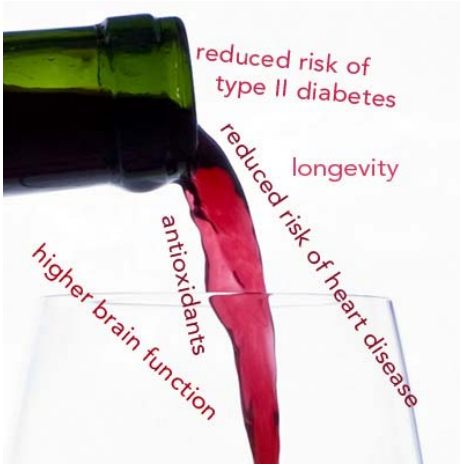
Wine and Health



James A. Kennedy
Department of Viticulture and Enology
California State University, Fresno

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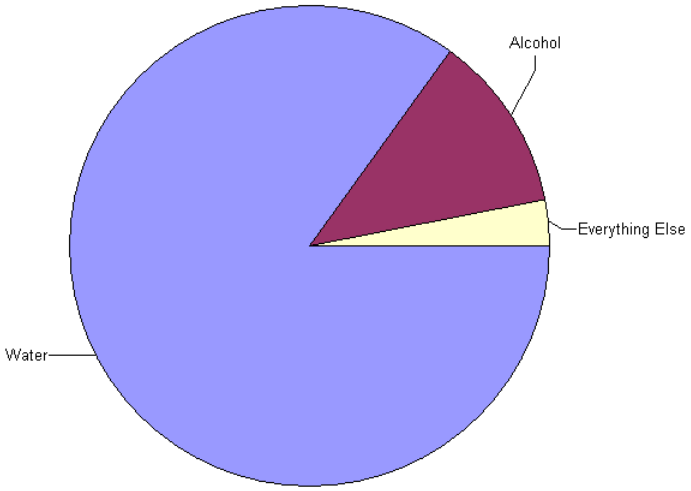
Insight Cruises
December 1, 2013
Somewhere on the Rhone

Wine Composition



Waterhouse, 2002

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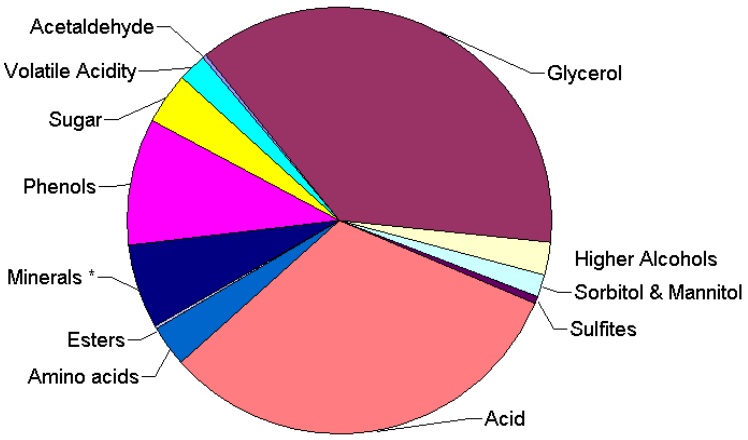
Wine Composition-Everything Else



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Waterhouse, 2002

Wine Composition-Phenolics

TABLE 3. Typical levels of phenolics in red and white table wine[a]

	White Wine		Red Wine	
Phenol Class	Young	Aged	Young	Aged
Non-flavonoids				
Hydroxycinnamates	154	130	165	60
Benzoic Acids	10	15	60	60
Hydrolyzable tannins (from oak)	0	100	0	250
Stilbenes (Resveratrol)	0.5	0.5	7	7
Total mg/L	**164.5**	**245.5**	**232**	**377**
Flavonoids				
Flavanol monomers	25	15	200	100
Proanthocyanidins and condensed tannins	20	25	750	1,000
Flavonols	—	—	100	100
Anthocyanins	—	—	400	90
Others	—	—	50	75
Total mg/L	**45**	**40**	**1,500**	**1,365**
Total all phenols	**209.5**	**285.5**	**1,732**	**1,742**

[a]Young means new wine, less than six months of age, not having been aged or fermented in oak barrels. Aged implies about one year for white, about two years for red and some oak barrel aging (or other oak contact).

