

Wine Quality Aspects and Wine Tasting



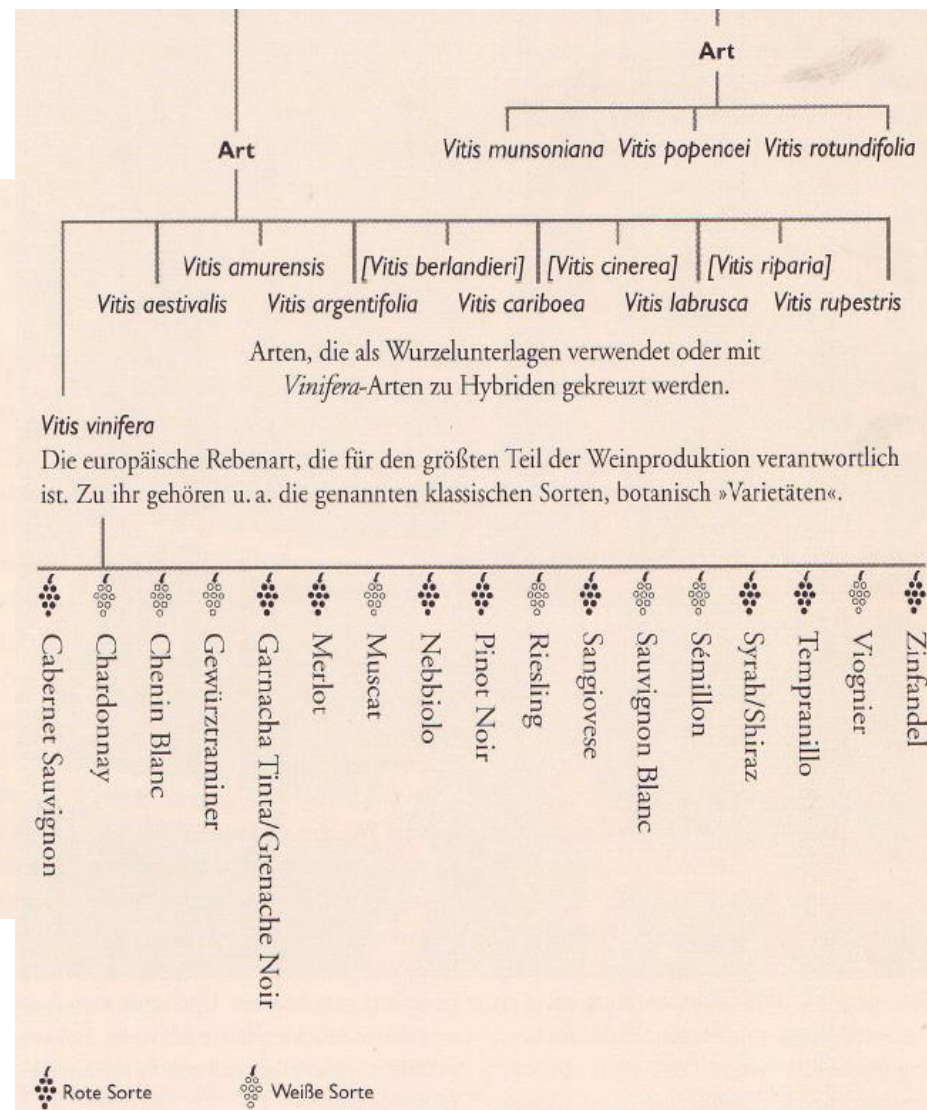
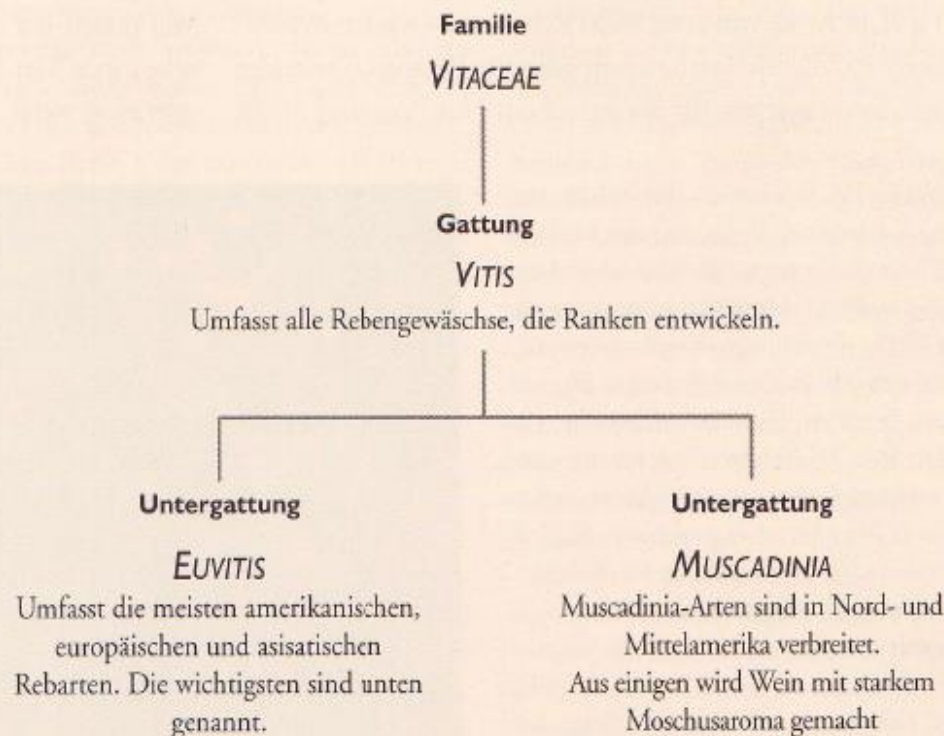
SHIMADZU
Excellence in Science

