The ripening strawberry
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The role of ethylene

Ethylene (C_2H_4, a planar hydrocarbon) is a gaseous phyto-hormone produced by plant tissues and detected by a membrane-bound receptor.

Solution?
- Studies are often performed upon detached tissues that are enclosed in gas-tight containers for prolonged periods
- Alternatively, some researchers use extracted tissue: extrapolating enzyme activity data.

However, numerous problems are associated with either of these approaches.

CO_2-photoacoustic (PA)-LASER spectroscopy has allowed the accurate and continuous determination of low ethylene concentrations from a range of whole attached ripening stages.

Ethylene is evolved throughout ripening in a predictable manner
- With the exception of ripe fruit, ethylene evolution during ripening exhibits a diurnal cycle.

Ethylene is evolved as:
- Flowers senesce or ovules are fertilised.
- Fruit expand from small dark-green fruits to pale-green fruits.
- As diurnal night-time peak, coinciding with fruit reddening.

Ongoing Research.
These results are correlative and work testing a causal role for ethylene has still to be done.
To identify ethylene responsive genes in harvested fruit.

Fruit metabolism

Molecular versus proteomic analysis?
- Many different strawberry cDNAs have been cloned.
- Many of these are differentially expressed during ripening.
- Few cloned cDNAs encode proteins involved in fruit flavour.

A non-molecular strategy was therefore adopted to identify differentially expressed proteins.

The enzymes mCS and mMDH were the focus of further analysis.
- The major strawberry organic acids are citrate (ca. 80%) and malate (ca. 20%).
- mCS and mMDH play important roles in energy production via the TCA-cycle.

The TCA cycle is also involved in the production of secondary metabolites
- The secondary-metabolites include flavour components such as volatiles and amino acids.

The cDNAs that encode each of these enzymes were cloned from ripe strawberry fruit and a biochemical and molecular characterisation of each enzyme/cDNA carried out.

The effectiveness of complementary (proteomic plus molecular) approaches is demonstrated.
The findings by Northern analysis are contrary to the other measurements made: is the translation of mCS and mMDH transcripts blocked during the early ripening stages?

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Effective packaging strategies

Modified atmosphere packaging techniques frequently use supra-ambient levels of O_2 and/or CO_2 to increase the shelf life of fresh produce.

High oxygen (80%) modified atmosphere packaging:
- Maintained ripening and quality in strawberry fruit.
- Reduced ethylene production by 75%.

Current research…. is aimed to identify novel genes whose expression is regulated by O_2 and CO_2.

RNA from control and 2-24 hours (high O_2/CO_2) treated fruit is to be compared.

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