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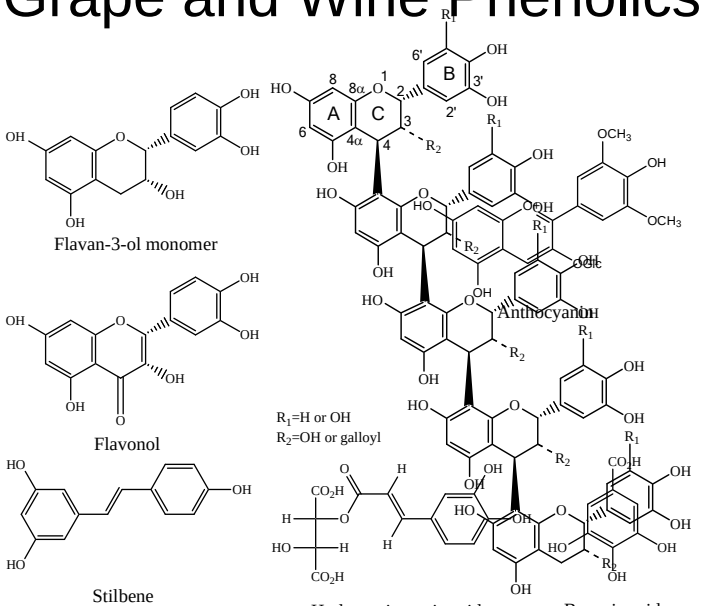
Waterhouse, A., Ann. N.Y. Acad. Sci. 2002, 957:21-36

Grape and Wine Phenolics



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Wine and Health History

- Wine or other alcohol consumed in dilute form as the primary beverage until ~1650
- Moderate wine consumption recommended for health
- Heavy use discouraged
- Wine used as a medicine and medium for other medicines

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Wine and Health

- Wine consumption has been associated with a reduction in disease incidence.
  - Cancer
  - Neurodegenerative disorders
  - Cardiovascular disease

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Wine and Cardiovascular Disease

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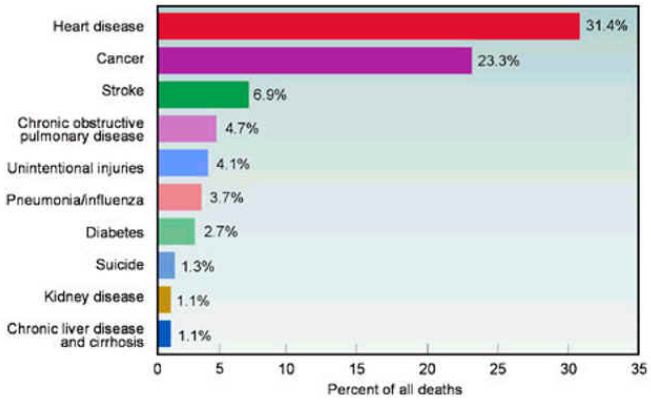
Leading Causes of Death in U.S.



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Source: Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System and unpublished data. 1997.

Early Wine Epidemiology

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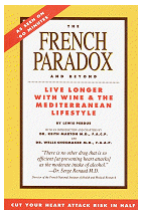
St. Leger et al., The Lancet, May 12, 1979, 1017-1020.

The French Paradox



- November, 1991: *60 Minutes* segment on the unusually low incidence of CHD among the French population despite a large dietary intake of saturated fat and cholesterol.
- These results were attributed to wine consumption.

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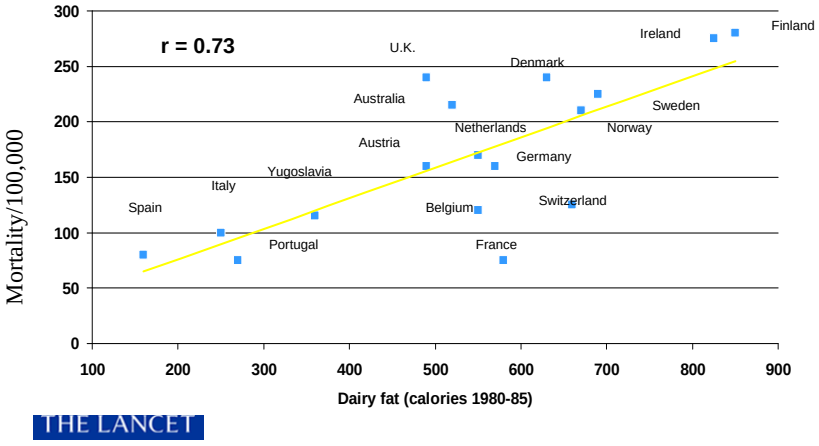
The French Paradox



THE LANCET

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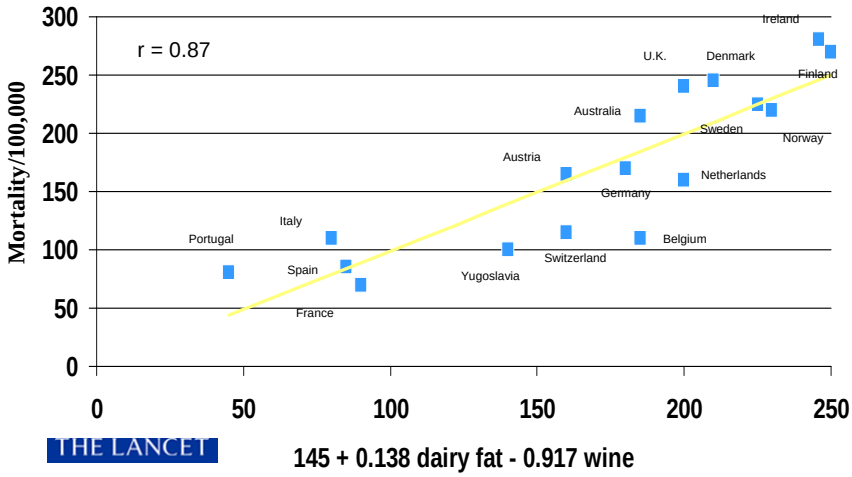
Renaud and de Lorgeril, The Lancet 339:1523, 1992

