



Molecular Nutrition

Bioactive food proteins

Esben Skipper Sørensen
ess@mbg.au.dk, Bygn. 1874, 2. etage



Molecular Nutrition - Many foods contain bioactive components with health-promoting or disease-preventing properties. Studies of these components and their physiological effects are essential for development of new advanced products within infant and clinical nutrition. At Molecular Nutrition Laboratory we offer student projects within bioactive milk proteins (Danish Dairy Research Foundation project) and digestion and bioactivity of Faba bean proteins (Novo project).

Osteopontin (OPN) – OPN is a multifunctional protein found in most tissues and physiological fluids, with the highest levels found in milk. OPN is a cytokine, a cell signaling molecule involved in a wide range of biological processes; immune stimulation, mineral transport and bioavailability, cell differentiation, interaction with bacteria and many others. OPN has many beneficial effects for infants and has recently been approved for use in infant nutrition in Europe. We study the function of OPN and the underlying molecular mechanisms in biological processes.

PROMISE - Chronic inflammation is a common denominator of multiple lifestyle-mediated conditions. These include obesity, Type 2 diabetes, inflammatory bowel disease, and neurodegenerative diseases. Gut barrier leakiness is at the center of lifestyle mediated chronic inflammation. A common manifestation of chronic inflammation is deficiency of the essential minerals, zinc and iron. In this project, we use cellular models of the intestinal barrier to investigate milk proteins as transporters of essential minerals to the gut to target inflammatory conditions.

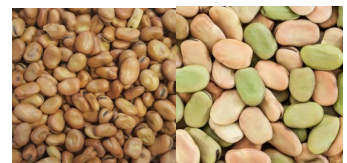
N2CROP - A Novo Challenge project investigating the potential of faba beans as a sustainable protein source in human nutrition. At Molecular Nutrition Laboratory, we develop and use molecular methods and models to investigate protein content, digestibility and presence of anti-nutrients and bioactive proteins and peptides in a large panel of faba bean varieties.

Techniques and methods used in the projects - Protein and peptide purification and characterization, cell culture, in vitro digestion models, cellular models of the gut-blood barrier, inflammatory models, cytokine assays, mineral binding and transport assays, various immunological techniques and many more.

General - Bachelor projects are planned so that they can be continued in molecular biology project work in the 4th year and finally in thesis projects. Many of our graduates find employment in the food industry, with Arla being a major employer but many are also finding work in the biomedical and biotechnology sector.

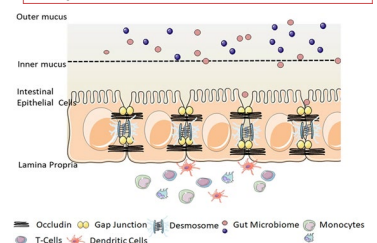


In collaboration with Arla Foods, we have patented a method for the purification of osteopontin from milk, as well as uses of this highly bioactive protein in infant formula, wound healing and toothpaste.



As part of the dietary transition to sustainable protein sources, we investigate the nutritional potential of faba beans in human nutrition.

Step	Description	Time
1	• Perform enzyme activity and bile assays	1
2	• Prepare SSF, SGF and SIF stock solutions	2
4	• Perform pH-test adjustment experiment	4
7-12	• Mix Food with SSF (1:1, (wt/wt))	7-12
13	• Include CaCl ₂ (1.5 mM in SSF)	13
14	• Add salivary amylase, if necessary (75 U/mL)	14
15, 16	• Incubate while mixing (2 min, 37 °C, pH 7)	15, 16
17, 18	• Mix oral bolus with SGF (1:1 (vol/vol))	17, 18
19	• Include CaCl ₂ (0.15 mM in SGF)	19
20, 21	• Add pepsin, gastric lipase (2,000, 60 U/mL)	20, 21
22-24	• Incubate while mixing (2 h, 37 °C, pH 3.0)	22-24
25, 26	• Mix gastric chyme with SIF (1:1 (vol/vol))	25, 26
27	• Include bile (10 mM bile salts)	27
28	• Include CaCl ₂ (0.6 mM in SIF)	28
29	• Add pancreatin (trypsin activity 100 U/mL)	29
30-32	• Incubate while mixing (2 h, 37 °C, pH 7.0)	30-32
	Sampling procedure and sample treatment (Table 1)	



We use in vitro models of human gastrointestinal digestion and build cellular models of biological membranes to investigate the uptake and effect of bioactive food proteins and minerals.