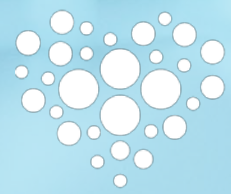




# DISCOVERING HEALTH EFFECTS OF DAIRY AND DAIRY INGREDIENTS



ARLA  
FOOD  
FOR  
HEALTH



**3 GOOD HEALTH AND WELL-BEING**

1 NO POVERTY

2 NO HUNGER

3 GOOD HEALTH AND WELL-BEING

4 QUALITY EDUCATION

5 GENDER EQUALITY

6 CLEAN WATER AND SANITATION

7 RENEWABLE ENERGY

8 GOOD JOBS AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

10 REDUCED INEQUALITIES

11 SUSTAINABLE CITIES AND COMMUNITIES

12 RESPONSIBLE CONSUMPTION

13 CLIMATE ACTION

14 LIFE BELOW WATER

15 LIFE ON LAND

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

17 PARTNERSHIPS FOR THE GOALS

**THE GLOBAL GOALS**  
For Sustainable Development

POPULATION:

**10** BILLION  
IN 2050



**1.9**  
BILLION

Adults, 18 years and  
older, are overweight

**>600**  
MILLION

of these are  
obese

**462**  
MILLION

Adults are underweight

**>200**  
MILLION

<5 is stunted/wasted





# RELEASING THE POTENTIAL OF DAIRY





# CREATING VALUE FOR PEOPLE, SCIENCE AND BUSINESS THROUGH COLLABORATION





# ARLA FOOD FOR HEALTH

A TRUE PUBLIC-PRIVATE PARTNERSHIP IN GLOBAL DAIRY NUTRITION RESEARCH



AARHUS UNIVERSITET



**Arla Foods Ingredients**  
Discovering the wonders of whey 



PARTNERSHIP



EXCELLENCE



TALENT



SHARING

DISCOVERING  
HEALTH EFFECTS  
OF DAIRY  
AND DAIRY  
INGREDIENTS

# THIS IS HOW WE ARE ORGANISED TO REALISE OUR VISION





# RESPONDING TO THREE RESEARCH NEEDS



**METABOLIC SYNDROME**



**MALNUTRITION**



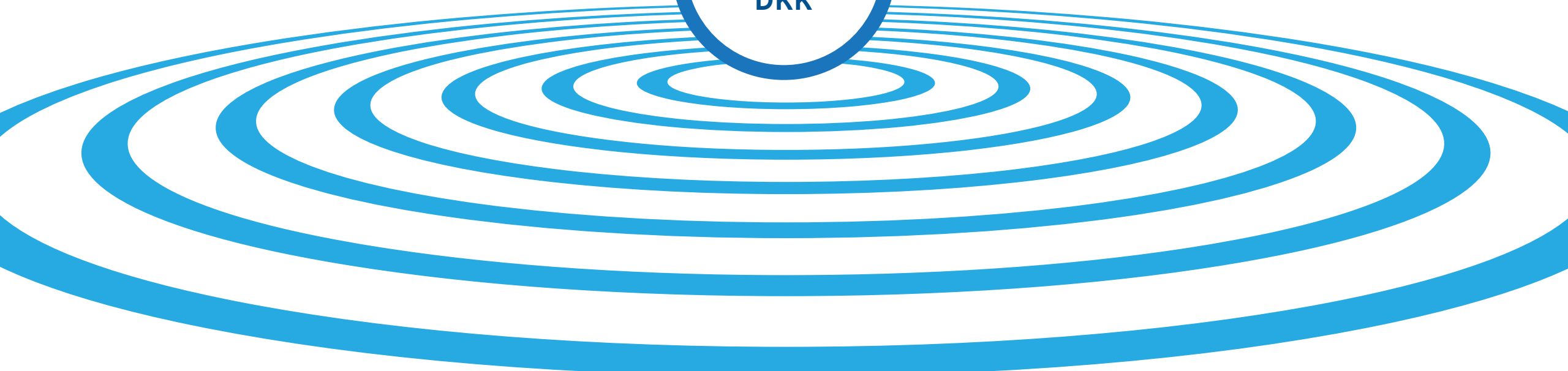
**IMMUNE DEFENSE**





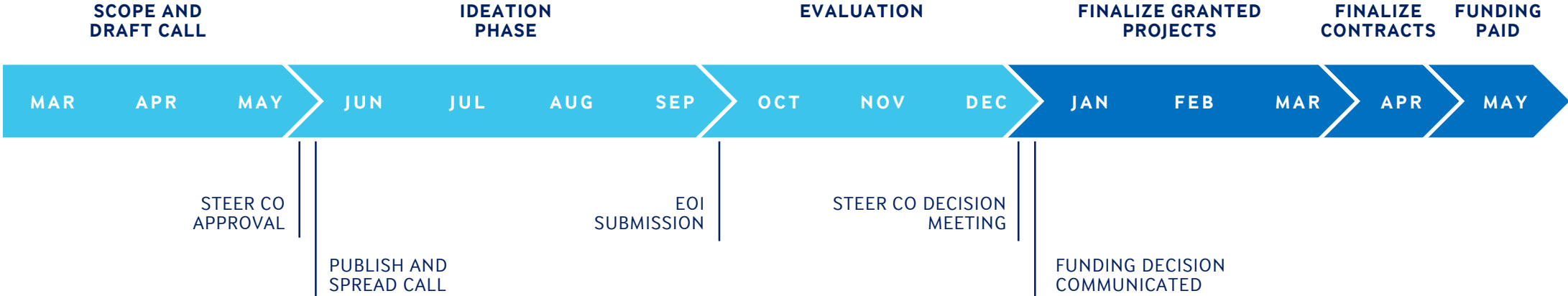


