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Lipid-soluble bioactive substances in Australian avocados

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Some general information about avocados

- Avocados are known to contain high amounts of phytonutrients:
 - monounsaturated fatty acids
 - phytosterols
 - carotenoids
 - vitamins B, C and E
 - polyphenols

- A recent study (using Californian-grown fruit) reported activity against prostate cancer cells

(Lu *et al.*, Journal of Nutritional Biochemistry, 16, 23-30, 2005)



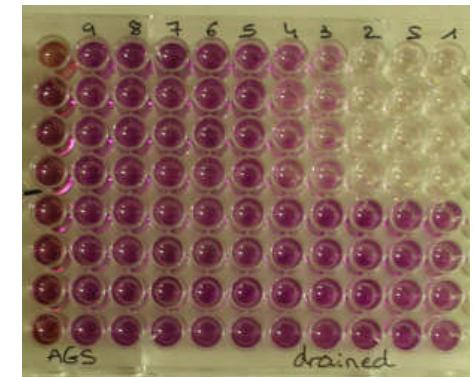
Our objective

- To obtain credible information relating to the health-promoting benefits of lipid-soluble substances found in Australian-grown avocados (Hass variety)
- This could then be used for:
 - promotion of the fruit/industry
 - education of public/consumers



Activities

- Measurement of selected substances in extracts
 - Vitamin E components
 - Chlorophylls- responsible for the green pigmentation
 - Carotenoids- responsible for the yellow pigmentation
- Assessment of antioxidant capacity of extracts
- Evaluation of growth-inhibitory activity against various human cancer cells:
 - Gastric
 - Colon
 - Leukaemia



Generation of lipid-soluble extracts

Fruit (randomly from 3 farms in QLD)

Homogenise &
extract with acetone



Concentrate

Extract with hexane &
concentrate under
vacuum

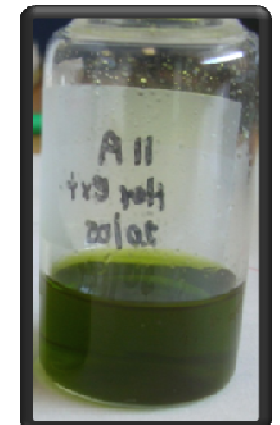


Crude extract

SPE Diol clean-up



Purified extract



HPLC, LC/MS

Antioxidant assay (DPPH)

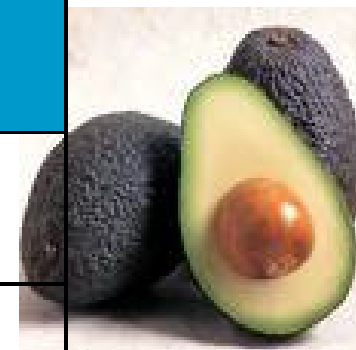
Anticancer assay (MTT)



Composition of 'Hass' extracts

Major lipid-soluble substances in 'Hass'

Compound	Concentration range ($\mu\text{g}/100\text{g}$ FFW)
α-Tocopherol	1197-2151
γ-Tocopherol	118-232
δ-Tocopherol	83-260
Chlorophyll a	1073-1465
Chlorophyll b	1231-2215
Lutein (all <i>trans</i>-)	160-273

