



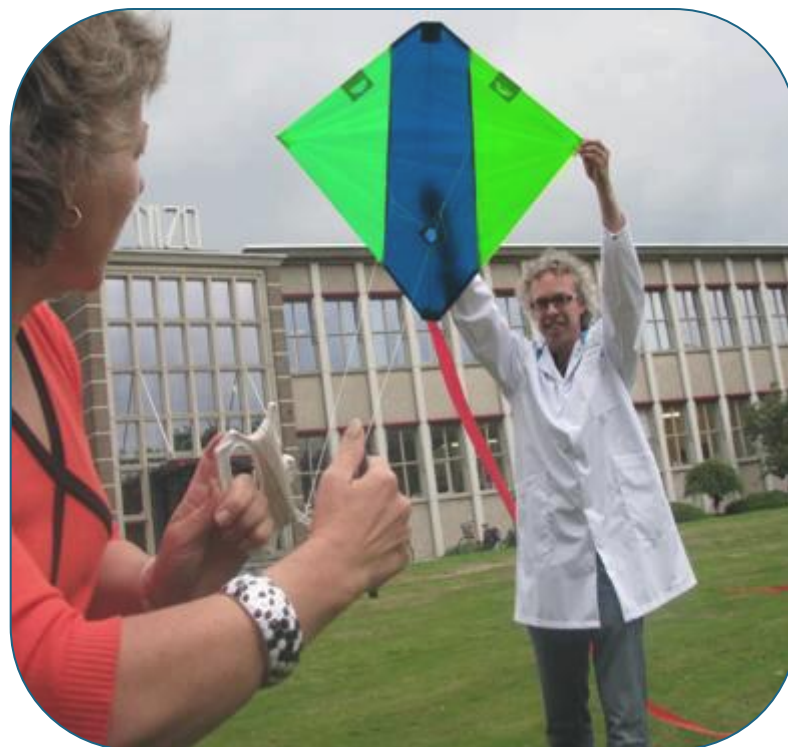
## Innovatie & ouderenvoeding

Food Valley Open Innovation Seminar  
Voeding voor vitale 50-plussers

NIZO food research

Jeroen Wouters, PhD  
Division Manager Health

[www.nizo.com](http://www.nizo.com)



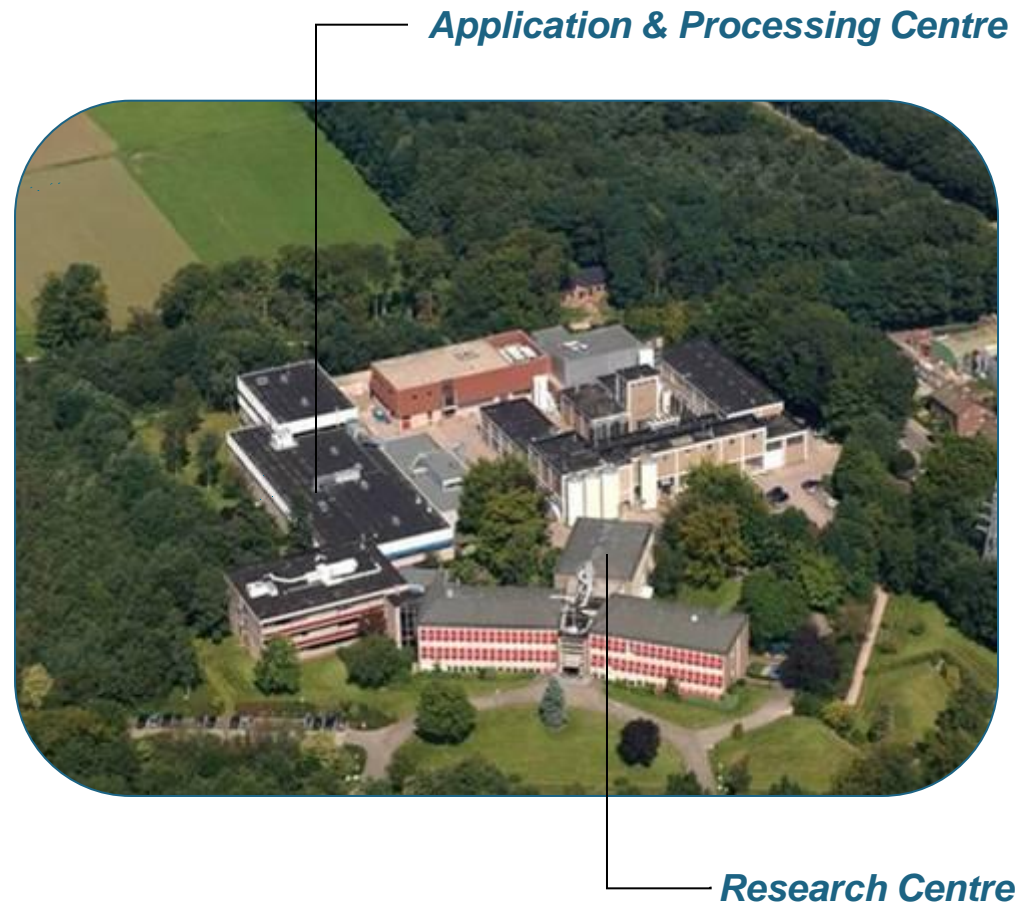
# “Ouderenvoeding en Innovatie”

- Introduction Elderly and Elderly nutrition
- Nutritional aspects:
  - Micronutrients
  - GI health
  - Protein
- Flavour perception
- Outlook for New Product Development
  - Multi-factoral and variation
  - EFSA

