International Year of the
POTATO

Quality and Nutritional Value

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Quality and Nutrition Challenges

Size and, shape
External blemishes
Internal defects
Cooking defects e.g. ACB
Storability
Processing quality
Flavour, texture
Nutritional profile, biofortification
Safety……





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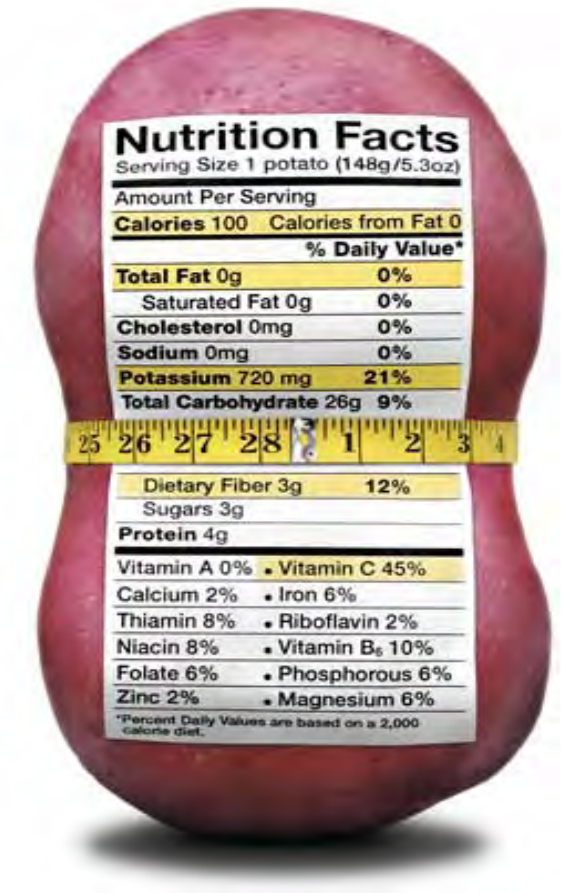
Nutritional Value



"White"Potato
140g

110 Calories
0 Fat

Nutrient	% RDA
Vitamin A	0
Vitamin C	45
Calcium	2
Iron	6
Thiamin	8
Riboflavin	2
Niacin	8
Pantothenate	10
Vitamin B6	10
Potassium	18
Phosphorus	6
Magnesium	6
Zinc	2
Copper	4

Per 100 g, after boiling in skin and peeling before consumption.
Source: United States Department of Agriculture, National Nutrient Database

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Potato: Nutritional Value

- The UN's Food and Agriculture Organisation is currently promoting the tuber as a more efficient food crop that can improve food security in developing countries.

- About 80 per cent of the potato crop can be used for human consumption, significantly more than for cereals like corn and wheat.

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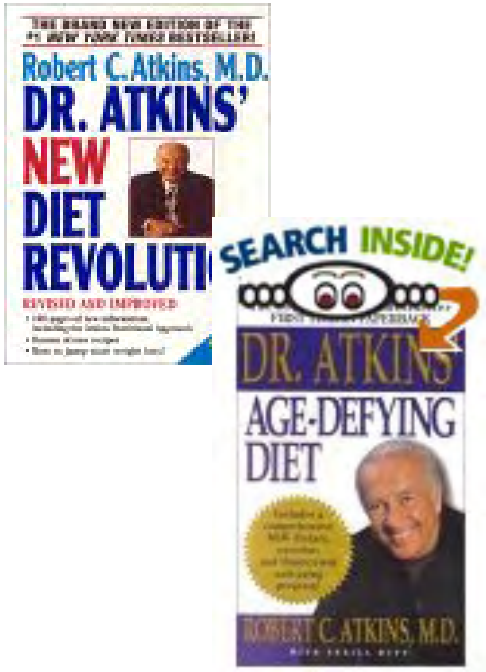
- **Improve utilisation of potato in processed products** →

Processed products & convenience foods with improved taste and texture. Exploit new cooking /processing technologies. Potato-based products with low Glycaemic index

- **To address consumer demands for healthy food** →

Tools to design better diets for individuals. Improved understanding of the role of compounds in potatoes in healthy diets

Glycaemic Index



Studies show that meat-heavy, high-protein eating patterns are, over the long run, linked to osteoporosis, heart disease, colon cancer, and renal disease, and pose particular dangers for people with diabetes.

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Genotype, Portion, Recipe

Most potatoes GI: 75 to 100

Nicola: GI of 58.

“Scientists make 'slimming' potato”

