



# SENSORY & CONSUMER SCIENCE FOR THE WINE INDUSTRY

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UNIVERSITÀ DEGLI STUDI DI MILANO



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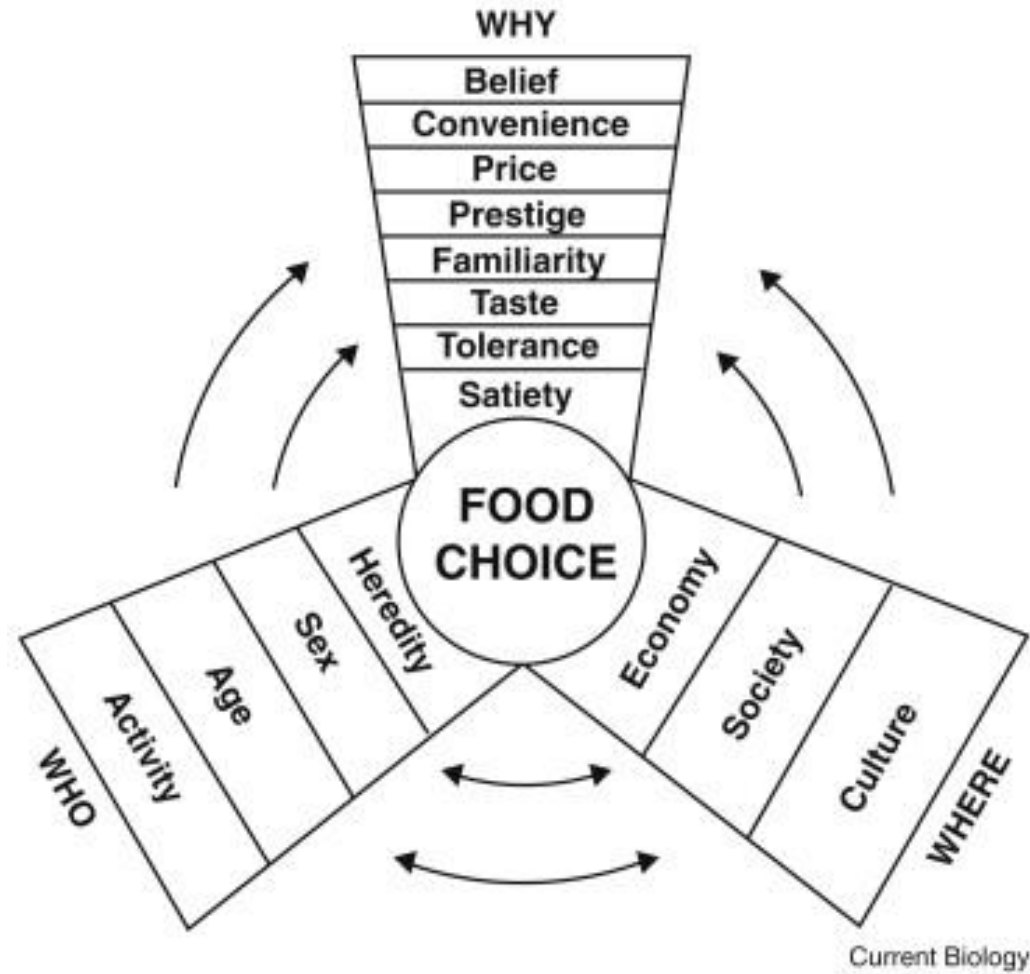
# Summary of the seminars

1. Introduction to sensory science (Monday 25<sup>th</sup> March 2019)
  - The five senses and wine tasting
2. Application of sensory science to the wine sector (Tuesday 26<sup>th</sup> March 2019)
  - Good practices in sensory science (the panel, the sensory lab)
  - Main sensory methods
3. Application of sensory science to the wine sector (Wednesday, 27<sup>th</sup> March 2019)
  - Case studies

