



# Dietary Polyphenols and Health

## Cardiovascular disease (CVD)



# The Problem is Oxygen!!!

- Used by the body to oxidise (burn) foods.
- This process is not 100% efficient.
- The undesirable products of metabolism include **free radicals** particularly superoxide ( $O_2^{\cdot-}$ ).
- A 70kg adult produces ~2kg of  $O_2^{\cdot-}$  / year.

These free radicals **must** be removed



# Free radicals processes have been implicated in these diseases

## Fatal:

Atherosclerosis

CVD

Cancers

Strokes

Ageing

Parkinson's Disease

Alzheimer's Disease

Radiation injury

Tobacco-induced

toxicity

## Non-fatal:

Asthma

Inflammatory bowel disorders

Cataracts

Arthritis

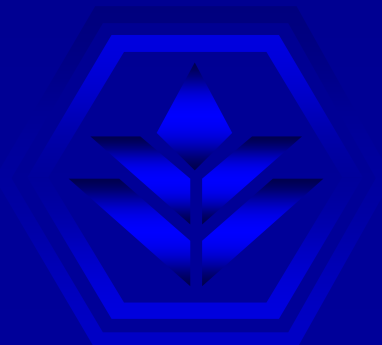
Diabetes

Rheumatism

Inflammation

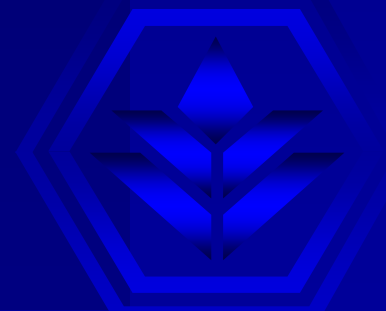
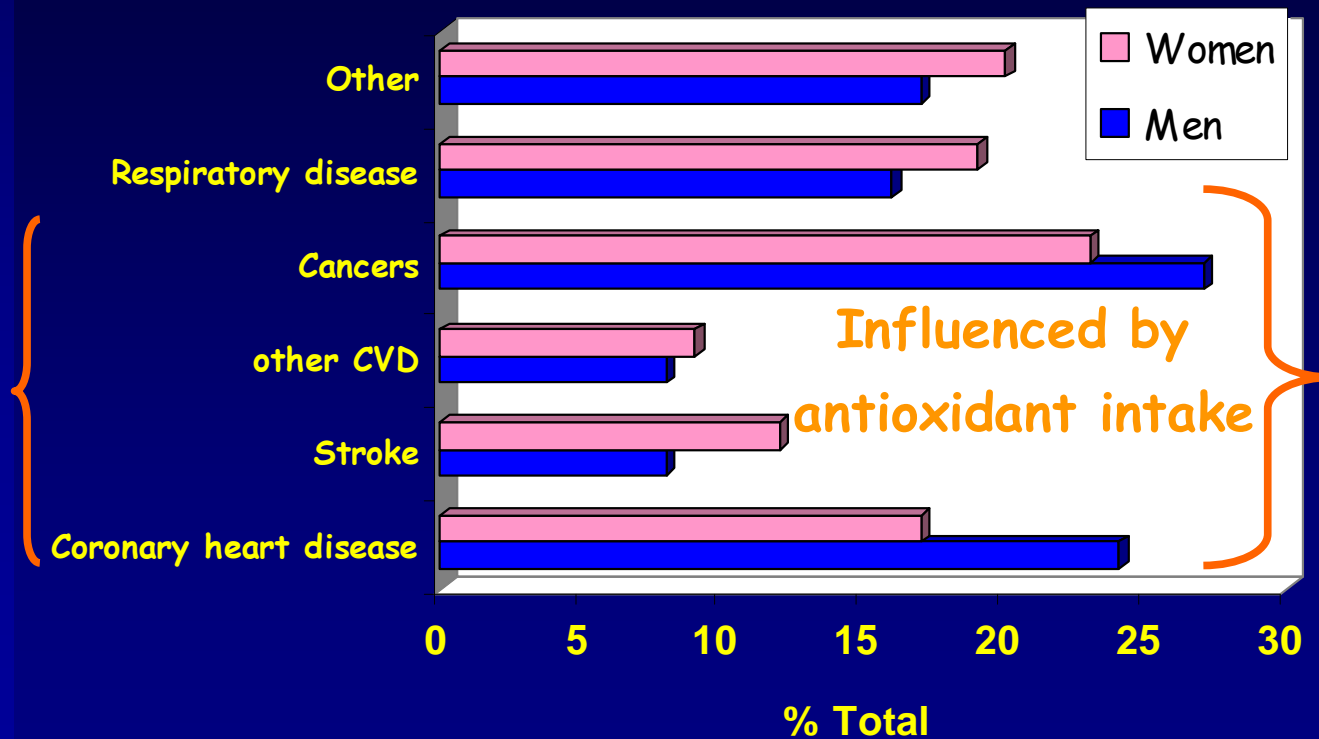
Muscular Dystrophy