Vivaldi: 38% less carbohydrate
56% fewer calories
% Dry Matter 18.9%

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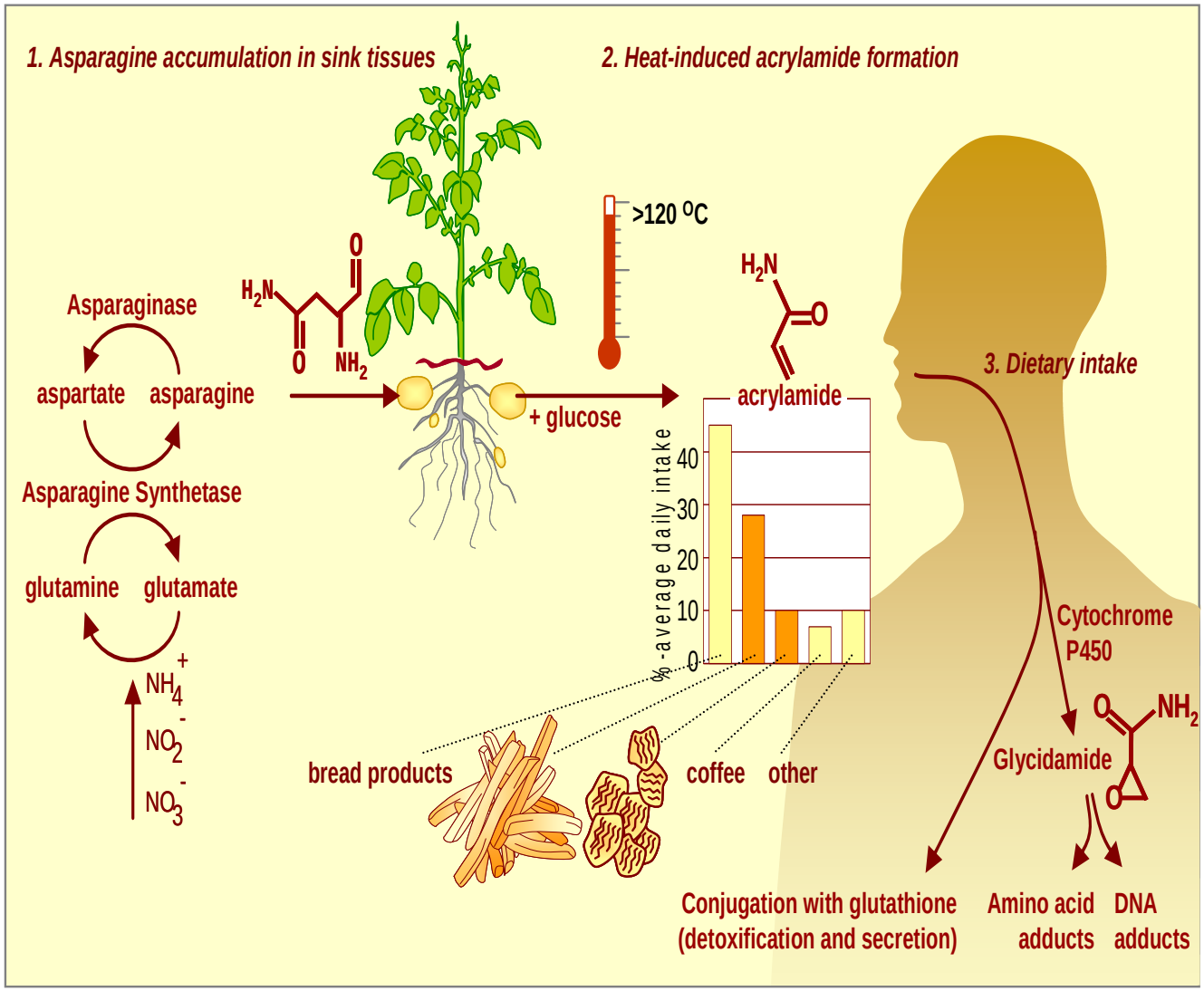
Acrylamide



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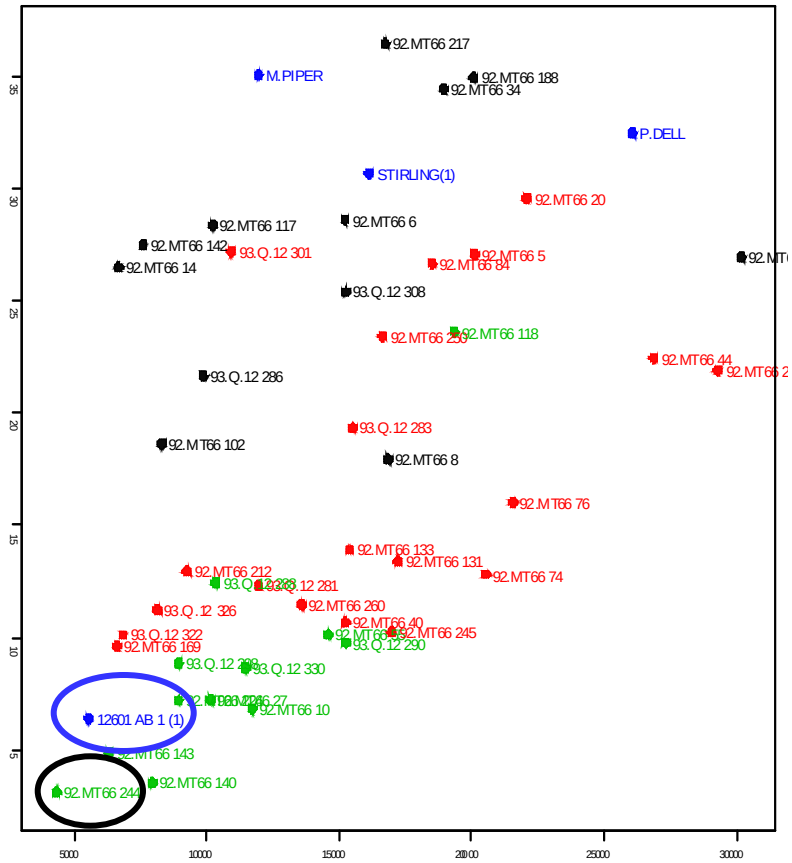
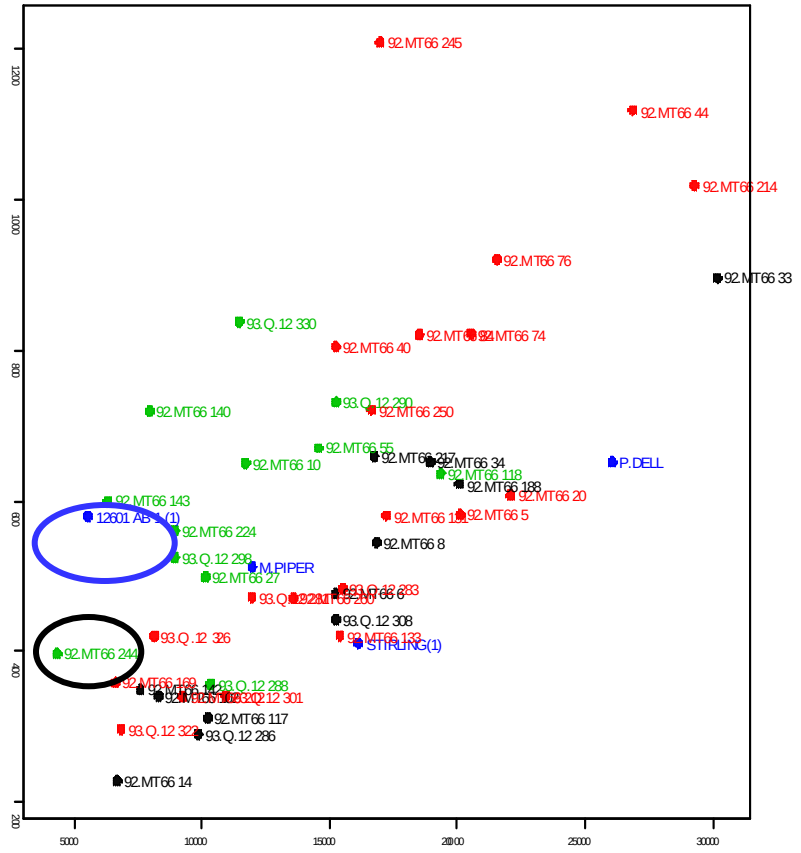
12601 AB1 X Stirling