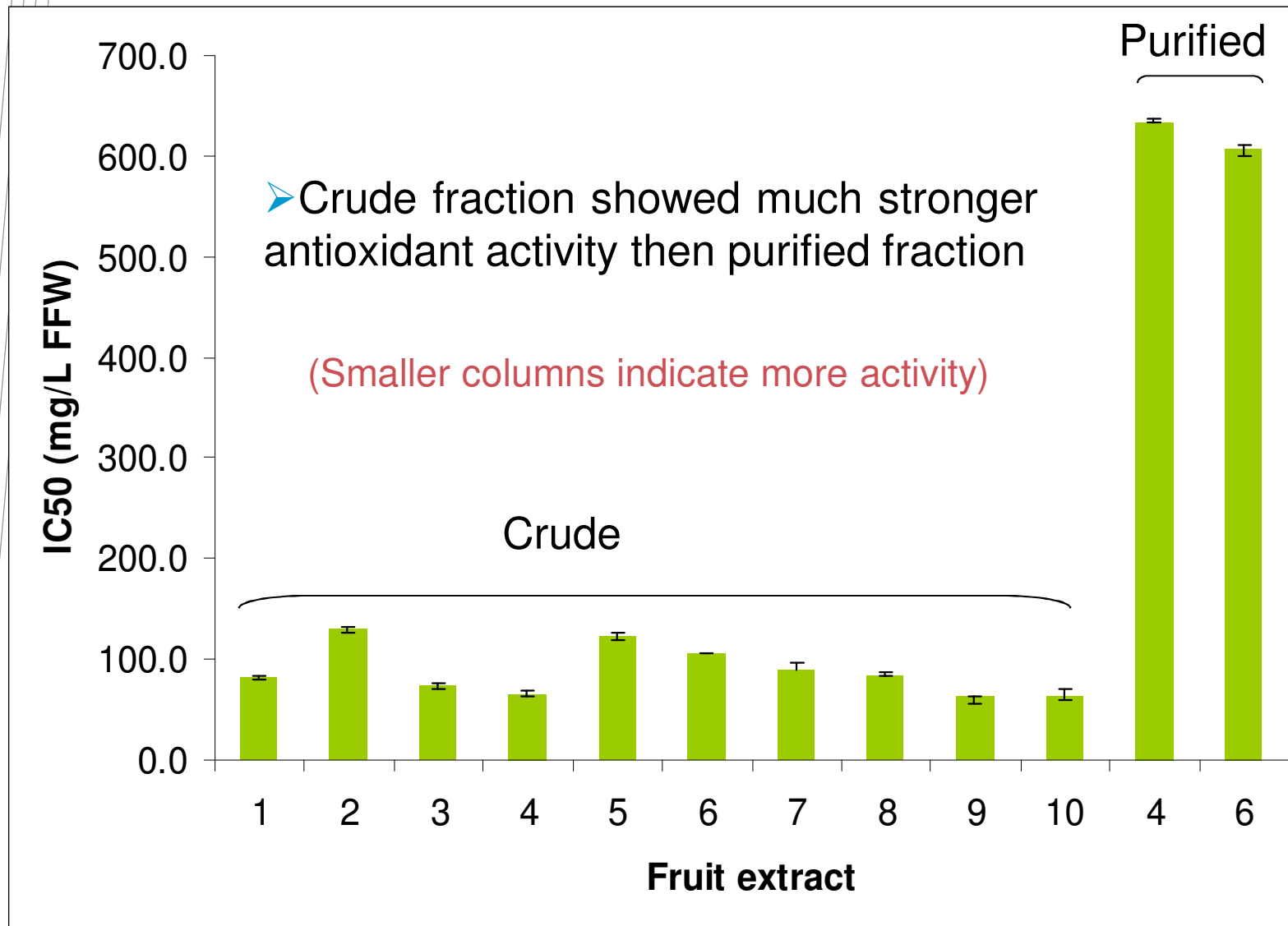


- Similar variation has been reported for Californian-grown fruit (Lu *et al.*, Journal of Nutritional Biochemistry, 16, 23-30, 2005).