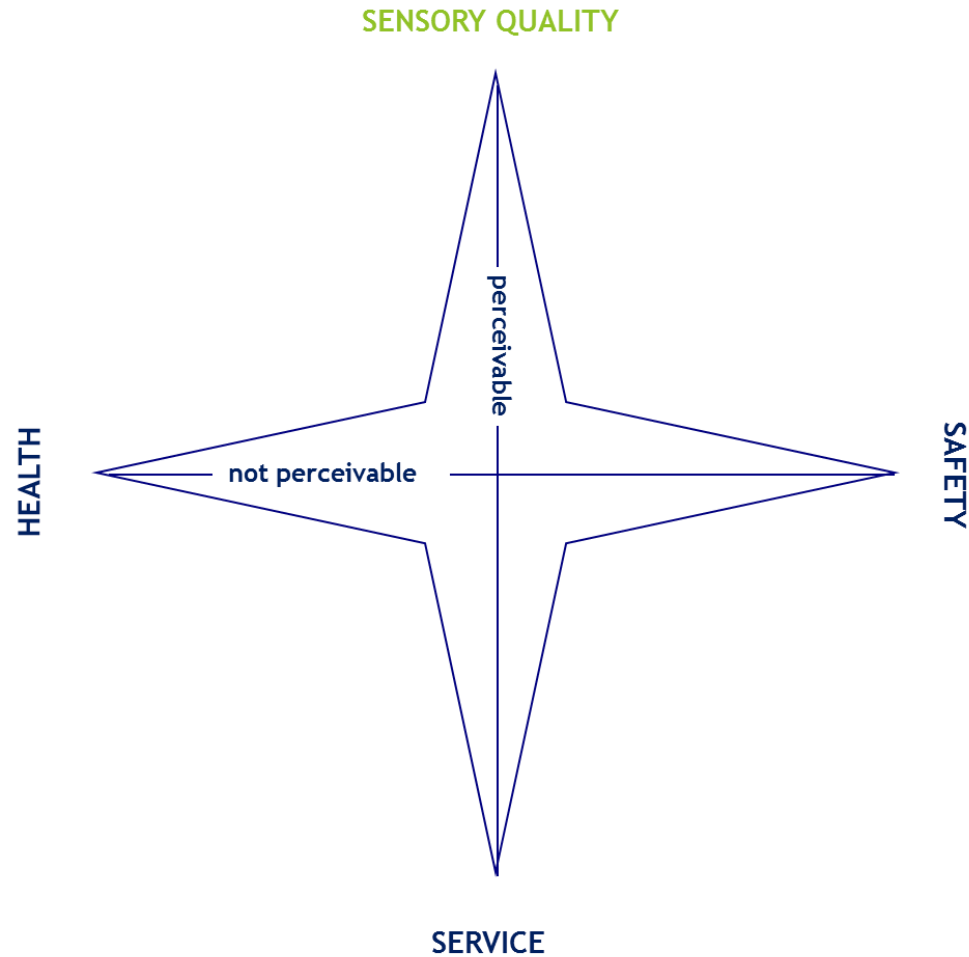
# Introduction to sensory science

- ❑ Sensory properties are the main drivers of food choice and selection
- ❑ Wine is an emotional product, which is often consumed based on feelings and hedonism
- ❑ Winemakers' main mission is to produce a wine which encounters *consumer sensory expectations*

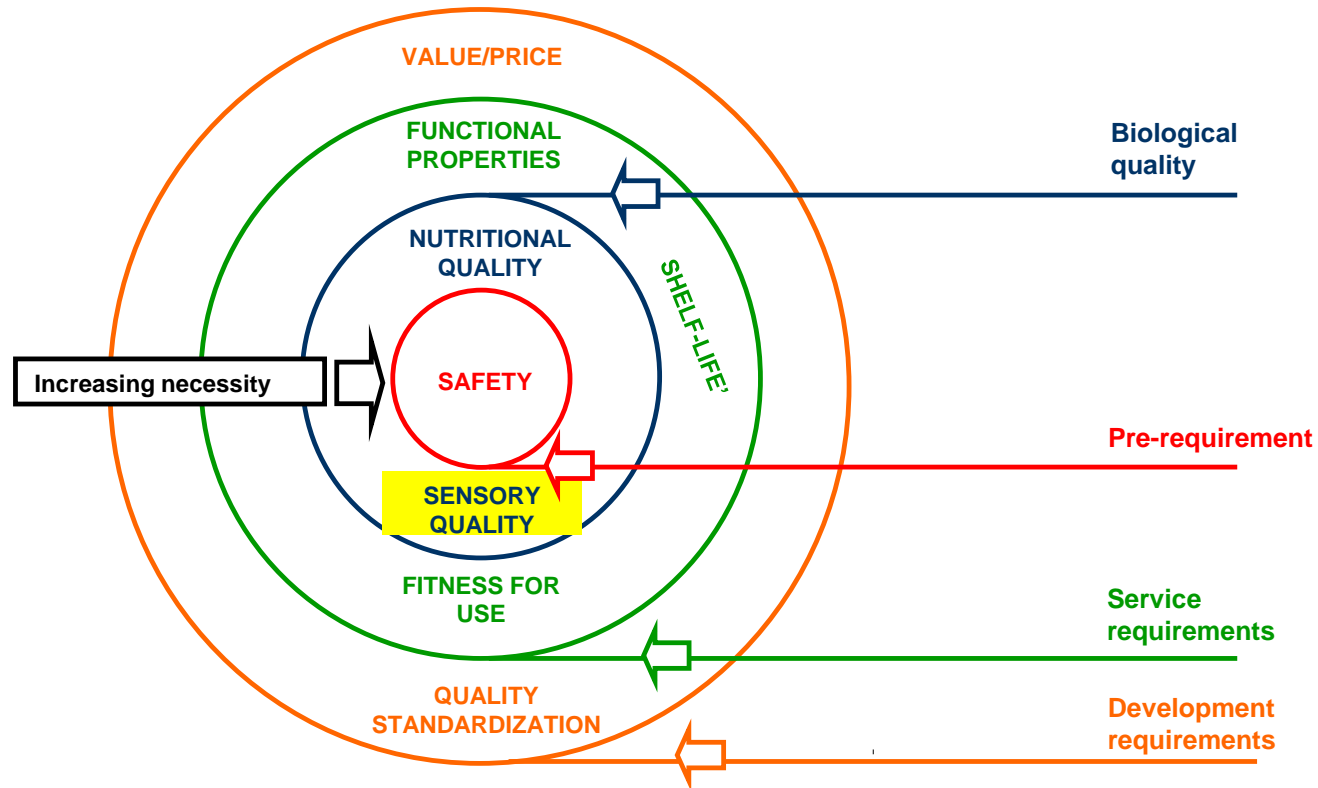
# Introduction to sensory science



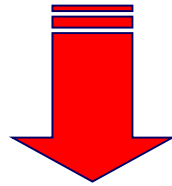
# Food quality and sensory quality



# Food quality and sensory quality



Among the parameters that define food quality, **SENSORY CHARACTERISTICS** represent the food aspects perceived by means of the 5 senses: e.g., colour, appearance, odour, taste and texture



