DISCOVERING HEALTH EFFECTS OF DAIRY AND DAIRY INGREDIENTS


1 NO POVERTY
2 NO HUNGER
3 GOOD HEALTH
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 RENEWA ENERGY
13 CLIMA ACTIO
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
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

690 MILLION
Undernourished

>200 MILLION
Children are stunted or wasted

WHO

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

UNIVERSITY OF COPENHAGEN

Arla Foods Ingredients
Discovering the wonders of whey

Arla

PARTNERSHIP

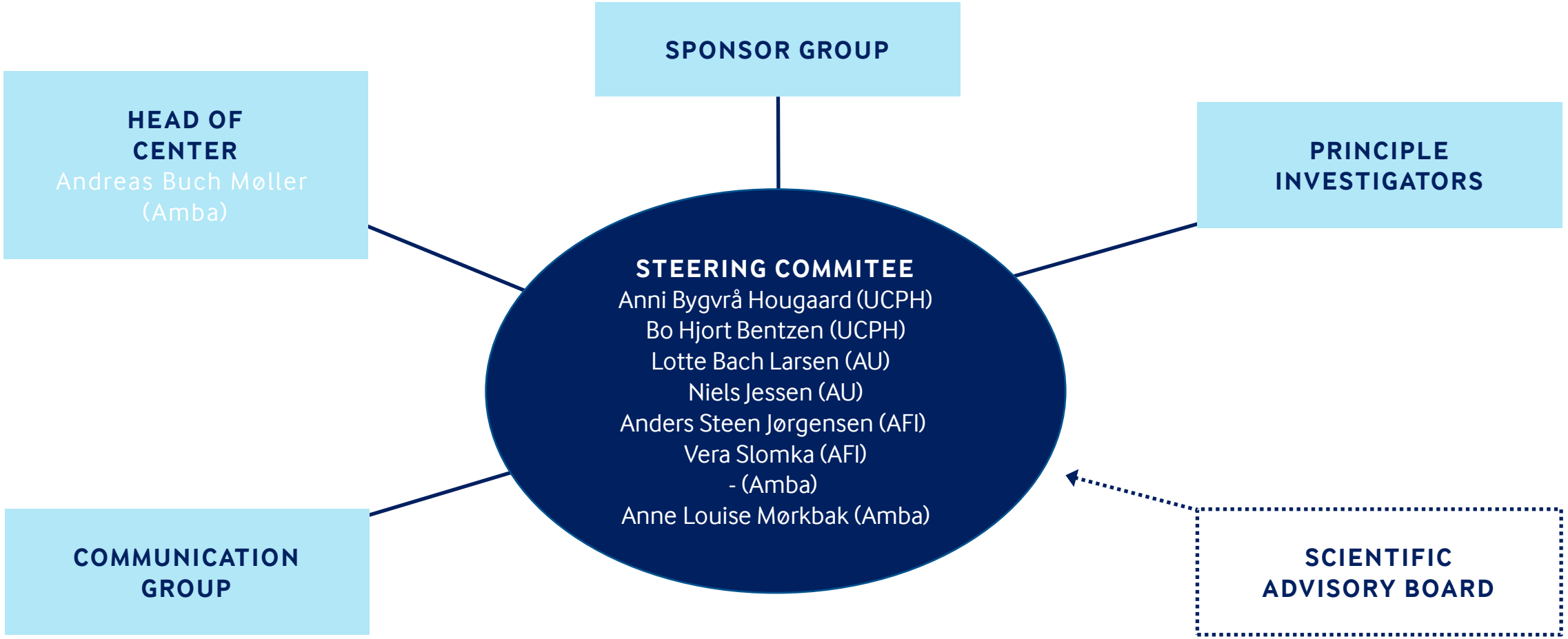
EXCELLENCE

TALENT

SHARING

DISCOVERING HEALTH EFFECTS OF DAIRY AND DAIRY INGREDIENTS

HOW WE ARE ORGANISED TO REALISE OUR VISION



THE SCIENTIFIC ADVISORY BOARD

SCIENTIFIC QUALITY AND RELEVANCE

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US Department of Agriculture

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University of California, Davis

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Chalmers University of Technology

