

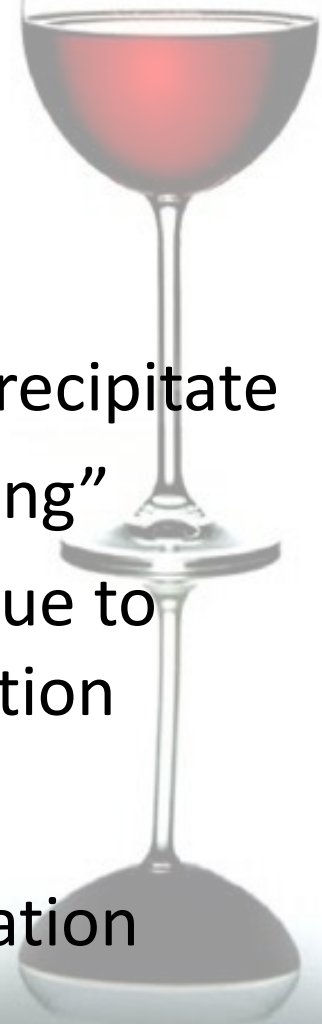
# Development and use of the Mouth-feel Wheel



Anita Oberholster

# Astringency Perception

- Astringency described as “roughing”, “drying” and “puckering”
- Tactile sensation
- Mechanism of astringency
  - Phenols bind with saliva proteins and precipitate
  - Stripping the mouth of lubrication “drying”
  - Texture effect of astringency could be due to precipitated complexes or those in solution
- Astringency is dynamic process
  - Changes during ingestion and expectoration



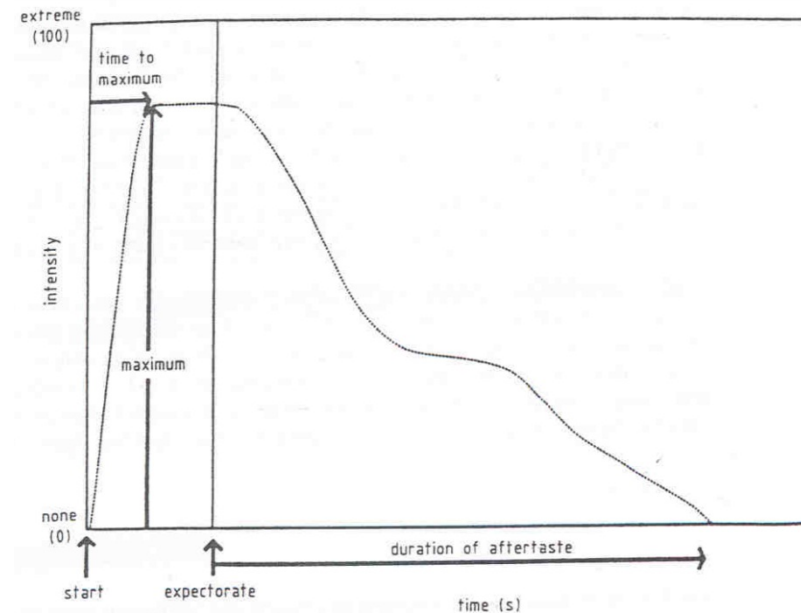
# Influences on Astringency + Bitterness

- Ethanol %
  - Decrease astringency perception
  - Increase bitterness perception
- Sugar content
  - Decrease bitterness
  - No influence on astringency, but more difficult to perceive
- Other wine compounds such as acid have astringent sub-qualities themselves

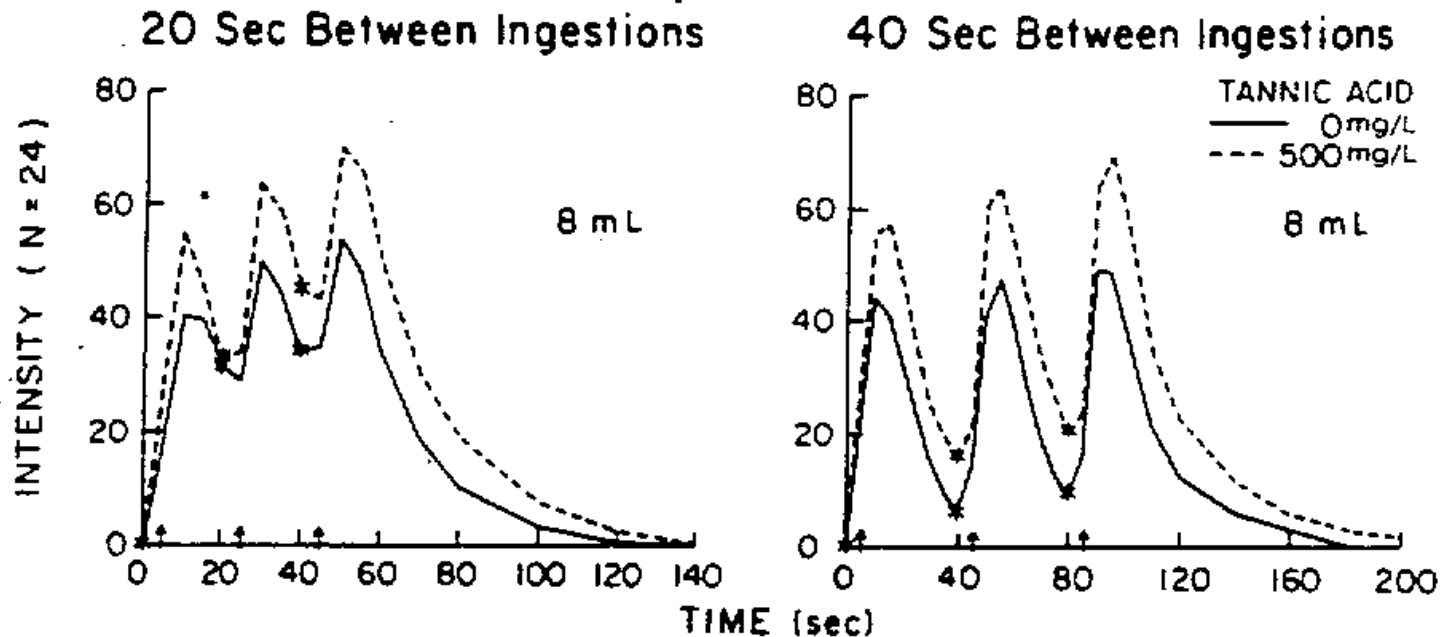


# Variation within Tasters

- Effect of variation in salivary flow rate on time-intensity scaling of bitterness and astringency
  - Low-flow; perceive max intensity later, more intense, persistence longer



