



ARLA FOODS

# RESEARCH ADDS VALUE

Research Strategy 2012





## Welcome to Research in Arla Foods!

Milk is by nature a unique raw material with superior taste and excellent nutritious properties, which, moreover, can be processed into a wide range of exiting and delighting dairy products and functionalised ingredients. In Arla Foods, our mission is to offer modern consumers milk-based food products that create inspiration, confidence, and wellbeing.

In an increasingly globalising food industry, the competition on acquiring, transforming, and communicating scientific knowledge into new products, production processes and business opportunities is of notorious value for Arla Foods.

In Arla Foods, research must show new and better opportunities to produce sustainable, safe, healthy and profitable high quality dairy products and ingredients for the consumers and customers of today and tomorrow. Research must build up knowledge and skills of key importance to our present and future products and production processes. These include competences within food physics, chemistry, microbiology, and processing together with health, nutrition and consumer preferences.

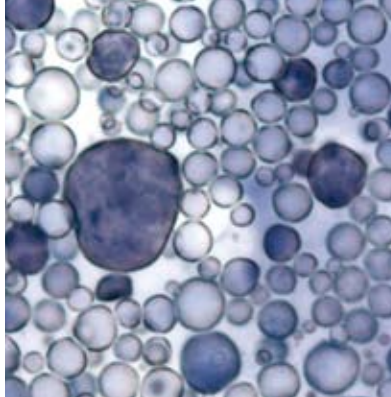
The Arla Foods Research Strategy stresses the crucial importance of supporting research in the entire milk value chain, ranging from farm to consumer wellbeing.

Arla Foods has a long tradition of collaboration with universities and research institutes. Our future research success relies on continuous and extended excellent collaboration with the scientific society in combination with extensive cooperation with commercial partners and our ability to attract and develop qualified and motivated people.

With this I invite you to experience the world of research and scientific priorities within Arla Foods.

Enjoy, please!





A handwritten signature in black ink, appearing to read 'H. Andersen'.

*Henrik Jørgen Andersen,  
Head of Corporate Research  
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## Research Organisation

Arla Foods employs close to 200 highly qualified persons within the area of innovation ranging from basic research to new product development. Research activities in Arla Foods are long-term initiatives, which provide the basis for competence development and knowledge transfer to the remaining innovation chain of importance for product and process development as well as marketing and sales.

Our research activities are organised within six research platforms, each representing a significant element in the milk value chain.



Milk Composition



Flavour and Functionality



Food Safety



Consumer Preferences



Process Development  
and Control



Wellbeing

A research platform coordinator and key representatives from organisational units in Arla Foods constitute each research platform. The research platforms secure effective internal communication of research-based knowledge and coordination and agreement on research needs.

In the following, you will find the vision and description of each of our six research platforms. Each platform contains specific and complementary research priority areas that constitute our overall research strategy. Within each priority area, we present our research needs and the scientific potential in relation to the overall mission of Arla Foods.



“We want to produce differentiated milk types targeted to create health and wellbeing, premium taste, and superior functional properties in our products!”



## Milk Composition

**Changing attitudes and improved economy in the consumer segments are setting new standards in consumer demands for differentiated dairy products. The demand for differentiation leads to increased requirement of documentation in terms of history, quality, safety, health and sustainability.**

Several parameters in primary milk production including breed and feeding together with milking strategy influence the raw milk composition, and ultimately define the natural functional and nutritional properties of the derived dairy products. The continuous development within technology and data handling will in the near future provide the basis for a new and deeper understanding of the complex mutually interacting factors of importance for the milk composition. This also includes the connection between raw milk composition and human health and wellbeing. Accordingly, implementation of advanced systems biology research tools becomes critical in future development of robust, integrated and proactive decision support systems for all actors within the milk supply chain.



## Differentiated milk production using the production system to control milk composition

Research must provide detailed knowledge of the influence of key parameters in the primary milk production on the composition of the derived raw milk. These parameters include cattle breed, feed composition, and farm management including milking procedures and raw milk handling. Establishment of the connection between the compositions of the differentiated milk types and premium taste, functionality and safety in every category of our dairy products and ingredients is of utmost importance.

## Connecting milk composition with human health benefits

Research must provide the analytical tools for robust documentation of the nutritive value of different raw milk types in relation to human health and wellbeing at all stages of human life. Likewise, research must provide the scientific basis for designating optimal downstream processing solutions for protecting key healthy components in raw milk.