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University College Cork

ARLA FOOD FOR HEALTH RESEARCH STRATEGY

DISCOVERING HEALTH EFFECTS OF DAIRY AND DAIRY INGREDIENTS

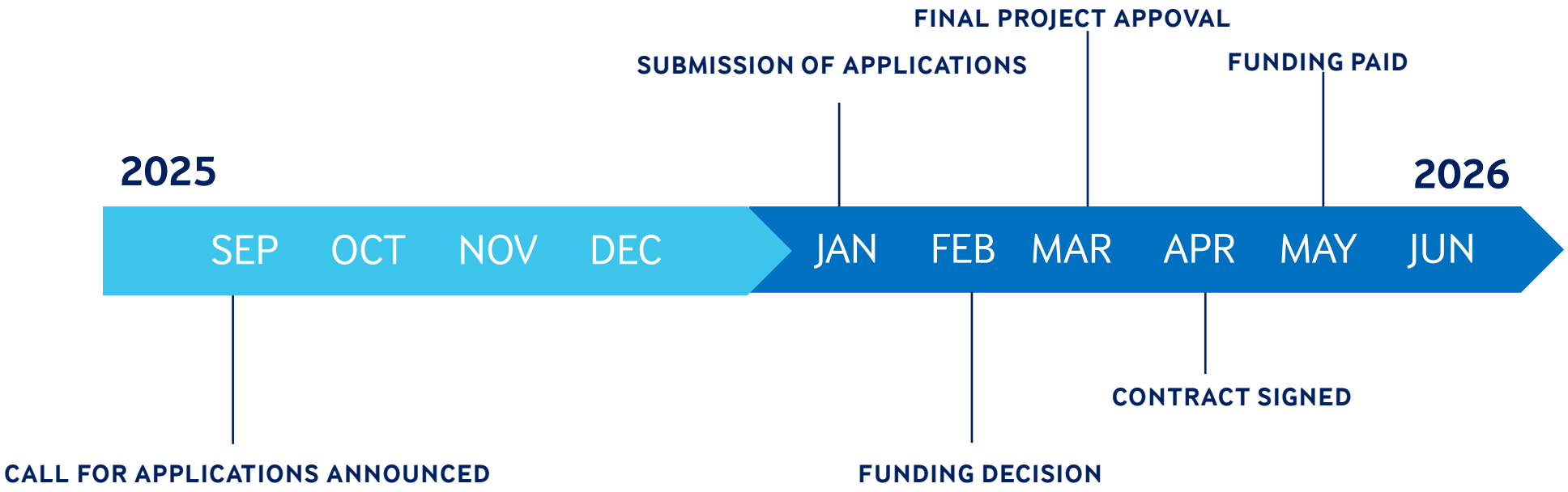
METABOLIC HEALTH

GASTRO-INTESTINAL HEALTH

HEALTHY GROWTH AND DEVELOPMENT

NUTRITION RESEARCH

OPENING THE DOOR FOR TALENTED SCIENTISTS AND GREAT SCIENCE – YEAR WHEEL



OUR CRITERIA FOR IDENTIFYING EXCELLENCE

SCIENTIFIC QUALITY AND RELEVANCE

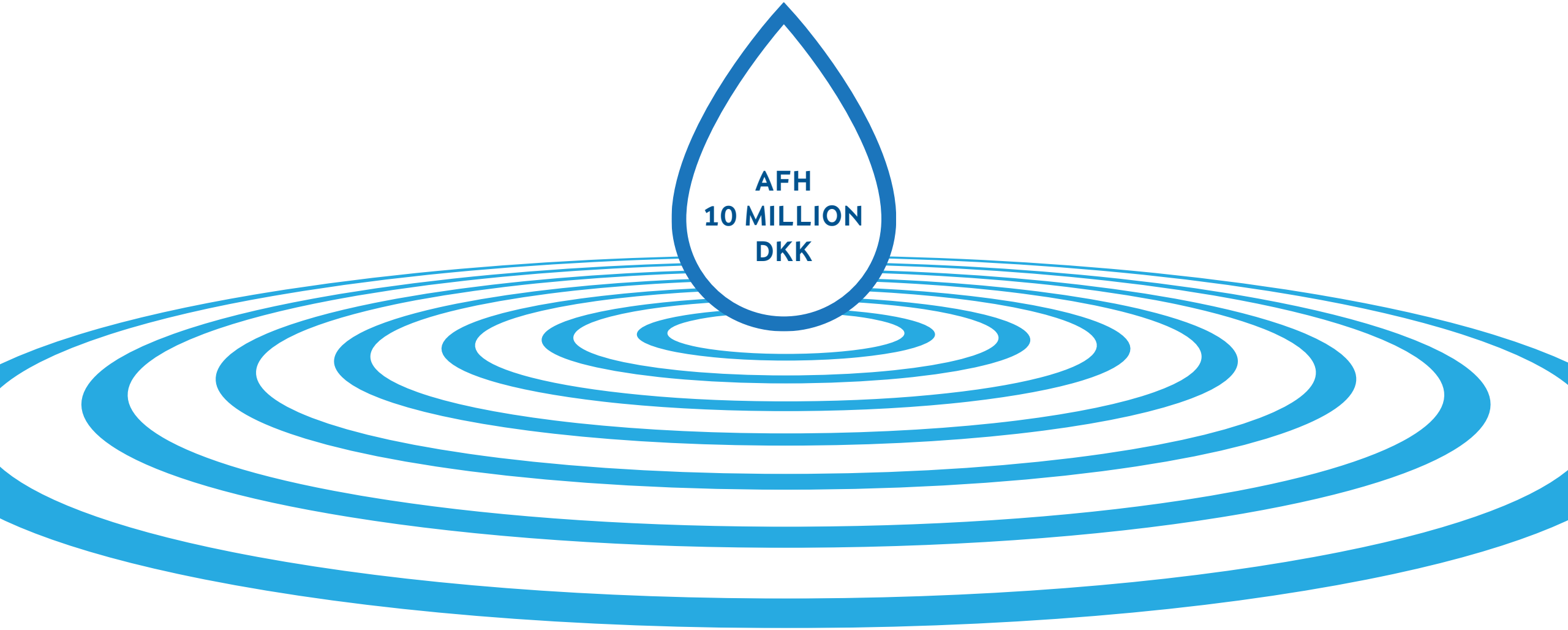
INSIDE CALL

IMPACT

RESEARCH COLLABORATION

SECURING TRANSPARENT AND INDEPENDENT RESEARCH

FUNDING INSPIRING FURTHER FUNDING



ARLA FOOD FOR HEALTH CONNECTS WITH THE ENTIRE WORLD

WE ARE CURRENTLY SUPPORTING 15 EXCITING PROJECTS

ProGuMs
A Novel Gut-Brain Signalling Axis – Global Profiling of Gut Messengers

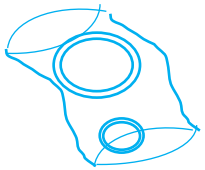
DARLING
DAiry polar lipids as Receptor LIgands modulating carbohydrate metabolism

DIDOF
Quantifying the health impact of the substitution of and interaction between Dietary Intake of Dairy and Other Food Groups

MILKY WAY
Milk as a natural way to protect and deliver phages to the newborn gut

ChildRAUM
Children's nutrient requirements, absorption, utilization & metabolic rates with emphasis on dairy protein

YourGutBrain
Yoghurt to alter gut movements and brain function



GutBioMod
Extracellular Vesicles in milk as Biological Modulators of Gut development and function during early life