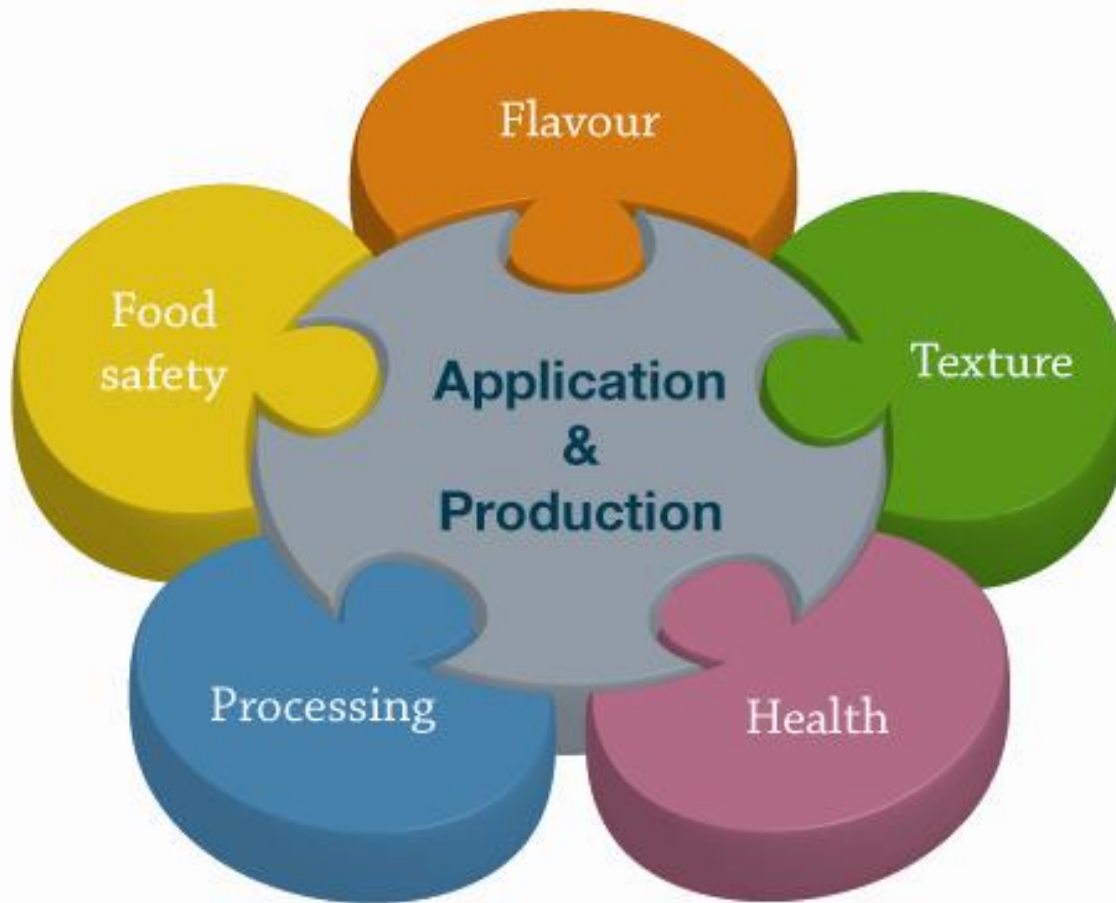


# Introducing **NIZO** food research

- Independent, private contract research company for the food industry
- HQ in The Netherlands (Food Valley)
  - Offices in France, UK, USA, Japan
- 200 professionals
- From lab to practice
  - Food-grade pilot plant
- ISO 9001:2000



# Expertise areas



**Innovation, cost reduction, responsibility  
(quality control, sustainability, health claims, ...)**





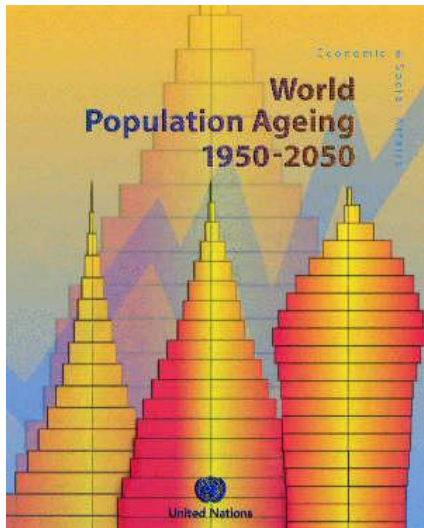
# The Fountain of Youth



Lucas Cranach – the elder 1546

# Ageing population world wide

- **Covered by previous speakers:**
  - Ageing population
  - Target groups within elderly population
  - Marketing of food products towards the elderly





# A new customer target group.....

Goed nieuws voor 50 plussers, want in ons filiaal te Groot-Ammers is het gedurende heel 2008 voortaan elke donderdag

## SENIORENDAG

alle 50-plussers krijgen ELKE DONDERDAG

### 25% KORTING

op de behandeling.



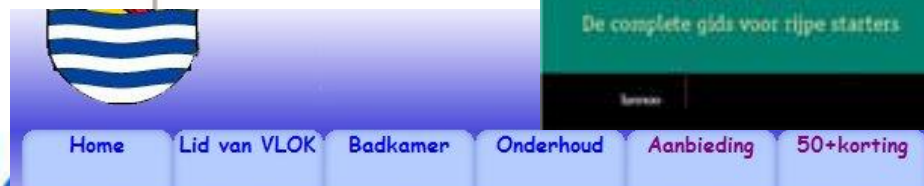
**SalonMode**  
haarmodegr

Groot-Ammers, Margrietstraat  
tel. 0184-661270



?

?



**50+korting**

Speciaal voor mensen boven de 50+ is er d bezorgt u 10% teruggave op uw totale reke materialen. Mooi meegenomen dus. Bent u meer voordeel rekenen.

Tip ....let goed op de aanbieding .



**ANBO**  
Voor 50-plussers

...which receives increasing attention... **NRZG**  
THE FOOD RESEARCHERS

# Can behavior of this group be steered ?



## Binnenland



Geniet van foto's Ik & mijn dier!