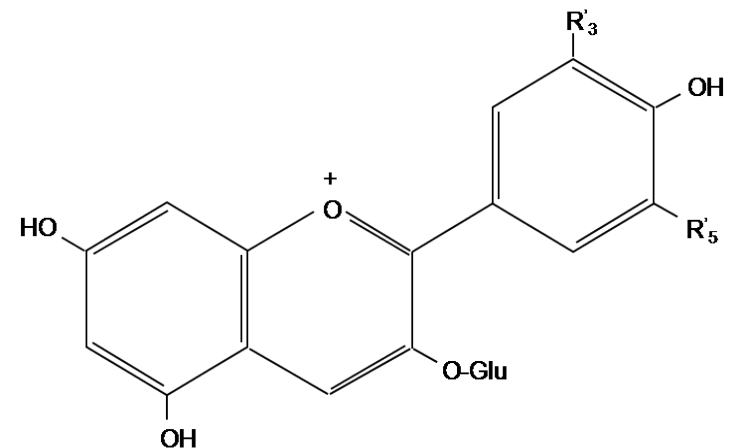
# Astringency as a taste



- Average time-intensity curves for astringency in wine upon three successive ingestions: left 20s between ingestions; right 40s between ingestions. Sample uptake and swallowing are indicated by a *star* and *arrow*, respectively

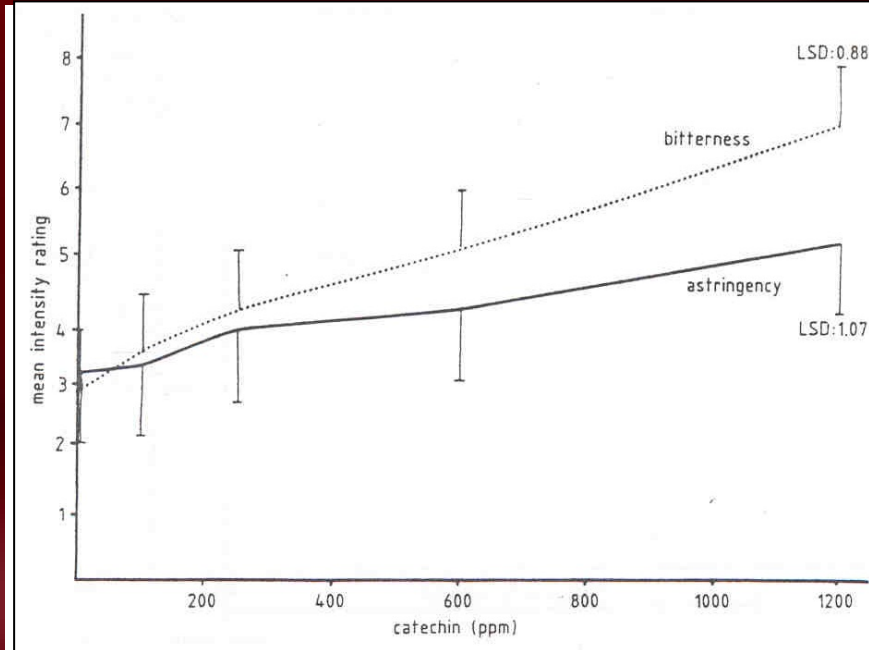
# Phenolics: Main Contributors to Astringency and Bitterness

- Main phenols (flavonoids) in red wine
  - Anthocyanins responsible for red color
  - Flavan-3-ols (ex. catechin, epicatechin)
    - Oligomers and polymers of flavan-3-ols, so called proanthocyanidins (PA) or condensed tannins Fig 1
- Extraction during wine making
  - Seed PA (mDP ~ 10)
  - Skin PA (mDP ~ 30)
  - Anthocyanins from skins



**Anthocyanin**

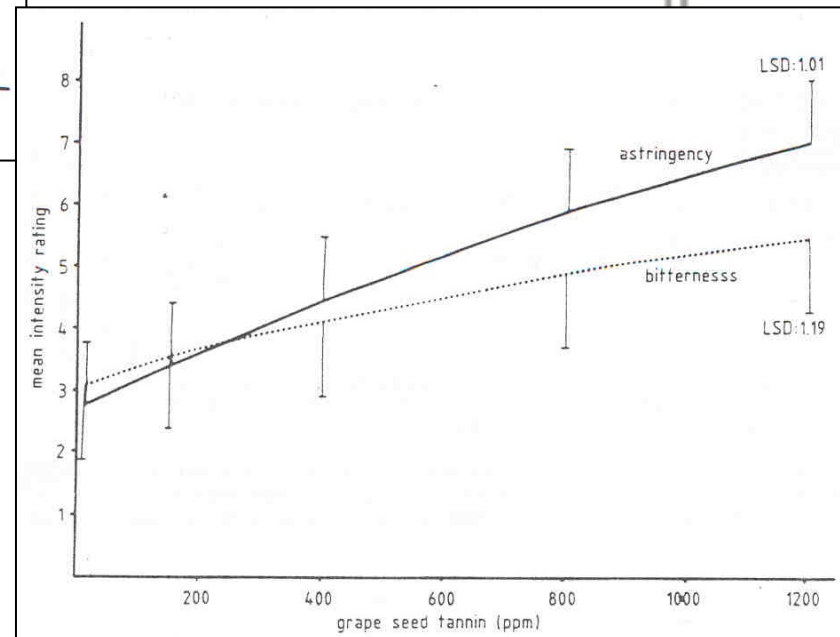
# Sensory Properties of Flavanols



- Monomers more bitter than astringent



- Ratio of astringency to bitterness  $\uparrow$  with  $\uparrow$  mDP



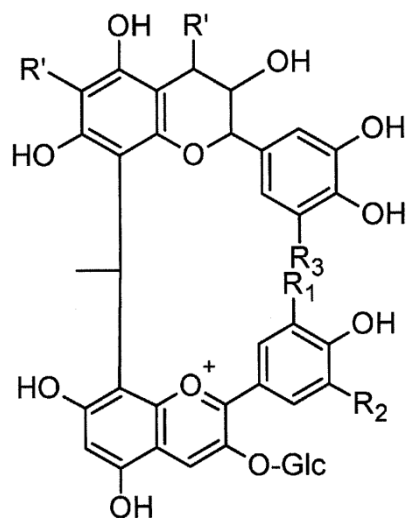
# Polymeric Phenols and Astringency

- Sensory properties of proanthocyanidins (PA)
  - Main contributors to bitterness and astringency
  - Ratio of astringency to bitterness increase with mDP
- During wine maturation and ageing
  - Anthocyanins and PA polymerise with each other by different mechanisms
  - Influenced by grape composition, presence of wood (hydrolyzable) tannins