# FUNDING INSPIRING FURTHER FUNDING





# OPENING THE DOOR FOR TALENTED SCIENTISTS AND GREAT SCIENCE – CALLS, EVALUATION AND ACTIONS





**SECURING  
TRANSPARENT  
AND  
INDEPENDENT  
RESEARCH**





# THE SCIENTIFIC ADVISORY BOARD

SCIENTIFIC QUALITY AND RELEVANCE



LINDSAY H. ALLEN



J. BRUCE GERMAN



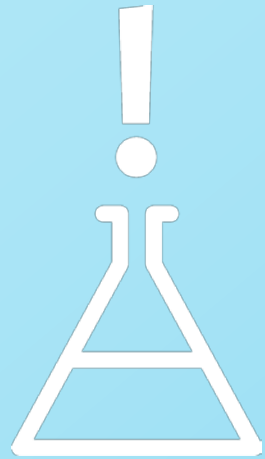
LUCA COCOLIN



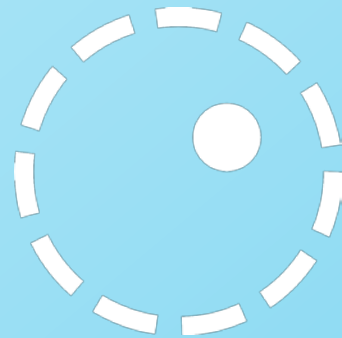
ALAN KELLY



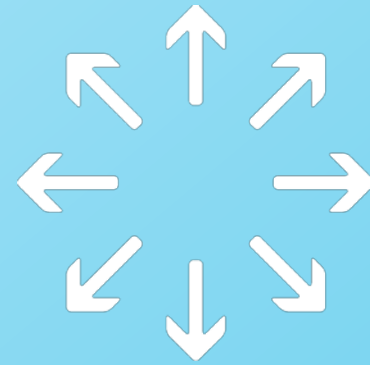
# OUR CRITERIA FOR IDENTIFYING EXCELLENCE



**SCIENTIFIC  
QUALITY AND  
RELEVANCE**



**INSIDE CALL**



**IMPACT**



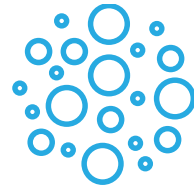
**RESEARCH  
COLLABORATION**

# WE ARE CURRENTLY SUPPORTING TEN EXCITING PROJECTS



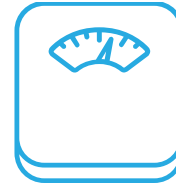
## InfantBRAIN

Valorisation of milk fat globule membrane enriched ingredients



## DairyMat

Designing biofunctional dairy foods: matrix structure of dairy products in relation to lipaemia



## OmniSam

A multimodal metric for predicting the satiating effects of real foods and drinks



## EnMet

ENergy METabolism - the molecular mechanisms governing the beneficial effects of milk-derived proteins



## MiPUAge

Milk Protein Utilisation and Age



## Stimmune

Bioactive milk diet to stimulate gut immune defense in infants born with perinatal inflammation



## CutDM

Cut down on carbohydrate usage in the diet of type 2 diabetes



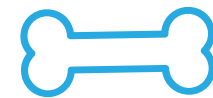
## TAKE

TAilor-made KEto-dairy nutrients to combat post-inflammatory protein and muscle waste