AD Dierendag

Auto's  
Banen  
Kleintjesmarkt  
Winkelplein

**NIEUWS**

Voorpagina  
Binnenland  
Sportwereld  
Buitenland  
Economie  
Multimedia  
Showbizz  
Cultuur en media  
Bizar  
ADtv

**DICHTBIJ**

maandag 17 september 2007

## Senioren krijgen steeds vaker korting

Door GERRY VAN DER LIT

UTRECHT - Steeds meer bedrijven bieden ouderen kortingen aan. Meestal gaat het om tien procent, soms oplopend tot wel 25 procent.



FOTO PETER HILZ

Maar overheidsinstellingen als musea geven juist steeds minder korting, constateert de Ouderenbond Unie KBO.

Vooral de recreatieve sector is gul. „Bedrijven verleiden senioren buiten het hoogseizoen gebruik te maken van recreatieve voorzieningen. Dat is in het belang van iedereen, want het



# Ageing = multi-factoral

➤ **Endogenic factors:**

- Genes

➤ **Exogenic factors:**

- Life style
- Environment
- **Nutrition**

**Exposure to damage**  
**Recovery mechanisms**

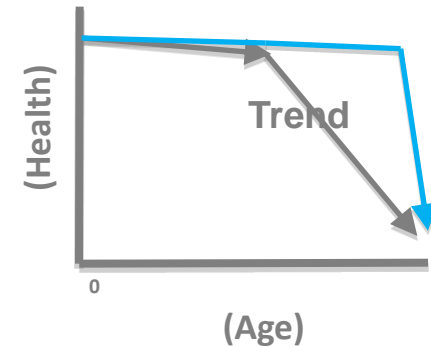
➤ **Fortune/Misfortune**



# Healthy ageing and quality of life

Ageing → decline in food intake

1. What causes this decline?
2. How can we intervene?



**Quality of life:** maintain a high quality of life as long as possible.

General items:

- \* reduced food intake
- \* reduced absorption of nutrients
- \* comorbidity (> 1 disease), 33% in 75+

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- **Nutritional aspects:**
  - **Micronutrients**
  - **GI health**
  - **Protein**
- Flavour perception
- Outlook for New Product Development
  - Multi-factoral and variation
  - EFSA





# Healthy ageing and nutritional aspects

## *General items:*

- \* *reduced food intake*
- \* *reduced absorption of nutrients*

## Nutritional aspects and deficiencies for elderly a.o.:

- \* **Micronutrients:**
  - \* **Vitamine D** (40% of elderly deficient)
  - \* **B-vitamins (B12)** (25% of elderly deficient)
  - \* **Iron**
- \* **GI health**
- \* **Macronutrients:**
  - \* **Protein intake**
- \* **Cognition**



“Quite a lot can be achieved by supplements but for bio-availability, acceptance and compliance the traditional/recognizable food matrix is of outmost importance”

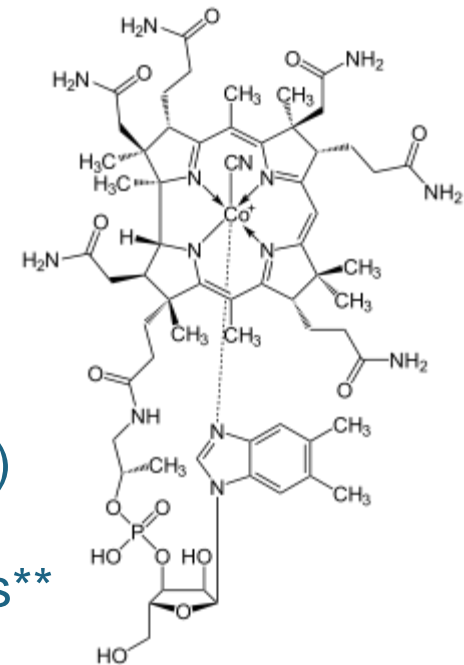
# Vit B12

## Deficiency in 24% in elderly people\*

(link to Alzheimer's disease?)

### Causes for Vit B12 (x-cobalamin) deficiency

- Malabsorption,
  - Food-bound (protein matrix)
- Inadequate supply
- An enriched drink (a.o. in Vit B12 and homocysteine) stimulates cognitive functioning in frail elderly and correlates with increased VitB12 blood plasma levels\*\*



\* Van Asselt, Am J Clin Nutr. 1998

\*\* Wouters-Wesseling, J Gerontol, 2005

# Vitamin-producing Lactic Acid Bacteria

- **Vitamin B2 (riboflavin)**
  - e.g. *Lactococcus lactis*, *Propionibacterium freudenreichii*
- **Vitamin B9 (folic acid)**
  - e.g. *Streptococcus thermophilus*, *Bifidobacterium* sp., *Lactococcus lactis*
- **Vitamin B12 (cobalamin)**
  - e.g. *Lactobacillus reuteri*, *Propionibacterium*
- **Vitamin K2 (menaquinones)**
  - e.g. *Lactococcus lactis*