Stress



# Majority of deaths could be influenced by antioxidant intake

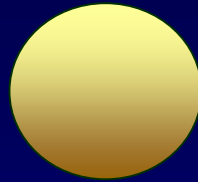
## Cause of death 2001



# Atherosclerosis



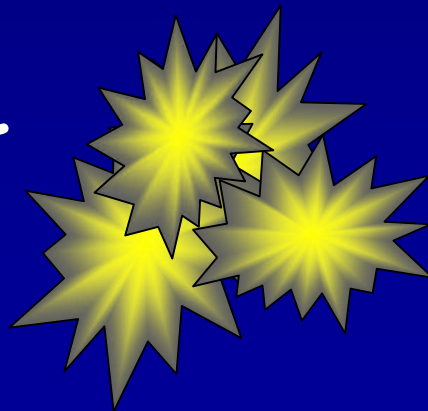
Low Density Lipoprotein  
(LDL - cholesterol  
transport)



+  $R^\cdot$  (free radicals)



Oxidised LDL  
"Sticky"



Accumulates in  
arterial FOAM cells  
leading to **thickening**  
(hardening) of the  
arteries

# Normal Coronary Artery

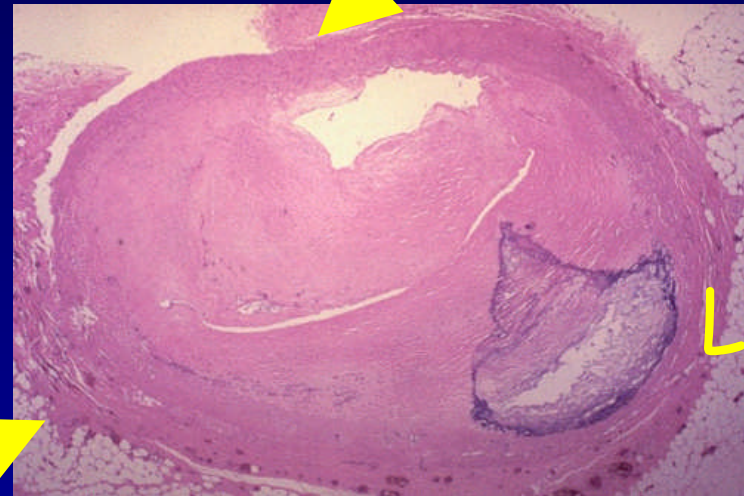


Pies/Beer/Smoking/NO fruit and veg  
(Scottish Lifestyle?)