## MAGMAM

Milk and Growth in Moderate Acute Malnutrition



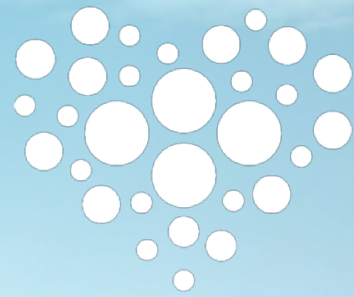
## D-pro

Effects of milk protein and vitamin D on children's growth and health



# ARLA FOOD FOR HEALTH CONNECTS WITH THE ENTIRE WORLD





ARLA  
FOOD  
FOR  
HEALTH

DISCOVERING HEALTH EFFECTS OF  
DAIRY AND DAIRY INGREDIENTS



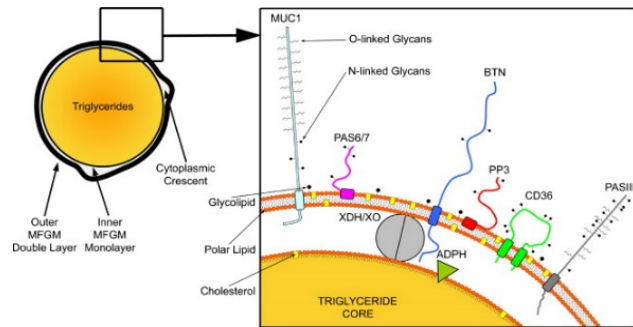




# InfantBRAIN

Identify lipid fractions from milk that support infant brain development and cognitive function

**The milk fat globule membrane (MFGM)** surrounds all fat globules in milk. It has recently received widespread attention as a value-added ingredient in e.g. infant formulas.



(Dewettinck et al., 2008)

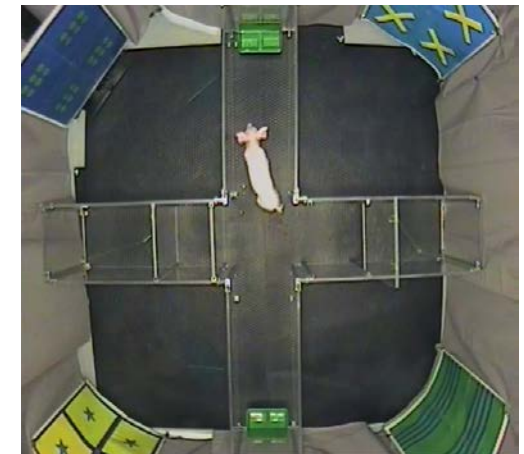
New types of MFGM fractions



*In-vitro and in-vivo trials:*

- i) In-vitro digestion studies of Oil/Water emulsions
- i) Digestion studies in piglets
- ii) Cognition study in piglets

0





# DairyMat

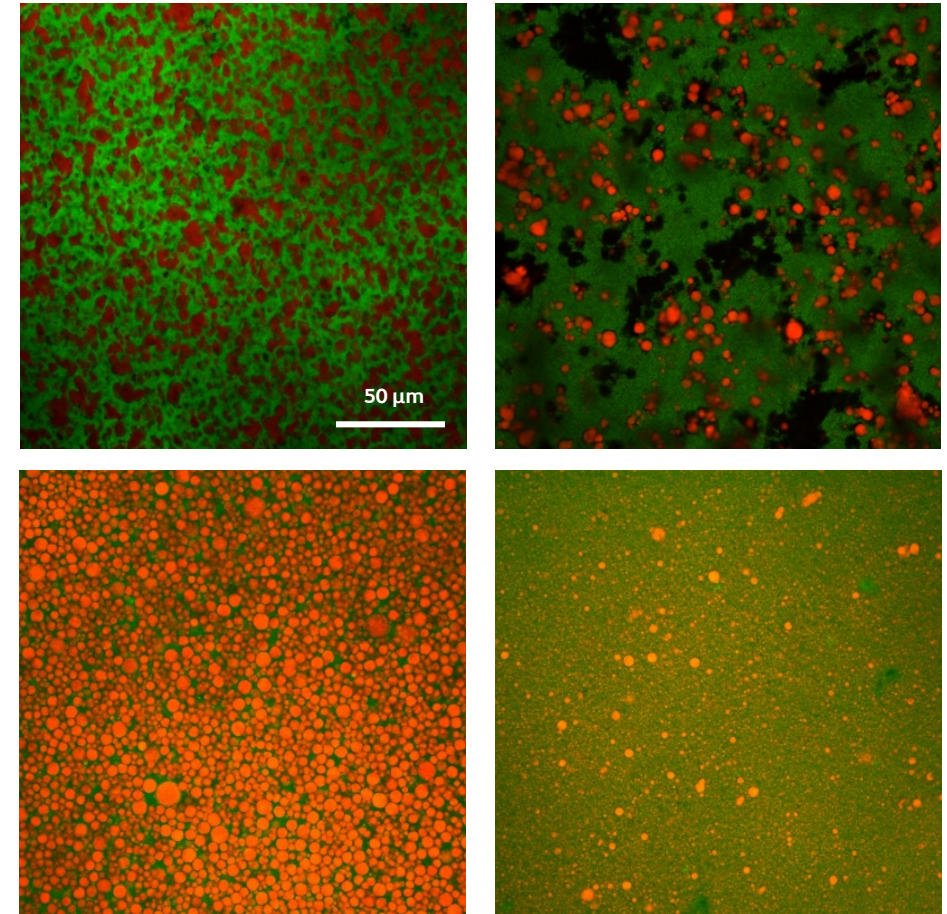
Designing biofunctional dairy foods: matrix structure of dairy products in relation to lipemia

Evidence has emerged that the postprandial response is fundamental for understanding how the diet contributes to development of lifestyle-related diseases such as the metabolic syndrome.