Fermentation with vitamin-producing LAB leads to natural enrichment

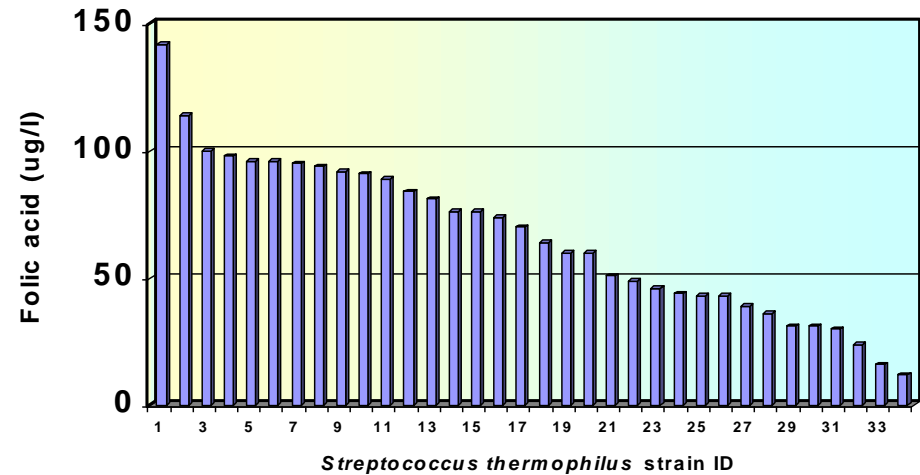
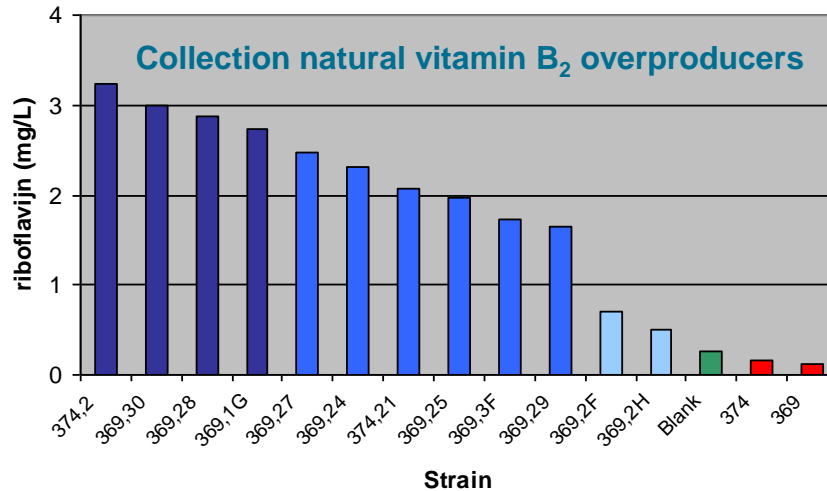
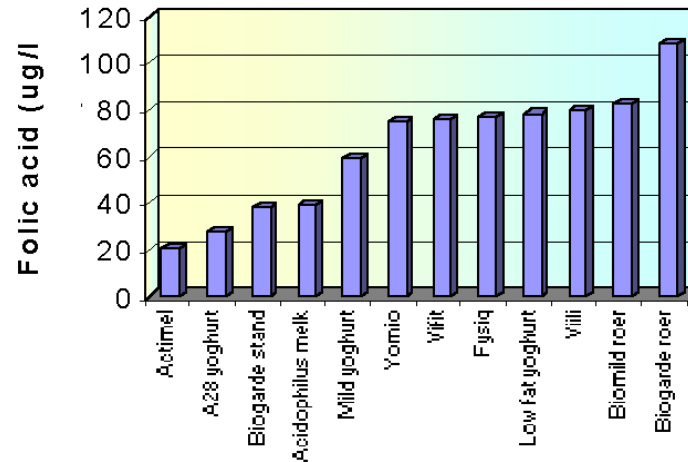
**Proven in non-dairy fermentations:**

- B2 (riboflavin)
- B11 (folate)
- B12 (cobalamin)



# High through-put screening of microbial strains

Examples: riboflavin (B2) and folic acid (B11)

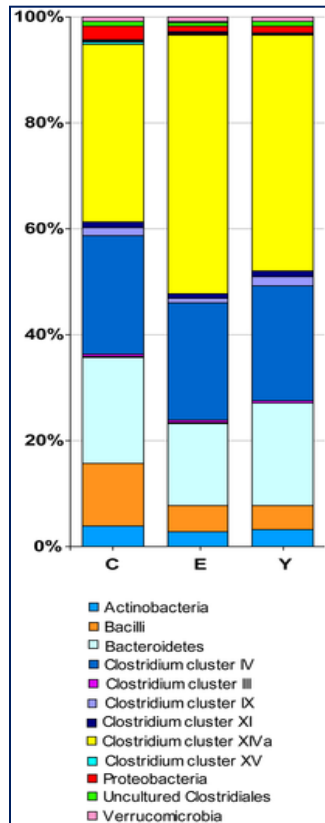


# Innovation concepts vitamin enriched fermented fruit drinks

Vitamin	Health benefit	DRI	Concentration via fermentation (per 100g fruit/veg substrates) NIZO examples
B2 (Riboflavine)	Preserves integrity of nervous system, eyes, skin	1-1,3 mg	3 mg
B9, B11 (Folate)	Protection against cardiovascular diseases, neural disorders	200-400 µg	26 µg
B12 (Cobalamin)	Protection against cardiovascular diseases, ageing. If deficient: cancer, pernicious anemia, neuropathy	1 µg	90 µg
K2 (Menaquinone)	Involved in blood coagulation Skin health	60-80 µg	nt
B3, B5 (Pantothenic acid)	If deficient: coenzyme A deficiency	-	nt