- Pale fry colour
- Dark fry colour

glucose



asparagine



acrylamide

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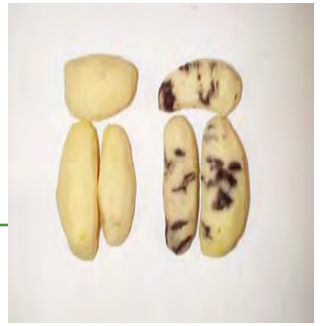
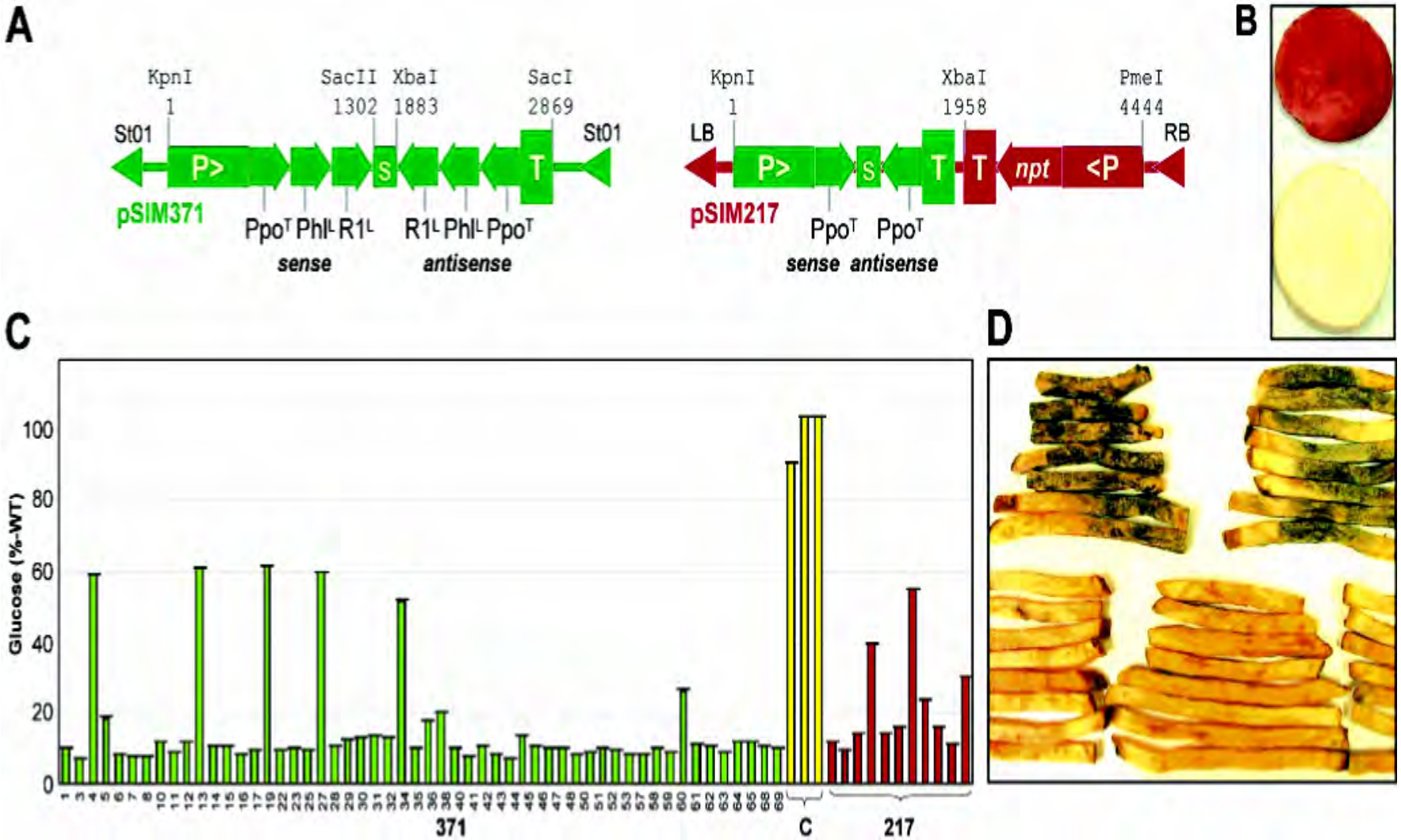
Cisgenics:
Low Acrylamide, Anti-bruise