“We want to stay competitive by building-in safety in the milk-chain from cow to consumer!”

## Food Safety

**Food safety is a key management target for Arla Foods in ensuring consumer confidence of all our dairy products and ingredients.**

Food safety is not an end-point check, but spans the entire milk chain from farm management to human consumption including physical, chemical and microbiological contaminants as well as potential allergenic issues.

The ultimate goal of our food safety initiatives is to avoid any kind of harmful food safety-related incident. This proceeds through continuous collaboration with scientific and legislative food safety experts combined with proactive implementation of technological countermeasures throughout the milk chain. The integration of dynamic food safety modelling and rapid analytical tools can provide the backbone for robust decision support systems, and has the potential of controlling raw material quality and limit end product holdback time.



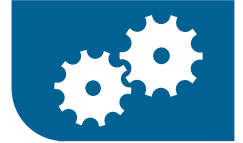
## New integrated safety monitoring methods

Research must provide advanced, yet easy-to-use and robust, analytical technologies for representative, rapid and in-line analyses of microbial, physical and chemical contaminants at critical points in the entire milk chain. Data must provide the basis for documentation and improved traceability. Development of analytical tools for quantifying and monitoring complex harmful multi-species microbial activities and their individual interplay together with other safety related issues in dairy processes and products is of high priority.

## Prediction of safety

Research must provide the tools for performing predictive modelling of the proliferation and suppression of pathogens and other contaminants throughout the entire milk chain. Model systems should iteratively include analytical data for generation of quantitative risk evaluations and suggested countermeasures.





“We want to create the basis for rational and flexible dairy processing using dis- and reassembling technologies and integrated process control!”

## Process Development and Control

**Raw milk is by far the most expensive part of processed dairy products and ingredients. Production efficiency and waste reduction can generally be achieved by securing full and optimal usage of the raw material and production capacity.**

For our entire dairy processing steps, the common goal is to secure cost-beneficial production and high product quality.

Cost-beneficial production of especially differentiated dairy products demands flexible production systems, and this can be obtained by integrating initial separation and partial processing of minor or major milk constituents with subsequent tailored recombination of semi-processed base products. Hereby, key milk constituents affecting product functionality and even health benefits can be kept intact or modified in a controlled manner.

Continuous and direct monitoring of raw material and process streams is key in controlling integrated flexible production processes, and sensor systems and data processing play an important role, also in relation to process design.





## Process analytical technologies

Research using multivariate data analysis must identify the critical physicochemical factors in all types of dairy processes that should be subject for control to secure quality, safety as well as process efficiency. Robust and sensitive analytical tools should be developed and adapted accordingly. Process characteristics like mixing properties, gel firmness, milk composition, as well as microbiological status are relevant examples.

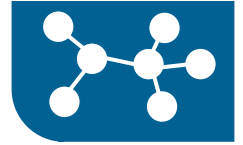
Process analytical technology must provide process understanding and facilitate easier scale-up. Dynamic process simulation should be a prerequisite for designing efficient and flexible integrated dairy processes.

## Dis- and reassembling

Research must provide the technologies for cost-beneficial separation of raw milk and subsequent flexible recombination of minor or major components to achieve superior quality and safety. These include formulation technologies like dosing and mixing. Process simulation tools should be developed within the concept of flexible process design, and also employed on existing production technologies.



“We want to provide the basis for demanded product properties within flavour and functionality!”



