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# Taking Functional Foods to Market

Food Futures Flagship

**Bruce Lee**

**Director, Food Futures Flagship**

**October 30<sup>th</sup>, 2009**

National Research  
**FLAGSHIPS**



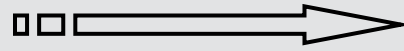
# Vision

- **Paradigm Shift** technologies - deliver step change
- Existing industry
- Create, or assist in creating new industries



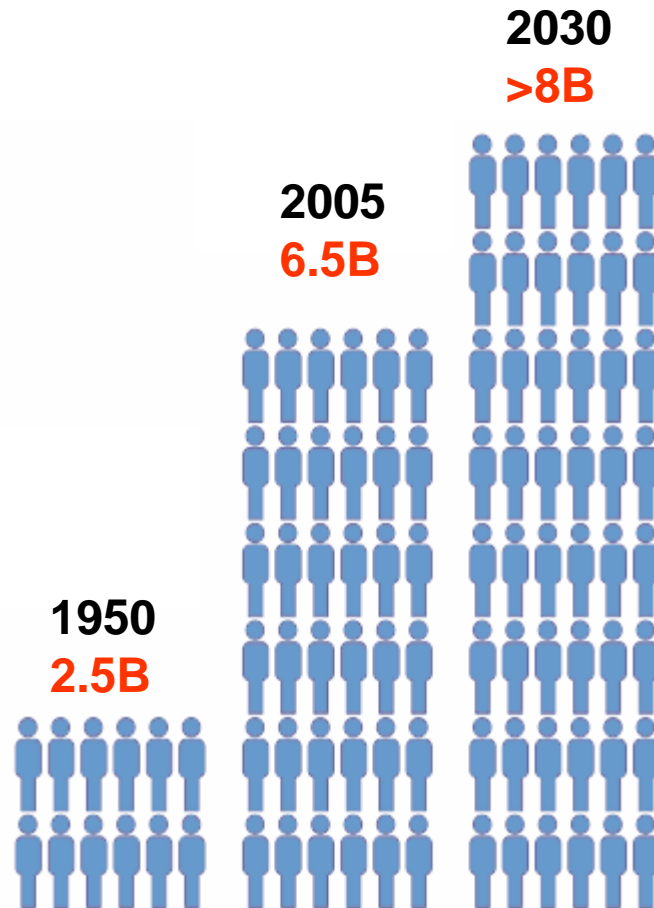
# Population and Land

# Scarcity

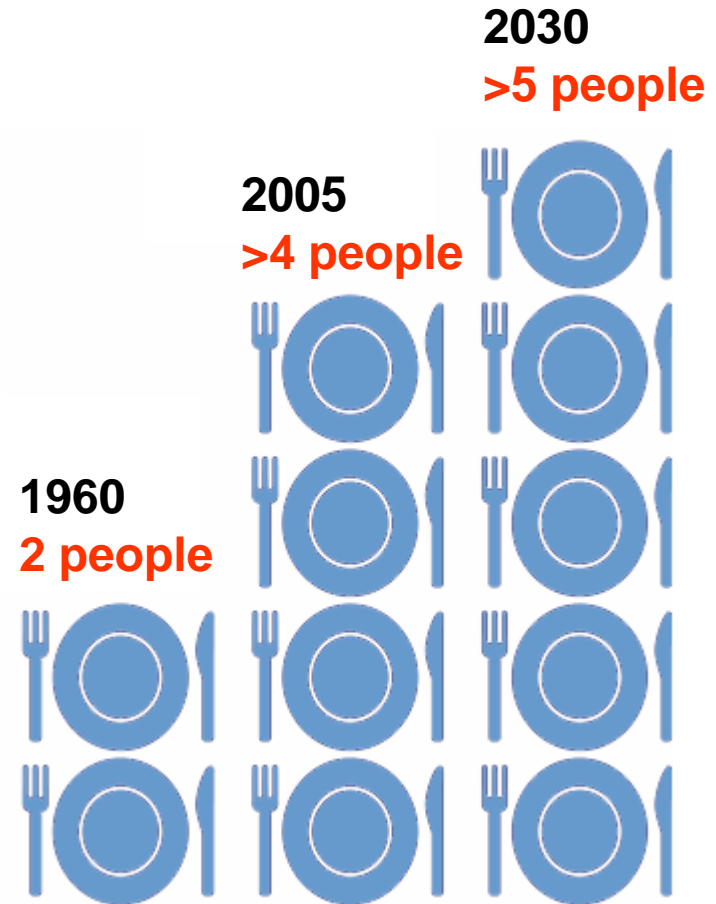


# Nutrition

## World population



## People fed per hectare



Source: FAO, World Bank statistics, Syngenta

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# The Future

- **Differentiate grains through quality attributes**
  - Reduce health care costs by increasing healthy grains consumption
- **Lowering input costs**
- **Increasing productivity**



# Research to Impact

## Opportunity

- New healthy grains into the Australian and NZ diets
  - BARLEYmax<sup>®</sup> - Wholegrain with high fibre plus resistant starch
  - High Amylose Wheat – Convenient and well accepted source of resistant starch



# Research to Impact

## Challenge

- Farm
- Food Manufacturer
- Consumer

## Food Regulations – Communication Tool & Limitation

- Communication of benefits is driver for uptake
  - Health Claims
  - Labelling requirements (Nutrition content claims, General health claims)
  - Eg. “High fibre” claim important marketing asset for these products