CASGUT
Caseins for gut comfort in infants

LAMETA
Lactate – the link between fermented dairy products and metabolic health?

DACAPRO
Dairy calcium to promote prebiotic effects in the gut

MainHealth
The influence of maternal health on human breast milk composition with downstream effects on infant metabolism and gut colonization

DAIPRO - NAFLD
A randomized controlled trial of effects of DAIry PROtein products on liver disease severity and metabolism in patients with Non-Alcoholic Fatty Liver Disease

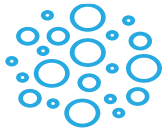
CutDM – The mealbox
Cut down carbohydrate usage in the diet of type 2 diabetes

SMiL
Special Milk Lipids for Improving Metabolic health

FINALIZED PROJECTS

MAGNUS

Examines how milk protein and whey permeate rescue linear and ponderal growth as well as child development in Moderate Acute Malnutrition



DairyMat

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

D-pro

Effects of milk protein and vitamin D on childrens growth and health

MiPUAge

Milk Protein Utilisation and Age

FerMets

Matrix characterization and effect of different types fermented dairy products on liver fat, cardiometabolic risk and gut microbiome in men with metabolic syndrome

InfantBRAIN

Valorisation of milk fat globule membrane enriched ingredients

Stimmune

Bioactive milk diet to stimulate gut immune defence 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