Sensory aspects are important since they are the strongest determinants of food **ACCEPTABILITY** and at the same time the most difficult aspects to be evaluated reliably

# What sensory analysis is?

## Definition of the Institute of Food Technologists:

*Sensory Evaluation is a scientific discipline to evoke, measure, analyse and interpret reactions to those characteristics of food as they are perceived through the five senses of sight, smell, touch, taste and hearing (IFT, 1990)*








# Sensory or ... organoleptic???



*“..... Several occasional users (and misusers) of simple sensory tests for product assessment still refer to their studies with the picturesque but archaic term ‘organoleptic’ - to judge with the organs. Since sensory receptors, not ‘organs’, respond to temperature, pain, touch, pressure, as well as to the chemical stimuli, **the more precise adjective ‘sensory’ is recommended.**”*

*(R.M. Pangborn, Food Technology, September 1989)*

# The five senses

SENSORY MEASURE		TYPE OF STIMULUS	RECEPTOR
<b>SIGHT</b>		Visible light (photons)	Cons and rods of the retina
<b>HEARING</b>		Mechanical vibrations	Cells of the organ of Corti
<b>SMELL</b>		Chemical molecules dissolved in a gas solution	Olfactory neurons in the superior nasal cavity
<b>TASTE</b>		Chemical molecules dissolved in a liquid solution	Taste buds distributed on tongue
<b>TOUCH*</b>		Mechanical pressure or temperature	Cells distributed on skin and into the oral cavity

\* Tactile sensation  
kinaesthetic sensation  
thermal  
chemesthetic

= roughness, astringency...  
= hardness, cohesiveness, adhesiveness, elasticity...  
= hot, cold...  
= hot, tingling, cold...

# The sensory properties of wine



## SIGHT

Color  
Limpidity  
Body  
Sparkling



## SMELL

Aroma\*



## TASTE

Sour  
Bitter  
Sweet  
Salty

## FLAVOUR

Aroma-taste\*

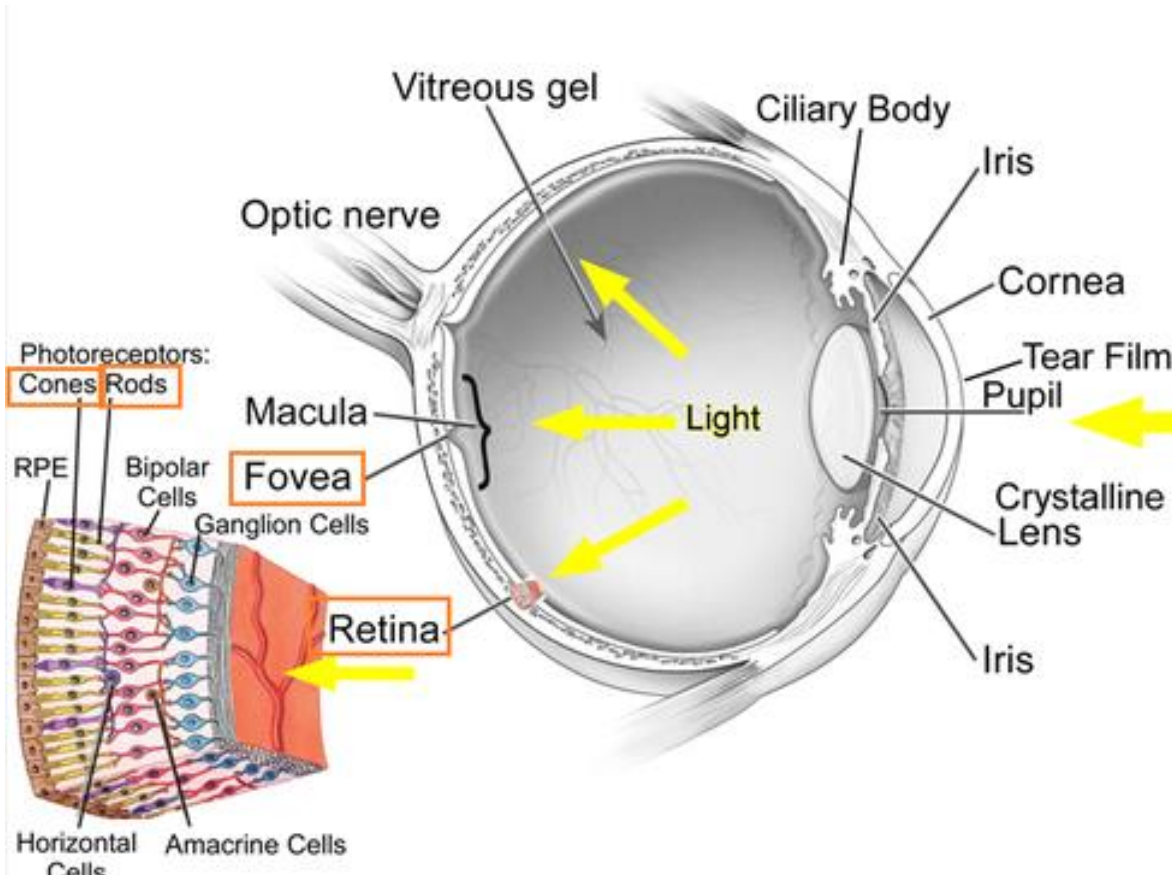


## TOUCH

Astringency  
Body  
Alcool/Burning  
Sparkling

\*Off-odor/Off-flavour

# Sight: Colour, Body, Limpidity, Sparkling



## Cones:

Blue (470 nm)

Green (490-570 nm)

Red (630-760nm)