Structurally different dairy food matrices with identical nutrient composition of fat, protein, carbohydrate, and minerals are hypothesized to affect the postprandial lipemia. The project presents a novel and new interdisciplinary approach, where food structure and texture, *in vitro* digestibility, *in vivo* human postprandial response and metabolomics are combined to elucidate the correlation hypothesized.

Four dairy products representing solid to liquid textures, with native or homogenized milk fat globules, and with/without protein network structure are developed. A cross-over postprandial study with 25 participants (or 20 completers) offered these products is performed. Blood samples are analysed for response in triglyceride concentration, lipoproteins, free fatty acids, glucose, insulin, and metabolites.

We expect to gain knowledge of which structures of dairy matrices modulate the lipid uptake, and how these structures can be used strategically to change kinetics of the postprandial fat absorption.



Confocal Laser Scanning Micrographs of dairy structures; green = protein, red = fat.



# OmniSam: The Omnibus Satiety Metric

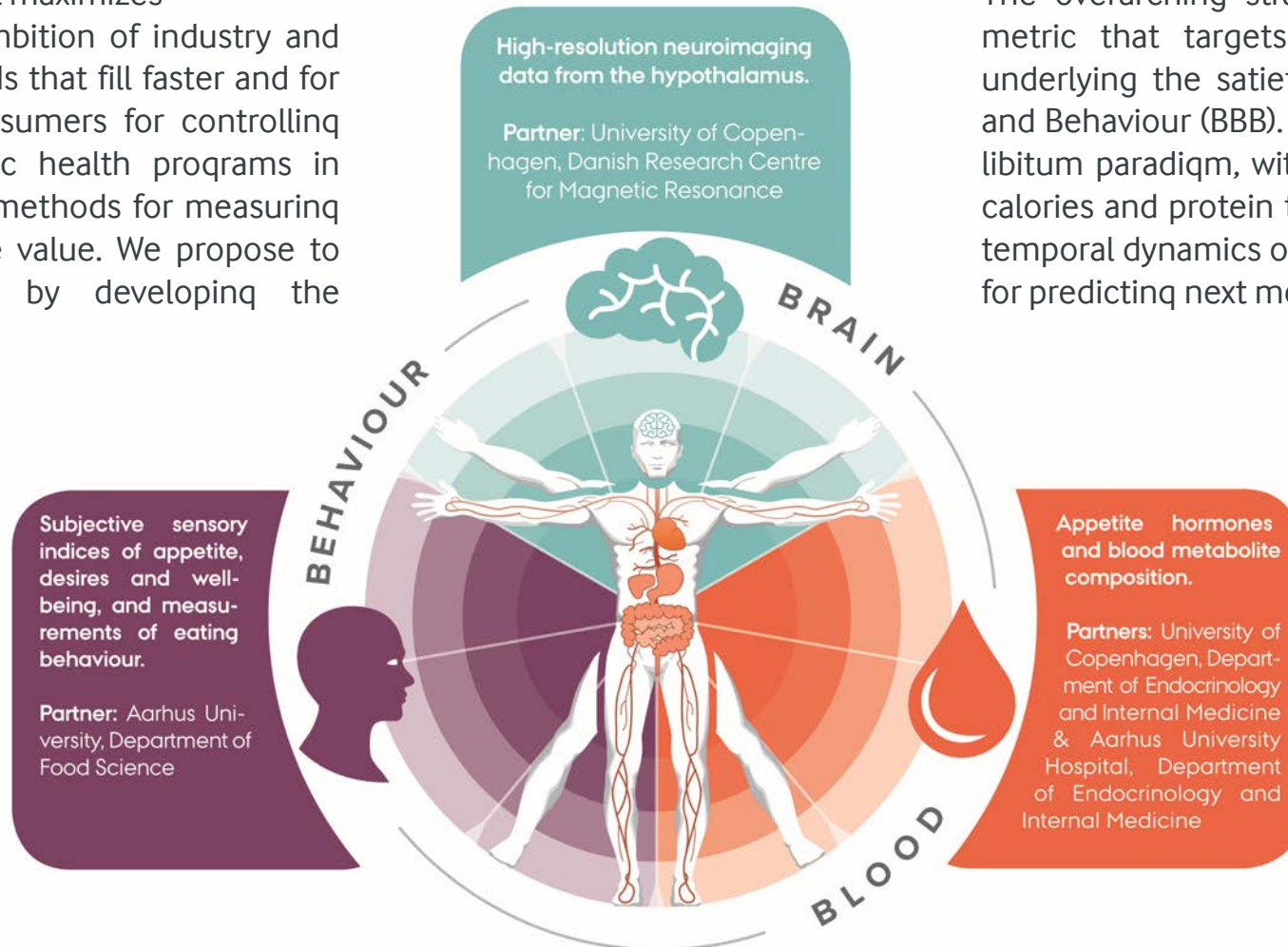
A multimodal metric for predicting the satiating effects of real foods and meals