# Redesigning Starches - Resistant Starch

- Modern starchy processed foods digested quickly in the small intestine. Foods are low in RS and high glycaemic index “GI”
- Small intestine flooded with glucose while the colon is starved (leading to dysfunction and risk of chronic disease)
- Low digestibility grains containing RS are good for health, low GI and bowel function
- High amylose starches are effective ingredients to increase RS



# BARLEYmax™ DNA change is known

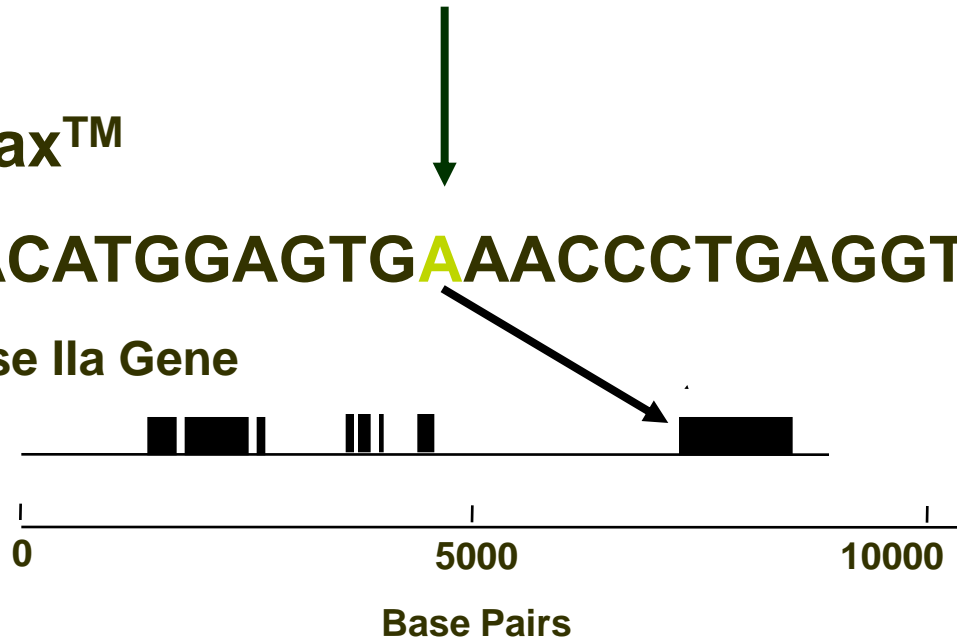
Standard barley

.....GACAACATGGAGTGAACCCTGAGGTGG.....

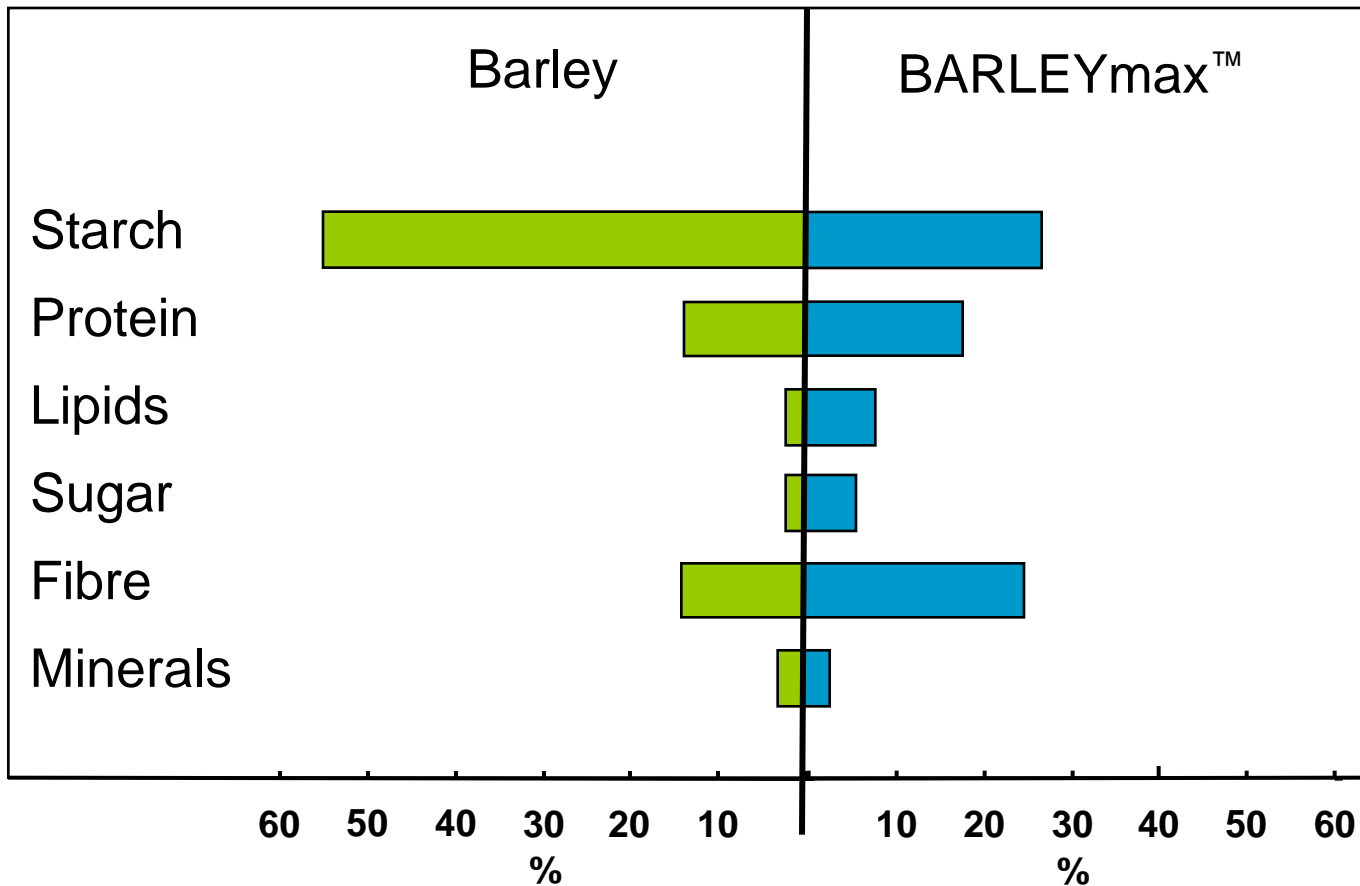
BARLEYmax™

.....GACAACATGGAGTGAACCCTGAGGTGG.....