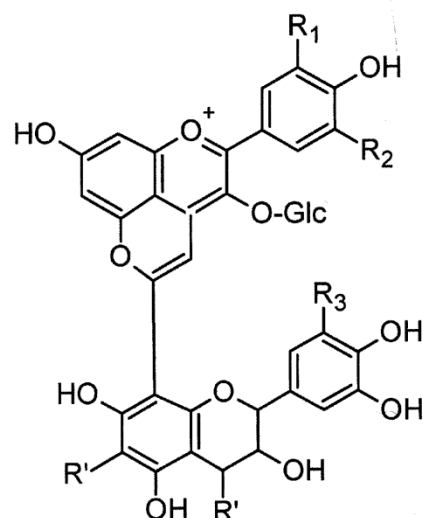




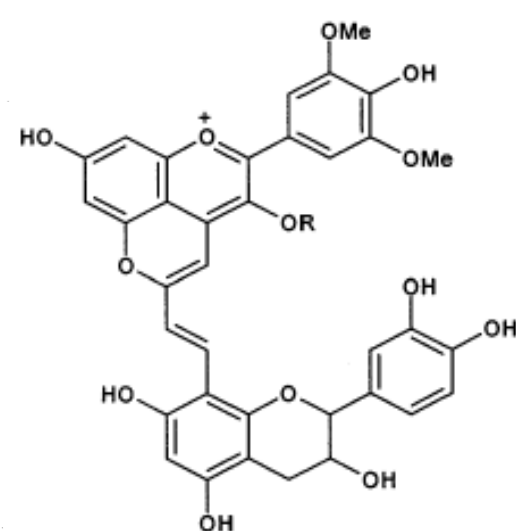
# Wine pigments



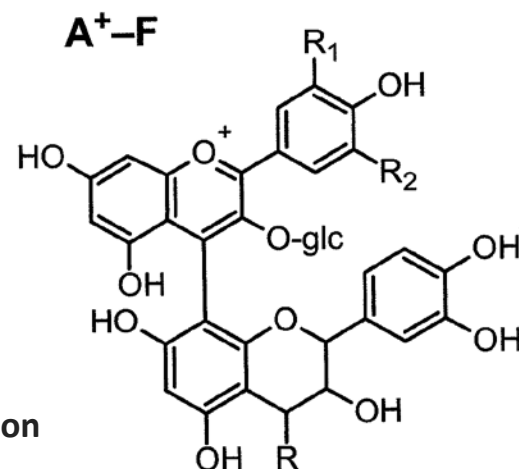
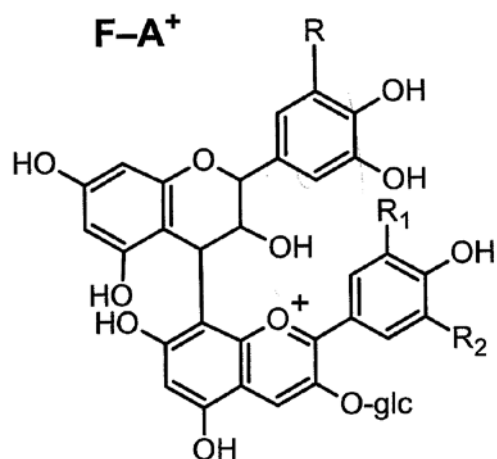
Flavan 3-ol-ethyl-anthocyanin



Flavanylpyranoanthocyanin



Flavanyl-vinyl-pyranoanthocyanin



Direct condensation

# Chemical and sensory properties of red wine pigments

- Characterization of polymeric pigments
  - Comparing the polymeric pigment profile of 6 month old and 5 year old Syrah wine from the same vineyard
    - $\uparrow$  conc. of polymeric pigments, methylmethine and vinyl-linked pigments
    - mDP of wine 4  $\rightarrow$  10
  - Development of the mouth-feel wheel



# Developing the mouth-feel wheel

- Panel of 14 tasters tasted 72 wines over 6 week period to derive a vocabulary
  - 6 months to 33 year old red wines (mean 4 yrs)
  - Mostly Australian Shiraz, Cab. Sauv. Pinot noir, Grenach
- Another 75 red wines tasted to derive mouth-feel terms not astringent-like
  - Influence mouth-feel
- Investigate standards
  - Taste standards for astringency not practical