TU
Graz
Graz University of Technology

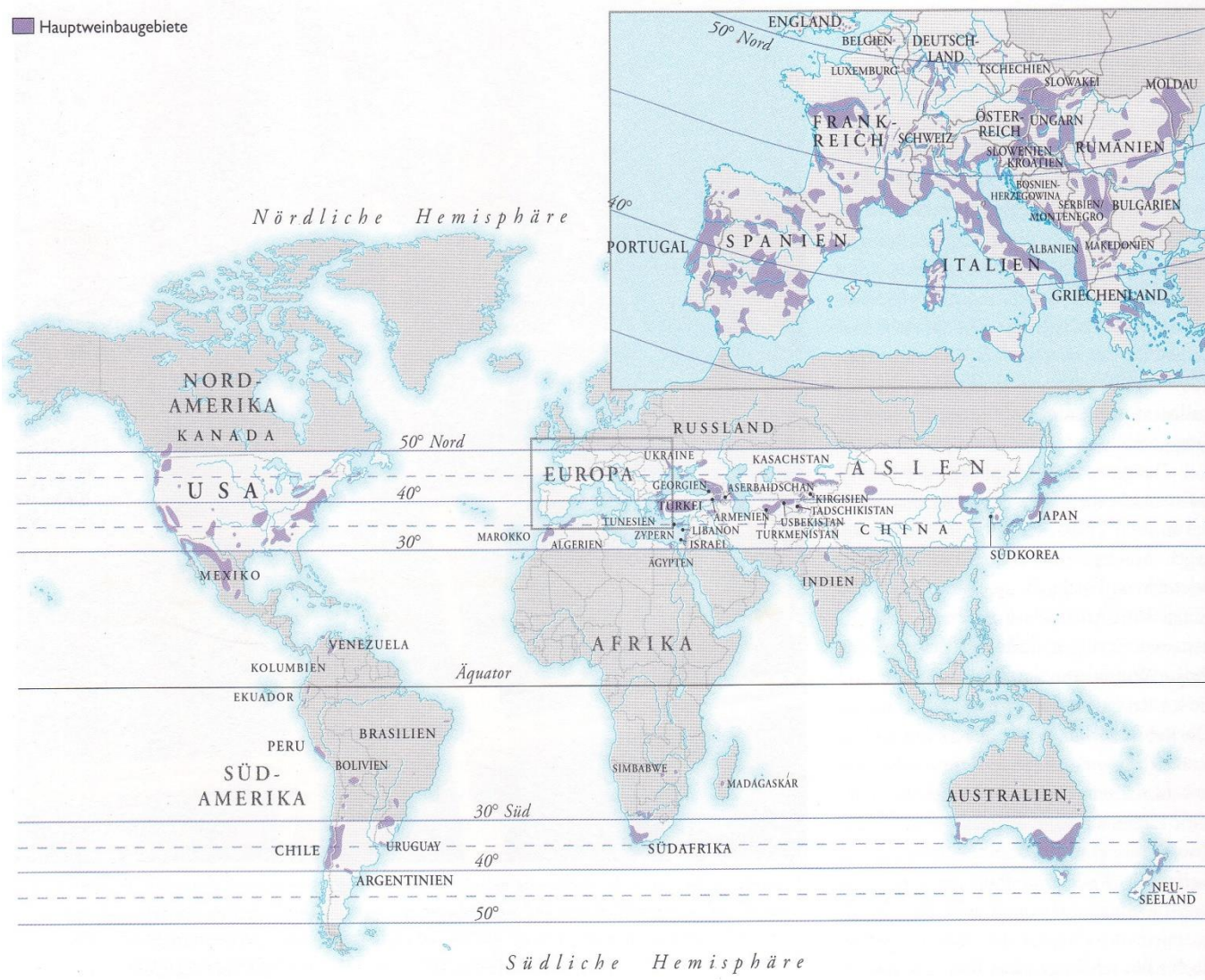
Erich Leitner

Institute of Analytical Chemistry and Food Chemistry

Botany of Wine



Wine Growing Areas



Australia



Portugal



Parameters Affecting the Wine Quality

Determining factors

Grape variety

Grape ripeness

Soil-composition

Climate

Yield

Fermentation

(single yeast strain vs spontaneous)

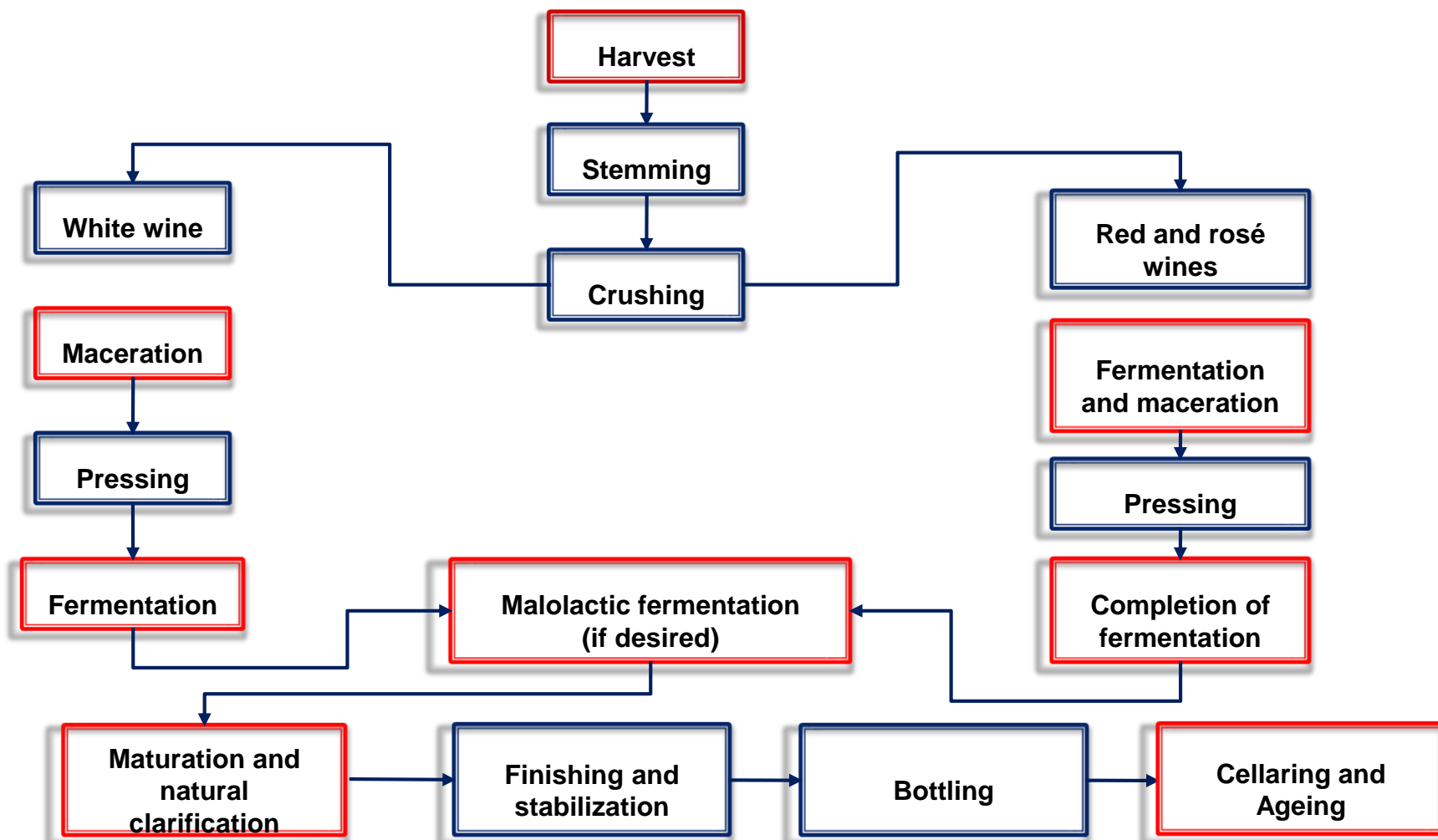
Technology

(reductive, oxidative, stainless steel, barrels)