OmniSam

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

EnMet

ENergy METabolism – the molecular mechanics governing the beneficial effects of milk-derived proteins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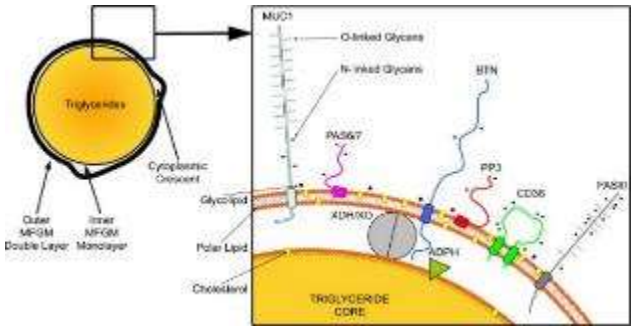
DAIRY AND DAIRY INGREDIENTS

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

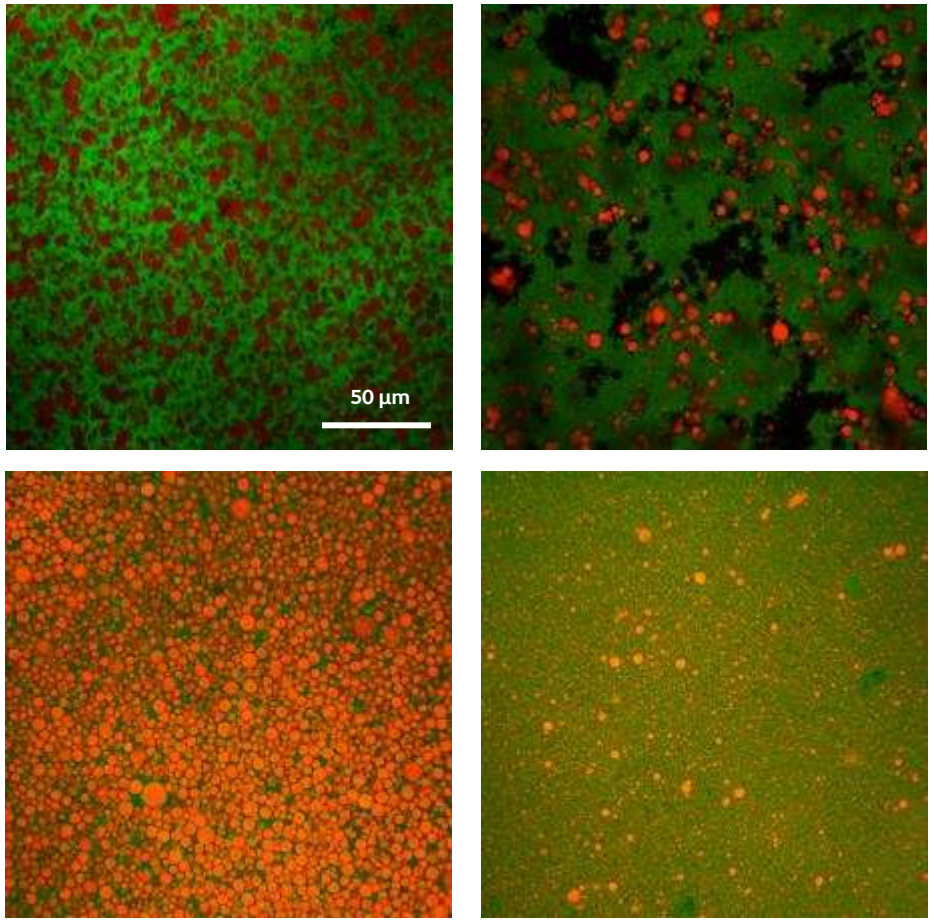
Designing biofunctional dairy foods: matrix structure of dairy products in relation to lipemia

