IWC PARIS 2008
5th International Whey Conference

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The Endless Possibilities of Whey: Still Many Opportunities for Innovation

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Food and Nutrition: Yesterday, Today, Tomorrow

- Industrialisation of traditional cooking
- Functional Food - diversity of functions
- Molecular background / micro- und nano-structure
- Biology + Biochemistry + Process Technology
- Nutrition: potential based on (technological) diversity

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Food Products – Quo Vadis ?

Fast Food
Convencience Food
Ethnic Food
Organic-Food
Health food
Performance Food
Super Food
Prescriptive Food
Pharmaco Food
etc., etc.,

Functional Food
Fitness Food
Nutritional Food
Therapeutic Food
Longevity Food
Pharma Food
Designer Food
Medicine, Drugs
Neutraceuticals

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USA: FAO – Accepted Health Claims

- calcium & osteoporosis
- lipids & cancer
- sodium & blood pressure
- saturated triglycerides, cholestrol & heart diseases
- fibres, grains, fruits & cancer
- fibres & coronary diseases
- folic acid & nerve defects

è typical example: health ingredients from soy

FOSHU – Foods for Specific Health Use (Japan)

- Foods or ingredients that provide specific health or medical benefits besides their nutritional value.
- Products recognised as "Foshu" by the Ministry of Health and Wellfare allow for "**Health Claims**", e.g.
  - è Milk with nutritional supplements
  - è Yoghurt.
- New product developments: enrichment / fortification with Probiotics, Fibres, Oligosaccharides.
- Enrichment:
  - è Calcium, Iron
  - è Carotene
  - è Bulgarian Aloe

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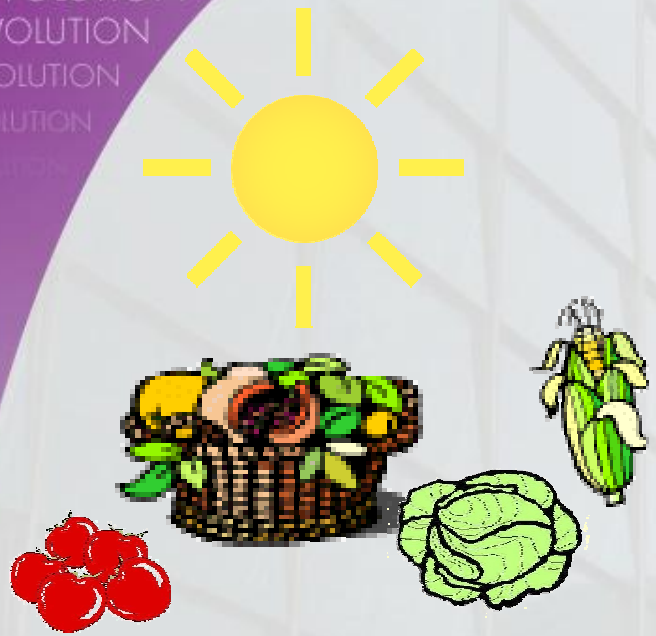
Impacts of „Functional Food“

- **Realisation** of physiological, nutritional requirements based on traditional mixed food and its bioactive composition

- **Realisation** based on validated, scientific results e.g. probiotic yoghurts

LC1 - Yoghurt

Functional Food



Area of conflicts:
Prevention
and/or
Therapy

Bridge between

Food
and

Pharma

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Whey/Milk serum as raw material I

Natural functionalities

- Sol-Gel transformation
- Milk enzymes
- Biotop-adapted immunological functions (specific IG´s)
- Peptides:
  - hormons
  - growth factors
  - gastrointestinal regulators
  - Immunostimulation
  - transport functions (phospho-, glycopeptides)
  - inhibitors (ACE inhibitor)
  - casomorphines
- Examples:
  - adapted baby nutrition
  - hypoallergenic nutrition
  - health products fo specific target groups
  - focus on specific metabolic functions: digestive probiotics

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Whey/Milk serum as raw material II

Added Value Ingredients

- Primary raw materials:
  - Proteins, Peptides, IG´s, Glyco- and Lipo-Derivates
  - Lipids, Phospholipids, Ceramides etc.
  - Carbohydrates: Lactose, Glycocompounds
  - Minerals: Calciumphosphate etc.
  - Vitamins and other Micronutrients
- Secondary raw materials:
  - Peptides, Phospho-, Glycoproteins/-pepides (enzymatic, physical-chemical)
  - Prebiotics: Lactulose, Galactooligosaccharides (GOS)
  - Lysophospholipides, Sphingomyelin
- Tertiary raw material:
  - Joghurt, Cheese
  - (fermentations) - Vitamins
  - Aminoacids, organic acids
  - Exopolysaccharides
- Complex ingredient systems:
  - Nutri-blocks with specific functionalities (antibiotic, antiviral, minerals etc.)