Starch Synthase IIa Gene  
Suppressed

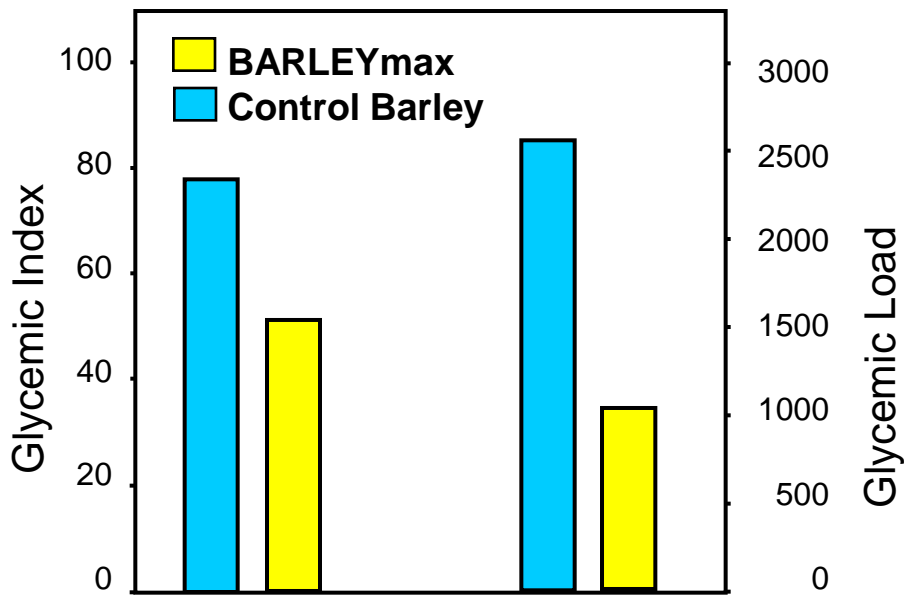


# BARLEYmax™ composition



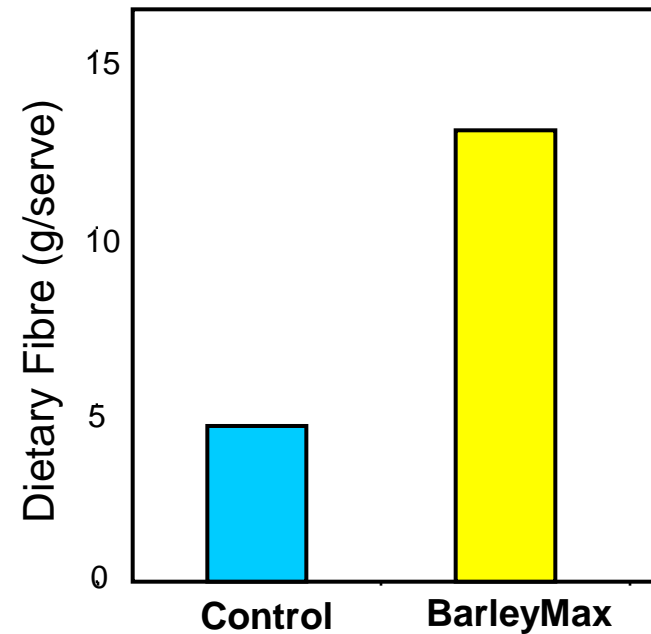
# Delivery Now – BARLEYmax™

## BARLEYmax Breakfast Cereals – on Supermarket Shelves



Reduced  
Glycemic Index

Less Than Half The  
Glycemic Load



More Than Twice  
The Fibre

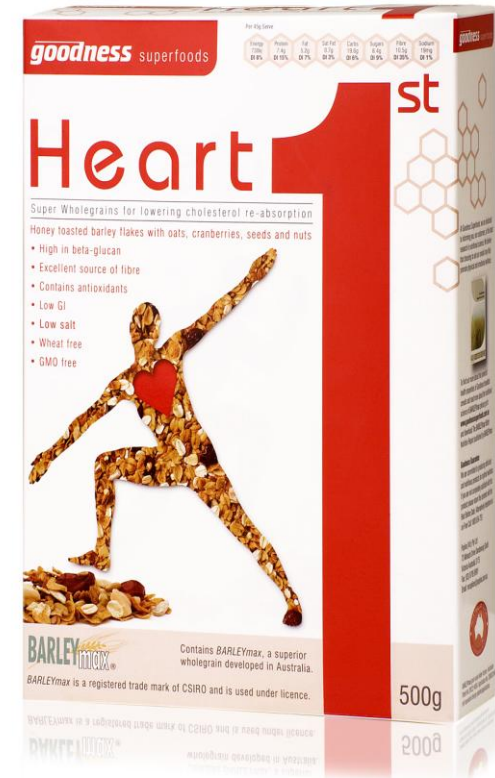
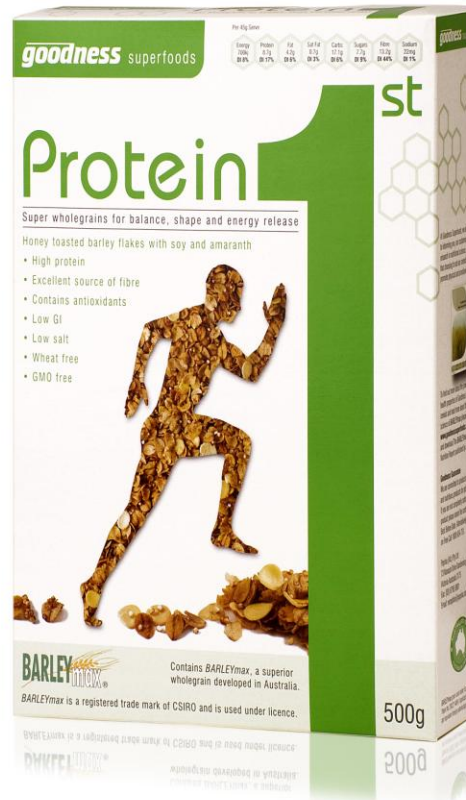
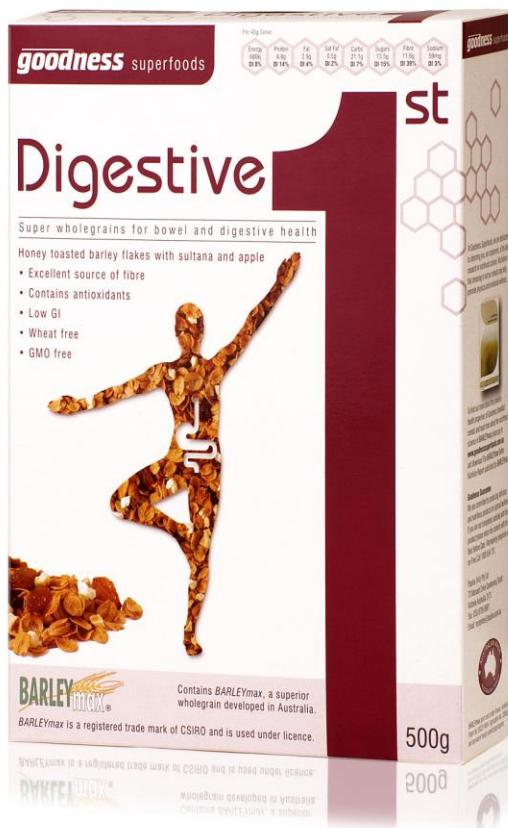
# BARLEYMax™ in Foods



"I am 44 years old and have HATED cereals my whole life. I have tried to eat them but they make me feel sick. I am struggling with several health issues, chronic pain condition, overweight and chronic constipation. Within a week I had moved my bowels without pain. I have worried about bowel cancer with the constipation. I cannot thank you enough. I am also finding I am losing weight because I am not snacking because I am not hungry!"