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

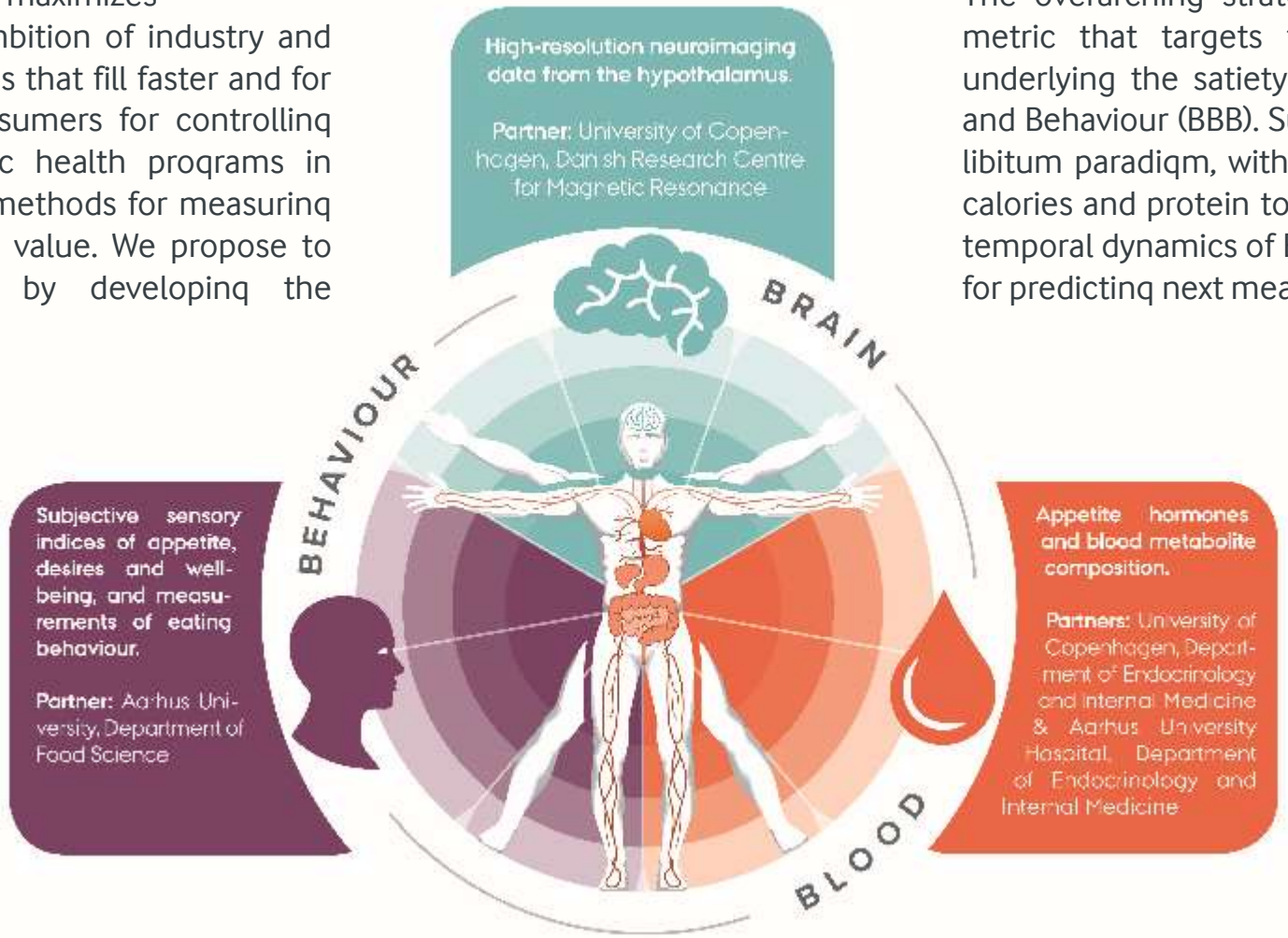
A multimodal metric for predicting the satiating effects of real foods and meals

BACKGROUND

Desiqninq food and drink that maximizes satiety has lonq been an ambition of industry and public health proqrams. Foods that fill faster and for lonqer are desirable to consumers for controllinq their weiqht. and for public health proqrams in obesity prevention. Current methods for measurinq satiety have weak predictive value. We propose to overcome this deficiency by developinq 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 satiatinq 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 composinq Brain, Blood and Behaviour (BBB). Subjects will undergo a preload - ad libitum paradiqm, with a 2-parameter factorial desiqn of calories and protein to carbohydrate ratio. Extractinq the temporal dynamics of BBB data. we will compute a metric for predictinq next meal enerqy consumption.

CONTACT

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Daily coordinator:
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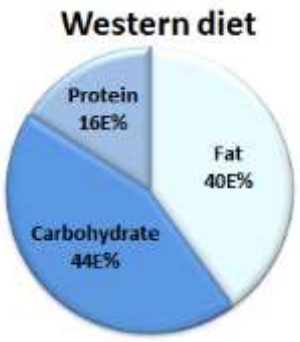
Website: www.omnisam.au.dk