## Flavour and Functionality

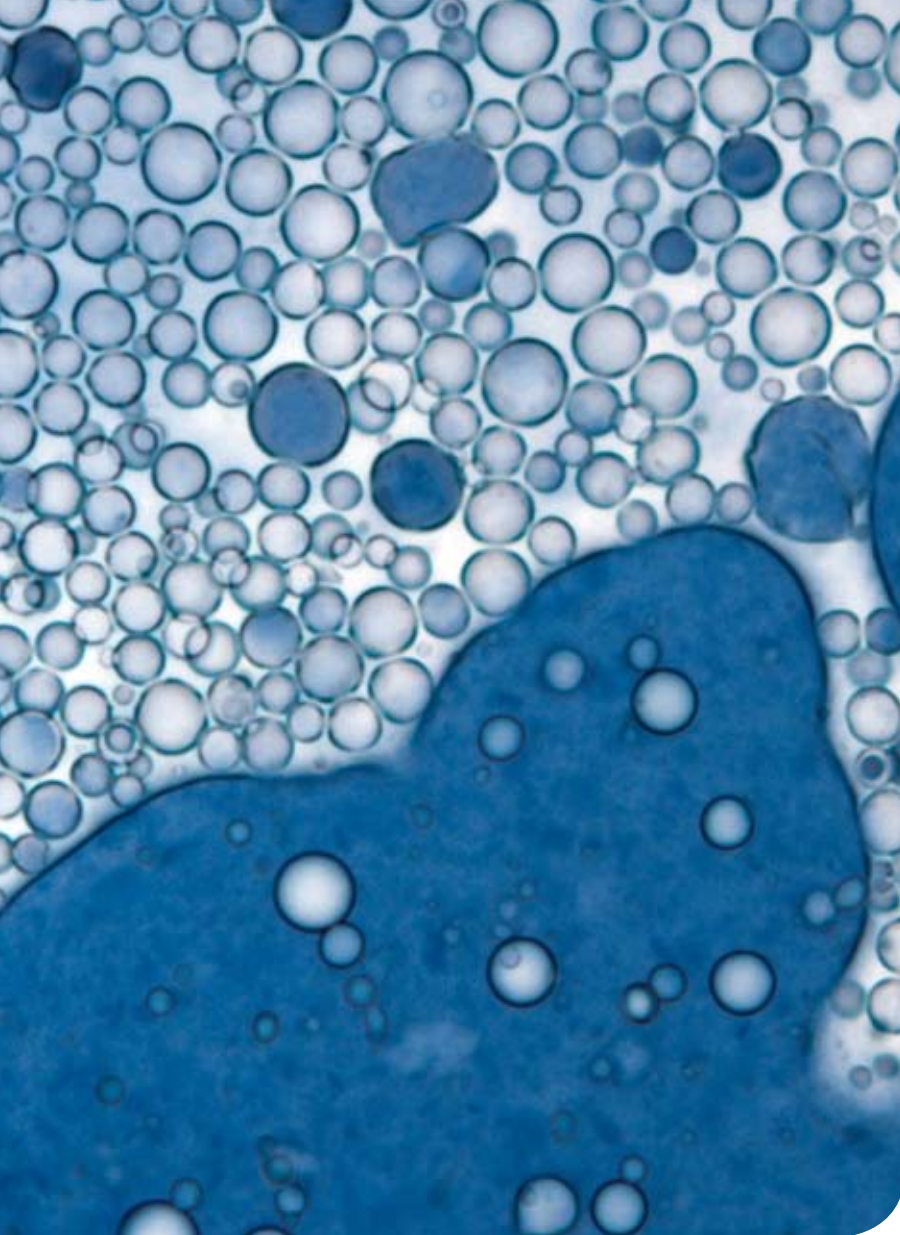
**Texture, taste and odour are the main contributors to overall sensory perception of dairy products. The ability to design and control flavour and functionality is a prerequisite for future successful product development.**

Gradually, a variety of non-dairy ingredients has been introduced into typical dairy products and dairy ingredients into non-dairy products, raising both challenges and possibilities within the control of flavour and functionality. And the tendency of separating and recombining semi-processed ingredients and process streams is expected to continue in the future.

Alongside mechanical dairy processing, microbial fermentation is key in the complex flavour and texture formation in a range of dairy products, and future development of bioinformatics and systems biology will make it feasible to control and differentiate these processes far more precise than today.

For all products and ingredients, the understanding and prevention of oxidative, microbial and enzymatic deterioration is essential to safeguard optimal shelf life within and beyond the supply chain.





PRIORITY AREAS

## Protein and lipid functionality

Research must provide expert knowledge within the influence of protein denaturation, aggregation, lactosylation, oxidation, cross binding and hydrolysis on functional properties such as solubility, gelling and water mobility. The crystal structures of different dairy lipid fractions must be explored in detail. Generally, dairy products and ingredients – eventually including non-dairy ingredients - must be explored in detail with the aim of relating a designed product microstructure to flavour perception.

## Flavour formation and control

Research must envisage the relation between different compositions and dairy processing on the formation and release of flavour. Tailored microbial fermentation and enzymatic processing should be developed aiming at forming desired flavours and microstructures. Shelf life technologies should be developed to control oxidation and Maillard reactions along the supply chain, and these should include emulsification, encapsulation, antioxidant systems and packaging.

“We want to provide tools for better understanding of consumer preferences and behaviour!”