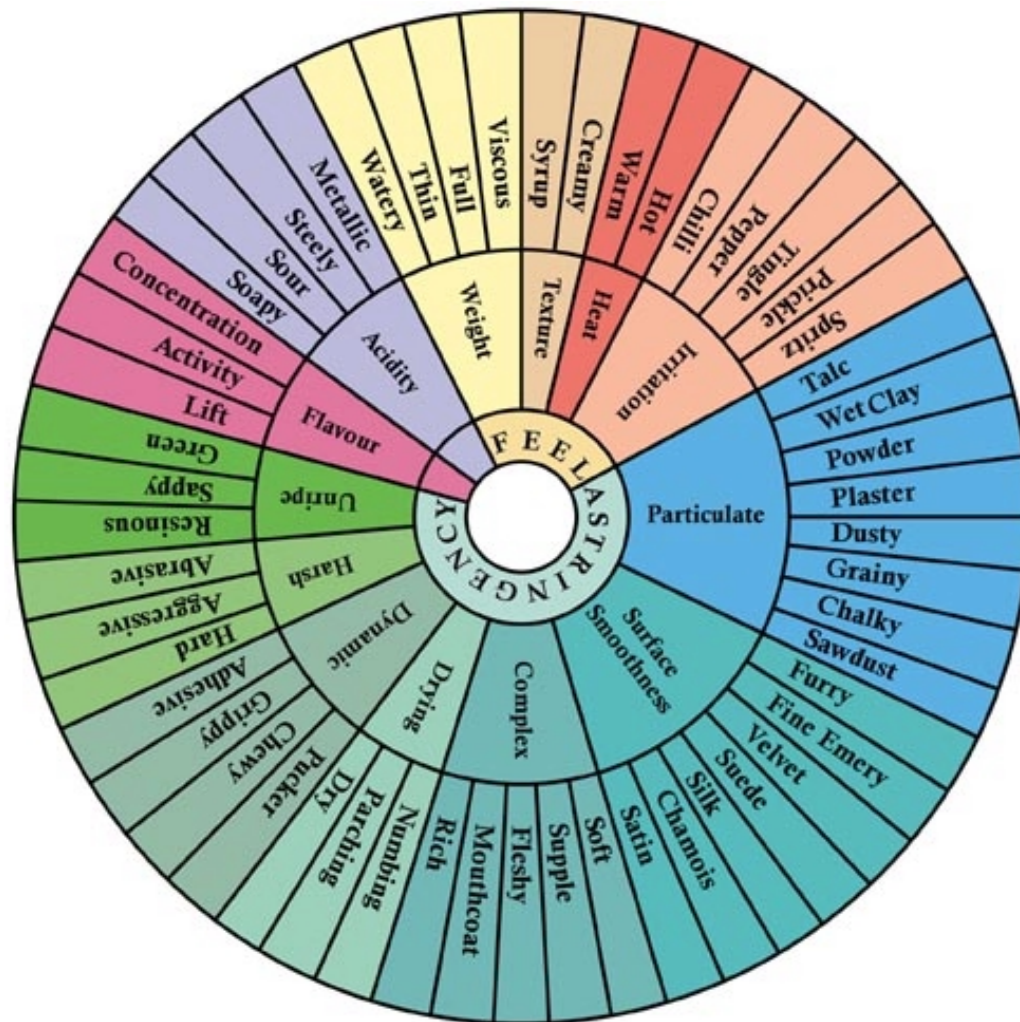


# Standards for Mouth-feel

- Taste standards
  - Commercial tannins and other
    - Complex profiles
    - Tiring, influence subsequent perceptions
    - Carry-over effects
  - Touch standards
    - Cutaneous sensations similar to those experienced in the mouth
  - Terms not represented by physical standards – well defined