## Rods:

Brightness

# Sight: Colour, Body, Limpidity, Sparkling

- ❑ There is no generally accepted terminology of the color of a wine since it is difficult to assess it in a reliable way
- ❑ Color descriptors should be kept at very minimum to enable an evaluation as simple as possible
- ❑ Sometimes, color is masked since it can influence the perception of other sensory properties (e.g. odors and flavors)



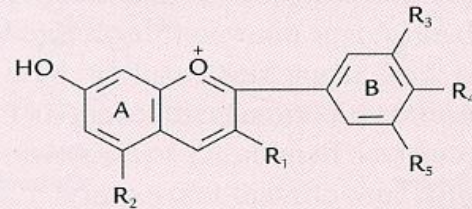


# Sight: Colour, Body, Limpidity, Sparkling

Anthocyanins  $\Rightarrow$  glucosidic form



Table 2.1 Anthocyanins occurring in wine<sup>a</sup>



Specific name	R <sub>3</sub>	R <sub>4</sub>	R <sub>5</sub>
Cyanidin	OH	OH	
Peonidin	OCH <sub>3</sub>	OH	
Delphinidin	OH	OH	OH
Petunidin	OCH <sub>3</sub>	OH	OH
Malvidin	OCH <sub>3</sub>	OH	OCH <sub>3</sub>

Derivatives

Structure

Monoglucoside

R<sub>1</sub> = glucose (bound at the glucose 1-position)

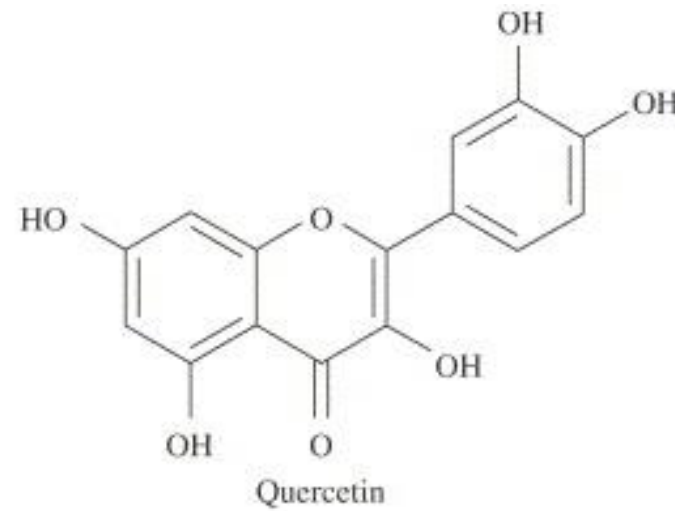
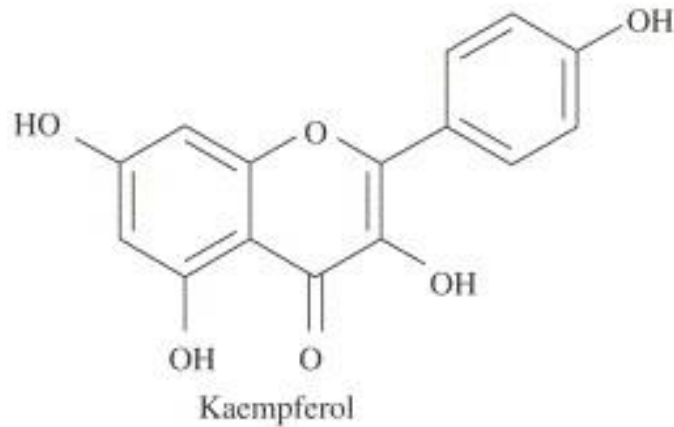
Diglucoside

R<sub>1</sub> and R<sub>2</sub> = glucose (bound at the glucose 1-position)