The French Paradox



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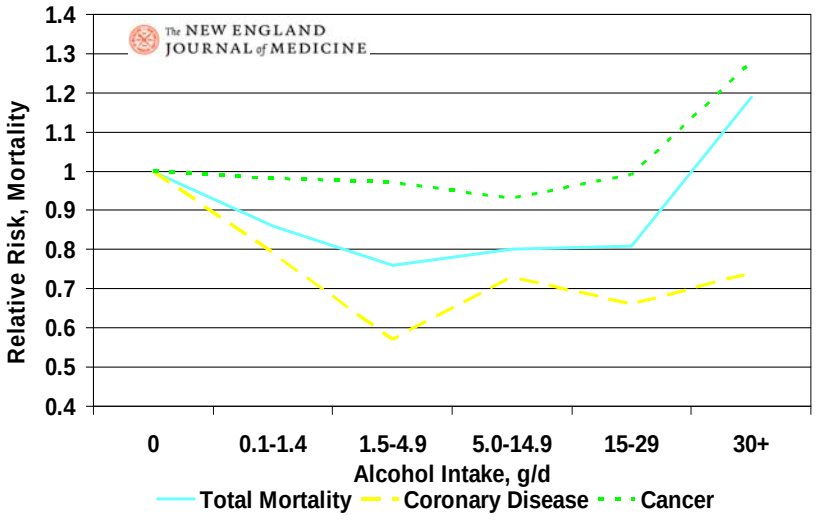
Renaud and de Lorgeril, the Lancet 339:1523, 1992

J-shaped Curve for Mortality



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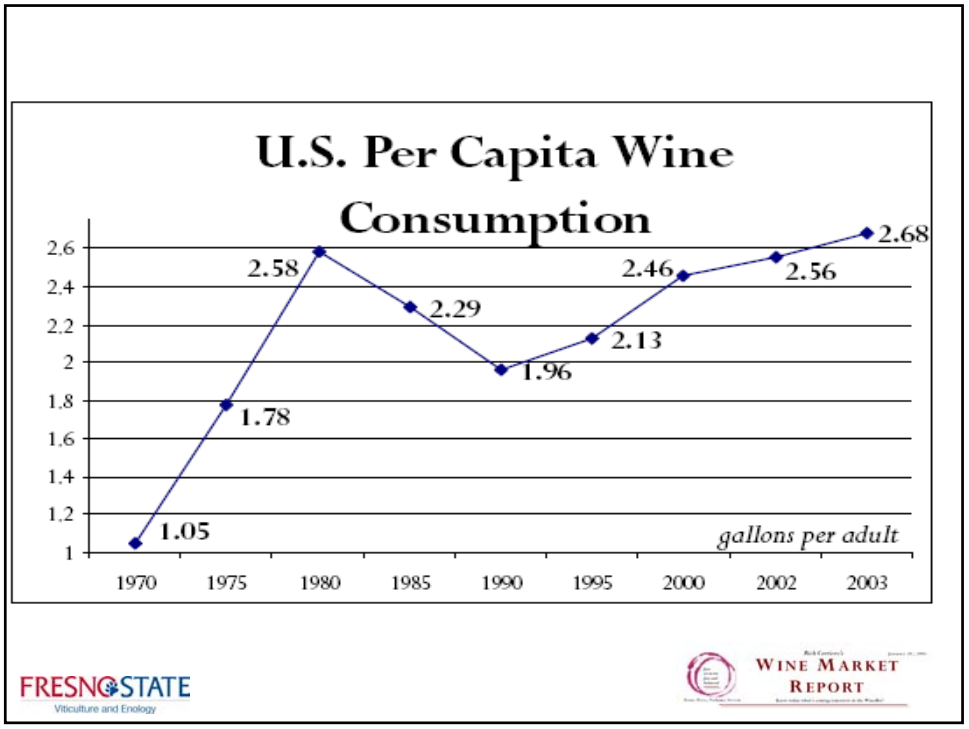
Fuchs et al., NEJM 332:1245, 1995


