

Mousiness, Brettanomyces, Cork Taints

Thomas Henick-Kling

Brett Effect in Wine

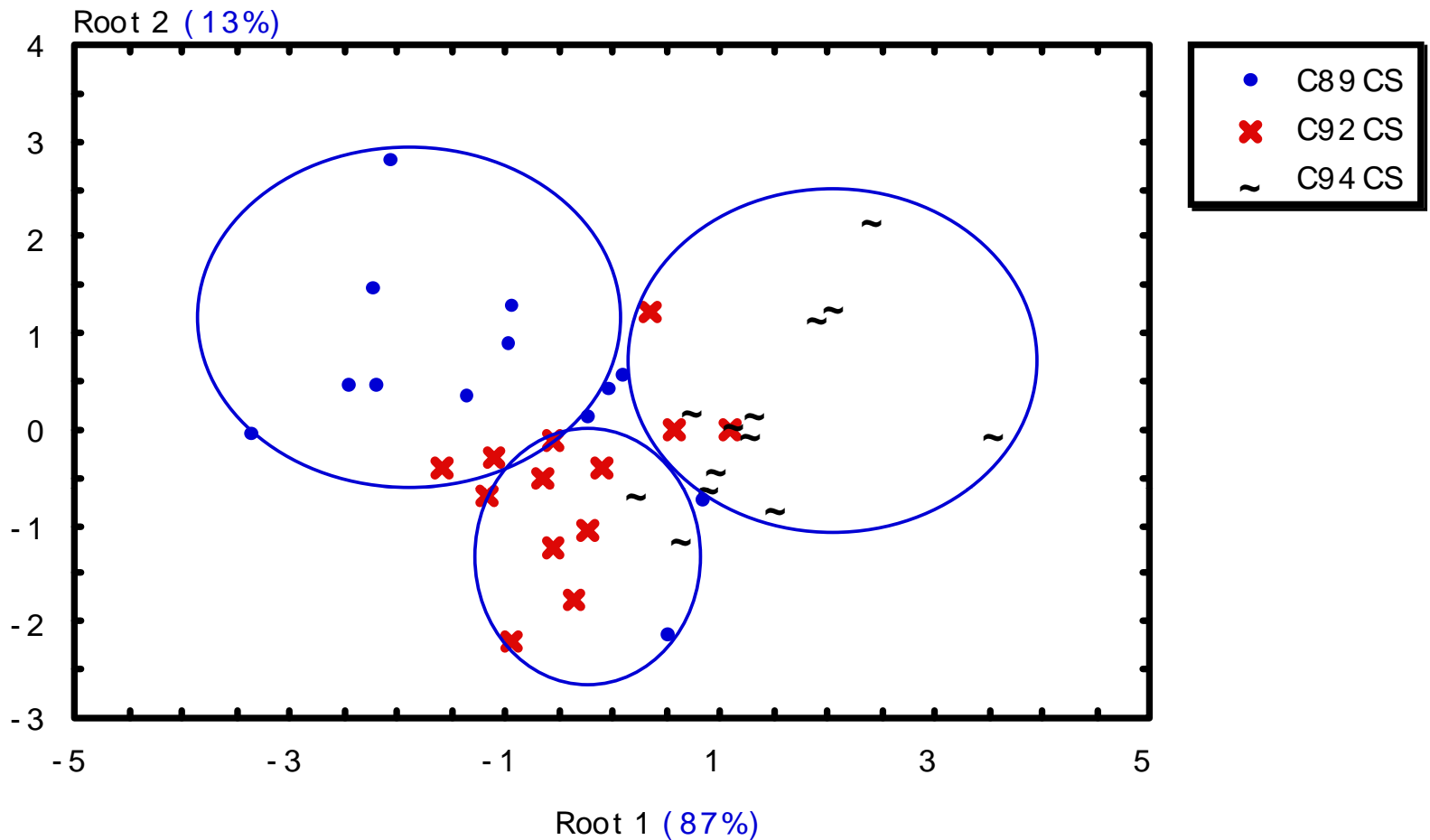
- Loss of 'fruit', 'floral' aromas
- Increase in 'Spice', 'Smoke'
- Increase in overall complexity
- Increase in 'Creosote', 'Plastic'
- Increase in 'Metallic' bitter taste
- Mousiness

What is the smell?