**Kathleen W. Queensland**

# BARLEYmax™ Current Product Range



# Australian & NZ - Definition Dietary Fibre

**Dietary fibre** fraction of the edible part of plants or their extracts, or synthetic analogues that –

(a) are resistant to the digestion and absorption in the small intestine, usually with complete or partial fermentation in the large intestine; and

(b) promote one or more of the following beneficial physiological effects –

**(i) laxation**

**(ii) reduction in blood cholesterol**

**(iii) modulation of blood glucose**

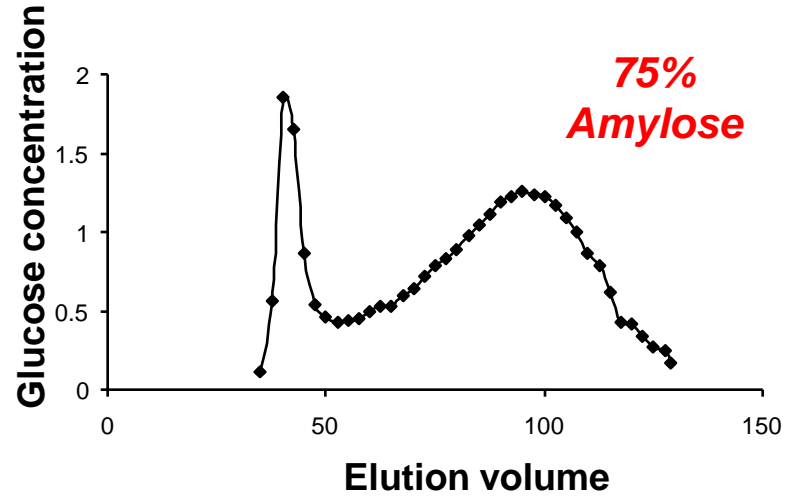
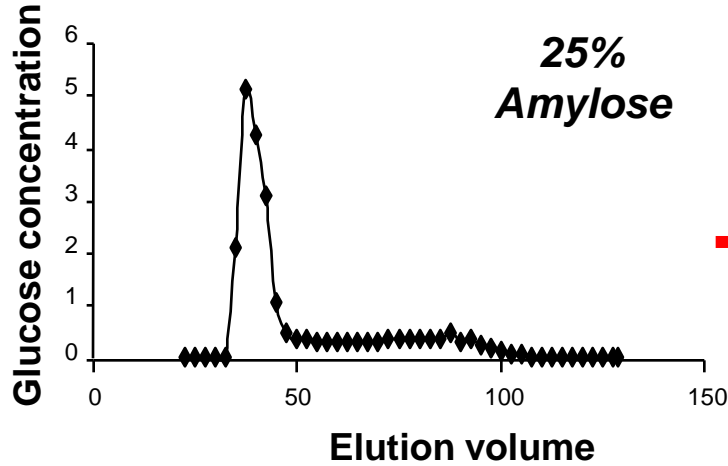
and includes polysaccharides, oligosaccharides (degree of polymerisation > 2) and lignins.

