



HEALTH • GRAIN

Exploiting bioactivity of European cereal grains for improved nutrition and health benefits

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Cereal grain kernel: endosperm+bran+germ

- White bread/ yellow pasta – flour mainly from endosperm
- Wholemeal (or wholegrain) bread/pasta – flour from entire kernel

Wholemeal vs. white: 2.5 - 5 x higher levels fibre/other bio-active compounds

Bran

(12-17%)

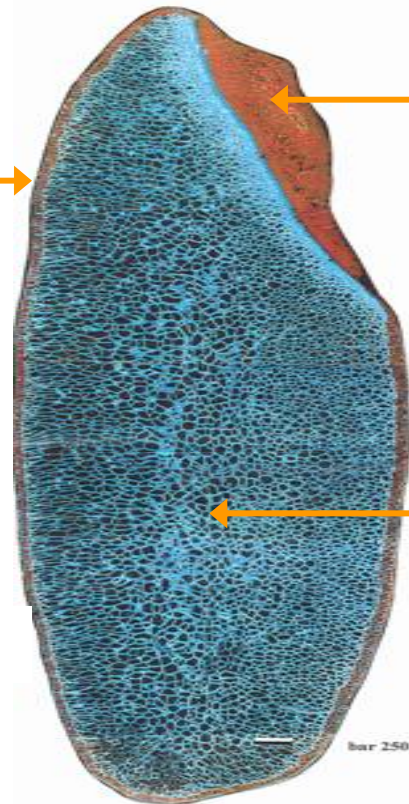
- Dietary fibre,
- B vitamins,
- trace minerals,
- phytochemicals (e.g anti-oxidants)

Germ (3%)

- Germ oil
- Antioxidants,
- vitamin E,
- B vitamins

Endosperm (80-85%)

- Starch,
- Protein
- (dietary fibre, vitamins)

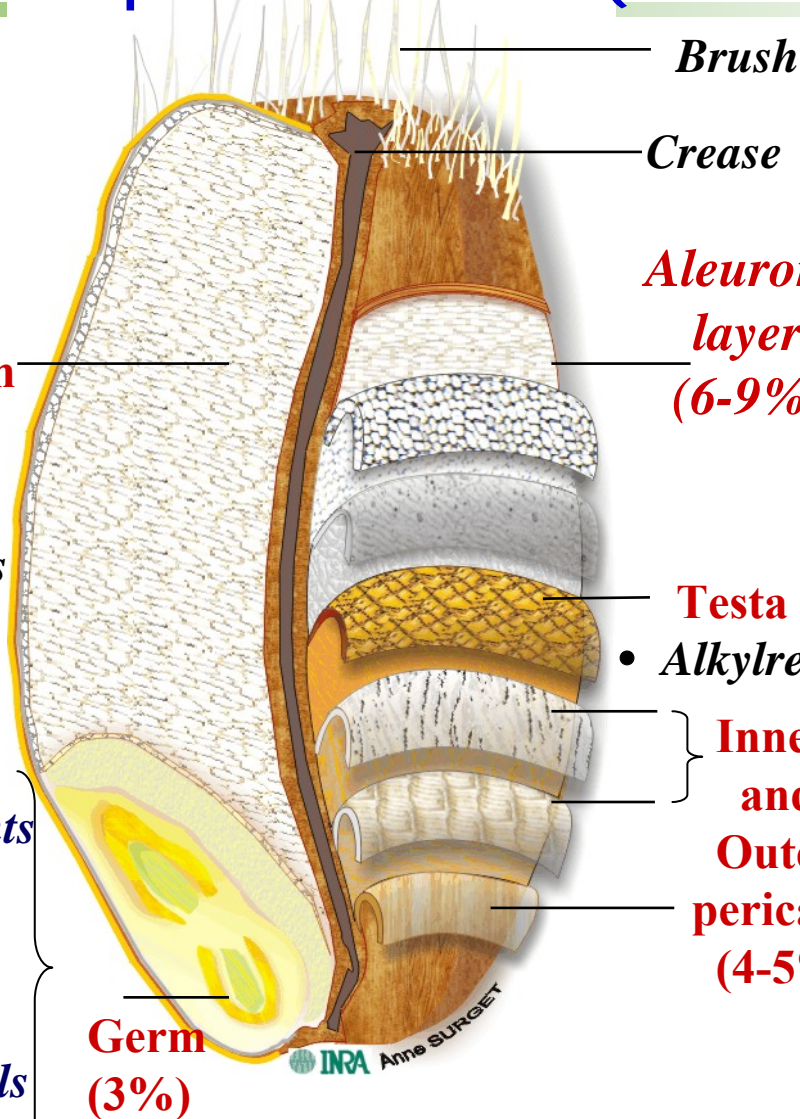


The wheat
kernel



THE WHEAT GRAIN KERNEL

Bran is heterogeneous
healthiest part = inner bran (aleurone)