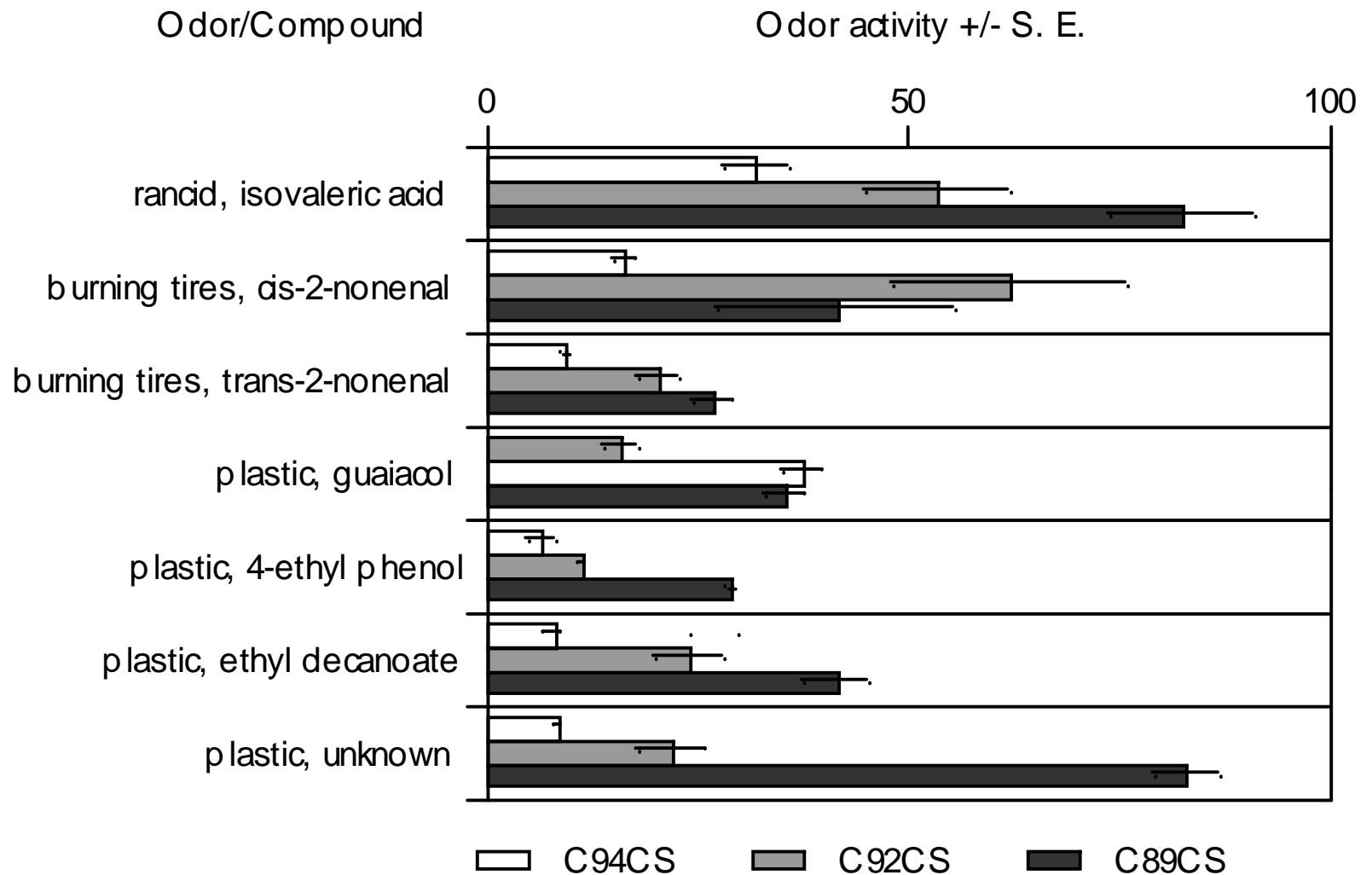
- Aromas generated by *Brett*:
 - ‘Sweaty horse’
 - ‘Wet wool’
 - ‘Leather’
 - ‘Burnt plastic’
 - ‘Bandaid®, medicinal’
 - ‘Barnyard’
 - ‘Smoky’
 - ‘Spicy’