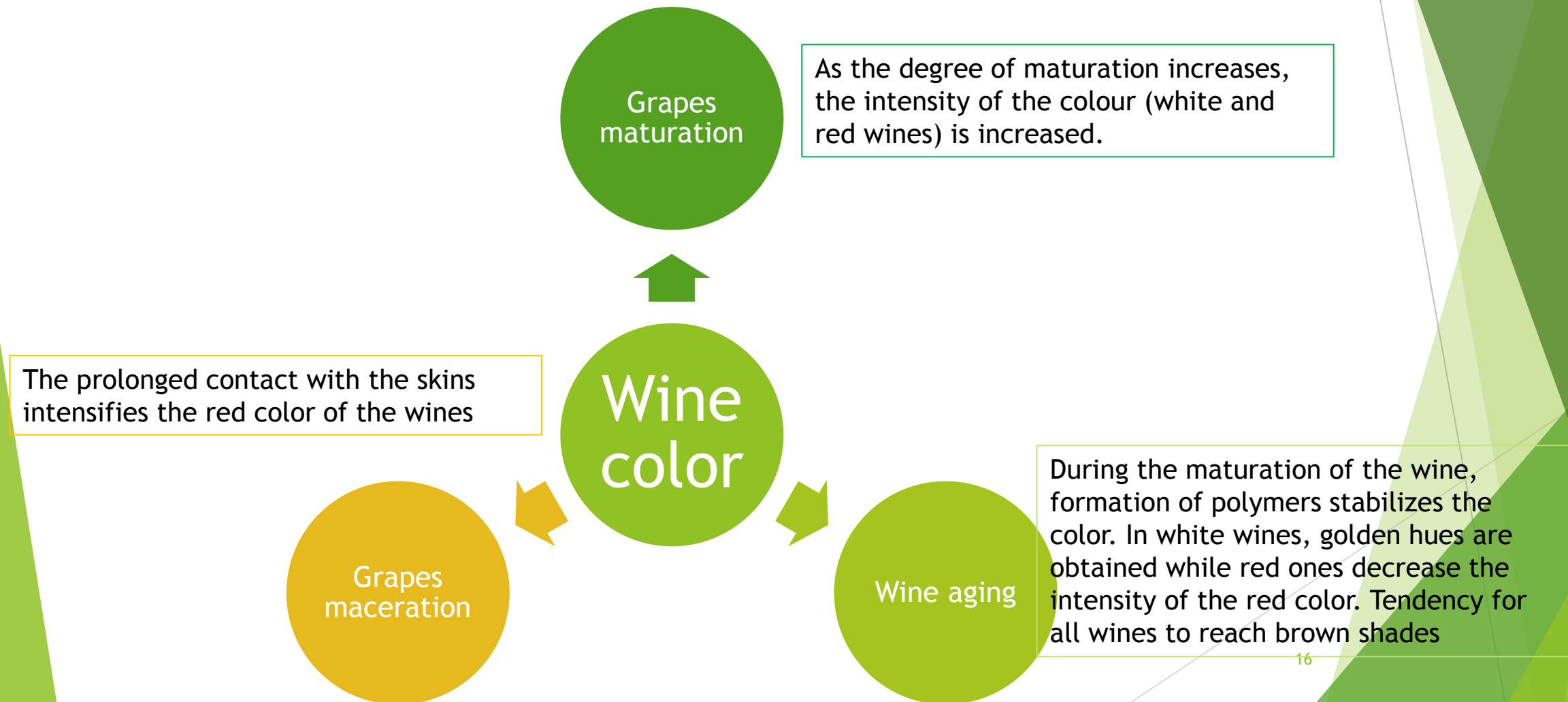
<sup>a</sup>After *Methods for Analysis of Musts and Wines*, MA Amerine and CS Ough, Copyright 1980 John Wiley and Sons, Inc. Reprinted by permission of John Wiley and Sons, Inc.

# Sight: Colour, Body, Limpidity, Sparkling

## Flavonolic compounds



# Sight: Colour, Body, Limpidity, Sparkling





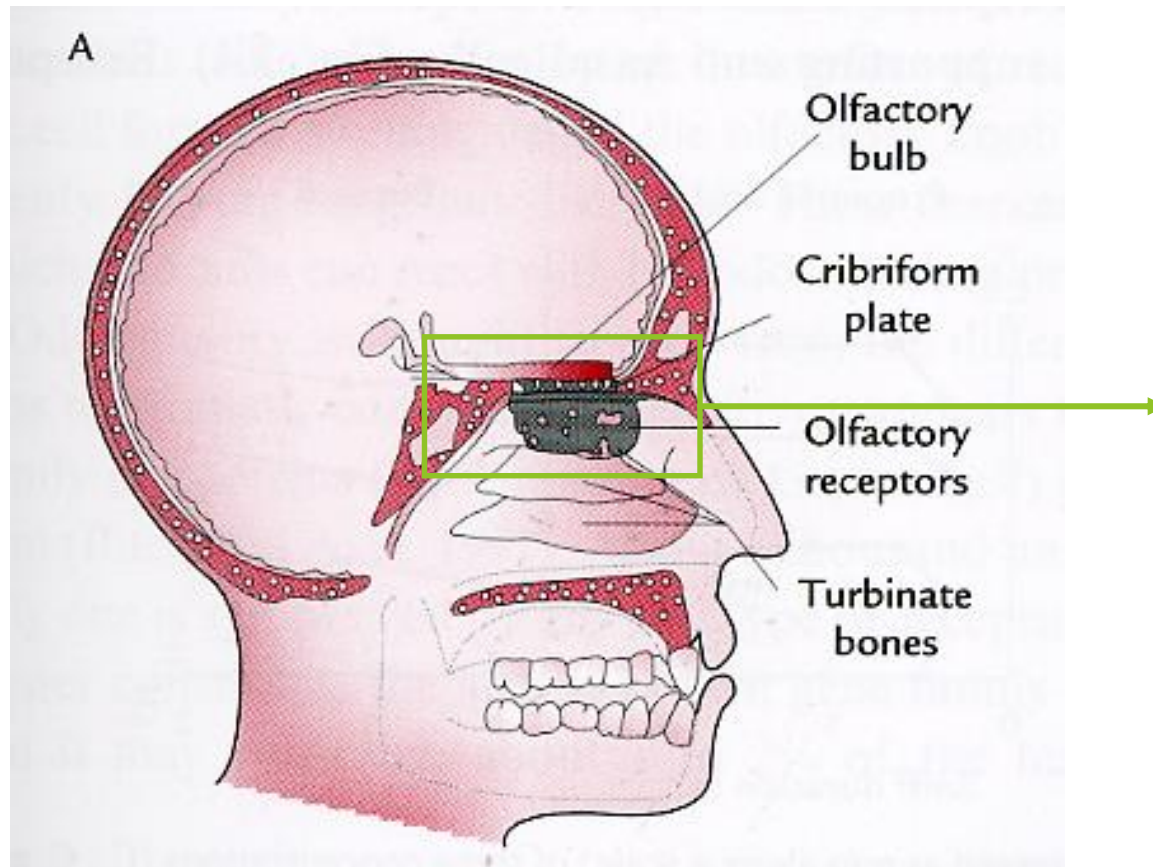
# Sight: Colour, Body, Limpidity, Sparkling