# Gut microbiota in seniors and centenarians is altered compared to young adults



C: centenarians

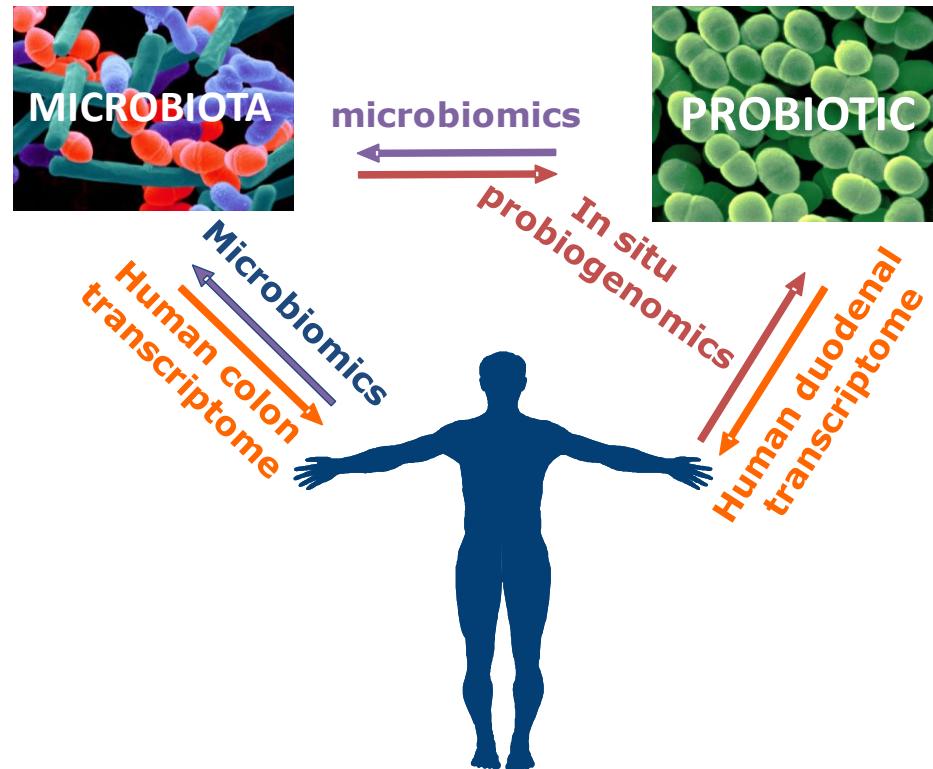
E: elderly

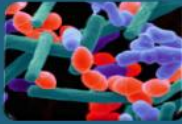
Y: young adults

- Increase in GI-discomfort at higher age.
- Ageing effects GI tract microbiota composition
- Centenarians (people > 100 y) compared to young adults
  - decrease of Clostridium cluster XIVa – known to have anti-inflammatory properties
  - increase in aerobes
  - decrease in butyrate producers
- Compromised microbiota is associated with an increase in inflammatory status (“inflammaging”)




# Molecular toolbox for studying GI microbiota functioning






**Who's There**

Phylogenetic characterization of a microbiota



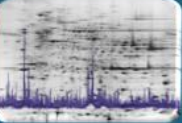
**What are they capable of?**

Metagenomics -> qPCR key bacterial activities




**What are they doing?**

- Metatranscriptomics
- Functional metagenomics



**What have they done?**

- metabolomics & metabonomics
- Metaproteomics



**How can we predict?**

- (pangenomic) Metabolic models
- Network modelling

# Target of selected probiotics for the elderly

Target	Age (years)	Strains	Outcome	Reference
Microbiota composition	60-87	<i>B. lactis</i> HN019 <i>B. longum</i> W11	Increase in bifidobacteria Increase in bifidobacteria	Ahmed et al. (2007) Del Piano et al. (2004)
	65-99	<i>B. lactis</i> Bb-12	Increase in <i>B. animalis</i>	Ouwehand et al. (2008)
	65-102	<i>B. longum</i> 2C + <i>B. longum</i> 46	Change in <i>Bifidobacterium</i> species composition	Ouwehand et al. (2008)
	84 ± 8	<i>B. longum</i> 2C + <i>B. longum</i> 46	Change in <i>Bifidobacterium</i> species composition	Lahtinen et al. (2009)
	70-100	<i>L. rhamnosus</i> GG + <i>L. rhamnosus</i> LC705 + <i>Proplonibacterium freudenreichii</i> ssp. <i>shermanii</i> JS	Reduced oral <i>Candida</i> colonisation	Hatakka et al. (2007)
Bowel function	76-95	<i>L. rhamnosus</i> Lc705+ <i>P. freudenreichii</i> subsp. <i>shermanii</i> JS	Increased defecation frequency	Ouwehand et al. (2002)
	70-96	<i>L. reuteri</i>	No change	Ouwehand et al. (2002)
	65-102	<i>B. longum</i> 46 + <i>B. longum</i> 2C	Increased defecation frequency	Pitkälä et al. (2007)
	65-99	<i>B. lactis</i> Bb-12 <i>Bifidobacterium</i>	Increased defecation frequency	Pitkälä et al. (2007) Tanaka and Shimosaka (1982)
	60-79	<i>B. lactis</i> LKM512	Increased defecation frequency	Matsumoto et al. (2001)
		<i>B. lactis</i> DN-173 010 <i>L. casei</i> Shirota	Reduced oro-faecal transit time Increased defecation frequency	Meance et al. (2001) Umesaki (1999)
Immune function		<i>B. lactis</i> HN019	Increased natural killer cell and phagocytic activity	Chiang et al. (2000); Arunachalam et al. (2000); Gill et al. (2001a,b)
		<i>L. rhamnosus</i> HN001	Increased natural killer cell and phagocytic activity	Sheih et al. (2001); Gill and Rutherford (2001); Gill et al. (2001a); Gill et al. (2001c)
	65-99	<i>B. lactis</i> Bb-12	Reduced inflammatory status	Ouwehand et al. (2008)
	65-102	<i>B. longum</i> 2C + <i>B. longum</i> 46	Reduced inflammatory status	Ouwehand et al. (2008)
	>60	<i>L. casei</i> DN-114 001	Reduced duration of winter infections	Turchet et al. (2003)

## Development of products targeting GI tract functioning for elderly

Tiihonen, 2010. Aging Research Review

# Protein intake

**The greater morbidity among the elderly is associated with the progressive decline in skeletal muscle mass and function.**

**Adequate protein intake impacts the muscle mass generation/prevents muscle mass decline**

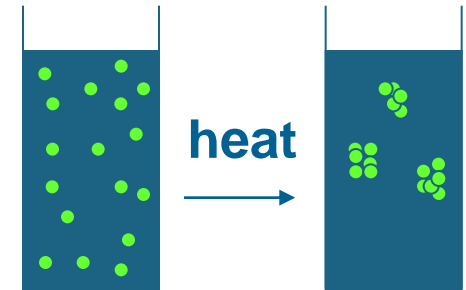
Desired protein intake:

the RDA for elderly may be greater than 0.8 g/kg/day\* (= target for adults).