Antioxidant activity of 'Hass' extracts

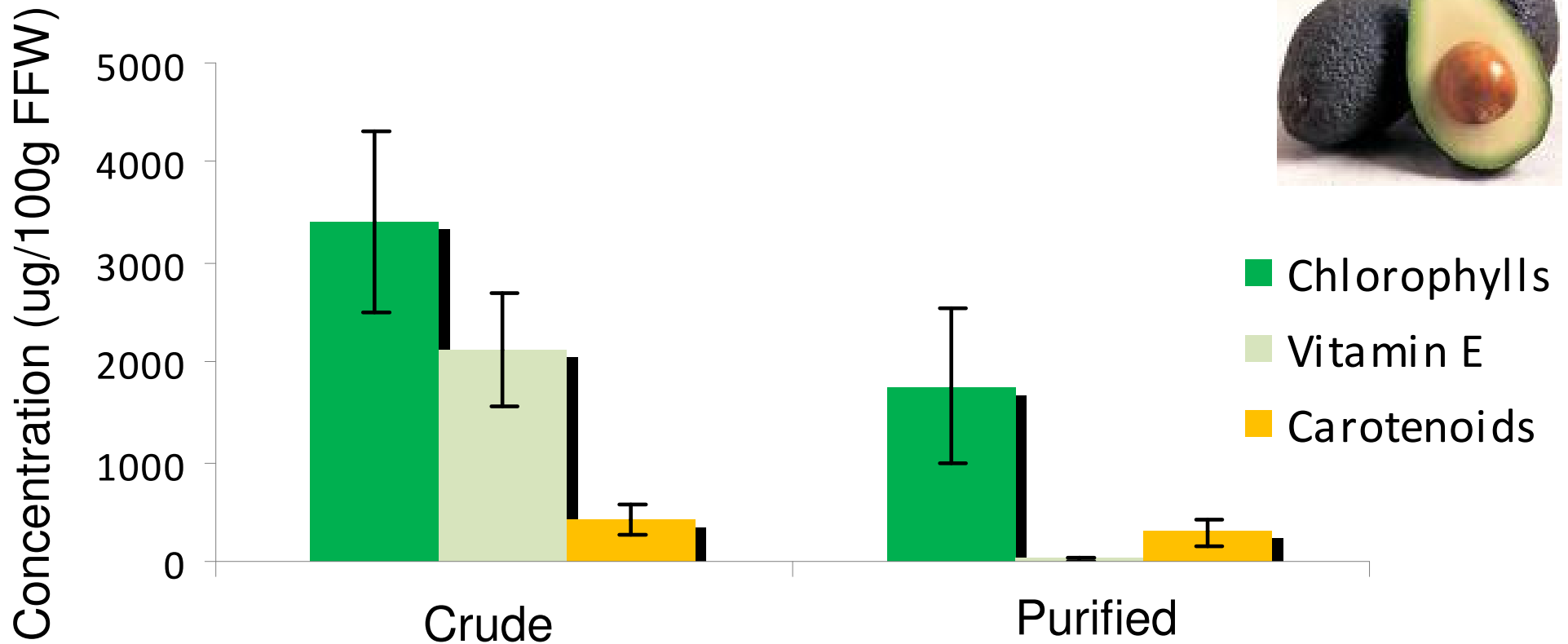
(antioxidants prevent and repair damage to our cells)