Discriminant Analysis Plot for the 13 Panelists' Mean Scores



Three Cabernet Sauvignon wines described as having no (C94), moderate (C92), and strong (C89) Brettanomyces flavor characteristics. Scatterplot of the canonical scores for the discriminant roots 1 and 2 based on the descriptor scores for each panelist.



Compounds identified by GCO and GCMS that are major contributors to the 'bretty' aroma in three Cabernet Sauvignon wines.

Compounds associated with 'Bretty' wine

- 4-ethyl phenol (Band-Aid®)
- 4-ethyl guaiacol (cloves, spicy)
- 4-ethyl catechol
- Isovaleric acid (goat, rancid)
- Guaiacol (plastic)
- Ethyl decanoate (plastic)
- Trans-2-nonenal (burning tires)
- Isoamyl alcohol (fruity)

What is *Brettanomyces*?

- A.K.A. *Dekkera* (sexual form)
- Produces potent off-flavors in wines
- Tolerant of acidity and ethanol
- Resistant to cycloheximide (50 to 100 mg/L)

What's the Difference?

- *Brettanomyces bruxellensis*
 - Asexual
 - No spore
 - Commonly found in beverages
- *Dekkera bruxellensis*
 - Sexual
 - Spores
 - Rare to find

The many names of *B. bruxellensis*



100+ years of research!

- **Synonyms**

- *B. abstinens*
- *B. intermedius*
- *B. lambicus*
- *B. schanderlii*
- *B. vini*
- *B. patavinus*
- *M. intermedia*
- *T. cylindrica*
- *D. bruxellensis*
- *B. bruxellensis*