U.S. Per Capita Wine Consumption
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
1.05
1.78
2.58
2.29
1.96
2.13
2.46
2.56
2.68
gallons per adult
1970
1975
1980
1985
1990
1995
2000
2002
2003
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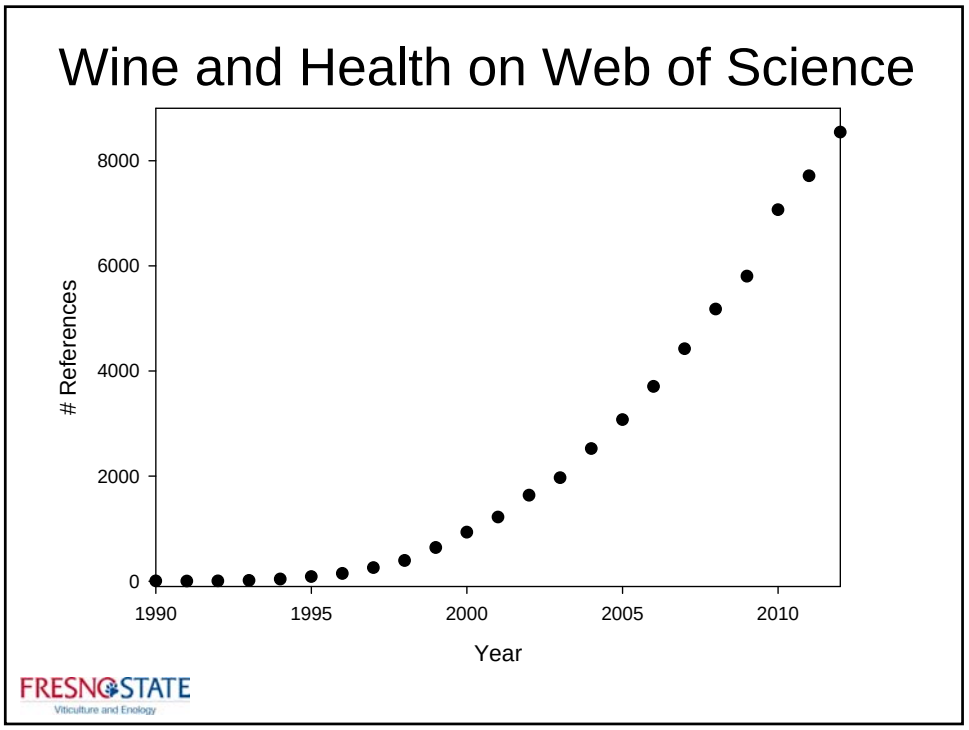
Wine Market Report


Wine and Health on Web of Science
8000
6000
4000
2000
0
References
1990
1995
2000
2005
2010
Year
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Wine and Health

- Increased longevity from regular, moderate alcohol consumption
- Drinkers, especially wine-drinkers have a lower incidence of many diseases
  - Cancer
  - Neurodegenerative disorders
  - Cardiovascular disease
- Explanation??

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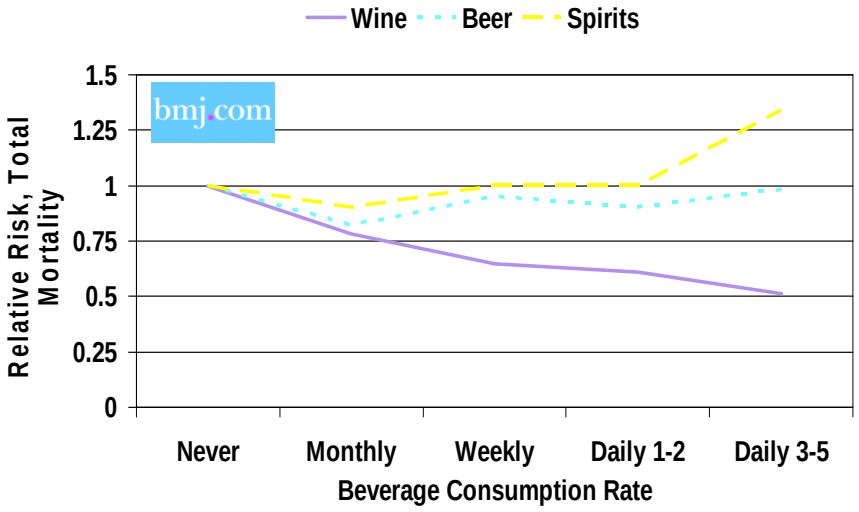
Effect of Alcoholic Beverage



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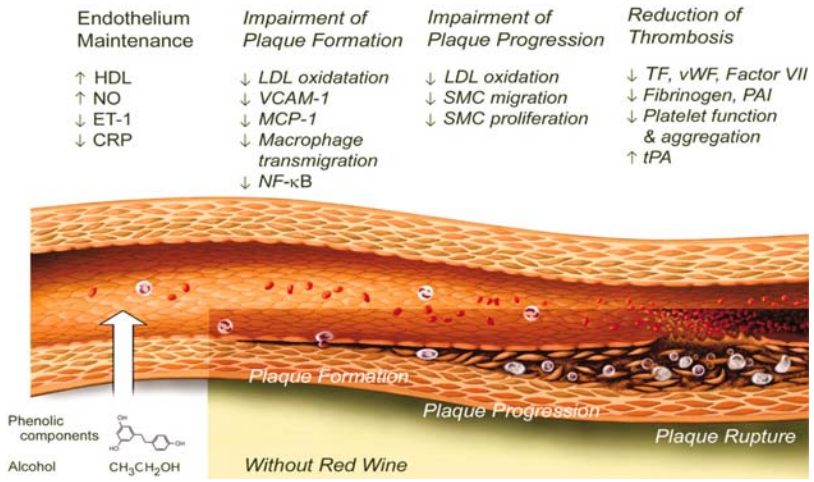
Grønbæk, BMJ, 310: 1165, 1995