Variation - Germplasm Collections

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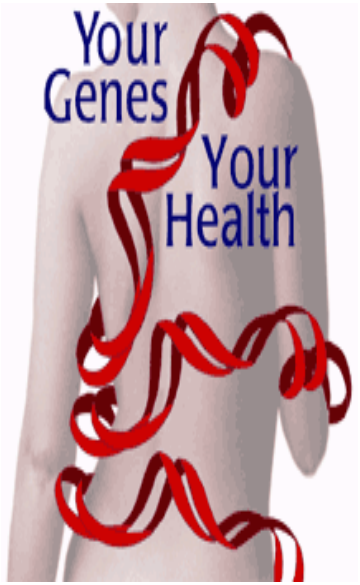
Nutritional Variation

Nutrient	Concentration Range (fold)
• Folate	3
• Phenolics	10
• Flavonoids	10
• Carotenoids	>100
• Anthocyanins	>100



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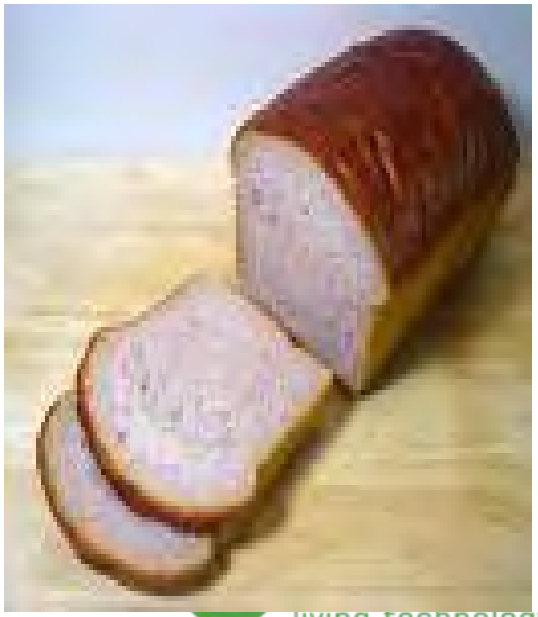
Heritage Potato



Potato Protein

FOOD

- Vegetable source
- No “e” number
- Powder and liquid forms
- Natural emulsifier
- Neutral taste
- Low salt
- Hypo allergen
- Satiety enhancing
- Balanced amino acids

PHARMA

Protease inhibitors

- Dermatitis
- Skin irritation
- Wound care

Drivers of Variation

Technology Toolkits, Genes Discovery and Process Control

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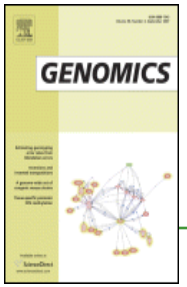
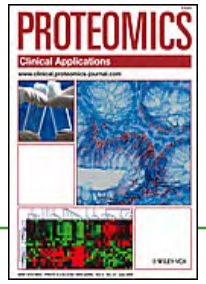
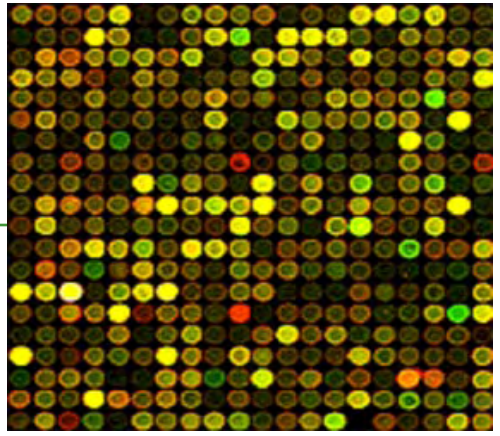
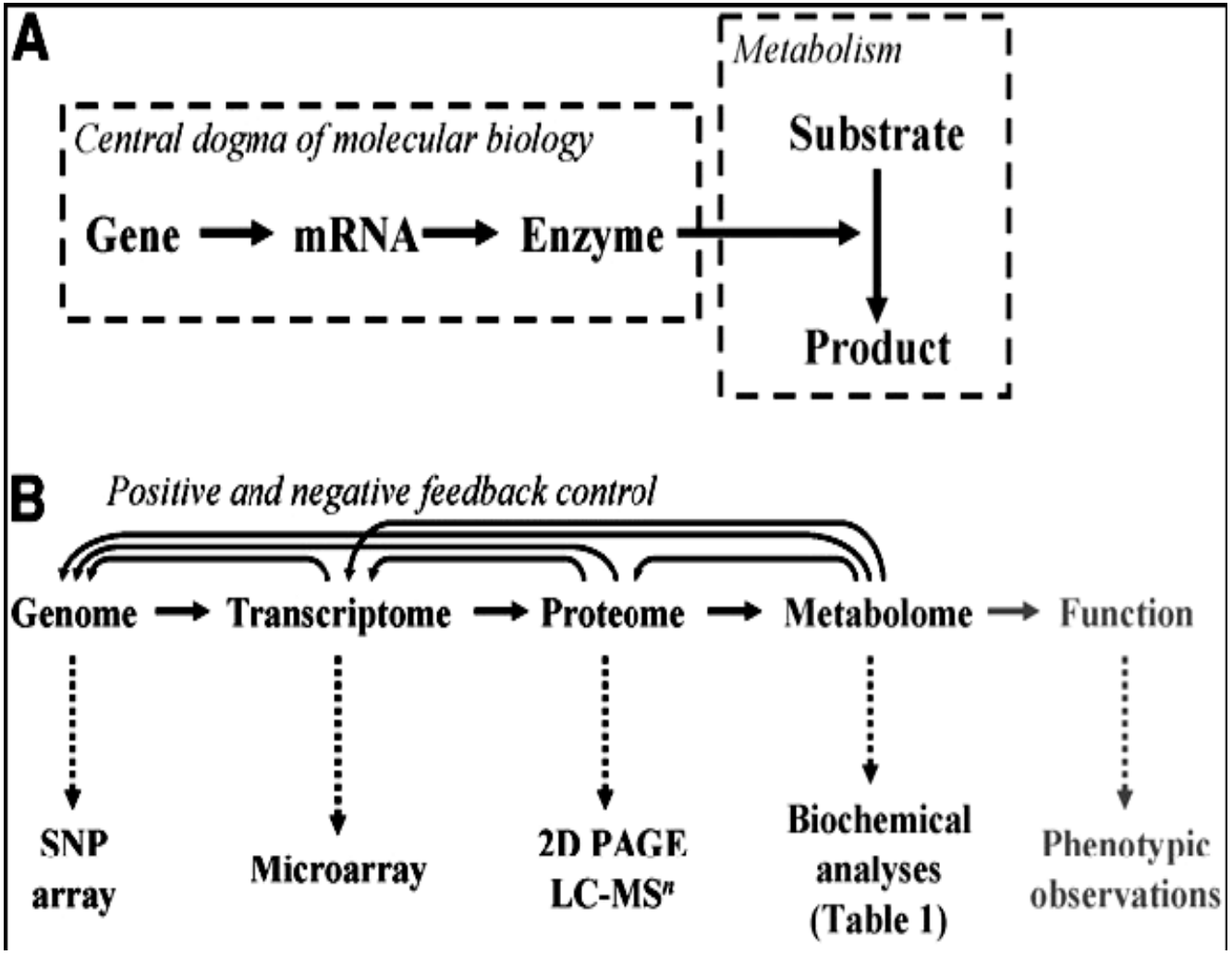