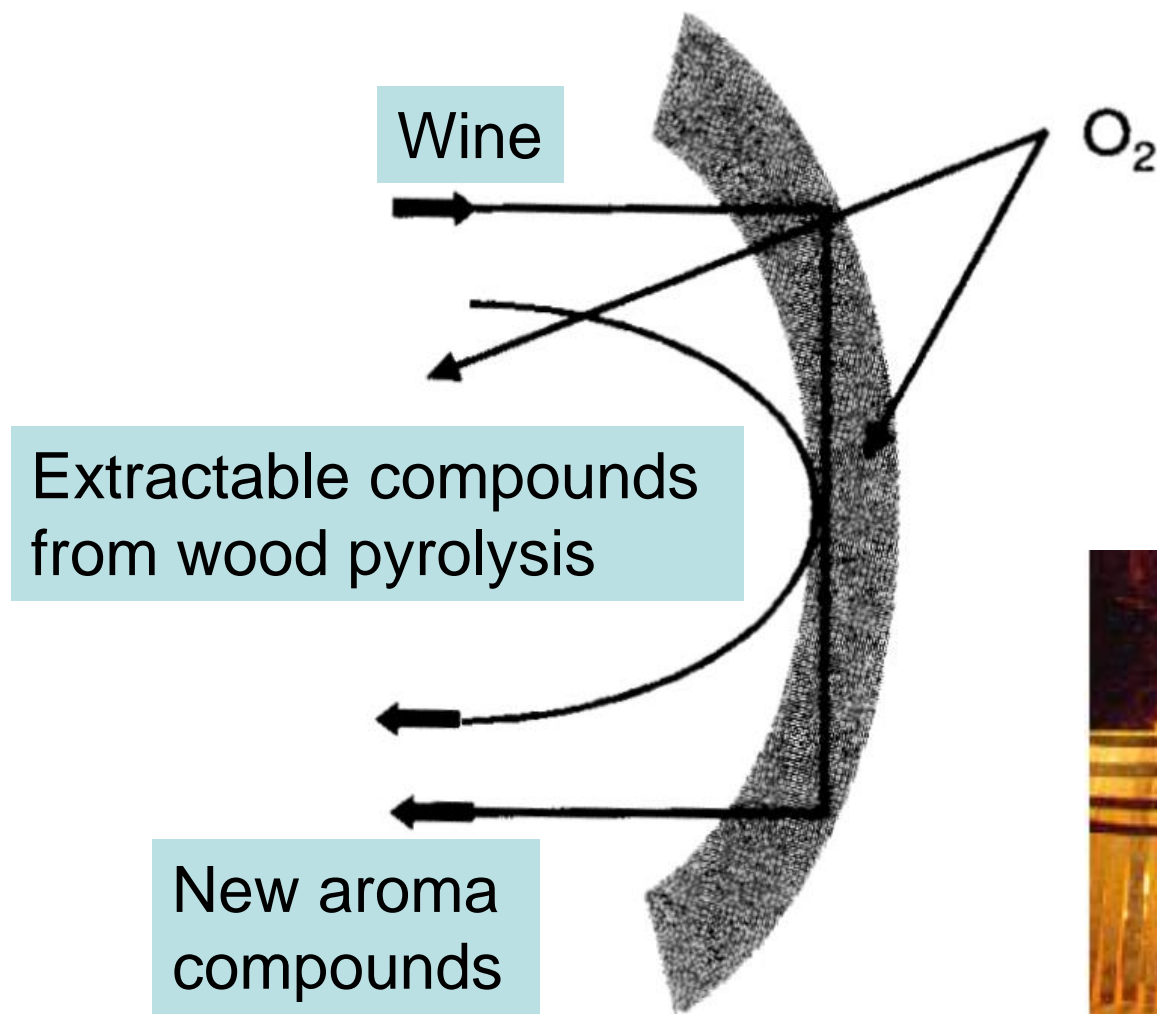
Ageing



Steps in Winemaking



What happens in the Barrel?



Extractable Compounds from the Barrel

Furanderivate	Furfural und Hydroxymethylfurfural (10–20 mg/l), Kochgeschmack
Eichenlacton	Geruch nach Kokosnuss
	1 mg/l Eichenlacton + 10 mg/l Furfural = Vanille Karamel und Sherryaroma
Vanillin	Schwellenwert 0,5mg/l, Vorkommen 0,3–0,8 mg/l, durch Wechselwirkungen mit anderen Aromen stärkere Ausprägung
Syringaldehyd	aus dem Ligninabbau, Waldbeerenaroma, Schwellenwert 15 mg/l
Eugenol	Hauptaroma von Gewürznelken, durchschnittlich 20 µg/l im Wein
4-Methylguajakol	angebranntes Holz
4-Ethylphenol	Schwellenwert 80 µg/l, holzig rauchig, würzig, ab 440 µg/l Speck und Pferdestall
4-Ethylguajakol	Schwellenwert 20 µg/l, ab 70 µg/l Stall und Pferdeschweiß
4-Ethylphenol + 4-Ethylguajakol	ab 425 µg/l Pferdeschweiß und Rauchspeck

Barrel Alternatives



Innerstaves

Oak Chips

- Packaged loose in 40 pound woven plastic bags
- Pre-packaged in two 20 pound "infusion bags" fabricated with polyester netting for direct placement into tanks. These two polyester bags are shipped inside a 40 pound protective outer bag.
- Pre-packaged in 20-pound food grade nylon mesh bags, designed for direct placement into stainless steel tanks.



**Small Size
Medium Toast
1/4" Granular
Consistency
Average**



**Small Size
Heavy Toast
1/4" Granular
Consistency
Average**



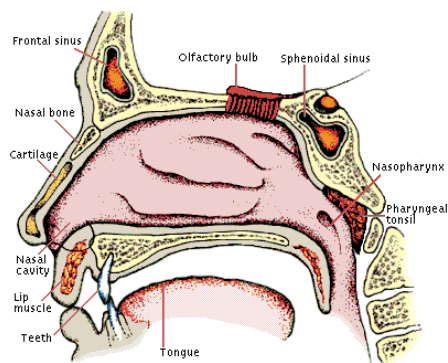
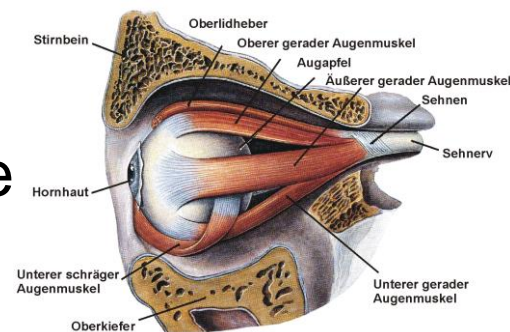
**Large Size
Medium Toast
3/4" Consistency
Average**