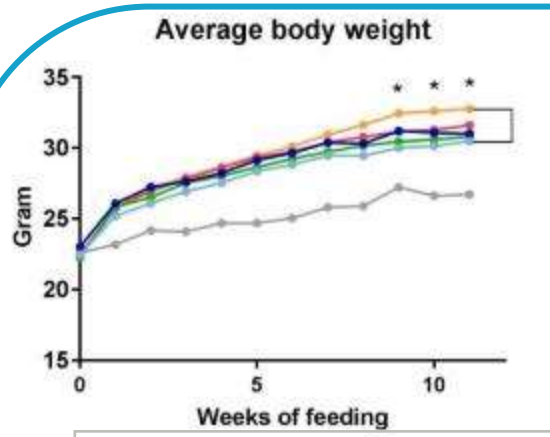
EnMet

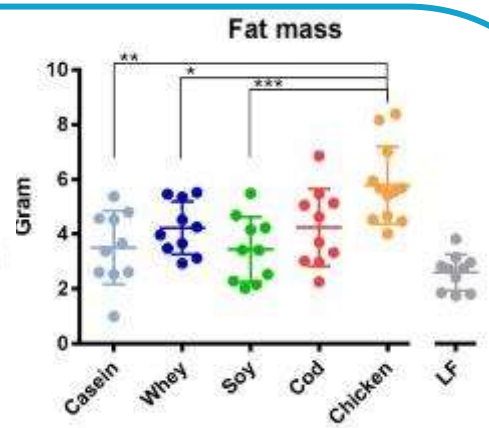
Milk proteins as regulator of obesity through modification of ENergy METabolism and gut microbiota



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

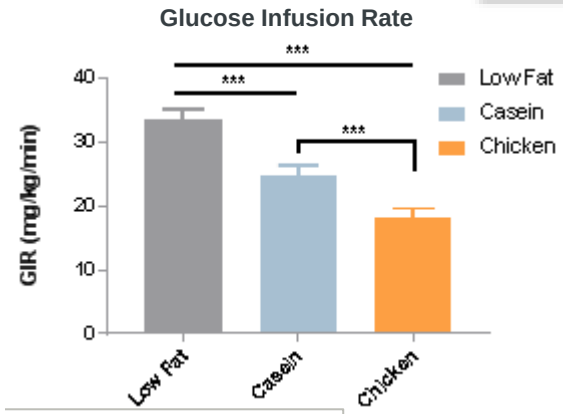
Results





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

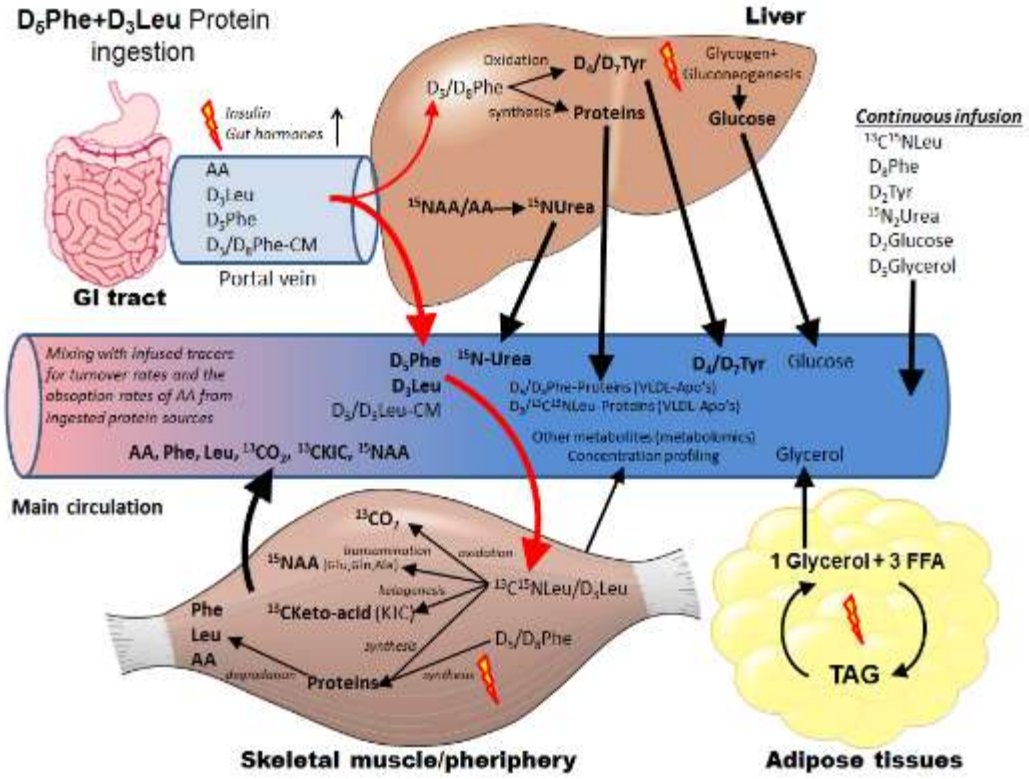
And more

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.