GENOMICS

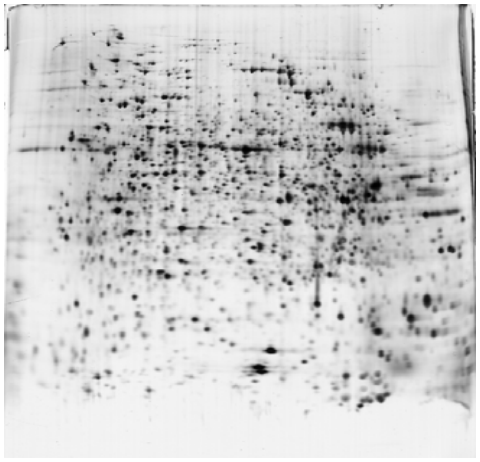

PROTEOMICS
Clinical Applications

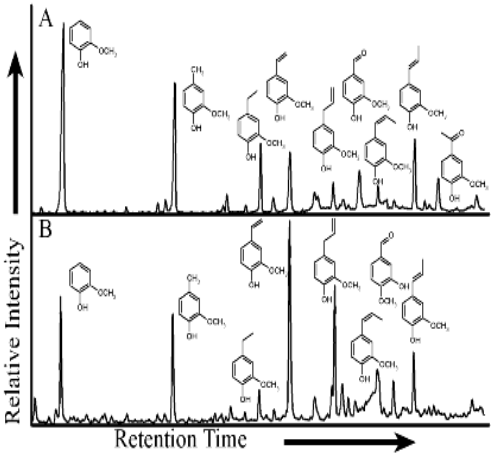

OMICS
A Journal of Integrative Biology


Metabolomics




A
Metabolism
Central dogma of molecular biology
Substrate
Gene
mRNA
Enzyme
Product
B
Positive and negative feedback control
Genome
Transcriptome
Proteome
Metabolome
Function
SNP array
Microarray
2D PAGE LC-MSⁿ
Biochemical analyses (Table 1)
Phenotypic observations



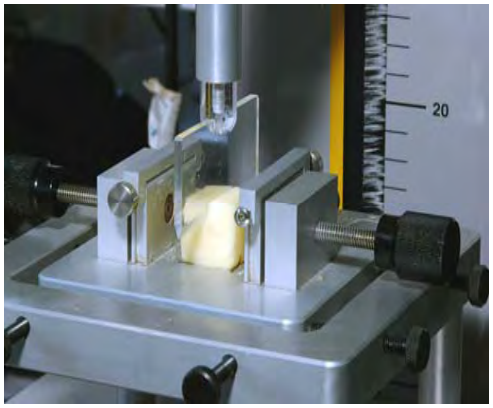

A
B
Relative Intensity
Retention Time

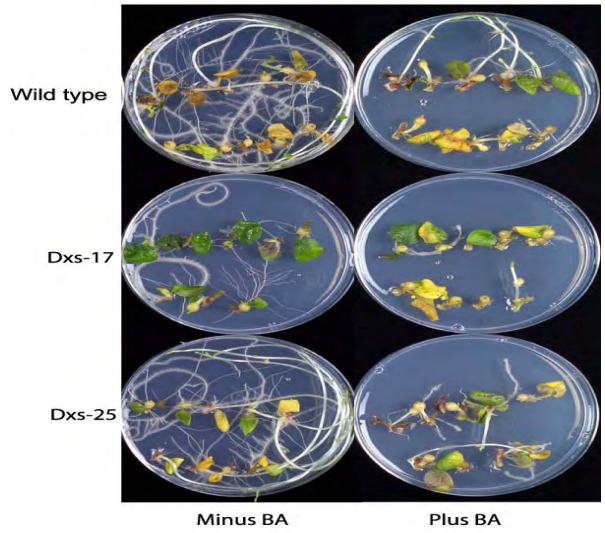
Examples of Genes Discovered

StTLRP gene

- Makes extra cellular protein-cell wall cross linking. Correlation between expression levels and firmness.

- Genotypes with specific allele have much higher expression (ca 60-fold) and firmer texture post-cooking.





