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Synchrotron SAXS and SANS Reveal the Formation of Functional Nanostructures during Food Digestion

The combination of in situ time-resolved small angle X-ray- and neutron scattering combined with cryogenic transmission electron microscopy can provide unique insights into transient soft nanostructures during food digestion and processing.
In this presentation, the discovery of highly ordered geometric nanostructures during the in vitro digestion of food emulsions such as milk and mayonnaise under simulated in vivo conditions will be discussed: Transitions from normal emulsion through a variety of differently ordered structures were observed. The colloidal structure formation and transformation may play a vital role in the delivery of the lipid-soluble bioactive food molecules such as hydrophobic vitamins, carotenoids and lipids to the circulatory system of the body [1,2,3]. Selective deuteration of lipids and solvent contrast variation was applied to map the location of molecules in the complex multicomponent nanostructures [4]. Based on these findings, we demonstrate the design of functional delivery systems for poorly water-soluble antimicrobial peptides, a promising alternative to conventional antibiotics. These peptide nanocarriers also protects the sensitive molecule from degradation and boost its antibacterial activity [5].
The results shed light on the formation and transformation of functional bio-nanostructures with the aim of designing biomimetic delivery systems for hydrophobic functional molecules.

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