Antioxidant activity of 'Hass' extracts



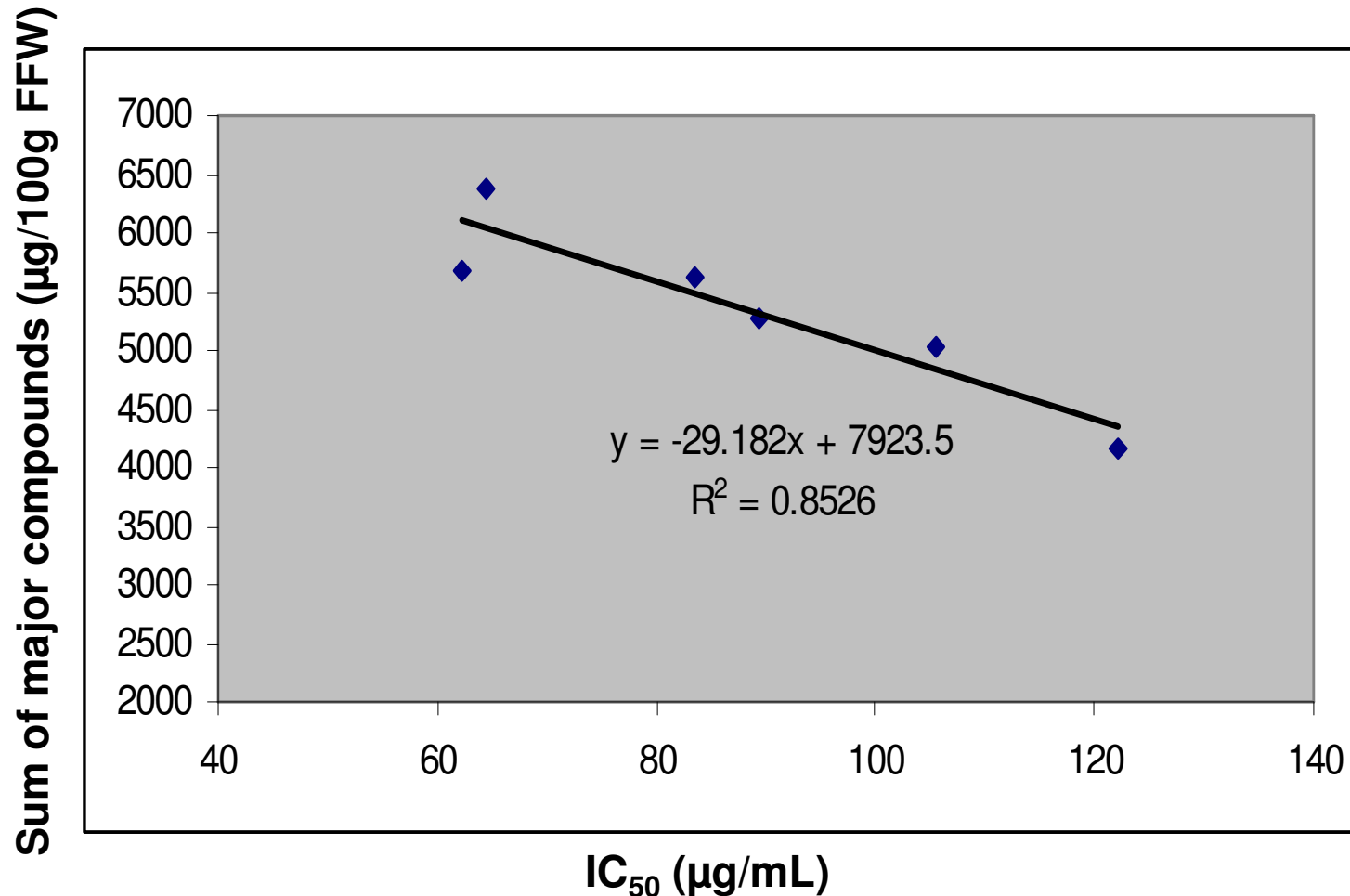
better

What has been identified in the two fractions?