## BACKGROUND

Designing food and drink that maximizes satiety has long been an ambition of industry and public health programs. Foods that fill faster and for longer are desirable to consumers for controlling their weight, and for public health programs in obesity prevention. Current methods for measuring satiety have weak predictive value. We propose to overcome this deficiency by developing the Omnibus Satiety Metric.

## PURPOSE

The overall purpose of the OmniSam project is to develop a proof-of-concept satiety metric that provides accurate predictions of the satiating effects of real foods and drinks.



## STRATEGY

The overarching strategy is to develop a multi-modal metric that targets the full spectrum of processes underlying the satiety cascade composing Brain, Blood and Behaviour (BBB). Subjects will undergo a preload - ad libitum paradigm, with a 2-parameter factorial design of calories and protein to carbohydrate ratio. Extracting the temporal dynamics of BBB data, we will compute a metric for predicting next meal energy consumption.

## CONTACT

Aarhus University  
Department of Food Science

Project leader:  
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Daily coordinator:  
Dr. Barbara V. Andersen  
[barbarav.andersen@food.au.dk](mailto:barbarav.andersen@food.au.dk)

Website: [www.omnisam.au.dk](http://www.omnisam.au.dk)

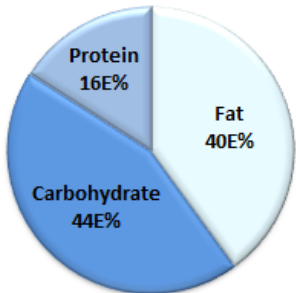


# EnMet

Milk proteins as regulator of obesity through modification of ENergy METabolism and gut microbiota

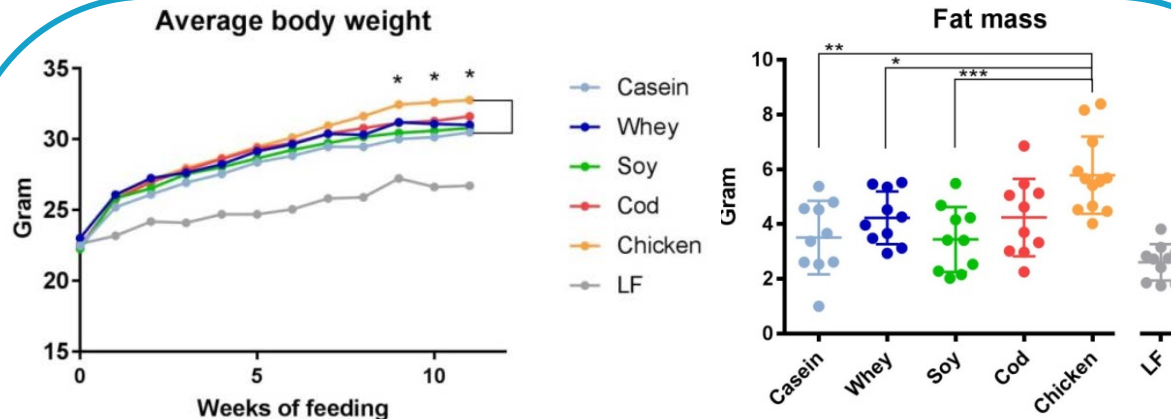


## Western diet



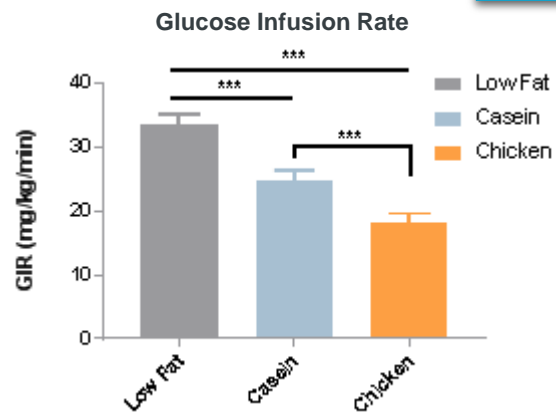
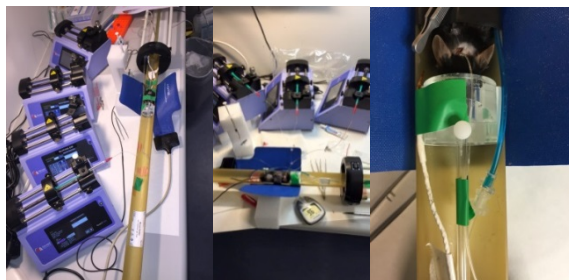
Mice were given a Western diet with either casein, whey, soy, cod or chicken as the only protein source to compare the obesogenic potential of different proteins ingested in normal amounts