Starchy endosperm (80-85%)

Starch & Proteins

- *Lipids*
- *Antioxidants*
- *Vitamin E*
- *B vitamins*
- *Minerals*
- *Plant sterols*
- *Enzymes*

Brush

Crease

Aleurone layer (6-9%)

Testa (1%)

- *Alkylresorcinols*


Inner - and Outer pericarp (4-5%)

Germ (3%)

- *Soluble & insoluble dietary fibre (xylans, β -glucans)*
- *Proteins*
- *Antioxidants (phenolic acids)*
- *Vitamin E*
- *B vitamins*
- *Minerals*
- *Phytic acid*
- *Enzymes*
- *Insoluble dietary fibre (xylans, cellulose, lignin)*
- *Antioxidants bound to cell walls (phenolic acids)*

Bran





Growing number of epidemiology / cohort studies of whole grain products
(with high fibre content) provide evidence of health benefits

Cardiovascular Disease

- Whole grains may lower cholesterol levels in part because of high level of soluble (viscous) fibre
- **Magnitude of risk reduction 27-37%**
- Larger cholesterol level reductions than from reduced cholesterol intake alone

Diabetes

- Consumption of whole grains included in recommendations for diabetes prevention
- **21 – 27% risk reduction by eating 3 servings** of whole grain daily
- Whole grain intakes associated with improved insulin sensitivity

Cancer

- Meta-analysis of Gastro-Intestinal cancers
= **21 - 43% lower risk**
- Meta-analysis of hormone dependent cancers =
- **10 - 40% risk reduction**

Obesity

- Lower Body Mass Index
- Lower risk of major weight gain

Constipation

- Grain fibres: excellent for prevention!



WHOLE GRAIN FOOD BIOACTIVITY

Synergistic effects of a large range of compounds!

