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Digestion and colloids - The way forward in advanced nutrient delivery

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Food manufacturers try to meet the rising expectations of consumers for nutritionally balanced and healthy foods. The current way to achieve this goal is based on "enhancing" nutritional functionality within a product by adding health beneficial bioactives such as probiotics, sterols, flavones, carotenoids, polyphenols to a common food base. Such enrichments are often linked to a health claim, supported by a clinical study, and aimed to prevent a potential health problem. The next major step in value addition to food will be to deliver food products adapted to the nutritional and health needs of an individual, as different people respond in different ways to similar diets and life styles. The current focus lies on nutrigenomics, studying how genetics and metabolic processes relate to nutrition. This approach will definitely help to better identify people who are statistically more likely to develop a particular disease and would require a personalized diet. A major challenge will be the translation of the obtained data into adequate nutrition solutions.

The study and understanding of how the digestive system functions will play another important role in food personalisation. Humans (and most animals) digest their food extra-cellularly, that is, outside of cells, involving a complex interplay between bio- and colloidal transformations of the ingested food. Consequently, food scientists will have to provide food products adapted to the physiological, physico- chemical and colloidal processes involved in perception as well as nutrient transformation, liberation and absorption during digestion. In other words it will be important to master the kinetics and thermodynamics of a) nutrient incorporation into a food product, b) liberation during digestion and c) adsorption into the cells making use of food structures that facilitate the realization of the desired sensorial and nutritional benefits. Of particular interest is the question how food structure and composition (e.g. microstructure such as particle size and shape, self-assembly structures, molecular structure) are influencing the dynamics of nutrient uptake.

We will review important physico-chemical and colloidal aspects regarding lipid digestion in relation to emulsion structure. Lipid digestion is a rather complex process, resulting in different intermediate self- assembly structures. We consider emulsions as ideal systems to study the relationship between food structure formation and lipid digestion, as they are easy to produce at different sizes and different internal self-assembly structures e.g. in form of cubosomes, hexosomes and isasomes. Moreover they can be loaded with lipo- and amphiphilic bioactives and can be easily evaluated using artificial or native digestion media such as saliva, gastric juices, lipolytic enzymes and bile.