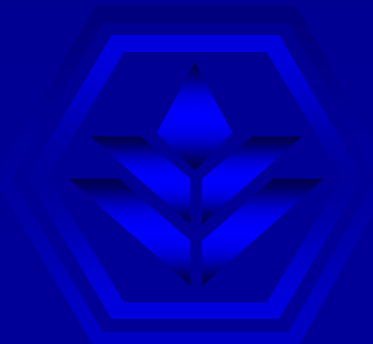


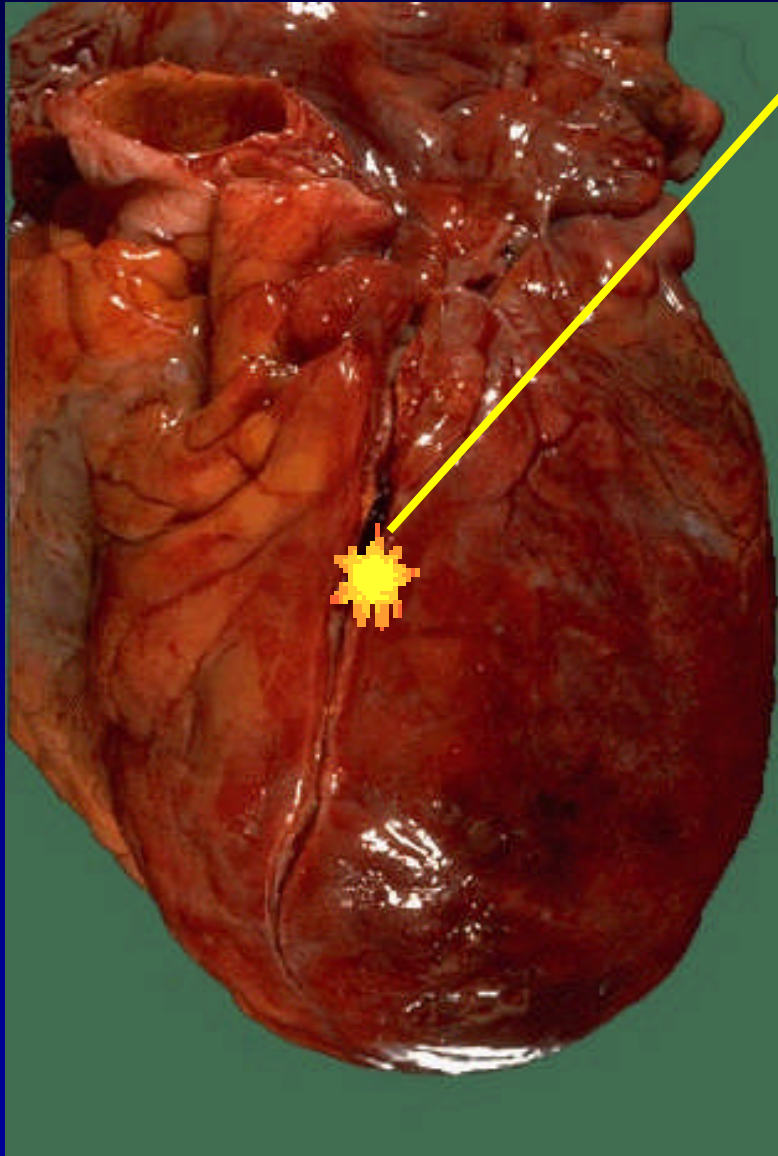
Atherosclerotic/thickened  
Coronary Artery

Weakened Arterial Wall



Leads to..





A ruptured left anterior  
descending coronary artery.

Within the lumen a dark red  
recent coronary thrombosis  
can be seen

Result - Heart Attack

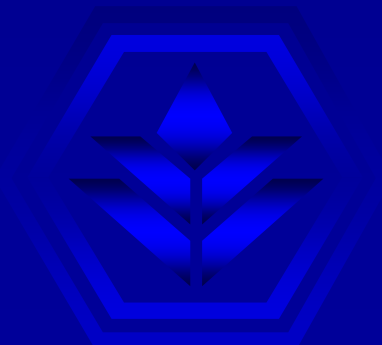
UK annual  
300,000 first incidents  
**50% fatality**  
UK cost = £10bn (est)  
USA: \$290bn (1999)