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Phenotypic and Genotypic Variation

Solanum phurjea

- Resistance to *Erwinia,* powdery scab, virus
- Novel flavour
- Novel texture
- High carotenoids
- Short dormancy

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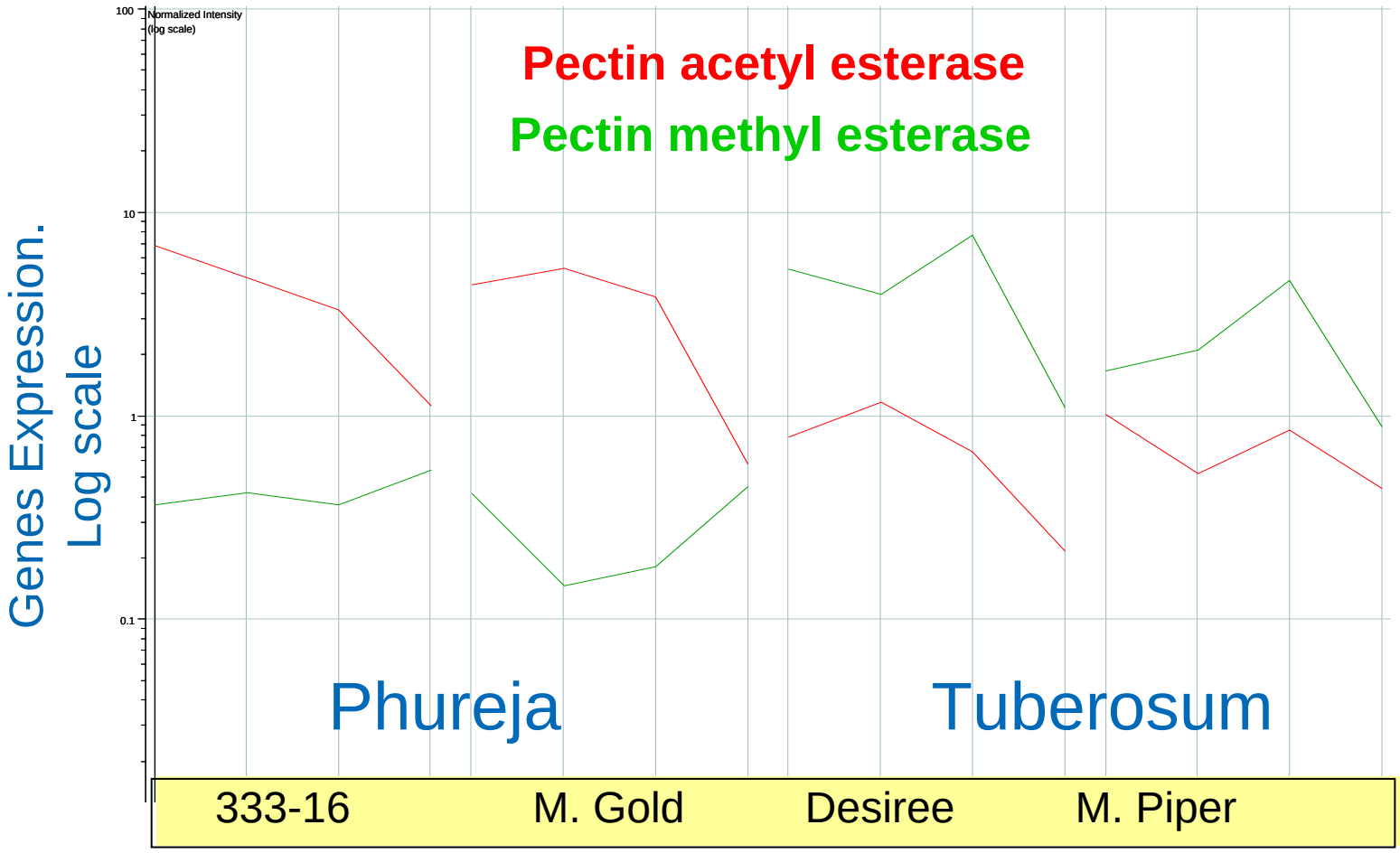
TEXTURE- Genes and Cell Walls



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FLAVOUR Volatiles: Phureja vs Tuberosum

	Volatile Compound	Mean	
		Phureja	Tuberosum
1	2-Methylpropanoic acid methyl ester	00.387	00.078
2	2-Ethylfuran	00.301	00.893
3	Pentanal	04.600	08.080
4	2,3-Pentanedione	00.255	00.599
5	2,3 Methylbutanoic acid methyl ester	00.640	00.000
6	Hexanal	33.400	73.100
7	Ethyl benzene	01.020	00.250
8	Dimethyl benzene	01.180	00.240
9	α pinene	00.840	00.170
10	Heptanal	00.481	00.206
11	2,4-Octadienal	00.031	00.098
12	2-pentylfuran	01.620	03.170
13	δ 3-carene	00.529	00.140
14	Limonene	01.970	00.350
15	Decanal	05.850	01.360
16	α copaene	09.200	00.100