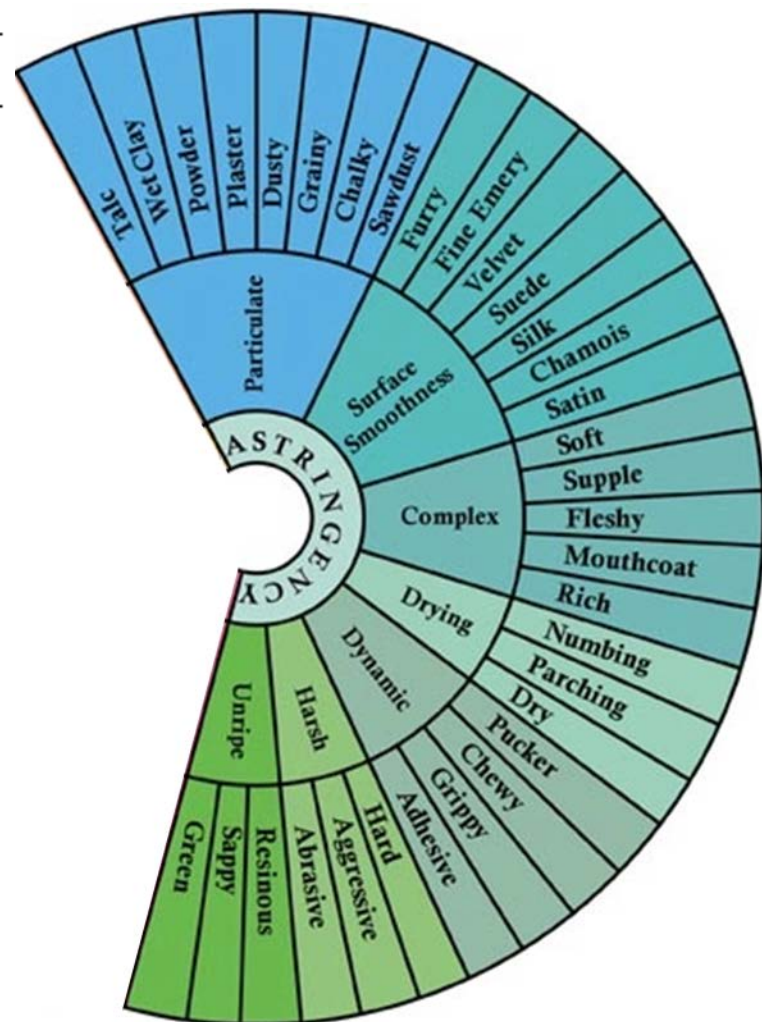
# Mouth-feel wheel





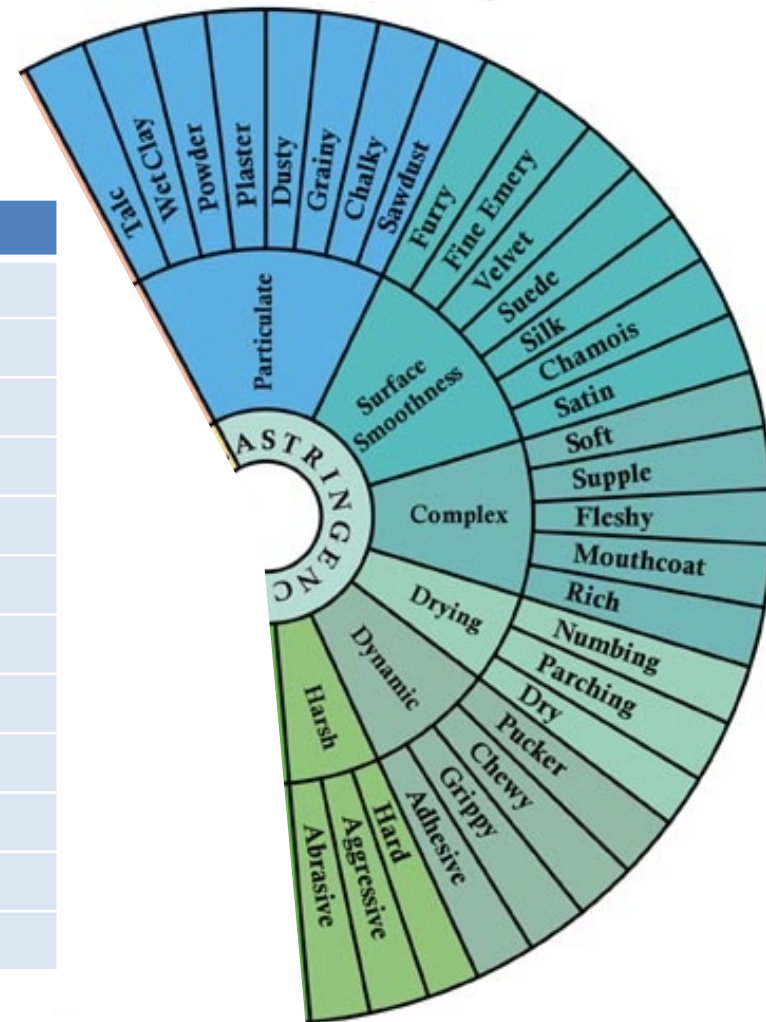
# Mouth-feel Wheel Astringency

Grouping	Distinguishing feature of the group
<i>particulate</i>	Feelings of particulate matter brushing against the surfaces of the mouth through the movement of the wine.
<i>surface smoothness</i>	Textures felt on mouth surfaces when the different surfaces come in contact with each other.
<i>complex</i>	A positive hedonic grouping consisting of an amalgam of pleasing astringency sensations, flavour and balanced acidity.
<i>drying</i>	Feelings of lack of lubrication or desiccation in the mouth.
<i>dynamic</i>	Sensations involving some form of mouth movement.
<i>harsh</i>	A negative hedonic grouping suggesting aspects of excessive unbalanced astringency, excessive roughness and/or bitterness.
<i>unripe</i>	A negative hedonic grouping consisting of an astringent feel associated with excessive acidity and associated green flavour notes.



# Touch Standards Representing Tactile Sensations

Descriptor	Touch standard
Talc	Johnson baby powder
Satin	Satin cloth
Plaster	Gypsum powder
Chamois	Moistened chamois
Silk	High grade silk cloth
Velvet	Velvet felt in direction of the nap
Suede	Medium suede leather
Furry	Short velour cloth
Fine emery paper	1000 grade emery paper
Corduroy	Medium cord cloth
Abrasive	600 grade sandpaper
Hessian	Carpet backing



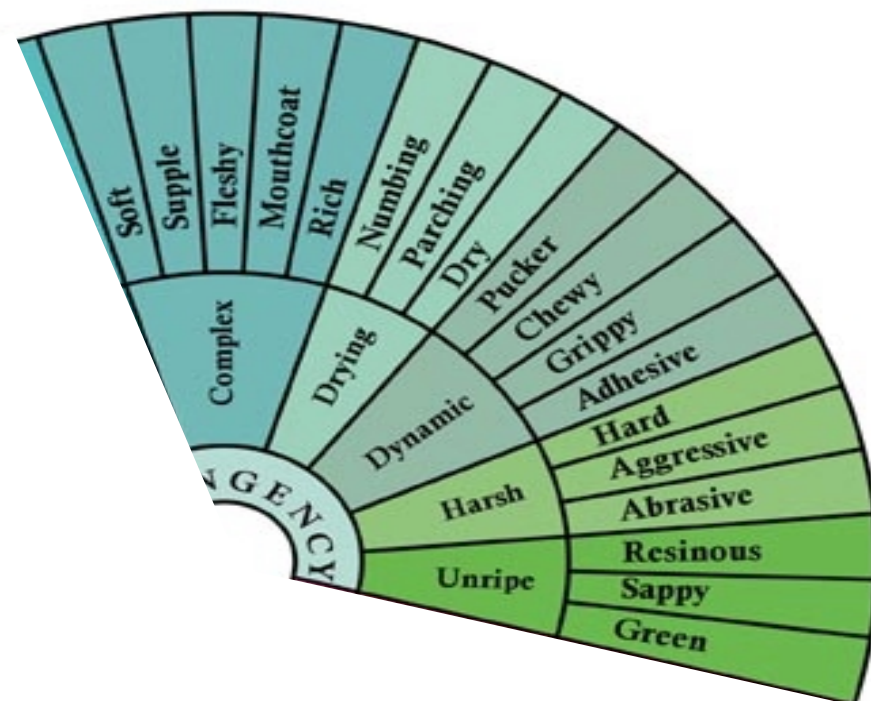
# Touch Standards Representing Tactile Sensations





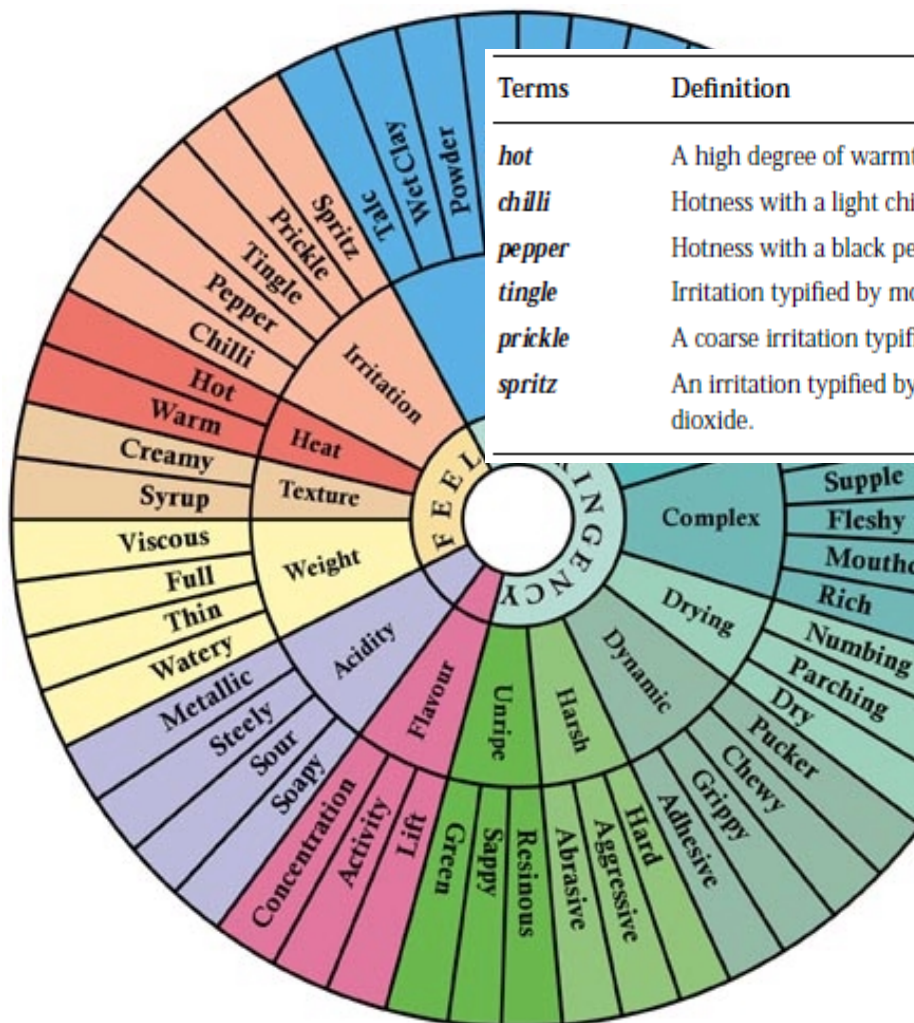
# Supplementary Definitions for Astringency Terms