- Daily intake reference value for Dietary Fibre is 30 grams

# Australia and NZ – Current situation

- **At present, nutrient content claims are allowed (e.g. ‘this food is high in fibre’), as are some health maintenance claims. However, there is a prohibition on other types of health claims, with the exception of claims about the benefit of maternal consumption of folate, to reduce the risk of fetal neural tube defects.**

# Resistant Starch Wheat High Amylose Grain



Normal wheat flour  
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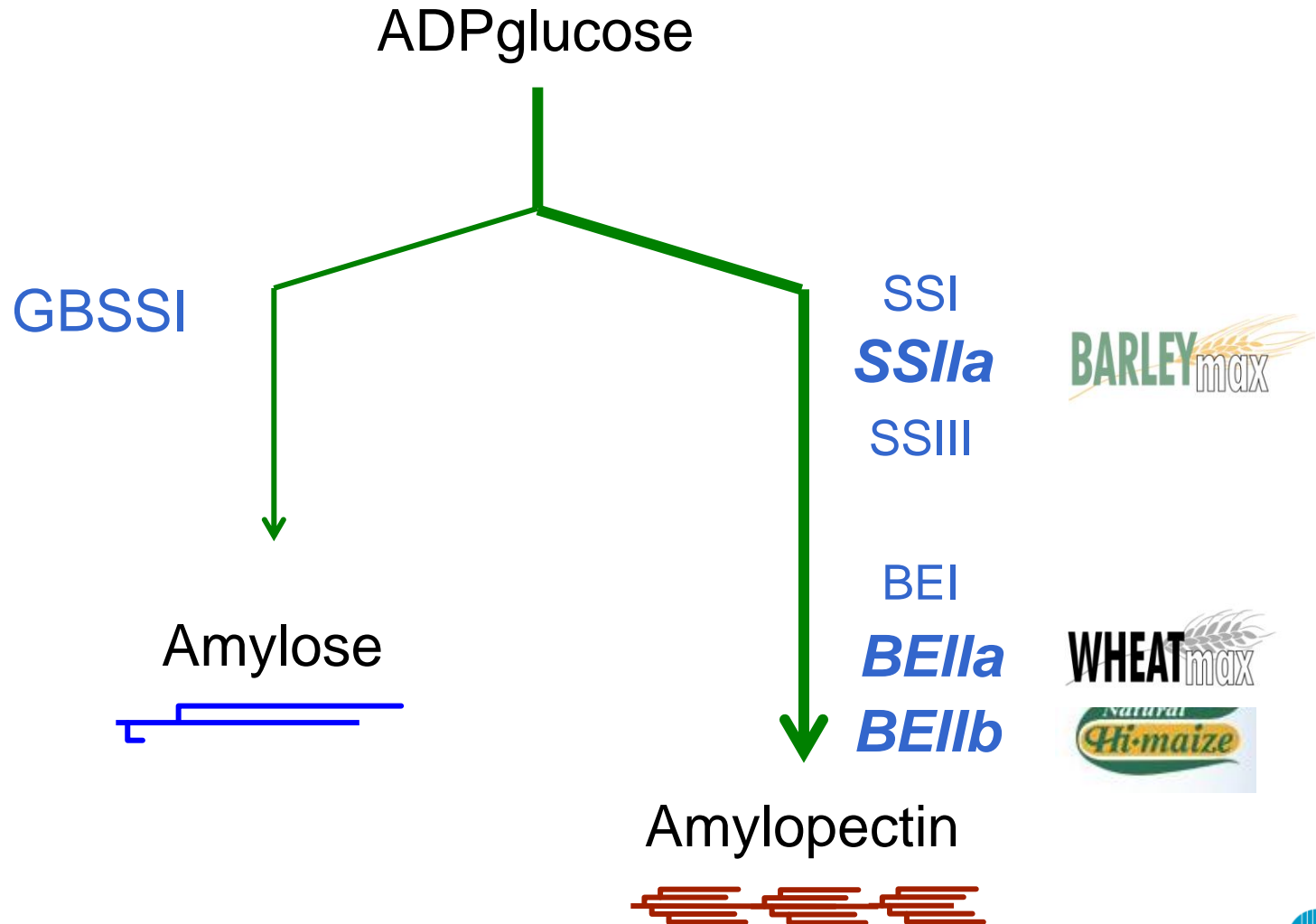


High Amylose flour

Positive changes in  
health biomarkers  
separated  
No adverse effects observed

