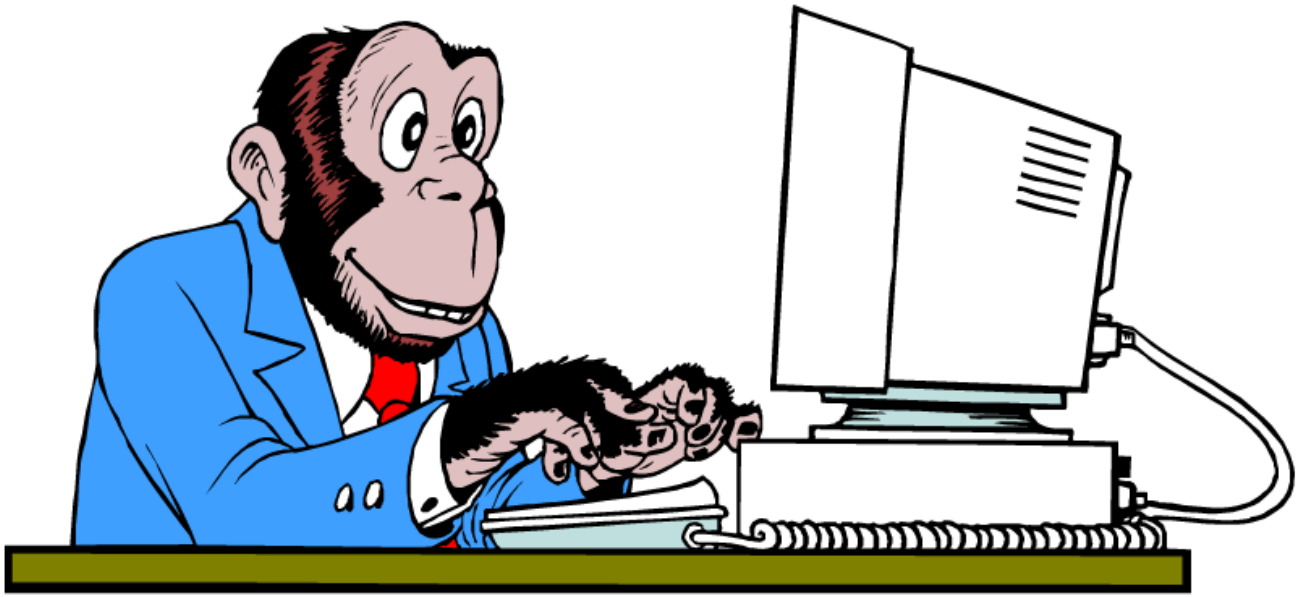
Another roadblock to uptake of spectroscopy/chemometric methods

SOLUTION?

Use AWRI expertise

The future.....

We would like measuring tannin to be so simple that this guy can do it…



Instinct

Information

Acknowledgements

- AWRI Tannin team (David Jeffery, Helen Holt, Mango Parker, Stella Kassara, Meagan Mercurio)
- AWRI Rapid Analytical Methods team (RAMS)
- AWRI Sensory team
- Hardy Wine Company (Chris Bevin), Fosters Group (Dr Eric Wilkes), Orlando Wines (Jai O'Toole), McGuigan Simeon Wines (Dr Bruce Kambouris).