In vitro and in vivo experimental research support the biological plausibility of red wine, both its ethanol and phenolic compounds, as an inhibitor of atherosclerosis



Szmitko, P. E. et al. Am J Physiol Heart Circ Physiol 288: H2023-H2030 2005; doi:10.1152/ajpheart.00868.2004

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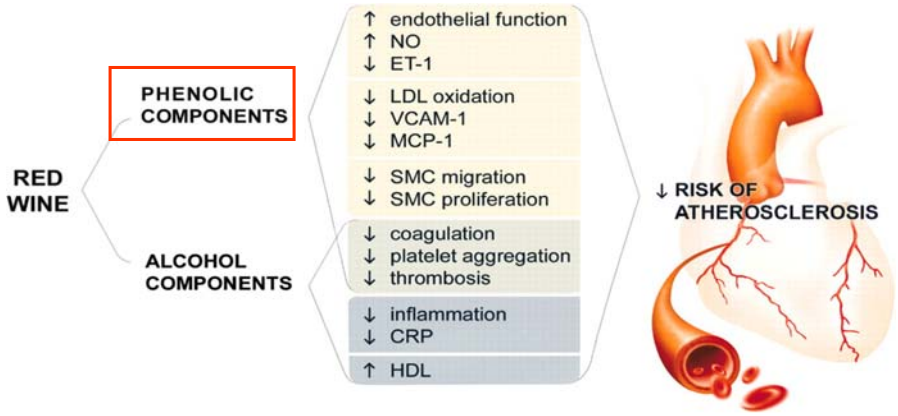
AJP - Heart and Circulatory Physiology

Both the alcohol and phenolic components found in red wine are believed to decrease the risk of atherosclerotic disease via several different mechanisms



Szmitko, P. E. et al. Am J Physiol Heart Circ Physiol 288: H2023-H2030 2005; doi:10.1152/ajpheart.00868.2004

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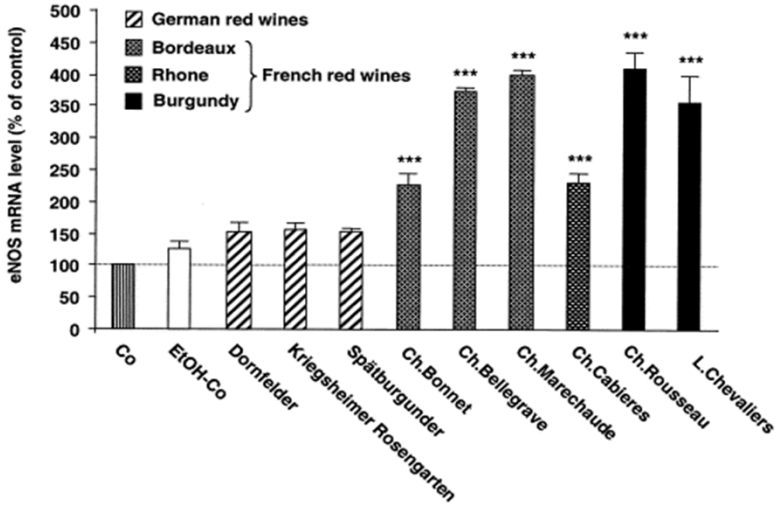
AJP - Heart and Circulatory Physiology

Expression of eNOS mRNA

- Nitric oxide is a potent vasodilator



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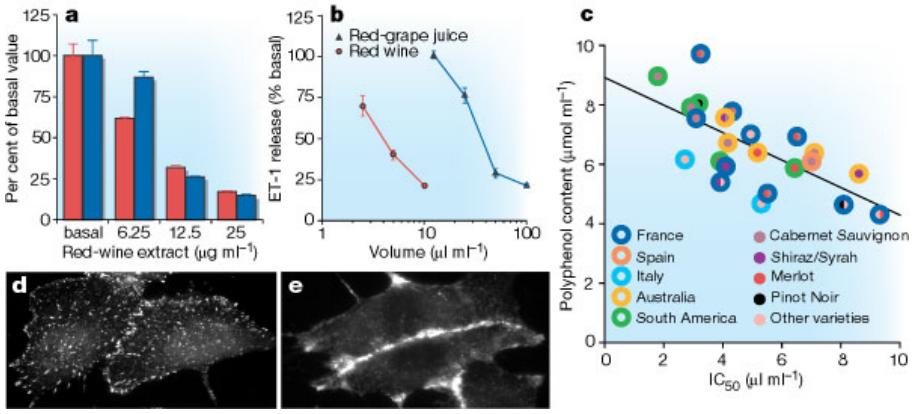
Wallerath et al., J. Am. Coll. Card., 41: 471, 2003