## Consumer Preferences

**Information is flowing ever faster, new channels emerge continuously and the behaviour and preferences of the individual consumer shifts rapidly.**

Simple yet effective internet-based subcultures and discussion fora often initiate new trends overnight. The life cycle of new products is decreasing, and competition is intense at all markets. Accordingly, the era of dividing markets into specific classical consumer segments has vanished.

Successful product launches require excellent understanding of upcoming market trends and strong branding, ultra short product development time, and the ability to meet or even exceed consumer expectations.

The perception of a product is not restricted to its sensory profile alone, but is associated with a range of impressions during the shelf life of the product. This includes its marketing, positioning at the point of sale, packaging design and usability, sensory profile, versatility, perceived wellbeing, shelf life and ease of waste disposal.



## Complex sensory phenomena

Research must provide the understanding of complex sensory phenomena such as product microstructure in relation to perception. Research within molecular gastronomy can assist this. Furthermore, research must enable the formulation of sensory descriptors that support product development, package design and marketing.

## Methods for integrated preference studies

Research within observations of consumer behaviours during shopping, selection, and usage should reveal key psychological mechanisms behind both product-specific and general consumer preferences. The integration of advanced sensory analyses of products, branding, packaging and understanding of consumer behaviour should be performed to develop model concept tools for all dairy product categories.





“We want to provide the basis for promoting dairy products that increase the wellbeing of the consumer!”

## Wellbeing

**Health and wellbeing are major trends in the global food market, already having significant influence on consumer behaviour, preferences and choices.**

Wellbeing is recognized in different situations of consumption ranging from the ‘mental health’ experience upon eating organic yoghurt, a designed milk drink matching your personal genetic profile and reducing your risk of developing osteoporosis, to a well-tasting traditional low fat cheese that fulfills your everyday needs.

Today, products containing probiotic are the fastest growing food category within the health and wellbeing area. Products with well-documented probiotic effects and substantial health claims are foreseen to create the value added growth in the health area.

Milk contains by nature a wide range of nutritious components, which are designed to give a superior start for the newborn mammal. New analytical tools make it possible to explore the potential functionality including specific health effects of these milk components, which subsequently have to be translated to their specific health effects in dairy products and milk-based matrices.





## Gut health

Research must focus on the significance of milk components on gut health and concomitant systemic effects in relation to human health. In this sense, immune system responses and fat metabolism effects are of interest. We need to gain a thorough understanding of how mixed probiotic strains, prebiotics, and bioactive milk peptides isolated or in combination affect gut health.

## Milk ingredients and health

Research must explore the exact physiological mechanisms of the effects of milk components on human health. Besides clinical documentation of the effects of milk calcium and specific peptides in relation to weight management and hypertension, respectively, focus should be put at understanding the role of milk protein in relation to satiety, muscle recovery after physical exercise, and the immune system. Considering that dairy products seldom constitute a meal alone, the health effects of specific milk components should be seen in relation to a complete diet, and hence in interaction with other food components.

## Health aspects of milk fat

Research must pursue recent findings indicating that ingestion of milk fat might reduce the risk of developing both cardiovascular disease and the metabolic syndrome. Specifically, a thorough understanding of whether these effects are caused by the specific fatty acid composition in milk fat, minor components in milk fat such as phospholipids, interactions between milk components and other dietary components or microstructural presentation, is highly needed.



## Arla Foods in Brief

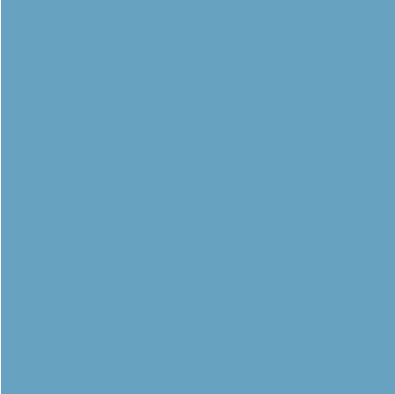
Arla Foods is a dairy cooperative with home markets in Denmark, Sweden and United Kingdom. Danish and Swedish milk farmers own Arla Foods, and supply the majority of the milk for further processing to the company.

Arla Foods is a leading supplier of a wide range of dairy products to the Northern European and UK market. Furthermore, Arla Foods operates in other important markets using national sales offices and production facilities, in several cases as the market leader.

Our production is mainly centered on modern, efficient dairy plants at our home markets. We serve other markets by export or local production using highly qualified workforce.

In addition Arla Foods is one of the leading suppliers of highly specialised milk-based ingredients for the international food industry.

Additional information about Arla Foods and our research, development and collaboration can be found at our website.





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