## Results



Chicken-fed mice gain more weight than casein-fed mice, and chicken-fed mice gain more fat mass than casein, whey or soy-fed mice

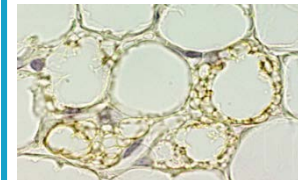
## Hyperinsulinemic euglycemic clamp



Even short-time feeding with a chicken-based Western diet decreases whole-body insulin sensitivity

## Upcoming

### Histology



### RNA seq



### Hyperpolarisation



And more



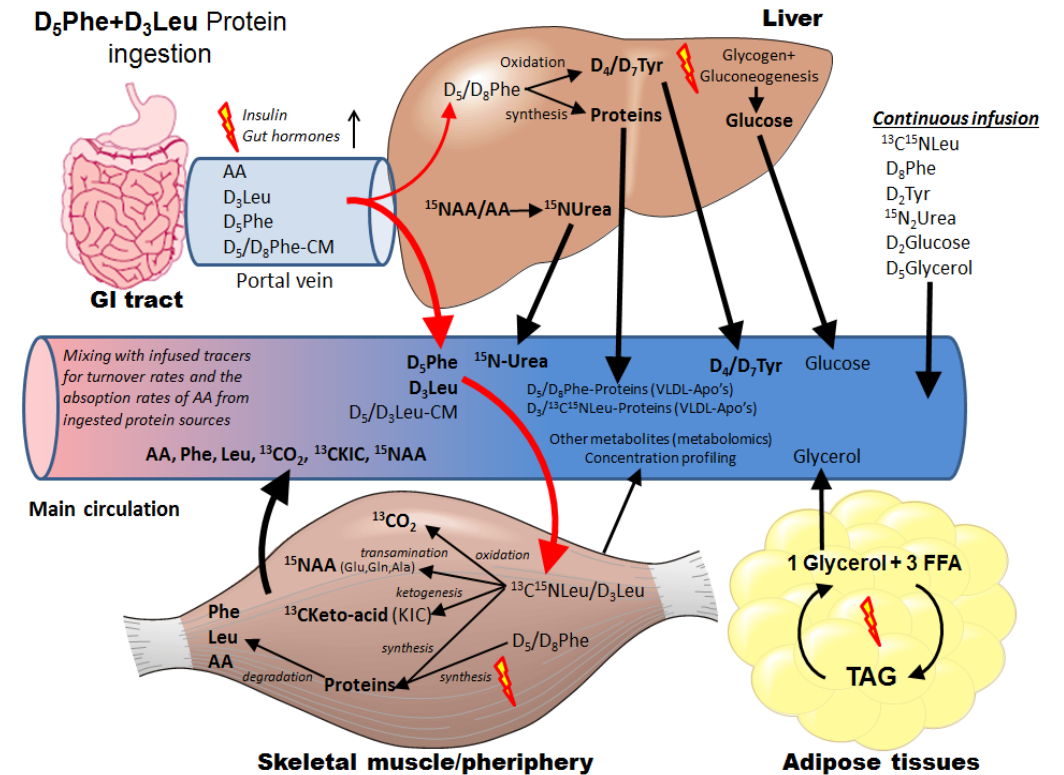
# MiPUAge

Whey and casein-derived protein ingredients: gastro-intestinal absorption, whole body utilization, and hormonal and metabolic regulation: a metabolomics approach

This project investigates how age affects the body's handling of differently characterized dietary milk-based protein ingredients in terms of digestion, respective amino acid absorption and the effect on whole body protein synthesis and degradation, hormones and metabolic regulation. State of the art stable isotope milk protein labelling and continuous infusion and mass-spectroscopy are employed to yield most precise results.

Therefore, in this project intrinsically stable isotope labeled milk-derived ingredients will be produced and used in the clinical trials with healthy young (19-25 years) and elderly (65+ years) individuals to determine *in vivo* digestion and metabolic rates.