Endothelin-1 Synthesis

- Endothelin-1 is a potent vasoconstrictor peptide
- Overproduction is a key component of cardiovascular disease



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Corder et al., Nature, 414:863, 2001

Red Wine Polyphenols and Health

- Atherosclerosis may be partly due to processes that occur after ingestion of high-fat foods that contain lipid oxidation end products (ALEs).
- Some products are cytotoxic and genotoxic such as:
  - Oxycholesterol
  - 4-hydroxy-nonenal
  - malondialdehyde (MDA)

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Gorelik et al., FASEB, 22: 41, 2008

Red Wine Polyphenols and Health

- 10 subjects were recruited
  - Given the following diets
    - A: cooked meat with water
    - B: cooked meat, red wine polyphenols (RWP) after cooking, red wine
    - C: RWP mixed with meat then cooked, red wine
  - MDA monitored in plasma and urine

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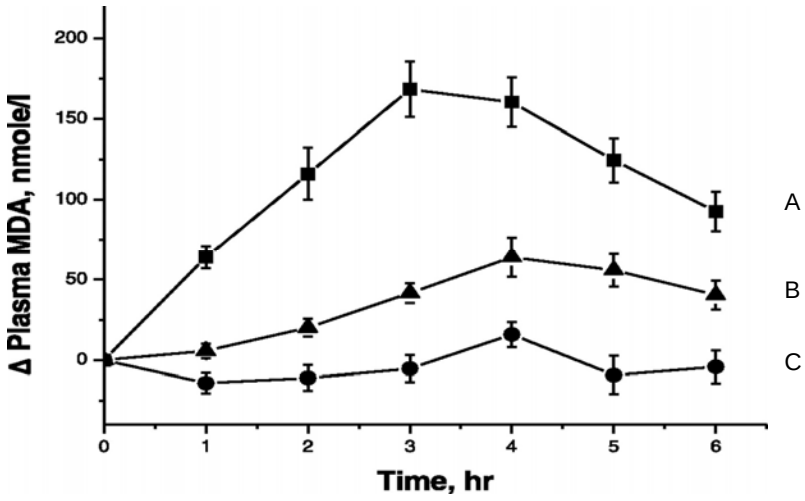
Gorelik et al., FASEB, 22: 41, 2008

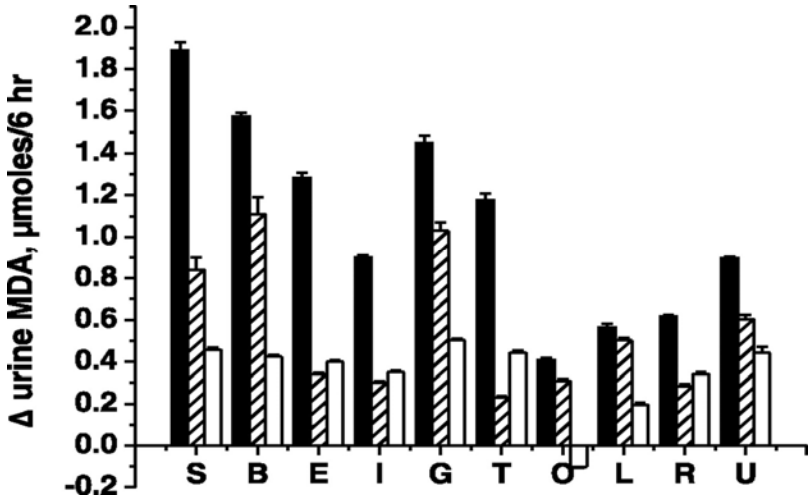
Plasma MDA Levels wrt Time



FRESNO STATE Viticulture and Enology

Gorelik et al., FASEB, 22: 41, 2008

Urine MDA Levels



FRESNO STATE Viticulture and Enology

Gorelik et al., FASEB, 22: 41, 2008

Wine and Health Summary

- Most studies associate moderate red wine consumption with a low incidence of cardiovascular disease
- Most studies implicate ethanol and phenolics as being the active components in wine

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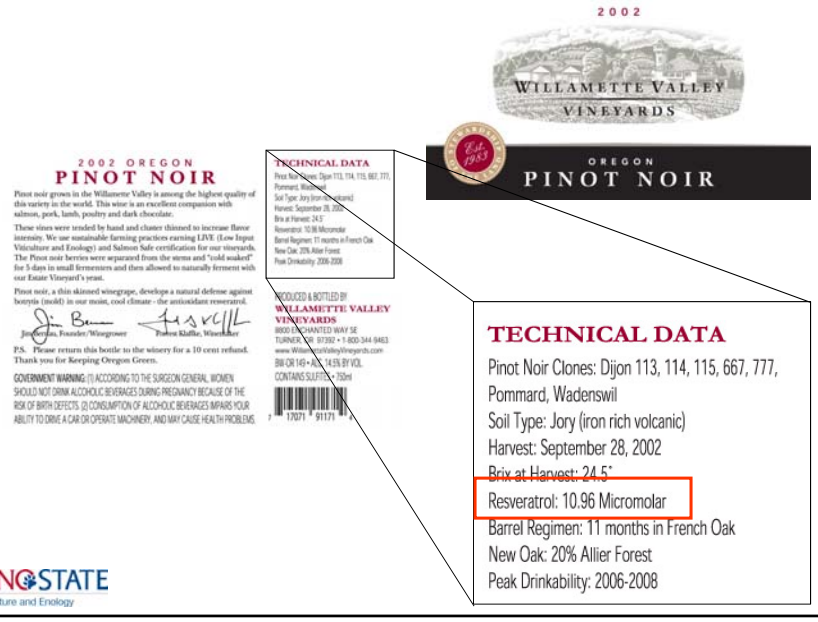
Resveratrol and Labeling