## Antioxidant capacity of foodstuffs ( $\mu\text{mol TEAC} / \text{gram}$ )

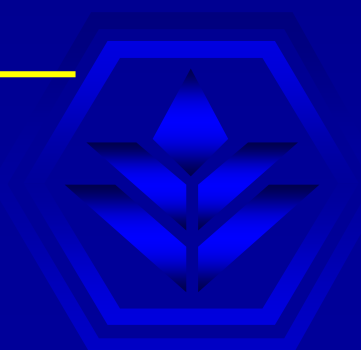
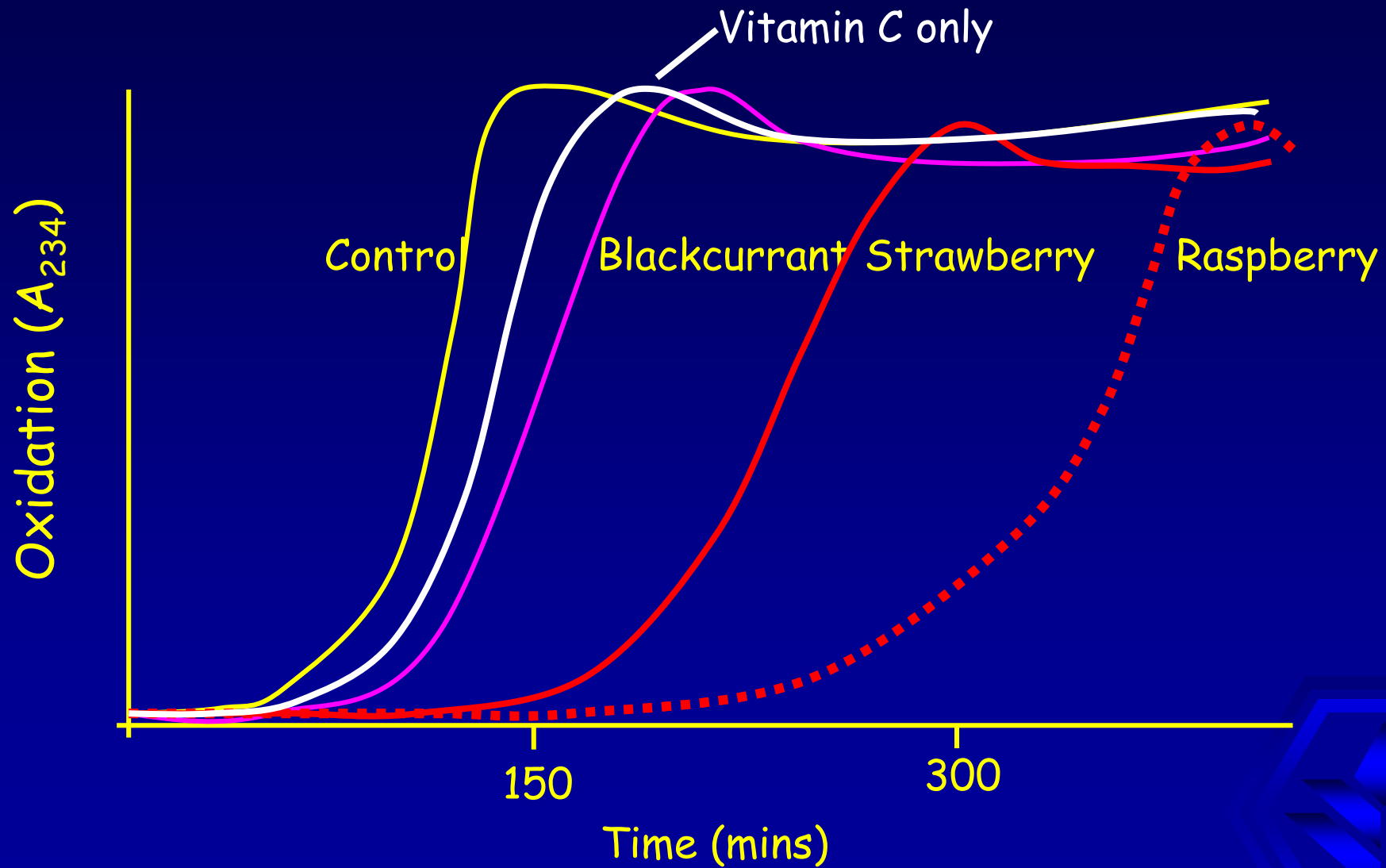
raspberry	12 - 23
<i>wild Raspberry</i>	1 - 47
strawberry	8 - 19
blackcurrant	12 - 60
<i>Wild blackcurrant</i>	9 - 190
plum	9.5
orange	7.5
grape	7.4 - 18
apple	2.2
blueberry	19 - 45
red wine	10 - 18
white wine	2 - 5