**Large Size
Heavy Toast
3/4" Consistency
Average**

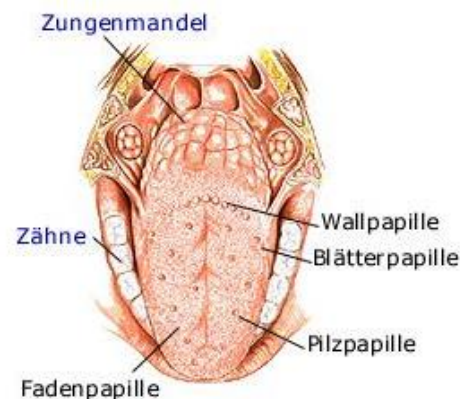
Steps in Wine Tasting

STEP 1: The Colour and Apperance



STEP 2: The Smell

STEP 3: The Taste



STEP 1 The Colour and the Apperance

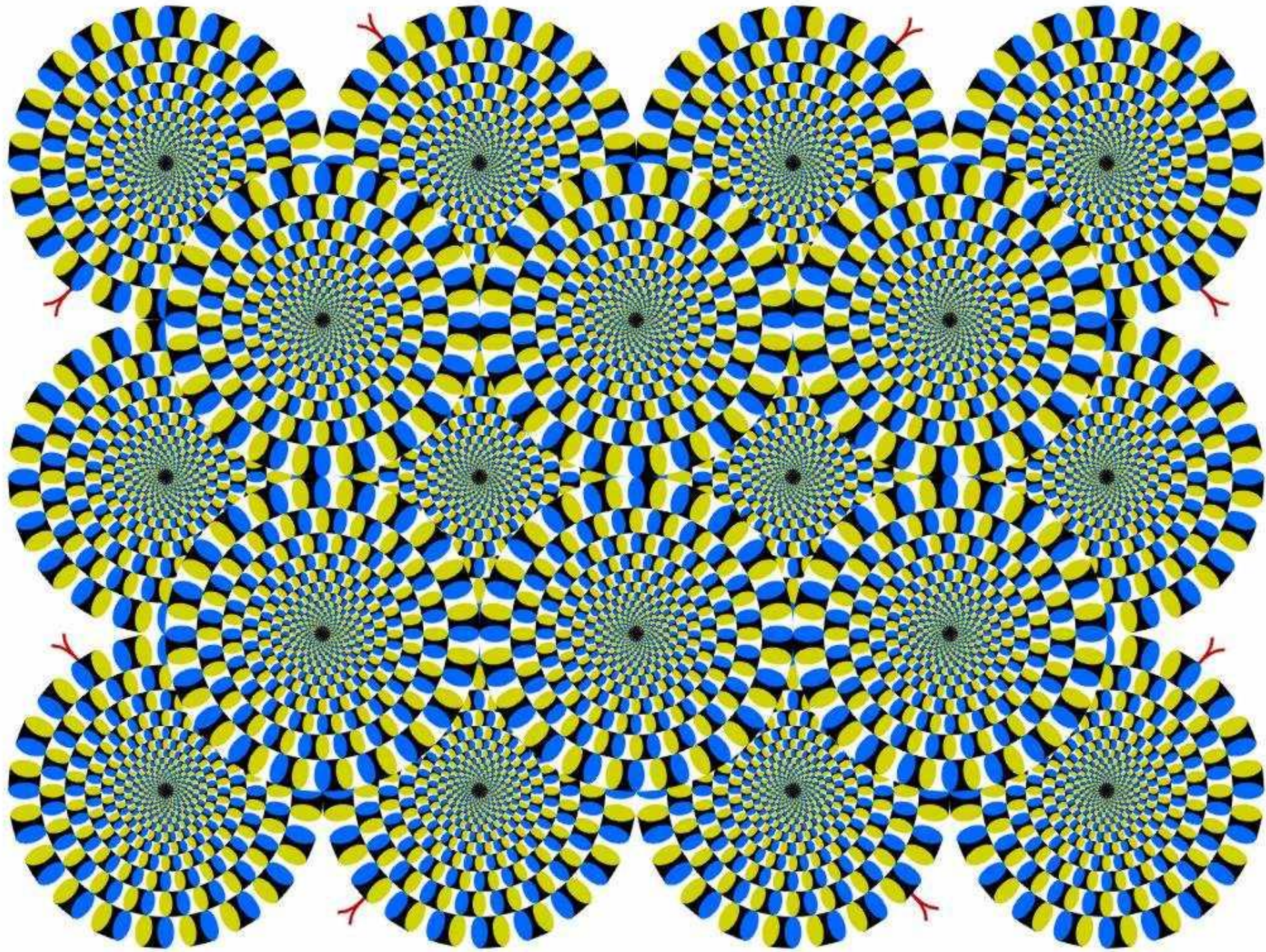
A lot of information is transported by the colour of the wine

Red or White

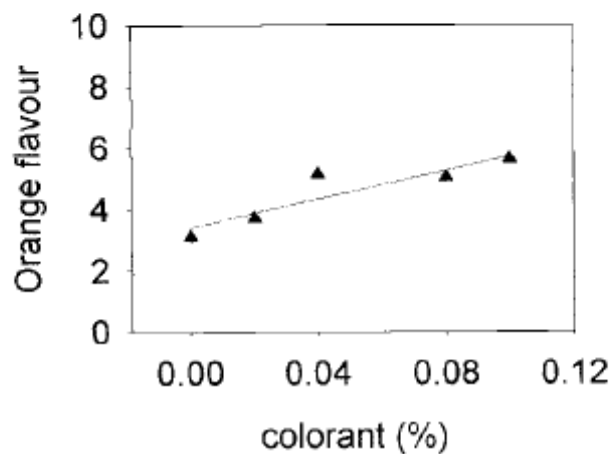
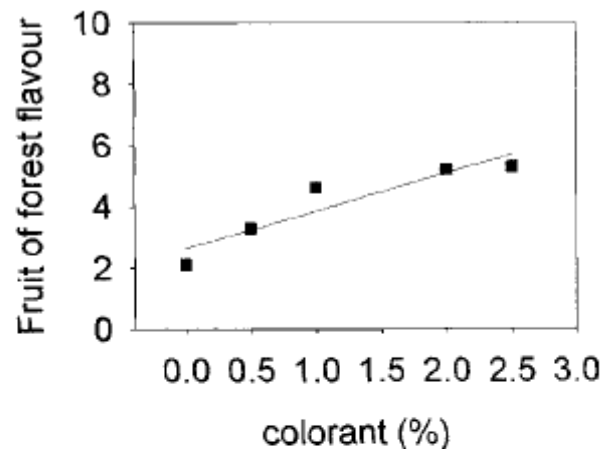
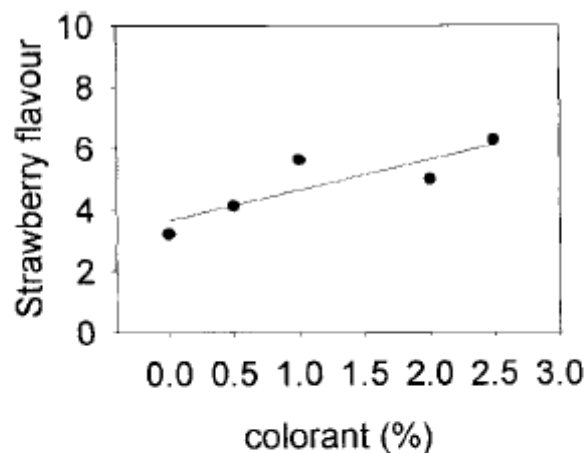
Age

Grape Variety

Ripening Stage.....



Cross Modality



C. Calvo et al, EurFoodResTechnol, 2001(213), 99-103

Changes of the Colour

WHITE WINE		RED WINE	
Pale yellow-green		Purple	
Straw yellow		Ruby	
Yellow-gold		Red	
Gold		Brick red	
Old gold		Red-brown	
Yellow-brown		Brown	
Maderized			
Brown			

Two different mechanisms are responsible for the colour changes in red and white

<http://www.theworldwidewine.com>

White Wine Colour Changes



Browning Reactions in Wine

Browning reactions is a severe problem in wine industry.
Normally SO_2 is added as an antioxidant

Mechanisms based on:

- enzymatic browning

Often correlated with caffeic and coumaric acid promoted by flavanols¹

- non-enzymatic browning

Oxidation of wine phenols²

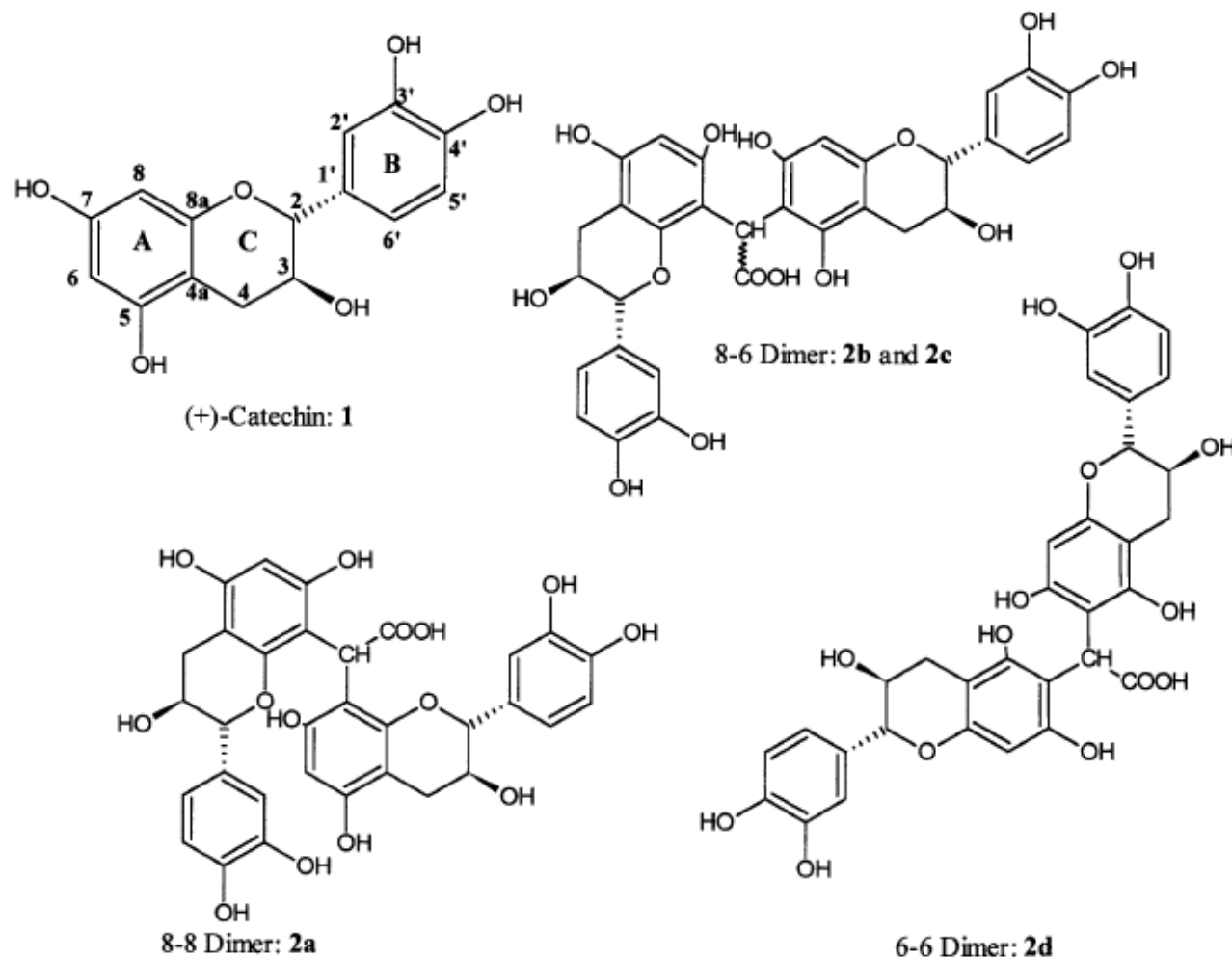
Oxygen activations

Fe & Cu ions

1) Cheynier et al., Journal of Agricultural and Food Chemistry, 37(4), 1069–1071

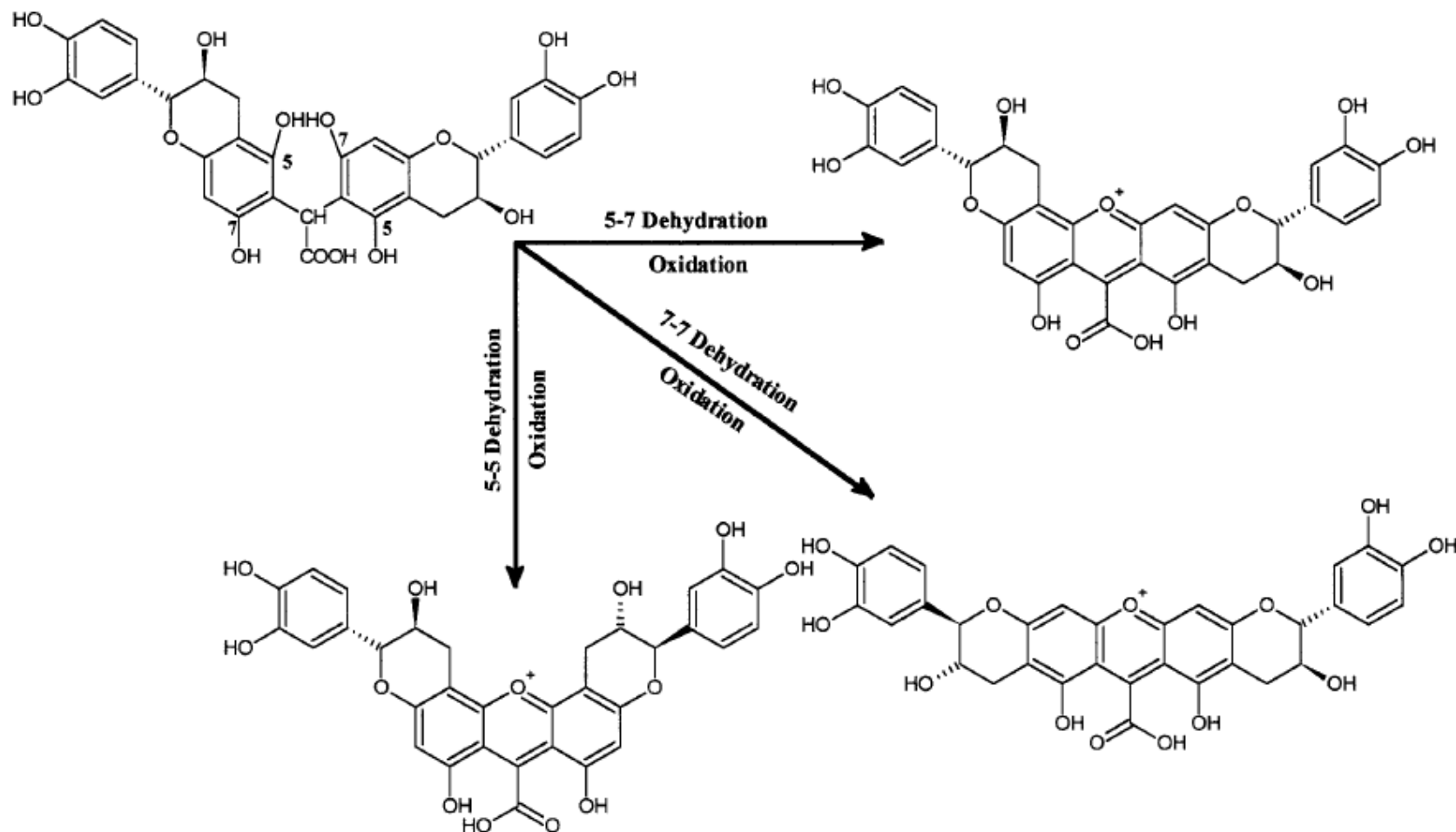
2) Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74