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Whey-Protein:
- carbohydrates
- lipids
- minerals

Whey-Protein:
- fractionation
- denaturation
- texturisation

Whey-Protein:
- chemical modifications
- enzymatic modifications, proteolysis, hydrolysis, crosslinking, transglutaminases
- technological modification pressure

Whey protein:
- emulsions
- gels
- foams

crossover

Milk Lipids: Phospholipides

Cephalin:	21 - 45 %
Lecithin:	22 - 48 %
Sphingomyelin:	12 - 35 %
Phosphoatidyl-Inosit:	2 - 11 %
Plasmalogene	2 - 3 %

n. Patton and Renner

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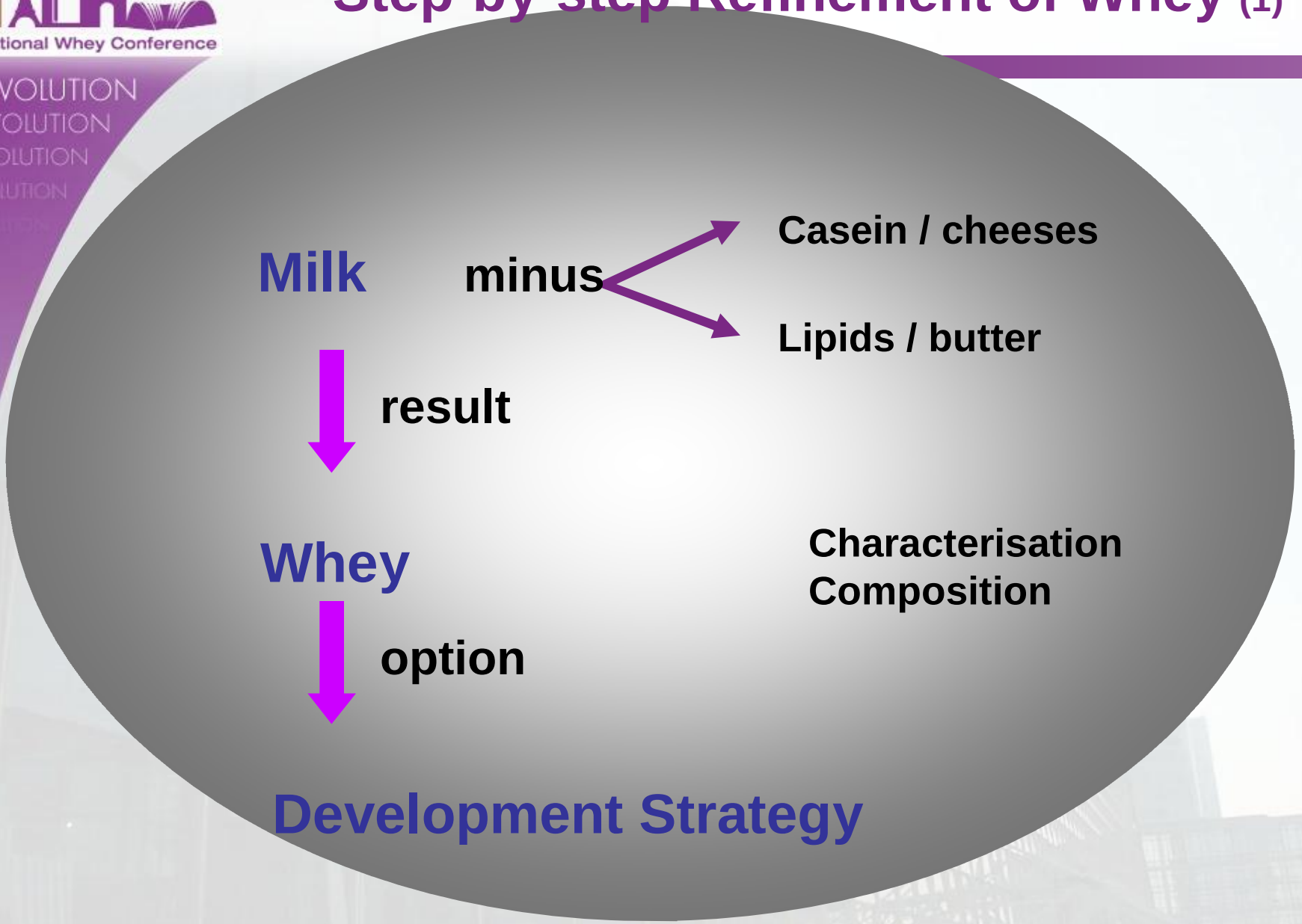
Step-by-step Refinement of Whey (1)



Step-by-step Refinement of Whey (2)