- ❑ Turbidity in a wine is considered unacceptable, although sometimes it does not affect the olfactory and taste perception
- ❑ Turbidity may be due to:
  - ✓ Crystals      Potassium or calcium bitartrate → do not impact other sensory properties
  - ✓ Sediments      Proteins, complex or polymerized anthocyanins, tannins → can develop an unwanted bitter taste or the so-called "chalk" defect
  - ✓ Microbial      Brettanomyces and Zygosaccharomyces may form flocculating or granular deposits if the bottling equipment has not been adequately cleaned and sanitized

# Sight: Colour, Body, Limpidity, Sparkling

- ❑ **Body** → Characteristic perceived through the sight due to the friction of the molecules of a liquid that limits its fluidity and mobility. This feature depends on the presence of compounds such as sugars, ethanol, glycerol, soluble polysaccharides
- ❑ **Sparkling** → Characteristic perceived through the sight as number, size and persistence of bubbles deriving from the presence of CO<sub>2</sub> produced during the fermentation process

# Smell



Volatiles reach the upper part of the nasal cavity. This “protected” location is due to the fact that olfactory receptors are neurons which are very susceptible to physical and chemical trauma (e.g. anosmia)

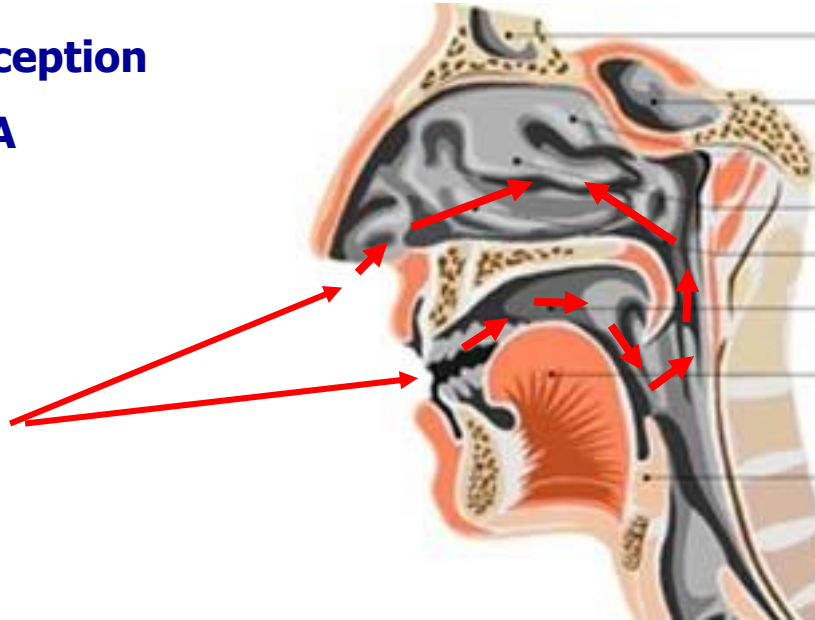
# Smell...some curiosities and characteristics

## □ Smell as an orthonasal versus retronasal sensation

*There are at least two reasons not to speak with full mouth : the first refers to a question of education, the second to the fact that when you do so you lose the precious smells that make their way to your nose (Piet Vroon, Smell: The Secret seducer , 1994)*

**Orthonasal perception**

**→ AROMA**

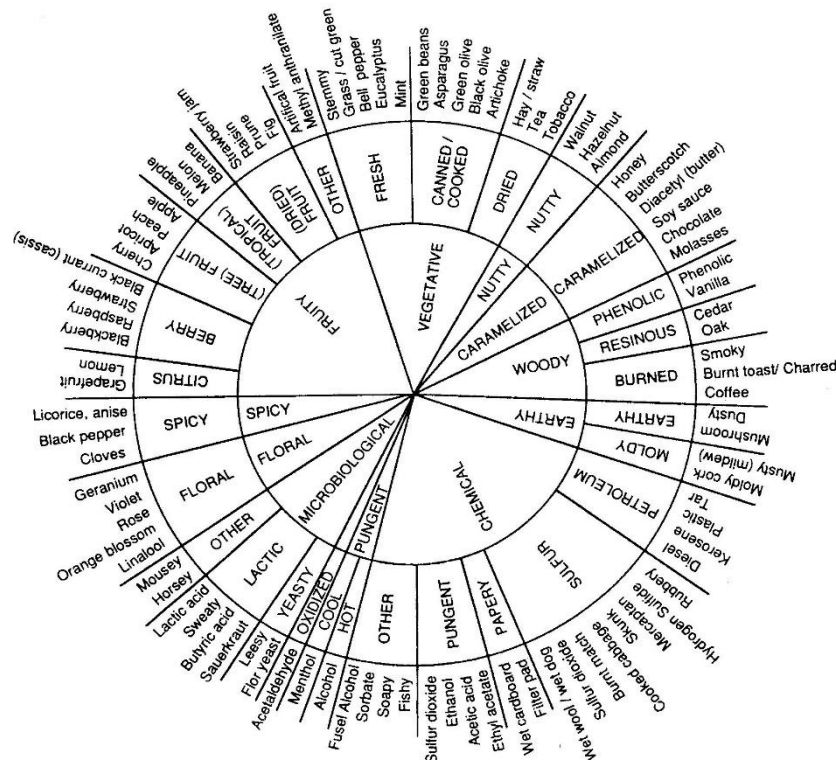


**Retronasal perception**

**→ FLAVOUR**

# Smell...some curiosities and characteristics

- ❑ Smell as an orthonasal versus retronasal sensation
- ❑ The olfactory receptors are nerve cells (General anosmia, Specific anosmia)
- ❑ Limited ability to recognize odors present in mixture