Step 1 Formation of (+)-Catechin Dimer



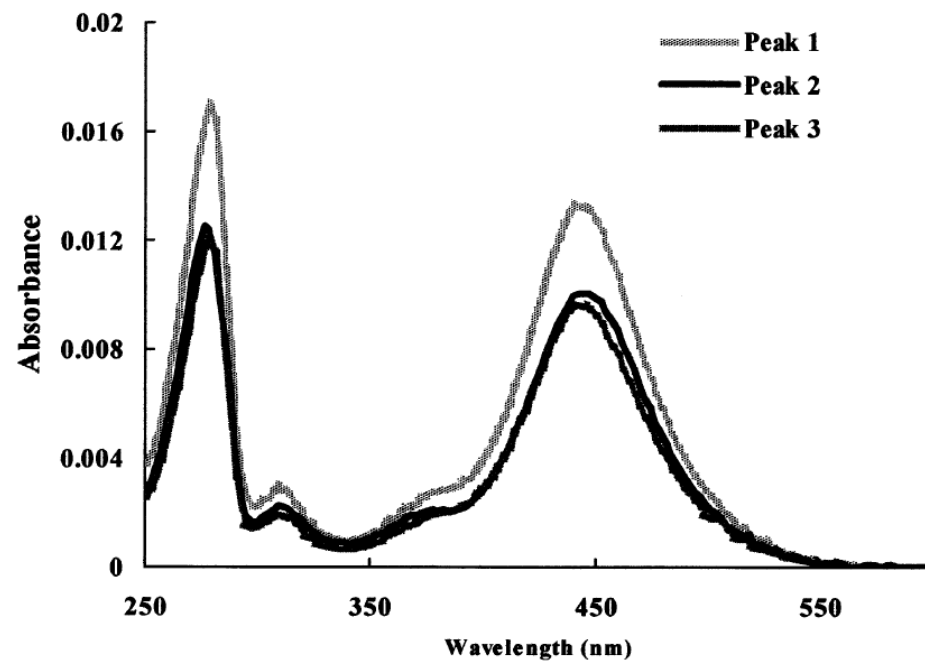
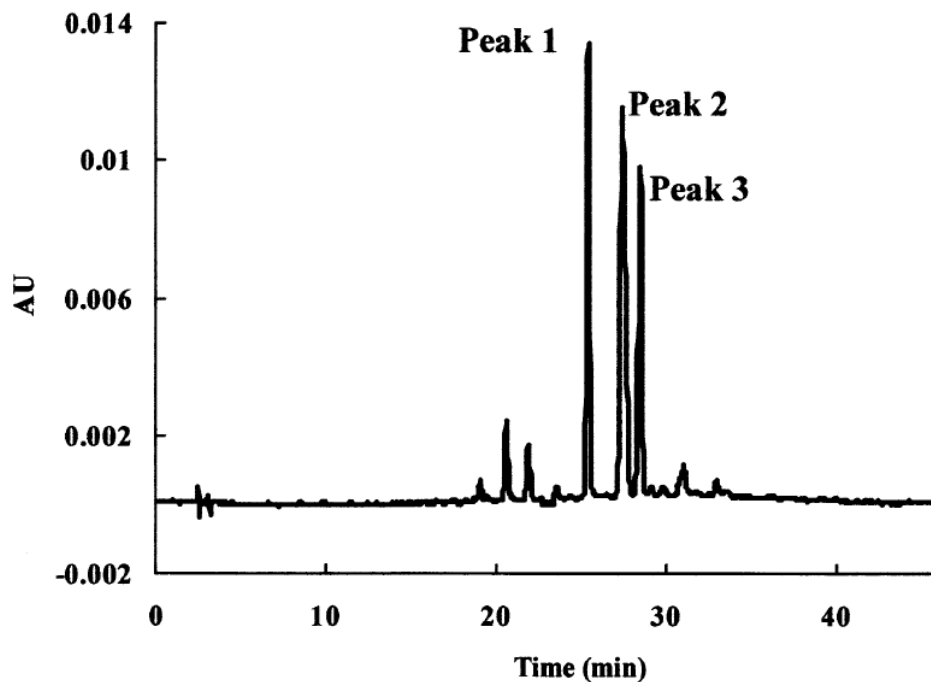
Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74

Further Reaction

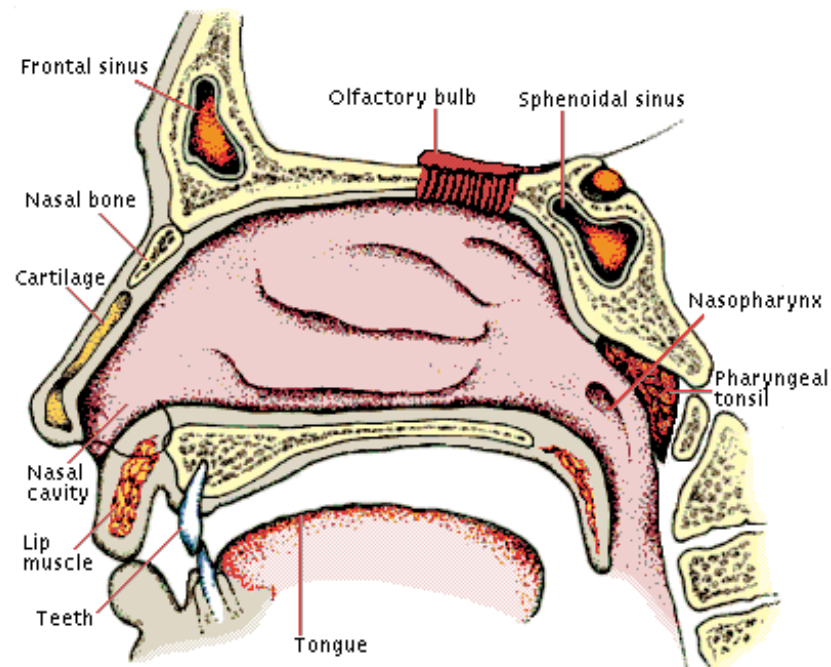


Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74

HPLC Monitoring



Es-Safi et al., International Journal of Food Science and Technology 2000, 35, 63–74