Oligo-
Saccharides
Prebiotic

Phytate
Antioxidant

Phytosterols
Cholesterol-lowering

Alkylresorcinols
Enzyme inhibitors

Ferulic acid
Antioxidant

Lignans
Phytoestrogens

Tocopherols & -
trienols
**Antioxidants, reduce
LDL oxidation**

Vitamin E
antioxidant

Folate
Choline, betaine
Methyl donors

Dietary fibre
**Improved
intestinal
function,
and glucose
and lipid
metabolism**



Magnesium,
chromium
**Improved
insulin
sensitivity**

Synergistic
effects

Beneficial
physiological
effects in
humans





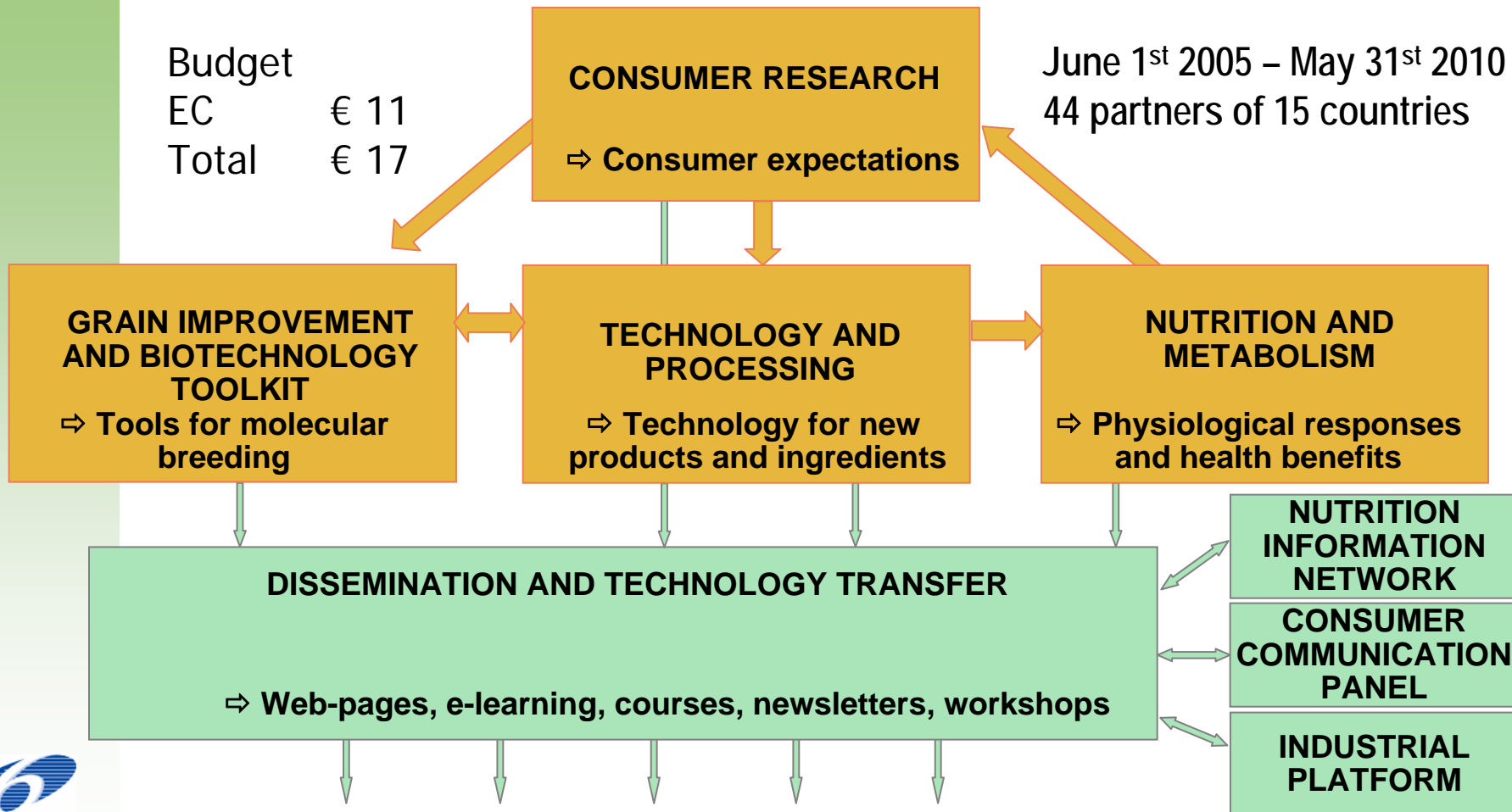
HEALTHGRAIN PROJECT

Integrated project: 'from fork to farm'- 5 Modules

Aim: provide scientific basis for increased intake of protective compounds and for understanding mechanisms for protection against diseases

Budget
EC € 11
Total € 17

June 1st 2005 – May 31st 2010
44 partners of 15 countries



Breeders, food industry, trade, consumer organisations, authorities

HEALTHGRAIN Results

Breeding (wheat, other grains) → **Higher levels fibre+bio-actives (F+BA)**

- **150 wheat varieties + 50 other cereal grains analysed for F+BA**
- Large variation in fibre + bio-actives levels
- Tools developed for breeding → varieties high in fibre and bio-actives
- Analytical methods for breeders/ grain buyers

Technology → **higher levels and increased bio-activity of F+BA**

- New milling technologies → high fibre+bio-actives ; less contaminants
- Technologies (enzymes, fermenting) → increased bio-availability and bio-activity
- Technologies for attractive gluten-free bread high in F+BA

Nutrition: Results support general picture → **Insights in mechanisms**

Consumer research (Finland, Germany, Italy, UK)

- Consumers prefer whole grain: Fi > D > UK > It
- Willingness to buy enhanced by: strong (Fi, D), weak (UK) resp. no claims (It)

Dissemination: Stakeholders! (in addition to publications/ presentations)

- Industrial Platform: **61 paying members (22 SME's)**
- Nutrition Information Network 25 invited experts (1-2 /country)
- Consumer Communication Panel



Impact on state of the art - 1

Strengthening of EU position in R&D for grains-grain products-health

- > 100 peer reviewed publications (50 more to come); > 500 presentations
 - 2x Special Issue J. Food Agric. Chem. (fibre+bioactives in 200 cereal cultivars)
 - International competitions: Awards for young HEALTHGRAIN researchers
- High quality research due to **cooperation between partners/**
- × 20 secondments of staff between partners

Major boost to awareness, and business opportunities for healthy/ healthier products high in grain fibre + bioactives

- 10 Workshops for Industrial Platform members
- Annual project meetings with EU nutrition top scientists + communicators
- Final Conference – 250 attendees (100 industry, 150 others)