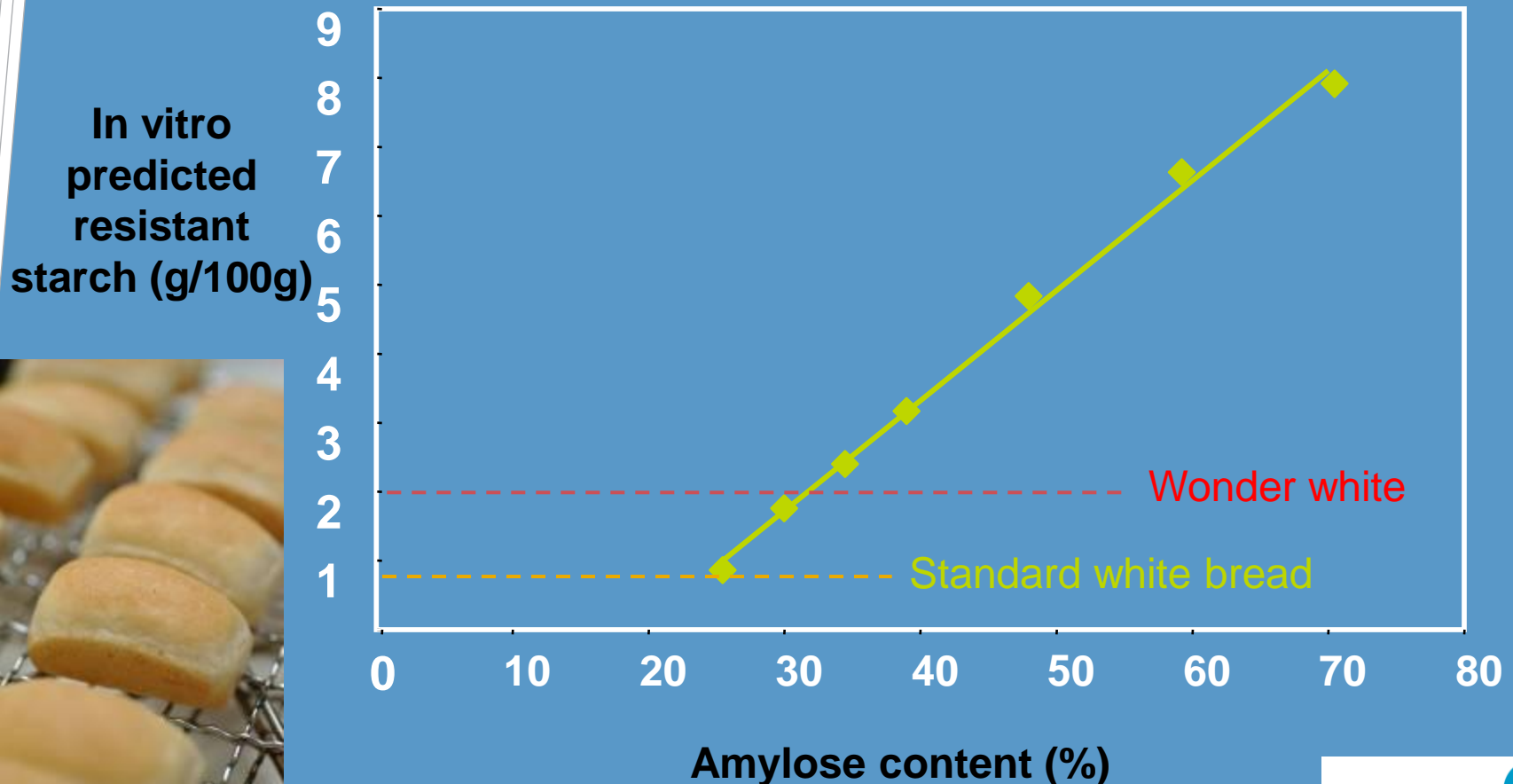
**STOP PRESS!**  
**OGTR Approval Granted**  
**for Human Health Trial!**

# Starch Synthesis Genes



# Amylose and Resistant Starch in Bread

## Resistant starch content of breads made from blends of a 70% amylose wheat



# Opportunities

- Develop “Low Gluten” barley for the production of “Low Gluten” beer suitable for people with Coeliac disease and gluten intolerance
- Potential 200,000 tonne value added crop for Australia
- Export opportunity for Australian farming and malting industry

# Opportunities for a Coeliac Beer

- Coeliac disease an immune disease involving the small intestine
- Only treatment lifelong avoidance of gluten (from wheat, rye, barley and oats)
- Persons with Coeliac Disease must limit gluten intake to under 10 – 50 mg / day
- A low gluten beer for people with Coeliac disease must contain considerably less than 10 mg per serving – target 100 times safety margin
- I.e. 0.1 mg per 285ml of beer (Middy) or 0.35mg per 1000ml
- To label “low gluten” beer in Australia, gluten level below 20mg per 100mls

# Market for “Low Gluten” Beer

- Estimated 1% of population have Coeliac Disease
- Gluten Intolerants estimated between 1% and 5% of population
- Reports indicate that up to 5% of the population would be customers for gluten free products, up to 1,000,000 Australian customers
- Additional customers include friends and relatives of people with coeliac disease, gluten intolerance and people with other medical and health based concerns

# Ultra Low Gluten Beer Developed



**Low hordein barley developed**

**Hordein levels in beer 20x lower than the limit for people with Coeliac disease**

**2014 Commercialisation < 20ppm of gluten**

# Sensory Panel



# Other Pipeline Products

- Cereals enriched with specific polysaccharides (NSP): arabinoxylan and (1,3;1,4)- $\beta$ -glucan
- Low GI Rice
- High Fructan Cereal Grains