Project leader:  
Professor Gerrit van Hall  
Biomedical Science, SUND, KU  
gerrit.van.hall@regionh.dk

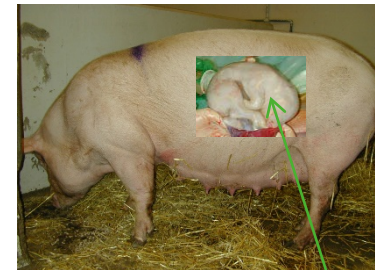




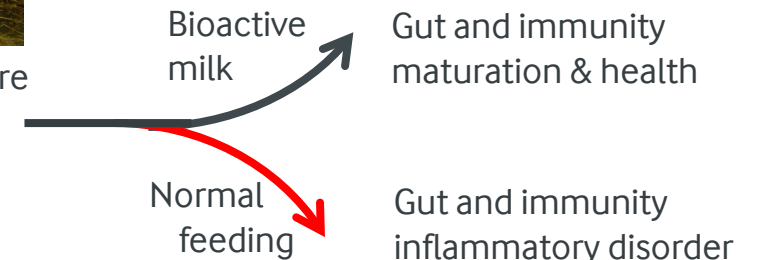
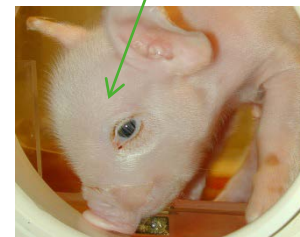
# STIMMUNE

Bioactive milk diets to stimulate immune defense in neonates born with perinatal inflammation

- Establish two new animal (piglet) models of perinatal inflammation, just before and after birth
- Investigate the effects on host gut functions and immunity, including metabolomics analyses
- Use the models to test the immunomodulatory effects of bovine caseinoglycomacropeptide, osteopontin and colostrum
- Apply novel -omic techniques (proteomics, transcriptomics and microbiome) to elucidate mechanisms of perinatal inflammation-induced systemic and gut disorders
- Investigate if perinatal inflammation results in dysregulated gut/systemic immunity in infants



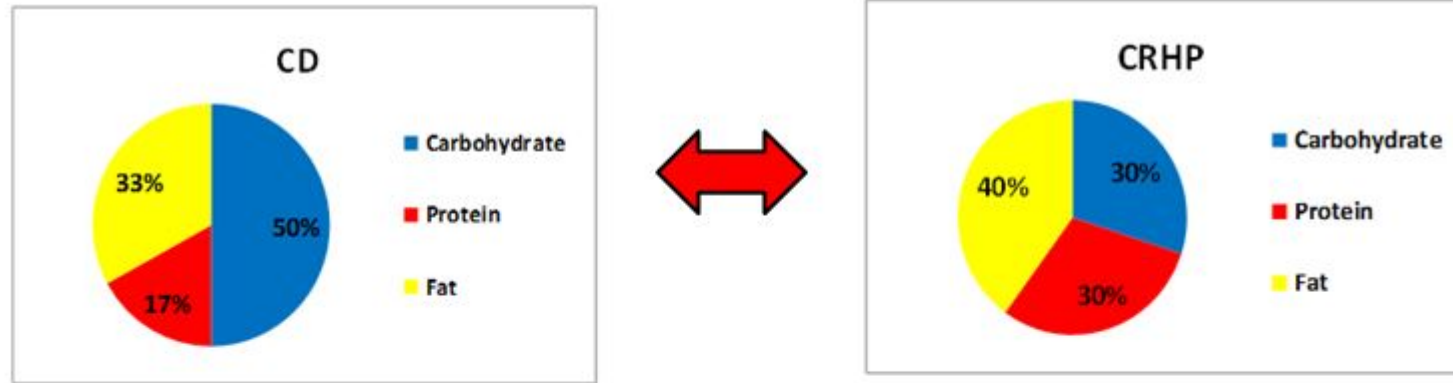
Inflammation just before or after birth





# CutDM

Establish if a carbohydrate-reduced high-protein diet has beneficial effects on people with type 2 diabetes



## Aim and hypothesis

To examine whether a carbohydrate reduced high protein (CRHP) diet compared with a conventional (CD) diet will:

Improve metabolic control by

- reducing postprandial plasma glucose excursions
- reducing diurnal blood glucose excursions
- reducing HbA1c

Improve cardiovascular markers by

- increasing heart rate variability
- reducing diurnal blood pressure
- reducing fasting triglycerides