Term	Definition
<i>pucker</i>	A reflex action of mouth surfaces being brought together and released in an attempt to lubricate mouth surfaces.
<i>chewy</i>	Gives the feeling that mouth movements (chewing) can displace the astringent sensation.
<i>grippy</i>	Distinct lack of slip between mouth surfaces resulting in the inability to easily move mouth surfaces across each other.
<i>adhesive</i>	The feeling that mouth surfaces are sticking or adhering to one another, yet can be pulled away from each other with slight pressure.
<i>hard</i>	Combined effect of bitterness and astringency. Synonym 'harsh'.
<i>aggressive</i>	Balance term indicating excessive astringency.
<i>abrasive</i>	Excessive astringency of a strongly roughing nature.
<i>soft</i>	A light and finely textured astringency.
<i>supple</i>	Balance term indicating low to moderate astringency with an appropriate level of acidity and flavour concentration.
<i>rich</i>	High flavour concentration with balanced astringency.
<i>fleshy</i>	High flavour concentration with suppleness.
<i>mouthcoat</i>	Gives the impression of a coating film that adheres to mouth surfaces, and which falls from the mouth surfaces with time.



Term	Definition
<i>parching</i>	Drying with a background of alcohol hotness.
<i>green</i>	Combined effect of excess acidity and astringency.
<i>sappy</i>	Astringency with high acid and slightly bitter. Reminiscent of the astringency elicited by chewing on a green grape stalk.
<i>resinous</i>	Astringency elicited as if chewing on a piece of raw wood.

# Non-astringent Mouth-feel Terms



Terms	Definition	
<i>hot</i>	A high degree of warmth.	ion of the degree of retronasal volatility.
<i>chilli</i>	Hotness with a light chilli-like irritation.	o a perfumer's top note.
<i>pepper</i>	Hotness with a black pepper-like irritation.	of freshness, often associated with a
<i>tingle</i>	Irritation typified by mouth exposure to sherbet.	ression that can be identified as varietal
<i>prickle</i>	A coarse irritation typified by exposure to acetic acid.	ived in young wines.
<i>spritz</i>	An irritation typified by exposure to dissolved carbon dioxide.	vour. Overall amount of flavour
		idity that provides a light soapy feel on
		ices.
		ean acidity.

<i>steely</i>	Sensation as if the mouth/tongue has contacted a stainless steel object.
<i>metallic</i>	Sensation of tasting a metal object. A low level of galvanic or electrical sensation.
<i>watery</i>	Low in body, viscosity and flavour.
<i>thin</i>	Low in body and flavour.
<i>full</i>	A feeling of a force pressing against the mouth surfaces and tongue.
<i>viscous</i>	An apparent thickness resulting in pressure required to move the wine around the mouth.
<i>syrup</i>	A high degree of viscosity.
<i>creamy</i>	A soft feel on the surfaces of the mouth, not unlike the feel of residual cream.
<i>warm</i>	Warming effect of the mouth surfaces primarily due to alcohol.

# Using the Mouth-feel Wheel (MFW)

- Vidal (2003, 2004) fractionated tannins from grape material – evaluate with MFW
  - Larger tannin more astringent and drying than smaller tannin
  - Seed tannin more astringent (coarse, drying) than skin tannin of equivalent size
  - Indicate → ‘Coarseness’ and ‘dryness’ of astringency increase with galloylation
  - Methylmethine-bridged flavanols more bitter than similar tannins



# Using the Mouth-feel Wheel (MFW)

- Anthocyanins have no taste or tactile effect (*Singleton and Trousdale, 1992*)
- Anthocyanins ↑ perceived astringency and “fullness” of model wine (*Vidal et al., 2004b*)
- Anthocyanins – more pure – no significant contribution to mouth-feel (*Vidal et al., 2004a*)
- How do you explain differences between white wine and red wine?



# Using the Mouth-feel Wheel (MFW)

- How do you explain changes in mouth-feel observed during aging?
  - Could polymerization reactions explain changes in mouth-feel observed?
  - Increase mDP proanthocyanidins ↑ astringency
  - Formation of polymeric pigments?