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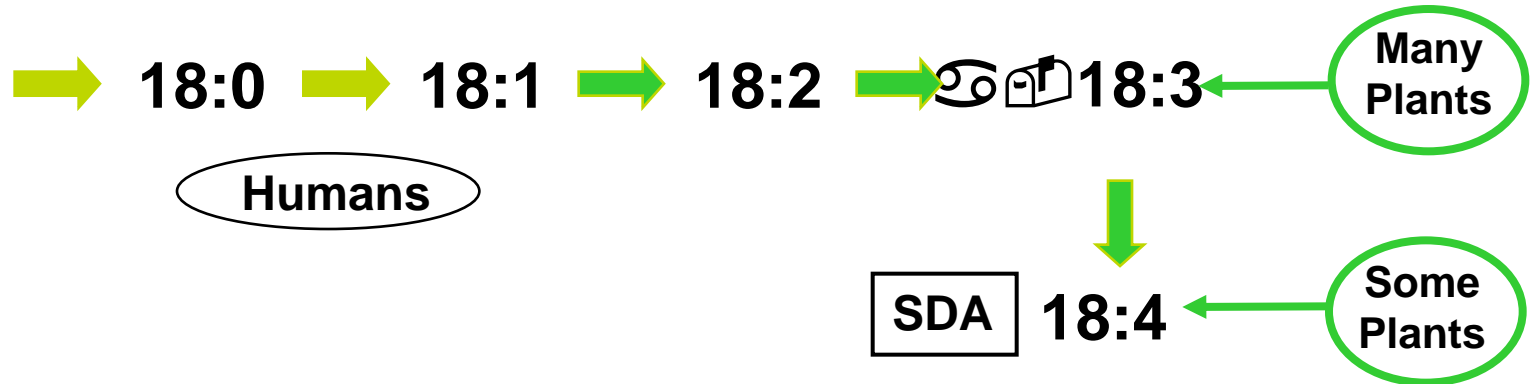
# Health Benefits of Omega-3 LC-PUFA

- **Required by every cell in the body**
- **Is a major building block for brain growth, nervous system and visual development**
- **Long chain Omega-3 DHA and EPA:**
  - **reduce inflammation**
  - **help reduce the risk of heart attack**