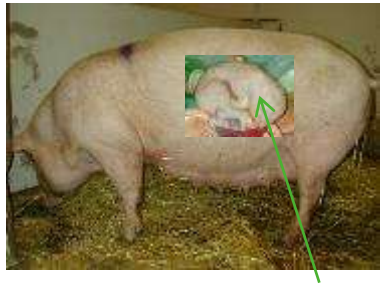


Project leader:
Professor Gerrit van Hall
Biomedical Science, SUND, KU
gerrit.van.hall@regionh.dk

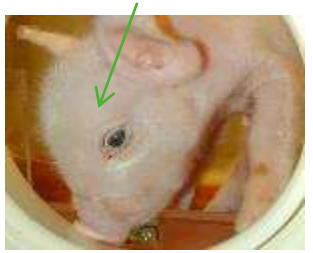
STIMMUNE

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 immunomudulatory 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

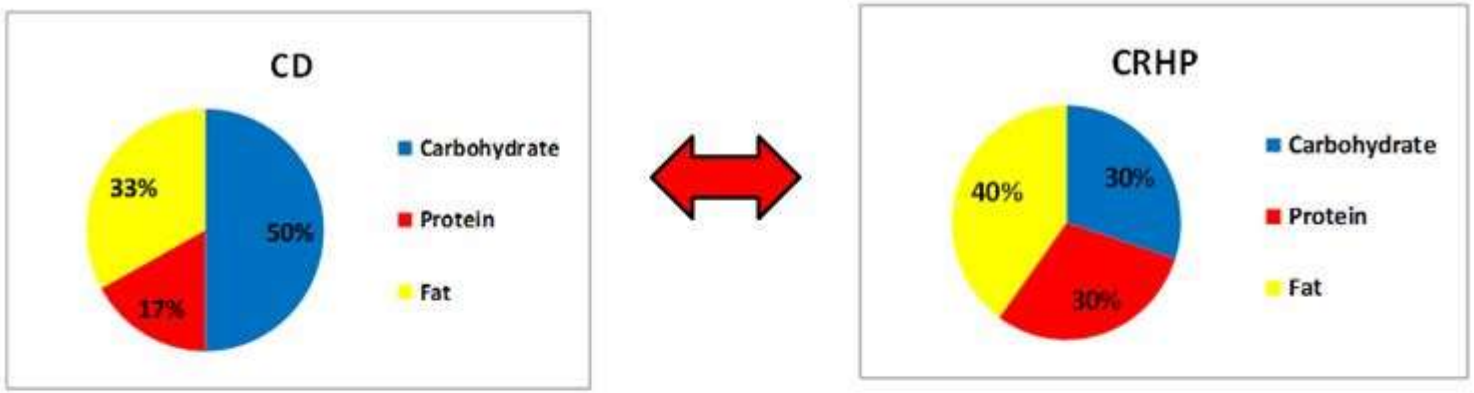


Bioactive milk → Gut and immunity maturation & health

Normal feeding → Gut and immunity inflammatory disorder

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

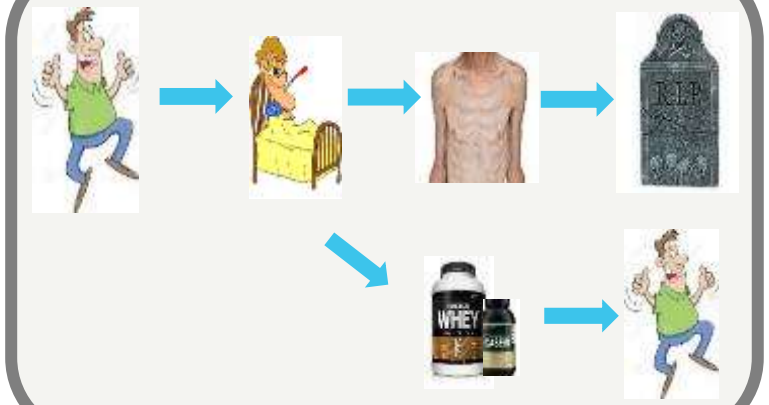
BACKGROUND: Loss of muscle protein during inflammatory disease and hospitalisation is a big problem, and is strongly associated with increased risk of death. Protein supplementation can reduce muscle loss. Especially leucine-rich supplements seem to be beneficial in performance sports. However, whether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