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University Suspects Fraud by a Researcher Who Studied Red Wine

A charge of widespread scientific fraud, involving 26 articles published in 11 journals, was leveled by the University of Connecticut today against Dipak K. Das, one of its researchers, whose work reported health benefits in red wine.

NY Times, January 11, 2012

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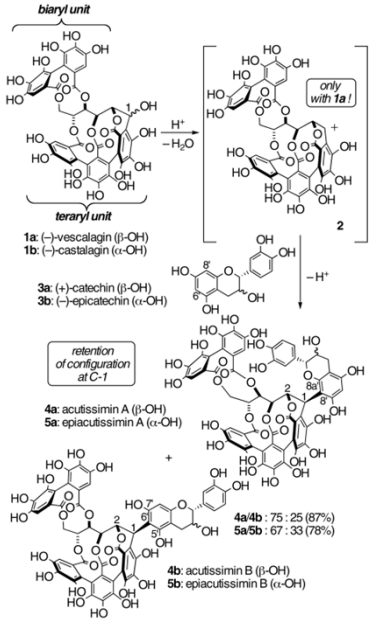
Many plant-based foods have high phenolics so why is wine special???



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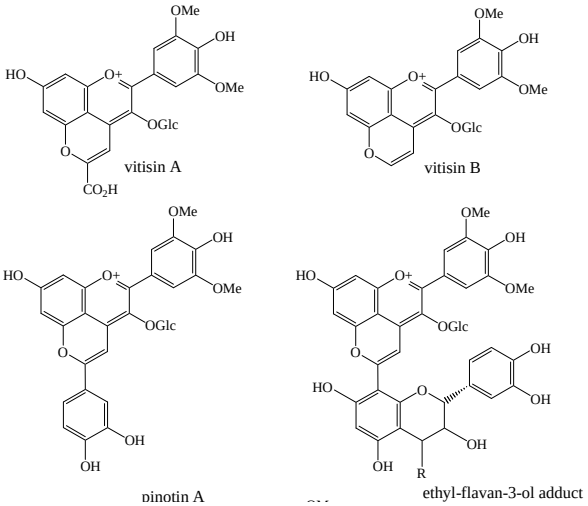
Quideau et al., Ang. Chem.-Int. ed.. 42 (48): 6012-6014 2003

Anthocyanin Products



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Optimizing Phenolics through Research

- Goal of Research program
  - Improve quality of red wine phenolics
    - Concentration
    - Balance
- Considerations
  - Oregon's climate
    - Short growing season
    - Predominant variety Pinot noir

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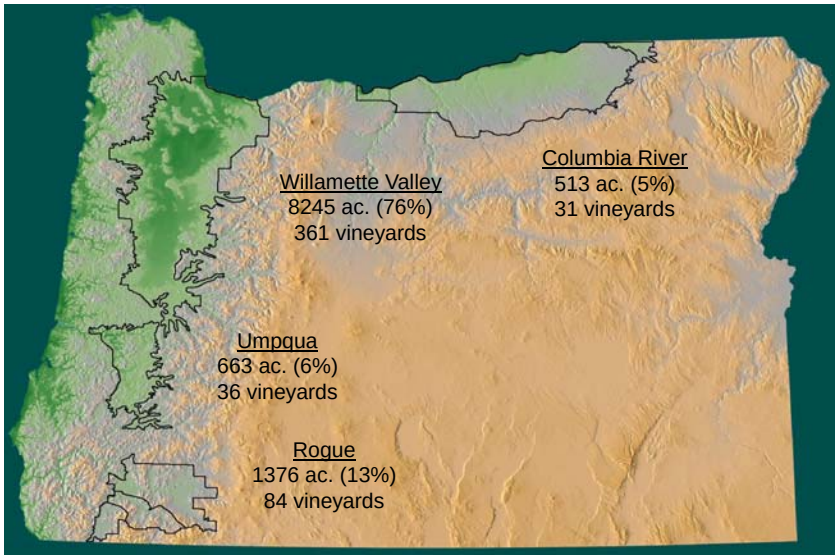
Influence of Place