# The wine aroma wheel

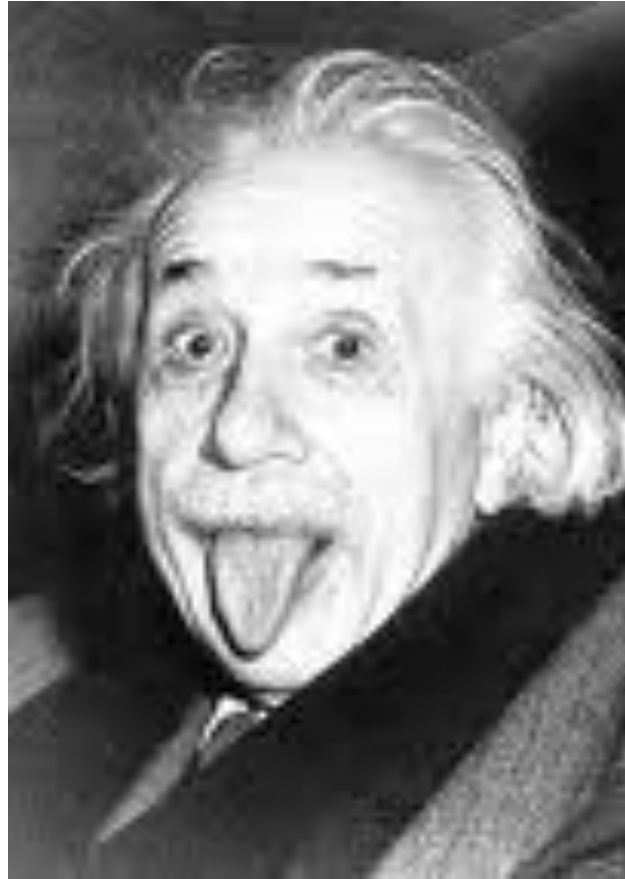
# Smell...some curiosities and characteristics

- ❑ Smell as an orthonasal versus retronasal sensation
- ❑ The olfactory receptors are nerve cells (General anosmia, Specific anosmia)
- ❑ Limited ability to recognize odors present in mixture
- ❑ Adaptation: saturation of the sensory receptors if several wines are evaluated consecutively
- ❑ Link with the limbic system: the limbic system is an area of the brain involved in a variety of functions including emotion, behavior, motivation, long-term memory, and olfaction.

<https://www.youtube.com/watch?v=5m7SGjJo7c4>



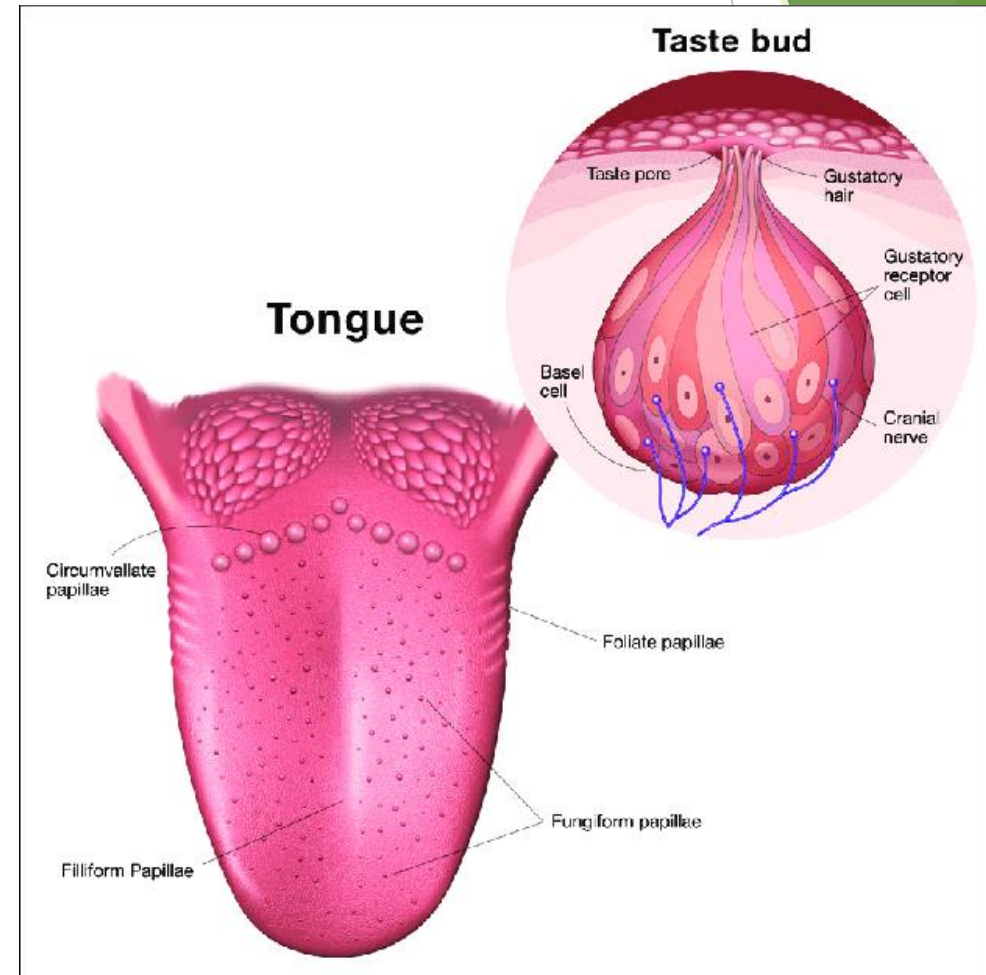
Taste: Sour, sweet, bitter and salty (umami)