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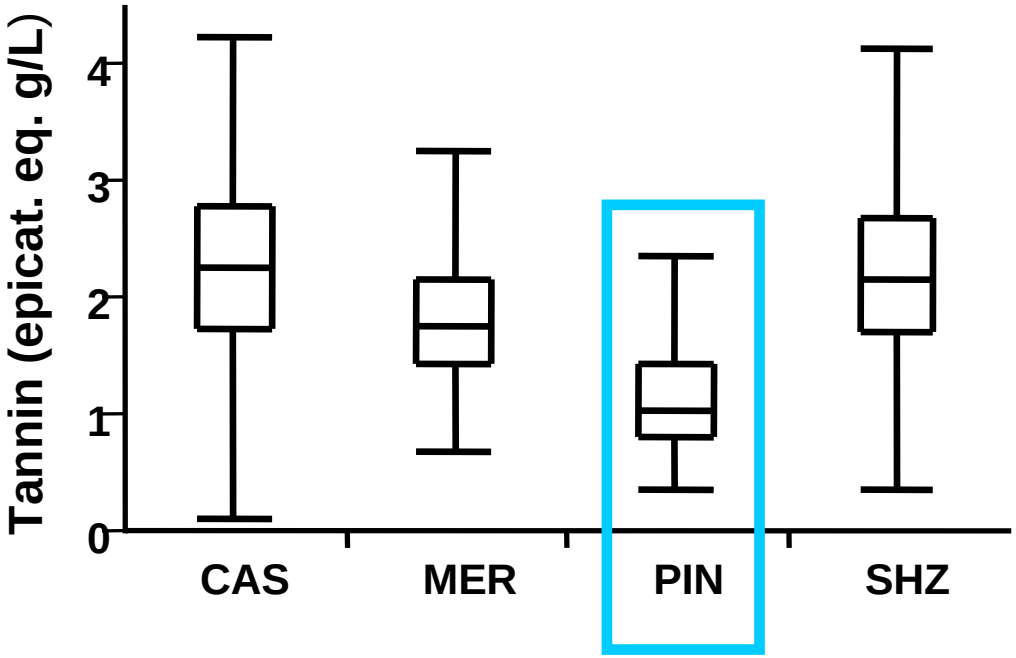
Question time

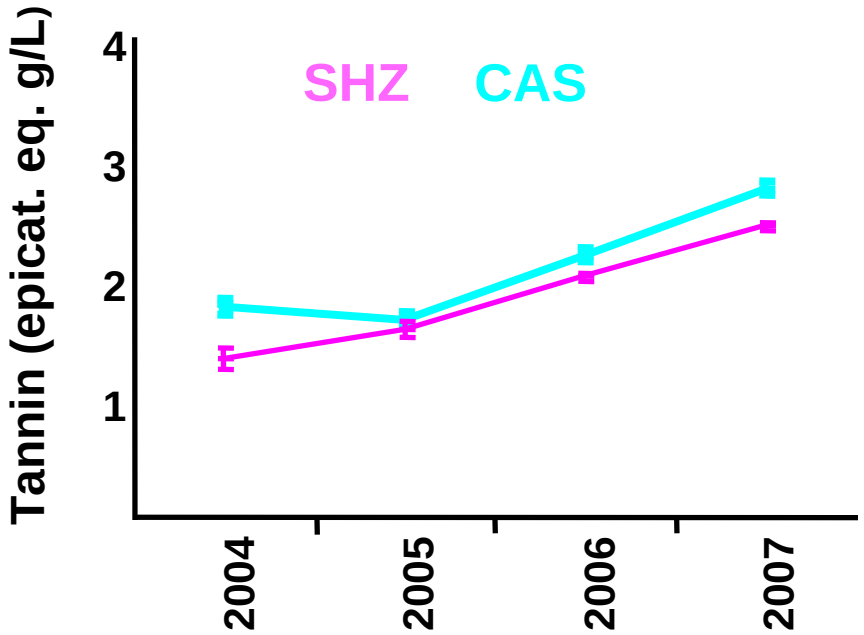
Varietal differences in Wine Tannin concentration



Variety	N	Low	Med	High	Mean
CAS	629	0.1 – 1.7	1.7 – 2.8	2.8 – 5.3	2.9
MER	188	0.3 - 1.4	1.4 – 2.2	2.2 – 3.3	1.8
PIN	112	0.4 – 0.8	0.8 – 1.4	1.4 – 3.5	1.2
SHZ	1107	0.4 – 1.7	1.7 – 2.7	2.7 – 4.9	2.2

Concentrations in g/L

Vintage differences in Wine Tannin concentration



	2004		2005		2006		2007	
Variety	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**
CAS	89	1.8	57	1.7	189	2.2	209	2.8
SHZ	69	1.3	62	1.6	290	2.0	603	2.5

Concentrations in g/L