STEP 2: The Smell and the Volatile Fraction

Tasting Glass

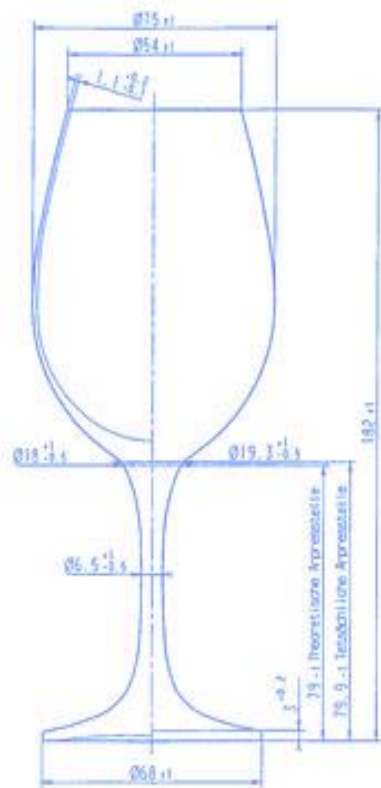


Bild 1: Prüfglas für Wein Form A



Different Types

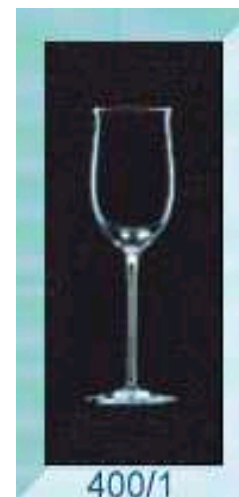
Burgundy 500 mL



Chianti 380 mL



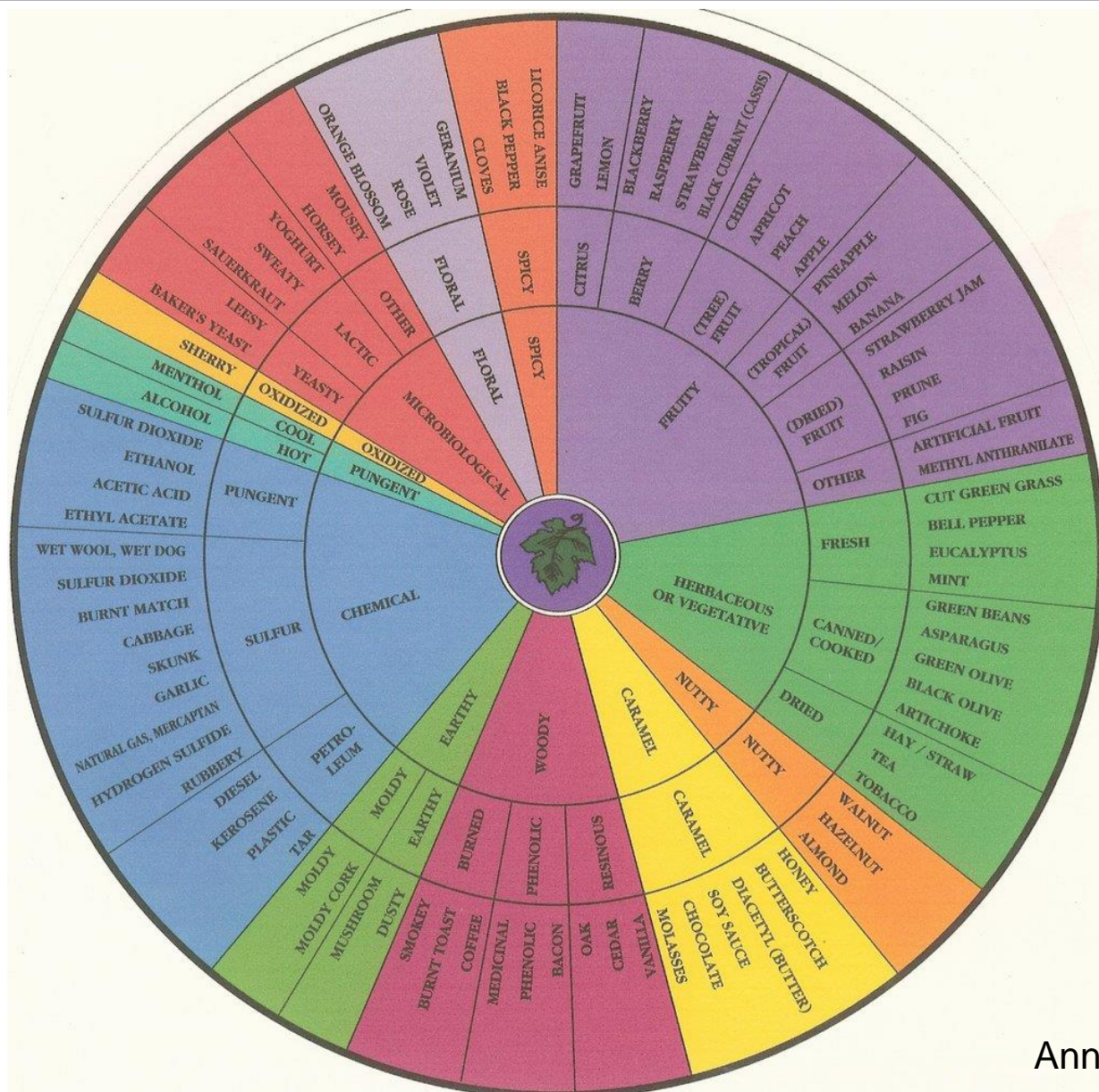
Young White 210 mL



Bordeaux 860 mL

Chardonnay 350 mL

The Aroma Wheel



Ann Noble UC Davis



Wine #1 Sauvignon Blanc 2016

Origin: France, the Loire. This variety was introduced in the Steiermark in the 19th century by Archduke Johann. At that time, it was known as Muskat-Sylvaner.

Parentage: Natural crossing of Traminer and Chenin blanc. The former name (Muskat-Sylvaner) is no longer permitted for use, as it is misleading. There is no relation to any muscat or sylvaner varieties and, moreover, the Sauvignon blanc has no muscat aroma.

Grown worldwide, this variety has a characteristic bouquet, which can be intrusively unripe and grassy when the grapes are not fully ripe. When the grapes have good ripeness, they develop complex aromas of black currants, gooseberries and tropical fruit. The wines develop – according to the level of maturity – from discreet to very complex. The complex versions have wonderful ageing potential especially from malolactic fermentation and barrique maturation. When the grapes are very ripe, the complex aromas retreat and a powerful, spicy wine unfolds.

<http://www.austrianwine.com/>

Relevant Aroma Compound

2-Isobutyl-3-methoxypyrazine

Sensory threshold: 1-2 ng/L

Odour descriptors: green bell pepper, green gooseberry, asparagus, vegetal

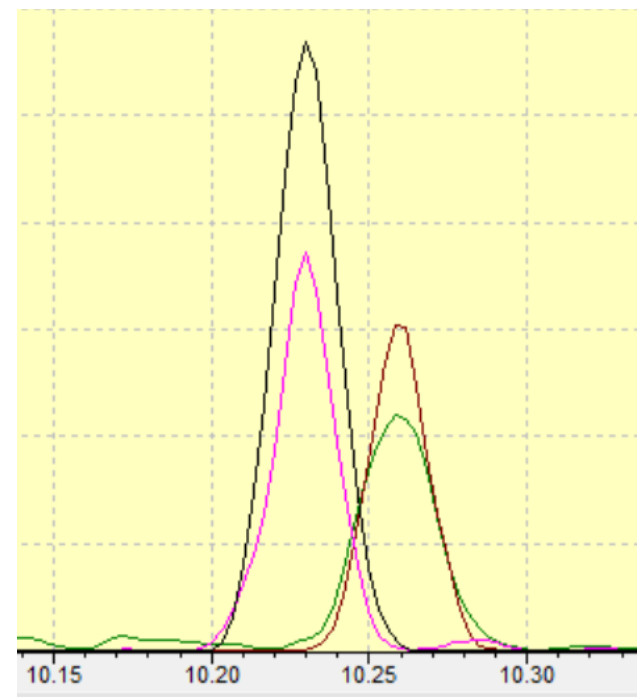
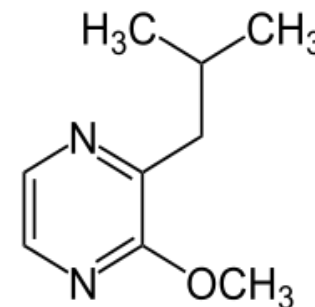
Required Instrumentation:

sample amount: 1 mL

HS-SPME or Arrows

TQ (MRM)

SIDA IBMP-d3 10 ng/L IS concentration





Wine #2 Gelber Muskateller

Origin: Unknown, but possibly from Italy or Greece

Parentage: It is one of the oldest grape varieties and yields different types, especially in Italy. Roter (Red) and Gelber (Yellow) Muscat are differentiated by the colour of their berries.