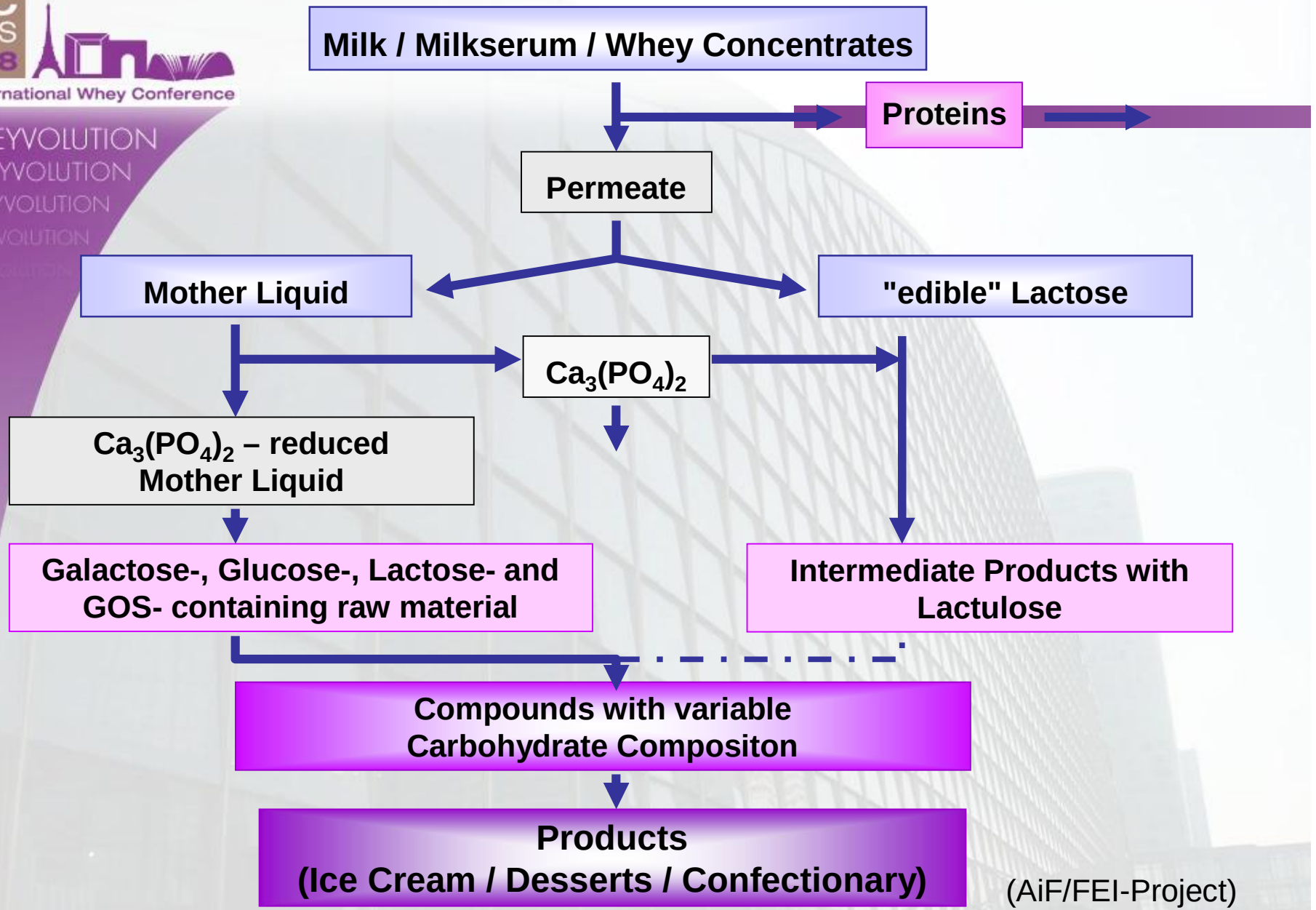
- Level I:Utilisation of traditional biological procedures
  - è e.g.
    - 4 Joghurt
    - 4 Butter
    - 4 cheese
  - è Products:
    - 4 cultures, probiotics
    - 4 exopolysaccharides (S. filans)
    - 4 lacticacid fermentation etc.
- Level II: Fermentation of whey with traditional biotechnology procedures
  - è Fermentation **è** flavor
  - è Enzymes **è** lactose hydrolysis
    è proteolysis
- Level III: Fractionation
  - è Fermentation:
    - 4 Production of bioactive nutrients
    - 4 e.g. vitamines, organic acids

Step-by-step Refinement of Whey (3)

- Level IV: Combined Products
  - è lactose hydrolysis + heat treatment ⇒ sugar colour
    ⇒maillard products
  - è peptides: - bioactive
    - technological functions

    e.g. bio-ingredients / raw materials
    for mayonnaises, dressings, bakery products etc.

- Level V:
  - è Function of whey water
  - è Utilisation as solution of ingredients in whey water
  - è Principle „Golden Liquid“, i.e. direct application of liquid whey or whey fractions



(AiF/FEI-Project)

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Biotransformation & Food Product Research

- Food Biochemistry - Molecular modifications
- Refinement of agricultural raw materials
- Enzymes / Biocatalysts
  a) original
  b) added
  c) contamination
- Enzyme kinetics - processing parameters
  a) matrices
  b) temperature / time
  c) enzyme specificity
- Fermentation: end-product - concept

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Molecular Design of Food Concept

- Food Matrix Expertise
  (interdisciplinary / multifactorial)
- Technology Approach + International Science
  (Emulsions, Gels, Foams, Extrusion, High Pressure, Electropulsation, Ultrasonics)
- Nutrition - Functional Food
  (Bioactive Molecules / Bioavailability)