Oberholster et al, (2009) *Austr. J. Grape Wine Res.* (15) 59-69

Singleton and Trousdale (1992) *AJEV* 43, 63-70

Vidal et al. (2004a) *Food Qual. Pref.* 15, 209-217

Vidal et al. (2004b) *Food Chem.* 85, 519-525

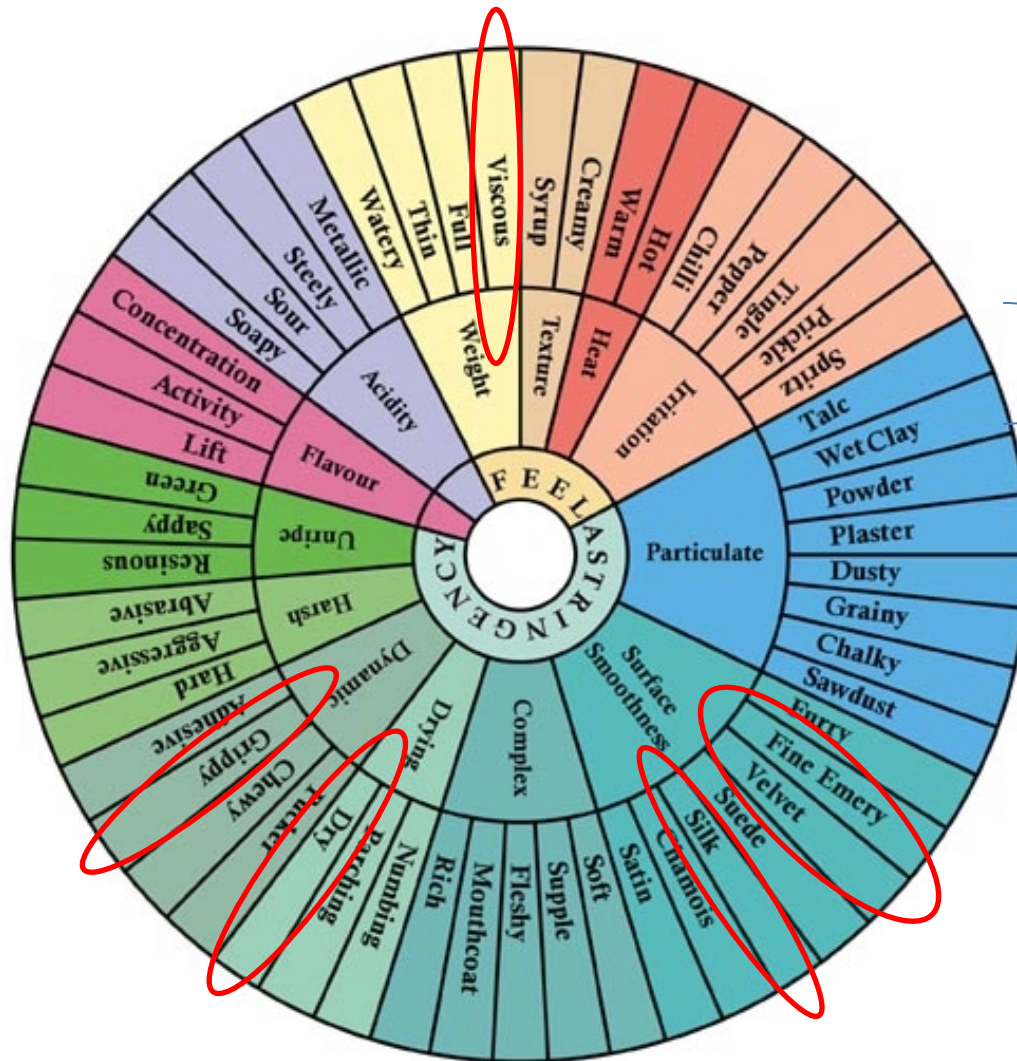




# Mouth-feel of different white wine treatments



# Mouth-feel Wheel



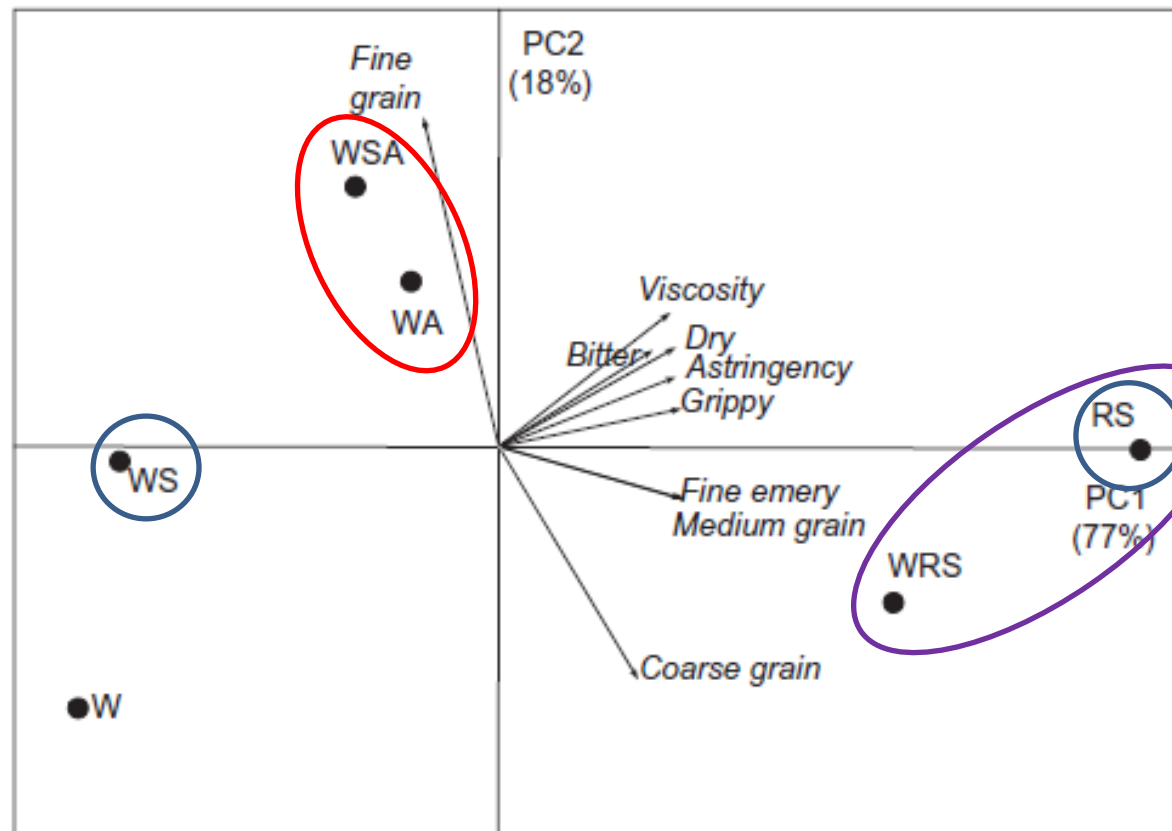
Fine grain (Talcum powder)

Medium grain (Bentonite)

Coarse grain (Celite S45 filter aid)



# Mouth-feel of different white wine treatments



- W: white free run juice
- WA: white free run juice + anth
- WS: white free run juice + white skins and seeds
- WSA: white free run juice + white skins and seeds + anth
- WRS: white free run juice + red skins and seeds
- RS: red wine



# Conclusion

- Using the MFW – small differences in phenol content could be related to mouth-feel differences
  - Anth increases astringency related terms, mainly fine grain sub-attributes
- But MFW is difficult to use – needs extensive training
- Doubt wine consumers will be able to use this wheel to communicate in meaningful way