# TAKE

Effect of protein type on combatting post-inflammatory protein and muscle waste

## THE IDEA & "DISEASE" MODEL

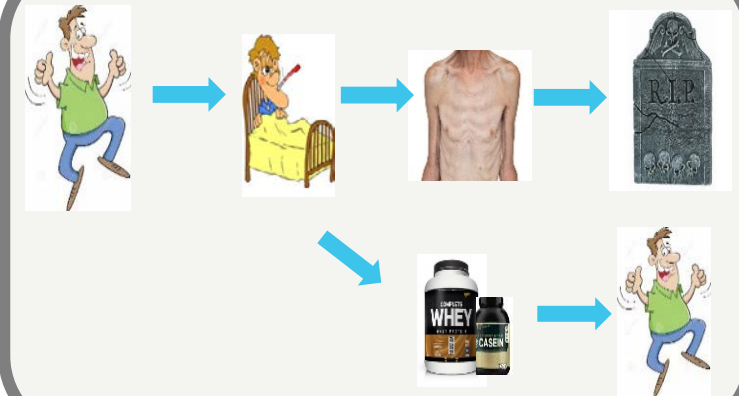
**BACKGROUND:** Loss of muscle protein during inflammatory disease and hospitalisation is a big problem, and is strongly associated with increased risk of death. Protein supplementation can reduce muscle loss. Especially leucine-rich supplements seem to be beneficial in performance sports. However, whether one protein type is superior to another during acute inflammatory disease needs further investigation.

**RISK FACTORS FOR MUSCLE LOSS:** Bed rest, decreased/no food intake and inflammation accelerates muscle loss.

**NEW "DISEASE" MODEL:** E. coli Lipopolysaccharide induced inflammation + 36-hour fast and bed rest mimics real inflammatory disease.

**HYPOTHESIS:** Leucine-enriched whey is superior to whey, which is superior to casein in maintaining muscle protein in the "New Disease Model".

## DESIGN



## INTERVENTIONS

1. Leucine-enriched whey
2. Whey
3. Casein





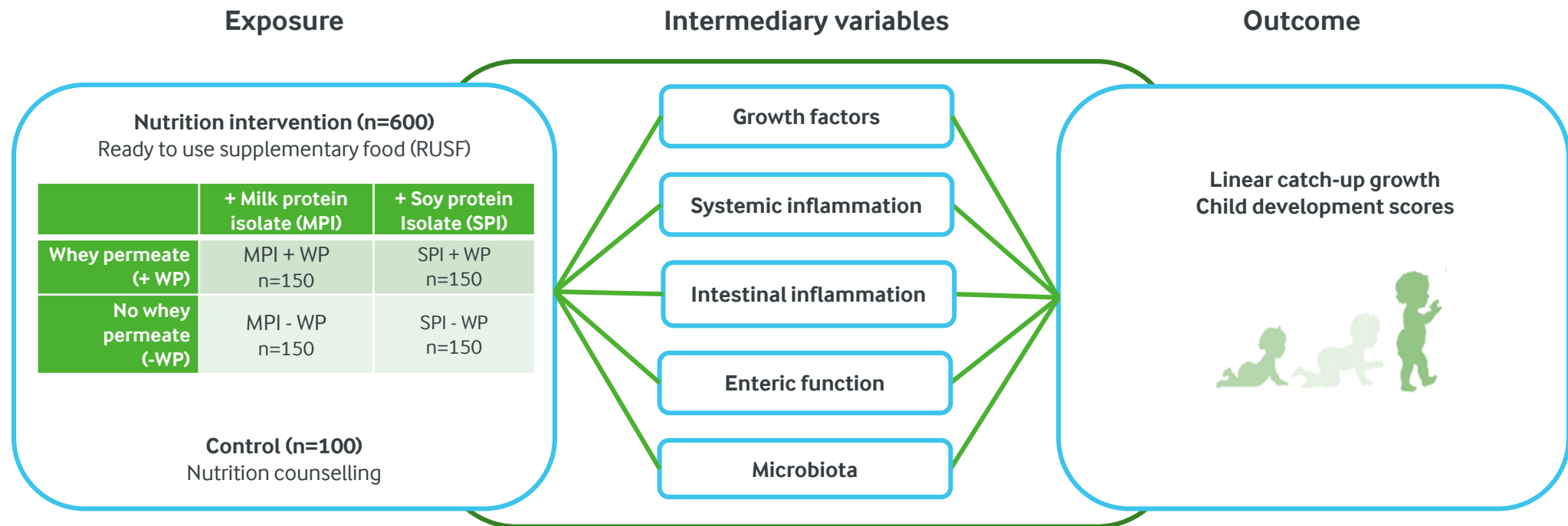
# MAGMAM

Milk and growth in moderate acute malnutrition



Photo: unicef.org

Objective: To assess the effectiveness of milk or soy protein isolates with or without whey permeate in the management of moderate acute malnutrition in Ugandan children aged 24-59 months





# D-pro

## Background

Consumption of milk and milk proteins as well as vitamin D have been positively associated with bone health, growth, lean mass, muscle strength and cardiometabolic health. However, most randomized trials have been conducted in adults and we lack evidence in children.

## Aim

To investigate the combined and separate effects of milk protein and vitamin D on bone health, growth, muscle strength, body composition and cardiometabolic health in 6-8 year-old children.

## Contacts

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Mette Hansen: [mhan@ph.au.dk](mailto:mhan@ph.au.dk)