Contribution to the growing availability of whole grain products in EU

Cooperation with other projects

- Contributions to Workshops and/or HEALTHGRAIN Final Conference:
 - × EuroPrevall, HELENA, NuGO, DIOGenes, LYCOCARD, EU-FRESH BAKE
- Joint training courses: **MoniQA** // Joint Workshop for breeders: **BioExploit**



Impact on state of the art – 2 – the future

Needed:

- Further translation of insights and tools to practical applications
- Further growth of awareness

ACTIONS:

Continuation of Network: The HEALTHGRAIN Forum (Association)

- Founded May 2010. Now 43 members (Industry, Research, Communication)

Aims:

- Maintaining the research network
- Communication issues (whole grain – health; whole grain definition)

National follow-up projects have been/ are being formed

- × **The Danish Approach** – successes in major increase of consumption (**'Fuldkorn'** – started after major success of fruit&vegs campaign)
 - endorsed by Industry Government, Consumer org. Nutrition experts, Disease Associations (heart, diabetes, cancer, ...)
 - new products and higher 'status' of whole grain





Social benefits – high potential impact on quality of life and health care costs

- Life expectancy still increases in Europe
- But number of healthy years decreases
 - × **35y NL female: 1988: 24.7 more healthy years; 2008: only 16.7**
- **Europe: Growing epidemics of Obesity and Diabetes type-2**
- Average intake of dietary fibre (preferably from fruit, vegetables, whole grains) far below recommended level by EFSA

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- **Shift towards whole grain and high grain fibre products**
Expected risk reduction > 20% – heart diseases,, diabetes, (colon) cancer

Potential impact of HEALTHGRAIN → further reduction of risks

- **Products higher in fibre & bioactives than whole grain products**
- **Taste and texture - improved products**
(making shift from white to whole-grain type products easier)
- **Growing awareness of health benefits of whole grain**



Potential economic benefits

Breeders

- Grains for products with extra health benefits (time scale ~ 7 years)
- Potential for added value

Flour millers

- HEALTHFLOUR option

Ingredient suppliers ('bread improvers')

- Healthy ingredients + know-how to make good bread

Bakers and other producers of consumer products

- End products with enhanced health benefits

Suppliers of equipment and analytical tools

- Systems for (rapid) measurements of fibre/ bioactive in grains/ flours, test kits etcetera



IMPORTANT: Continued support for whole grain/ high grain fibre by nutritional information / recommendations

Economic benefits - 2

Benefits for SME's resulting from the HEALTHGRAIN Network

- Cooperation Agrasys (innovative SME, Spain) - major firms
Products with a new grain variety 'Tritordeum'
- Studies on technology and health benefits of grain fibre based prebiotic
(AXOS – Fugeia company, Belgium)
- Support of SME with approved EFSA Health Claim (Beta-Glucans)
- Access to French market for UK SME (*'recommended by INRA'*)

The Definition of Whole Grain (WG)

developed by the HEALTHGRAIN Consortium (2010)

Broad agreement between nutritionists, food processors etcetera

- **WG defined in alignment with modern production processes**
- **Removal of very outer grain layer allowed → reduced risk for contaminants**



HEALTHGRAIN and EC Policies - 1

Nutrition and Health Claims (EC1924/2006)

- Approved health claims tend to be 'pharma-like':
 - ✗ for **specific ingredients**, targeted to **one function/disease**
 - ✗ **Less suitable for broad categories** e.g. 'whole grain products' beneficial for many functions

(National) nutritional recommendations more important than health claims for whole grain, high grain fibre and related products

HEALTHGRAIN Definition of whole grain – approval sought at EU level

Dietary fibre – new EC definition (2008)

- includes more fibre than the 'old' analytical methods
- grain based products are higher in fibre than listed
- **revision of Food Composition databases required for correct information about fibre levels in cereal grain products**

Contacts HEALTHGRAIN Forum – EUROFIR established



HEALTHGRAIN and EC Policies - 2

Enhancing health and quality of life in Europe

- Public R&D funding required for
 - ✗ *Healthier **basic** foods*
 - ✗ *Breeding of crops for enhancing health benefits*
 - ✗ **Priority: crops with limited potential for profits (WHEAT!)**
 - ✗ *Wheat with healthier endosperm (more fibre)*
 - ✗ *Wheat with reduced capabilities for causing coeliac disease*
 - ✗ Communication/ how to promote healthier life-style and food intake

Joint Programming Initiative – Healthy Diet for a Healthy Life

- Can be excellent tool for
 - ✗ Enhancing alignment of national projects
 - ✗ Funding for continued monitoring of cohorts in Europe (area where USA has superior performance)





MORE OF GRAIN - FROM SCIENCE TO ACTION