- Purified fraction has less of these substances compared to the crude extract

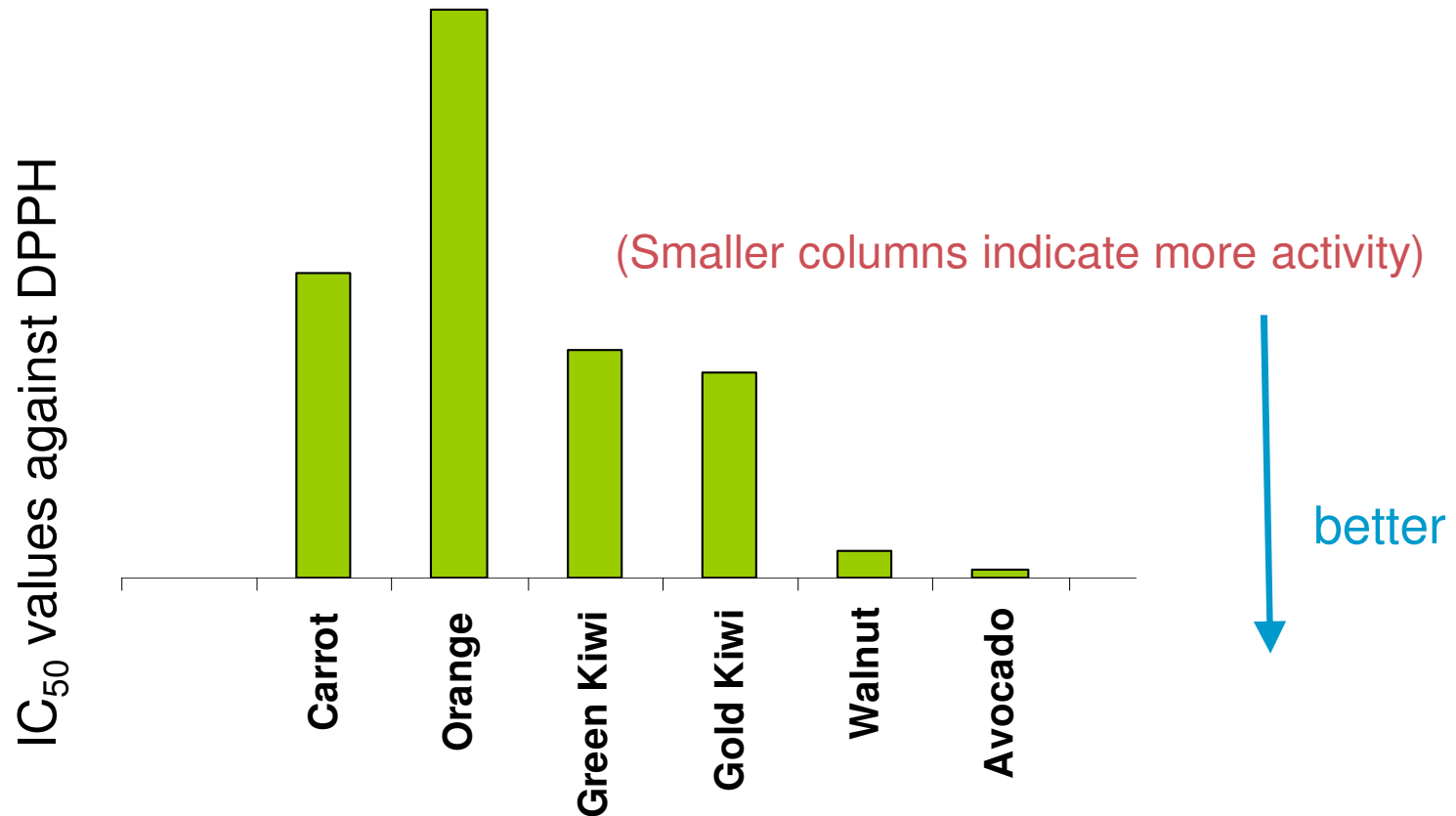
Antioxidant activity of 'Hass' extracts



- Vitamin E, chlorophylls and carotenoids are primarily responsible for the antioxidant activity of 'Hass' extracts

Lipid-soluble antioxidants from 'Hass': how do they compare?

- Lipid-soluble antioxidant fraction from 'Hass' very strong compared to similar fraction from other sources