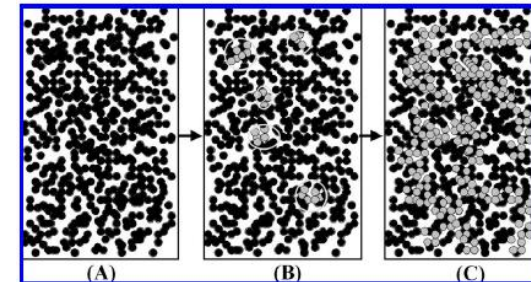


Wolfe et al., 2008. Clin. Nutr.

# Protein fortification of foods

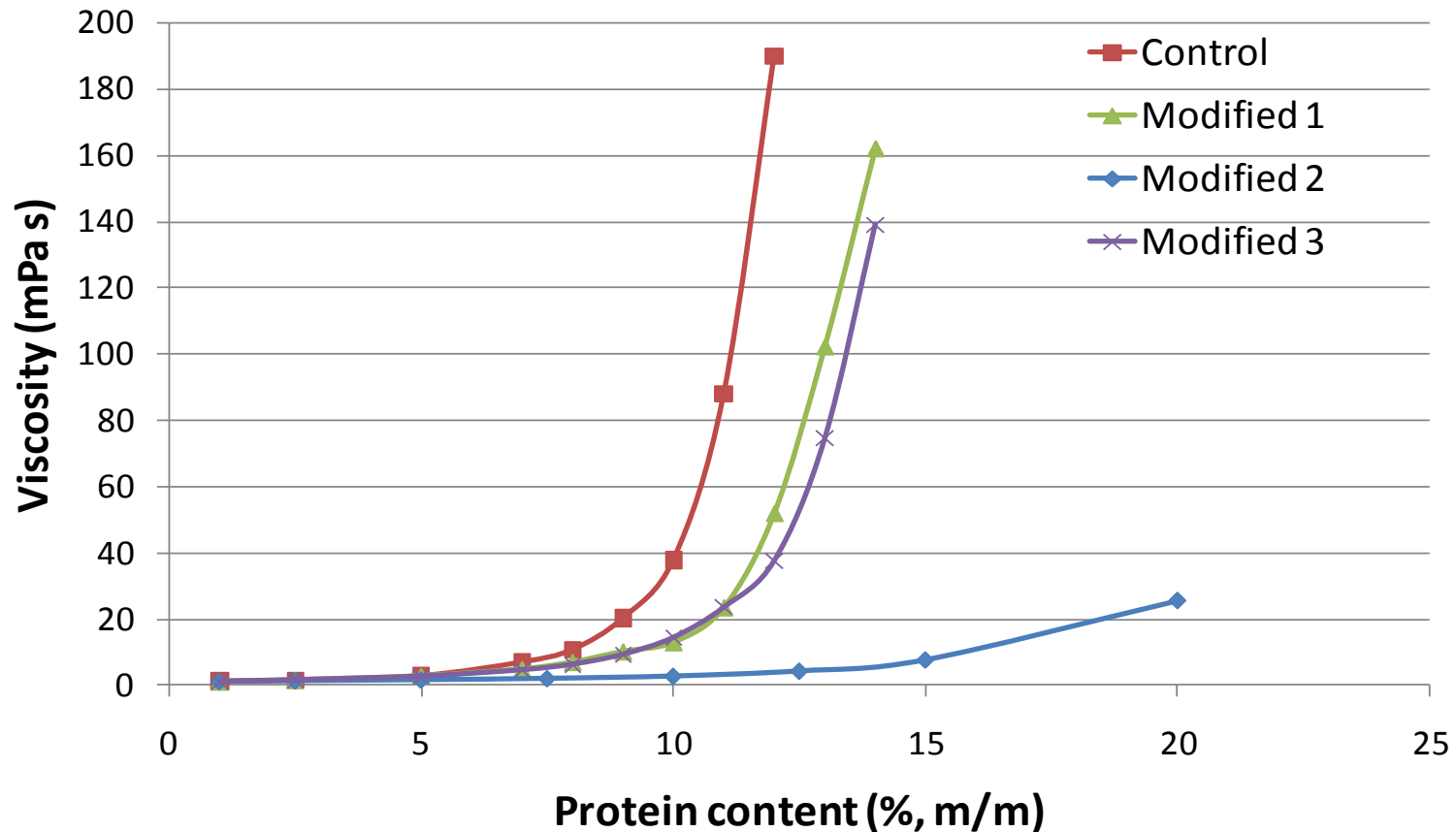


- Simply increasing protein content of products leads to texture and sensory defects
- **Drinkables**
  - High protein content can lead to aggregation, gelation and separation during processing and storage
  - Sensory defects: sandy / inhomogeneous / gelled
- **Semi-solids and solids**
  - Strong protein networks results in undesirable texture
  - Sensory defects: tough / rubbery / sticky / mealy / crumbly
- **Tailored protein ingredients can provide the solution!**





# Drinkables: modulating viscosity of caseinates

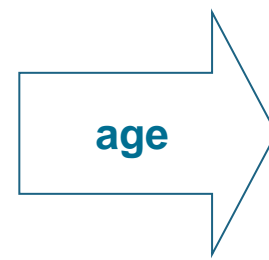
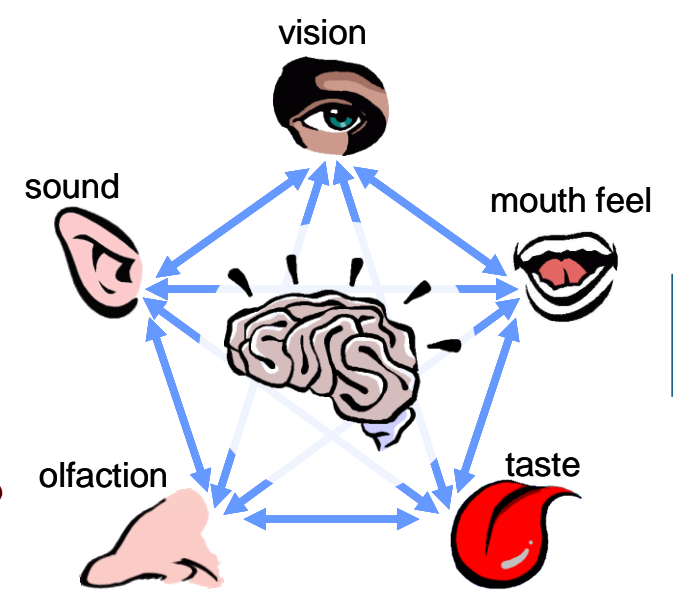
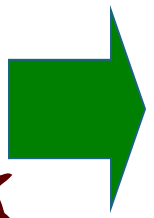