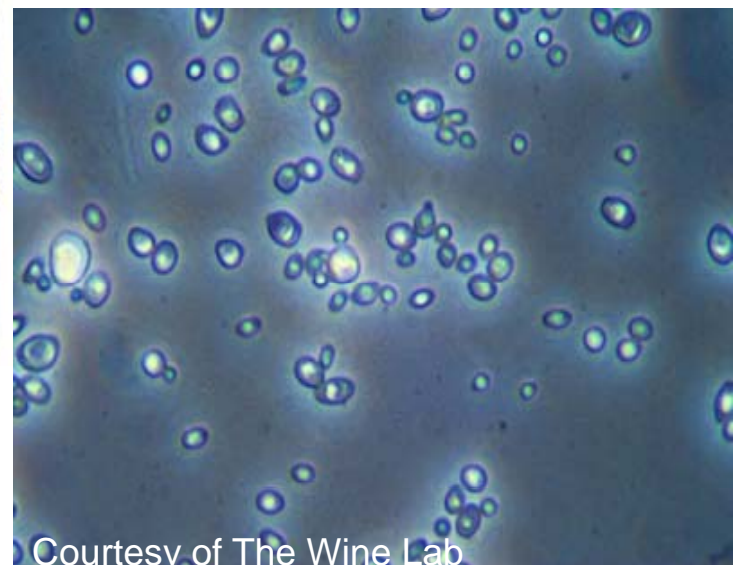
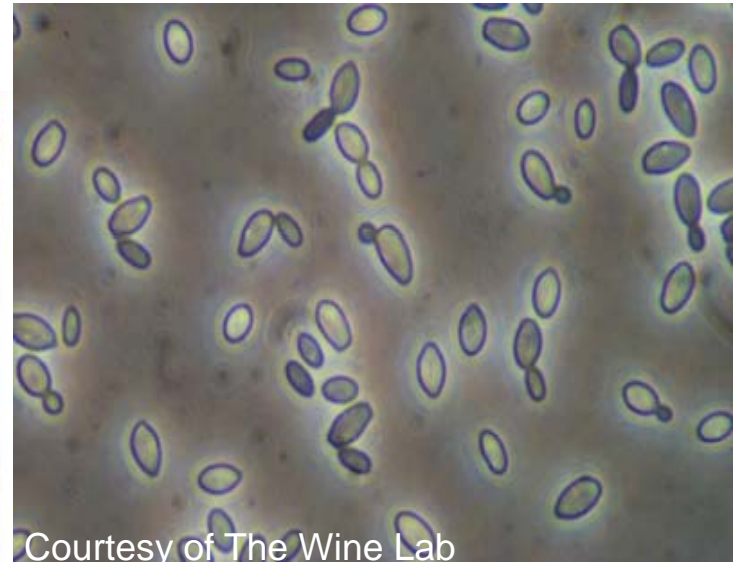
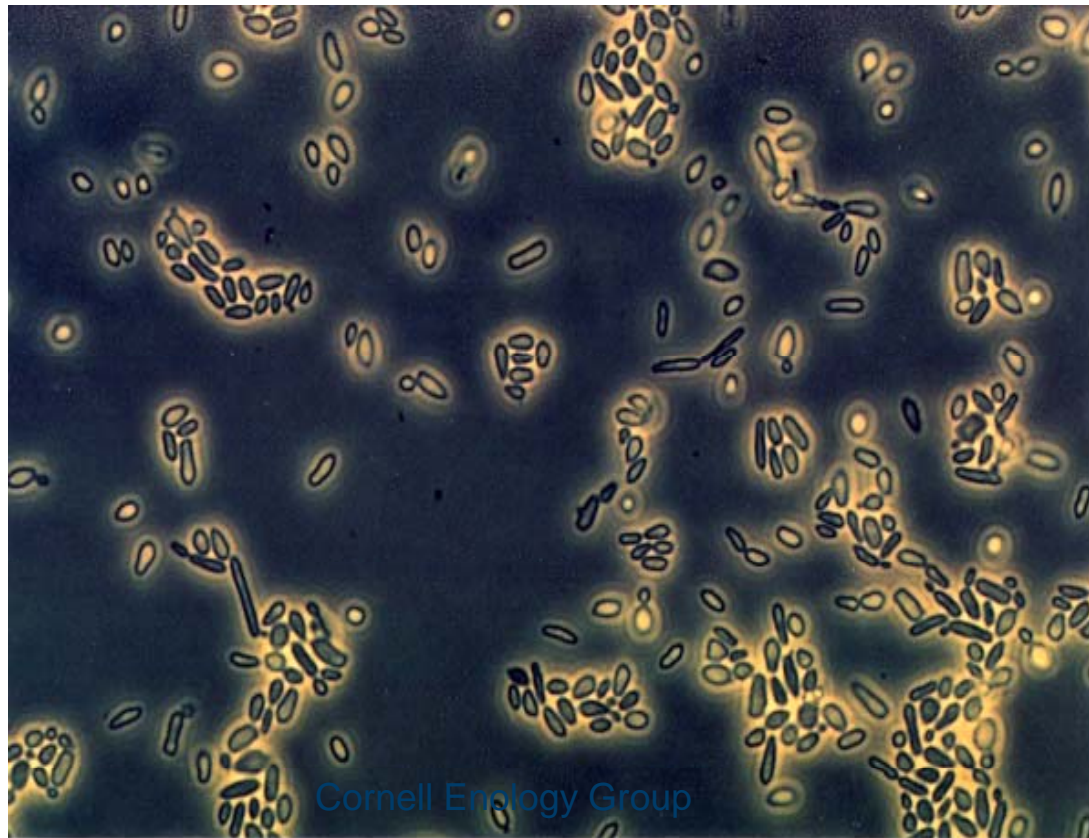
Nutritional needs

- Carbon: Glucose, fructose, cellulose, trehalose or ethanol
- Nitrogen: amino acids
- Oxygen: low levels desirable
- Temperature: $>13^{\circ}\text{C}$ or $<30^{\circ}\text{C}$
- Free SO_2 (<30 mg/L)
- Time: weeks to years;
 - up to 35 years!