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Courtesy of Gregory Jones

Arcus Estate: Dundee, Oregon

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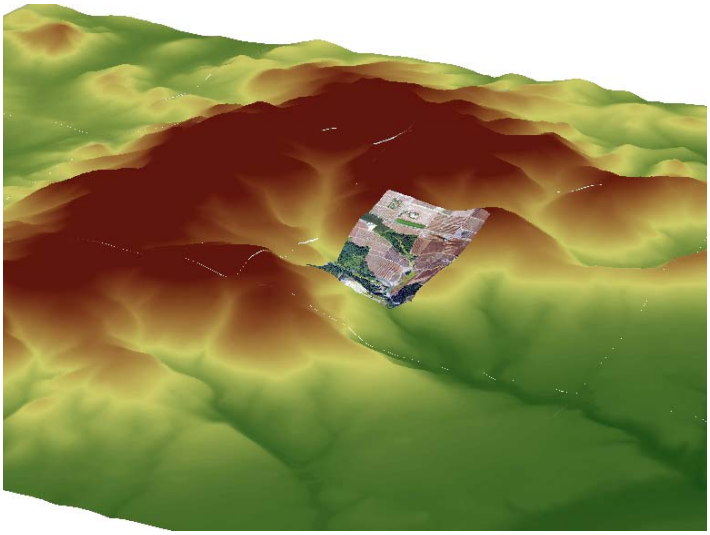
Halbleib and Cortell, 2003

Terrain Map w/ Image Overlay



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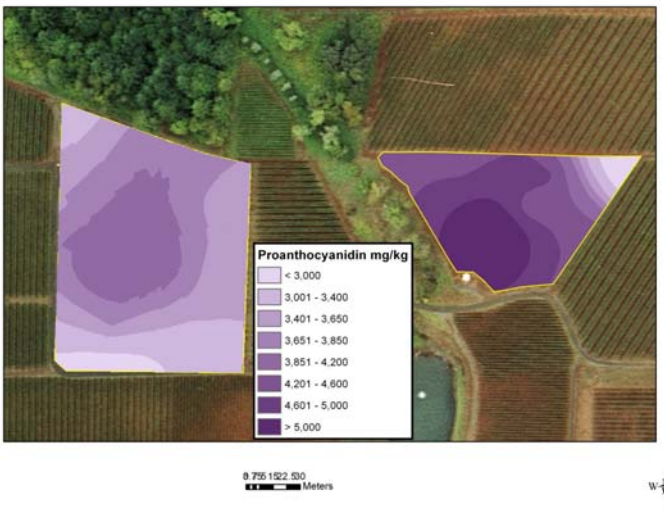
Courtesy of Mike Halbeib

Spatial Map of Tannins



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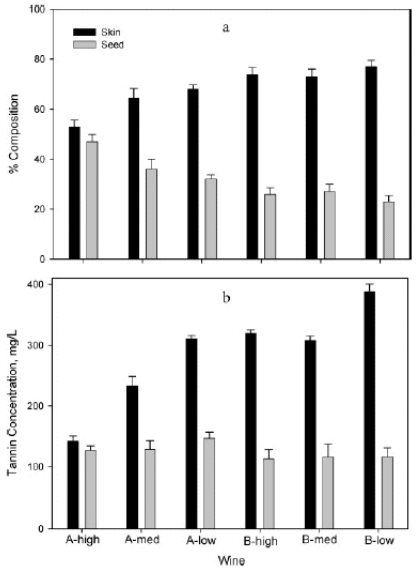
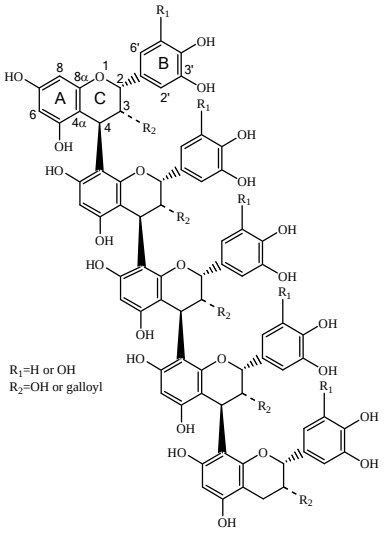
Cortell et al., J. Agric. Food. Chem., 53: 5798, 2005

Wine Tannin and Vigor





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Cortell et al., J. Agric. Food. Chem., 53: 5798, 2005

So Which Wines are Healthier?

- In most studies, red wines are more effective than white wines
  - Due to phenolics
- For red wines, higher phenolic concentrations considered more effective
  - Specific phenolics?
    - Studies have focused on grape-based phenolics and red wine phenolic mixtures
  - Labelling?
    - Consumer information

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In Summary

- Epidemiology is clear but . . .
- Has wine's causality been confirmed?
  - Japan
  - Socioeconomics
- Issues with phenolics
  - Absorption
  - Metabolism
- If confirmed, issues remain with alcohol

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"By the way, the health benefits of a glass of wine a day are not retroactive."

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The New Yorker, June 5, 2006