# Thank you

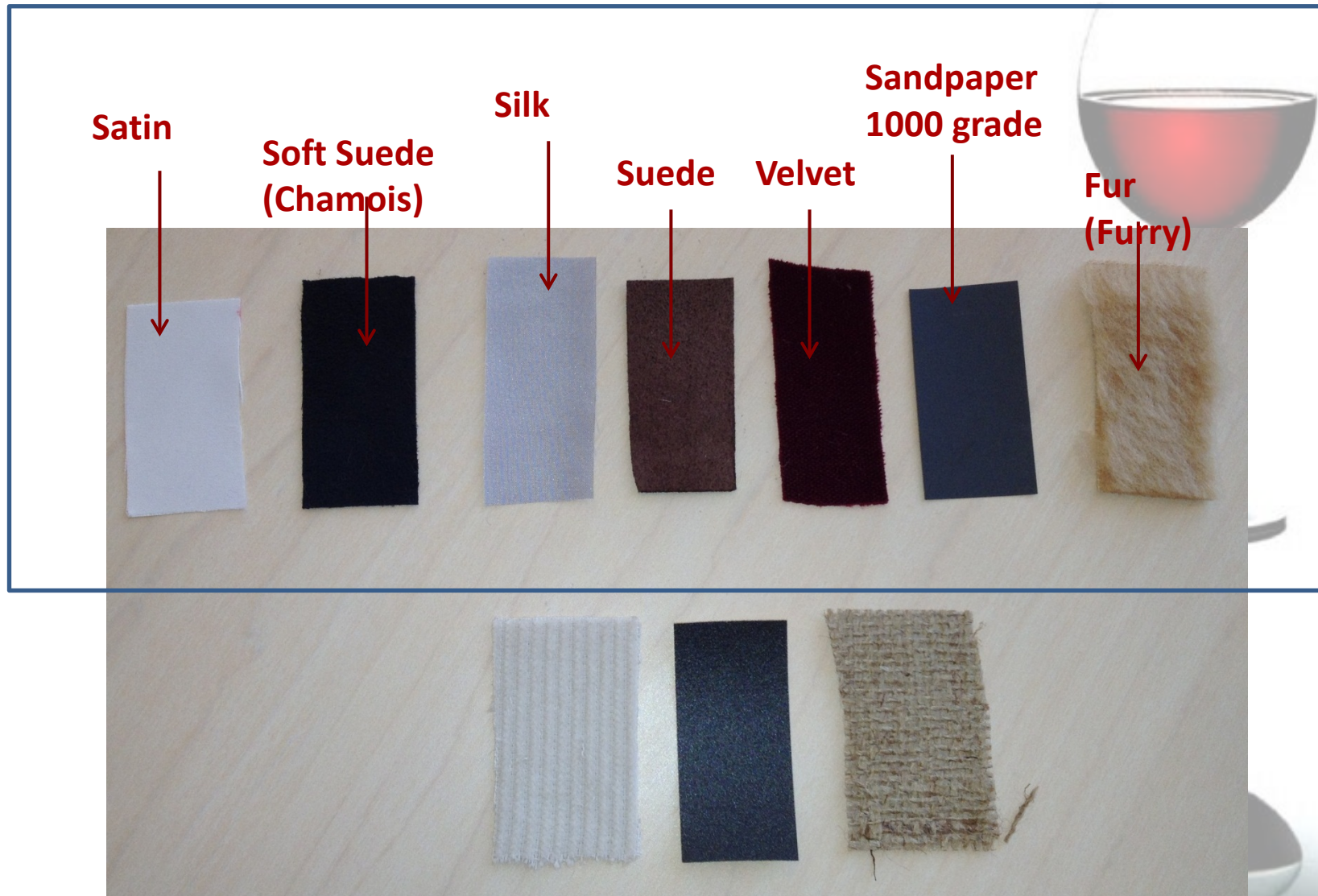
- Funding (GWRDC)
- Mouth-feel panel

**Elizabeth Waters**  
**Graham Jones**  
**Patrick Iland**  
**Leigh Francis**  
**Richard Gawel**

**Karen Block**  
**Linda Bisson**  
**Lucy Joseph**  
**Kay Bogart**

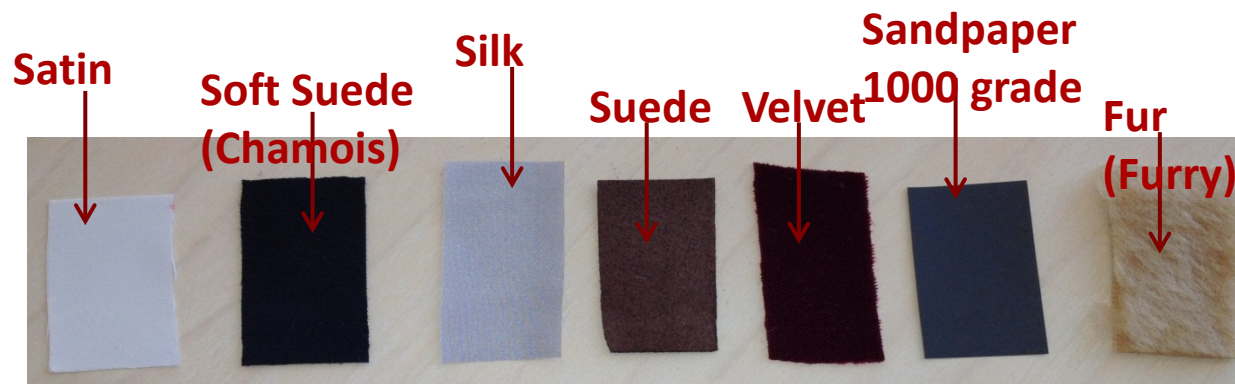


# Touch Standards Representing Tactile Sensations



# Mouth-feel Standards and Definitions

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# Tasting

Glass 1: Control	Glass 2: Control + 1.5 g/L V.R. Supra	Glass 2: Control + 1.5 g/L Biotan	Sphere
Powder Suede → Fine Emery → Furry Dry (Low) Adhesive (Low)	Plaster Suede → Fine Emery (High) Drying (High) Grippy (High)	Plaster Suede → Fine Emery (Very High) Drying ( Very High) Grippy ( Very High)	