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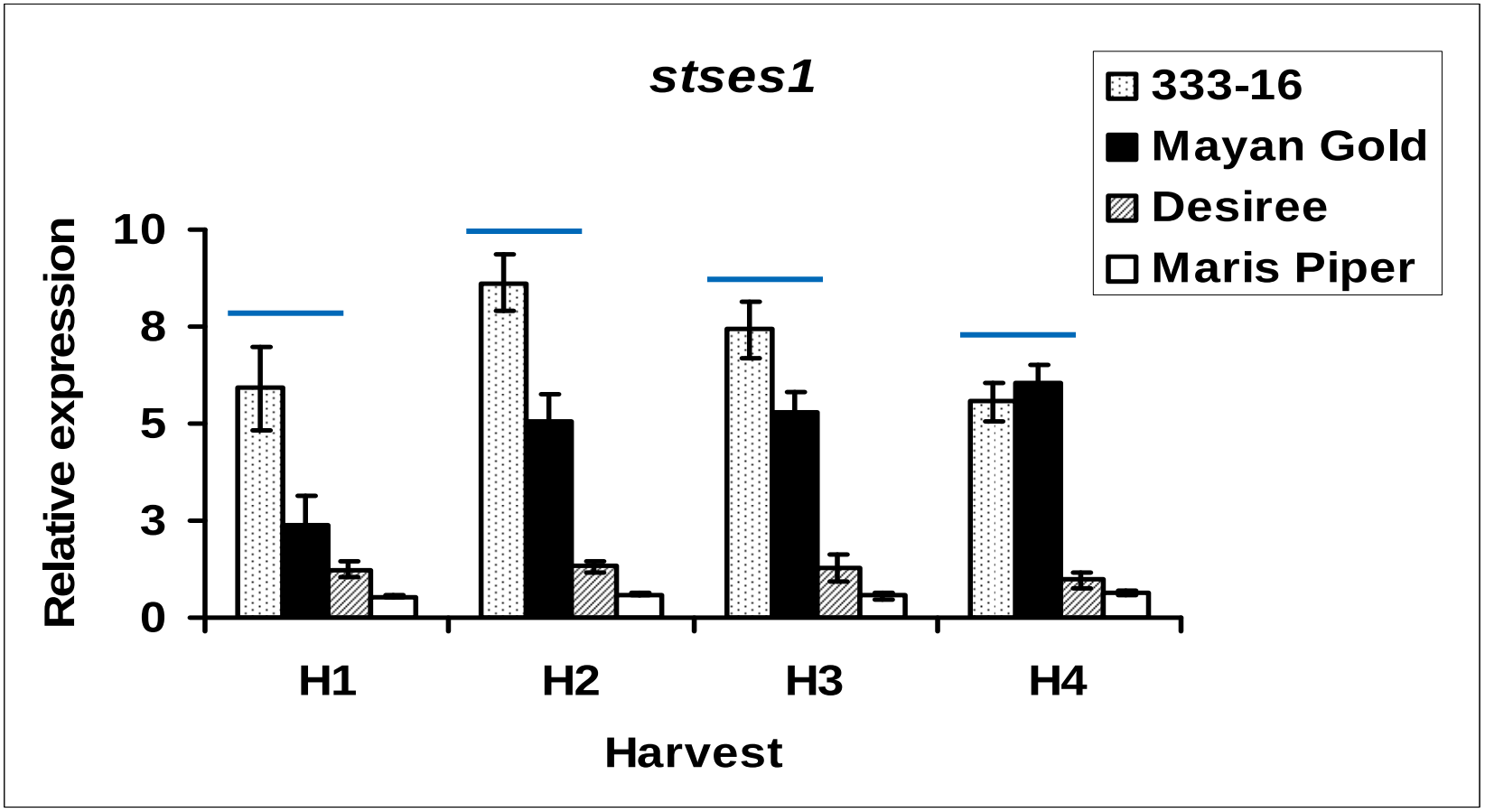
Expression of α-copaene synthase: tubers



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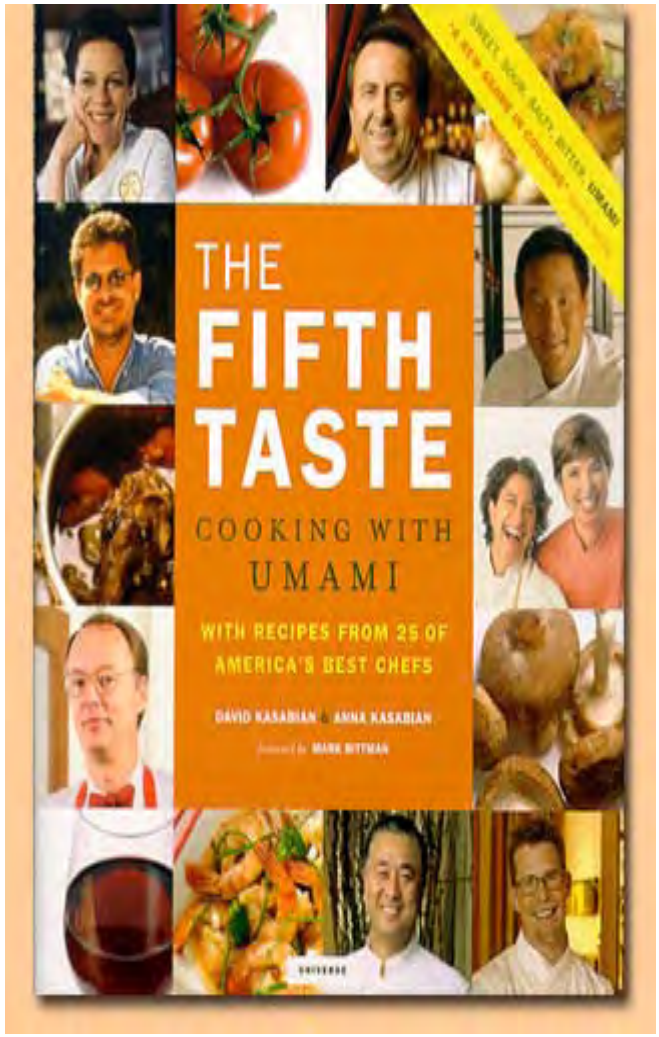
UMAMI: the 5th Taste



"…an inexplicable, delicious taste sensation that differs from sweet, sour, salty and bitter tastes by providing a meaty, savory sensation."