# Taste: Sour, sweet, bitter and salty (umami)

- ❑ Taste receptors are present in modified epithelial cell membranes
- ❑ The cells contains receptors for all the basic tastes: sweet, sour, bitter, salty and umami
- ❑ 30-50 epithelial cells constitute a taste bud; The latter are located on each taste papilla



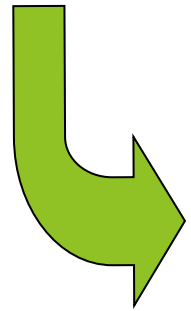


Taste: Sour, sweet, bitter and salty (umami)



# Touch: a very complex sensation

- Touch is a sense mainly elicited by physical stimuli (e.g. pressure, temperature, except in one case...

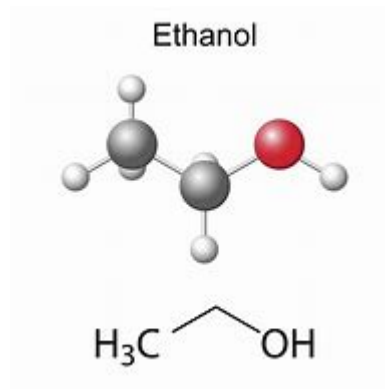
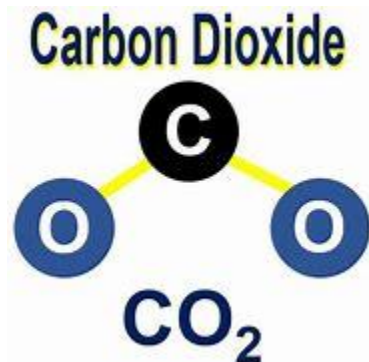


**Tactile sensations:** Roughness of a surface, **astringency**

**Texture properties:** hardness, elasticity, adesiveness ...

**Thermal sensations:** hot, **cold**

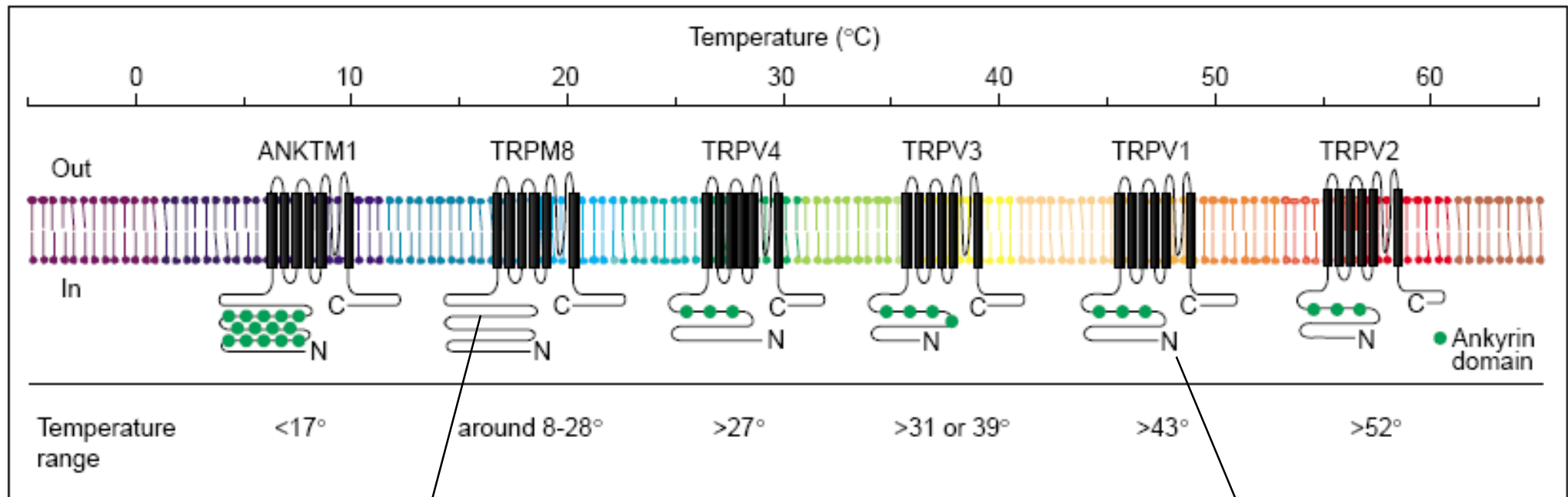
**Chemical sensation:** **hot and irritation from chemical stimuli**



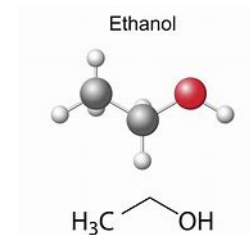
# Touch: Chemesthetic sensations

- ❑ Those sensations that are chemically induced and do not imply the activation of taste receptors (salty, sour, sweet, bitter and umami) and of the sense of smell
- ❑ The receptors responsible for the perception of these stimuli are the TRP receptors (Transient Receptor Potential), which belong to the family of ion channels and respond to tactile, painful and temperature stimuli
- ❑ These receptors have the peculiarity of being activated both by chemical substances present in the food and by physical stimuli, such as temperature and pressure thus, chemesthesis can be defined as the chemical activation of receptors for physical stimuli

# Touch: Chemesthetic sensations



Mint



Capsaicin