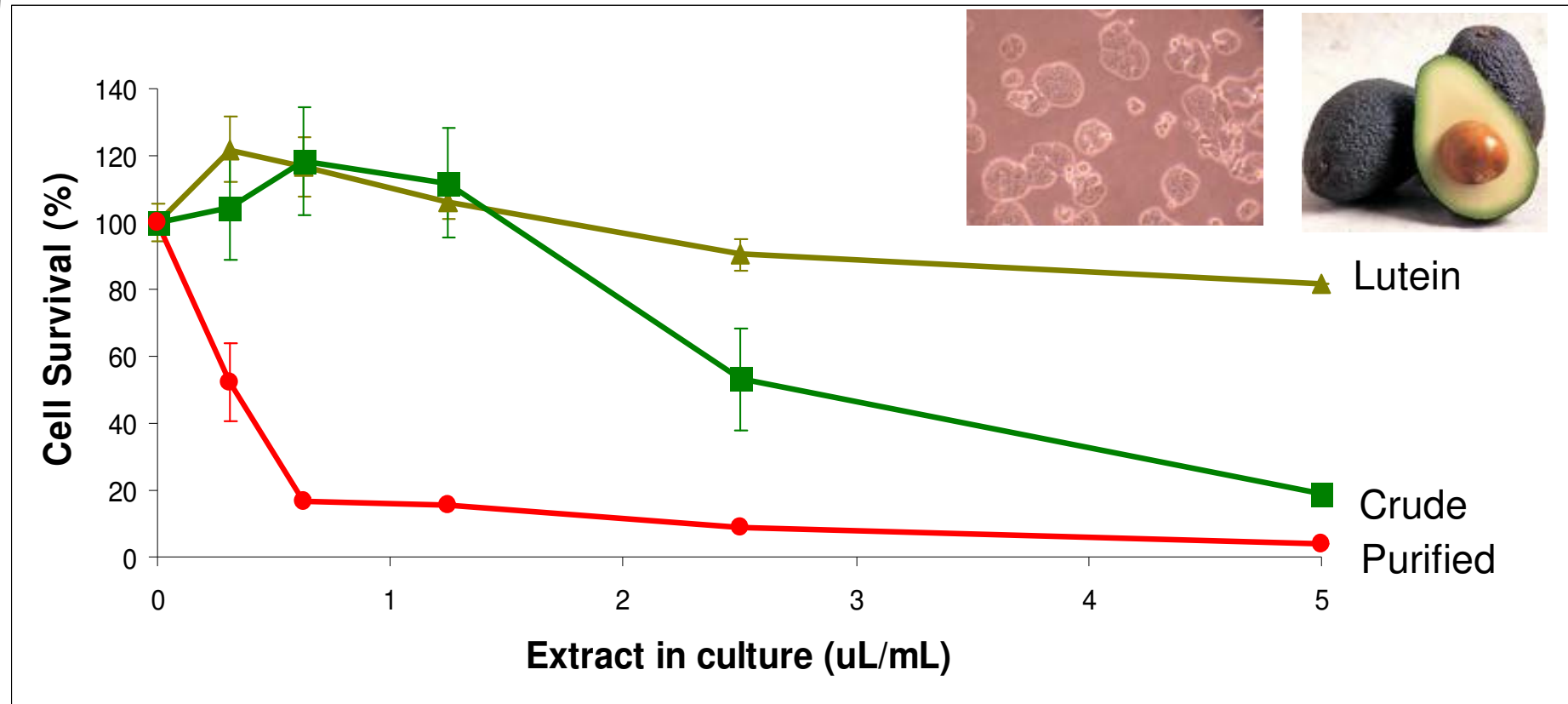


Please note that total activity= lipid-soluble + water soluble components