Soft fruits  
are rich in  
antioxidants

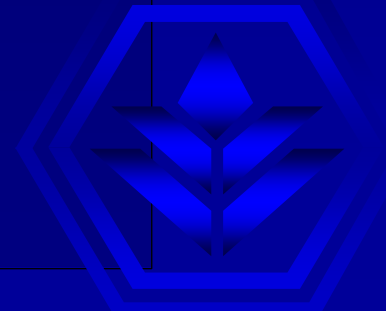
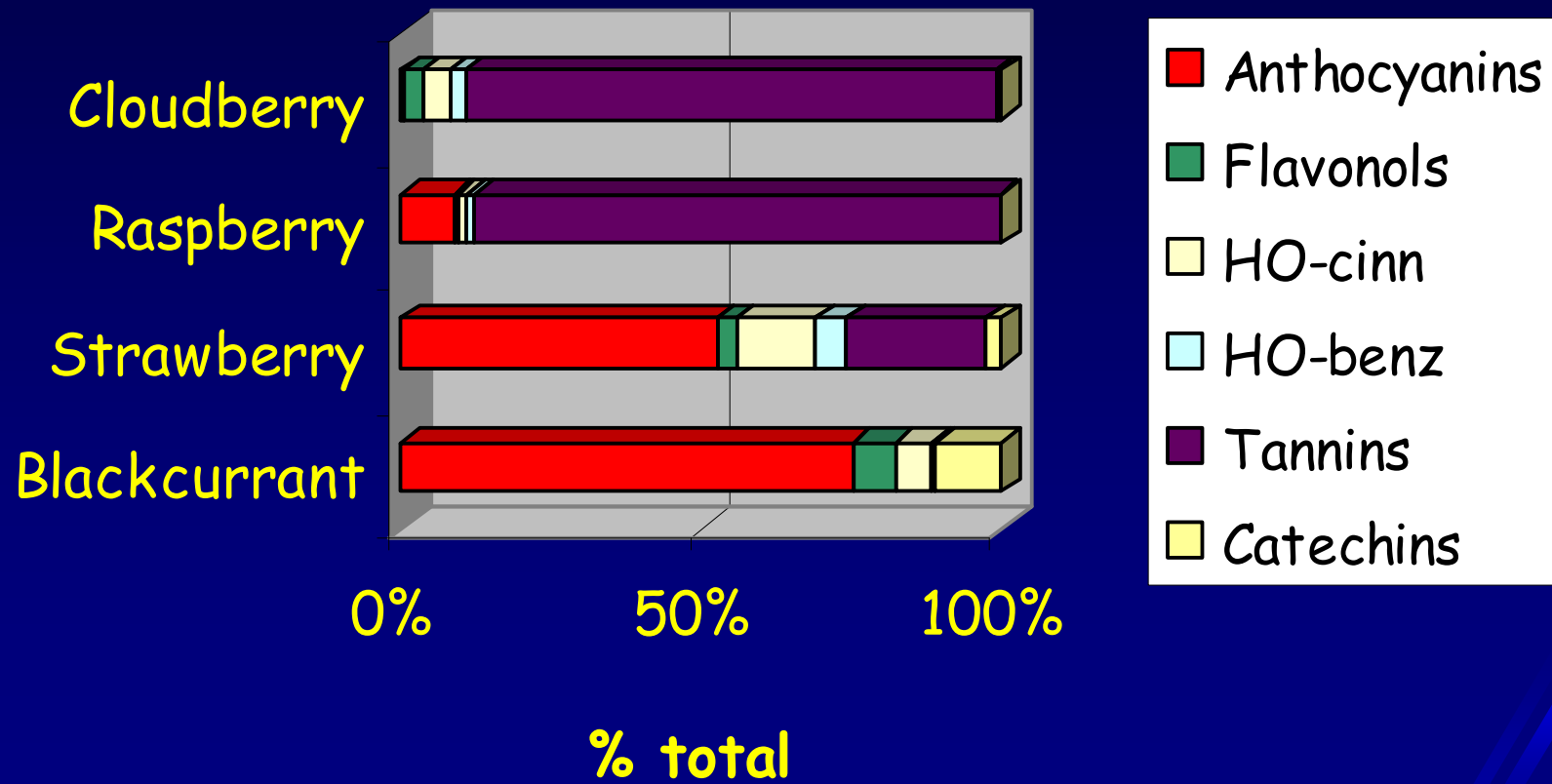




Raspberry, Blackcurrant and Strawberry juices are more effective in preventing LDL oxidation than the equivalent vitamin C content



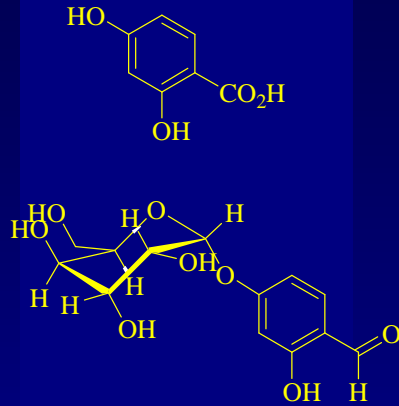
# Variation in polyphenol composition in fruits



# Where are we now??

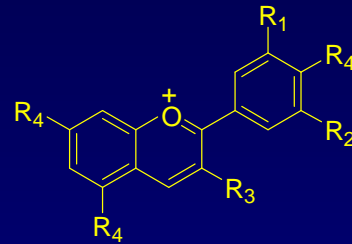
Polyphenols have a basic structural motif = phenol

Which polyphenols most benefit CVD?