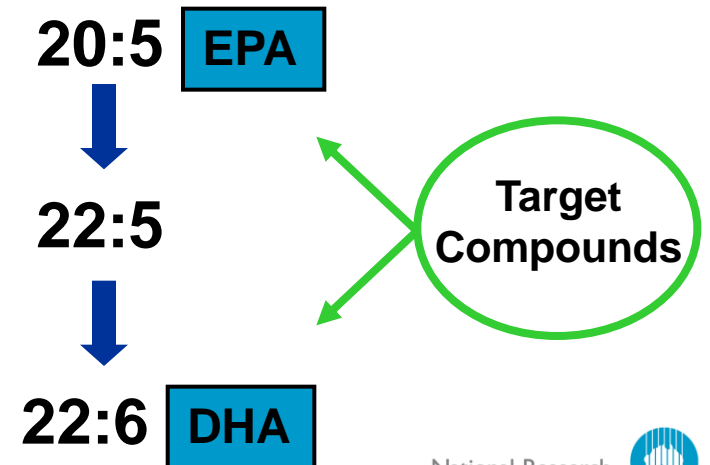




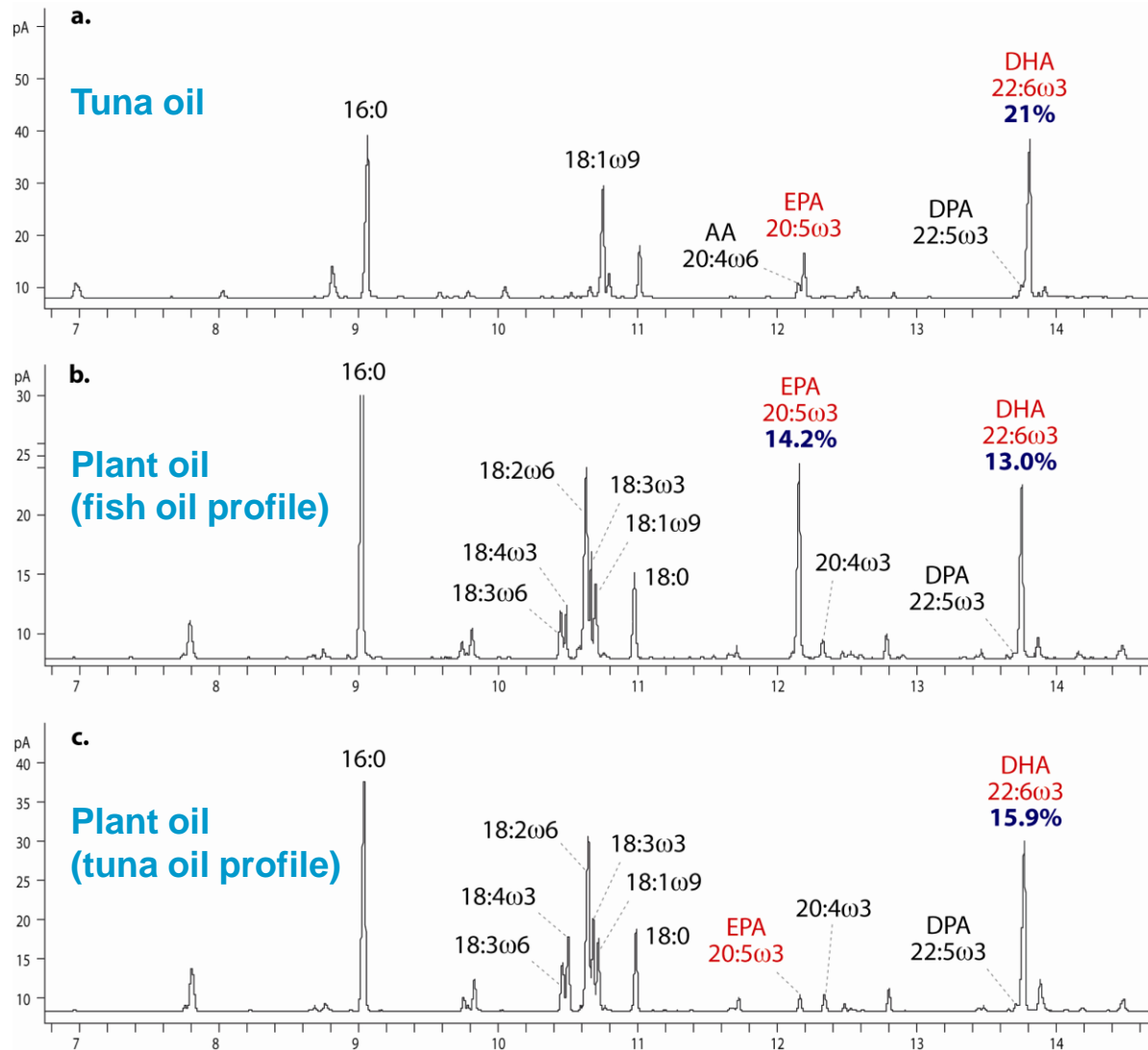
# LC-Omega-3 PUFA Biosynthesis



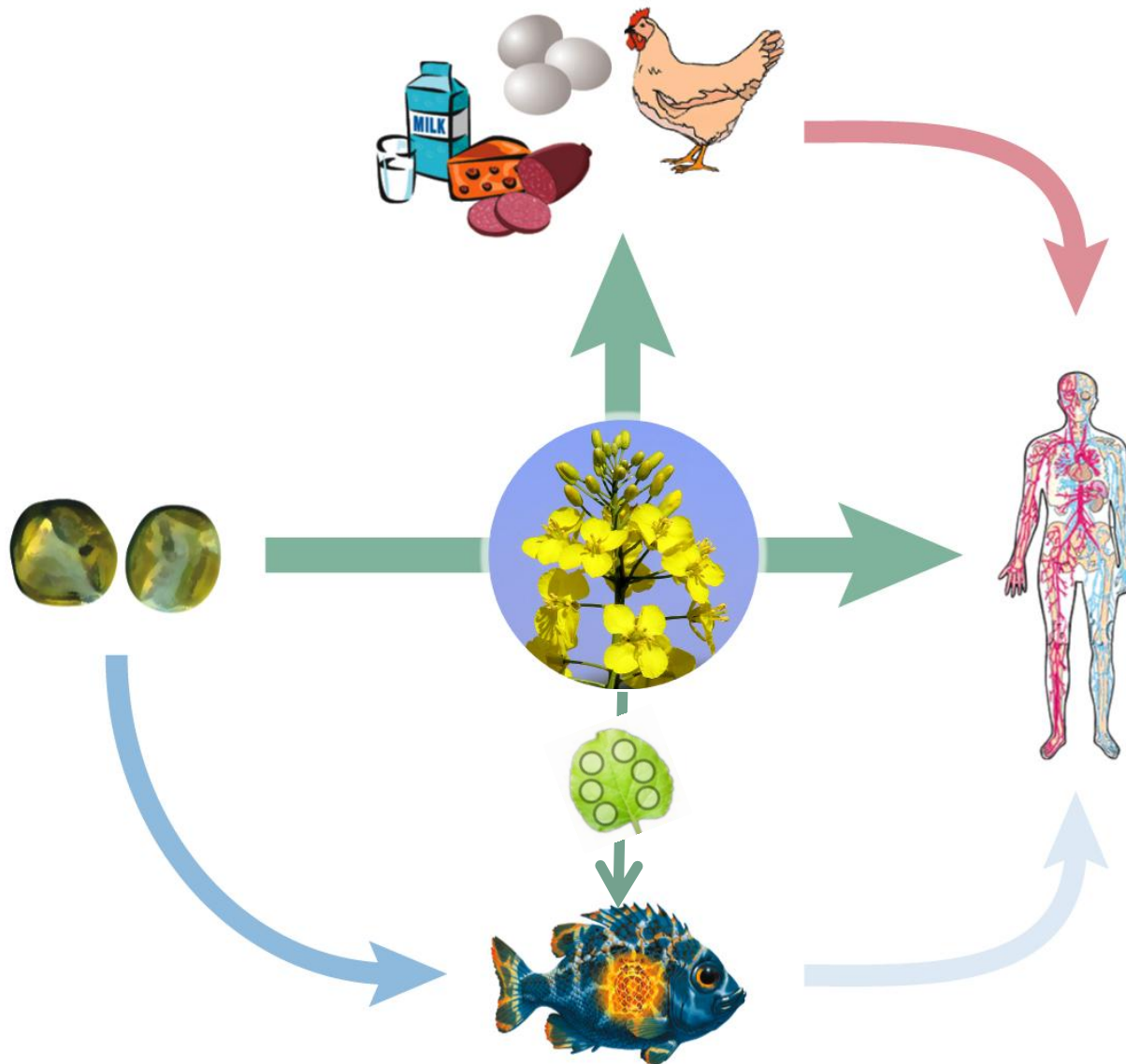
Metabolic Engineering Solutions Required to Bridge the Elongation/Desaturation Gap



# Metabolic tailoring: modifying EPA / DHA ratios



# Omega-3 Oils for Health and Healthy Foods



Food

# Consumer Engagement



- ❖ Critical and early on
- ❖ Australia and key markets (USA)
- ❖ Consumer preference for GM “one step removed”

# Acknowledgements

- **Colleagues  
CSIRO**
- **University /  
Institute  
Partners**
- **Industry  
Partners**
- **RDCs**