Wine selects for *Brettanomyces*

- A specific environment
- Multiple organic carbon sources
- Much organic nitrogen
- Few competitors
- Opportunity for travel
- Time (months in barrel, years in bottle)

Brettanomyces bruxellensis cell morphology



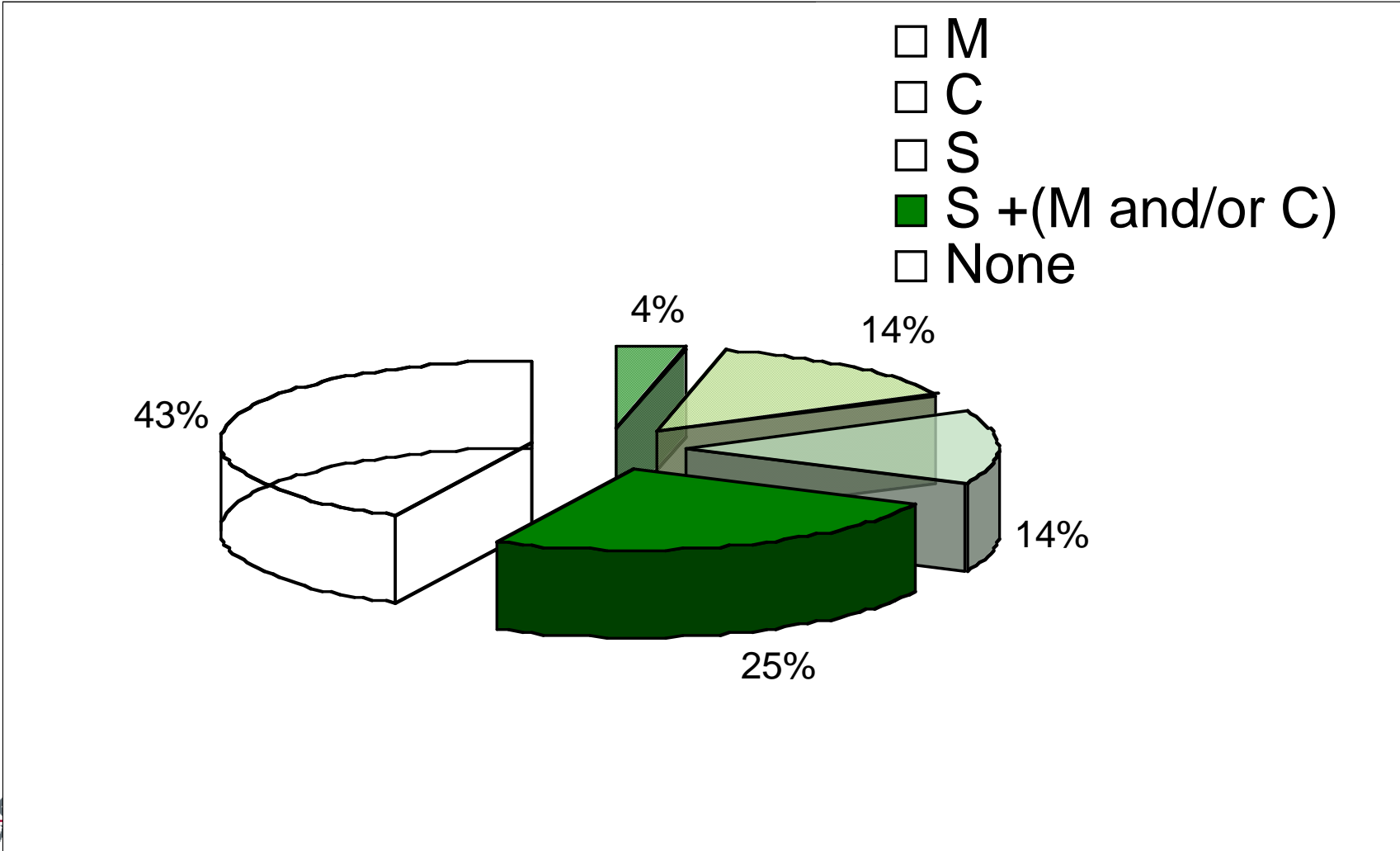
How does *Brett.* become established in a winery?

