Understanding structure and function in lipid systems

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Lipid formulations, specifically lipid nanoparticles, have in recent years seen an explosion of interest due to their successful use in the COVID-19 vaccines. However, aside from therapeutics, lipid formulations have for many years been used in a range of industries including cosmetics and food. Lipid formulations span a broad range of composition and structures including bulk and nanoparticles. Understanding the structure of lipid systems and their interactions with the surrounding environment is an integral tool towards understanding how structure contributes to function. This is particularly relevant to compare payload release and the degradation of the lipid system. Environmental conditions including temperature, pressure and interactions with enzymes also play a key role. Small angle scattering (X ray and neutron) combined with single particle Raman analysis, is enabling us to systematically quantify and therefore decouple how the structure of lipid nanocarriers impacts their function. In the long term, this will contribute to the ultimate goal of rational design of lipid systems tailored for specific applications.