Antiproliferative activity of 'Hass' extracts

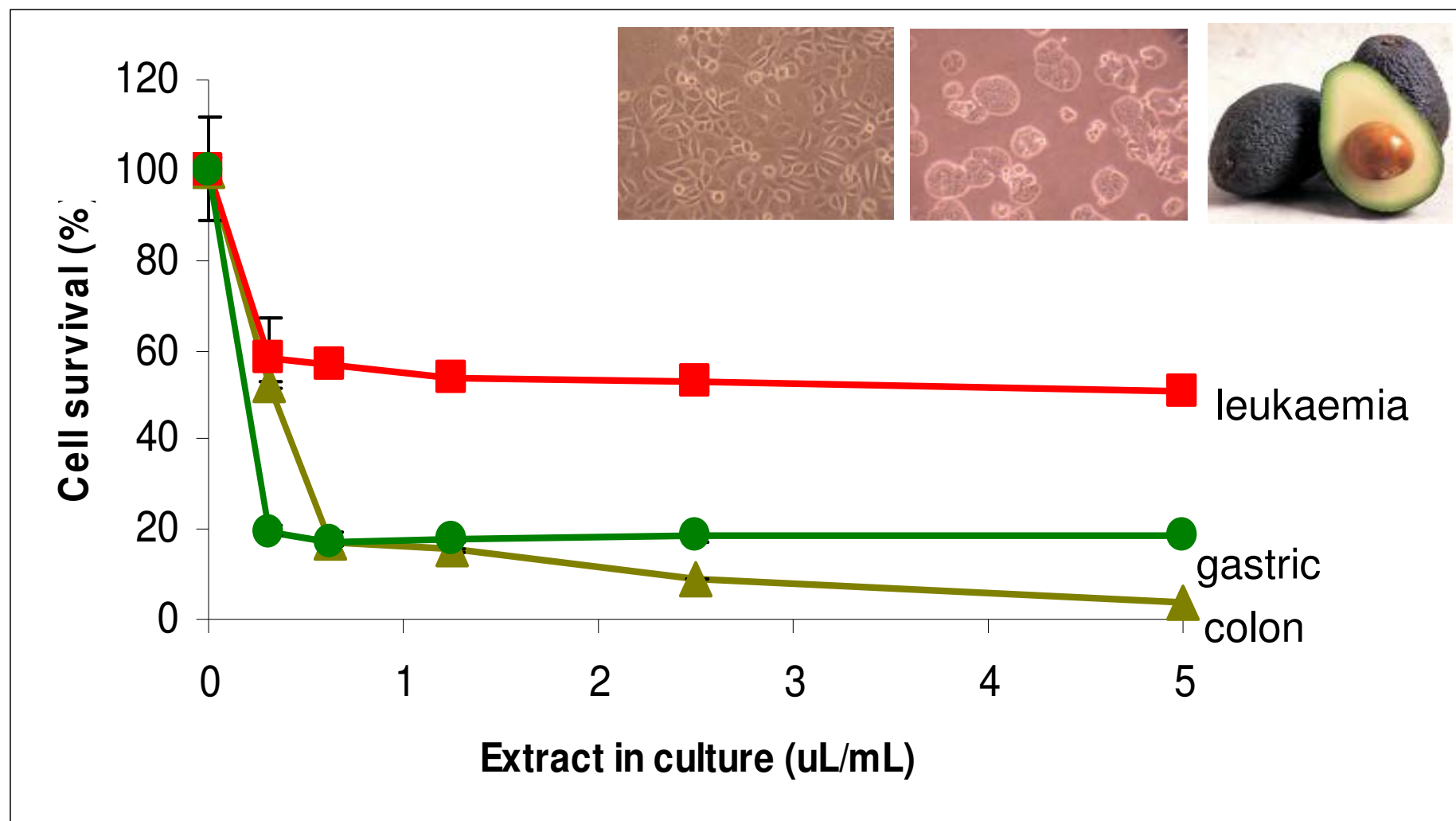
(inhibition of growth of cancer cells)