- There are several routes:
 - Diseased or injured fruit
 - New barrels
 - Old barrels
 - Inappropriate cellar methods
 - use of infected wine for topping
 - neglected barrels (not topping)
 - use of infected equipment
 - incorrect use of SO₂

Control of *Brettanomyces* in the winery

- Sanitation
 - Avoid diseased or injured fruit
 - Keep equipment and cellar environment clean
- Control of pH and use of SO₂
 - keep juice and wine pH low: ideally below 3.5
 - in grape must, especially when cold macerating
 - sulfite wine promptly after completion of alcoholic or malolactic fermentation
- Monitoring
 - each lot

Detection of *Brettanomyces bruxellensis* in Finger Lakes Pinot Noir wines by microbiological (M), chemical (C), and sensory (S) analysis



Control of *Brettanomyces* in the winery

- Monitoring wines at risk

Sensory evaluation

Microscopic analysis

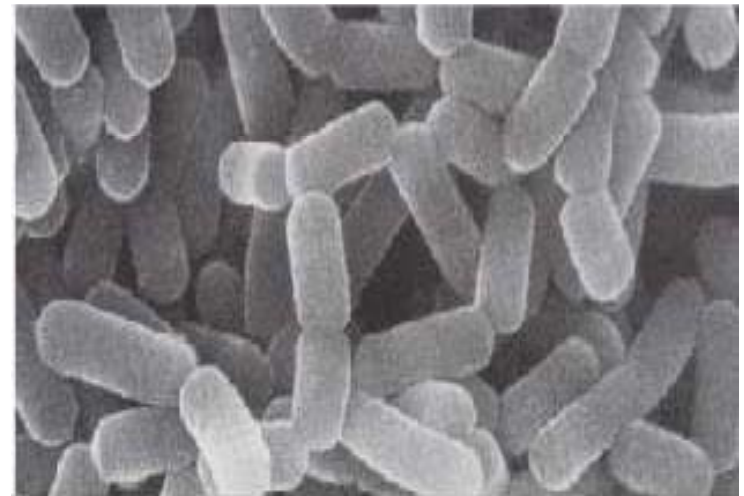
Chemical indicators, 4EP, 4EG, 4EC

4-ethyl phenol, 4-ethylguaiacol, 4-ethylcatechol

Plating (nutrient agar with 50 mg/L cycloheximide)

Lactic acid bacteria

- *Pediococcus*, *Lactobacillus*, *Leuconostoc*
- Produce off-characters such as
 - Diacetyl
 - Mousiness
 - Oxidation products of lysine, hydroxycinnamic acids
 - tetrapyridines
 - Acetic acid (vinegar); “Pique Acetique”
 - “La Tourne”, “Amertume”
 - Tartaric acid metabolism
→ VA, CO₂, propanal
 - “Mannite”
 - Mannitol, VA



Lactic acid bacteria

- *Pediococcus* sp., *Lactobacillus brevis*

- Mousiness

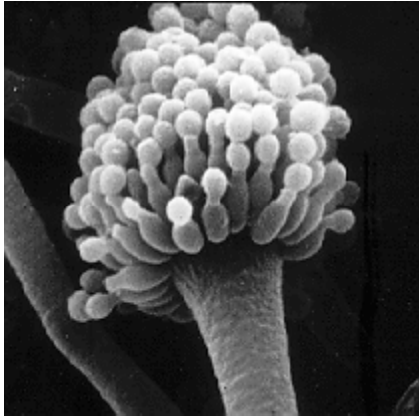
Lysine + ethanol → Acetyl tetrahydropyridines