- Caseinates can be easily tailored to provide readily dispersible ingredients which give extremely low viscosity at very high concentration

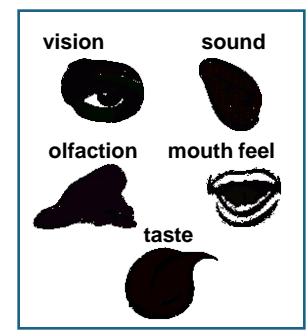
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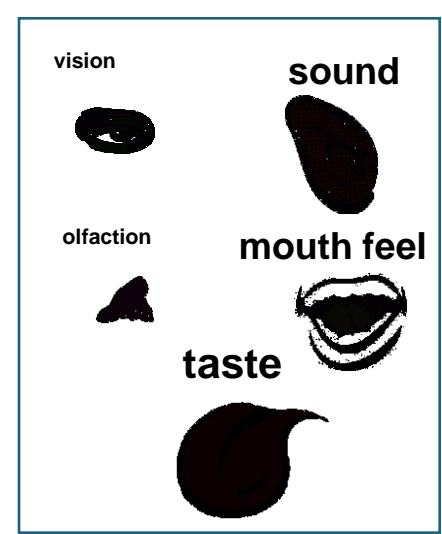
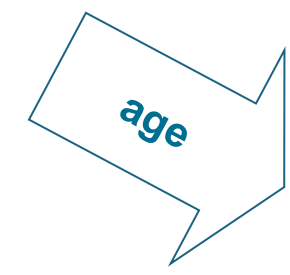




## General decline

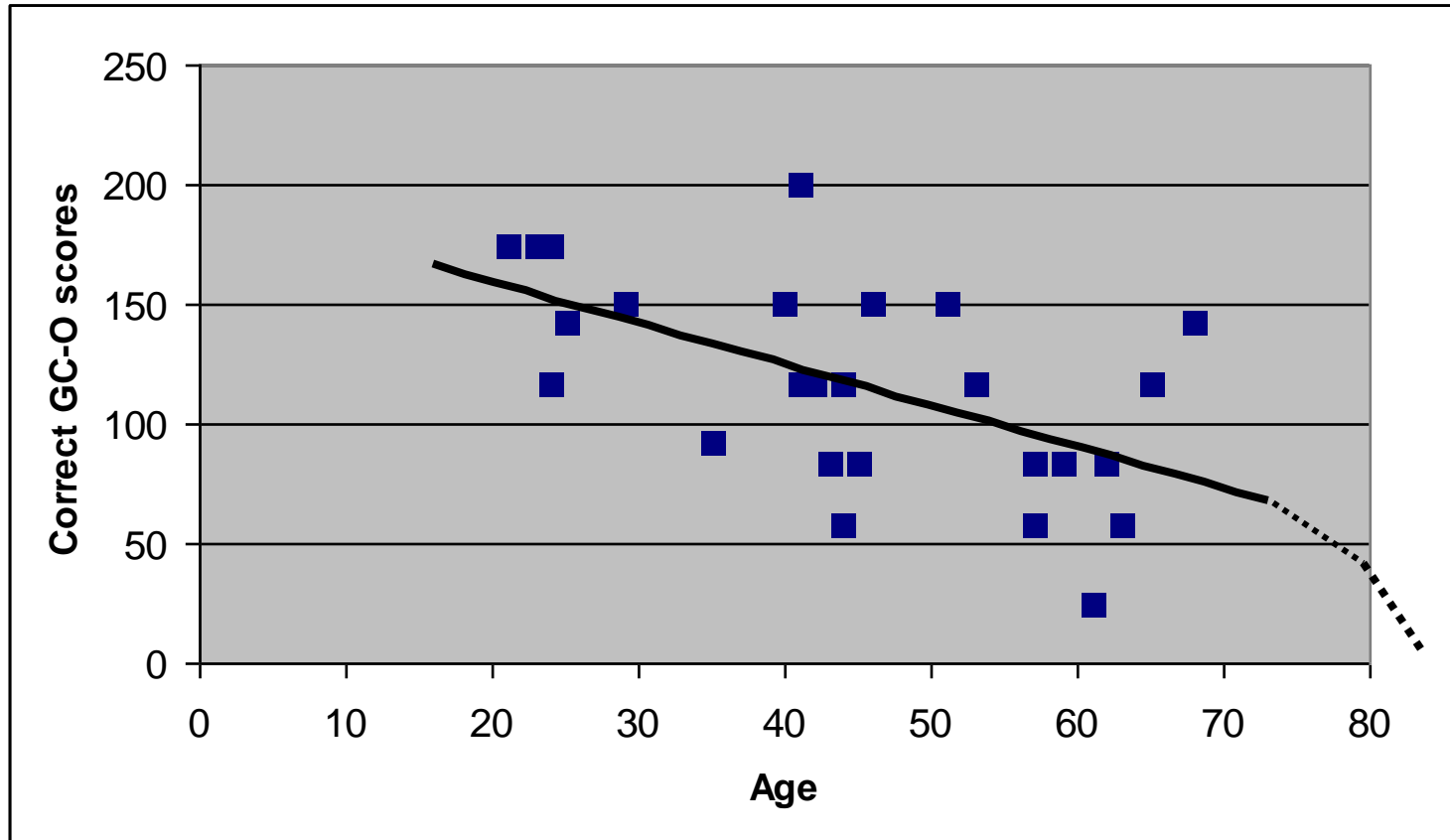


## Selective decline



## Food satiety for elderly

## Odour sensitivity and Age



- Sweet, creamy, dairy fruity flavours significant negative correlation
- Not found for savoury flavours