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

Exposure

Nutrition intervention (n=600)
Ready to use supplementary food (RUSF)

	+ Milk protein isolate (MPI)	+ Soy protein Isolate (SPI)
Whey permeate (+ WP)	MPI + WP n=150	SPI + WP n=150
No whey permeate (-WP)	MPI - WP n=150	SPI - WP n=150

Control (n=100)
Nutrition counselling

Intermediary variables

- Growth factors
- Systemic inflammation
- Intestinal inflammation
- Enteric function
- Microbiota

Outcome

Linear catch-up growth
Child development scores

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.

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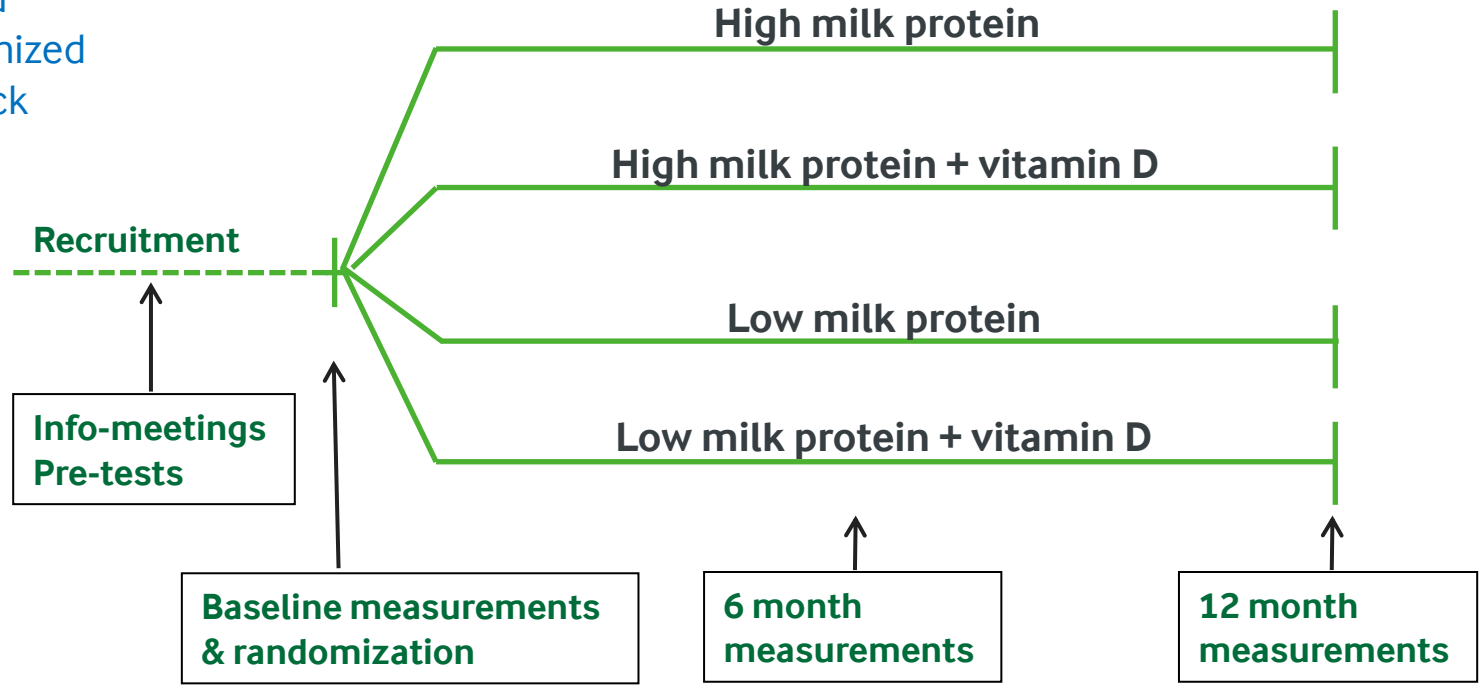

SMiL

Special Milk Lipids for improving Metabolic Health

Assistant professor
Maximilian Kleinert
NEXS, KU

What we will do

- Uncover the mechanisms responsble for health effects of medium chain fatty acids (MCFA).
- Develop a dairy product enriched in MCFA to harness health benefits.

Benefit to Arla

- New technology that enables MCFA enrichment.
- Enables us to design dairy products with added health benefits.