- **Amino acids** – Glutamate, Aspartate
- **Major nucleotides** - 5'-AMP, 5'-GMP

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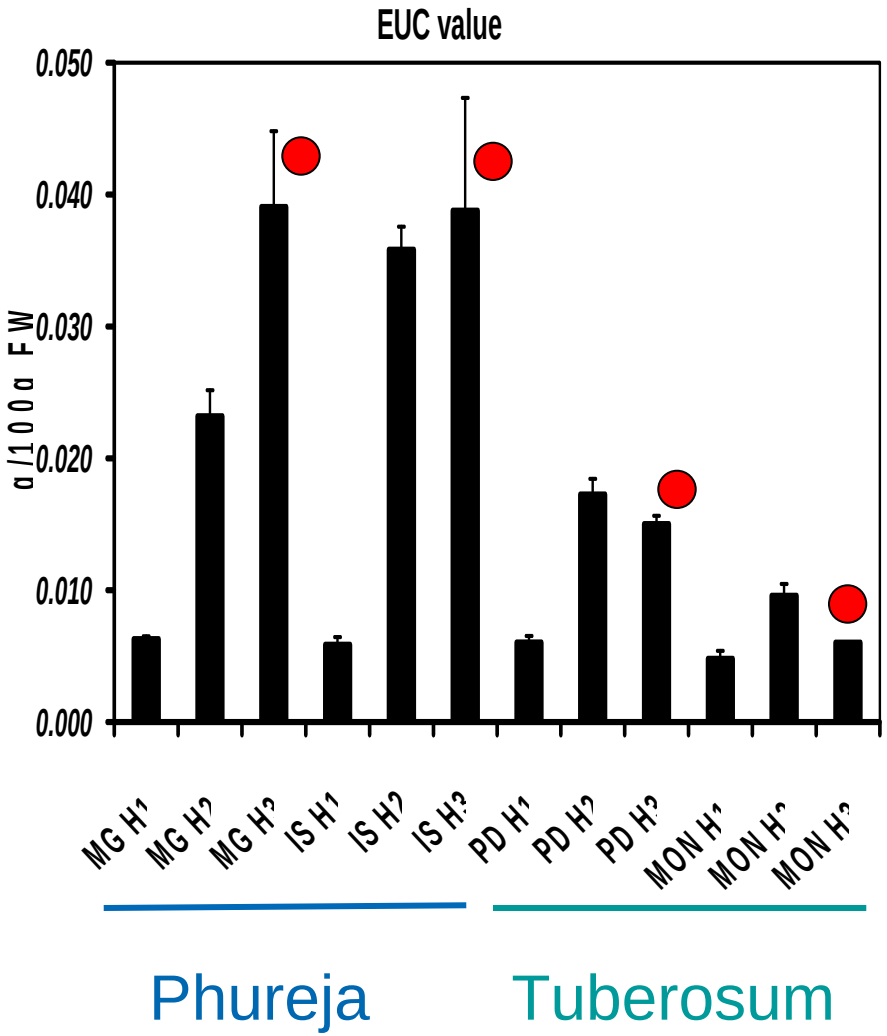
Phureja: Higher Equivalent Umami Concentration



$$Y = \sum a_i b_i + 1218(\sum a_i b_i)(\sum a_j b_j)$$

- mature tubers

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BBC NEWS

Wednesday, 29 June, 2005

Kukoamines

Only previously been found in an exotic plant (*Lycium chinense "Gou Qi Zi"*) whose bark is used to make an infusion in Chinese herbal medicine).

"Potatoes may be healthier to eat than previously thought, after scientists found them to contain chemicals which lower blood pressure"

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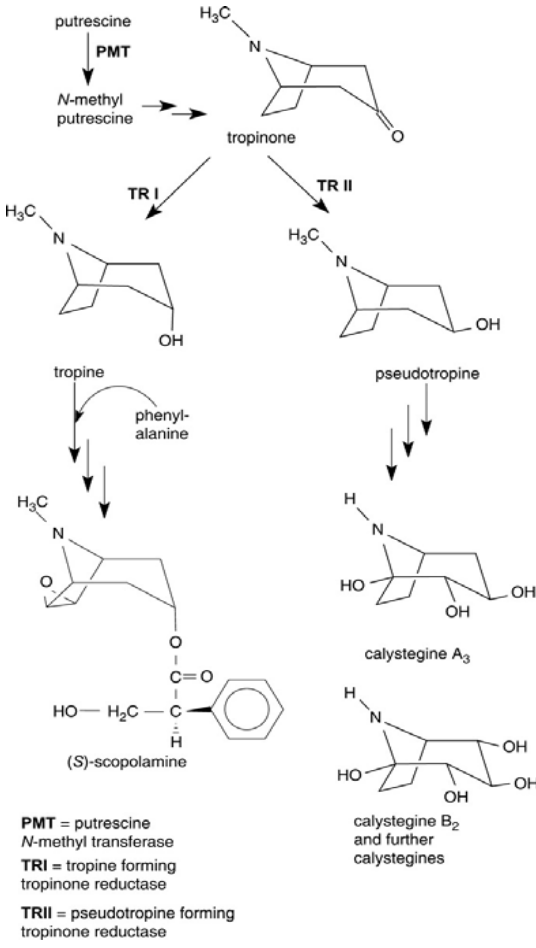
Calystegines

Nortropane alkaloids

- A3, Bl, B2, and Cl detected in wide range of crops Including potatoes, eggplants, tomatoes
- Class of alkaloid includes important medicinal alkaloids: cocaine, scopolamine atropine
- Anticholinergic, antiemetic, parasympatholytic, anesthetic, and many other actions.
- Inhibitors of mammalian β-glucosidase and α-galactosidase activities *in vitro.*



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Mark Taylor, Glenn Bryan, Louise Shepherd, Heather Ross, Wayne Morris, Laurence Ducreux, Derek Stewart, John Bradshaw, Findlay Dale, Gavin Ramsay, Gaynor McKenzie, Pete Hedley, Jim McNicol and many others…….

Scottish Government
Potato Council Ltd
Greenvale

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