# Aroma sensitivity

## Flavour molecules to screen for (sweet, savoury creamy and non-food)



Flavour	Category	Description
Diacetyl	Creamy/dairy	Strong, buttery odor and taste on dilution
Ethylbutyrate	sweet	Ethereal, fruity odor; buttery, ripe fruit notes
Dimethyldisulfide	savoury	Strong onion, cabbage-like odor
Isoamyl acetate	sweet	banana aroma
d-limonene	sweet	Fresh, sweet, hydrocarbon and orange citrus odor
2,6-dimethyl-2-heptanol	<i>non-food</i>	Lavender
2,6-dimethylpyrazine	savoury	Chocolate, roasted nuts, fried potato odor;
Dimethyltrisulfide	savoury	Strong, onion-garlic odor and taste
(-)-menthol	<i>non-food</i>	Peppermint
3-methyl-2-hexenoic acid	<i>non-food</i>	body odour
Benzothiazol	savoury	Meaty, vegetative, cooked, beefy and coffee-like at 3 ppm
Gamma-decalactone	creamy/fruity	Coconut-peach like odor; in dilution, peach taste
Gamma-dodecalactone	creamy/fruity	(fruity)
Vanillin	sweet	Powerful, creamy, vanilla-like odor & sweet taste

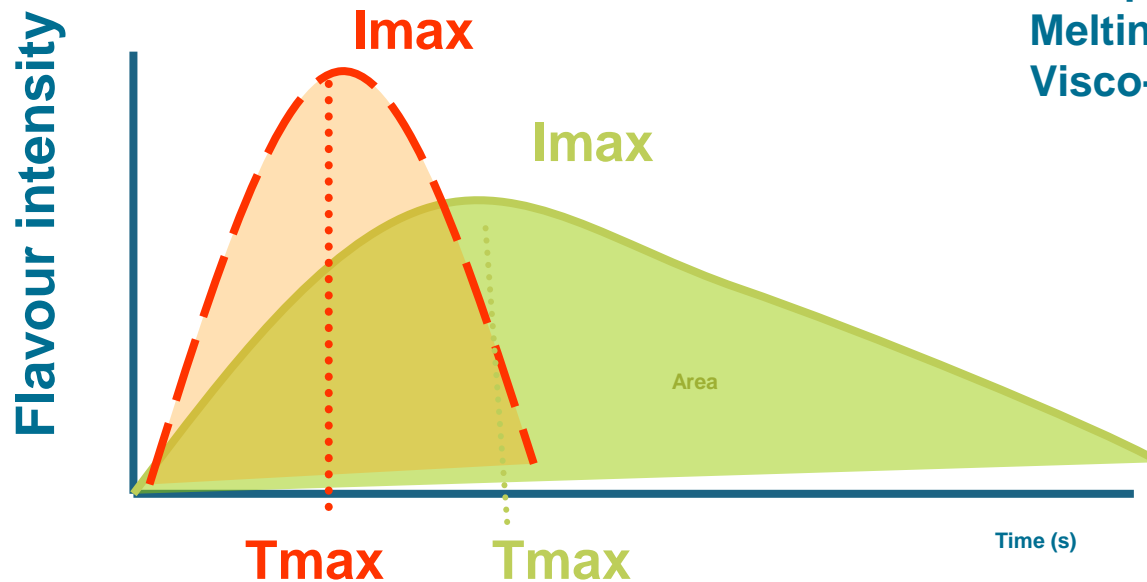
# Factors determining flavour release

## Ingredients

Oils and fats  
Proteins  
Hydrocolloids  
Emulsifiers

## Texture

Coarse/fine  
Waterholding capacity  
Compartmentalisation  
Melting properties  
Visco-elasticity



## In mouth conditions

Geometry  
Mastication  
Saliva  
BMI, AGE

## Flavour properties

lipofilicity  
volatility

# Chewability is an important driver for adequate food intake for the elderly

- Chewing force declines for the elderly
- Saliva production declines
- Tooth problems

**Brownie**



**Biscotti**



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  - **Multi-factoral and variation**
  - **EFSA**





# Strategies to increase continuation of eating and drinking

## Multi-factoral and variation

### ‘Easy’ strategies to apply:

- Attractive meals, high variety of health foods
- Use herbs and spices instead of salt to enhance taste
- Stimulate appetite with a walk before dinner
- Use healthy nutrient-dense food as the base of the menu
- Stimulate saliva production with regularly intake of sugar free candies.
- Socialisation at meals
- Promote attention to the difference what elderly eat and what they should eat to meet the recommendations



## Different types of EFSA claims in field of nutrition

- **Nutrition claim:** defines the nutritional composition of a product (Annex of EU 1924/2006)  
e.g. “enriched with vitamins”
- **Health claim:** defines the benefit of a product  
e.g. “lowers cholesterol level”
  - Based on generally accepted scientific evidence (art 13.1)
  - Based on newly developed scientific evidence or requesting data protection (5 yrs; art. 13.5)
- **Disease reduction claim:**  
defines the risk reduction of human disease (Art. 14)  
e.g. “reduces the risk of cardiovascular disease”
- **Claims on development and health of children** (Art. 14)



# To conclude: a future for specialized elderly nutrition

- Further progress on research on nutritional status of elderly and ageing (nutrigenomics)

## The “ideal food” for elderly:

- Good nutrient density and nutritional value
- Health benefit (vitamins, GI health, muscle)
- Strong/pronounce flavour profile (e.g. savoury)
- Chewable, saliva generating
- Variation
  
- *In combination with physical activity (exercise)*
- *Enjoyed in a social context*



**Thank you for  
your attention**

**Together to the  
next level**