Colon cancer-cell survival when treated with 'Hass' extract in test-tube assays



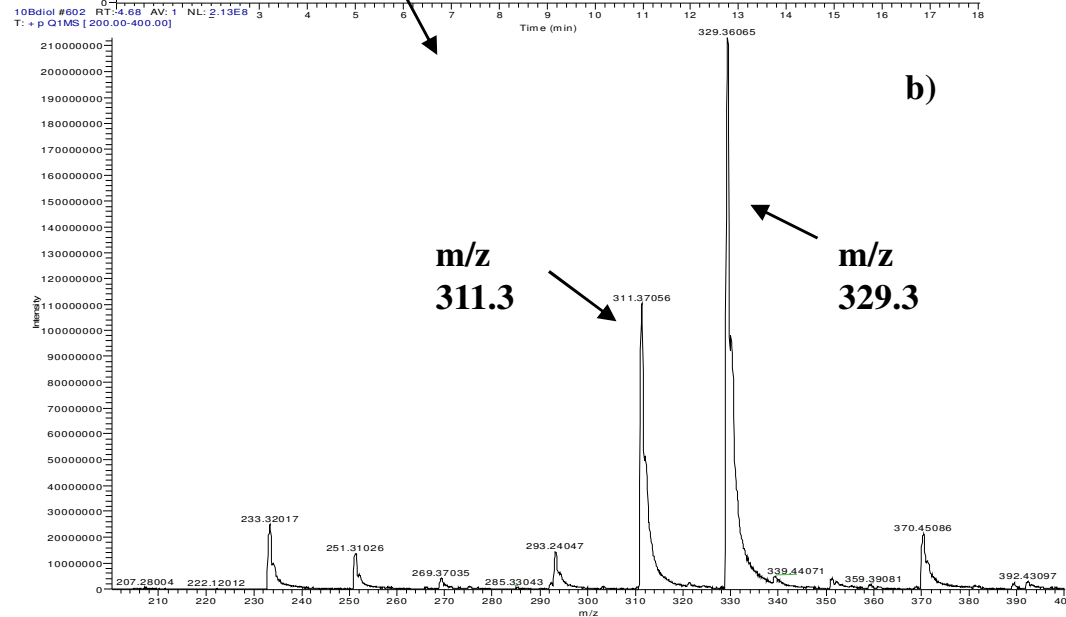
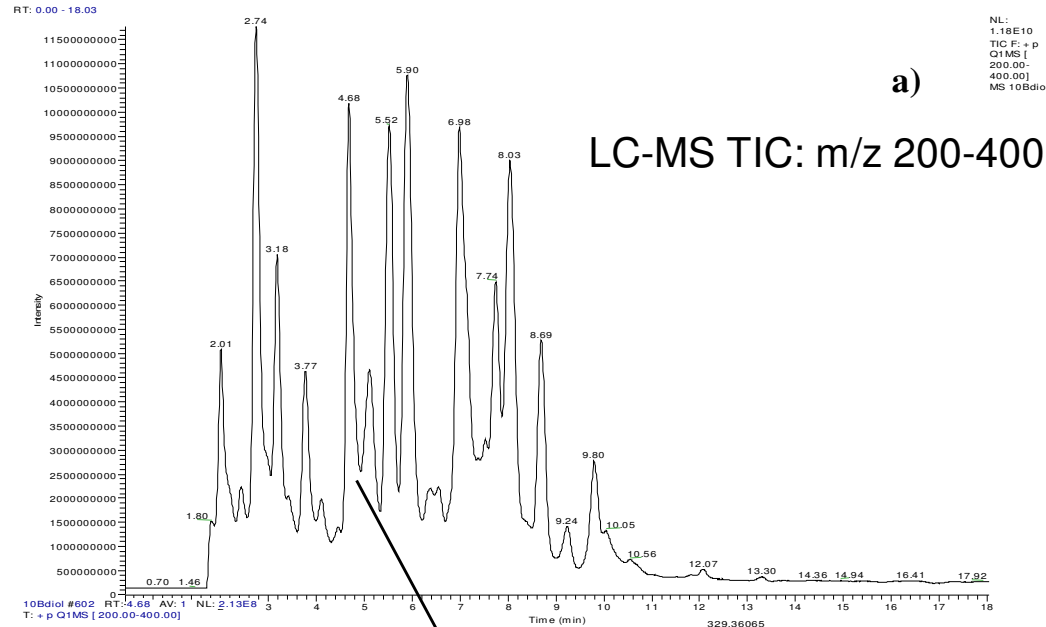
1 μL extract contained substances found in approx. 1.5 mg fruit FW. The concentration of lutein was 25 times higher than found in fruits.

Survival of various cancer-cells when treated with 'Hass' extract in test-tube assays



Assuming complete extraction, 1 μL extract contains phytochemicals found in approx. 1.5 mg fruit fresh weight

Several unreported as yet components?



➤ Persin and a few other fatty acid derivatives are known bioactives in avocados (e.g. work at the Garvan Institute)

➤ However, data indicates that the active fraction contains several additional unreported components

➤ Further work will hopefully reveal more about the active phytochemicals

Conclusions

- Lipid-soluble extracts from 'Hass' fruit were found, as expected, to be rich in Vitamin E, chlorophylls and carotenoids
- Extracts exhibited strong antioxidant and antiproliferative activity against various human cancer cells
- Different components were responsible for each activity:
 - Carotenoids, chlorophylls, vitamin E - **antioxidants**
 - Others (e.g. persin, unidentified) - **antiproliferative**

Significance of the work?

- This information can now be used to promote avocado consumption and educate consumers

(For example, retail surveys show that health-minded consumers are more likely to purchase avocados than other consumers)

(Hughes, D. Infocado Summit 2008)

Acknowledgements

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