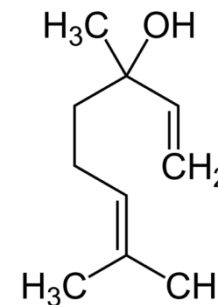
Delivers wines with a more or less intense citrus, elderberry blossoms and nutmeg aroma and flavour. With too little ripeness, the wines are low in extract and therefore thin and have marked acidity. The Muskateller is especially delicious as an aperitif and with appetizers.

Relevant Aroma Compound

Linalool

Sensory threshold: 15 µg/L

Odour descriptor: citrus, lavender,
coriander seeds, Earl Grey

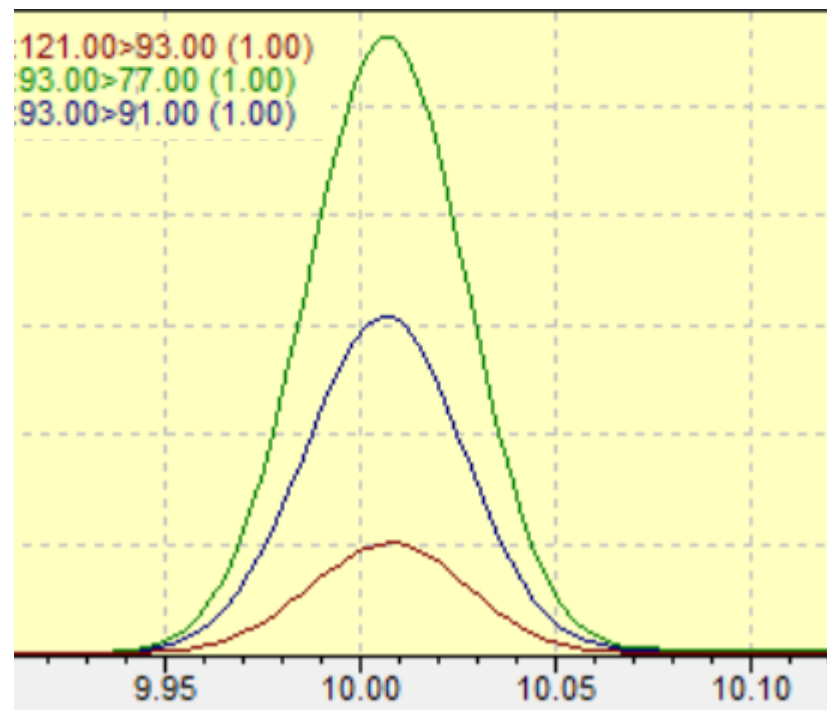


Required instrumentation:

Sample amount: ~10 µL-1 mL

HS-SPME or Arrows

GC-SQMS (scan) or TQ



Wine #3 Mystery Wine

Please describe what you see, smell and taste

Can you identify the grape variety?

Can you identify the country of origin?

Can you identify anything about the vinification process?



Wine #4 Mystery Wine

Grape variety: Tinto fino (Tempranillo)



Wine #4 Gewürztraminer

Origin: Likely from southeast Europe. In the Middle Ages, the variety was found in Südtirol (South Tyrol), now in northern Italy. In fact, Traminer was named after the lively South Tyrolean town of Tramin, long-established in the wine trade.

Parentage: Selected from wild vines, Traminer is one of the oldest European varieties and was even likely known by the Romans as *Vitis aminera*.

The variety is differentiated by its range of colours. Roter Traminer has red grapes; Gewürztraminer shows light red/pink grapes; and with yellow grapes it is the Gelber Traminer. These also deliver different spicy flavours influenced by their terroirs. Name-wise, all of the Traminer types can be referred to as Gewürztraminer. Traminer is often a natural crossing partner for other varieties, including the Grüner Veltliner (Traminer x St. Georgen).

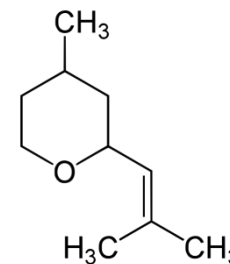
The wines are low in acidity, but rich in extract and aromas (roses, lemon, forest berry, raisin, dried fruit), have good durability and excellent ageing potential. Prädikat wines often have a residual sweetness and a discreet, harmonious bitter touch.

Relevant Aroma Compound

cis Rose oxide

Sensory threshold: 0.2 µg/L

Odour descriptor: floral, rose

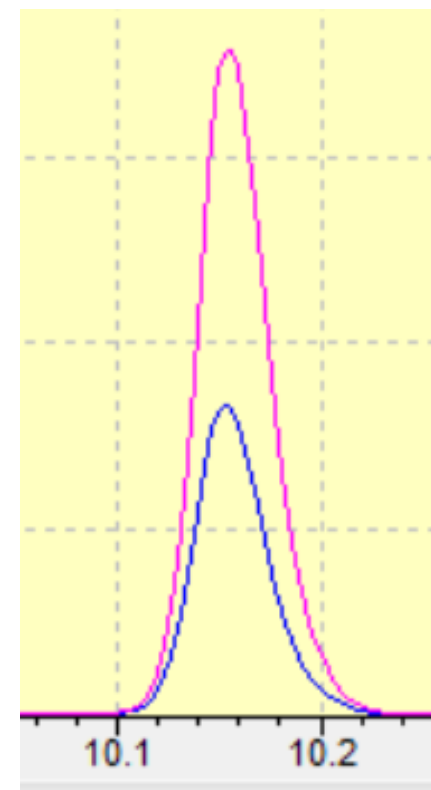


Required instrumentation:

HS-SPME or Arrows

Sample amount: ~1 mL

GC-SQMS (SIM) or TQ





Wine #5 Riesling Auslese

Origin: Germany, Oberrhein. The earliest documentation of the name was in 1435, in Rüsselsheim.

Parentage: Natural crossing of Weißem Heunisch, *Vitis sylvestris* and Traminer. The variety was probably taken from wild vines on the Oberrhein (the Upper Rhine). Roter Riesling is a red grape variation, a bud mutation of the Weißer Riesling. The Weißer Riesling is not related to the Welschriesling variety.

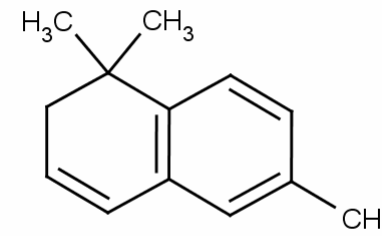
Young Riesling wines exude charming fruitiness and flavour, and can develop into great and complex wines through ageing. For these, notes of stone fruit are dominant and include peach, apricot and exotic fruits. Riesling ripens slowly and reaches the highest quality as aged wines with rose-like scent. Depending on the level of ageing, they develop a pleasurable petrol tone, something that perhaps not all wine consumers like. When the late harvest grapes are infected with noble rot, then special wines are the result – Auslesen and Beerenauslesen styles with outstanding quality.

Relevant Aroma Compounds

1,1,6-Trimethyldihydronaphthalene (TDN)

Sensory threshold: 2 µg/L

Odour descriptor: petrol, kerosene



Required instrumentation:

HS-SPME or Arrows

Sample amount ~100 µL-1 mL

GC-SQMS or TQ



Summary

Wine has a very complex aroma composition, where sometimes tiny changes has a dramatic influence on the sensory perception

Analytical methods based on GC can provided useful data for better understanding

Headspace based sample prep method can dramatically improve the sensitivity and reduce the sample amount
10 μ L-1 mL is sufficient

Depending on the concentration different instrumentations and methods are required to cover the sensitivity and the concentration range

GC-SQ (Scan or SIM), TQ (MRM), GCxGC (EI & NCI)

Thank you for your attention.....