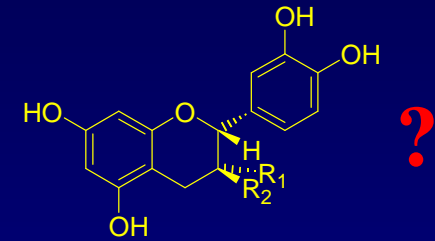
Simple Phenolics

?



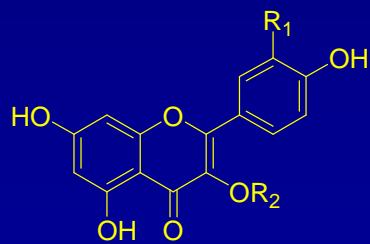
Anthocyanins

?



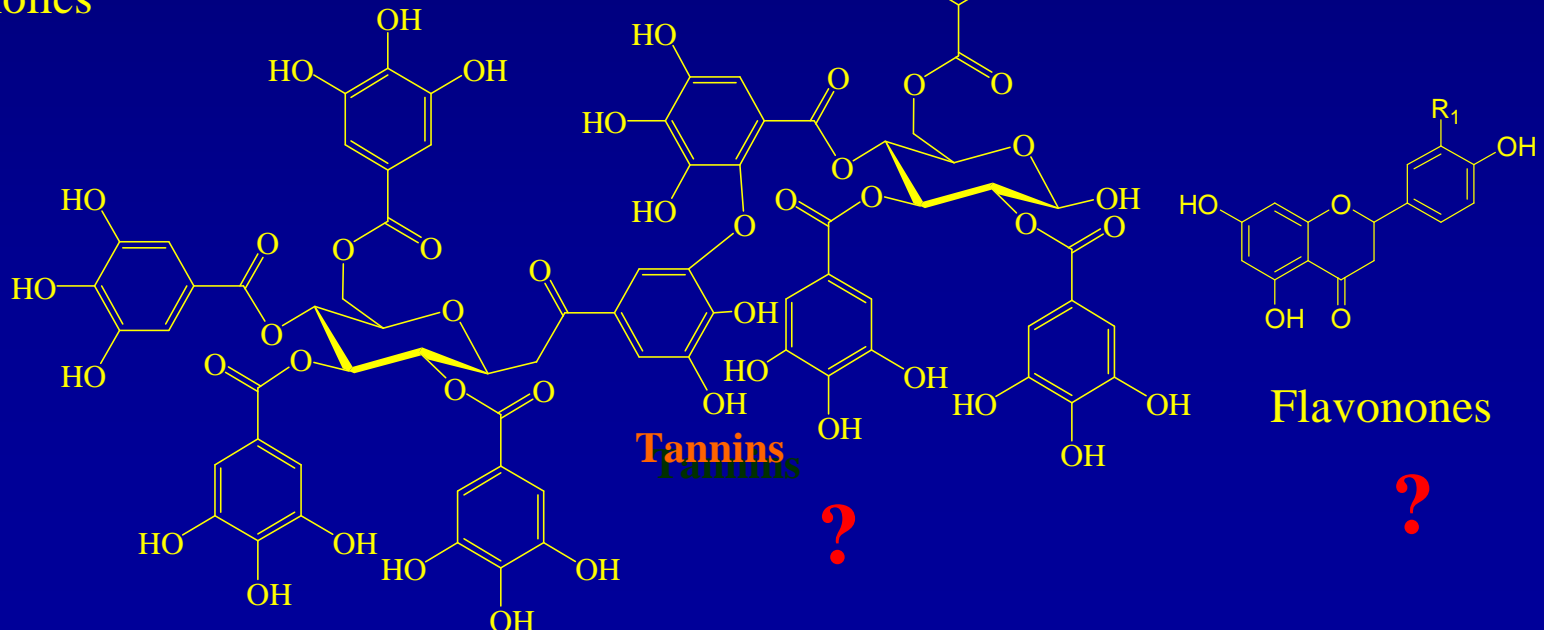
?

Catechins



Flavonols

?



Tannins

?

Flavonones

?