Compounds responsible

two 2-acetyl tetrahydropyridine isomers

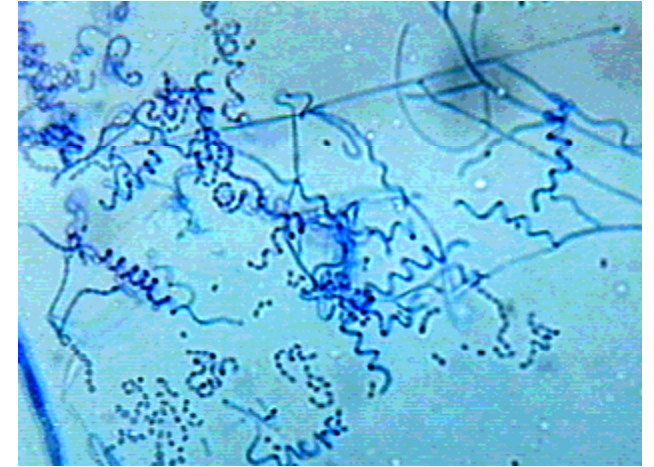
2-acetyl-1-pyrroline

very low sensory threshold around 1.6 ng/l



Cork Off-Odors

Caused by molds
and *Streptomyces* bacteria



TCA and moldy, musty, earthy aromas

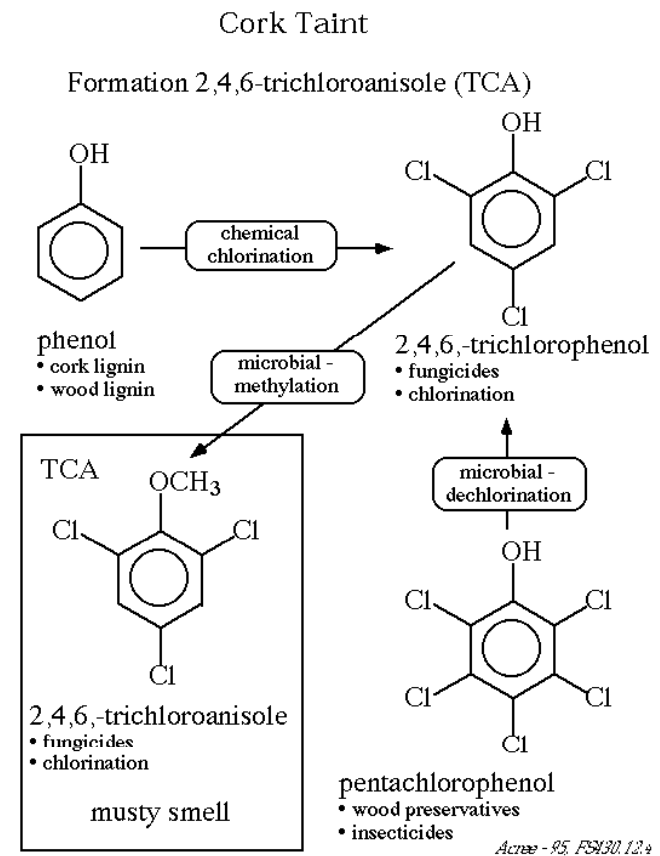
TCA cork taint

molds

Hypochlorite + lignins → chlorinated phenols → TriChloroAnisole

Cork taints

- Development of fungi such as *Aspergillus sp.* and *Penicillium*
- **Guaiacol, geosmin, 2-methylisoborneol (MIB), octen-3-ol and octen-3-one; 2,4,6 trichloroanisole (TCA)**
- **At low concentrations:** reduces varietal aromatic characteristics, **at higher concentrations:** contributes aromatic note: musty, mouldy, wet newspaper, dank cellar
- Very low flavour threshold of 1.4 ng/l, good teaspoon full of pure TCA to spoil all the wine that is made in the USA



Cork Off-Odors

Caused by molds
and *Streptomyces* bacteria
TCA and moldy, musty, earthy aromas

Sources are contaminated winery surfaces and hypochlorite-treated corks

- Prevention
 - Good hygiene
 - Avoid the use of chlorine

Wine defects: prevention

- Good hygiene
- Good hygiene
- Good hygiene

- Manage microbial population in must and in wine